HP 8960 Series 10 E5515A Wireless Communications Test Set
HP E1960A GSM Mobile Test Application

Reference Manual

http://www.hp.com/hp8960support/

Test Application Revision A.01

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Revison C

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Liberty Lake, WA 99019-9599

U.S.A.

Legal Information

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

- Schalldruckpegel Lp < 70 dB(A).
- Diese Information steht im Zusammenhang mit den Anforderungen der Maschinenlärminformationsverordnung vom 18 Januar 1991.
- Am Arbeitsplatz.
- Normaler Betrieb.
- Nach ISO 7779:1988/EN 27779:1991 (Typprüfung).

Safety Considerations

GENERAL

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

This product has been designed and tested in accordance with *IEC Publication 1010*, "Safety Requirements for Electronic Measuring Apparatus," and has been supplied in a safe condition. This instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

SAFETY EARTH GROUND

A 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

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

⚡ Indicates hazardous voltages.

⏚ Indicates earth (ground) terminal

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

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

WARNING **This product is a Safety Class I instrument (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

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.

If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.

No operator serviceable parts in this product. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers.

Servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.

The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the product from all voltage sources while it is being opened.

The power cord is connected to internal capacitors that my remain live for 5 seconds after disconnecting the plug from its power supply.

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

Always use the three-prong ac power cord supplied with this product. Failure to ensure adequate earth grounding by not using this cord may cause product damage.

This product is designed for use in Installation Category II and Pollution Degree 2 per *IEC 1010* and *IEC 664* respectively. FOR INDOOR USE ONLY.

This product has autoranging line voltage input, be sure the supply voltage is within the specified range.

To prevent electrical shock, disconnect instrument from mains (line) before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.

Ventilation Requirements: When installing the product in a cabinet, the convection into and out of the product must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the product by 4° C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

Product Markings

CE **-** the CE mark is a registered trademark of the European Community. A CE mark accompanied by a year indicated the year the design was proven.

CSA **-** the CSA mark is a registered trademark of the Canadian Standards Association.

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.

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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 BASE 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.

DECLARATION OF CONFORMITY

according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name:	**Hewlett-Packard Co.**
Manufacturer's Address:	**Spokane Division** **24001 E. Mission Avenue** **Liberty Lake, Washington 99019-9599** **USA**

declares that the product

Product Name:	HP 8960 Series 10 Wireles Communications Test Set
Model Number:	HP E6515A
Product Options:	This declaration covers all options of the above product.

conforms to the following Product specifications:

Safety: IEC 1010-1:1990+A1+A2 / EN 61010-1:1993

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

Supplementary Information:

This product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC
and carries the CE-marking accordingly.

Spokane, Washington USA November 20,1998

Vince Roland
Reliability & Regulatory
Engineering Manager

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1 Call Processing

Establishing an Active Link with the Mobile Station

Making a Base Station Originated Call

The process for making a base station originated call is to:

1. If necessary, configure the traffic channel parameters for the call assignment. See "CALL:TCHannel" on page 245.
2. If necessary, set the IMSI state. See "CALL:PAGing:IMSI" on page 237.

   Example 1.

   ```
   OUTPUT 714;"CALL:PAGING:IMSI ““01012345678901”""
   ```

   would set the paging IMSI to 01012345678901.
3. If necessary, set the repeat paging state. See "CALL:PAGing:REPeat[:STATe]" on page 237.

   Example 2.

   ```
   OUTPUT 714;"CALL:PAGING:REPEAT ON"
   ```

   would turn on repeat paging.
4. Configure the necessary call processing connect/disconnect synchronization conditions. See "Call Processing State Synchronization" on page 34.
5. Page the mobile station by sending the call originate command to the test set.

   Example 3.

   ```
   OUTPUT 714;"CALL:ORIGINATE"
   ```

   would start the process of making a base station originated call.

IMPORTANT To verify that the origination is successfully completed, see "Call Processing State Synchronization" on page 34

Making a Mobile Station Originated Call

The process for making a mobile station originated call is to:

1. If necessary, configure the necessary traffic channel parameters for the call assignment. See "CALL:TCHannel" on page 245.
2. Configure the necessary call processing connect/disconnect synchronization conditions. See "Call Processing State Synchronization" on page 34.
3. Initiate a call from the mobile station.

NOTE There is no facility in the test set to initiate a call from the mobile station. This must be accomplished manually or through a test bus built-in to the mobile station.

IMPORTANT To verify that the origination is successfully completed, see "Call Processing State Synchronization" on page 34

Operating Considerations

The test set must be in active cell operating mode. The correct frequency band must be selected.

Call Processing Event Synchronization

Description

Synchronizing the test set with an external controller ensures that neither device does something before it is supposed to, which can cause errors, or does something well after it could have, which wastes time.

The following table of call processing subsystem commands are overlapped (see "Sequential versus overlapped commands" on page 41).

Using the "Call Processing Overlapped Command Synchronization Commands" on page 32, the user can query the test set to find out when an overlapped command operation is done (:DONE?, :OPC?), force the test set to not execute any more commands until an overlapped command operation has completed (:WAIT), or simply force an overlapped command to behave as a sequential command (:SEQ).

Pending Operation Flags

Associated with each overlapped command, the test set maintains a is a binary indicator known as a pending operation flag. A pending operation flag is set true when the operation started by the overlapped command is executing, and is set false when the operation is no longer executing.

NOTE In addition to the call processing subsystem overlapped commands, the test set also provides the measurement-related INITiate <measurement> overlapped commands. These commands, however, do not use the "Call Processing Overlapped Command Synchronization Commands" on page 32. Refer to "Measurement Event Synchronization" on page 109

Call Processing Overlapped commands

The following table describes the purpose of each call processing overlapped command, and the conditions that set the corresponding pending operation flag false.

Table 1. Call Processing Subsystem Overlapped Commands

Call Processing Command	Purpose Of Command	Pending Operation Flag (POF) is false when
CALL:ORIGinate	Performs a base station call origination.	The call processing state leaves the Idle state (when the operating mode is active cell), or The test set has noted this parameter change (when the operating mode is test mode).
CALL:END	Performs a base station call termination.	The call processing state reaches the Idle state (when the operating mode is active cell), or The test set has noted this parameter change (when the operating mode is test mode).

Table 1. Call Processing Subsystem Overlapped Commands

Call Processing Command	**Purpose Of Command**	**Pending Operation Flag (POF) is false when**
CALL[:CELL[1]]:BCHannel[:ARFCn][:SELected]	Sets the BCH ARFCN for currently selected broadcast band.	The downlink signal is transmitting on the new broadcast channel.
CALL[:CELL[1]]:BCHannel[:ARFCn]:<broadcast band>	Sets the BCH ARFCN for a broadcast band not currently selected.	The test set has noted this parameter change.
CALL:TCHannel[:ARFCn][:SELected]	Sets the TCH ARFCN for currently selected traffic band.	At least one of the following conditions has been met for all occurances of these call processing commands that have begun execution: The channel assignment has been successfully completed (when a call is established), or The test set has noted this parameter change (no call established), or The test set has noted this parameter change (not currently selected band), or An error message was generated.
CALL:TCHannel[:ARFCn]:<traffic band>	Sets the TCH ARFCN for a traffic band not currently selected.	
CALL:TCHannel:TSLot	Sets the TCH timeslot.	
CALL:MS:TADVance	Sets the mobile station timing advance.	
CALL:MS:TXLevel[:SELected]	Sets the mobile station transmit level for currently selected band.	
CALL:MS:TXLevel:<traffic band>	Sets the mobile station transmit level for a traffic band not currently selected.	
CALL:CONNected:ARM[:IMMediate]	Arms the call control status change detector.	The call control status change detector has been disarmed. See “Connected/Idle Query” on page 34.

Table 2. Call Processing Overlapped Command Synchronization Commands

Command	Purpose Of Command	Example

:DONE?	Returns a 0 if the associated command’s pending operation flag is true, or a 1 if it is false.	`10 OUTPUT 714;”CALL:TCH 65”`
		`20 OUTPUT 714;”SETUP:TXP:CONT OFF”`
		`30 OUTPUT 714;”SETUP:PFER:CONT OFF”`
		`40 REPEAT`
		`50 OUTPUT 714;”CALL:TCH:DONE?”`
		`60 ENTER 714;Process_done`
		`70 UNTIL Process_done`
		`80 OUTPUT 714;INIT:TXP;PFER”`
		`90 END`
		Commands the test set to perform a traffic channel handover and execute two setup commands. After the two setup commands have finished, the :DONE? command is used to find out if the handover is finished

:SEQuential	Forces an overlapped command to execute in a sequential manner. No subsequent commands will be executed until the pending operation flag for this operation is false.	`OUTPUT 714;”CALL:TCH:SEQ 65”` Commands the test set to perform a traffic channel handover and to not execute any more commands until the pending operation flag associated with the CALL:TCH command is false.

:WAIT	Forces the test set to wait until the associated command’s pending operation flag is false before executing any more commands.	`10 OUTPUT 714;”CALL:TCH 65”`
		`20 OUTPUT 714;”SETUP:TXP:CONT OFF”`
		`30 OUTPUT 714;”SETUP:PFER:CONT OFF”`
		`40 OUTPUT 714;”CALL:TCH:WAIT”`
		`50 OUTPUT 714;”INIT:TXP;PFER”`
		`60 END`
		Commands the test set to perform a traffic channel handover and execute two setup commands. After the two setup commands have finished, the :WAIT command is sent to prevent the test set from executing the INIT command until the handover is finished.

:OPComplete?	Places a 1 in the test set’s output queue when the associated command’s pending operation flag goes false. Controlling program hangs on this query until the 1 is retrieved.	`10 OUTPUT 714;”CALL:TCH 65”`
		`20 OUTPUT 714;”SETUP:TXP:CONT OFF”`
		`30 OUTPUT 714;”SETUP:PFER:CONT OFF”`
		`40 OUTPUT 714;”CALL:TCH:OPC?”`
		`50 ENTER 714;Op_complete`
		`60 OUTPUT 714;”INIT:TXP;PFER”`
		`70 END`
		Commands the test set to perform a traffic channel handover and execute two setup commands. After the two setup commands have finished, the :OPC? command is sent to hang program execution until a 1 is put in the test set’s output queue, satisfying the ENTER statement and allowing program execution to continue with the INIT command.

Operating Considerations

When using the "Call Processing Overlapped Command Synchronization Commands" on page 32, check the conditions that set the operation's pending operation flag false to avoid unexpected results. These conditions are found in the table of "Call Processing Subsystem Overlapped Commands" on page 30.

For example, when using the CALL:ORIGinate command, the event that sets the pending operation flag false is the test set transitioning from the idle state, not arriving at the connected state. In many cases, you will want to synchronize to call processing state transitions by querying the call processing state directly (see "Direct Query of Call Processing State" on page 34) or by querying the call processing state using status bits (see "STATus:OPERation:CALL Status Register" on page 37).

Related Topics

****

"Call Processing State Synchronization" on page 34

****

Call Processing State Synchronization

Description

Synchronizing the test set with an external controller ensures that neither device does something before it is supposed to, which can cause errors, or does something well after it could have, which wastes time.

There are six possible call processing states the test set can be in. By querying the test set, the user can determine which call processing state the test set is currently in, and if a state transition has occurred between any combination of idle and connected states.

The methods available for synchronizing to call processing states are:

- Direct query of call processing state
- Connected/idle query
- Call state change detector
- STATus:OPERation:CALL status register

Direct Query of Call Processing State

The following command performs a query of the current state of a call:

```
OUTPUT 714;"CALL:STATUS:STATE?"
ENTER 714;Inst_state$
```

This query will return one of the following mnemonics for `Inst_state$`:

- IDLE" - Idle
- "SREQ" - Setup Request
- "PROC" - Proceeding
- "ALER" - Alerting
- "CONN" - Connected
- "DISC" - Disconnecting

Connected/Idle Query

The following command is referred to as the connected/idle query, and will simply determine if a call is connected or disconnected by returning an integer value of 1 if the call is connected or a 0 if the call is disconnected.

```
OUTPUT 714;"CALL:CONNECTED:STATE?"
```

If the call is in the setup request, proceeding, alerting, or disconnecting state, this command will not return a value until the call status is either connected or disconnected.

Call State Change Detector

The test set also has a feature called the change detector that, when used with the "Connected/Idle Query" on page 34, eliminates the ambiguity between a call processing state that exists because an attempted call processing event never started, or that same state existing because the call processing event failed.

When the call state change detector is armed and the connected/idle query is sent, the response is held-off until the change detector is disarmed.

The call state change detector becomes *disarmed* when any of the following conditions have been met:

- A call processing state transition has occurred and the call processing state has progressed to either connected or idle

  or...

- A call processing state transition has occurred, but the attempt to connect or disconnect a call failed and one of the test set's protocol timers timed out

  or...

- no call processing state transitions occurred within the time period specified by the timeout timer

If a state transition does not occur, the change detector is disarmed by the timeout timer (see "CALL:CONNected:TIMeout" on page 213). After a timeout, the connected/idle query will return the current state of a call. The timeout timer is user settable, but the user setting is only applied during mobile station originated call processing operations. For base station originated call processing operations, the timeout timer is automatically set to 60 seconds by the test set.

The following commands automatically arm the call state change detector, besides starting base station originated call processing functions:

```
OUTPUT 714;”CALL:ORIGINATE” !Used for base station originated call connect
```

```
OUTPUT 714;”CALL:END” !Used for base station originated call disconnect (idle)
```

The following command arms the call state change detector, but does not cause any call processing function to start:

```
OUTPUT 714;”CALL:CONNECTED:ARM[:IMMEDIATE]” !Used for mobile station originated calls
```

See "Change Detector Programming Examples" on page 35

Change Detector Programming Examples

Example 4. Using the Change Detector - Mobile Station Originated Call

The following example illustrates the use of the call state change detector and connected/idle query for a mobile station originated call. This program prompts the operator to make a call from the mobile station being tested. When the CALL:CONNECTED:ARM command is sent, it causes the reply from the CALL:CONNECTED:STATE? query to be held-off temporarily until the connected or idle state is reached. The timeout is provided for cases where an expected call state change does not happen, for instance if the user does not make the call when prompted by the program.

```
10 OUTPUT 714;"CALL:CONNECTED:TIME 10 S"     !Sets timeout time to 10 seconds (in case call
is not made)
20 OUTPUT 714;"CALL:CONNECTED:ARM"         !Arm the change detector
30 OUTPUT 714;"CALL:CONNECTED:STATE?"       !Initiate the connected/idle query
40 DISP “Make a mobile station originated call."
50 ENTER 714;Call_connected           !Program will hang here until state

                                   !change or timer expires

60 IF Call_connected THEN

70 DISP “Call connected”

80 ELSE

100 DISP “Call not connected”

110 END IF

120 END
```

Example 5. Using the Connected/Idle Query - Base Station Originated Call

The following example illustrates the use of the call state change detector and Connected/Idle query for a base station originated call. This code originates a call, then waits for the connected/idle query to return a result.

Note that this code does not include the CALL:CONNECTED:TIME (timeout timer) or the CALL:CONNECTED:ARM (change detector arm) commands. These commands are unnecessary since the change detector is armed automatically by the CALL:ORIGINATE command, and the timeout timer value is never applicable since a base station originated call guarantees a state change.

```
10 OUTPUT 714;"CALL:ORIGINATE"         !Begin the BS originated call
20 OUTPUT 714;"CALL:CONNECTED:STATE?"       !Initiate the connect/idle query
30 ENTER 714;Call_connected           !Program will hang here until state change or
protocol timer expires.
                                   !If mobile is not set to auto-answer, SEND key must be
pressed here.
40 IF NOT Call_connected THEN         !Check if connection successful
45  DISP “Call not connected”
50 END IF
```

STATus:OPERation:CALL Status Register

The STATus subsystem provides a status register group that allows the user to query call processing states. Call processing state synchronization can be performed using the bit transitions of STATus:OPERation:CALL to generate interrupts to the external controller. Refer to “STATus:OPERation:CALL Condition Register Bit Assignment” on page 363 for status bit definitions and HP-IB command syntax.

Example 6. Generating a Service Request (SRQ) Interrupt - Dropped Call

The following example illustrates the use of the STATus subsystem to generate a service request when a call has been dropped.

```
OUTPUT 714;"STATUS:OPERATION:CALL:PTR 0;NTR 4"         !Enable negative transition filter on connected bit

OUTPUT 714;"STATUS:OPERATION:CALL:ENABLE 4”        !Enable the CONNECTED bit to generate a summary message

OUTPUT 714;”STATUS:OPERATION:ENABLE 1024”           !Enable the CALL summary bit to generate a summary message

OUTPUT 714;”*SRE 128” !Enable the service request enable register to generate SRQ

OUTPUT 714;"*CLS"     !Clear all status data structures

ON INTR 7,15 CALL Error_handler !Define interrupt-initiated branch with a priority of 15 (highest)

ENABLE INTR 7;2 !Enable interrupt on interface card 7 with a bit mask (for interface’s interrupt-enable register) of 2

OUTPUT 714;”CALL:ORIGINATE” !Connect a call

LOOP !Instead of a “dummy” loop, controlling application could be performing setups, making measurements, etc.

 WAIT .1

DISP “Press the END key on the mobile station handset”

END LOOP

END

SUB Error handler

DISP “Call Dropped”

Clear_interrupt=SPOLL(714) !Clear the RQS message in the status byte register

OUTPUT 714;”*CLS” !Clear all status data structures

STOP

SUBEND
```

Related Topics

****

“Call Processing Event Synchronization” on page 30

****

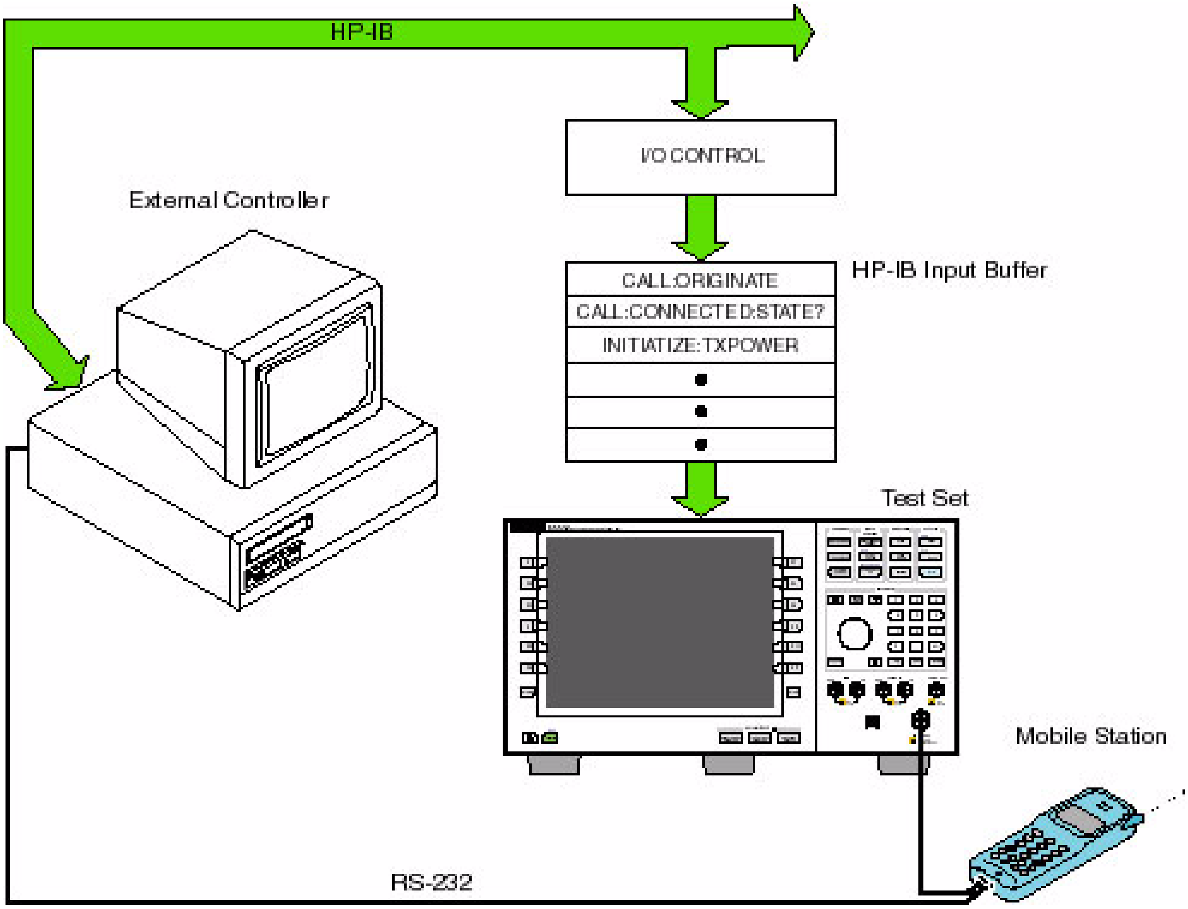
Test System Synchronization Overview

Description

Typical test systems include an external controller with an HP-IB connection to the test set, an RF (and possible AF) connection between the test set and a mobile station under test, and a serial connection between the mobile station and the external controller (see “Test System” on page 40)

Synchronizing an external controller with the test set and a mobile station under test ensures that no device does something before it is supposed to, which can cause errors, or does something well after it could have, which wastes time.

Figure 1. **Test System**


HP-IB
I/O CONTROL
External Controller
HP-IB Input Buffer
CALL:ORIGINATE
CALL:CONNECTED:STATE?
INITIATIZE:TXPOWER
Test Set
Mobile Station
RS-232

Sequential versus overlapped commands

The test set uses both sequential and overlapped commands (see "Call Processing Overlapped commands" on page 30). Sequential commands are easiest to synchronize to because subsequent commands are not executed until the previous sequential command is finished. Once the test set has begun execution of an overlapped command, however, another command or commands may begin executing, allowing the test set to use its internal resources as efficiently as possible. Overlapped commands are more difficult to synchronize to because an overlapped operation that started several commands earlier may still be executing as subsequent commands are being parsed out from the input buffer and executed. This can present a problem unless the external controller is properly synchronized to the test set's execution of commands.

The test set's HP-IB command set supports the following methods to achieve synchronization. In some cases, combinations of these methods will provide the best results:

Methods for synchronization

Methods one and two do not require the external controller to query the test set, nor to perform any branching or decision-making associated with information acquired from the test set.

1. Force the test set to execute overlapped commands sequentially.
2. Force the test set to wait until an overlapped command is done executing before executing any more commands.

Methods three through six rely on responses from the test set to an external controller, indicating that some event has occurred. The external controller can then make decisions based on these responses to control the flow of commands to the test set and other devices in the test system.

3. Query the test set to determine when a command has finished executing.
4. Query the test set to determine when all commands sent to it have at least begun executing.
5. Query the test set to determine the current call processing state.
6. Program the test set to generate a service request when an operation has completed or the test set is in a certain state

Commands used for synchronization:

- "CALL:STATus[:STATe]?" on page 243

  This command queries the test set's current call processing state. This command supports synchronization method five. (See "Direct Query of Call Processing State" on page 34).

- "CALL:CONNected[:STATe]?" on page 212

  This command determines the connected/idle state of a call. A feature called the change detector provides the user with a way to hold off the response to this query until a call processing state transition has taken place. (See "Connected/Idle Query" on page 34). This command supports synchronization method five.

- :DONE? and :OPC?
  These specialized commands can be appended to call processing overlapped commands to support synchronization method three. (See "Call Processing Overlapped Command Synchronization Commands" on page 32.)

- :WAIT
  This specialized command can be appended to call processing overlapped commands to support synchronization method two.
  (See "Call Processing Overlapped Command Synchronization Commands" on page 32.)

- :SEQ
  This specialized command can be appended to call processing overlapped commands to support synchronization method one.
  (See "Call Processing Overlapped Command Synchronization Commands" on page 32.)

- "INITiate:DONE?" on page 296
  This specialized command causes the test set to return a mnemonic indicating if a measurement is done. If not, the returned mnemonic will indicate if the measurement is still executing. This command supports synchronization method three.
  (See "INITiate:DONE?" on page 109.)

- STATUS:<register>
  Status bits in the "STATus:OPERation:CALL" on page 361 register are provided to indicate the test set's call processing state. These bits support synchronization methods five and six.

  Status bits in the "STATus:OPERation:NMRReady" on page 361 register are provided to indicate when a measurement is ready to be fetched. These bits support synchronization method three and six.

  Many other status bits are provided in the HP-IB status subsystem (see hpib_status_description) that are useful for synchronization.

- "SYSTem:SYNChronized" on page 393
  This specialized command puts a 1 in the test set's output queue when the test set responds to the query by sending a 1 to the external controller, all prior sequential commands have completed and all prior overlapped commands have at least begun execution. This command supports synchronization method four.
- "SYSTem:SYNChronized" on page 393
  This specialized command causes a condition bit to be set then cleared when all prior sequential commands have completed and all prior overlapped commands have at least begun execution. (See Status:Operation). This command supports synchronization four and six.

- "*OPC" on page 395, "*OPC?" on page 395, and "*WAI" on page 396 (not recommended)

  Note: These commands look at all of the test set's operations collectively. Because multiple processes are likely to be executing at the same time, it is recommended that the other commands above be used instead.

Related Topics

****

"Call Processing State Synchronization" on page 34

****

2 Measurements

Analog Audio Measurement Description

How is an analog audio measurement made?

Analog audio measurement response is measured from the mobile station's audio output, which also may be an acoustic coupler or electrical connection from the mobile station connected to the test set's AUDIO IN connector.

The expected voltage is the absolute peak audio input signal voltage at the front panel BNC. The expected voltage sets the analog audio clipping level and must be set. The expected voltage is peak voltage and the results are returned as rms, so a 1-volt rms input signal would need a 1.414 V_{peak} expected voltage value.

The measurement integrity indicator will return Under Range if the audio signal is more the 20 dB_{pk}, below the expected measurement range, and will return Over Range if the signal is more than 3 dB_{pk} above the expected measurement range.

