HP 8922G User's Guide

HEWLETT PACKARD

HP Part No. 08922-90022 (without Performance Test Disk)
08922-90011 (with Performance Test Disk)
08922-90028 Instructional Video Tape (NTSC format)
08922-90029 Instructional Video Tape (SECAM format)
08922-90030 Instructional Video Tape (PAL format)

Printed in USA August 3, 1993 (Rev. E)

Fifth Edition: Firmware Revision A.04.00

Notice

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

Ordering Information

To order this manual, call or write your nearest Hewlett-Packard Sales office. Within the USA, it is better to order directly from the HP Support Materials Organization in Roseville, California. Ask your nearest HP office for information and forms for the "Direct Order System."

Sound Emission

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).

Safety Considerations

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).

Before Applying Power

Verify that the product is set to match the available line voltage and verify that the correct fuse is installed.

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.

Safety Symbols

The following symbols may be found on the instrument or throughout the instrument's documentation.

This is the instruction manual symbol. The product will be marked with this symbol when it is necessary for the user to refer to the

instruction manual (refer to Table of Contents).

This symbol indicates hazardous voltages.

This symbol indicates earth (ground) terminal.

Warning **The WARNING symbol 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 symbol until the indicated conditions are fully understood and met.

Caution The CAUTION symbol denotes a hazard. It calls attention to a 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 symbol until the indicated conditions are fully understood and met.

Safety Considerations for this Product

Warning

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnection of the protective earth terminal will cause a potential shock hazard that could result in 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, and so forth). Do not use repaired fuses or short circuited fuseholders.

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR

A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.

REGIONAL SALES AND SERVICE OFFICES

SOUTH EAST EUROPE
Hewlett-Packard S.A.
World Trade Center
110 Avenue Louis-Casai
1215 Cointrin, **GENEVA**
Switzerland
Tel: (022) 98 96 51
Telex: 27225 hpner
Mail Address:
P.O. Box
CH-1217 Meyrin 1
GENEVA
Switzerland

MIDDLE EAST AND CENTRAL AFRICA
Hewlett-Packard S.A.
Middle East/Central
Africa Sales H.Q.
7, rue du Bois-du-Lan
P.O. Box 364
CH-1217 Meyrin 1
GENEVA, Switzerland
Tel: (022) 7807111
Telex: 27835 hmea ch

ASIA
Hewlett-Packard Asia Ltd.
22/F Bon Centre, West Tower
89 Queensway, Central
HONG KONG
G.P.O. Box 863 Hong Kong
Tel: 5-8487777
Telex: 76793 HPA HX
Cable: HPASIAL TD

NORTHERN EUROPE
Hewlett-Packard S.A.
V.D. Hooplaan 241
NL-1105 LN **AMSTELVEEN**
The Netherlands
Tel: 20 5479832
Telex: 18919 hpser

UNITED KINGDOM
Hewlett-Packard Ltd.
Nine Mile Ride
WOKINGHAM
Berkshire, RG113LL
Tel: 0344 773100

OTHER INTERNATIONAL AREAS
Hewlett-Packard Co.
Intercontinental
Headquarters
3495 Deer Creek Road
PALO ALTO, CA 94304

Tel: (415) 857-5027
Telex: 034 8300
Cable: HEWPACK

CANADA
Hewlett-Packard (Canada) Ltd.
6877 Goreway Drive
MISSISSAUGA, Ontario L4V 1M8
Tel: (416) 678-9430
V Mail: (416) 678-9533

EASTERN EUROPE
Hewlett-Packard Ges. m.b.h.
Liebigasse 1
P.O. Box 72
A-1222 **VIENNA**, Austria
Tel: (222) 2500-0
Telex: 1 3 4425 HEPA A

EASTERN USA
Hewlett-Packard Co.
4 Choke Cherry Road
ROCKVILLE, MD 20850
Tel: (301) 670-4300

MIDWESTERN USA
Hewlett-Packard Co.
5201 Tollview Drive
ROLLING MEADOWS
IL, 60008
Tel: (708) 255-9800

SOUTHERN USA
Hewlett-Packard Co.
2015 South Park Place
ATLANTA, GA 30339
Tel: (404) 955-1500

WESTERN USA
Hewlett-Packard Co.
5161 Lankershim Blvd.
NORTH HOLLYWOOD,
CA 91601
Tel: (818) 505-5875

UNITED STATES OF AMERICA
Customer Information Center
Tel: (800) 752-0900
6:00 AM to 5:00 PM
Pacific Time

In This Book

This book contains operating information for the HP 8922G.

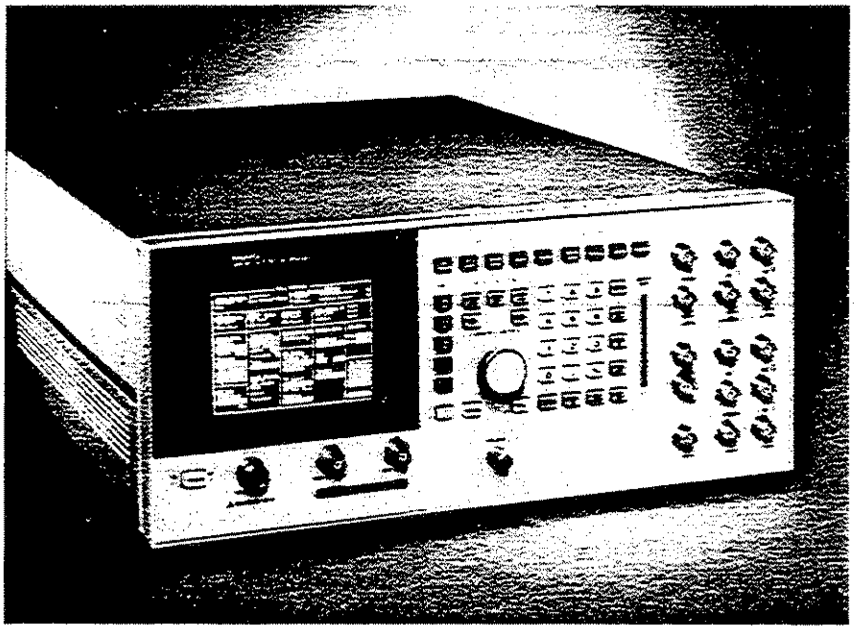
Use the instructional video tape to learn how to establish a link and place a phone call between the HP 8922G and a GSM mobile radio.

Use Volume 1 to learn how to perform measurements. It can also be used to remind you of the basic steps in the measurement process. If problems occur, see the Solving Problems section of Making Measurements. Use the performance test disk to verify performance. Specifications can be found in the Verifying Performance chapter.

Use Volume 2 to look up information about the product. It provides descriptions of the display screens, keys, connectors, and HP-IB (programming) codes. Refer to this volume whenever you need more information about the product's features.

HEWLETT PACKARD

Output RF Spectrum Measurements Using a 3-Pole Synchronously Tuned Measurement Filter



GSM Recommendation 11.10 and 11.20 set the requirements for the out-of-channel performance of base station and mobile station transmitters with the Output RF Spectrum specification. The specification calls for the measurement of transmitted energy at several offsets from the carrier frequency. Two types of measurements are required: one to check the interference due to modulation, and one to check the interference due to the ramping of the signal amplitude (switching transients). Limits are specified for each type of measurement at specified frequency offsets. The GSM specified limits are based on a 5-pole synchronously tuned measurement filter.

In the HP 8922, Output RF Spectrum measurements are made using a 3-pole synchronously tuned measurement filter. The measurement results will differ from measurements using a 5-pole filter. The size of the difference depends on the characteristics of the measured signal (shape of the modulation spectrum and the shape of the signal amplitude envelope). Therefore, it is impossible to determine a correction factor that predicts the results of a measurement using a 5-pole filter from one using a 3-pole filter.

HP 8922 GSM Test Set

Given the complexity of determining a correction factor for 3-pole measurements, another approach is to determine equivalent limits based on a 3-pole synchronously tuned filter. For the modulation case, this is done by determining the difference between the GSM specified limits and measurements of an ideal signal using a 5-pole filter. This difference, called the specification margin, represents the allowed deviation of the transmitted spectrum from the ideal spectrum. The specification margin is then added to the results of measurements of the same ideal signal using a 3-pole filter to get the desired specification limits.

A similar approach is used to obtain the specification limits for Output RF Spectrum due to Switching Transients. Because there is no ideal signal for this case, a signal whose amplitude envelope conforms to both the amplitude versus time requirements and the switching transient specifications is used. Again, the specification margin is the difference between the GSM specified limits and measurements on this "ideal" signal using a 5-pole filter. The desired specification limits are obtained by adding the specification margin to the results of measurements of the same signal using a 3-pole filter.

The difference between measurements of the "ideal" signals using a 3-pole filter and a 5-pole filter are shown in tables 1 and 2. These values are added to the GSM specifications to obtain equivalent limits for Output RF Spectrum measurements using a 3-pole synchronously tuned measurement filter. The adjusted Output RF Spectrum limits based on a 3-pole filter are shown in tables 3 and 4.

Table 1 Adjustment for Output RF Spectrum due to Modulation Specification for 3-Pole Filter

3-Pole Specification Difference Output RF Spectrum due to Modulation					
	Offset from Carrier (kHz)				
	100	200	250	400	600 to 1800
Difference (dB)	0	2.5	1.0	9.0	0

Table 2 Adjustment Output RF Spectrum due to Switching Transients Specification for 3-Pole Filter

3-Pole Specification Difference Output RF Spectrum due to Switching				
	Offset from Carrier (kHz)			
	400	600	1200	1800
Difference (dB)	6	4	2	0

It is important to note that these values are estimates based on simulation and measurements. They are intended to allow the user to estimate their transmitters conformance to the GSM Output RF Spectrum requirement.

Although, the HP 8922 Output RF Spectrum measurements cannot guarantee conformance to GSM standards, they provide an indication of a mobile's performance and can be useful for comparative purposes. The measurements will indicate trends in the manufacturing process affecting Output RF Spectrum performance.

The HP 8922's 3-pole filter does not provide as much rejection as a 5-pole filter. This can result in higher adjacent channel levels when measured on an HP 8922 relative to measurements on a system with a 5-pole filter. If the HP 8922 measured value is better than the GSM specification (based on 5-pole filter), then the mobile is definitely good.

Table 3 Adjusted Output RF Spectrum due to Modulation Specifications for 3-Pole Filter

Adjusted Limits Based on 3-Pole Filter Output RF Spectrum Due to Modulation						
Power Control Level	Offset from Carrier (kHz)					
	0	100	200	250	400	600 to 1800
0 (43 dBm)	0 dB	0.5 dB	-27.5 dB	-32 dB	-51 dB	-70 dB
2 (39 dBm)	0	.5	-27.5	-32	-51	-66
3 (37 dBm)	0	.5	-27.5	-32	-51	-64
≥5 (≤33 dBm)	0	.5	-27.5	-32	-51	-60

Table 4 Adjusted Output RF Spectrum due to Switching Transients Specifications for 3-Pole Filter

Adjusted Limits Based on 3-Pole Filter Output RF Spectrum Due to Switching				
Power Level (dBm)	Offset from the Carrier (kHz)			
	400	600	1200	1800
43	-3 dBm	-17 dBm	-19 dBm	-24 dBm
41	-5	-17	-19	-24
39	-7	-17	-19	-24
37	-9	-17	-19	-24
35	-11	-17	-19	-24
33	-13	-17	-19	-24
31	-15	-19	-21	-26
29	-17	-21	-23	-28
27	-17	-22	-25	-30
25	-17	-22	-27	-32
23	-17	-22	-29	-34
≤21	-17	-22	-30	-36

Data subject to change
Printed in USA 3/92
1000-1223

Contents—Volume 1

Chapter 1—Installing Your HP 8922G

Chapter 2—Making Measurements

Contents—Volume 2

Chapter 4—Screens

Chapter 5—Keys

Chapter 6—Connectors

Chapter 7—HP-IB Codes

1

Installing Your HP 8922G

Using this Chapter

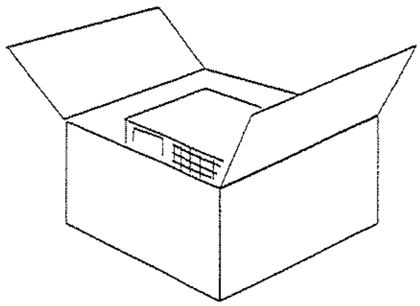
Use the following procedure to get the HP 8922G powered-up correctly. After completing this procedure, refer to Making Measurements for an introduction to operating the HP 8922G.

Equipment Supplied

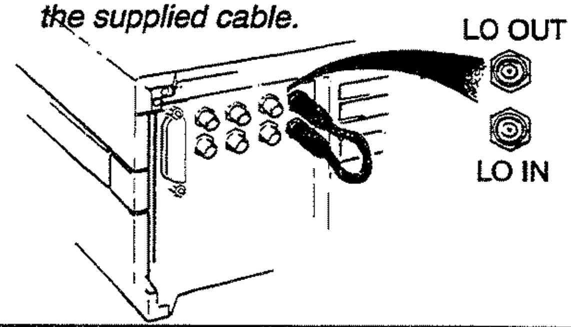
- Fuse Envelope and Fuse
- LO IN/LO OUT cable
- REF OUT/REF IN cable (Option 001 only)
- Power Cord

Installation Overview

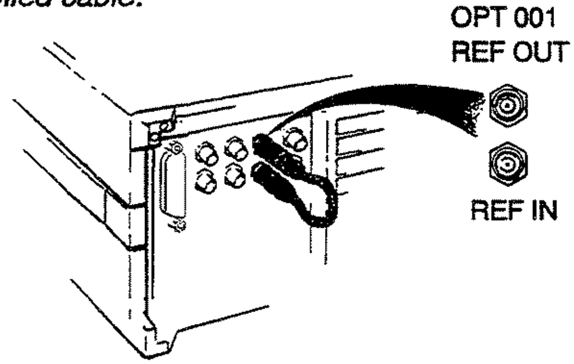
1 *Unpack the HP 8922G.*



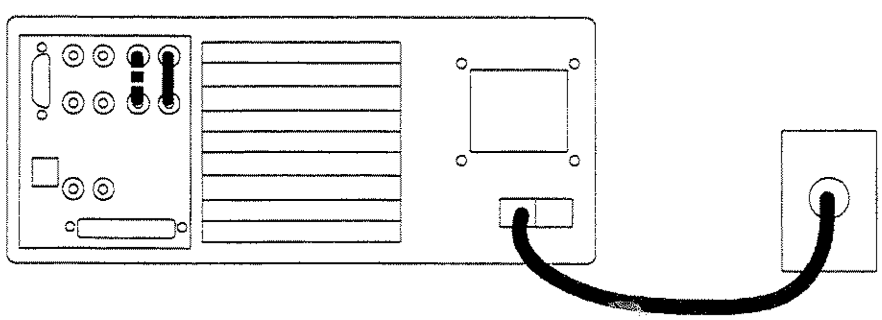
2 *If the LO IN and LO OUT connectors are present on your instrument, connect the LO OUT to LO IN using the supplied cable.*

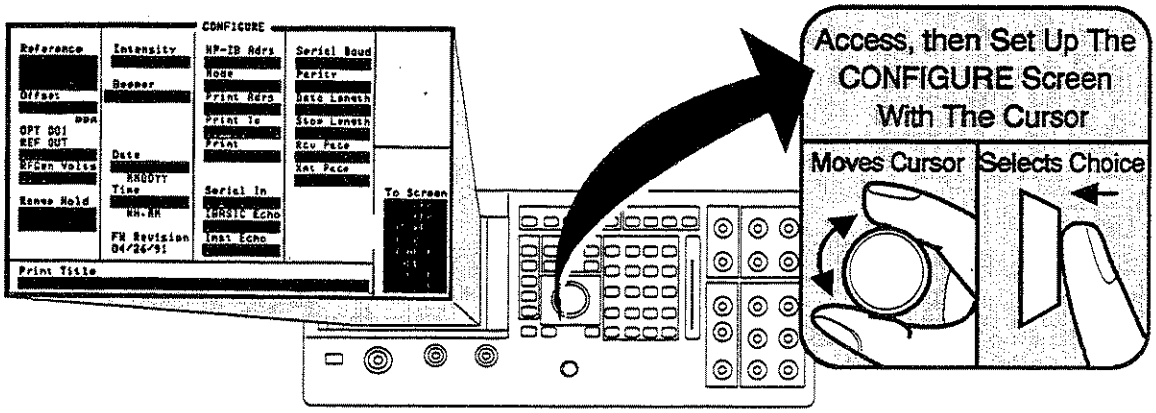


3 *Connect a 1, 2, 5, 10, or 13 MHz signal to REF IN. If you have OPT 001, connect as shown with the supplied cable.*

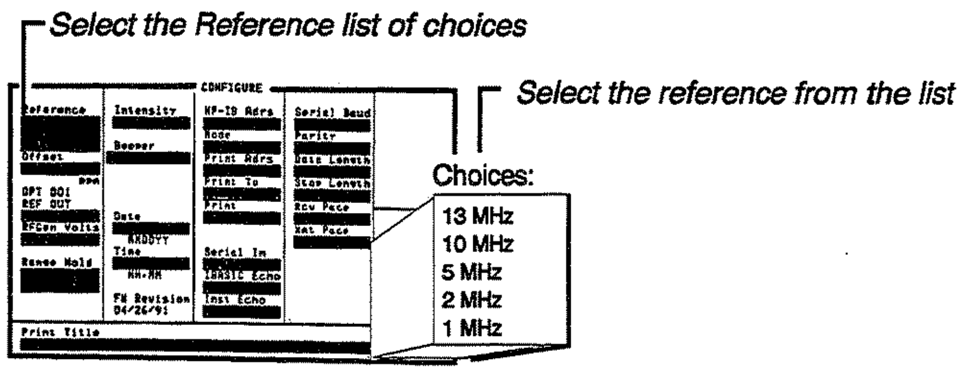


4 *Connect the supplied power cord to the HP 8922G and power up the instrument.*





5 *Enter 10 MHz for OPT 001, or enter your signals reference.*



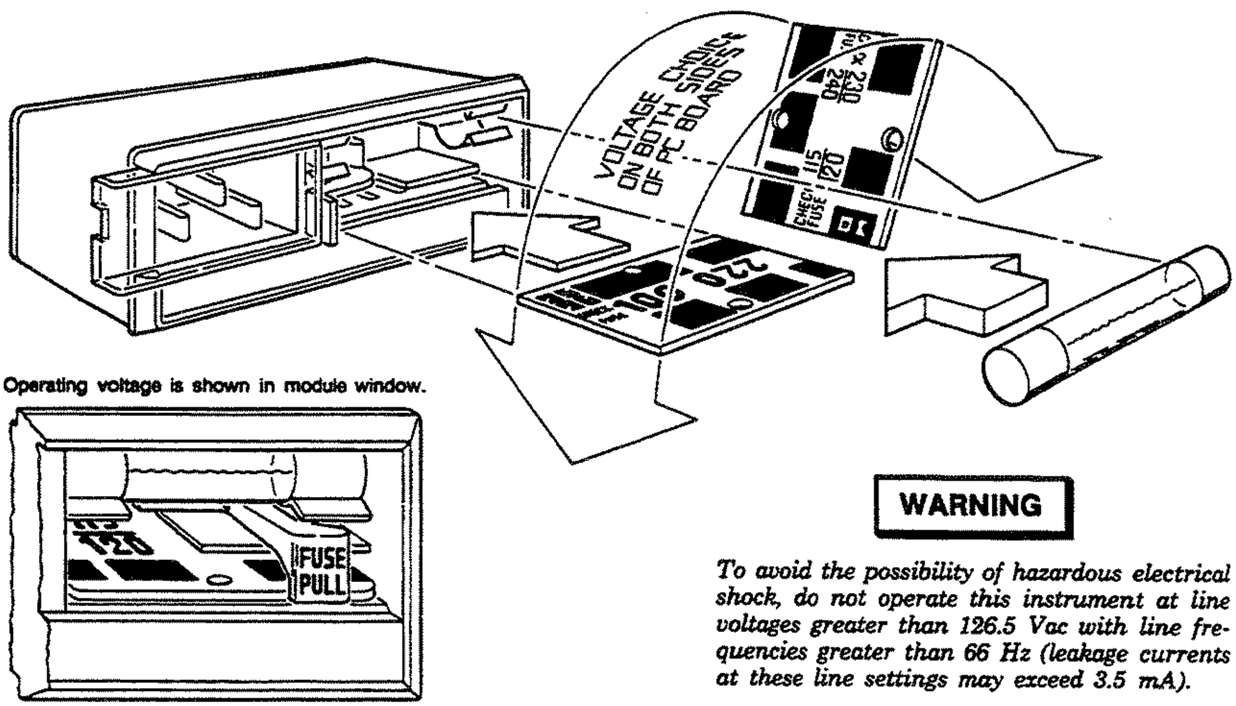
Fuses and Power Cords

Caution

Before plugging this instrument into the Mains (line) voltage, be sure the correct voltage on the line voltage selection card has been selected.

Line Voltage and Fuse Selection

Verify that the line voltage selection card is matched to the power source (see figure). Order fuse HP part 2110-0083 (2.5 A 250 V, normal blow) for replacement.



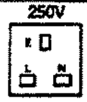
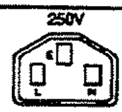
WARNING

To avoid the possibility of hazardous electrical shock, do not operate this instrument at line voltages greater than 126.5 Vac with line frequencies greater than 66 Hz (leakage currents at these line settings may exceed 3.5 mA).

1. Open cover door, pull the FUSE PULL lever and rotate to left. Remove the fuse.
2. Remove the Line Voltage Selection Card. Position the card so the line voltage appears at top-left cover. Push the card firmly into the slot.
3. Rotate the Fuse Pull lever to its normal position. Insert a fuse of the correct value in the holder. Close the cover door.

Voltage Selection Card and Fuse Installation

Power Cords

Plug Type	Cable HP Part Number	C D	Plug Description	Cable Length (inches)	Cable Color	Location
250V 	8120-1351	0	90°/STR BS1363A*	90	Mint Gray	United Kingdom, Cyprus, Nigeria, Rhodesia, Singapore
	8120-1703	4	90°/90°	90	Mint Gray	
250V 	8120-1369	0	STR/STR NZSS198/ASC112*	79	Gray	Australia, New Zealand
	8120-0696	4	STR/90°	80	Gray	
250V 	8120-1689	7	STR/STR*	79	Mint Gray	East and West Europe, Saudi Arabia, Egypt, (unpolarized in many nations)
	8120-1692	2	STR/90°	79	Mint Gray	
125V 	8120-1378	1	STR/STR NEMA5-15P*	80	Jade Gray	United States, Canada, Mexico, Philippines, Taiwan,
	8120-1521	6	STR/90°	80	Jade Gray	
	8120-1751	1	STR/STR	90	Jade Gray	U.S/Canada
100V (Same plug as above)	8120-4753	2	STR/STR	90	Dark Gray	Japan only
	8120-4754	3	STR/90°	90	Dark Gray	Japan only
250V 	8120-2104	3	STR/STR SEV1011 1959-24507 Type 12	79	Gray	Switzerland
	8120-2296	4	STR/90°	79	Gray	
	8120-3997	4	STR/90°	177	Gray	
250V 	8120-0698	6	STR/STR NEMA6-15P	90	Black	United States, Canada
250V 	8120-2956	3	90°/STR	79	Gray	Denmark
	8120-2957	4	90°/90°			
	8120-3997	4	STR/STR			
250V 	8120-4211	7	STR/STR*IEC83-B1	79	Black	South Africa, India
	8120-4600	8	STR/90°	79	Gray	
250V 	8120-1860	6	STR/STR*CEE22-V1 (Systems Cabinet Use)	59	Jade Gray	
	8120-1575	0	STR/STR	31	Jade Gray	
	8120-2191	8	STR/90°	59	Jade Gray	
	8120-4379	8	90°/90°	80	Jade Gray	

* Part number shown for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable including plug. E = Earth Ground; L = Line; N = Neutral; STR = Straight

General Information

Operation and Storage Environment

Refer to *General Specifications* in the Specifications section of Verifying Performance for information about the operation or storage environment.

Instrument Options

Refer to Specifications in the Verifying Performance chapter for information about instrument options. (Also see the full-color brochure included in this manual.)

Specifications

Refer to Verifying Performance for instrument specifications.

2

Making Measurements

Using This Chapter

The HP 8922G provides you with 2 methods of making measurements on a GSM mobile station.

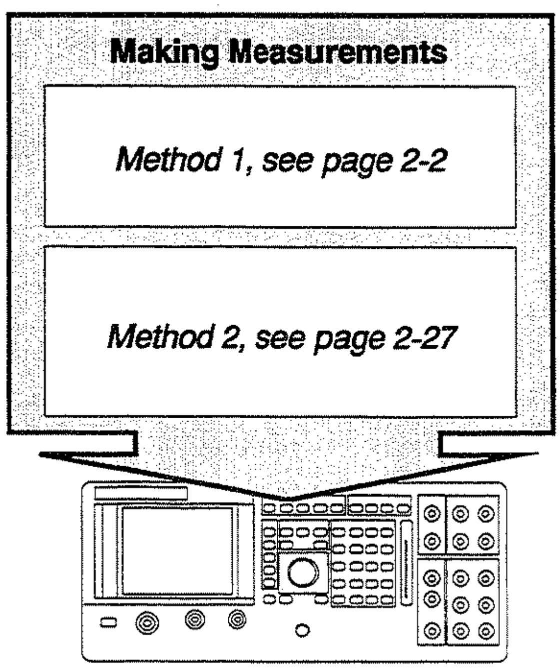
Method 1

Refer to Method 1 when you have a fully-operational mobile station, capable of establishing and maintaining a link. All of the measurement capability provided with Method 2, plus bit-error testing is provided with Method 1.

An instructional video tape is included with your HP 8922G to demonstrate Method 1 tasks. It shows how to get a mobile station to camp on, how to originate and receive calls, and how to run tests. If possible, watch the video as you perform these tasks, or view the video prior to doing Method 1 tasks.

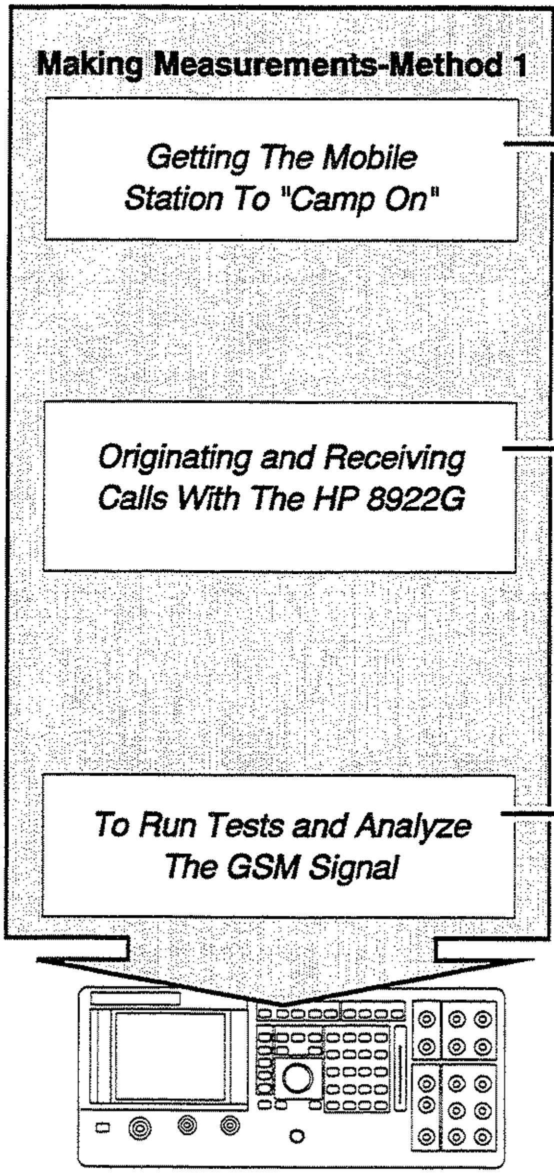
Method 2

Refer to Method 2 when you do not want to establish a link between the HP 8922G and your mobile station (such as when you are testing modules only). When this method is chosen, some parameters that would be provided by a GSM link must be entered into the HP 8922G.



Method 1

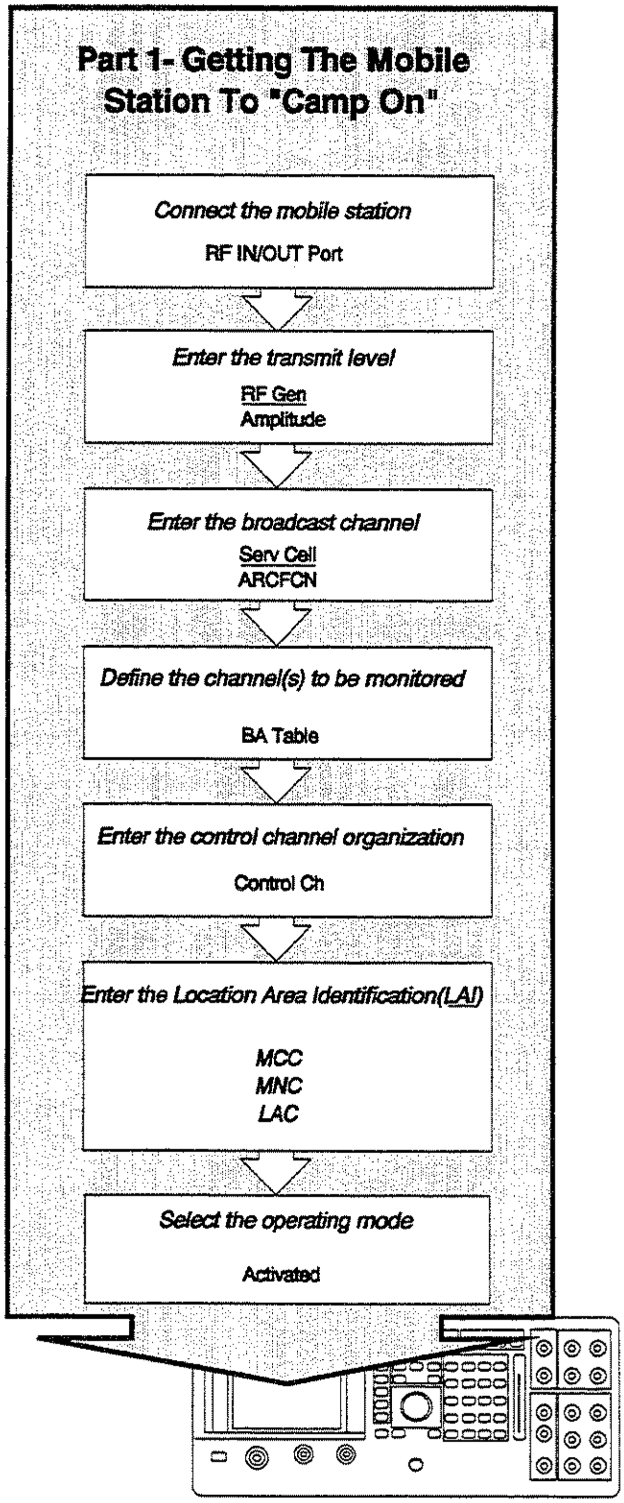
Use Method 1 when you have a fully-operational mobile station, capable of establishing and maintaining a link.



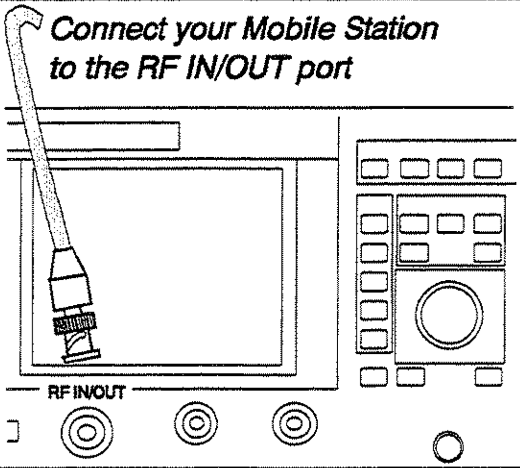
Part 1 consists of the steps to ouTput a broadcast channel from the HP 8922G and to get the mobile station to "camp on" to the broadcast channel.

Part 2 consists of steps for entering information about the mobile station and originating and receiving the GSM calls with the HP 8922G.

Part 3 consists of the steps to partially test the transmitter and receiver sections of the mobile station (DSP Analyzer, Bit Error Test, Fast TX Carrier Power).

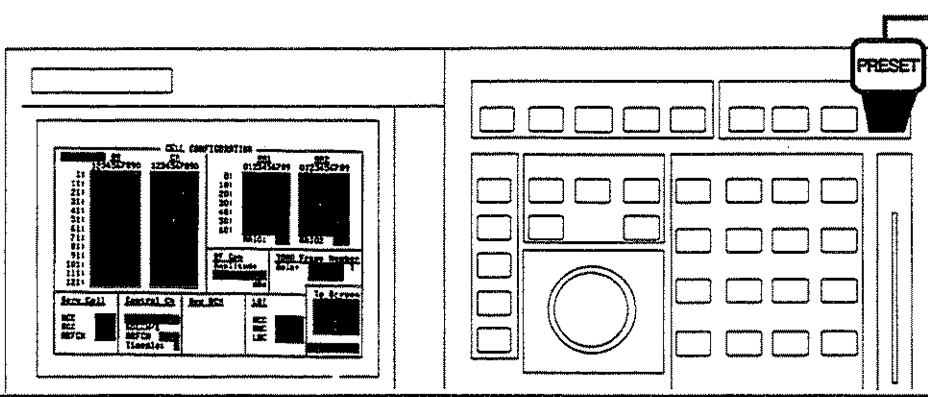

Part 1- Getting The Mobile Station To "Camp On"
Connect the mobile station
RF IN/OUT Port
Enter the transmit level
RF Gen
Amplitude
Enter the broadcast channel
Serv Cell
ARCFCN
Define the channel(s) to be monitored
BA Table
Enter the control channel organization
Control Ch
Enter the Location Area Identification(LAI)
MCC
MNC
LAC
Select the operating mode
Activated

1 *Connect your Mobile Station to the RF IN/OUT port*



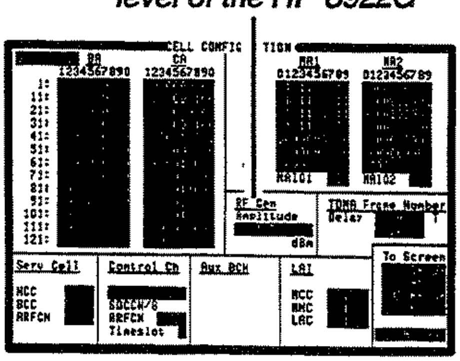
How to get the mobile station to "Camp On" the HP 8922G.

2 **Remove all previous settings from the HP 8922G memory:**

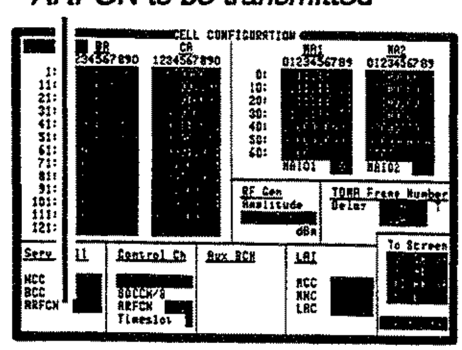


Press (The CELL CONFIGURATION screen should display.)

3 *Enter the transmit power level of the HP 8922G*

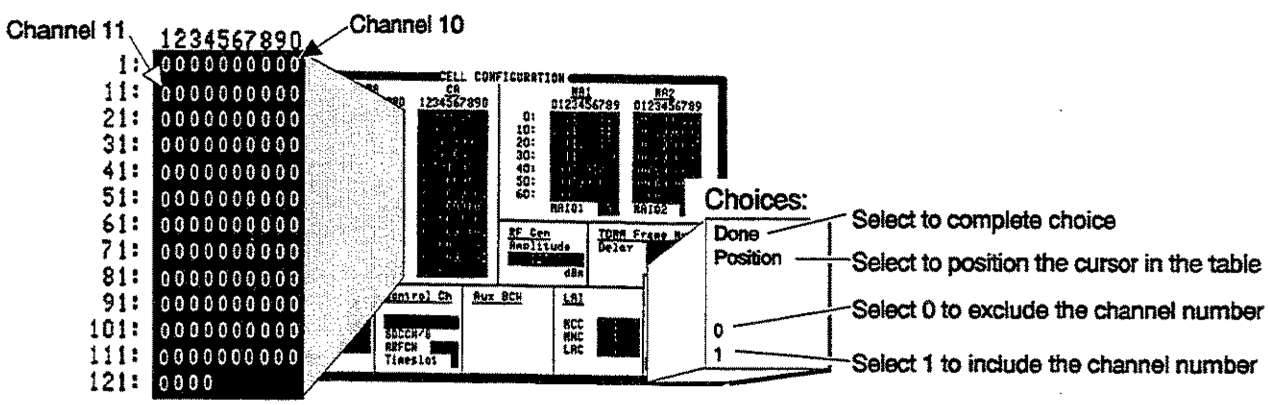


4 *Enter the Broadcast Channel ARFCN to be transmitted*

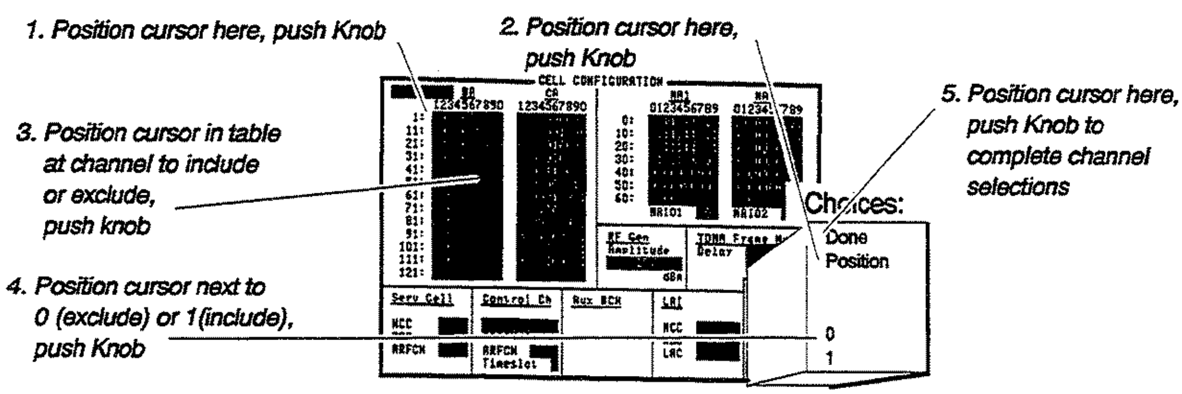


The BA Table defines the channels the mobile station will monitor when it is searching for a Broadcast Channel (BCH) or measuring power levels of adjacent cells.

Editing information for the BA table modification (see steps below)



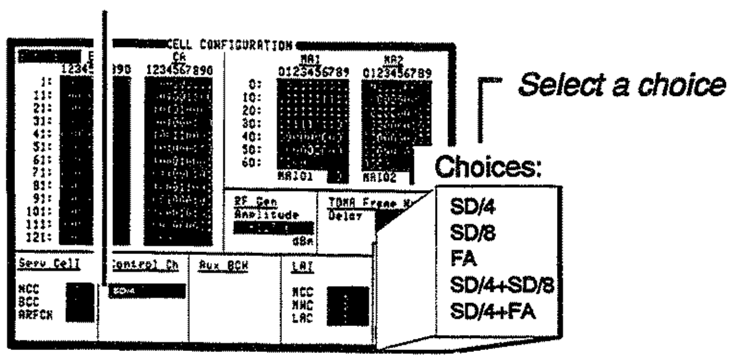
5 Select the channels for the BA table:



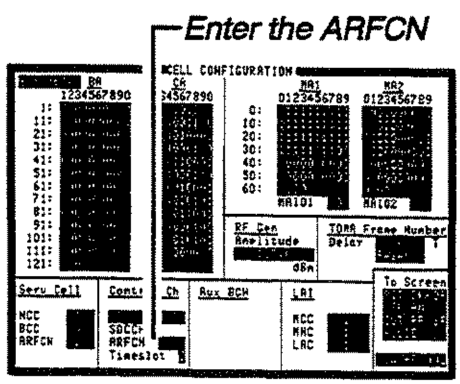
Select a control channel. The control channel (Control Ch field) is used when originating or placing a call.

For information describing the Control Ch fields refer to Screens: Cell Config (Control Ch)

6 Select the control channel organization:



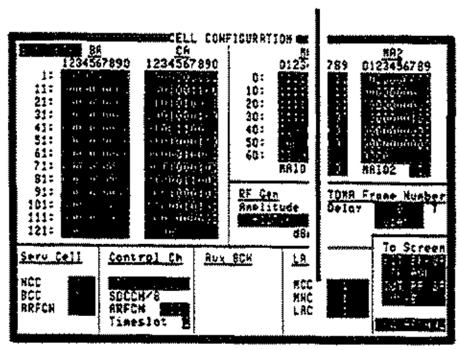
7 Enter the ARFCN if SD/8 was selected in Step 6:



Location Area Identification (LAI) fields must be entered. The Mobile Country Code (MCC field) and Mobile Network Code (MNC field) numbers must be part of the mobile station's list of allowable systems. The list of allowable systems is found in your mobile station's SIM module.

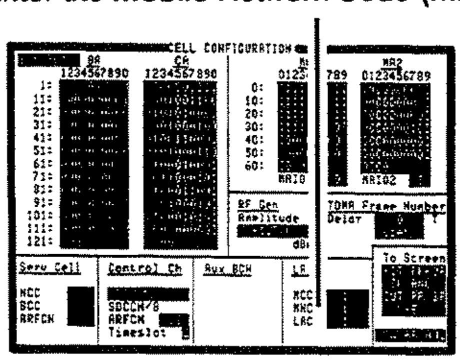
8

Enter the Mobile Country Code (MCC)



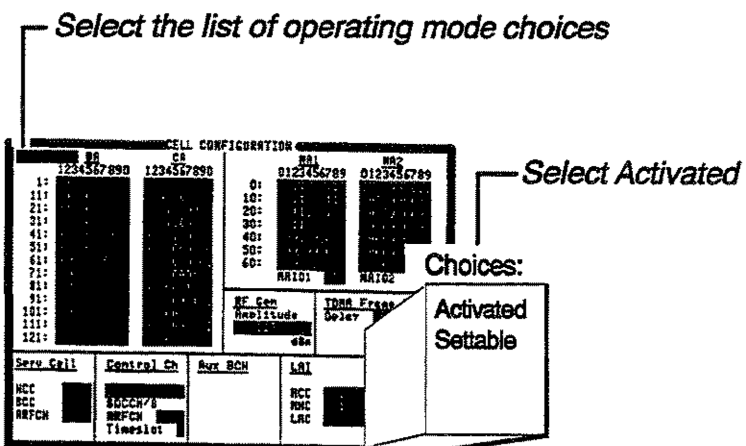
9

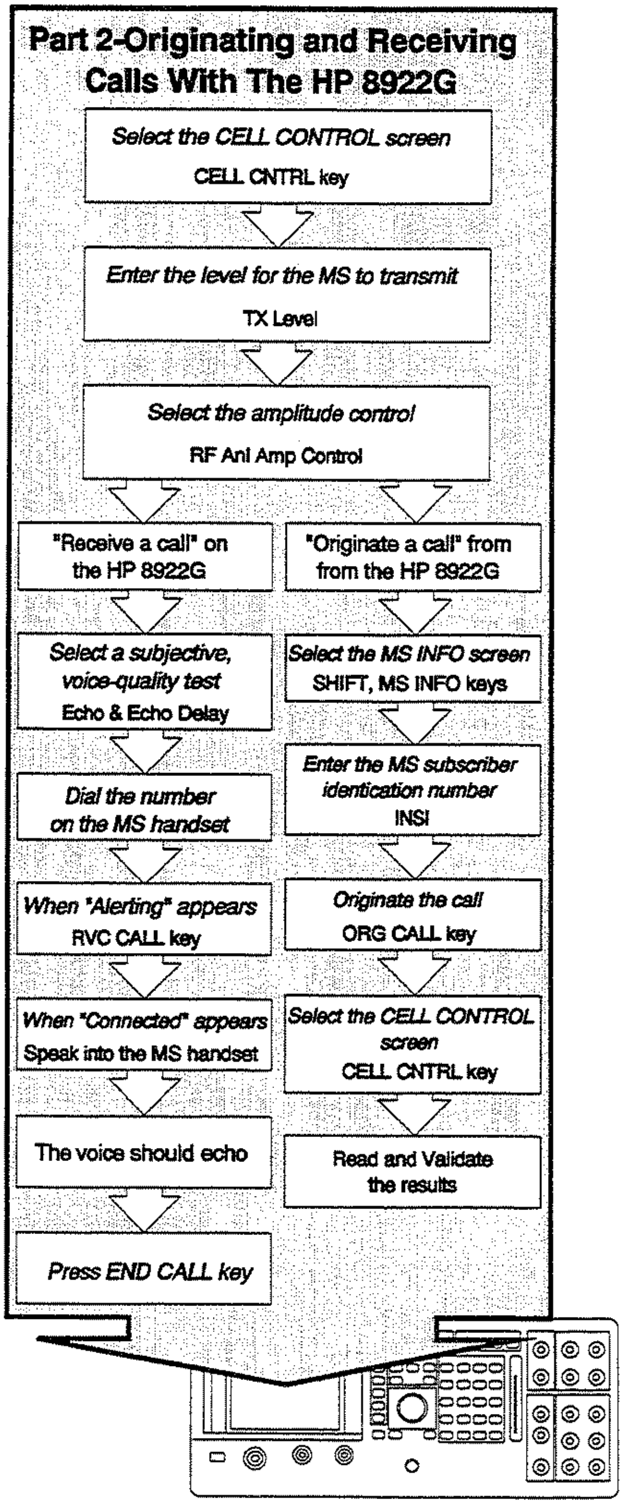
Enter the Mobile Network Code (MNC)



To begin transmitting the Broadcast Channel, the operating mode is changed from "Settable" to "Activated". When "Activated" is displayed the HP 8922G begins transmitting a broadcast channel and the mobile station should "camp on" momentarily.

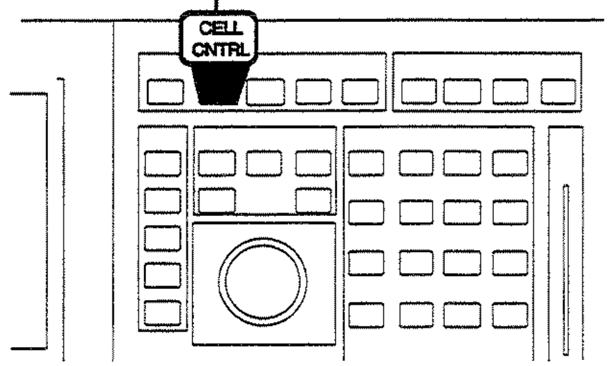
10



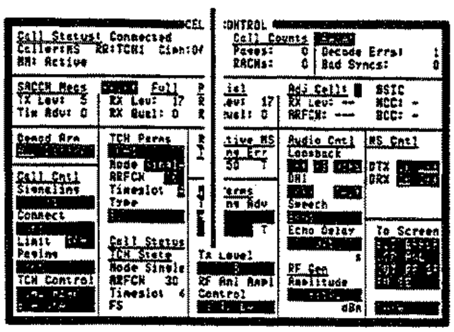

Part 2-Originating and Receiving Calls With The HP 8922G
Select the CELL CONTROL screen
CELL CNTRL key
Enter the level for the MS to transmit
TX Level
Select the amplitude control
RF Anl Amp Control
"Receive a call" on the HP 8922G
Select a subjective, voice-quality test
Echo & Echo Delay
Dial the number on the MS handset
When "Alerting" appears
RVC CALL key
When "Connected" appears
Speak into the MS handset
The voice should echo
Press END CALL key
"Originate a call" from from the HP 8922G
Select the MS INFO screen
SHIFT, MS INFO keys
Enter the MS subscriber identcation number
INSI
Originate the call
ORG CALL key
Select the CELL CONTROL screen
CELL CNTRL key
Read and Validate the results

How to originate and receive calls.

1 Press to display the CELL CONTROL screen



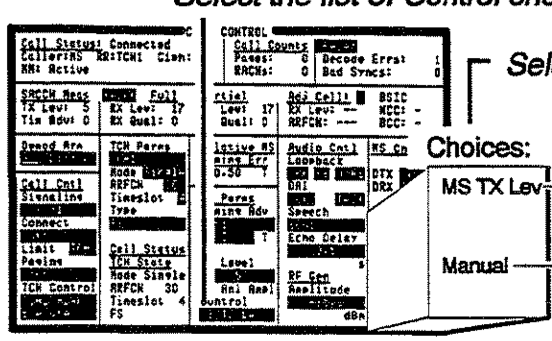
2 Enter the power level the mobile station will transmit



The correct sensitivity for the RF Analyzer input setting must be set based on the mobile station's transmit level. This can be automatic or manual.

3 Select the RF Analyzer amplitude control mode:

Select the list of Control choices



Select the choice

Choices:

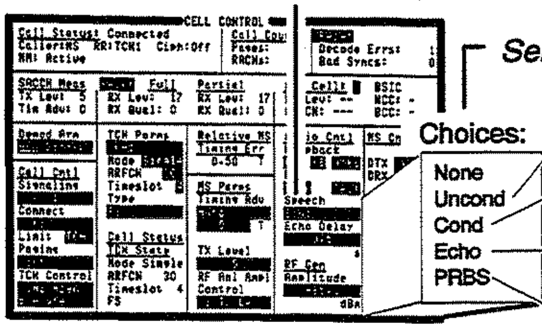
MS TX Lev — Select for automatically setting the sensitivity based on the mobile station transmit level.

Manual — Select for manually setting the expected sensitivity of the mobile-station transmit level.

Use the Echo field to verify that a link has been established and to make a subjective voice quality test.

4 To make a subjective voice quality test:

Select the list of Speech choices



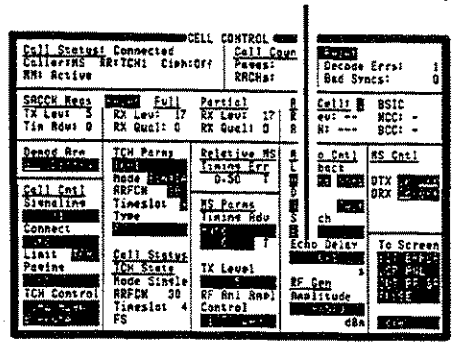
Select the choice

Choices:

- None — Select to route signal to MON/SPEECH OUT port
- Uncond — Select to route signal through Mod Dist section for filtering and audio gain
- Cond
- Echo — Select to retransmit speech with a selectable delay
- PRBS — Select to perform bit-error-rate tests

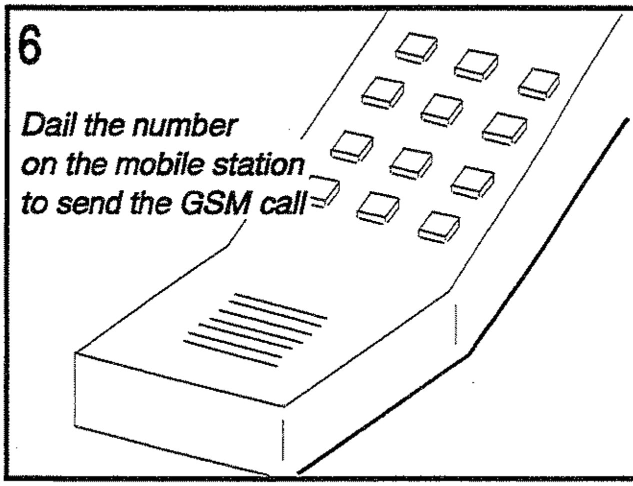
5 Enter a delay period if Echo is selected in Step 4:

Enter the delay time

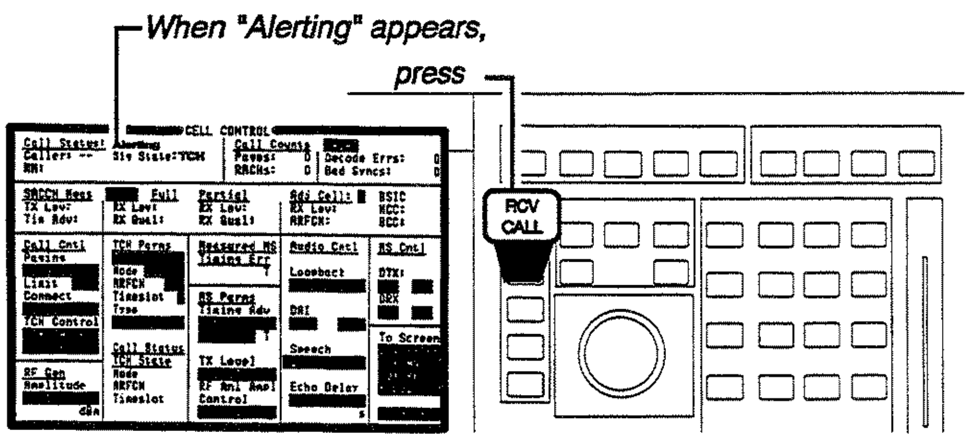


To place a call from the mobile station and "receive the call" on the HP 8922G.

6



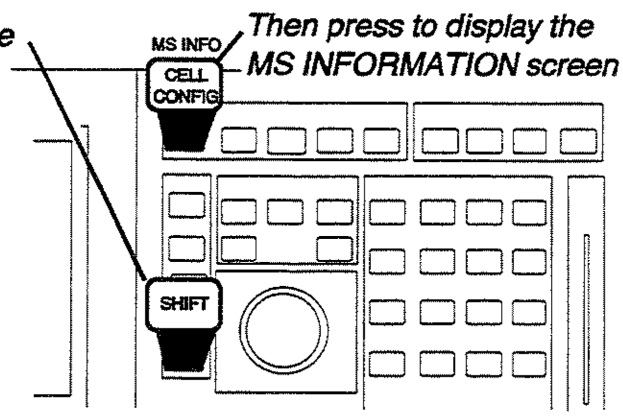
7



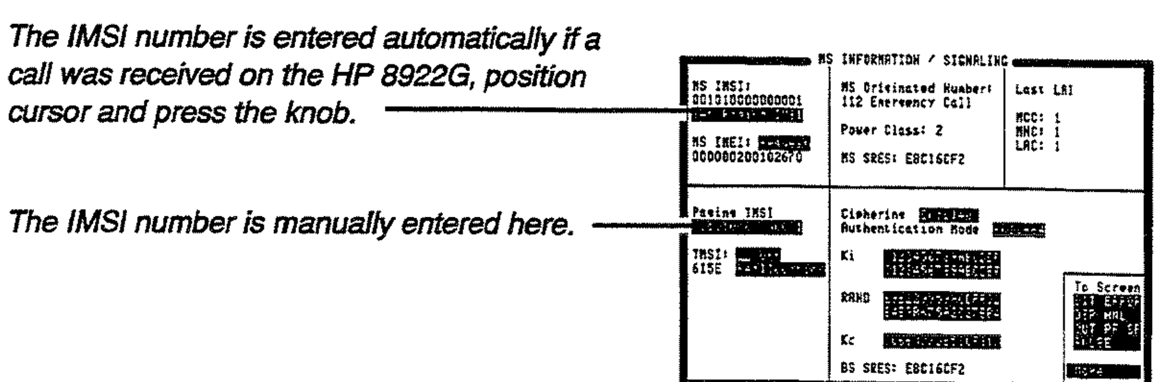
To "originate a call" from the HP 8922G.

The HP 8922G must have the international mobile subscriber identification(IMSI) number entered.

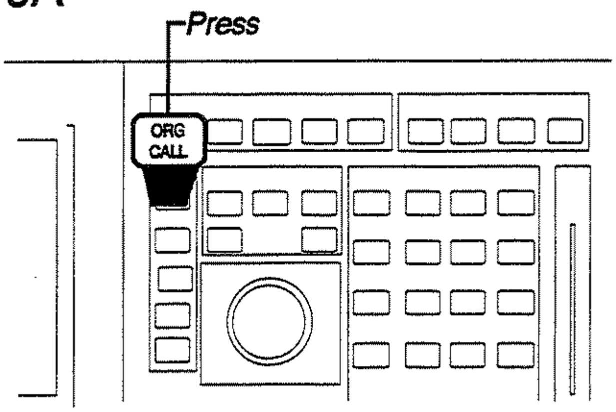
6A

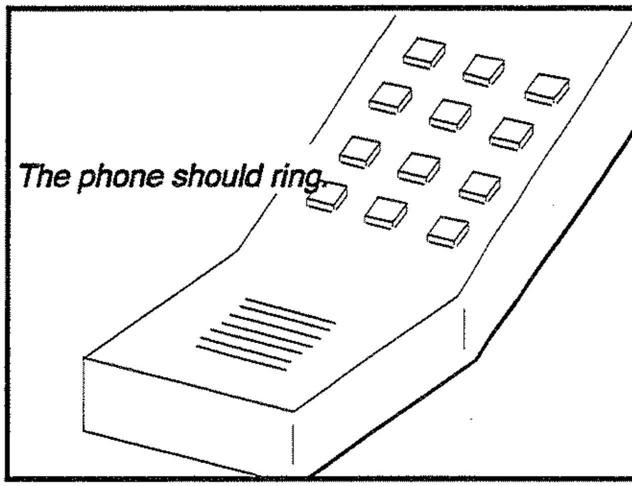


7A Enter the MS subscriber identification number

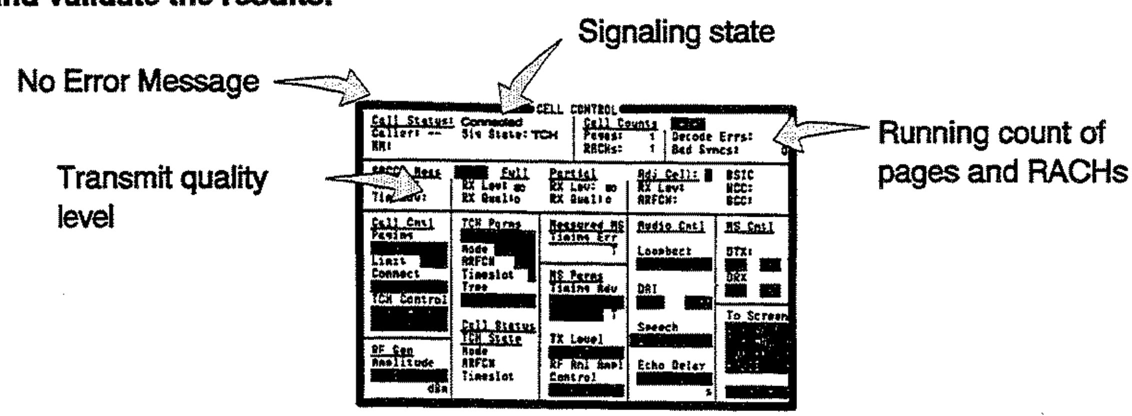


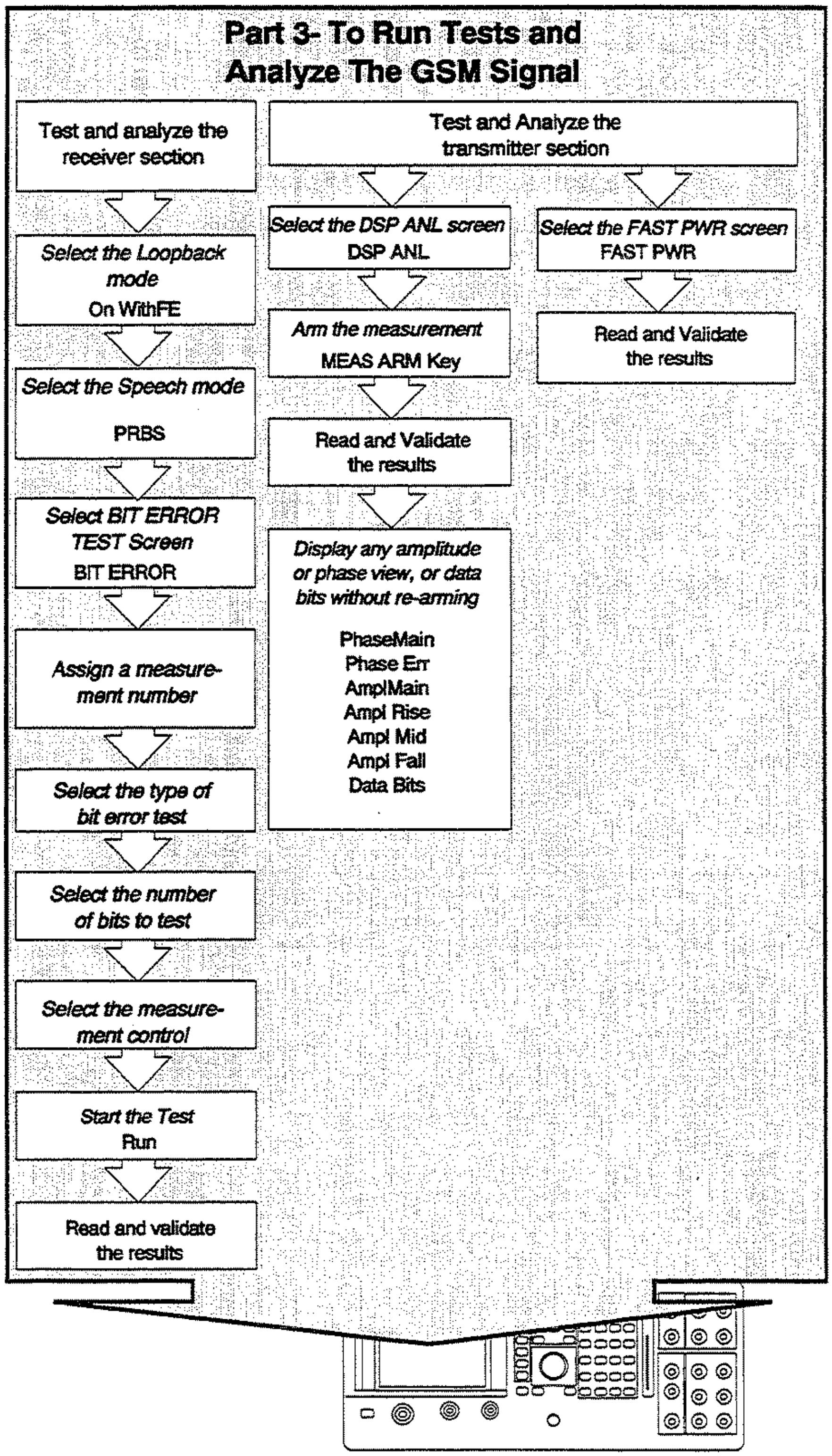
9A





Read and validate the results:

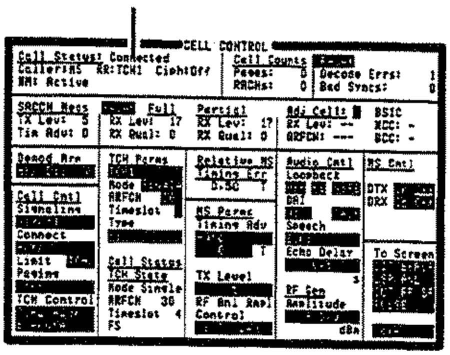



Part 3- To Run Tests and Analyze The GSM Signal
Test and analyze the receiver section
Select the Loopback mode
On WithFE
Select the Speech mode
PRBS
Select BIT ERROR TEST Screen
BIT ERROR
Assign a measurement number
Select the type of bit error test
Select the number of bits to test
Select the measurement control
Start the Test
Run
Read and validate the results
Test and Analyze the transmitter section
Select the DSP ANL screen
DSP ANL
Arm the measurement
MEAS ARM Key
Read and Validate the results
Display any amplitude or phase view, or data bits without re-arming
PhaseMain
Phase Err
AmplMain
Ampl Rise
Ampl Mid
Ampl Fall
Data Bits
Select the FAST PWR screen
FAST PWR
Read and Validate the results

To test and analyze the transmitter section of the mobile station using the DSP Analyzer screen.

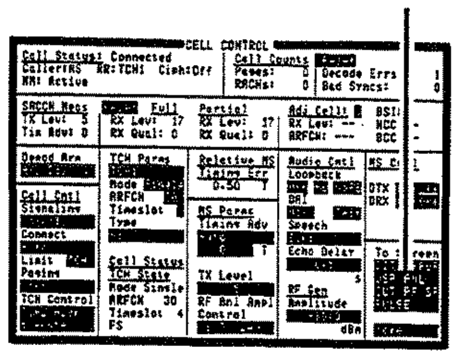
1

Call Status: Connected



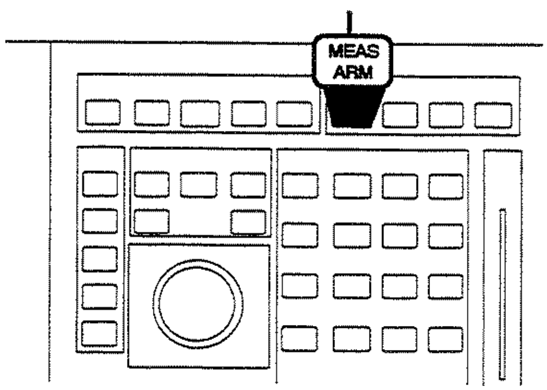
2

Select DSP ANL

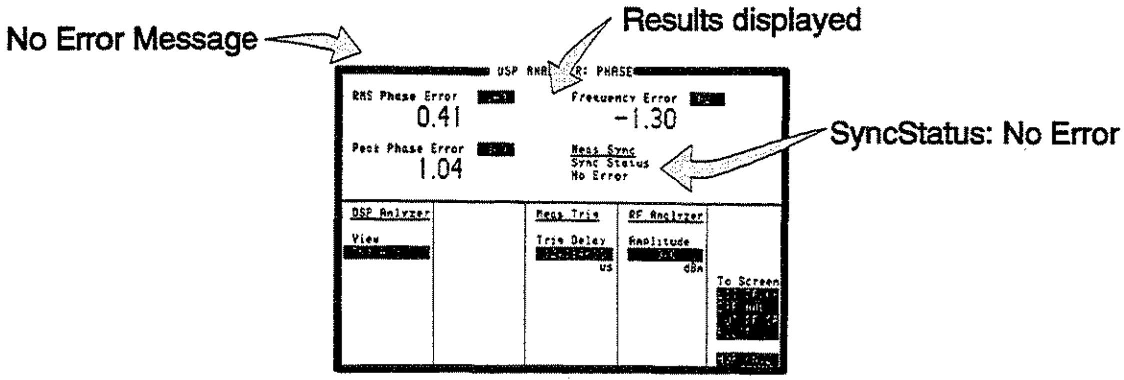


3

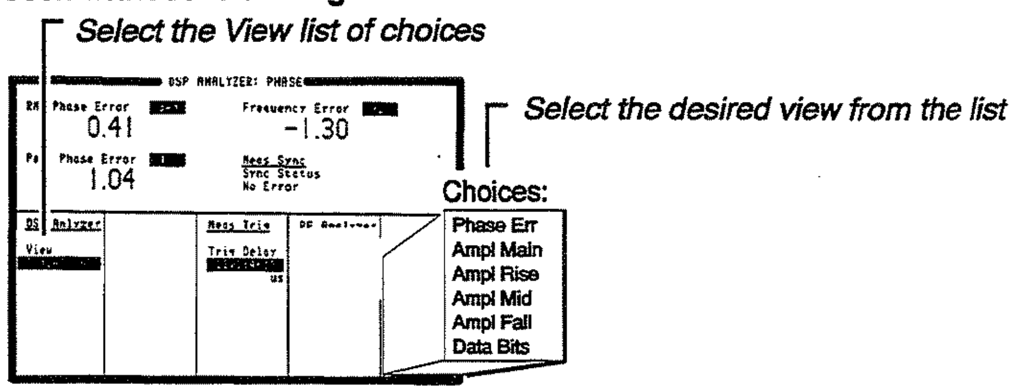
Press to arm the measurement



4 **Read and validate your measurement.**



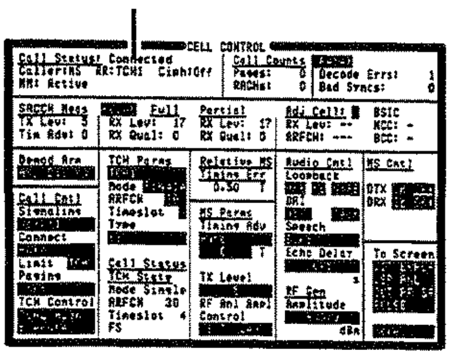
After a DSP analyzer measurement has been made, any of the phase or amplitude views can be chosen without re-arming.



To test and analyze the transmitter section of the mobile station using the FAST PWR screen.

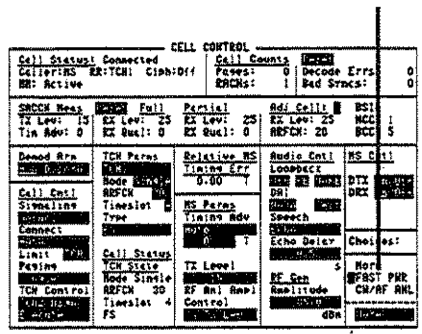
1

Call Status: Connected



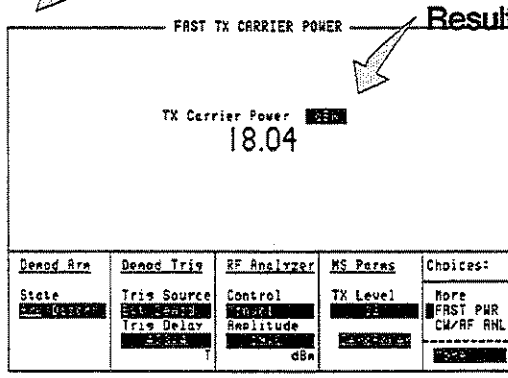
2

Select FAST PWR



3 No Error Message

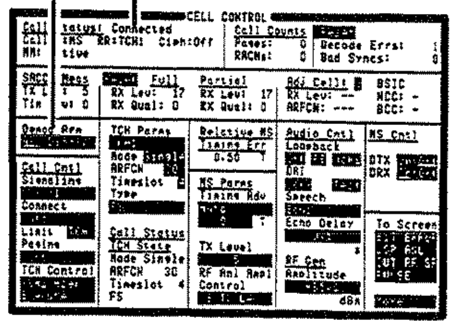
Results displayed



To test and analyze the receiver section of the mobile station.

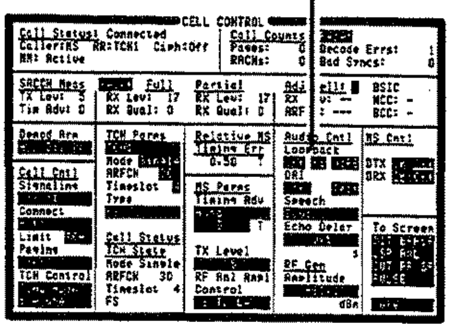
1 *Demod Arm: Arm*

Call Status: Connected



2 The mobile station must be in loopback mode:

Select the Loopback mode



Off — No loopback

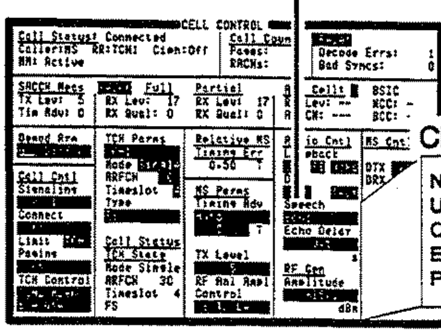
FE — Loopback on, with frame erasure

NoFE — Loopback on, without frame erasure

3 The HP 8922G needs to send a Pseudo-Random Bit Sequence:

Select the list of Speech choices

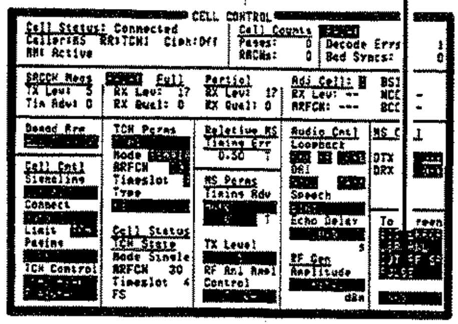
Select PRBS



Choices:

None
Uncond
Cond
Echo
PRBS

4 *Select BIT ERROR to display the BIT ERROR TEST screen*

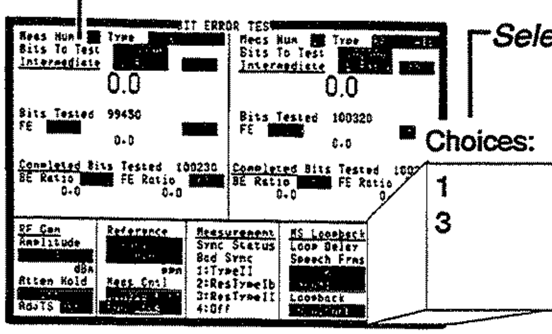


The HP 8922G is capable of doing four bit error tests simultaneously. All four bit error tests can be set up before running the test, however only two of the bit error tests are displayed at one time. The numbers selected in the Meas Num field determine which bit error test will be displayed.

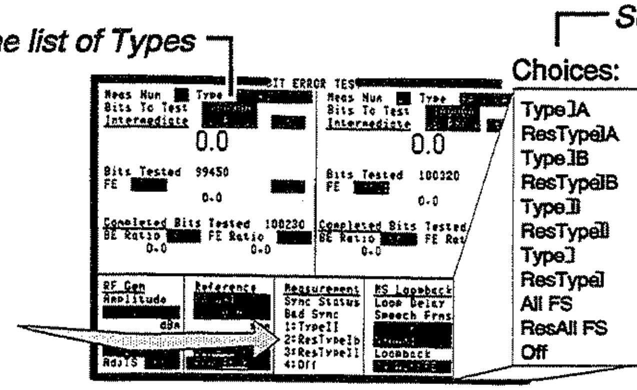
5 **Assign a Measurement Number for the left portion of the screen:**

Select a number to identify the bit error test results

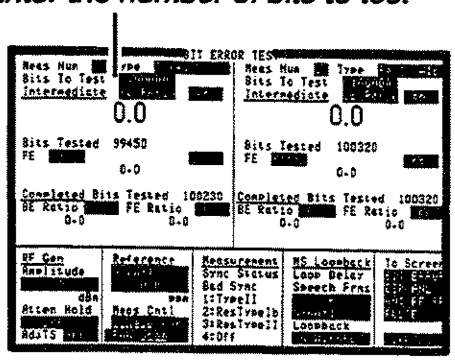
Select the number



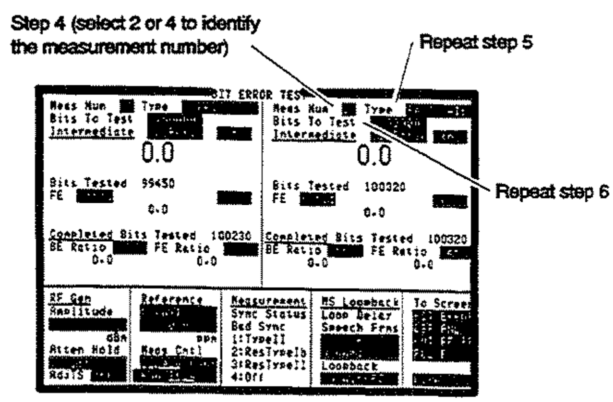
6 Select the type of bit error test results to display:



7

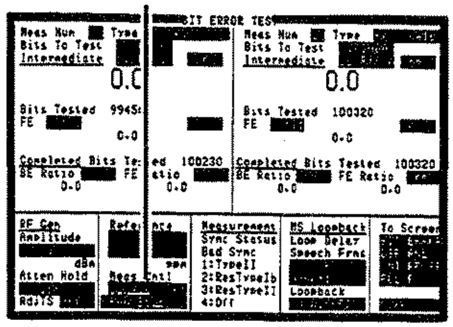


Repeat steps 4 through 6 for the second measurement results to display



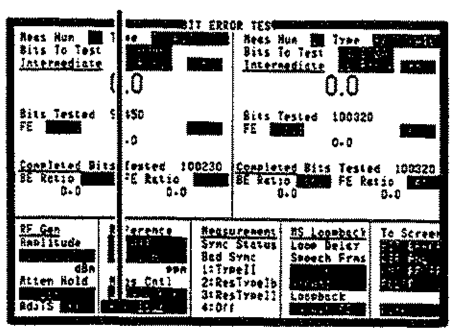
8 Select the type of Measurement Control for the bit error test :

Select Single or Cont(Continuous)

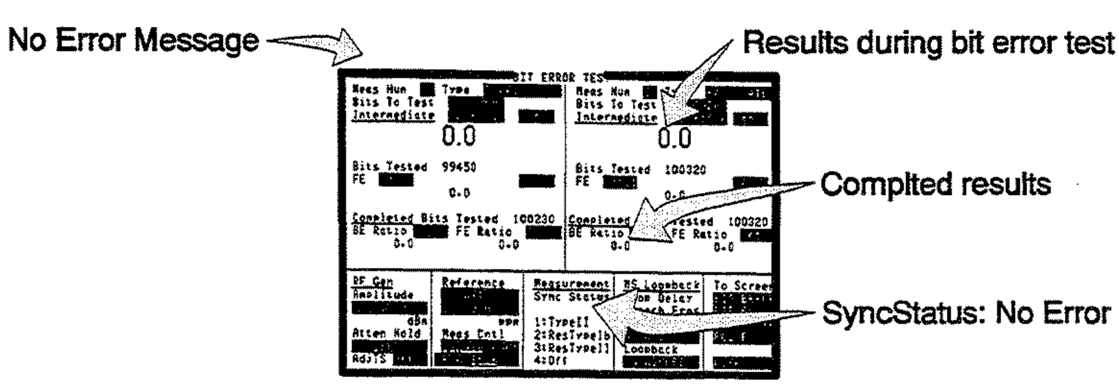


9 Start the bit error test:

Select Run

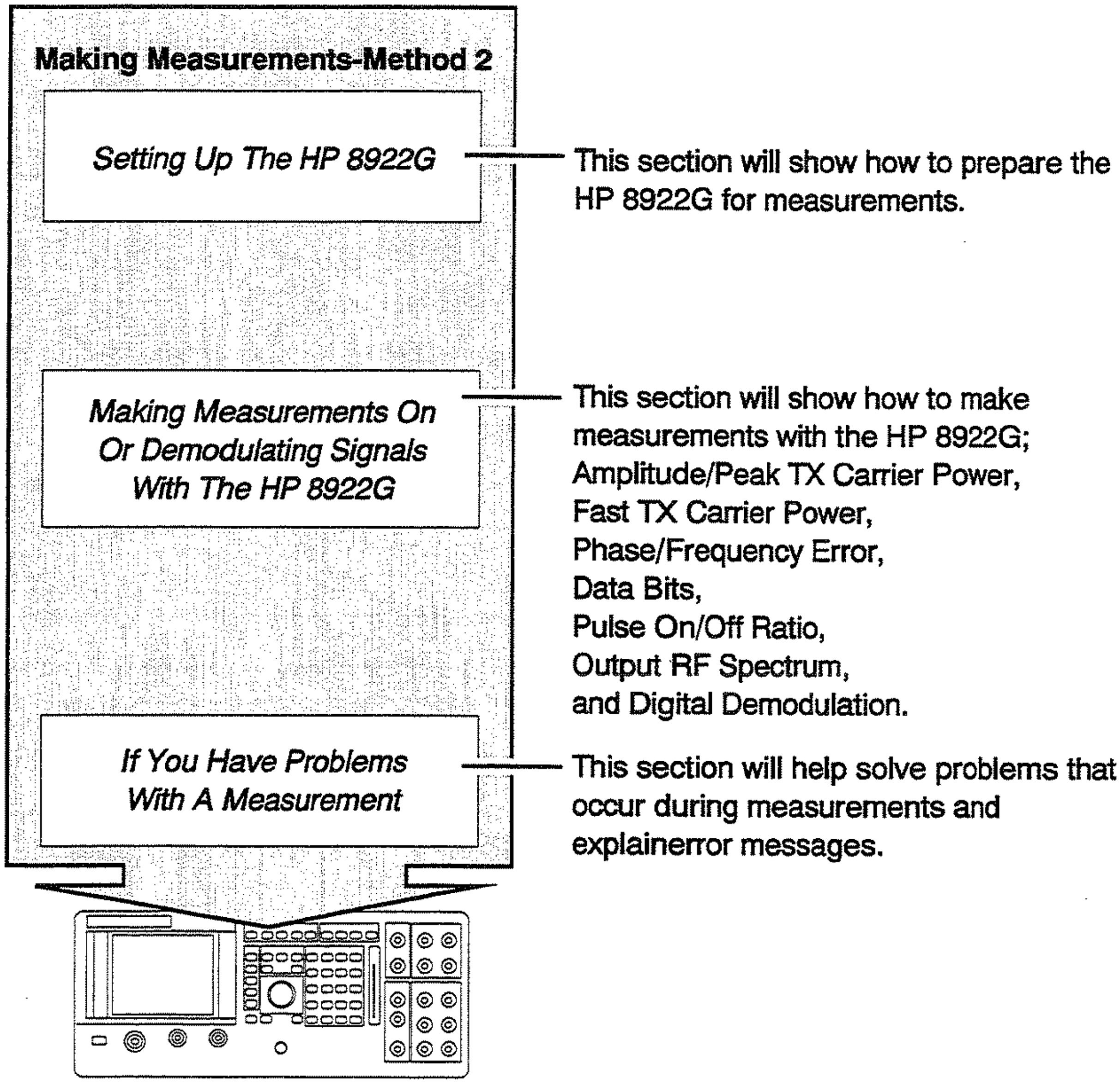


10 Read and validate the bit error tests



Method 2

Use this method when you do not want to establish a link between the HP 8922G and your mobile station (such as when testing modules).



What You Need to Provide

If you want to use this method to learn how to operate the HP 8922, you must provide a GSM signal. In most cases you will also need to provide a trigger signal.

If you do not have the capability for generating a GSM signal that meets the requirements listed below, the HP 8922A K01 Pulse/Timing Generator is a good source. It provides GSM formatted data and clock signals and a trigger signal that modulate the HP 8922G generator.

GSM Signal Requirements

The GSM signal must have the following:

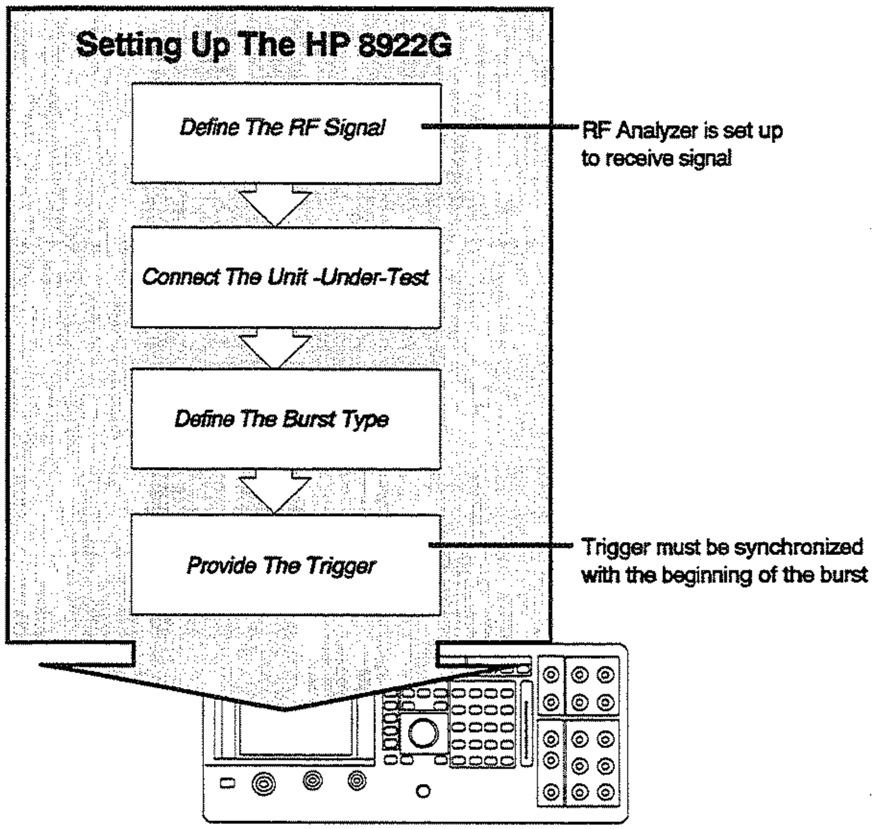
- At least one pulse every two frames with equal length pulses.
- One of the following midambles (unless you choose Amplitude in the Sync Mode field):
  1. Training Sequence Color Code (TSC) 0, 1, 2, 3, 4, 5, 6, 7.
  2. Random Access Channel (RACH).
  3. Synchronization Channel (SCH).
- A known amplitude (to within ±3 dB).
- For digital demodulation, an input signal that meets the following specifications:
  1. Frequency Error < 0.1 ppm
  2. RMS Phase Error < 5°
  3. Peak Phase Error < 20°
  4. Amplitude Flatness < 0.1 dB (during burst)

Finding More Information

Refer to Volume 2, Reference Information, for the specific requirements and features of each screen, key, or connector.

Setting up the HP 8922G

Whenever measurements are made without placing a call between the HP 8922G and the mobile station, you must set the HP 8922G to pre-measurement conditions. The steps for setting these conditions are shown in this section.

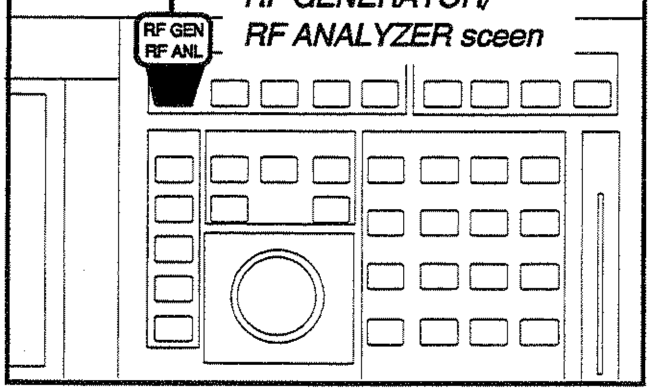


All GSM measurements begin with accessing the RF GENERATOR/RF ANALYZER screen to define the RF signal, and to select your signal's connection.

Press the PRESET key or cycle the power to the HP 8922 to place the instrument in a known state.

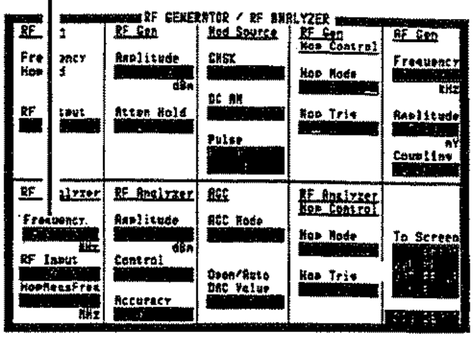
1

Press to display the RF GENERATOR/ RF ANALYZER sceen



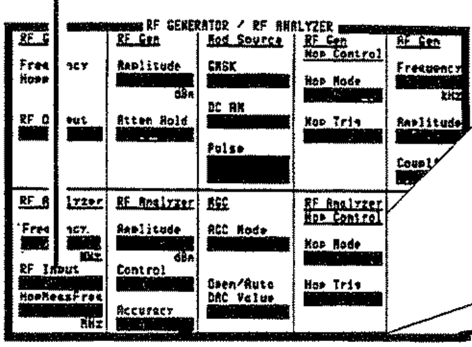
2

Enter your signal's RF Frequency



3

Select the RF Input list of choices



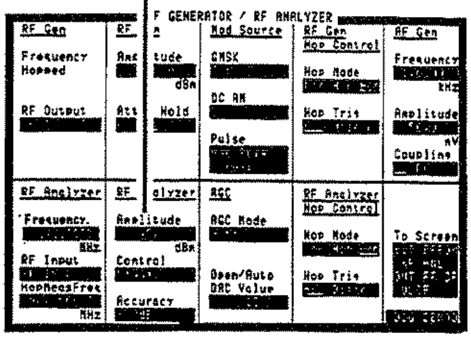
Select an RF input from the list

Choices:

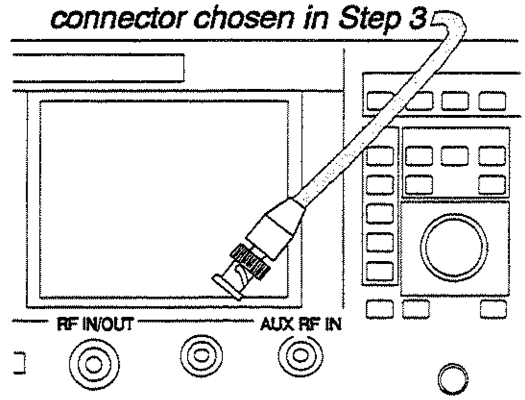
AUX RF IN – If your signal's amplitude level range is -36 to +20 dBm.

RF IN/OUT – If your signal's amplitude level range is 0 to +45 dBm. (Must be selected for Peak Transmitter Carrier Power or Pulse On/Off measurements).

4 Enter the expected amplitude of your signal



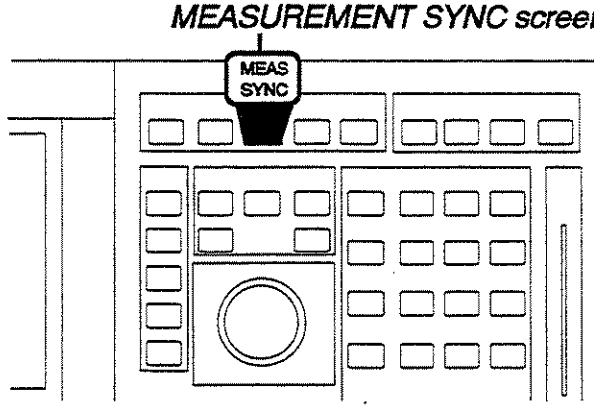
5 Connect your signal to the HP 8922 connector chosen in Step 3



If you want to demodulate clock and data from your signal, turn to Performing Digital Demodulation. For all other measurements ...

Continue the set up by accessing the MEASUREMENT SYNC screen to define the your signal's midamble or "burst" type. The burst type must be displayed in the Burst Def: field before it can be selected.

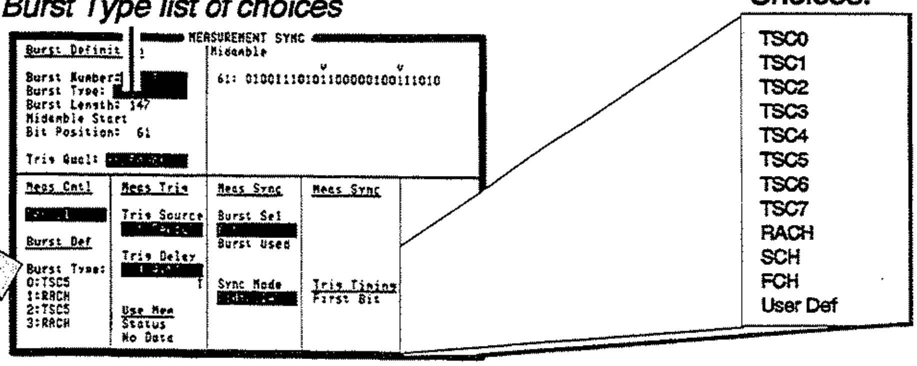
6 Press to display the MEASUREMENT SYNC screen



7 Define your signal's Burst Type: (If it is already displayed in Burst Def: go to Step 9)

Select the Burst Type list of choices

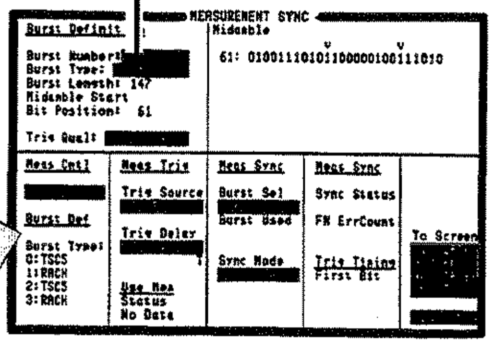
Burst Def is the list of currently defined burst types



Select your signal's Burst Type

8 **Assign any of the 4 available Burst Numbers to your signals' Burst Type defined in Step 7:**

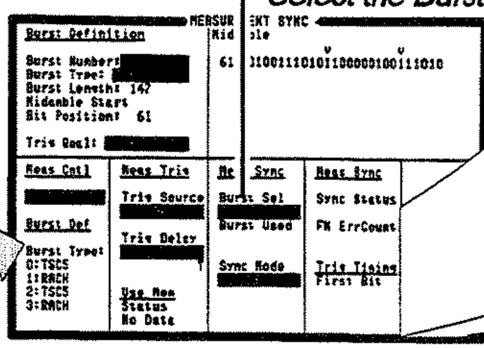
Select a number to identify your signal's Burst Type



Burst Def types will update

9 **Select the Burst Number the HP 8922G will use in the measurement:**

Select the Burst Sel list of choices



Your signal's Burst Type must be displayed to select

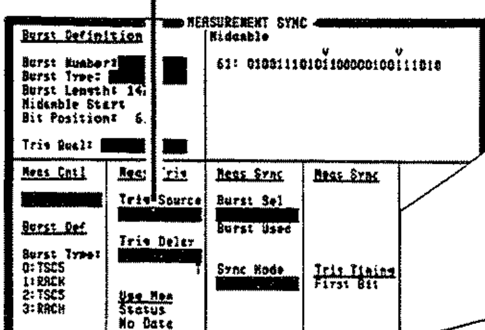
Choices:

0
1
2
3

Select the Burst Number that corresponds to your signal's Burst Type

10

Select the Trigger Source list of choices



Select a Trigger Source from the list

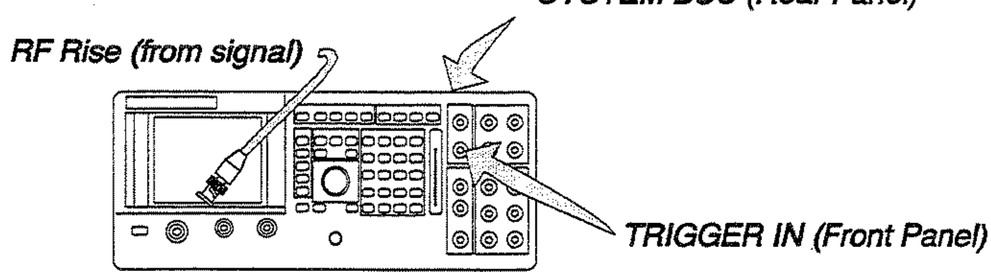
Choices:

Ext Demod — Rear panel SYSTEM BUS connector
RF Rise — Rising edge of the amplitude envelope
Ext Meas — Front panel TRIGGER IN connector

Trigger signals on the SYSTEM BUS or the TRIGGER IN front-panel connector must occur near bit 0 of the transmitted burst, or be delayed to occur near bit 0 using the Trigger Delay field (see Screens, Measurement Sync).

If RF Rise is chosen as the Trigger Source, the trigger is automatically generated when the rising edge of the amplitude envelope is detected.

11 **Connect the trigger signal to the HP 8922G:**



You have now completed setting up the HP 8922G for GSM measurements or demodulating signals.