The test set has a tunable bandpass filter with a 100 Hz bandwidth that can be used to tune out ambient noise for making 217 Hz buzz or 8 kHz whine tests. The filter's range is from 200 Hz to 8.0 kHz.

The analog audio measurement returns the following measurement results:

- Audio Measurement Integrity Indicator
- Audio Measurement Result (0 V_{rms} to +20 V_{rms})
- Audio Multi-measurement Maximum (0 V_{rms} to +20 V_{rms}) when multi-measurement count is on.
- Audio Multi-measurement Minimum (0 V_{rms} to +20 V_{rms}) when multi-measurement count is on.
- Audio Multi-measurement Standard Deviation (0 V to +14.14214 V) when multi-measurement count is on.

None of the analog audio measurement results are affected by amplitude offset.

Trigger Source

Analog audio measurements are triggered immediately after being armed. Arming is not necessary if the trigger state is set to continuous.

Related Topics

****

"Programming an Analog Audio Measurement" on page 47

"Decoded Audio Measurement Description" on page 56

"Test Adherence to Standards" on page 89

****

Programming an Analog Audio Measurement

This section provides an example of how to make the analog audio (AAUDio) measurement. The following procedure assumes that an audio source is connected to the AUDIO IN connector. See "Analog Audio Measurement Description" on page 46.

1. Configure analog audio measurement parameters using the SETup subsystem.
2. Start the analog audio measurement using the INITiate subsystem.
3. Use the INITiate:DONE? command to find out if analog audio measurement results are available.
4. Use the FETCh? command to obtain analog audio measurement results.

Programming Example

```
10 OUTPUT 714;”SETUP:AAUDIO:CONTINUOUS OFF”!Configures the analog audio measurement to
single trigger mode.

20 OUTPUT 714;”SETUP:AAUDIO:EXPECTED:VOLTAGE:PEAK 3”!Set the clipping level for audio
input voltage in RMS.

30 OUTPUT 714;”SETUP:AAUDIO:FILTER:SFREQUENCY 8KHZ!Specifies the tunable bandpass filter
frequency to be 8 kHz and turns the filter state ON.

40 OUTPUT 714;”INITIATE:AAUDIO”!Start the analog audio measurement.

50 REPEAT

60 OUTPUT 714;”INITIATE:DONE?”!Check to see if analog audio measurement is done.

70 ENTER 714;Meas_complete$

80 UNTIL Meas_complete$=”AAUD”

90 OUTPUT 714;”FETCH:AAUDIO?”! Fetch analog audio measurement results.

100 ENTER 714;Integrity, Analog_audio

110 END
```

Returned Values

The measurements returned by this program are:

- `Integrity` returns the measurement "Integrity Indicator" on page 98 (0 means a successful measurement with no errors).
- `Analog_audio` returns the analog audio level in volts rms.

Related Topics

****

“Analog Audio Measurement Description” on page 46

“INITiate” on page 295

“SETup:AAUDio” on page 316

“FETCh:AAUDio” on page 252

“Comprehensive Program Example” on page 170

****

AAUDio Troubleshooting

Possible Setup Issues

During remote operation of the analog audio measurement the user should configure the trigger arm to single, see “SETup:AAUDio:CONTinuous” on page 317.

Failure to set trigger arm to single may result in the measurement never giving a result. When trigger arm is continuous the measurement rearms itself and starts another measurement cycle, during remote operation the fetch query may not be synchronized to the measurement cycle, see “Measurement States” on page 123.

The analog audio measurement results are rms values, the Expected Peak Audio Amplitude is a peak value.

Interpreting Integrity Indicator values

See “Integrity Indicator” on page 98.

If over range (5) is returned then the input level is greater than 3dB above the Expected Peak Audio Amplitude value or the maximum input level of 20 volts peak.

If under range (6) is returned then the input level is greater than 20dB below the Expected Peak Audio Amplitude value maximum value.

If the signal has both over range and under range conditions only the over range (5) will be indicated.

Bit Error Measurement Description

Bit Error Measurements versus Fast Bit Error Measurements

There are three commonly used types of bit error measurements in GSM:

- "BER with Frame Erasure" or "Residual BER" when the mobile station has been configured to loopback Type A.
- "BER without Frame Erasure" or "Non-residual BER" when the mobile station has been configured to loopback Type B.
- BER using burst-by-burst loopback when the mobile staion has been configured to loopback Type C.

The test set allows the user to select between Loopback Type A or B, and the fast bit error measurement, which uses Loopback Type C. Refer also to "Fast Bit Error Measurement Description" on page 61.

How is a bit error (BER) measurement made?

During BER measurements, the test set generates a downlink TCH with pseudo-random binary sequence, PRBS-15, data at a known level. The mobile station receives the data, loops it back to its transmitter, and returns the data to the test set. The test set compares data sent to data received, and BER is calculated.

SETup subsystem commands are sent to the test set to specify the number of bits to test, measurement type, speech frames delay, measurements units, trigger arm, and measurement timeout values. When a call is established on the TCH, the loopback type corresponding to one of the BER measurement types must be sent to the mobile station (see "CALL:TCHannel:LOOPback" on page 248). For residual measurements, type A loopback mode is used. For non-residual measurements, type B loopback mode is used. You must ensure that your mobile is setup for the correct measurement type.

NOTE The user must set the loopback type for the mobile station, this is not done automatically by the test set during a BER measurement.

The correct measurement type (Type A or Type B) must be set in order for the desired measurements results to be returned (see "SETup:BERRor[:TYPE]" on page 321). If the user queries a Type A result when a Type B measurement is initiated, the test set returns 9.91 E+37 (NAN). The Measurement Type field must be changed for manual operation. Measurement type must be changed before initiating a BER measurement. See "Measurements type" on page 51

Speech Frames Delay can be configured so the test set will automatically determine the proper delay needed or the user may manually set the delay (see "SETup:BERRor:LDControl:AUTO" on page 322). Each mobile station may have a different delay between receiving a speech frame and re-sending it on the uplink, back to the test set. The BER measurement starts after the speech frame delay has been determined, the test set can be queried for this value. When the test set is configured to LDControl:AUTO:ON, the amount of delay needed is determined when the test set has correctly received 80% of the downlink bits back on the uplink. A timeout mechanism must be provided in the case the mobile station fails to close the loop. Without the timout, the open loop would cause the measurement to hang.

The BER measurement trigger source is always set to immediate. The BER measurement does not offer multi-measurement results. See "Statistical Measurement Results" on page 113

BER, FBER, and DAUDIO (uplink speech level) measurements are mutually exclusive measurements. Whichever of these measurements is activated last forces the others to become inactive.

Measurements type

Type A BER measurements are:

- Residual Type Ia (50 bits per speech frame)
- Residual Type Ib (132 bits per speech frame)
- Residual Type II (78 bits per speech frame)

For Type A, bit error measurements (BER with FE) the mobile station will indicate, in speech frames, if the downlink frame was received with CRC (cyclic redundancy check) errors that would cause speech frames to be erased. The mobile station sets all bits in the uplink speech frame to 0, indicating speech frames were erased.

Type B BER measurements are:

- Type Ia (non-residual) (50 bits per speech frame)
- Type Ib (non-residual) (132 bits per speech frame)
- Type II (non-residual) (78 bits per speech frame)

For Type B bit error measurements (BER with CRCs) the mobile station will not indicate if any speech frames in the downlink were erased.

BER measurement results

The results of a BER measurement can be displayed in two ways, (number of errors counted) or (the ratio bad bits (errors) to total bits counted). For the remote user these results are available by using the FETCh command, see “FETCh:BERRor:COUNt” on page 256 or “FETCH:BERRor:RATio” on page 257. The manual user will need to select either Count or % from the Measurement Units field.

Type A Residual Measurement Results

- Integrity Indicator
- Bit Error Ratio
- Bits Tested
- Bit Error Count
- Frame Erasure Ratio
- Frame Erasure Count

Type B Non-Residual Measurement Results

- Integrity Indicator
- Bit Error Ratio
- Bits Tested
- Bit Error Count
- CRC Ratio
- CRC Count

Related Topics

****

“Fast Bit Error Measurement Description” on page 61

“Programming a Fast Bit Error Measurement” on page 63

****

Programming a Bit Error Measurement

This section provides an example of how to make the bit error (BER) measurement via HP-IB. This procedure requires that the mobile station is connected to the test set, a call is connected, and that the test set is in active cell operating mode with the cell activated state on:

1. Set the cell power to a good level.
2. Configure BER measurement parameters using the SETup subsystem.
3. Set the measurement type for Type A residual or Type B non-residual measurements.
4. Set loopback control to manual.
5. Configure speech frames delay to 6 frames so.
6. Set the loopback type for the mobile station.
7. Wait for the mobile station to close its loop.
8. Set the cell power to a low level for BER measurement.
9. Use the INITiate command to begin a BER measurement.
10. Use the ITITiate:DONE? command to find out if the BER measurement results are available.
11. Use the FETCh? command to obtain BER measurement results.
12. Send the command to turn loopback off.
13. Set the cell power to a good level

Program Example

```
10 OUTPUT 714;”SETUP:BERROR;TIMEOUT:TIME 5” ! BER measurement times out after 5 seconds

20 OUTPUT 714;”CALL:CELL:POWER:AMPLITUDE -85 DBM” !Sets the cell power level to a “good”
level.

30 OUTPUT 714;”SETUP:BERROR:CONTINUOUS OFF” ! Configures a BER measurement to Single
Trigger.

40 OUTPUT 714;”SETUP:BERROR:COUNT 10000” ! Sets the number of bits to measure at 10,000.

50 OUTPUT 714;”SETUP:BERROR:TYPE TYPEIA” ! Sets measurement type to IA.

60 OUTPUT 714;”SETUP:BERROR:LDCONTROL:AUTO OFF” ! Configure looback control to manual.

70 OUTPUT 714;”SETUP:BERROR:MANUAL:DELAY 6” ! Set frame delay to 6 frames to correlate
uplink and downlink bits

80 OUTPUT 714;”CALL:TCHANNEL:LOOPBACK B” ! Send type B loopback (non-residual) message to
mobile station.

****************************************************************************
! When it has been determined that the mobile station has closed its loop, send the line of
code, which will arm the FBER measurement.
****************************************************************************

90 OUTPUT 714;”CALL:CELL:POWER:AMPLITUDE -102 DBM” ! Sets the cell power level to a “low”
levelfor the BER measurement.

100 OUTPUT 714;”INITIATE:BERROR” ! Start BER measurement.
```

```
110 REPEAT
120 OUTPUT 714;”INITIATE:DONE?” ! Check to see if BER measurement is Done.
130 ENTER 714;Meas_complete$
140 UNTIL Meas_complete$=”BERROR”
150 OUTPUT 714;”FETCH:BERROR?” ! BER results.
160 ENTER 714;Integrity, Bits_tested, Bit_err_ratio, Bit_err_count
170 OUTPUT 714;”FETCH:BERROR:COUNT:CRC?” ! Query CRC Count results (will return NAN if
loopback type is one of the residual types)
180 ENTER 714;Crc_count
190 OUTPUT 714;”CALL:TCHANNEL:LOOPBACK OFF” ! Turn off loopback.
200 OUTPUT 714;”CALL:CELL:POWER:AMPLITUDE -85 DBM” !Sets the cell power level to a “good”
level.
```

Returned values

The measurements returned by this program are:

- Integrity Indicator returns the “Integrity Indicator” on page 98 (0 means a successful measurement with no errors).
- Bits_tested returns the number of bits tested.
- Bit_err_ratio returns the ratio of bit errors to total bits tested.
- Bit_err_count returns the number of bit errors.
- Crc_count returns the CRC count (cyclic redundancy check).

Related Topics

****

“Bit Error Measurement Description” on page 50

“SETup:BERRor” on page 320

“INITiate” on page 295

“FETCh:BERRor” on page 256

****

BERR Troubleshooting

Possible Setup Issues

During remote operation of the analog audio measurement the user should configure the trigger arm to single, see “SETup:BERRor:CONTinuous” on page 321.

Failure to set trigger arm to single may result in the measurement never giving a result. When trigger arm is continuous the measurement rearms itself and starts another measurement cycle, during remote operation the fetch query may not be synchronized to the measurement cycle, see “Measurement States” on page 123.

Set the loopback type to A or B, see “CALL:TCHannel:LOOPback” on page 248.

Interpreting Integrity Indicator values

See “Integrity Indicator” on page 98.

Decoded Audio Measurement Description

How is a decoded audio (DAUDIO) measurement made?

This measurement is also known as decoded audio or uplink speech level measurement. The DAUDIO measurement tests the ability of the mobile station to encode an audio signal onto the uplink traffic channel.

1. The audio signal originates from the test set's AUDIO OUT connector. The audio signal is connected to the mobile station by means of an audio frequency input connector, or acoustically through a speaker placed near the microphone of the mobile station.
2. The mobile station digitizes and encodes the audio signal that is transmitted on the uplink TCH.
3. The uplink TCH is decoded with a bit accurate GSM RPE-LTP decoder to yield a block of 13-bit PCM samples within the DSP. As described in ETSI GSM 06.10.

NOTE The DAUDIO measurement needs a pulsed audio signal at a 10 Hz rate with 50% duty cycle.

The decoded audio measurement returns the rms value, in percent of full scale, of the speech signal present on the uplink (encoded) audio signal over a 100 ms (10 hz) period of time.

The DAUDIO measurement performs an rms level measurement of a speech signal on the uplink TCH with optional bandpass filtering. Speech data can be filtered using a tunable 100 Hz bandpass filter prior to analysis. The center frequency of the 100 Hz bandpass filter may be tuned from 200 Hz to 3.6 kHz. Setting the frequency will activate the filter.

The trigger source for a DAUDIO measurement is always set to Immediate.

The DAUDIO measurement, BERR and Fast BER measurements are mutually exclusive. Whichever of these measurements is activated last forces the other to become inactive.

Single or Multi-Measurements

The DAUDIO measurement can return single or averaged measurements defined by the multi-measurement count. A single measurement (multi-measurement count off) returns an estimate of the rms value of the decoded speech signal after removal of any dc component. The measurement units are in percent of full scale (%FS), ranging from 0 to 100%. Values greater than 70.70% may only result from non-sinusoidal signals. Multiple measurements (multi-measurement count >1) provide average, minimum, maximum, and standard deviation results. An integrity indicator is returned for both multi-measurement states. None of the results are affected by amplitude offset.

Trigger Source

DAUDIO measurement does not support any trigger source other than immediate.

Related Topics

****

“Programming a Decoded Audio Measurement” on page 58

“Test Adherence to Standards” on page 89

****

Programming a Decoded Audio Measurement

This section provides an example of how to make the decoded audio (DAUDio) measurement. The following procedure assumes that an active link is established between the test set and the mobile station. See "Establishing an Active Link with the Mobile Station" on page 28.

1. Configure decoded audio measurement parameters using the SETup subsystem.
2. Start the decoded audio measurement using the INITiate subsystem.
3. Use the INITiate:DONE? command to find out if decoded audio measurent results are available.
4. Use the FETCh? command to obtain decoded audio measurement results.

Programming Example

```
10 OUTPUT 714;"SETUP:DAUDIO:CONTINUOUS OFF"!Configures the decoded audio measurement to
single trigger mode.

20 OUTPUT 714;"SETUP:DAUDIO:FILTER:SFREQUENCY 3.6 KHZ!Specifies the tunable bandpass
filter frequency to be 3.6 kHz and turns the filter state ON.

30 OUTPUT 714;"INITIATE:DAUDIO"!Starts the decoded audio measurement.

40 REPEAT

50 OUTPUT 714;"INITIATE:DONE?"!Check to see if decoded audio measurement is done.

60 ENTER 714;Meas_complete$

70 UNTIL Meas_complete$="DAUD"

80 OUTPUT 714;"FETCH:DAUDIO?"! Fetch decoded audio measurement results.

90 Enter 714;Integrity, Decoded_audio

100 End
```

Returned Values

The measurements returned by this program are:

- `Integrity` returns the measurement "Integrity Indicator" on page 98 (0 means a successful measurement with no errors).
- `Decoded_audio` returns the decoded audio measurement results in percent (%).

Related Topics

****

"Decoded Audio Measurement Description" on page 56

"SETup:DAUDio" on page 326

"INITiate" on page 295

"FETCh:DAUDio" on page 261

"Comprehensive Program Example" on page 170

****

Decoded Audio (DAUDIO) Troubleshooting

Possible Setup Issues

During remote operation of the analog audio measurement the user should configure the trigger arm to single, see "SETup:DAUDio:CONTinuous" on page 327.

Failure to set trigger arm to single may result in the measurement never giving a result. When trigger arm is continuous the measurement rearms itself and starts another measurement cycle, during remote operation the fetch query may not be synchronized to the measurement cycle, see "Measurement States" on page 123.

The audio signal expected by the DAUDIO measurement is, pulsed at a 10 Hz rate and has a 50% duty cycle. The device under test should have echo cancellation disabled.

The signal measured is whatever is coming back in the speech frames, this includes any electrical or accoustical coupling from the downlink signal, earpiece or any noise coupled from the microphone of the MS.

Interpreting Integrity Indicator values

See "Integrity Indicator" on page 98.

If PCM Full Scale Warning (14) is returned the measurement is accurate, however the user may want to reduce the signal level applied to the test set to achive an integrity indicator of zero.

Fast Bit Error Measurement Description

Bit Error Measurements vs. Fast Bit Error Measurements

There are three commonly used types of bit error measurements in GSM:

- “BER with Frame Erasure” or “Residual BER” when the MS has been configured to loopback Type A.
- “BER without Frame Erasure” or “Non-residual BER” when the MS has been configured to loopback Type B.
- BER using burst-by-burst loopback when the MS has been configured to loopback Type C.

The test set provides the Bit Error Measurement, which allows the user to select between Loopback Type A or B, and the Fast Bit Error Measurement, which uses Loopback Type C.

How is a fast bit error (FBER) measurement made?

During FBER measurements, the test set generates a downlink TCH with (Pseudo Random Binary Sequence) PRBS-15 data at a known low level. The mobile station receives the data, loops it back to its transmitter, and returns the data to the test set. The test set compares data sent to data received, and FBER is calculated. see “CALL:TCHannel” on page 245

SETup subsystem commands are sent to the test set to specify the number of bits to test, TDMA frames delay, measurement unit, trigger arm, and measurement timeout values. When a call is established on the TCH, the loopback type, see “CALL:TCHannel:LOOPback” on page 248, must be sent to the mobile station.

NOTE The user must set the loopback type for the MS, this is not done automatically by the test set during a FBER measurement.

FBER measurements use MS burst-by-burst loopback, referred to as loopback type C. In loopback type C the comparison is made between the 114 bits of data sent from the test set to the MS, then looped back and received by the test set.

After a call is made, the type C loopback message must be sent to the mobile station. If FBER is armed immediately following the message, the test set will begin the measurement without waiting for the mobile station to close its loop.

The TDMA Frames Delay, see “SETup:FBERror:LDControl:AUTO” on page 331 or “SETup:FBERror:MANual:DELay” on page 332 can be configured so the test set will automatically determine the proper delay needed or the user may manually set the delay. Each MS may have a different delay between receiving a speech frame and re-sending it on the uplink, back to the test set. The FBER measurement starts after the TDMA frame delay has been determined, the test set can be queried for this value. When the test set is configured to LDControl:AUTO:ON, the amount of delay needed is determined when the test set has correctly received 80% of the downlink bits back on the uplink. A timeout mechanism must be provided in the case that the MS fails to close the loop, causing the measurement to hang.

The FBER, BERR and the DAUDIO (uplink speech level) measurements are mutually exclusive, that is which ever of these measurements is activated last forces the other to become inactive. see “Decoded Audio Measurement Description” on page 56

FBER measurement trigger source is always set to immediate. The FBER measurement does not offer multi-measurement results. see “Statistical Measurement Results” on page 113

FBER measurement results

These measurement results are from an FBER measurement.

Manual user results

- Fast BER Ratio (bad bits to total bits tested)
- Fast BER Count (bad bits found during a measurement)
- TDMA frame Delay (if TDMA Frame Loopback Delay Control = Manual)
- RX Level
- RX Quality

Remote user results see “FETCh:FBERror” on page 265

- Fast BER Ratio (bad bits to total bits tested)
- Integrity Indicator
- TDMA Frame Delay (if TDMA Frame Loopback Delay Control = Manual)
- Intermediate Count
- Fast BER Count (bad bits found during a measurement)

Related Topics

****

“Programming a Fast Bit Error Measurement” on page 63

“Test Adherence to Standards” on page 89

“SETup:FBERror” on page 330

****

Programming a Fast Bit Error Measurement

This section provides an example of how to make the fast bit error (FBER) measurement via HP-IB.

The following procedure assumes the mobile station is connected to the test set and is transmitting or ready to transmit in response to events such as call origination, and that the test set is in active cell operating mode with the cell activated state is on. See “Active Cell Operating Mode” on page 408

1. Configure FBER measurement parameters using the SETup subsystem.
2. Originate a call from the mobile station or the test set.
3. Send the type C loopback message to the mobile station with good (approximately -85 dBm) cell power.
4. Wait for the mobile station to close its loop.
5. Adjust cell power to the BER test level.
6. Start the FBER measurement using the INITiate subsystem.
7. Use the INITiate:DONE? command to find out if the FBER measurement results are available.
8. Use the FETCh? command to obtain FBER measurement results.
9. Adjust cell power back to a good level.
10. Send the command to turn loopback off.
11. End the call.

Program Example

```
10 OUTPUT 714;”SETUP:FBERROR:CONTINUOUS OFF”!Configures FBER measurements to single
trigger mode.

20 OUTPUT 714;”SETUP:FBERROR:COUNT 100!Sets the number of bits to measure at 100.

25 OUTPUT 714;”CALL:CELL:POWER:AMPLITUDE -85 DBM” !Sets the cell power level to a “good”
level.

30 OUTPUT 714;”CALL:ORIGINATE”!Establish an active link with the mobile station using
sequential command.

40 OUTPUT 714;”CALL:CONNECTED:STATE”!Query the call processing state to make sure a call is
connected.

50 ENTER 714;State

60 IF State <> 1 THEN

70    DISP “Call origination failed”

80    STOP

90 END IF

100 OUTPUT 714;”CALL:TCH:LOOPBACK C”!Send type C loopback message to mobile station.

****************************************************************************
! When it has been determined that the mobile station has closed its loop, send the next
line of code, which will arm the FBER measurement.
****************************************************************************
```

```
110 OUTPUT 714;”INITIATE:FBERROR”!Start FBER measurement.
120 REPEAT
130 OUTPUT 714;”INITIATE:DONE?”!Check to see if FBER measurement is done.
140 ENTER 714;Meas_complete$
150 UNTIL Meas_complete$=”FBER”
160 OUTPUT 714;”FETCH:FBERROR?”!FBER results.
170 ENTER 714;Integrity, Bits_tested, Bit_error_ratio, Bit_err_count
180 PRINT Integrity, Bits_tested, Bit_error_ratio, Bit_err_count
190 END
```

Returned values

The measurements returned by this program are:

- `Integrity` returns the measurement “Integrity Indicator” on page 98 (0 means a successful measurement with no errors).
- `Bits_tested` returns the number of bits tested.
- `Bit_error_ratio` retuns the ratio of bit errors to total bits tested, in percent (%).
- `Bit_error_count` returns the number of bit errors.

Related Topics

****

“Fast Bit Error Measurement Description” on page 61

“SETup:FBERror” on page 330

“INITiate” on page 295

“FETCh:FBERror” on page 265

“Comprehensive Program Example” on page 170

****

FBER Troubleshooting

Possible Setup Issues

During remote operation of the Fast BER measurement the user should configure the trigger arm to single, see "SETup:FBERror" on page 330.

Failure to set trigger arm to single may result in the measurement never giving a result. When trigger arm is continuous the measurement rearms itself and starts another measurement cycle, during remote operation the fetch query may not be synchronized to the measurement cycle, see "Measurement States" on page 123.

Set the loopback type to C, see "CALL:TCHannel:LOOPback" on page 248.

The test set may never correlate the uplink and downlink, see "SETup:FBERror:LDControl:AUTO" on page 331 so that the measurement appears to hang. The MS may not have closed its loop after the loopback type was set, the user needs to allow sufficient time for the MS to close its loop and set time out mechanisms see "SETup:FBERror:TIMeout[:STIMe]" on page 332.

Interpreting Integrity Indicator values

See "Integrity Indicator" on page 98.

Questionable Result for PGSM (15) Fast BER measurement appears to work but it is only possible on a Phase 2 GSM system.

Output RF Spectrum Measurement Description

How is an output RF spectrum (ORFS) measurement made?

ORFS is a narrow-band measurement that provides information about the distribution of the mobile station transmitter’s out-of-channel spectral energy due to modulation and switching as defined in ETSI 05.05, section 4.2.1 and ETSI 11.10, section 13.4.2.

The test set’s measurements include both ORFS due to modulation and ORFS due to switching. Switching and modulation measurements may be performed from the same burst, if the user requests both modulation and switching results at the same frequency offsets measurement throughput is improved. Measurements are made using a 30 kHz IF bandwidth, 5-pole synchronously tuned filter.

ORFS due to modulation measures out of channel interference during the useful part of the burst excluding the midamble. The measurement returns relative results in (dB) using the power in a 30 kHz bandwidth at zero offset as the reference. The user may set from 0 to 22 offsets.

ORFS due to switching measures out of channel interference over the entire burst, plus up to 10 additional bits on either side of the 147 bit wide normal burst. The measurement returns absolute power results (dBm) for each offset indicating the maximum value over the entire burst. The user may set from 0 to 8 ORFS due to switching offsets.

The number of measurements to be averaged for each offset may be different. The test set internally controls all other aspects of the measurement, including calibration, there is no user calibration required.

TX power (average power), 30 kHz bandwidth power at zero offset, ORFS due to modulation average power, and ORFS due to switching maximum power are included in an ORFS measurement, when both modulation and switching measurements are made. (TX power is performed using the same method as the “Transmit Power Measurement Description” on page 84, which synchronizes the measurement with the burst amplitude).