See the following section for:

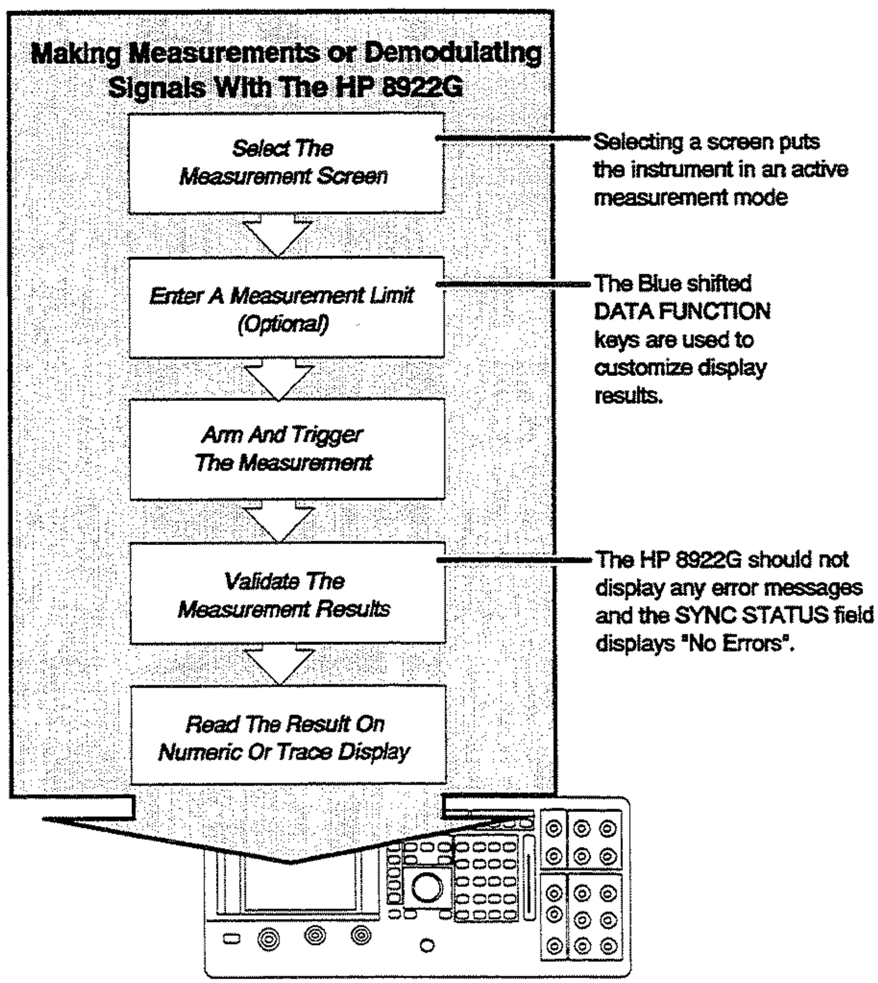
Making an Amplitude and Peak Transmitter Carrier Power Measurement,
Making a Phase/Frequency Error Measurement,
Making a Data Bits Measurement,
Making a Pulse On/Off Ratio Measurement,
Making an Output RF Spectrum Measurement,
Performing Digital Demodulation.

Making Measurements on Modules with the HP 8922G

Making measurements on modules begins with selecting a measurement screen from the To Screen (in the lower-right corner of the display). After completing the measurement setup just described, all you need to do is arm the instrument. The measurement will then be made on the next valid trigger event. You can display the measurement results in a graphic format (a trace, or in some cases, a meter) or in a numeric format (a digital readout).

Demodulating Signals with the HP 8922G

Digital demodulation begins with selecting DIG DEMOD from the To Screen (in the lower-right corner of the display). After completing the measurement setup just described, all you need to do is follow the instructions given in *Performing Digital Demodulation*.



Choosing a Measurement or Demodulation

After you have set up your instrument, choose one of the following procedures.

Making an Amplitude/Peak Transmitter Carrier Power Measurement

The amplitude measurement provides 12 amplitude measurements, taken from time-positions within the burst. You can choose your own time-positions, or use the default settings. The dynamic range of the amplitude envelope measurement is specified to −30 dB. You can also view the rising, middle, or falling portions of the amplitude trace.

Peak transmitter carrier power averages the transmitter carrier power for a single burst. The average is calculated over the time that the useful information bits are transmitted. Performing this measurement also displays peak± flatness over the useful bits in a measured burst.

Making a Fast Transmitter Carrier Power Measurement

Fast transmitter carrier power averages the transmitter carrier power for a single burst. The average is calculated over the time that the useful information bits are transmitted. Performing this measurement also displays peak± flatness over the useful bits in a measured burst.

Measuring Phase/Frequency Error

Phase error and frequency error measure the difference between a theoretical, expected phase trajectory for a signal, and a sampled measurement of that signal. You can also view the phase error trace versus time.

Making a Data Bits Measurement

The Data Bits screen displays the demodulated data with midamble bits and RF level error bits marked.

Making a Pulse On/Off Ratio Measurement

Pulse on/off ratio measures the ratio of the average transmitter-power (pulse on) to a specified time-position when power is reduced (pulse off). You can view the rising or falling portion of the pulse trace.

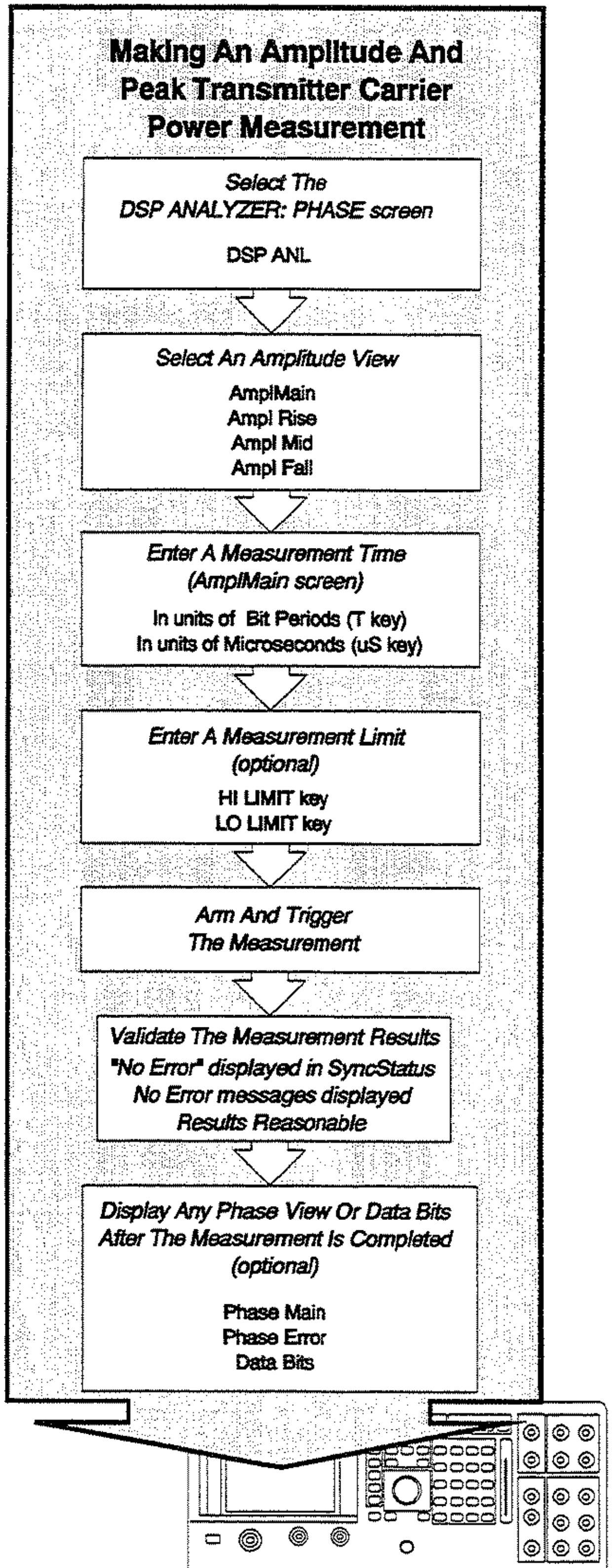
Making an Output RF Spectrum Measurement

Output RF spectrum measures the spectral power (due to the effects of ramping or modulation) at a specified frequency offset. You can view the output RF spectrum trace.

Performing Digital Demodulation

Digital demodulation demodulates 0.3 GMSK clock and data from the RF input signal. The demodulated clock and data are output to the front-panel Demodulation Out connectors, and to the rear-panel System Bus connector.

Making an Amplitude/Peak TX Carrier Power Measurement

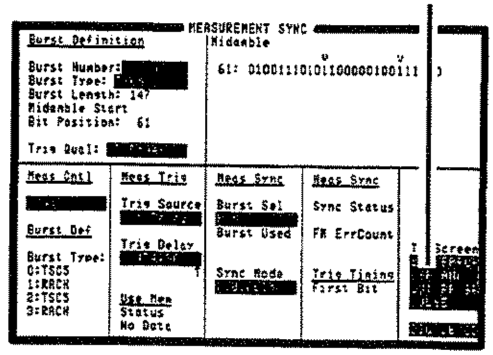


The HP 8922G must be set up before starting this measurement, see Setting Up The HP 8922G.

The Peak Transmitter Carrier Power will be valid if the the RF IN/OUT connector is chosen as the RF Input.

1

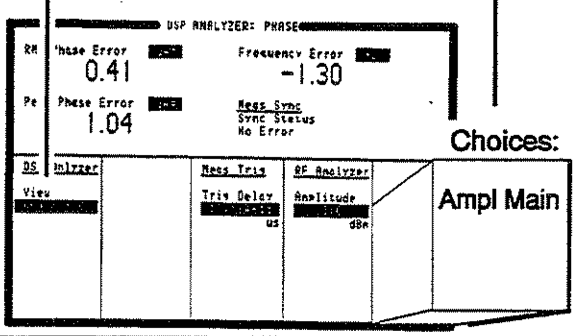
Select DSP ANL



2

Select the View list of choices

Select Ampl Main from the list



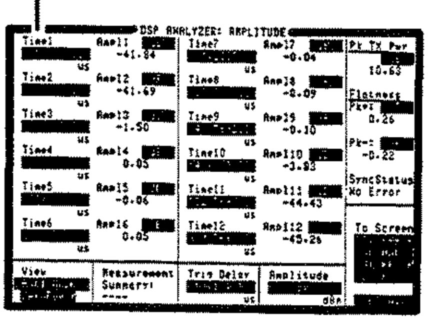
The DSP ANALYZER: AMPLITUDE Main screen displays 12 power measurements. The time displayed with each measurement is relative to bit 0 of the GSM burst.

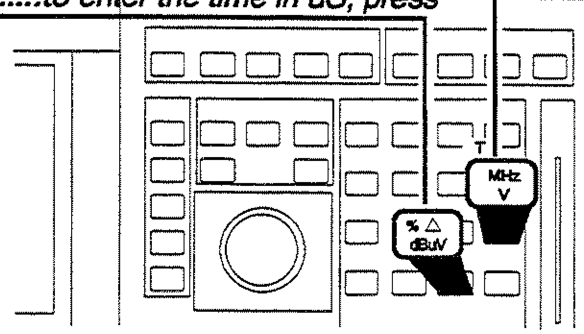
3 **Enter the measurement time:**

Key in the measurement time,

............to enter the time in bit period, press

............to enter the time in uS, press



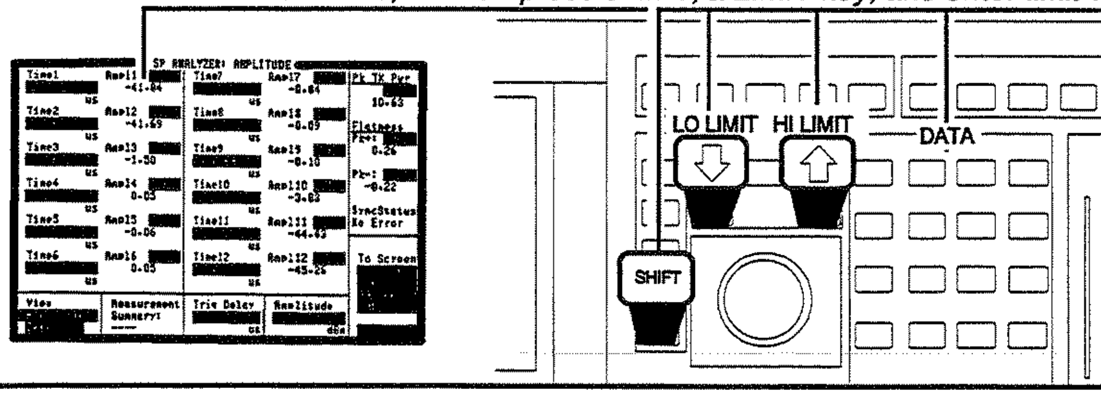


It is optional to set high and low measurement limits. If the measurement exceeds a limit, the Hi or Lo annuciators will flash.

Limits can also be set for Pk Tx Pwr or Flatness measurements.

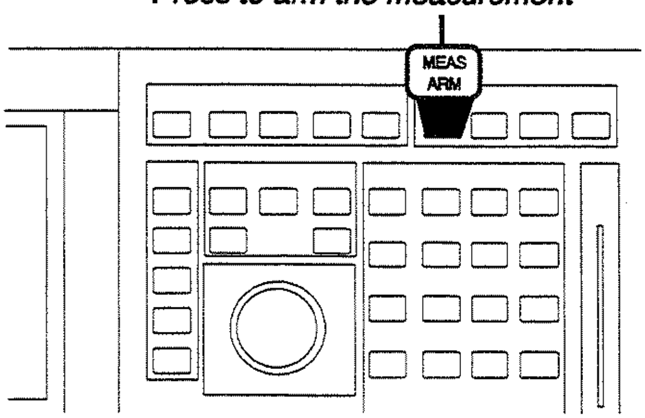
4 **Enter the measurement limit:**

Position cursor here,......then press SHIFT, a LIMIT key, and enter limit value

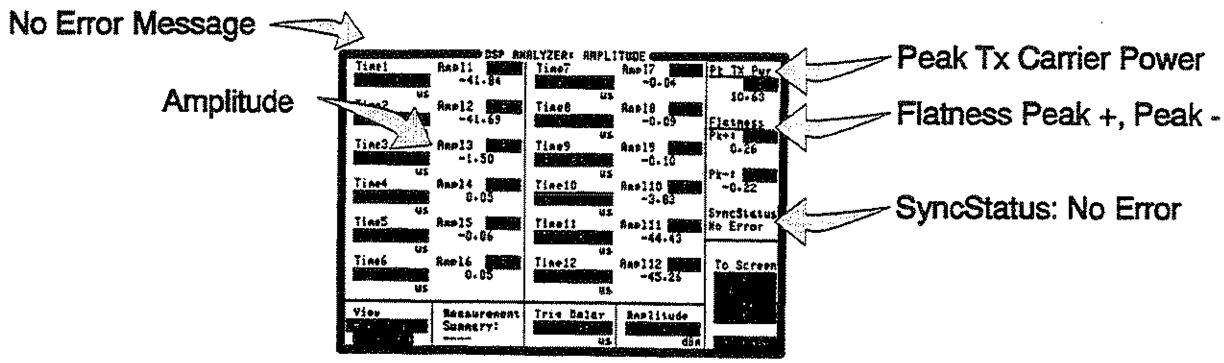


5

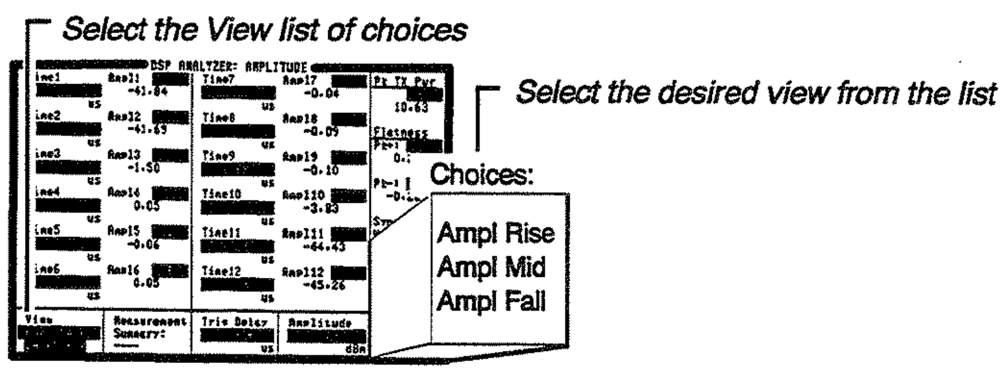
Press to arm the measurement



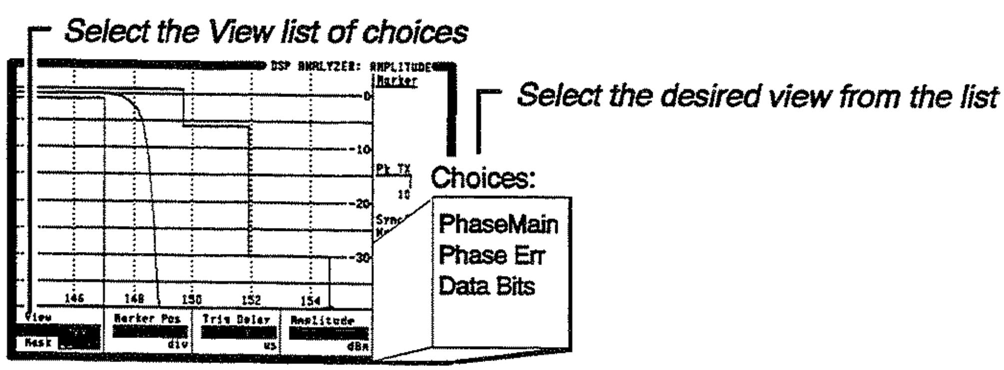
6 **Read and validate your measurement.**



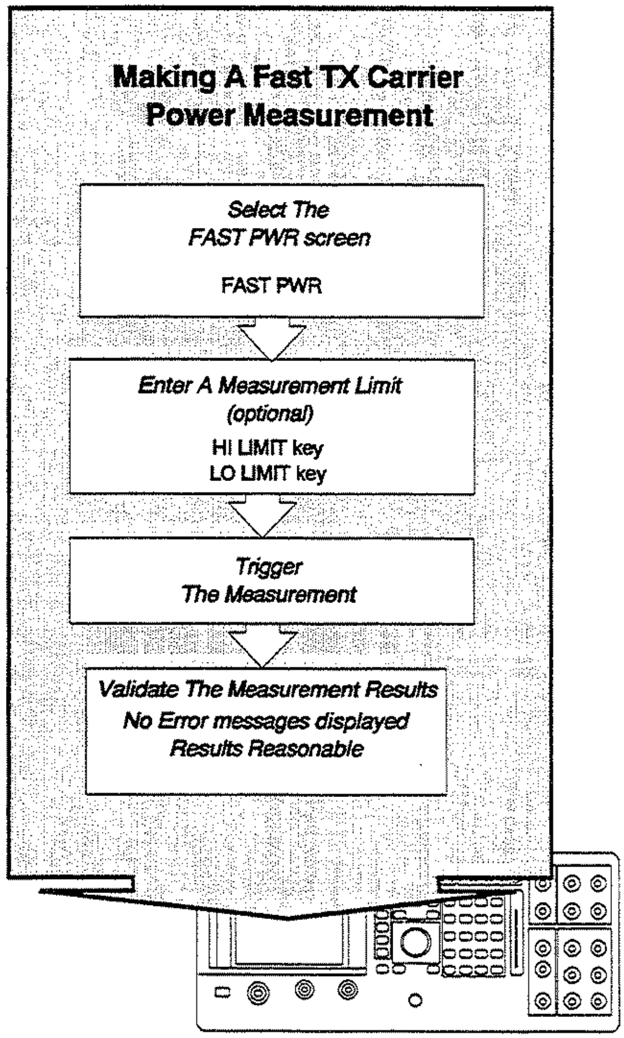
7 **Display portions of the amplitude envelope as a trace:**



After a DSP Analyzer measurement has been made, any of the phase views or data bits can be chosen without re-arming and triggering.



Making a Fast TX Carrier Power Measurement

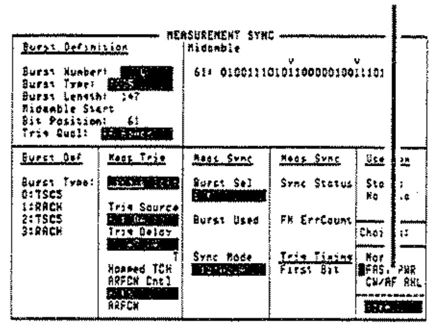


The HP 8922G must be set up before starting this measurement, see Setting Up The HP 8922G.

The Fast Transmitter Carrier Power will be valid only if the RF IN/OUT connector is chosen as the RF input.

1

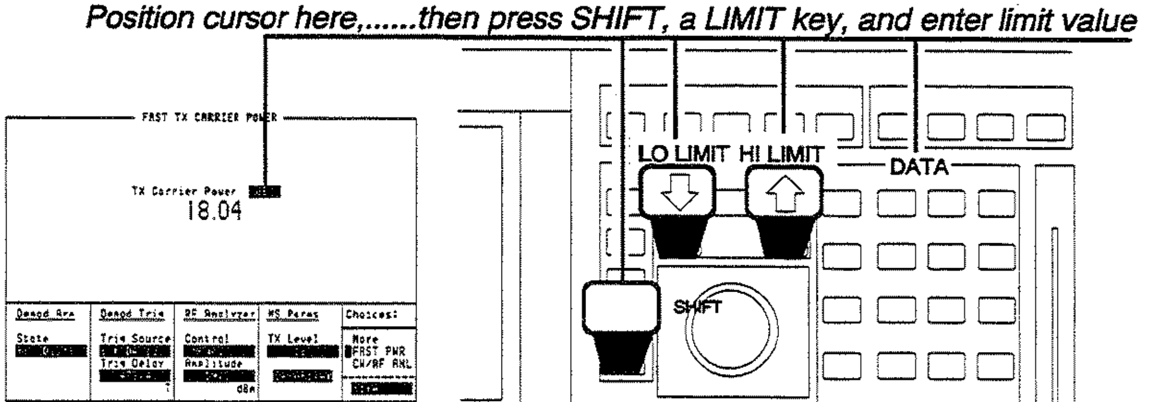
Select FAST PWR



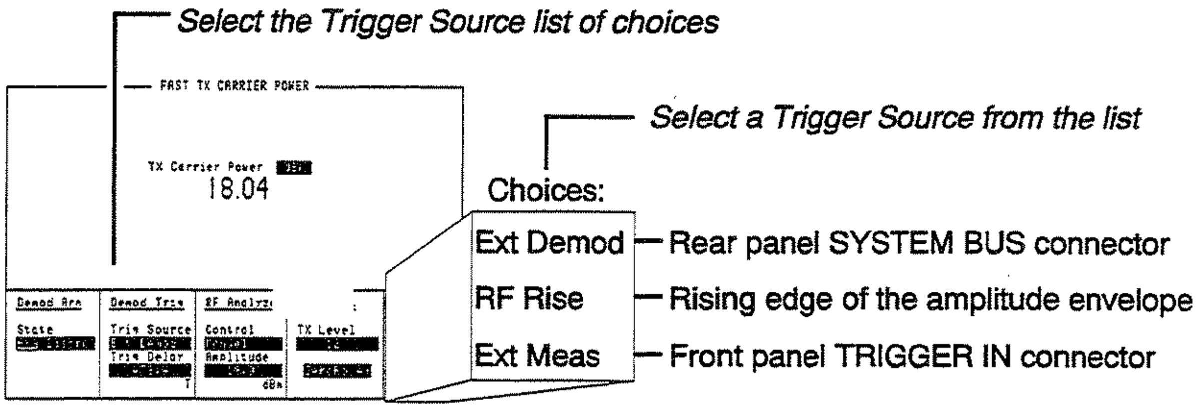
It is optional to set high and low measurement limits. If the measurement exceeds a limit, the HI or Lo annuciators will flash.

2 Enter the measurement limit:

Position cursor here,......then press SHIFT, a LIMIT key, and enter limit value



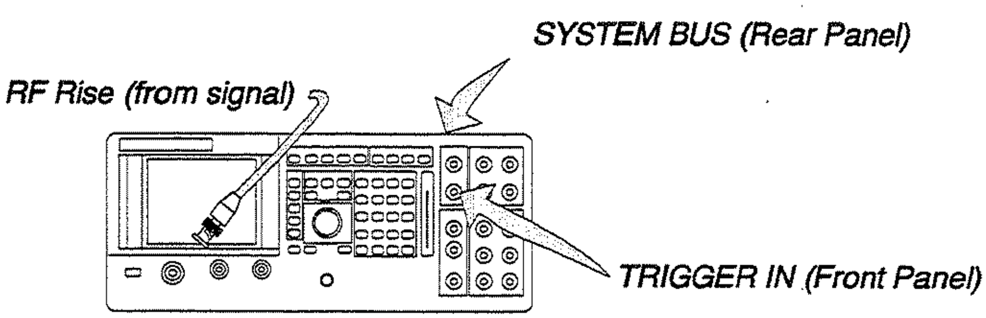
3



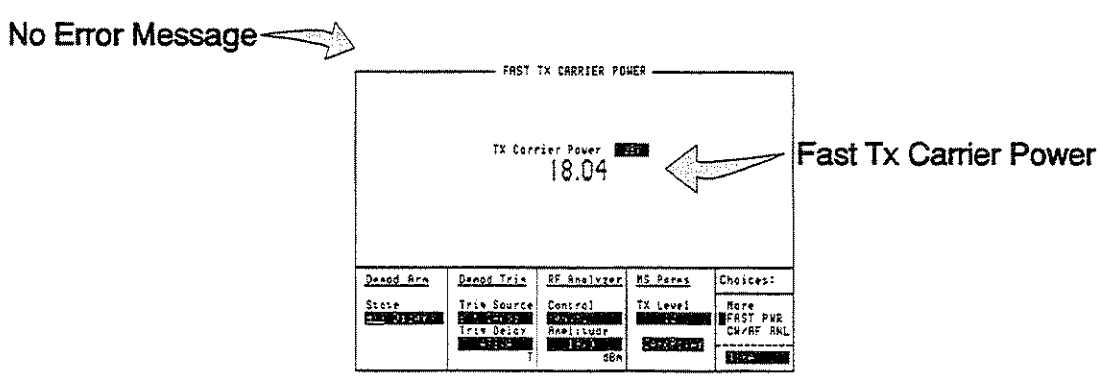
Trigger signals on the SYSTEM BUS or the TRIGGER IN front-panel connector must occur near bit 0 of the transmitted burst, or be delayed to occur near bit 0 using the Trigger Delay field (see Screens, FAST PWR).

If RF Rise is chosen as the Trigger Source, the trigger is automatically generated when the rising edge of the amplitude envelope is detected.

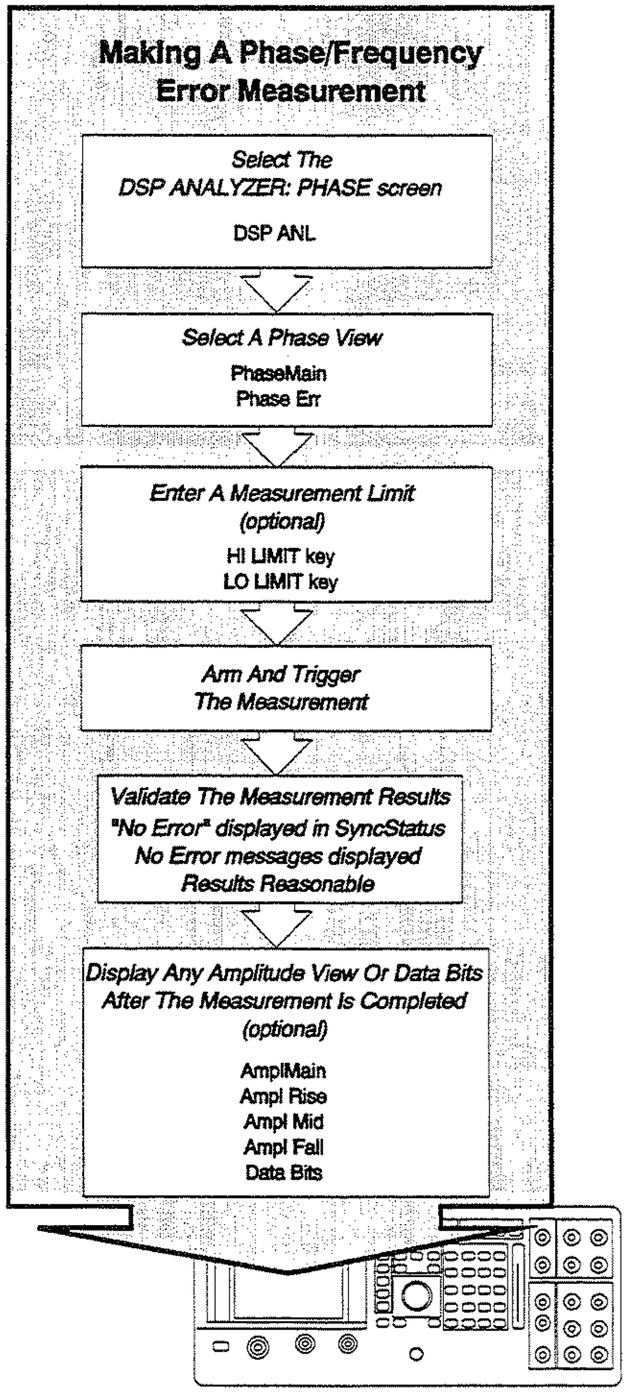
4 **Connect the trigger signal to the HP 8922G:**

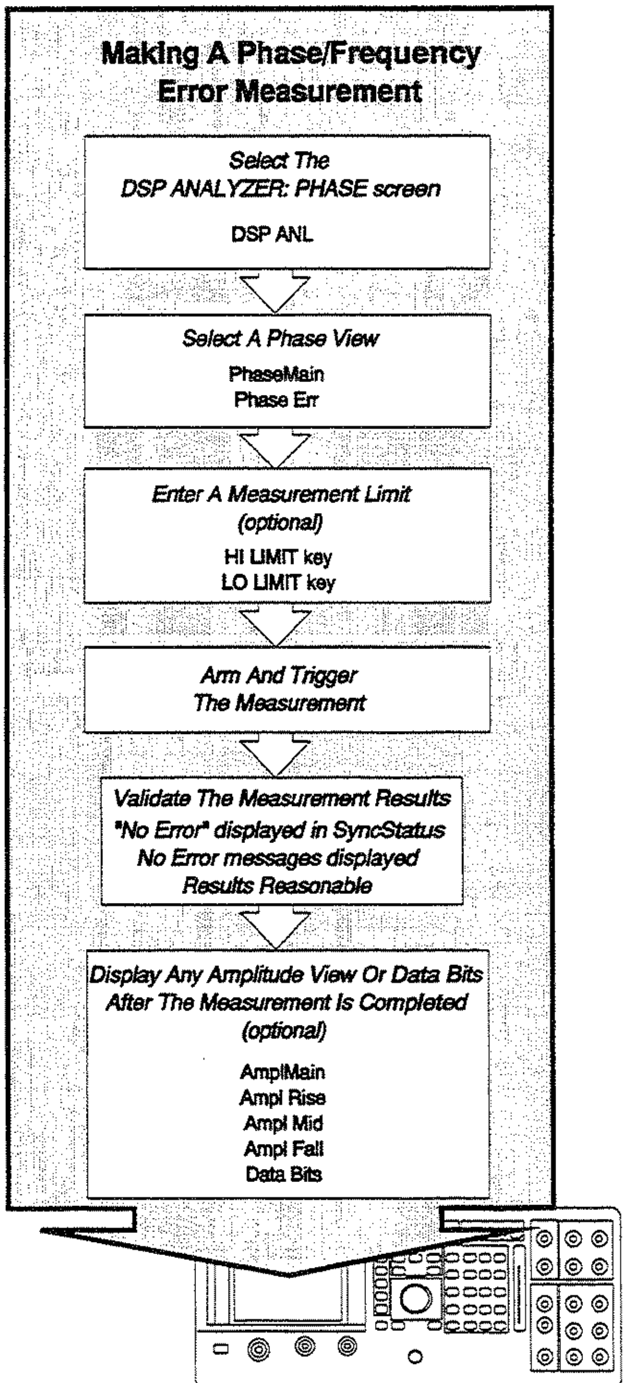


5 **Read and validate your measurement.**



Measuring Phase/Frequency Error

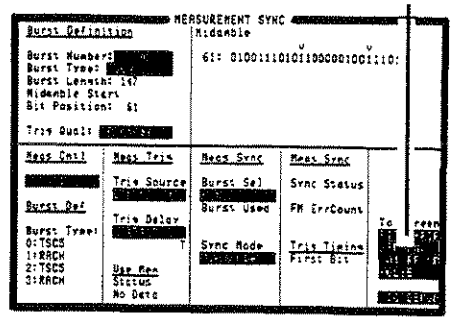



Making A Phase/Frequency Error Measurement
Select The DSP ANALYZER: PHASE screen
DSP ANL
Select A Phase View
PhaseMain
Phase Err
Enter A Measurement Limit (optional)
HI LIMIT key
LO LIMIT key
Arm And Trigger The Measurement
Validate The Measurement Results
"No Error" displayed in SyncStatus
No Error messages displayed
Results Reasonable
Display Any Amplitude View Or Data Bits After The Measurement Is Completed (optional)
AmplMain
Ampl Rise
Ampl Mid
Ampl Fall
Data Bits

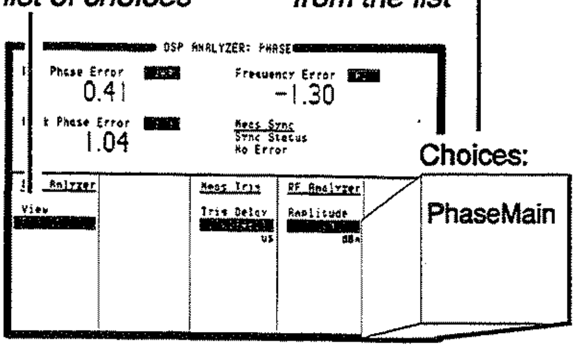
The HP 8922G must be set up before starting this measurement, see Setting Up The HP 8922G.

1

Select DSP ANL



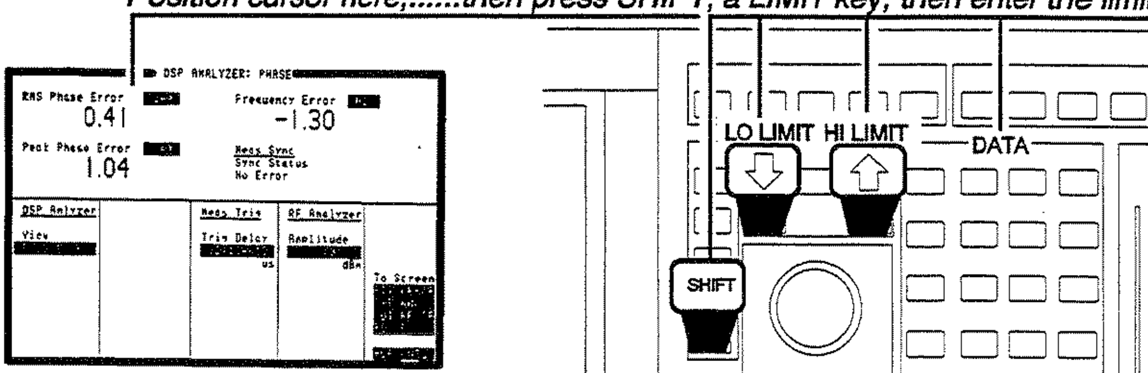
2 *Select the View list of choices* *Choose PhaseMain from the list*



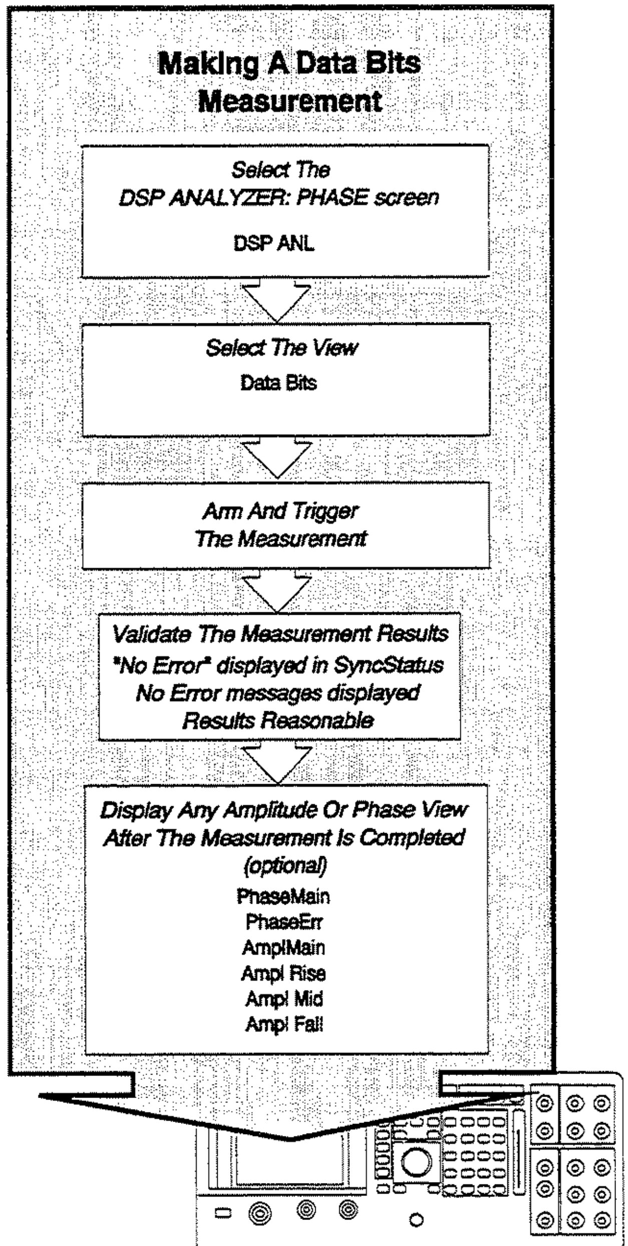
It is optional to set high and low measurement limits. If the measurement exceeds a limit, the HI or Lo annuclator will flash.

3 **Enter the measurement limit:**

Position cursor here,......then press SHIFT, a LIMIT key, then enter the limit value



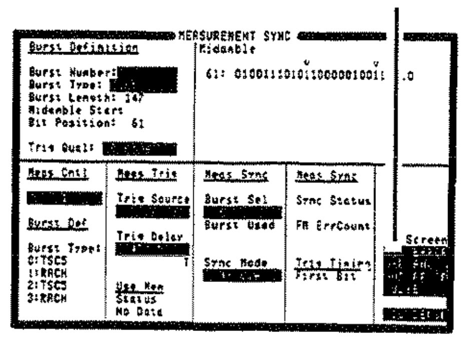
Making a Data Bits Measurement



The HP 8922G must be set up before starting this measurement, see Setting Up The HP 8922G.

1

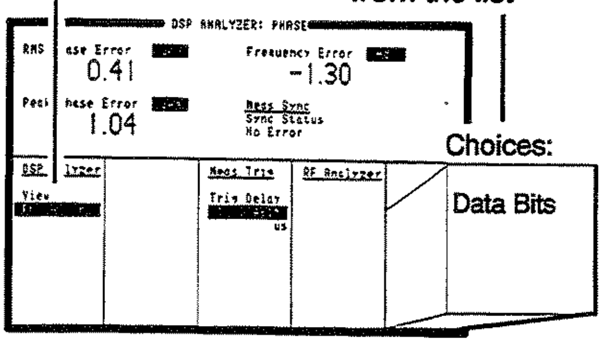
Select DSP ANL



2

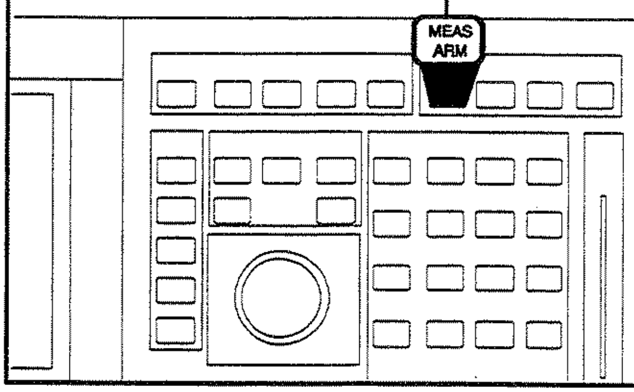
Select the View list of choices

Select Data Bits from the list



3

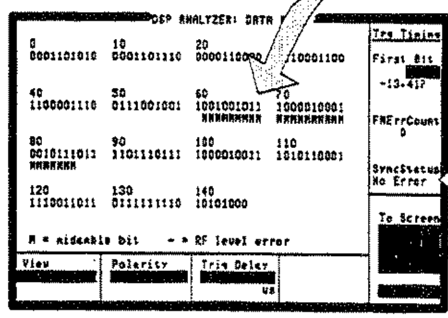
Press to arm the measurement



4 Read and validate your measurement.

No Error Message

Results displayed

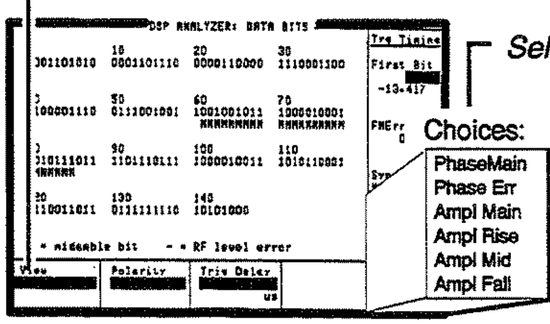


SyncStatus: No Error

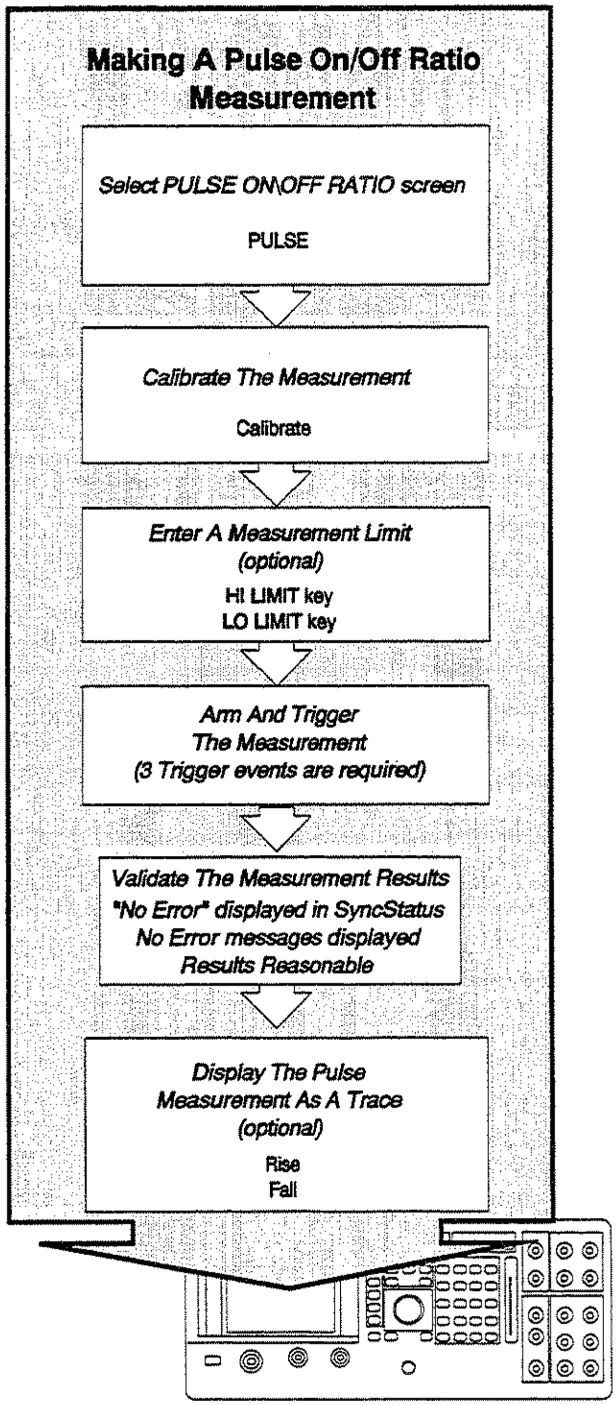
After a DSP analyzer measurement has been made, any of the phase or amplitude views can be chosen without re-arming and triggering.

Select the View list of choices

Select the desired view from the list



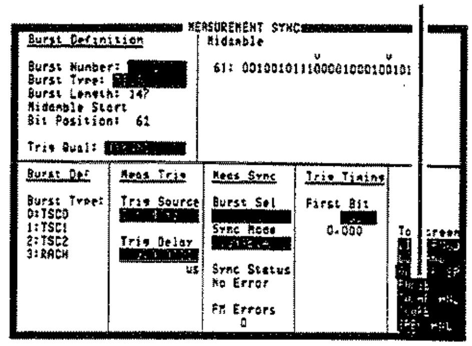
Making a Pulse On/Off Measurement



The HP 8922G must be set up before starting this measurement, see Setting Up The HP 8922G.

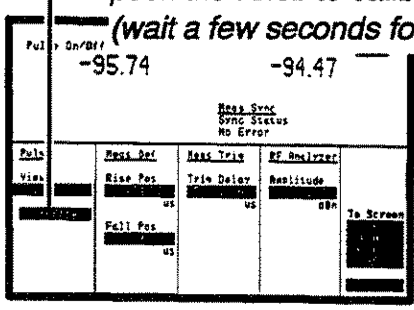
The Trigger Source for this measurement must be Ext Demod or Ext Meas, see Step 10 of Setting Up The HP 8922G.

1 *Select PULSE to display the PULSE ON/OFF RATIO screen*



2 The Pulse measurement must be calibrated within 5 minutes of making a measurement:

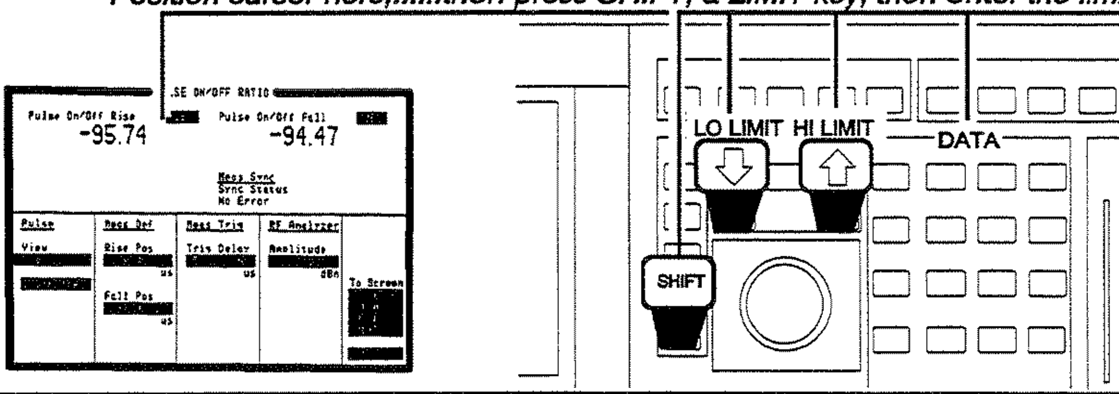
Position cursor here,
push the Knob to calibrate
(wait a few seconds for calibration)



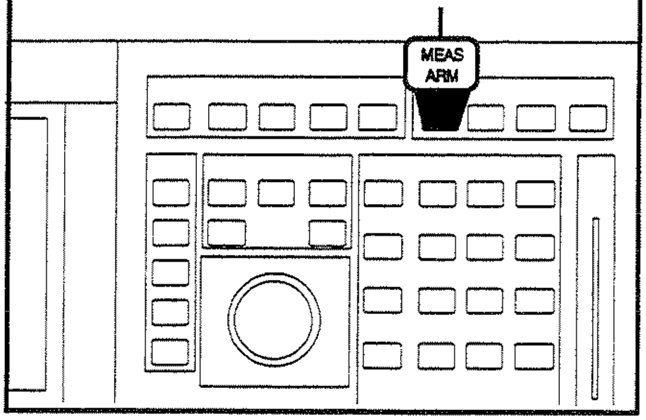
It is optional to set high and low measurement limits. If the measurement exceeds a limit, the HI or LO annuciator will flash.

3 Enter the measurement limit:

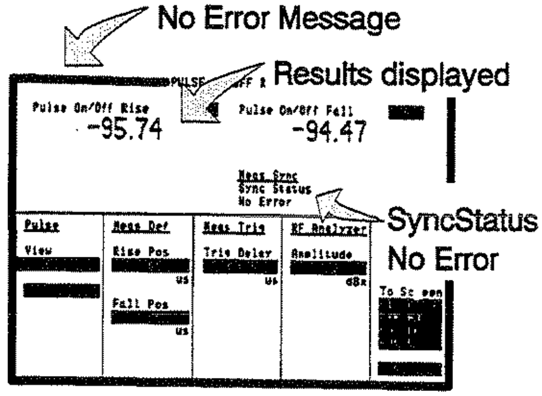
Position cursor here,......then press SHIFT, a LIMIT key, then enter the limit value



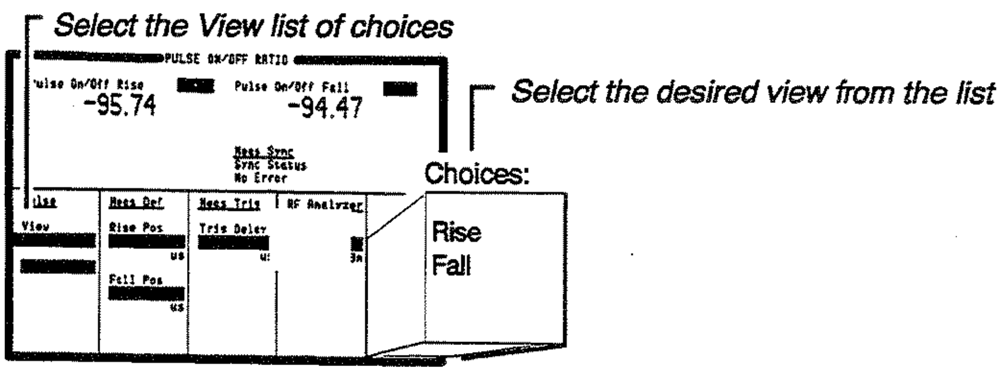
4 *Press to arm the measurement*



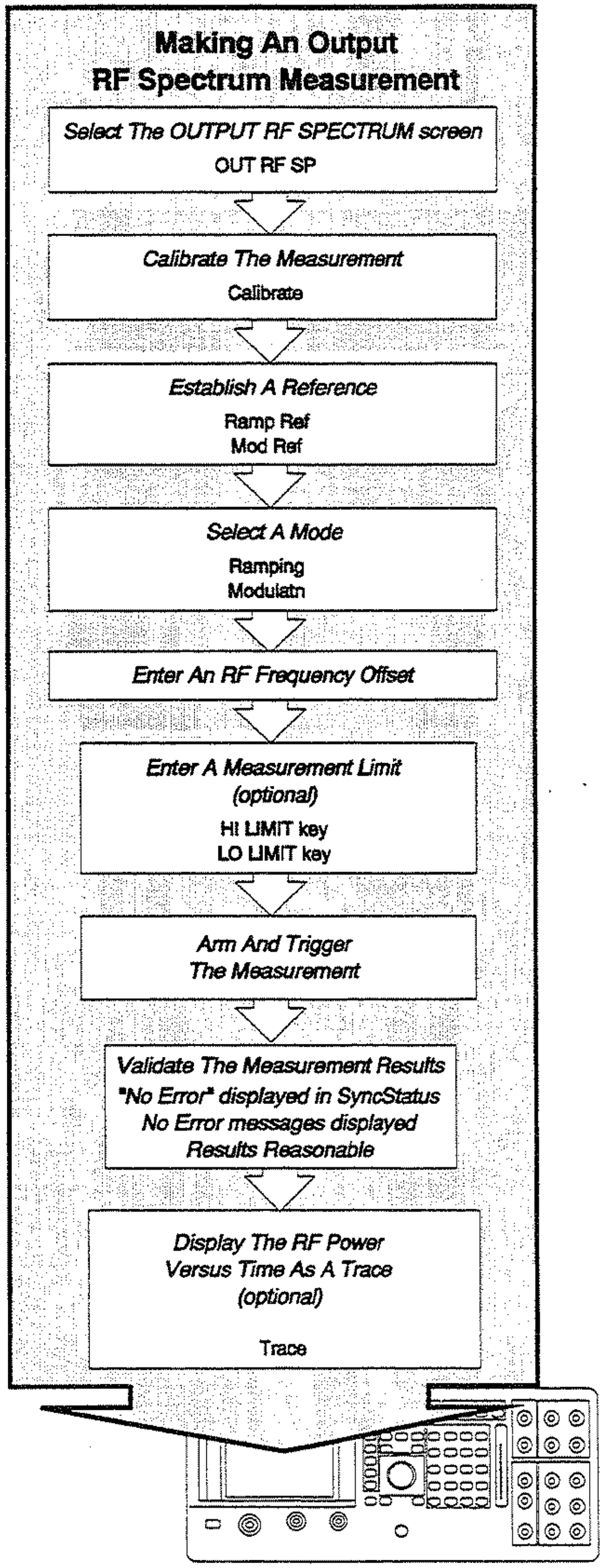
5 **Read and validate your measurement.**



6 **A trace view of the rising or falling portion of the pulse can be displayed:**

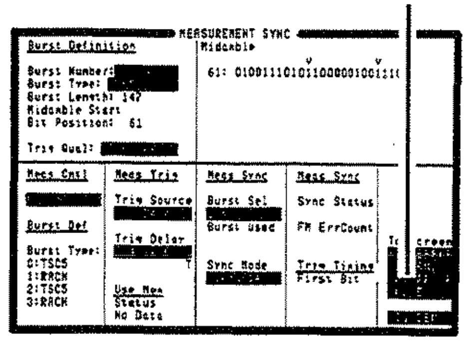


Making an Output RF Spectrum Measurement



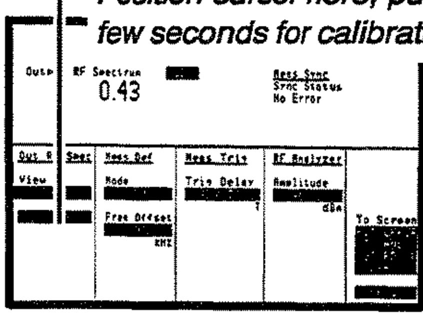
The HP 8922G must be set up before starting this measurement, see Setting Up The HP 8922G.

1 *Select OUT RF SP to display the OUTPUT RF SPECTRUM screen*



2 **Spectrum Analyzer measurements must be calibrated within 5 minutes of making a measurement:**

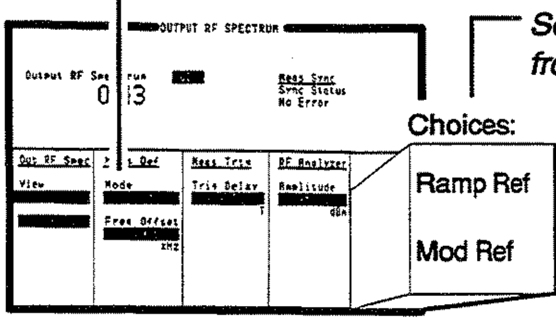
Position cursor here, push the Knob to calibrate (wait a few seconds for calibration)



3 **A reference must be established:**

Select the Mode list of choices

Select the desired reference measurement from the list



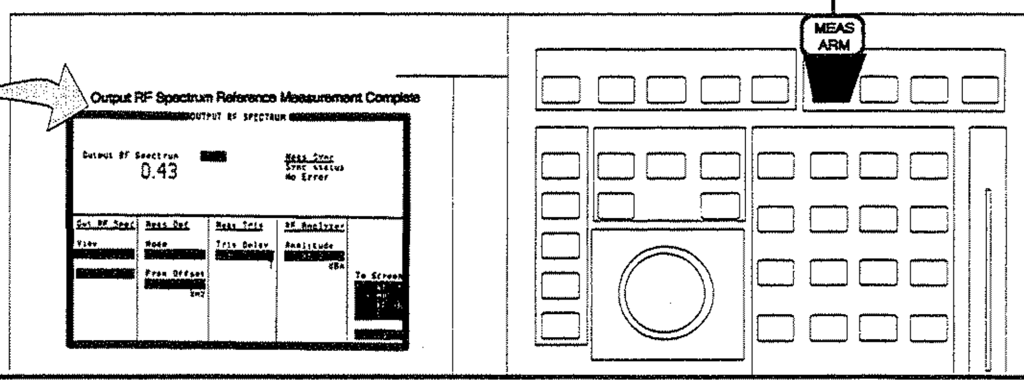
Choices:

Ramp Ref — For Output RF Spectrum due to pulse ramp

Mod Ref — For Output RF Spectrum due to modulation

4 *Press to establish a reference*

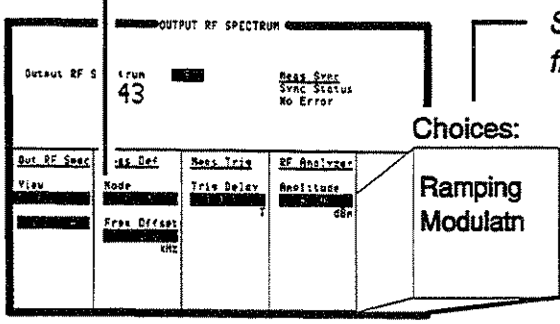
Message must display before continuing



5 **Select the mode that corresponds to the established reference (Step 3):**

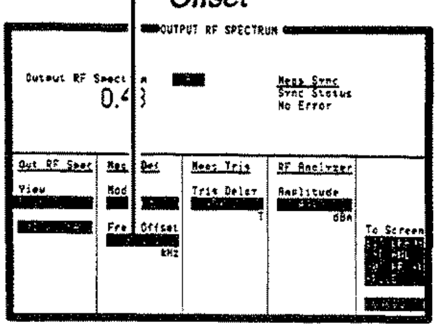
Select the Mode list of choices

Select Ramping or Modulation from the list



6

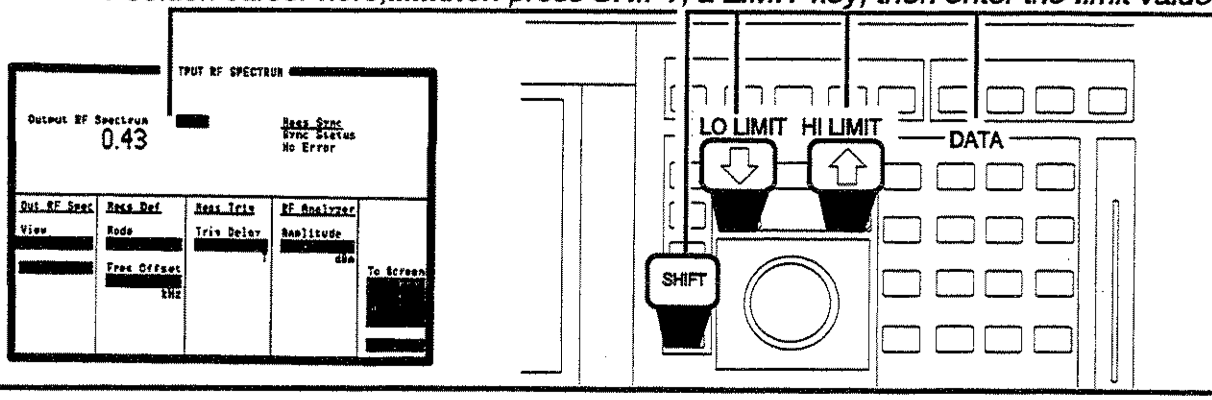
Enter an RF Frequency Offset



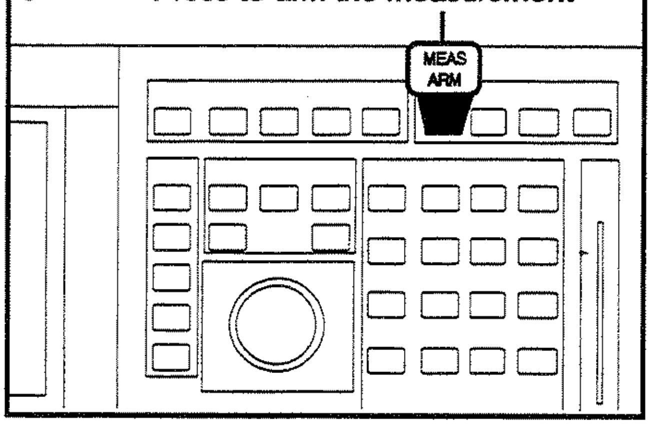
It is optional to set high and low measurement limits. If the measurement exceeds a limit, the HI or LO annunciator will flash.

7 **Enter the measurement limit:**

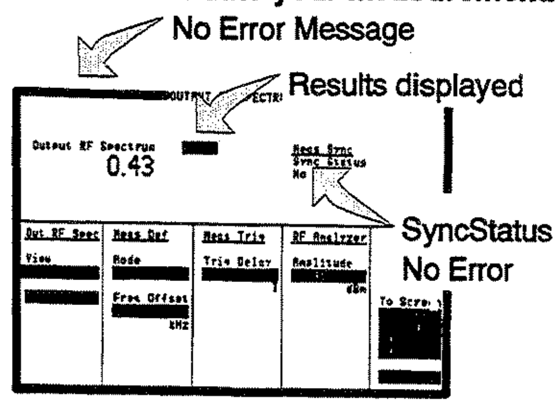
Position cursor here,......then press SHIFT, a LIMIT key, then enter the limit value



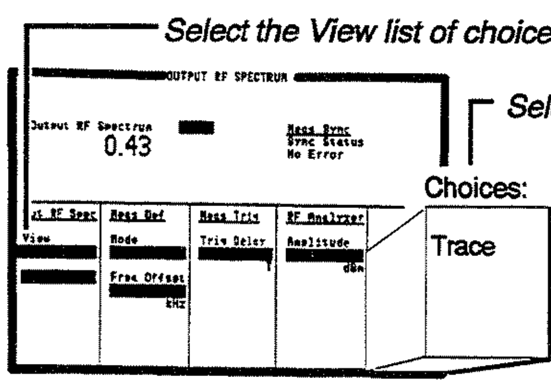
8 *Press to arm the measurement*



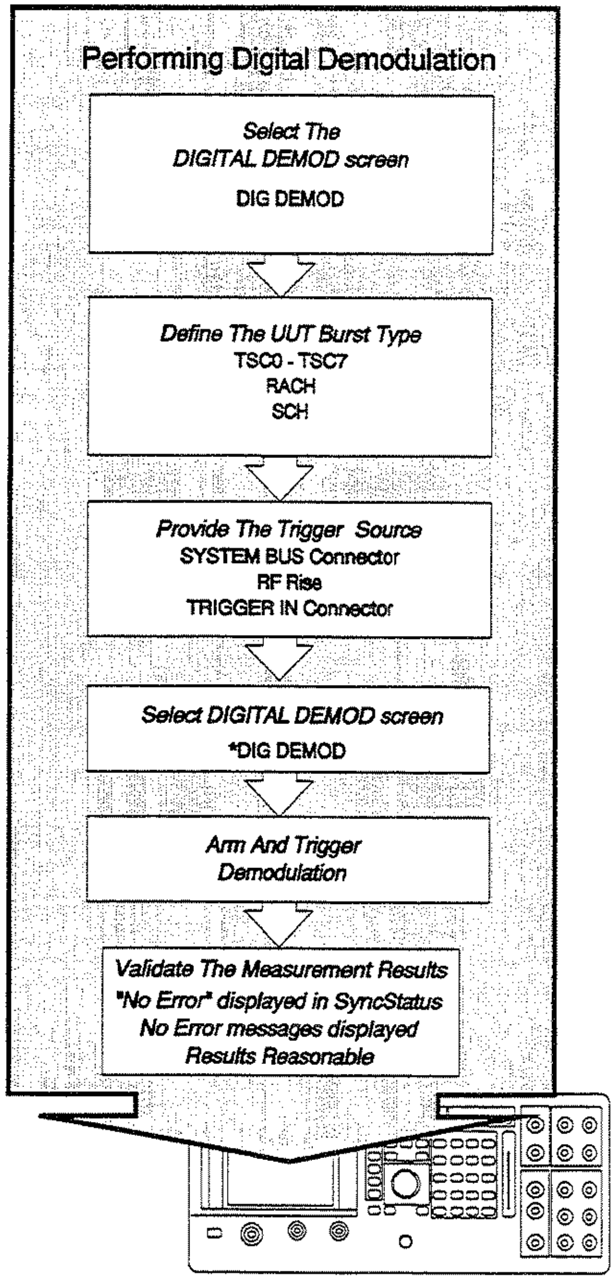
9 **Read and validate your measurement.**



10 **A trace view of RF power versus time can be displayed:**

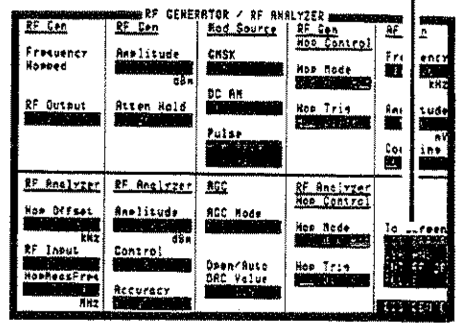


Performing Digital Demodulation



The HP 8922G must be set up before starting this measurement, see Setting Up The HP 8922G. Steps 1 through 5.

1 *Select DIG DEMOD to display the DIGITAL DEMOD screen*

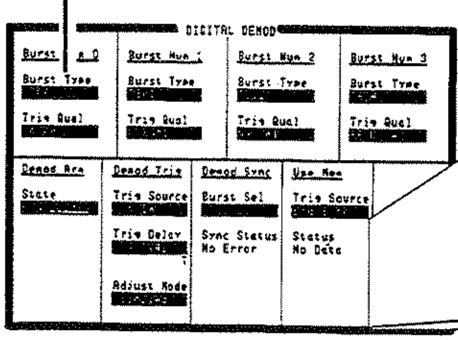


The DIGITAL DEMOD screen is used to define your signal's midamble or "burst" types.

A burst must be defined before it can be selected. The currently assigned Burst Types are displayed in the Burst Num 0, Burst Num 1, Burst Num 2, Burst Num 3 columns.

2 **Define your signal's Burst Type:**

Select the Burst Type list of choices



Choices: — *Select your signal's Burst Type*

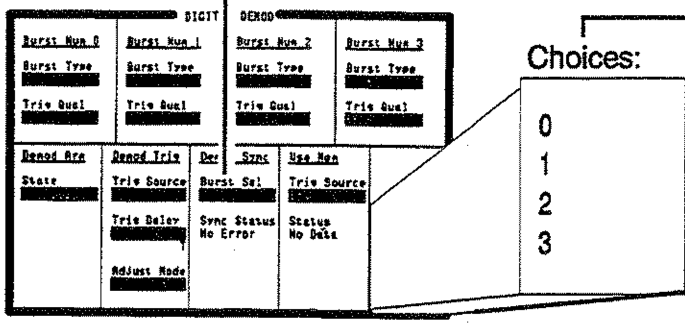
TSC0
TSC1
TSC2
TSC3
TSC4
TSC5
TSC6
TSC7
RACH
FCH
User Def

3 **Select the Burst Number the HP 8922G will use in the measurement:**

Select the Burst Num list of choices

Select the Burst Number that corresponds to the your signal's Burst Type

Choices:

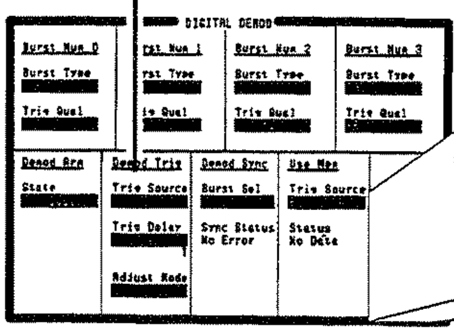


4

Select the Trig Source list of Choices

Select a Source from the list

Choices:



Ext Demod — Rear panel SYSTEM BUS connector

RF Rise — Rising edge of the amplitude envelope

Ext Meas — Front panel TRIGGER IN connector

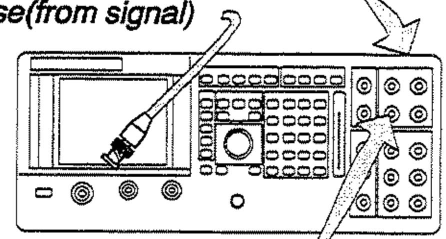
Trigger signals on the SYSTEM BUS or the TRIGGER IN front-panel connector must occur near bit 0 of the transmitted burst, or be delayed to occur near bit 0 using the Trigger Delay field.

If RF Rise is chosen as the Source, the trigger is automatically generated when the rising edge of the amplitude envelope is detected.

5 **Connect the trigger signal to the HP8922G.**

SYSTEM BUS (Rear Panel)

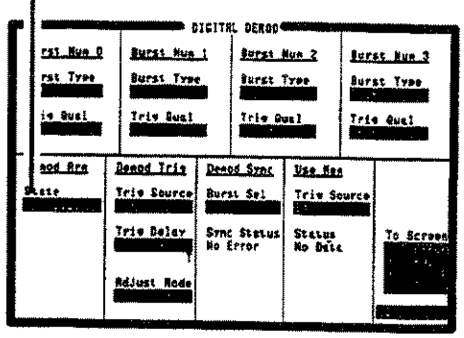
RF Rise(from signal)



TRIGGER IN (Front Panel)

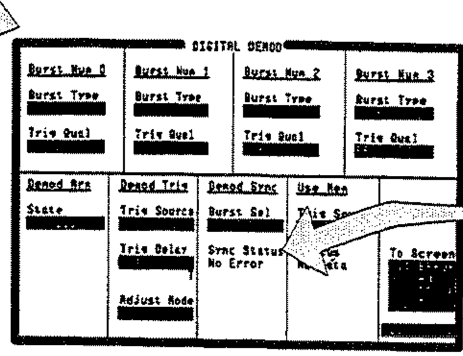
6

Select Arm to arm demodulation



7 **Validate your measurement.**

No Error Message



SyncStatus: No Error

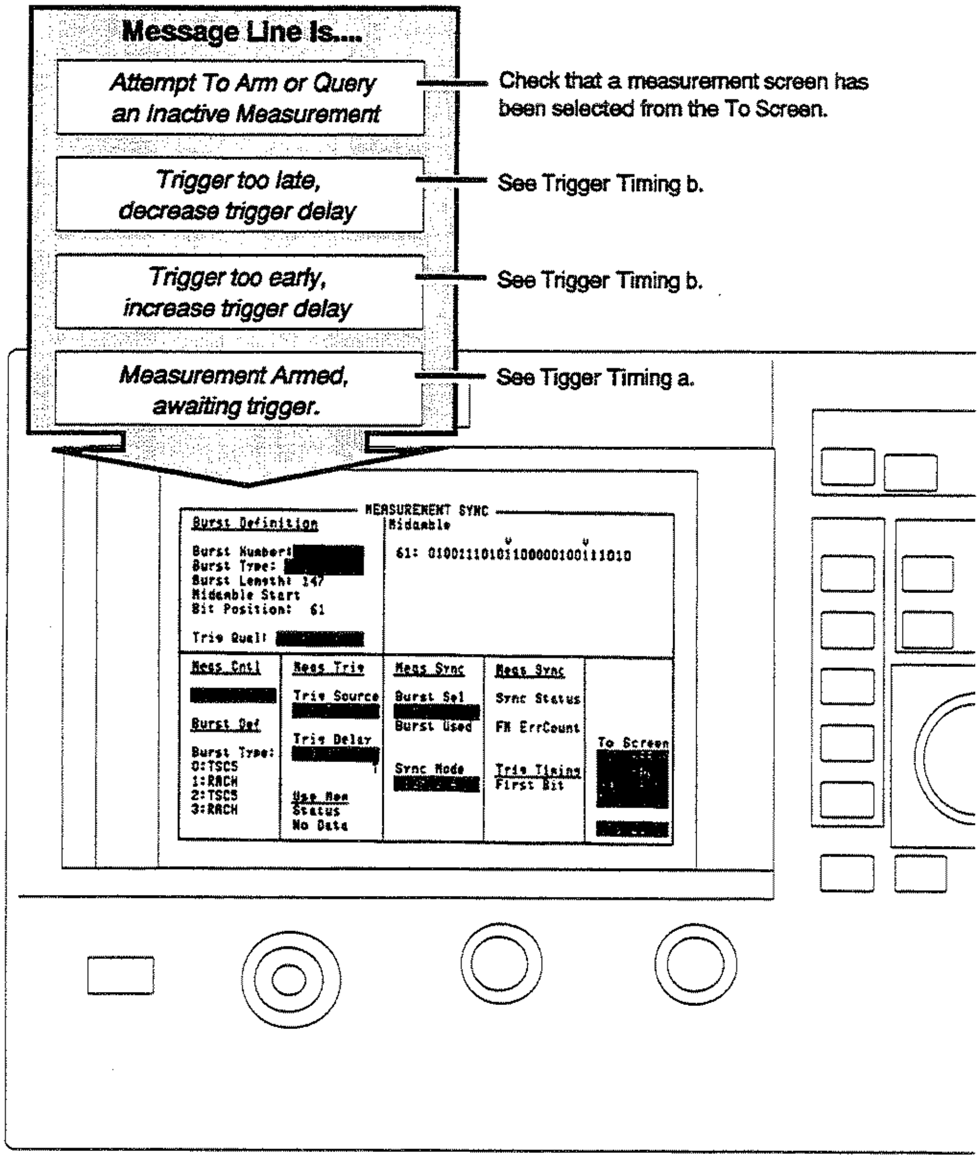
If You Have Problems with a Measurement

This section tells you what to do if either of the following screen display events occurs.

- Message Line Messages
- Sync Status Messages

See the Messages chapter in volume 2 for more information about messages.

Is A Message Line displayed at the top of the screen?



Possible solutions to Message Line errors.

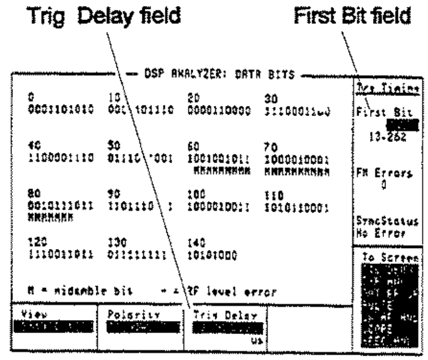
Trigger Timing

☐ *a. Check if the trigger is being received.*

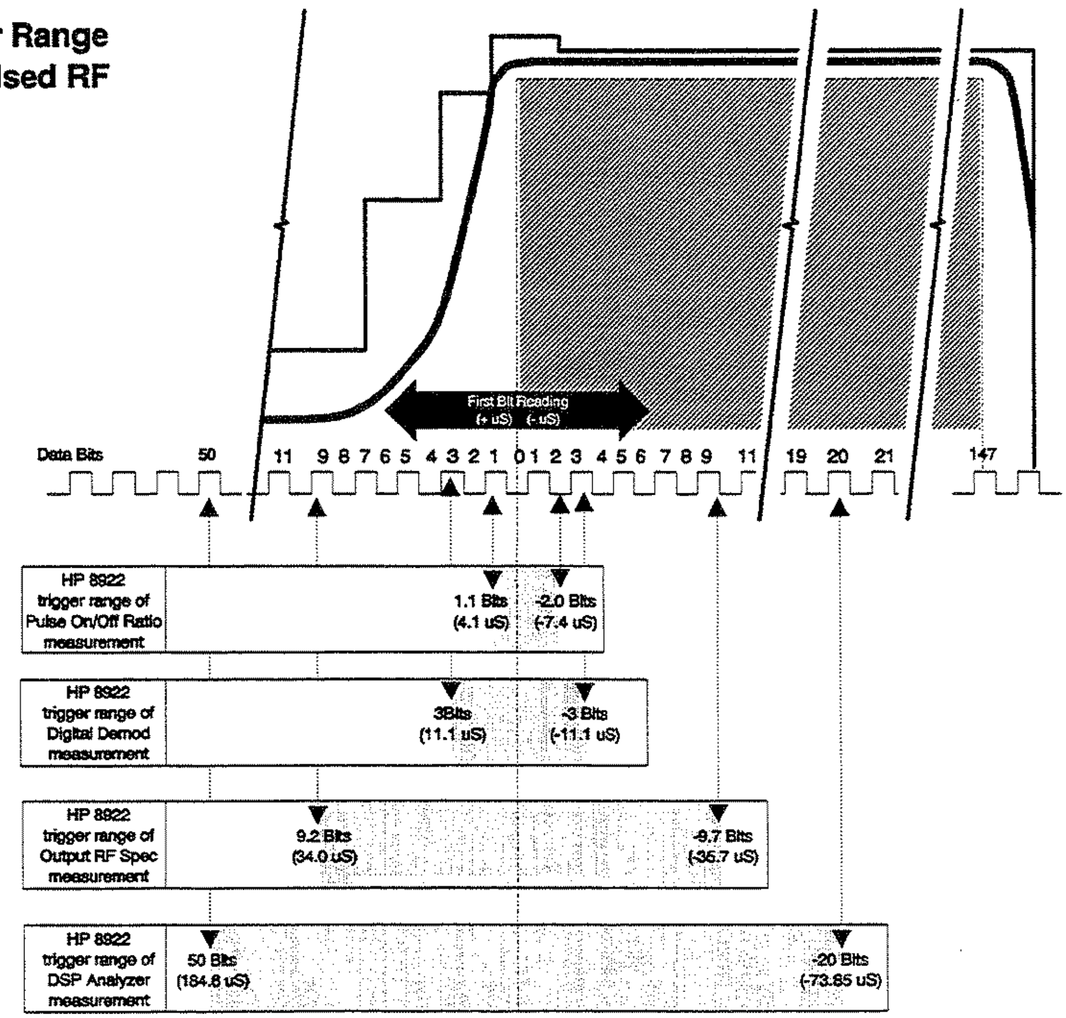
On the MEASUREMENT SYNC screen check if the correct burst type has been defined. See Steps 10 and 11 in Setting Up the HP 8922G.

☐ *b. Check if the trigger is being received at the correct time.*

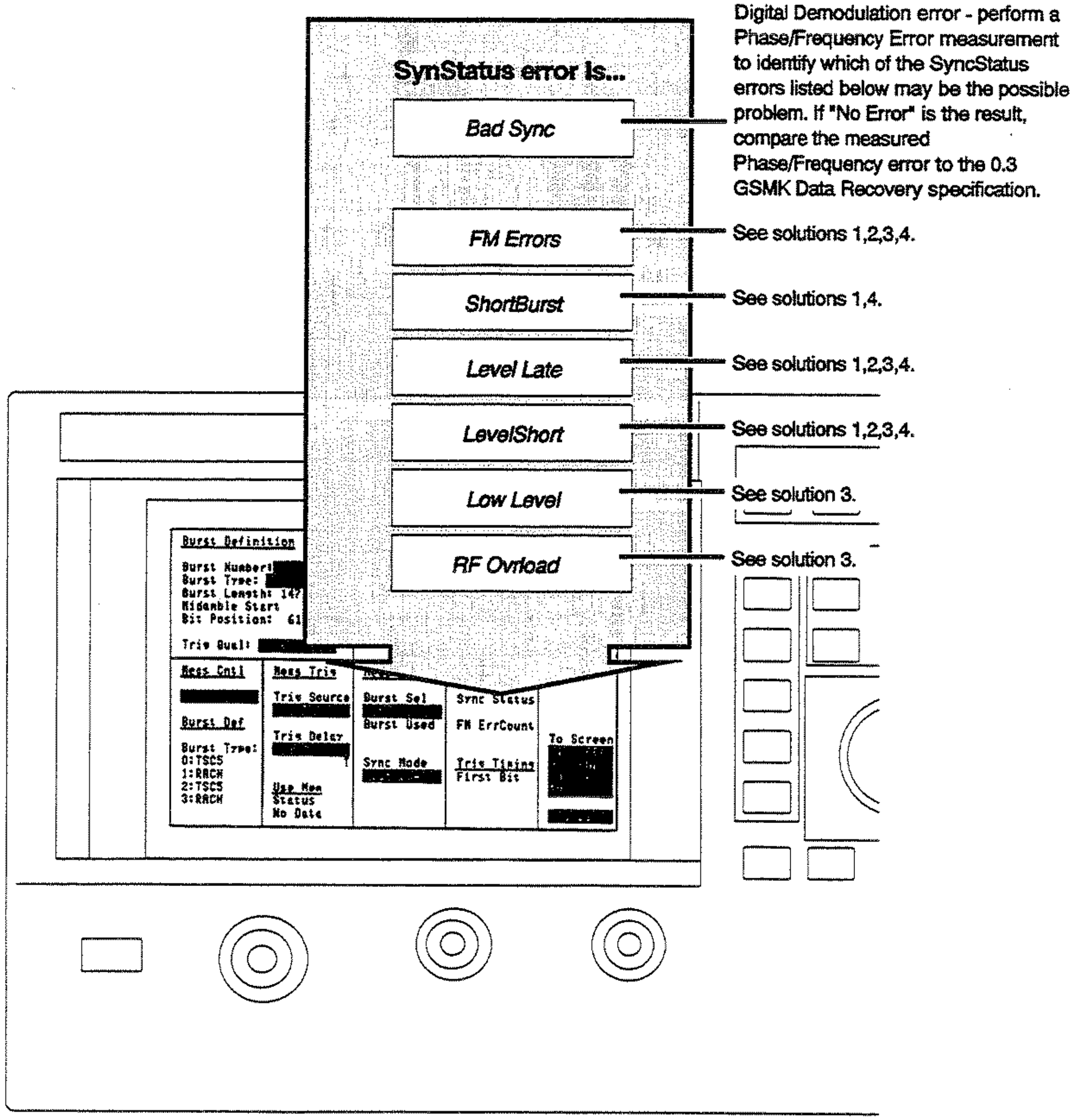
The First Bit field on the DATA BITS screen displays the time difference between when a trigger is being received and when the first bit of a burst occured. The time difference is only valid if FMErrCount is 0.



Trigger Range For Pulsed RF

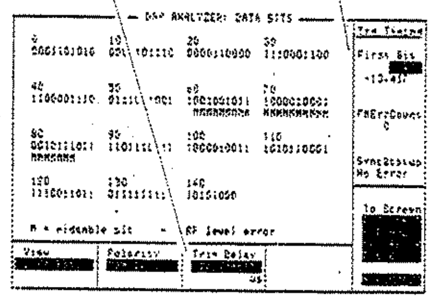


Is an error message displayed in the SyncStatus field?



Possible solutions to SyncStatus errors.

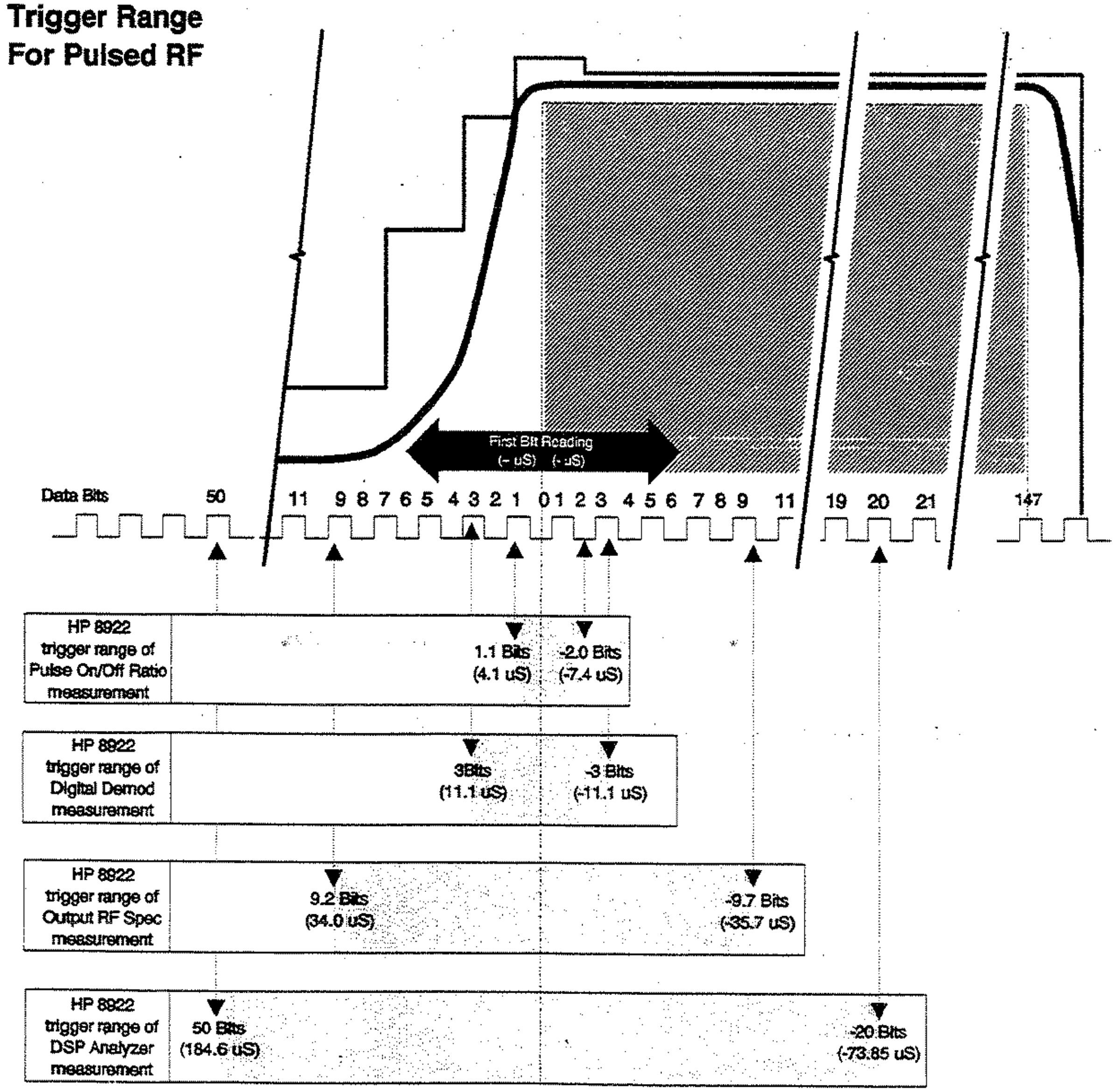
1. Trigger Timing



- [ ] *Check if the trigger is being received.*
  On the MEASUREMENT SYNC screen check if the correct burst type has been defined. See Steps 10 and 11 in Setting Up the HP 8922G.

- [ ] *Check if the trigger is being received at the correct time.*
  The First Bit field on the DATA BITS screen displays the time difference between when a trigger is being received and when the first bit of a burst occured. The time difference is only valid if FMErrCount is 0.

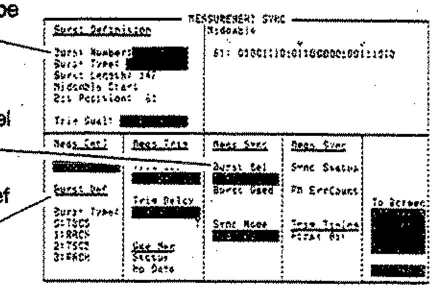
Trigger Range For Pulsed RF

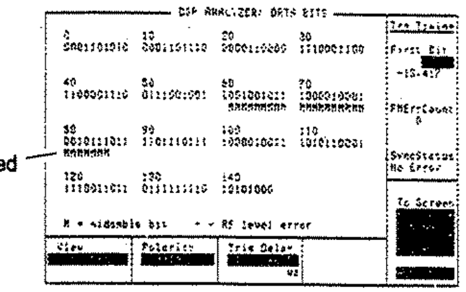


2. Midamble Sync

- [ ] *Check the definition of the signal's burst type.*
  On the MEASUREMENT SYNC screen check the Burst Sel field. See Steps 7-9, in Setting Up the HP 8922G.

- [ ] *Check the bit pattern of your measurement.*
  Perform a Data Bits measurement. An "M" will display under the bits that are identified as the midamble bits. See Making a Data Bits Measurement.

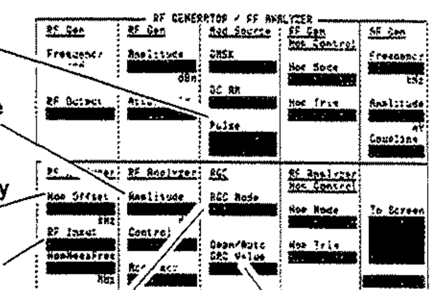




3. Level

- [ ] *Check the following fields on the RF GENERATOR/RF ANALYZER screen.*
  Frequency field for the correct frequency, see Step 2 in Setting Up the HP 8922G.
  RF Input field for the correct connector choice, see Step 3 in Setting Up the HP 8922G.
  Amplitude field for the expected amplitude, see Step 4 in Setting Up the HP 8922G.
  AGC Mode field. If either Open or Auto is the selected mode, check the value in the Open Loop DAC Value field. If Closed is the selected mode, check that the burst is repetitive (at least 1 timeslot every 2 frames).
  Pulse field (if signal is pulsed) Ext or Hop Trig should be selected.

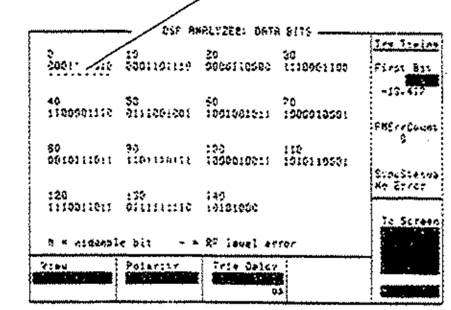
- [ ] *Check the actual amplitude of the input signal.*
  Perform a Peak TX Power Carrier measurement. See Making an Amplitude/Peak TX Carrier Power measurement.



4. Amplitude Envelope

- [ ] *Check if the Pulse Amplitude is ±1 dB of the expected value during the useful part of the burst.*
  If FM Errors:
  Perform a Data Bits measurement. Dashes will display under the bits that are where power is too low. See Making a Data Bits Measurement.

  If No FM Errors:
  Perform a pulse demodulation measurement. Connect PULSE, DEMODULATION OUT connector to SCOPE IN, MEASURE connector.



3

Verifying Performance

The tests in this chapter verify the electrical performance of the HP 8922 Test Set using the HP 8922 Performance Test Software provided with this manual. If the instrument passes this verification, its operation and specifications are assured within the measurement uncertainties provided in the performance test print out. Because of the specialized nature of the HP 8922 and the equipment required to support it, it is recommended that calibration and repair be performed only by specially equipped Hewlett-Packard service centers.

A list of specifications is found at the end of this chapter.

Setting up the Tests

This chapter contains the following information:

Getting the Right Test Equipment

Required Test Equipment lists the test equipment needed for the performance tests. This is the only equipment supported by the HP 8922 Performance Test Software and is required to verify instrument operation. Equipment substitutions or manual performance tests are not recommended or supported by Hewlett-Packard.

Installing and Operating the Software

Performance Test Software describes how to install and operate the HP 8922 Performance Test software.

Understanding the Tests

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

Understanding Test Failures

Test Failures contains a matrix that describes which hardware modules would be the most likely to cause certain performance tests to fail. This section is intended to be used in conjunction with the 8922 Assembly Level Repair Manual to isolate hardware problems.

Getting the Right Equipment

The following equipment is required to do all of the performance tests. The test descriptions have an equipment list that specifies the equipment used for each particular test.

Required Test Equipment

Equipment	HP Model Number
Measuring Receiver	HP 8902A
Sensor Module	HP 11722A
Audio Analyzer	HP 8903B
Voltmeter	HP 3456A
Signal Generator	HP 8657B
Multifunction Synthesizer	HP 8904A Opt. 001, 002
Pulse Generator	HP 8116A
Spectrum Analyzer	HP 8566B
Technical Computer with Rocky Mountain BASIC and DS Disk Drive	HP 9000 Series 200/300
HP-IB printer	HP 2225A

Installing and Operating the Software

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

To Load the Program

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

To Configure the HP-IB Addresses

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

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

To Run the Program

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

Notes on Running the Program.

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

The second screen which will appear is the main Performance Tests selection menu. Three options are available on this screen:

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

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

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

Understanding the Tests

This section describes the theory of each performance test, lists the equipment needed for the test, and provides some problem solving information.

Test 01: Signal Generator Level

Equipment Required

HP 8902A .... Measuring Receiver
HP 11722A .... Sensor Module

Theory of the Test

The UUT is set to generate CW signals at various levels and frequencies. The HP 8902A/HP 11722A is used as a power meter to measure high level signals and the HP 8902A tuned RF level function is used to measure low level signals.

Things To Check In Case Of Problems

- The HP 8902A/HP 11722A must be calibrated and zeroed for accurate measurement results. The HP 11722A calibration factors must be entered into the HP 8902A.
- Low level signals from the HP 8922 must be very stable to be measured by the tuned RF level function of the HP 8902A. The instrument timebases should be locked together. Also, if the HP 8922 source has unusually high residual FM it may cause the low level measurements to fail because the HP 8902A cannot lock onto the signal.
- Mismatch uncertainty causes a high level of uncertainty in this measurement.

Test 02: Signal Generator Spectral Purity

Equipment Required

HP 8566B .... Spectrum Analyzer

Theory of the Test

The UUT is set to generate a CW signal at various levels and frequencies. The HP 8566B is used to measure the signal level and then the level of the harmonics or spurious signals.

Things To Check In Case Of Problems

- The instruments should have their timebases locked together to assure that the frequency offsets for the spurious measurements are accurate.

Test 03: Signal Pulse Modulation

Equipment Required

HP 8116A .... Pulse Generator

Theory of the Test

HP 8922A/B

The pulse generator drives the pulse input of the UUT and causes it to generate pulsed RF signals. These signals are detected with the internal UUT pulse demodulator and analyzed with the UUT's oscilloscope. The UUT is set to generate two different on/off ratios: 30 dB and 80 to 90 dB. Rise time and fall time for each of these is measured.

HP 8922E/G

The reference signals for this test are generated using the loopback feature of the 8922E/G. No external equipment is required.

Things To Check In Case Of Problems

- The oscilloscope is used to automatically measure rise and fall times. If the RF signal has high video feedthrough, it may cause the oscilloscope to make a faulty reading by triggering on the video feedthrough instead of the actual pulse.

Test 04: Signal Generator 0.3 GMSK Modulation

Equipment Required

HP 8904A Option 001, 002 .... Multifunction Synthesizer

Theory of the Test

HP 8922A/B

The HP 8904A is used to generate a 270.833 kHz clock and random data. This drives the UUT RF generator to generate the 0.3 GMSK modulated signals with random data. This signal is then analyzed by the UUT to assure that the frequency and phase errors are correct.

HP 8922E/G

The reference signals for this test are generated using the loopback feature of the 8922E/G. No external equipment is required.

Things To Check In Case Of Problems

- This test should only be performed if the UUT analyzer is known to be accurate. Run test #9 first if there is any question about the accuracy of the UUT analyzer.

- Even when the accuracy of the UUT analyzer is known, its specification is such that this test still has a high degree of measurement uncertainty.
- It is possible to verify an instrument that fails this test by using a second HP 8922 to analyze the signal or by using the HP 11836A 0.3 GMSK measurement software. This software (and its associated hardware) has a lower measurement uncertainty but is not currently supported with the HP 8922 Performance Test software.

Test 05: Audio Frequency Generator

Equipment Required

HP 3456A .... Voltmeter
HP 8903B .... Audio Analyzer
HP 8902A .... Measuring Receiver

Theory of the Test

The UUT is set to generate audio signals at various levels and frequencies. The voltmeter measures AC and DC level accuracy, the audio analyzer measures residual distortion, and the measuring receiver measures frequency accuracy.

Things To Check In Case Of Problems

- The measuring receiver and the UUT should have their timebases locked to make accurate frequency measurements.

Test 06: Audio Frequency Analyzer

Equipment Required

HP 8904A Option 001, 002 .... Multifunction Synthesizer
HP 3456A .... Voltmeter

Theory of the Test

The HP 8904A is used to generate accurate test signals which are analyzed by the UUT. The voltmeter is used to reduce measurement uncertainty by accurately characterizing the test signal level to predict the correct response of the UUT. The voltmeter is used in the AC level, DC level, SINAD, and distortion measurements. Distortion test signals are generated by summing two sinewaves in the HP 8904A; one as the desired signal, the other as a distortion product.

Things To Check In Case Of Problems

- For frequency accuracy measurements the HP 8904A timebase should be locked to the UUT.
- The voltmeter reading is used as a reference to normalize the reading from the UUT. The output "measured" result is the

actual reading from the UUT normalized by the actual reading from the voltmeter. If the voltmeter makes a faulty reading, it will normalize the actual UUT response and cause it to appear faulty also. If the front panel reading from the UUT is significantly different than the printed "measured" response, the normalization may be the cause.

Test 07: Oscilloscope

Equipment Required

HP 8903B .... Audio Analyzer
HP 3456A .... Voltmeter

Theory of the Test

The audio analyzer is used to generate CW reference signals which are characterized by the voltmeter and fed into the UUT. The voltmeter reading is used to normalize the reading from the UUT oscilloscope. The oscilloscope measurements are taken using the UUT marker function which is set to the peak of the input sinewave.

Things To Check In Case Of Problems

- The voltmeter reading is used as a reference to normalize the reading from the UUT. The output "measured" result is the actual reading from the UUT normalized by the actual reading from the voltmeter. If the voltmeter makes a faulty reading, it will normalize the actual UUT response and cause it to appear faulty also. If the front panel reading from the UUT is significantly different than the printed "measured" response, the normalization may be the cause. If the oscilloscope triggers incorrectly, the peak search may not find the actual peak response on the display.

Test 08: RF Analyzer Level

Equipment Required

HP 8657A/B .... Signal Generator
HP 8902A .... Measuring Receiver
HP 11722A .... Sensor Module

Theory of the Test

The signal generator is used to generate CW signals at various frequencies and power levels. These are accurately characterized by the HP 8902A/HP 11722A and used as a reference. The CW signals are then used to test the UUT which is compared to the reference reading taken by the HP 8902A/HP 11722A.

Things To Check In Case Of Problems

- Mismatch uncertainties cause a high level of measurement uncertainty in this measurement. If the HP 11722A or HP 8657 has a high SWR, the accuracy of the results may be reduced.

Test A: RF Analyzer Pulse Demodulation

Equipment Required

HP 8657B Option 003 .... Signal Generator
HP 8116A .... Pulse Generator

Theory of the Test

The Pulse generator drives the signal generator to generate Pulsed RF signals at various frequencies. The UUT demodulates these signals and the oscilloscope measures the rise and fall time of the demodulated waveform. This test verifies the demodulator rise and fall time specifications.

Things To Check In Case Of Problems

- The oscilloscope measurement functions are used to measure the 10% to 90% rise and fall time. If the demodulated waveform has significant video feedthrough or the oscilloscope cannot trigger the measurements properly, an incorrect measurement may result.

Test B: Spectrum Analyzer

Equipment Required

HP 8657B .... Signal Generator

Theory of the Test

The signal generator is used to stimulate the UUT spectrum analyzer at various frequencies. At each frequency, the spectrum analyzer is tuned to measure its own image and spurious responses. The level of the signal generator is set to various levels to determine the spectrum analyzer's log-linearity.

Things To Check In Case Of Problems

- The absolute accuracy of the signal generator causes a significant measurement uncertainty in the log linearity measurements. A more accurate measurement is to reduce the signal level using a precision attenuator. This is an acceptable secondary manual test if the UUT fails the automated test.

Understanding Test Failures

This section is intended to be used in conjunction with the 8922 Assembly Level Repair Manual for assembly level repair and troubleshooting. If a performance test fails and hardware is suspected, the following table is a guideline to help identify the hardware assemblies most likely to cause each failure. Before replacing an assembly, the memory card diagnostics (supplied with the Assembly Level Repair Manual) should also be run to help verify which assembly is defective.

ASSEMBLIES TESTED (P=Primary S=Secondary)																				
Performance Test	A2	A3	A4	A5	A6	A9	A11	A12	A13	A14	A15	A16	A17	A18	A19	A23	A24	A25	A26	A27
Sig Gen Level				S				S	P		S					P	S	S	S	S
Sig Gen Spectral Purity				S				S	S		S					S	S	S	S	S
Sig Gen Pulse Mod				S				P	S	P	S					S	S	S	S	S
Sig Gen .3 GMSK				P				S	S	S	S					S	S	S	S	P
AF Generator			S		S															
AF Analyzer	P	P													S					
Oscilloscope		S													S					
RF Analyzer Power															S	P				
RF Analyzer GMSK Mod						P	S					P	S			S				
RF Analyzer Pulse Demod							S					P	S			S				
Spectrum Analyzer							S					S	S	P		S				

HP 8922G Specifications

SPECIFICATIONS
Describe the instrument's warranted performance and apply after a 30 minute warm-up. These SPECIFICATIONS are valid over its Operating / Environmental Range unless otherwise noted.

GSM Functionality

Bit/Frame Error Rate Measurements: Class Ia, Ib, and Class II bits in both raw and residual form.
MS Power Output Level Control: 0-15 with RF analyzer auto adjust.
Broadcast Channel Capability: BCCH+CCCH or BCCH+CCCH+SDCCH/4.
Control Channels (SDCCH, FACCH, SACCH): BCCH+CCCH, BCCH+CCCH+SDCCH/4, SDCCH/8 (non-hopped), and SACCH/FACCH.
Call Control Capabilities: BS originated call (FS), MS originated call (FS), MS camp on, BS call disconnect, MS call disconnect.
Traffic Channels: TCH/FS.
Timing: Auto, manual, uplink-downlink offset measurement.
Hopping: Cyclic only, two independent MA tables with offsets.
Digital Audio Interface (DAI): Normal operation and test of acoustic devices and A/D & D/A (according to GSM Rec. 11.10 section III.1.4).
Speech Encoding/Decoding: Full rate speech.
Echo Mode: User selectable delay, 0 to 5 sec.
Measurement Coordination: Flexible control of burst and ARFCN.
SACCH MEAS Results: RXLEV, RXQUAL, and timing advance.
Encryption: Future firmware release will support ON, OFF, User supplied key.
Electrical Man Machine Interface: Future firmware release will support via HP-IB.

[1]GSM frequency bands are 890 to 915 MHz and 935 to 960 MHz, however specifications apply from 890 to 935 MHz and 935 to 980 MHz.
[2]Specification applies to the lower level in 30 dB pulse mode.
[3]Level Accuracy degrades 0.2 dB when using the RF In/Out connector for both RF Generator and RF Analyzer.

SUPPLEMENTAL CHARACTERISTICS
(shown in *italics*) are intended to provide additional information, useful in applying the instrument by giving typical (expected), but not warranted performance parameters. These characteristics are shown in italics or labeled as "typical", "useable to", or "nominal".

RF Generator Specifications

Frequency

Range: 10 MHz to 1 GHz.
Resolution: 1 Hz.
Accuracy: Reference accuracy ± 0.5 Hz.
Stability: Same as Reference.
Supplemental Characteristics
Frequency Overrange: *to 1015 MHz with uncalibrated output and modulation.*
Switching Speed: *577 μs over the GSM frequency bands[1] in hop mode (refer to 0.3 GMSK modulation specs).*

Output

RF In/Out Connector
Level Range: -19 to -127 dBm.
Level Resolution: 0.1 dB.
Level Accuracy[2]
GSM bands[1]: ±1.0 dB[3], levels ≥-127 dBm.
±1.0 dB[3], typically for levels ≥-127 dBm while hopping.
10 MHz-1 GHz: ±1.5 dB, levels ≥-107 dBm.
±2.0 dB, levels -107 to -127 dBm.
Reverse Power: 30 watts continuous.
100 watts for 10 seconds/minute.
SWR: 1.5:1.

Aux RF Out Connector
Level Range: +7 to -127 dBm.
Level Resolution: 0.1 dB.
Level Accuracy
GSM bands[1]: ±1.0 dB, levels ≥-107 dBm.
±1.5 dB, levels -107 to -127 dBm.
±1.0 dB, typically for levels ≥-127 dBm while hopping.
10 MHz - 1 GHz: ±1.5 dB, levels ≥-107 dBm.
±2.0 dB, levels -107 to -127 dBm.
Reverse Power: 200 milliwatts.
SWR: 2.0:1, level <-4 dBm.

Spectral Purity

Spurious Signals (for ≤+1 dBm output level at Aux RF Out or ≤-25 dBm output level at RF In/Out).
Harmonics: <-25 dBc.
Non-Harmonic Spurious: <-50 dBc, >5 kHz offset from carrier.

0.3 GMSK Modulation

After one timeslot, 577 μs, from an isolated RF Generator Hop Trigger in the GSM frequency bands[1].

Phase Error: ≤1° rms.
Peak Phase Error: ≤4° peak.
Frequency Error: ±(0.02 ppm (18 Hz) + reference accuracy), for normal bursts.
Typically ±(0.03 ppm (27 Hz) + reference accuracy), for RACHs.
Amplitude Flatness: ±0.25 dB peak.
Clock Input
Frequency: 270.833 kHz ± 2 Hz (relative to reference).
Level: TTL.
Data Input
Format: Non differentially encoded input[4].
Level: TTL.

Supplemental Characteristics

After three timeslots, 1.73 ms, from an isolated RF Generator Hop Trigger in the GSM frequency bands[1].
Phase Error: *≤0.5° rms.*
Peak Phase Error: *≤2.0° peak.*
Frequency Error: *±(0.01 ppm (9 Hz) + reference accuracy), for normal bursts.*
±(0.02 ppm (18 Hz) + reference accuracy), for RACH bursts.

Pulse Modulation

Input Levels: TTL.
Rise/Fall Time (10 - 90%): ≤5 μs.
Supplemental characteristics
On/off ratio: *>80 dB.*

30 dB Pulse Modulation

All timeslots 30 dB higher than desired/active timeslot, to test adjacent timeslot rejection.
Input Levels: TTL.
Rise/Fall Time (10 - 90%): ≤5 μs.

Delay Times:
Supplemental Characteristics:
Transition from +30 or 0 dB to +24 dB: 8.9 ± 2 *μs.*
Transition from +30 db to -6 dB: 15 ± 3.5 *μs.*

AM for Level Control

For output levels ≤+1 dBm at Aux RF Out or ≤-25 dBm at RF In/Out.
Supplemental Characteristics
Input
Range: *-1.0 V to +0.6 V.*
Impedance: *600 Ω nominal, DC coupled.*
Sensitivity: *100% AM per volt, nominal.*
Calibration: *0 VDC input produces calibrated output from the RF Generator.*
Rise/Fall Time (10 - 90%): *≤10 μs.*

[4]Can be switched to accept data that has already been differentially encoded.
[5]When setting up the RF Analyzer for measurements, the user will need to enter the value for the incoming signal within the limits shown for specified performance.
[6]To calculate accuracy, add or subtract the 0.5 dB error (0.6 dB for Peak Transmitter Carrier Power) from the absolute power in dBm then convert to mW and add or subtract the 0.75 mW noise effect.

RF Analyzer Specifications

Frequency

Range: 10 MHz to 1 GHz.
Resolution: 1 Hz.
Hop Mode -
Resolution: 100 kHz.
Offset Frequency: ≤50 kHz.
Offset Resolution: 1 Hz for digital data recovery and modulation accuracy measurements.
RF In/Out SWR: <1.5:1.
Supplemental Characteristics
Frequency Overrange: *to 1015 MHz.*
Offset Resolution: *500 Hz for FM Demodulation Out.*

CW RF Frequency Measurement

Range: 10 MHz to 1 GHz.
Level Range
RF In/Out: 0 to +45 dBm.
Aux RF IN: -36 to +20 dBm.
Input Frequency Setting Error[5]: ±500 kHz.
Accuracy: ±(1 Hz + reference accuracy).
Supplemental Characteristics
Minimum Resolution: *1 Hz.*

CW RF Power Measurement

RF In/Out only
Range: +10 to +45 dBm.
Input Frequency Setting Error[5]: ±500 kHz.
Accuracy[6]: ±0.5 dB ± noise effects (0.75 mW).
Supplemental Characteristics
Minimum Resolution: *0.01 dB.*

Peak Transmitter Carrier Power Measurement

RF In/Out only. After one timeslot, 577 μs, from an isolated Receiver Hop Trigger in the GSM bands[1].
Range: +10 to +45 dBm.
Input Frequency Setting Error[5]: ±10 kHz.
Input Level Setting Error[5]: ±3 dB.
Accuracy[6]: ±0.6 dB ± noise effects (0.75 mW).
Supplemental Characteristics
Minimum Resolution: *0.2 dB.*

Pulse ON/OFF Ratio Measurement

ON power is averaged over the useful part of the burst. OFF power is averaged over a 1 bit interval centered at a user specified time. Non-hopped mode only.
Input Frequency Setting Error[5]: ±10 kHz.
Input Level Setting Error[5]: ±3 dB.
Timing Accuracy: ±1.7 μs *(±1.1 μs typical)*
Accuracy (ON/OFF ≥40 dB, RF In/Out only):

Amplitude Envelope Measurement

After one timeslot, 577 μs, from an isolated Receiver Hop Trigger in the GSM frequency bands[1].
Measurement Range

OFF Power (dBm)	ON/OFF Ratio Accuracy	
-24 to +5	±2.4 dB	*±1.1 dB typically*
-31 to -24	±2.9 dB	*±1.3 dB typically*
-36 to -31	±3.7 dB	*±1.7 dB typically*
-41 to -36	±4.2 dB	*±2.1 dB typically*

RF In/Out: 0 to +45 dBm.
Aux RF In: -36 to +20 dBm.
Input Frequency Setting Error[5]: ±10 kHz.
Inaccuracy due to Noise (for overshoots ≤1 dB):

Relative Level	Input Level Setting Error[5]		
	±1 dB	±3 dB	±3 dB w/5 averages
0 dB	<±0.15 dB pk	<±0.2 dB pk	<±0.2 dB pk
-6 dB	<±0.2 dB	<±0.3 dB	<±0.3 dB
-30 dB	<+3.0 dB -3.8 dB	<+4.2 dB -7.5 dB	<+2.2 dB -2.6 dB

Phase and Frequency Measurement

(as described in GSM recommendation 11.10)
After one timeslot, 577 µs, from an isolated Receiver Hop Trigger in the GSM frequency bands[1].
Range
RF In/Out: 0 to +45 dBm.
Aux RF In: -36 to +20 dBm.
Input Frequency Setting Error[5]: ±10 kHz.
Input Level Setting Error[5]: ±3 dB.
RMS Phase Error Accuracy: ≤1° rms
Peak Phase Error Accuracy: ≤4° peak
Frequency Error Accuracy: ±(0.02 ppm (18 Hz) + reference accuracy), for normal bursts.
Typically, ±(0.03 ppm (27 Hz) + reference accuracy), for RACHs.
Supplemental Characteristics
After three timeslots, 1.73 ms, from an isolated Receiver Hop Trigger in the GSM frequency bands[1].
RMS Phase Error Accuracy: *≤0.5° rms*
Peak Phase Error Accuracy: *≤2° peak*
Frequency Error Accuracy: *±(0.01 ppm (9 Hz) + reference accuracy), for normal bursts.*
±(0.02 ppm (18 Hz) + reference accuracy), for RACH bursts.

0.3 GMSK Data Recovery

After one timeslot, 577 µs, from an isolated Receiver Hop Trigger in the GSM frequency bands[1].
Range
RF In/Out: 0 to +45 dBm.
Aux RF IN: -36 to +20 dBm.
Input Frequency Setting Error[5]: ±100 Hz.
Required Input Phase Accuracy: ≤5° rms, ≤20° peak.
Demodulation Duty Cycle: 1 timeslot per frame.
Outputs: Data, Clock, and Data Valid.
Data Output Clock: Clocked at 1 MHz rate.
Delay, data: ≤1 frame (4.62 ms).
Output Level: TTL.

FM Demodulation Output

Range
RF IN/OUT: 0 to +45 dBm.
AUX RF IN: -36 to +20 dBm.
Sensitivity: 20 µV/Hz ± 5% (into open circuit).
Input Frequency Setting Error[5]: ±50 kHz, with ≤100 kHz pk deviation.
Input Level Setting Error[5]: ±3 dB.
Supplemental Characteristics
3 dB Bandwidth: *DC to 270 kHz.*
Output Impedance: *600 Ω.*
DC Offset: *≤5 mV.*

Pulse Demodulation Output

Range
RF In/Out: 0 to +45 dBm.
Aux RF In: -36 to +20 dBm.
Input Frequency Setting Error[5]: ±50 kHz.
Input Level Setting Error[5]: ±3 dB.
Rise time (10 - 90%): ≤2.5 µs.
Fall time (90 - 10%): ≤2.5 µs.
Supplemental Characteristics
Output Impedance: *600 Ω, DC coupled.*
Output Level: *2 Vpk into an open circuit.*

Output RF Spectrum Measurement

After one timeslot, 577 µs, from an isolated Receiver Hop Trigger in the GSM frequency bands[1].
Range
RF In/Out: 0 to +45 dBm.
Aux RF IN: -36 to +20 dBm.
Input Levels for Optimum Dynamic Range
RF In/Out: +13, +23, +33, +43 dBm.
Aux RF IN: -23, -13, -3, +7 dBm.
Input Frequency Setting Error[5]: ±10 kHz
Input Level Setting Error[5]: ±3 dB.
Supplemental Characteristics
Log Linearity: *±0.4 dB*
Amplitude Flatness: *±1.0 dB*
Amplitude Resolution: *0.4 dB*
Dynamic Range (dB): *This describes the spectrum analyzer resolution bandwidth filter used when measuring Output RF Spectrum. The dynamic range of the measurement will be a combination of this filter response and the modulation spectrum of the incoming signal.*

	Offset (kHz)					
	100	*200*	*300*	*400*	*600*	*800 to 1800*
Range (dB)	*29*	*45*	*51*	*63*	*73*	*75*

Note: *When using Output RF Spectrum due to Ramping measurement, the dynamic range is decreased by 12 dB (due to Peak Hold).*

Spectrum Analyzer Specifications

Frequency Range: 10 MHz to 1 GHz.

Frequency Span/Resolution

Bandwidth (coupled):

Span	Bandwidth
<50 kHz	300 Hz
<200 kHz	1 kHz
<1.5 MHz	3 kHz
≤4 MHz	30 kHz

Display: Log, 10 dB/div.

Display Range: 80 dB.

Log Linearity: ±1.1 dB.

Reference Level Range

RF In/Out: +48 to -18 dBm.

Aux RF In: +23 to -55 dBm.

Non-harmonic Spurious Responses: -50 dBc max, for inputs ≤-30 dBm.

Residual Responses: <-70 dBm (no input signal, 0 dB attenuation).

Image Rejection: >50 dB.

Supplemental Characteristics

Level Accuracy: *±2.5 dB.*

Frequency Overrange: *To 1015 MHz.*

Displayed Average Noise Level: *<-116 dBm (0 dB attenuation, <50 kHz spans).*

Audio Source Specifications

Frequency

Range: DC to 25 kHz.

Accuracy: 0.025% of setting.

Supplemental Characteristics

Minimum Resolution: *0.1 Hz.*

Output Level

Range: 0.1 mV to 4 V_{rms}.

Maximum Output Current: 20 mA peak.

Output Impedance: <1 Ω.

Accuracy: ±(2% of setting + resolution). Level ≥ 50 mV_{rms}

Residual Distortion (THD+noise, amplitude >200 mV_{rms}): 0.1%, 20 Hz to 25 kHz in 80 kHz BW.

Supplemental Characteristics

Minimum Resolution: *Level ≤0.01 V: 50 µV.*
Level ≤0.1 V: 0.5 mV.
Level ≤ 1 V: 5 mV.
Level > 1 V: 50 mV.

DC Coupled Offset: *<50 mV.*

Audio Analyzer Specifications

Frequency Measurement

Range: 20 Hz to 400 kHz.

Accuracy: ±(0.02% + 1 count + reference accuracy).

External Input: 20 mV_{rms} to 30 V_{rms}.

Supplemental Characteristics

Minimum Resolution: *f < 10 kHz: 0.01 Hz.*
f < 100 kHz: 0.1 Hz.
f ≥ 100 kHz: 1 Hz.

AC Voltage Measurement

Voltage Range: 0 to 30 V_{rms}.

Accuracy (20 Hz to 15 kHz, input >1 mV_{rms}): ±3% of reading.

Residual Noise + THD (15 kHz BW): 175 µV.

Supplemental Characteristics

3 dB Bandwidth: *2 Hz to 100 kHz.*

Input Impedance: *1 M Ω 145 pF at AUDIO IN.*

Minimum Resolution: *4 digits for inputs ≥100 mV.*
3 digits for inputs <100 mV.

DC Voltage Measurement

Voltage Range: 100 mV to 42 V.

Accuracy: ±(1.0% of reading + DC Offset).

DC Offset: ±45 mV.

Supplemental Characteristics

Minimum Resolution: *1 mV.*

Distortion Measurement

Fundamental Frequency: 1 kHz ± 5 Hz.

Input Level Range: 30 mV_{rms} to 30 V_{rms}.

Display Range: 0.1% to 100%.

Accuracy: ±1 dB (0.5 to 100% distortion).

Residual THD+Noise (15 kHz BW): the greater of -60 dB or 175 µV.

Supplemental Characteristics

Minimum Resolution: *0.01% Distortion.*

Audio Filters

50 Hz HPF	300 Hz HPF
300 Hz LPF	3 kHz LPF
15 kHz LPF	750 µs deemphasis
1 kHz notch.	

Audio Detectors

RMS	Pk+	Pk-
Pk+hold	Pk-hold	Pk±/2
Pk±/2 hold	Pk±max	Pk±max hold.

Oscilloscope Specifications

Frequency Range (3 dB): 2 Hz to 50 kHz.

Scale/Division: 10 mV to 10 V in 1, 2, 5, 10 steps.

Amplitude Accuracy (20 Hz to 10 kHz): ±1.5% of reading ± 0.1 division.

Time/Division: 10 µs to 100 ms in 1, 2, 5, 10 steps.

External Trigger Level: TTL.

Supplemental Characteristics

3 dB Bandwidth: *Typically >100 kHz.*

Internal DC Offset: ≤0.1 division for ≥50 µV/div sensitivity.

Maximum Voltage:

Scope In: 5 V_{pk}

Audio In: 30 V_{rms}

Remote Programming

HP-IB: Hewlett Packard's implementation of IEEE Standard 488.2.
Functions Implemented: SH1, AH1, T6, L4, SR1, RL1, LE0, TE0, PP0, DC1, DT1, C4, C11 ,E2.
RS-232: 3-wire RJ-11 connector used for serial data in and out.
Baud Rates: 300, 1200, 2400, 4800, 9600, and 19200 selectable.

General Specifications

Size: 177H x 426W x 574D mm. (7 x 16.75 x 23 in).
Weight: 32 kg, 70 lbs.
Operating Temperature: 0° to +55°C.
Storage Temperature: -40° to +75°C.
Power: 100, 120, 220, 240 Vac, 48 to 440 Hz, ±10% of line voltage, approximately 450 VA.
EMI: Conducted and radiated interference meets FTZ 1046, FTZ 526/527, and MIL STD 461B RE02, CE03 narrowband, and CE03 broadband above 200 kHz. Conducted susceptibility meets MIL 461B CS01 and CS02. Radiated susceptibility meets IEC 801-3 RS1.

Supplemental Characteristics
Leakage: *At RF Generator output levels <-40 dBm, typical leakage is <1 μV induced in a resonant dipole antenna 1 inch away from any surface except the rear panel. Spurious leakage levels are typically <5 μV in a resonant dipole antenna 1 inch away from any surface except the rear panel.*

Reference Specifications

(The accuracy needs for testing GSM radios require the unit to be operated with the High Stability Reference (Opt. 001) or an external high stability reference.)

Accuracy (after warm up): ±[(Time since calibration x Aging Rate) + Temperature Effects + Accuracy of calibration]
External Reference Input
Frequency: 13, 10, 5, 2, or 1 MHz, ±30 ppm.
Level: 0 to +10 dBm.
Nominal Impedance: *50 Ω.*
Supplemental Characteristics
***10 MHz OUT** (rear panel BNC)*
Level: *+8 dBm nominal.*
Impedance: *50 Ω nominal.*
***13 MHz OUT** (rear panel BNC)*
Level: *+8 dBm nominal.*
Impedance: *50 Ω nominal.*

Fixed Reference Mode

Aging: <2 ppm/year.
Temperature Stability: ±1 ppm (0° to +55°C).
Warm-up Time: <30 seconds, ±2 ppm of final frequency.

Tunable Reference Mode

Allows offsetting the internal reference by a selected amount relative to the High Stability Reference (Opt. 001) or an External Reference.
Required External Reference
Accuracy: ±0.5 ppm.
Tune Range: ±30 ppm.
Reference Accuracy (after calibration): ±1 ppm + accuracy of External Reference or High Stability Reference (Opt 001).
Temperature Stability (after calibration, 0° to 55°C): ≤4 ppm, for selected offsets of up to ±30 ppm.

High Stability Reference (Option 001)

Aging: <5x10⁻⁴ ppm/day after 24 hour warm-up. <0.1 ppm/year for continuous operation.
Temperature Stability: <2.5x10⁻³ ppm/°C (0°- +55°C).
Warm up time: Within 5x10⁻⁴ ppm of final value 10 min. after turn on, at 25°C.
Supplemental Characteristics
***Opt 001 Ref Out** (rear panel BNC to be connected to Ref In)*
Frequency: *10 MHz nominally.*
Level: *+7.5 dBm nominally.*

Transit Protection (Option 002)

Option 002 adds accessories which protect the HP 8922G during handling and transport. This option adds a rugged front panel cover, extended rear feet and an accessory pouch. The snap-on front cover protects the CRT and front panel from impact damage. The extended rear feet allow the unit to stand vertically with cables attached to the rear panel.

Protocol Logging (Option 003)

With Option 003, the HP 8922G copies protocol messages sent and received while maintaining a simulated mobile to base station link and sends them to the PT-300/500 via the data output port. Once received, protocol messages are logged by the PT-300/500 for verification and further analysis.

Ordering Information

HP 8922G GSM MS Test Set

Option 001 High Stability Reference.
Option 002 Transit Protection (Provides front panel cover, and extended rear feet).
Option 003 Protocol Logging (adds data output port and firmware for use with HP IDACOM PT-300 or PT-500 Protocol Analyzers.
Option 910 Provides a total of two sets of Operation Manuals (08922-90011) and Service Manuals (08922-90006).
Option 913 Rack Mount Flange Kit (5062-4072).
Option 915 Adds Service Manual (08922-90006).

Associated Equipment

HP 83210A Service Kit includes extender boards and cables, diagnostic software, and assembly level repair manual, (08922-90006).

HP 85700A 32 Kbytes static RAM memory card.
HP 85702A 128 Kbytes static RAM memory card.
HP 85704A 256 Kbytes static RAM memory card.
HP 85705A 512 Kbytes static RAM memory card.
HP 85701A 128 Kbytes OTP ROM memory card.
HP 85703A 256 Kbytes OTP ROM memory card.

08922-61062 High Stability Reference (Option 001) retrofit kit.

08922-61070 Transit Protection (Option 002) retrofit kit.

08922-61079 Protocol Logging (Option 003) retrofit kit.

9211-2662 Transit Case.

9211-1303 Operating Case (8.75" height to accommodate weight).

External Monitor: The HP 8922G external CRT output requires a multisync monitor capable of locking to a horizontal scanning frequency of 19.2 kHz.

HP Systems Engineering Assistance

Extra assistance from Hewlett-Packard in the form system installation, productivity assistance, programmer or user training, or solution consulting are available on a consulting basis. Call Hewlett-Packard for a quote.

Index

C

D

G

H

M

N

O

P

Q

R

S

T

U

V

W

X

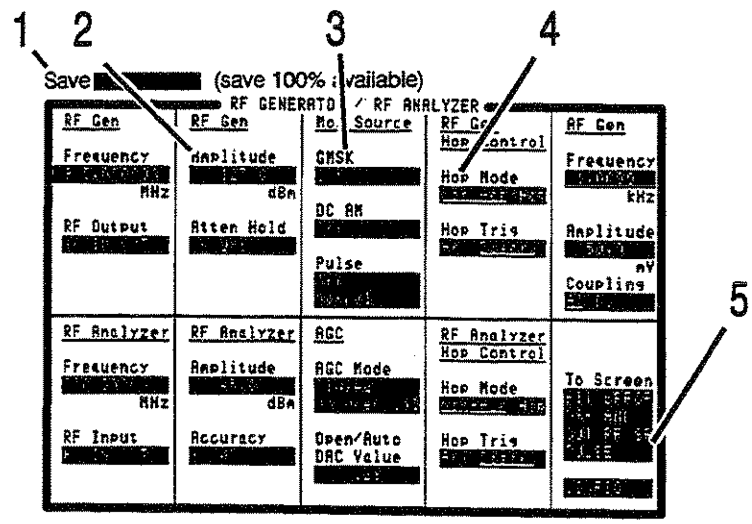
Z

4

Screens

Contents

Field Types



1. Alphanumeric

This field type allows entry of names or titles.

To enter, position the cursor next to a character or edit function, then push the knob to select it. (A list of character and function choices appears in the bottom-right corner of the screen.)

2. Data Entry

This field type allows entry of numeric values.

To enter a numeric value, position the cursor next to the field and change the value in one of two ways:

- Key in the value using the DATA keys.
- Push the knob then, turn it to increment or decrement the value.

3. List of Choices

This field type allows selection from a list of choices.

To make a selection, position the cursor next to the field and push the knob. A list of choices will appear in the bottom-right corner of the screen. Position the cursor and then push the knob to choose.

4. Underlined Entry

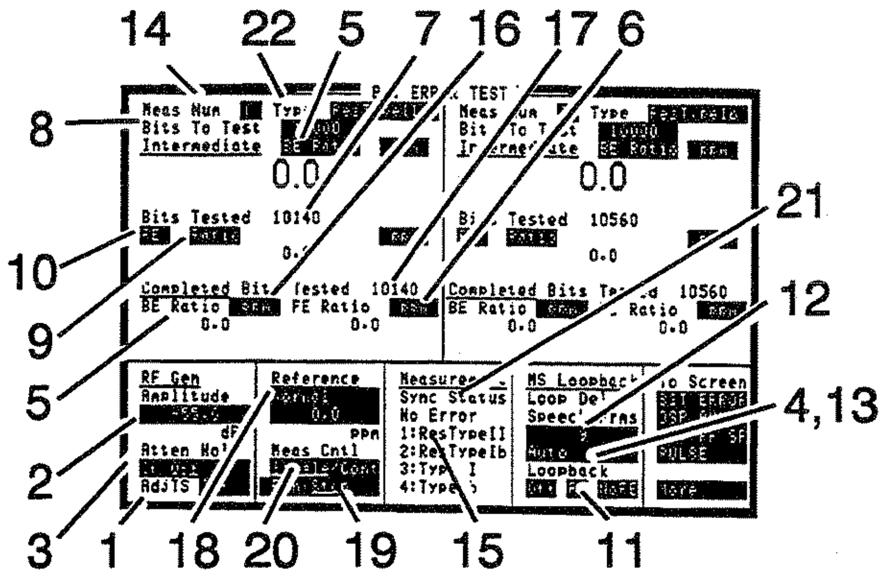
This type of field allows selection between the two labels in the field separated by a slash (/).

To make a selection, position the cursor next to the field and push the knob. The underlined choice is activated.

5. To Screen List

This field allows selection of alternate screens. Position the

Bit Error Test



Each time the Bit Error Test is run, four measurements are made (see Meas Num). Because of limited screen space, only two measurements are displayed at one time. The upper left side of the screen will display measurement 1 or 3, and the upper right side will display measurement 2 or 4. For further information, read the field description for Meas Num.

The test results display area is separated into Intermediate results, which are results obtained during a test, and Completed results, which are results from the last completed test.

1. Adj TS

This field selects automatic pulse modulation for the adjacent timeslots.

Choices

- **+30 dB** automatically pulses the adjacent timeslots 30 dB higher than the RF generator amplitude setting.

  The entire preceding timeslot is 30 dB higher. The first few bits of the following timeslot are 30 dB higher. The remainder of the following timeslot is pulsed off.
- **Off** makes all timeslots the same amplitude.

2. Amplitude

This field changes the RF generator amplitude. It is a duplicate of the RF generator's Amplitude field on the RF Generator/RF Analyzer screen.

See Also

Screens: RF Generator/RF Analyzer.

3. Atten Hold

This field turns the RF generator's attenuator-hold off or on.

See Also

Screen: RF Generator/RF Analyzer

4. Auto

This field sets the loop delay automatically whenever a bit error test is started.

See also

Screens: Bit Error Test (`Speech Frms`)

5. BE

These fields select how bit errors will be displayed for both the Intermediate and Completed results.

Choices

- **BE Count** displays the total number of bit errors.
- **BE Ratio** calculates and displays the ratio of bit errors counted to the total number of bits measured (depends on measurement type).

6. Bits Tested (Completed)

This field displays the number of bits that were tested during the last fully completed test.

Bit error tests may extend beyond the number entered in the Bits To Test field so that the last speech frame may be completed.

7. Bits Tested (Intermediate)

This field displays the number of bits that have been tested during a measurement that is currently running. This number includes only bits that are tested by the selected measurement type.

8. Bits To Test

This field selects the number of bits which will be tested. This number includes only bits that are tested by the selected measurement type.

9. Count or Ratio

This field determines how the frame erasures or cyclic-redundancy-check (CRC) errors will be displayed.

Choices

- **Count** displays the number of frame erasures or cyclic-redundancy-check (CRC) errors.
- **Ratio** displays the ratio of frame erasures or cyclic-redundancy-check (CRC) errors to total frames.

See Also

Keys: ON/OFF, LO LIMIT, HI LIMIT, REF SET, AVG, Units

10. CRC or FE

These fields determine what data will be displayed.

Choices

- **CRC** displays cyclic-redundancy-check (CRC) errors.
- **FE** displays frame erasures.

See Also

Keys: ON/OFF, LO LIMIT, HI LIMIT, REF SET, AVG, Units

11. Loopback

These fields select the loopback mode for the mobile station. When one of these fields is selected, the HP 8922G will attempt to put the mobile station in the described loopback mode.

Choices

- **Off** turns loopback mode off.
- **No FE** turns off frame erasure.
- **FE** selects loopback mode and turns on frame erasure.

See Also

Screens: Cell Control

12. Loop Delay Speech Frms

This field is used to enter or display amount of delay (expressed in number of speech frames), before bits are compared. The HP 8922G uses this value to synchronize to the correct received PRBS speech frame. The correct number of speech frames can be determined automatically by making a Bit Error Test using Auto Mode when the bit error ratio is ≈<20% (Bit Error Test Type = All FS). Then, if faster measurements are desired or if the bit error ratio exceeds 20%, change the mode to manual.

See Also

Screens: Bit Error Test (Manual, Auto)

13. Manual

This field allows you to set the loop delay in the upper field.

See Also

Screens: Bit Error (Speech Frms)

14. Meas Num

Use this field to define and display measurements 1 or 3. The right side of the screen allows access to measurements 2 or 4.

15. Measurement 1—4

These fields display a summary of the measurement Type definitions for all measurements 1—4. To change these fields, use the Meas Num and Type fields.

16. %, ppm (BE ratios)

These fields select the units (ppm or %) for BE Ratios. When BE Count is selected, these fields are blank.

See also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET,

17. %, ppm (FE or CRC ratios)

These fields allow selection of units for FE or CRC ratios. When FE or CRC count is selected, these fields are blank.

18. Reference

This field selects the HP 8922G internal reference's tuning mode. It is a duplicate of the field found on the Configure screen.

See Also

Screens: Configure

19. Run/Stop (Meas Cntl)

Run starts a bit error test. The Speech field in the Cell Control screen will automatically be set to PRBS. Digital Demod will automatically be armed if it was disarmed.

Stop discontinues the bit error test in progress.

20. Single/Cont (Meas Cntl)

Single allows one test to be performed. Cont allows testing to automatically repeat (until Stop is selected).

21. Sync Status

This field displays any errors that occurred while trying to synchronize to the midamble of demodulated data.

- **Bad Sync** appears if a synchronization error happened since the last Demodulation Arm (when Adjust Mode is disabled) or since the last change to Trig Delay (when Adjust Mode is enabled with Demod Arm already selected).

  Possible causes of Bad Sync are:
  Power was too low.
  Demodulation trigger too early or too late.
  FM (bit) errors found while synchronizing to desired midamble.
  RF overload (increase RF Analyzer Amplitude setting).
- **No Error** appears when no synchronization error occurred.

22. Type

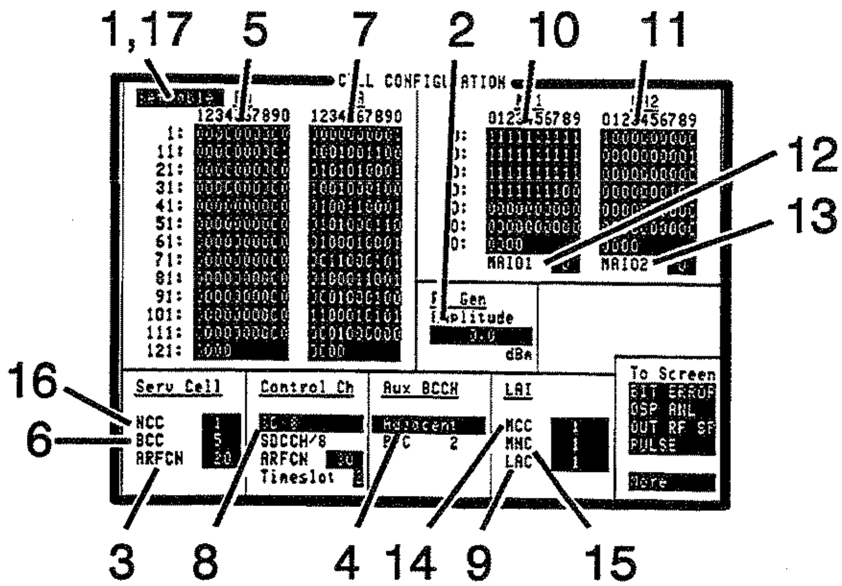
This field selects the type of bit error test results to display. (Res means residual).

Choices

- **TypeIA**
- **ResTypeIA**
- **TypeIB**
- **ResTypeIB**
- **TypeII**
- **ResTypeII**
- **TypeI**
- **ResTypeI**
- **AllFS**
- **ResAllFS**
- **Off**

Note Intermediate results for measurement type "Off" will return zeros.

Cell Configuration



1. Activated

When Activated is displayed, the HP 8922G is operating as a base station simulator, and calls can be attempted.

Most settings affecting cell configuration are not settable (cannot be changed) while Activated.

Choices

- **Activated** means that all of the Cell Configuration screen's settings are in use (activated) and cannot be changed. Also, the Hop Control screen functions cannot be changed.
- **Settable** means that most of the settings on this screen can be set. When Settable, the operating state of the HP 8922G is equal to the HP 8922A.

  When the HP 8922G operating state is changed from Settable to Activated, some fields are automatically changed or overwritten. Use the following table to locate the fields that might affect your setup.

Note

Some fields are displayed on more than one screen. This list will not show all field locations.

Screen	Field	State
Hop Control	RF Gen, Hop Trig	Arm
Hop Control	RF Anl, Hop Trig	check setting
Hop Control	Hop Address, Address Source	Seq
Hop Control	RF Gen, Settling	Normal
Hop Control	RF Analyzer, Settling	Normal
Hop Control	RF Gen, Hop Mode	Hop
Hop Control	RF Analyzer, Hop Mode	check setting
Hop Control	RF Analyzer, Hop Frequencies Address	0
Hop Control	RF Generator, Hop Frequencies Address	0
Hop Control	Hop Address	0
Hop Control	Hop Address Next	check setting
Digital Demod	Burst Num 0 Burst Type	Depends on Serv Cell BCC
Digital Demod	Burst Num 1 Burst Type	RACH
Digital Demod	Burst Num 2 Burst Type	Depends on Serv Cell BCC
Digital Demod	Burst Num 3 Burst Type	RACH
Digital Demod	Burst Num 0 Trig Qual	RF Power
Digital Demod	Burst Num 1 Trig Qual	RF Power
Digital Demod	Burst Num 2 Trig Qual	Normal
Digital Demod	Burst Num 3 Trig Qual	Normal
Digital Demod	Demod Sync, Burst Sel	Ext
Digital Demod	Demod Trig, Trig Source	Ext Demod
Digital Demod	Demod Arm, State	Arm
Measurement Sync	Meas Sync, Sync Mode	Midamble
Measurement Sync	Meas Sync, Burst Sel	Ext

See Also

Screens: Cell Configuration (`Settable`)

2. Amplitude

This field changes the RF generator amplitude. It is a duplicate of the RF Gen Amplitude field on the RF Generator/RF Analyzer screen.

See Also

Screens: RF Generator/RF Analyzer.

3. ARFCN

This field sets the absolute RF channel number for the serving cell Broadcast Channel.

4. Aux BCCH

This field allows selection of data and clock outputs.

Choices

- **Off** causes the front-panel MODULATION IN/OUT DATA and CLOCK connectors to be inputs.
- **Adjacent** causes data and clock signals to be output on the front-panel MODUALTION IN/OUT DATA and CLOCK connectors. These signals can be connected to a 0.3 GMSK generator (HP 8657A/B Option 022.) A mobile station should be able to camp on to the Aux BCCH.

  The BCC (Base Station Colour Code) is displayed in this field and has a number plus 1 modulo 4 relationship with Serv Cell BCC.

Note

The data output includes a midamble, which will result in discrete sidebands. If random data is desired, use an HP 8904A Option 001 or 002 to generate random data and clock signals to the 0.3 GMSK generator.

See Also

Connectors and Timing Diagrams: CLOCK (MODULATION)
Connectors and Timing Diagrams: IN/OUT DATA (MODULATION)

5. BA

This field is a 124-element Boolean array defining which ARFCNs are in the base station allocation. The serving cell ARFCN does not have to be set to a 1 in this table.

Choices

- **Done** exits the choices menu.
- **Position** moves the cursor to the desired position in the array.
- **0** means the ARFCN is not selected.
- 1 means the ARFCN is selected.

6. BCC

This field sets the base-station colour-code portion of the BSIC (base station identity code for the serving cell).

Range

0—7

7. CA

This field is a 124-element Boolean array defining which ARFCNs are in the cell allocation table. It is used to define the ARFCNs used in the TCH hop sequence.

Choices

- **Done** exits the choices menu.
- **Position** moves the cursor to the desired position in the array.
- **0** means the ARFCN is not selected.
- **1** means the ARFCN is selected.

8. Control Ch

This field selects the control channel organization.

Choices

- **SD/4** selects a broadcast channel with a BCCH + CCCH + SDCCH/4 channel organization. The broadcast channel will be on the physical channel defined under the Serv Cell ARFCN field, timeslot 0.
- **SD/8** selects a broadcast channel with a BCCH + CCCH organization. The SDCCH/8 control channel is defined by the following 2 fields.
  a. SDCCH/8 ARFCN
  b. SDCCH/8 Timeslot
- **FA** (fast associated) sets the control channel to use stolen FACCH frames on the TCH selected on the Cell Control screen. When this choice is made, the BCH will have a BCCH + CCCH channel organization. All call signaling is done on FACCH channels on the TCH.
- **SD/4+FA** selects a BCCH + CCCH + 4 SDCCH/4 broadcast channel. All call signaling is done on FACCH channels on the TCH.

9. LAC

This field is the location-area-code (LAC) portion of the location area identity (LAI).

Range

0—65535

10. MA1

This field is a 64-element Boolean array that defines which cell-allocation absolute radio frequency channel numbers (CA ARFCNs) will be in mobile allocation number 1 (MA1). MA1 defines which of the first 64 entries of 1s in the CA will be part of the sequential hop sequence for MA1.

Choices

- **Done** exits the choices menu.
- **Position** moves the cursor to the desired position in the array.
- **0** does not select an ARFCN from the CA table.
- **1** selects an ARFCN from the CA table.

11. MA2

This field is a 64-element Boolean array that defines which cell-allocation absolute radio frequency channel numbers (CA ARFCNs) will be in mobile allocation number 2 (MA2). MA2 defines which of the first 64 entries of 1s in the CA will be part of the sequential hop sequence for MA2.

Choices

- **Done** exits the choices menu.
- **Position** moves the cursor to the desired position in the array.
- **0** does not select an ARFCN from the CA table.
- **1** selects an ARFCN from the CA table.

12. MAIO1 This field is the integer mobile-allocation index offset 1 (MAIO1). It offsets the cyclic hop-sequence by the specified number of TDMA frames.

Range

0 through 63

13. MAIO2 This field is the integer mobile-allocation index offset 2 (MAIO2). It offsets the cyclic hop-sequence by the specified number of TDMA frames.

Range

0 through 63

14. MCC This field is the mobile country-code (MCC) portion of the location area identity (LAI).

Range

0—999

15. MNC This field is the mobile network-code (MNC) portion of the location area identity (LAI).

Range

0—99

16. NCC

This field sets the NCC: PLMN Colour Code portion of the base station identity code (BSIC) for the serving cell.

Range

0 through 7

17. Settable

This field, when Settable is displayed, indicates that all Cell Configuration settings can be set or modified.

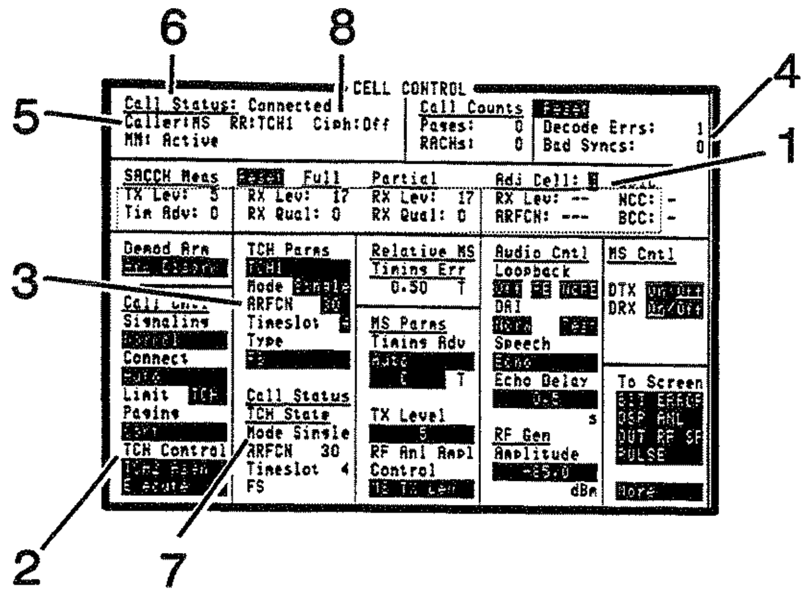
When the HP 8922G Cell Configuration is changed from Activated to Settable, some fields are automatically changed or overwritten. Use the following table to locate the fields that might affect your setup.

Note

Some fields are displayed on more than one screen. This list will not show all field locations.

Screen	Field	State
Digital Demod	Demod Arm State	Disarm
Hop Control	RF Gen Hop Trig	Disarm
Hop Control	RF Anl Hop Trig	Disarm
Hop Control	RF Gen Hop Mode	Non-Hop
Hop Control	RF Analyzer Hop Mode	Non-Hop

Cell Control



1. Adj Cell

This field selects which adjacent cell SACCH measurement result to display. The adjacent cells are prioritized by power level. 1 is the largest signal.

Range

1 to 6

2. Amplitude

This field changes the RF generator amplitude. It is a duplicate of the RF generator Amplitude field on the RF Generator/RF Analyzer screen.

See Also

Screens: RF Generator/RF Analyzer.

3. ARFCN

This field selects the ARFCN for TCH1 or TCH2 when the Mode field is set to Single.

Other Settings

- MA1 or MA2 appears in this field when Mode is set to Hopped.

4. Bad Syncs

This field is a count of bad synchronization occurrences during the current call, or since the last reset.

5. Caller

This field indicates who initiated the current call.

- MS indicates mobile station initiation.
- BS indicates base station initiation.
- — — indicates status call status is inactive.

6. Call Status

This field indicates the state of the current call.

- Inactive
- Setup Request
- Alerting
- Connected
- Disconnect
- Proceeding

7. Call Status TCH State

These fields give information about the current TCH. (If the HP 8922G is not on a TCH yet, these will be blank.)

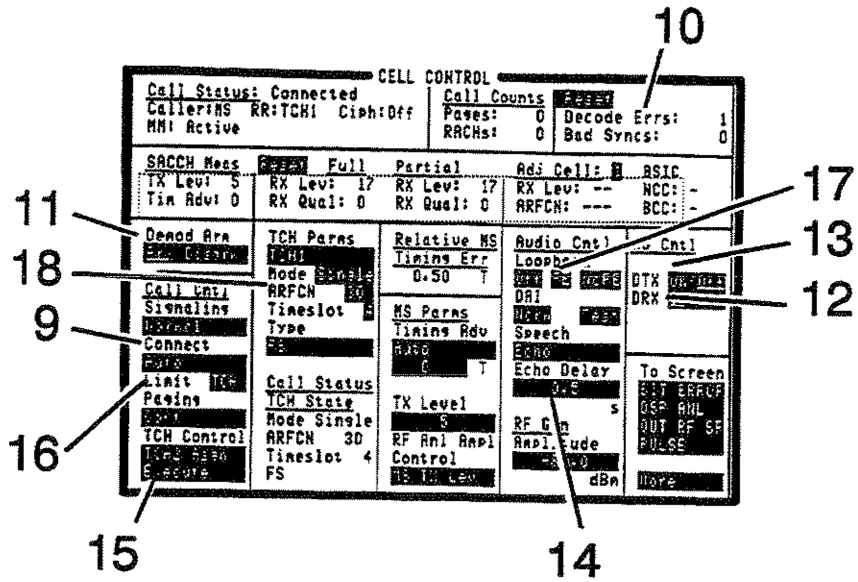
- Mode (Hopped or Single)
- ARFCN (this will be an integer if TCH Mode is single, otherwise MA1 or MA2)
- Timeslot

8. Ciph:

This field displays the current Ciphering mode of the mobile station. If Option 005 is installed in the HP 8922G, the Ciphering Mode can be changed using the Ciphering field on the MS INFORMATION/SIGNALING screen.

Choices

- Off (disabled)
- On (enabled)



9. Connect This field selects how an MS originated call will be connected.

Choices

- **Manual** connection means that a mobile-initiated call must be answered manually using the RCV CALL key.
- **Auto** connection means that a mobile-initiated call will be answered automatically.

10. Decode Errors This field indicates the number of decode errors during the current call or since the last Reset.

11. Demod Arm This field arms or disarms triggering for digital demodulation. It is identical to the Demod Arm State field on the Digital Demod screen.

Important

This field is set to Disarm whenever a measurement screen (DSP Analyzer, Output RF Spectrum, or Pulse) is accessed. When Demod Arm is disarmed, the HP 8922G cannot display information about the uplink. When Demod Arm is re-armed, Cell Control fields that display information about the uplink will resume normal operation.

When Demod Arm is re-armed, measurement results (DSP Analyzer, Output RF Spectrum, Pulse) are lost.

12. DRX This field turns the discontinuous reception (DRX) mode of the mobile station on or off.

13. DTX This field turns the discontinuous transmission (DTX) mode of the mobile station on or off.

14. Echo Delay This field sets the echo delay when the Speech field is set to Echo mode.

15. Execute This field executes the function selected in the TCH Control field.

16. Limit This field selects what signaling state a call will be limited to.

Choices

- BCCH is the broadcast channel. The instrument will not respond to RACHs.
- DCCH is the dedicated control channel. The instrument will not assign to a TCH.
- TCH is the traffic channel. This is the normal operating mode.

17. Loopback These fields select the loopback mode for the mobile station. When one of these fields is selected, the HP 8922G will attempt to put the mobile station in the described loopback mode.

Choices

- **Off** turns loopback mode off.
- **No FE** turns on loopback with no frame erasure.
- **FE** turns on loopback with frame erasure.

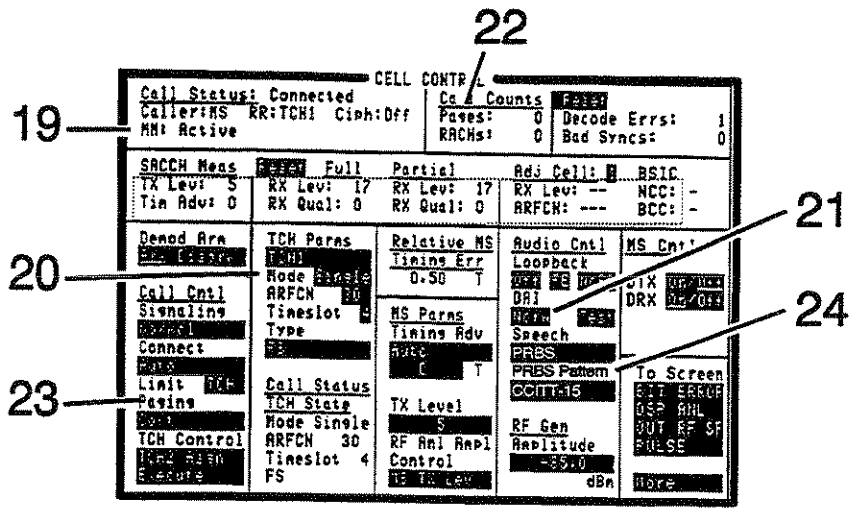
18. MA1, MA2 This field selects which MA table on the Cell Config screen will be used by the TCH selected when the Mode field is set to Hopped.

Choices

- MA1 selects the MA1 table for frequency hopping.
- MA2 selects the MA2 table for frequency hopping.

Other Settings

- ARFCN appears in this field when Mode is set to Single.



19. MM This field displays the latest events from the Mobility Management sublayer.

- **Loc Upd**
- **Ident**
- **Auth**
- **TMSI**
- **Inactive**
- **Active**

20. Mode This field selects the mode for the traffic control channel selected in the TCH Parms field.

Choices

- **Single** selects a single ARFCN.
- **Hopped** selects a hopped traffic control channel using an MA table.

See Also

Screens: Cell Config (MA1)
Screens: Cell Config (MA2)

21. Norm

This field uses the digital-audio interface (DAI) to select the normal operating mode for the mobile station.

22. Pages

This field indicates the number of pages made since the last Reset.

23. Paging

This field selects the paging mode.

Choices

- **Single** pages just once when attempting to make a call.
- **Cont** pages continuously until a connection is made.

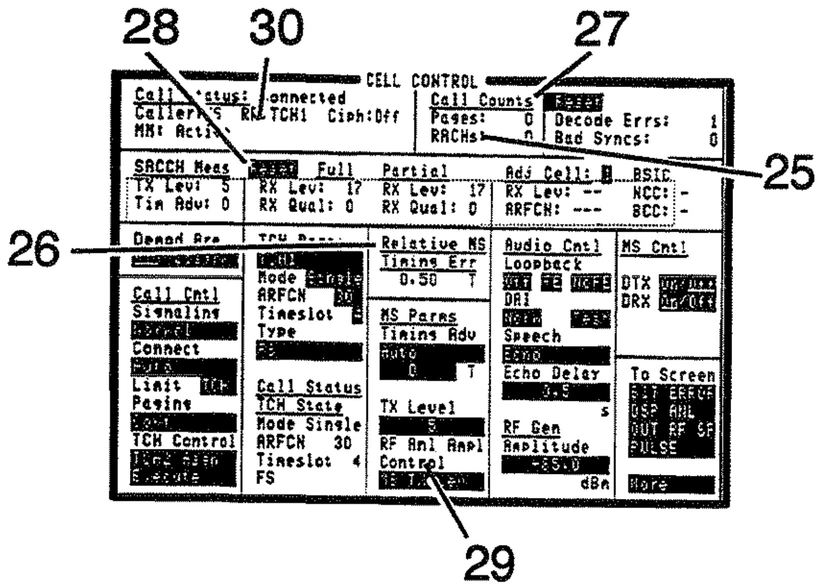
24. PRBS Pattrn

This field allows you to choose from 6 different bit patterns. The HP 8922G will send the selected sequence to a mobile station. The mobile station must be in loopback mode (see Loopback field description) to return the bit sequence for bit error testing.

This field is displayed only when PRBS is selected in the Speech field.

Choices

- **CCITT-15** ($2^{15} - 1$ bit pseudo-random pattern, see CCITT Rec. 0.151)
- **CCITT-23** ($2^{23} - 1$ bit pseudo-random pattern, see CCITT Rec. 0.151)
- **0** (all zeros)
- **1** (all ones)
- **01** (alternating 0,1)
- **10** (alternating 1,0)



25. RACHs

This field indicates the number of RACHs received during the current call or since the last Reset.

26. Relative MS Timing Err

This field displays the length of time between when the HP 8922G expected the uplink burst to arrive and the time it actually arrived.

Timing error measurements on the uplink burst are made from the center of bit 0, and are relative to the default trigger delay value of 473.4 T (see Measurement Sync, Trigger Delay).

The HP 8922G normally expects the uplink burst 468.75 bit periods after the beginning of the downlink burst. The trigger delay's default value of 473.4 T reflects an additional HP 8922G delay of 4.65 T (468.75 + 4.65 = 473.4 T).

The accuracy of this measurement is ±0.25 T. For more accurate measurements, refer to DSP Analyzer, Data Bits, First Bit.

See Also

Screens: DSP Analyzer: Data Bits (`First Bit`)

27. Reset (Call Counts)

This field clears out the counts of pages, RACHs, synchronization, and decode errors detected.

28. Reset (SACCH Meas)

This field clears-out all of the SACCH measurements.

29. RF Anl Ampl Control

This field selects control of the RF analyzer's amplitude setting field.

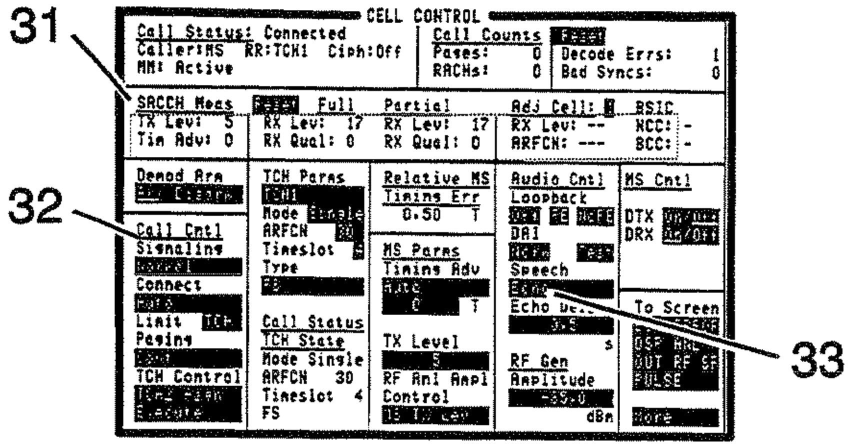
Choices

- **MS TX Lev** automatically sets the RF analyzer's amplitude setting based on the TX Level field.
- **Manual** requires manual setting of the RF analyzer's amplitude.

30. RR

This field displays the currently established logical channel as indicated by the Radio Resource sublayer.

- **BCCH** indicates that a broadcast channel is being transmitted, and the HP 8922G is ready to receive a RACH.
- **DCCH** indicates that a control channel is established. The physical channel organization depends on the Control Channel setting (see Cell Configuration screen).
- **TCH1** indicates that a traffic channel is established using the parameters from a TCH1 setup (see TCH Parms, Cell Control screen).
- **TCH2** indicates that a traffic channel is established using the parameters from a TCH2 setup (see TCH Parms, Cell Control screen).
- **None** is displayed when the instrument mode is Settable (see Cell Configuration screen).



31. SACCH Meas

These fields indicate the measurement results of a slow associated control channel measurement.

- TX Lev indicates the mobile station's reported transmitter power level.
- Tim Adv is the mobile station's reported timing advance.
- **Full** RX Lev is the mobile station's received level of power from the serving cell using the Full measurement method.
- **Full** RX Qual is the mobile station's received quality of signal from the serving cell using the Full measurement method.
- **Partial** RX Lev is the mobile station's level of power from the serving cell using the Partial measurement method.
- **Partial** RX Qual is the mobile station's received quality of signal from the serving cell using the Partial measurement method.
- **Adj Cell** RX Lev is the reported level of power of the adjacent cell selected in the Adj Cell field.
- **Adj Cell** ARFCN is the absolute radio frequency channel number of the adjacent cell selected in the Adj Cell field.
- **BSIC** NCC reads the NCC: PLMN Colour-Code portion of the base station identity code (BSIC) of the adjacent cell selected in the Adj Cell field.
- **BSIC** BCC reads the BCC: Base Station Colour-Code portion of the base station identity code (BSIC) of the adjacent cell selected in the Adj Cell field.

32. Signaling

Choices

- **Normal** will cause the call to follow the normal GSM recommended signaling to make a call.
- **Limited** will eliminate normal call signaling and force an immediate transition to the final channel configuration permitted by the Limit field.

33. Speech

This field selects the speech mode.

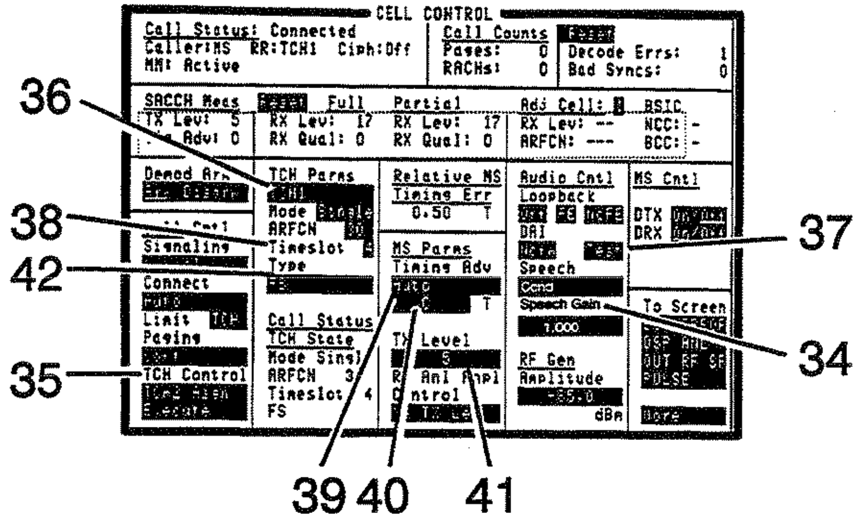
Choices

- **None**
- **Uncond** (unconditioned) activates the MODULATION IN AM/SPEECH connector on the front panel, but the speech signal is not conditioned by filters, and no gain control is provided.
- **Cond** (conditioned) activates the MODULATION IN AM/SPEECH connector on the front panel and conditions speech through filters. Gain control is available in the Speech Gain field.

  DCAM must be off when Cond is selected. See Screens, RF Generator/RF Analyzer.

  To hear the demodulated audio from the mobile station, go to the CW Meas/AF Analyzer screen. Under AF Analyzer In, select SpeechOut. The audio signal will also be available at the Demodulation Out Mon/Speech Out connector.
- **Echo** causes the HP 8922G to send back to the mobile station the speech that the HP 8922G receives. The echo delay is the additional delay the HP 8922G inserts before sending back speech to a mobile station.
- **PRBS** generates a pseudo random bit sequence which is used for making bit error tests. When selected, a field called PRBS Pattrn is displayed (refer to PRBS Pattrn field description).

  PRBS is selected automatically when Run is selected on the Bit Error Test screen.



34. Speech Gain

This field sets the amplification of the Cond speech mode.

35. TCH Control

This field selects traffic-channel control type.

Choices

- **TCH1 HO** selects an intercell handover based on the TCH1 parameter selections.
- **TCH2 HO** selects an intercell handover based on the TCH2 parameter selections.
- **TCH1 Asgn** selects a traffic channel assignment based on the TCH1 parameter selections.
- **TCH2 Asgn** selects a traffic channel assignment based on the TCH2 parameter selections.

36. TCH Parms

This field selects which traffic channel parameter settings to display.

Choices

- **TCH1** displays traffic channel 1 settings.
- **TCH2** displays traffic channel 2 settings.

37. Test

This field tells the mobile station to select the "Test of acoustic devices and A/D and D/A" mode. This is done over the digital-audio interface (DAI).

38. Timeslot

This field selects the timeslot for the traffic channel selected in the TCH Parms field.

Range

2 through 6

39. Timing Advance (mode)

This field selects the timing advance mode.

Choices

- **Manual** allows manual setting of the MS timing advance.

  When Manual is selected, the mobile station's timing advance can be changed by entering a number in the Timing Advance (number) field. The mobile station's current timing advance, displayed in the SACCH Meas Tim Adv field, should match the Timing Advance number.
- **Auto** automatically calculates and sets MS timing advance.

40. Timing Advance (number)

This field sets the MS's timing advance.

Range

0 through 63

41. TX Level

This field selects the transmitter power for the mobile station to use.

Range

0 through 15

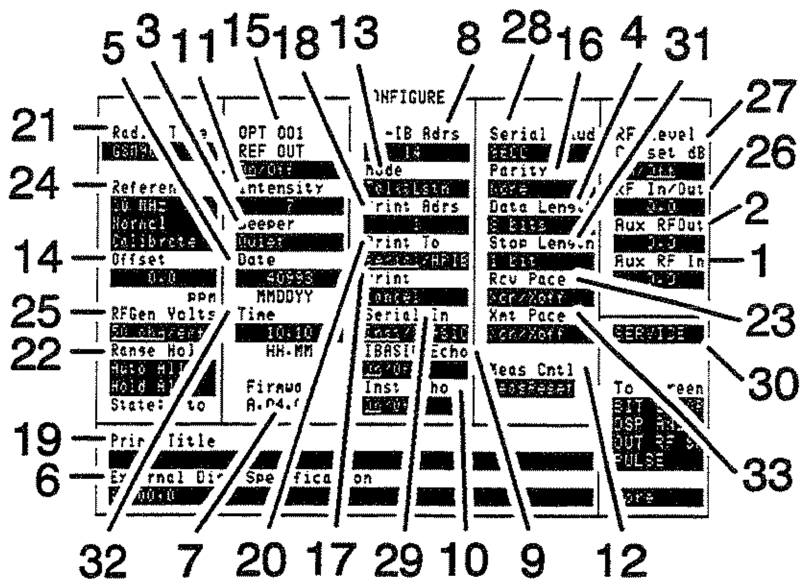
42. Type

This field selects the traffic channel type for the TCH selected in TCH Parms.

Choices

- FS Full rate speech.

Configure



1. Aux RF In This field is used to indicate losses or gains between the AUX RF IN port and the device under test.

Enter a **positive** value to indicate a gain (such as an amplifier). The Spectrum Analyzer Marker Level (Lvl), CW Power, PK TX Power and Fast TX Carrier Power measurements are automatically reduced. (The Spectrum Analyzer Ref Level is automatically decreased, so the trace position does not appear to change.)

Enter a **negative** value to indicate a loss (such as cable loss). The Spectrum Analyzer Marker Level (Lvl), CW Power, PK TX Power and Fast TX Carrier Power measurements are automatically increased. (The Spectrum Analyzer Ref Level is automatically increased, 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

2. Aux RF Out

This field is used to indicate losses or gains between the AUX RF 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 `Aux RF In` setting, or decrease the `Aux RF Out` value.

This field is only used when the `RF Level Offset` field is set to `On`.

3. Beeper

This field controls the beeper volume.

Choices

- Off
- Quiet
- Loud

4. Data Length

This field sets the Serial Port word length.

Choices

- 7 bits
- 8 bits

5. Date

This field sets the date for the internal calendar. The Date can be read by a controller using HP-IB, then printed on test results.

6. External Disk Specification

This field sets the external disk address used by the Tests screen's Location field when it is set to Disk.

See Also

Keys: Tests

7. Firmware

This field displays the firmware revision number for the current firmware.

8. HP-IB Adrs

This is the HP-IB address entry field.

Range

0 to 30.

9. IBASIC Echo

This field turns IBASIC echo on or off. When IBASIC Echo is on, non-graphic characters printed to the HP 8922G display during a "Print-to-Screen" operation, will also be printed to a PC terminal.

10. Inst Echo

This field turns instrument echo on or off. When Inst Echo is set to on, IBASIC commands entered into the HP 8922G through a computer

or ASCII RS-232 terminal will appear on both the HP 8922G screen and the terminal.

11. Intensity

This is the CRT intensity adjustment field.

Range

1 to 8.

12. Meas Reset (Meas Cntl)

Selecting Meas Reset will erase any accumulated measurements used for calculating a final result, and re-start the measurement process for the following functions:

- HI LIMIT
- LO LIMIT
- AVG

See Also

Keys: HI LIMIT, LO LIMIT, AVG

13. Mode

This field selects the remote, HP-IB operation mode.

Choices

- **Talk&Lstn** sets the instrument to normal HP-IB operation.
- **Control** turns the instrument into the HP-IB controller.

14. Offset

This field sets the reference frequency offset in parts-per-million (ppm).

15. OPT 001 REF OUT

This field turns the optional high stability timebase on or off (when installed).

16. Parity

This field selects parity for the rear panel serial port.

Choices

- None
- Odd
- Even
- Always 1
- Always 0

17. Print

This field cancels printing.

See Also

Keys: Print

18. Print Adrs

This field sets the HP-IB print address.

Range

0 to 30

19. Print Title

This field is used to enter a title, up to 50 characters, to be printed at the top of all screen printouts.

Choices

- **Done**
- **Position** moves the cursor to any position in the title block.
- **Over/Ins** When the cursor is blinking, you are in insert mode.

  when the cursor is not blinking, you are in typeover mode.
- **Delete** erases the character at the cursor.
- **Del End** erases all the characters from the cursor position to the end of the string (including the character at the cursor).
- **Bk Space** erases the characters in the space previous to the cursor.
- Upper and lower case letters: A through Z.
- Numerals: 0 through 9
- Special characters: space _ " # $ % & ' ( ) * + , - . / : ; < = > ? @ [\ ] ^ ` { | } ~

20. Print To

This field selects the printer port bus to print to, either serial or HP-IB.

21. Radio Type

This field selects the type of radio to be tested.

Choices

- **GSM900**
- **DCS1800**

22. Range Hold

This field selects the ranging mode for the AF analyzer and the spectrum analyzer.

Choices

- **Auto All** selects auto ranging.
- **Hold All** selects range hold, allowing manual setting of spectrum analyzer input attenuation and AF Analyzer gain control.

See Also

Screens: Spectrum Analyzer (`Input Atten`)
Screens: CW Meas/AF Analyzer (`Gain Cntl`)

23. Rcv Pace

This field is used to select if data will be paced through the serial port.

Choices

- **None** disables the Xon/Xoff function
- **Xon/Xoff** sets ASCII control codes Xon and Xoff to start and stop data transmission from the computer to the instrument.

24. Reference

This field selects the external reference frequency that the instrument locks to, and sets the reference tuning mode.

Choices

- 13 MHz
- 10 MHz
- 5 MHz
- 2 MHz
- 1 MHz
- **Normal** locks the instrument to the external reference frequency selected.
- **Tunable** enables the instrument to adjust its internal frequency reference. Frequency adjustment is relative to an external reference which the internal reference is calibrated to.
- **Calibrate** calibrates the internal reference to the external reference for use in Tunable mode.

25. RFGen Volts

This field selects between 50 ohm and emf voltage units for the RF generator amplitude settings.

26. 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 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 CW Power, PK TX Power, Fast TX Carrier Power measurements, and Spectrum Analyzer Marker Level (`Lvl`), are automatically *reduced*.

- Enter a **negative** value to indicate a loss (such as cable loss). The RF 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 CW Power, PK TX Power, Fast TX Carrier Power measurements, and Spectrum Analyzer Marker (`Lvl`), are *increased*.

This field is only used when the `RF Level Offset` field is set to `On`.

27. RF Level Offset

This field enables/disables the effects of the `RF In/Out`, `Aux RFOut`, and `Aux RF 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

`Aux RF In`
`Aux RFOut`
`RF In/Out`

28. Serial Baud

This field sets the baud rate for serial port.

Choices

- 300
- 600
- 1200
- 2400
- 4800
- 9600
- 19200

29. Serial In

This field configures the serial port (Inst) communication to the serial input port or IBASIC control of the serial input port.

- **Inst** configures the serial port to connect to an external ASCII RS-232 terminal or computer.
- **IBASIC** allows the IBASIC controller to read the serial port.

30. SERVICE

This field in the To Screen list is only present on the Configure screen. It allows access to the Service screen.

31. Stop Length

This field sets the number of stop bits used for serial communication.

Choices

- 1 bits
- 1.5 bits
- 2 bits

32. Time

This field sets the internal instrument clock.

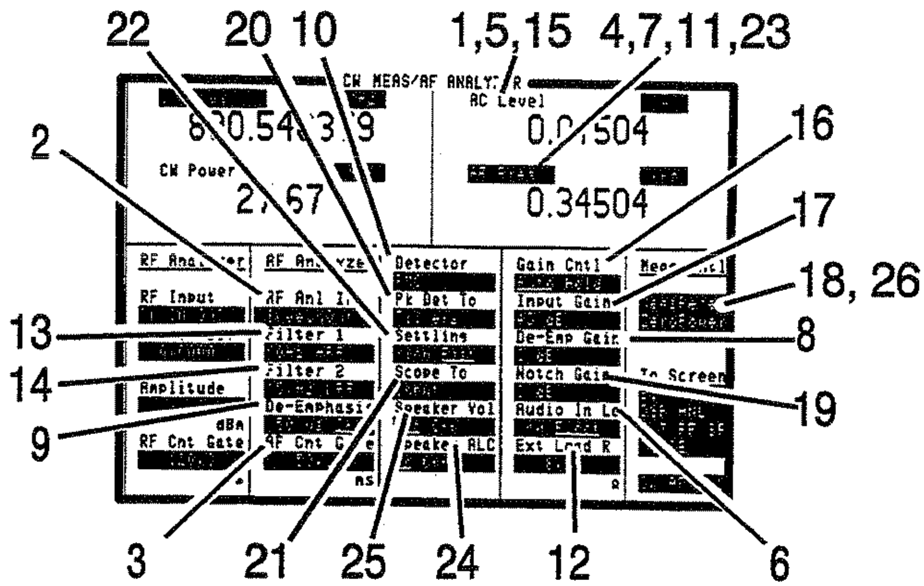
33. Xmt Pace

This field is used to select if data will be paced through the serial port.

Choices

- **None** disables the Xon/Xoff function.
- **Xon/Xoff** sets ASCII control codes Xon and Xoff to start and stop the instrument from transmitting to the computer.

CW Meas/AF Analyzer (AF Analyzer)



1. AC Level

This field displays the measured ac level of the AF analyzer input (AF Anl In) when Audio Out, Pls Demod, Audio In, Speech In, Speech Out, or Scope In is selected as the input.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, METER, Units

2. AF Anl In

This field selects the AF analyzer input.

Choices

- **Scope In** selects the SCOPE IN (MEASURE) front-panel connector.
- **Speech Out** selects the signal going to the MON/SPEECH (DEMODULATION OUT) front-panel connector.
- **AM Mod In** selects the IN AM/SPEECH (MODULATION) front-panel connector.
- **Speech In** selects the IN AM/SPEECH (MODULATION) front-panel connector.
- **FM Demod** selects the FM demodulation discriminator.
- **Pls Demod** selects the pulse demodulation detector.
- **Audio In** selects the IN (AUDIO) front-panel connector.
- **Audio Out** selects the signal going to the AUDIO OUT front-panel connector.

3. AF Cnt Gate

This field sets the frequency counter's gate time.

Range

0.01 seconds to 1 second.

4. AF Freq

This field selects the type of measurement to be made on the input signal. The input signal to be measured is selected in the AF Anl In field.

Choices

- **AF Freq** measures the audio frequency.
- **DC Level** measures the dc level.
- **Distn** measures the distortion.
- **SINAD** measures SINAD.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, METER, Units

5. AM Depth

This field displays the measured AM depth of the AF analyzer input (AF Anl In) when AM Mod In is selected as the input.

6. Audio In Lo

This field sets the reference for the Audio In Lo BNC connector. The choices are Float or Gnd.

7. DC Level

This field selects the type of measurement to be made on the input signal. The input signal to be measured is selected in the AF Anl In field.

Choices

- **AF Freq** measures the audio frequency.
- **DC Level** measures the dc level.
- **Distn** measures the distortion.
- **SINAD** measures SINAD.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, METER, Units

8. De-Emp Gain

This field sets the gain of the AF analyzer de-emphasis filter. If Gain Cntl is set to Auto, the value selected in this field may be overwritten.

Choices

- 0 dB
- 10 dB
- 20 dB
- 30 dB

9. De-Emphasis

This field selects the 750 μs de-emphasis filter or turns off de-emphasis.

10. Detector

This field selects the Detector used for AF analyzer measurements.

Choices

- **RMS** selects the root-mean-square detector.
- **Pk+** selects the positive peak detector.
- **Pk−** selects the negative peak detector.
- **Pk+−/2** selects the peak average detector.
- **Pk+−Max** selects the maximum peak detector.
- **Pk+ Hold** selects the positive peak hold detector.
- **Pk− Hold** selects the negative peak hold detector.
- **Pk+−/2 Hd** selects the average peak hold detector.
- **Pk+−Mx Hd** selects the maximum peak hold detector.

11. Distn

This field selects the type of measurement to be made on the input signal. The input signal to be measured is selected in the AF Anl In field.

Choices

- **AF Freq** measures the audio frequency.
- **DC Level** measures the dc level.
- **Distn** measures the distortion.
- **SINAD** measures SINAD.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, METER, Units

12. Ext Load R

This field sets the AF analyzer external load resistance for displaying AF analyzer measurement results in Watts.

Range

0.1 ohm to 1 megohm.

13. Filter 1

This field selects the high-pass filter at the AF analyzer input.

Choices

- <20Hz HPF
- 50Hz HPF
- 300Hz HPF

14. Filter 2

This field selects the low-pass filter at the AF analyzer input.

Choices

- 300Hz LPF
- 3kHz LPF
- 15kHz LPF
- >99kHz LP

15. FM Deviation

This field displays the measured FM deviation of the AF analyzer input (AF Anl In) when FM Demod is selected as the input.

16. Gain Cntl

This field selects the AF analyzer gain control. When Auto is selected, gain is set automatically, based on audio level. When Hold is selected, gain values can be set manually.

17. Input Gain

This field sets the gain of the AF analyzer input when Gain Cntl is set to Hold. If Gain Cntl is set to Auto, the value selected in this field may be overwritten.

Choices

- 0 dB
- 20 dB
- 40 dB

18. Meas Reset (Meas Cntl)

Selecting Meas Reset will erase any accumulated measurements used for calculating a final result, and re-start the measurement process for the following functions:

- HI LIMIT
- LO LIMIT
- AVG

This field resets the AF Analyzer measurements.

See Also

Keys: HIGH LIMIT, LO LIMIT, AVG

19. Notch Gain

This field sets the gain of the AF analyzer notch when Gain Cntl is set to Hold. If Gain Cntl is set to Auto, the value selected in this field may be overwritten.

Choices

- 0 dB
- 10 dB
- 20 dB
- 30 dB
- 40 dB

20. Pk Det To

This field selects whether the de-emphasis filter is used when making measurements using a peak detector.

Choices

- **De-Emp** Places the de-emphasis filter in the signal path for peak-detected measurements.
- **Filters** Measurements are made without the de-emphasis filter.

21. Scope To

This field selects the oscilloscope measurement point. It allows you to look at the signal at different points in the AF analyzer signal path. Except for the Input setting, all Scope To choices are

ac-coupled. Use the Input setting to provide dc-coupling if the signal to be measured is $\leq$20 Hz.

Choices

- **Input** selects the analyzer input.
- **Filters** selects a point immediately following the filters.
- **De-Emp** selects a point immediately following the de-emphasis filter.
- **Notch** selects a point immediately following the notch filter.

22. Settling

This field selects the AF analyzer detector Settling. Slow is used for low-frequency audio measurements $\leq$200 Hz. Fast is used for higher-frequency audio measurements >200 Hz.

23. SINAD

This field selects the type of measurement to be made on the input signal. The input signal to be measured is selected in the AF Anl In field.

Choices

- **AF Freq** measures the audio frequency.
- **DC Level** measures the dc level.
- **Distn** measures the distortion.
- **SINAD** measures SINAD.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, METER, Units

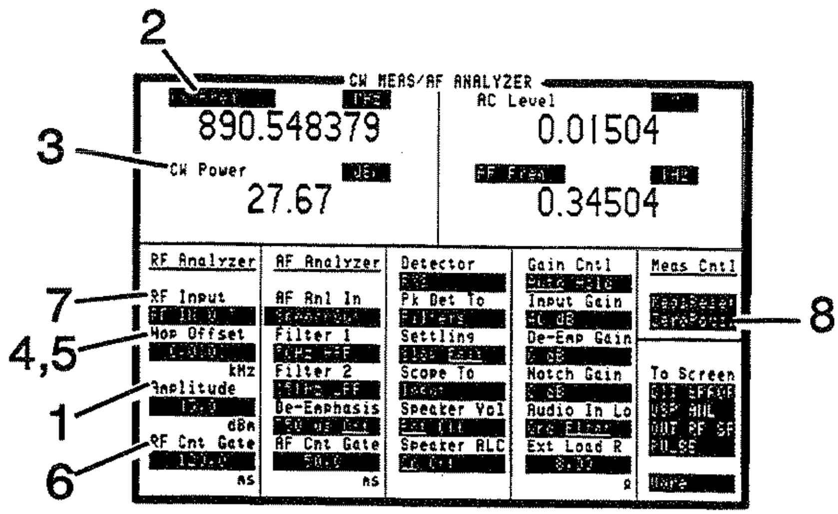
24. Speaker ALC

This field selects the Speaker ALC mode. On maintains the speaker output at a constant amplitude for audio signals/tones of different levels. Off allows the audio signal/tone level to determine the speaker output.

25. Speaker Vol

This field turns the Speaker Volume off or directs control to the front-panel volume control. Pot selects front-panel volume control knob. Off turns the speaker off.

CW Meas/AF Analyzer (CW Meas)



1. Amplitude

This field is the input amplitude to be assumed at the selected RF analyzer input. The amplitude shown is for the port selected in the RF Input field.

Range

RF IN/OUT: −21.9 to +45.0 dBm.
AUX RF IN: −58.0 to +20.0 dBm.

See Also

Screens: RF Analyzer/RF Generator

2. CW Freq, CWFreqErr

This field selects the type of measurement to be made on the signal at the RF input. This measurement is valid only for non-pulsed signals.

Choices

- **CW Freq** displays the measured frequency.
- **CWFreqErr** displays the measured frequency error relative to the continuous wave frequency set in the RF Analyzer's Frequency field.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, METER, Units

3. CW Power

This field displays the measured CW power. This measurement is valid only for non-pulsed signals at the front-panel RF IN/OUT connector. This measurement is made at the frequency entered in the Frequency field.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, METER, Units

4. Frequency

This field sets the RF analyzer's input frequency when the RF analyzer's Hop Mode is Non-Hop. This field is displayed only when the RF analyzer's Hop Mode is Non-Hop.

Range

10.0 to 1015.0 MHz.

5. Hop Offset

This field sets the hop offset when the RF analyzer's Hop Mode is set to Hop. The frequency offset is applied to all of the frequencies in the RF analyzer's hop frequency table when the RF analyzer is hopping.

Range

−50.000 to +50.000 kHz.

6. RF Cnt Gate

This field sets the frequency counter's gate time.

Range

0.11 seconds to 1 second.

7. RF Input

This field selects the front-panel RF input for the RF analyzer.

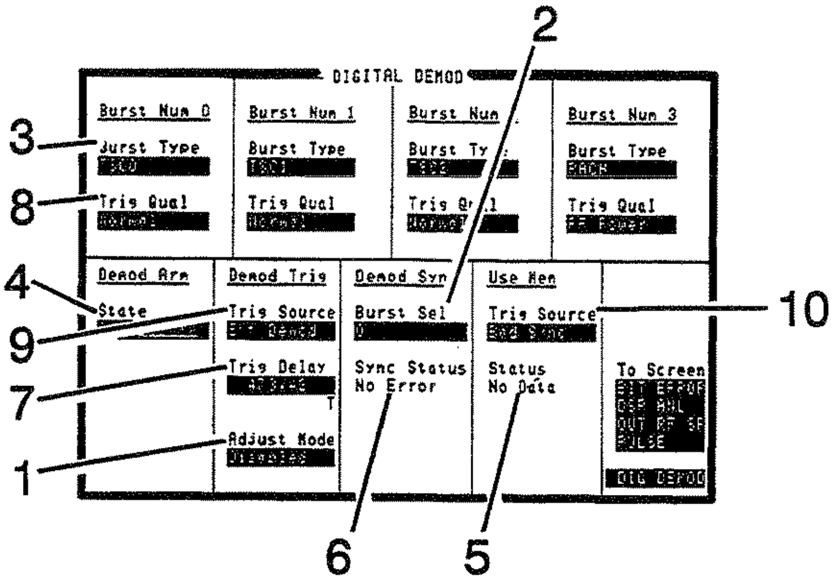
Choices

- RF IN/OUT
- AUX RF IN

8. ZeroPower (Meas Cntl)

This field zeros the power meter. RF power must be disconnected from the RF IN/OUT port when executing this function.

Digital Demod



1. Adjust Mode

The field enables or disables adjust mode.

Choices

- **Enabled** allows Trig Delay to be changed even while digital demodulation is armed. Some demodulation triggers may be missed when changing Trig Delay with Adjust Mode enabled.
- **Disabled** allows Trig Delay to be changed only when State is set to Disarm.

2. Burst Sel

This field selects the burst number that digital demodulation will synchronize to. This field cannot be changed when State is set to Arm.

Choices

- 0
- 1
- 2
- 3
- **Ext** is used for selecting burst number 0, 1, 2, or 3 in real-time using the SYSTEM BUS (rear-panel connector) or using internal signals while Activated (see Screens: Cell Config (Activated)).

See Also

Connectors: System Bus

3. Burst Type

This field selects the burst type for demodulation synchronization.

This field cannot be changed when State is set to arm.

Choices

- **TSC0** through **TSC7**, training sequence codes, are used for normal bursts.
- **RACH**, random access channel, is used for access bursts.
- **SCH**, synchronization channel, is used for synchronization bursts.
- **FCH**, frequency channel, is used for frequency correction bursts. *This burst type is not supported at this time.*
- **User Def**, user defined, is used for user defined bursts. *This burst type is not supported at this time.*

4. State

This field arms or disarms triggering for digital demodulation.

5. Status (Use Mem)

This field will indicate whether any data is available for a Use Mem measurement, and whether current data has had a measurement performed on it. (The Use Mem function allows DSP measurements over one archived GSM burst.)

- **No Data:** No data has been stored.
- **Old Data:** Data is available for a measurement, but Digital Demod has been disarmed and then armed again since the data was stored. This indicates that a measurement was made on the data.
- **New Data:** Data is available for a measurement and Digital Demod has not been disarmed and then armed again since the data was stored.

See Also

Keys: Use Mem
Screens: Meas Sync (`Status (Use Mem)`)
Screens: Digital Demod (`Trig Source (Use Mem)`)

6. Sync Status

This field shows if a synchronization error happened since the last demodulation arm (when Adjust Mode is disabled) or since the last change to Trig Delay (when Adjust Mode is enabled with demodulation arm already selected).

See Also

Making Measurements: If You Have Problems with a Measurement

7. Trig Delay

This field sets the time delay between a valid trigger event and the digital demodulation.

Trig Delay can only be changed under the following conditions:

1. State is set to Disarm.
2. Adjust Mode is set to Enabled.

Range

0 to 5000.000000 μs.

8. Trig Qual

This field selects the type of trigger qualifier the digital demodulator will use.

Choices

- **Normal,** no trigger qualifier is used.
- **RF Power,** trigger events will only be valid when RF power is detected at the selected input.

9. Trig Source (Demod Trig)

This field selects the source of the trigger for digital demodulation. This field cannot be changed when State is set to Arm. When Activated (see Screens: Cell Configuration), triggers for digital demodulation are generated internally.

Choices

- **Ext Demod** selects triggering through RP_DMOD_TRIG on the rear panel SYSTEM BUS CONNECTOR.
- **RF Rise** selects triggering when the rising edge of the RF signal is detected. RF Rise is used with pulsed RF input signals.
- **Ext Meas** selects triggering through the MEASURE TRIGGER IN connector.

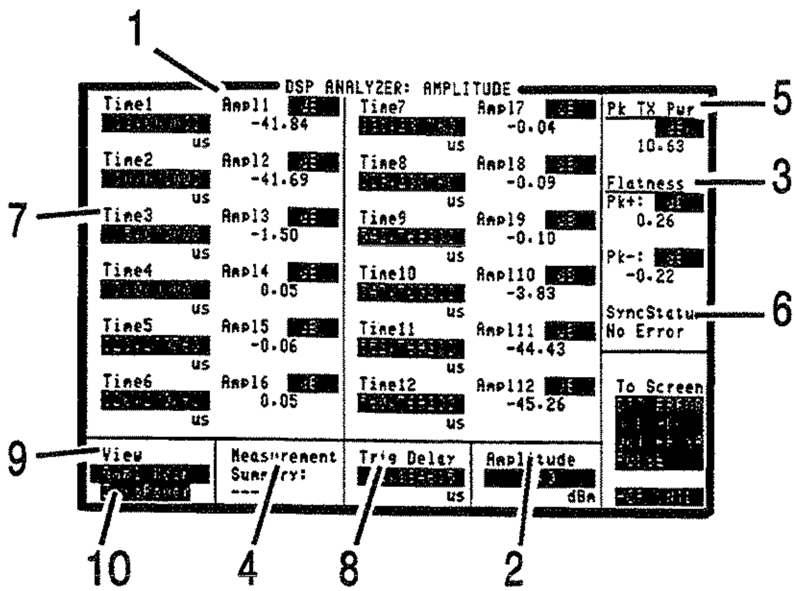
10. Trig Source (Use Mem)

This field selects the source of the trigger for Use Mem. When Use Mem is triggered, demodulated data is captured in memory.

Choices

- **Bad Sync** causes demodulated data to be stored when Sync Status becomes Bad Sync.
- **External** causes demodulated data to be stored using the rear-panel system bus connector. USE_MEM_EXT_TRIG is high and a valid demodulation trigger is received.

DSP Analyzer: Amplitude, Ampl Main View



1. Ampl1—12

These fields display the amplitude measured on the amplitude envelope at the corresponding time set in the Time1-12 field.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

2. Amplitude

This is a copy of the RF analyzer Amplitude field. This is the amplitude to be assumed at the selected input port.

Range

RF IN/OUT: −21.9 to +45.0 dBm.
AUX RF IN: −58.0 to +20.0 dBm.

See Also

Screens: RF Generator/RF Analyzer, RF Analyzer

3. Flatness

This field displays the positive and negative amplitude peaks relative to the average power over the useful bits in the measured burst.

- **Pk+** is the positive amplitude peak, relative to the average power.
- **Pk−** is the negative amplitude peak, relative to the average power.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

4. Measurement Summary

This field displays whether HI/LO limits set for the measurement display fields, (Ampl1-12 and flatness) were exceeded in the last measurement.

See Also

Making Measurements: Solving Problems, Messages

5. Pk TX Pwr

This field displays the average transmitted power over the useful bits in the measured burst. It is measured from the center of the first useful bit to the center of the last useful bit. This measurement is only available when using the RF IN/OUT port.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

6. SyncStatus

This field displays any errors that occurred while trying to synchronize to the demodulated data.

See Also

Making Measurements: Solving Problems
Messages

7. Time1-12

These fields select the time (relative to the center of bit zero) the amplitude will be measured on the amplitude envelope. Bit zero is the first useful bit in the measured burst.

Range

−50.0 to +593.0 μs.

8. Trig Delay

This field sets the time delay between a valid trigger event and the beginning of a measurement.

Range

0 to 5000.000000 μs.

9. View

This field selects alternate views of the measurement.

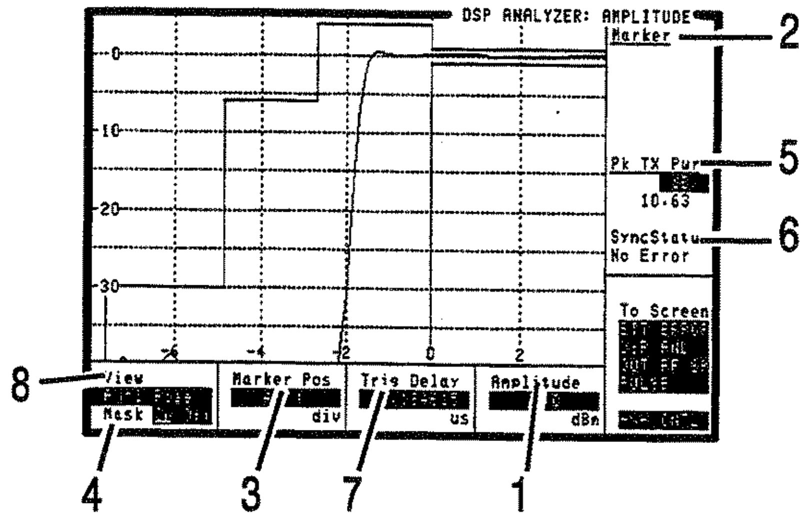
Choices

- Phase Main
- Phase Err
- Ampl Main
- Ampl Rise
- Ampl Mid
- Ampl Fall
- Data Bits

10. ZeroPower

This field zeros the power meter. RF power must be disconnected from the RF IN/OUT port when executing this function.

DSP Analyzer: Amplitude, Ampl Rise View



This view displays the rising portion of the amplitude envelope with the amplitude mask superimposed. The vertical range is −40 to +5 dB. The horizontal range is −8 to +4 bit periods.

1. Amplitude

This is a copy of the RF analyzer Amplitude field. This is the amplitude to be assumed at the selected input port.

Range

RF IN/OUT: −21.9 to +45.0 dBm.
AUX RF IN: −58.0 to +20.0 dBm.

See Also

Screens: RF Generator/RF Analyzer RF Analyzer

2. Marker

These fields display the time and level at the current marker position.

3. Marker Pos

This field sets the marker position. The marker position is settable in units of division (div) only.

4. Mask

This field turns the amplitude mask on or off.