ORFS due to modulation

When multiple offsets for the ORFS due to modulation measurement are set, the DSP averages the power across the appropriate time segments (40 bits) of the burst with a 30 kHz resolution bandwidth, 5-pole, synchronously tuned filter placed at the center frequency of the burst and compares it to a time segment of the response of the same filter placed at some frequency offset. The result is a relative power measurement using the 30 kHz bandwidth power at zero offset as a reference. For each user specified offset, the DSP retunes the filter and measures the 30 kHz bandwidth power and compares it to the reference, giving a relative power measurement of signal power over the entire burst. The DSP processes the data and makes the results available to the user. The 30 kHz bandwidth power at zero offset is measured only if the user requests at least one ORFS due to modulation measurement.

For offsets up to 1.799999 MHz, an ORFS due to modulation measurement uses the 30 kHz resolution bandwidth filter required in GSM 05.05. At 1800 kHz offset frequency the ORFS due to modulation measurement is made using 30 kHz resolution bandwidth filter, not the 100 kHz resolution bandwidth filter required by ETSI.

The ORFS due to modulation measurement measures both the front and back data portions of the burst. Measurements occur from bit 15 to 60 and from bit 87 to 132. GSM 11.10 recommends that this measurement be performed on only the back section of the burst. Measuring both the front and back of the burst has the speed advantage of providing two modulation measurements per burst.

ORFS due to switching

When multiple offsets for the ORFS due to switching measurement are set, the DSP tunes the 30 kHz resolution bandwidth, 5-pole, synchronously tuned filter to the first requested offset and samples the power of the signal over the entire burst. The result for this measurement is the maximum of these sampled values and is reported as an absolute power measurement. The DSP then retunes the filter, samples the signal, processes the data for each requested offset, then makes the results available to the user.

The 30 kHz bandwidth power at zero offset measurement is not made during ORFS due to switching measurements. In order to make that measurement, the user must request at least one ORFS due to *modulation* measurement.

Single or Multi-Measurements

To obtain statistical measurement results, the multi-measurement count must be set for both switching and modulation measurements. (See “Statistical Measurement Results” on page 113 for more information.)

Changing the multi-measurement modulation or switching count number or setting multi-measurement to ON allows the test set to make multiple measurements at each frequency offset, thereby providing average power results across the number of frequency offsets selected. Multi-measurement count state OFF means only one ORFS measurement will be completed at each offset (that is, one ORFS due to modulation, and one ORFS due to switching measurement).

- If the user wants to make multiple ORFS due to *modulation* measurements and no ORFS due to switching measurements, a number must be entered in the multi-measurement modulation count, and all the *switching* offset frequencies must be off.
- In order to make multiple ORFS due to *switching* measurements and no ORFS due to modulation measurements, a number must be entered in the multi-measurement switching count, and all *modulation* offset frequencies must be off.

Types of Signals ORFS can Measure

ORFS measurements can be made on these types of input signals:

- Normal GSM TCH burst with mobile station in active cell mode.
- Normal GSM TCH burst with mobile station in test mode.
- Non-bursted signal including GMSK modulation with mobile station in test mode.

  For a non-bursted signal, an ORFS due to switching measurement result is not useful.

Input Signal Requirements

The ORFS measurement will complete and meet its accuracy specification under the following conditions:

- Level is between −10 dBm and +43 dBm.
- Level within ±3 dB of the expected input level.
- Frequency is within ±200 Hz of expected input frequency.

Trigger Source

Auto triggering is the recommended trigger source for each measurement, allowing the test set to choose the preferred trigger source. However, the user may want to select the trigger source.

Table 3. Recommended Trigger Source Settings

Input Signal Type	Recommended Trigger Source
Normal GSM TCH burst with mobile station in active cell mode	Protocol
Normal GSM TCH burst with mobile station in test mode	RF Rise
Non-bursted signal including GMSK data with mobile station in test mode	RF Rise

Related Topics

****

"Programming an Output RF Spectrum Measurement" on page 69

"Test Adherence to Standards" on page 89

****

Programming an Output RF Spectrum Measurement

This section provides an example of how to make the output RF spectrum (ORFS) measurement via HP-IB.

The following procedure assumes that an active link is established between the test set and the mobile station. See “Establishing an Active Link with the Mobile Station” on page 28.

1. Configure the ORFS measurement parameters using the SETup subsystem.
2. Start the ORFS measurement using the INITiate subsystem.
3. Use the INITiate:DONE? command to find out if ORFS measurement results are available.
4. Use the FETCh? command to obtain ORFS Power measurement results.

Example Program

```
10 OUTPUT 714;”SETUP:ORFSPECTRUM:CONTINUOUS OFF” !Configures a ORFS measurement to single
trigger mode.

20 OUTPUT 714;”SETUP:ORFSPECTRUM:COUNT:STATE ON” !Configures a multi-measurement state to
on.

30 OUTPUT 714;”SETUP:ORFSPECTRUM:TRIGGER:SOURCE AUTO” !Configure trigger source to auto.

40 OUTPUT 714;”SETUP:ORFSPECTRUM:SWITCHING:COUNT:NUMBER 50” !Configures ORFS due to
switching multi-measurement count

50 OUTPUT 714;”SETUP:ORFSPECTRUM:SWITCHING:FREQUENCY 200KHZ,400KHZ” !Configure switching
offsets

60 OUTPUT 714;”SETUP:ORFSPECTRUM:MODULATION:COUNT:NUMBER 100” !Configure ORFS due to
modulation multi-measurement count

40 OUTPUT 714;”SETUP:ORFSPECTRUM:MODULATION:FREQUENCY 200KHZ” !Configure modulation offset

50 OUTPUT 714;”INITIATE:ORFSPECTRUM” !Start ORFS measurement.

60 REPEAT

70 OUTPUT 714;”INITIATE:DONE?” !Check to see if ORFS measurement is done.

80 ENTER 714;Meas_complete$

90 UNTIL Meas_complete$=”ORFS” !”ORFS” must be all upper case

100 OUTPUT 714;”FETCH:ORFSPECTRUM:ALL?” !Fetch ORFS results.

110 ENTER 714;Integrity,Tx_pwr,Max_swit_200,Max_swit_400,Bw_pwr,Avg_mod_200

120 END
```

Returned values

The measurements returned by this program are:

- `Integrity` returns the measurement "Integrity Indicator" on page 98 (0 means a successful measurement with no errors).
- `Tx_pwr` returns the transmit power in dBm.
- `Max_swit_200,Max_swit_400` returns maximum ORFS power due to switching in dBm (one maximum power level at a 200 kHz offset and one maximum power level at a 400 kHz offset).
- `Bw_pwr` returns the power level in a 30 kHz bandwidth at zero offset in dBm (this is the reference level for ORFS power due to switching and ORFS power due to modulation).
- `Avg_mod_200` returns the average ORFS power due to modulation in dBm (one average power level at a 200 kHz offset).

Related Topics

****

"Output RF Spectrum Measurement Description" on page 66

"SETup:ORFSpectrum" on page 334

"INITiate" on page 295

"FETCh:ORFSpectrum" on page 268

"Comprehensive Program Example" on page 170

****

ORFS Troubleshooting

Possible Setup Issues

During remote operation of the Output RF Spectrum measurement the user should configure the trigger arm to single, see "SETup:ORFSpectrum" on page 334.

Failure to set trigger arm to single may result in the measurement never giving a result. When trigger arm is continuous the measurement rearms itself and starts another measurement cycle, during remote operation the fetch query may not be synchronized to the measurement cycle, see "Measurement States" on page 123.

ORFS due to modulation measurements: Averaging for each measurement, including the zero offset measurement, is performed over 40 or more bits on the front and back of the burst, from bit 15 to 60 and bit 87 to 132. ETSI standards only require measuring the back bits 87 to 132. By making measurements on the front and back of the burst, two measurements per burst are achieved.

When fetching (frequency offsets) for ORFS due to modulation or switching remotely, the values for the offsets are entered after the " ? ", see "FETCh:ORFSpectrum:MODulation:FREQuency[:OFFSet]?" on page 272 or "FETCh:ORFSpectrum:SWITChing:FREQuency[:OFFSet][:MAXimum]?" on page 274 for HP-IB commands.

The ORFS Transmit Power, 30 kHz BW Power, Max switching offset level and Average switching offset level results are shifted in proportion to the value of Amplitude Offset that a user may set. Table 1 shows the measurements that are affected and how amplitude offset affects them.

Table 4. Measurements affected by amplitude offset

Amplitude offset command, see "Measurement Related Configuration" on page 451	ORFS Transmit Power	30 kHz BW Power	Max switching offset level	Average switching offset levels (up to 8)	Cell Power setting
OUTPUT 714;"SYSTEM:CORRECTION:SGAIN -3" !offset for 3 dB of loss in the network	6.74 dBm	-1.42 dBm	-35.60 dBm	-36.07 dBm	-82 dBm
OUTPUT 714;"SYSTEM:CORRECTION:SGAIN 3" !offset for 3 dB of gain in the network	6.75 dBm	-1.66 dBm	-35.71 dBm	-36.09 dBm	-88 dBm
OUTPUT 714;"SYSTEM:CORRECTION:SGAIN 0" !zero dB of offset	6.67 dB	-1.18 dBm	-35.64 dBm	-36.09 dBm	-85 dBm

Interpreting Integrity Indicator values

See "Integrity Indicator" on page 98.

If over range (5) is returned the input signal is likely to clip during the useful part of the burst. The input level is above the Expected Power, see "Expected Power" on page 418.

If under range (6) is returned the input signal is more than 3 dB below the Expected Power.

If signal too noisy (10) is returned, the actual power at certain offsets is > 8 dB off from the expected level.

Phase and Frequency Error Measurement Description

How is a phase and frequency error (PFER) measurement made?

The PFER measurement performs a narrow-band (<200 kHz) measurement of the modulation quality and frequency accuracy of the GSM mobile station's transmitter. The test set measures frequency error, rms phase error and peak phase error over the useful part of the burst. The PFER measurement demodulates the data and compares the measured wave form with the "ideal" waveform that was expected for the data received. The frequency error is the difference in frequency, after adjustment for the effect of the modulation and phase error, between the RF transmission from the mobile station and the test set. The phase error is the difference in phase, after adjustment for the effect of the frequency error, between the mobile station and the theoretical "ideal" transmission. This measurement conforms to the ETSI 05.05 and 11.10 standards.

The PFER measurement is controlled by the DSP in the test set. No calibration is required by the user, the DSP gets calibration information during test set power up. PFER measurements can run with any other measurement made by the test set.

Single or Multi-Measurements

The DSP demodulates the data and compares the measured waveform with the "ideal" waveform created by the DSP.

A single burst for a PFER measurement calculates the following:

- peak phase error
- rms phase error
- frequency error

A multiple burst PFER measurement is made when the multi-measurement state is on and calculates the maximum, minimum and average values for the following:

- peak phase error
- rms phase error
- frequency error
- worst frequency error (Worst frequency error is the frequency furthest from zero.)

All of these results are available to the user with the FETCh command. If the most positive and the most negative frequency error are the same value, the most positive frequency will be returned. Worst frequency error is only accessible through HP-IB. The test set always has integrity indicator available to the user regardless of single or multiple burst measurements.

Types of Signals PFER can Measure

PFER measurements can be made of these types of input signals.

- Normal GSM TCH burst with mobile station in active cell mode.
- Access (RACH) burst with mobile station in active cell mode.
- Normal GSM TCH burst with mobile station in test mode.

- Access (RACH) burst with mobile station in test mode.
- Bursted signal with GMSK modulation without a valid midamble.

Input Signal Requirements

The PFER measurement will complete and meet its accuracy specification of:

- Frequency error measurement accuracy of ±12 Hz + timebase reference.
- rms phase error measurement accuracy of less than ±1 degree.
- Peak phase error measurement accuracy of less than ±4 degrees.

under these conditions

- Level is between –15 dBm and +43 dBm.
- Level within ±3 dB of the expected input level.
- Frequency is within ±100 kHz of expected input frequency.

Trigger Source

Auto triggering is the recommended trigger source for each measurement allowing the test set may choose the preferred trigger source. However, the user may want to select the trigger source. Immediate trigger source is not recommended for PFER measurements.

Table 5. Recommended Trigger Source settings

Input Signal Type	Recommended Trigger Source
Normal GSM TCH burst with mobile station in active cell mode	Midamble or Amplitude
RACH burst with mobile station in active cell mode	Midamble or Amplitude
Normal GSM TCH burst with mobile station in test mode	Amplitude
RACH burst with mobile station in test mode	Amplitude
Bursted signal with GMSK modulation but no valid midamble	Amplitude
Non-bursted non-GMSK signals with a manual frequency offset of +/- 67.7083 kHz	Immediate

Related Topics

****

“Programming a Phase and Frequency Error Measurement” on page 74

“Test Adherence to Standards” on page 89

****

Programming a Phase and Frequency Error Measurement

This section provides an example of how to make the phase and frequency error (PFER) measurement via HP-IB.

The following procedure assumes that an active link is established between the test set and the mobile station. See “Establishing an Active Link with the Mobile Station” on page 28.

1. Configure PFER measurement parameters using the SETup subsystem.
2. Start the PFER measurement using the INITiate subsystem.
3. Use the INITiate:DONE? command to find out if PFER measurent results are available.
4. Use the FETCh? command to obtain PFER measurement results.

Example Program

```
10 OUTPUT 714;”SETUP:PFERROR:CONTINUOUS OFF”!Configures a PFER measurement to single trigger mode.
20 OUTPUT 714;”SETUP:PFERROR:COUNT:NUMBER 100!Configures a multi-measurment of 100.
30 OUTPUT 714;”SETUP:PFERROR:TRIGGER:SOURCE AUTO”!Configure trigger source to auto.
40 OUTPUT 714;”SETUP:PFERROR:BSYNC:MIDAMBLE !Configures a PFER measurement so that burst synchronization, which will synchronize the timing of the measurement algorithm relative to the data sample, will be set to midamble
60 OUTPUT 714;”INITIATE:PFERROR”!Starts the PFER measurement
70 REPEAT
80 OUTPUT 714;”INITIATE:DONE?”!Query to see if PFER measurement is done
90 ENTER 714;Meas_complete$
100 UNTIL Meas_complete$=“PFER”
110 OUTPUT 714;”FETCH:PFERROR:ALL?”
120 ENTER 714;Integrity, Max_phase_err, Max_peak_error, Worst_freq_err
130 END
```

Returned values

The measurements returned by this program are:

- `Integrity` returns the measurement “Integrity Indicator” on page 98 (0 means a successful measurement with no errors).
- `Max_phase_err` returns the maximum rms phase error in degrees
- `Max_peak_phase_error` returns the maximum peak phase error in degrees
- `Worst_freq_err` returns the the frequency, in Hz, that is the furthest from zero, if the most positive and the most negative frequency error are the same value, the most positive will be returned.

Related Topics

****

"Phase and Frequency Error Measurement Description" on page 72

"SETup:PFERror" on page 343

"INITiate" on page 295

"FETCh:PFERror" on page 276

"Comprehensive Program Example" on page 170

****

PFER Troubleshooting

Possible Setup Issues

During remote operation of the Phase and Frequency Error measurement the user should configure the trigger arm to single, see “SETup:PFERror:CONTinuous” on page 344.

Failure to set trigger arm to single may result in the measurement never giving a result. When trigger arm is continuous the measurement rearms itself and starts another measurement cycle, during remote operation the fetch query may not be synchronized to the measurement cycle, see “Measurement States” on page 123.

The Manual Frequency must be offset by +/- 67.7083 kHz in order to measure non-bursted or non-GMSK modulated signals.

If the Trigger Source is set to RF Rise and the signal measured is not burst modulated the measurement will wait until aborted or timed out.

If the input signal is more than 10 dB below the Expected Power, see “Expected Power” on page 418 or if the input signal is below -30 dBm there is not enough power to generate an RF Rise trigger so the measurement will hang.

Interpreting Integrity Indicator values

See “Integrity Indicator” on page 98.

If the signal has both over range (5) and under range(6) conditions only the over range (5) will be indicated.

Syn Not Found (11) will be returned if the measurement Burst Synchronization is set to Midamble synchronized and Expected Burst pattern is not set to TSC0 through TSC7, or RACH. see “CALL:BURSt” on page 210

Power versus Time Measurement Description

How is a power versus time (PvT) measurement made?

During PvT measurements, the test set measures the instantaneous power of a received GSM burst as a function of time.

The purpose of a PvT measurement is used to determine if the mobile station's transmitter power is within specified power and timing ranges. Figure 2. on page 80 shows a GSM signal and the mask of acceptable power and timing ranges.

This is a narrow-band measurement of the transmitted carrier power of the mobile station as it varies across the TDMA burst. Measuring over approximately a 70 dB dynamic range from one burst. A broad band carrier power measurement of the average power across the burst is made from the same burst.

The TX power measurement does not use midamble synchronization as per ETSI GSM recommendations. This is to save time by providing a faster measurement. The PvT measurement provides the slower midamble synchronization as recommended in ETSI GSM 11.10 by making the PvT carrier power measurement. Users may take advantage of the PvT carrier power measurement to verify carrier power and not initiate the TX power measurement.

The test set allows the user to set 12 time markers. These can be used for statistical analysis of the mobile station. The PvT measurement returns a pass or fail result based on a point by point mask comparison and not just on whether the 12 offsets pass. The pass fail result does not include the PvT carrier power result. The carrier power measurement is used to calculate the pass fail limits.

This measurement conforms to “ETSI GSM 11.10 Ver 4.21.1 Sect 13.3” which is based on “ETSI GSM 05.05 Ver. 4.21.0 Annex B”.

Power versus Time Measurement Results

The primary result of a PvT measurement is a pass/fail result. The pass/fail result that test set returns to the user indicates that the **entire** burst fell within power and timing ranges determined by a point-by-point comparison of with the power versus time measurement mask. Note that these points are not the 12 time markers settable by the user.

The PvT measurement examines the burst to determine the points where the burst fails by the most or is closest to failing the upper and lower limits. At these points, the worst case performance of the burst mask is measured, providing the upper and lower limit margin results. A negative value, (along with the offset time) is returned for the result if the burst fails the mask. A positive value indicates the burst is within the mask.

The following list enumerates all of the results available from a completed PvT measurement.

- Results for a **single** PvT measurement include:
  1. PvT pass/fail result (0 = Pass, 1 & NaN = Fail)
  2. PvT measurement integrity indicator
  3. PvT measurement path headroom
  4. Transmit carrier power in dB (average power during the burst), TX power with midamble synchronization
  5. Upper limit power margin worst case (how close to or where the signal exceeded upper power limit)

6. Lower limit power margin worst case (how close or where the signal exceeded lower power limit)
7. Upper limit timing margin worst case (the time offset where the signal came close to or exceeded upper timing limit)
8. Lower limit timing margin worst case (the time offset where the signal came close to or exceeded lower timing limit)

- The following carrier power results are also available when multi-measurement count is greater than 1:
  1. Average of transmit carrier power measurements (average of averages)
  2. Maximum transmit carrier power measured across each burst
  3. Minimum transmit carrier power measured across each burst
  4. Standard deviation of transmit carrier power measured across each burst
- The user has the option, via programming commands, to retrieve statistical results across ALL of the active time offset markers or across a SUBSET of the markers.

  The following relative power measurements are available:
  1. Average Power (in dBc) measured at the marker(s) relative to transmit power (carrier power)
  2. Maximum power (in dBc) measured at the marker(s) relative to transmit power (carrier power)
  3. Minimum power (in dBc) measured at the marker(s) relative to transmit power (carrier power)
  4. Standard deviation of power (in dBc) measured at the marker(s) relative to transmit power (carrier power)
- The measurement integrity indicator is another result available for any completed PvT measurement. This result provides information about error conditions which occurred and may have affected the accuracy of the most recently completed measurement. For more information about measurement integrity, refer to “Integrity Indicator” on page 98.
- Measurement progress report is a feature that allows the user to periodically see how far multi-measurement cycle has progressed. When the multi-measurement count is greater than 1, the progress report will indicate the number of individual sub-measurements that have been completed, *n*, out of the total number to be completed, *m*. “n” is referred to as ICOunt remotely. “m,” the total number of measurements to be made, is based on the PvT user settings and input signal attributes.

  The progress report is displayed on the test set’s screen in an “n of m” format. The number of measurements completed, *n*, increases from zero to the total number of measurements which need to be made, *m*.

Types of Signals Power vs. Time Can Measure

The following list summarizes the input signal attributes and mobile station operating modes for which PvT can be measured with the test set.

1. Normal GSM TCH burst with mobile station in active cell mode
2. Normal GSM TCH burst with mobile station in test mode (no protocol)
3. RACH burst with valid midamble with mobile station in active cell mode

Power vs. Time Input Signal Requirements

The PvT measurement will complete and meet the PvT measurement accuracy specifications when the signal meets the following input signal conditions.

1. Input signal level is between - 15 dBm and +43 dBm.
2. Transmit power is within ±3 dB of expected input level.
3. Input signal frequency is within ±10 kHz of expected input frequency.

Trigger Source

The selection of trigger source determines how a PvT measurement is triggered after it is initiated. Triggering choices available for the PvT measurement are RF rise, protocol, immediate, and auto. In most cases, choosing auto triggering provides the optimum measurement triggering condition for the PvT measurement.

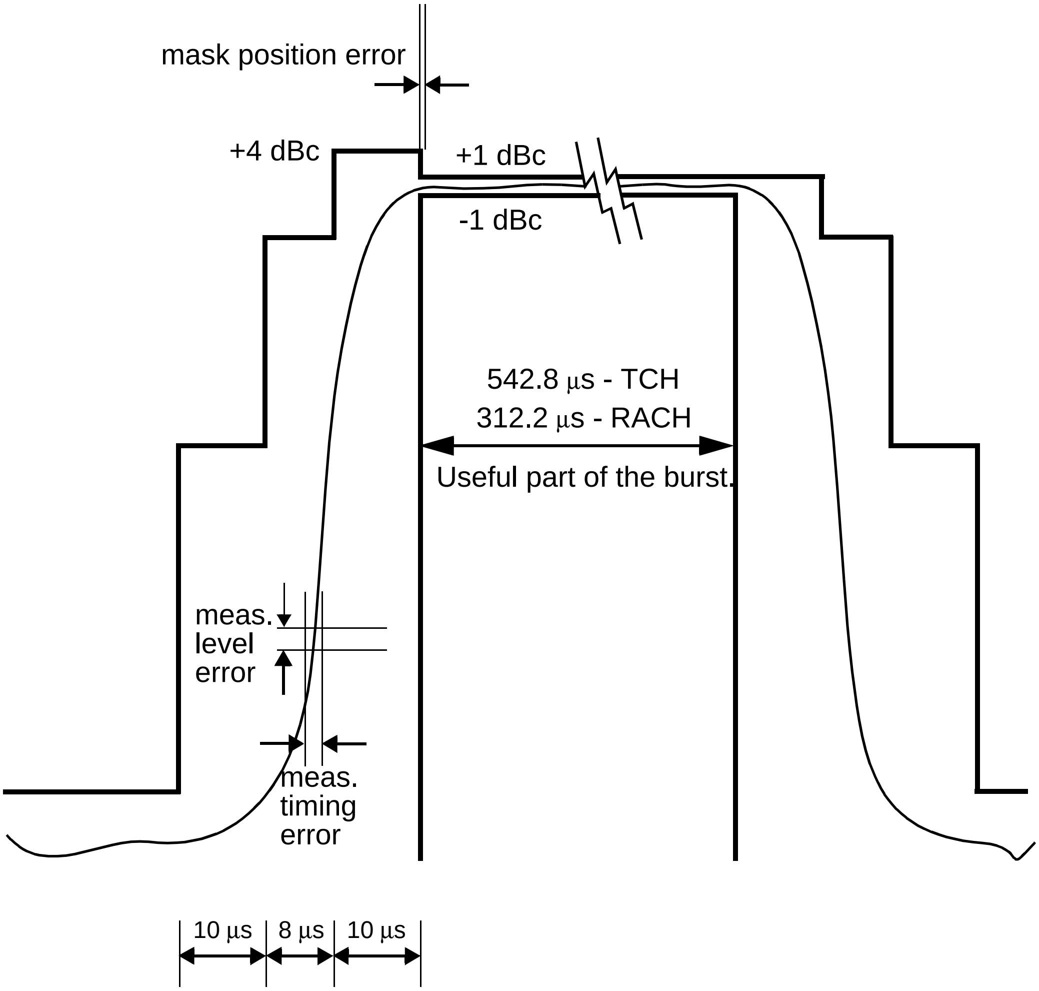
When auto triggering is selected, the test set chooses the trigger source to optimize the measurement. For the PvT measurement, the test set will choose protocol triggering whenever a protocol trigger is available, for example, when the mobile station is in active cell mode. In situations where no protocol is available, for example, the mobile station is in test mode, the test set will choose RF rise triggering for the PvT measurement.

Table 6. Recommended Trigger Source Settings

Input Signal Type	Recommended Trigger Source
Normal GSM TCH burst with mobile station in active cell mode	RF Rise or Protocol
RACH burst with mobile station in active cell mode	RF Rise or Protocol
Normal GSM TCH burst with mobile station in test mode	RF Rise
RACH burst with mobile station in test mode	RF Rise
Bursted signal with GMSK modulation but no valid midamble	RF Rise
CW signal	Immediate

For more information on measurement triggering, refer to "Measurement Triggering" on page 121.

Figure 2. Typical GSM PvT Measurement


mask position error
+4 dBc
+1 dBc
-1 dBc
542.8 µs - TCH
312.2 µs - RACH
Useful part of the burst.
meas. level error
meas. timing error
10 µs
8 µs
10 µs

Related Topics

****

"Programming a Power versus Time Measurement" on page 81

"Test Adherence to Standards" on page 89

****

Programming a Power versus Time Measurement

This section provides an example of how to make the power versus time (PvT) measurement via HP-IB.