5. Pk TX Pwr

This field displays the average power over the useful bits in the measured burst. It is measured from the center of the first useful bit to the center of the last useful bit.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

6. SyncStatus

This field displays any errors that occurred while trying to synchronize to the demodulated data.

See Also

Making Measurements: Solving Problems, Messages

7. Trig Delay

This field sets the time delay between a valid trigger event and the beginning of a measurement.

Range

0 to 5000.000000 μs.

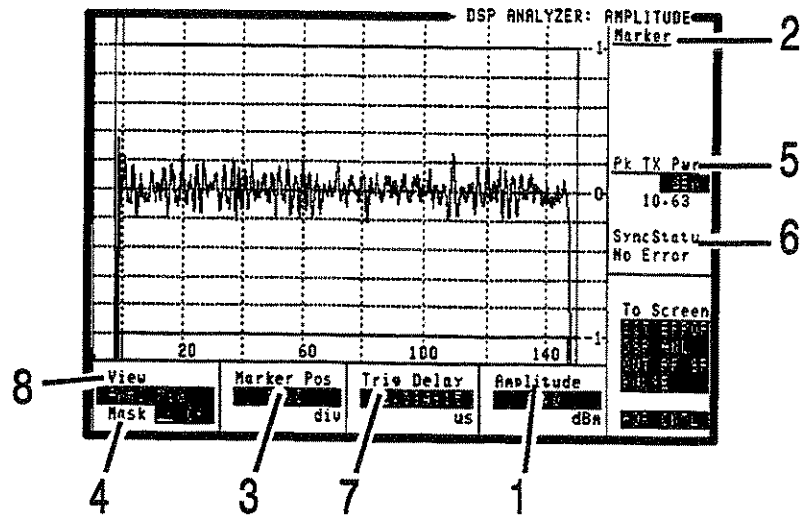
8. View

This field selects alternate views of the measurement.

Choices

- Phase Main
- Phase Err
- Ampl Main
- Ampl Rise
- Ampl Mid
- Ampl Fall
- Data Bits

DSP Analyzer: Amplitude, Ampl Mid View



This view displays the middle portion of the amplitude envelope with the amplitude mask superimposed. The vertical range is −1.2 to +1.2 dB. The horizontal range is −10 to +160 or −6 to +96 bit periods depending on the burst type.

1. Amplitude This is a copy of the RF analyzer Amplitude field. This is the amplitude to be assumed at the selected input port.

Range

RF IN/OUT: −21.9 to +45.0 dBm.
AUX RF IN: −58.0 to +20.0 dBm.

See Also

Screens: RF Generator/RF Analyzer (RF Analyzer)

2. Marker These fields display the time and level at the current marker position.

3. Marker Pos This field sets the marker position. The marker position is settable in units of division (div) only.

4. Mask

This field turns the amplitude mask on or off.

5. Pk TX Pwr

This field displays the average power over the useful bits in the measured burst. It is measured from the center of the first useful bit to the center of the last useful bit. This measurement is only available when using the RF IN/OUT port.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

6. SyncStatus

This field displays any errors that occurred while trying to synchronize to the demodulated data.

See Also

Making Measurements: Solving Problems
Messages

7. Trig Delay

This field sets the time delay between a valid trigger event and the beginning of a measurement.

Range

0 to 5000.000000 μs.

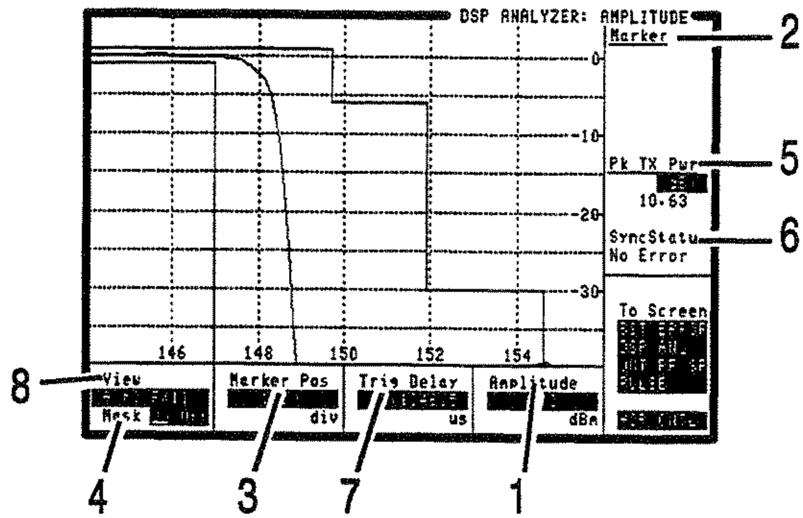
8. View

This field selects alternate views of the measurement.

Choices

- Phase Main
- Phase Err
- Ampl Main
- Ampl Rise
- Ampl Mid
- Ampl Fall
- Data Bits

DSP Analyzer: Amplitude, Ampl Fall View



This view displays the falling portion of the amplitude envelope with the amplitude mask superimposed. The vertical range is −40 to +5 dBm. The horizontal range is +144 to +156 or +84 to +96 bit periods depending on the burst type.

1. Amplitude

This is a copy of the RF analyzer Amplitude field. This is the amplitude to be assumed at the selected input port.

Range

RF IN/OUT: −21.9 to +45.0 dBm.
AUX RF IN: −58.0 to +20.0 dBm.

See Also

Screens: RF Generator/RF Analyzer RF Analyzer

2. Marker

These fields display the time and level at the current marker position.

3. Marker Pos

This field sets the marker position. The marker position is settable in units of division (div) only.

4. Mask

This field turns the amplitude mask on or off.

5. Pk TX Pwr

This field displays the average power over the useful bits in the measured burst. It is measured from the center of the first useful bit to the center of the last useful bit. This measurement is only available when using the RF IN/OUT port.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

6. SyncStatus

This field displays any errors that occurred while trying to synchronize to the demodulated data.

See Also

Making Measurements: Solving Problems
Messages

7. Trig Delay

This field sets the time delay between a valid trigger event and the beginning of a measurement.

Range

0 to 5000.000000 μs.

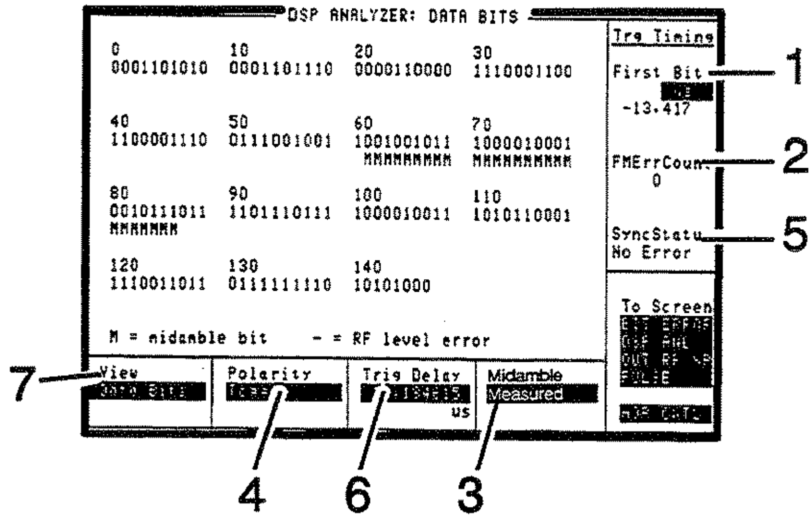
8. View

This field selects alternate views of the measurement.

Choices

- Phase Main
- Phase Err
- Ampl Main
- Ampl Rise
- Ampl Mid
- Ampl Fall
- Data Bits

DSP Analyzer: Data Bits



This screen displays the measured demodulated data bits and tags indicating how each bit was interpreted by the measurement.

1. First Bit

This field displays the position in time of the first useful bit relative to the delayed measurement trigger.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

2. FM ErrCount

This field displays the number of bit differences detected when comparing the demodulated data bits to the selected midamble or user defined synchronization pattern when Sync Mode is set to Midamble. This field will display 0 if Sync Mode is set to Amplitude.

See Also

Screens: Measurement Sync (Sync Mode)

3. Midamble

This field provides the option of specifying the bits used for calculating an ideal phase trajectory. (The DSP Analyzer calculates the ideal phase trajectory, then compares it with the transmitted signal's phase trajectory to determine phase and frequency error).

Choices

- **Expected** causes the DSP Analyzer to calculate the ideal phase trajectory using the bits displayed on the Meas Sync screen. This field is called Midamble or User Defined Sync Pattern, depending on which Burst Type is chosen.
- **Measured** causes the DSP Analyzer to calculate the ideal phase trajectory based entirely on demodulated data bits.

Note

When measuring noisy signals (approx 10 deg rms), define your entire burst as a User Defined Sync Pattern, and select Expected. This will eliminate the problem of bit errors causing gross peak phase errors.

See Also

Screens: Measurement Sync

4. Polarity

This field toggles the polarity of the displayed bits.

5. SyncStatus

This field displays any errors that occurred while trying to synchronize to the demodulated data.

See Also

Making Measurements: Solving Problems
Messages

6. Trig Delay

This field sets the time delay between a valid trigger event and the beginning of a measurement.

Range

0 to 5000.000000 μs.

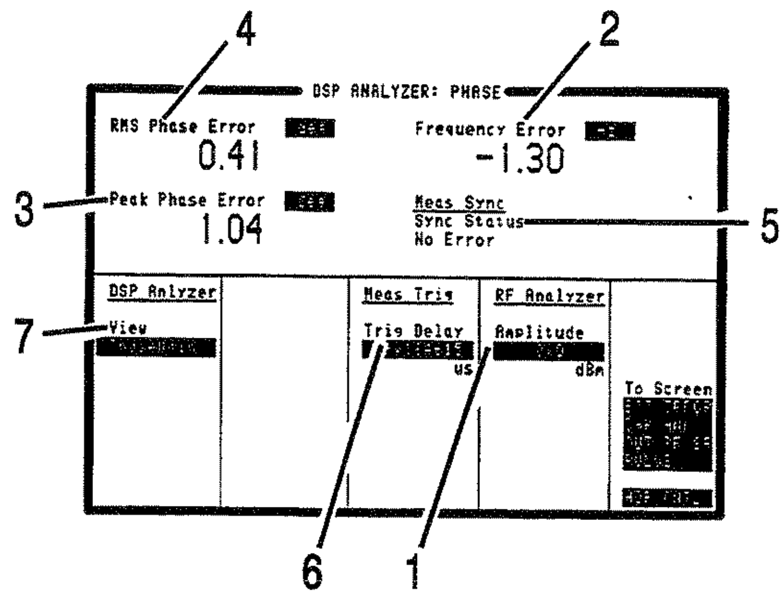
7. View

This field selects alternate views of the measurement.

Choices

- Phase Main
- Phase Err
- Ampl Main
- Ampl Rise
- Ampl Mid
- Ampl Fall
- Data Bits

DSP Analyzer: Phase, PhaseMain View



1. Amplitude

This is a copy of the RF Analyzer Amplitude field. This is the amplitude to be assumed at the selected input port.

Range

RF IN/OUT: −21.9 to +45.0 dBm.
AUX RF IN: −58.0 to +20.0 dBm.

See Also

Screens: RF Generator/RF Analyzer, RF Analyzer

2. Frequency Error

This field displays the derived Frequency Error over the useful bits in the measured burst.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, METER, Units

3. Peak Phase Error

This field displays the measured Peak Phase Error over the useful bits in the measured burst.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, METER, Units

4. RMS Phase Error

This field displays the measured RMS Phase Error over the useful bits in the measured burst.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, METER

5. Sync Status

This field displays any errors that occurred while trying to synchronize to the demodulated data.

See Also

Making Measurements: Solving Problems
Messages

6. Trig Delay

This field sets the time delay between a valid trigger event and the beginning of a measurement.

Range

0 to 5000.000000 μs.

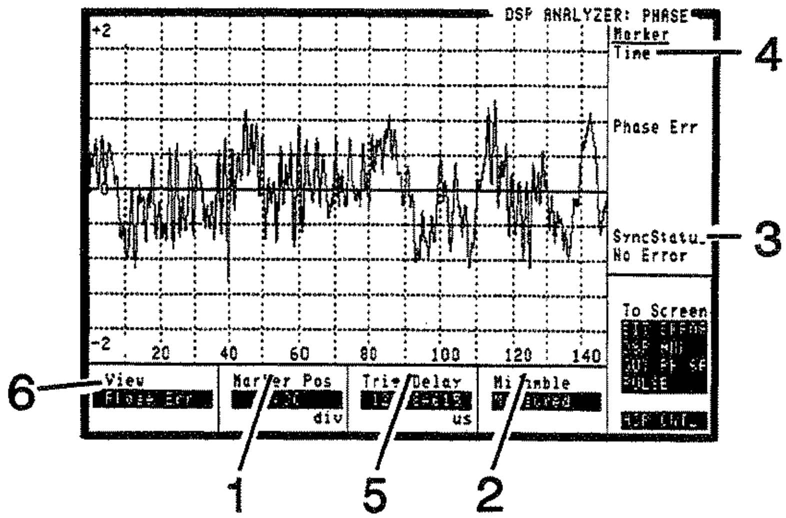
7. View

This field selects alternate views of the measurement.

Choices

- Phase Main
- Phase Err
- Ampl Main
- Ampl Rise
- Ampl Mid
- Ampl Fall
- Data Bits

DSP Analyzer: Phase, Phase Err View



This view displays phase error versus time. The vertical range is scaled to the measurement. The horizontal range is 0 to 147 or 0 to 87 bit periods depending on the burst type.

1. Marker Pos This field sets the position on the trace that phase error will be measured and displayed. The marker position is settable in units of division (div) only.

2. Midamble

This field provides the option of specifying the bits used for calculating an ideal phase trajectory. (The DSP Analyzer calculates the ideal phase trajectory, then compares it with the transmitted signal's phase trajectory to determine phase and frequency error).

Choices

- **Expected** causes the DSP Analyzer to calculate the ideal phase trajectory using the bits displayed on the Meas Sync screen. This field is called Midamble or User Defined Sync Pattern, depending on which Burst Type is chosen.
- **Measured** causes the DSP Analyzer to calculate the ideal phase trajectory based entirely on demodulated data bits.

Note

When measuring noisy signals (approx 10 deg rms), define your entire burst as a User Defined Sync Pattern, and select Expected. This will eliminate the problem of bit errors causing gross peak phase errors.

See Also

Screens: Measurement Sync

3. SyncStatus

This field displays any errors that occurred while trying to synchronize to the demodulated data.

See Also

Making Measurements: Solving Problems
Messages

4. Time

This field displays the marker position in time relative to bit 0 of the received burst.

5. Trig Delay

This field sets the time delay between a valid trigger event and the beginning of a measurement.

Range

0 to 5000.000000 μs.

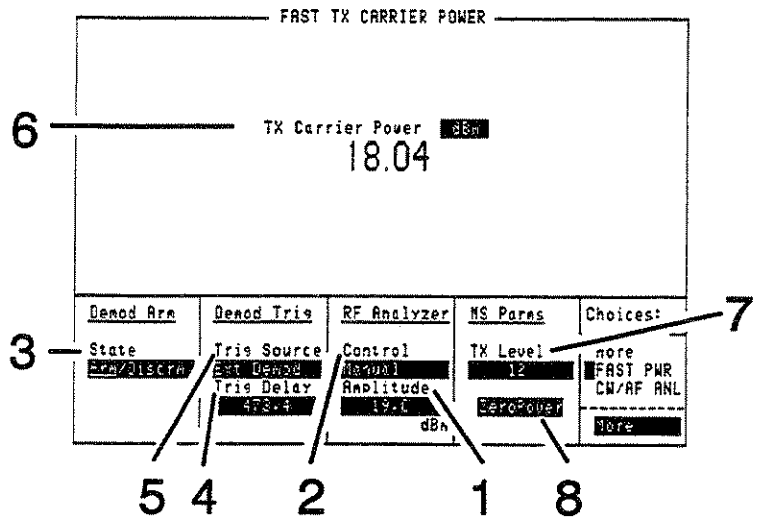
6. View

This field selects alternate views of the measurement.

Choices

- Phase Main
- Phase Err
- Ampl Main
- Ampl Rise
- Ampl Mid
- Ampl Fall
- Data Bits

Fast TX Carrier Power



Note

The Fast TX Carrier Power measurement assumes that the burst conforms to the GSM recommended amplitude mask. Deviation from the recommended amplitude mask may cause erroneous results.

1. Amplitude

This field, which may be adjusted when in `Manual` control mode, sets the expected input level of the RF Analyzer on the RF IN/OUT port. This level must be within ±3 dB of the actual level in order that fully calibrated measurements may be made.

Range

GSM900: −21.9 to +45.0 dBm.
DCS1800: −47.9 to +32.0 dBm.

See Also

Screens: RF Generator/RF Analyzer, RF Analyzer

2. Control

This field toggles between manual setting of the expected input level or having the expected input level set automatically.

Choices

- **Manual (Default)** allows the Amplitude field to be adjusted.
- **MS TX Lev** automatically sets the input level to the RF Analyzer according to the TX Level field.

3. State

This field arms or disarms triggering for digital demodulation.
The State field must be set to Arm to make fast TX Carrier Power measurements. In most situations, this field is automatically set to ARM when the

Fast TX Carrier Power measurements screen is accessed. However, if no measurement results are displayed, check this field and arm digital demod if necessary.

4. Trig Delay

This field sets the time delay between a valid trigger event and the beginning of a measurement. This field cannot be changed when the State field is set to Arm. It will be necessary to re-arm digital demod after changing this field to allow the measurement to resume.

Choices

- **0 T** is normally set when the Trig Source field is set to RF Rise.
- **473.4 T (Default)** is normally set when the Trig Source field is set to Ext Demod.
- A user determined value can be set when the Trig Source field is set to Ext Meas.

Range

0 to 5000.000000 μs
or
0 to 1354.2 T

5. Trig Source

This field selects the source of the trigger for digital demodulation, and fast TX power measurement. It cannot be changed when the State field is set to Arm. It will be necessary to re-arm the State field after changing this field to allow the measurement to resume. When activated (See Screens: Cell Configuration), triggers are generated internally.

Choices

- **Ext Demod** selects triggering through RP_DEMOD_TRIG on the rear panel SYSTEM BUS CONNECTOR.
- **RF Rise** selects triggering when the rising edge of the RF signal is detected. RF Rise is used with pulsed RF input signals.
- **Ext Meas** selects triggering through the MEASURE TRIGGER IN connector.

6. TX Carrier Power

This field displays the measured TX carrier power. The fast power measurement requires that digital demod be armed for the measurement to run.

Note

The measurement display will *not* update if digital demod is set to Disarm.

The measurement display will *not* update if there is no signal to measure. This includes the case where the expected input level has been set much too high.

7. TX Level

This field is used to command the mobile station to transmit at the specified level. This field may be coupled to the "RF Analyzer Amplitude" field by the "RF Analyzer Control" field.

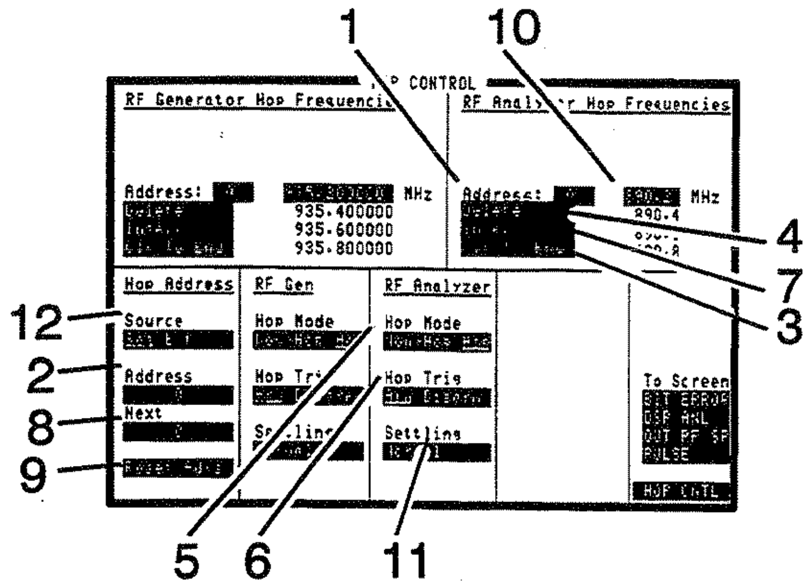
Range

GSM900:	0 to 15
DCS1800:	0 to 13

8. ZeroPower

This field zeros the power meter. RF power must be disconnected from the RF IN/OUT port when executing this function.

Hop Control (RF Analyzer)



1. Address

This field selects the hop frequency address and displays the corresponding hop frequency in the RF Analyzer Hop Frequencies field. Changing this field also changes the other Address fields.

Range

0 to 2047.

2. Address

This field is only displayed when Source is set to Seq. It works with the Next field to determine the hop sequence for both the RF Generator and RF Analyzer. Changing this field also changes the other Address fields.

Range

0 to 2047.

3. Clr To End

This field replaces all frequency entries from the currently displayed address onward with 0 MHz.

If Source is set to Seq, this field is not displayed.

4. Delete

This field deletes the hop frequency at the currently displayed address. Hop frequencies after the deletion move down by one address and address 2047 is changed to 0 MHz.

If Hop Trig is set to Arm, this field will not execute. If Source is set to Seq, this field is not displayed.

5. Hop Mode

This field selects between the Hop and Non-Hop modes of the RF Analyzer. If Hop Trig is set to Arm, this field cannot be modified.

Note

Do not make measurements with Hop Mode set to Hop and Hop Trig set to Disarm.

6. Hop Trig

This field arms or disarms the hop controller to accept a hop trigger.

Hop Trig cannot be set to Arm under the following conditions:

1. Hop Mode is set to Non-Hop.
2. There are no hop frequencies entered.
3. Hop frequencies entered cross frequency bands.

Note

Do not make measurements with Hop Trig set to Disarm and Hop Mode set to Hop.

7. Insert

This field inserts an entry of 0 MHz at the currently displayed address. Hop frequencies after the insertion move up one address and the frequency at address 2047 is lost.

If Hop Trig is set to Arm, this field will not execute. If Source is set to Seq, this field is not displayed.

8. Next

This field is displayed only when Source is set to Seq. It is used with the Address field to define the next hop address. The next hop address can be defined for each address. The default setting is the value of Address plus 1, modulo 2048.

9. Reset Adrs

This field is displayed only when Source is set to Seq. It resets the internal hop Address to zero when Source is set to Seq and Hop Trig is set to Disarm.

If Hop Trig is set to Arm, this field cannot be modified.

10. RF Analyzer Hop Frequencies

This is the hop frequency entry field for the RF Analyzer.

Range

10.0 to 1015.0 MHz in 5 bands.

```
Hop frequency bands:

     10     to  150    MHz
    150     to  380.7  MHz
    380.7   to  650    MHz
    650     to  710    MHz
    710     to  1015   MHz
```

11. Settling

This field changes the settling mode.

If Hop Trig is set to Arm, this field cannot be modified, and it will not execute.

Choices

- **Normal** is used for hops less than 75 MHz.
- **LargeHops** is used for hops greater than 75 MHz.

12. Source

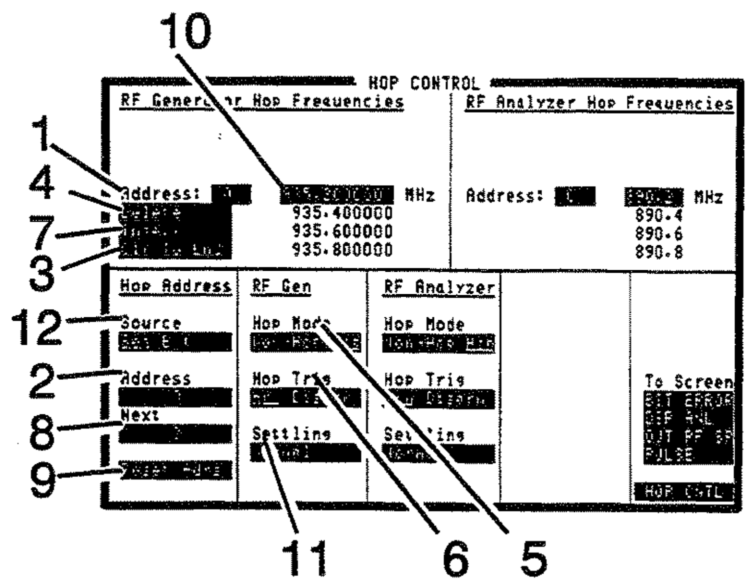
This field selects an internal or external source for the hop address.

When Seq is selected, frequency hopping is sequenced through the hop frequencies in an order determined by the Address and Next fields. While Activated, internal sources control hopping.

When Ext is selected, the hop address of the next hop frequency comes from the address lines on the SYSTEM BUS connector on the rear panel.

If Hop Trig is set to Arm, this field cannot be modified.

Hop Control (RF Generator)



1. Address

This field selects the hop frequency address and displays the corresponding hop frequency in the RF Generator Hop Frequencies field. Changing this field also changes the other Address fields.

Range

0 to 2047.

2. Address

This field is only displayed when Source is set to Seq. It works with the Next field to determine the hop sequence for both the RF Generator and RF Analyzer. Changing this field also changes the other Address fields.

Range

0 to 2047.

3. Clr to End

This field replaces all frequency entries from the currently displayed address onward with 0 MHz.

If Source is set to Seq, this field effects both the RF Generator and RF Analyzer frequencies.

4. Delete

This field deletes the hop frequency at the currently displayed address. Hop frequencies after the deletion move down by one address and address 2047 is changed to 0 MHz.

If Hop Trig is set to Arm, this field will not execute. If Source is set to Seq, this field effects both the RF Generator and RF Analyzer frequencies.

5. Hop Mode

This field selects between the Hop and Non-Hop modes of the RF Generator. If Hop Trig is set to Arm, this field cannot be modified, and it will not execute.

Note

Do not make measurements with Hop Mode set to Hop and Hop Trig set to Disarm.

6. Hop Trig

This field arms or disarms the hop controller to accept a hop trigger.

Hop Trig cannot be set to Arm under the following conditions:

1. Hop Mode is set to Non-Hop.
2. There are no hop frequencies entered.
3. Hop frequencies entered cross frequency bands.

Note

Do not make measurements with Hop Trig set to Disarm and Hop Mode set to Hop.

7. Insert

This field inserts an entry of 0 MHz at the currently displayed address. Hop frequencies after the insertion move up one address and the frequency at address 2047 is lost.

If Hop Trig is set to Arm, this field will not execute. If Source is set to Seq, this field effects both the RF Generator and RF Analyzer hop tables.

8. Next

This field is displayed only when Source is set to Seq. It is used with the address field to define the next hop address. The next hop address can be defined for each address. The default setting is the value of Address plus 1, modulo 2048.

9. Reset Adrs

This field is displayed only when Source is set to Seq. It resets the internal hop address to zero when Source is set to Seq and Hop Trig is set to Disarm.

If Hop Trig is set to Arm, this field cannot be modified.

10. RF Generator Hop Frequencies

This is the hop frequency entry field for the RF Generator.

Range

10.0 to 1015.0 MHz in 6 bands.

```
Hop frequency bands:

     10     to  20    MHz
     20     to  249   MHz
    249     to  380.7 MHz
    380.7   to  501   MHz
    501     to  710   MHz
    710     to  1015  MHz
```

11. Settling

This field changes the settling mode.

If Hop Trig is set to Arm, this field cannot be modified.

Choices

- **Normal** is used for hops less than 75 MHz.
- **LargeHops** is used for hops greater than 75 MHz.

12. Source

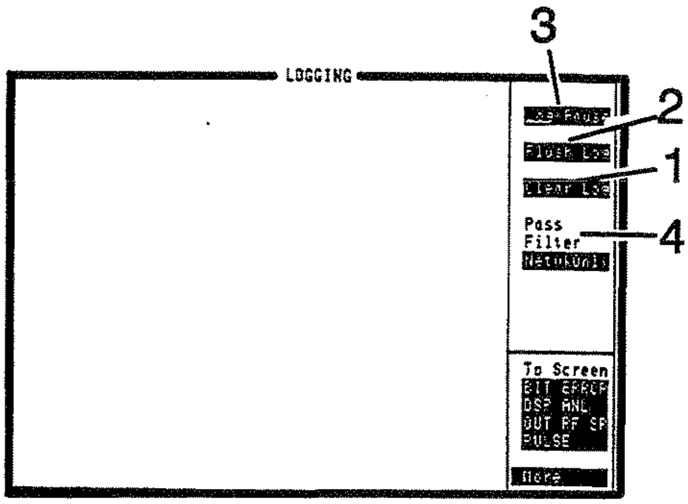
This field selects an internal or external source for the hop address.

When Seq is selected, frequency hopping is sequenced through the hop frequency in an order determined by the Address and Next fields. While Activated, internal sources control hopping.

When Ext is selected, the hop address of the next hop frequency comes from the address lines on the SYSTEM BUS connector on the rear panel.

If Hop Trig is set to Arm, this field cannot be modified.

Logging



Important

Option 003 must be installed and an external Protocol Logger must be connected for Logging functions to work. Logging captures protocol messages to and from the mobile station in buffers in the HP 8922G. Messages can then be sent to an external Protocol Logger through the Protocol Interface connector on the rear panel. No protocol logging messages appear on the HP 8922G Logging screen.

To log protocol messages into the HP 8922G

1. Select Pause
2. Select Clear
3. Select Log
4. Initiate event

When the event is over

1. Select Pause
2. Select Flush Log

1. Clear Log

Clear erases the contents of the logging buffers.

2. Flush Log

Flush Log transfers messages from partially full buffers to an external Protocol Logger through the Protocol Interface connector (rear panel).

When buffers are full, they are automatically flushed. Messages continue to be logged-in during Flush Log.

3. Log/Pause

Log will activate accumulation, or "logging" of protocol messages into dual circular logging buffers in the HP 8922G. Although the messages are delayed, the original sequence is maintained.

Pause will suspend logging.

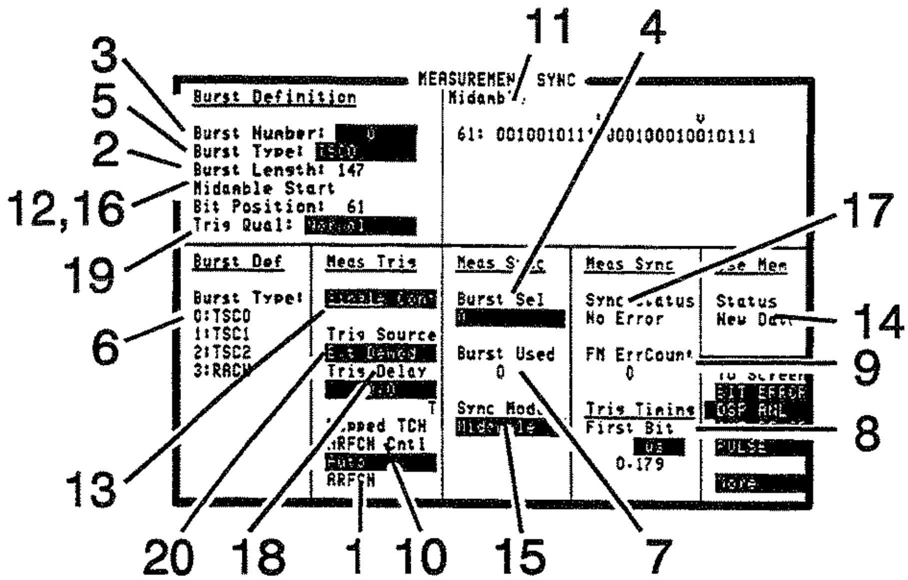
4. Pass Filter

The Pass Filter allows you to select only the category of protocol messages you want logged into the HP 8922G internal logging buffers. Note: The Pass Filter will not filter out GSM messages defined after the release date of the current version of the Firmware (see Configure screen for current version of Firmware).

Choices

- **NetwkOnly** will pass these messages:
  - peer-to-peer messages between the network layers (signaling layer 3).
- **+Datalink** will pass these messages:
  - peer-to-peer messages between the network layers
  - peer-to-peer messages between the data link layers.
- **+Service** will pass these messages as (defined by GSM recommendations):
  - peer-to-peer messages between the network layers
  - peer-to-peer messages between data link layers
  - intra-layer/inter-layer service request and response messages.
  - Service primitives exchanged between the signaling layer of the HP 8922G.

Measurement Sync



This screen defines settings that determine how synchronization will occur for any of the following measurements:

- DSP Analyzer
- Output RF Spectrum
- Pulse On/Off Ratio

1. ARFCN

If Auto is chosen in the Hopped TCH ARFCN Cntl field, the measured ARFCN will be displayed in this field, as soon as a measurement is completed on a Hopped TCH. It will be the lowest frequency ARFCN in the hop sequence.

If Specific is chosen from the Hopped TCH ARFCN Cntl field, enter a specific ARFCN from the hop sequence into this field. After Meas Arm is selected, the HP 8922G will make a measurement when the mobile is transmitting on the selected frequency.

2. Burst Length

This field displays the burst length of the Burst Type selected. If Burst Type is set to User Defined, the Burst Length will be 87 or 147.

3. Burst Number

This field selects which burst definition is being displayed.

Range

0 to 3.

4. Burst Sel

This field selects the burst that the measurement will synchronize to.

Choices

- 0
- 1
- 2
- 3
- **Ext** is used for selecting burst number 0, 1, 2, or 3 in real- time using the SYSTEM BUS (rear-panel connector) or using internal signals while Activated.

5. Burst Type

This field defines the burst type. Choose from eleven burst types, or User Def for specifying a user defined burst type.

Choices

- **TSC0 through TSC7** (Training Sequence Codes) are used for normal bursts.
- **RACH** (Random Access Channel) is used for access bursts.
- **SCH** (Synchronization Channel) is used for synchronization bursts.
- **FCH** (Frequency Channel) is used for frequency correction bursts.
- **User Def** (User Defined) is used when your burst does not conform to any of the burst types listed (such as PRBS), or when measuring noisy signals.

User defined burst lengths must be 87 or 147 (plus 4 guard bits), and the User Defined Sync Pattern can comprise part of or all of the bits in the burst.

To measure a noisy signal (approx 10 deg rms), enter the entire burst in User Defined Sync Pattern, and use Midamble Expected (see Screens: DSP Analyzer: Data Bits or Phase Err). The ideal phase trajectory will be calculated from the User Defined Sync Pattern, eliminating the problem of extremely high peak phase error due to bit errors.

User Def is not allowed for Digital Demod.

6. Burst Type

This field displays a summary of the Burst Type definitions for the four definable bursts.

7. Burst Used

This field displays which one of four possible burst types was used for synchronization or alignment during a measurment. Refer to the Burst Definition or Burst Def fields.

8. First Bit

This field displays the position in time of the of the burst's first useful bit relative to the delayed measurement trigger.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

9. FM ErrCount

This field displays the number of bit differences detected when comparing the demodulated data bits to the selected synchronization pattern when Sync Mode is set to Midamble. This field will display 0 if Sync Mode is set to Amplitude.

See Also

Screens: DSP Analyzer: Data Bits

10. Hopped TCH ARFCN Cntl

This field is used to determine the HP 8922G's method for selecting which ARFCN to measure during a hopping TCH.

The frequency of the ARFCN selected in this field is displayed in the HopMeasFreq field on the RF Generator/RF Analyzer screen.

Choices

- **Auto** causes the HP 8922G to make a measurement on the lowest ARFCN in the hop sequence and display it in the ARFCN field.
- **Specific** requires that you enter an ARFCN in the field that appears when Specific is chosen. Make sure this ARFCN is in an MA table and a CA table (see Screens: Cell Configuration). If the specified ARFCN is not in the MA table, no measurement triggers will be generated and the HP 8922G will wait until the measurement is disarmed.

11. Midamble

This field displays the midamble bit pattern of the Burst Type selected for bursts other than user defined bursts.

12. Midamble Start Bit Position/Sync Pattern Start Position

If Midamble Start Bit Position is displayed, the number displayed represents the expected position (within the Burst Type you have selected) of the first bit of the burst's midamble. Example: If you have selected Burst Type TSC0, the Midamble Start Bit Position will be 61, and you will see this number displayed in this field and in the Midamble field to the right.

If Sync Pattern Start Position is displayed, the number displayed represents the expected position (within a User Defined burst) of the first bit in a user defined pattern that the DSP Analyzer will try to synchronize to. The field labeled Burst Type must be set to User Def for Sync Pattern Start Position to be displayed.

13. Single/Cont (Meas Trig)

Single performs one GSM measurement (DSP Analyzer, Pulse On/Off, and Output RF Spectrum) after Meas Arm is selected and a valid trigger event occurs.

Cont performs GSM measurements continuously. Each time a GSM measurement is performed, the measurement screen will be updated with new information.

Note

Screens that display traces update more slowly than screens that display numbers.

If no measurements are being made while in continuous (Cont), check Trig Qual (see Screens:RF Generator/RF Analyzer). If it is set to RF Power, change it to Normal.

---

14. Status (Use Mem)

This field will indicate whether any data is available for a Use Mem measurement, and whether current data has had a measurement performed on it. (The Use Mem function allows DSP measurements over one archived GSM burst.)

- **No Data:** No data has been stored.
- **Old Data:** Data is available for a measurement, but Digital Demod has been disarmed and then armed again since the data was stored. This indicates that a measurement was made on the data.
- **New Data:** Data is available for a measurement and Digital Demod has not been disarmed and then armed again since the data was stored.

See Also

Keys: Use Mem
Screens: Measurement Sync (`Status (Use Mem)`)
Screens: Digital Demod (`Trig Source (Use Mem)`)

15. Sync Mode

This field selects how the location of the demodulated data bits are determined within the measured burst.

Choices

- **Midamble** attempts to bit pattern match the demodulated data bits to the selected Midamble or User Defined Sync Pattern.
- **Amplitude** centers the demodulated data within the detected amplitude envelope.

16. Sync Pattern Start Position

This field is only displayed when Burst Type is set to User Def. It selects the starting bit position of a user defined synchronization pattern.

Range

0 to 147.

17. Sync Status

This field displays problems that were detected during digital demodulation or DSP analyzer measurements.

See Also

Making Measurements: Solving Problems
Messages

18. Trig Delay

This field sets the time delay between a valid trigger event and the beginning of a measurement.

Range

0 to 5000.000000 μs.

19. Trig Qual

This field selects whether a trigger qualifier will be used.

Choices

- **Normal,** no trigger qualifier is used.
- **RF Power,** trigger events will only be valid when RF power is detected at the selected input. If no RF Power is present at the time of the trigger, the measurement will re-arm after seven timeslots.

Note

If no measurements are being made while in continuous (Cont), check Trig Qual (see Screens:RF Generator/RF Analyzer). If it is set to RF Power, change it to Normal.

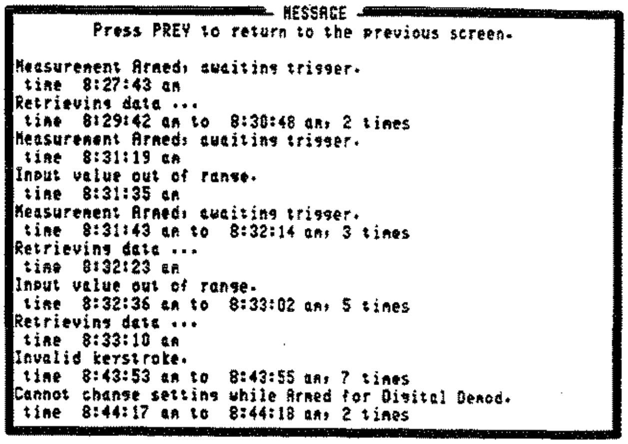
20. Trig Source

This field selects the source of the trigger. When Activated (see Screens: Cell Configuration), triggers for digital demodulation are generated internally.

Choices

- **Ext Demod** selects triggering through RP_DMOD_TRIG on the rear-panel SYSTEM BUS CONNECTOR.
- **RF Rise** selects triggering when the rising edge of an RF signal is detected. RF Rise is used with pulsed RF input signals.
- **Ext Meas** selects triggering through the MEASURE TRIGGER IN connector.

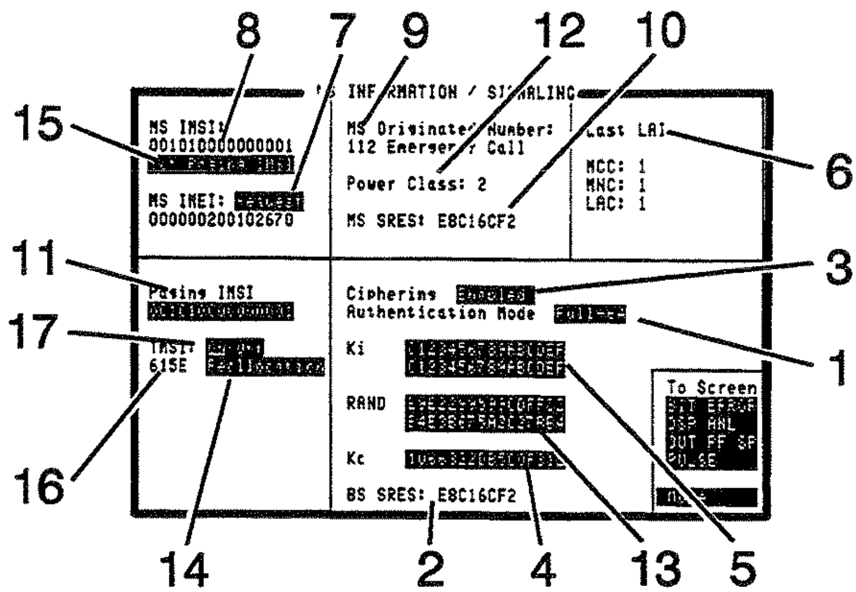
Message



This screen makes a record of any messages. Up to 10 messages can be displayed. If the 10-message limit is exceeded, the latest message is added to the bottom of the screen, and the top message is removed from the screen.

If the same operation error occurs multiple times, you will see the number of occurrences at the end of the message.

MS Information / Signaling



1. Authentication Mode

Choices

- **Full-64** Authentication Mode requires that you use a test SIM that implements the authentication algorithm specified in Rec. 11.10, sec. III.1.6.3
  - □ You must enter an Authentication Key (Ki). If no Ki is entered, a default value of 0 is used.
  - □ When an authentication request occurs, the BS SRES generated by the HP 8922G should match the MS SRES received from the mobile station.
- **Full-54** Authentication Mode requires that you use a test SIM that implements the authentication algorithm specified in Rec. 11.10, sec. III.1.6.3
  - □ The HP 8922G generates 0's for the 10 least significant bits of the 64 bit Cipher Key (Kc).
  - □ You must enter an Authentication Key (Ki). If no Ki is entered, a default value of 0 is used.
  - □ When an authentication request occurs, the BS SRES generated by the HP 8922G should match the MS SRES received from the mobile station.
- **Partial** Authentication Mode requires that you enter a RANDom number and the associated Kc for a particular SIM. The MS SRES from the mobile station will be displayed, but no BS SRES will be generated by the HP 8922G.
- **None** results in no authentication being performed.

2. BS SRES

This field is the Base Stations Signed RESponse, and is only displayed when Authentication Mode is Full.

BSRES is calculated by the HP 8922G, then used to validate MSRES by checking for a match between BSRES and MSRES.

When the Authentication Mode field is Partial or None, this field will be blanked.

3. Ciphering

This field selects the ciphering mode of the mobile station and the HP 8922G during the next call made.

Choices

- **Off** results in no ciphering signal.
- **Enabled** (Option 005 only) sends a ciphering mode message and enables ciphering. (If the Authentication Mode is Full-64 or Full-54, MSRES and BSRES must match for the call to proceed and enable ciphering.
- **Disabled** sends a ciphering mode message, and disables ciphering.

4. Kc

This field displays the Ciphering Key (Kc) generated by the HP 8922G when the Authentication Mode is Full.

If the Authentication Mode is Partial or None, you must enter Kc into this field.

The HP 8922G will use all 64 bits from this field. Entries into the Kc field must account for any truncation of bits that may be done by the mobile station.

Example: If the mobile station truncates 10 bits, resulting in a 54-bit Kc, enter a hexadecimal number in the HP 8922G Kc field that correctly positions the 54 bits that will be used, inserting 0's where necessary.

5. Ki

This field is used to enter the mobile station's Authentication Key (Ki). When the Authentication Mode is Partial or None, this field is not displayed.

6. Last LAI

These fields display the mobile station's LAI (Local Area Identification) after the last location update.

7. MS IMEI:Request

When this field is selected during a call, the HP 8922G will attempt to obtain the IMEI (International Mobile Equipment Identity) number of the mobile station. If a correct IMEI number is obtained, it will be displayed directly below MS IMEI:Request.

8. MS IMSI

This field displays the mobile station's IMSI (International Mobile Subscriber Identity) number, obtained from the mobile station during call setup or a location update.

9. MS Originated Number

This field displays the called party BCD number the mobile station sent during the last MS originated call.

This field is updated each time an MS initiated call is accepted.

This field is blank if no called party BCD number was included in the message from the mobile station.

If an emergency call is made, 112_EMERGENCY_CALL is displayed.

10. MS SRES

This field is the Mobile Stations Signed RESponse to an authentication request. When the Authentication Mode field is None, this field will be blanked. When the Authentication Mode is Full, BSRES and MSRES should match. If BSRES and MSRES don't match, the call will be cleared.

11. Paging IMSI

This is the IMSI number the HP 8922G will use when paging the mobile station. If you would like to automatically enter an MS (mobile station) obtained IMSI into this field , make a MS originated call, then select Set Paging IMSI.

You can also enter the IMSI number manually.

12. Power Class

This field displays the power class of the mobile station, as sent by the mobile station during a call. This number will correspond with a maximum power level the mobile station is allowed to transmit.

13. RAND

This field displays the RAND number when the Authentication Mode is Full. You must enter the RAND number (and Kc) when the Authentication Mode is Partial. This field is not displayed when Authentication Mode is None.

14. Reallocation

When this field is selected a random TMSI number is generated for reallocation to a mobile station. The random TMSI number is displayed in the TMSI Number field.

15. Set Paging IMSI

When this field is selected, the MS IMSI number reported by the mobile station is copied to the Paging IMSI field, to be used for HP 8922G BS (base station) originated calls (Mobile Terminated Calls).

16. TMSI Number

This field displays the current Temporary Mobile Subscriber Identity (TMSI) number assigned to the mobile station.

If a TMSI received from the mobile station is not valid, the HP 8922G will calculate a new TMSI and automatically reallocate it to the mobile station. Any time a signaling link is established, TMSI reallocation can be performed manually. See Reallocation.

17. TMSI On/Off

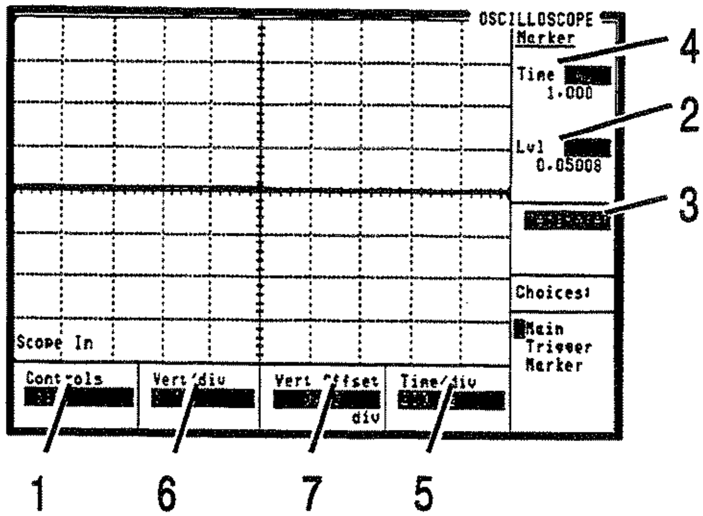
When On is selected, the HP 8922G will attempt to identify the mobile station by its TMSI (Temporary Mobile Subscriber Identity) number.

The TMSI is checked as part of the call setup process. During an initial call setup with a mobile station, the TMSI will have to be assigned to the mobile station by the HP 8922G. This assigned TMSI is then expected by the HP 8922G during subsequent call setups, as long as a TMSI is used and the IMSI remains the same.

If a TMSI received from the mobile station is not valid, the HP 8922G will calculate a new TMSI and reallocate it to the mobile station as part of the call setup. The following situations can cause a TMSI to not be valid; when the mobile station identifies itself with an IMEI number (emergency call), or when a new IMSI is used.

When Off is selected, the mobile station will continue to use the old TMSI until the next location update occurs. When the next location update occurs, the mobile station will be instructed to delete its last TMSI, and the HP 8922G will perform the identification procedure to determine the IMSI.

Oscilloscope, Main Controls



This screen displays the measurements on an oscilloscope display. The input signal is selected by the AF Anl In field on the CW MEAS/AF ANALYZER screen. The selected input is shown in the lower-left corner of the oscilloscope's display.

See Also

Screens: CW Meas/AF Analyzer, AF Analyzer (AF Anl In)
Screens: CW Meas/AF Analyzer, AF Analyzer (Scope To)

1. Controls

This field selects the set of oscilloscope controls.

Choices

- Main
- Trigger
- Marker

2. Lvl

This field displays the signal level at the current marker position. The units-of-measure for this field are determined by the AF Anl In selection.

See Also

Screens: CW Meas/AF Analyzer, AF Analyzer (AF Anl In)
Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

3. Meas Reset

Selecting Meas Reset will erase any accumulated measurements used for calculating a final result, and re-start the measurement process for the following functions:

- HI LIMIT
- LO LIMIT
- AVG

See Also

Keys: HI LIMIT, LO LIMIT, AVG

4. Time

This field displays the time elapsed from the trigger point to the current marker position.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, Units

5. Time/div

This field selects the horizontal sweep time per division.

Choices

- 200, 100, 50, 20, 10, 5, 2, or 1 ms
- 500, 200, 100, 50, 20, 10, 5, 2, or 1 μs

6. Vert/div

This field, vertical sensitivity, sets the vertical amplitude per division. The units-of-measure for this field are determined by the AF Anl In selection.

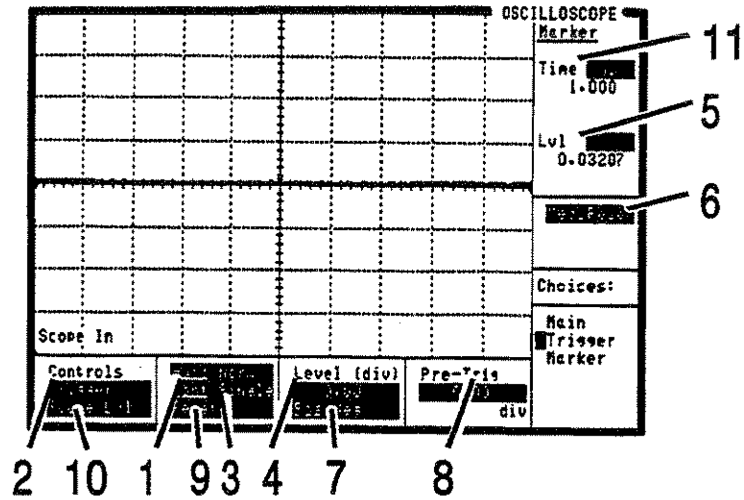
See Also

Screens: CW Meas/AF Analyzer, AF Analyzer (AF Anl In)

7. Vert Offset

This field moves the displayed signal trace above or below the oscilloscope's fixed centerline.

Oscilloscope, Trigger Controls



1. Auto/Norm

This field affects triggering as described below.

Auto automatically triggers a sweep if a triggering signal is not detected within ≈50 ms of the end of the previous sweep when in Cont triggering mode.

Norm requires a specific triggering signal before triggering.

2. Controls

This field selects the set of oscilloscope controls.

Choices

- Main
- Trigger
- Marker

3. Cont/Single

This field specifies how measurements are armed to accept a trigger.

If Cont is selected, the oscilloscope is continuously armed to accept a sweep trigger.

If Single is selected, the oscilloscope is armed each time Reset is selected.

4. Level (div)

This field sets the trigger level when the Scope Lvl is the trigger source. The trigger level is indicated by small pointers that appear on each side of the graticule. The units are vertical divisions.

5. Lvl

This field displays the signal level at the current marker position. The units-of-measure for this field are determined by the AF Anl In selection.

See Also

Screens: CW Meas/AF Analyzer, AF Analyzer (AF Anl In)
Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

6. Meas Reset

Selecting Meas Reset will erase any accumulated measurements used for calculating a final result, and re-start the measurement process for the following functions:

- HI LIMIT
- LO LIMIT
- AVG

See Also

Keys: HI LIMIT, LO LIMIT, AVG

7. Pos/Neg

This field specifies whether triggering occurs on the trigger signal's positive-going (Pos), or negative-going (Neg) slope.

8. Pre-Trig

This field specifies the number of horizontal divisions to be displayed previous to the trigger point. The trigger point is indicated by small pointers that appear at the top and bottom of the graticule.

9. Reset

This field is used to arm a sweep trigger when Single is selected.

10. Scope Lvl

This field selects the trigger source.

Choices

- **Scope Lvl** uses the input signal level for triggering.
- **External** uses the front-panel MEASURE TRIGGER IN signal for triggering.

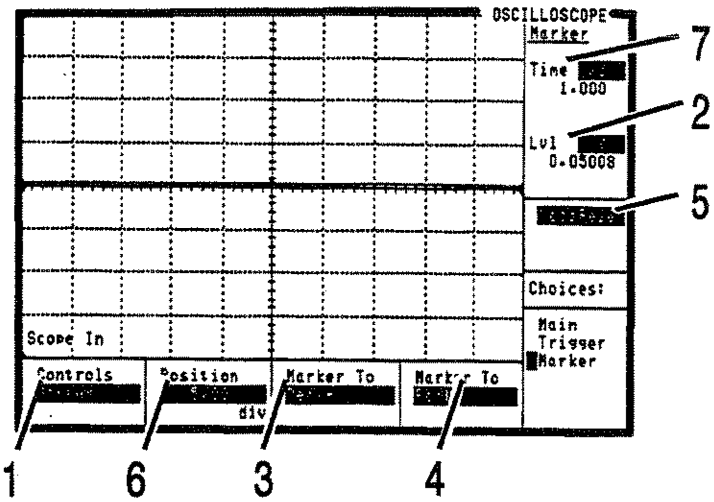
11. Time

This field displays the time elapsed from the trigger point to the current marker position.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

Oscilloscope, Marker Controls



1. Controls This field selects the set of oscilloscope controls.

Choices

- Main
- Trigger
- Marker

2. Lvl This field displays the signal level at the current marker position. The units-of-measure for this field are determined by the AF Anl In selection.

See Also

Screens: CW Meas/AF Analyzer, AF Analyzer (AF Anl In)
Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

3. Marker To (Peak+) This field causes the marker to move to the highest positive peak displayed.

4. Marker To (Peak−) This field causes the marker to move to the lowest negative peak displayed.

5. Meas Reset

Selecting Meas Reset will erase any accumulated measurements used for calculating a final result, and re-start the measurement process for the following functions:

- HI LIMIT
- LO LIMIT
- AVG

See Also

Keys

6. Position

This field controls the position of the marker.

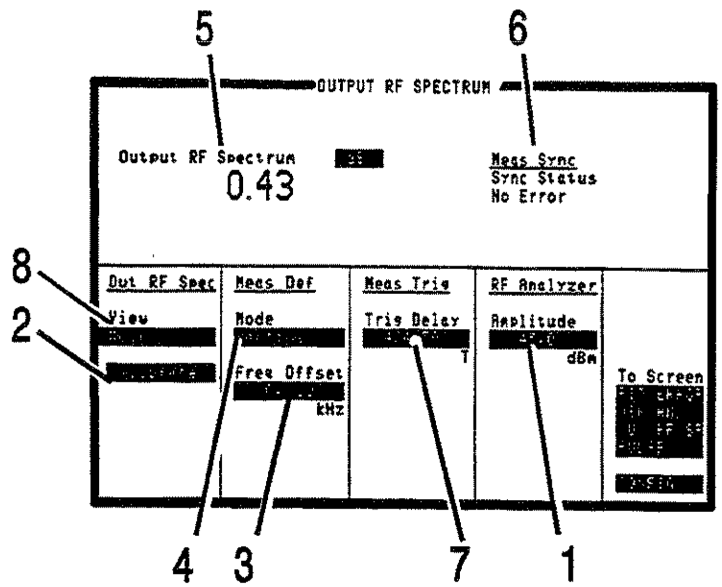
7. Time

This field displays the time elapsed from the trigger point to the current marker position.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

Output RF Spectrum, Main View



The HP 8922G uses a 3-pole synchronously tuned filter to make Output RF Spectrum measurements rather than a 5-pole filter as specified in the GSM recommendations. Refer to the technical paper titled "Output RF Spectrum Measurements Using a 3-Pole Synchronously Tuned Measurement Filter, found at the front of this manual set."

1. Amplitude

This is a copy of the RF Analyzer Amplitude field. This is the amplitude to be assumed at the selected input port, see RF Analyzer Functions).

Range

RF IN/OUT: −21.9 to +45.0 dBm.
AUX RF IN: −58.0 to +20.0 dBm.

See Also

Screens: RF Generator/RF Analyzer, RF Analyzer

2. Calibrate

This field calibrates the spectrum analyzer for making Output RF Spectrum and Pulse On/Off Ratio measurements.

Note

This function should be executed within 5 minutes before making this measurement to maintain measurement accuracy.

3. Freq Offset

This sets the frequency offset for the Output RF Spectrum measurement. This field is used when not making reference measurements. The offset used is 0.0 kHz when Mode is set to Ramp Ref or Mod Ref.

Range

−2.0 MHz to +2.0 MHz.

4. Mode

This field selects the Output RF Spectrum measurement Mode.

Choices

- **Ramping** measures the Output RF Spectrum power due to ramping. (The peak value is returned within the time interval 28 μs before bit 0 to 28 μs after bit 147 or bit 87, depending on the burst type.)
- **Ramp Ref** makes a reference measurement needed for the Output RF Spectrum measurement when making ramping measurements.
- **Modulatn** (modulation) measures the Output RF Spectrum power due to modulation.
- **Mod Ref** makes a reference measurement needed for the Output RF Spectrum measurement when making modulation measurements.

5. Output RF Spectrum

This field displays the measured Output RF Spectrum power at the specified Freq Offset setting.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

6. Sync Status

This field displays any errors that occurred while trying to synchronize to the demodulated data.

See Also

Making Measurements: Solving Problems
Messages

7. Trig Delay

This field sets the time delay between a valid trigger event and the beginning of a measurement.

Range

0 to 5000.000000 μs

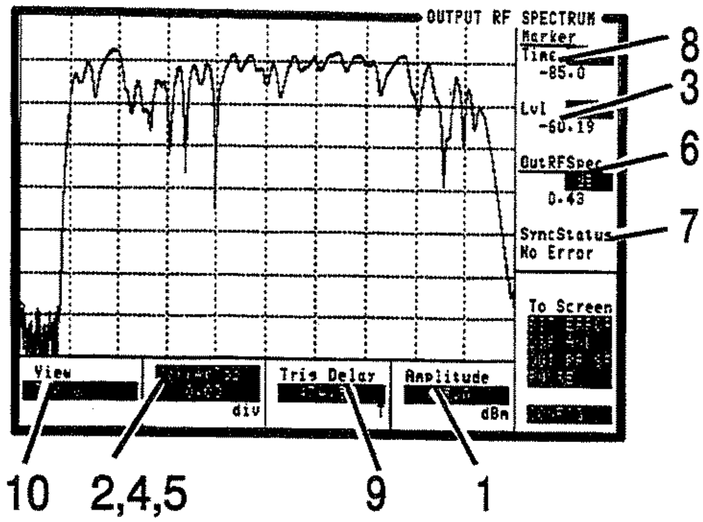
8. View

This field selects the alternate views of the Output RF Spectrum measurement.

Choices

- **Main**
- **Trace** displays Output RF Spectrum power spectral density (at the Freq Offset setting) versus time.

Output RF Spectrum, Trace View



This view displays output RF spectrum power spectral density (at the Freq Offset setting) versus time.

The HP 8922G uses a 3-pole synchronously tuned filter to make Output RF Spectrum measurements rather than a 5-pole filter as specified in the GSM recommendations. Refer to the technical paper titled "Output RF Spectrum Measurements Using a 3-Pole Synchronously Tuned Measurement Filter, found at the front of this manual set."

1. Amplitude

This is a copy of the RF Analyzer Amplitude field. This is the amplitude to be assumed at the selected input port.

Range

RF IN/OUT: −21.9 to +45.0 dBm.
AUX RF IN: −58.0 to +20.0 dBm.

See Also

Screens: RF Generator/RF Analyzer, RF Analyzer

2. Freq Offs

This sets the frequency offset for the Output RF Spectrum measurement. This field is used when not making reference measurements. The offset used is 0.0 kHz when Mode is set to Ramp Ref or Mod Ref.

Range

−2.0 MHz to +2.0 MHz.

3. Lvl

This field displays the level at the current marker position.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF, AVG, Units

4. MarkerPos

This field controls the marker position.

Choices

- **MarkerPos**
- **Freq Offs** selects the frequency offset for the trace.
- **Meas Mode** selects the output RF spectrum measurement mode.

5. Meas Mode

This field selects the Output RF Spectrum measurement Mode.

Choices

- **Ramping** measures the Output RF Spectrum power due to ramping. (The peak value is returned within the time interval 28 μs before bit 0 to 28 μs after bit 147 or bit 87, depending on the burst type.)
- **Ramp Ref** makes a reference measurement needed for the Output RF Spectrum measurement when making ramping measurements.
- **Modulatn** (modulation) measures the Output RF Spectrum power due to modulation.
- **Mod Ref** makes a reference measurement needed for the Output RF Spectrum measurement when making modulation measurements.

6. OutRFSpec

This field displays the measured Output RF Spectrum power at the specified Freq Offset setting.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF, AVG, Units

7. SyncStatus

This field displays any errors that occurred while trying to synchronize to the demodulated data.

See Also

Making Measurements: Solving Problems
Messages

8. Time

This field displays the time at the current marker position relative to the center of bit zero.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF, AVG, Units

9. Trig Delay

This field sets the time delay between a valid trigger event and the beginning of a measurement.

Range

0 to 5000.000000 μs

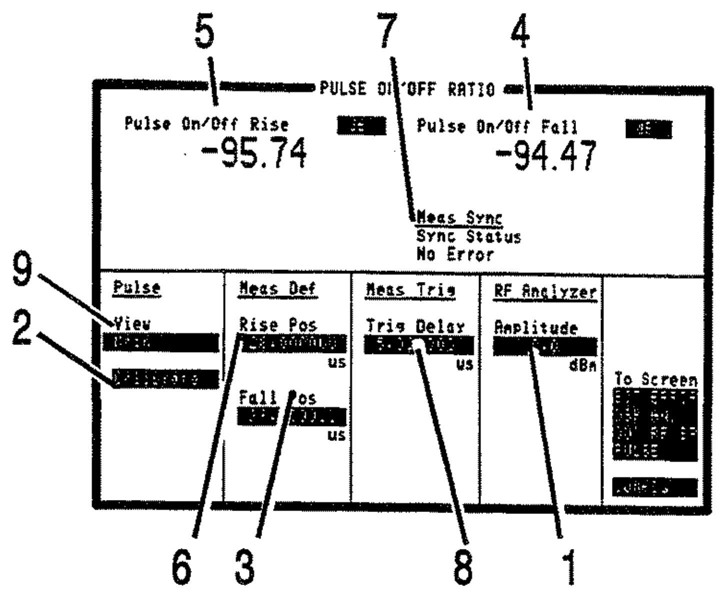
10. View

This field selects the alternate views of the Output RF Spectrum measurement.

Choices

- **Main**
- **Trace** displays Output RF Spectrum power spectral density (at the Freq Offset setting) versus time.

Pulse On/Off Ratio, Main View



1. Amplitude

This is a copy of the RF Analyzer Amplitude field. This is the amplitude to be assumed at the selected input port.

Range

RF IN/OUT: −21.9 to +45.0 dBm.
AUX RF IN: −58.0 to +20.0 dBm.

See Also

Screens: RF Generator/RF Analyzer, RF Analyzer

2. Calibrate

This field calibrates the spectrum analyzer for making Pulse On/Off Ratio or Output RF Spectrum measurements.

Note

This function should be executed within 5 minutes before making this measurement to maintain measurement accuracy.

3. Fall Pos

This field selects the time (relative to the center of the last bit) that the amplitude on the amplitude envelope will be measured.

Range

0.0 μs to +56 μs.

4. Pulse On/Off Fall

This field displays the measured amplitude at the fall-position time relative to the average On power over the useful bits in the measured burst.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, METER, Units

5. Pulse On/Off Rise

This field displays the measured amplitude at the rise-position time relative to the average On power over the useful bits in the measured burst.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, METER, Units

6. Rise Pos

This field selects the time (relative to the center of bit zero) that the amplitude on the amplitude envelope will be measured.

Range

−56.0 μs to 0.0 μs.

7. Sync Status

This field displays any errors that occurred while trying to synchronize to the demodulated data.

See Also

Making Measurements: Solving Problems
Messages

8. Trig Delay

This field sets the time delay between a valid trigger event and the beginning of a measurement.

Range

0 to 5000.000000 μs

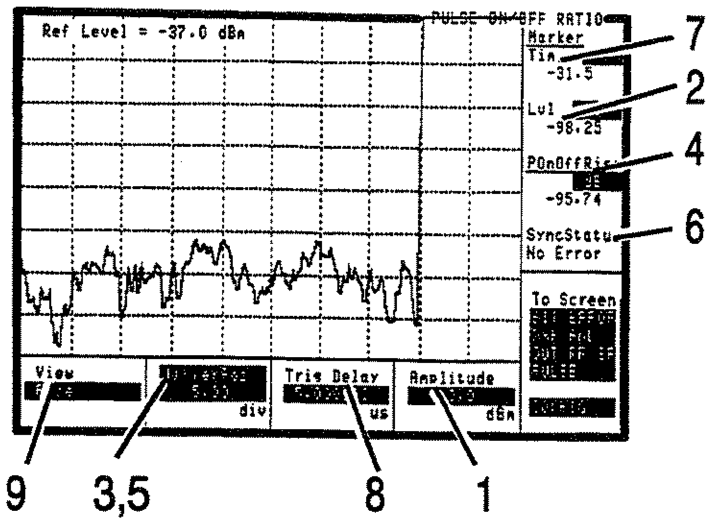
9. View

This field selects the alternate Views of the Pulse On/Off Ratio measurement.

Choices

- **Main**
- **Rise** displays the rising portion of the pulse trace.
- **Fall** displays the falling portion of the pulse trace.

Pulse On/Off Ratio, Rise View



This view displays Pulse On/Off power spectral density versus time for the rising portion of the burst.

1. Amplitude This is a copy of the RF Analyzer Amplitude field. This is the amplitude to be assumed at the selected input port,

Range

RF IN/OUT: −21.9 to +45.0 dBm.
AUX RF IN: −58.0 to +20.0 dBm.

See Also

Screens: RF Generator/RF Analyzer, RF Analyzer

2. Lvl This field displays the level at the current marker position.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF, AVG, Units

3. MarkerPos

This field selects the marker position for the rising trace.

Choices

- MarkerPos
- Rise Pos

4. POnOffRise

This field displays the measured amplitude at the rise-position time relative to the average On power over the useful bits in the measured burst.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, Units

5. Rise Pos

This field selects the time (relative to the center of bit zero) that the amplitude on the amplitude envelope will be measured.

Choices

- MarkerPos
- Rise Pos

Range

$-56.0\ \mu s$ to $0.0\ \mu s$.

6. SyncStatus

This field displays any errors that occurred while trying to synchronize to the demodulated data.

See Also

Making Measurements: Solving Problems
Messages

7. Time

This field displays the time elapsed from the center of bit zero to the current marker position.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

8. Trig Delay

This field sets the time delay between a valid trigger event and the beginning of a measurement.

Range

0 to 5000.000000 μs

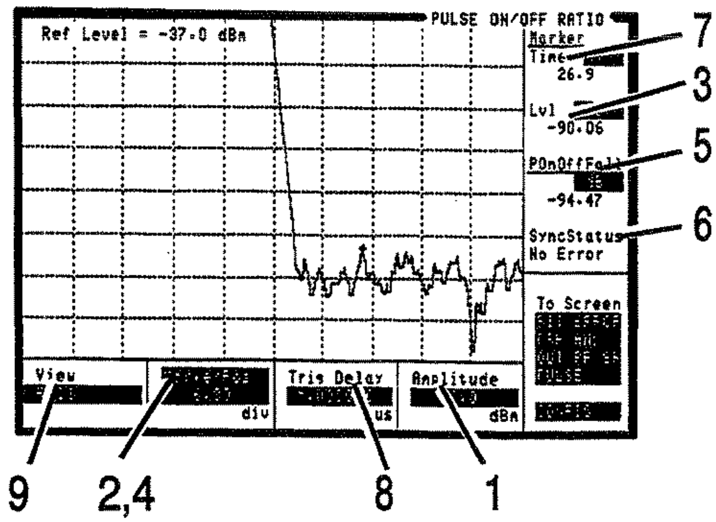
9. View

This field selects the alternate Views of the Pulse On/Off Ratio measurement.

Choices

- **Main**
- **Rise** displays the rising portion of the pulse trace.
- **Fall** displays the falling portion of the pulse trace.

Pulse On/Off Ratio, Fall View



This view displays Pulse On/Off power spectral density versus time for the falling portion of the burst.

1. Amplitude

This is a copy of the RF Analyzer Amplitude field. This is the amplitude to be assumed at the selected input port,

Range

RF IN/OUT: −21.9 to +45.0 dBm.
AUX RF IN: −58.0 to +20.0 dBm.

See Also

Screens: RF Generator/RF Analyzer, RF Analyzer

2. Fall Pos

This field selects the time (relative to the center of the last bit zero) that the amplitude on the amplitude envelope will be measured.

Choices

- MarkerPos
- Fall Pos

Range

0.0 to +56.0 μs

3. Lvl

This field displays the level at the current marker position.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF, AVG, Units

4. MarkerPos

This field selects the marker position for the rising trace.

Choices

- MarkerPos
- Fall Pos

5. POnOffFall

This field displays the measured amplitude at the fall-position time relative to the average On power over the useful bits in the measured burst.

6. SyncStatus

This field displays any errors that occurred while trying to synchronize to the demodulated data.

See Also

Making Measurements: Solving Problems
Messages

7. Time

This field displays the time elapsed from the center of the last bit to the current marker position.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

8. Trig Delay

This field sets the time delay between a valid trigger event and the beginning of a measurement.

Range

0 to 5000.000000 μs

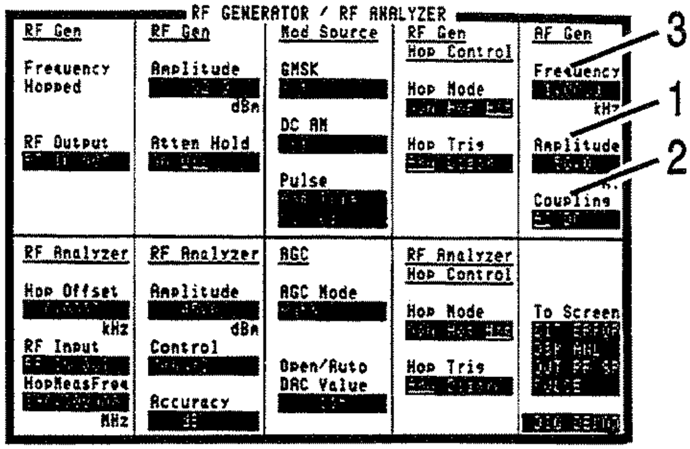
9. View

This field selects the alternate Views of the Pulse On/Off Ratio measurement.

Choices

- **Main**
- **Rise** displays the rising portion of the pulse trace.
- **Fall** displays the falling portion of the pulse trace.

RF Generator / RF Analyzer (AF Gen)



1. Amplitude

This field is the AF Generator Audio Out amplitude setting.

Range

0.0 mV rms to 8.84 V rms.

2. Coupling

This field selects ac or dc coupling of the AF Generator Audio Out signal.

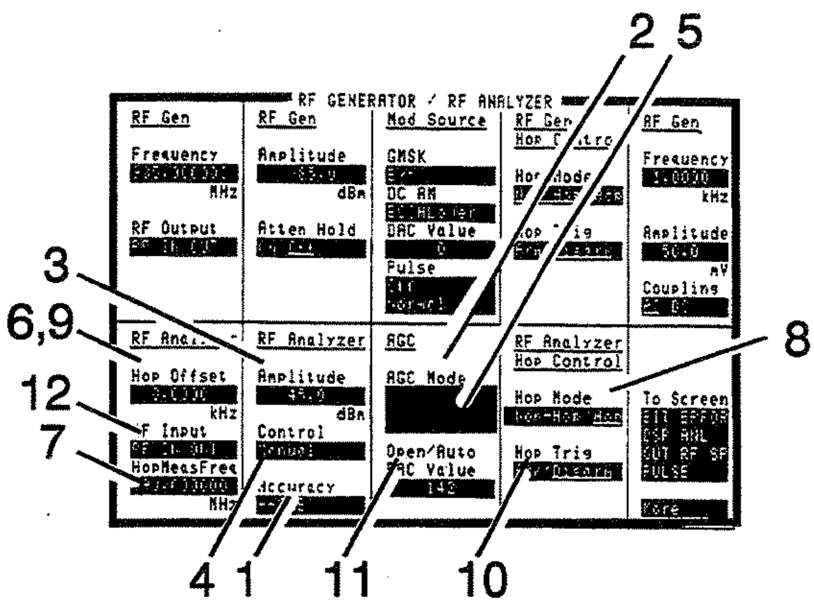
3. Frequency

This field is the AF Generator Audio Out Frequency setting.

Range

dc to 30 kHz.

RF Generator / RF Analyzer (RF Analyzer)



1. Accuracy

This field selects the input accuracy of the RF Amplitude setting to be assumed by the instrument for setting the Open/Auto DAC Value when in Auto AGC mode.

Choices

- +-3 dB
- +-1 dB

2. AGC Mode

This field selects the AGC Mode.

Choices

- **Closed** is closed-loop AGC operation. It is used for stable, repeating RF signals and provides greater accuracy measurements.
- **Open** is used for isolated pulses, for example RACHs.
- **Auto** is used to automatically set the Open/Auto DAC Value based on the entered amplitude and accuracy.

3. Amplitude

This field is the input amplitude to be assumed at the selected RF Analyzer input. The amplitude shown is for the port selected in the RF Input field.

Range

RF IN/OUT: −21.9 to +45.0 dBm.
AUX RF IN: −58.0 to +20.0 dBm.

4. Control

This field determines how the RF Analyzer amplitude is selected.

Choices

- **MS TX Lev** automatically selects the RF Analyzer amplitude based on the level set in TX Level on the Cell Control screen if the RF analyzer's RF input connector selection is RF IN/OUT.
- **Manual** requires setting the RF Analyzer amplitude using the front-panel keys.

5. Do Open Cal

This field is displayed only when AGC Mode is closed. When selected, the correct Open/Auto DAC Value for the signal input, using the present RF Analyzer setting, is entered in the Open/Auto Dac Value field.

A stable, repeating RF signal is required for open loop calibration.

Doing an open loop calibration is useful for establishing an AGC DAC Value to be used when AGC Mode is Open.

See Also

Screens: RF Analyzer (AGC Mode, Open/Auto DAC Value)

6. Frequency

This field sets Frequency when RF Analyzer Hop Mode is set to Non-Hop.

Range

10.0 to 1015.0 MHz.

7. Hop Meas Freq

This is the frequency entry field for the frequency assumed when making measurements while the RF Analyzer is frequency hopping.

8. Hop Mode

This field selects between the Hop and Non-Hop modes of the RF Analyzer. Hop Mode cannot be set to Non-Hop until Hop Trig is set to Disarm.

Note

Do not make measurements with Hop Mode set to Hop and Hop Trig set to Disarm.

9. Hop Offset

This field sets the Hop Offset when the RF Analyzer Hop Mode is set to Hop. The frequency offset is applied to all of the frequencies in the RF Analyzer Hop Frequency table when the RF Analyzer is hopping.

Range

−50.000 to +50.000 kHz.

10. Hop Trig

This field selects whether the RF Analyzer is armed or disarmed to accept a hop trigger. Hop Trig cannot be set to Arm until Hop Mode is set to Hop.

Note

Do not make measurements with Hop Trig set to Disarm and Hop Mode set to Hop

11. Open/Auto DAC Value

This field is the AGC level DAC value when in Open or Auto AGC mode. This value can be entered automatically by choosing Auto AGC Mode. It can also be entered by performing a Do Open Cal operation while in Open AGC mode, or manually while in Open or Closed AGC Mode.

During Auto operation, the DAC value is based on the RF Analyzer Amplitude setting, and will be updated each time RF Analyzer Amplitude is changed.

See Also

Screens: RF Analyzer (Do Open Cal, AGC Mode)

Range

0 to 255.

12. RF Input

This field selects the RF input port for the RF Analyzer.

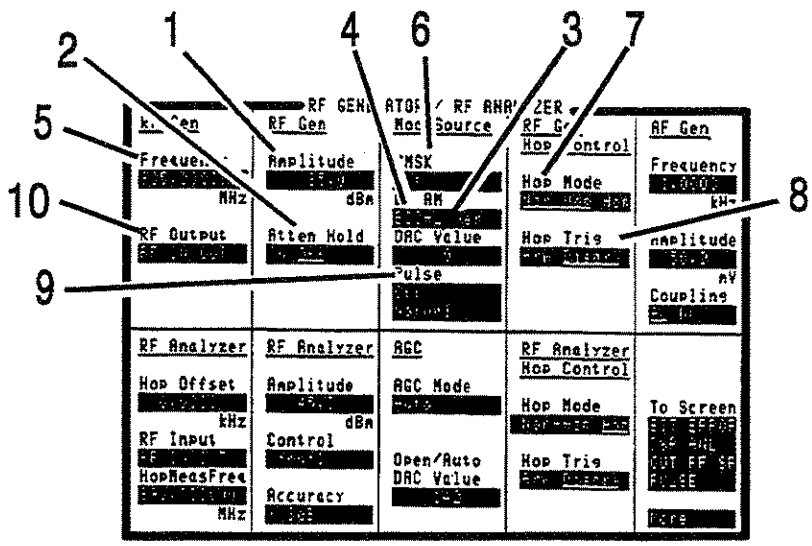
Choices

- RF IN/OUT
- AUX RF IN

Range

RF IN/OUT: −21.9 to +45.0 dBm.
AUX RF IN: −58.0 to +20.0 dBm.

RF Generator / RF Analyzer (RF Gen)



1. Amplitude This is the amplitude entry field. The amplitude shown is for the port selected in the RF Output field.

Range

RF IN/OUT: −127.0 to −12.0 dBm.
AUX RF OUT: −127.0 to +14.0 dBm.

2. Atten Hold This field prevents attenuator switching when On is selected.

3. DAC Value This field allows the DC AM modulation level to be set through the modulation source DAC.

Range

0 through 255

4. DC AM

This field selects the status of DC AM. When the instrument mode is Activated (see Screens: Cell Configuration), the broadcast and traffic channels' amplitude can be lowered using choices in this field.

Choices

- **Ext** turns on the front-panel input for DC AM.
- **Off** turns off DC AM.
- **TCH Lower** reduces the TCH amplitude by a level determined by DAC Value.
- **BCCH Lower** reduces the BCCH amplitude by a level determined by DAC Value.
- **Both Lower** reduces the TCH and BCCH amplitude by a level determined by DAC Value.

See Also

Screens: RF Generator / RF Analyzer, Mod Source (`DAC Value`)
Screens: Cell Configuration

5. Frequency

This is the non-hopped frequency entry field. When the RF Gen, Hop Control, Hop Mode is set to Hop, this field will show the frequency status as Hopped.

Range

10.0 to 1015.0 MHz.

6. GMSK

This field turns on the input for external GMSK modulation. When Activated (see Screens: Cell Configuration), Ext is connected to internally generated signals.

Choices

- Ext
- Off

7. Hop Mode

This field selects between the Hop and Non-Hop modes of the RF Generator.

Note

Do not make measurements with Hop Mode set to Hop and Hop Trig set to Disarm.

8. Hop Trig

This field selects whether the RF Generator is armed or disarmed to accept a hop trigger.

Note

Do not make measurements with Hop Trig set to Disarm and Hop Mode set to Hop

9. Pulse

This field selects pulse modulation and triggering. When Activated (see Screens: Cell Configuration) these signals are internally generated.

Choices

- **Off** turns pulse modulation off.
- **Hop Trig** automatically pulses the RF Generator off for one timeslot at a valid hop trigger.
- **Ext** allows the pulse signal to be input from the MODULATION IN PULSE connector or pin 6 (PULSE_MOD_IN) on the SYSTEM BUS connector.
- **Normal and Ext** pulses the RF signal >80 dB below the RF Generator Amplitude setting when a TTL low is present. And, when a TTL high is present, the RF Generator output is at the set Amplitude.
- **Normal and Hop Trig** pulses the RF signal >80 dB below the RF Generator Amplitude setting for one timeslot at a hop trigger.
- **30 dB and EXT** pulses the RF Generator output 30 dB *above* the RF Generator Amplitude setting, when a TTL high is present. And, when a TTL low is present, the RF Generator output is at the set RF Amplitude.
- **30 dB and Hop Trig** pulses the RF Generator output down 30 dB to the set Amplitude for one timeslot on a hop trigger.

10. RF Output

This field selects the RF output port.

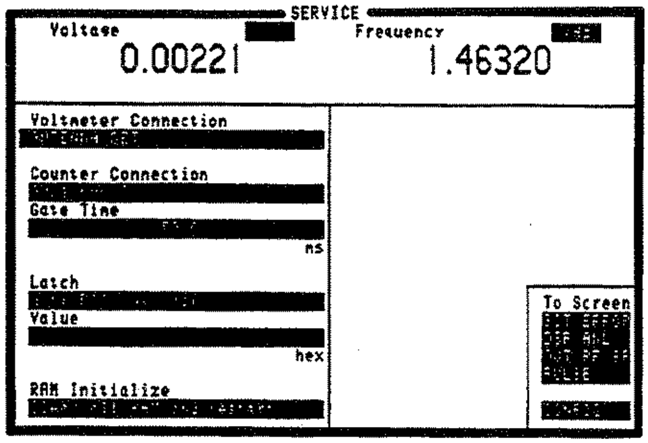
Choices

- RF IN/OUT
- AUX RF OUT

Range

RF IN/OUT: −127.0 to −12.0 dBm.
AUX RF OUT: −127.0 to +14.0 dBm.

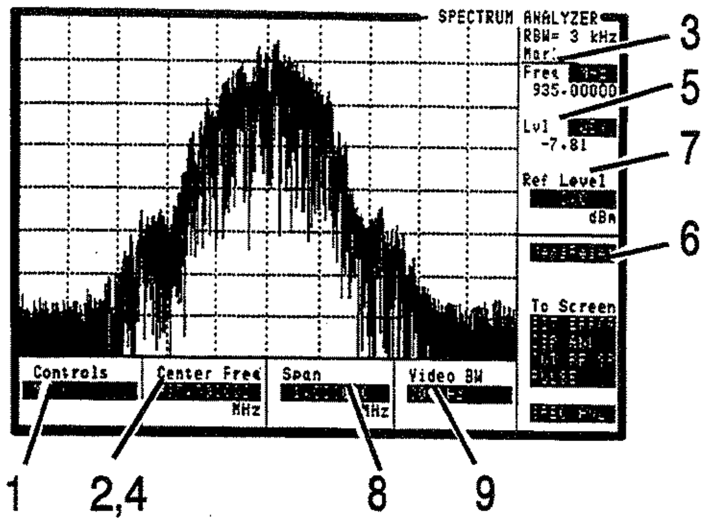
Service



This screen will be documented in the service documentation.

To escape, press (PREV).

Spectrum Analyzer, Main Controls



This screen displays the Spectrum Analyzer power spectral density versus frequency trace.

Important Consideration

When Reference is set to Tunable (see Configure screen) and Offset is $\neq 0$ ppm, the frequency calibration of the Spectrum Analyzer will be inaccurate.

This also affects RF Analyzer outputs such as FM DEMOD OUT, DSP Analyzer frequency measurement results, Phase, and Output RF Spectrum.

1. Controls

This field selects the alternate Controls of the Spectrum Analyzer measurement.

Choices

- Main
- RF Gen
- Marker
- Auxiliary

2. Center Freq

This field sets the center frequency when the RF Analyzer's Hop Mode is set to Non-Hop.

Range

10.0 to 1015.0 MHz.

3. Freq

This field displays the frequency at the current marker position.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

4. Hop Offset

This field sets the hop offset when the RF Analyzer's Hop Mode is set to Hop. The frequency offset is applied to all of the frequencies in the RF Analyzer Hop Frequency table when the RF Analyzer is hopping.

Range

−50.000 to +50.000 kHz.

5. Lvl

This field displays the level at the current marker position.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF, AVG, Units

6. Meas Reset

Selecting Meas Reset will erase any accumulated measurements used for calculating a final result, and re-start the measurement process for the following functions:

- HI LIMIT
- LO LIMIT
- AVG

See Also

Keys: HI LIMIT, LO LIMIT, AVG

7. Ref Level

This field is the reference level entry field for the selected RF input port.

Range

RF IN/OUT: −18.9 dBm to +48.0 dBm.
AUX RF IN: −55.0 dBm to +23.0 dBm.

8. Span

This field sets the frequency span.

Range

5 kHz to 4 MHz.

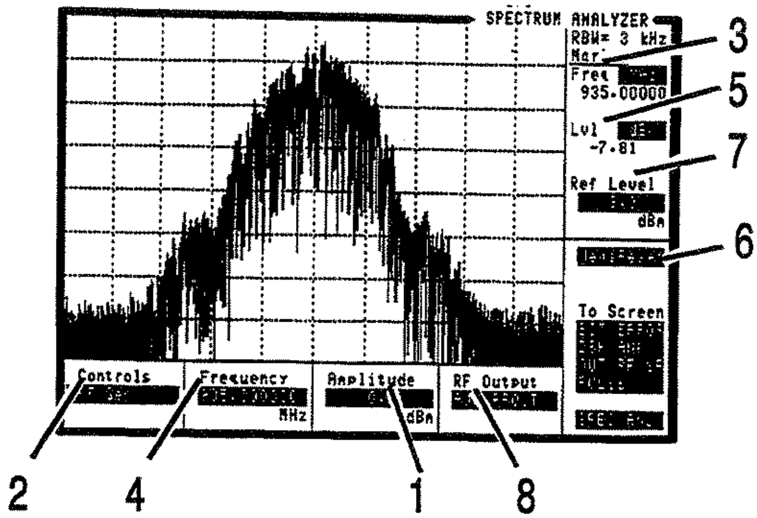
9. Video BW

This field selects the video bandwidth.

Choices

- 30 kHz
- 100 kHz
- 1 MHz

Spectrum Analyzer, RF Gen Controls



1. Amplitude This field sets the RF generator's amplitude. The amplitude shown is for the port selected in the RF Output field.

Range

RF IN/OUT: −127.0 to −12.0 dBm.
AUX RF OUT: −127.0 to +14.0 dBm.

2. Controls This field selects the alternate Controls of the Spectrum Analyzer measurement.

Choices

- Main
- RF Gen
- Marker
- Auxiliary

3. Freq This field displays the frequency at the current marker position.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

4. Frequency

This field sets the non-hopped frequency; or if the RF Gen, Hop Control, Hop Mode is set to Hop, this field will show the frequency status as Hopped.

Range

10.0 to 1015.0 MHz.

5. Lvl

This field displays the level at the current marker position.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF, AVG, Units

6. Meas Reset

Selecting Meas Reset will erase any accumulated measurements used for calculating a final result, and re-start the measurement process for the following functions:

- HI LIMIT
- LO LIMIT
- AVG

See Also

Keys: HI LIMIT, LO LIMIT, AVG

7. Ref Level

This field is the reference level entry field for the selected RF input port.

Range

RF IN/OUT: −18.9 dBm to +48.0 dBm.
AUX RF IN: −55.0 dBm to +23.0 dBm.

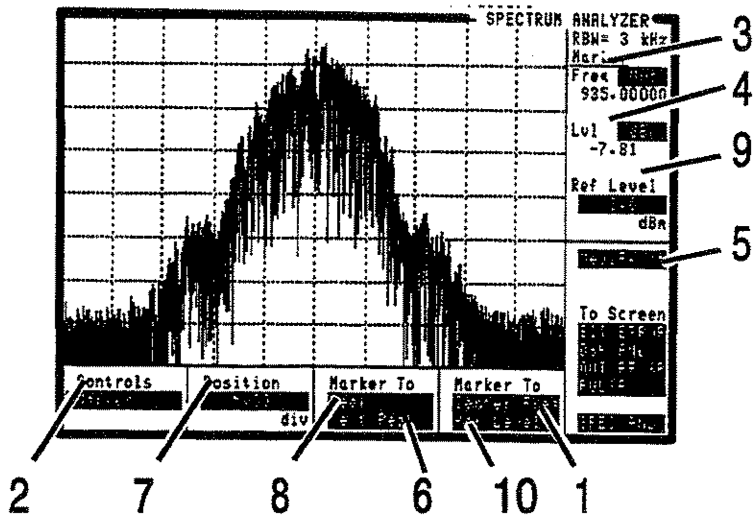
8. RF Output

This field selects between the RF IN/OUT and the AUX RF OUT ports as the RF output port.

Range

RF IN/OUT: −127.0 to −12.0 dBm.
AUX RF OUT: −127.0 to +14.0 dBm.

Spectrum Analyzer, Marker Controls



1. Center Freq (Marker To)

This field changes the center frequency setting to the frequency at the marker position.

2. Controls

This field selects the alternate Controls of the Spectrum Analyzer measurement.

Choices

- Main
- RF Gen
- Marker
- Auxiliary

3. Freq

This field displays the frequency at the current marker position.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

4. Lvl

This field displays the level at the current marker position.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF, AVG, Units

5. Meas Reset

Selecting Meas Reset will erase any accumulated measurements used for calculating a final result, and re-start the measurement process for the following functions:

- HI LIMIT
- LO LIMIT
- AVG

See Also

Keys: HI LIMIT, LO LIMIT, AVG

6. Next Peak (Marker To)

This field moves the marker to the next amplitude peak to the right of the current marker position.

7. Position

This field sets the Marker Position for the trace.

Range

0 to 10 divisions.

8. Peak (Marker To)

This field moves the marker to the highest amplitude point on the trace.

9. Ref Level

This field sets the reference level for the selected RF input port.

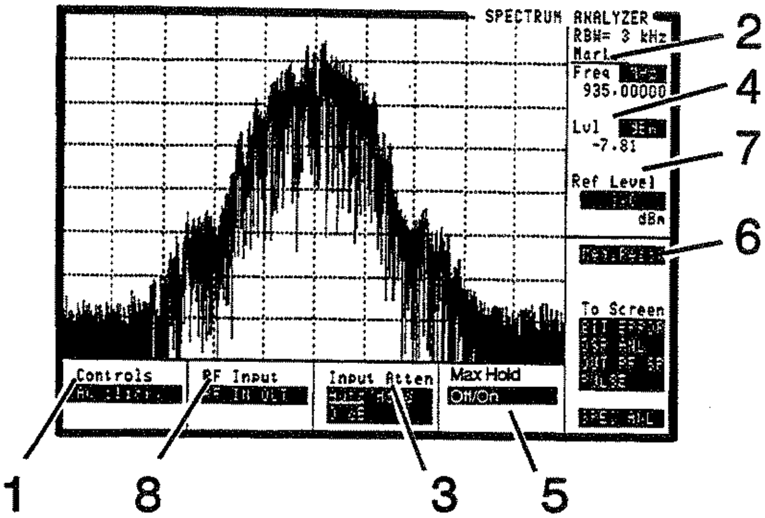
Range

RF IN/OUT: −18.9 dBm to +48.0 dBm.
AUX RF IN: −55.0 dBm to +23.0 dBm.

10. Ref Level (Marker To)

This field changes the Ref Level setting to the level at the marker position.

Spectrum Analyzer, Auxiliary Controls



1. Controls This field selects the alternate Controls of the Spectrum Analyzer measurement.

Choices

- Main
- RF Gen
- Marker
- Auxiliary

2. Freq This field displays the frequency at the current marker position.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF SET, AVG, Units

3. Input Atten

This field selects the Input Attenuator mode or value. The list of choices depends on the Radio Type selected on the Configure screen (GSM900 or DCS1800).

Choices (GSM900)

- **Auto** selects the input attenuation automatically.
- **Hold** allows the input attenuation to be changed manually.
- **0 dB**
- **10 dB**
- **20 dB**
- **30 dB**
- **40 dB**

Choices (DCS1800)

- **Auto** selects the input attenuation automatically.
- **Hold** allows the input attenuation to be changed manually.
- **0 dB**
- **5 dB**
- **10 dB**
- **15 dB**
- **20 dB**
- **25 dB**
- **30 dB**
- **35 dB**

See Also

Screens: Configure (Radio Type)

4. Lvl

This field displays the level at the current marker position.

See Also

Keys: ON/OFF, HI LIMIT, LO LIMIT, REF, AVG, Units

5. Max Hold

When Max Hold is on traces accumulate on the display until Max Hold is turned off.

See Also

Screens: Spectrum Analyzer: Auxiliary Controls (Meas Reset)

6. Meas Reset

Selecting Meas Reset will erase any accumulated measurements used for calculating a final result, and re-start the measurement process for the following functions:

- HI LIMIT
- LO LIMIT
- AVG

See Also

Keys: HI LIMIT, LO LIMIT, AVG

7. Ref Level

This field sets the reference level for the selected RF input port.

Range

RF IN/OUT: −18.9 dBm to +48.0 dBm.
AUX RF IN: −55.0 dBm to +23.0 dBm.

8. RF Input

This field selects the RF input port for the spectrum analyzer.

Choices

- RF IN/OUT
- AUX RF IN

Range

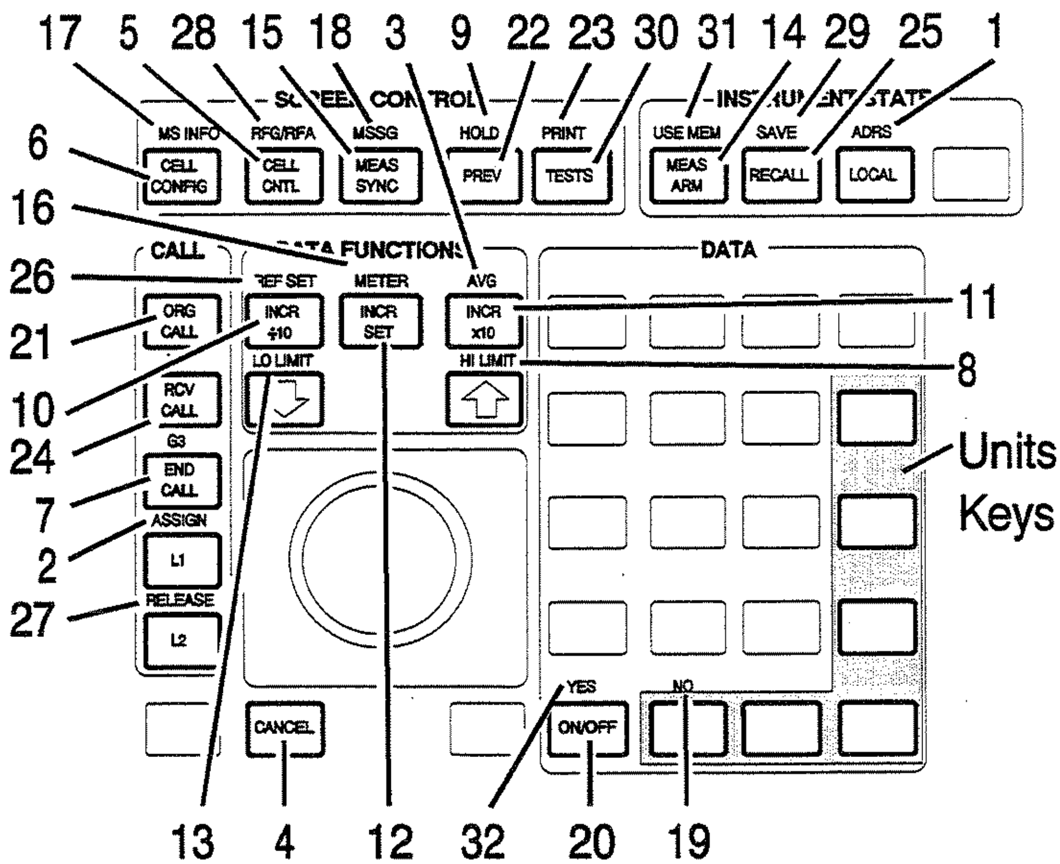
RF IN/OUT: −21.9 to +45.0 dBm.
AUX RF IN: −58.0 to +20.0 dBm.

Tests

Instrument BASIC Refer to chapter 10, *Instrument BASIC* for information about the Tests Screen.

5

Keys



17 5 28 15 18 3 9 22 23 30 31 14 29 25 1
MS INFO
RFG/RFA
MSSG
HOLD
PRINT
USE MEM
SAVE
ADRS
CELL CONFIG
CELL CNTL
MEAS SYNC
PREV
TESTS
MEAS ARM
RECALL
LOCAL
CALL
FUNCTIONS
DATA
REF SET
METER
AVG
INCR ÷10
INCR SET
INCR x10
LO LIMIT
HI LIMIT
ORG CALL
RCV CALL
G3
END CALL
ASSIGN
L1
RELEASE
L2
CANCEL
YES
NO
ON/OFF
6
16
26
21
10
24
7
2
27
11
8
Units Keys
13 4 12 32 20 19

Function Keys

1. ADRS

This key is used to display the HP-IB address.

2. ASSIGN

This key is used to assign global (G1, G2, G3) and local (L1, L2) keys for single-keystroke access to a field on the currently displayed screen, or to display a field from another screen.

See Also

Global Keys
Local Keys

3. AVG

This key allows you to display the average value of a number of measurements when the instrument is continuously making measurements.

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.

4. CANCEL

This key cancels the current operation.

5. CELL CNTL

This key accesses the Cell Control screen.

See Also

Screens: Cell Control

6. CELL CONFIG

This key accesses the Cell Config screen.

See Also

Screens: Cell Config

7. END CALL This key ends a call-in-progress.

8. HI LIMIT This key is used if you want to be alerted when a measurement exceeds a specified value.

To Set a High Limit

- Position the cursor at the measurement field of your choice.
- Press (SHIFT)
- Press (⇧) (HI LIMIT).
- Enter the value you want the high limit to be.
- Press (ENTER) or a units key. A HI (or H) annunciator will appear.

If a limit is exceeded during a measurement, a beep will sound (if the beeper is on) and "Measurement high limit exceeded" will be displayed. The HI (or H) annunciator will also flash as long as the measurement is displayed.

To Turn Off (or On) a High limit

When a limit is turned off, its value is retained but is not used.

- Press (SHIFT)
- Press (⇧) (HI LIMIT).
- Press (ON/OFF)

9. HOLD This key is used to retain measurement results by stopping swept or continuously updated measurements.

10. INCR ÷10 This key is used to adjust the increment value by a factor of ÷10. To display the increment value, press (INCR SET).

11. INCR ×10 This key is used to adjust the increment value by a factor of ×10. To display the increment value, press (INCR SET).

12. INCR SET This key is used to display or set the increment value.

1. Press (INCR SET).
2. Enter an increment value using the DATA keys.

13. LO LIMIT

This key is used if you want to be alerted when a measurement is less than a specified value.

To Set a Low Limit

- Position the cursor at the measurement field of your choice.
- Press (SHIFT)
- Press (⇩) (LO LIMIT).
- Enter the value you want the lower limit to be.
- Press (ENTER) or a units key. A LO (or L) annunciator will appear.

If a limit is exceeded during a measurement, a beep will sound (if the beeper is on) and "Measurement low limit exceeded" will be displayed. The LO annunciator will also flash as long as the measurement is displayed.

To Turn Off (or On) a Low limit:

When a limit is turned off, its value is retained but is not used.

- Press (SHIFT)
- Press (⇩) (LO LIMIT).
- Press (ON/OFF)

14. MEAS ARM

This key is used to arm a one-time-only (Meas Trig, Single) measurement. After MEAS ARM is pressed, the instrument will wait for a valid trigger event, then make the measurement currently selected. Meas Arm only applies to DSP analyzer, output RF spectrum, and pulse on/off measurements.

See Also

Screens: Measurement Sync (`Meas Trig`)

15. MEAS SYNC

This key is used to access the measurement synchronization screen.

See Also

Screens: Measurement Sync

16. METER

This key is used to display a measurement in both a digital readout and an analog meter display.

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 Meter menu in the lower-right corner of the screen.
3. Select On/Off to display the meter.

17. MS INFO

This key is used to access the MS (mobile station) Information/Signaling screen.

18. MSSG

This key is used to access the message screen.

See Also

Screens: Message

19. NO

This key is used to respond to Yes/No questions that appear on the screen.

20. ON/OFF

This key is used to turn functions on or off.

21. ORG CALL

This key, Originate Call, is used to make a base-station-originated call from the HP 8922G.

22. PREV

This key is used to return to the screen displayed prior to the current screen.

23. PRINT

This key is used to print the current screen.

See Also

Screens: Configure

24. RCV CALL

This key, Receive Call, causes a mobile-station-originated call to be received by the HP 8922G. It is not necessary to press RCV CALL when the Connect field on the Cell Control screen is set to Auto.

See Also

Screens: Cell Control

25. RECALL

This key is used to recall instrument setups.

To Recall an Instrument Setup

1. Press (RECALL).
2. Use the knob to select the desired setup to be recalled from the choices at the bottom right of the screen.

When Recall is pressed, the following fields are ALWAYS set to their default settings regardless of their setting in the saved setup.

- Meas Trig, Single/Cont is always reset to Single (Measurement Sync screen).
- Demod Arm, Arm/Disarm is always reset to Disarm (Digital Demod and Cell Control screens).
- Settable or Activated is always reset to Settable (Cell Configuration screen).
- Hop Mode, Hop/Non-Hop is always reset to Non-Hop (Hop Control and RF Genenerator/RF Analyzer screens).
- Hop Control, Arm/Disarm is always reset to Disarm (Hop Control and RF Genenerator/RF Analyzer screens).

26. REF SET

This key is used to set a reference if you want a measurement result to be offset by a certain value.

To Set a Reference

1. Use the knob to position the cursor at the measurement field of your choice.
2. Press SHIFT
3. Press INCR ÷10 (REF SET)

   The current reference value, with the word Reference below it, is displayed.

   If you want the current measurement result to be the reference, press ENTER and skip the next two steps.
4. Enter the value you want the Reference to be.
5. Press a units key to set the Reference. Or, press ENTER or the knob to default to the units currently displayed.

   When a measurement is displayed, REF (or R) will be displayed below it.

To Turn a Reference Off or On

When a reference is turned off, its value is stored but not applied to the measurement.

A Reference can be turned off, or turned back on using the ON/OFF key.

- Press SHIFT
- Press INCR ÷10 (REF SET)
- Press ON/OFF.

The REF (or R) annunciator will be dimly displayed when the Reference is on. When you turn the Reference off, the absolute measurement value will be displayed with no annunciator.

27. RELEASE

This key is used to clear a global (G1, G2, G3) or local (L1, L2) key.

See Also

Global Keys
Local Keys

28. RFG/RFA

This key is used to access the RF Generator / RF Analyzer screen.

See Also

Screens: RF Generator / RF Analyzer

29. SAVE

This key is used to save instrument setups to be recalled later.

Changes made on the Configure and Tests screens are automatically maintained through power-down and Preset cycles.

Help, Message, and Tests screens cannot be saved. The states of the following fields will not be saved: Demod Arm, Hop Arm, Activated, Meas Arm.

To Save an Instrument Setup

1. Make any changes to the instrument that you want to SAVE.
2. Press SHIFT, SAVE.
3. Name the setup using the data keys, or the Save choices at the bottom right of the screen. (You can use numbers, letters, or a combination of both.)

30. TESTS

This key is used to access the Tests screen. Refer to chapter 10 *Instrument BASIC* for more information.

See Also

Screens: Tests

31. USE MEM

This key arms and triggers a DSP measurement using data captured in memory. USE MEM is not available when Activated is selcted.

For information about data capture see Screens: Digital Demod, Trig Source (Use Mem).

See Also

Screens: Digital Demod (`Trig Source (Use Mem)`, `Status (Use Mem)`)
Screens: Measurement Sync (`Status`)
Screens: Cell Configuration

32. YES

This key is used to respond to Yes/No questions that appear on the screen.

Local Keys

L1, L2 Keys L1 and L2 are local keys. They are used to move between fields on the screen that is currently displayed.

To Assign a Local Key

- Use the knob to position the cursor at the field of your choice.
- Press (SHIFT)
- Press (L1) (ASSIGN).
- Press one of the Local keys (L1), (L2).

The field you assigned should now have the local number next to it.

When you press the local key, the chosen field will be accessed. A toggled field will toggle or cause immediate action in certain types of fields.

Re-assigning the local key clears the previous setting, or pressing RELEASE and then a local key clears that key.

Note Some fields cannot be assigned to local keys.

To Use Pre-Assigned Local Keys

Fields that might be used frequently have local keys assigned to them by the factory. Following this procedure will make the factory assigned local keys available.

1. Press (SHIFT), ASSIGN, (ENTER). The numbers 1 and 2 will appear in front of the two pre-assigned fields.
2. Press the Local key (L1 or L2) and notice how the cursor immediately moves to the corresponding field.
3. To stop using the default Local keys, press (SHIFT), RELEASE, (ENTER).

Global Keys

G1, G2, G3

Keys G1 through G3 ((SHIFT) (G1), (G2), or (G3)) are global keys. They can access fields that are not displayed on the current screen.

To Assign a Global Key,

- Use the knob to position the cursor at the field of your choice.

Note

The following screens do not allow global keys to be assigned, or allow fields to be pulled in from other screens: TEST, HELP, and MESSAGE.

The SERVICE screen only allows fields to be pulled in.

- Press (SHIFT)
- Press (L1) (ASSIGN).
- Press (SHIFT)
- Press one of the global keys, G1, G2, or G3.

The field you assigned can now be accessed from any allowable screen. You can also make changes to the assigned field.

Note

Some fields cannot be assigned to global keys.

Units Keys

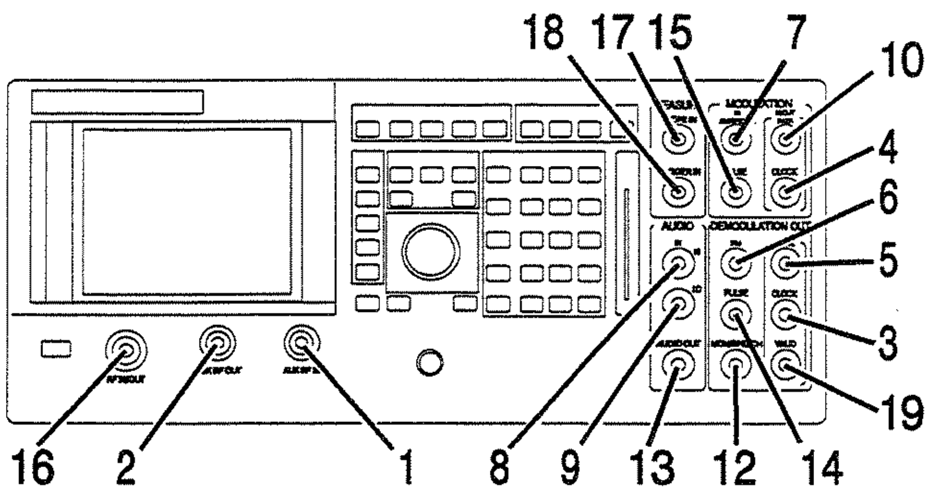
Units in some field types can be changed by pressing an applicable units key.

- Pressing a units key while the cursor is positioned next to a measurement field converts the measurement to the new units.
- Pressing a units key before a measurement is displayed changes the units displayed and will display any new measurement in the new units.
- Pressing a units key while the measurement display is turned off will turn on the measurement display showing the new units.

6

Connectors

Front-Panel Connectors



1. AUX RF IN

The auxiliary RF input connects to the input section and to the RF analyzer (if selected). This connector provides a higher sensitivity and lower maximum-power connection from the DUT. It is not normally used for transceiver testing.

AUX RF IN has its own input level setting (RF analyzer amplitude) separate from RF IN/OUT. It is reverse power protected.

This connector is selected when the RF analyzer's RF input is set to AUX RF IN.

See Also

Screens: RF Generator / RF Analyzer, RF Analyzer

2. AUX RF OUT

The auxiliary RF output connects to the input section from the RF generator's step attenuators (if selected). This connector provides higher output levels to a device-under-test (DUT). It is not normally used for transceiver testing.

This connector has its own output amplitude setting (RF generator amplitude) separate from RF IN/OUT. It is reverse power protected.

This connector is selected when the RF generator's RF output is set to AUX RF OUT.

See Also

Screens: RF Generator / RF Analyzer, RF Gen

3. CLOCK (DEMODULATION OUT)

The clock connector is connected to the DSP analyzer's digital demodulation clock output. This signal is the digital demodulation CLOCK signal which is generated when digitally demodulating one out of eight timeslots of GSM 0.3 GMSK modulation.

CLOCK (DEMODULATION OUT) is only active when the digital demodulation mode is selected and armed. This is a fast burst of clocks, not a continuous clock.

This connector is undefined when the demodulation output data valid signal is TTL high

This connector is connected directly in parallel with DEMOD_CLK on the SYSTEM BUS connector.

Requirements

High drive: 1 mA
Low drive: 1 mA
Duty cycle: 50%
Repetition Rate: 1 MHz

See Also

Screens: DSP Analyzer
Specifications
Signal Descriptions for the System Bus
Timing Diagrams

4. CLOCK (MODULATION)

CLOCK (Input)

The clock connector is connected to the Premod/NSM circuitry. This connector is used in combination with DATA (MODULATION IN).

CLOCK (MODULATION IN) is selected when the RF generator's modulation source GMSK field is set to Ext. This connector is directly in parallel with FP_CLOCK on the SYSTEM BUS connector.

This must be a continuous signal. Also, significant phase changes or loss of this signal will result in an out-of-lock condition in the data synchronizer.

Note

The two inputs are directly coupled to each other. Avoid putting signals on both inputs simultaneously.

Clock Input Requirements

High drive requirement: 100 μA
Low drive requirement: 1.2 mA
Active edge: rising edge

CLOCK (Output)

When Activated is selected and Aux BCCH is set to Adjacent, CLOCK is an output.

As and output, this connector can be use in conjunction with IN/OUT DATA to clock data to an external GMSK signal generator.

When used as an output, this line must be terminated in 50 ohms at the destination.

Clock Output Requirements

Drive: 3 mA TTL
Active Edge: rising
Termination: 50 ohms at destination

See Also

Screens: RF Generator / RF Analyzer, RF Gen
Screens: Cell Configuration (Aux BCCH)
Specifications
Signal Descriptions for the System Bus

5. DATA (DEMODULATION OUT)

The data connector is connected to the DSP analyzer's digital demodulation data output. This connector is the digital demodulation DATA signal which is generated when digitally demodulating one out of eight timeslots of GSM 0.3 GMSK modulation.

DATA (DEMODULATION OUT) is only active when digital demodulation mode is selected and armed. This is a fast burst of data, not continuous data.

This output is undefined when the demodulation output data valid signal is TTL HIGH. Differential data decoding is done internally.

DATA (DEMODULATION OUT) is active only when the digital demodulator's State field is set to Arm.

This connector is connected directly in parallel with DEMOD_DATA on the SYSTEM BUS connector.

Requirements

High drive: 1 mA
Low drive: 1 mA

See Also

Screens: DSP Analyzer
Specifications
Signal Descriptions for the System Bus
Timing Diagrams

6. FM (DEMODULATION OUT)

The FM connector is connected to the receiver circuitry. This connector provides an output of the FM discriminated signal.

This signal is muted whenever the pulsed RF input signal is OFF.

This output is always active.

See Also

Specifications

7. IN AM/SPEECH (MODULATION)

This connector can be used for transmitting speech to an MS. To select speech, choose Cond or Uncond from the Cell Control screen, Speech field.

This connector is also used as the DC AM input of the HP 8922G. To select DC AM, choose Ext from the RF Generator/RF Analyzer screen, DC AM field. The RF carrier will now be AM modulated (with fixed sensitivity) through this connector.

See Also

Screens: Cell Control (Speech)
Screens: RF Generator/RF Analyzer, RF Gen (DC AM)
Screens: CW Meas/AF Analyzer, AF Analyzer (AF Anl In)
Specifications

Note

IN AM/SPEECH and AM IN (a rear-panel connector) are connected directly in parallel. Avoid putting signals on both inputs simultaneously.

8. IN HI (AUDIO)

The input high connector is connected to the audio analyzer input. This connector is used as the main (external) audio analyzer input connection (when selected). This connector is also used in combination with the audio input low signal to input a floating input signal (for better noise performance) to the audio analyzer.

See Also

Screens: CW Meas/AF Analyzer, RF Analyzer
IN LO (AUDIO)

9. IN LO (AUDIO)

The input low connector is connected to the audio analyzer input. This connector is the main (external) audio analyzer input connection (when selected, and in FLOAT mode).

This connector is used in combination with the audio input, high signal to input a floating input signal (for better noise performance) to the audio analyzer.

See Also

Screens: CW Meas/AF Analyzer, RF Analyzer
IN HI (AUDIO)

10. IN/OUT DATA (MODULATION)

Data Input

This connector is a data input when the instrument is settable. (See the Cell Configuration screen.) It is used to input 0.3 GMSK modulation data (if selected) to the RF generator.

This connector is selected when RF generator's modulation source GMSK field is set to Ext. This connector is connected directly in parallel with FP_DATA on the SYSTEM BUS connector.

Note The two inputs are directly coupled to each other. Avoid putting signals on both inputs simultaneously.

Data Input Requirements:

High drive requirement: 100 μA
Setup Time: 150 ns
Hold Time: 0
Low drive requirement: 1.2 mA
An internal differential data encoder is used.
Sense: TTL HIGH results in a positive frequency deviation.

Data Output

IN/OUT DATA becomes a data output when Activated is selected and Aux BCCH is set to Adjacent. To simulate an adjacent cell BCCH, IN/OUT DATA and Modulation Clock can be connected to an external 0.3 GMSK signal generator. THe channel characteristics of the auxiliary BCCH will be the same as the serving cell BCCH, except that the base station color code (BCC) for the auxiliary BCCH is modulo 4.

Data Output Requirements:

Drive: 4 mA TTL
Valid: rising edge of modulation clock
Termination: 50 ohms at destination
Bit Rate: 13E6/48 bps

See Also

Screens: Cell Configuration (`Activated, Aux BCH` and `Serving Cell, Colour`)
Screens: RF Generator / RF Analyzer (RF Gen)
Specifications
Signal Descriptions for the System Bus

12. MON/SPEECH

This connector is the output of the Audio Analyzer. One of several uses for this connector is to monitor the received speech from an MS. To choose demodulated speech, select SpeechOut from the CW Meas/AF Analyzer screen, AF Anl In field. The same signal choices made for AF Analyzer measurements apply to this output. The same signal that goes to the AF Analyzer appears at this connector.

MON/SPEECH is directly in parallel with the rear-panel MONITOR OUT connector.

This output is always active.

See Also

Screens: CW Meas/AF Analyzer, AF Analyzer (AF Anl In)

13. OUT (AUDIO)

The out connector is connected to the modulation distribution board from AFG1 (unless OFF). It is a general purpose audio signal(s) output. No internal connection is provided for this signal.

See Also

Screens: RF Generator / RF Analyzer, AF Gen

14. PULSE (DEMODULATION OUT)

The pulse connector is connected to the receiver circuitry. This signal provides the demodulated envelope of the RF input signal.

This output is always active.

See Also

Specifications

15. PULSE (MODULATION)

The PULSE connector connects to the hop controller and to output section (when selected as active).

This signal is the TTL input to externally control when the amplitude is pulsed ON (TTL HIGH) or OFF (TTL LOW). It also pulses the envelope up (TTL HIGH) and down (TTL LOW) when in 30 dB Pulse mode.

This connector can be used in combination with AM (MODULATION IN) to generate pulsed and/or shaped amplitude envelopes of different levels for each RF generator pulse in real-time.

PULSE (MODULATION IN) is selected when the RF generator's modulation source Pulse field is set to Ext. This connector is connected directly in parallel with PULSE_MOD_IN on the SYSTEM BUS connector.

Note

The two inputs are directly coupled to each other. Avoid putting signals on both inputs simultaneously.

Requirements

High drive requirements: 100 μA
Low drive requirements: 1 mA
TTL HIGH: On or Higher Level
TTL LOW: Off or Lower Level

See Also

Screens: RF Generator / RF Analyzer RF Gen
Specifications
Signal Descriptions for the System Bus

16. RF IN/OUT

The RF input/output is connected to the input section to the RF analyzer and the RF generator's step attenuators. It is the main device-under-test (DUT) connection for the radio's RF signals. It is normally used for transceiver testing.

This connector is not reverse power protected, but can handle high power levels for extended periods of time because there is a temperature sensor for this signal.

This is connector is selected when the RF generator's RF output is set to RF IN/OUT or when the RF analyzer's RF input is set to RF IN/OUT.

See Also

Screens: RF Generator / RF Analyzer

17. SCOPE IN (MEASURE)

The measurement input for the oscilloscope connects to the Audio analyzer and to the oscilloscope (when selected as an Audio analyzer input source). This is the input for general purpose oscilloscope measurements, but it can be used for other measurements as well (for example, audio analyzer measurements, filtering an audio signal when used with the demodulation output monitor signal).

See Also

Screens: Oscilloscope

18. TRIGGER IN (MEASURE)

The measurement trigger input is the trigger source for the oscilloscope, spectrum analyzer, and DSP analyzer. It can also be used for digital demodulation.

All triggered measurements, when trigger is selected as external, are triggered by this signal: oscilloscope, spectrum analyzer, and DSP analyzer.

It is not possible to separately trigger an oscilloscope or spectrum analyzer measurement from a DSP analyzer measurement.

TRIGGER IN is selected when the digital demodulator's Trig Source is set to Ext Meas, or when the measurement synchronization Trig Source is set to Ext Meas.

See Also

Screens: Digital Demod, DSP Analyzer, Oscilloscope, Spectrum Analyzer

19. VALID (DEMODULATION OUT)

The valid connector is connected to the DSP analyzer's digital demodulation data valid output.

This signal is the digital demodulation data valid signal which is generated when digitally demodulating one out of eight timeslots of GSM 0.3 GMSK modulation. It can be used to load the digitally demodulated data.

This signal is used for gate timing when the demodulation output data-signal and the demodulation output clock-signal are valid.

This output is only active while outputting, not while demodulating, and it is only active when the digital demodulation mode is selected and armed.

This connector is connected directly in parallel with DEMOD_VALID on the SYSTEM BUS connector.

Specifications

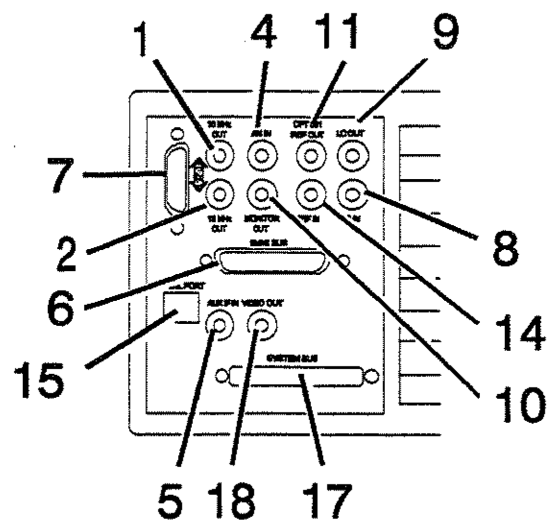
High drive: 1 mA
Low drive: 1 mA
Active level: LOW
Active for: leading tailbits, first half of data, midamble, second half of data, and trailing tailbits.
Inactive for: guard bits
Duration depends on type of burst being demodulated.

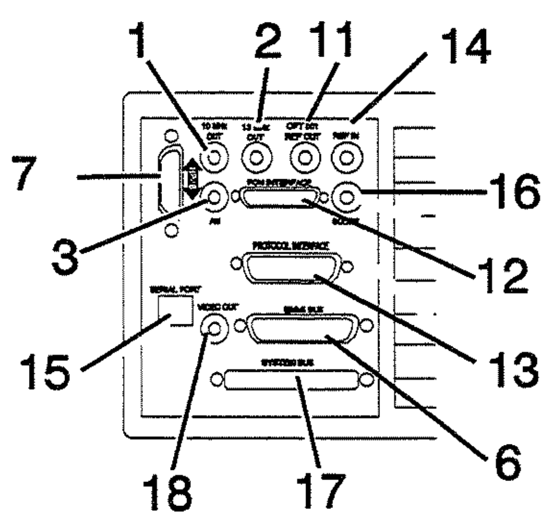
See Also

Screens: DSP Analyzer
Specifications
Signal Descriptions for the System Bus

Rear-Panel Connectors

You will have one of the following rear-panel configurations on your instrument.





1. 10 MHz OUT

The 10 MHz output connector is connected to the 10 MHz oscillator in the reference circuitry. This signal is a general-purpose 10 MHz reference output (sine wave). This connector can be either free-running or locked to an external reference of 1, 2, 5, 10 or 13 MHz reference. Typically, it is locked to the HP 10811 high-stability timebase reference, (if option 001 is installed, connected, and enabled).

10 MHz OUT is always active.

See Also

Specifications
REF IN

2. 13 MHz OUT

The 13 MHz output connector is connected to the 13 MHz oscillator in the reference circuitry. This signal is a general-purpose 13 MHz reference output, (sine wave). It can either be free-running or locked to any external reference of 1, 2, 5, 10 or 13 MHz reference. Typically, it is locked to the HP 10811 high-stability timebase reference, (if option 001 is installed, connected, and enabled).

13 MHz OUT is always active.

See Also

Specifications
REF IN

3. AM

Note

This connector is not present on earlier versions of the instrument.

This connector is used in conjuction with the HP 83220A DCS 1800 Test Set. Refer to HP 83220A DCS1800 Test Set manual (part number 83220-90000).

4. AM IN

The AM input connector connects to the modulation distribution board and to the output section when selected as an active DC AM input.

This connector provides external DC AM (fixed sensitivity) for controlling either the amplitude envelope shaping or for generating different levels for each RF generator pulse in real-time.

For DC AM, this connector is always dc-coupled. This connector is connected directly in parallel with the front-panel AM (MODULATION IN) connector. It is selected when the RF generator's modulation source DC AM field is set to Ext.

Note

The two inputs are directly coupled to each other. Avoid putting signals on both inputs simultaneously.

This connector is not present on later versions of the instrument.

See Also

Screens: RF Generator / RF Analyzer (RF Gen)
Specifications
AM (MODULATION IN)

5. AUX IF IN

Note

This connector is not present on later versions of the instrument.

The auxiliary IF input connector connects to the DSP analyzer input (if selected from the Service screen using latch control). It can be used to bypass the receiver circuitry, which may be useful for better phase accuracy, and so forth. This input can also be used for digital demodulation.

See Also

Screens: Configure, Service, DSP Analyzer

6. EMMI BUS

The EMMI bus is the Digital Audio Interface defined by GSM Rec. 11.10 sec III.1.4. The EMMI Bus is used to emulate the GSM-standard man-to-machine interface and for DAI control.

The pin assignment of the connector is as follows:

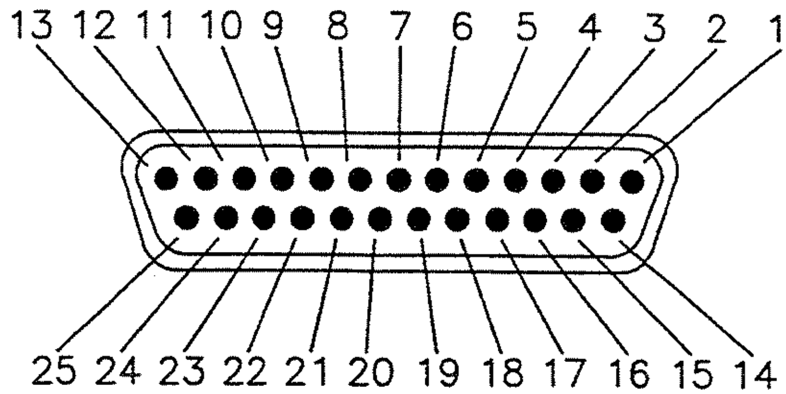
Pin	Usage	Function	To/From
1		Chassis ground	
2	EMMI TX	Signal	To ME
3	EMMI RX	Signal	From ME
4—6	Not used		
7	EMMI	Signal ground	
8—10	Not Used		
11	DAI	Test control 1	To ME
12	DAI	Signal ground	To ME
13	DAI	Test control 2	To ME
14—21	Not Used		
22	DAI	Reset	To ME
23	DAI	Data	From ME
24	DAI	Data Clock	From ME
25	DAI	Data	To ME

DAI input 24, Data Clock, is terminated in 10 kΩ.

Electrical Characteristics of the DAI/EMMI

The state of a signal pin is defined by the voltage (V) between the pin and its associated ground.

Logical State	Voltage (V)	Current
0 or LOW or ON	$0\ V < V < +0.8\ V$	2.4 mA
1 or HIGH or OFF	$+3.5\ V < V < +5\ V$	$-400\ \mu A$
Undefined	$+0.8\ V < V < 3.5\ V$	
Forbidden	$V < 0\ V$ or $V > +5\ V$	



EMMI Connector Pin Numbers

See Also

Screens: Cell Control (DAI: Test, Norm)

7. HP-IB

The Hewlett-Packard Interface Bus is an IEEE-488.1 connector. It is connected to the main microprocessor. This connector is used for IEEE-488.1 operation and control of other instruments using IBASIC (if available).

The instrument can be talker and listener, or a controller, depending on selection made in the Mode field on the Configure screen.

HP-IB is always active.

See Also

Screens: Configure
Specifications
HP-IB
HP-IB Connections

8. LO IN

Note

This connector is not present on later versions of the instrument.

The local oscillator input connector should always be connected to the LO OUT connector. Internally, this input is connected to the receiver circuitry. It is the LO signal for the receiver.

This connector is normally connected to LO OUT using a short HP-supplied coax jumper. It can be disconnected from LO OUT if LO IN is to be used to substitute a user-provided local oscillator for the receiver (for example, to get better frequency resolution, noise, or switching time characteristics).

RF Analyzer hopping is still operational when this input is connected to a user-provided LO (for example, the input section filters will still be hopped); however, the actual hopping of the receiver's demodulation will depend on the signal connected to LO IN being hopped at the right time.

LO IN is always active.

See Also

Installing Your HP 8922A
EXT LO OUT

9. LO OUT

Note

This connector is not present on later versions of the instrument.

The local oscillator output connector should always be connected to the LO IN connector. Internally, this output is connected to the receiver circuitry's step loop (LO) output signal.

This connector is only supplied as a connection to LO IN (using an HP-supplied short coax jumper). It will be disconnected from LO IN when LO IN is connected to a substitute LO for the receiver.

LO OUT is always active.

See Also

LO IN

10. MONITOR OUT

Note

This connector is not present on later versions of the instrument.

The monitor output is connected to the output of the audio analyzer. The same signal choices made for AF Analyzer measurements apply to this output. The same signal that goes to the AF Analyzer appears at this connector.

This connector is directly in parallel with the front-panel MONITOR OUT (DEMODULATION OUT) connector.

This output is always active.

See Also

Screens: CW Meas/AF Analyzer (AF Analyzer)
MONITOR OUT (DEMODULATION OUT)

11. OPT 001 REF OUT

The option 001 reference output connector is connected to an HP 10811 high-stability 10 MHz reference, (if option 001 is installed). Typically, it is connected to REF IN (using a HP-supplied short jumper cable) to get all timebase references locked to the high-stability timebase reference. This connector can also be used as a general-purpose output.

This output should be turned off when not in use, to reduce spurs and other unwanted signals.

Option 001 REF OUT is turned on and off by the OPT 001 REF OUT field on the Configure screen.

See Also

Screens: Configure
Specifications
REF IN

12. PCN Interface

Note

This connector is not present on earlier versions of the instrument.

This connector is used in conjuction with the HP 83220A DCS 1800 Test Set. Refer to HP 83220A DCS1800 Test Set manual (part number 83220-90000).

13. PROTOCOL INTERFACE

Note

This connector is not present on earlier versions of the instrument.

This connector is used in conjunction with the HP 37900D Signaling Test Set. It is available only when option 003 is ordered.

14. REF IN

The timebase reference input is a BNC connector. It is connected to the reference circuitry. This connector is the main timebase reference input. Normally, it is connected to Option 001 REF OUT (if option 001 is installed) using an HP-supplied short jumper cable. RF IN can also be connected to a user-provided 1, 2, 5, 10 or 13 MHz reference by selecting the appropriate frequency from the Reference field on the Configure screen.

If RF IN is left unconnected, the internal timebase will not be locked to any external reference.

See Also

Screens: Configure
Specifications

15. SERIAL PORT

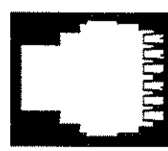
The serial interface port is a multipin connector. It is connected to the main microprocessor. It is used to connect a terminal to develop IBASIC programs, locally, without an external HP-IB controller. It can also be used for printing the contents of the display.

SERIAL PORT is always active.

Specifications

Baud Rates:

300
1200
2400
4800
9600
19200



16. SCOPE

Refer to HP 83220A DCS1800 Test Set manual (part number 83220-90000).

17. SYSTEM BUS

The system bus connector is used to externally control frequency hopping and contains duplications of several individual connectors.

See Also

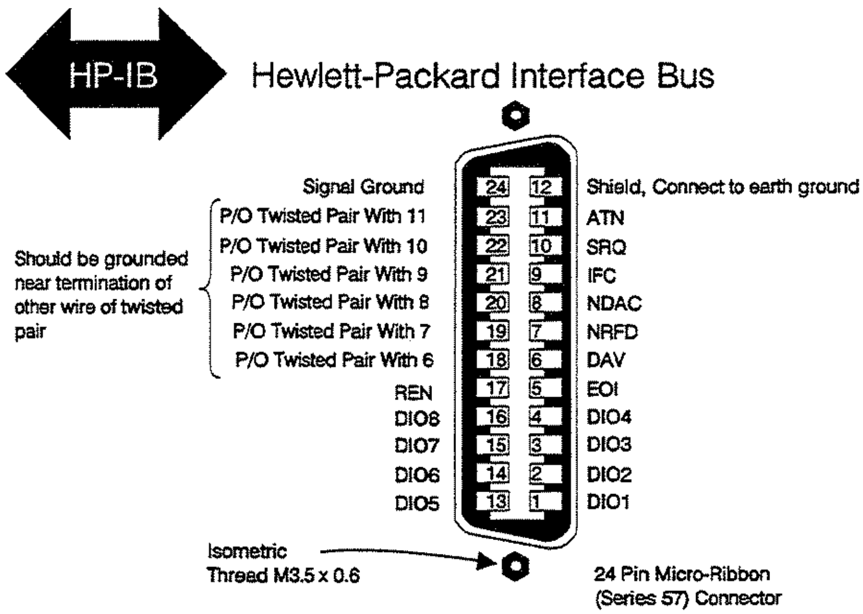
Signal Descriptions for the System Bus

18. VIDEO OUT

The video output connector connects to the CRT hardware. It can be used to connect a larger display.

VIDEO OUT is always active.

HP-IB Connections



Logic Levels

The Hewlett-Packard Interface Bus logic levels are TTL compatible, that is, the true (1) state is 0.0 Vdc to +0.4 Vdc and the false state (0) is +2.5 Vdc to +5 Vdc.

Mating Connector

HP 1251-0293; Amphenol 57-30240

Mating Cables Available

HP 10833A, 1 meter (3.3 ft.)
HP 108033B, 2 meters (6.8 ft.)
HP 10833C, 4 meters (13.2 ft.)
HP 10833D, 0.5 meters (1.6 ft.)

Cabling Restrictions

1. A Hewlett-Packard Interface Bus system may contain no more than 2 meters (6.6 ft.) of connecting cable per instrument.

2. The maximum accumlative length of connecting cable for any Hewett-Packard Interface Bus system is 20 meters (65.5 ft.).

m:\manuals\boiler\hpibconn.drw

Signal Descriptions for SYSTEM BUS

DEMOD_DATA, DEMOD_CLK, DEMOD_VALID

DATA-Pin 22
CLK-Pin 4
VALID-Pin 23
Outputs

These are the digital demodulation data output signal, the digital demodulation clock output signal, and the digital demodulation valid output signal. These signals are connected directly in parallel with their respective front-panel connectors.

See Also

Front Panel Connectors: DATA (DEMODULATION OUT), CLOCK (DEMODULATION OUT), VALID (DEMODULATION OUT)

FP_DATA, FP_CLOCK

DATA-Pin 1
CLOCK-Pin 20
Inputs

These are the front-panel DATA, and CLOCK inputs. These signals are connected directly in parallel with their respective front-panel connectors.

Note

The two inputs are directly coupled to each other. Avoid putting signals on both inputs simultaneously.

See Also

DATA (MODULATION IN)
CLOCK (MODULATION IN)

G_EXT_TRIG_OUT

Pin 24
Output

This output is a 1-bit-wide trigger. The timeslot and bit position in the timeslot are programmable on the Service screen.

Requirements

Amplitude: TTL Levels
Low Drive: 10 μA
High Drive: 2 mA

See Also

Screens: Service

MEAS_TRIG_OUT

Pin 21
Output

This is the measurement trigger output. It is connected to the DSP analyzer trigger-source multiplexer hardware. It is used as an auxiliary trigger output signal for use with an external spectrum analyzer.

PULSE_MOD_IN

Pin 6
Input

This is the pulse modulation input. This signal is connected directly in parallel with the PULSE (MODULATION IN) front-panel connector.

Note

The two inputs are directly coupled to each other. Avoid putting signals on both inputs simultaneously.

See Also

Screens: RF Generator
Front-Panel Connectors: PULSE (MODULATION IN)

RP_BURST_T1, RP_BURST_T2

T1-Pin 26, T2-Pin 8
Select/Control

These are the rear-panel DSP analyzer burst type select signals. They are connected to the DSP analyzer. These signals can be used during digital demodulation or DSP Analyzer measurements to select the burst type in real-time for each burst being operated on.

When digitally demodulating, burst select must be set to Ext to use these signals. When making triggered measurements, the measurement synchronization burst selection must be set to Ext. Each of the four burst type definitions can be selected.

Requirements

Amplitude: TTL levels
High drive requirement: 100 μA
Low drive requirement: 2 mA

Table 6-1.

RP_BURST_T2	RP_BURST_T1	BURST NUMBER SELECTED
TTL LOW	TTL LOW	0
TTL LOW	TTL HIGH	1
TTL HIGH	TTL LOW	2
TTL HIGH	TTL HIGH	3

See Also

Screens: Measurement Sync, Digital Demod
Specifications
Timing Diagrams

RP_DMOD_TRIG

Pin 7
Input

This is the rear-panel trigger signal input for digital demodulation. It connects to the DSP analyzer. It can also be used for other triggered measurements.

This signal is active when the digital demodulator's demodulation trigger source is set to Ext Demod, or when the measurement synchronization trigger source is set to Ext Demod.

Requirements

Amplitude: TTL levels
High drive requirements: 100 μA
Low drive requirements: 2 mA
Active edge: rising edge.

See Also

Screens: DSP Analyzer, Digital Demod
Specifications
Timing Diagrams

RP_GSM_RST_IN

Pin 3
Input

This connector is an active low input that halts and resets the HP 8922G GSM counters (frame, timeslot, and bits). It is used when two or more HP 8922Gs are connected together (daisy-chained) to simulate a GSM system.

Requirements

Amplitude: TTL Levels
Low Drive: 100 μA
High Drive: 2 mA
Active Level: Low

RP_GSM_RST_OUT

Pin 5
Output

This connector indicates whether the HP 8922G GSM counters have been halted (by RP-GSM-RST-IN). It is always active (TTL Low) when the HP 8922G is in the Settable Mode.

Requirements

Amplitude: TTL Levels
Low Drive: 100 μA
High Drive: 2 mA
Active Level: Low

RP_HOP_ADRS0, through RP_HOP_ADRS9, RP_HOP_ADRS10

ADRS0-Pin 12, ADRS1-Pin 31
ADRS2-Pin 13, ADRS3-Pin 32
ADRS4-Pin 14, ADRS5-Pin 33
ADRS6-Pin 15, ADRS7-Pin 34
ADRS8-Pin 16, ADRS9-Pin 35
ADRS10-Pin 17, Inputs

These are the rear-panel hop frequency table address input lines. They connect to the to hop controller. These lines select entries from user-entered RF generator and RF analyzer hop frequency tables. These lines have multiple uses, depending on the selected modes.

1. Used in combination with RP_TX_HOP to frequency hop the RF generator.
2. Used in combination with RP_RX_HOP to frequency hop the RF analyzer.
3. Used in combination with RP_RST_SEQ_HOP to reset the internal hop address register.

These signals are read on the positive-going edge of RP_TX_HOP when the RF generator's hop mode is set to Hop, the hop trigger is set to Arm, and the hop address source is set to Ext.

These signals can also be read on the positive-going edge of RP_RX_HOP when the RF analyzer's hop mode is set to Hop, the hop trigger is set to Arm, and the hop address source is set to Ext.

Or, these signals are read on the positive going edge on RP_SEQ_HOP when the address source is set to Seq, the RF analyzer's hop trigger is set to Arm, or RF generator's hop trigger is set to Arm.

Requirements

Amplitude: TTL levels
High drive requirement: 100 μA
Low drive requirement: 1 mA
Format: unassigned binary, high=1.

See Also

Screens: Hop Control (RF Generator), Hop Control (RF Analyzer)
Specifications
Timing Diagrams

RP_HOP_INHIBIT

Pin 30
Input

This is the rear-panel internal hop inhibit input. It connects to the hop controller. It is used to inhibit internal hopping. The internal hop sequence address register is still sequenced, however. This signal should normally be kept TTL high.

This line is active whenever the hop controller' hop address source is set to Seq.

Requirements

Amplitude: TTL levels
High drive requirements: 100 μA
Low drive requirements: 2 mA
Active level: Low

See Also

Screens: Hop Control (RF Generator), Hop Control (RF Analyzer)
Specifications
Timing Diagrams

RP_RST_SEQ_HOP

Pin 11
Input

This is the rear-panel input to reset the internal hop sequence address register. It connects to the hop controller. This signal is primarily used to reset the internal hop address register to zero before a hopping sequence reaches the end of the hop frequency table(s). The signal should normally be kept TTL high.

This signal is always active. To reset the internal hop sequence counter, however, the reset will only occur on a subsequent RP_SEQ_HOP signal when the hop controller's hop address source is set to Seq.

Requirements

Amplitude: TTL levels
High drive requirement: 100 μA
Low drive requirement: 2 mA
Active level: Low

See Also

Screens: Hop Control (RF Generator), Hop Control (RF Analyzer)
Specifications
Timing Diagrams

RP_RX_HOP

Pin 10
Input

This is the rear-panel trigger signal input for hopping the RF analyzer (if selected). It is used when externally addressing the hop frequencies.

You must supply signals on the rear-panel hop frequency table address input lines to select each RF analyzer hop frequency for each RF analyzer hop trigger. Also, the hop controller's hop address source must be set to Ext.

This line is active when the hop controller's hop address source is set to Ext, the RF analyzer's hop mode is set to Hop, and the RF analyzer's hop trigger is set to Arm.

Requirements

Amplitude: TTL levels
High drive requirement: 100 μA
Low drive requirement: 2 mA
Triggered by: rising edge

See Also

Screens: Hop Control (RF Generator), Hop Control (RF Analyzer)
Specifications
Timing Diagrams

RP_SEQ_HOP

Pin 29
Input

This is the rear-panel trigger signal input for hopping the RF generator and/or the RF analyzer (if selected). It is used when internally sequencing through the hop frequencies. It is connected to the hop controller.This signal can also be configured to control RF generator output pulsing (automatic level pulsing when this trigger occurs). It is used along with internal hop sequence reset input to control frequency hopping through user-entered RF generator and RF analyzer hop frequency tables.

Hop frequencies are automatically selected through user-entered RF generator and RF analyzer hop frequency tables. Hop frequency table address input lines are used for resetting the internal sequence address register.

For the hop sequence to be active, the hop controller's hop address source must be set to Seq. To generate frequency hops, the hop controller's hop address source must be set to internal, the RF generator's (or RF analyzer's) hop mode must be set to hop, and the RF generator's (or RF analyzer's) hop trigger must be set to arm.

Requirements

Amplitude: TTL levels
High drive requirements: 100 μA
Low drive requirements: 2 mA
Triggered by: rising edge

See Also

Screens: Hop Control (RF Generator), Hop Control (RF Analyzer)
Specifications
Timing Diagrams
RP_RST_SEQ_HOP

RP_TXD, RP_RXD

TXD-Pin 37
RXD-Pin 18
Output/Input

These are the rear-panel serial transmit data and rear-panel serial receive data lines.

Note

Ground signals not listed individually here.

RP_TX_HOP

Pin 28
Input

This is the rear-panel trigger signal input for hopping the RF generator (if selected). It is used when externally addressing the hop frequencies. It is connected to the hop controller. It can also be configured to control RF generator output pulsing (automatic level pulsing when this trigger occurs).

You must supply signals on the rear-panel hop frequency table address input lines to select each RF generator hop frequency for each hop trigger. Also, the hop controller's hop address Source field must be set to Ext.

This line is active when the hop controller's Source field is set to Ext, the RF generator's hop mode is set to Hop, and the RF generator's hop trigger is set to Arm.

Requirements

Amplitude: TTL levels
High drive requirement: 100 μA
Low drive requirement: 2 mA
Triggered by: rising edge

See Also

Screens: Hop Control (RF Generator), Hop Control (RF Analyzer)
Specifications
Timing Diagrams

SEQ_TRIG_OUT

Pin 9
Output

This is the sequence trigger output. It is connected to the DSP analyzer. It outputs a positive-going pulse when an internal sequence goes through something other than the next higher address, or when reset occurs (Hop Address Source=Int).

USE_MEM_EXT_TRIG

27 Pin
Input

This is the external trigger source for Use Mem.

When Trig Source is Ext (see Screens: Digital Demod), a TTL high on this pin will initiate data capture for Use Mem.

RP_BURST_T1 and RP_BURST_T2 must select the correct burst number (see signal descriptions for RP_BURST_T1, RP_BURST_T2).

Input

High: demodulated data is stored for later use.
Low: data is not stored.

Requirements

TTL
High drive: 100 μA
Low: 2 mA

See Also

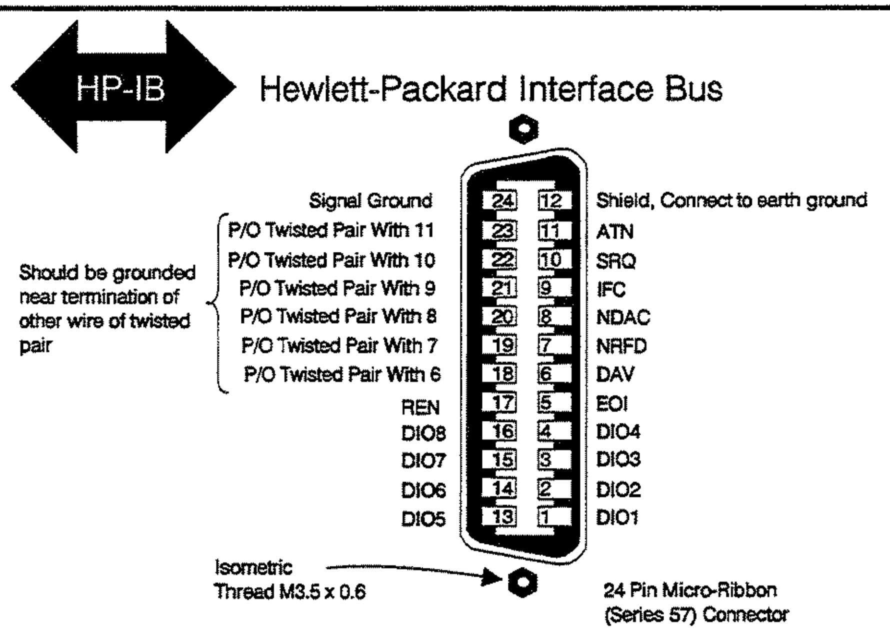
Keys: Use Mem
Connectors: System Bus, RP_BURST_T1, RP_BURST_T2

System Bus Pin Number Overview

Table 6-1. System Bus Connector Pin Numbers

Pin Number	Signal Name	Pin Number	Signal Name
1	FP_DATA	20	FP_CLOCK
2	GND	21	MEAS_TRIG_OUT
3	RP_GSM_RST_IN	22	DEMOD_DATA
4	DEMOD_CLK	23	DEMOD_VALID
5	RP_GSM_RST_OUT	24	G_EXT_TRIG_OUT
6	PULSE_MOD_IN	25	GND
7	RP_DMOD_TRIG	26	RP_BURST_T1
8	RP_BURST_T2	27	RP_BURST_T3
9	SEQ_TRIG_OUT	28	RP_TX_HOP
10	RP_RX_HOP	29	RP_SEQ_HOP
11	RP_RST_SEQ_HOP	30	RP_HOP_INHIBIT
12	RP_HOP_ADRS0	31	RP_HOP_ADRS1
13	RP_HOP_ADRS2	32	RP_HOP_ADRS3
14	RP_HOP_ADRS4	33	RP_HOP_ADRS5
15	RP_HOP_ADRS6	34	RP_HOP_ADRS7
16	RP_HOP_ADRS8	35	RP_HOP_ADRS9
17	RP_HOP_ADRS20	36	GND
18	RP_RXD	37	RP_TXD
19	GND		

HP-IB Connections



Logic Levels

The Hewlett-Packard Interface Bus logic levels are TTL compatible, that is, the true (1) state is 0.0 Vdc to +0.4 Vdc and the false state (0) is +2.5 Vdc to +5 Vdc.

Mating Connector

HP 1251-0293; Amphenol 57-30240

Mating Cables Available

HP 10833A, 1 meter (3.3 ft.)
HP 108033B, 2 meters (6.8 ft.)
HP 10833C, 4 meters (13.2 ft.)
HP 10833D, 0.5 meters (1.6 ft.)

Cabling Restrictions

1. A Hewlett-Packard Interface Bus system may contain no more than 2 meters (6.6 ft.) of connecting cable per instrument.

2. The maximum accumlative length of connecting cable for any Hewett-Packard Interface Bus system is 20 meters (65.5 ft.).

m:\manuals\boiler\hpibconn.drw

Timing Diagrams

Contents

Symbol	min	max	description
Tbth	1.2 ms +Trig Delay		hold time of valid burst type after demod trigger
Tbtl		500 us +Trig Delay	latency time from demod trigger until valid burst type
Tdch	400 ns	600 ns	width of high state of DEMOD_CLK (rep rate 1 MHz)
Tdcl	400 ns	600 ns	width of low state of DEMOD_CLK (rep rate 1 MHz)
Tdh	100 ns		hold time of DEMOD_DATA after rising edge of DEMOD_CLK
Tds	100 ns		setup time of DEMOD_DATA prior to rising edge of DEMOD_CLK
Tdth	1 us		width of high state of demod trigger
Tdtl	1 us		width of low state of demod trigger
Tdtr	4.615 ms		time between subsequent demod triggers
Tdtv	3.8 ms +Trig Delay	4.2 ms +Trig Delay	latency time from demod trigger until DEMOD_VALID active
Tva	200 ns	400 ns	time from DEMOD_VALID active until rising edge of DEMOD_CLK
Tvi	500 ns	1 us	time from rising edge of last DEMOD_CLK until NOT DEMOD_VALID

Figure 6-1. Digital Demodulation Timing Specification Table

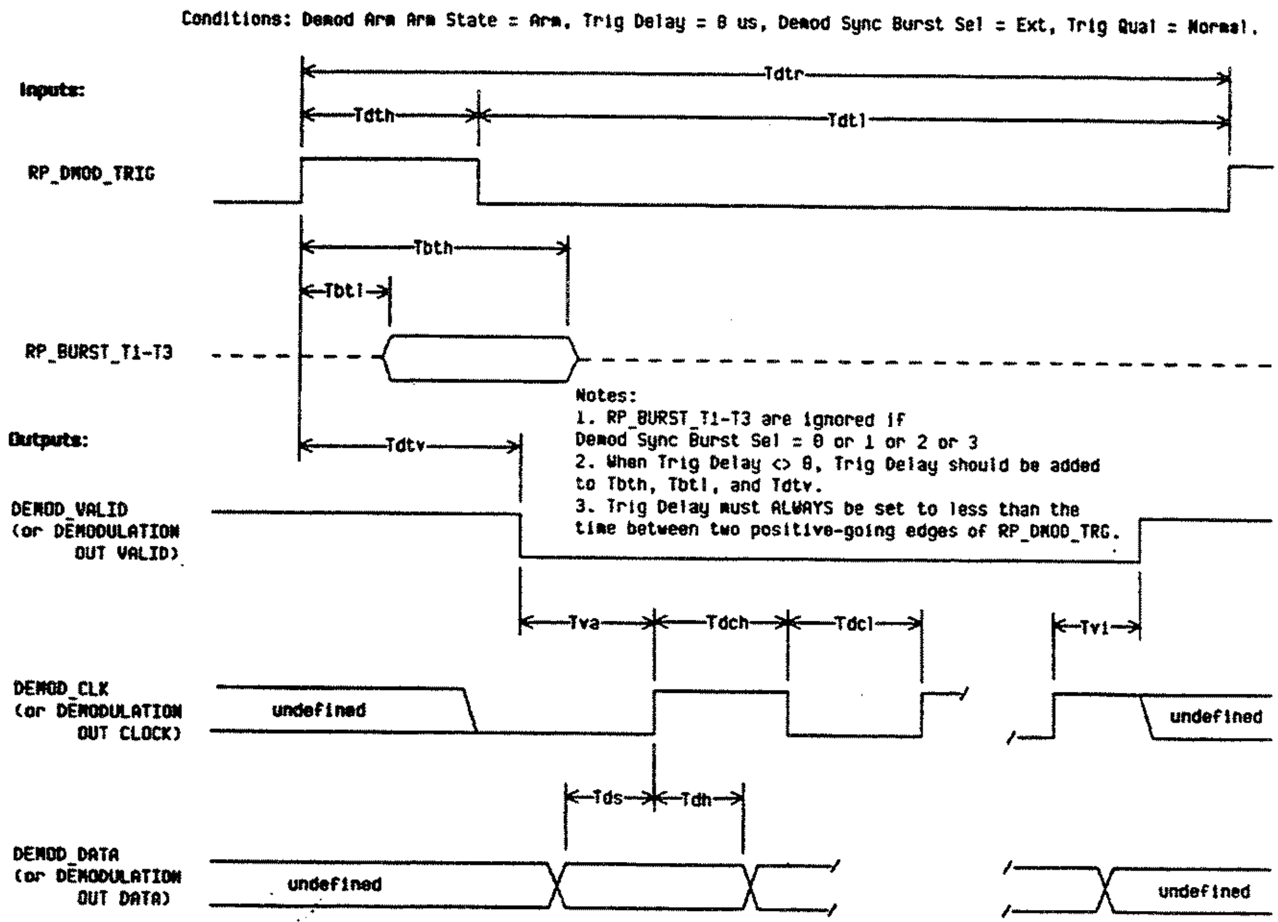
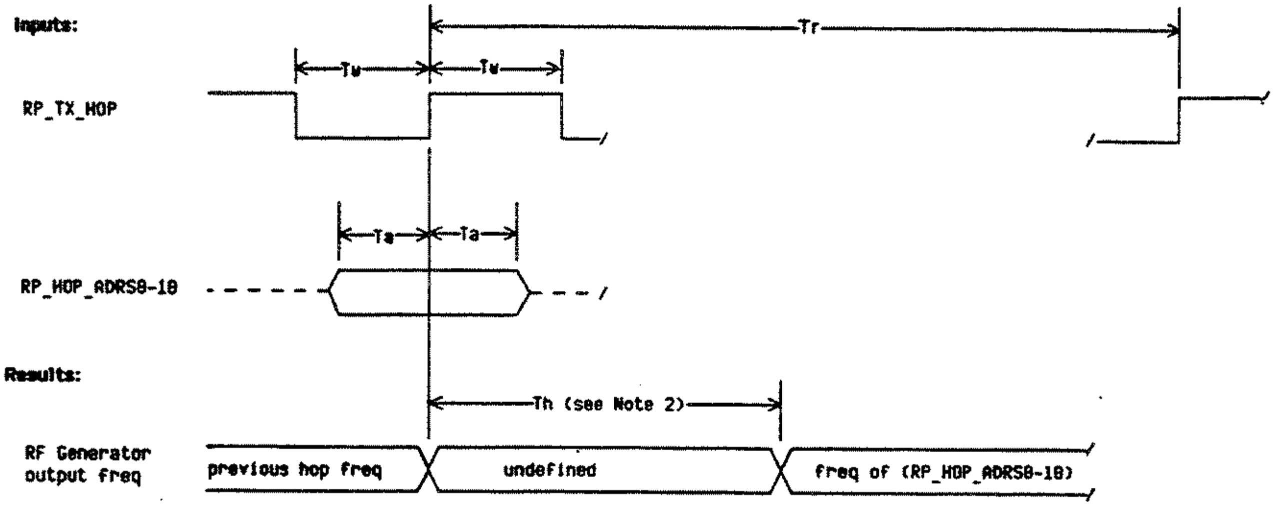


Figure 6-2. Digital Demod Timing Diagram

Symbol	min	max	description
Ta	1 us		time RP_HOP_ADRS0-10 is stable before and/or after event
Th	0	570 us	time from hop trigger rising edge for RF Gen or RF Analyzer to meet frequency/phase specs (for 1 timeslot hop)
Th2	0	850 us	time from hop trigger rising edge for RF Gen or RF Analyzer to meet frequency/phase specs (for 1 timeslot hop) during simultaneous hopping
Tr	577 us		time between subsequent hop triggers of the same type (not useful less than 1.15 ms)
Trs	1 us		time after RP_RST_SEQ_HOP returns high until RP_SEQ_HOP rising edge can occur
Tsr	1 us		time after previous RP_SEQ_HOP rising edge until low RP_RST_SEQ_HOP can occur
Tw	1 us		pulse widths

Figure 6-3. Frequency Hop Timing Specification Table

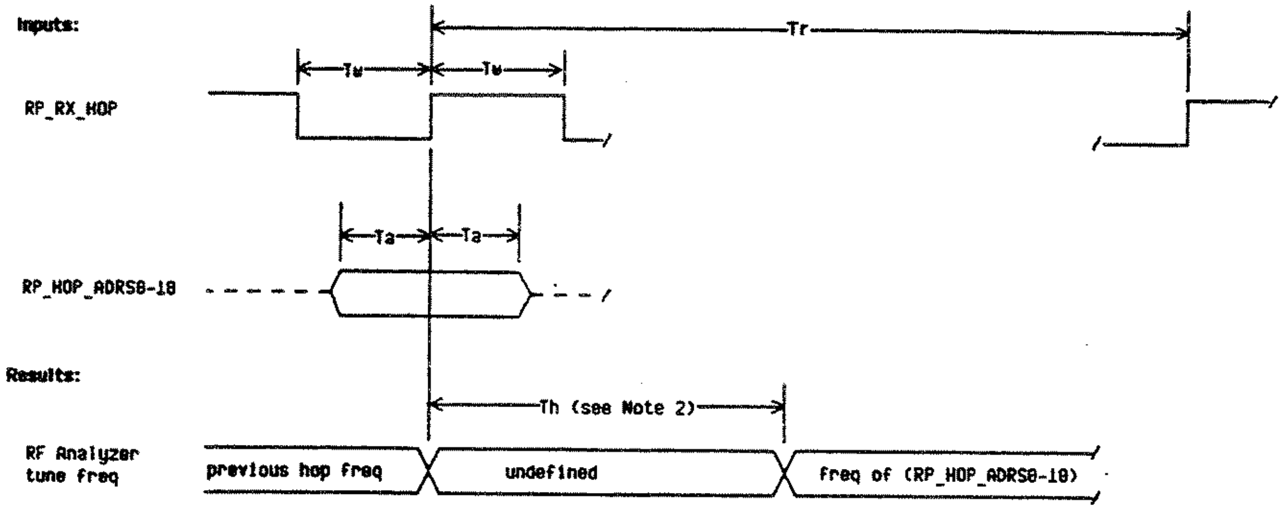
Conditions: RF Gen Hop Mode = Hop, RF Gen Hop Trig = Arm, Hop Address Source = Ext,
RF Analyzer Hop Mode = Non-Hop or RF Analyzer Hop Trig = Disarm



Notes:
1. If RF Analyzer Hop Mode = Hop and RF Analyzer Hop Trig = Arm, then this timing diagram applies only if RP_RX_HOP occurs at least 250 us before RP_TX_HOP.
2. If RF Analyzer Hop Mode = Hop and RF Analyzer Hop Trig = Arm, and RP_RX_HOP occurs between 20 us and 250 us before RP_TX_HOP, then Th above doesn't apply. Rather, the RF Generator Output will be hopped within Th2 of the RP_RX_HOP.
3. When the RF Analyzer should hop before the RF Generator, RP_RX_HOP rising edge should lead the RP_TX_HOP rising edge by at least 10 us.
4. The RF Generator Output meets phase/frequency accuracy specs for the RF Generator Hop Frequency based on the address on the RP_HOP_ADRS0-10 signals.
5. The RF Generator Output can also be pulsed off automatically during hopping by selecting RF Generator Mod Source Pulse = Hop Trig.

Figure 6-4. RF Generator Hop (Address Source = Ext) Timing Diagram

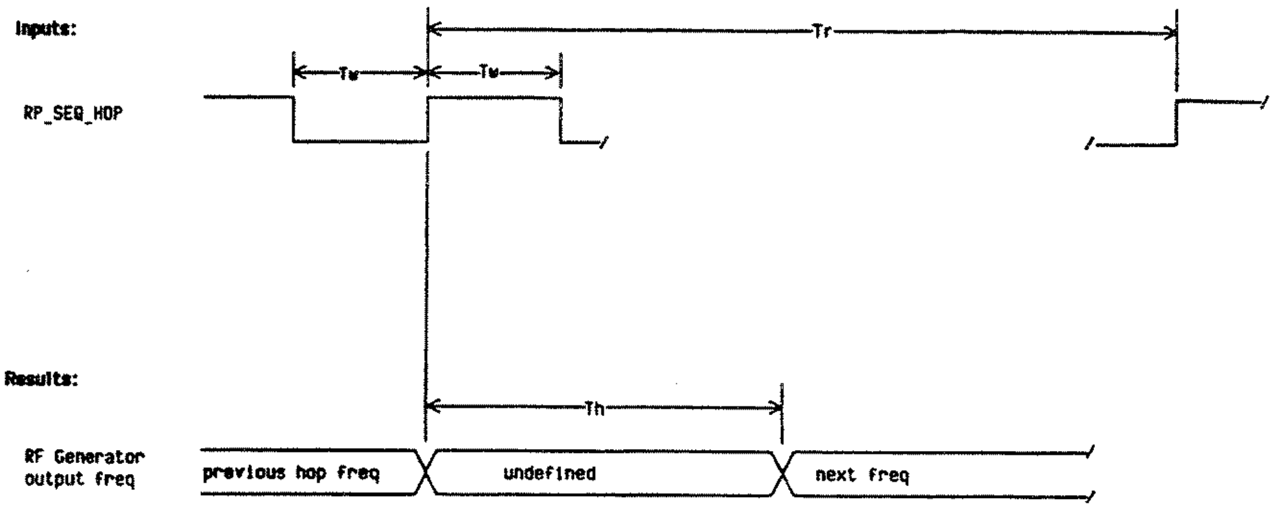
Conditions: RF Analyzer Hop Mode = Hop, RF Analyzer Hop Trig = Arm, Hop Address Source = Ext,
RF Gen Hop Mode = Non-Hop or RF Gen Hop Trig = Disarm



Notes:
1. If RF Gen Hop Mode = Hop and RF Gen Hop Trig = Arm, then this timing diagram applies only if RP_TX_HOP occurs at least 250 us before RP_RX_HOP.
2. If RF Gen Hop Mode = Hop and RF Gen Hop Trig = Arm, and RP_TX_HOP occurs less than 250 us before RP_RX_HOP, then Th above doesn't apply. Rather, the RF Analyzer tune freq will be hopped within Th2 of the RP_TX_HOP.
3. When the RF Analyzer should hop before the RF Generator, RP_RX_HOP rising edge should lead the RP_TX_HOP rising edge by at least 10 us.
4. The RF Analyzer is tuned based on the address on the RP_HOP_ADRS0-10 signals.

Figure 6-5. RF Analyzer Hop (Address Source = Ext) Timing Diagram

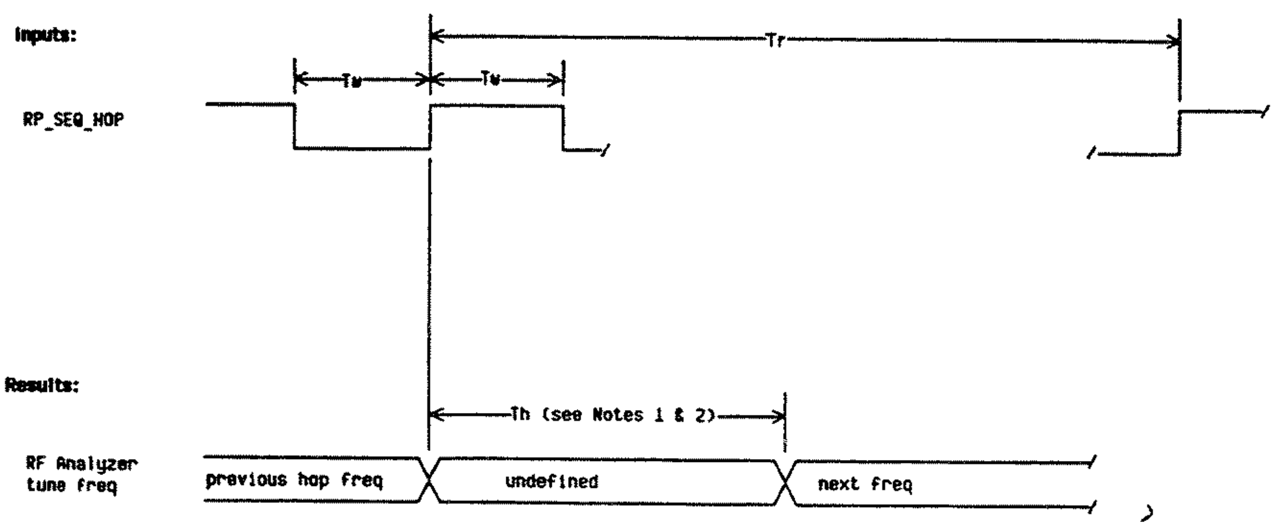
Conditions: RF Gen Hop Mode = Hop, RF Gen Hop Trig = Arm, Hop Address Source = Int, RP_RST_SEQ_HOP stays TTL HIGH.



Notes:
1. This Timing Diagram applies even if RF Analyzer Hop Mode = Hop and RF Analyzer Hop Trig = Arm.
2. The RF Generator Output power can also be pulsed off automatically during hopping by selecting RF Generator Mod Source Pulse = Hop Trig.

Figure 6-6. RF Generator Hop (Address Source = Int) Timing Diagram

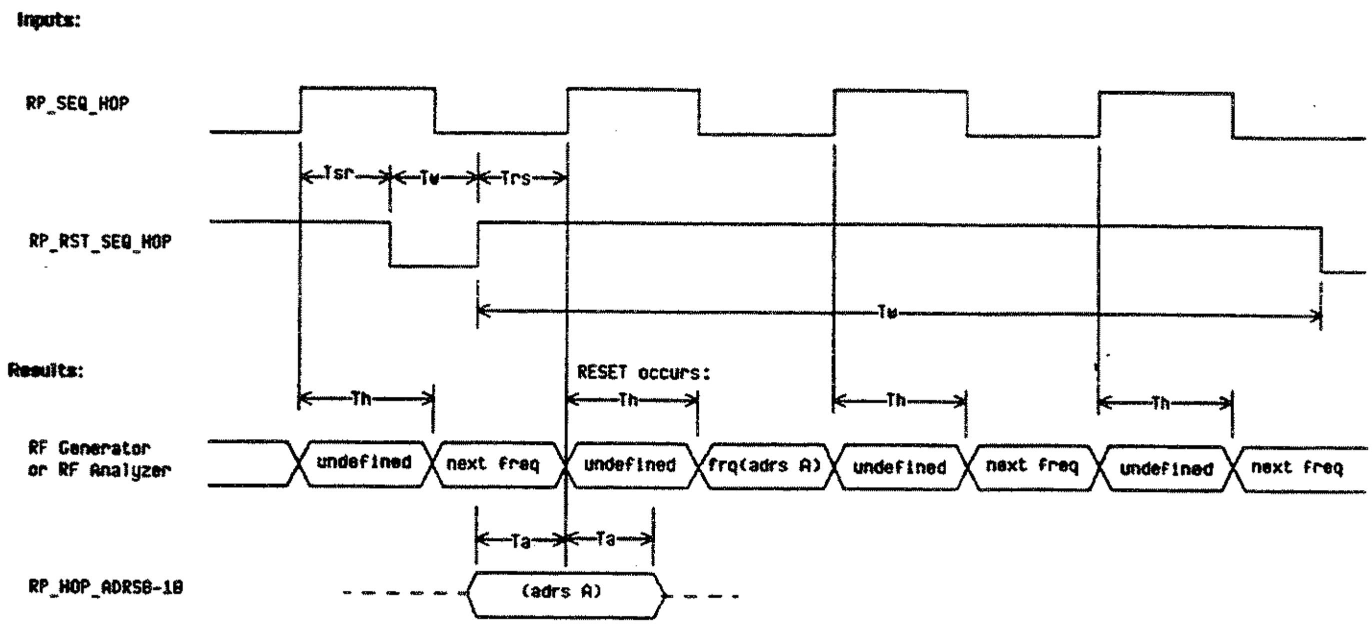
Conditions: RF Analyzer Hop Mode = Hop, RF Analyzer Hop Trig = Arm, Hop Address Source = Int, RF Gen Hop Mode = Non-Hop or RF Gen Hop Trig = Disarm, RP_RST_SEQ_HOP stays TTL HIGH.



Notes:
1. If RF Gen Hop Mode = Hop and RF Gen Hop Trig = Arm, then Th2 applies instead of Th.
2. If the next freq is the same as the currently tuned frequency, no hopping will occur. This allows the RF Analyzer to settle longer which is needed for making accurate measurements.
3. RP_HOP_INHIBIT is assumed to be high here.

Figure 6-7. RF Analyzer Hop (Address = Int) Timing Diagram

Conditions: Hop Address Source = Int and { [RF Gen Hop Mode = Hop and RF Gen Hop Trig = Arm] and/or [RF Analyzer Hop Mode = Hop and RF Analyzer Hop Trig = Arm] } .



Notes:
1. Tw and Tr for RP_SEQ_HOP as well as Th or Th2 apply as per the other Address Source = Int Timing Diagrams.
2. Note that RP_RST_SEQ_HOP is not required to be TTL LOW at the actual RP_SEQ_HOP rising edge in order to cause RESET. RP_RST_SEQ_HOP is only required to have gone TTL LOW Tsr after the previous RP_SEQ_HOP rising edge and RP_RST_SEQ_HOP must be TTL LOW for at least Tw.
3. RP_HOP_INHIBIT is assumed to be high here.

Figure 6-8. Reset Hop Once (Address Source = Int) Timimg Diagram

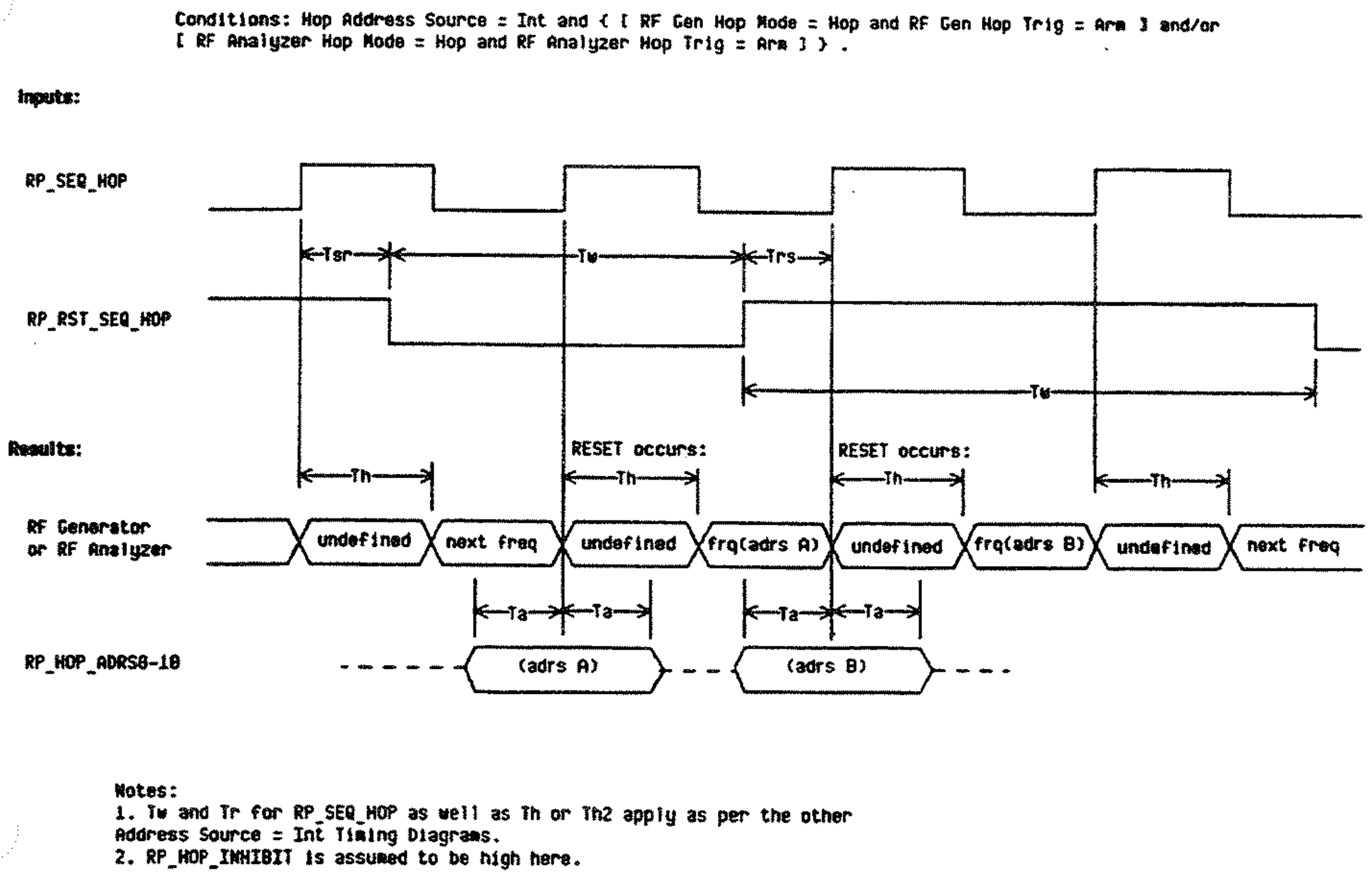
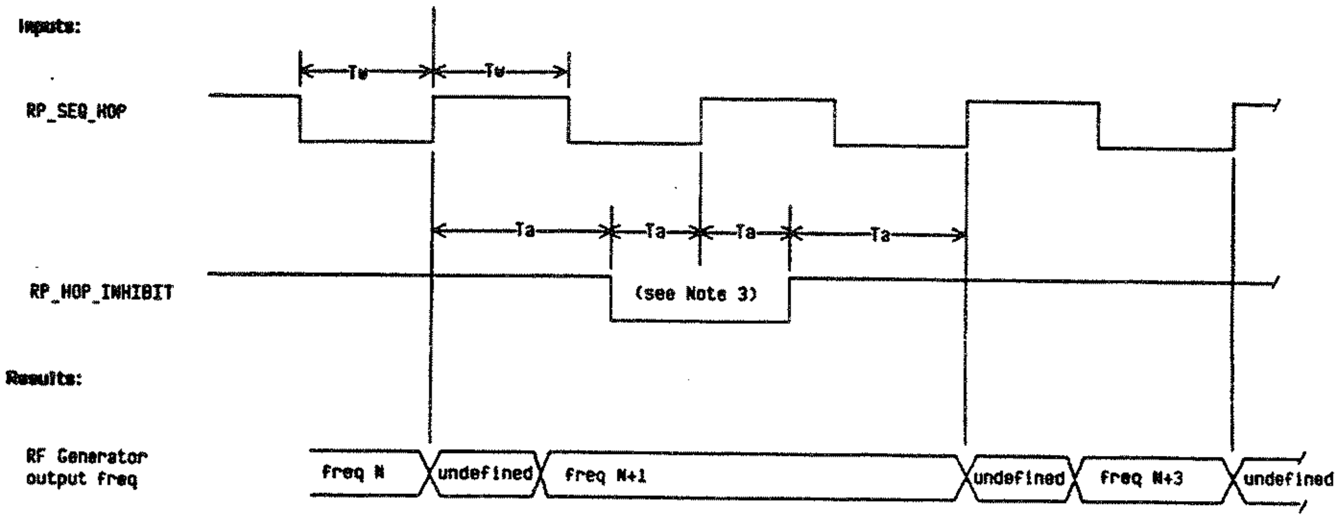


Figure 6-9. Reset and Hold Hop (Address Source = Int) Timing Diagram

Conditions: RF Gen Hop Mode = Hop, RF Gen Hop Trig = Arm, Hop Address Source = Int, RP_RST_SEQ_HOP stays TTL HIGH.



Notes:
1. This Timing Diagram applies even if RF Analyzer Hop Mode = Hop and RF Analyzer Hop Trig = Arm.
2. The RF Generator Output power can also be pulsed off automatically during hopping by selecting RF Generator Mod Source Pulse = Hop Trig.
3. Note that freq N+2 is NOT hopped to, but the hop counter is incremented to N+2.
4. RF Analyzer hopping is affected similarly by the RP_HOP_INHIBIT signal.
5. Assumed here is a sequential hop table.

Figure 6-10. Hop Inhibit (Address Source = Int) Timing Diagram

7

HP-IB

Notation

Extensive use is made of command syntax tables throughout this chapter. Associated with these tables are programming format conventions which are described in the following paragraphs.

Interpreting Command Tables

Command tables are used to define the set of HP 8922 HP-IB commands. The table shows the commands (keywords), their hierarchical relationships, and their related parameters (if any). (Refer to figure 7—1.) Following each command or parameter is a description.

The KEYWORDs provide the name of the command. The actual name of the command consists of one or more keywords (the commands are based on a hierarchical structure). Associated commands are grouped together under a common node in the hierarchy where the first keyword is considered the root level node.

A command (keyword) may be appended with a number if there are more than one commands with the same name. For example, the following commands exist: RFANalyzer:AMPLitude1 and RFANalyzer:AMPLitude2. This means that there are two separate amplitude commands that may be set for the RFANalyzer.

Note When using the shortened form of the command, obtain the short form and then append the appropriate number (for example, RFAN:AMPL1 and RFAN:AMPL2).

The PARAMETER indicates the allowable input for the command. This may be a numeric value with or without units, a quoted string describing the parameter selection or an enumerated type (no quotes) describing the parameter selection.

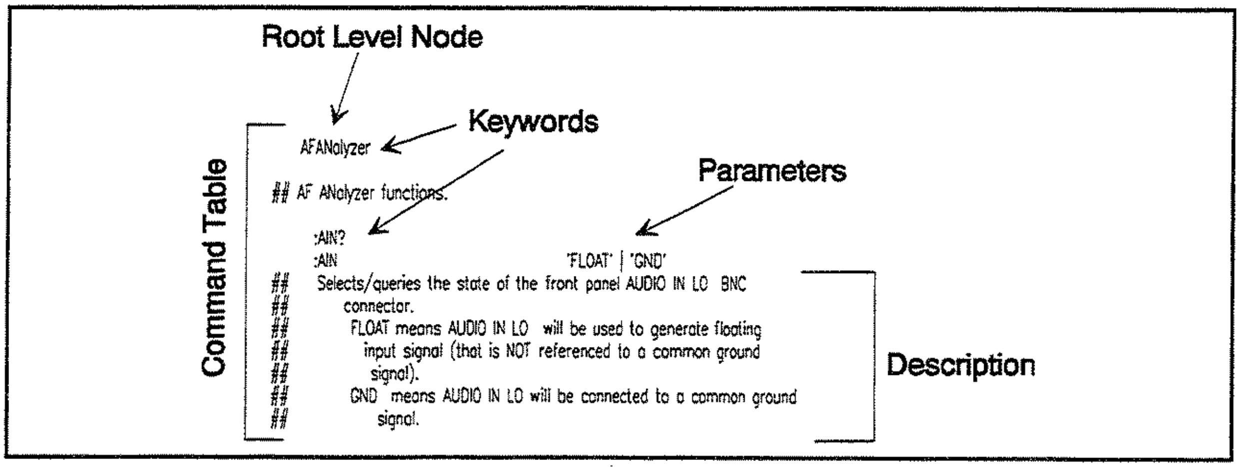


Figure 7-1. Command Syntax Table

Programming Format Conventions

Syntax commands and returned data descriptions use the following format conventions.

Upper case letters indicate the shortened acceptable form of a command.

Square brackets, [ ], indicate that enclosed command or command parameters are optional.

Vertical bar, |, indicates that one-and-only-one item separated by the vertical bar can be used at any given time. The vertical bar is read as "or." For example, A|B indicates that either A or B can be chosen, but not both.

Question mark, ?, indicates a query command. Most commands accept this command when it is entered immediately after the command name. The returned information (<value>) varies in format according to the type of the field.

- Fields that accept quoted string parameters will return the active choice in quotes when queried. For example if the RF generator Output was set to the RF IN/OUT parameter (RFG:OUTP "RF IN/OUT") and the queried (RFG:OUTP?), the return would be "RF IN/OUT".
- Fields that accept decimal numeric data will return the current field value as an exponentiated decimal number.
- Fields that accept floating point numeric data will return the current field value as a floating point number in the current HP-IB units.
- Fields that accept character data (unquoted strings) will return the queried information without quotes.

Quotation marks, " ", enclose command and string entries. Be sure to follow the correct syntax for using quotations that are specific to your basic language.

Colons, :, are used to separate keywords and show hierarchical relationship.

```
"RFANalyzer:FREQuency 935 MHz"
```

A Semicolons + a Colon, ;:, is used to separate two or more root level command statements on the same line.

```
"RFAN:INP 'RF IN/OUT';:RFAN:AMPL1 -20 dBm".
```

Semicolons, ;, can also be used to condense command words on one line if the commands are equal, or of decreasing hierarchy under the keyword. (The following example is equivalent to the previous command statement, but the root level keyword :RFAN is removed by using semicolons.)

```
"RFAN:INP 'RF IN/OUT';AMPL1 -20 dBm"
```

Commas are used to separate multiple parameter entries.

Angle brackets, < >, enclose variable items that represent user choices (parameters) to be entered.

Units of Measure

Units for measurements are implemented such that a measurement query result will be returned in the current HP-IB unit.

Units for settings are implemented such that if a unit is not sent along with the setting value, then a default HP-IB unit is used.

- For example, RFGenerator:AMPLitude1 assumes dBm and RFGenerator:FREQuency assumes Hz. If a unit is sent with the setting, then this unit will be used. The HP-IB unit may be changed using the units commands described later.
- Each measurement or setting description defines the allowable units for that field. When units are sent with a command, they should not be quoted.

The complete allowable set of HP-IB units that setting queries or measurement queries may be returned in are:

- DB (dB), DBM (dBm), DBUV (dB micro-volt),
- DEG (degree), DIV (division),
- HZ (Hz), OHM (ohm), PCT (percent), PPM (parts-per-million),
- S (second), T (bit periods),
- V (volt), W (watts)

The complete allowable set of units that can be sent with setting commands or units that can be displayed on the front panel are:

- DB (dB), DBM (dBm), DBMW (dB milli-watt), DBUV (dB micro-volt),
- HZ (Hz), KHZ (kHz), MHZ (MHz), GHZ (GHz),
- T (bit periods), S (second), MS (milli-second), US (microsecond),
- V (volt), MV (millivolt), UV (microvolt),
- W (watts), MW (milliwatt),
- PCT (percent), PPM (parts-per-million),
- DEG (degree) DIV (division), OHM (ohm),

Optional Commands

The following are symbols used to designate optional commands that may be used with the given command.

a. INUM is a symbol that designates the following list of optional commands that apply to Integer Numeric Entry fields.

   Included in INUM are the following commands:

```
        :INCRement?
##      Queries the field's current INCRement value.

        :INCRement              <UP | DOWN | (value)>
##      INCRement <value> sets the field INCRement value. INCR UP
##        or INCR DOWN cause the field to be modified up or down by
##        the current INCRement value.
```

b. FNUM is a symbol that designates the following list of optional commands that apply to Floating Point Numeric Entry fields.

   Included in FNUM are the following commands:

```
        :UNITs?
        :UNITs                         <HP-IB unit>
##      Sets/queries the HP-IB fundamental UNITs that the floating
##        point number queries will be returned in.

        :DUNits?
        :DUNits                        <measurement unit>
##      Sets/queries the Displayed UNits on the front panel for the
##        given floating point number.

        :INCRement?
##      Queries the field's current INCRement value.

        :INCRement              <UP | DOWN | (value) [units]>
##      INCRement <value> sets the field INCRement value. INCR UP
##        or INCR DOWN cause the field to be modified up or down by
##        the current INCRement value.

            :DUNits?
            :DUNits                    <increment unit>
##          Sets/queries the Displayed UNits on the front panel for
##            the field's increment setting.

            :MODE?
            :MODE                      LINear | LOGarithm
##          Sets/queries the MODE of INCRement value to be in
##            either LINear or LOGarithmic (displayed in dB) steps.

            :MULTiply
##          MULTiplies the INCRement value by 10.

            :DIVide
##          DIVides the INCRement value by 10.
```

c. FNUM_MOD includes all of the FNUM optional commands except INCR:MODE.

d. MM is a symbol that designates the following list of optional commands that control Measurement field functions. These attributes are listed here in hierarchal relationship. Included are commands for state, units, low limits and high limits, and reference.

   Included in MM are the following commands:

```
      :STATe?
      :STATe                          ON | OFF | 1 | 0
##     Selects/queries the STATe of the measurement to be ON or
##       OFF.  Note: ON = 1 and OFF = 0

      :UNITs?
      :UNITs                          <HP-IB measurement unit>
##     Sets/queries the HP-IB fundamental UNITs that measurement
##       queries will be returned in.

      :DUNits?
      :DUNits                         <measurement unit>
##     Sets/queries the Displayed UNits on the front panel for the
##       given measurement.

      :AUNits?
      :AUNits                         <HP-IB attribute unit>
##     Sets/queries the HP-IB fundamental UNITs that measurement
##       Attribute queries (e.g., low limit, high limit, etc.) are
##       returned in.

      :HLIMit
##     High LIMit measurement information.

          :DUNits?
          :DUNits                     <measurement unit>
##         Sets/Queries the measurement High LIMit Displayed UNits.

          :EXCeeded?
##          Queries whether the High LIMit for the measurement was
##            EXCeeded.

          :RESet
##           RESet the High LIMit exceeded state so that new limit
##             data can be acquired.

          :STATe?
          :STATe                      ON | OFF | 1 | 0
##         Sets/queries the High LIMit STATe.
##           Note: ON = 1 and OFF = 0.

         [:VALue]?
         [:VALue]                     <numeric value>
##         Sets/queries the measurement High LIMit VALue.

      :LLIMit
##     Low LIMit measurement information.

          :DUNits?
          :DUNits                     <measurement unit>
##         Sets/queries the measurement Low LIMit Displayed UNits.

          :EXCeeded?
##         Queries whether the Low LIMit for the measurement was
##           EXCeeded.

          :RESet
##         RESet the Low LIMit exceeded state so that new limit
##           data can be acquired.

          :STATe?
          :STATe                      ON | OFF | 1 | 0
##         Sets/queries the Low LIMit STATe.
##           Note: ON = 1 and OFF = 0.

         [:VALue]?
```

```
        [:VALue]                    <numeric value>
##        Sets/queries the measurement Low LIMit VALue.

      :REFerence
##    Measurement REFerence information.

         :DUNits?
         :DUNits                    <measurement unit>
##        Sets/queries the REFerence Displayed UNits on the front
##          panel for the given measurement.

         :STATe
         :STATe                     ON | OFF | 1 | 0
##        Sets/queries the REFerence STATe.
##          Note: ON = 1 and OFF = 0.

        [:VALue]?
        [:VALue]                    [<numeric value>]
##        Sets/queries the measurement REFerence VALue.
##          If no <numeric value> is specified, then the
##          REFerence VALue will be set to the current measurement
##          result.
```

e. MM_MOD includes all of the MM optional commands except the units commands (UNITs, DUNits, AUNits).

f. AVG is a symbol that designates the following list of optional commands that apply to measurement fields that use averaging. These attributes are listed here in hierarchal relationship.

Included in AVG are the following commands:

```
      :AVERage
##    MEASurement AVERage commands.  NOTE : These are only useful
##      for continuous measurements.

         :RESet
##        RESet the AVERaged measurement result to begin giving
##          measurement results from the first measurement up to
##          the number if measurements given by
##          <measurement>:AVERage:VALue.

         :STATe?
         :STATe                     ON | OFF | 1 | 0
          Sets/queries the AVERage STATe.
##          Note: ON = 1 and OFF = 0.
##          ON allows display of the average value of the number
##            of measurements given in
##            <measurement>:AVERage:VALue

        [:VALue]?
        [:VALue]                    <numeric value>
##        Sets/queries the number (VALue) of measurements to be
##          used in calculating the AVERaged measurement result.
```

g. MET is a symbol that designates the following list of optional commands that apply to measurement fields that use meters. These attributes are listed here in hierarchal relationship.

Included in MET are the following commands:

```
       :METer
##      METer commands.  NOTE : These are only useful for
##        continuous measurements.
```

```
         :HEND?
         :HEND                     <numeric value>
##        Sets/queries the High END value to display on the METer
##          for the measurement.

         :DUNits?
         :DUNits                   <meter display unit>
##        Sets/queries the measurement METer High END Displayed
##          UNits.

         :INTerval?
         :INTerval                 <numeric value>
##        Sets/queries the number of INTervals to display on the
##          METer between the low end and high end for the
##          measurement.

         :LEND?
         :LEND                     <numeric value>
##        Sets/queries the Low END value to display on the METer
##          for the measurement.

           :DUNits?
           :DUNits                 <meter display unit>
##          Sets/Queries the measurement METer Low END Displayed
##            UNits.

         :STATe?
         :STATe                    ON | OFF | 1 | 0
##        Sets/queries the METer STATe.
##          Note: ON = 1 and OFF = 0.
```

Additional Program Information

All lines beginning with 2 pound signs (##) are comment lines that contain detailed, command descriptions.

The subsystems are organized in alphabetical order. The MEASure subsystem contains mainly measurement result queries and the settings are listed within separate subsystems. Trigger commands for most subsystems are available in the TRIGger subsystem.