The following procedure assumes that an active link is established between the test set and the mobile station. See “Establishing an Active Link with the Mobile Station” on page 28.

1. Configure PvT measurement parameters using the SETup subsystem.
2. Start the PvT measurement using the INITiate subsystem.
3. Use the INITiate:DONE? command to find out if the PvT measurement results are available.
4. Use the FETCh? command to obtain PvT measurement results.

Example Program

```
10 OUTPUT 714;”SETUP:PVTIME:CONTINUOUS OFF”!Configures a PvT measurement to single trigger mode.

20 OUTPUT 714;”SETUP:PVTIME:COUNT:NUMBER 100!Configures a multi-measurment of 100.

30 OUTPUT 714;”SETUP:PVTIME:TRIGGER:SOURCE AUTO”!Configure trigger source to auto.

40 OUTPUT 714;”SETUP:PVTIME:BSYNC MIDAMBLE”!Configures a PvT measurement so that burst synchronization, which will synchronize the time of the measurement algorithm relative to the data sample, will be set to midamble.

50 OUTPUT 714;”SETUP:PVTIME:TIME:OFFSET -28US,-18US !Turns on time markers -28 and -18 microseconds.

70 OUTPUT 714;”INITIATE:PVTIME”!Start PvT measurement.

80 REPEAT

90 OUTPUT 714;”INITIATE:DONE?”!Check to see if PvT measurement is done.

100 ENTER 714;Meas_complete$

110 UNTIL Meas_complete$=”PVT”

120 OUTPUT 714;”FETCH:PVTIME:ALL?”!PvT results for time measurements

130 ENTER 714;Integrity,Pvt_mask, Pvt_power, Max_offset

140 END
```

Returned values

The measurements returned by this program are:

- `Integrity` returns the measurement “Integrity Indicator” on page 98 (0 means a successful measurement with no errors).
- `Pvt_mask` returns the mask pass/fail indicator. When the multi-measurement count is greater than 1, the PvT mask pass/fail result will return Fail (1) if any single measurement fails.
- `Pvt_power` returns the PvT carrier power in dBm.
- `Max_offset` returns the maximum offset level in dB, relative to the PvT carrier power.

Related Topics

****

"Power versus Time Measurement Description" on page 77

"SETup:PVTime" on page 348

"INITiate" on page 295

"FETCh:PVTime" on page 282

"Comprehensive Program Example" on page 170

****

PvT Troubleshooting

Possible Setup Issues

During remote operation of the Power vs. Time measurement the user should configure the trigger arm to single, see “SETup:PVTime:CONTinuous” on page 349.

Failure to set trigger arm to single may result in the measurement never giving a result. When trigger arm is continuous the measurement rearms itself and starts another measurement cycle, during remote operation the fetch query may not be synchronized to the measurement cycle, see “Measurement States” on page 123.

If the Trigger Source is set to RF Rise and the signal measured is not burst modulated the measurement will wait until aborted or timed out.

If the input signal does not rise above the threshold set at 20 to 30 dB below the Expected Power, see “Expected Power” on page 418 there is not enough power to generate an RF Rise trigger so the measurement may hang.

The PvT Transmit Power measurement results are shifted in proportion to the value of Amplitude Offset that a user may set. Table 1 shows the measurements that are affected and how amplitude offset affects them.

Table 7. Measurements affected by amplitude offset

Amplitude offset command (see “Measurement Related Configuration” on page 451)	PVT Transmit Power			Cell Power setting
	Minimum	Maximum	Average	
OUTPUT 714;”SYSTEM:CORRECTION:SGAIN -3” !offset for 3 dB of loss in the network	7.123 dB	7.152 dB	7.136 dB	-82 dBm
OUTPUT 714;”SYSTEM:CORRECTION:SGAIN 3” !offset for 3 dB of gain in the network	7.129 dB	7.16 dB	7.14 dB	-88 dBm
OUTPUT 714;”SYSTEM:CORRECTION:SGAIN 0” !zero dB of offset	7.112 dB	7.147 dB	7.124 dB	-85 dBm

Interpreting Integrity Indicator values

See “Integrity Indicator” on page 98.

If under range (6) is returned the PvT Transmit Power result is more than 3 dB below the Expected Power level.

Syn Not Found (11) will be returned if the measurement Burst Synchronization is set to Midamble synchronized and Expected Burst pattern is not set to TSC0 through TSC7, or RACH. see “CALL:BURSt” on page 210

Transmit Power Measurement Description

How is a transmit power (TXP) measurement made?

The TXP measurement performs a power measurement on a mobile station, averaged over the useful part of the burst. The signal is captured with a wide band 3 GHz fast RF power detector.

In order to provide the user with a very fast TXP measurement the test set measures the power without synchronizing it to the midamble. The measurement is made with RF amplitude synchronization; therefore, the signal does not need to be demodulated to determine the midamble. This technique is different than the TXP measurement defined in ETSI GSM 11.10.

Power versus time and output RF spectrum measurements use the TXP measurement as part of their process, the results are available when both of these measurements are iniatiated. The power versus time measurement provides an average power measurement that is synchronized to the burst's midamble this conforms to the ETSI GSM 11.10 standard.

The TXP measurement is completely controlled by the digital signal processor (DSP) in the test set. Any power measurement requires calibration to ensure accuracy. The power meter used for this measurement is zeroed automatically by the DSP as needed, with no action required by the user. No temperature dependent calibration is required because temperature compensation in the power detector circuits provide temperature stability.

Single or Multi-Measurements

The DSP analyzes the data and calculates the results. A single burst for a TXP measurement calculates the average power over the useful part of the burst. A multiple burst transmit power measurement is made when the multi-measurement state is on. This measurement calculates average, minimum, maximum, and standard deviation of the average power measured. All of these results are available to the user with the FETCh command. The test set always has an integrity indicator avaliable to the user regardless of whether single or multiple burst measurements are selected.

Types of Signals TX Power can Measure

TXP measurements can be made on these types of input signals.

- Normal GSM TCH burst with mobile station in active cell mode.
- Access (RACH) burst with mobile station in active cell mode.
- Normal GSM TCH burst with mobile station in test mode.
- Access (RACH) burst with mobile station in test mode.
- Bursted signal with GMSK modulation without a valid midamble.
- CW signal.

Input Signal Requirements

The TX Power measurement will complete and meet its accuracy specification of less than ±0.6dB when.

- Level is between –20dBm and +3 dBm.
- Level within ±3 dB of the expected input level.

- Frequency is within ±100kHz of expected input frequency.

Trigger Source

Auto triggering is the recommended trigger source for each measurement allowing the test set may choose the prefered trigger source. However the user may want to select the trigger source. See Table 8. on page 85

Table 8. Recommended Trigger Source Settings

Input Signal Type	Recommened Trigger Source
Normal GSM TCH burst with mobile station in active cell mode	Amplitude or Protocol
RACH burst with mobile station in active cell mode	Amplitude or Protocol
Normal GSM TCH burst with mobile station in test mode	Amplitude
RACH burst with mobile station in test mode	Amplitude
Bursted signal with GMSK modulation but no valid midamble	Amplitude
CW signal	Immediate

Related Topics

****

"Programming a Transmit Power Measurement" on page 86

"Test Adherence to Standards" on page 89

****

Programming a Transmit Power Measurement

This section provides an example of how to make the transmit power (TXP) measurement via HP-IB.

The following procedure assumes that an active link is established between the test set and the mobile station. See “Establishing an Active Link with the Mobile Station” on page 28.

1. Configure the TXP measurement parameters using the SETup subsystem.
2. Start the TXP measurement using the INITiate subsystem.
3. Use the INITiate:DONE? command to find out if TXP measurement results are available.
4. Use the FETCh? command to obtain TXP measurement results.

Example Program

```
10 OUTPUT 714;”SETUP:TXPOWER:CONTINUOUS OFF”!Configures a TXP measurement to single
trigger mode.

20 OUTPUT 714;”SETUP:TXPOWER:COUNT:NUMBER 100!Configures a multi-measurement of 100.

30 OUTPUT 714;”SETUP:TXPOWER:TRIGGER:SOURCE AUTO”!Configure trigger source to auto.

50 OUTPUT 714;”INITIATE:TXPOWER”!Start TXP measurement.

60 REPEAT

70 OUTPUT 714;”INITIATE:DONE?”!Check to see if TXP measurement is done.

80 ENTER 714;Meas_complete$

90 UNTIL Meas_complete$=”TXP” !”TXP” must be all upper case

100 OUTPUT 714;”FETCH:TXPOWER:ALL?”!Fetch TXP results.
110 ENTER 714;Integrity, Avg_tx_power
120 END
```

Returned Values

The measurements returned by this program are:

- `Integrity` returns the measurement “Integrity Indicator” on page 98 (0 means a successful measurement with no errors).
- `Avg_tx_power` returns the average transmit power in dBm.

Related Topics

****

“Transmit Power Measurement Description” on page 84

“SETup:TXPower” on page 354

“INITiate” on page 295

“FETCh:TXPower” on page 290

“Comprehensive Program Example” on page 170

```
*******************************************************************************************
```

Transmit Power Troubleshooting

Possible Setup Issues

During remote operation of the Transmit Power measurement the user should configure the trigger arm to single, see “SETup:TXPower” on page 354.

Failure to set trigger arm to single may result in the measurement never giving a result. When trigger arm is continuous the measurement rearms itself and starts another measurement cycle, during remote operation the fetch query may not be synchronized to the measurement cycle, see “Measurement States” on page 123.

If trigger source immediate is used for burst modulated signals the results returned will be unreliable. Burst modulated signals should be measured with Trigger Source set to RF Rise or Auto.

The Transmit Power Average, Transmit Power Maximum, Transmit Power Minimum results are shifted in proportion to the value of Amplitude Offset that a user may set. Table 1 shows the measurements that are affected and how amplitude offset affects them.

Table 9. Measurements affected by amplitude offset

Amplitude offset command, see “Measurement Related Configuration” on page 451	Transmit Power			Cell Power setting
	Average	Maximum	Minimum	
OUTPUT 714;”SYSTEM:CORRECTION:SGAIN -3” !offset for 3 dB of loss in the network	6.86 dBm	6.86 dBm	6.85 dBm	-88 dBm
OUTPUT 714;”SYSTEM:CORRECTION:SGAIN 3” !offset for 3 dB of gain in the network	6.86 dBm	6.86 dBm	6.86 dBm	-82 dBm
OUTPUT 714;”SYSTEM:CORRECTION:SGAIN 0” !zero dB of offset	6.86 dBm	6.87 dBm	6.85 dBm	-85 dBm

Interpreting Integrity Indicator values

See “Integrity Indicator” on page 98.

If under range (6) is returned then the input level is greater than 3dB below the Expected Power value.

If the signal has both over range and under range conditions only the over range (5) will be indicated.

Test Adherence to Standards

AAUDio

- This measurement does not directly correspond to Type Approval Audio measurements.

BERRor

- Not available

DAUDio

- The uplink TCH is decoded with a bit accurate GSM RPE-LTP decoder to yield a block of 13-bit PCM samples within the DSP. As described in ETSI GSM 06.10.

FBERror

- This measurement conforms with the measurement technique described in ETSI GSM 11.10 version 4.21.1 section 14.2. GSM 11.10 version 4.20.1 section 10.1.3 and 10.2.3 calls for truly randomized bits on the downlink using encryption, the test set uses the PRBS CCITT-15 sequence not encryption to randomize the bits on the downlink.

ORFSpectrum

- ORFS is a narrow band measurement that provides information about the distribution of the mobile station transmitter’s out-of-channel spectral energy due to modulation and switching as defined in ETSI 05.05, section 4.2.1 and ETSI 11.10, section 13.4.2.
- The ORFS due to modulation measurement measures both the front and back sections of the burst. Measurements occur from bit 15 to 60 and from bit 87 to 132. GSM 11.10 requires that this measurement be performed only on the back section of the burst.
- At exactly 1800 kHz offset frequency the ORFS due to modulation measurement uses a 30 kHz resolution bandwidth filter not the 100 kHz resolution bandwidth filter required by ETSI GSM 05.05 version 4.21.0 section 4.2.

PFERror

- This measurement conforms to the ETSI 05.05 and 11.10 standards.

PVTime

- This measurement conforms to “ETSI GSM 11.10 Version 4.21.1 Sect 13.3” which is based on “ETSI GSM 05.05 Ver. 4.21.0 Annex B”.

TXPower

- In order to provide the user with a very fast TXP measurement the test set measures the power without synchronizing it to the midamble. The measurement is made with RF amplitude synchronization; therefore, the signal does not need to be demodulated to determine the midamble. This technique is different than the TXP measurement defined in ETSI GSM 11.10.

3 General Programming

Burst Synchronization of Measurements

Measurement Synchronization

Measurement Synchronization Description

Measurement Synchronization occurs after the measurement data is captured. The measurement algorithm itself must provide this functionality. The measurement synchronization setting determines how the measurement's time reference is developed from the measurement data. There are three possible settings for measurement synchronization.

- Midamble synchronization uses the DUT transmitted data Midamble as the time reference. A measurement is capable of Midamble synchronization when it is able to determine transmitted data from measurement samples (demodulation).
- RF Amplitude synchronization uses the envelope of DUT signal to develop the measurement time reference. The measurement finds the DUT's transmit burst in the sampled time record, using the rising and falling edges of the burst to determine timing. If RF Amplitude synchronization is used on a non-bursted DUT signal, the measurement will use the beginning and end of the time record as the rise and fall of the RF Amplitude. The samples used by the measurement will be taken from the middle of the time record in this case.
- None synchronization operates like RF Amplitude synchronization. None synchronization is provided as a convenience to the user measuring a non-bursted DUT signal, RF Amplitude is not a obvious choice for measuring a non-bursted DUT signal.

An Integrity Indicator is returned for each completed measurement. When multiple measurement integrity errors occur during a measurement, the user will be informed of the most likely root error. Integrity errors are prioritized so when multiple errors occur, the highest priority error is returned as the root error. The Integrity Indicator returns a number 0 to 15, where zero = Normal some of the error values Burst Short, Trigger Early, Fall Early, Trigger Late, Rise Late and Sync Not Found are related to synchronization.

Example

```
OUTPUT 714;"SETUP:PVTIME:BSYNC MIDAMBLE"!set synchronization for PVT measurment
```

Related Topics

****

"Integrity Indicator" on page 98

"INITiate" on page 295

"SETup Subsystem" on page 315

****

Programming a Dualband Handover

The dualband handover function has been implemented as an interband channel assignment rather than an interband handover, since the test set currently has one BCH (cell).

How the Test Set Performs a Dualband Handover

The test set has the ability to switch traffic channels (TCH) from the EGSM or PGSM band to the DCS or PCS band, from the DCS or PCS band to the EGSM or PGSM band. No other combinations of traffic channel band handovers are supported. Also, the traffic channel band can be changed only when an active link exists between the test set and a mobile station. See "Establishing an Active Link with the Mobile Station" on page 28

To perform a handover from the test set's front panel from PGSM select DCS or PCS from the Traffic Band field in the Call Parms window.

To perform a handover from the test set's front panel from EGSM select DCS or PCS from the Traffic Band field in the Call Parms window.

There is a set of parameters that can be set up to take on different values depending on the broadcast band currently selected. These are called "Frequency Banded Parameters" on page 399. After a handover, the frequency banded parameters for the new band are active. Only one set of frequency banded parameters is active at any one time; however, the user can set up any of the BCH and TCH parameters for both bands involved in the handover because the test set will remember the settings and switch to them when the handover occurs.

Programming Example

```
OUTPUT 714;“CALL:TCHANNEL:BAND DCS” !Performs a dualband handover to the currently selected
DCS traffic channel.
```

Related Topics

****

"Performing a Dual-Band Handover" on page 164

"CALL:TCHannel" on page 245

****

Dealing With Semicolon Separated Response Data Lists

In accordance with IEEE 488.2-1992 Section 8.4.1 the test set uses the semicolon (;) as the response message unit separator (RMUS). The RMUS separates sequential response message unit elements from one another when multiple response message unit elements are sent in a response message. This condition would occur when combining multiple queries into a single HP-IB transaction.

Query Response Data Types Used By Test Set

The test set can return the following data types in response to queries:

- character data (char): ASCII characters A-Z (65-90 decimal), underscore (95 decimal), digits (48-57 decimal).
- string data: ASCII characters enclosed in quotes (for example, “5551212” or “PGSM”)
- numeric response data (nr1): numeric data in the form +/- dddddddd
- numeric response data (nr3): numeric data in the form +/- ddd.ddd E +/- dddd

Semicolon Separated Response Data Lists Containing Mixed Data Types

Problems can occur when trying to enter semicolon separated response data lists containing mixed data types.

For example: If the following command string is sent to the test set, the test set will respond by constructing a response message which contains multiple response message unit elements (that is, one response message unit element for each query item contained in the command string). Some response message unit elements are string data type, some are character data type and some are nr3 data type.

```
OUTPUT 714;"CALL:MS:REP:IMSI?;PCL?;REV?;SBAN?;ONUM?;MCC?;MNC?;LAC?"
```

An example response message generated by the test set in response to the above OUTPUT statement would be:

```
“001012345678901”;+4.00000000E+000;PHAS1;”PGSM”;”5551212”;9.91E37;9.91E37;9.91E37
```

Since the programmer knows that the control program should expect multiple responses to the above command string he or she might construct the following data entry statement:

```
ENTER 714;Imsi$,Pcl,Rev$,Sban$,Onum$,Mcc,Mnc,Lac
```

In the HP BASIC environment the above ENTER statement will fail with an ‘Insufficient data for ENTER’ error. Some programming languages, HP BASIC for example, cannot use the semicolon character as a data item terminator for string variables. In this example HP BASIC will attempt to enter data into Imsi$ until it sees an LF (line feed) data item terminator. The test set does not send the LF until all the data has been sent. Consequently when HP BASIC sees the LF it terminates entry of data into Imsi$ and starts to look for data to enter into Pcl. Since the test set is no longer sending any data the error message ‘Insufficient data for ENTER’ is generated.

One possible workaround is to enter all the data into a single string variable, replace all semicolons with line feeds and then enter the data from the string into the individual data items. For example:

```
DIM Response$[500]
!
!
OUTPUT 714;"CALL:MS:REP:IMSI?;PCL?;REV?;SBAN?;ONUM?;MCC?;MNC?;LAC?"
```

```
ENTER 714;Response$
Semicolon=POS(Response$,”;”)
WHILE Semicolon
Response$[Semicolon,Semicolon]=CHR$(10)
Semicolon=POS(Response$,”;”)
END WHILE
ENTER Response$;Imsi$,Pcl,Rev$,Sban$,Onum$,Mcc,Mnc,Lac
```

Semicolon Separated Response Data Lists Containing Only Numeric Data Types

Semicolon separated response data lists containing only numeric data types do not present the types of problem associated with semicolon separated response data lists containing mixed data types. The number building routines in most languages will use any non-numeric character (that is, anything other than +/- 0123456789 E .) as the data item terminator. Consequently when the number building routines encounter the semicolon the data item is terminated. The following example illustrates this:

```
OUTPUT 714;”FETCH:TXP:INT?;POW:MIN?;MAX?”
ENTER 714;Integrity,Min_power,Max_power
```

Concurrent Measurements

A number of measurements can be initiated (with the INITiate command) while other measurements are being made, and the test set will perform as many operations simultaneously as its architecture allows. This technique is referred to as concurrency. Performing measurements concurrently can greatly improve test throughput.

Programming Example

See “Programming Example” on page 110.

Operating Considerations

The only absolute restriction regarding concurreny is that the downlink speech source cannot be used when the FBER or BER measurements are running. These measurements take absolute control of the downlink speech source and use it to generate the pseudo-random data. The test set prevents the user from accessing the downlink speech source while the FBER or BER measurements are running.

Related Topics

****

“Measurement Event Synchronization” on page 109

****

Integrity Indicator

Description

The test set can evaluate its own performance and make a determination as to the validity of a measurement result. The test set evaluates the conditions surrounding a measurement and reports to the user its evaluation of these conditions in a parameter called the measurement integrity indicator. A measurement integrity indicator value is returned for every completed measurement. It is recommended that the user take advantage of this feature in every measurement.

The returned value defines whether or not a problem was encountered by the measurement process. It is not, however, guaranteed to be the only or root cause of the measurement problem. This is because some of the conditions surrounding a measurement may interact and the test set may have insufficient information to determine the root cause of the measurement problem. However, in most cases, the value returned is the most likely cause of the problem. The values returned by the measurement integrity indicator range from 0 to 15. Not all 16 values are available for each measurement, if a value doesn't apply it will not be available.

Normal (0): Indicates the measurement completed successfully without error and the result is accurate.

No Result Available (1): Indicates that there is no measurement result and returns NAN (not a number).

Measurement Timeout (2): Indicates that a measurement has timed out. The measurement timeout state must be set to ON.

Hardware Not Installed (3): Indicates that a piece of hardware is not installed in the test set, or the hardware has failed in a way which leads the instrument controller to believe it isn't installed.

Hardware Error (4): Indicates that a hardware failure has occurred. These include failures such as a phase lock loop out-of-lock, defective DSP samplers, or power detectors that can not be calibrated.

Over Range (5): Indicates that the input signal is over range. The amplitude of the device-under test's (DUT's) signal is causing the voltage at a DSP sampler to be above its maximum input level or the frequency is too high or the voltage measured is beyond the maximum voltmeter range, either positive or negative.

Under Range (6): Indicates that the input signal is under range. The amplitude of the DUT's signal is not high enough for the DSP sampler to produce accurate results with the measurement algorithm.

Burst Short (7): Indicates that the burst duration is too short, or part of the burst was not sampled due to improper triggering.

Trigger Early or Fall Early (8): This integrity value can only occur when measurement synchronization is set to midamble. It indicates that the DUT's burst amplitude fell prematurely, or the measurement sampling operation terminated before the falling edge of the burst (early relative to a transmitted burst). If this condition happens with synchronization other than midamble, it generates a Burst Short (7) error.

Trigger Late or Rise Late (9): This integrity value can only occur when measurement synchronization is set to midamble. It indicates that either the rising edge of the DUT's burst was late or the measurement sampling operation didn't start until after the rising edge of the transmitted burst (late relative to a transmitted burst). If this condition happens with synchronization other than midamble, it generates a Burst Short (7) error.

Signal Too Noisy (10): Indicates that the measurement algorithm has found the signal measured to be too noisy to provide accurate results.

Sync Not Found (11): This integrity value can only be returned when measurement synchronization is set to midamble. It indicates that the midamble was not found therefore the measurement was not synchronized.

Oven Out of Range (12): Indicates that a temperature controlled oven (other than the internal timebase oven) is outside of its operating range. The power meter’s oven is checked and its condition reported with this value. (The internal timebase generates a temporary error message (out of lock) that is sent to the system error queue and the display. This is not an integrity indicator value, it is an error message.)

Unidentified Error (13): Indicates errors which are not covered by the other integrity values. Examples include: parameter errors, algorithm memory errors (too many measurements), measurements unavailable (unable to control), autorange unable to converge, default calibration data used.

PCM Full Scale Warning (14): Indicates that the PCM signal has reached plus or minus full scale. The measurement made will be accurate on the PCM signal but would typically indicate an overdriven or oscillating element in the DUT.

Questionable Result for PGSM (15): Indicates that the user attempted to make an FBER measurement in a phase 1 system. FBER is only possible in a phase 2 GSM system. This indicator is available only when the selected broadcast band is PGSM.

Example Program

```
10 OUTPUT 714;”INITIATE:TXPOWER” !Start TXP measurement

20 OUTPUT 714;”FETCH:TXPOWER?” !Request measurement results

30 ENTER 714;Integrity,Tx_power !Read measurement results

40 IF Integrity = 0 THEN !Permits measurement to be printed if integrity indicator
indicates a successful measurement

50 PRINT “TX Power =”;Tx_power!if 0 then measurement was successful

60 ELSE

70 PRINT “Measurement integrity questionable, integrity value = “;Integrity !If integrity
not zero then print integrity value

80 END IF

90 END
```

Integrity Indicators verses Error Message

Error messages are divided into four classes: integrity errors, fatal errors, persistent errors, and non-persistent errors.

Integrity indicator errors are 1 of 16 different messages that indicate if a measurment was valid.

Fatal errors consist of asserts and exceptions. Asserts occur when firmware encounters a condition that should never occur. Exceptions occur when firmware attempts to access a memory location that is invalid.

Non-persistent occur errors if a condition exists that is incorrect but has no serious lasting effect on instrument operation.

Persistent errors occur when hardware failures are found or when damage or injury to a person or the test set may occur.

Power Ranging

The codeware in the initial release of test set does not implement automatic power ranging (autoranging).

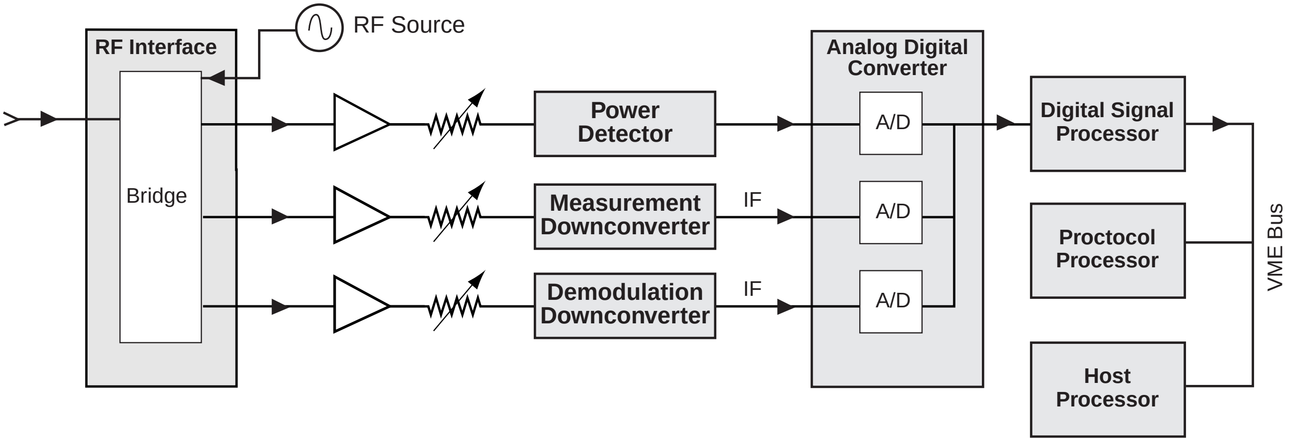
In a manufacturing environment, it is necessary to calibrate the power of the mobile station. During power calibration of the mobile station, it is possible that the power transmitted by the mobile station may be out of the specified limits. In the absence of autoranging in test set, it is necessary to verify that the input signal power does not create adverse signal measurement conditions. It is possible that measurements performed in non-optimum signal conditions may not meet the specified measurement accuracy.

To eliminate the possibility of inaccurate measurements during power calibration of the mobile station, it is desirable to implement a simple and fast algorithm that will perform power ranging using external software.

Signal Measurement Conditions

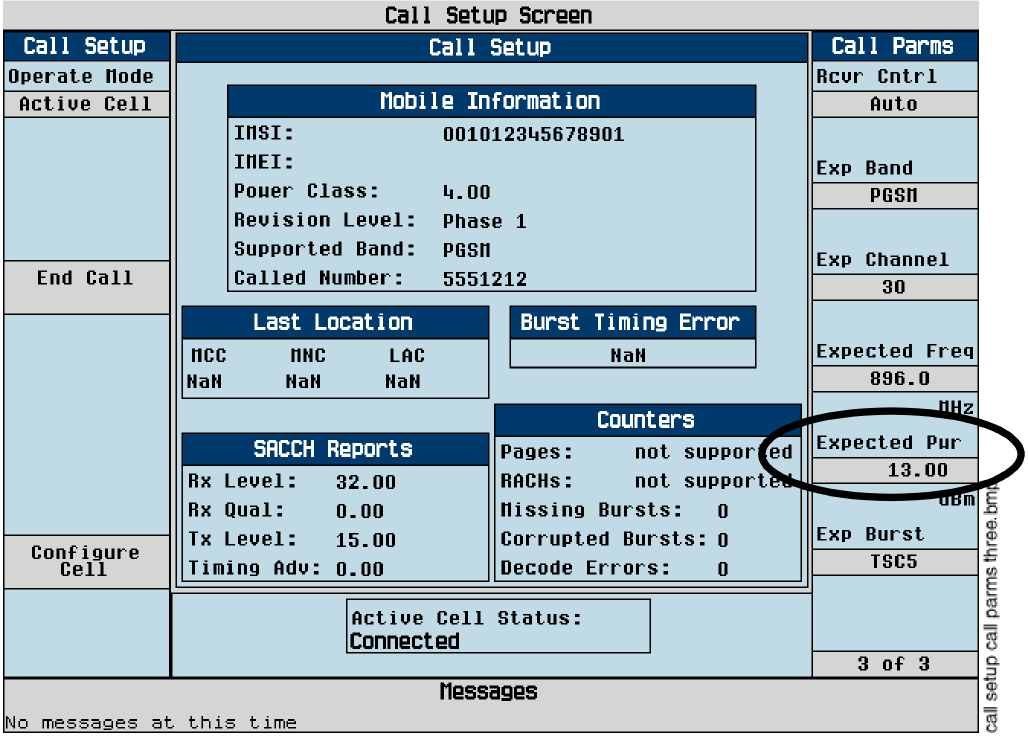
The test set predetermines gain and attenuation levels for its various signal paths based on the expected power of the RF analyzer of the instrument, see Figure 3.

Figure 3. Various Signal Paths in the Test Set


RF Source
RF Interface
Bridge
Power Detector
Measurement Downconverter
Demodulation Downconverter
IF
IF
Analog Digital Converter
A/D
A/D
A/D
Digital Signal Processor
Proctocol Processor
Host Processor
VME Bus

The expected power is entered in the Expected Pwr field, shown in Figure 4. The expected power can be a default value, or entered by the user.

Figure 4. Call Setup Screen and Expected Power Field



Call Setup Screen

Call Setup

Operate Mode

Active Cell

End Call

Configure Cell

Call Setup

Mobile Information

IMSI: 001012345678901
IMEI:
Power Class: 4.00
Revision Level: Phase 1
Supported Band: PGSM
Called Number: 5551212

Last Location

MCC	MNC	LAC
NaN	NaN	NaN

Burst Timing Error

NaN

SACCH Reports

Rx Level: 32.00
Rx Qual: 0.00
Tx Level: 15.00
Timing Adv: 0.00

Counters

Pages: not supported
RACHs: not supported
Missing Bursts: 0
Corrupted Bursts: 0
Decode Errors: 0

Active Cell Status:
Connected

Call Parms

Rcvr Cntrl
Auto

Exp Band
PGSM

Exp Channel
30

Expected Freq
896.0
MHz

Expected Pwr
13.00
dBm

Exp Burst
TSC5

3 of 3

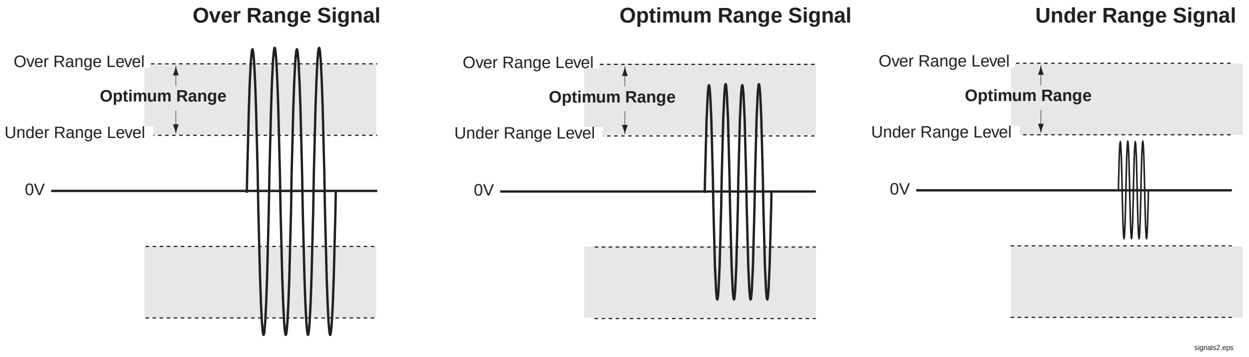
Messages

No messages at this time

Once the expected power is set, the input power can create three possible signal measurement conditions for any measurement (see Figure 5.):

- An optimum measurement condition, where the signal power lies within the accuracy limits of the analog-to-digital-converter (ADC). The measured result is accurate, and an integrity value of 0 (or other than 5 or 6) is returned along with the measurement results.
- An over range measurement condition, where the input signal power is above the accuracy limits of the ADC in the digital signal processing path. The measured result is inaccurate, and an integrity value of 5 is returned with measurement results. This adverse condition can occur when the actual input signal is significantly higher than the expected power.
- An under range condition, where the input signal power is significantly lower than the accuracy limits of the ADC in the digital signal processing path. The measured result may not be accurate, and an integrity value of 6 is returned along with the measurement result. This adverse condition can occur, when the actual input power is significantly (3 dB) lower than the expected power

Figure 5. Signal Measurement Conditions



Method for Power Ranging

A simple and fast algorithm is presented here to autorange the test set using external software. Users may decide to modify the technique to match their needs. The technique involves making a transmit power measurement before making any other measurement, such as phase and frequency error, output radio frequency spectrum, or power versus time.

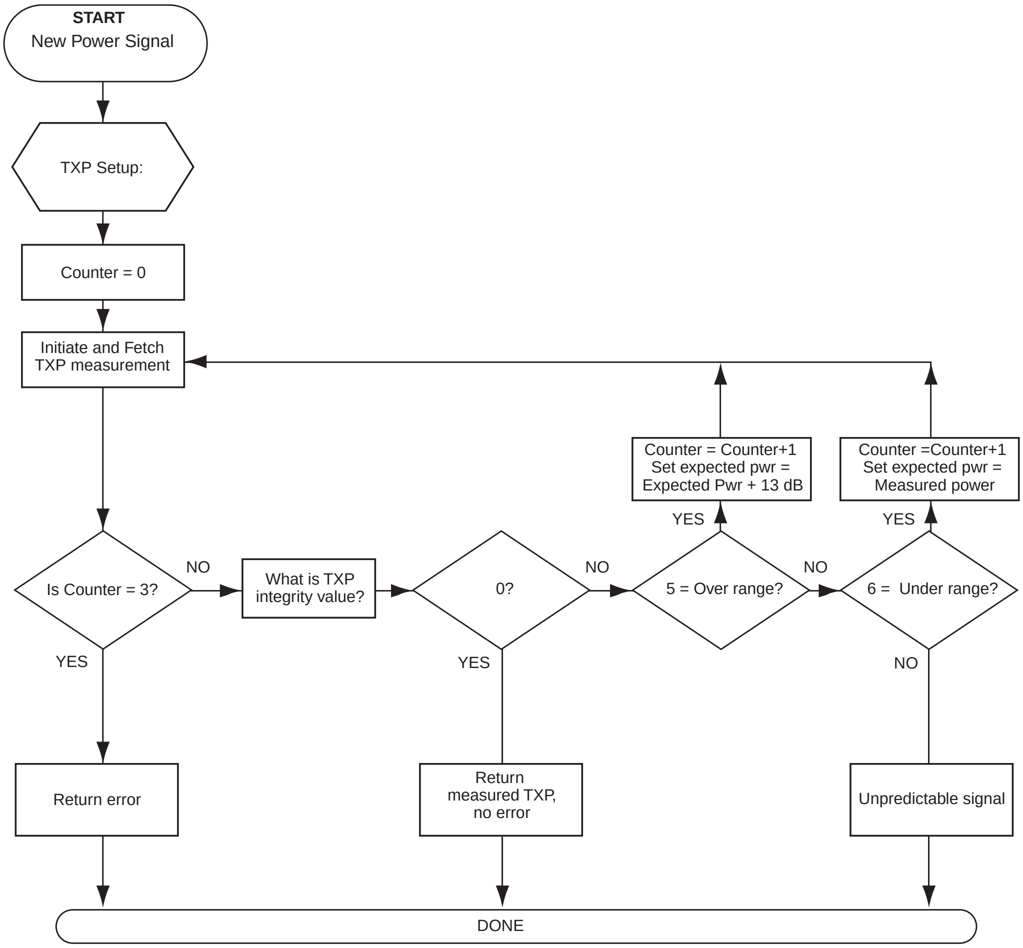
The transmit power measurement is a very fast measurement, with a typical measurement time of 20 milliseconds for a single burst measurement. The transmit power measurement is made with the default value or an estimated value entered for expected power. The measured transmit power and the integrity indicator are used in determining the signal measurement condition (see Figure 6.):

- If the transmit power integrity is a normal value (0), the estimated/default value for the expected power is considered to be the correct power setting, and no changes are made to the expected power. The measured transmit power is, in this case, accurate.
- If the transmit power integrity value is under-range (6), the expected power is re-set to the measured transmit power. The transmit power is then re-measured, and the integrity value is checked again.
- If the transmit power integrity value is over-range (5), the expected power is re-set to a new value, which is the previous expected power + 13 dB. The transmit power is then re-measured, and the integrity value is checked again.

Thus, the transmit power integrity value is checked for any under-range and over-range conditions caused by the input power. The expected power is iteratively re-set to match the input signal conditions, and hence to obtain a normal value for integrity on subsequent transmit power measurement. If the number of iterations is more than 3, the input signal is considered to be a non-ideal signal, and cannot be ranged using this simple algorithm. Further details are shown in Figure 4. on page 101.

After obtaining the most accurate expected power using this algorithm, additional measurements can be made at the same input signal power level and frequency. When the input signal changes in power level and/or frequency, the algorithm must be repeated before making new measurements to ensure the optimum signal measurement condition is achieved.

Figure 6. Power Ranging Algorithm Flowchart


START
New Power Signal
TXP Setup:
Counter = 0
Initiate and Fetch TXP measurement
Is Counter = 3?
NO
YES
What is TXP integrity value?
0?
NO
YES
5 = Over range?
YES
NO
6 = Under range?
YES
NO
Counter = Counter+1 Set expected pwr = Expected Pwr + 13 dB
Counter =Counter+1 Set expected pwr = Measured power
Return error
Return measured TXP, no error
Unpredictable signal
DONE

A Program for Implementing Power Ranging

```
10    !This example is intended to show an implementation
20    !of power ranging algorithm.
30    !The power ranging algorithm is contained in the subroutine RANGE.
40    !
50    !Phone call setup is not shown in this example.
60    !User is required to add code to bring up a phone call
70    !or put the phone in test mode.
80    !
90    ! RE-STORE "C:\HPBASIC\autorang"
100   REAL Measured_pwr,Expected_pwr
110   REAL Txp_array(1:2),Pfer(1:4)
```

```
120   INTEGER Err
130     !
140     !SETUP TXP and PFER measurements you want to do after power ranging
150   OUTPUT 714;"SET:TXP:CONTINUOUS OFF"
160   OUTPUT 714;"SET:PFER:COUNT:NUMBER 5;STAT ON"
170   OUTPUT 714;"SET:PFER:CONTINUOUS OFF"
180     !
190     !Handoff to a powerlevel 10 and channel 30.
200     !Perform power ranging.
210     !Make the two measurements:TXP and PFER.
220   OUTPUT 714;"CALL:MS:TXL:SEQ 10"
230   OUTPUT 714;"CALL:TCH:SEQ 30"
240   OUTPUT 714;"RFANALYZER:EXPECTED:POWER?"
250   ENTER 714;Expected_pwr
260   CALL Range(Measured_pwr,Expected_pwr,Err)     !Power range algorithm
270   IF Err=1 THEN PRINT "ERROR: COULD NOT RANGE"
280   OUTPUT 714;"INIT:TXP;PFER"
290   OUTPUT 714;"FETCH:TXP?;PFER?"
300   ENTER 714;Txp_array(*),Pfer(*)
310   PRINT Txp_array(*),Pfer(*)
320   END
330 Range: SUB Range(REAL Measured_pwr,REAL Expected_pwr,INTEGER Err)
340     INTEGER Counter,Countstate_prev
350     Counter=0
360     Err=0
370     !
380     !Housekeeping for Txpower setup.
390     OUTPUT 714;"SETUP:TXPOWER:CONTINUOUS OFF"
400     OUTPUT 714;"SETUP:TXPOWER:COUNT:STATE?"
410     ENTER 714;Countstate_prev
420     OUTPUT 714;"SETUP:TXPOWER:COUNT:STATE OFF"
430     OUTPUT 714;"SETUP:TXPOWER:TRIGGER:SOURCE?"
440     ENTER 714;Trigsource_prev$
450     OUTPUT 714;"SETUP:TXPOWER:TRIGGER:SOURCE RISE"
460     PAUSE
470     !RF ANALYZER EXPECTED POWER
```

```
480     OUTPUT 714;"RFANALYZER:EXPECTED:POWER";Expected_pwr
490     !
500     REPEAT
510       OUTPUT 714;"INIT:TXP"
520       OUTPUT 714;"FETCH:TXP?"
530       ENTER 714;Integrity,Measured_pwr
540       IF Integrity=0 THEN
550         OUTPUT 714;"SET:TXPOWER:COUNT:STATE ";Countstate_prev
560         OUTPUT 714;"SET:TXPOWER:TRIGGER:SOURCE ";Trigsource_prev$
570         SUBEXIT
580       END IF
590     !OVER_RANGE
600       IF Integrity=5 THEN
610         Expected_pwr=Expected_pwr+13
620         OUTPUT 714;"RFANALYZER:EXPECTED:POWER";Expected_pwr
630       END IF
640     !UNDER_RANGE
650       IF Integrity=6 THEN
660         Expected_pwr=Measured_pwr
670         OUTPUT 714;"RFANALYZER:EXPECTED:POWER";Expected_pwr
680       END IF
690       !INTEGRITY OTHER THAN 0,5 OR 6
700       IF Integrity<>0 AND Integrity<>5 AND Integrity<>6 THEN
710         PRINT "INTEGRITY IS ";Integrity
720         PRINT "REFER TO DOCUMENTATION FOR WHAT INTEGRITY MEANS”
730         SUBEXIT
740       END IF
750       Counter=Counter+1
760     UNTIL Counter>3
770     Err=1
780   SUBEND
```

Timeouts

Description

The primary use of measurement timeouts is to regain control of the test set's HP-IB in cases where the bus could potentially "hang."

The time normally required for a measurement to complete may vary greatly depending on the individual measurement, its settings, it's multiple measurement count value, and so forth. Because of this, the default timeout and timeout resolution are fairly coarse and are set to allow large variations in measurement time. You may need to set the timeout longer than the default for measurements where a large number of multiple measurements are requested or where measurement triggers may be infrequent.

Be careful when setting a timeout that is shorter than the default. It is possible, especially when measurements are performed concurrently, to specify a timeout that is so short the measurement does not even have a chance to begin. Measurement timeouts should always be at least several seconds long.

Table 10. List of Timeouts and Default Values

Measurement Function	Default Timeout Time	Default Timeout State	Integrity Indicator Value
Transmit Power (TX power or TXP)	10 seconds	OFF	2
Power versus Time (PvT)	10 seconds	OFF	2
Phase and Frequency Error (PFER)	10 seconds	OFF	2
Output RF Spectrum (ORFS)	10 seconds	OFF	2
Fast Bit Error Rate (FBER)	10 seconds	OFF	2
Bit Error Rate (BER)	10 seconds	OFF	2
Analog Audio (AAUDIO)	10 seconds	OFF	2
Decoded Audio[a] (DAUDIO)	10 seconds	OFF	2
Call Control Status Change Arm	10 seconds	OFF	Not included

[a] Also known as uplink speech level.

Timeout units default to S (seconds). The seconds suffix is an optional part of the command. If you want MS (milliseconds), US (microseconds) or NS (nanoseconds), you must specify these units in the suffix.

Program Example

The following program will force a timeout to occur on an attempted transmit power measurement. The integrity indicator should return a 2 (the measurement timeout indicator).

```
10 OUTPUT 714;”CALL:END” !Ends a call that may have been connected, inhibiting protocol as
a trigger source.

20 OUTPUT 714;”SETUP:TXPOWER:TIMEOUT:TIME 5;STATE ON” !Sets a timeout value of 5 seconds

30 OUTPUT 714;”INITIATE:TXPOWER”!Initiates a single TX power measurement

40 OUTPUT 714;”FETCH:TXPOWER?” !Queries the TX Power measurement result

50 ENTER 714;Integrity,Tx_pwr_result !

60 PRINT “Integrity indicator was “;Integrity

65 IF Integrity = 2 THEN !Integrity Indicator 2 indicates TX power timed-out.

70 PRINT “Measurement timed out”

75 ELSE

80 PRINT “Measurement did not time out, TX power measurement result was “;Tx_pwr_result

85 END IF

90 END
```

In this example, if the TX power measurement takes longer than 5 seconds to complete, the FETCh command will obtain an integrity value of 2. The test set’s HP-IB will then be available to accept more commands.

Related Topics

****

“Integrity Indicator” on page 98

****

Measurement Progress Report

The measurement progress report is a query of how far along a multi-measurement cycle (see "Statistical Measurement Results" on page 113) has progressed. When multi-measurement count is greater than one, a measurement progress report is available that will indicate the number of measurements that have completed, incrementing from zero to the multi-measurement count number. The returned value will be the last update and not the actual number, because the value is updated periodically not for each cycle. Every measurement has the measurement progress report available.

Example

```
OUTPUT 714;”FETCH:PVTIME:ICOUNT?”!Returns the approximate number of measurement cycles
completed during a multi-measurement count cycle.
```

Related Topics

****

"Statistical Measurement Results" on page 113

****

Measurement Event Synchronization

Description

Measurement event synchronization controls the communication between the controller, the test set, and the mobile station so that no device does something before it is supposed to, which can cause errors, or does something well after it could have, which wastes time. Because the test set provides for measurement execution concurrently (see “Concurrent Measurements” on page 97), it is necessary that the control program know when individual measurement results are available.

Measurement event synchronization is accomplished using the INITiate subsystem’s command INITiate:DONE? or the STATus:OPERation:NMRReady status registers.

INITiate:DONE?

The INITiate:DONE? query returns one of the following indicators:

- "NONE" - No measurements that are not excluded from the query are in the ON state.
- "TXP" - The transmit power measurement results are available
- "PVT" - The power versus time measurement results are available.
- "PFER" - The phase and frequency error measurement results are available.
- "FBER" - The fast bit error rate measurement results are available.
- “BERR” - The bit error measurement results are available.
- "AAUD" - The analog audio measurement results are available.
- "DAUD" - The decoded audio measurement results are available.
- "ORFS" - The output RF spectrum measurement results are available.
- "WAIT" - There are one or more measurements which are in the ON state and which are not excluded from the query and those measurements are not done yet.

Programming Example

The following example assumes that a call is currently connected and that no measurements other than TX power (TXP) and phase and frequency error (PFER) are currently being triggered. See “Establishing an Active Link with the Mobile Station” on page 28 and “Triggering Process Description” on page 122.

```
10 OUTPUT 714;”SETUP:TXPOWER:CONTINUOUS OFF;:SETUP:PFERROR:CONTINUOUS OFF” !Sets TX power and
PFER trigger mode to single.

15 OUTPUT 714;”INITiate:TXPower;PFERror” !Begins a TX power and PFER measurement.

20 REPEAT

30 OUTPUT 714;”INITIATE:DONE?” !Queries the test set for measurements that are done

40 ENTER 714;Meas_done$ !String value representing DONE measurements, NONE if no
measurements are done.

45 SELECT Meas_done$ !This variable will be set to WAIT until measurements are DONE.

50 CASE “TXP” !Characters must be upper case

60 OUTPUT 714;”FETCH:TXPOWER:POWER?” !If this case is selected, Tx power (no integrity
indicator) is FETCHed.

70 ENTER 714;Tx_power

80 PRINT “TX_Power is “;Tx_power

90 CASE “PFER” !Characters must be uppercase.

100 OUTPUT 714;”FETCH:PFERROR:RMS?” !If this case is selected, rms phase error measurement
is FETCHed.

110 ENTER 714;Phs_error

120 PRINT “Max RMS Phase Error is “;Phs_error

130 END SELECT

140 UNTIL Meas_done$ = “NONE” !When all triggered measurements have completed, the
INITiate:DONE? query returns NONE.

150 END
```

STATUS:OPERATION:NMRREADY

The “STATus:OPERation:NMRReady Condition Register Bit Assignment” on page 365 status register provides status reporting on the following measurement completions:

- TX Power
- Power vs. Time
- Phase/Frequency Error
- Output RF Spectrum
- Analog Audio
- Decoded Audio
- Fast Bit Error
- Bit Error Rate

Example 7. Generating a Service Request (SRQ) Interrupt - Bit Error Rate NMRR

The following example illustrates the use of the STATus subsystem to generate a service request when a BERR measurement has completed. This code assumes a call is already connected and the BERR measurement is setup (mobile station must be in loopback type A or B).

```
10 OUTPUT 714;"STATUS:OPERATION:NMRREADY:PTR 256"         !Enable positive transition
filter on fast BER bit

20 OUTPUT 714;"STATUS:OPERATION:NMRREADY:ENABLE 256”        !Enable the fast BER Bit to
generate a summary message

30 OUTPUT 714;”STATUS:OPERATION:ENABLE 512”            !Enable the Operation summary bit
to generate a summary message

40 OUTPUT 714;”*SRE 128” !Enable the service request enable register to generate SRQ

50 OUTPUT 714;"*CLS"     !Clear all status data structures

60 ON INTR 7,15 CALL Meas_complete !Define interrupt-initiated branch with a priority of 15
(highest)

70 ENABLE INTR 7;2 !Enable interrupt on interface card 7 with a bit mask (for interface’s
interrupt-enable register) of 2

80 OUTPUT 714;”SETUP:FBER:CONTINUOUS OFF;:INITIATE:FBERROR” !Initiate a single fast BER
test

90 LOOP

100 DISP “Waiting for BERR test to complete”

110 WAIT .1 !”Dummy” loop

120 END LOOP

130 !Instead of a “dummy” loop, controlling application could be performing setups, making
measurements, etc.

140 END

150 SUB Meas_complete

160 DISP “BER test complete, OK to FETCh results now”
```

```
170 Clear_interrupt=SPOLL(714) !Clear the RQS message in the status byte register
180 STOP
190 SUBEND
```

Operating Considerations

Only one indicator is returned per query.

To ensure that when a measurement completes it will remain in a state that qualifies it as DONE, use the SETup subsystem to set all active measurements to single (CONTinous:OFF) trigger mode.

Related Topics

****

“INITiate Command Functions” on page 292

“What Happens When a Measurement is INITiated?” on page 294

****

Statistical Measurement Results

Description

Most measurements have a setup window that provides for the entry of a multi-measurement count value. This value specifies how many measurements the test set will perform to obtain a set of values from which to calculate the following statistical measurement results:

- Average (arithmetic mean) of measurement set
- Minimum value from measurement set
- Maximum value from measurement set
- Standard Deviation of measurement set

Programming Example

```
OUTPUT 714;”SETUP:TXPOWER:SNUMBER 10” !Enters a TX Power multi-measurement count value of
10, and turns the TX Power multi-measurement state on.
```

Operating Considerations

The advantages of using the multi-measurement feature to obtain statistical measurement data include: reduced time associated with HP-IB bus traffic, and reduced time configuring hardware. This is because the number of measurements specified in the multi-measurement count value are performed during one measurement cycle.