AF ANalyzer Subsystem

```
AFANalyzer
## AF ANalyzer functions.

   :AIN?
   :AIN                               'FLOAT' | 'GND'
##  Selects/queries the state of the front panel AUDIO IN LO BNC connector.
##    FLOAT means AUDIO IN LO will be used to generate floating input
##      signal (that is NOT referenced to a common ground signal).
##    GND means AUDIO IN LO will be connected to a common ground signal.

   :DEMPhasis?
   :DEMPhasis                         '750 US' | 'OFF'
##  Selects/queries the AF ANalyzer DE-EMPhasis state.

       :GAIN?
       :GAIN                          '0 DB' | '10 DB' | '20 DB' | '30 DB'
##      Selects/queries the DE-EMPhasis GAIN selection.  This is typically
##        automatically selected, based on audio level.

   :DETector?
   :DETector                          'RMS' | 'PK+' | 'PK-' | 'PK+-/2' |
                                      'PK+-MAX' | 'PK+ HOLD' | 'PK- HOLD' |
                                      'PK+-/2 HD' | 'PK+-MX HD'
##  Selects/queries the AF ANalyzer DETector which is used for all AF ANalyzer
##    measurements.

       :PKLocation?
       :PKLocation                    'FILTERS' | 'DE-EMP'
##      Selects/queries the PeaK DETector Location.  These selections pick
##        locations in our block diagram that AF ANalyzer measurements will be
##        made.

       :SETTling?
       :SETTling                      'SLOW' | 'FAST'
##      Selects/queries the DETector SETTling mode.
##        SLOW is useful for low frequency audio measurements.
##        FAST is useful for higher frequency audio measurements.
```

```
   :ELResistor?
   :ELResistor                          <(value) [units]> | [FNUM]
##  Sets/queries the External Load Resistor assumed for measuring watts
##    of power into an external load resistor.
##    Default HP-IB and display unit is Ohms.

   :FILTer1?
   :FILTer1                             '<20HZ HPF' | '50HZ HPF' |
                                        '300HZ HPF' |
##  Selects/queries the AF ANalyzer FILTer 1.

   :FILTer2?
   :FILTer2                             '300HZ LPF' | '3KHZ LPF' | '15KHZ LPF'|
                                        '>99KHZ LP' |
##  Selects/queries the AF ANalyzer FILTer 2.

   :GTIMe?
   :GTIMe                               <(value) [units]> | [FNUM]
##  Sets/queries the AF ANalyzer Gate TIMe (AF Cnt Gate).
##    Default HP-IB unit is seconds (S).
##    Default display unit is milli-seconds (MS).

   :INPut?
   :INPut                               'SCOPE IN' | 'FM DEMOD' | 'PLS DEMOD' |
                                        'AUDIO IN' | 'AUDIO OUT'| 'AM MOD IN' |
                                        'SPEECH IN' | 'SPEECHOUT'

##  Selects/queries the AF ANalyzer INPut.  This selection determines what
##    signal is to be measured by the AF ANalyzer as well as for the
##    oscilloscope.

       :GAIN?
       :GAIN                            '0 DB' | '20 DB' | '40 DB'
##      Selects/queries the INPut GAIN.  This is typically selected
##        automatically based on audio level.

   :SMPoint?
   :SMPoint                             'DE-EMP' | 'FILTERS' | 'INPUT' |
                                        'NOTCH'
##  Selects/queries the Scope Measurement Point.  This selection determines
##    where in the hardware block diagram the oscilloscope is making the
##    desired measurement.
```

```
   :NOTCh

       :GAIN?
       :GAIN                              '0 DB' | '10 DB' | '20 DB' |
                                          '30 DB' | '40 DB'
##      Selects/queries the NOTCh GAIN.  This is typically selected
##        automatically based on audio level.

   :RANGing?
   :RANGing                               'AUTO' | 'HOLD'
##  Selects/queries the RANGing (Gain Cntl) STATe.
##    AUTO results in gain selections being made automatically based on
##      audio level.
##    HOLD causes all gain selections to maintain their present state
##      for either manual selection or until AUTO is selected.

   :SPEaker

       :MODE?
       :MODE                              'ON' | 'OFF'
##      Selects/queries the SPEaker ALC MODE.

       :VOLume?
       :VOLume                            'POT' | 'OFF'
##      Selects/queries the SPEaker VOLume.
##        POT means the SPEaker VOLume is controlled via the front panel
##          VOLUME control.
##        OFF means the SPEaker VOLume is turned off, independent of the
##          front panel VOLUME control.
```

AF Generator Subsystem

```
AFGenerator

## AF Generator commands.

   :AMPLitude?
   :AMPLitude                          <(value) [units]> | [FNUM]
##  Sets/queries the AF Generator Audio Output AMPLitude, which will
##    be present at the front panel AUDIO OUT connector.
##    HP-IB unit is Volts.
##    Display units are V and mV.
##    Default display unit is mV.

   :COUPling?
   :COUPling                           'AC' | 'DC'
##  Selects/queries the AF Generator Audio Output COUPling.

   :FREQuency?
   :FREQuency                          <(value) [units]> | [FNUM]
##  Sets/queries the AF Generator Audio Output, which will
##    be present at the front panel AUDIO OUT connector.
##    Default HP-IB unit is HZ.
##    Default display unit is kHZ.
```

Bit Error Test Subsystem

```
BETest

## Bit Error Test commands.

   :BITS<n>?
   :BITS<n>                      <value> | [INUM]
##  Sets/queries the number of BITS to test to make this Bit
##    Error Test measurement complete, where <n> = 1 .. 4.

   :LOOPback
##  MS LOOPback parameters.

       :LDELay?
       :LDELay                    <value> | [INUM]
##      Sets/queries the Loop DELay.
##        This is the number of speech frames to be assumed for loopback.
##          delay.  This affects how/when bit error test measurement bit
##          patterns are compared.

           :MODE?
           :MODE                  'AUTO' | 'MANUAL'
##          Sets/queries the Loop DELay MODE.
##            AUTO automatically sets LDELay (above) once when the
##              measurement is started.  This is a timing calibration action.
##            MANUAL means the Loop DELay is controlled manually via the
##              :LDELay command.


   :TYPE<n>?
   :TYPE<n>                      'TYPEI' | 'RESTYPEI' | 'TYPEIA' |
                                  'RESTYPEIA' | 'TYPEII' | 'RESTYPEII' |
                                  'TYPEIB' | 'RESTYPEIB' | 'ALLFS' |
                                  'RESALLFS' | 'OFF'
##  Selects/queries the Bit Error Test measurement TYPE, where <n> = 1 .. 4.
##    This defines the Bit Error Test measurement TYPE for each of the 4
##    available Bit Error Test measurements.
```

Cell Configuration Subsystem

```
CCONfigure

## Cell CONfiguration commands.

   :ABCCh?
   :ABCCh                              'OFF' | 'ADJACENT'
##  Selects/queries the Auxiliary BCCH.
##    This defines the state of the auxiliary BCCH data and clock outputs.
##      OFF means the auxiliary BCCH is deactivated.
##      ADJACENT means the auxiliary BCCH outputs are intended to be used
##        to generate an adjacent cell BCCH (using an external 0.3 GMSK
##        RF Generator).

       :BCC?
##      Queries the Auxiliary Base station Color Code.
##        This is always the same as CCON:SCEL:BCC? plus one modulo four.

   :CCHannel?
   :CCHannel                           'SD/4' | 'SD/8' | 'FA' | 'SD/4+FA'
##  Selects/queries the type of Control CHannel to be used.
##    SD/4 means the SDCCH shares the same physical channel as the BCCH.
##    SD/8 means the SDCCH is separate from the BCCH and is on a physical
##      channel specified by the user.
##    FA is the same as SD/8, except the TCH1 configuration is used in
##      'signaling only' mode instead of using the SDCCH channel.
##    SD/4 + FA is the same as SD/4, except the TCH1 configuration is
##      used in 'signaling only' mode instead of using the SDCCH channel.

       :SDCCh8

           :ARFCn?
           :ARFCn                      <value> | [INUM]
##          Sets/queries the Control CHannel ARFCN (Absolute Radio Frequency
##            Channel Number) for the SDCCH/8.
##            This is used only when CCON:CCH is 'SD/8'.

           :TSLot?
           :TSLot                      <value> | [INUM]
##          Sets/queries the Time SLot for the SDCCH/8.
##            This is used only when CCON:CCH is 'SD/8'.
```

```
   :DCS1800
## DCS1800 Radio Type commands.
## These are only valid for CONFigure:RADio 'DCS1800'.

      :BA<n>?
      :BA<n>                          0 | 512-885
##     Where <n> = 1 to 16
##      Sets/queries the Broadcast control channel Allocation.
##      Entries in BA table must be in contiguous ascending order.
##      The allocation must begin at BA1 and continue through BA<m>.
##      Zeros (0) are used to fill unallocated entries.
##      Where <m> = the highest number allocated in the range 1 to 16.

      :CA<n>?
      :CA<n>                          0 | 512-885
##     Where <n> = 1 to 16
##      Sets/queries the Cell Allocation.
##      Entries in CA table must be in contiguous ascending order.
##      The allocation must begin at CA1 and continue through CA<m>.
##      Zeros (0) are used to fill unallocated entries.
##      Where <m> = the highest number allocated in the range 1 to 16.


      :MA1?
      :MA1                            <quoted string>
##     Sets/queries the Mobile Allocation 1.
##      This is a binary string representing which CA ARFCNs will be in Mobile
##      Allocation number 1. This defines which of the first 16 entries in
##      the CA will be part of the sequential hop sequence for MA1.
##      NOTE: all 16 entries must be input.

          :IOFFset?
          :IOFFset                    <value> | [INUM]
##         Sets/queries the Mobile Allocation 1 Index OFFset.
##           This defines where the hop sequence starts for MA1.

      :MA2?
      :MA2                            <quoted string>
##     Sets/queries the Mobile Allocation 2.
##       This is a binary string representing which CA ARFCNs will be in Mobile
##       Allocation number 2. This defines which of the first 16 entries in
##       the CA will be part of the sequential hop sequence for MA2.
##       NOTE: all 16 entries must be input.

         :IOFFset?
         :IOFFset                     <value> | [INUM]
##        Sets/queries the Mobile Allocation 2 Index OFFset.
##          This defines where the hop sequence starts for MA2.
```

```
  [:GSM900]
##  GSM900 Radio Type commands.
##  These are only valid for CONFigure:RADio 'GSM900'.

     :BA?
     :BA                                  <quoted string>
##    Sets/queries the Broadcast control channel Allocation.
##      This is binary string representing which ARFCNs are in the
##      BCCH Allocation.  A '1' in the first entry represents the
##      existence of ARFCN 1.  NOTE: all 124 entries must be input.

     :CA?
     :CA                                  <quoted string>
##    Sets/queries the Cell Allocation.
##      This is binary string representing which ARFCNs are in the Cell
##      Allocation.  A '1' in the first entry represents the existence of
##      ARFCN 1.  NOTE: all 124 entries must be input.

     :MA1?
     :MA1                                 <quoted string>
##    Sets/queries the Mobile Allocation 1.
##      This is binary string representing which CA ARFCNs will be in
##      Mobile Allocation number 1.  This defines which of the first 64
##      entries of 1's in the CA will be part of the sequential hop sequence
##      for MA1.  NOTE: all 64 entries must be input.

         :IOFFset?
         :IOFFset                         <value> | [INUM]
##        Sets/queries the Mobile Allocation 1 Index OFFset.
##          This defines where the hop sequence starts for MA1.

     :MA2?
     :MA2                                 <quoted string>
##    Sets/queries the Mobile Allocation 2.
##      This is binary string representing which CA ARFCNs will be in
##      Mobile Allocation number 2.  This defines which of the first 64
##      entries of 1's in the CA will be part of the sequential hop sequence
##      for MA2.  NOTE: all 64 entries must be input.

         :IOFFset?
         :IOFFset                         <value> | [INUM]
##        Sets/queries the Mobile Allocation 2 Index OFFset.
##          This defines where the hop sequence starts for MA2.
```

```
   :LAI
##  Location Area Identification commands.

       :MCCode?
       :MCCode                          <value> | [INUM]
##      Sets/queries the Mobile Country Code (3 decimal digits).


       :MNCode?
       :MNCode                          <value> | [INUM]
##      Sets/queries the Mobile Network Code (2 decimal digits).

       :LACode?
       :LACode                          <value> | [INUM]
##      Sets/queries the Location Area Code.

   :SCELl
##  Serving CELl commands.

       :ARFCn?
       :ARFCn                           <value> | [INUM]
##      Sets/queries the Serving CELl ARFCN (Absolute Radio
##        Frequency Channel Number).

       :BCC?
       :BCC                             <value> | [INUM]
##      Sets/queries the Serving CELl Base station Color Code.

       :NCC?
       :NCC                             <value> | [INUM]
##      Sets/queries the Serving CELl Network Color Code.


   :STATe?
   :STATe                               'SETTABLE' | 'ACTIVATED'
##  Selects/queries the Cell CONfiguration STATe.
##    SETTABLE means that all CCON settings can be changed and that
##      the signaling state will be "None".  An active call will be
##      automatically terminated in this state.
##    ACTIVATED means that all CCON settings are "frozen" and the signaling
##      state will be at least "BCCH".  This state will not be allowed if the
##      settings on the CCON (Cell Config) screen are not compatible.
##      The instrument must also be in demodulation mode (on the Cell Config
##      screen or on the Dig Demod screen).
```

Cell Control Subsystem

```
CELL

## CELL control commands.

    :AUDio
##   AUDio control commands.

        :DAI
##       Digital Audio Interface commands.

            :ATESt
##           This selects the DAI (Digital Audio Interface) Audio TESt mode.

            :NORMal
##           This selects the DAI (Digital Audio Interface) NORMal mode.

        :LOOPback
##       AUDio control LOOPback commands.

            :FE
##           Turns MS LOOPback on with Frame Erasure.

            :OFF
##           Turns MS LOOPback OFF.

            :NOFE
##           Turns MS LOOPback on with NO Frame Erasure.
```

```
       :SPEech
           :CONFigure?
           :CONFigure                   'NONE' | 'UNCOND' |
                                        'COND' | 'ECHO' | 'PRBS'
##          Selects/queries the SPEech CONFiguration.
##            Note: this has couplings with DC AM.
##            NONE means that speech (hardware) is deactivated.
##            UNCOND means that speech will be unconditioned (i.e.,
##              not amplifiable).
##            COND means that speech will be conditioned (i.e., amplifiable).
##            ECHO means that speech (hardware) will be put into an "echo"
##              mode, where we will echo back to the MS whatever we
##              received, with a settable echo delay (time).
##            PRBS means that speech (hardware) is outputting a pseudo random
##              binary sequence.

           :EDELay?
           :EDELay                      <(value) [units]> | [FNUM]
##          Sets/queries the SPEech Echo DELay.
##            This is the delay time for the ECHO SPEech mode.  This only
##            applies when CELL:AUD:SPE:CONF is ECHO.
##            Default HP-IB and display unit is seconds (S).

           :GAIN?
           :GAIN                        <value> | [INUM]
##          Sets/queries the SPEech GAIN (unitless).
##            This is the SPEech GAIN for the CONDitioned SPEech mode.
##            This only applies when CELL:AUD:SPE:CONF is CONDitioned.

           :PRBS
               :PATTern?
               :PATTern            'CCITT-15' | 'CCITT-23' |
                                   '0' | '1' | '01' | '10'
##              Sets/queries the SPEech PRBS PATTern.
##                This is the PATTern for the PRBS SPEech.
##                This only applies when CELL:AUD:SPE:CONF is PRBS.
```

```
   :CALL
##  CALL control commands.

       :CONNect?
       :CONNect                          'AUTO' | 'MANUAL'
##      Selects/queries the CONNect (mode).
##        AUTO means that we will automatically attempt to connect to
##          an MS-initiated call.
##        MANUAL means that you must use CELL:CALL:RECeive to receive
##          an MS-initiated call.

       :COUNt
##      CALL COUNt commands.

           :BSYNc?
##          COUNt of Bad SYNcs detected during this call or since COUNt:RESet.
##            Note: it is normal to detect Bad SYNcs during call setup.
           :DERRor?
##          COUNt of Decoding ERRors detected during this call or since
##            COUNt:RESet.  Note: it is normal to detect Decode ERRors
##            during call setup.

           :PAGE?
##          COUNt of PAGEs made during this call or since COUNt:RESet.

           :RACH?
##          COUNt of RACHs received during this call or since COUNt:RESet.

           :RESet
##          RESets all CALL COUNts to zero.

       :END
##      Executes an END (i.e., terminate) CALL.
##        This terminates a call in progress and is the same as selecting
##          the END CALL front panel hardkey.
```

```
        :LIMit?
        :LIMit                        'BCCH' | 'DCCH' | 'TCH'
##       Selects/queries the CALL control LIMit.
##         This affects how far a call will be allowed to get, which is
##         useful when making measurements on transient states while
##         setting up a call.

        :ORIGinate
##       Executes an ORIGinate (i.e., make) a CALL.
##         This attempts a BS originated (MS terminated) call and is the same
##           as selecting the ORG CALL front-panel hardkey.

        :PAGing?
        :PAGing                       'CONT' | 'SINGLE'
##       Selects/queries the PAGing mode.
##         CONT means continuous pages will occur when attempting to make
##           a BS-originated call.
##         SINGLE means that just one page will occur when attempting to make
##           a BS-originated call.

        :RECeive
##       Executes RECeive (i.e., connect to) a CALL.
##         This connects the call ('answers the phone') and is the same as
##           selecting the RCV CALL front-panel hardkey.

        :SIGNaling?
        :SIGNaling              'NORMAL' | 'LIMITED'
##       Selects/queries the amount of SIGNaling that the HP8922G will
##         perform.
##         NORMAL signaling mode uses all the normal GSM messages to
##           change the channel configuration.
##         LIMITED specifies that the HP 8922G should perform an operation
##           with a limited amount of signaling.  The user can therefore
##           achieve the 'force TCH' capability by merely pressing the
##           ORG CALL front-panel hardkey.
```

```
        :STATus
##       CALL STATus commands.

            :CALLer?
##            Returns 'BS', 'MS', or '--'.  Indicates who originated the call
##            in progress.  '--' indicates that the Call STatus is inactive.

            :CIPHering
            [:STATe]?
##              Queries the CIPHering STATe as 'On' or 'Off'.

            :MM
              [:STATe]?
##              Queries the Mobility Management (layer) STATe.
##                Indicates the 'LOC UPD' | 'IDENT' | 'AUTH' |
##                'TMSI' | 'INACTIVE' | 'ACTIVE' state of the Mobility
##                Management protocol layer.
##                INACTIVE means there are no MM-connections between the
##                  HP 8922G and the MS.
##                IDENT means the MM sub-layer has initiated the Identification
##                  common procedure and is waiting for the MS to respond.
##                AUTH means the MM sub-layer has initiated the Authentication
##                  common procedure and is waiting for the MS to respond.
##                TMSI means the MM sub-layer has initiated the TMSI reallocation

##                  common procedure and is waiting for the MS to respond.
##                LOC UPD means the MM sub-layer has received a Location
##                  Update Request from the MS.
##                ACTIVE means an MM-connection exists between the 8922G and
##                  the MS, and may be used to transfer CC messages..

            :RR | :SIGNaling
              [:STATe]?
##              Queries the Radio Resource STATe.
##                Indicates the 'BCCH' | 'DCCH' | 'TCH1' | 'TCH2' | 'NONE'
##                state of signaling.
##                  BCCH means idle on a Broadcast Control CHannel.
##                  DCCH means on a Dedicated Control CHannel.
##                  TCH1 means on a Traffic CHannel as defined by TCH1 settings.
##                  TCH2 means on a Traffic CHannel as defined by TCH2 settings.
##                  NONE means that the signaling state is totally undefined
##                    (probably not even putting out a BCCH).
```

```
          :STATe?
##         Queries the CALL STatus STATe.
##           Indicates the 'SETUP REQUEST' | 'PROCEEDING' | 'ALERTING' |
##           'SETUP CONFIRM' | 'CONNECTED' | 'INACTIVE' state of the call
##           in progress.

          :TCH
##         Traffic CHannel CALL STATus commands.

            :ARFCn?
##           Queries the current Traffic CHannel ARFCN (Absolute Radio
##             Frequency Channel Number).  This applies if TCH:MODE is 'SINGLE'.


            :MALLocation?
##           Queries the current Traffic CHannel Mobile ALLocation as 'MA1'
##             or 'MA2'.  This applies if TCH:MODE is 'HOPPED'.

            :MODE?
##           Queries the Traffic CHannel MODE as 'HOPPED' or 'SINGLE'.
##             HOPPED means that the current Traffic CHannel is a hopped
##               traffic channel.
##             SINGLE means that the current Traffic CHannel is a
##               non-hopped traffic channel (i.e., a single ARFCN).

            :TSLot?
##           Queries the current Traffic CHannel Time SLot.

            :TYPE?
##           Queries the current Traffic CHannel TYPE.
```

```
         :TCHControl?
         :TCHControl                     'TCH1 HO' | 'TCH2 HO' |
                                         'TCH1 ASGN' | 'TCH2 ASGN'
##       Sets/queries the TCH Control selection.
##         TCH1 HO means upon execution, cause an intracell HandOver to TCH1
##           based on the CELL:TCH1 selections.
##         TCH2 HO means upon execution, cause an intracell HandOver to TCH2.
##           based on the CELL:TCH2 selections.
##         TCH1 ASGN means upon execution, do a traffic channel assignment
##           based on the CELL:TCH1 selections.
##         TCH2 ASGN means upon execution, do a traffic channel assignment
##           based on the CELL:TCH2 selections.

           :EXECute
##         Executes the TCH Control selection.


     :MS
##   Mobile Station commands.

         :DRX
           [:STATe]?
           [:STATe]                      'ON' | 'OFF
##           Selects/queries the Discontinuous RX (receiver) STATe.

         :DTX
           [:STATe]?
           [:STATe]                      'ON' | 'OFF
##           Selects/queries the Discontinuous TX (transmission) STATe.


         :TADVance?
         :TADVance                       <value> | [INUM]
##       Sets/queries the MS's Timing ADVance (setting) 0 to 63.

           :MODE?
           :MODE                         'AUTO' | 'MANUAL'
##           Selects/queries the MS's Timing ADVance (setting) MODE.
##             AUTO means we will automatically adjust the MS's timing
##               advance setting in real time to keep bit zero aligned.
##             MANUAL means the TADVance setting will directly set the
##               MS's timing advance setting.

         :TLEVel?
         :TLEVel                         <value> | [INUM]
##       Sets/queries the MS's TX (transmitter) (power) LEVel.
```

```
   :TCH1
##  Traffic CHannel 1 commands.

        :ARFCn?
        :ARFCn                          <value> | [INUM]
##      Sets/queries the Traffic CHannel 1 ARFCN (Absolute Radio
##        Frequency Channel Number).
##        This only applies if CELL:TCH1:MODE is SINGLE.

        :MALLocation?
        :MALLocation                    'MA1' | 'MA2'
##      Selects/queries the Traffic CHannel 1 Mobile ALLocation.
##        This only applies if CELL:TCH1:MODE is HOPPED.

        :MODE?
        :MODE                           'HOPPED' | 'SINGLE'
##      Selects/queries the Traffic CHannel 1 MODE.
##        HOPPED means that TCH1 will be hopped traffic channel.
##        SINGLE means that TCH1 will be a non-hopped traffic channel
##          (i.e., a single ARFCN).

        :TSLot?
        :TSLot                          <value> | [INUM]
##      Sets/queries the Traffic CHannel 1 Time SLot (2 - 6 valid).

        :TYPE?
        :TYPE                           'FS'
##      Selects/queries the Traffic CHannel 1 TYPE.
```

```
    :TCH2
##  Traffic CHannel 2 commands.

        :ARFCn?
        :ARFCn                              <value> | [INUM]
##       Sets/queries the Traffic CHannel 2 ARFCN (Absolute Radio
##         Frequency Channel Number).
##         This only applies if CELL:TCH2:MODE is SINGLE.

        :MALLocation?
        :MALLocation                        'MA1' | 'MA2'
##       Selects/queries the Traffic CHannel 2 Mobile ALLocation.
##         This only applies if CELL:TCH2:MODE is HOPPED.

        :MODE?
        :MODE                               'HOPPED' | 'SINGLE'
##       Selects/queries the Traffic CHannel 2 MODE.
##         HOPPED means that TCH2 will be hopped traffic channel.
##         SINGLE means that TCH2 will be a non-hopped traffic channel
##           (i.e., a single ARFCN).

        :TSLot?
        :TSLot                              <value> | [INUM]
##       Sets/queries the Traffic CHannel 2 Time SLot (2 - 6 valid).

        :TYPE?
        :TYPE                               'FS'
##       Selects/queries the Traffic CHannel 2 TYPE.
```

Configure Subsystem

```
CONFigure

## CONFigure subsystem setting commands.

    :BADDress?
    :BADDress                           <value> | [INUM]
##  Sets/queries the HP-IB Bus ADDress.  The range is 0 to 30.

    :BEEPer?
    :BEEPer                             'OFF' | 'QUIET' | 'LOUD'
##  Selects/queries the audio BEEPer volume.

    :BMODe?
    :BMODe                              'CONTROL' | 'TALK&LSTN'
##  Selects/queries the HP-IB Bus operating MODe.
##    CONTROL is used to control external instruments using the
##      HP 8922A/G.
##    TALK&LSTN is used for "normal" HP-IB operation.

    :DATE?
    :DATE                      <value> | [INUM]
##  Sets/queries the current DATE for the internal clock.

    :INTensity?
    :INTensity                          <value> | [INUM]
##  Sets/queries the screen INTensity.
##    The range is 1 (very dim) to 8 (bright).
```

```
    :OFLevel

        :MODE?
        :MODE                              'ON' | 'OFF'
##       Selects/queries the RF OFfset Level MODE.

        :AUXIn?
        :AUXIn                             <(value) [units]> | [FNUM]

##       Sets/queries the RF OFfset Level at the AUX RF In port.
##         In affect when OFL:MODE 'ON' is selected.
##         Valid unit is dB.

        :AUXOut?
        :AUXOut                            <(value) [units]> | [FNUM]

##       Sets/queries the RF OFfset Level at the AUX RF Out port.
##         In affect when OFL:MODE 'ON' is selected.
##         Valid unit is dB.

        :RFINout?
        :RFINout                           <(value) [units]> | [FNUM]

##       Sets/queries the RF OFfset Level at the RF IN/out port.
##         In affect when OFL:MODE 'ON' is selected.
##         Valid unit is dB.

    :OPERation

        :AUTO
##       Enables several auto-ranging routines, providing automatic
##         adjustment of the affected settings.
##         Turns the RF Analyzer attenuator hold setting to AUTO.
##           (SANalyzer:ATTenuator:MODE 'AUTO')
##         Turns the AF Analyzer gain cntl to AUTO.
##           (AFANalyzer:RANGing 'AUTO')

        :HOLD
##       Disables several auto-ranging routines, requiring manual
##         adjustment of the affected settings.
##         Turns the RF Analyzer attenuator hold setting to HOLD.
##           (SANalyzer:ATTenuator:MODE 'HOLD')
##         Turns the AF Analyzer gain cntl to HOLD.
##           (AFANalyzer:RANGing 'HOLD')
```

```
   :PRINt

       :ADDRess?
       :ADDRess                      <value> | [INUM]
##      Sets/queries the HP-IB ADDRess of the PRINter connected
##        to the HP-IB port.

       :DESTination?
       :DESTination                      'SERIAL' | 'HPIB'
##      Selects/queries the PRINter DESTination (port).

       :TITLe?
       :TITLe                        <quoted string>
##      Enters/queries a string to be printed at the top of all
##        screen printouts.

   :RADio?
   :RADio                                'GSM900' | 'DCS1800'

## Selects/queries the RADio type mode of operation.

   :RFIMpedance?
   :RFIMpedance                              '50 OHM' | 'EMF'
## Selects/queries whether RF voltages should be expressed as the
##   voltage across a 50 OHM load or the open circuit voltage (EMF).
```

```
    :ROSCillator

       :CALibrate
##     Executes a calibration cycle for the reference.

       [:FREQuency]?
       [:FREQuency]                     '13 MHZ' | '10 MHZ' |
                                        '5 MHZ' | '2 MHZ' | '1 MHZ'
##      Selects/queries the expected external Reference OSCillator
##        FREQuency.  This frequency will be locked to when an external
##        reference is connected.

       :OFFSet?
       :OFFSet                          <(value) [units]> | [FNUM]
##      Sets/queries the Reference OSCillator tuning OFFSet.
##        In affect when ROSC:TUN 'TUNABLE' is selected.
##        Default HP-IB and display unit is PPM.

       :TUNing?
       :TUNing                          'TUNABLE' | 'NORMAL'
##     Selects/queries the Reference OSCillator tuning MODE.
##       TUNABLE means the reference can be tuned by the value given
##         for ROSC:OFFSet.
##       NORMAL means the reference can lock to an external reference
##         selected by :ROSC[:FREQ] or if no external reference is
##         connected then the reference will be free-running.

    :ROUT?
    :ROUT                               'ON' | 'OFF'
##  Selects/queries the OPT 001 REF OUT that appears on the rear panel.
##    ON means turn on the reference.
##    OFF means turn off the reference (timebase oven still kept warm).
```

```
    :SPORt
##  Serial PORT commands.

        :BAUD?
        :BAUD                          '300' | '600' | '1200' | '2400' |
                                       '4800' | '9600' | '19200'
##      Selects/queries the BAUD rate for serial communications
##        when using the rear-panel Serial PORt .

        :DATA?
        :DATA                          '7 BITS' | '8 BITS'
##      Selects/queries the DATA length - the number of bits used
##        for each word of serial data when using the Serial PORt.

        :IBECho?
        :IBECho                        'ON' | 'OFF'
##      Selects/queries the Serial PORt RS-232 input IBasic
##        ECHo state as On or Off.  This enable/disable screen
##        and error message echoing from IBASIC.

        :IECHo?
        :IECHo                         'ON' | 'OFF'
##      Selects/queries the Serial PORt RS-232 input Instrument
##        ECHo state as On or Off - enable/disables screen echoing.

        :PARity?
        :PARity                        'NONE' | 'ODD' | 'EVEN' |
                                       'ALWAYS 1' | 'ALWAYS 0'
##      Selects/queries the Serial PORt PARity bits setting.

        :RPACe?
        :RPACe                         'XON/XOFF' | 'NONE'
##      Selects/queries the Serial PORt PACe when Receiving
##        serial data.
##        XON/XOFF lets the instrument 'talk' to the transmitting
##          device to alter the rate of the data being sent.
##        NONE disable the XON/XOFF function.

        :SIN?
        :SIN                           'INST' | 'IBASIC'
##      Selects/queries the Serial PORt RS-232 Serial INput.
##        INST configures the serial port to connect to an external
##          RS-232 terminal or computer.
##        IBASIC is used to allow the IBASIC controller to read the
##          serial port.
```

```
        :STOP?
        :STOP                           '1 BIT' | '2 BITS'
##       Selects/queries the STOP length- the number of stop bits used
##         when using the Serial PORt.

        :XPACe?
        :XPACe                          'XON/XOFF' | 'NONE'
##       Selects/queries the Serial PORt PACe when transmitting (tX)
##         serial data.
##         XON/XOFF lets the receiving device 'talk' to the instrument
##           to alter the rate of the data being sent.
##         NONE disable the XON/XOFF function.

    :TIME?
    :TIME                               <value> | [INUM]
##  Sets/queries the TIME-of-day for the instrument's clock
##    (given in HH.MM hour format).
```

CW Subsystem

```
CW

## CW subsystem commands.

   :PMZero
##  Zeroes the Power Meter in order to make calibrated CW
##    Power measurements.  Note: The user should disconnect the
##    input signal when selecting this.  This field is the same as
##    DSP:AMPL:PMZero.
```

Digital Demod Subsystem

```
DDEMod

## Digital DEMod subsystem setting commands.

    :BURSt
        :TQUalifier<n>?
        :TQUalifier<n>                     'NORMAL' | 'RF POWER'
##       Selects/queries the Trigger QUalifier for burst number n, where
##         <n> = 0 to 3.  Note: this selects the trigger qualifier for both
##         DDEMod:BURSt:TQU<n> and MSYNc:BURSt:TQU<n>.
##         NORMAL means no trigger qualifier.
##         RF POWER means 'automatically rearm for another trigger if RF
##           POWER never came up'.

        :TYPE<n>?
        :TYPE<n>                          'TSC0' | 'TSC1' | 'TSC2' | 'TSC3' |
                                           'TSC4' | 'TSC5' | 'TSC6' | 'TSC7' |
                                           'RACH' | 'SCH'  | 'FCH' | 'USER DEF'
##       Selects/queries the BURSt TYPE for burst number n, where <n> = 0 to 3.
##         Note: this selects the type for both DDEMod:BURSt:TYPE<n> and
##         MSYNc:BURSt:TYPE<n>.
##         Note: Demod cannot be armed if
##                :SYNC:BSELect = '0' and :BURSt:TYPE0 = 'USER DEF'
##             or :SYNC:BSELect = '1' and :BURSt:TYPE1 = 'USER DEF'
##             or :SYNC:BSELect = '2' and :BURSt:TYPE2 = 'USER DEF'
##             or :SYNC:BSELect = '3' and :BURSt:TYPE3 = 'USER DEF'
##             or :SYNC:BSELect = 'EXT' and :BURSt:TYPE0,1,2,or 3 = 'USER DEF'

    :SYNC
        :BSELect?
        :BSELect                           '0' | '1' | '2' | '3' | 'EXT'
##       Selects/queries the Burst SELection to SYNC demod to.
##         0 means always sync to burst number 0.
##         1 means always sync to burst number 1.
##         2 means always sync to burst number 2.
##         3 means always sync to burst number 3.
##         EXT means use external signals to decide which
##           burst number to sync to.

        :SStatus?
##       Queries the Digital DEMod SYNC STatus.  Will return
##         'NO ERROR', or 'BAD SYNC'. This field will only be updated when the
##         demod arm state goes from "DISARM" to "ARM."
```

DISPlay Subsystem

```
DISPlay

## DISPlay subsystem setting commands.

   [:SCReen]?
   [:SCReen]                              CONFigure | CWAFanalyzer | DDEMod |
                                          DSPanalyzer | FTCPower | HELP |
                                          HOPControl | MESSages| MSYNc |
                                          ORFSpectrum | OSCilloscope | PULSe |
                                          RFANalyzer | RFGenerator |
                                          SANalyzer | SERVice | TCONfigure |
                                          TESTs | TFReq | TSPec | BETest |
                                          CELL | CCONfigure | LOGGing | MSINfo
##  Selects/queries the screen to activate, display and perform any
##    necessary screen transitioning functionality.

      :BETest
##     Bit Error Test DISPlay commands.

         :MNUMber

            :LEFT?
            :LEFT                   '1' | '3'
##           Selects/queries the Bit Error Test Measurement NUMber to
##             DISPlay on the LEFT side of the screen.

            :RIGHt?
            :RIGHt                  '2' | '4'
##           Selects/queries the Bit Error Test Measurement NUMber to
##             DISPlay on the RIGHt side of the screen.
```

```
        :CELL
##          CELL Control DISPlay commands.

            :SACCh
##          CELL Cont SACCH DISPlay commands.

                :ACEL1?
                :ACEL1                     <value> | [INUM]
##               Selects/queries the SACCH Adjacent Cell measurements to DISPlay
##               (1 - 6 valid).

            :TCH
##          Traffic CHannel DISPlay commands.

               [:SELect]?
               [:SELect]                   'TCH1' | 'TCH2'
##               Selects/queries which TCH parameters to display on the Cell
##                 Control screen.

        :DSPanalyzer
##      DSP Analyzer SCReen DISPlay commands.

            :AMPLitude

                :MASK?
                :MASK                      'ON' | 'OFF'
##               Selects/queries whether the DSP analyzer AMPLitude MASK should
##                 be DISPlayed on the 'AMPL MID', 'AMPL RISE' and 'AMPL FALL'
##                 screen VIEWs.

            :VIEW?
            :VIEW                          'PHASEMAIN' | 'PHASE ERR' |
                                           'AMPL MAIN' | 'AMPL MID' |
                                           'AMPL RISE' | 'AMPL FALL' |
                                           'DATA BITS'
##          Selects/queries the VIEW to be selected when DISPlay:SCReen
##            DSPanalyzer is selected.
```

```
        :MSYNc
##       Measurement SYNc SCReen DISPlay commands.

           :BURSt

               :NUMBer?
               :NUMBer                   <value> | [INUM]
##              Sets/queries the MSYNc BURSt NUMBer to be displayed when the
##                MEAS SYNC screen is displayed.

        :ORFSpectrum
##       Output RF Spectrum SCReen DISPlay commands.

           :VIEW?
           :VIEW                         'MAIN' | 'TRACE'
##          Selects/queries the Output RF Spectrum VIEW to be selected when
##            DISPlay:SCReen ORFSpectrum is selected.

        :PULSe
##        DSP Analyzer PULSe On/Off SCReen DISPlay commands.

           :VIEW?
           :VIEW                         'MAIN' | 'FALL' | 'RISE'
##          Selects/queries the PULSe On/Off VIEW to be selected when
##            DISPlay:SCReen PULSe is selected.

        :SANalyzer

           :CONTrol?
           :CONTrol                      'MAIN' | 'RF GEN' |
                                         'MARKER' | 'AUXILIARY'
##          CONTrols the Spectrum ANalyzer views - various fields will appear
##            on the trace screen based on the CONTrol selection.
```

DSP Analyzer Subsystem

```
DSPanalyzer

## DSP analyzer subsystem setting commands.

   :AMPLitude

       :MARKer
##      AMPLitude MARKer functions.
            :POSition

               :FALL?
               :FALL                   <value> | [INUM]
##              Sets/queries the  AMPLitude MARKer FALL trace position setting.
##                The value is given in units of divisions from the
##                left side of the FALL trace
##                (144 Bit Periods (T) to 156 Bit Periods (T) = 6 divisions).

               :MID?
               :MID                    <value> | [INUM]
##              Sets/queries the  AMPLitude MARKer MID trace position setting.
##                The value is given in units of divisions from the
##                left side of the MID trace
##                (-10 Bit Periods (T) to 160 Bit Periods (T) = 8.5 divisions).

               :RISE?
               :RISE                   <value> | [INUM]
##              Sets/queries the  AMPLitude MARKer RISE trace position setting.
##                The value is given in units of divisions from the
##                left side of the RISE trace
##                (-8 Bit Periods (T) to 4 Bit Periods (T) = 6 divisions).
```

```
        :PMZero
##      Zeroes the Power Meter in order to make calibrated Average TX
##        Power measurements.  Note: The user should disconnect the input
##        signal when selecting this. This field is the same as CW:PMZero.

        :TIME<n>?
        :TIME<n>                         <(value) [units]> | [FNUM]
##      Sets/queries the TIME<n=1..12> to make amplitude measurements.
##        HP-IB units are seconds (S), bit periods (T).
##          Default HP-IB unit is seconds (S).
##          Default display unit is micro-seconds (US).

    :DBITs
##  Data BITs commands.

        :TPOLarity
##      TOggle the POLarity of the Data BITs for the current measurement.

    :PHASe

        :MARKer
##      PHASe MARKer functions.

            :POSition?
            :POSition                    <value> | [INUM]
##          Sets/queries the PHASe MARKer POSition setting.
##            The value is given in units of divisions from the
##            left side of the trace (0 to 14.7 divisions).

        :MIDamble?
        :MIDamble                        'MEASURED' | 'EXPECTED'
##      Selects/queries the MIDamble to use for DSP analyzer phase displays
##        as the actual measured midamble or the midamble that the user
##        expects to use.
```

Electrical Man-Machine Interface Subsystem

```
EMMI

   :BRATe?
   :BRATe    "600" | "1200" | "2400" | "4800" | "9600"
##  Selects/queries EMMI port Baud RATe.

   :DATA?
##  Returns a response message sent by the mobile station.  Response messages
##    are stored in a message in a message buffer in the HP 8922.
##    This EMMI DATA is in the form:
##
##    num-decimal-digits num-data-chars  emmi-hex-data  (no spaces)
##
##    num-decimal-digits: (range: 1..3) The number of characters following
##                        to be interpreted as num-data-chars.
##
##    num-data-chars:     (range: 0..510) The number of data characters
##                        that will follow.  NOTE: This must be an even
##                        number since every two characters will
##                        represent one byte of hex data.
##
##    emmi-hex-data:      Hex character data.  Each pair of characters
##                        represents one byte of EMMI hex data.
##
##      eg. #2161234567890abcdef
##           -  ----------------
##           |--       |
##           | |       emmi-hex-data = 12 34 56 78 90 ab cd ef
##           | |
##           | num-data-chars = 16
##           |
##          num-decimal-digits = 2
##
##      Note: #10 is interpreted as no EMMI data (num-data-chars = 0).
##
##   The user can do the following:
##     a) Read all the messages in the message buffer by sending EMMI:DATA?
##     commands until #10 is returned. (Messages are read first-in-first-out.)
##     b) Clear the message buffer by sending EMMI:RESet.
```

```
   :DATA     <data entry>
##  Writes the DATA to the EMMI port using the form:

      # num-decimal-digits num-data-chars  emmi-hex-data  (no spaces)
##
##    num-decimal-digits: (range: 1..3) The number of characters following
##                        to be interpreted as num-data-chars.
##
##    num-data-chars:     (range: 0..510) The number of data characters
##                        that will follow.  NOTE: This must be an even
##                        number since every two characters will
##                        represent one byte of hex data.
##
##    emmi-hex-data:      Hex character data.  Each pair of characters
##                        represents one byte of EMMI hex data.
##
##      eg. #2161234567890abcdef
##           -  ----------------
##           |--       |
##           | |       emmi-hex-data = 12 34 56 78 90 ab cd ef
##           | |
##           | num-data-chars = 16
##           |
##           num-decimal-digits = 2
##
##    When the data write is complete, a status bit will be set that
##    reflects what happened with the EMMI data.  See the Status Subsystem
##    for EMMI.
```

```
   :RESet
## EMMI RESet clears out transmit and receive (message) buffers and
##   sends XON (ready to receive) frame to the mobile station.

   :TIMEout
       :MS
           :XON?
           :XON                    <(value) [units]> | [FNUM]
##          Sets/queries the EMMI TIMEout (time limit) allowed for the mobile
##            to send XON.  This adjusts a timer that provides the time delay
##            needed when the EMMI bus is attempting to send a message before
##            the MS or the HP 8922G are ready.  If the XON timeout expires,
##            then the STATus:EMMI:EVENt? will return a 4 (XON timeout exceeded).
##            Default HP-IB and display unit is seconds (S).

           :RESPonse?
           :RESPonse               <(value) [units]> | [FNUM]
##          Sets/queries the EMMI TIMEout (time limit) allowed for the mobile
##            stations' RESPonse (ie. to send an ACK or NAK to the HP 8922G).
##            If the response timeout expires, then the STATus:EMMI:EVENt? will
##            return an 8 (response timeout exceeded).
##            Default HP-IB and display unit is seconds (S).
```

Hop Control Subsystem

```
HOPControl

## HOP Controller subsystem setting commands.

   :ADDRess?
   :ADDRess                              <value> | [INUM]
##  Sets/queries the ADDRess for entering hop frequencies into the hop
##    tables and for entering the next frequency for HOPC:ADDR:SOUR:INT mode.

       :NEXT?
       :NEXT                             <value> | [INUM]
##      Sets/queries the NEXT HOP ADDRess to hop to.  This is used when
##        HOPC:ADDR:SOUR is 'INT' to make looped internal sequences.

       :RESet
##      RESets the internal sequence hop address register to zero.

       :SOURce?
       :SOURce                           'SEQ' | 'EXT'
##      Selects/queries the HOP Control ADDRess SOURce.
##        SEQ hopping mode causes the hop control address to come
##          from a hop sequence address register.  Hop addresses
##          are automatically sequenced based on next settings.
##        EXT hopping mode causes the hop control address to come
##          from external lines.
```

```
   :CTENd
## This Clear To ENd command replaces the RF ANalyzer hop frequency entry
##   and the RF Generator hop frequency entry at HOPC:ADDRess, and all
##   hop frequency entries after them, with 0 MHz.
##   I.e., the hop frequency entry at HOPC:ADDRess, HOPC:ADDRess + 1, ...
##   up to entry 2047 are replaced with 0 MHz.
##   HOPC:ADDR:NEXT values are set to ADDRess+1 modulo 2048 starting at
##   ADDRess.

   :DELete
## This DELetes the RF ANalyzer hop frequency entry and the RF Generator
##   hop frequency entry at HOPC:ADDRess. All other RF ANalyzer
##   and RF Generator hop frequency entries move down by one address.
##   Entry 2047 in the hop table is replaced with 0 MHz.

   :INSert
## This INSerts an entry of 0 MHz into the RF ANalyzer hop table and the
##   RF Generator hop table.  All other entries move down one address.
##   Entry 2047 in the RF ANalyzer hop table and the RF Generator
##   hop table is lost (forever!).

   :RFANalyzer

       :CTENd
##     This Clear To ENd command replaces the RF ANalyzer hop frequency entry
##       at HOPC:ADDRess, and all hop frequency entries after it, with 0 MHz.
##       I.e., the hop frequency entry at HOPC:ADDRess, HOPC:ADDRess + 1, ...
##       up to entry 2047 are replaced with 0 MHz.

       :DELete
##     This DELetes the RF ANalyzer hop frequency entry at HOPC:ADDRess.
##       All other RF ANalyzer hop frequency entries move down by one
##       address.  Entry 2047 in the hop table is replaced with 0 MHz.
```

```
        :FREQuency?
        :FREQuency                      <(value) [units]> | [FNUM]
##       Set/queries the RF ANalyzer hop FREQuency entry at HOPC:ADDRess.
##         Default HP-IB unit is HZ.
##         Default display unit is MHZ.

        :INSert
##       This INSerts an entry of 0 MHz into the RF ANalyzer hop table.  All
##         other entries move down one address.  The last entry in the
##         RF ANalyzer hop table is lost (forever!).

        :MODE?
        :MODE                           'NON-HOP' | 'HOP'
##       Selects/queries the RF ANalyzer hop MODE.

        :SETTling?
        :SETTling                       'NORMAL' | 'LARGEHOPS'
##       Selects/queries the RF ANalyzer hop SETTling.
##          NORMAL should be used for small hops.
##          LARGEHOPS should be used for large hops (~ >75 MHz).

       [:TRIGger]
           :ASTate?
           :ASTate                      'ARM' | 'DISARM'
##          Selects/queries the RF ANalyzer hop TRIGger Arm STate.

    :RFGenerator

        :CTENd
##       This Clear To ENd command replaces the RF Generator hop frequency entry
##         at HOPC:ADDRess, and all hop frequency entries after it, with 0 MHz.
##         I.e., the hop frequency entry at HOPC:ADDRess, HOPC:ADDRess + 1, ...
##         up to entry 2047 are replaced with 0 MHz.
```

```
        :DELete
##       This DELetes the RF Generator hop frequency entry at HOPC:ADDRess.
##         All other RF Generator hop frequency entries move down by one
##         address.  Entry 2047 in the hop table is replaced with 0 MHz.

        :FREQuency?
        :FREQuency                      <(value) [units]> | [FNUM]
##       Sets/queries the RF Generator hop FREQuency entry at HOPC:ADDRess.
##         Default HP-IB unit is HZ.
##         Default display unit is MHZ.

        :INSert
##       This INSerts an entry of 0 MHz into the RF Generator hop table.  All
##         other entries move down one address.  Entry 2047 in the
##         RF Generator hop table is lost (forever!).

        :MODE?
        :MODE                           'NON-HOP' | 'HOP'
##       Selects/queries the RF Generator hop MODE.

        :SETTling?
        :SETTling                       'NORMAL' | 'LARGEHOPS'
##       Selects/queries the RF Generator hop SETTling.
##          NORMAL should be used for small hops.
##          LARGEHOPS should be used for large hops (~ >75 MHz).

       [:TRIGger]
            :ASTate?
            :ASTate                     'ARM' | 'DISARM'
##            Selects/queries the RF Generator hop TRIGger Arm STate.
```

IEEE 488.2 Common Commands

```
   *CLS
##  CLears Status data structures - clears all event registers
##    summarized in the status byte.

   *ESE?
   *ESE                                  <value> | [INUM]
##  Sets/queries the Standard Event Status Enable Register.

   *ESR?
##  Queries the Standard Event Status Register.

   *IDN?
##  Returns the identification string which is the following fields
##  separated by commas.
##  Field 1: Manufacturer  - Hewlett-Packard
##  Field 2: Model Number  - 8922G
##  Field 3: Serial Number - 0 if unavailable
##  Field 4: Firmware Version Number - 0 if unavailable

   *OPC
##  Sets the 'Operation Complete' event-bit in the Event Status Register
##    when all pending device operations have been finished.

   *OPC?
##  The Operation Complete query places a '1' in the Output Queue when
##    all pending operations are completed.
##    Note: this function is only valid while measurements are running.
```

```
   *OPT?
## Returns an Option string for all options that are installed,
##   and returns a "0" for any options that are not installed
##   (these return values are separated by commas). Available
##   options are "CIPHERING" and "HP83220A" -- DCS1800 Test Set.
##   If all the given options are installed, *OPT? would return:
##   "CIPHERING,HP83220A".
##   If none of the given options are installed, *OPT? would return:
##   "0,0".

   *RCL                                   <value> | [INUM]
## ReCaLls the state of the device from a memory register associated
##   with the received integer parameter.
##   IMPORTANT: the following fields do not participate in Save/Recall,
##              and will be set to the settings given when *RCL is executed:
##  Cell Config - Settable| Activated : SETTABLE
##       CCON:STAT 'SETTABLE'
##  Dig Demod Arm State - Arm | Disarm : DISARM
##       TRIG:DDEM:AST 'DISARM'
##  Meas Arm State - Arm | Disarm : DISARM
##       TRIG:AST 'DISARM'
##  Meas Sync - Single | Cont : SINGLE
##       TRIG:MODE:DSP 'SINGLE'
##  Bit Error Test - Run | Stop : STOP
##       TRIG:BET:MODE 'STOP'
##  Bit Error Test MS Loopback Loop Delay mode - Manual | Auto : Manual
##       BET:LOOP:LDEL:MODE 'AUTO'
##  Hop Control RF Generator - Arm | Disarm : DISARM
##       HOPC:RFG:TRIG:AST 'DISARM'
##  Hop Control RF Analyzer  - Arm | Disarm : DISARM
##       HOPC:RFAN:TRIG:AST 'DISARM'
##  Hop Control RF Generator - Non-Hop | Hop : NON-HOP
##       HOPC:RFG:MODE 'NON-HOP'
##  Hop Control RF Analyzer  - Non-Hop | Hop : NON-HOP
##       HOPC:RFG:MODE 'NON-HOP'
##  None of the CONFigure commands except :RADio, :ROSCillator:OFFSet,
##    ROSCillator:TUNing, and :PRINt:TITLe participate in Save/Recall,
##    and will instead remain at their last setting.
```

```
   *RST
## Causes the HP 8922G to do an instrument preset.  Sets operating
##   parameters to a known state.  It does not affect the status reporting
##   information, nor does it clear the error or message queue.

   *SAV                                  <value> | [INUM]
## SAVe the current state of the device in a memory register associated
##   with the integer parameter.  (See *RCL for the fields that do not
##   participate in Save/Recall.

   *SRE?
   *SRE                                  <value> | [INUM]
## Sets/queries the Service Request Enable Register.

   *STB?
## Queries the HP-IB Status Byte.

   *TST?
## Self-test query.  Returns a 0 unless the self-test was not completed or
##   was completed with errors detected.

   *WAI
## The Wait-to-Continue command prevents the instrument from executing
##   any further commands or queries until there are no more operations
##   pending (HP-IB buffer empty).
##   Note: this function is only valid while measurements are running.
```

LOGGing Subsystem

```
LOGGing

## LOGGing subsystem commands.

   :DATA

       :FLUSh
##      FLUSh the LOGGing DATA - empties the contents of the log into
##        an output stream to the external monitoring device.
##        Note, the data will not be cleared.

       :CLEar
##      CLEars the LOGGing DATA.

   :PFILter?
   :PFILter                 'NETWKONLY' | '+DATALINK' |  '+SERVICE'

## Selects/queries the Pass FILter used when data is logged.
##   NETWKONLY means log peer-to-peer messages between the
##     network layers.
##   +DATALINK means NETWKONLY plus log peer-to-peer messages between the
##     between the data link layers.
##   +SERVICE means NETWKONLY plus DATALINK plus log inter-layer messages
##     and intra-layer service request and response messages.

   :STATe?
   :STATe                'LOG' | 'PAUSE'
## Selects/queries the current LOGGing STATe.
##   LOG indicates that data is being logged.
##   PAUSE indicates that data is temporarily not being logged.
```

Measure Subsystem

```
MEASure

## Measure subsystem commands.
##   Measure commands are used to control measurements and get back the
##   value of the displayed measurement.  To get a valid measurement, the
##   instrument must first be set up to access the desired measurement.
##   In most cases, this means that you must be on the screen (or set of
##   screens) associated with the measurement.  For example, to retrieve Output
##   RF Spectrum measurement results, you must be on the Output RF Spectrum
##   'Main' screen or 'Trace' screen.  (See the DISPlay subsystem commands.)
##   The Trigger commands are then used to cause a measurement to occur.
##   Once a measurement result is available it may be queried.
```

Audio Frequency Commands (Measure Subsystem)

```
    :AFRequency
##  Audio FRequency MEASurements.

        :ACLevel
            [MM] | [AVG] | [MET]
##      Sets/queries AC Level MEASurement attributes.
##        HP-IB unit is V.
##        Display units are dBm, V, mV, µV, dBµV, W;
##          default unit is V.

        :ACLevel?
##      Queries the AC Level MEASurement result for AF Analyzer inputs
##        (AFAN:INP) that are in units of AC level.

        :AM
            [MM] | [AVG] | [MET]
##      Sets/queries AM Depth MEASurement attributes.
##          HP-IB unit is % (PCT).
##          Display unit is % (PCT).

        :AM?
##      Queries the AM Depth MEASurement result for AF Analyzer inputs
##        (AFAN:INP) that are in units of percent.

        :DCAM
            [MM] | [AVG] | [MET]
##      Sets/queries DC AM Level MEASurement attributes.
##        HP-IB unit is % (PCT).
##        Display unit is % (PCT).
```

```
        :DCAM?
##       Queries the DC Level MEASurement result for AF Analyzer inputs
##         (AFAN:INP) that are in units of percent.

        :DCFM
            [MM] | [AVG] | [MET]
##       Sets/queries DC FM Level MEASurement attributes.
##         HP-IB unit is HZ.
##         Display units are kHZ, HZ;
##           default unit is HZ.

        :DCFM?
##       Queries the DC Level MEASurement result for AF Analyzer inputs
##         (AFAN:INP) that are in units of Hertz.

        :DCVolts
            [MM] | [AVG] | [MET]
##       Sets/queries DC Volts MEASurement attributes.
##         HP-IB unit is V.
##         Display units are dBm, V, mV, μV, dBμV, W;
##           default unit is V.

        :DCVolts?
##       Queries the DC Level MEASurement result for AF Analyzer inputs
##         (AFAN:INP) that are in units of DC Volts.

        :DISTortion
            [MM] | [AVG] | [MET]
##       Sets/queries DISTortion MEASurement attributes.
##         HP-IB and display units are dB and percent (PCT);
##         default HP-IB and display unit is PCT.

        :DISTortion?
##       Queries the DISTortion MEASurement result.
```

```
        :FM
            [MM] | [AVG] | [MET]
##       Sets/queries FM deviation MEASurement attributes.
##         HP-IB unit is HZ.
##         Display units are kHZ, HZ;
##           default unit is HZ.

        :FM?
##       Queries the FM deviation MEASurement result for FM DEMOD
##         AF Analyzer input.

        :FREQuency
            [MM] | [AVG] | [MET]
##       Sets/queries Audio Frequency MEASurement attributes.
##         HP-IB unit is HZ.
##         Display units are kHZ, HZ;
##           default unit is HZ.

        :FREQuency?
##       Queries the Audio FREQuency MEASurement result.

        :SELect?
        :SELect                          'AF FREQ' | 'DC LEVEL' |
                                         'DISTN' | 'SINAD'
##       Selects/queries the Audio FRequency SELected measurement
##         to provide measurement results for.
##         NOTE: to get valid measurements for DC AM, DC FM and
##         DC Volts, this filed must be set to 'DC LEVEL' and the
##         AF Analyzer Input (AFAN:INP) is set to look at an AM, FM,
##         or voltage source (respectively).

        :SINad
            [MM] | [AVG] | [MET]
##       Sets/queries SINad MEASurement attributes.
##         HP-IB and display units are dB and percent (PCT);
##         default HP-IB and display unit is dB.

        :SINad?
##       Queries the SINAD MEASurement result.
```

Bit Error Test Commands (Measure Subsystem)

```
    :BETest
##  Bit Error Test measurement commands.

        :BESelect<n>?
        :BESelect<n>                       'BE COUNT' | 'BE RATIO'
##      Selects/queries the Bit Error SELected Bit Error Test measurement
##        to display (BE Ratio, BE Count) for the given measurement number n,
##        where <n> = 1..4.

        :BERRor
##      Bit ERRor measurement results.

            :COUNt<n>
                [MM_MOD] | [AVG]
##          Sets/queries Bit ERRor COUNt<n> MEASurement attributes,
##            where <n> = 1 .. 4.

            :COUNt<n>?
##          Queries the Bit ERRor COUNt<n> (completed), where <n> = 1 .. 4.

            :ICOunt<n>
                [MM_MOD] | [AVG]
##          Sets/queries Bit ERRor Intermediate COunt<n> MEASurement
##            attributes, where <n> = 1 .. 4.

            :ICOunt<n>?
##          Queries the Bit ERRor Intermediate COunt<n>, where <n> = 1 .. 4.
##            NOTE: This can only be queried when in the state
##                  TRIGger:BETest:MODE  'RUN'.
```

```
            :IRATio<n>
                [MM] | [AVG]
##           Sets/queries Bit ERRor Intermediate RATio<n> MEASurement
##             attributes, where <n> = 1 .. 4.
##             HP-IB units are % (PCT), PPM;
##               default unit is PPM.
##             Display units are % (PCT), PPM;
##               default unit is PPM.

            :IRATio<n>?
##           Queries the Bit ERRor Intermediate RATio <n>, where <n> = 1 .. 4.
##             NOTE: This can only be queried when in the state
##                   TRIGger:BETest:MODE  'RUN'.

            :RATio<n>
                [MM] | [AVG]
##           Sets/queries Bit ERRor RATio<n> MEASurement attributes,
##             where <n> = 1 .. 4.
##             HP-IB units are % (PCT), PPM;
##               default unit is PPM.
##             Display units are % (PCT), PPM;
##               default unit is PPM.

            :RATio<n>?
##           Queries the Bit Error RATio<n> (completed), where <n> = 1 .. 4.

        :BTESted<n>?
##       Queries the number of Bits TESted for the completed Bit
##         Error Test measurements, where <n> = 1 .. 4.
```

```
        :CRC
##       Cyclic Redundancy Check measurement results.
##         This is useful when No Frame Erasure is selected.

           :COUNt<n>
               [MM_MOD] | [AVG]
##           Sets/queries CRC COUNt<n> MEASurement attributes,
##             where <n> = 1 .. 4.

           :COUNt<n>?
##           Queries the CRC COUNt<n> (completed), where <n> = 1 .. 4.

           :ICOunt<n>
               [MM_MOD] | [AVG]
##           Sets/queries CRC Intermediate COunt<n> MEASurement attributes,
##             where <n> = 1 .. 4.

           :ICOunt<n>?
##           Queries the CRC Intermediate COunt<n>, where <n> = 1 .. 4.
##             NOTE: This can only be queried when in the state
##                   TRIGger:BETest:MODE  'RUN'.

           :IRATio<n>
               [MM] | [AVG]
##           Sets/queries CRC Intermediate RATio<n> MEASurement attributes,
##             where <n> = 1 .. 4.
##             HP-IB units are % (PCT), PPM;
##               default unit is PPM.
##             Display units are % (PCT), PPM;
##               default unit is PPM.

           :IRATio<n>?
##           Queries the CRC Intermediate RATio<n>, where <n> = 1 .. 4.
##             NOTE: This can only be queried when in the state
##                   TRIGger:BETest:MODE  'RUN'.

           :RATio<n>
               [MM] | [AVG]
##           Sets/queries CRC RATio<n> MEASurement attributes,
##             where <n> = 1 .. 4.

           :RATio<n>?
##           Queries the CRC RATio<n> (completed), where <n> = 1 .. 4.
```

```
        :FERasure
##      Frame ERasure measurement results.

          :COUNt<n>
              [MM] | [AVG]
##         Sets/queries Frame ERasure COUNt<n> MEASurement attributes,
##           where <n> = 1 .. 4.

          :COUNt<n>?
##         Queries the Frame ERasure COUNt<n> (completed),
##           where <n> = 1 .. 4.

          :ICOunt<n>
              [MM_MOD] | [AVG]
##         Sets/queries Frame ERasure Intermediate COunt<n> MEASurement
##           attributes, where <n> = 1 .. 4.

          :ICOunt<n>?
##         Queries the Frame ERasure Intermediate COunt<n>,
##           where <n> = 1 .. 4.
##           NOTE: This can only be queried when in the state
##                 TRIGger:BETest:MODE  'RUN'.

          :IRATio<n>
              [MM] | [AVG]
##         Sets/queries Frame ERasure Intermediate RATio<n> MEASurement
##           attributes, where <n> = 1 .. 4.
##           HP-IB units are % (PCT), PPM;
##             default unit is PPM.
##           Display units are % (PCT), PPM;
##             default unit is PPM.

          :IRATio<n>?
##         Queries the Frame ERasure Intermediate RATio<n>,
##           where <n> = 1 .. 4.
##           NOTE: This can only be queried when in the state
##                 TRIGger:BETest:MODE  'RUN'.
```

```
          :RATio<n>
              [MM] | [AVG]
##         Sets/queries Frame ERasure RATio<n> MEASurement attributes,
##           where <n> = 1 .. 4.
##           HP-IB units are % (PCT), PPM;
##             default unit is PPM.
##           Display units are % (PCT), PPM;
##             default unit is PPM.

          :RATio<n>?
##         Queries the Frame ERasure RATio<n> (completed),
##           where <n> = 1 .. 4.

      :FLSelect<n>?
      :FLSelect<n>                      'COUNT' |'RATIO'
##     Selects/queries the Frame Loss Selected Bit Error Test measurement to
##       display (Count or Ratio) for the given Frame Loss TYpe (FE or CRC).

      :FLTYpe<n>?
      :FLTYpe<n>                       'FE' | 'CRC'
##     Selects/queries the Frame Loss TYpe Bit Error Test measurement
##       to display (FE or CRC) for the given Frame Loss Select (Count
##       or Ratio) for the given measurement number n, where <n> = 1..4.

      :IBTested<n>?
##     Queries the number of Bits Tested for the Intermediate Bit
##       Error Test measurements, where <n> = 1 .. 4.
##       NOTE: This can only be queried when in the state
##              TRIGger:BETest:MODE  'RUN'.

      :SSTatus?
##     Queries the Bit Error Test SYNC STatus.  Will return 'NO ERROR'
##       or 'BAD SYNC'.  This field will only be updated when the demod
##       arm state goes from "DISARM" to "ARM." This is the same as
##       DDEMod:SYNC:SSTatus.
```

Mobile Station Commands (Measure Subsystem)

```
    :CELL

        :MS
##      Mobile Station measurement commands.

            :TERRor?
##          Queries the Mobile Station Timing Error actually MEASured
##            by the HP8922G.

        :SACCh
##      Measurement results reported on the SACCH back from the MS.

            :ACELl
##          Adjacent CELl functions.
##            There are 6 of these, 1 representing the biggest adjacent cell
##            found.

                :ARFCn<n>?
##              Queries the Adjacent CELl ARFCN (Absolute Radio Frequency
##                Channel Number), where <n> = 1 .. 6.

                :BCC<n>?
##              Queries the Adjacent CELl (BSIC) Base station Color Code,
##                where <n> = 1 .. 6.

                :NCC<n>?
##              Queries the Adjacent CELl (BSIC) Network Color Code, where
##                <n> = 1 .. 6.

                :RLEVel<n>?
##              Queries the Adjacent CELl RX LEVel, where <n> = 1 .. 6.
```

```
        :FULL

            :RLEVel?
##           Queries the FULL RX LEVel (serving cell).

            :RQUality?
##           Queries the FULL RX QUality (serving cell).

        :PARTial

            :RLEVel?
##           Queries the PARTial RX LEVel (serving cell).

            :RQUality?
##           Queries the PARTial RX QUality (serving cell).

        :RESet
##       RESets the SACCH measurement results.

        :TADVance?
##       Queries the SACCH Timing ADVance reported by the MS.

        :TLEVel?
##       Queries the SACCH TX LEVel reported by the MS.
```

CW Commands (Measure Subsystem)

```
    :CW
##  CW MEASurements.

        :FREQuency

            [:ABSolute]
                [MM] | [AVG] | [MET]
##          Sets/queries the CW ABSolute FREQuency MEASurement attributes.
##            HP-IB unit is HZ.
##            Display units are GHZ, MHZ, kHZ, HZ;
##             default unit is MHZ.

            [:ABSolute]?
##          Queries the CW ABSolute FREQuency MEASurement result.

            :ERRor
                [MM] | [AVG] | [MET]
##          Sets/queries the CW FREQuency ERRor MEASurement attributes.
##            HP-IB unit is HZ.
##            Display units are GHZ, MHZ, kHZ, HZ;
##              default unit is MHZ.

            :ERRor?
##          Queries the CW FREQuency ERRor MEASurement result.

            :SELect?
            :SELect                      'CW FREQ' | 'CWFREQERR'
##          Selects/queries the CW FREQ SELected measurement
##            to display.

        :POWer
            [MM] | [AVG] | [MET]
##      Sets/queries the CW POWer MEASurement attributes.
##        HP-IB unit is W.
##        Display units are dBm, V, mV, µV, dBµV, W;
##          default unit is dBm.

        :POWer?
##      Queries the CW POWer MEASurement result.
##        This is only valid for RFAN:INP of 'RF IN/OUT'.
```

DSP Analyzer Commands (Measure Subsystem)

```
    :DSPanalyzer
 ##  DSP Analyzer MEASurements.

       [:AMPLitude]
 ##     DSP Analyzer AMPLitude MEASurements.

           :AMPLitude<n>
               [MM] | [AVG]
 ##         Sets/queries the AMPLitude measurement attributes,
 ##           where <n> = 1 .. 12.
 ##           HP-IB unit is dB.
 ##           Display unit is dB.

           :AMPLitude<n>?
 ##         Queries the AMPLitude measurement result based on the
 ##           DSP:AMPL:TIME<n> setting, where <n> = 1 .. 12.

           :MARKer
 ##         AMPLitude MARKer MEASurements.

               :LEVel

                   :FALL
                       [MM] | [AVG]
 ##                 Sets/queries the AMPLitude MARKer FALL trace attributes.
 ##                   HP-IB unit is dB.
 ##                   Display unit is dB.

                   :FALL?
 ##                 Queries the AMPLitude MARKer FALL trace level which is
 ##                   relative amplitude data. This value is a function of the
 ##                   fall trace marker position set/queried by
 ##                   DSP:AMPL:MARK:POS:FALL.  This is only valid when on
 ##                   IMPORTANT: The user MUST be on the Amplitude Fall
 ##                   screen to query this result (DISP:DSP:VIEW 'AMPL FALL').
```

```
          :MID
              [MM] | [AVG]
##         Sets/queries the AMPLitude MARKer MID trace attributes.
##           HP-IB unit is dB.
##           Display unit is dB.

          :MID?
##         Queries the AMPLitude MARKer MID trace level which is
##           relative amplitude data. This value is a function of the
##           mid trace marker position set/queried by
##           DSP:AMPL:MARK:POS:MID.
##           IMPORTANT: The user MUST be on the Amplitude Mid
##           screen to query this result (DISP:DSP:VIEW 'AMPL MID').

          :RISE
              [MM] | [AVG]
##         Sets/queries the AMPLitude MARKer RISE trace attributes.
##           HP-IB unit is dB.
##           Display unit is dB.

          :RISE?
##         Queries the AMPLitude MARKer RISE trace level which is
##           relative amplitude data. This value is a function of the
##           rise trace marker position set/queried by
##           DSP:AMPL:MARK:POS:RISE.
##           IMPORTANT: The user MUST be on the Amplitude Rise
##           screen to query this result (DISP:DSP:VIEW 'AMPL RISE').
```

```
            :TIME

                :FALL
                    [MM] | [AVG]
##               Sets/queries the MARKer FALL trace TIME attributes.
##                 HP-IB units are seconds (S),bit periods (T);
##                   default unit is seconds (S).
##                 Display units are US (micro-second), T (bit periods);
##                   default unit is US (micro-second).

                :FALL?
##               Queries the MARKer FALL trace TIME which is the marker's
##                 position relative to the last bit in the measured burst.
##                 This value is a function of the fall trace marker
##                 position set or queried by DSP:AMPL:MARK:POS:FALL.
##                 IMPORTANT: The user MUST be on the Amplitude Fall
##                 screen to query this result (DISP:DSP:VIEW 'AMPL FALL').

                :MID
                    [MM] | [AVG]
##               Sets/queries the MARKer MID trace TIME attributes.
##                 HP-IB units are seconds (S),bit periods (T);
##                   default unit is seconds (S).
##                 Display units are US (micro-second), T (bit periods);
##                   default unit is US (micro-second).

                :MID?
##               Queries the MARKer MID trace TIME which is the marker's
##                 position relative to bit zero in the measured burst..
##                 This value is a function of the mid trace marker
##                 position set or queried by DSP:AMPL:MARK:POS:MID.
##                 IMPORTANT: The user MUST be on the Amplitude Mid
##                 screen to query this result (DISP:DSP:VIEW 'AMPL MID').
```

```
                 :RISE
                    [MM] | [AVG]
##                Sets/queries the MARKer RISE trace TIME attributes.
##                  HP-IB units are seconds (S),bit periods (T);
##                    default unit is seconds (S).
##                  Display units are US (micro-second), T (bit periods);
##                    default unit is US (micro-second).

                 :RISE?
##                Queries the MARKer RISE trace TIME which is the marker's
##                  position relative to bit zero in the measured burst.
##                  This value is a function of the rise trace marker
##                  position set or queried by DSP:AMPL:MARK:POS:RISE.
##                  IMPORTANT: The user MUST be on the Amplitude Rise
##                  screen to query this result (DISP:DSP:VIEW 'AMPL RISE').

         :MSUMmary?
##        Queries the AMPLitude Measurement SUMmary and returns 'PASSED',
##          'FAILED' or '- - - -'.
##          '- - - -' means that the MSUMmary results are currently
##             indeterminate.
##          'PASSED' means that all of the following are true after an
##             amplitude measurement completes:
##             a) Each AMPLitude measurement (AMPL<1> thru AMPL<12>),
##                does NOT exceed it's HI LO limits OR is OFF.
##             b) Pk+ Flatness does NOT exceed it's HI LO limits OR
##                Pk+ Flatness measurement is OFF. (PPFLatness)
##             c) Pk- Flatness does NOT exceed it's HI LO limits OR
##                Pk- Flatness measurement is OFF. (NPFLatness)
##              AND for each of the above (a-c) that is ON it must have a
##              valid measurement result (i.e. not '- - - -').
##           IMPORTANT: The user MUST be on the Amplitude Main (Ampl Main)
##           screen to query this result (DISP:DSP:VIEW 'AMPL MAIN').
```

```
        :NPFLatness
            [MM] | [AVG]
##       Sets/queries the Negative Peak FLatness measurement attributes.
##         HP-IB unit is dB.
##         Display unit is dB.

        :NPFLatness?
##       Queries the Negative Peak FLatness measurement result.  This is
##         the most negative amplitude in dB relative to the average power
##         over the useful bits in the measured burst.

        :PPFLatness
            [MM] | [AVG]
##       Sets/queries the Positive Peak FLatness measurement attributes.
##         HP-IB unit is dB.
##         Display unit is dB.

        :PPFLatness?
##       Queries the Positive Peak FLatness measurement result.  This is
##         the most positive amplitude in dB relative to the average power
##         over the useful bits in the measured burst.

        :PTCPower
            [MM] | [AVG]
##       Sets/queries the Peak Transmitter Carrier Power MEASurement
##         attributes.
##         HP-IB units are dBm, W;
##           default unit is dBm.
##         Display units are dBm, V, mV, μV, dBμV, W;
##           default unit is dBm.

        :PTCPower?
##       Queries the Peak Transmitter Carrier Power MEASurement result.
##         This is the average power over the useful bits in the measured
##         burst.
```

```
            :TRACe?
##           Returns the DSP Analyzer AMPLitude TRACe measured data
##             length(integer), time reference(floating point), and the
##             floating point TRACe AMPLitude data array for the given
##             length separated by commas.

        :DBITs?
##       Queries the demodulated Data BITs returned for the
##         current measurement made.

            :TAGS?
##           Queries the TAGS for each of the Data BITs.
##             M  means midamble bit.
##             -  means RF level error.

        :FBIT
            [MM] | [AVG]
##       Sets/queries the position of the First (useful) BIT attributes.
##         HP-IB units are seconds (S),bit periods (T);
##           default unit is seconds (S).
##         Display units are US (micro-second), T (bit periods);
##           default unit is US (micro-second).

        :FBIT?
##       Queries the position of the First (useful) BIT in time
##         relative to when the DSP measurement trigger occurred.

        :FMERrors?
##       A query of number of FM ERrors returns the number of FM demodulated
##         bits different from the best bit match (of the demodulated burst
##         bits) to the selected midamble before differential decoding for the
##         current DSP measurement.  This is only valid for
##         MSYN:SYNC:MODE 'MIDAMBLE'.
```

```
        :PHASe
##      DSP Analyzer PHASe MEASurements.

          [:ERRor]

                :FREQuency
                    [MM] | [AVG]
##               Sets/queries the FREQuency ERRor MEASurement attributes.
##                 HP-IB unit is HZ.
##                 Display units are HZ, kHZ;
##                   default unit is HZ.

                :FREQuency?
##               Queries the FREQuency ERRor MEASurement result.  This is the
##                 slope of the average phase over the useful bits in the
##                 measured burst.

                :PEAK
                    [MM] | [AVG]
##               Sets/queries the PEAK PHASe ERRor MEASurement attributes.
##                 Display unit is degrees.

                :PEAK?
##               Queries the PEAK PHASe ERRor MEASurement result over the useful
##                 bits in the measured burst.
##                 HP-IB unit is degrees.

                :RMS
                    [MM] | [AVG]
##               Sets/queries the RMS PHASe ERRor MEASurement attributes.
##                 HP-IB unit is degrees.
##                 Display unit is degrees.

                :RMS?
##               Queries the RMS PHASe ERRor MEASurement result over the useful
##                 bits in the measured burst.
```

```
          :MARKer
##        DSP Analyzer PHASe MARKer MEASurements.

              :ERRor
                  [MM] | [AVG]
##            Sets/queries the PHASe ERRor measurement attributes.
##              HP-IB unit is degrees.
##              Display unit is degrees.

              :ERRor?
##            Queries the PHASe ERRor measurement result.  This is the y-axis
##              MARKer position of the phase error. This value is a function
##              of the marker position set or queried by DSP:PHAS:MARK:POS.
##              IMPORTANT: The user MUST be on the Phase Err screen
##              to query this result (DISP:DSP:VIEW 'PHASE ERR').

              :TIME
                  [MM] | [AVG]
##            Sets/queries the MARKer TIMe attributes.
##              HP-IB units are seconds (S),bit periods (T);
##                default unit is seconds (S).
##              Display units are US (micro-second), T (bit periods);
##                default unit is US (micro-second).

              :TIME?
##            Queries the MARKer TIMe which is the marker's position relative
##              to bit zero in the measured burst.  This value is a function
##              of the marker position set or queried by DSP:PHAS:MARK:POS.
##              IMPORTANT: The user MUST be on the Phase Err screen
##              to query this result (DISP:DSP:VIEW 'PHASE ERR').

          :TRACe?
##        Returns the DSP Analyzer PHASe TRACe measured data length(integer),
##          and the floating point PHASe AMPLitude data array for the given
##          length separated by commas.
```

```
        :SSTatus?
##       Queries the Sync STatus for the current DSP measurement.
##         Will return 'No Error', 'ShortBurst', 'Level Late', 'LevelShort',
##         'FM Error', 'Low Level', 'Math Error' or 'RF Ovrload'.
##         The message return priority (highest to lowest) is as follows:
##            Math Error
##            RF Ovrload | Low Level
##            FM Error
##            ShortBurst | Level Late | LevelShort
##            No Error
##         ShortBurst - amplitude envelope not long enough for the selected
##                      burst length
##         RF Ovrload - the DSP Analyzer sampler hardware overloaded during
##                       sampling
##         FM Error - at least one FM error was detected during the Midamble
##                    (or User Defined Sync Pattern) portion of the selected
##                    burst (only possible for MSYN:SYNC:MODE 'MIDAMBLE')
##         Level Late - amplitude of the burst did not rise until after the
##                      first few bits were received
##         Level Short - amplitude of the burst fell before the last few bits
##                      were received
##         Low Level - DSP Analyzer RF level never got high enough to make a
##                      valid measurement
##         Math Error - DSP Analyzer math-related error occurred
##         No Error - no error occurred in synchronizing to the selected burst
```

Fast TX Carrier Power (Measure Subsystem)

```
   :FTCPower

        [:POWer]
            [MM] | [AVG] | [MET]
##       Sets/queries the Fast Transmitter Carrier Power MEASurement attributes.
##         HP-IB units are dBm, W;
##           default unit is dBm.
##         Display units are dBm, V, mV, µV, dBµV, W;
##           default unit is dBm.

        [:POWer]?
##       Queries the Fast Transmitter Carrier Power MEASurement result.
##         This is only valid for RFAN:INP of 'RF IN/OUT'.
```

Output RF Spectrum Commands (Measure Subsystem)

```
    :ORFSpectrum
##   Output RF Spectrum MEASurements.

       :FBIT
##      Sets/queries the position of the First (useful) BIT attributes.
##        HP-IB units are seconds (S),bit periods (T);
##          default unit is seconds (S).
##        Display units are US (micro-second), T (bit periods);
##          default unit is US (micro-second).

       :FBIT?
##      Queries the position of the First (useful) BIT in time relative
##        to when the Output RF Spectrum measurement trigger occurred.

       :FMERrors?
##      FM ERrors query returns the number of FM demodulated bits different
##        from the best bit match (of the demodulated burst bits) to the
##        selected midamble before differential decoding for ORFS[:POWer]
##        measurement.  This only valid for MSYN:SYNC:MODE 'MIDAMBLE'.

       :MARKer
##      Output RF Spectrum MARKer MEASurements.

           :LEVel
               [MM] | [AVG]
##          Sets/queries the MARKer LEVel attributes.
##            HP-IB unit is dB.
##            Display unit is dB.

           :LEVel?
##          Queries the MARKer LEVel which is relative amplitude data.
##            This value is a function of the marker position set or queried by
##            ORFSpectrum:MARKer:POSition.
##            Default unit is dB relative to the average power over the useful
##            bits in the measured burst when ORFS:FREQ was set to zero.

           :TIME
               [MM] | [AVG]
##          Sets/queries the MARKer TIME attributes.
##            HP-IB units are seconds (S),bit periods (T);
##              default unit is seconds (S).
##            Display units are US (micro-second), T (bit periods);
##              default unit is US (micro-second).

           :TIME?
##          Queries the MARKer TIME  which is the marker's position relative
##            to bit zero in the measured burst. This value is a function
##            of the marker position set or queried by ORFS:MARK:POS.
```

```
        [:POWer]
            [MM] | [AVG]
##        Sets/queries the Output RF Spectrum POWer MEASurement attributes.
##          Default unit is dB relative (as per GSM rec. 5.05, etc.).
##          HP-IB unit is dB.
##          Display unit is dB.

        [:POWer]?
##        Queries the Output RF Spectrum POWer MEASurement result.

        :SSTatus?
##        Queries the Sync STatus for the current DSP measurement.
##          Will return 'No Error', 'ShortBurst', 'Level Late', 'LevelShort',
##          'FM Error', 'Low Level', 'Math Error' or 'RF Ovrload'.
##          The message return priority (highest to lowest) is as follows:
##             Math Error
##             RF Ovrload | Low Level
##             FM Error
##             ShortBurst | Level Late | LevelShort
##             No Error
##          ShortBurst - amplitude envelope not long enough for the selected
##                       burst length
##          RF Ovrload - the DSP Analyzer sampler hardware overloaded during
##                        sampling
##          FM Error - at least one FM error was detected during the Midamble
##                     (or User Defined Sync Pattern) portion of the selected
##                     burst (only possible for MSYN:SYNC:MODE 'MIDAMBLE')
##          Level Late - amplitude of the burst did not rise until after the
##                       first few bits were received
##          Level Short - amplitude of the burst fell before the last few bits
##                       were received
##          Low Level - DSP Analyzer RF level never got high enough to make a
##                       valid measurement
##          Math Error - DSP Analyzer math-related error occurred
##          No Error - no error occurred in synchronizing to the selected burst

        :TRACe?
##        Queries the Output RF Spectrum MEASurement result
##          and returns 417 floating-point numbers representing the trace.
##          NOTE: the time between each point is 1.7 µS.
```

Oscilloscope Commands (Measure Subsystem)

```
    :OSCilloscope
##  OSCilloscope MEASurements.

        :MARKer

            :LEVel
##          OSCilloscope MARKer LEVel MEASurements.

                :AM
                    [MM] | [AVG]
##               Sets/queries the MARKer AM LEVel attributes.
##                 HP-IB unit is Percent (PCT);
##                 Display unit is Percent (PCT).

                :AM?
##               Queries the MARKer LEVel which is the signal level of the
##                 current marker position for AF Analyzer input
##                 selections (AFAN:INP) that have AM units of Percent.
##                 This value is a function of the marker position set or
##                 queried by OSC:MARK:POS.

                :FM
                    [MM] | [AVG]
##               Sets/queries the MARKer FM LEVel attributes.
##                 HP-IB unit is HZ;
##                 Display units are HZ, kHZ;
##                   default unit is kHZ.

                :FM?
##               Queries the MARKer LEVel which is the signal level of the
##                 current marker position for AF Analyzer input
##                 selections (AFAN:INP) that have FM units of Hertz.
##                 This value is a function of the marker position set or
##                 queried by OSC:MARK:POS.
```

```
                :VOLTs
                    [MM] | [AVG]
##               Sets/queries the MARKer VOLTs LEVel attributes.
##                 HP-IB units is Volts (V);
##                 Display units is V, mV;
##                   default unit is V.

                :VOLTs?
##               Queries the MARKer LEVel which is the signal level of the
##                 current marker position for AF Analyzer input
##                 selections (AFAN:INP) that have units of VOLTs.
##                 This value is a function of the marker position set or
##                 queried by OSC:MARK:POS.

            :TIME
                [MM] | [AVG]
##           Sets/queries the MARKer TIME MEASurement attributes.
##             HP-IB unit is seconds (S);
##             Display units are S, MS;
##               default unit is MS.

            :TIME?
##           Queries the MARKer TIME MEASurement which time elapsed from the
##             trigger point to the current marker position.  This value is a
##             function of the marker position set or queried by OSC:MARK:POS.

            :TRACe?
##          Queries the OSCilloscope TRACe MEASurement result.
```

Pulse On/Off Ratio Commands (Measure Subsystem)

```
     :PULSe
##   PULSe On/Off Ratio MEASurements.

       :FBIT
           [MM] | [AVG]
##     Sets/queries the position of the First (useful) BIT attributes.
##       HP-IB units are seconds (S),bit periods (T);
##         default unit is seconds (S).
##       Display units are US (micro-second), T (bit periods);
##         default unit is US (micro-second).

       :FBIT?
##     Queries the position of the First (useful) BIT in time relative
##       to when the Pulse On/Off measurement trigger occurred.

       :FMERrors?
##     FM ERrors query returns the number of FM demodulated bits different
##       from the best bit match (of the demodulated burst bits) to the
##       selected midamble before differential decoding for the Pulse
##       measurement.  This only valid for MSYN:SYNC:MODE 'MIDAMBLE'.

       :MARKer
##     PULSe On/Off Ratio MARKer MEASurements.

          :LEVel

              :FALL
                  [MM] | [AVG]
##             Sets/queries the FALL trace MARKer LEVel attributes.
##               Default unit is dB relative to the average power over the
##               useful bits in the measured burst.
##               HP-IB units are dB.
##               Display units are dB.
```

```
                :FALL?
##               Queries the FALL trace MARKer LEVel which is relative amplitude
##                 data.  This value is a function of the marker position set
##                 or queried by PULS:MARK:POS:FALL.

                :RISE
                    [MM] | [AVG]
##               Sets/queries the RISE trace MARKer LEVel attributes.
##                 Default unit is dB relative to the average power over the
##                 useful bits in the measured burst.
##                 HP-IB units are dB.
##                 Display units are dB.

                :RISE?
##               Queries the RISE trace MARKer LEVel which is relative amplitude
##                 data.  This value is a function of the marker position set
##                 or queried by PULS:MARK:POS:RISE.

            :TIME

                :FALL
                    [MM] | [AVG]
##               Sets/queries the MARKer FALL trace TIME attributes.
##                 HP-IB units are seconds (S),bit periods (T);
##                   default unit is seconds (S).
##                 Display units are US (micro-second), T (bit periods);
##                   default unit is US (micro-second).

                :FALL?
##               Queries the MARKer FALL trace TIME which is the marker's
##                 position relative to bit zero in the measured burst.
##                 function of the marker position set or queried by
##                 PULS:MARK:POS:FALL.
```

```
            :RISE?
                [MM] | [AVG]
##           Sets/queries the MARKer RISE trace TIME attributes.
##             HP-IB units are seconds (S), bit periods (T);
##               default unit is seconds (S).
##             Display units are US (micro-second), T (bit periods);
##               default unit is US (micro-second).

            :RISE?
##           Queries the MARKer RISE trace TIME which is the marker's
##             relative to bit zero in the measured burst.  This value
##             is a function of the marker position set or queried by
##             PULS:MARK:POS:RISE.

    :OORatio
##   Pulse On/Off Ratio measurement commands.

        :FALL
            [MM] | [AVG]
##       Sets/queries the PULSe On/Off Ratio FALL trace attributes.
##         Default units: dB relative to the average power over the
##           useful bits in the measured burst.
##         HP-IB unit is dB.
##         Display unit is dB.

        :FALL?
##       Queries the PULSe On/Off Ratio FALL trace MEASurement result.

        :RISE
            [MM] | [AVG]
##       Sets/queries the PULSe On/Off Ratio RISE trace attributes.
##         Default units: dB relative to the average power over the
##           useful bits in the measured burst.
##         HP-IB unit is dB.
##         Display unit is dB.

        :RISE?
##       Queries the PULSe On/Off Ratio RISE trace MEASurement result.
```

```
        :SSTatus?
##       Queries the Sync STatus for the PULSe measurement.
##         Will return 'No Error', 'ShortBurst', 'Level Late', 'LevelShort',
##         'FM Error', 'Low Level', 'Math Error' or 'RF Ovrload'.
##         The message return priority (highest to lowest) is as follows:
##            Math Error
##            RF Ovrload | Low Level
##            FM Error
##            ShortBurst | Level Late | LevelShort
##            No Error
##         ShortBurst - amplitude envelope not long enough for the selected
##                      burst length
##         RF Ovrload - the DSP Analyzer sampler hardware overloaded during
##                      sampling
##         FM Error - at least one FM error was detected during the Midamble
##                    (or User Defined Sync Pattern) portion of the selected
##                    burst (only possible for MSYN:SYNC:MODE 'MIDAMBLE')
##         Level Late - amplitude of the burst did not rise until after the
##                      first few bits were received
##         Level Short - amplitude of the burst fell before the last few bits
##                      were received
##         Low Level - DSP Analyzer RF level never got high enough to make a
##                      valid measurement
##         Math Error - DSP Analyzer math-related error occurred
##         No Error - no error occurred in synchronizing to the selected burst

        :TRACe

            :FALL?
##           Queries the Pulse On/Off FALL TRACe MEASurement result
##             and returns 417 floating-point numbers representing the trace.
##             NOTE: the time between each point is 0.2 µS;S.

            :RISE?
##           Queries the Pulse On/Off RISE TRACe MEASurement result
##             and returns 417 floating-point numbers representing the trace.
##             NOTE: the time between each point is 0.2 µS.
```

Spectrum Analyzer Commands (Measure Subsystem)

```
    :SANalyzer
##  Spectrum ANalyzer MEASurements.

        :MARKer

            :FREQuency
                [MM] | [AVG]
##           Sets/queries the MARKer FREQuency MEASurement attributes.
##             HP-IB unit is HZ.
##             Display units are MHZ, kHZ, HZ;
##               default unit is HZ.

            :FREQuency?
##           Queries the MARKer FREQuency MEASurement result.

            :LEVel
                [MM] | [AVG]
##           Sets/queries the MARKer LEVel MEASurement attributes.
##             HP-IB units are dBm, W.
##               default unit is dBm.
##             Display units are dBm, W, V, dBμV;
##               default unit is dBm.

            :LEVel?
##           Queries the MARKer LEVel MEASurement result.

        :TRACe?
##       Queries the Spectrum Analyzer TRACe MEASurement result.
```

MS Information Subsystem

```
MSINfo

## MS INformation subsystem setting commands.

    :CIPHering
##  CIPHering (encryption) commands.

        :AMODe?
        :AMODe                  'FULL-54' | 'FULL-64' | 'PARTIAL' | 'NONE'
##       Selects/queries the CIPHering Authentication MODe.
##         FULL-54 means that the user need only provide the Authentication
##           Key (KI). Only the first 54 bits of the Authentication Key will
##           be used, and the 10 least-significant-bits will be unused.
##         FULL-64 means that the user need only provide the Authentication
##           Key (KI). The entire 64 bits of the Authentication Key will
##           be used.
##         PARTIAL means that the Ciphering Key (KC) and a random
##           number (RAND) is needed.
##         NONE means that no authentication will take place.

        :KC?
        :KC                     <quoted string representing a
                                           hexadecimal (64 bit) value>
##       Sets/queries the Ciphering Key (KC).

        :KI?
        :KI                     <quoted string representing a
                                           hexadecimal (128 bit) value>
##       Sets/queries the Authentication Key (KI).

        :RAND?
        :RAND                   <quoted string representing a
                                           hexadecimal (128 bit) value>
##       Sets/queries the RAND value (random number).
```

```
        :SRES?
##       Queries the BS SRES (Signed RESponse to RAND).
##         This is a quoted string representing a 32 bit hexadecimal.

       [:STATe]?
       [:STATe]                'OFF' | 'DISABLED' | 'ENABLED'
##       Selects/queries the CIPHering (encryption) STATe of the MS
##         and BS for the next call made.
##         OFF means no ciphering and don't send out the ciphering
##           signaling.
##         DISABLED meas send out the ciphering signaling, but select
##           ciphering disabled.
##         ENABLED means enable ciphering - this is only allowed if the
##           Ciphering Option is installed (see *OPT?).

    :MS
##   Mobile Station commands.

        :CMARk
##       Class MARk commands.

            :PCLass?
##           Queries the Class MARk Power CLass - comes from the
##             MS when a call is made.

        :IMEI?
##       Queries the MS International Mobile Equipment Identity.
##         (This is quoted string of up to 15 decimal digits).

            :REQuest
##           REQuests the IMEI from the MS - a call must be in place.
```

```
        :IMSI?
##       Queries the MS's International Mobile Subscriber
##         Identity. (This is quoted string of up to 15 decimal digits).

            :SPAGing
##           Sets the PAGing IMSI - copies the MS's IMSI (MS:IMSI) to the
##             MS's Paging IMSI ([:PAGing]:IMSI).

        :LAI
##       MS's last Location Area Identification.

            :LACode?
##           Queries the Location Area Code portion of the last LAI.

            :MCCode?
##           Queries the Mobile Country Code portion of the last LAI.

            :MNCode?
##           Queries the Mobile Network Code portion of the last LAI.

        :ONUMber?
##       Queries the MS Originated NUMber.
##         This quoted string represents up to 20-digit decimal number
##         representing the party number the MS was calling for an
##         MS-initiated call.  The field will show a leading '+' if this
##         is an international call.

        :SRES
##       Queries the MS SRES (MS Signed RESponse to RAND).
##        This is a quoted string representing a 32 bit hexadecimal.
```

```
[:PAGing]

    :IMSIdentity?
    :IMSIdentity                     <quoted string>
##   Sets/queries the MS's PAGing IMSI (International Mobile
##     Subscriber Identity). This is a quoted string representing
##     up to 15 decimal digits.

    :TMSI?
##   Queries the TMSI (Temporary Subscriber Identity) value.

        :REALlocation
##       REALocates a new TMSI value based on generating a
##         random number.

        :STATe?
        :STATe            'ON' | 'OFF'
##       Selects/queries whether to use the TMSI value when the
##         next call is made.
```

Measurement Sync Subsystem

```
MSYNc

## Measurement SYNc subsystem setting commands.

    :BURSt
##   MSYNc BURSt definition setting commands.

       :LENGth<n>?
       :LENGth<n>                      '87' | '147'
##      Selects/queries the MSYNc user-defined BURSt LENGth
##        for the selected burst number n, where <n> = 0 to 3.

       :SPSPosition<n>?
       :SPSPosition<n>                 <value> | [INUM]
##      Sets/queries the MSYNc user-defined Sync Pattern Start Position
##        for the selected burst number n, where <n> = 0 to 3.

       :TQUalifier<n>?
       :TQUalifier<n>                  'NORMAL' | 'RF POWER'
##      Selects/queries the Trigger QUalifier for the selected burst number
##        n, where <n> = 0 to 3.  Note: this selects the trigger qualifier for
##        both MSYNc:BURSt:TQU<n> and DDEMod:BURSt:TQU<n>.
##        NORMAL means no trigger qualifier.
##        RF POWER means 'rearm for another trigger if RF POWER never came up'.

       :TYPE<n>?
       :TYPE<n>                        'TSC0' | 'TSC1' | 'TSC2' | 'TSC3' |
                                       'TSC4' | 'TSC5' | 'TSC6' | 'TSC7' |
                                       'RACH' | 'SCH' | 'FCH' | 'USER DEF'
##      Selects/queries the MSYNc BURSt TYPE for the selected burst number
##        n, where <n> = 0 to 3.  Note: this selects the type for both
##        MSYN:BURSt:TYPE<n> and DDEMod:BURSt:TYPE<n>.
```

```
        :UDSPattern<n>?
        :UDSPattern<n>                    <quoted string>
##      Sets/queries the MSYNc User Defined Sync Pattern definition
##        for the selected burst number n, where <n> = 0 to 3.

     :SYNC
##   MSYNc SYNC setting commands.

        :BSELect?
        :BSELect                          '0' | '1' | '2' | '3' | 'EXT'
##      Selects/queries the Burst SELection to SYNC measurements to.
##        0 means always sync to burst number 0.
##        1 means always sync to burst number 1.
##        2 means always sync to burst number 2.
##        3 means always sync to burst number 3.
##        EXT means use external signals to decide which
##          burst number to sync to.

        :BUSed?
##      Returns the burst definition that was selected (Burst USed) based on
##        Burst SELect (BSELect) when the measurement's ADC samples were taken.

        :MODE?
        :MODE                             'MIDAMBLE' | 'AMPLITUDE'
##      Selects/queries the SYNC MODE algorithm that is used to determine
##        the location of the demodulated data bits in the measured burst.
##        MIDAMBLE means sync using the best bit match of the demodulated
##        data bits to the selected midamble or user-defined sync pattern.
##        AMPLITUDE means sync by centering the burst in the detected
##        amplitude envelope.
```