Related Topics

****

“Measurement Progress Report” on page 108

****

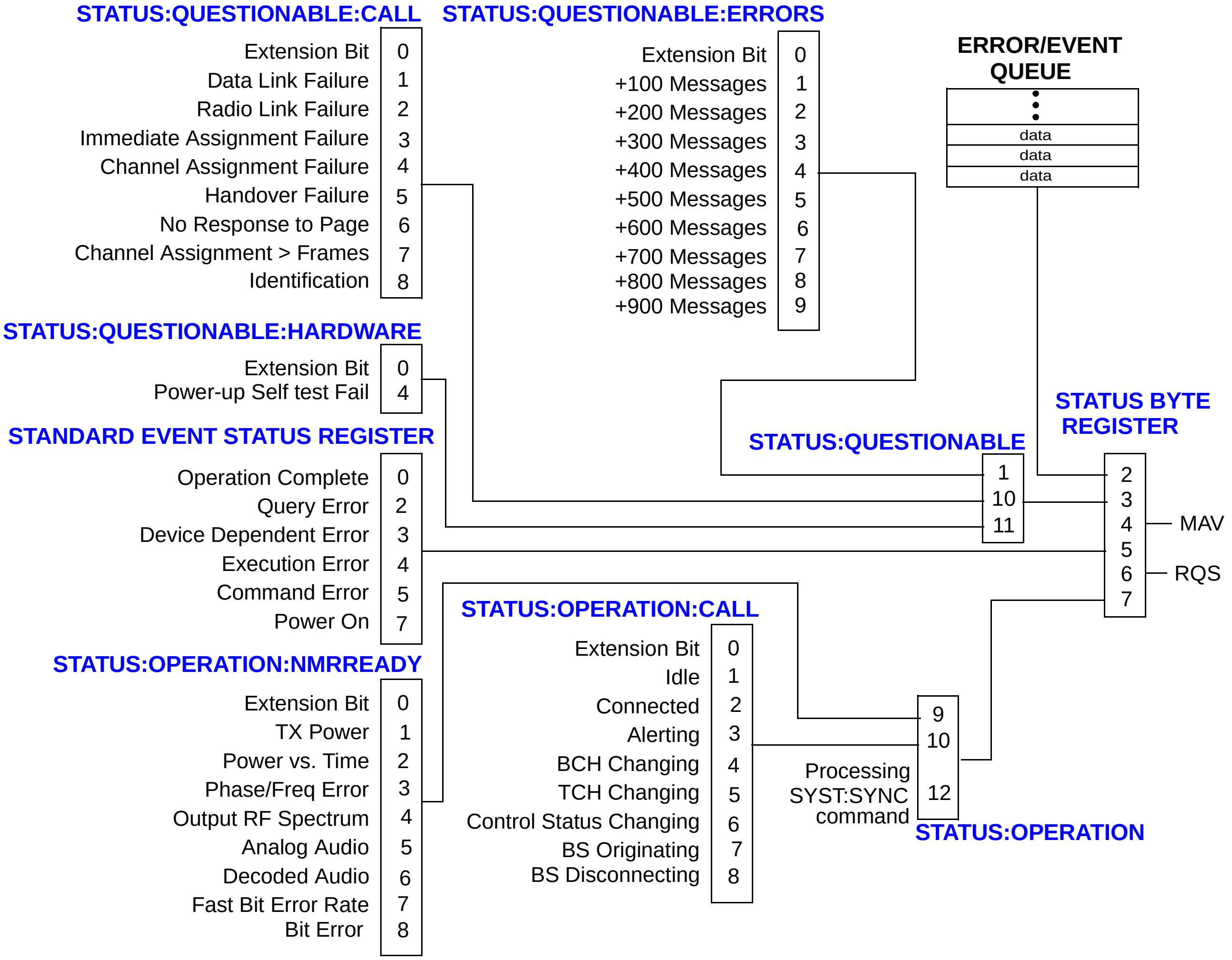
Status Subsystem Overview

The Test Set's STATus Subsystem

The following STATus subsystem functionality, leveraged from SCPI and IEEE 488.2 are implemented in the Test Set:

- SCPI - defined "fan-out", where a Summary Message Bit is associated with another entire register (see "Overview of STATus Reporting Structure" on page 115.
- IEEE 488.2 Status Data Structure - Register Model (see "Status Data Structure - Register Model" on page 115).
- The SCPI - defined Error/Event queue (see "Status Data Structure - Queue Model" on page 118.
- The IEEE 488.1 - defined and IEEE 488.2 - defined Status Byte (see "*STB?" on page 376)
- The SCPI OPERation and QUEStionable (data/signal) Status Registers (see "Syntax Diagrams and Command Descriptions" on page 359.
- The IEEE 488.2 - defined Standard Event Status Register (see "Standard Event Status Register Model" on page 119)

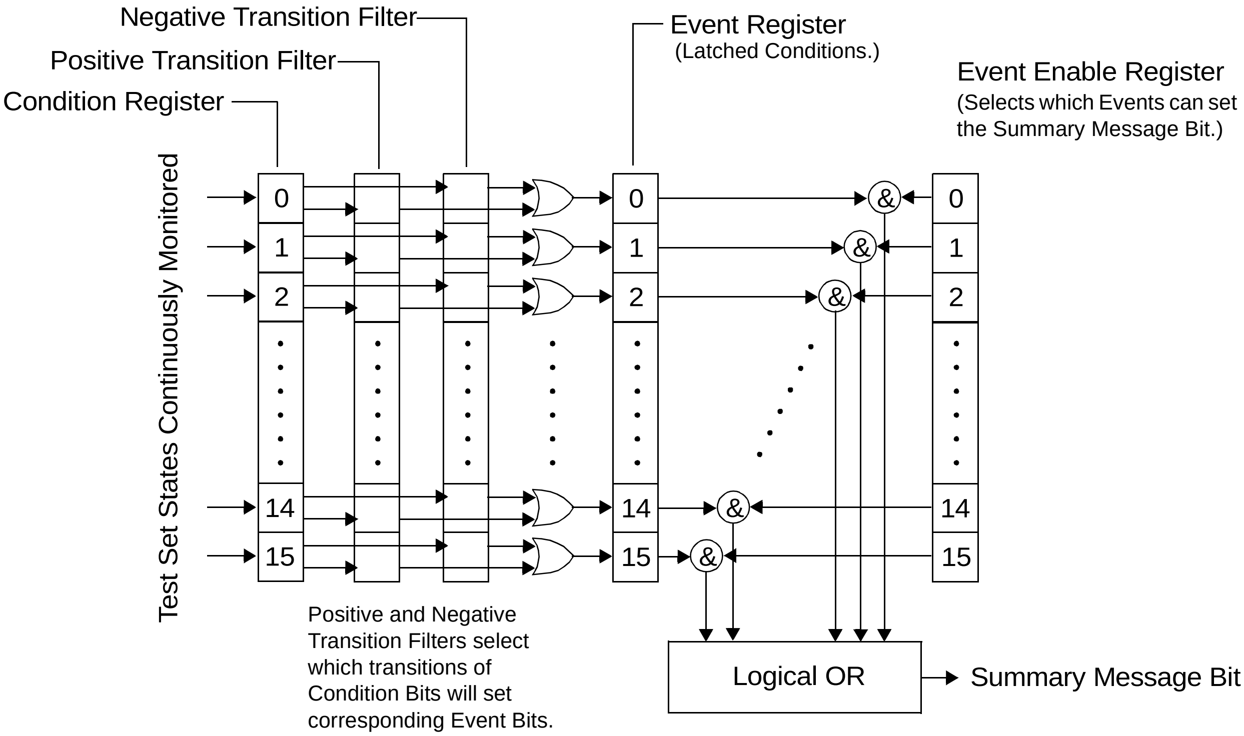
Overview of STATus Reporting Structure


STATUS:QUESTIONABLE:CALL
Extension Bit 0
Data Link Failure 1
Radio Link Failure 2
Immediate Assignment Failure 3
Channel Assignment Failure 4
Handover Failure 5
No Response to Page 6
Channel Assignment > Frames 7
Identification 8
STATUS:QUESTIONABLE:ERRORS
Extension Bit 0
+100 Messages 1
+200 Messages 2
+300 Messages 3
+400 Messages 4
+500 Messages 5
+600 Messages 6
+700 Messages 7
+800 Messages 8
+900 Messages 9
ERROR/EVENT QUEUE
data
data
data
STATUS:QUESTIONABLE:HARDWARE
Extension Bit 0
Power-up Self test Fail 4
STANDARD EVENT STATUS REGISTER
Operation Complete 0
Query Error 2
Device Dependent Error 3
Execution Error 4
Command Error 5
Power On 7
STATUS:QUESTIONABLE
1
10
11
STATUS BYTE REGISTER
2
3
4 MAV
5
6 RQS
7
STATUS:OPERATION:NMRREADY
Extension Bit 0
TX Power 1
Power vs. Time 2
Phase/Freq Error 3
Output RF Spectrum 4
Analog Audio 5
Decoded Audio 6
Fast Bit Error Rate 7
Bit Error 8
STATUS:OPERATION:CALL
Extension Bit 0
Idle 1
Connected 2
Alerting 3
BCH Changing 4
TCH Changing 5
Control Status Changing 6
BS Originating 7
BS Disconnecting 8
Processing SYST:SYNC command
STATUS:OPERATION
9
10
12

Status Data Structure - Register Model

The generalized status register model consists of a Condition Register, Transition Filters, an Event

Register, an Enable Register, and a Summary Message Bit.


Negative Transition Filter
Positive Transition Filter
Condition Register
Event Register
(Latched Conditions.)
Event Enable Register
(Selects which Events can set the Summary Message Bit.)
Test Set States Continuously Monitored
0
1
2
14
15
&
Positive and Negative Transition Filters select which transitions of Condition Bits will set corresponding Event Bits.
Logical OR
Summary Message Bit

Condition Register

A condition is a Test Set state that is either TRUE or FALSE (an HP-IB command error has occurred or an HP-IB command error has not occurred). Each bit in a Condition Register is assigned to a particular Test Set state. A Condition Register continuously monitors the hardware and firmware states assigned to it. There is no latching or buffering of any bits in a Condition Register; it is updated in real time. Condition Registers are read-only. Condition Registers in the Test Set are 16 bits long and may contain unused bits. All unused bits return a zero value when read.

Some status register groups do not implement Condition registers for certain Test Set conditions. In the tables labeled “Bit Definitions”, these conditions are indicated by the word “NO” in the column labeled “Is Condition Register Implemented?”.

Transition Filters

In the Test Set, the Transition Filters are implemented as two registers: a 16-bit positive transition (PTR) register and a 16-bit negative transition (NTR) register.

For each bit in the Condition Register, a Transition Filter bit determines the state transitions which will set a corresponding bit in the Event Register. Transition Filters may be set to pass positive transitions (PTR), negative transitions (NTR) or either (PTR or NTR). A positive transition refers to a condition bit which has changed from 0 to 1. A negative transition refers to a condition bit which has changed from 1 to 0.

A positive transition of a bit in the Condition register will be latched in the Event Register if the corresponding bit in the positive transition filter is set to 1. A positive transition of a bit in the Condition register will not be latched in the Event Register if the corresponding bit in the positive transition filter is set to 0.

A negative transition of a bit in the Condition register will be latched in the Event Register if the corresponding bit in the negative transition filter is set to 1. A negative transition of a bit in the Condition register will not be latched in the Event Register if the corresponding bit in the negative transition filter is set to 0. Either transition (PTR or NTR) of a bit in the Condition Register will be latched in the Event Register if the corresponding bit in both transition filters is set to 1. No transitions (PTR or NTR) of a bit in the Condition Register will be latched in the Event Register if the corresponding bit in both transition filters is set to 0.

Transition Filters are read-write.

Transition Filters are unaffected by a *CLS (clear status) command.

Transitions Filters are set to pass positive transitions (all 16 bits of the PTR register are set to 1 and all 16 bits of the NTR register are set to 0) at power on or after receiving the *RST (reset) command.

Event Register

The Event Register captures bit-state transitions in the Condition Register as defined by the Transition Filters. Each bit in the Event Register corresponds to a bit in the Condition Register, or if there is no Condition Register/Transition Filter combination, each bit corresponds to a specific condition in the Test Set. Bits in the Event Register are latched, and, once set, they remain set until cleared by a query of the Event Register or a *CLS (clear status) command. This guarantees that the application can't miss a bit-state transition in the Condition Register. There is no buffering; so while an event bit is set, subsequent transitions in the Condition Register corresponding to that bit are ignored. Event Registers are read-only. Event Registers in the Test Set are either 8 or 16 bits long and may contain unused bits. All unused bits return a zero value when read.

Event Enable Register

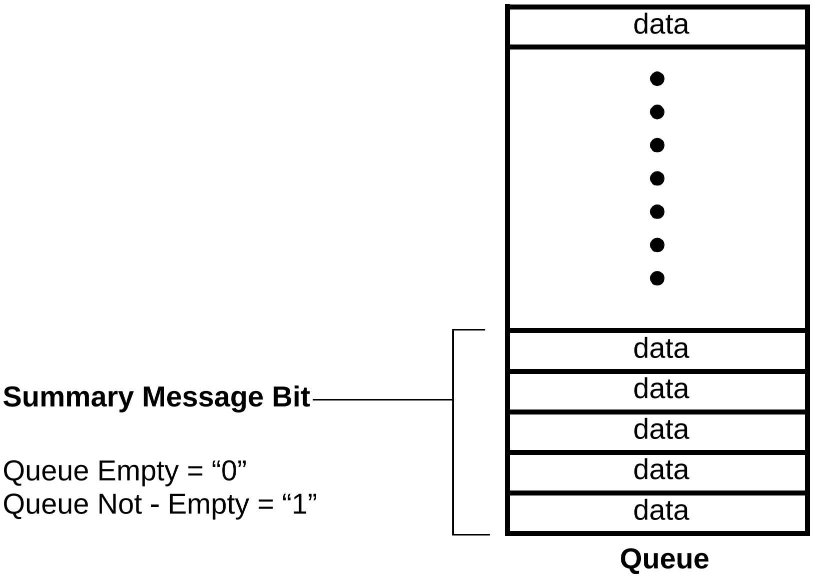
The Event Enable Register defines which bits in the Event Register will be used to generate the Summary Message. Each bit in the Enable Register has a corresponding bit in the Event Register. The Test Set logically ANDs corresponding bits in the Event and Enable registers and then performs an inclusive OR on all the resulting bits to generate the Summary Message. By using the enable bits the application program can direct the Test Set to set the Summary Message to the 1 or TRUE state for a single event or an inclusive OR of any group of events. Enable Registers are read-write. Enable Registers in the Test Set are either 8 or 16 bits long and may contain unused bits which correspond to unused bits in the associated Event Register. All unused bits return a zero value when read and are ignored when written to. Enable Registers are unaffected by a *CLS (clear status) command or queries.

Summary Message Bit

The Summary Message is a single-bit message which indicates whether or not one or more of the enabled events have occurred since the last reading or clearing of the Event Register. The Test Set logically ANDs corresponding bits in the Event and Enable registers and then performs an inclusive OR on all the resulting bits to generate the Summary Message. By use of the enable bits, the application program can direct the Test Set to set the Summary Message to the 1, or TRUE, state for a single event or an inclusive OR of any group of events. The Summary Message is TRUE when an enabled event in the Event Register is set TRUE. Conversely, the Summary Message is FALSE when no enabled events are TRUE. Summary Messages are always seen as bits in another register.

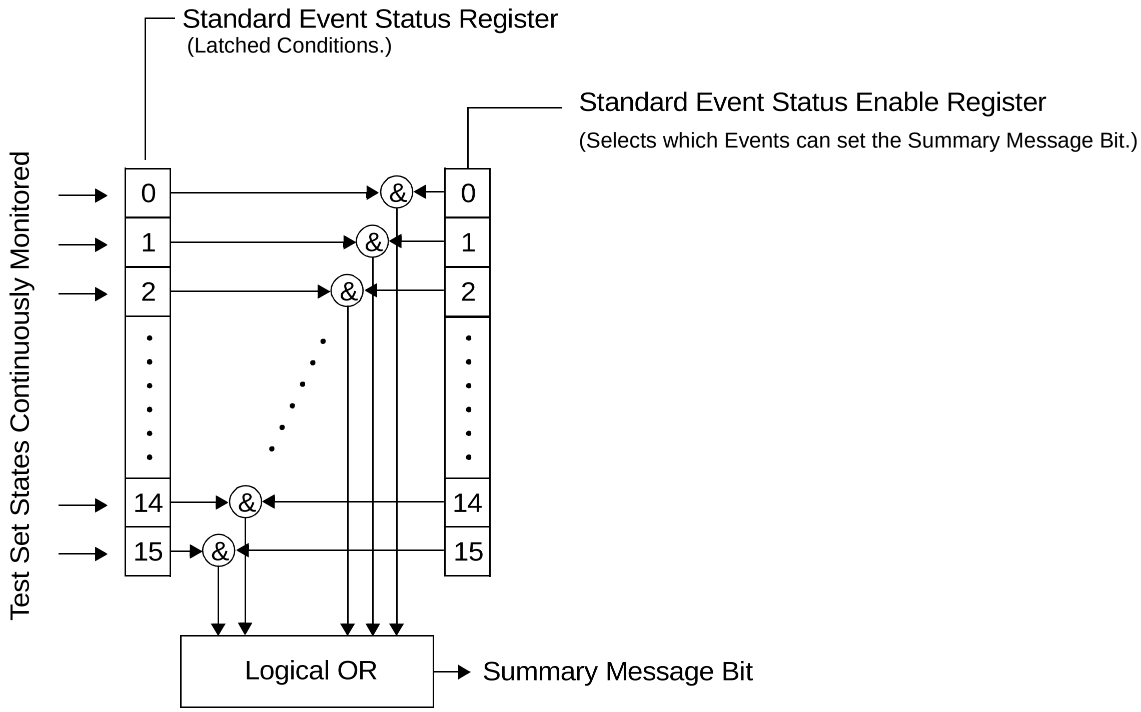
Status Data Structure - Queue Model

The generalized status queue model is the basis upon which all the status queues in the Test Set are built. A queue is a data structure containing a sequential list of information. The queue is empty when all information has been read from the list. The associated Summary Message is TRUE, logic 1, if the queue contains some information and FALSE, logic 0, if the queue is empty. Queues can be cleared by reading all the information from the queue. Queues, except the Output Queue, can also be cleared using the *CLS (clear status) command.


data
data
data
data
data
data
Summary Message Bit
Queue Empty = “0”
Queue Not - Empty = “1”
Queue

Standard Event Status Register Model

This data structure is a specific implementation of the “Status Data Structure - Register Model” on page 115. For bit definitions and command syntax, see “Standard Event Status Register” on page 377


Standard Event Status Register
(Latched Conditions.)
Standard Event Status Enable Register
(Selects which Events can set the Summary Message Bit.)
Test Set States Continuously Monitored
0
1
2
14
15
&
Logical OR
Summary Message Bit

Related Topics

****

“HP-IB STATus Subsystem” on page 359

****

Triggering of Measurements

Measurement Triggering

Trigger Source Description

A measurement trigger causes hardware (for example, a sampler) to capture data which is used by a measurement algorithm to produce a measurement result. The following table shows the trigger source selections available to the user.

Table 11. Trigger Source choices

Trigger Source	Function
RF Rise	Generates trigger from amplitude of signal being measured.
Protocol	Generates trigger from protocol timing.
External	Generates trigger from an external signal.
Immediate	Generates trigger from measurement initiation.
Auto	The test set selects the trigger source optimized for a given measurement.

RF Rise Trigger Source: When RF rise triggering is selected, a measurement dependent threshold is used to define the trigger point on the envelope of the signal being measured. The envelope amplitude must fall below this threshold and remain there for a measurement-dependent period of time before the trigger is armed. After the trigger is armed, a trigger will occur as the envelope amplitude increases and passes through the threshold.

Protocol Trigger Source: When protocol triggering is selected, a data capture is triggered by a protocol generated signal. The test set's protocol engine knows when the DUT's signal should be present and generates a trigger signal for use by the measurement to trigger the data capture.

External Trigger Source: When external triggering is selected, the user supplies an external trigger signal to trigger data capture. The trigger will occur on the rising edge of this signal.

Immediate Trigger Source: When immediate triggering selected, the trigger occurs as soon as any pre-trigger samples required by the measurement algorithm are taken. Data capture is triggered when the measurement is initiated.

Auto Trigger Source: When auto triggering is selected, the test set automatically chooses the best trigger source for that measurement. This trigger source setting is convenient because the measurement trigger doesn't need to be changed when switching parameters. Auto trigger source is the best choice for most users. When the operating mode = active cell mode, Auto triggering sets the trigger source to Protocol. When the operating mode = test mode, auto triggering sets the trigger source to RF Rise. See "Test Mode Operating Mode" on page 422 and "Active Cell Operating Mode" on page 408.

HP-IB Example

```
OUTPUT 714;"SETUP:PVTIME:TRIGGER:SOURCE AUTO"!sets Trigger Source to Auto
```

Triggering Process Description

The triggering process controls the present and future states of the test set during the measurement cycle. Triggers are set up using the SETup commands and can be set up when a measurement is in the inactive state. A measurement is activated (selected) with an INITitate command. If a measurement is initiated while in its measurement cycle, it will terminate that measurement and restart it. The active state is not a single state but a collection of any state other than the inactive state. Deactivating (de-selecting) the measurement is accomplished through an INITiate:<MEAS>:OFF command. Refer to Figure 7. on page 122 for a summary of the measurement states.

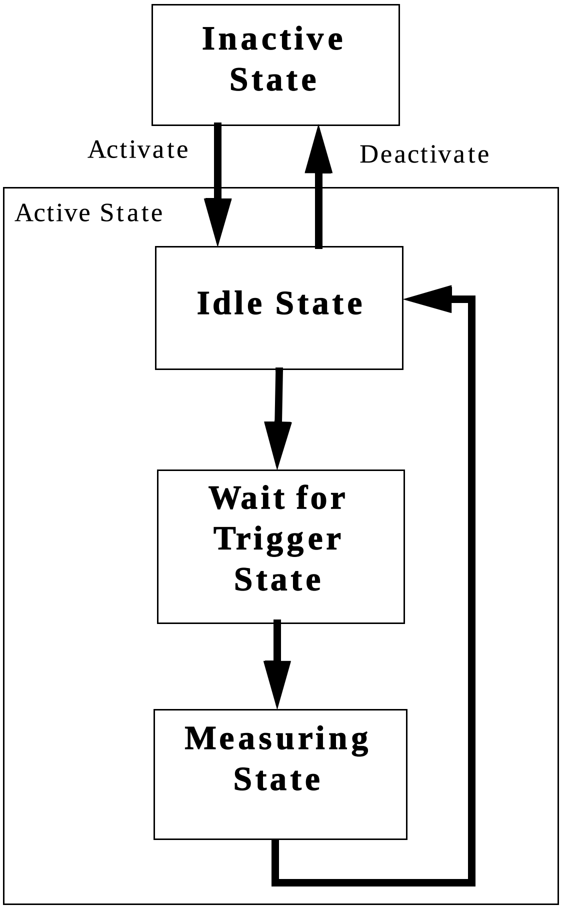
Manually, a measurement is activated by selecting it from the Measurement Selection menu. A measurement is inactivated by pressing the Measurement Selection key, scrolling to measurement in the Measurement Selection menu, and then pressing F4 (Close Measurement).

HP-IB Examples

```
OUTPUT 714;”INITIATE:PVTIME:OFF”!Turns off a PvT measurement.
```

```
OUTPUT 714;”INITIATE:PVTIME”!Turns on a PvT measurement.
```

Figure 7. The Test Set’s Measurement States



Measurement States

The following examples describe states of the test set under various conditions. Refer to Figure 7. on page 122.

Example 8. Inactive State

If the test set has just been powered on, or any form of preset has been performed, then the measurement state is inactive.

Example 9. Wait for Trigger State

If a measurement has been initiated with the INITiate command but has not been triggered, or a measurement has been selected from the Measurement Selection menu but has not been triggered, then the measurement state is wait for trigger. See "INITiate:<measurement mnemonic>" on page 295

Example 10. Measuring and Idle States (Trigger Arm Single)

If the trigger arm is set to single, the trigger source is available, and the trigger qualifier (optional) is satisfied, the measurement state transitions to measuring and measurement results are now available to the user. After results are available, the state transitions to idle (awaiting another INITiate). (See "Trigger Qualifier Description" on page 124 and "Trigger Source Description" on page 121 and "Trigger Arm (Single or Continuous) Description" on page 123)

Example 11. Measuring State (Trigger Arm Continuous)

If the trigger arm is set to continuous, the trigger source is available, and the trigger qualifier (optional) is satisfied, the measurement state transitions to measuring and measurement results are now available to the user. The measurement is continually triggered until the measurement is deactivated. When the measurement is deactivated (INITiate:<MEAS>:OFF. or Close Measurement), it becomes inactive. (See "Trigger Qualifier Description" on page 124 and "Trigger Source Description" on page 121 and "Trigger Arm (Single or Continuous) Description" on page 123.)

Trigger Arm (Single or Continuous) Description

Trigger arm determines if a measurement will make one measurement then return to idle (single), or automatically rearm on completion of a measurement and repeat the process (continuous).

NOTE When operating the test set remotely, trigger arm must be set to single, this causes the measurement cycle to transition to the idle state but remain active.

Pressing the Start Single key on the front panel will cause all currently active measurements with trigger arm set to single to arm and make the measurement.

Pressing Shift, Start Single (Stop) causes all measurements with trigger arm set to single to abort the measurement.

It is unnecessary to arm a measurement if trigger arm is set to continuous it will continue to cycle in the measuring state.

Table 12. Trigger Arm Default Settings

Action	Trigger Arm Default Setting
Power up of test set	Continuous
Manual Full Preset	Continuous
*RST (Remote) Full Preset	Single
Partial Preset	No change

HP-IB Example

```
OUTPUT 714;”SETUP:PFERROR:CONTINUOUS OFF”!Set PFER measurement to single trigger mode.
```

Trigger Qualifier Description

When the trigger qualifier is on, the test set analyzes (samples) the input signal when a trigger is received. It then determines if the input signal was valid by looking at its power level. If the power level during sampling did not meet the requirements of a valid signal, the state returns to wait for trigger without making a measurement. Trigger qualifier is available for TX Power and Phase Frequency Error measurements only.

If a valid signal is present, then it is qualified, and the samples are processed.

Example

```
OUTPUT 714;”SETUP:PFERROR:TRIGGER:QUALIFIER ON”!Trigger Qualifier set to ON
```

Trigger Delay Description

Trigger delay controls the delay time between the trigger and the start of sampling. Resolution is 1 nanosecond per measurement and the units are in seconds. A negative value indicates the sampling should occur prior to the trigger. The default is zero seconds which is preferred for most measurements.

Example

HP-IB Example

```
OUTPUT 714;”SETUP:TXPOWER:TRIGGER:DELAY .0012 S”
!Sets a trigger delay of 1.2 milliseconds. The units (seconds) are an optional part of the
command.
```

Related Topics

****

“Integrity Indicator” on page 98

“INITiate:<measurement mnemonic>” on page 295

“INITiate:DONE?” on page 109

“SETup Subsystem” on page 315

****

4 Programming the HP 8960 Series 10 for GSM Mobile Testing in Active Cell Operating Mode

Introduction

Conventions Used in This Programming Guide

Throughout this Programming Guide the term “test set” refers to an HP 8960 Series 10 wireless communications test set with the E1960A GSM mobile test application installed.

Purpose of This Programming Guide

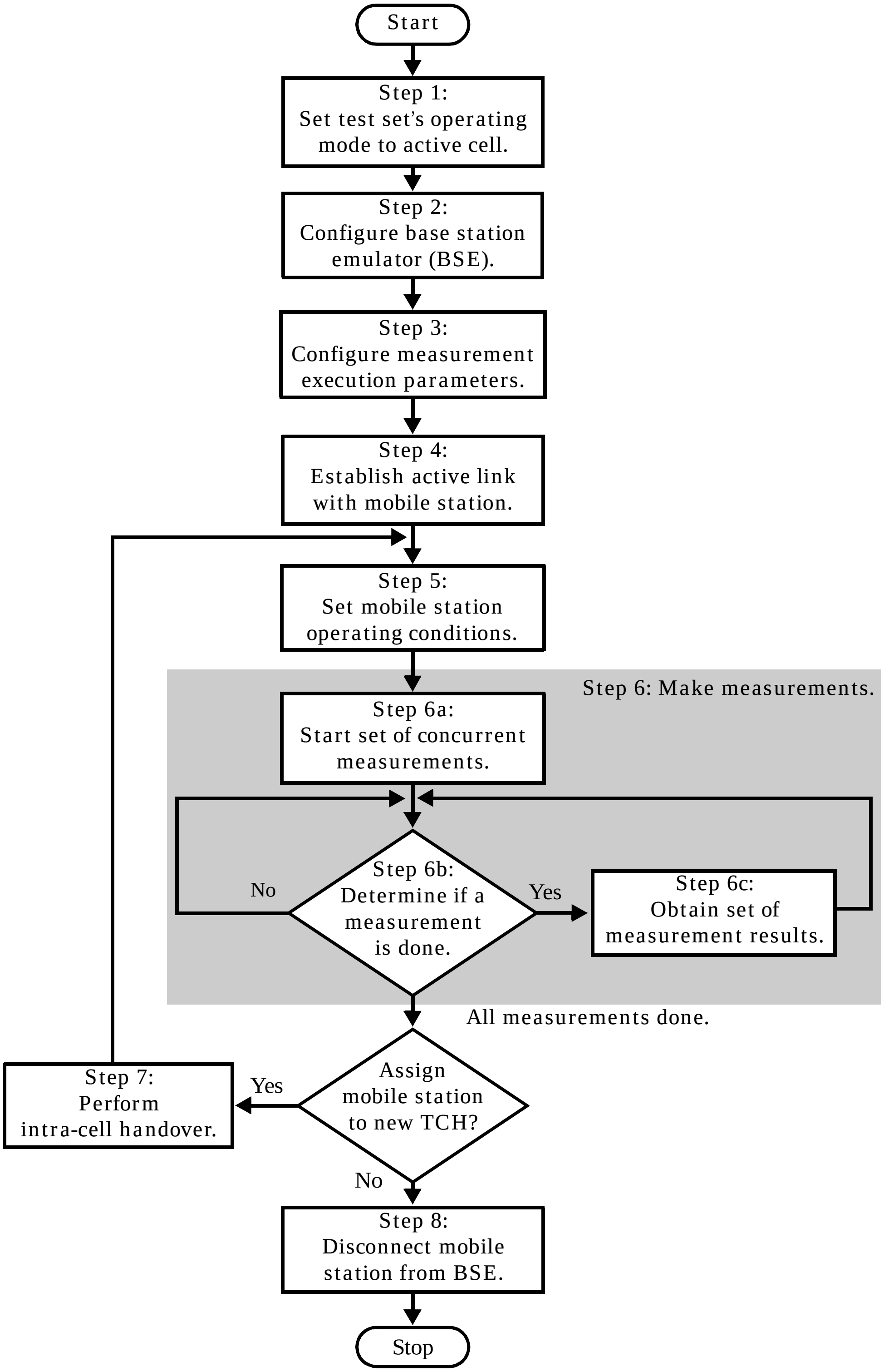
The test set represents state-of-the-art technology in one-box-testers and contains many powerful test capabilities which are accessible through easy-to-use HP-IB programming commands. The purpose of this Programming Guide is to teach you how to write a basic control program, using the test set’s HP-IB command set. This program will perform fundamental manufacturing tests on a GSM mobile station with the test set operating in active cell mode.

How This Programming Guide Is Organized

The Programming Guide is organized around a typical set of tasks a control program would normally perform when testing a GSM mobile station in a manufacturing environment. The set of tasks is shown in Figure 4-1. on page 128.

Typically in a manufacturing environment, steps 1, 2, and 3 are done once each time a production run is started, steps 4 and 8 are done once for each mobile station tested during the production run, and steps 5, 6, and 7 are done iteratively for each mobile station tested during the production run. The number of iterations for steps 5, 6, and 7 is dependent upon how many mobile station operating conditions are being tested (that is, number of channels, number of power levels, and so fourth).

Figure 4-1. Typical Flow of Tasks Performed by Control Program


Start
Step 1:
Set test set's operating mode to active cell.
Step 2:
Configure base station emulator (BSE).
Step 3:
Configure measurement execution parameters.
Step 4:
Establish active link with mobile station.
Step 5:
Set mobile station operating conditions.
Step 6: Make measurements.
Step 6a:
Start set of concurrent measurements.
No
Step 6b:
Determine if a measurement is done.
Yes
Step 6c:
Obtain set of measurement results.
All measurements done.
Step 7:
Perform intra-cell handover.
Yes
Assign mobile station to new TCH?
No
Step 8:
Disconnect mobile station from BSE.
Stop

How to Use This Programming Guide

This Programming Guide is divided into 9 sections. Sections 1 through 8 (step 1 through 8) should be read in sequence. Each section, in order, discusses one of the tasks to be performed by the control program, showing how to accomplish that task using the test set's HP-IB command set. As you progress through each section your understanding of how the test set's HP-IB interface operates will increase as you see the control program evolve.

The last section of the Programming Guide presents a comprehensive programming example which uses all of the topics discussed in sections 1 through 8 together in one program to give the programmer a sense of how to tie everything together.

About the Programming Examples Presented in This Programming Guide

Programming Language:

Programming examples presented in this Programming Guide are written in the HP BASIC programming language, also known as RMB or Rocky Mountain BASIC.

Syntax Used in Programming Examples:

1. Programming examples use the shortened form of the command syntax to minimize HP-IB bus transactions. The shortened form of a command is defined by use of capital letters in the command syntax.

   Example 4-1. Command Syntax:

   ```
   CALL:STATus:TCHannel:TSLot?
   ```

   Example 4-2. Shortened Form:

   ```
   CALL:STAT:TCH:TSL?
   ```

2. Programming examples do not include default nodes. Default nodes in the command syntax are defined by enclosing the node inside the [ ] brackets.

   Example 4-3. Command Syntax:

   ```
   CALL[:CELL[1]]:ACTivated[:STATe]<ON|1|OFF|0>
   ```

   Example 4-4. Command Syntax without Default Nodes:

   ```
   CALL:ACT <ON|1|OFF|0>
   ```

3. Programming examples make extensive use of compound commands using the ; and the ;: separators. Refer to the test set's reference information for information on the definition and use of these command separators.

Step 1: Set the Test Set’s Operating Mode to Active Cell

Background

The test set contains a GSM base station emulator (BSE). The BSE’s primary purpose is to provide the GSM call processing necessary for parametric measurements on the RF and audio signals of a GSM mobile station (MS).

An important characteristic of the test set’s BSE is its operating mode. The operating mode sets the way in which the BSE interacts with the mobile station. The BSE has two operating modes; active cell mode and test mode.

Active cell mode is used when emulating a normal GSM cell. Test mode is used when it is not possible, or not desired, to communicate with the MS via over-the-air signaling, but downlink stimulus and uplink measurements are still needed.

This Programming Guide focuses on programming the test set’s BSE in active cell operating mode.

Overview of Active Cell Operating Mode

Active cell is the default operating mode of the test set’s BSE and is used when emulating a normal GSM cell (that is, active signaling between the MS and the BSE).

Active Cell Features

The basic features provided by the BSE when the operating mode is set to active cell are:

- Generation of a BCH (broadcast channel) without TCH (traffic channel).
- Support for location updating.
- Call setup, both MS and BSE originated.
- Changing TCH parameters during a call using over-the-air signaling.
- BSE initiated and MS initiated call disconnection.
- All measurements supported in the test application are available.
- The BSE automatically controls the test set’s demodulation receiver.

Setting the Test Set’s Operating Mode to Active Cell

The test set’s operating mode is set using the CALL:OPERating:MODE command.

Example 4-5. Command Syntax:

```
CALL:OPERating:MODE <CELL|TEST>
```

Example 4-6. Programming Example:

```
!**********************************************************************
! Step 1: Set Test Set Operating Mode To Active Cell
!**********************************************************************
!
OUTPUT Test_set;"CALL:OPER:MODE CELL"
```

Step 2: Configure the Base Station Emulator (BSE)

Background

The test set contains a GSM base station emulator (BSE). In active cell operating mode the BSE, using the test set’s GMSK modulated source, generates a downlink (BSE to MS direction) broadcast channel (BCH) which represents a cell. The MS can camp to this signal, just as it would camp to a cell on a real network. The BSE can then page the MS on the BCH and listen to the response of the MS on the uplink (MS to BSE direction), using the test set’s demodulating receiver. Calls can then be set up with the establishment of a traffic channel (TCH) in both the downlink and uplink directions. Measurements can be made, using the BSE’s measuring receiver, under essentially identical conditions to that which the MS would experience on a real network.

The BS Emulator can emulate a cell in any one of the following GSM frequency bands:

- PGSM - Primary (band) GSM, also known as GSM900
- EGSM - Extension (band) GSM (includes PGSM)
- DCS - Also known as DCS1800
- PCS - Also known as PCS1900

NOTE The term GSM is used to refer to any combination of, or all of, the supported bands. It is not used as a shortened term for PGSM.

The task of configuring the BSE consists of configuring the BCH and the TCH. There are numerous parameters that can be configured for both the BCH and the TCH. It may not be necessary to configure all the parameters all the time. The test set’s default settings should allow a properly functioning MS to successfully camp on the cell under most circumstances.

In a manufacturing environment it may be desirable to explicitly configure the BCH and TCH parameters to ensure that the settings have not been corrupted by someone setting a parameter’s value through the test set’s front panel.

Configuring the Broadcast Channel Parameters

The broadcast channel parameters are configured using the CALL processing subsystem commands shown in Table 4-1.

Table 4-1. Broadcast Channel Settable Parameters

Parameter	**Command Syntax**
Cell Band [a]	CALL[:CELL[1]]:BAND <PGSM | EGSM | DCS | PCS>
Cell Power	CALL[:CELL[1]]:POWer[:AMPlitude]<numeric value>[<suffix>]
Cell Power State	CALL[:CELL[1]]:POWer:STATe <ON | 1 | OFF | 0>
Cell Power and State [b]	CALL[:CELL[1]]:POWer[:SAMPlitude]<numeric value>[<suffix>]
Cell BCH Number [c]	CALL[:CELL[1]]:BCHannel[:ARFCn][:SELected]<numeric value> OR CALL[:CELL[1]]:BCHannel[:ARFCn]:<PGSM | EGSM | DCS | PCS> <numeric value>
Mobile Country Code [d]	CALL[:CELL[1]]:MCCode <numeric value>
PCS Mobile Country Code [d]	CALL[:CELL[1]]:PMNCode:VALue <numeric value>
Use PCS MNC [d]	CALL[:CELL[1]]:PMNCode:STATe <ON | 1 | OFF | 0>
PCS Mobile Country Code and Use PCS NMC State [d,e]	CALL[:CELL[1]]:PMNCode[:SVALue] <numeric value>
Mobile Network Code [d]	CALL[:CELL[1]]:MNCode <numeric value>
Location Area Code [d]	CALL[:CELL[1]]:LACode <numeric value>
Network Color Code [d]	CALL[:CELL[1]]:NCCode <numeric value>
Base Station Color Code [d]	CALL[:CELL[1]]:BCCode <numeric value>
Paging IMSI	CALL[:CELL[1]]:PAGing:IMSI <string>
Repeat Paging State	CALL[:CELL[1]]:PAGing:REPeat[:STATe] <ON | 1 | OFF | 0>
Auto IMEI Request	CALL[:CELL[1]]:IMEI:AUTO <ON | 1 | OFF | 0>

Table 4-1. Broadcast Channel Settable Parameters

Parameter	**Command Syntax**
BA Table Entries [f]	CALL[:CELL[1]]:BA:TABle[:SELected][<numeric value>{,<numeric value>}] OR CALL[:CELL[1]]:BA:TABle:<PGSM|EGSM|DCS|PCS> [<numeric value>{,<numeric value>}]

a. The cell band setting becomes the selected (:SELected) band (see note 3).
b. Sets amplitude to <numeric value> and state to ON in one command.
c. Sets the BCH channel for the cell band selected with the cell band command (see note 1).
d. Can only be set when Cell Activated State = OFF. See "Things That Can Go Wrong" on page 136.
e. Sets PCS mobile country code to <numeric value> and state to ON in one command.
f. Sets the BA table entries for the cell band selected with the cell band command (see note 1).

Example 4-7. Programming Example:

The following program example illustrates proper use of the BSE BCH configuration commands. Not all parameters are accessed. Note the use of the cell activated state command to set the network configuration parameters.

```
!**********************************************************************
! Step 2: Configure Base Station Emulator (BSE)
!**********************************************************************
!
OUTPUT Test_set;"CALL:CELL:BAND PGSM"
OUTPUT Test_set;"CALL:ACT OFF"
OUTPUT Test_set;"CALL:CELL:MCC 1;LAC 1;MNC 1;NCC 1;BCC 5"
OUTPUT Test_set;"CALL:ACT ON"
OUTPUT Test_set;"CALL:BCH 20"
OUTPUT Test_set;"CALL:POW:SAMP -85"
```

Configuring the Traffic Channel Parameters

The traffic channel parameters are configured using the CALL processing subsystem commands shown in Table 4-2.

Table 4-2. Traffic Channel Settable Parameters

Parameter	**Command Syntax**
TCH Band[a]	CALL:TCHannel:BAND <PGSM | EGSM | DCS | PCS>
Channel Number[b]	CALL:TCHannel[:ARFCn][:SELected] <numeric value> OR CALL:TCHannel[:ARFCn]:<PGSM | EGSM | DCS | PCS> <numeric value>
Loopback Mode	CALL:TCHannel:LOOPback <OFF | A | B | C>
Timeslot	CALL:TCHannel:TSLot <numeric value>
Downlink Speech Source	CALL:TCHannel:DOWNlink:SPEech <NONE | ECHO | PRBS15 | SIN300 | SIN1000>

a. The TCH band setting becomes the selected band (see Note 2).
b. Sets the TCH channel for the TCH band selected with the TCH Band command (see Note 1).

Example 4-8. Programming Example:

The following program example illustrates proper use of the BSE TCH configuration commands. Not all parameters are accessed.

```
OUTPUT Test_set;"CALL:TCH 45"
OUTPUT Test_set;"CALL:TCH:TSL 4"
```

Things That Can Go Wrong

Trying to Set the MCC, MNC, LAC, NCC, or BCC While the Cell Activated State = ON

Trying to set any of the network configuration parameters while the cell is in the active state will generate the following error:

```
GSM operation rejected; Attempting to set <MCC|MNC|LAC|NCC|BCC> while generating a BCH
```

Background The network configuration parameters are encoded into the messaging broadcast on the BCH. Changing the network parameter values while the BCH is active would require the BCH to be stopped, and have the new values encoded, and then the BCH would have to be re-started. This would cause calls to be dropped or disrupt an MS camped to the cell. Consequently the network configuration parameters cannot be changed while the cell is active.

Control of the Cell Activated State The active/inactive state of the cell is controlled using the cell activated state command. This command is only used when the operating mode is set to active cell mode.

Example 4-9. Command Syntax:

```
CALL[:CELL[1]]:ACTivated[:STATe]<ON|1|OFF|0>
```

Example 4-10. Programming Example:

```
OUTPUT Test_set;"CALL:ACT ON"
```

Effects of Activating and Deactivating the Cell

Effects of Deactivating the Cell Among others (refer to the test set’s reference information for a complete listing of actions), setting the cell activated state to OFF causes the following actions to take place:

- The control program is no longer prevented from setting the following parameters: MCC, MNC, PCS MNC, Use PCS MNC, BCC, NCC and LAC.
- All signaling operations, uplink demodulation and downlink (BCH & TCH) generation are stopped.
- Any measurements that rely on uplink demodulation are aborted. No special error messages are generated.

Effects of Activating the Cell Among others (refer to the test set’s reference information for a complete listing of actions), setting the cell activated state to ON causes the following actions to take place:

- The control program is prevented from setting the following parameters: MCC, MNC, PCS MNC, Use PCS MNC, BCC, NCC and LAC.
- If the cell activated state was previously OFF, the TDMA frame number of the BS emulator starts from zero, and a BCH is generated.
- If a TCH was present prior to setting cell activated state to OFF, the TCH is not reinstated.

Step 3: Configure the Measurement Execution Parameters

Background

Measurement execution parameters control the conditions under which a measurement operates. The general set of measurement execution parameters and their generic categories are as follows:

- Measurement Averaging (used by most measurements)
  - Multi-Measurement Count State
  - Multi-Measurement Count Number
- Measurement Triggering (used by most measurements)
  - Trigger Arm
  - Trigger Source
  - Trigger Delay
  - Trigger Qualifier
- Measurement Synchronization (used by some measurements)
  - Burst Synchronization
- Measurement Timeouts (used by all measurements)
  - Measurement Timeout
  - Measurement Timeout State
- Measurement Specific (execution parameters specific to an individual measurement)

NOTE Not all measurements use all the execution parameters shown above. Additionally, some measurements have parameters that are specific to the measurement such as offset frequency lists or filter settings. Each measurement has its own set of parameters which are unique to it and have no affect on the execution of other measurements. Refer to the HP-IB syntax listing for a detailed list of execution parameters for individual measurements.

Overview

The SETup subsystem is used to configure measurement parameters. Each individual measurement parameter can be set and queried using the associated SETup subsystem command. The general hierarchy of the SETup subsystem command structure is as follows:

```
SETup:<meas-mnemonic>:<measurement parameter><parameter setting/value>
```

Table 4-3. shows the measurements available in the HP E1960A GSM mobile test application and their associated <meas-mnemonic> used in the SETup command syntax.

Table 4-3. Measurement Mnemonics Used In The SETup Subsystem

Measurement	<meas-mnemonic>
Transmit Power	TXPower
Power vs Time	PVTime
Phase & Frequency Error	PFERror
Output RF Spectrum	ORFSpectrum
Bit Error	BERRor
Fast Bit Error	FBERror
Decoded Audio	DAUDio
Analog Audio	AAUDio

Configuring Measurement Averaging Parameters

Multi-Measurement Count State Parameter

The Multi-Measurement Count State parameter is used to turn measurement averaging on and off.

Example 4-11. Command Syntax:

```
SETup:<meas-mnemonic>:COUNt:STATe <ON|1|OFF|0>
```

Example 4-12. Programming Example:

```
OUTPUT Test_set;"SET:PVT:COUN:STATe ON"
```

would turn measurement averaging ON for the power versus time measurement.

Multi-Measurement Count Number Parameter

The Multi-Measurement Count Number parameter sets the number of measurement samples taken during each measurement cycle when the COUNt:STATe parameter is set to ON.

Example 4-13. Command Syntax:

```
SETup:<meas-mnemonic>:COUNt:NUMBer <numeric value>
```

Example 4-14. Programming Example:

```
OUTPUT Test_set;"SET:TXP:COUN:NUMB 10"
```

would set the number of averages to 10 for the transmit power measurement.

Configuring Multi-Measurement Count State and Count Number Simultaneously

The multi-measurement count state can be set to ON and the multi-measurement count number can be set to some value using a single complex command.

Example 4-15. Command Syntax:

```
SETup:<meas-mnemonic>:COUNt[:SNUMber] <numeric value>
```

Example 4-16. Programming Example:

```
OUTPUT Test_set;"SET:TXP:COUN:SNUM 10"
```

would set the multi-measurement count state to ON and set the number of averages to 10 for the transmit power measurement. Note that in this example the optional command mnemonic :SNUMber has been included for purposes of clarity.

Configuring Measurement Triggering Parameters

Trigger Source Parameter

The Trigger Source parameter selects the source of the measurement trigger signal.

Example 4-17. Command Syntax:

```
SETup:<meas-mnemonic>:TRIGger:SOURce <AUTO|IMMediate|PROTocol|RISE>
```

Example 4-18. Programming Example:

```
OUTPUT Test_set;"SET:TXP:TRIG:SOUR AUTO"
```

would set the trigger source to AUTO for the transmit power measurement.

Trigger Delay Parameter

The Trigger Delay parameter controls the delay between the trigger event (the point in time at which the trigger signal is received) and the start of sampling. Negative values indicate that the sampling should occur prior to the trigger event.

Example 4-19. Command Syntax:

```
SETup:<meas-mnemonic>:TRIGger:DELay <numeric value>[<suffix>]
```

Example 4-20. Programming Example:

```
OUTPUT Test_set;"SET:TXP:TRIG:DEL 10 US"
```

would set the trigger delay to 10 µs for the transmit power measurement.

Trigger Qualifier Parameter

The Trigger Qualifier parameter enables or disables automatic trigger re-arming following a trigger event which occurred when no valid signal (burst) was present.

Example 4-21. Command Syntax:

```
SETup:<meas-mnemonic>:TRIGger:QUALifier <ON|1|OFF|0>
```

Example 4-22. Programming Example:

```
OUTPUT Test_set;"SET:TXP:TRIG:QUAL ON"
```

would turn the trigger qualifier on for the transmit power measurement.

Trigger Arm Parameter

The Trigger Arm parameter determines whether a measurement will make one measurement then stop (single), or automatically re-arm upon completion of one measurement and repeat the process (continuous).

Example 4-23. Command Syntax:

```
SETup:<meas-mnemonic>:CONTinuous <ON|1|OFF|0>
```

NOTE The recommend trigger arm setting for all measurements when using the remote user interface is single (CONTinuous OFF).

Example 4-24. Programming Example:

```
OUTPUT Test_set;"SET:TXP:CONT OFF"
```

would set the trigger arming to single for the transmit power measurement.

Configuring the Burst Synchronization Parameter

Burst Synchronization Parameter

The burst synchronization parameter specifies where in the sampled data stream the measurement algorithm starts making its analysis of the captured data. Burst synchronization occurs after the measurement data is captured. The burst synchronization parameter's setting determines how the measurement's time reference is developed from the sampled data.

Not all measurements will have synchronization choices and not all synchronization choices will be available in measurements that use synchronization. Measurement synchronization and measurement triggering are independent settings and may be used in any combination.

Example 4-25. Command Syntax:

```
SETup:<meas-mnemonic>:BSYNc <MIDamble|AMPLitude|NONE>
```

Example 4-26. Programming Example:

```
OUTPUT Test_set;"SET:PVT:BSYN MID"
```

would set the burst synchronization to midamble for the power versus time measurement.

Configuring Measurement Timeout Parameters

Measurement Timeout State Parameter

The Measurement Timeout State parameter is used to enable or disable measurement timeout functionality.

Example 4-27. Command Syntax:

```
SETup:<meas-mnemonic>:TIMeout:STATe <ON|1|OFF|0>
```

Example 4-28. Programming Example:

```
OUTPUT Test_set;"SET:PVT:TIM:STAT ON"
```

would enable measurement timeouts for the power versus time measurement.

Measurement Timeout Time Parameter

The Measurement Timeout Time parameter sets the maximum time that a measurement will execute before failing with a timeout error (when the TIMEout:STATe parameter is set to ON).

Example 4-29. Command Syntax:

```
SETup:<meas-mnemonic>:TIMeout:TIME <numeric value>[<suffix>]
```

Example 4-30. Programming Example:

```
OUTPUT Test_set;"SET:TXP:TIM:TIME 10 S"
```

would set the measurement timeout time to 10 seconds for the transmit power measurement.

Configuring Measurement Timeout State and Timeout Time Simultaneously

The measurement timeout state can be set to ON and the measurement timeout time can be set to some value using a single complex command.

Example 4-31. Command Syntax:

```
SETup:<meas-mnemonic>:TIMeout[:STIMe] <numeric value>[<suffix>]
```

Example 4-32. Programming Example:

```
OUTPUT Test_set;"SET:TXP:TIM:STIM 10"
```

would set the measurement timeout state to ON and set the measurement timeout time to 10 seconds for the transmit power measurement. Note that in this example the optional command mnemonic :STIMe has been included for purposes of clarity.