Oscilloscope Subsystem

```
OSCilloscope

##  OSCilloscope subsystem setting commands.

   :CONTrol?
   :CONTrol                         'MAIN' | 'TRIGGER' | 'MARKER'
##  Selects/queries the OSCilloscope CONTrols - various
##    fields will appear based on the CONTrol selection.

   :MARKer

       :NPEak
##      Causes the OSCilloscope MARKer to move to the lowest
##        Negative PEak displayed.

       :PPEak
##      Causes the OSCilloscope MARKer to move to the highest
##        Positive PEak displayed.

       :POSition?
       :POSition                    <value> | [INUM]
##      Sets/queries the MARker POSition.  This is the number of divisions
##        from the left side of the graticule to the marker.

   :SCALe

       :TIME?
       :TIME                       '200 ms' | '100 ms' | '50 ms' | '20 ms' |
                                   '10 ms' | '5 ms' | '2 ms' | '1 ms', |
                                   '500 us' | '200 us' | '100 us' | '50 us' |
                                   '20 us' | '10 us' | '5 us' | '2 us' |
                                   '1 us'
##      Selects/queries the horizontal sweep time per division.
```

```
:VERTical

    :AM?
    :AM                       '100 %' | '50 %' | '20 %' | '10 %' | '5 %'|
                              '2 %' | '1 %' | '500 m%' | '200 m%' |
                              '100 m%' | '50 m%' | '20 m%' | '10 m%' |
                              '5 m%' | '2 m%' | '1 m%' | '500 u%' |
                              '200 u%' | '100 u%' | '50 u%' | '20 u%' |
                              '10 u%' | '5 u%' | '2 u%'
##      Selects/queries the VERTical amplitude per division for AF Analyzer
##        input selections (AFAN:INP) that have AM units of Percent.

    :FM?
    :FM                       '50 kHz' | '20 kHz' | '10 kHz' | '5 kHz' |
                              '2 kHz' | '1 kHz' | '500 Hz' | '200 Hz' |
                              '100 Hz' | '50 Hz' | '20 Hz' | '10 Hz' |
                              '5 Hz' | '2 Hz' | '1 Hz' | '500 mHz' |
                              '200 mHz' | '100 mHz' | '50 mHz' |
                              '20 mHz' |'10 mHz' | '5 mHz' | '2 mHz'
##      Selects/queries the VERTical amplitude per division for AF Analyzer
##        input selections (AFAN:INP) that have FM units of Hertz.

    :OFFSet?
    :OFFSet                     <value> | [INUM]
##      Sets/queries the number of divisions that the displayed signal is
##        VERTically OFFSet above the Oscilloscope's fixed centerline.

    :VOLTs?
    :VOLTs                    '20 V' | '10 V' | '5 V' | '2 V' | '1 V' |
                              '500 mV' | '200 mV' | '100 mV' | '50 mV' |
                              '20 mV' | '10 mV' | '5 mV' | '2 mV' |
                              '1 mV' | '500 uV' | '200 uV' | '100 uV' |
                              '50 uV' | '20 uV' | '10 uV' | '5 uV' |
                              '2 uV' | '1 uV' | '500 nV' | '200 nV' |
                              '100 nV' | '50 nV' | '20 nV' | '10 nV'
##      Selects/queries the VERTical amplitude per division for AF Analyzer
##        input selections (AFAN:INP) that have units of VOLTs.
```

```
:TRIGger

    :LEVel?
    :LEVel                          <value> | [INUM_MOD]
##   Sets/queries the TRIGger LEVel.  This only applies when TRIGger:SOURce
##     is 'Scope Lvl'.  The TRIGger LEVel is indicated by small pointers
##     that appear on each side of the graticule.
##      HP-IB units is DIV.
##      Example: "OSC:TRIG:LEV 2 DIV" set the oscilloscope trigger to 2
##      divisions above the horizontal axis.

    :MODE?
    :MODE                           'CONT' | 'SINGLE'
##   Selects/queries how measurements are armed to accept a trigger.
##     CONT means that the oscilloscope is continuously armed to
##       accept a trigger.
##     SINGLE means that the oscilloscope is armed to accept a trigger
##       each time that TRIGger:RESet is selected.
##   IMPORTANT: This command will set the trigger mode when in Local mode,
##     it is overridden by TRIGger:MODE:RETRigger REPetitive | SINGle
##     when in Remote mode.

    :PRETrigger?
    :PRETrigger                     <value> | [INUM_MOD]
##   Sets/queries the PRETrigger value.  This is the number of divisions
##     previous to the trigger point.

    :RESet
##   Arms a measurement when TRIGger:MODE 'SINGLE' is selected or when
##     TRIGger:MODE:RETRigger SINGle is selected.

    :SENSe?
    :SENSe                          'POS' | 'NEG'
##   Selects/queries whether TRIGgering occurs on the positive-going (POS)
##     or negative-going(NEG) trigger signal.
```

```
        :SOURce?
        :SOURce                          'SCOPE LVL' |'EXTERNAL'
##       Selects/queries the Oscilloscope TRIGger SOURce.
##         SCOPE LVL means that the input signal level is used for triggering.
##         EXTERNAL means that the front panel MEASURE TRIGGER IN is used
##           for triggering.

        :TYPE?
        :TYPE                            'AUTO' | 'NORM'
##       Selects/queries the Oscilloscope TRIGger TYPE.
##         AUTO means automatically trigger a sweep is a triggering signal
##           is not detected within about 50 ms of the last trigger.
##         NORM meas that a specific triggering signal is required before
##           triggering.
```

Output RF Spectrum Subsystem

```
ORFSpectrum

##  Output RF Spectrum subsystem setting commands.

    :FREQuency

        :OFFSet?
        :OFFSet                          <(value) [units]> | [FNUM]
##       Sets/queries the Output RF Spectrum FREQuency OFFSet setting.
##         This field is only used when not making reference measurements.
##         The offset is automatically set to 0.0 kHz when MODE is set to
##         either RAMP REF or MOD REF.
##         Default HP-IB unit is HZ.
##         Default display unit is kHZ.

    :MARKer
##   Output RF Spectrum MARKer functions.

        :POSition?
        :POSition                        <value> | [INUM]
##       Sets/queries the Output RF Spectrum MARKer POSition setting.
##         The value is given in units of divisions from the
##         left side of the trace (0 to 10 divisions).

    :MODE?
    :MODE                                'RAMP REF' | 'RAMPING' |
                                         'MOD REF' | 'MODULATN'
##   Selects/queries the MODE for Output RF Spectrum measurements.
##      RAMP REF means make a reference measurement needed to make
##        Output RF Spectrum due to ramping measurements.
##      RAMPING means power is measured for the Output RF Spectrum
##        during the time when the envelope is ramping up and down.
##        (The peak value is returned within the time interval 28 us
##        before bit 0 to 28 us after bit 147.)
##      MOD REF means make a reference measurement needed to make
##        Output RF Spectrum due to modulation measurements.
##      MODULATN (modulation) means power is measured for the Output
##        RF Spectrum during the useful bits.

    :SACalibrate
##   Calibrates the Spectrum Analyzer for making Output RF Spectrum
##     or Pulse On/Off Ratio measurements.  This command is only
##     active when TRIG:MODE[:DSP] = 'SINGLE'.
```

Pulse On/Off Ratio Subsystem

```
PULSe

##  PULSe On/Off Ratio subsystem setting commands.

     :MARKer
##    PULSe MARKer functions.

        [:POSition]

             :FALL?
             :FALL                       <value> | [INUM]
##            Sets/queries the PULSe MARKer FALL trace POSition
##              setting.  The value is given in units of divisions
##              from the left side of the trace (0 to 10 divisions).

             :RISE?
             :RISE                       <value> | [INUM]
##            Sets/queries the PULSe MARKer RISE trace POSition
##              setting.  The value is given in units of divisions
##              from the left side of the trace (0 to 10 divisions).

     :OPOSition

         :FALL                           <(value) [units]> | [FNUM]
##        Sets/queries the PULSe Off POSition FALL setting.
##          This is the time (relative to the center of the last bit)
##          that the amplitude on the amplitude envelope will be
##          measured.  The range is 0.0 us to +56.0 us.
##          HP-IB units are seconds (S), bit periods (T).
##            default unit is seconds (S),
##            default display unit is US (micro-second).
```

```
    :RISE                              <(value) [units]> | [FNUM]
##   Sets/queries the PULSe Off POSition RISE setting.
##     This is the time (relative to the center of bit zero) that
##     the amplitude on the amplitude envelope will be measured.
##     The range is -56.0 us to 0.0 us.
##     HP-IB units are seconds (S), bit periods (T).
##       default unit is seconds (S),
##       default display unit is US (micro-second).

  :SACalibrate
## Calibrates the Spectrum Analyzer for making Output RF Spectrum
##   or Pulse On/Off Ratio measurements.  This command is only
##   active when TRIG:MODE[:DSP] = 'SINGLE'.
```

RF Analyzer Subsystem

```
RFANalyzer

## RF ANalyzer subsystem setting commands.

   :AGC

       :CALibrate
##      Does an open loop AGC CALibration if in RFAN:AGC:MODE 'CLOSED'.

       :DVALue?
       :DVALue                          <value> | [INUM]
##      Sets/queries the open/auto AGC DAC VALue.

       :MODE?
       :MODE                            'CLOSED' | 'OPEN' | 'AUTO'
##      Selects/queries the AGC MODE.  (NORMAL is closed loop.)

   :AMPLitude1?
   :AMPLitude1                          <(value) [units]> | [FNUM]
##  Sets/queries the amplitude (input level to assume) of the
##    RF IN/OUT port.  Used when RFAN:INP is 'RF IN/OUT'.
##    HP-IB and display units are dBm, Volts (V) and Watts (W);
##      Default HP-IB and display unit is dBm.

   :AMPLitude2?
   :AMPLitude2                          <(value) [units]> | [FNUM]
##  Set/queries the amplitude (input level to assume) of the
##    AUX RF IN port.  Used when RFAN:INP is 'AUX RF IN'.
##    HP-IB and display units are dBm, Volts (V) and Watts (W);
##      Default HP-IB and display unit is dBm.
```

```
  [:AMPLitude]

       :ACCuracy?
       :ACCuracy                          '+-3dB' | '+-1dB'
##      Selects/queries the RF ANalyzer AMPLitude ACCuracy.

       :CONTrol?
       :CONTrol                           'MS TX LEV' | 'MANUAL'
##      Selects/queries the RFAnalyzer AMPLitude CONTrolling mechanism.
##        MS TX LEV means that the AMPLitude (RFAN:AMPL1 or RFAN:AMPL2)
##          is set automatically based on the setting of CELL:MS:TLEVel.
##        MANUAL means that the user can manually set the AMPLitude
##          (RFAN:AMPL1 or RFAN:AMPL2).

   :FREQuency?
   :FREQuency                             <(value) [units]> | [FNUM]
##  Sets/queries the non-hop FREQuency for the RF ANalyzer.
##    Default HP-IB unit is HZ.
##    Default display unit is MHZ.

       :HMEas?
       :HMEas                             <(value) [units]> | [FNUM]
##      Sets/queries the Hop Meas Frequency, which is the frequency
##        to be assumed when making measurements while hopping.
##        Default HP-IB unit is HZ.
##        Default display unit is MHZ.

       :OFFSet?
       :OFFSet                            <(value) [units]> | [FNUM]
##      Sets/queries the hop frequency OFFSet for the RF ANalyzer.
##        Default HP-IB unit is HZ.
##        Default display unit is kHZ.

   :GTIMe?
   :GTIMe                                 <(value) [units]> | [FNUM]
##  RF ANalyzer Gate TIME (RF Cnt Gate).
##    Default HP-IB unit is seconds (S).
##    Default display unit is micro-seconds (US).

   :INPut?
   :INPut                                 'RF IN/OUT' | 'AUX RF IN'
##  Selects/queries the selected INPut port for the RF ANalyzer.
```

RF Generator Subsystem

```
RFGenerator

## RF Generator subsystem setting commands.

   :AMPLitude1?
   :AMPLitude1                        <(value) [units]> | [FNUM]
##  Sets/queries the amplitude of the RF Generator when the RF IN/OUT
##    port is selected.
##    HP-IB and display units are dBm, Volts (V) and Watts (W);
##      Default HP-IB and display unit is dBm.

       :ATTenuation

          [:AUTO]?
          [:AUTO]                     'OFF' | 'ON'
##          Selects the ATTenuation of the RF IN/OUT port automatically
##            each time a change of amplitude setting occurs when ON.

   :AMPLitude2?
   :AMPLitude2                        <(value) [units]> | [FNUM]
##  Sets/queries the amplitude of the RF Generator when the AUX RFOUT
##    port is selected.
##    HP-IB and display units are dBm, Volts (V) and Watts (W);
##      Default HP-IB and display unit is dBm.

       :ATTenuation

          [:AUTO]?
          [:AUTO]                     'OFF' | 'ON'
##          Selects the ATTenuation of the AUX RFOUT port automatically
##            each time a change of amplitude setting occurs when ON.
```

```
   :FREQuency?
   :FREQuency                         <(value) [units]> | [FNUM]
##  Sets/queries the non-hop FREQuency of the RF Generator.
##    Default HP-IB unit is HZ.
##    Default display unit is MHZ.

   :MODulation

       :DCAM?
       :DCAM                          'EXTERNAL' | 'OFF' |
                                      'TCH LOWER' | 'BCCHLOWER' |
                                      'BOTHLOWER'
##      Selects/queries the state of DC AM MODulation.
##        EXTERNAL means DC AM comes from an external AM input.
##        OFF means no DC AM.
##        TCH LOWER means the BCCH will be at the RF Level of the RF Analyzer
##          Amplitude setting and the TCH RF Level will be lower by the dB
##          determined by setting RFANalyzer:INPut.
##        BCCHLOWER means the TCH will be at the RF Level of the RF Analyzer
##          Amplitude setting and the TCH RF Level will be lower by the dB
##          determined by setting RFANalyzer:INPut.
##        BOTHLOWER means both the TCH and the BCCH will be lower by the dB
##          determined by setting RFANalyzer:INPut.

          :DVALue?
          :DVALue                     <value> | [INUM]
##         Sets/queries the DC AM DAC VALue for RFG:MODE:DCAM
##           selected as TCH LOWER', 'BCCHLOWER' or 'BOTHLOWER'.

       :GMSK?
       :GMSK                          'EXT' | 'OFF'
##      Selects/queries the state of GMSK modulation.
##        EXT means GMSK comes from external data and clock inputs.
##        OFF means the RF output is an unmodulated carrier.
```

```
        :PULSe?
        :PULSe                          'EXT' | 'HOP TRIG' | 'OFF'
##       Selects/queries the state of PULSe modulation.
##         EXT means PULSe modulation comes from an external (TTL) input.
##         HOP TRIG means the RF output automatically pulses off (for a
##           little while) during switching transients when an RF Generator
##           hop trigger occurs.
##         OFF means no PULSe modulation.

            :MODE?
            :MODE                       'NORMAL' | '30 DB'
##           Selects/queries the pulse modulation level MODE.
##             NORMAL means pulse off will be very far down.
##             30 DB means the RF envelope will usually be 30 dB higher
##               than the selected amplitude and can be pulsed down to
##               the selected amplitude setting.

    :OUTPut?
    :OUTPut                             'RF IN/OUT' | 'AUX RFOUT'
##  Selects/queries the selected OUTPut port for the RF Generator.
```

Spectrum Analyzer Subsystem

```
SANalyzer

## Spectrum ANalyzer functions

   :ATTenuator? | ATTenuator1?
   :ATTenuator | ATTenuator1         '0 dB' | '10 dB' | '20 dB' |
                                     '30 dB' | '40 dB'
##  Selects/queries the input ATTenuator GSM900 selection.  This is
##    only valid when ATT1:MODE 'HOLD' is selected, otherwise,
##    automatic attenuator selection is done.
##    NOTE: This is only valid for CONFigure:RADio 'GSM900'.

       :MODE?
       :MODE                         'AUTO' | 'HOLD'
##      Selects/queries the ATTenuator1 MODE selection.

   :ATTenuator2?
   :ATTenuator2                      '0 dB' | '5 dB' | '10 dB' | '15 dB |
                                     '20 dB | '25 dB' | '30 dB' | '35 dB'
##  Selects/queries the input ATTenuator DSC1800 selection.  This is
##    only valid when ATT2:MODE 'HOLD' is selected, otherwise,
##    automatic attenuator selection is done.
##    NOTE: This is only valid for CONFigure:RADio 'DCS1800'.

       :MODE?
       :MODE                         'AUTO' | 'HOLD'
##      Selects/queries the ATTenuator2 MODE selection.

   :CFRequency?
   :CFRequency                       <(value) [units]> | [FNUM]
##  Center FRequency setting.  (This is the same as RFA:FREQ.)
##    Default HP-IB unit is HZ.
##    Default display unit is MHZ.

   :MARKer

       :CFRequency
##      Sets MARKer and signal to Center FRequency.

       :NPEak
##      Sets MARKer to Next PEak.

       :PEAK
##      Sets MARKer to PEAK.
```

```
        :POSition?
        :POSition                      <value> | [INUM]
##      Sets/queries the MARKer POSition setting.

        :RLEVel
##      Sets MARKer and signal to Reference LEVel.


    :RLEVel1?
    :RLEVel1                           <(value) [units]> | [FNUM]
##  Reference LEVel for the RF IN/OUT port.
##    HP-IB units are dBm, Volts (V) and Watts (W);
##      Default HP-IB and display unit is dBm.

    :RLEVel2?
    :RLEVel2                           <(value) [units]> | [FNUM]
##  Reference LEVel for the AUX RF IN port.
##    HP-IB units are dBm, Volts (V) and Watts (W);
##      Default HP-IB and display unit is dBm.

    :SPAN?
    :SPAN                              <(value) [units]> | [FNUM]
##  SPAN setting.  Default HP-IB unit is HZ.
##    Default display unit is MHz.

    :TRACe

        :MHOLd?
        :MHOLd               'ON' | 'OFF'
##      Selects/queries the Spectrum Analyzer Max HOLd
##        function for the TRACe as On or Off.


    :VBWidth?
    :VBWidth                           '30 kHz' | '100 kHz' | '1 MHz'
##  Selects/queries the Video BandWidth selection.
```

Status Subsystem

```
STATus
## STATus commands.

## Status Structure descriptions:
#******

Status Byte:

   bit definitions:

    7 - Operation Status Register
    6 - RQS
    5 - Standard Event Status Register
    4 - MAV
    3 - Questionable Data/Signal Status Register
    1 - Hardware 2 Status Register
    0 - Hardware 1 Status Register


Hardware 1 Status Register:  Status Byte Bit 0

   condition register bit definitions:

    7  - Communication Status Register Summary
    6  - Power up tests failed
    5 -  Pulse On Trace RF Overload    (PULSe)
    4  - Measurement Trigger too early (DSPanalyzer, ORFSpectrum, PULSe)
    3  - Measurement Trigger too late  (DSPanalyzer, ORFSpectrum, PULSe)
    2  - Measurement Sync Error        (DSPanalyzer, ORFSpectrum, PULSe)
    0  - Measurement armed             (DSPanalyzer, ORFSpectrum, PULSe)

   event register bit definitions:

    1  - Measurement Limit(s) Exceeded
    8  - EMMI Status Register Event Summary
    14 - OverPower Protection Tripped
```

```
Hardware 2 Status Register:  Status Byte Bit 1

   condition register bit definitions:

    2  - RF Frequency - change RF Gen Freq
    1  - RF Src Level setting
         - change Ref Level, Input Port or Attenuator (if using \"Hold\").",
    0  - RF Analyzer Level setting
         - change RF Gen Amplitude, Output Port or Atten Hold (if on).",


Questionable Data/Signal Status Register:  Status Byte Bit 3

## The QUEStionable status register set contains bits which give an
## indication of the quality of various aspects of the signal/data.
##
## A bit set in the condition register indicates that the data currently
## being acquired or generated is of questionable quality due to some
## condition affecting the parameter associated with that bit.

   condition register bit definitions:

    7  - CALibration Register Summary


Standard Event Status Register:  Status Byte Bit 5

   condition register bit definitions:

    5  - Command Error
    4  - Execution Error
    3  - Device Dependant Error
    2  - Query Error

   event register bit definitions:

    7  - Power On Occurred
    6  - User Request
    1  - Request Control
    0  - Operation Complete Occurred
```

```
Operation Status Register:  Status Byte Bit 7

## The OPERation status register set contains conditions which
## are part of the instrument's normal operation.

   condition register bit definitions:

    14 - PROGram running


Communication Status Register: Status Byte Bit 0,
                               Hardware 1 Status Register Bit 7

   condition register bit definitions:

    3 - Protocol Processor Communication Channel Failure
    2 - DSP Analyzer Communication Channel Failure
    1 - Hop Controller Communication Channel Failure
    0 - Communication failure with Signaling Board


CALibration Register: Status Byte Bit 3,
                      Questionable Data/Signal Status Register Bit 7

   condition register bit definitions:

    6  - Reference calibrate failure
    5  - AGC Open Loop cal failure
    3  - Voltmeter Self cal failure
    2  - Counter Self cal failure
    1  - Sampler Self cal failure
    0  - Spectrum Analyzer Self cal failure
```

```
EMMI Status Register: Status Byte Bit 0,
                      Hardware 1 Status Register Bit 8

   event register BIT definitions:

    3 - Response timeout
    2 - Mobile XON timeout
    1 - NAK
    0 - ACK

##  The   STATus:EMMI:EVENt? queries the EMMI STATus buffer.  When an
##  EMMI:DATA <data entry> occurs, one of the above bits will be set.
##  Reading the status will clear all bits, subsequently setting the EMMI
##  status to idle.  Based on the above bits, the status buffer will return
##  one of five numbers indicating the status of the last EMMI message sent by
##  the HP8922G.
##     (0) There was no data sent since that last status check and there were
##         no events to report, or the last EMMI:DATA <data entry> had
##         improper format.
##     (1) A message was received and acknowledged by the mobile station.
##         Important: this does not mean that the mobile was able to understand
##         or perform the operation (ACK received).
##     (2) The HP 8922G attempted to send a message, but the mobile station
##         did not receive the message intact (NAK received).
##     (4) EMMI data was sent, but the XON timeout expired before the
##         acknowledge was received (EMMI:TIMEout:MS:XON).
##     (8) EMMI data was sent, but the Response timeout expired
##        (EMMI:TIMEout:MS:RESPonse).


## Condition register bits will hold their state until the condition changes.
## Event register bits will be cleared as soon as they are read.
##
```

STAT is a symbol that designates the following list of optional commands that apply to given status subsystem.

Included in STAT are the following commands:

```
    :CONDition?
##   Queries the contents of the CONDition register associated
##     with the status structure defined in the command.

    :ENABle?
    :ENABle                          <value> | [INUM]
##   Sets/queries the ENABle mask which allows true conditions
##     in the event register to be reported in the summary bit.
##     If a bit is 1 in the enable register and its associated
##     event bit transitions to true, a positive transition will
##     occur in the associated summary bit.

   [:EVENt]?
##   Queries the contents of the EVENt register associated
##     with the status structure defined in the command.

    :NTRansition?
    :NTRansition                     <value> | [INUM]
##   Sets/queries the Negative TRansition filter.  Setting a bit in the
##     negative transition filter causes a 1 to 0 transition in the
##     corresponding bit of the associated CONDition register to cause a 1 to
##     be written in the associated bit of the corresponding EVENt register.

    :PTRansition?
    :PTRansition                     <value> | [INUM]
##   Sets/queries the Positive TRansition filter.  Setting a bit in the
##     positive transition filter causes a 0 to 1 transition in the
##     corresponding bit of the associated CONDition register to cause a 1 to
##     be written in the associated bit of the corresponding EVENt register.
```

```
STATus

    :CALibration
        [STAT]

    :COMMunication
        [STAT]

    :EMMI
        [STAT]

    :HARDware1
        [STAT]

    :HARDware2
        [STAT]

    :OPERation
        [STAT]

    :QUEStionable
        [STAT]

    :PRESet
##  PRESet configures the status data structures such that device-
##    dependent events are reported through the status-reporting
##    mechanism.  The preset command affects only the enable register
##    and transition filter registers.  (Presets all registers except
##    event status registers, service request enable register,
##    event status enable register and condition register bits.)

## NOTE - see IEEE 488.2 Common Commands for additional status commands.
```

System Subsystem

```
SYSTem

  [:ERRor]?
## Queries the SYSTem ERRor queue.  This returns an error number and
##   a corresponding quoted message string separated by a comma.
##   Once the error is queried, it is removed from the queue.  If the
##   error queue becomes full, then the earliest messages are removed.

##   Example: if a command parameter is given that is out of range, then
##   SYST:ERR? will return:
##        -200,"Execution error;Parameter value out of range."
```

Trigger Subsystem

```
TRIGger

## TRIGger commands.

NOTE: ASTate, SOURce, MODE[:DSPanalyzer] and UMEMory
      apply to the following types of measurements:
        DSPanalyzer - Phase, Amplitude, Data Bits
        PULSe       - Pulse On/Off Ratio
        ORFSpectrum - Output RF Spectrum
      DELay and HTCH apply to Digital Demod and Bit Error Test
      as well as the above measurements.

NOTE: ABORt, [IMMediate], and MODE are remote-only commands and apply to the
      following types of measurements: AF Analyzer, CW Meas, OSCilloscope,
      and SANalyzer.

   :ABORt
##  ABORts TRIGgering of a measurement that has been triggered using
##    TRIGger:IMMediate.

   :ASTate?
   :ASTate                                'ARM' | 'DISARM'
##  Selects/queries the Arm STate of the currently selected measurement.
##    This command is used for all appropriate measurements listed in the
##    MEASure subsystem.

   :BETest?
   :BETest                                'SINGLE' | 'CONT'
##  Selects/queries the TRIGger for Bit Error Test measurements
##    for local operation.
##    SINGLE means each Bit Error Test measurement will just be made once
##      (based on each measurement's definition of number of bits to
##      make the measurement over).
##    CONT means make each Bit Error Test measurement continuously,
##      repeatedly, copying Intermediate results into Complete results as
##      one or more of the termination conditions are met.
```

```
        :MODE?
        :MODE                             'RUN' | 'STOP'
##       Selects/queries the Bit Error Test measurement TRIGger MODE.
##         RUN initializes the Bit Error Test measurements to start and
##           starts all Bit Error Test measurements.
##         STOP Bit Error Test measurements - this is useful in aborting
##           long Bit Error Test measurements.

    :DDEMod

        :ADJMode?
        :ADJMode                          'ENABLED' | 'DISABLED'
##       Selects/queries the Digital DEMod TRIGger ADJust Mode.
##         Trigger adjust mode enables the user to change TRIG:DEL even
##         while Demod is armed.  Some Demod triggers will be missed while
##         changing trigger delay.

        :ASTate?
        :ASTate                           'ARM' | 'DISARM'
##       Selects/queries the Arm STate of the Digital DEMod TRIGger.
##         Must be on digital demod, cell configuration or cell control
##         screens to Arm Digital Demod.

        :SOURce?
        :SOURce                           'EXT MEAS' | 'EXT DEMOD' | 'RF RISE'
##       Selects/queries the Digital DEMod TRIGger SOURce.
##         EXT DEMOD means Demod is triggered from an external trigger
##            signal that is normally intended for doing Demod.
##         RF RISE means the measurement is triggered automatically when a
##            rising edge is detected on the RF envelope of the input.
##         EXT MEAS means Demod is triggered from an external trigger
##            signal that is normally intended for doing measurements.

    :DELay?
    :DELay                                <(value) [units]> | [FNUM]
##   Sets/queries the TRIGger DELay.  This applies to measurements
##     as well as Digital Demod.
##     HP-IB units are seconds (S), bit periods (T).
##     Default HP-IB unit is seconds (S).
##     Default display unit is bit periods (T).
```

```
   :HTCH                             'SPECIFIC' | 'AUTO'
##  Selects/queries the Hopped TCH ARFCN Trigger control.
##    This only applies when TCH:MODE is 'HOPPED' and the Cell Configuration
##    is 'ACTIVATED' and the radio has been assigned to a TCH channel.

     :ARFCn

        [:SPECific]?
        [:SPECific]                          < value >
##            Sets/queries the SPECific ARFCn to use for a Hopping
##              TCH measurement when TRIGger:TCH is set to 'SPECIFIC'.

           :AUTO?
##            Queries the ARFCn that is being used for a Hopping
##              TCH measurement when TRIGger:TCH is set to  'AUTO'.
##              This value is the lowest ARFCN in the currently used
##              MA table (MA1 or MA2).

   :[IMMediate]
##  IMMediately TRIGgers the currently active measurement.

   :MODE

      [:DSP]?
      [:DSP]                                 'SINGLE' | 'CONT'
##      Selects/queries the DSP TRIGger MODE as SINGLE or CONTinous.
##        This is used for Phase, Amplitude, Output RF Spectrum,
##        Pulse On/Off Ratio and Data Bits measurements.
##        NOTE: in CONTinous mode, the user does not manually arm
##              the instrument, but must provide a trigger in order
##              for the measurement to complete.
##        NOTE: This command is valid in both local and remote modes.

       :RETRigger?
       :RETRigger                            REPetitive | SINGle
##      Selects/queries the RETRigger MODE for the currently active
##        measurement.  Default setting is REPetitive.
##      IMPORTANT: The remote-only command will override local triggering
##            commands for continuous (repetitive) and single settings
##            for AF Analyzer, CW Meas, OSCilloscope, and SANalyzer.
```

```
   :SOURce?
   :SOURce                              'EXT MEAS' | 'EXT DEMOD' | 'RF RISE'
##   Selects/queries the measurement TRIGger SOURce.
##      EXT MEAS means the measurement is triggered from an external
##         trigger signal that is normally intended for doing measurements.
##      RF RISE means the measurement is triggered automatically when a
##         rising edge is detected on the RF envelope of the input.
##      EXT DEMOD means the measurement is triggered from an external
##         trigger signal that is normally intended for doing demod.


   :UMEMory
## Executes the Use MEMory function.  This is the same as hitting the
##   USE MEM hardkey on the front panel.

       :SOURce?
       :SOURce                          'EXTERNAL' | 'BAD SYNC'
##      Selects/queries the USE MEM (Use MEMory) TRIGger SOURce.
##        BAD SYNC means that the UMEMory (USE MEM) memory will be
##          automatically filled when the Demod Sync Status changes from
##          'No Error' to 'Bad Sync' (DDEMod:SYNC:SSTatus?).
##        EXTERNAL means that the UMEMory (USE MEM) memory will be
##          automatically filled when an external line on the SYSTEM BUS
##          connector on the rear panel is in a particular state when a
##          valid demod trigger occurs.

       :STATus?
##      Returns 'No Data', 'New Data' or 'Old Data'.
##        NO DATA means that the UMEMory (USE MEM) memory contains
##          no valid data.
##        NEW DATA means that the UMEMory (USE MEM) memory contains
##          newly captured data from the most recent time demod was
##          armed (TRIGger:DDEMod:ASTate 'ARM') and bad synchronization
##          occurred (midamble did not exactly match the bits in the
##          defined midamble).
##        OLD DATA means that the UMEMory (USE MEM) memory contains
##          previously captured data from a previous time demod was
##          armed (TRIGger:DDEMod:ASTate 'ARM') or from a previous
##          DSP analyzer, Output RF Spectrum or Pulse On/Off Ratio
##          measurement (TRIGger:ASTate 'ARM').
```

HP-IB Program Examples

The following examples illustrate control of the HP 8922G from an external controller through the HP-IB interface. There are eight examples:

1. Mobile station "camp" on.
2. HP 8922G originated call.
3. Mobile station originated call.
4. Ending a call.
5. Bit error test.
6. DSP Analyzer measurement during a call.
7. Pulse On/Off measurement without call processing.
8. High speed DSP Analyzer measurements.

The examples were written with few subprograms or subroutines to make the program listings easier to follow.

Mobile Station Camp On Example

```
10    !
20    ! Example 01
30    !
40    ! Getting a Mobile Station to "Camp On":
50    !   Sets up the HP 8922G to output a broadcast channel and gets the
60    !   mobile station to camp on to the broadcast channel.
70    !
80    !******************************************************************
90    ! System Configuration:
100   ! - Connect mobile station to the HP 8922G RF IN/OUT port.
110   !
120   !******************************************************************
130   ! Declarations:
140   !
150   ASSIGN @Test_set TO 714          ! Assign an I/O path to the HP 8922G
160                                    ! at HP-IB address 714.
170   DIM Ba_table$[126]               ! Base station allocation table string
180                                    ! variable.
190   DIM System_error$[80]            ! System error message string variable.
200   !
210   ! System dependent parameters:
220   Ncc=1                            ! Network Color Code.
230   Bcc=5                            ! Base station Color Code.
240   Serving_arfcn=25                 ! Serving cell ARFCN.
250   Control_channel$="'SD/8'"        ! Control channel selection.
260   Cont_ch_arfcn=30                 ! Control channel ARFCN.
270   Cont_ch_tslot=2                  ! Control channel time slot.
280                                    ! Base station allocation table:
290   Ba_table$="'0000000000"          ! ARFCN 1 through 10.
300   Ba_table$=Ba_table$&"0000000000"! ARFCN 11 through 20.
310   Ba_table$=Ba_table$&"0000100000"! ARFCN 21 through 30.
320   Ba_table$=Ba_table$&"0000000000"! ARFCN 31 through 40.
330   Ba_table$=Ba_table$&"0000000000"! ARFCN 41 through 50.
340   Ba_table$=Ba_table$&"0000000000"! ARFCN 51 through 60.
350   Ba_table$=Ba_table$&"0000000000"! ARFCN 61 through 70.
360   Ba_table$=Ba_table$&"0000000000"! ARFCN 71 through 80.
370   Ba_table$=Ba_table$&"0000000000"! ARFCN 81 through 90.
380   Ba_table$=Ba_table$&"0000000000"! ARFCN 91 through 100.
390   Ba_table$=Ba_table$&"0000000000"! ARFCN 101 through 110.
400   Ba_table$=Ba_table$&"0000000000"! ARFCN 111 through 120.
410   Ba_table$=Ba_table$&"0000'"      ! ARFCN 121 through 124.
```

```
420   Mcc=1                              ! Mobile Country Code.
430   Mnc=1                              ! Mobile Network Code.
440   Lac=1                              ! Location Area Code.
450   !
460   !**********************************************************************
470   !
480   !----------------------------------------------------------------------
490   ! Set Up HP 8922G
500   !----------------------------------------------------------------------
510   ! Instrument Preset.
520   OUTPUT @Test_set;"*RST"
530   !
540   ! Display the Cell Configuration screen.
550   OUTPUT @Test_set;"DISPLAY:SCREEN CCON"
560   !
570   ! Zero the power meter for future power measurements.
580   ! Turn down RF Generator amplitude first to avoid interference.
590   OUTPUT @Test_set;"RFGENERATOR:AMPLITUDE1 -127 dBm"
600   OUTPUT @Test_set;"CW:PMZERO"
610   !
620   ! Set RF Generator output amplitude.
630   OUTPUT @Test_set;"RFGENERATOR:AMPLITUDE1 -85 dBm"
640   !
650   ! Set the Network Color Code and the Base station Color Code.
660   OUTPUT @Test_set;"CCONFIGURE:SCELL:NCC ";Ncc
670   OUTPUT @Test_set;"CCONFIGURE:SCELL:BCC ";Bcc
680   !
690   ! Set the serving cell ARFCN.
700   OUTPUT @Test_set;"CCONFIGURE:SCELL:ARFCN ";Serving_arfcn
710   !
720   ! Set the base station allocation table.
730   OUTPUT @Test_set;"CCONFIGURE:BA "&Ba_table$
740   !
750   ! Set the control channel organization.
760   OUTPUT @Test_set;"CCONFIGURE:CCHANNEL "&Control_channel$
```

```
770   !
780   ! Set the control channel ARFCN and timeslot.
790   OUTPUT @Test_set;"CCONFIGURE:CCHANNEL:SDCCH8:ARFCN ";Cont_ch_arfcn
800   OUTPUT @Test_set;"CCONFIGURE:CCHANNEL:SDCCH8:TSLOT ";Cont_ch_tslot
810   !
820   ! Set the Mobile Country Code, the Mobile Network Code, and the
830   ! Location Area Code.
840   OUTPUT @Test_set;"CCONFIGURE:LAI:MCCODE ";Mcc
850   OUTPUT @Test_set;"CCONFIGURE:LAI:MNCODE ";Mnc
860   OUTPUT @Test_set;"CCONFIGURE:LAI:LACODE ";Lac
870   !
880   ! Select the Cell Configure Activated state.
890   OUTPUT @Test_set;"CCONFIGURE:STAT 'ACTIVATED'"
900   !
910   !-------------------------------------------------------------------
920   ! Wait for the HP 8922G to Output a Broadcast Channel
930   !-------------------------------------------------------------------
940   ! Wait for up to 20 seconds for BCCH.
950   Time_out=20
960   Time_exceeded$="NO"               ! Timeout variable.
970   Start_time=TIMEDATE               ! Time reference for timeout.
980   !
990   ! Wait until BCCH is output.
1000  REPEAT
1010    ! Short wait to allow HP 8922G to process information.
1020    WAIT .2
1030    DISP "Waiting for HP 8922G to provide a BCCH..."
1040    ! Query the Cell Control radio resource signaling state.
1050    OUTPUT @Test_set;"CELL:CALL:STATUS:RR?"
1060    ENTER @Test_set;Call_status$
1070    !
1080    ! Check to see if time allotted has been exceeded.
1090    IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
1100    !
1110    ! Exit the loop if a BCCH is present or time allotted has been
1120    ! exceeded.
1130  UNTIL Call_status$="""BCCH""" OR Time_exceeded$="YES"
```

```
1140 !
1150 !----------------------------------------------------------------------
1160 ! Validate Results
1170 !----------------------------------------------------------------------
1180 ! Check for system errors.
1190 ! Query all system errors that may be in the queue.
1200 REPEAT
1210   OUTPUT @Test_set;"SYSTEM:ERROR?"
1220   ENTER @Test_set;System_error$
1230   Sys_err_number=VAL(System_error$)
1240   !
1250   ! System error number 0 corresponds to NO ERROR.
1260   IF Sys_err_number<>0 THEN
1270     PRINT "Results are invalid."
1280     PRINT "System Error: "&System_error$
1290   END IF
1300   !
1310 UNTIL Sys_err_number=0
1320 !
1330 ! Check to see if time allotted was exceeded.
1340 IF Time_exceeded$="YES" THEN
1350   DISP "Camp failure. No BCCH is present."
1360 ELSE
1370   DISP "BCCH is present."
1380 END IF
1390 END
```

HP 8922G Originated Call Example

```
10    !
20    ! Example 02
30    !
40    ! HP 8922G Originated Call:
50    !   Sets up the HP 8922G with information about the mobile station and
60    !   places a base station originated call.
70    !
80    !**********************************************************************
90    ! System Configuration:
100   ! - Connect mobile station to the RF IN/OUT port.
110   ! - MS should be camped (see example 01).
120   !
130   !**********************************************************************
140   ! Declarations:
150   !
160   ASSIGN @Test_set TO 714          ! Assign an I/O path to the HP 8922G
170                                    ! at HP-IB address 714.
180   DIM System_error$[80]            ! System error message string variable.
190   !
200   ! Mobile station dependent parameters:
210   Ms_tx_level=6                    ! Mobile station transmit level.
220   Imsi$="'001010000000001'"        ! Mobile station's International Mobile
230                                    ! Subscriber Identity (IMSI).
240   !
250   !**********************************************************************
260   !
270   !----------------------------------------------------------------------
280   ! Set Up HP 8922G and Originate Call
290   !----------------------------------------------------------------------
300   ! Display the Cell Control screen.
310   OUTPUT @Test_set;"DISPLAY:SCREEN CELL"
320   !
```

```
330   ! Set the traffic channel  parameters.
340   ! Set traffic channel mode to non-hopped.
350   OUTPUT @Test_set;"CELL:TCH1:MODE 'SINGLE'"
360   !
370   ! Set the traffic channel to ARFCN 62.
380   OUTPUT @Test_set;"CELL:TCH1:ARFCN 62"
390   !
400   ! Set the traffic channel type to full rate speech.
410   OUTPUT @Test_set;"CELL:TCH1:TYPE 'FS'"
420   !
430   ! Set the traffic channel to time slot 4.
440   OUTPUT @Test_set;"CELL:TCH1:TSLOT 4"
450   !
460   ! Set the mobile station transmit level. Wait a maximum of 1 second to
470   ! allow the mobile to process the command.
480   OUTPUT @Test_set;"CELL:MS:TLEVEL ";Ms_tx_level
490   WAIT 1
500   !
510   ! Set RF Analyzer amplitude automatically based on the MS transmit level.
520   OUTPUT @Test_set;"RFANALYZER:AMPLITUDE:CONTROL 'MS TX LEV'"
530   !
540   ! Set the mobile station paging IMSI.
550   OUTPUT @Test_set;"MSINFO:PAGING:IMSI "&Imsi$
560   !
570   ! Originate the call.
580   OUTPUT @Test_set;"CELL:CALL:ORIGINATE"
590   !
600   !-----------------------------------------------------------------------
610   ! Wait for the Call to be Connected
620   !-----------------------------------------------------------------------
630   ! Wait up to 30 seconds for the call to connect.
640   Time_out=30
650   Time_exceeded$="NO"            ! Timeout variable.
660   Start_time=TIMEDATE            ! Time reference for timeout.
670   !
680   ! Wait for call to connect.
```

```
690   REPEAT
700     ! Short wait to allow HP 8922G to process information.
710     WAIT .2
720     DISP "Waiting for mobile to answer..."
730     ! Query the call status state.
740     OUTPUT @Test_set;"CELL:CALL:STATUS:STATE?"
750     ENTER @Test_set;Call_status$
760     !
770     ! Check to see if time allotted has been exceeded.
780     IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
790     !
800     ! Exit the loop if the call is connected or time allotted has been
810     ! exceeded.
820   UNTIL Call_status$="""CONNECTED""" OR Time_exceeded$="YES"
830   !
840   !----------------------------------------------------------------
850   ! Validate Results
860   !----------------------------------------------------------------
870   ! Check for system errors.
880   ! Query all system errors that may be in the queue.
890   REPEAT
900     OUTPUT @Test_set;"SYSTEM:ERROR?"
910     ENTER @Test_set;System_error$
920     Sys_err_number=VAL(System_error$)
930     !
940     ! System error number 0 corresponds to NO ERROR.
950     IF Sys_err_number<>0 THEN
960       PRINT "Results are invalid."
970       PRINT "System Error: "&System_error$
980     END IF
990     !
1000  UNTIL Sys_err_number=0
1010  !
1020  ! Check to see if time allotted was exceeded.
1030  IF Time_exceeded$="YES" THEN
1040    DISP "Connection Failure. Call not connected."
1050  ELSE
1060    DISP "Call in process..."
1070  END IF
1080  END
```

Mobile Station Originated Call Example

```
10    !
20    ! Example 03
30    !
40    ! Receive a Mobile Station Originated Call:
50    !   Sets up the HP 8922G to receive a mobile station originated call.
60    !
70    !*******************************************************************
80    ! System Configuration:
90    ! - Connect mobile station to the RF IN/OUT port.
100   ! - MS should be camped (see example 01).
110   !
120   !*******************************************************************
130   ! Declarations:
140   !
150   ASSIGN @Test_set TO 714        ! Assign an I/O path to the HP 8922G
160                                  ! at HP_IB address 714.
170   DIM System_error$[80]          ! System error message string variable.
180   DIM Ms_o_number$[22]           ! MS originated number string variable.
185   DIM Rach_cnt$[8]               ! RACH count string variable.
190   !
200   ! Mobile station dependent parameters:
210   Ms_tx_level=6                  ! Mobile station transmit level.
220   !
230   !*******************************************************************
240   !
250   !-------------------------------------------------------------------
260   ! Set Up the HP 8922G
270   !-------------------------------------------------------------------
280   ! Display the Cell Control screen.
290   OUTPUT @Test_set;"DISPLAY:SCREEN CELL"
300   !
```

```
310   ! Set the traffic channel parameters.
320   ! Use traffic channel 1 parameters.
330   OUTPUT @Test_set;"CELL:CALL:TCHCONTROL 'TCH1 ASGN'"
340   !
350   ! Set the traffic channel mode to non-hopped.
360   OUTPUT @Test_set;"CELL:TCH1:MODE 'SINGLE'"
370   !
380   ! Set the traffic channel to ARFCN 62.
390   OUTPUT @Test_set;"CELL:TCH1:ARFCN 62"
400   !
410   ! Set the traffic channel type to full rate speech.
420   OUTPUT @Test_set;"CELL:TCH1:TYPE 'FS'"
430   !
440   ! Set the traffic channel to time slot 4.
450   OUTPUT @Test_set;"CELL:TCH1:TSLOT 4"
460   !
470   ! Set the mobile station transmit level. Wait a maximum of 1 second to
480   ! allow the mobile to process the command.
490   OUTPUT @Test_set;"CELL:MS:TLEVEL ";Ms_tx_level
500   WAIT 1
510   !
520   ! Set RF Analyzer amplitude automatically based on the MS transmit
530   ! level.
540   OUTPUT @Test_set;"RFANALYZER:AMPLITUDE:CONTROL 'MS TX LEV'"
550   !
600   ! Set the audio speech configuration to echo speech back to the mobile.
610   ! Wait a maximum of 0.5 seconds to allow the HP 8922G to process the
620   ! commmand.
630   OUTPUT @Test_set;"CELL:AUDIO:SPEECH:CONFIGURE 'ECHO'"
640   WAIT .5
```

```
650    !
660    ! Set the audio speech echo delay time to 1 second.
670    OUTPUT @Test_set;"CELL:AUDIO:SPEECH:EDELAY 1 S"
680    !
690    ! Reset the call count fields to zero and wait for reset to take place.
700    ! Wait a maximum of 1 second to allow the HP 8922G to process the
710    ! command.
720    OUTPUT @Test_set;"CELL:CALL:COUNT:RESET"
730    WAIT 1
740    !
750    !---------------------------------------------------------------------
760    ! Wait For Mobile to Originate Call
770    !---------------------------------------------------------------------
780    ! Wait up to 120 seconds for the mobile to begin the call.
790    Time_out=120
800    Time_exceeded$="NO"               ! Timeout variable.
810    Start_time=TIMEDATE               ! Time reference for timeout.
820    !
830    ! Wait for mobile to send a RACH.
840    REPEAT
850      ! Short wait to allow HP 8922G to process information.
860      WAIT .2
870      DISP "Waiting for mobile to call... Originate a call from the mobile."
880      ! Query call count for RACH received.
890      OUTPUT @Test_set;"CELL:CALL:COUNT:RACH?"
900      ENTER @Test_set;Rach_cnt
905      Rach_count=VAL(Rach_cnt$)
910      !
920      ! Check to see if time allotted has been exceeded.
930      IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
940      !
950      ! Exit loop if a RACH has been sent or time allotted has been
960      ! exceeded.
970    UNTIL Rach_count>=1 OR Time_exceeded$="YES"
```

```
980   !
990   !----------------------------------------------------------------------
1000  ! Validate Results and Continue
1010  !----------------------------------------------------------------------
1020  ! Check for system errors.
1030  ! Query all system errors that may be in the queue.
1040  REPEAT
1050    OUTPUT @Test_set;"SYSTEM:ERROR?"
1060    ENTER @Test_set;System_error$
1070    Sys_err_number=VAL(System_error$)
1080    !
1090    ! System error number 0 corresponds to NO ERROR.
1100    IF Sys_err_number<>0 THEN
1110      PRINT "Results are invalid."
1120      PRINT "System Error: "&System_error$
1130    END IF
1140    !
1150  UNTIL Sys_err_number=0
1160  !
1170  ! Check to see if time allotted was exceeded.
1180  IF Time_exceeded$="YES" THEN
1190    DISP "Connection Failure. No RACH was received."
1200  ELSE
1210    !
1220    !--------------------------------------------------------------------
1230    ! Wait For Call to Reach Alerting State
1240    !--------------------------------------------------------------------
1250    ! Wait up to 20 seconds for the call to reach the alerting state.
1260    Time_out=20
1270    Time_exceeded$="NO"           ! Timeout variable.
1280    Start_time=TIMEDATE           ! Time reference for timeout.
1290    !
1300    ! Wait for call to reach alerting state.
```

```
1310     REPEAT
1320       ! Short wait to allow HP 8922G to process information.
1330       WAIT .2
1340       DISP "Waiting for call to reach alerting state... "
1350       ! Query call status state.
1360       OUTPUT @Test_set;"CELL:CALL:STATUS:STATE?"
1370       ENTER @Test_set;Call_status$
1380       !
1390       ! Check to see if time allotted has been exceeded.
1400       IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
1410       !
1420       ! Exit loop if call status state reaches alerting or time allotted
1430       ! has been exceeded.
1440     UNTIL Call_status$="""ALERTING""" OR Time_exceeded$="YES"
1450     !
1460     !------------------------------------------------------------------
1470     ! Validate Results and Receive Call
1480     !------------------------------------------------------------------
1490     ! Check for system errors.
1500     ! Query all system errors that may be in the queue.
1510     REPEAT
1520       OUTPUT @Test_set;"SYSTEM:ERROR?"
1530       ENTER @Test_set;System_error$
1540       Sys_err_number=VAL(System_error$)
1550       !
1560       ! System error number 0 corresponds to NO ERROR.
1570       IF Sys_err_number<>0 THEN
1580         PRINT "Results are invalid."
1590         PRINT "System Error: "&System_error$
1600       END IF
1610       !
1620     UNTIL Sys_err_number=0
1630     !
1640     ! Check to see if time allotted was exceeded.
1650     IF Time_exceeded$="YES" THEN
1660       DISP "Connection Failure. Call did not reach alerting state."
1670     ELSE
1680       ! Receive the call.
1690       OUTPUT @Test_set;"CELL:CALL:RECEIVE"
```

```
1700      !
1710      !----------------------------------------------------------------
1720      ! Wait for the Call to be Connected
1730      !----------------------------------------------------------------
1740      ! Wait up to 20 seconds for the call to connect.
1750      Time_out=20
1760      Time_exceeded$="NO"        ! Timeout variable.
1770      Start_time=TIMEDATE        ! Time reference for timeout.
1780      !
1790      ! Wait for call to connect.
1800      REPEAT
1810        ! Short wait to allow HP 8922G to process information.
1820        WAIT .2
1830        DISP "Waiting for call to be connected..."
1840        ! Query the call status state.
1850        OUTPUT @Test_set;"CELL:CALL:STATUS:STATE?"
1860        ENTER @Test_set;Call_status$
1870        !
1880        ! Check to see if time allotted has been exceeded.
1890        IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
1900        !
1910        ! Exit loop if the call is connected or time allotted has been
1920        ! exceeded.
1930      UNTIL Call_status$="""CONNECTED""" OR Time_exceeded$="YES"
1940      !
1950      !----------------------------------------------------------------
1960      ! Validate Results and Print MS Parameters
1970      !----------------------------------------------------------------
1980      ! Check for system errors.
1990      ! Query all system errors that may be in the queue.
2000      REPEAT
2010        OUTPUT @Test_set;"SYSTEM:ERROR?"
2020        ENTER @Test_set;System_error$
2030        Sys_err_number=VAL(System_error$)
2040        !
2050        ! System error number 0 corresponds to NO ERROR.
2060        IF Sys_err_number<>0 THEN
2070          PRINT "Results are invalid."
2080          PRINT "System Error: "&System_error$
2090        END IF
2100        !
```

```
2110      UNTIL Sys_err_number=0
2120      !
2130      ! Check to see if time allotted was exceeded.
2140      IF Time_exceeded$="YES" THEN
2150        DISP "Connection Failure. Call not connected."
2160      ELSE
2170        DISP "Call in process..."
2180        ! Determine the mobile station parameters.
2190        ! Query and print the class mark power class.
2200        OUTPUT @Test_set;"MSINFO:MS:CMARK:PCLASS?"
2210        ENTER @Test_set;Power_class
2220        PRINT "MS Power Class is ";Power_class
2230        !
2240        ! Query and print the MS originated number.
2250        OUTPUT @Test_set;"MSINFO:MS:ONUMBER?"
2260        ENTER @Test_set;Ms_o_number$
2270        PRINT "MS Originated Number is ";Ms_o_number$
2280        !
2290        ! Query and print the MS IMSI.
2300        OUTPUT @Test_set;"MSINFO:MS:IMSI?"
2310        ENTER @Test_set;Imsi$
2320        PRINT "MS IMSI is ";Imsi$
2330        !
2340        ! Copy the MS IMSI to the MS paging IMSI for future base station
2350        ! originated calls.
2360        OUTPUT @Test_set;"MSINFO:MS:IMSI:SPAGING"
2370        !
2380        ! Request the IMEI from the MS.
2390        OUTPUT @Test_set;"MSINFO:MS:IMEI:REQUEST"
2400        !
2410        ! Query and print the IMEI.
2420        ! Wait for MS to respond to IMEI request.
2430        DISP "Waiting for mobile to send IMEI..."
2440        ! The mobile may take up to 10 seconds to send the IMEI. Normally
2450        ! the IMEI is sent in less than 2 seconds.
2460        WAIT 2
2470        ! Query the IMEI.
2480        OUTPUT @Test_set;"MSINFO:MS:IMEI?"
2490        ENTER @Test_set;Imei$
2500        PRINT "MS IMEI is ";Imei$
2510        !
2520        DISP "Call in progress..."
2530        !
2540      END IF
2550    END IF
2560  END IF
2570  END
```

Ending A Call Example

```
10    !
20    ! Example 04
30    !
40    ! Ending a Call From the HP 8922G:
50    !
60    !*******************************************************************
70    ! System Configuration:
80    ! - Connect mobile station to the RF IN/OUT port.
90    ! - MS should be camped (see example 01).
100   ! - Call should be in progress (see example 02 or 03).
110   !
120   !*******************************************************************
130   ! Declarations:
140   !
150   ASSIGN @Test_set TO 714          ! Assign an I/O path to the HP 8922G
160                                    ! at HP-IB address 714.
170   DIM System_error$[80]            ! System error message string variable.
180   !
190   !*******************************************************************
200   !
210   !-------------------------------------------------------------------
220   ! End the Call and Wait for Call Status State to Reach Inactive
230   !-------------------------------------------------------------------
240   ! Display the Cell Control screen.
250   OUTPUT @Test_set;"DISPLAY:SCREEN CELL"
260   !
270   ! End the call.
280   OUTPUT @Test_set;"CELL:CALL:END"
290   !
300   ! Wait up to 20 seconds for the call to reach the inactive state.
310   Time_out=20
320   Time_exceeded$="NO"              ! Timeout variable.
330   Start_time=TIMEDATE              ! Time reference for timeout.
```

```
340   !
350   ! Wait for call to reach inactive state.
360   REPEAT
370     ! Short wait to allow HP 8922G to process information.
380     WAIT .2
390     DISP "Waiting for call to end..."
400     ! Query call status state.
410     OUTPUT @Test_set;"CELL:CALL:STATUS:STATE?"
420     ENTER @Test_set;Call_status$
430     !
440     ! Check to see if time allotted has been exceeded.
450     IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
460     !
470     ! Exit loop if call status state reaches inactive or time allotted
480     ! has been exceeded.
490   UNTIL Call_status$="""INACTIVE""" OR Time_exceeded$="YES"
500   !
510   !-----------------------------------------------------------------------
520   ! Validate the Results and Wait for Radio Resource State to Reach BCCH
530   !-----------------------------------------------------------------------
540   ! Check for system errors.
550   ! Query all system errors that may be in the queue.
560   REPEAT
570     OUTPUT @Test_set;"SYSTEM:ERROR?"
580     ENTER @Test_set;System_error$
590     Sys_err_number=VAL(System_error$)
600     !
610     ! System error number 0 corresponds to NO ERROR.
620     IF Sys_err_number<>0 THEN
630       PRINT "Results are invalid."
640       PRINT "System Error: "&System_error$
650     END IF
660     !
```

```
670   UNTIL Sys_err_number=0
680   !
690   ! Check to see if time allotted was exceeded.
700   IF Time_exceeded$="YES" THEN
710     DISP "Call End Failure. Call status is not 'INACTIVE'"
720   ELSE
730     ! Wait for up to 20 seconds for radio resource state to reach BCCH.
740     Time_out=20
750     Time_exceeded$="NO"           ! Timeout variable.
760     Start_time=TIMEDATE           ! Time reference for timeout.
770     !
780     ! Wait for radio resource state to reach BCCH.
790     REPEAT
800       ! Short wait to allow HP 8922G to process information.
810       WAIT .2
820       DISP "Waiting for call to end..."
830       ! Query the radio resource signaling state.
840       OUTPUT @Test_set;"CELL:CALL:STATUS:RR?"
850       ENTER @Test_set;Rr_status$
860       !
870       ! Check to see if time allotted has been exceeded.
880       IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
890       !
900       ! Exit loop if the radio resource signaling state is BCCH or time
910       ! allotted has been exceeded.
920     UNTIL Rr_status$="""BCCH""" OR Time_exceeded$="YES"
930     !
940     !-------------------------------------------------------------------
950     ! Validate the Results
960     !-------------------------------------------------------------------
970     ! Check for system errors.
980     ! Query all system errors that may be in the queue.
```

```
990     REPEAT
1000      OUTPUT @Test_set;"SYSTEM:ERROR?"
1010      ENTER @Test_set;System_error$
1020      Sys_err_number=VAL(System_error$)
1030      !
1040      ! System error number 0 corresponds to NO ERROR.
1050      IF Sys_err_number<>0 THEN
1060        PRINT "Results are invalid."
1070        PRINT "System Error: "&System_error$
1080      END IF
1090      !
1100    UNTIL Sys_err_number=0
1110    !
1120    ! Check to see if time allotted was exceeded.
1130    IF Time_exceeded$="YES" THEN
1140      DISP "Call End Failure. Signaling status is not 'BCCH'"
1150    ELSE
1160      DISP "Call ended."
1170    END IF
1180  END IF
1190  END
```

Bit Error Test Example

```
10    !
20    ! Example 05
30    !
40    ! Bit Error Test Example:
50    !   Runs a TYPE IA test and a Residual Type II test simultaneously
60    !   for 10,000 bits.
70    !   First determines the loopback loop delay for the design of the
80    !   mobile station under test. This only needs to be done once for a
90    !   given mobile station design. It will not change from mobile to
100   !   mobile.
110   !   Results for the first test are returned in terms of total bit
120   !   errors and ratio of frame erasures to total frames. Results for the
130   !   second test are returned in terms of bit error ratio and total
140   !   number of frame erasures.
150   !
160   !**********************************************************************
170   ! System Configuration:
180   ! - Connect mobile station to the RF IN/OUT port.
190   ! - MS should be camped (see example 01).
200   ! - A call should be in progress (see example 02 or 03).
210   !
220   !**********************************************************************
230   ! Declarations:
240   !
250   ASSIGN @Test_set TO 714          ! Assign an I/O path to the HP 8922G
260                                    ! at HP-IB address 714.
270   DIM System_error$[80]            ! System error message string variable.
280   !
290   !**********************************************************************
300   !
```

```
310   !-------------------------------------------------------------------------
320   ! Measurement Setup
330   !-------------------------------------------------------------------------
340   ! Display the Cell Control screen.
350   OUTPUT @Test_set;"DISPLAY:SCREEN CELL"
360   !
370   ! Make sure digital demodulation is  armed.
380   OUTPUT @Test_set;"TRIGGER:DDEMOD:ASTATE 'ARM'"
390   !
400   ! Turn on loopback with frame erasure. Wait a maximum of 1 second to
410   ! allow the mobile to process the command.
420   OUTPUT @Test_set;"CELL:AUDIO:LOOPBACK:FE"
430   WAIT 1
440   !
450   ! Select the PRBS audio speech configuration. Wait a maximum of 2
460   ! seconds to allow the HP 8922G to process the command.
470   OUTPUT @Test_set;"CELL:AUDIO:SPEECH:CONFIGURE 'PRBS'"
480   WAIT 2
490   !
500   ! Display the Bit Error Test screen.
510   OUTPUT @Test_set;"DISPLAY:SCREEN BET"
520   !
530   ! Set the measurement number to be displayed on the left and right side
540   ! of the Bit Error Test screen
550   OUTPUT @Test_set;"DISPLAY:BETEST:MNUMBER:LEFT '1'"
560   OUTPUT @Test_set;"DISPLAY:BETEST:MNUMBER:RIGHT '2'"
570   !
580   ! Set the Bit Error Test type.
590   OUTPUT @Test_set;"BETEST:TYPE1 'TYPEIA' "
600   OUTPUT @Test_set;"BETEST:TYPE2 'RESTYPEII' "
610   OUTPUT @Test_set;"BETEST:TYPE3 'OFF' "
620   OUTPUT @Test_set;"BETEST:TYPE4 'OFF' "
630   !
640   ! Set the number of bits to test.
650   OUTPUT @Test_set;"BETEST:BITS1 10000"
660   OUTPUT @Test_set;"BETEST:BITS2 10000"
670   !
```

```
680   ! Select the single measurement mode.
690   OUTPUT @Test_set;"TRIGGER:BETEST 'SINGLE'"
700   !
710   !--------------------------------------------------------------------
720   ! Begin a Partial Bit Error Test to Determine the Loopback Loop Delay
730   !--------------------------------------------------------------------
740   ! Set RF Generator output amplitude to a high level to minimize bit
750   ! errors.
760   OUTPUT @Test_set;"RFGENERATOR:AMPLITUDE1 -85 dBm"
770   !
780   ! Set the loopback loop delay automatically when the bit error tests
790   ! are started. Start with a value of 1. After the measurement check to
800   ! make sure the value changes. A valid loopback loop delay will always
810   ! be greater than one for a PRBS pattern.
820   OUTPUT @Test_set;"BETEST:LOOPBACK:LDELAY:MODE 'MANUAL'"
830   OUTPUT @Test_set;"BETEST:LOOPBACK:LDELAY 1"
840   OUTPUT @Test_set;"BETEST:LOOPBACK:LDELAY:MODE 'AUTO'"
850   !
860   ! Reset the call counts. The call counts will be used to check for
870   ! sync errors during the bit error test. Sync status is not used in
880   ! this case because bad syncs are common when a call is first
890   ! established. Resetting the call counts and then checking the number
900   ! of bad syncs after the measurement is complete checks for sync errors
910   ! during the measurement itself.
920   ! A wait is not used after the reset in this case because there is
930   ! enough time for the HP 8922G to process the command before the
940   ! call count query.
950   OUTPUT @Test_set;"CELL:CALL:COUNT:RESET"
960   !
970   ! Check for system errors that occurred prior to the bit error tests.
980   OUTPUT @Test_set;"SYSTEM:ERROR?"
990   ENTER @Test_set;System_error$
1000  Sys_err_number=VAL(System_error$)
1010  !
```

```
1020  IF Sys_err_number<>0 THEN
1030    PRINT "Measurement Results Invalid."
1040    PRINT "System Error: "&System_error$
1050    !
1060    ! Query all system errors that may be in the queue.
1070    REPEAT
1080      OUTPUT @Test_set;"SYSTEM:ERROR?"
1090      ENTER @Test_set;System_error$
1100      Sys_err_number=VAL(System_error$)
1110      !
1120      ! System error number 0 corresponds to NO ERROR.
1130      IF Sys_err_number<>0 THEN
1140        PRINT "System Error: "&System_error$
1150      END IF
1160      !
1170    UNTIL Sys_err_number=0
1180    !
1190    DISP "Bit Error Test Failure. System error prior to test."
1200    GOTO End_of_test
1210  END IF
1220  !
1230  ! Run the partial bit error tests.
1240  OUTPUT @Test_set;"TRIGGER:BETEST:MODE 'RUN'"
1250  !
1260  !--------------------------------------------------------------------
1270  ! Wait for Bit Error Test to Complete 1000 Bits
1280  !--------------------------------------------------------------------
1290  ! Wait up to 10 seconds for bit error test to complete 1000 bits.
1300  Time_out=10
1310  Time_exceeded$="NO"            ! Timeout variable.
1320  Start_time=TIMEDATE            ! Time reference for timeout.
1330  !
1340  ! Wait until 1000 bits have been tested.
```

```
1350 REPEAT
1360   ! Short wait to allow HP 8922G to process information.
1370   WAIT .2
1380   !
1390   DISP "Waiting for bit error test to complete 1000 bits..."
1400   ! Query the number of bits tested.
1410   OUTPUT @Test_set;"MEASURE:BETEST:IBTESTED1?"
1420   ENTER @Test_set;Bits_tested
1430   !
1440   ! Check to see if time allotted has been exceeded.
1450   IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
1460   !
1470   ! Exit loop if 1000 bits have been tested or time allotted has been
1480   ! exceeded.
1490 UNTIL Bits_tested>=1000 OR Time_exceeded$="YES"
1500 !
1510 ! Stop Bit Error Test.
1520 OUTPUT @Test_set;"TRIGGER:BETEST:MODE 'STOP'"
1530 !
1540 !----------------------------------------------------------------------
1550 ! Validate Measurement and Query Loopback Loop Delay
1560 !----------------------------------------------------------------------
1570 ! Check call counts for errors that occurred while synchronizing to
1580 ! midamble of demodulated data.
1590 OUTPUT @Test_set;"CELL:CALL:COUNT:BSYNC?"
1600 ENTER @Test_set;Bad_syncs
1610 !
1620 ! Check for system errors that occurred during the bit error tests.
1630 OUTPUT @Test_set;"SYSTEM:ERROR?"
1640 ENTER @Test_set;System_error$
1650 Sys_err_number=VAL(System_error$)
1660 !
```

```
1670 IF Bad_syncs>0 OR Sys_err_number<>0 THEN
1680   PRINT "Measurement Results Invalid."
1690   PRINT "Number of Bad Syncs: ";Bad_syncs
1700   PRINT "System Error: "&System_error$
1710   !
1720   ! Query all system errors that may be in the queue.
1730   REPEAT
1740     OUTPUT @Test_set;"SYSTEM:ERROR?"
1750     ENTER @Test_set;System_error$
1760     Sys_err_number=VAL(System_error$)
1770     !
1780     ! System error number 0 corresponds to NO ERROR.
1790     IF Sys_err_number<>0 THEN
1800       PRINT "System Error: "&System_error$
1810     END IF
1820     !
1830   UNTIL Sys_err_number=0
1840   !
1850   DISP "Bit Error Test Failure. Error during loop delay determination."
1860   GOTO End_of_test
1870   !
1880 END IF
1890 !
1900 ! Check to see if time allotted was exceeded.
1910 IF Time_exceeded$="YES" THEN
1920   DISP "BET Failure. Did not determine loop delay within allotted time."
1930   !
1940   GOTO End_of_test
1950   !
1960 ELSE
1970   !
1980   ! Query the loopback loop delay. This value will be constant for a
1990   ! given mobile station design. Once the value has been determined it
2000   ! can be used until the mobile design changes.
2010   OUTPUT @Test_set;"BETEST:LOOPBACK:LDELAY?"
2020   ENTER @Test_set;Loop_delay
2030   !
2040   ! Check loop delay to make sure it was changed from a value of 1 by
2050   ! the automatic loop delay process.
2060   IF Loop_delay<=1 THEN
2070     DISP "Bit Error Test Failure. Invalid Loopback Loop Delay."
2080     !
2090     GOTO End_of_test
2100     !
2110   END IF
2120 END IF
```

```
2130  !
2140  ! Set the loopback loop delay to manual mode using the delay determined
2150  ! in auto mode.
2160  OUTPUT @Test_set;"BETEST:LOOPBACK:LDELAY:MODE 'MANUAL'"
2170  !
2180  !---------------------------------------------------------------------
2190  ! Begin the Bit Error Test
2200  !---------------------------------------------------------------------
2210  ! Reset the call counts. The call counts will be used to check for
2220  ! sync errors during the bit error test. Sync status is not used in
2230  ! this case because bad syncs are common when a call is first
2240  ! established. Resetting the call counts and then checking the number
2250  ! of bad syncs after the measurement is complete checks for sync errors
2260  ! during the measurement itself.
2270  ! A wait is not used after the reset in this case because there is
2280  ! enough time for the HP 8922G to process the command before the
2290  ! call count query.
2300  OUTPUT @Test_set;"CELL:CALL:COUNT:RESET"
2310  !
2320  ! Set RF Generator output amplitude to a low level for bit error test.
2330  OUTPUT @Test_set;"RFGENERATOR:AMPLITUDE1 -100 dBm"
2340  !
2350  ! Run the bit error tests.
2360  OUTPUT @Test_set;"TRIGGER:BETEST:MODE 'RUN'"
2370  !
2380  !---------------------------------------------------------------------
2390  ! Wait for Bit Error Test to Complete
2400  !---------------------------------------------------------------------
2410  ! Wait up to 10 seconds for bit error test to complete.
2420  Time_out=10
2430  Time_exceeded$="NO"            ! Timeout variable.
2440  Start_time=TIMEDATE            ! Time reference for timeout.
2450  !
2460  ! Wait until measurements have completed.
```

```
2470 REPEAT
2480   ! Short wait to allow HP 8922G to process information.
2490   WAIT .2
2500   !
2510   DISP "Waiting for bit error test to end..."
2520   ! Query the bit error test mode.
2530   OUTPUT @Test_set;"TRIGGER:BETEST:MODE?"
2540   ENTER @Test_set;Bet_status$
2550   !
2560   ! Check to see if time allotted has been exceeded.
2570   IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
2580   !
2590   ! Exit loop if bit error test is completed or time allotted has been
2600   ! exceeded.
2610 UNTIL Bet_status$="""STOP""" OR Time_exceeded$="YES"
2620 !
2630 !----------------------------------------------------------------------
2640 ! Validate Measurement and Print Results
2650 !----------------------------------------------------------------------
2660 !
2670 ! Check call counts for errors that occurred while synchronizing to
2680 ! midamble of demodulated data.
2690 OUTPUT @Test_set;"CELL:CALL:COUNT:BSYNC?"
2700 ENTER @Test_set;Bad_syncs
2710 !
2720 ! Check for system errors that occurred during the bit error tests.
2730 OUTPUT @Test_set;"SYSTEM:ERROR?"
2740 ENTER @Test_set;System_error$
2750 Sys_err_number=VAL(System_error$)
2760 !
2770 IF Bad_syncs>0 OR Sys_err_number<>0 THEN
2780   PRINT "Measurement Results Invalid."
2790   PRINT "Number of Bad Syncs: ";Bad_syncs
2800   PRINT "System Error: "&System_error$
2810   !
2820   ! Query all system errors that may be in the queue.
```

```
2830    REPEAT
2840      OUTPUT @Test_set;"SYSTEM:ERROR?"
2850      ENTER @Test_set;System_error$
2860      Sys_err_number=VAL(System_error$)
2870      !
2880      ! System error number 0 corresponds to NO ERROR.
2890      IF Sys_err_number<>0 THEN
2900        PRINT "System Error: "&System_error$
2910      END IF
2920      !
2930    UNTIL Sys_err_number=0
2940    !
2950  END IF
2960  !
2970  ! Check to see if time allotted was exceeded.
2980  IF Time_exceeded$="YES" THEN
2990    DISP "Bit Error Test Failure. Did not complete within allotted time."
3000    !
3010    ! Stop Bit Error Test.
3020    OUTPUT @Test_set;"TRIGGER:BETEST:MODE 'STOP'"
3030  ELSE
3040    !
3050    !-------------------------------------------------------------------
3060    ! Select How Test Results Will be Returned
3070    !-------------------------------------------------------------------
3080    ! Select how bit errors will be returned.
3090    OUTPUT @Test_set;"MEASURE:BETEST:BESELECT1 'BE COUNT'"
3100    OUTPUT @Test_set;"MEASURE:BETEST:BESELECT2 'BE RATIO'"
3110    !
3120    ! Set bit error ratio units for measurement 2 to percent.
3130    OUTPUT @Test_set;"MEASURE:BETEST:BERROR:RATIO2:UNITS PCT"
3140    !
3150    ! Set frame loss type and selection for both measurements.
3160    OUTPUT @Test_set;"MEASURE:BETEST:FLTYPE1 'FE'"
3170    OUTPUT @Test_set;"MEASURE:BETEST:FLSELECT1 'RATIO'"
3180    OUTPUT @Test_set;"MEASURE:BETEST:FLTYPE2 'CRC'"
3190    OUTPUT @Test_set;"MEASURE:BETEST:FLSELECT2 'COUNT'"
3200    !
3210    ! Set frame erasure ratio units for measurement 1 to parts per
3220    ! million.
3230    OUTPUT @Test_set;"MEASURE:BETEST:FERASURE:RATIO1:UNITS PPM"
3240    !
```

```
3250    !--------------------------------------------------------------------
3260    ! Query and Print the Measurement Results
3270    !--------------------------------------------------------------------
3280    ! Number of bits tested for measurement 1.
3290    OUTPUT @Test_set;"MEASURE:BETEST:BTESTED1?"
3300    ENTER @Test_set;Bits_tested_1
3310    PRINT "Measurement 1: Bits tested = ";Bits_tested_1
3320    !
3330    ! Bit Error Count for measurement 1.
3340    OUTPUT @Test_set;"MEASURE:BETEST:BERROR:COUNT1?"
3350    ENTER @Test_set;Bet_count_1
3360    PRINT "               Bit Error Count = ";Bet_count_1
3370    !
3380    ! Frame Erasure ratio for measurement 1.
3390    OUTPUT @Test_set;"MEASURE:BETEST:FERASURE:RATIO1?"
3400    ENTER @Test_set;Frame_erasure_1
3410    PRINT "               Frame Erasure Ratio (ppm) = ";Frame_erasure_1
3420    PRINT
3430    !
3440    ! Number of bits tested for measurement 2.
3450    OUTPUT @Test_set;"MEASURE:BETEST:BTESTED2?"
3460    ENTER @Test_set;Bits_tested_2
3470    PRINT "Measurement 2: Bits tested = ";Bits_tested_2
3480    !
3490    ! Bit Error Ratio for measurement 2.
3500    OUTPUT @Test_set;"MEASURE:BETEST:BERROR:RATIO2?"
3510    ENTER @Test_set;Bet_ratio_2
3520    PRINT "               Bit Error Ratio (%) = ";Bet_ratio_2
3530    !
3540    ! CRC Count measurement 2.
3550    OUTPUT @Test_set;"MEASURE:BETEST:CRC:COUNT2?"
3560    ENTER @Test_set;Crc_count_2
3570    PRINT "               CRC Count = ";Crc_count_2
3580    !
3590    DISP "Bit Error Test Complete."
3600  END IF
3610 End_of_test: !
3620  END
```

DSP Analyzer Measurement During a Call Example

```
10    !
20    ! Example 06
30    !
40    ! Measurement Setup with Call In Process.
50    !   Performs a phase error (RMS and Peak) and a frequency error
60    !   measurement on a mobile station after a call has been placed.
70    !
80    !
90    !*****************************************************************
100   ! System Configuration:
110   ! - Connect mobile station to the RF IN/OUT port.
120   ! - Mobile Station should be camped (see example 01).
130   ! - A call should be in progress (see example 02 or 03).
140   !
150   !*****************************************************************
160   ! Declarations:
170   !
180   ASSIGN @Test_set TO 714          ! Assign an I/O path to the HP 8922G
190                                    ! at HP-IB address 714.
200   DIM System_error$[80]            ! System error message string variable.
210   !
220   Traffic_arfcn=62                 ! Traffic channel ARFCN.
230   !
240   !*****************************************************************
250   !
260   !-----------------------------------------------------------------
270   ! Measurement Setup
280   !-----------------------------------------------------------------
290   ! Set the measurement to be made. Digital demodulation is automatically
300   ! disarmed when a measurement screen is displayed.
310   OUTPUT @Test_set;"DISPLAY:SCREEN DSP"
320   !
330   ! Make sure the RF Analyzer is not hopping.
340   OUTPUT @Test_set;"HOPCONTROL:RFANALYZER:TRIGGER:ASTATE 'DISARM'"
350   OUTPUT @Test_set;"HOPCONTROL:RFANALYZER:MODE 'NON-HOP'"
```

```
360   !
370   ! Set the RF Analyzer frequency to the traffic channel ARFCN.
380   OUTPUT @Test_set;"RFANALYZER:FREQUENCY ";890+Traffic_arfcn*.2;" MHz"
390   !
400   !----------------------------------------------------------------------
410   ! Arm the Measurement and Wait for the Measurement to Complete.
420   !----------------------------------------------------------------------
430   ! Arm the measurement. Wait a maximum of 1 second to allow the
440   ! HP 8922G to begin the measurement.
450   OUTPUT @Test_set;"TRIGGER:ASTATE 'ARM'"
460   WAIT 1
470   !
480   ! Wait up to 20 seconds for the measurement to complete.
490   Time_out=20
500   Time_exceeded$="NO"            ! Timeout variable.
510   Start_time=TIMEDATE            ! Time reference for timeout.
520   !
530   ! Wait for the trigger arm state to reach disarmed.
540   REPEAT
550     ! Short wait to allow HP 8922G to process information.
560     WAIT .2
570     DISP "Waiting for measurement to complete..."
580     ! Query the trigger arm state.
590     OUTPUT @Test_set;"TRIGGER:ASTATE?"
600     ENTER @Test_set;Arm_state$
610     !
620     ! Check to see if time alloted for measurement has been
630     ! exceeded.
640     IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
650     ! Exit loop if measurement is complete or time allotted has been
660     ! exceeded.
670   UNTIL Arm_state$="""DISARM""" OR Time_exceeded$="YES"
```

```
680   !
690   !-------------------------------------------------------------------
700   ! Validate Measurement and Print Results
710   !-------------------------------------------------------------------
720   ! Check sync status for error during the DSP Analyzer measurement.
730   OUTPUT @Test_set;"MEASURE:DSPANALYZER:SSTATUS?"
740   ENTER @Test_set;Sync_status$
750   ! For DSP Analyzer, Output RF Spectrum, and Pulse On/Off measurements,
760   ! the string returned for sync status is in mixed upper and lower case.
770   ! To avoid confusion, and ensure future software compatibility, set the
780   ! string to all upper case before making string comparisons using the
790   ! sync status for these measurements.
800   Sync_status$=UPC$(Sync_status$)
810   !
820   ! Check for system errors.
830   OUTPUT @Test_set;"SYSTEM:ERROR?"
840   ENTER @Test_set;System_error$
850   Sys_err_number=VAL(System_error$)
860   !
870   IF Sync_status$<>"""NO ERROR""" OR Sys_err_number<>0 THEN
880     PRINT "Measurement Results Invalid."
890     PRINT "Sync Status is: "&Sync_status$
900     PRINT "System Error: "&System_error$
910     !
920     ! Query all system errors that may be in the queue.
930     REPEAT
940       OUTPUT @Test_set;"SYSTEM:ERROR?"
950       ENTER @Test_set;System_error$
960       Sys_err_number=VAL(System_error$)
970       !
980       IF Sys_err_number<>0 THEN
990         PRINT "System Error: "&System_error$
1000      END IF
1010      !
1020    UNTIL Sys_err_number=0
1030    !
1040  END IF
```

```
1050  !
1060  ! Check to see if time allotted was exceeded.
1070  IF Time_exceeded$="YES" THEN
1080    DISP "Measurement Failure. Did not complete within allotted time."
1090    !
1100    ! Disarm the measurement.
1110    OUTPUT @Test_set;"TRIGGER:ASTATE 'DISARM'"
1120  ELSE
1130    ! Query and print the measurement results.
1140    OUTPUT @Test_set;"MEASURE:DSPANALYZER:PHASE:ERROR:RMS?"
1150    ENTER @Test_set;Phase_err_rms
1160    PRINT "RMS Phase Error = ";Phase_err_rms
1170    !
1180    OUTPUT @Test_set;"MEASURE:DSPANALYZER:PHASE:ERROR:PEAK?"
1190    ENTER @Test_set;Phase_err_peak
1200    PRINT "Peak Phase Error = ";Phase_err_peak
1210    !
1220    OUTPUT @Test_set;"MEASURE:DSPANALYZER:PHASE:ERROR:FREQUENCY?"
1230    ENTER @Test_set;Freq_error
1240    PRINT "Frequency Error = ";Freq_error
1250    !
1260    DISP "Measurement complete."
1270    !
1280  END IF
1290  END
```

Pulse On/Off Measurement without Call Processing Example

```
10    !
20    ! Example 07
30    !
40    ! Measurement Setup with No Call Placed.
50    !   Performs a pulse on/off measurement on a device under test
60    !   that does not have call processing capabilities.
70    !
80    !**********************************************************************
90    ! System Configuration:
100   ! - Connect Device Under Test to the RF IN/OUT port.
110   ! - Device Under Test should be set up to transmit as follows:
120   !          - RF output frequency: 902.4 MHz
130   !          - RF output amplitude:  31 dBm
140   !          - Midamble: TSC5
150   ! - A trigger signal should be provided that is synchronous with the
160   !   transmitted signal.
170   ! - The trigger signal's location, with respect to bit 0 of the burst
180   !   to be measured, must be known within +1.1 /-2.0 bits.
190   ! - Trigger signal should be connected to Front Panel MEASURE: TRIGGER
200   !   IN connector.
210   !
220   !**********************************************************************
230   ! Declarations:
240   !
250   ASSIGN @Test_set TO 714          ! Assign an I/O path to the HP 8922G
260                                    ! at HP-IB address 714.
270   DIM System_error$[80]            ! System error message strung variable.
280   !
290   ! Device Dependent Parameters:
300   Rf_an_ampl=31                    ! RF Analyzer amplitude (in dBm).
310   Rf_an_freq=902.4                 ! RF Analyzer frequency (in MHz).
320   Trigger_delay=0                  ! Location of trigger signal, relative
330                                    ! to the center of bit 0 of the burst
340                                    ! to be measured (in bit periods).
350   Tsc$="TSC5"                      ! Training sequence code.
360   Off_pos_rise=-28                 ! Measurement position for the rising
370                                    ! edge of the burst, relative to bit 0
380                                    ! (in microseconds).
```

```
390   Off_pos_fall=28                  ! Measurement position for the falling
400                                    ! edge of the burst, relative to the
410                                    ! last bit of the burst (in
420                                    ! microseconds).
430   !
440   !------------------------------------------------------------------
450   ! Measurement Setup
460   !------------------------------------------------------------------
470   ! Instrument Preset.
480   OUTPUT @Test_set;"*RST"
490   !
500   ! Set the RF Analyzer amplitude (in dBm).
510   OUTPUT @Test_set;"RFANALYZER:AMPLITUDE1 ";Rf_an_ampl
520   !
530   ! Set the RF Analyzer frequency (in MHz).
540   OUTPUT @Test_set;"RFANALYZER:FREQUENCY ";Rf_an_freq;" MHz"
550   !
560   ! Set the measurement sync information:
570   ! Burst selected:
580   OUTPUT @Test_set;"MSYNC:SYNC:BSELECT '0'"
590   !
600   ! Burst type:
610   OUTPUT @Test_set;"MSYNC:BURST:TYPE0 '"&Tsc$&"'"
620   !
630   ! Set the trigger source.
640   OUTPUT @Test_set;"TRIGGER:SOUR 'EXT MEAS'"
650   !OUTPUT @Test_set;"TRIG:SOUR 'EXT DEMOD'"
660   !
670   ! Set the trigger delay.
680   OUTPUT @Test_set;"TRIGGER:DELAY ";Trigger_delay;" T"
690   !
700   ! Set the measurement to be made.
710   OUTPUT @Test_set;"DISPLAY:SCREEN PULSE"
720   !
730   ! Set the measurement position for the rising and falling edges of
740   ! the burst.
```

```
750    OUTPUT @Test_set;"PULSE:OPOSITION:RISE ";Off_pos_rise;" US"
760    OUTPUT @Test_set;"PULSE:OPOSITION:FALL ";Off_pos_fall;" US"
770    !
780    ! Initiate a spectrum analyzer calibration.
790    ! HP 8922G will not process any new commands until the calibration
800    ! is complete.
810    OUTPUT @Test_set;"PULSE:SACALIBRATE"
820    !
830    !----------------------------------------------------------------------
840    ! Arm the Measurement and Wait for the Measurement to Complete
850    !----------------------------------------------------------------------
860    ! Arm the measurement. Wait a maximum of 1 second for the HP 8922 to
870    ! begin the measurement.
880    OUTPUT @Test_set;"TRIG:ASTATE 'ARM'"
890    WAIT 1
900    !
910    ! Wait up to 20 seconds for the measurement to complete.
920    Time_out=20
930    Time_exceeded$="NO"            ! Timeout variable.
940    Start_time=TIMEDATE            ! Time reference for timeout.
950    !
960    ! Wait for the trigger arm state to reach disarmed.
970    REPEAT
980      ! Short wait to allow HP 8922G to process information.
990      WAIT .2
1000     DISP "Waiting for measurement to complete..."
1010     ! Query the trigger arm state.
1020     OUTPUT @Test_set;"TRIGGER:ASTATE?"
1030     ENTER @Test_set;Arm_state$
1040     !
1050     ! Check to see if time alloted for measurement has been
1060     ! exceeded.
1070     IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
1080     ! Exit loop if arm state is 'DISARM' or time allotted has been
1090     ! exceeded.
```

```
1100 UNTIL Arm_state$="""DISARM""" OR Time_exceeded$="YES"
1110 !
1120 !-----------------------------------------------------------------------
1130 ! Validate the Measurement and Print Results
1140 !-----------------------------------------------------------------------
1150 ! Check sync status for errors during the DSP Analyzer measurement.
1160 OUTPUT @Test_set;"MEASURE:PULSE:SSTATUS?"
1170 ENTER @Test_set;Sync_status$
1180 ! For DSP Analyzer, Output RF Spectrum, and Pulse On/Off measurements,
1190 ! the string returned for sync status is in mixed upper and lower case.
1200 ! To avoid confusion, and ensure future software compatibility, set the
1210 ! string to all upper case before making string comparisons using the
1220 ! sync status for these measurements.
1230 Sync_status$=UPC$(Sync_status$)
1240 !
1250 ! Check for system errors.
1260 OUTPUT @Test_set;"SYSTEM:ERROR?"
1270 ENTER @Test_set;System_error$
1280 Sys_err_number=VAL(System_error$)
1290 !
1300 IF Sync_status$<>"""NO ERROR""" OR Sys_err_number<>0 THEN
1310   PRINT "Measurement Results Invalid."
1320   PRINT "Sync Status is: "&Sync_status$
1330   PRINT "System Error: "&System_error$
1340   !
1350   ! Query all system errors that may be in the queue.
1360   REPEAT
1370     OUTPUT @Test_set;"SYSTEM:ERROR?"
1380     ENTER @Test_set;System_error$
1390     Sys_err_number=VAL(System_error$)
1400     !
1410     ! System error number 0 corresponds to NO ERROR.
1420     IF Sys_err_number<>0 THEN
1430       PRINT "System Error: "&System_error$
1440     END IF
```

```
1450      !
1460    UNTIL Sys_err_number=0
1470    !
1480  END IF
1490  !
1500  ! Check to see if time allotted was exceeded.
1510  IF Time_exceeded$="YES" THEN
1520    DISP "Measurement Failure. Did not complete within allotted time."
1530    !
1540    ! Disarm the measurement.
1550    OUTPUT @Test_set;"TRIGGER:ASTATE 'DISARM'"
1560    !
1570  ELSE
1580    ! Query and print the measurement results.
1590    PRINT "Pulse On/Off:"
1600    !
1610    OUTPUT @Test_set;"MEASURE:PULSE:OORATIO:RISE?"
1620    ENTER @Test_set;Ooratio_rise
1630    !
1640    PRINT "   Rise Position = ";Off_pos_rise;" uSec"
1650    ! Check for "No Measurement Results" indication.
1660    ! Number returned of approximatley 1.7E+308 indicates there are no
1670    ! results available for the query.
1680    IF Ooratio_rise>1.E+300 THEN
1690      PRINT "   On/Off Ratio = ---- dB"
1700    ELSE
1710      PRINT "   On/Off Ratio = ";Ooratio_rise;" dB"
1720    END IF
1730    PRINT
1740    !
1750    OUTPUT @Test_set;"MEASURE:PULSE:OORATIO:FALL?"
1760    ENTER @Test_set;Ooratio_fall
1770    !
1780    PRINT "   Fall Position = ";Off_pos_fall;" uSec"
1790    ! Check for "No Measurement Results" indication.
1800    ! Number returned of approximatley 1.7E+308 indicates there are no
1810    ! results available for the query.
1820    IF Ooratio_fall>1.E+300 THEN
1830      PRINT "   On/Off Ratio = ---- dB"
1840    ELSE
1850      PRINT "   On/Off Ratio = ";Ooratio_fall;" dB"
1860    END IF
1870    PRINT
1880    !
1890    DISP "Measurement Complete."
1900    !
1910  END IF
1920  END
```

High Speed DSP Analyzer Measurement Example

```
10    !
20    ! Example 08
30    !
40    ! Fast Characterization of Phase Noise with No Call Placed.
50    !   Performs a statistical analysis of many phase error measurements
60    !   on a device under test that does not have call processing
70    !   capabilities.
80    !
90    !   Phase and frequency error measurements of a device under test
100   !   will result in varying answers.  This is primarily due to the
110   !   windowing effect of the time during which the measurement is
120   !   made.  Larger low frequency phase noise will tend to make these
130   !   measurements more variable.  By performing a statistical analysis
140   !   of many measurements, the user can be more certain if a change
150   !   in measurement results is due to a change in radio performance
160   !   or due to the random nature of these measurements.
170   !
180   !**********************************************************************
190   ! System Configuration:
200   ! - Connect Device Under Test to the RF IN/OUT port
210   ! - Device Under Test should be set up to transmit as follows:
220   !        - RF output frequency: 902.4 MHz
230   !        - RF output amplitude:  31 dBm
240   !        - Midamble: TSCO
250   ! - A trigger signal should be provided that is synchronous with the
260   !   transmitted signal.
270   ! - The trigger signal's location, with respect to bit 0 of the burst
280   !   to be measured, must be known within +50 /-20 bits.
290   ! - Trigger signal should be connected to Front Panel MEASURE: TRIGGER
300   !   IN connector.
310   !**********************************************************************
320   !
```

```
330   ! Declarations:
340   INTEGER N,Meas_number,Error_flag,Error_count
350   DIM A$[30]
360   ASSIGN @Test_set TO 714         ! Assign an I/O path to the HP 8922 at
370                                   ! HP-IB address 714.
380   ON TIMEOUT 7,30 CALL Hpib_abort ! Call an error reporting subroutine
390                                   ! if HP-IB is not working or if
400                                   ! triggers are not present.
410                                   ! The interface select code is 7 and
420                                   ! a 30 second timeout is used.
430   !
440   ! Device Dependent Parameters:
450   Rf_an_ampl=31                   ! RF Analyzer amplitude (in dBm).
460   Rf_an_freq=902.4                ! RF Analyzer frequency (in MHz).
470   Trigger_delay=0                 ! Location of trigger signal, relative
480                                   ! to the center of bit 0 to be
490                                   ! measured (in bit periods).
500   Tsc$="TSC0"                     ! Training sequence code.
510   Meas_number=20                  ! Number of measurements to take.
520                                   ! The standard deviation of the mean
530                                   ! decreases as the square root of
540                                   ! the number of measurements.
550   !
560   !-------------------------------------------------------------------
570   ! Measurement Setup
580   !-------------------------------------------------------------------
590   CLEAR SCREEN
600   !
610   !
620   ! Instrument Preset.
630   OUTPUT @Test_set;"*RST"
640   !
650   ! Set the RF Analyzer amplitude (in dBm).
660   OUTPUT @Test_set;"RFANALYZER:AMPLITUDE1 ";Rf_an_ampl
670   !
680   ! Set the RF Analyzer frequency (in MHz).
690   OUTPUT @Test_set;"RFANALYZER:FREQUENCY ";Rf_an_freq;" MHz"
```

```
700   !
710   ! Set the midamble.
720   OUTPUT @Test_set;"MSYNC:BURST:TYPEO '"&Tsc$&"'"
730   !
740   ! Set the trigger source.
750   OUTPUT @Test_set;"TRIGGER:SOURCE 'EXT MEAS'"
760   !
770   ! Set the trigger delay.
780   OUTPUT @Test_set;"TRIGGER:DELAY ";Trigger_delay;" T"
790   !
800   ! Set the measurement to be made.
810   OUTPUT @Test_set;"DISPLAY:SCREEN:DSP:VIEW 'PHASEMAIN'"
820   OUTPUT @Test_set;"DISPLAY:SCREEN DSP"
830   !
840   ! This is an optional line that will save 50 milliseconds per
850   ! measurement.  It saves the time that would be used to update the
860   ! DSP phase screen.
870   OUTPUT @Test_set;"DISPLAY RFG"
880   !
890   !-----------------------------------------------------------------------
900   ! Initialize statistics variables
910   !-----------------------------------------------------------------------
920   Spk=0
930   Spk2=0
940   Srms=0
950   Srms2=0
960   Sfreq=0
970   Sfreq2=0
980   Error_count=0
```

```
990   !
1000  !--------------------------------------------------------------------
1010  ! Make Meas_number measurements of phase and frequency error.
1020  !--------------------------------------------------------------------
1030  DISP "Making";Meas_number;"measurements..."
1040  FOR N=1 TO Meas_number
1050    !
1060    ! Measure peak phase, RMS phase, and frequency.
1070    ! Allow this set of measurements to complete even with occasional
1080    ! detection errors.  Consider a detection error to be likely if
1090    ! peak phase is greater than 55 degrees or the sync status reports
1100    ! an error.
1110    REPEAT
1120      OUTPUT @Test_set;"TRIG:AST 'ARM'"        ! Arm measurement.
1130      OUTPUT @Test_set;"MEAS:DSP:PHASE:PEAK?"  ! Query peak phase.
1140      ENTER @Test_set;Peak
1150      OUTPUT @Test_set;"MEAS:DSP:SSTATUS?"     ! Query error status.
1160      ENTER @Test_set;A$
1170      A$=UPC$(A$)                              ! Convert to upper case.
1180      Error_flag=0
1190      !
1200      ! Check for detection error.
1210      IF Peak>55 OR A$<>"""NO ERROR""" THEN
1220        Error_flag=1
1230        Error_count=Error_count+1
1240        IF Error_count>=Meas_number THEN
1250          DISP
1260          PRINT "Measurement aborted due to";Error_count;"detection errors."
1270          STOP
1280        END IF
1290      END IF
1300    UNTIL Error_flag=0
```

```
1310     OUTPUT @Test_set;"MEAS:DSP:PHASE:RMS?"     ! Query RMS phase.
1320     ENTER @Test_set;Rms
1330     OUTPUT @Test_set;"MEAS:DSP:PHASE:FREQ?"    ! Query frequency error.
1340     ENTER @Test_set;Freq
1350     !
1360     ! Update statistics variables
1370     Srms=Srms+Rms
1380     Srms2=Srms2+Rms*Rms
1390     Spk=Spk+Peak
1400     Spk2=Spk2+Peak*Peak
1410     Sfreq=Sfreq+Freq
1420     Sfreq2=Sfreq2+Freq*Freq
1430   NEXT N
1440   !
1450   !------------------------------------------------------------------------
1460   ! Calculate and output results.
1470   !------------------------------------------------------------------------
1480   DISP
1490   !
1500   ! Calculate average phase and frequency errors.
1510   Srms=Srms/Meas_number
1520   Spk=Spk/Meas_number
1530   Sfreq=Sfreq/Meas_number
1540   !
1550   ! Calculate standard deviations.
1560   Srmsdev=SQRT((Srms2-Meas_number*Srms*Srms)/(Meas_number-1))
1570   Spkdev=SQRT((Spk2-Meas_number*Spk*Spk)/(Meas_number-1))
1580   Sfreqdev=SQRT((Sfreq2-Meas_number*Sfreq*Sfreq)/(Meas_number-1))
1590   Sqrt_n=SQRT(Meas_number)
1600   Srmsmeandev=Srmsdev/Sqrt_n
1610   Spkmeandev=Spkdev/Sqrt_n
1620   Sfreqmeandev=Sfreqdev/Sqrt_n
1630   !
1640   ! Output results.
1650   PRINT "                      RMS phase         peak phase     frequency"
1660   A$="18A,7D.3D,15D.3D,11D.2D"
1670   PRINT USING A$;"mean              ",Srms,Spk,Sfreq
1680   PRINT USING A$;"standard deviation",Srmsdev,Spkdev,Sfreqdev
1690   PRINT USING A$;"stan dev of mean  ",Srmsmeandev,Spkmeandev,Sfreqmeandev
1700   END
1710   SUB Hpib_abort
1720     DISP
1730     PRINT "Measurement aborted due to HP-IB timeout."
1740     PRINT "This will occur if HP-IB is not working or if triggers are"
1750     PRINT "not present."
1760     STOP
1770   SUBEND
```

Transient Settling Times

The following transient settling (wait times) should be considered when executing HP-IB programs from an external controller or using the built-in IBASIC controller to execute programs.

Note

During query loops (especially for IBASIC applications), it is recommended to use a WAIT statement like WAIT Delta_t, where Delta_t is user defined (i.e. WAIT 0.5 ! wait 0.5 seconds).

1. Each of the following operations requires checking that a certain state has been reached before continuing with other HP-IB commands:

   a. Ending a Call. Wait for CELL CONTROL Call Status to be 'INACTIVE'and then check for Call Status RR to be 'BCCH'.

```
OUTPUT 714;"CELL:CALL:END"
REPEAT
  WAIT Delta_t
  OUTPUT 714;"CELL:CALL:STATUS:STATE?"    ! Query the Call Status
  ENTER 714;Query$
UNTIL Query$="""INACTIVE"""
IF (Query$="""INACTIVE""")
   REPEAT
     WAIT Delta_t
     OUTPUT 714;"CELL:CALL:STAT:RR?"     ! Query the RR Call Status
     ENTER 714;Query$
   UNTIL Query$="""BCCH"""
END IF
```

   b. Originating a Call. Must wait for CELL CONTROL Call Status to be 'CONNECTED':

```
OUTPUT 714;"CELL:CALL:ORIG"
! Answer call when the mobile rings
REPEAT
  WAIT Delta_t
  OUTPUT 714;"CELL:CALL:STATUS:STATE?"    ! Query the Call Status
  ENTER 714;Query$
UNTIL Query$="""CONNECTED"""
```

   c. Setting the HP 8922G to an Activated state. Must wait for the CELL CONTROL Signaling (RR) Call Status to be 'BCCH'.

```
OUTPUT 714;"DISP CCON"
OUTPUT 714;"CCON:STAT 'ACTIVATED'"
DISP "Waiting for HP 8922G to provide BCCH. . ."
REPEAT
  WAIT Delta_t
  OUTPUT 714;"CELL:CALL:STAT:RR?"     ! Query the RR Call Status
  ENTER 714;Query$
UNTIL Query$="""BCCH"""
```

   d. Setting the HP 8922G back to a Settable state. Must wait for the field to change its state.

```
OUTPUT 714;"CCON:STAT 'SETTABLE'"
REPEAT
  WAIT Delta_t
  OUTPUT 714;"CCON:STAT?"      ! Query the Cell Configure state
  ENTER 714;Query$
UNTIL Query$="""SETTABLE"""
```

e. Doing a PRESET (*RST). Must make sure the call is ended (See (a)).

f. Running a Bit Error Test measurement. Must wait for STOP after a RUN is executed to query any measurement results.

```
OUTPUT 714;"DISP BET"
OUTPUT 714;"TRIG:BET:MODE 'RUN'"
REPEAT
  WAIT Delta_t
  OUTPUT 714;"TRIG:BET:MODE?"     ! Query the Bit Error Test Trigger mode
  ENTER 714;Query$
UNTIL Query$="""STOP"""
```

g. Querying measurements in SINGLE or CONT (continous) mode. Refer to the section for querying measurements through HP-IB.

2. The following operations may affect how much wait time is needed between HP-IB or IBASIC commands.

   a. IBASIC operation - especially tight query loops

   b. Continous measurements

      i. DSP Analyzer - Phase, Amplitude and Data Bits measurements

      ii. Output RF Spectrum measurements

      iii. Pulse On/Off Ratio measurements

      iv. Spectrum Analyzer measurements

      v. Oscilloscope measurements

      vi. CW measurements

      vii. AF Analyzer measurements

   c. Signaling operations:

      i. SACCH measurements

      ii. Intercell Handovers

      iii. Intracell Handovers

      iv. Trace views are active

3. When performing the following operations, include a wait statement, for a maximum of the period of time given, before issuing the next command.

   a. Executing Loopback functions - loopback on and off: 1 second

```
OUTPUT 714,"CELL:AUD:LOOP:OFF"  ! loopback off
   WAIT 1

OUTPUT 714,"CELL:AUD:LOOP:FE"   ! on with frame erasure
   WAIT 1

OUTPUT 714,"CELL:AUD:LOOP:NOFE" ! on without frame erasure
   WAIT 1
```

   b. Changing Audio Speech Configurations to 'NONE' or 'UNCOND' or 'COND' or 'ECHO': 0.5 second

```
OUTPUT 714,"CELL:AUD:SPE:CONF  'COND'
    WAIT 0.5
```

c. Changing Audio Speech Configurations to 'PRBS': 2 seconds

```
OUTPUT 714,"CELL:AUD:SPE:CONF  'PRBS'
    WAIT 2
```

d. Setting the MS TX power Level: 1 second

```
OUTPUT 714,"CELL:MS:TLEV 7"
    WAIT 1
```

e. Arming DSP Analyzer, Output RF Spectrum or Pulse On/Off measurements in Single mode from IBASIC - after sending the Arm command wait approximately 1 second.

```
OUTPUT 714,"TRIG:ASTate 'ARM'"
    WAIT 1
```

f. Executing a Reference Oscillator calibration: 10 second

```
OUTPUT 714,"CONF:ROSC:CAL"
    WAIT 10
```

g. IMEI Request: 10 second

```
OUTPUT 714,"MSIN:MS:IMEI:REQ"
  - WAIT 10
```

h. TMSI Reallocation: Query TMSI value (should change within 10 seconds)

   i. Read TMSI string `OUTPUT 714,"MSIN:PAG:TMSI?"`

   ii. Send TMSI Reallocation command `OUTPUT 714,"MSIN:PAG:TMSI:REAL"`

   iii. Wait until `OUTPUT 714,"MSIN:PAG:TMSI?"` returns a new string

      1) 10 seconds maximum

We expect users, operating remotely, to make measurements in single mode, mainly for speed reasons. However, if you operate in continuous (CONT) measurement mode and you change a parameter that affects the measurement result, then (at a maximum) the third measurement result queried will be an outcome of the new setup and not the previous setup.

8

EMMI (Electrical Man Machine Interface)

The EMMI interface is a half-duplex communication link between the HP 8922G and a mobile station. GSM 11.10 Aspect III describes pin assignments, logic levels, and timing requirements of EMMI connectors.

This chapter provides descriptions of the EMMI and HP-IB programming examples for using the EMMI.

You can use the EMMI program codes to do these things:

- Simulate keystrokes on the handset's keypad.
- Set operating states of the mobile station that aren't controlled by the handset's keypad.
- Report the mobile station's operating state.

Refer to GSM 11.10 Aspect III for message structure.

Variables used in the descriptions and examples are as follows:

```
DIM Data$[255], Err$[255]

REAL Xontime, Resptime

INTEGER Baud, Stat
```

Using the Status Subsystem (HP-IB) with EMMI

The Status subsystem can be used to find out whether EMMI messages were sent or received successfully. (For more information about the Status subsystem, refer to chapter 7, HP-IB.)

STATus:EMMI:EVENT?

`STATus:EMMI:EVENT?` queries a status buffer. The status buffer will return one of five numbers indicating the status of the last EMMI message sent by the HP 8922G.

(0) EMMI Idle	There was no data sent since the last status check, and there were no events to report.
(1) Message Acknowledged	A message was received and acknowledged by the mobile station. Important: This does not mean the mobile was able to understand or perform the operation.
(2) Message Not Acknowledged	The HP 8922G attempted to send a message, but the mobile station did not receive it.
(4) Mobile XOF	The timer that waits for the mobile station to send XON expired (see EMMI:TIMEout:MS:XON)
(8) Timeout	The timer that waits for the mobile station to send an ACK or NACK expired (see EMMI:TIMEout:MS:RESPonse).

EMMI Status Event Programming Example

```
OUTPUT 714; "stat:emmi:event?"   Check status of last data write.

ENTER 714;Stat
PRINT Stat
+1                               Last message sent was received and
                                 acknowledged by the mobile station.
```

Using the EMMI Subsystem (HP-IB)

The EMMI subsystem is used to read and write messages to the mobile station or to read the status of the mobile station. (For more information about the EMMI subsystem, refer to chapter 7, HP-IB.)

RESet

RESet will erase all messages that are in the HP 8922G's EMMI message buffer. When a reset is sent, the HP 8922G will also send an XON (ready to receive) frame to the mobile station.

EMMI Reset Programming Example

```
OUTPUT 714;"emmi:reset"   Clear HP 8922G EMMI message buffer
                          and send XON to the mobile
```

EMMI:BRATe:

`EMMI:BRATe:` sets the baud rate of the HP 8922G EMMI port. The baud rate of the HP 8922G must be set to the same baud rate as the mobile station.

These are the allowable baud rates:

- 600 bits per second
- 1200 bits per second
- 2400 bits per second
- 4800 bits per second
- 9600 bits per second (default value)

EMMI:BRATe?:

EMMI:BRATe? queries the baud rate of the HP 8922G EMMI port.

EMMI Baud Rate Programming Example

`OUTPUT 714;"emmi:brat?"`	*Query the HP 8922G for its current EMMI baud rate*
`ENTER 714;Baud`	
`PRINT Baud`	
`"9600"`	*Current EMMI baud rate*
`OUTPUT 714;"emmi:brat '4800'"`	*Set the HP 8922G's EMMI baud rate to match the mobile's EMMI baud rate*
`OUTPUT 714;"emmi:brat?"`	*Query the HP 8922G for its current EMMI baud rate*
`ENTER 714:Baud`	
`PRINT Baud`	
`"4800"`	*Current EMMI baud rate*

EMMI:DATA <data entry>

EMMI:DATA sends a message to the mobile station. The data entry following the DATA keyword must be entered in the form shown in figure 8—1.

1. Determine the hexadecimal pairs in the message (a message identifier, possibly followed by additional hexadecimal pairs).

   Example: 3a 33 34 35 14
2. Count the number of hexadecimal characters in the message (this must be an even number).

   Example: 10
3. Determine the number of digits in the hex character count.

   Example: 2
4. Prefix the message with #.

Prefix   Message (10 Characters)

```
OUTPUT 714;"emmi:data #2103a33343514"
```

Figure 8-1. EMMI Data Entry

EMMI Data Programming Example

`OUTPUT 714;"emmi:data #2103a33343514"`	*Initiate a mobile originated call using the station keys 345:* *3a = Perform keystrokes* *33 = Key 3* *34 = Key 4* *35 = Key 5* *14 = Send (function)*
`OUTPUT 714;"stat:emmi:event?"`	*Check status of last data write*

`ENTER 714;Stat`
`PRINT Stat`
`+1`
	Last message sent was received and acknowledged by the mobile

Note EMMI data format errors (no message sent) will result in `system:error`.

`OUTPUT 714;"emmi:data #12abc"`	*Num-data-chars does not match data*
`OUTPUT 714;"emmi:data:#12xy"`	*Non hex characters*
`OUTPUT 714;"emmi:data #121g"`	*Non hex character*
`OUTPUT 714;"emmi:data #1512345"`	*Odd number of characters in the message portion of the data*
`OUTPUT 714;stat:emmi:event?"`	*Check status of last data write*

`ENTER 714;Stat`
`PRINT Stat`
`+0`
	EMMI idle, no data sent since last status check

EMMI:DATA?

`EMMI:DATA?` reads a response message sent by the mobile station.

Response messages are stored in a message buffer in the HP 8922G.

You can do the following:

- Read all the messages in the message buffer by sending DATA? commands until #10 (no data) is returned. (Messages are read first-in-first-out.)
- Clear the message buffer by sending RESet.

To monitor error messages, it is recommended that you routinely read the message buffer after each request is sent to the mobile station.

EMMI:DATA? Programming Example

`OUTPUT 714;"emmi:data #1237`	*Send request for the mobile's power level: 37 = Request for power level*
`OUTPUT 714;"stat:emmi:event?"`	*Check status of last data write*
`ENTER 714;Stat`	
`PRINT Stat`	
`+1`	*Last message sent was received and acknowledged by the mobile*
`OUTPUT 714;"emmi:data?"`	*Read message buffer*
`ENTER 714;Data$`	
`PRINT Data$`	
`#145D02`	
	Returned data from the mobile: *5D = Response, power level* *02 = power level*

EMMI:TIMEout:MS:RESPonse

EMMI:TIMEout:MS:RESPonse adjusts the time allowed for the mobile station to send an ACK or NACK to the HP 8922G.

The following events will happen if the response timeout expires:

- The HPIB bus is released (another message can now be attempted).
- The STATus:EMMI:EVENT command will return an 8 (Response Timeout Exceeded).

EMMI TIMEout MS RESPonse Programming Example

`OUTPUT 714;"emmi:time:ms:resp?"`	*Query current mobile response timeout*
`ENTER 714:Resptime`	
`PRINT Resptime`	
`+1.00000000E+000`	*Mobile response timeout is 1 second*
`OUTPUT 714;"emmi:time:ms:resp 3"`	*Set current mobile response timeout to 3 seconds*

EMMI:TIMEout:MS:XON

EMMI:TIMEout:MS:XON adjusts a timer that provides the time delay needed when the EMMI bus is attempting to send a message before the mobile station or 8922G are ready. Without this time delay, a message would be rejected immediately if certain events have not occured.

Example: If the mobile station sends an XOF to the HP 8922G, the HP 8922G cannot send any messages to the mobile station until XON is received. Also, XON must be received within the length of time specified by EMMI:TIMEout:MS:XON.

The following events will happen if time expires:

- The HPIB bus is released (another message can now be attempted).
- The STATus:EMMI:EVENT command will return a 4 (Mobile XOF).

EMMI TIMEout MS XON Programming Example

`OUTPUT 714;"emmi:time:ms:xon?"`	*Query current xon timeout*
`ENTER 714;Xontime`	
`PRINT Xontime`	
`+1.00000000E+000`	*Current xon timeout is 1 second*
`OUTPUT 714;"emmi:time:ms:xon 1.5"`	*Set current xon timeout to 1.5 seconds*

Example EMMI Program

Start with the mobile station camped on:

```
2350!
2360 Wait_2_camp:SUB Wait_2_camp
2370    COM /Addr_22/ @Addr_22
2380    COM /String/ String$[50]
2390    INTEGER Timeout
2400    Timeout=40
2410    PRINT "Polling EMMI until the radio is camped."
2420    ON DELAY Timeout GOTO No_camp
2430! repeat until camped
2440    REPEAT
2450 ! give the mobile a chance to do something
2460      WAIT 1
2470 ! empty the emmi receive buffer
2480      Empty_emmi_b
2490 ! request status indication
2500      OUTPUT @Addr_22;"emmi:data #1236"
2510 ! determine status of the emmi data write
2520      OUTPUT @Addr_22;"status:emmi:event?"
2530      ENTER @Addr_22;String$
2540      PRINT String$
2550      IF (String$="+8") THEN
2560        PRINT "EMMI INTERFACE IS DEAD"
2570        STOP
2580      END IF
2590      IF (String$="+4") THEN
2500        PRINT "Mobile is in XOFF state."
2610        STOP
2620      END IF
2630      IF (String$="+2") THEN
2640        PRINT "Max retries exceeded"
2650        STOP
2660      END IF
2670      IF (String$="0") THEN
2680        PRINT "CHECK DATA ENTRY"
2690        STOP
2700      END IF
2710 ! read status indication
2720      OUTPUT @Addr_22;"emmi:data?"
2730      ENTER @Addr_22;String$
2740    UNTIL (String$="#145C01")
2750    OFF DELAY
2760    GOTO Bye_camp
2770 No_camp:!
2780    PRINT "ERROR: unable to camp after ";Timeout;"seconds"
2790 Bye_camp:SUBEND
2800 !
```

9

Messages

Messages can be reviewed by pressing (SHIFT) (MEAS SYNC).

See Also

Screens: Message

Communication Failures

The following messages require you to cycle power on the instrument to continue any operation.

- DSP Analyzer Communication Failure
- Hop Controller Communication Channel Failure
- Protocol Processor Communication Channel Failure
- Communication failure with Signaling Board

Measurement Summary

The Measurement Summary field on the DSP Analyzer Ampl Main screen displays whether HI/LO limits set for the measurement display fields, (Ampl1-12, pk+ flatness, or pk- flatness) were exceeded in the last measurement. The possible Measurement Summary displays are:

Failed

One or more measurement limit was exceeded.

Passed

No measurement limits were exceeded.

- - - -

No measurement limits are set, or, all of the Ampl and Pk measurement displays are turned off.

A blank field

The blank field is displayed when the measurement is armed. It will remain blank until the measurement is complete.

Sync Status

This field displays any errors that occurred while trying to synchronize the demodulated data.

Bad Sync (for demodulation only)

This message appears if a synchronization error happened since the last Demodulation Arm (when Adjust Mode is disabled) or since the last change to Trig Delay (when Adjust Mode is enabled with Demod Arm already selected).

Possible causes of Bad Sync are:

- Useful bits occurred while power was too low.
- Demodulation trigger too early or too late.
- FM (bit) errors found while synchronizing to desired midamble.
- RF overload.

FM Error

At least one bit error was detected when comparing the measured midamble to the selected Midamble or User Defined Sync Pattern, (Sync Mode=Midamble only).

Level Late

The amplitude of the burst did not rise until after the first few bits were received.

Level Short

The amplitude of the burst fell before the last few bits were received.

Low Level

The DSP analyzer's RF level did not rise high enough to make a valid measurement.

No Error

No synchronization error occurred.

RF Ovrload

The measurement hardware overloaded during the measurement. (Increase RF Analyzer Amplitude setting to correct).

ShortBurst

The amplitude envelope was shorter than the expected burst.

Protocol Error Messages

A prototcol error may be generated by one of six sources.

- Expiry of a timer
- An error detected by the physical hardware interface layer (PH)
- An error detected by the Data Link layer (DL)
- An error detected by the Radio Resource sublayer (RR)
- An error detected by the Mobility Management sublayer (MM)
- An error detected by the Call Control sublayer (CC)

The error may be fatal or nonfatal. Fatal errors will cause the call to be cleared and will display an error message containing the timer name or the abbreviation for the layer or sublayer (PH, DL, RR, MM, CC), and an error code. Nonfatal errors may only be observed by inspecting the signaling log.

Errors are fatal for calls in progress or signalling being attempted.

Timer names are taken from GSM Rec. 04.06, 04.08 and 05.08, with the exception of T3299, which is HP unique.

T100 has been disabled on the HP 8922. Normally this failure results in a radio link timeout (loss of SACCH uplink), but this has been disabled on the HP 8922 so that measurements may be made without clearing the call.

The timer expiry appears at the top of the display and is of the form:

```
"Call disconnected: timer T??? expired."
```

An unknown timer is reported as:

```
"Call disconnected: cause unknown."
```

Timers

The following is a brief description of the timers.

Physical Layer Timer

```
T100      Radio Link Failure [Disabled in HP 8922]
          "Loss of SACCH on uplink."
```

Data Link Layer Timers

```
T200      Data Link Failure
          "Failed to receive RR or other acknowledgement of an I frame."
```

Radio Resource Management Timers.

```
T3101     IMMEDIATE ASSIGNMENT timer
          "MS failed to seize the assigned channel."

T3103     HANDOVER timer
          "MS failed to seize the assigned channel."

T3105     Physical information repetition timer

T3107     ASSIGNMENT COMMAND timer
          "MS failed to seize the assigned channel."

T3109     Loss of communication timer

T3111     Channel deactivation delay timer.

T3113     PAGING REQUEST timer
          "MS did not respond to page."

TT01      TCH loopback timer.
```

Mobility Management Timers.

```
T3250     TMSI_REAL_CMD or LOC_UPD_ACC timer
          "MS failed to acknowledge a new TMSI."

T3260     AUTHENT_REQUEST timer
          "MS failed to authenticate."

T3270     IDENTITY_REQUEST timer
          "MS failed to identify."

T3299     HP Unique timer: CIPHER_REQUEST
          "HP 8922 failed to configure for ciphering."
```

Call Control Timers.

T301	Call Received timer "MS failed to connect."
T303	Call Present timer "MS failed to respond to SETUP with CALL_CONF or REL_COMP."
T305	Disconnect Indication timer "MS failed to respond to DISC with REL or DISC."
T306	Disconnect Indication Tone timer "MS failed to respond to DISC with REL or DISC."
T308	Release Request timer "MS failed to respond to REL with REL_COMP or REL."
T310	Incoming call proceeding timer "MS failed to ALERT, CONN or DISC on incoming call."
T313	Connect Indication timer "MS failed to respond to CON with CON_ACK."
T323	Modify Request timer "MS failed to respond to MOD with MOD_COMP or MOD_REJ."

Timer Values

The timer values have been set as follows:

Timer Values

Timer	Value (ms)	Timer	Value (ms)	Timer	Value (ms)
T200	0^1	T3113	8000	T301	20000
		TT01	2000	T303	10000
T3101	5000			T305	10000
T3103	5000	T3250	5000	T306	10000
T3105	50	T3260	5000	T308	10000
T3107	5000	T3270	5000	T310	10000
T3109	5000	T3299	5000	T313	10000
T3111	500			T323	10000

1 varies with channel type; see Rec. 04.06 Table 9

Disconnects

Physical Layer Disconnects

Physical Hardware interface layer error codes are proprietary to the HP 8922. The defined error codes are as follows:

```
"Call disconnected: PH Error: 0x00??"

Causes:
   0x0096 - 0x009c    Channel or Speech coder failure.
   0x009d             Channel coder auto recovery to BCCH. [Non-fatal]
   0x009e             Channel coder failed, cycle power to recover. [Fatal]
   0x00a0             Channel coder failure.
   0x00a1             Speech coder failure.
   0x00a5             Invalid GSM Protocol Processor ROMS.
   0x00a6             RTI failed to configure.
   0x00a7             Channel or Speech coder failed to boot.
   0x00aa             Channel or Speech coder I/O overloaded.
   0x00ab             T100 expired.
   0x00ac             Protocol Message Allocation failed.
```

Data Link Layer Disconnects

Data Link layer error codes are proprietary to the HP 8922. The defined error codes are as follows:

```
"Call disconnected: DL Error: 0x00??"

Causes:
   0x00c8             SAPI incorrect.
   0x00c9             Timer T200 expired.
   0x00ca             Re-establish link.
   0x00cb             Unexpected UA response.
   0x00cc             Unexpected DM response.
   0x00cd             Unexpected DM response in multiframe.
   0x00ce             Unexpected S frame.
   0x00cf             Frames out of sequence.
   0x00d0             Bad parameters in U frame.
   0x00d1             Bad parameters in S frame.
   0x00d2             Bad M bit in I frame.
   0x00d3             I frame length incorrect.
   0x00d4             Invalid frame.
   0x00d5             Unexpected SABM.
   0x00d6             SABM in I frame.
   0x00d7             Unexpected release.
```

Radio Resource Layer Disconnects

The RR sub-layer only generates timer expiry error codes.

```
"Call disconnected: RR Error: 0x00??"
```

```
Causes:
   No RR reports are supported.
```

Mobility Management Layer Disconnects

Mobility Management sub-layer error codes are proprietary to the HP 8922. The defined error codes are as follows:

```
"Call disconnected: MM Error: 0x00??"
```

```
Causes:
   0x0001          Authorization procedure failed.
   0x0002          MS rejected.
```

Call Control Layer Disconnects

Call Control sub-layer error codes are actually CC cause values as defined by Rec. 04.08 Table 10.53. The cause values used by the HP 8922are as follows:

```
"Call disconnected: CC Cause: 0x00??"

Causes:
   0x0001    Unassigned number.
   0x0002    No route to specified transit network.
   0x0003    No route to destination.
   0x0006    Channel unacceptable.
   0x0010    Normal call clearing.
   0x0011    User busy.
   0x0012    User not responding.
   0x0013    User no answer.
   0x0015    Call rejected no good reason.
   0x0016    Number changed.
   0x001b    Destination out of order.
   0x001c    Invalid number.
   0x001e    Response to STATUS_ENQUIRY.
   0x001f    Normal, unspecified.
   0x0022    No circuit/channel available.
   0x0026    Network out of order.
   0x0029    Network temporary failure.
   0x002a    Switching equipment congestion.
   0x002b    Access information discarded.
   0x002c    Requested circuit/channel not available.
   0x002f    Resource unavailable, unspecified.
   0x0039    Bearer capability not authorized.
   0x003a    Bearer capability not available.
   0x003f    Service or option not available, unspecified.
   0x0041    Bearer service not implemented.
   0x0046    Only restricted digital information bearer capability
             is available.
   0x004f    Service or option not implemented, unspecified.
   0x0051    Invalid call reference value.
   0x0058    Incompatible destination.
   0x005f    Invalid message, unspecified.
   0x0060    Mandatory information element error.
   0x0061    Message type non-existent or not implemented.
   0x0062    Message not compatible with call state or message type
             non-existent or not implemented.
   0x0063    Information element non-existent or not implemented.
   0x0064    Invalid information element contents.
   0x0065    Message not compatible with call state.
   0x0066    Recovery on timer expiry.
   0x006f    Protocol error, unspecified.
   0x007f    Interworking, unspecified.
```

Host I/O Error:

"Call disconnected: Host I/O Error."

Operating System Error:

"Call disconnected: Operating System Error."

Unknown Errors:

"Call disconnected: 0x00??"

10

Instrument BASIC

HP 8922 Instrument BASIC Overview

The HP 8922 contains an HP Instrument BASIC computer that can run programs to control the HP 8922 and any connected HP-IB equipped instruments. This provides a powerful test instrument and test system controller in one package.

Programs can be written on an external computer and loaded into the HP 8922, or can be typed directly into the HP 8922's Instrument BASIC computer. Programs can then be stored on memory cards.

IBASIC

The rest of this section of the manual refers to the HP Instrument BASIC Language simply as **IBASIC**.

In This Chapter

The information in this chapter is divided into two broad categories: general information about IBASIC, and information about IBASIC programming using the TESTS subsystem.

The general information category contains for sections:

The IBASIC programming category contains information on structuring IBASIC programs to run in the TESTS subsystem and some of the features of the TESTS subsystem that can be used in writing programs.

The IBASIC programming category contains one section:

The TESTS Subsystem and IBASIC

The HP 8922's IBASIC computer is the "core" of an automated test environment referred to as the TESTS subsystem. This environment is available by accessing the **TESTS** screen.

Programs can also be written that do not use the special TESTS subsystem capabilities, using only the IBASIC computer core.

Programs That Use the TESTS Subsystem

The TESTS subsystem's capabilities were designed to allow the operator to "pick and choose" the tests and parameters they need from a larger set, eliminating unnecessary tests and reducing test time. This is especially helpful when a very large program has been written containing several tests and a multitude of associated specifications, test parameters and frequencies.

Writing programs to run in this environment requires you to understand and adhere to the program structure and syntax required by the TESTS subsystem.

Programs That Do Not Use the TESTS Subsystem

If you have a common test routine that uses the same tests and parameters every time it is run, it may be easier to write your test program to run directly in the IBASIC computer without using the TESTS subsystem.

These programs are much like any stand-alone program, and development of these programs will not be covered by this chapter. All of the general information sections of this chapter can be applied to these types of IBASIC programs.

By writing tests that do not use the TESTS subsystem, you lose the ability to easily access and change the test order and associated parameters with the subsystem's editing screens (although you can write your program to provide operator input during the test to change parameters).

Configuration and Instrument Control

Controlling HP 8922 Functions

The HP 8922's IBASIC computer acts much like a system controller connected by an HP-IB cable to the HP 8922; but instead of a cable, the HP 8922 has its own internal control bus connected to the IBASIC controller.

The internal bus address is **8xx**. (xx is any valid HP-IB address.) When you write programs to run on the HP 8922's IBASIC computer to address HP 8922 functions, you must use the "8xx" address to output commands.

For example, if you want a program in the IBASIC computer to reset the HP 8922 at the start of a test procedure, the program code to do this would be written
`OUTPUT 814;"*RST"`

Controlling Connected Instruments

When the HP 8922's HP-IB `Mode` field, on the Configure screen is set to `Control`, it takes on the role of system controller. This allows it to control other test instruments connected by HP-IB cables.

Instruments controlled by the HP 8922 use the normal **7xx** HP-IB address prefix.

For example, if two HP 8922's are used in a test system, and the second instrument's HP-IB address is 715, a program running in the *controlling* HP 8922 would output the command
`OUTPUT 715;"*RST"`
to reset the *controlled* HP 8922.

Multiple Controllers

Only one system controller can be connected to the bus at any time. If the HP 8922 is used in a test system that has its own controller, the HP 8922 can not be used as a controller unless the system controller is turned off or disconnected from the bus.

If an HP 8922 is used as a controller in a system with another HP 8922, the HP-IB `Mode` of the non-controller HP 8922 must be set to `Talk&Listen`.

Hardware Connections and HP 8922 Configuration

HP 8922 provides an RS-232 Serial port and an HP-IB port for a variety of uses:

- Controlling the HP 8922 using a connected controller
- Controlling connected instruments using the HP 8922's IBASIC computer
- Printing screen images and test results
- Entering and editing IBASIC programs

The HP 8922's **CONFIGURE** screen is used to configure these ports for the desired use.

HP-IB Configuration For Programming

1. Access the HP8922's **CONFIGURE** screen.
2. Set the `HP-IB Adrs` to the desired address.
3. Set the `Mode` field to `Talk&Lstn`.
4. Enter the `Print Adrs` if an HP-IB printer is connected.
   a. Set the `Print To` field to `HPIB`.
5. Connect HP-IB cables to other instrument(s).

This configuration prepares the HP 8922 to be controlled by a system controller, allowing program transfers over the bus. Refer to *Entering and Editing Programs*, to start programming or editing.

Serial Port Configuration for Programming

Connecting the Serial Port

1. Connect an RJ-11/RS-232 adapter (HP P/N 98642-66508) to the 25-pin RS-232 connector of your terminal or personal computer (PC). (If your PC has a 9-pin RS-232 port, use the appropriate adapter and use the table below to varify connections.)
2. Connect a 4-conductor RJ-11 cable (HP P/N 98642-66505) from the adapter to the Serial Port of the HP 8922.

RJ-11 Connectors

RJ-11 cables and adapters can be wired differently. If you buy a cable or adapter from a supplier other than HP, verify the connections for the pins indicated in the following table before connecting cables to the instruments.

HP 8922 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)

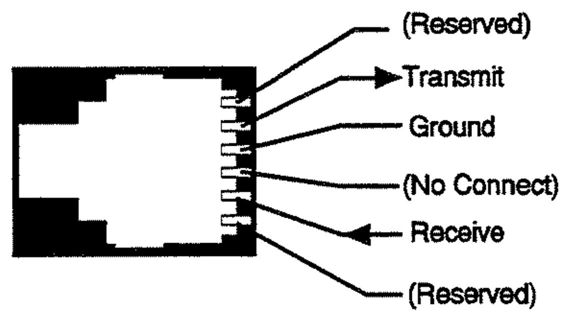


Figure 10-1. Serial Port Connections

Configuring the HP 8922

1. Access the HP8922's **CONFIGURE** screen.
2. Set `Serial In` field to `Inst` to allow the HP 8922's IBASIC controller to accept characters from a PC or ASCII terminal.
3. Set `IBASIC Echo` to `On`.
4. Set `Inst Echo` to `On`.
5. Set the `Serial Baud` to 4800. (Baud can be altered as required by your terminal.)
6. Set `Parity` field to `None`.
7. Set `Data Length` to `8 bits`.
8. Set `Stop Length` to `1 bit`.
9. Set `Rcv Pace` to `None`.
10. Set `Xmt Pace` to `Xon/Xoff`.

Configuring Your Terminal or PC

Configuring an ANSI Terminal

1. Select **ANSI** operating mode.
2. Set **Baud Rate** to **4800** (if this rate is not available on your terminal, set it to a rate that can be selected on the HP 8922's **CONFIGURE** screen.
3. Set **Parity** to **none.**
4. Set **Data Bits** to 8.
5. Set **AnqAck** to **no** (or **none**).
6. Set **Receive/Transmit Pacing** to match the HP 8922's settings.

Your terminal may have additional fields available for different configurations, but should be able to communicate with the HP 8922 if these settings are made.

Configuring an IBM-Compatible PC With HP AdvanceLink

HP AdvanceLink is a popular PC terminal emulator used to emulate a variety of terminals. If you are using a different terminal emulator program on a PC, configure it using the above settings.

1. Load and run HP AdvanceLink on your PC.
2. Set the *Global Configuration* settings.
   a. Keyboard: USASCII
   b. Personality: HP
   c. Language: ENGLISH
   d. Terminal Mode: Alphanumeric
   e. Remote To: (Enter your PC's serial port number.)
   f. Printer I/F: None
   g. Memory Size: 32K
   h. Plotter I/F: None
   i. HP Mode: Yes
   j. Video Type: (Select your display type.)
   k. Forms Path: (Enter path if used.)
   l. Screen Size: (Enter the size.)
3. Set the *Terminal Configuration* settings.
   a. Terminal ID: 2392A
   b. Local Echo: OFF
   c. CapsLock: OFF
   d. Start Col: 01
   e. Bell: ON
   f. XmitFnctn(A): NO
   g. SPOW(B): NO
   h. InhEolWrp(C): NO
   i. Line/Page(D): LINE
   j. InhHndShk(G): No
   k. Inh DC2(H): NO
   l. Esc Xfer(N): YES
   m. ASCII 8 Bits: YES
   n. FldSeperator: US
   o. BlkTerminator: RS
   p. ReturnDef: CR
   q. Copy: Fields
   r. Type Ahead: No
   s. ROW Size: 80
   t. Host Prompt Character: D1
   u. Horiz. Scrolling Increment: 08
   v. Large [+] Key: +
4. Set the *Remote Configuration* settings
   a. Baud Rate: 4800
   b. Parity/Data Bits: None/8
   c. Eng Ack: No
   d. Asterisk: OFF
   e. Chk Parity: NO
   f. SR(CH): LO
   g. Recv Pace: None
   h. Xmit Pace: None
   i. CS(CB)Xmit: No

Verifying Serial Port to IBASIC Operation

1. Access the HP 8922's **TESTS** screen.
2. Select IBASIC from the Test Function field to access the **IBASIC Controller** screen.
3. Position the cursor in the top left corner of the screen. (The top of the screen contains two command lines for entering commands and editing code.)
4. Type SCRATCH, Enter :**Note** - *this clears any existing programs in memory.*
5. Type 10 PRINT "HELLO WORLD", Enter.
6. Type 20 END, Enter.
7. Press k1 on the HP 8922 (or type RUN, Enter on your terminal) to run this two line program.
8. HELLO WORLD should be displayed on the HP 8922 and the terminal/PC's screen.

After the cable and adapter have been connected, and the HP 8922 and terminal (or PC) have been configured, you should be able to type on your terminal's keyboard and "talk" to the HP 8922.

As you type each command, the letters appear on the HP 8922's command lines and the terminal/PC screen. The letters appear on the terminal/PC screen because the Inst Echo field in the **CONFIGURE** screen is set to On.

When the program is run, HELLO WORLD appears on the HP 8922's display area and on the terminal/PC's screen because the IBASIC Echo field in the **CONFIGURE** screen is On. Any non-graphic character that is printed to the HP 8922's display area during a "print-to- screen" operation (CAT, LIST, PRINT,..) is also printed to the terminal/PC.

Refer to *Entering and Editing Programs*, to start programming or editing.

Loading, Storing, and Running

This section describes loading, storing, and running both IBASIC programs and test procedures using the TESTS subsystem.

Loading An IBASIC Program From A Memory Card

1. Insert the memory card.
2. Access the **IBASIC Controller** screen from the Test Function field on the TESTS screen.
3. Using the knob, select the field and enter the following command to load your program:

```
GET "<filename>:INTERNAL"
```

Loading an IBASIC Program From An HP-IB Disk Drive

1. Insert the disk into the drive.
2. Access the IBASIC controller screen from the Test Function field on the TESTS screen.
3. Using the knob, select the field and enter the following command to load your program:

```
LOAD "<filename>:7xx,x"
```

Downloading An IBASIC Program Into the HP 8922

This procedure downloads an IBASIC program from your connected IBASIC computer to the HP 8922's IBASIC Controller. This procedure assumes your HP 8922's HP-IB address is set to 14.

1. Access the HP 8922's **IBASIC Controller** screen.
2. Load your IBASIC program into your connected IBASIC computer.
3. Enter the following commands on your IBASIC computer to copy the program into the HP 8922's IBASIC Controller:

   a. `OUTPUT 714;"PROG:DEL"  <enter>`

   b. `OUTPUT 714;"PROG:DEF #0"  <enter>`

   c. `LIST #714  <enter>`

   d. `OUTPUT 714;" "END  <enter>`

Storing IBASIC Programs On Memory Cards

1. Use the previous procedure to download your program into the HP 8922's RAM.
2. Press (LOCAL), (SHIFT), (CANCEL) on the HP 8922 to perform an IBASIC reset.
3. If your memory card has not been initialized, insert your memory card into the HP 8922 and enter the following command on your computer:

```
OUTPUT 714;"PROG:EXEC 'INITIALIZE"":INTERNAL""'"
```

4. Insert the initialized memory card into the HP 8922.
5. Define the memory card as the Mass Storage device by entering the following command on your computer:

```
OUTPUT 714;"PROG:EXEC 'MSI "":INTERNAL""'"
```

6. Save your program to the memory card by entering the following command on your computer:

```
OUTPUT 714;"PROG:EXEC 'SAVE ""<filename>""'"
```

7. Press (LOCAL).

Storing an IBASIC Program On An HP-IB Disk Drive

1. Insert the disk into the drive.
2. Access the IBASIC controller screen from the Test Function field on the TESTS screen.
3. Using the knob, select the field and enter the following command to save your program:

```
STORE "<filename>:7xx,x"
```

Running Your Program

Once the program is loaded into the **IBASIC Controller's** RAM, it can be run by using the knob to enter the RUN command, or by selecting the Run field in the top right corner of the screen.

Loading a Test Procedure

A Test Procedure file includes all the user defined channels, frequencies, limits, and values from the Test Executive for the radio under test. You can make as many Test Procedure files as needed for the different radios you are testing.

1. Press the front-panel (TESTS) key and select the Location field. Refer to item (1) in figure 10—2.
2. Choose the location (Card, ROM, RAM, or Disk) where the Test Procedure is found. Refer to item (2) in figure 10—2. (The location you select appears in the field (1) area.)

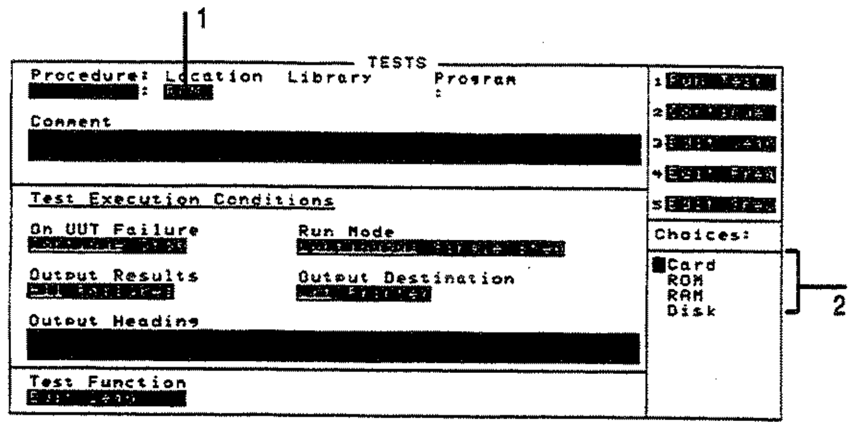


Figure 10-2. Loading a Test Procedure (1 of 2)

3. Select the Procedure field. Refer to item (3) in figure 10—3.
4. Choose the Test Procedure file that you want to download. Refer to item (4) in figure 10—3. (The Test Procedure you select appears in the field (3) area.)
5. Read the Comment field to ensure that the loaded Test Procedure file is the one you want. Refer to item (5) in figure 10—3.

Note

The Test Procedure file should have a Test Library file with the same name. Refer to the *Programming and Using the TEST Subsystem* for descriptions of Test Procedure and Library files, and how these files relate to the program's code file.

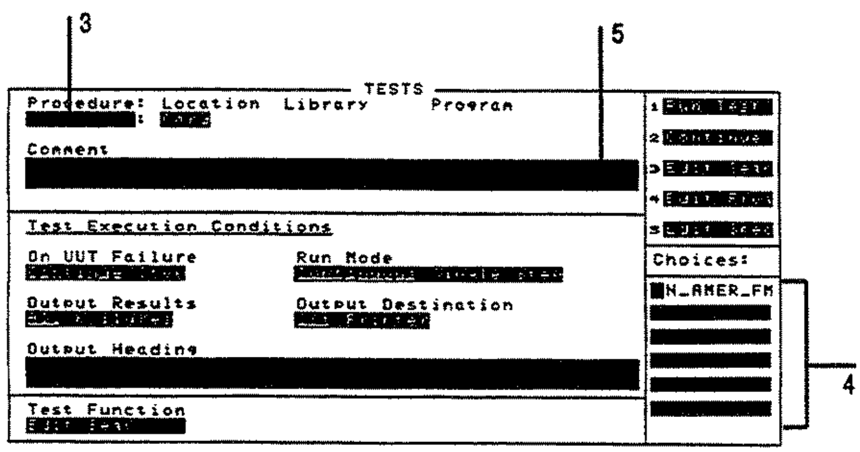


Figure 10-3. Loading a Test Procedure (2 of 2)

Making or Deleting Test Procedure Files

1. Select the front-panel (TESTS) key, and then select the Test Function field shown by item (1) in figure 10—4.
2. Select Proc Mngr shown by item (2) in figure 10—4.

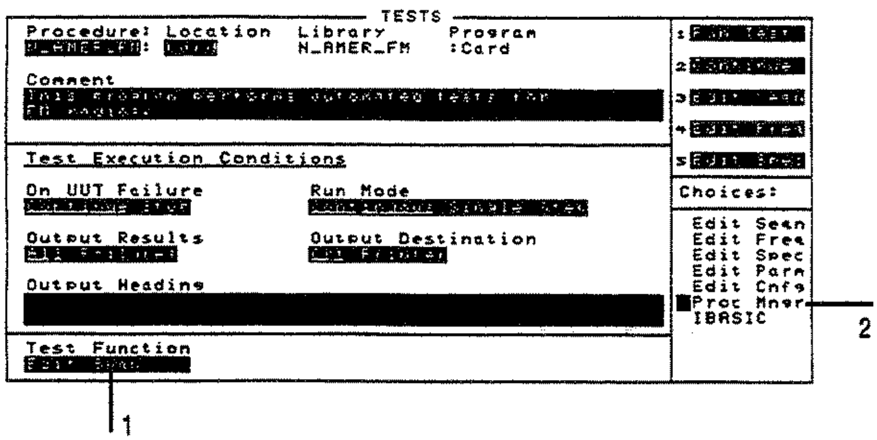


Figure 10-4. Test Procedure and Test Library Files

3. Select the Procedure field shown by item (3) in figure 10—5.
4. Enter the Test Procedure filename that you want to make or delete by using the alpha/numeric list of characters shown by item (4) in figure 10—5.
5. Select the Location to Make or Delete field shown by item (5) in figure 10—5, then select the file's location to be on memory card, RAM, or Disk from the list of choices shown in item (4).
6. Enter up to two lines of comments to identify the new Test Procedure. Refer to item (6) in figure 10—5.
7. Select whether the new Test Procedure will use the current Test Library or if it will use no library as shown by item (7) in figure 10—5. (All HP 11807A Test Procedures must be tied to a Test Library, other IBASIC programs may not require an associated library file.)
8. Select where the program for the Test Procedure is to be found. Refer to item (8) in figure 10—5.
9. Select the Make Procedure field or the Delete Procedure field as shown in item (9).

Use the Pass Number *field in the lower-right corner of the Procedure Manager menu to un-secure a Test Procedure file. The ROM program* SECURE_IT *is used to secure Test Procedure files.*

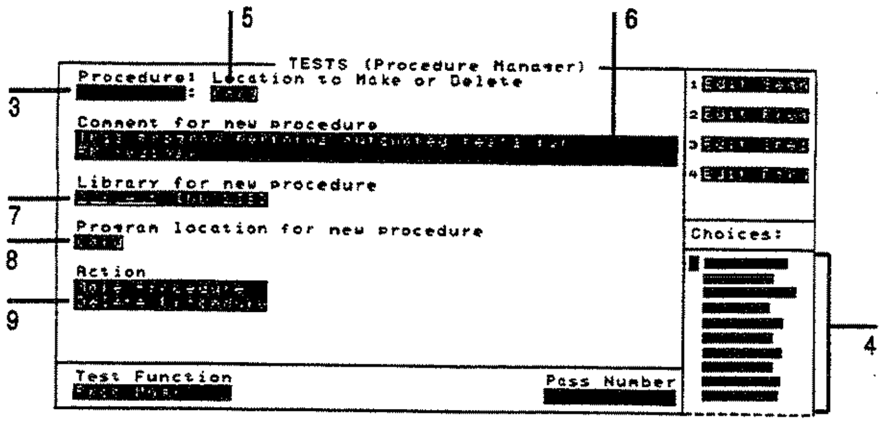


Figure 10-5. Making a Test Procedure File

Running a Test Sequence

1. Select the Run Test field.
2. Follow directions and prompts on the HP 8922 screen according to the test sequence being run.
3. When testing is complete, the HP 8922 will respond to front panel or remote input. If at any time you need to stop testing, press the front-panel (CANCEL) key.

Note

A program takes up to 3 minutes to load into the HP 8922 and is loaded when the Run Test field is first pressed.

Press the front-panel (SHIFT) (CANCEL) keys to abort from an error condition or to abort from the program. When you abort from loading the program, you'll need to clear HP 8922 RAM memory in order to correctly re-load the program at a later time.

To clear HP 8922 RAM, select and run the ROM program COPY_PL from the Procedure field in the TESTS menu. (Running COPY_PL deletes all **SAVE/RECALL** registers. So instead you may want to load another program, run it, and then re-load the original program that was aborted.

Entering and Editing Programs

The **IBASIC Controller** screen is the "computer" for the TESTS subsystem. You enter and edit programs just like any other IBASIC computer, with the exceptions that the HP 8922 does not have a computer keyboard connected directly to it, and full screen editing does not yet exist.

Programs can be entered into the IBASIC computer's RAM using a variety of methods:

- Using the IBASIC Controller screen and the Cursor Control knob.
- Using an external IBASIC controller connected to the HP 8922 by HP-IB.
- Using an external ASCII terminal or Personal Computer (PC) connected to the HP 8922 by RS-232.

Accessing the HP 8922's IBASIC Controller

1. Access the **TESTS** screen by pressing (TESTS).
2. Select the `Test Function` field at the bottom of the screen to display a list of choices.
3. Select IBASIC to display the **IBASIC Controller** screen.

Using the Knob

After accessing the **IBASIC Controller** screen, position the cursor in front of the command line at the top of the screen and press the Cursor Control knob. A list of characters is displayed that you select from to enter your commands. A maximum of 100 characters may be entered into the command line. After the command is entered on the command line, select 'Done' at the top of the list of characters to execute it.

Commands and program lines are entered just as you would enter them using a keyboard. For example, to set the default mass storage device to the memory card slot, you would enter the command

```
MSI ":INTERNAL"
```

and select 'Done'

To list the contents of the default mass storage device, enter

```
CAT
```

and select 'Done'.

Using HP-IB

The easiest way to enter and edit a program is to create it on your computer, using your computer's editing features, and then download it into the HP 8922. The usual development sequence is:

1. Write the program on your computer to control the HP 8922 using the normal 7xx HP-IB address.
2. Run the program to verify that it controls the HP 8922 correctly.
3. Change the HP 8922's HP-IB address in your program to 8xx.
4. Download the program into the HP 8922. (See Downloading a Program Into the HP 8922.)
5. Run the program on the HP 8922 to verify correct operation.
6. Copy the program to a memory card for future use.

PROGram Interface Commands

The HP 8922's IBASIC Controller has a special Program Interface it uses to communicate with other computers over HP-IB. When sending a command to the HP 8922 from another computer, you must use a 'PROG' command to tell the HP 8922 you need it to perform an operation.

In the following list, 'Addr' is the address of the HP 8922, and '<filename>' represents the name of the file you are saving or retrieving.

Note

For more information on memory cards, see the Memory Cards section.

To initialize a memory card use this command:

```
OUTPUT Addr;"PROG:EXEC 'INITIALIZE "":INTERNAL""'"
```

To change the default Mass Storage device use this command:

```
OUTPUT Addr;"PROG:EXEC 'MSI "":INTERNAL""'"
```

To save a file to the default Mass Storage device, use this command:

```
OUTPUT Addr;"PROG:EXEC 'SAVE ""<filename>""'"
```

To retrieve a file from the default Mass Storage device, use this command:

```
OUTPUT Addr;"PROG:EXEC 'GET ""<filename>""'"
```

Other PROG Commands

Two additional PROG Commands are used to prepare the HP 8922's IBASIC Controller RAM for receiving programs.

```
OUTPUT Addr;"PROG:DEL"
```

deletes any programs currently residing in RAM.

```
OUTPUT Addr;"PROG:DEF #0"
```

defines the address in RAM where a downloaded program will be stored.

Preparing the HP 8922 to Receive Programs

1. Configure the HP-IB port as described in section 2 (*HP-IB Configuration*).
2. Access the **IBASIC Controller** screen.

Downloading A Program Into the HP 8922

This procedure assumes your HP 8922's HP-IB address is **14**. If it is not, change the address in the following procedure to match your instrument's address.

1. Load the IBASIC program to be downloaded into your controller.
2. Enter these commands to transfer the program to the HP 8922:

```
10   DIM LINE$[200], FILE_NAME$[120]
20   Addr=714
30   INPUT "NAME OF (ASCII) IBASIC FILE TO DOWN-LOAD?", FILE_NAME$
40   ASSIGN @FILE TO FILE_NAME$; FORMAT ON
50   ON END @FILE GOTO DONE
60   OUTPUT Addr;"PROG:DEL"
70   OUTPUT Addr;"PROG:DEF #0"
80   WHILE (1)
90   ENTER @FILE; LINE$
100  OUTPUT Addr; LINE$
110  END WHILE
120  DONE: !
130  OUTPUT Addr; " " END
140  PRINT "Done with down-load"
150  END
```

Figure 10-6. Download Program for Computers using HP-IB

To verify that your code was downloaded, type in the command- `OUTPUT 714;"PROG:EXEC 'LIST '"`.
Your program should be listed on the HP 8922's **IBASIC Controller** screen.

Line-by-line Entry and Editing

Program lines in the HP 8922's RAM can be entered and edited one line at a time from your computer using the PROG command -

```
OUTPUT Addr;"PROG:EXEC '<program line/command> '"
```

with <program/command> representing any command or program line you want to enter.

For example, to enter or change line 20 of a program to '20 A=3.14', you would enter the following command on your computer

```
OUTPUT Addr;"PROG:EXEC '20 A=3.14 '"
```

Quoted strings, such as those used in PRINT commands, must use double quotes. Example -

```
OUTPUT Addr;"PROG:EXEC '30 PRINT ""TEST"" '"
```

Using a Terminal

A connected terminal, or PC using a terminal emulator, is used to enter characters directly into the HP 8922 IBASIC Controller's command line.

Editing a program line requires you to re-enter the full line with corrections.

Configuring your terminal/PC for this operation is explained in section 2, *Serial Port Configuration for Programming*.

Entering Commands

When program lines or commands are entered, you press the ENTER key on your terminal to execute the command. For example, to LIST a program in RAM you would type
LIST, (ENTER)

This differs from using the Cursor Control knob to enter characters where you select 'Done' to execute the command.

Memory Cards

This section contains information about memory cards and about programming the HP 8922. Programs may be either "user written", or taken from the HP 11807A Radio Test Software. You are also shown how to connect a radio to the HP 8922 in order to run automated tests from the main radio-test screen (referred to as the "Test Executive").

This section covers:

- *Using the Memory Card* – Inserting and removing memory cards, setting write protection, backing up programs, and changing memory-card batteries.
- *Programming the HP 8922* – Using HP Instrument BASIC, entering programs, downloading programs over HP-IB, editing programs line-by-line over the serial port, and using HP 11807A software.
- *Automated Radio Testing* – Connecting radios to the HP 8922, and using the HP 8922 Test Executive to test radios.

Using Memory Cards

Figure 6-1 illustrates how to insert a memory card into the HP 8922 front panel. To remove a memory card, simply pull it out.
Pay attention to memory-card orientation as it's inserted; otherwise, the card will not be seated correctly in the slot. The memory-card label is marked with an arrow that must be inserted on the same side as the arrow shown on the front-panel slot.

Memory cards may be inserted and removed with the HP 8922 powered on or off.

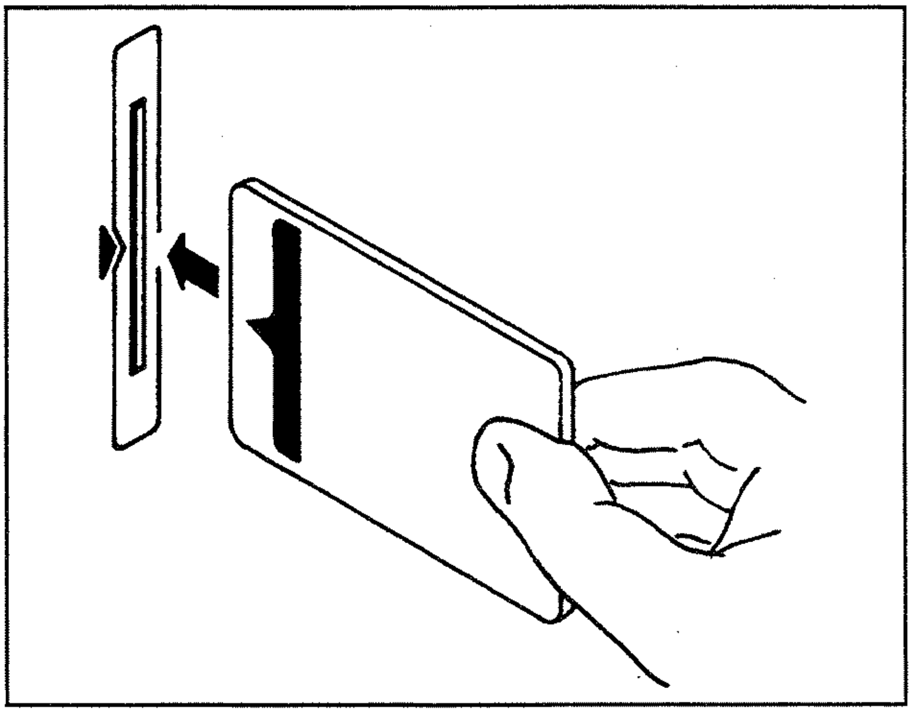


Figure 10-7. Inserting a Memory Card

Types of Memory Cards

Two types of memory cards may be purchased from Hewlett-Packard as shown in table 6-1:

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

Table 10-1. Memory Card Part Numbers

Memory	Type	Part Number
32 kilobytes	SRAM	HP 85700A
128 kilobytes	OTP	HP 85701A
128 kilobytes	SRAM	HP 85702A
256 kilobytes	OTP	HP 85703A
256 kilobytes	SRAM	HP 85704A
512 kilobytes	SRAM	HP 85705A
512 kilobytes	OTP	HP 85706A

SRAM memory cards require a battery to maintain stored information. OTP memory cards do not require a battery and will maintain stored information indefinitely.

Initializing an SRAM Memory Card

An SRAM memory card must be initialized before it can be used. Initialize the SRAM memory card by using the `COPY_PL` program (which at the same time you can copy Test Procedure and Test Library files to the memory card). Otherwise, initialize the SRAM card using the IBASIC computer as follows:

1. Press the front-panel (TESTS) key and then select the `Test Function` field (lower-left corner of screen).
2. Choose `IBASIC` from the `Choices` menu.
3. Select the IBASIC field, then use the knob to type:

   `INITIALIZE ":INTERNAL"`

   Then select `Done`.

   The initialization process takes only a second to complete.
4. Ensure that the SRAM memory card is initialized. Select the IBASIC field, then use the knob to type:

   `CAT`

   Then select `Done`.

   Information for the initialized memory card should appear on the screen.

If the error message "`ERROR 85 Medium uninitialized`" appears on the screen, check the SRAM battery to ensure that it's charged and that its polarity is correctly oriented in the battery holder.

Setting the Write-Protect Switch

The SRAM memory card's write-protect switch lets you secure its contents from being accidentally overwritten or erased. The switch has two positions as illustrated in figure 6-2:

- *Read-write* – The memory-card contents can be changed or erased, and new files may written on the card.
- *Read-only* – The memory-card contents can be read by the HP 8922, but cannot be changed or erased.

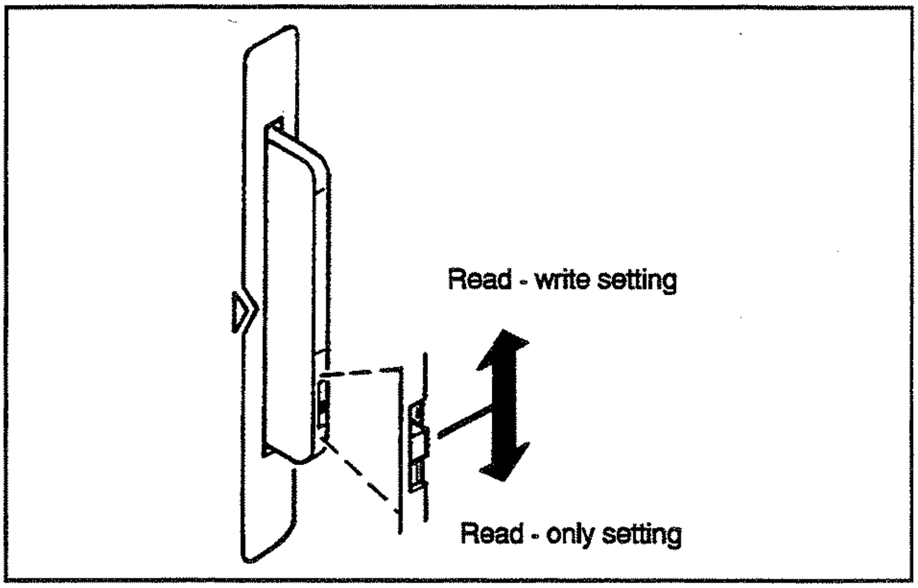


Figure 10-8. Setting the SRAM Write-Protect Switch

Backing Up the Memory-Card Programs

SRAM memory cards contain a battery to preserve its contents when the HP 8922 is turned off or when the card is removed. Memory-card contents may be backed up using the following procedure:

Procedure for Backing Up a Memory Card

The program `COPY_PL` on HP 8922 ROM backs up Test Procedure and Test Library files onto a SRAM memory card. The program `COPY_PL` also lets you to initialize the SRAM memory card. (Code files should reside on OTP memory cards; an external "device programmer" is required to download code files into an OTP memory card.)

Note Test Procedure files are identified in the IBASIC screen when a catalog (CAT) is done. A lowercase "p" is prefixed to a Test Procedure filename. Test Library filenames are prefixed with a lowercase "l."

---

1. Press the front-panel [TESTS] key.
2. Select the program `COPY_PL` from ROM in the `Procedure` field, and then select the `Run Test` field. (Refer to *Loading a Test Procedure* on page 6-18 for help.)
3. Select the `Run Test` field.
4. Read the instructions on the screen and continue with the copy program when you are ready. (Directions are provided on the screen as you continue.)
5. Press the front-panel [PREV] key to exit the screen.

The Memory Card Battery

A memory-card battery should last between 3 and 5 years depending on its use. Write the date a battery is installed in the memory card. The date is important for determining when to replace the battery.

When the battery needs replacing, insert the card into the HP 8922 and turn the **POWER** switch on. An inserted memory card takes power from the HP 8922 preventing the card's contents from being lost.

Replace the battery as shown in figure 6-3 with a 3 volt 2016 coin cell. *Hold the card in with your other hand while pulling the battery out. Also, be sure to install the battery with the side marked "+" on the same side marked "+" on the battery holder.*

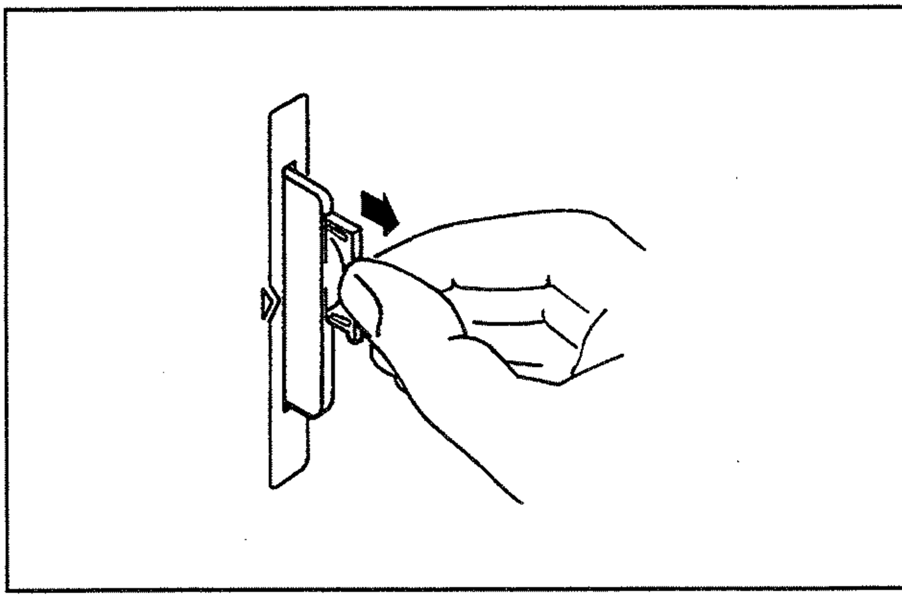


Figure 10-9. Replacing the Memory-Card Battery

Avoid touching the flat sides of the battery when replacing it. Finger oils may contaminate battery contacts in the memory-card.

Warning **Do not mutilate, puncture, or dispose of batteries in fire. The batteries can burst or explode, releasing hazardous chemicals. Discard unused batteries according to the manufacturer's instructions.**

Programming and Using the TESTS Subsystem

This section describes the concepts and tasks associated with the TESTS subsystem. It is intended to help the experienced programmer develop programs, or modify existing programs.

TESTS Subsystem File Descriptions

Three types of files are used in the TESTS subsystem to store different types of information.

Code Files

The first aspect of an automated definition is the code itself. This is just a standard IBASIC Code file that can reside either on the Memory card, on an external disk drive connected to the HP-IB port of the HP 8922, or in an internal RAM disk. The name of this file is preceded by a lower case 'c'. This tells the TESTS subsystem that this particular file contains program code.

Library Files

A Library indicates all of the available test subroutines in the code, the set of all parameters that might be entered using the user-interface screens, and all specifications that might be used by the subroutines in the code to decide if a test point passes or fails.

Only one Library is defined for each Code file. The name of this file is preceded by a lower case 'l', telling the TESTS system that this is a Library file. Also, both the Library and Code file should have the same base name to indicate the relationship between them.

A Library is required if you want to use the user-interface screen functions of the TESTS subsystem. If the program is simple enough that there is no need for user-input, or if all the user-input is simple enough to be accomplished through INPUT statements, then a [NO LIB] option is available.

Procedure Files

A Procedure allows the user to define which of the test subroutines, parameters, and specifications defined in the Library will be used to test a specific Radio. There may be many Procedures defined that use the same IBASIC Code and Library, each using a different subset of the choices available in the Library. These files are preceded with a lower case 'p', but are *not* required to have the same base name as either the Library or the Code. The name of the corresponding Library (if any) is stored in each Procedure file.

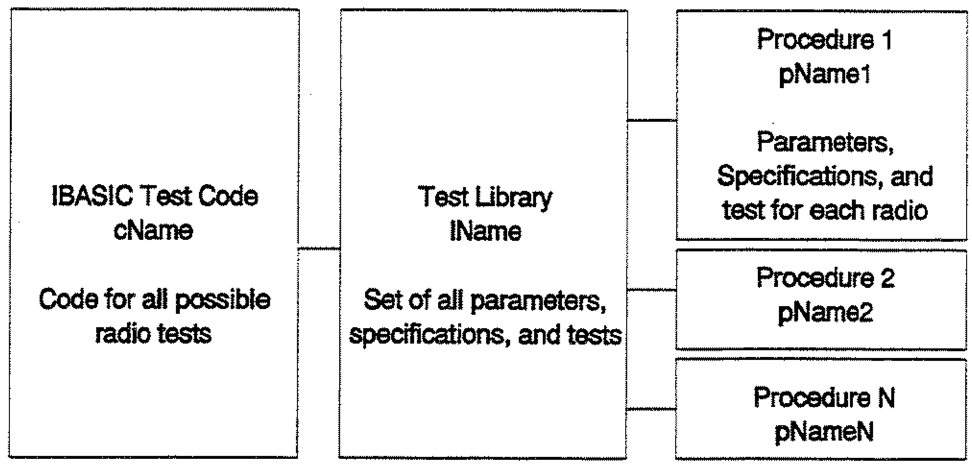


Figure 10-10. TESTS Subsystem File Relationship

TESTS Subsystem Screens

The TESTS subsystem uses several screens to create, select, and copy files, and to run tests.

The Main TESTS Subsystem Screen

Refer to figure 10—11.

The Main TESTS screen is accessed by pressing the front panel (TESTS) key. Notice that the first line shows the currently selected Procedure. The associated Library is listed, as well as the location of the code.

The comment area is simply available to give the user a more complete explanation of this particular Procedure.

To view all the Procedures available on the selected media, simply select the **Procedure** field. A menu will appear in the lower right corner of the screen, displaying all the Procedures are available. This is not a listing of the full contents of the disk; it is only a list of the Procedures that have been stored.

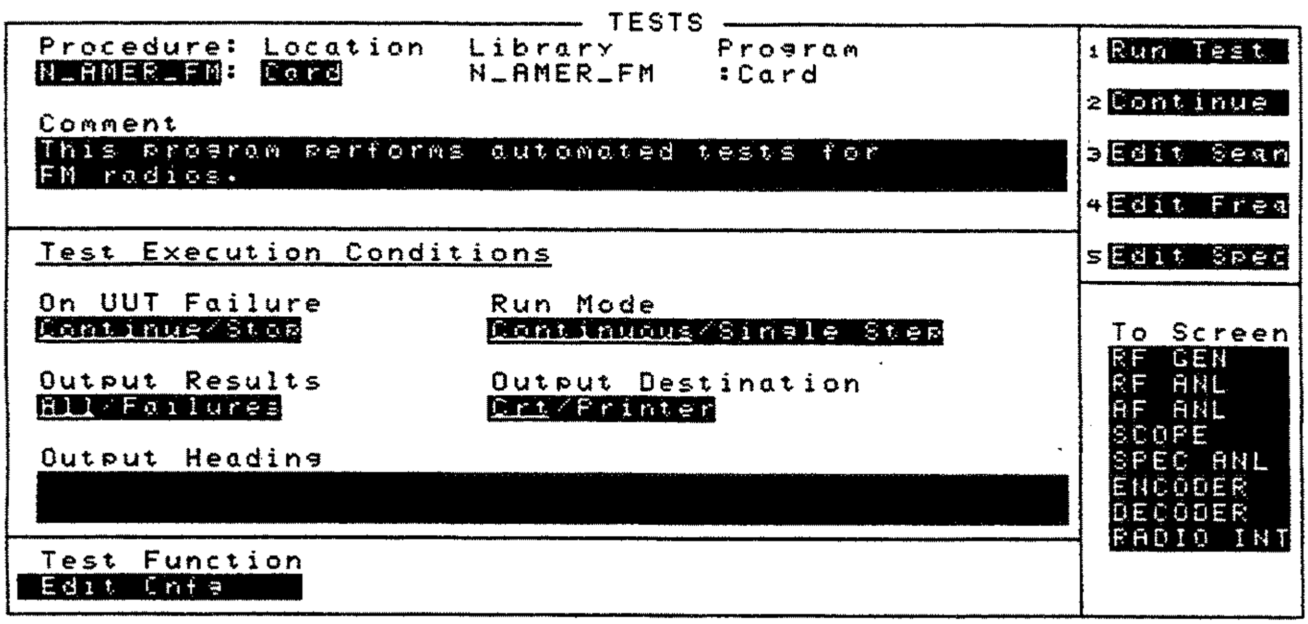


Figure 10-11. The Main TESTS Subsystem Screen

TESTS Subsystem User-Interface Screens

The TESTS subsystem allows the user to easily modify the test subroutines, parameters, specifications and configuration to correspond to the requirements of a specific Radio. There are several user-interface screens that allow the user to do this.

To access any of these screens, select the `Test Function` field at the bottom of the main TESTS screen to display the screen choices.

- The *Edit Sequence* screen lets you select the desired test(s) from the full set of available tests in the default Procedure file.
- The *Edit Specifications* screen defines the specifications used to generate pass/fail messages during testing.
- The *Edit Parameters* screen is used to define instrument settings and characteristics to match those of the radio being tested (audio load impedance, audio power, power supply voltage,..etc.).
- The *Edit Configuration* screen identifies all connected HP-IB equipped instruments and their HP-IB addresses.
- The *Procedure Manager* screen is used to make or delete Procedures.

IBASIC Programming

IBASIC gives you control over the internal functionality of the HP 8922, as well as control over any external instruments connected to the HP-IB.

Refer to the HP 8922 *HP Instrument BASIC Programmer's Guide* for details about IBASIC. The manual contains important information about the IBASIC programming-language code, Test Procedure and Test Library file structures, and programming and interfacing techniques.

Program Status

A single-character "run indicator" is displayed in the upper-right corner of the screen to indicate program status:

- If the screen is blank, the program is stopped.
- An asterisk "*", indicates the program is running or doing other input/output.
- A dash "-" indicates the program is paused.
- A question mark "?" indicates the program is awaiting user input.

Three alpha characters are also displayed in the upper-right corner of the screen to indicate status:

- An "R" indicates the HP 8922 is in remote operation; the absence of an "R" means the HP 8922 has changed to local operation.
- An "T" indicates the HP 8922 is "talking" on the HP-IB.
- An "L" indicates the HP 8922 is "listening" on the HP-IB.

Setting Up the Test Execution Conditions.

Five Test Execution Condition fields are shown in figure 10—12. Set up each field according to your testing needs.

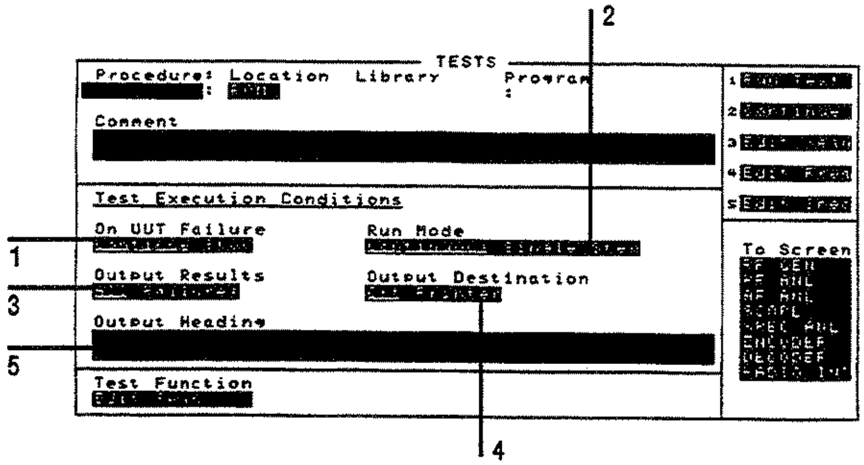


Figure 10-12. Test Execution Conditions

To Have Testing Stop or Continue on a UUT Failure

Refer to item (1) in figure 10—12.

On UUT Failure .... Continue

Testing continues whenever the UUT (Unit Under Test) 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.

On UUT Failure ....Stop

Testing stops whenever the UUT fails to meet test specification limits.

To Continue or Pause After Each Test

Refer to item (2) in figure 10—12.

Run Mode .... Continuous

All tests run in sequence. Testing pauses only if the operator is required to interact with the UUT or HP 8922; interaction such as changing UUT channels, setting squelch, changing audio level, and so forth, cause testing to pause.

Run Mode .... Single Step

The program stops running at the completion of each test. The test-system operator is prompted to select `Continue` to proceed with testing.

To Select Printing Conditions

Refer to item (3) in figure 10—12.

Output Results .... All

All test results are shown on the output device (CRT and/or printer). Printouts include a "banner" listing the test conditions, measured values, lower and upper limits, and whether the test passed or failed. The `Comment` field is shown at the top along with any identifying information from the `Output Heading` field. Date, and time is also output.

Output Results .... Failures

Test results are shown only when a UUT failure or software error occurs. Printouts include a "banner" listing the test conditions, measured values, and lower and upper limits of the failed test. The `Comment` field and any identifying information from the `Output Heading` field is also output.

To Have Test Results Appear on a CRT or Printer

Refer to item (4) in figure 10—12.

Output Destination .... Crt

Test results are output to the HP 8922 CRT screen only.

Output Destination .... Printer

Test results are output to the CRT and printer. A printer must be correctly configured in order to get a printout.

- To configure an RS-232 printer, refer to chapter 3 for **CONFIGURE** screen descriptions.
- To configure an HP-IB printer, refer to the instructions in the following section titled *Configuring External Instruments for HP-IB Control*.

To Enter Comments in the Output Heading Field

Refer to item (5) in figure 10—12.

1. Select the `Output Heading` field. (An alpha/numeric list of characters appears in the lower-right corner of the screen.)
2. Select characters one at a time using the knob in order to compose the comment you want to make. (Two lines of comments, 50 characters in length, may be entered.)
3. Select `Done` when you are finished.

Making a Test Sequence

The Test Sequence menu lets you select radio tests and the order you want them performed.

1. Select the `Edit Seqn` field. A test-sequence screen similar to that shown in figure 10—13 appears.
2. Select the `Insrt Stp` field or `Delet Stp` field as needed to insert or delete tests on the screen. Refer to item (**1**) in figure 10—13.
3. Select the `Step #` field and turn the knob to the test you want to change. Refer to item (**2**) in figure 10—13. (As you turn the knob, the test's step number, name, and description changes. Refer to item (**3**) in figure 10—13.)
4. Select the `Test Name` field and turn the knob to select the desired test. Refer to item (**4**) in figure 10—13. (As you turn the knob, the test name and description changes along with the test number shown in the `Choices` menu. Refer to item (**5**) in figure 10—13.)
5. Select the `Yes/No` field and decide if the test is to be run on all channels (select **Yes**), or if the test is to be run on prime channels only (select **No**). Refer to item (**6**) in figure 10—13. (Prime channels are selected from the `Edit Freq` field.)
6. Repeat steps 3–5 as needed for each test. When finished, select the next Test Function you want.

Four factors determine how long it takes to test a radio:

- The number of tests selected in the sequence.
- The kind of tests that are selected.
- The order in which the tests are selected.
- The number of points measured in a test. (This is determined by the start, stop, and step values in certain test parameters.)

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.

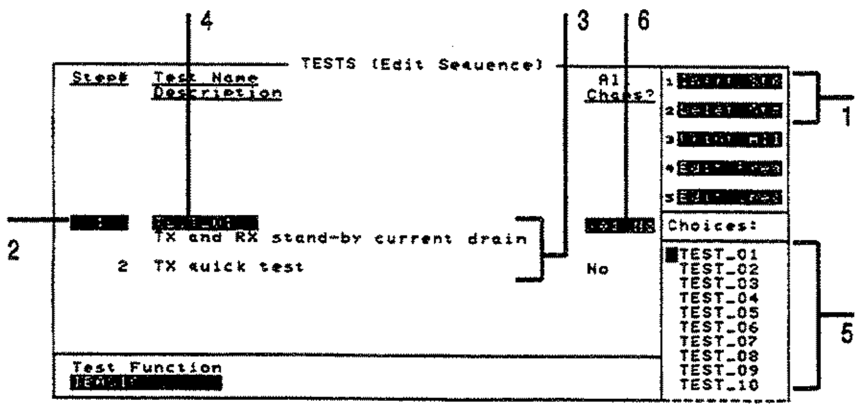


Figure 10-13. Test-Sequence Screen (Example from HP 11807A Option 001)

Editing Test Specifications

Test Specifications are the upper and lower limit values that are used by the Test Executive to describe the manufactured specifications of the radio itself. For a radio to pass a test, the measured value must fall within the test's specified value (lower limit, upper limit, or both upper and lower limits).

1. Select the `Edit Spec` field. A test-specification screen similar to that shown in figure 10—14 appears.
2. Select the **Spec #** field and turn the knob to the specification you want to change. (Hint: If you know the specification that you want by number, key in the number, push the knob, and the specification you want appears.) Refer to item (**1**) in figure 10—14. (As you turn the knob, the test's specification number, description, and limits change.)
3. Select the **Lower Limit** or **Upper Limit** field you want to change. Refer to item (**2**) in figure 10—14. (The **Units** column show how the upper and lower limits will be terminated; for example, %, dBm, kHz, and so forth.)
4. Select the **Check** field. Refer to item (**3**) in figure 10—14.
5. Select whether the test will verify upper, lower, both, or none of the specified limits. Refer to item (**4**) in figure 10—14. (Selecting both upper and lower limits increases test time; however, this may be a necessary requirement.)
6. Repeat steps 2–5 as needed for each specification. When finished, select the next Test Function you want.

Note The tests you select determine the specifications that are required.

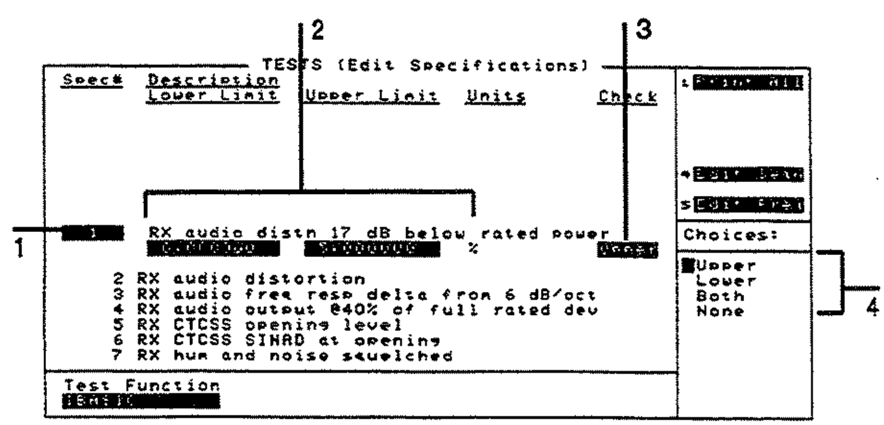


Figure 10-14. Test-Specification Screen (Example from HP 11807A Option 001)

Editing Test Parameters

Test Parameters are used to set functions on the test-system instruments, and to change characteristics of the test-system instruments in order to match those of the radio being tested. For example, audio-load impedance, audio power, power-supply voltage, and so forth.

1. Select the Test Function Edit Parm (from the Test Executive lower-left corner). A test-parameter screen similar to that shown in figure 10—15 appears.
2. Select the Parm # field and turn the knob to the test parameter you want to change. (Hint: If you know the parameter that you want by number, key in the number, push the knob, and the parameter you want appears.) Refer to item (1) in figure 10—15. (As you turn the knob, the test parameter's number, description, and value changes.)
3. Select the Value field and change the parameter's value. Refer to item (2) in figure 10—15. (The Units column show how the value will be terminated; for example, %, dBm, kHz, and so forth.)
4. Repeat steps 2 and 3 as needed for each parameter. When finished, select the next Test Function you want.

Note The tests you select determine the parameters that are required.

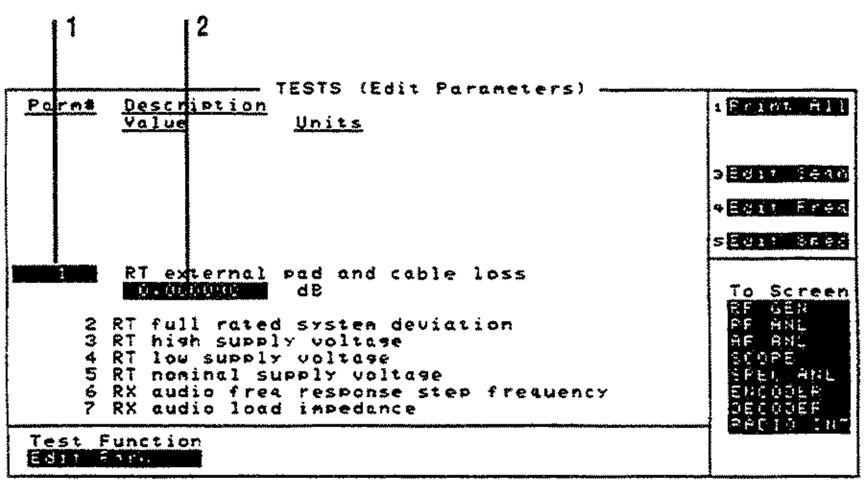


Figure 10-15. Test-Parameter Screen (Example from HP 11807A Option 001)

Configuring External Instruments for HP-IB Control

Use the following instructions to configure the IBASIC computer to see external instruments on the HP-IB "700" bus.

1. Select the front-panel (TESTS) key, and then the `Test Function` `Edit Cnfg`. A configuration screen similar to that shown in figure 10—16 appears.
2. Select the `Calling Name` field and enter the instrument's name in upper-case letters. For example, `PRINTER`, `POWER SUPPLY`, `DATA COLLECTION`, and so forth. Refer to item (1) in figure 10—16.
3. Select the `Model` field and enter the instrument's model number. There is no specific syntax for entering model numbers into this field. Refer to item (2) in figure 10—16.
4. Select the `Addr` (address) field and turn the knob to enter the last two digits of the instrument's HP-IB address. Refer to item (3) in figure 10—16. (The RS-232 address must be 9, and the Data Collection address must be 1.)
5. Select the `Options` field (refer to item (4) in figure 6-16) and enter the instrument's option number(s) if any. 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 option – `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".
6. Press the `Insrt Ins` field or `Delet Ins` field as needed or turn the knob to insert or delete as many instruments as needed. Refer to item (5) in figure 10—16.

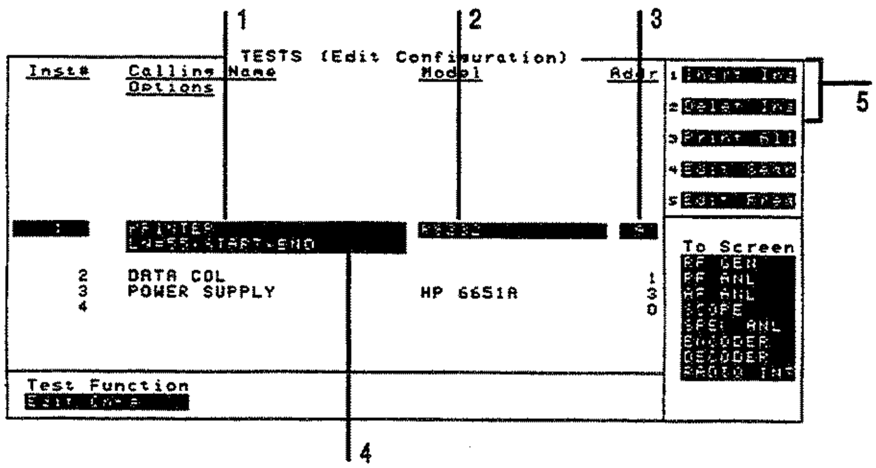


Figure 10-16. Instrument-Configuration Screen

Program Structure for TESTS Subsystem Programs

Writing programs that take advantage of the TESTS subsystem capabilities requires the programmer to understand how to structure the program to access the TESTS subsystem user-interface screens.

General Organization

Here are the steps to a basic algorithm that can be used to execute a number of test subroutines at a number of different frequencies:

```
BEGIN
SET UP (Set up the COM area to hold the global variables.)
REPEAT (for all Test Frequencies)
  REPEAT (for all Defined Tests)
    DO SUBROUTINE (defined Test)
  UNTIL (All Defined Tests Done)
UNTIL (All Test Frequencies Tested)
END
SUBROUTINE1 (Defined Test 1)
SUBROUTINE2 (Defined Test 2)
SUBROUTINE3 (Defined Test 3)
```

Program Example

The following example IBASIC program uses the basic algorithm shown above and the TESTS subsystem to execute a number of test subroutines at a number of defined test frequencies. Also included are examples of how to interact with the user-interface to allow a user to access parameters, specifications, and configuration fields to define a specific set of test requirements.

An explanation of the program example is given at the end of the listing.

Note This program is not designed for the HP 8922.

Program Listing

```
10    ! DEMO_1
20    !
30    ! THE FIRST LINE MUST CONTAIN THE NAME OF THE LIBRARY
40    !
50    !-----------------------------------------------------------
60    !
70    ! THIS PROGRAM IS A DEMO PROGRAM TO DEMONSTRATE THE USE
80    ! OF THE TEST SUBSYSTEM ON THE HP 8922G
90    !
100   ! REVISION: 1 APRIL, 1991
110   !-----------------------------------------------------------
120   !
130   COM /I_o/ I_o$[470]
140   ! INPUT OUTPUT STRING
150   COM /Freq/ Rx_f,Tx_f
160   ! PRESENT RX AND TX FREQUENCIES IN MHZ
170   !
180   INTEGER Test_return
190   !  TITLE SCREEN FOR OUR TESTS
200   CLEAR SCREEN
210   PRINT TABXY(2,2),"___DEMO PROGRAM FOR THE TESTS SUBSYSTEM___"
220   !
230   !  SET UP A SOFT KEY TO HALT THE PROGRAM
240   ON KEY 1 LABEL "Stop Test",5 GOTO Stp_test
250   !
260   !  CLEAR THE INTERNAL HP 8922 BUS
270   CLEAR 800
280   !
290   ! NOW READ THE TEST FREQUENCIES IN ONE AT A TIME AND DO THE
300   ! SEQUENCE OF TESTS ON THEM
310   Ch=1
320   REPEAT
330     OUTPUT 800;"TESTS:FREQ? "&VAL$(Ch)
340     I_o$=""
```

```
350     ENTER 800;I_o$
360     !                               SET THE VALUE OF THE RX FREQUENCY
370     Rx_f=VAL(I_o$[4;12])
380     !                               SET THE VALUE OF THE TX FREQUENCY
390     Tx_f=VAL(I_o$[30;12])
400     !                               SET WHETHER TO TEST THIS FREQUENCY

410     T_it$=I_o$[56;1]
420     !                               SET IF THIS IS A PRIME FREQUENCY
430     IF (LEN(I_o$)>57) THEN
440       Prime$=I_o$[58;1]
450     ELSE
460       Prime$="N"
470     END IF
480     !                               IF THIS FREQUENCY IS TO BE TESTED
490     IF T_it$="Y" THEN
500       PRINT TABXY(2,6),"RX FREQUENCY = ",Rx_f
510       PRINT TABXY(2,7),"TX FREQUENCY = ",Tx_f
520       PRINT TABXY(2,8),"TEST THIS FREQUENCY ?",T_it$
530       Run_ts=1
540       !                             RUN THROUGH THE SEQUENCE OF TESTS
550       REPEAT
560         Done_t=0
570         !                           ENTER IN THE TEST SEQUENCE
580         OUTPUT 800;"TESTS:SEQN? "&VAL$(Run_ts)
590         I_o$=""
600         ENTER 800;I_o$
610         Tst=VAL(I_o$[4;2])
620         !                           IF THIS TEST IS TO BE SKIPPED THEN SET THIS
630         IF I_o$[7;1]="N" THEN Tst=-Tst
640         !                           IF THIS IS A PRIME FREQUENCY RUN THE TEST
650         IF Tst&<0 AND Prime$="Y" THEN
660         !                           CALLS THE SUBROUTINE NAME T(ABS(Tst))
670           T(ABS(Tst),Test_return)
680           IF (Test_return=1) THEN GOTO Test_error
690           Done_t=1
700         END IF
710         !                 IF THIS TEST IS TO BE DONE AND IS NOT A PRIME FREQUENCY
720         IF Tst>0 AND NOT Done_t THEN
730         !                           CALLS THE SUBROUTINE NAME T(ABS(Tst))
740           T(ABS(Tst),Test_return)
750           IF (Test_return=1) THEN GOTO Test_error
760         END IF
770         Run_ts=Run_ts+1
780       UNTIL Tst=0 OR Run_ts=51
790     END IF
800     Ch=Ch+1
810   UNTIL Ch=51 OR Tx_f=-1 OR Rx_f=-1
820 Stp_test:  !
830   CLEAR SCREEN
840   PRINT TABXY(2,10),"FINISHED TESTING"
```

```
850   GOTO End_program
860 Test_error:  !
870   CLEAR SCREEN
880   PRINT TABXY(2,10),"PROGRAM STOPPED, TEST ",ABS(Tst),"FAILED"
890 End_program:  !
900   END
910 T01:SUB T01(Test_return)
920     COM /I_o/ I_o$
930     COM /Freq/ Rx_f,Tx_f
940     DIM Calling_name$[22],Model$[22],Options$[22]
950   !  TEST ROUTINE NUMBER 1
960     PRINT TABXY(2,12),"DOING TEST NUMBER 1 FOR FREQ ",Rx_f
970     !                                   GET THE PARAMETER 1 FOR THIS TEST
980     OUTPUT 800;"TESTS:PARM? "&VAL$(1)
990     I_o$=""
1000    ENTER 800;I_o$

1010    !                               IF THERE IS NO PARAMETER THEN PAUSE
1020    IF I_o$[1;5]="Error" THEN
1030      PRINT TABXY(2,14),"ERROR IN RECALLING THE PARAMETERS FOR
TEST 1"
1040      Test_return=1
1050    END IF
1060    Parm_1=VAL(I_o$)
1070    !                               GET CONFIGURATION 1 INFO FOR THIS TEST
1080    OUTPUT 800;"TESTS:CONF? "&VAL$(1)
1090    I_o$=""
1100    ENTER 800;I_o$
1110    Calling_name$=I_o$[4;21]
1120    Model$=I_o$[27;21]
1130    I1addr=VAL(TRIM$(I_o$[50]))
1140    Options$=I_o$[54]
1150    !                               GET SPECIFICATION 1 FOR THIS TEST
1160    OUTPUT 800;"TESTS:SPEC? "&VAL$(1)
1170    I_o$=""
1180    ENTER 800;I_o$
1190    IF I_o$[1;5]="Error" THEN
1200      PRINT TABXY(2,14),"ERROR IN RECALLING THE SPECIFICATIONS FOR TEST 1"
1210      Test_return=1
1220    END IF
1230    Lower_limit=VAL(TRIM$(I_o$[4]))
1240    Upper_limit=VAL(TRIM$(I_o$[17]))
1250    Test$=TRIM$(I_o$[30])
1260  SUBEND
1270 T02:SUB T02(Test_return)
1280    COM /I_o/ I_o$
1290    COM /Freq/ Rx_f,Tx_f
1300  !  TEST ROUTINE NUMBER 2
1310    PRINT TABXY(2,13),"DOING TEST NUMBER 2 FOR FREQ ",Rx_f
1320  SUBEND
1330 T03:SUB T03(Test_return)
```

```
1340     COM /I_o/ I_o$
1350     COM /Freq/ Rx_f,Tx_f
1360   !  TEST ROUTINE NUMBER 3
1370     PRINT TABXY(2,14),"DOING TEST NUMBER 3 FOR FREQ ",Rx_f
1380   SUBEND
1390 T:SUB T(N,Test_return)
1400     ! CALL THE PASSED TEST NUMBER (N)
1410     SELECT N
1420     CASE 1
1430       T01(Test_return)
1440     CASE 2
1450       T02(Test_return)
1460     CASE 3
1470       T03(Test_return)
            ""
            ""
            ""
2380     CASE 49
2390       T49(Test_return)
2400     CASE 50
2410       T50(Test_return)
2420     END SELECT
2430   SUBEND
```

Program Listing Explanation

10: This first line must contain the name of the Library and the program. This is checked by the TESTS subsystem when loading the program.

130: Establish a common I_o$ string for the ENTER statements.

150: Establish common Rx_f and Tx_f that can be used by the subprograms (tests).

180: The Integer Test_return is used by the subprograms to indicate the test ended with some error condition. The meaning of Test_return could be expanded to include the status of the test (ie PASS/FAIL).

200: Clears the IBASIC Screen.

210: Prints and indication that the Demo program is running.

240: Allows the User to stop the program using a softkey.

270: Clear the Internal Bus of the HP 8922G

310: Ch keeps track of which channel we are currently testing.

320: Now Repeat for all Frequencies:

330: Request all the channel values from the HP 8922G.

340: I_o$ gets the string return.

370: The Rx frequency is pulled from the string.

390: The Tx frequency is pulled from the string.

410: T_it$ gets either a "Y" or an "N" depending on whether this frequency is to be tested.

430: If a Prime channel has been specified then Prime$ gets a value of "Y".

490: If this frequency is to be tested:

500-520: Print out some information on the test about to be performed.

530: Run_ts holds the value of the test currently being run.

550: Repeat for all Specified Tests:

560: Done_t is initialized to not completed.

580: Get the Test specifier for the current Test.

590: Initialize I_o$ to a null string.

600: I_o$ holds the value of the return string.

610: Tst now hold the value of the current test. This value is equal to the index of the Test Name in the Test selection list shown on the Test Seqn screen.

630: This tests whether this test is to be run for all channels. If not, the value is still kept around but is made negative. This will be used in later tests.

650: If the number of the test is indeed negative but the channel is prime, then the test is done.

670: This calls a subroutine that maps the number of the test with the subroutine that defines this test.

680: If there is an error, then the program stops and the error is reported.

690: Done_t is set to completed.

700: End this IF statement.

720: If Tst is suppose to be done, and has not yet been done, then now do it.

740: Again, This calls a subroutine that maps the number of the test with the subroutine that defines this test.

750: If there is an error, then the program stops and the error is reported.

760: End this IF statement.

770: Increment the step for the Test index.

780: If there are no more steps specified, or if the number of tests run is 51, then leave the test seqn loop.

790: End the Tst IF statement.

800: Increment the Channel number.

810: Stop stepping through the channels if the number of channels reaches 51, or if the Receive or Transmit frequencies are specified at -1.

820: The goto location for the stop test softkey.

830: Clear the screen

840: Indicate that the test is finished.

850: Goto the end statement.

860: The goto location if an error occurs in one of the subroutines.

870: Clear the screen.

880: Indicate that one of the tests have failed.

890: The goto for the end of the program.

900: End of the main program.

910: Subroutine T01-This corresponds with test #1. This subroutine illustrates how to enter values from the Parameters, Configuration, and Specification screens.

920-930: Includes the common variables.

940: Dimension some variables that will be used to store values from the configure screen.

960: Indicate that the first test is now active.

980: Enter the value of the first Parameter. This is the value of the first parameter on the Parameter Screen.

990: Initialize the I_o$ string.

1000: Enter the value.

1020-1050: If there is no defined parameter this string will catch the error and return it to the main program.

1080: Get the information for the first instrument stored on the configure screen.

1090: Initialize the I_o$ string.

1100: Enter the string.

1110: Calling_name$ now holds the string associated with the Calling Name field on the configure screen.

1120: Model$ now holds the string associated with the Model field on the configure screen.

1130: I1addr equals the value in the Addr field on the configure screen.

1140: Options$ now holds the string associated with the Options field on the configure screen.

1160: Get the information for the first Specification listed on the Specification system.

1170: Initialize the I_o$ string to null.

1180: ENTER the I_o$ string.

1190-1220: If there is no specification defined for this specification number, then an Error will appear in the I_o$ string. If this occurs, stop the test and return the error to the main program.

1230: Set the lower limit from the value in the string.

1240: Set the upper limit from the value in the string.

1250: Set Test$ to whether "Upper", "Lower", "Both", or "None" of the specs are to be tested.

1260: End of this subroutine.

1270-1380: These are the second and third subroutines. They are labeled T02 and T03 to correspond with the second and third test routines defined on the Test Seqn screen.

1390-2430: SUB T maps the calls from the main program to the correct subroutine. The mapping is quite simple, with the main program specifying which test to run and this subroutine calling the correct subroutine based on the SELECT statement.

Creating A Library And Default Procedure File

Once the Code file has been created, an associated Library and default Procedure file for the Code file can also be created.

Creating A Procedure File With No Library

If you do not want your program to use the different user-interface screens of the TESTS subsystem, you can create a Procedure from your Code file that does not have a Library associated with it. When the test information is defined, [NO LIB] is selected for the Library Name.

When creating a procedure to run without a Library, the first line of your Code file must be an exclamation point followed by the Code file name. For example, if your procedure is called 'FM_TESTS' the first line of your Code file **must** be-

```
1    ! FM_TESTS
```

TAB 10

INDEX

Index

B

D

M

N

O

P

Q

R

S

T