Configuring Measurement Specific Parameters

Background

Some measurements have parameters that are specific to the measurement. Refer to the HP-IB syntax listings for a detailed list of execution parameters for individual measurements. This section gives you some insight into the possible programming techniques that can be used to configure these measurement specific execution parameters.

Sending Comma-Separated Parameter Configuration Lists to the Test Set

High-level measurements in the test application may require numerous parameters to configure the measurement. For example: the output RF spectrum measurement can require up to 22 frequency offsets for the modulation part of the measurement and up to 8 frequency offsets for the switching part of the measurement. The offsets are sent as comma separated lists. There are a variety of techniques that can be used to send these lists. Some of these techniques are shown below.

1. Include each individual parameter in the command itself. For example:

   ```
   OUTPUT Test_set;"SET:ORFS:SWIT:FREQ .4MHZ,.6MHZ,-.4MHZ,-.6MHZ"
   ```

2. Store the parameter values in a data structure and send the command with the data structure appended to it. For example:

   - Using a string variable:

     ```
     DIM Swit_offs$[255]
     Swit_offs$=".4MHZ,.6MHZ,-.4MHZ,-.6MHZ,1.2MHZ,-1.2MHZ"
     OUTPUT Test_set;"SET:ORFS:SWIT:FREQ "&Swit_offs$
     ```

   - Using numeric arrays:

     ```
     OPTION BASE 1
     REAL Swit_offs(8),Mod_offs(22)
     !
     DATA 400,-400,600,-600,1200,-1200,1800,-1800
     DATA .1,-.1,.2,-.2,.25,-.25,.4,-.4,.6,-.6,.8,-.8
     DATA 1,-1,1.2,-1.2,1.4,-1.4,1.6,-1.6,1.8,-1.8
     !
     READ Swit_offs(*)
     READ Mod_offs(*)
     !
     Swit_img:IMAGE K,7(K,"KHZ,"),K,"KHZ"
     Mod_img:IMAGE K,21(K,"MHZ,"),K,"MHZ"
     OUTPUT Test_set USING Swit_img;"SET:ORFS:SWIT:FREQ",Swit_offs(*)
     OUTPUT Test_set USING Mod_img;"SET:ORFS:MOD:FREQ",Mod_offs(*)
     ```

Example 4-33. Programming Example:

The following example illustrates configuring the measurement execution parameters for the output RF spectrum, transmit power, and phase and frequency error measurements.

```
!**************************************************************************
! Step 3: Configure Measurement Execution Parameters
!**************************************************************************
!
! Configure ORFS Measurement:
!
OUTPUT Test_set;"SET:ORFS:SWIT:COUN 5"     ! Examples of using complex
OUTPUT Test_set;"SET:ORFS:MOD:COUN 10"     ! commands to set multi-meas
                                           ! state and count at same time.
OUTPUT Test_set;"SET:ORFS:TRIG:SOUR AUTO"  ! Set trig source to AUTO.
OUTPUT Test_set;"SET:ORFS:CONT OFF"        ! Set trig mode to single.
OUTPUT Test_set;"SET:ORFS:TIM 60"          ! Set timeout time to 60 sec.
! Put switching and modulation offsets to be tested into string variables.
Swit_offs$="400KHZ,-400KHZ,600KHZ,-600KHZ,1200KHZ,-1200KHZ,1800KHZ,-1800KHZ"
Mod_offs$=".2MHZ,-.2MHZ,.4MHZ,-.4MHZ,.6MHZ,-.6MHZ,.8MHZ,-.8MHZ,1MHZ,-1MHZ"
OUTPUT Test_set;"SET:ORFS:SWIT:FREQ "&Swit_offs$
OUTPUT Test_set;"SET:ORFS:MOD:FREQ "&Mod_offs$
!
! Configure TX Power Measurement:
!
OUTPUT Test_set;"SET:TXP:COUN 3"
OUTPUT Test_set;"SET:TXP:TRIG:SOUR RISE;QUAL ON"
OUTPUT Test_set;"SET:TXP:CONT OFF"
OUTPUT Test_set;"SET:TXP:TIM 20"
!
! Configure Phase & Frequency Error Measurement:
!
OUTPUT Test_set;"SET:PFER:COUN 8"
OUTPUT Test_set;"SET:PFER:TRIG:SOUR PROT;QUAL ON"
OUTPUT Test_set;"SET:PFER:CONT OFF"
OUTPUT Test_set;"SET:PFER:TIM 30"
OUTPUT Test_set;"SET:PFER:BSYN MID"
!
```

Step 4: Establish an Active Link with Mobile Station

Overview

Establishing an active link with the mobile station when the test set is in active cell operating mode can be accomplished in one of two ways:

- Base station originated call
- Mobile station originated call

Call Connect/Disconnect Problems

Some of the problems faced by the control program when trying to establish an active call using a newly manufactured mobile station are:

- has the connection or disconnection process started?
- if it has started but not completed, how long should the control program wait until it decides the process will not complete?
- if it has completed, was it successful or did it fail?

It is important that the control program be able to answer these questions correctly and without ambiguity.

Call States

At any instant in time a call can be in one of the following states:

- Idle
- Setup Request
- Proceeding
- Alerting
- Disconnecting
- Connected

The control program can directly query the state of a call with the CALL:STATus:STATe? query command, which immediately returns one of the above states.

However, depending upon the speed with which the call state is queried, it is possible that a state change may occur before the query or between queries and would be missed. From a program synchronization perspective, the possibility of missing a state change introduces ambiguity. In order to eliminate this ambiguity, the test set has a set of commands designed specifically for call connect/disconnect synchronization.

In order to fully utilize these specialized commands it is necessary to understand the call connect/disconnect processes.

Call Connect Process Overview

- Call state starts at Idle.
- Connect process starts and call state moves from Idle to one of the transitory states (that is, Setup Request, Proceeding, Alerting). Which state depends upon whether it is a MS or BS originated call. The key fact is that the call state has moved out of the Idle state into some transitory state. GSM-defined protocols limit the amount of time that can be spent in any of the transitory states, so the call state will never remain in a transitory state forever.
- If the process is successful the call state moves to the Connected state.
- If the process fails the call state moves back to the Idle state.

Call Disconnect Process Overview

- Call state starts at Connected.
- Disconnect process starts and call state moves from Connected to the transitory Disconnecting state. Again the key fact is that the call state has moved out of the Connected state into a transitory state. GSM-defined protocols limit the amount of time that can be spent in any of the transitory states, so the call state will never remain in a transitory state forever.
- If the process is successful the call state moves to the Idle state.
- If the process fails the call state moves back to the Connected state.

Functionality Required for Call Connect/Disconnect Synchronization

The following conclusions can be made after reviewing the call connect/disconnect processes:

- Starting is keyed to a change in the call state. In order to eliminate any ambiguity the control program must be able to determine explicitly when the process starts. In the test set this is accomplished through the implementation of a call-state-change-detector.
- There must be some way for the control program to determine if the process completed and if it succeeded or failed. In the test set this is accomplished through implementaiton of a call connected state query command. When the test set receives this query it must not return a value until the process completes, either successfully or failed.
- If a process is started but no state change occurs there must be some way to prevent the control program from waiting forever for a response to a call connected state query. In the test set this is accomplished through the implementation of a call-state-change-detector timeout mechanism.

Call Connect/Disconnect Synchronization Commands

Call-connected-state Query Command The call-connected-state query command allows the control program to synchronize to call connection/disconnection. This command works for both MS and BS initiated origination and disconnection.

The basic operation of this query is:

- If the call is in one of the transitory states (that is, Setup Request, Proceeding, Alerting Disconnecting), the query hangs until the call state changes to either Idle or Connected and then behaves as follows:
- If the call is in the Idle state, the query immediately returns a 0.
- If the call is in the Connected state, the query immediately returns a 1.

Example 4-34. Command Syntax:

```
CALL:CONNected[:STATe]?
```

Call-state-change-detector Arm Command The call-state-change-detector arm command allows the control program to tell the test set that it is expecting a change to the state of a call prior to initiating the state change.

Using this change detector mechanism in conjunction with the call-connected-state query command allows the control program to determine if the process of connecting or disconnecting a call has started and if the process has completed.

Example 4-35. Command Syntax:

```
CALL:CONNected:ARM[:IMMediate]
```

The call-state-change-detector is armed by sending the call connected arm command. The detector remains armed until there is a call state change to Idle or Connected from one of the transitory states. The call-state-change-detector is not disarmed by a call state change to one of the transitory states, nor is it disarmed by any transitions from Idle to Idle, or Connected to Connected.

The arm state of the change detector can be queried with the call connected arm state query command. This command never hangs and immediately returns a 1 if the change detector is armed and a 0 if it is not armed. The command is:

Example 4-36. Command Syntax:

```
CALL:CONNected:ARM:STATe?
```

If the change detector is armed when the call connected state query is received, the reply is held off temporarily until the connection or disconnection operation reaches a final (Idle or Connected) state.

If the change detector is armed and the mobile attempts to originate a call but the test set never progresses from the Idle state, the call-connected-state query would hang forever. This could easily happen if the mobile is badly broken, the mobile is not connected to the test set, no one pushes the “send” button on the mobile, etc..

Call-state-change-detector Timeout Command The call-state-change-detector timeout mechanism allows the test set to disarm the call-state-change-detector which releases the call connected state query if it is currently hanging.

A timeout timer is started whenever the call-state-change-detector becomes armed or gets rearmed when already armed. The duration of this timeout is a settable parameter and should be greater than the maximum amount of time the control program needs/wants to wait between arming and the connect/disconnect operation starting. Once the process starts and the call state has moved into one of the transitory states the GSM defined protoocl timers take over and prevent the call state from staying in a transitory state forever.

Example 4-37. Command Syntax:

```
CALL:CONNected:TIMeout <numeric value>[<suffix>]
```

If the timer expires while the call is in the Idle or Connected state, the call-state-change-detector is disarmed, which releases the call connected state query if it is currently hanging.

If the timer expires while the call is in one of the transitory states, the call-state-change-detector is not disarmed and continues to wait for a transition to Idle or Connected (recall that GSM-defined protocols limits the amount of time that can be spent in the transitory states).

The timeout time is only meaningful when doing MS originate or MS disconnect operations since the test set both arms the call-state-change-detector and starts the connect/disconnect operation at the same time when doing BS connect/disconnect operations. When doing BS connect/disconnect operations the call connected timeout time is set to an internally determined value which is long enough to guarantee that the operation has proceeded to one of the transitory states.

Call-state-change-detector Auto Arming As a programming convenience the test set automatically arms the call-state-change-detector, using a fixed timeout value, whenever a BS originate or BS disconnect is requested. The fixed timeout value is long enough to ensure that the test set has had time to begin the connect or disconnect operation.

Because of this, there is never a need for the control program to explicitly arm the call-state-change-detector or set a call-state-change-detector timeout value before BS initiated events. If for sake of coding efficiency, the programmer wishes to use the same code segment for both BS and MS call processing events, the commands to arm the call-state-change-detector and to set the call-state-change-detector timeout time will be accepted but ignored should the control program actually send the commands to the test set for BS call processing events.

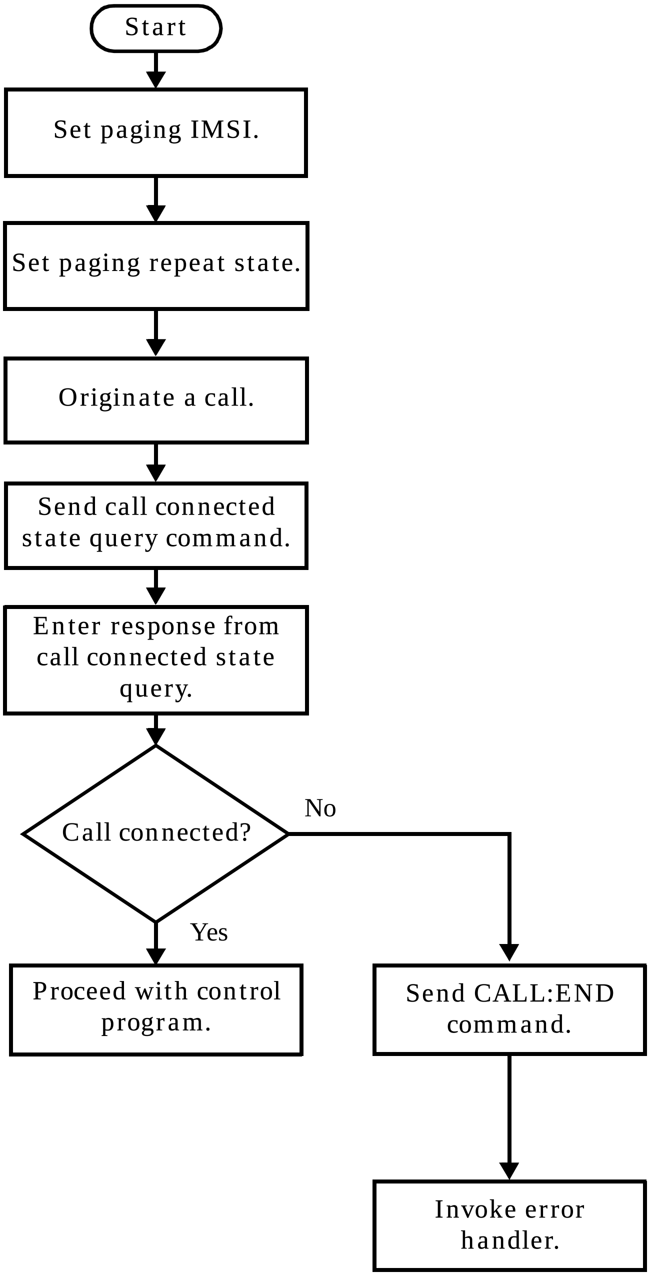
Process for Making a Base Station Originated Call

The recommended process for making a base station originated call is shown in Figure 4-2. on page 148.

The CALL:ORIGinate command is used to initiate a base station originated call.

If the call origination process fails it is necessary to send the CALL:END command to the test set to force immediate termination of all processes associated with the current call origination. This ensures that if another CALL:ORIGinate command is sent to the test set before all processes associated with the failed call origination have been terminated, it will not be ignored. Note that if the test set is currently executing a call origination and it receives another call origination command it will be ignored (that is, you are telling the test set to do something it is already doing and hence it will accept the command but it will be ignored).

Figure 4-2. Process for Making a Base Station Originated Call


Start
Set paging IMSI.
Set paging repeat state.
Originate a call.
Send call connected state query command.
Enter response from call connected state query.
Call connected?
No
Yes
Proceed with control program.
Send CALL:END command.
Invoke error handler.

Example 4-38. Programming Example:

```
!**********************************************************************
! Step 4: Establish Active Link with Mobile Station
!**********************************************************************
!
OUTPUT Test_set;"CALL:PAG:IMSI ‘001012345678901’" ! Set paging IMSI
OUTPUT Test_set;"CALL:PAG:REP OFF"  ! Set paging repeat state to off
OUTPUT Test_set;"CALL:ORIG" ! Start a base station originated call
OUTPUT Test_set;"CALL:CONN:STAT?" ! Hanging HP-IB query
ENTER Test_set;Call_connected     ! Program will hang here until
                                  ! origination passes or fails
IF NOT Call_connected THEN        ! Check if connection successful
  OUTPUT Test_set;"CALL:END"
! <put error handler here>
END IF
! Call is connected so proceed with control program
```

Call Origination Process Commands

Paging the Mobile Station Paging the mobile station is accomplished using the CALL:ORIGinate command.

Example 4-39. Command Syntax:

```
CALL:ORIGinate
```

Example 4-40. Programming Example:

```
OUTPUT Test_set;"CALL:ORIG"
```

would start the process of making a base station originated call.

Setting the Paging IMSI The paging IMSI is set using the PAGing:IMSI command.

Example 4-41. Command Syntax:

```
CALL:PAGing:IMSI <string>
```

Example 4-42. Programming Example:

```
OUTPUT Test_set;"CALL:PAG:IMSI ‘001012345678901’"
```

would set the paging IMSI to 001012345678901.

Setting the Paging Repeat State The paging repeat state is set using the PAGing:REPeat:STATe command.

Example 4-43. Command Syntax:

```
CALL:PAGing:REPeat[:STATe] <ON|1|OFF|0>
```

Example 4-44. Programming Example:

```
OUTPUT Test_set;"CALL:PAG:REP ON"
```

would turn on paging repeat.

Process for Making a Mobile Station Originated Call

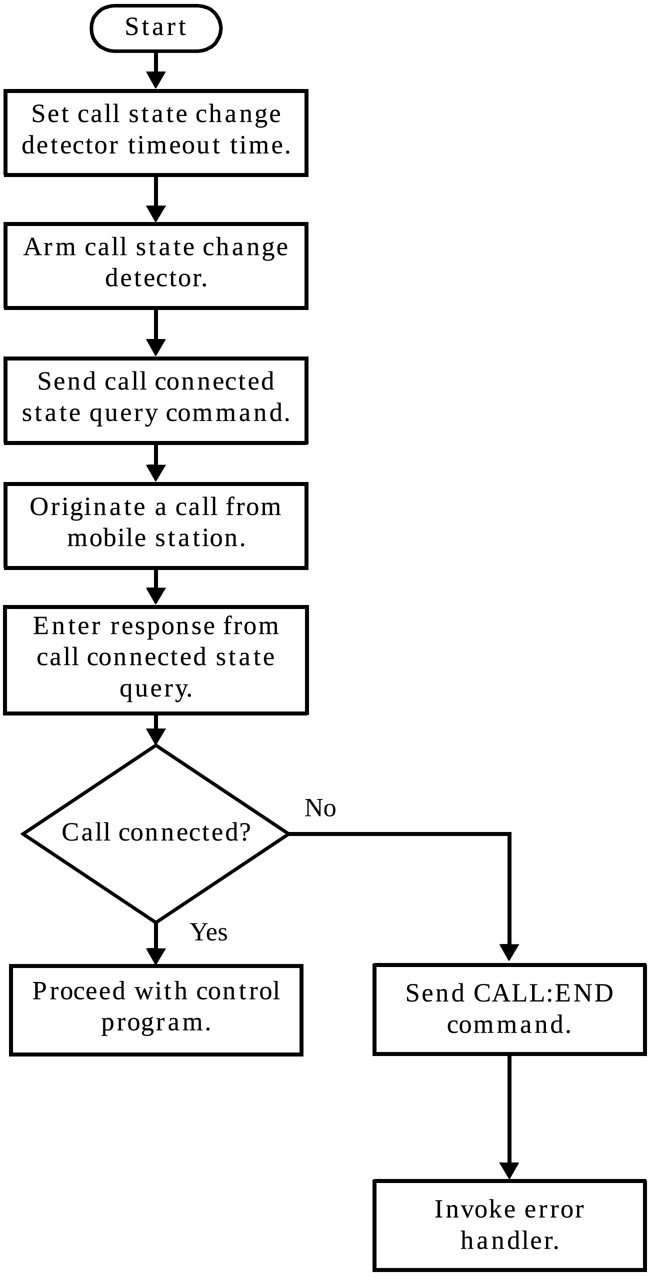
The recommended process for making a mobile station originated call is shown in Figure 4-3. on page 151.

There is no facility in the test set to initiate a call connect from the mobile station. This must be accomplished manually or through a test bus built into the mobile station.

If the call origination process fails it is necessary to send the CALL:END command to the test set to force immediate termination of all processes associated with the current call origination. This ensures that if the mobile station attempts another originate before all processes associated with the failed call origination have been terminated, it will not be ignored. Note that if the test set is currently executing a call origination and it receives another call origination command it will be ignored (that is, you are telling the test set to do something it is already doing and hence it will accept the command but it will be ignored).

For mobile station originated calls where the call is originated by physically dialing a number (as opposed to using a test bus) ensure that the call-state-change-detector timeout time is long enough to allow a human to dial the number.

Figure 4-3. Process For Making A Mobile Station Originated Call


Start
Set call state change detector timeout time.
Arm call state change detector.
Send call connected state query command.
Originate a call from mobile station.
Enter response from call connected state query.
Call connected?
No
Yes
Proceed with control program.
Send CALL:END command.
Invoke error handler.

Example 4-45. Programming Example:

```
OUTPUT Test_set;"CALL:CONN:TIM 5"    ! Set timeout time to 5 seconds
OUTPUT Test_set;"CALL:CONN:ARM"      ! Arm the change detector
OUTPUT Test_set;"CALL:CONN:STAT?"    ! Initiate call connect state query
DISP "Originate call from mobile station."
ENTER Test_set;Call_connected        ! Program will hang here until
                                     ! origination passes or fails
IF NOT Call_connected THEN           ! Check if connection successful
  OUTPUT Test_set;"CALL:END"
! <put error handler here>
END IF
! Call is connected so proceed with control program
```

Step 5: Set the Mobile Station’s Operating Conditions

Overview

The mobile station’s operating conditions are set using the CALL processing subsystem commands shown in Table 4-4.

Table 4-4. Settable Mobile Station Operating Conditions

Parameter	Command Syntax
Timing Advance	CALL:MS:TADVance <numeric value>
Transmit Level[a]	CALL:MS:TXLevel[:SELected] <numeric value> OR CALL:MS:TXLevel:<PGSM | EGSM | DCS | PCS> <numeric value>
Discontinuous Transmission	CALL:MS:DTX[:STATe] <ON | 1 | OFF | 0>

[a] The TCH band setting becomes the selected band

Example 4-46. Programming Example:

```
!**********************************************************************
! Step 5: Set Mobile Station Operating Conditions
!**********************************************************************
!
OUTPUT Test_set;"CALL:MS:DTX OFF"
OUTPUT Test_set;"CALL:MS:TXL 14"
```

Step 6: Make Measurements

Background

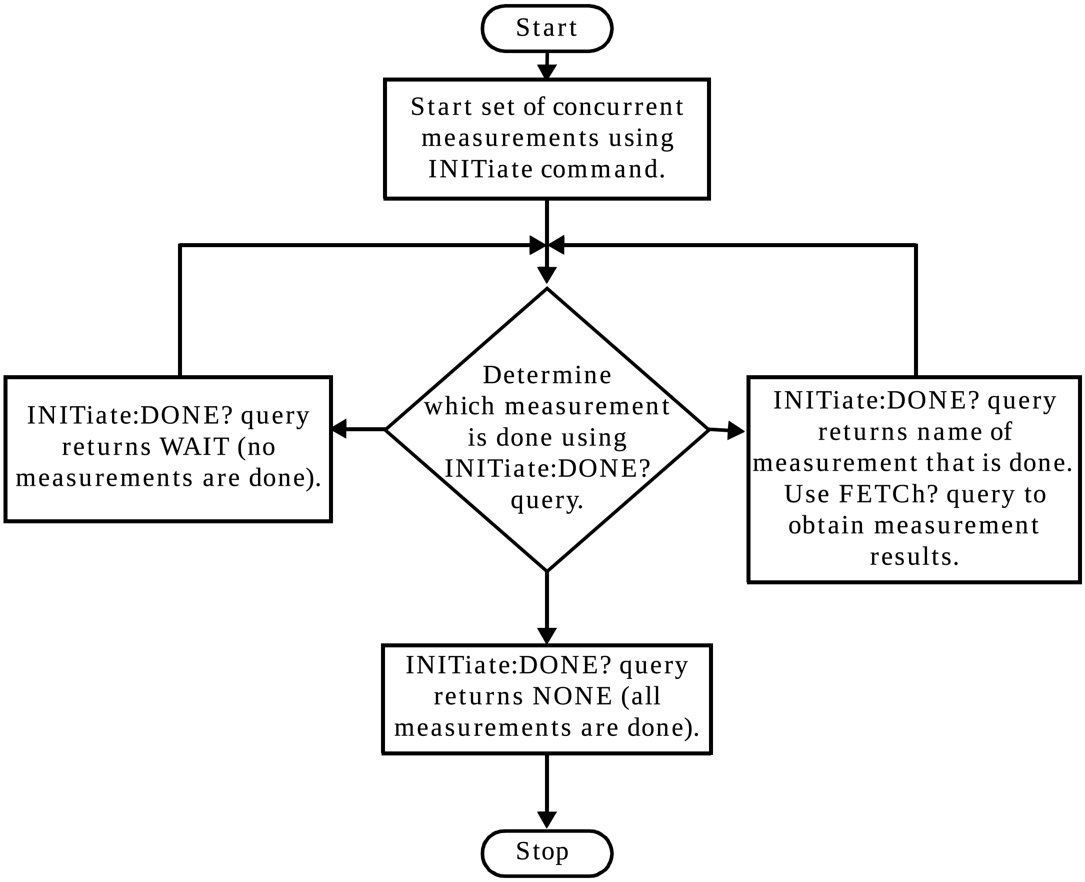
The multiple signal path, DSP based, multiple processor architecture of the test set allows the test set to make concurrent measurements. This means that:

- multiple measurements can execute and finish at the same time (concurrently)
- individual measurement completion is not influenced by other measurement processes
- availability of measurement results is not dependent upon the sequence that the measurements were requested in
- results from measurements that take few processor cycles are available without having to wait for measurements that take many processor cycles

There are no special programming commands or techniques required to implement measurement concurrency.

Figure 4-4. on page 155 shows the recommended process for making concurrent measurements using the test set's command set.

Figure 4-4. Process for Making Measurements


Start
Start set of concurrent measurements using INITiate command.
Determine which measurement is done using INITiate:DONE? query.
INITiate:DONE? query returns WAIT (no measurements are done).
INITiate:DONE? query returns name of measurement that is done. Use FETCh? query to obtain measurement results.
INITiate:DONE? query returns NONE (all measurements are done).
Stop

Example 4-47. Programming Example:

The following program segment illustrates making a transmit power measurement and a phase and frequency error measurement concurrently using the recommended process shown in Figure 4-4. on page 155.

```
!**********************************************************************
! Step 6: Make Measurements
!**********************************************************************
!
! Step 6a: Start Set of Concurrent Measurements:
!
OUTPUT Test_set;"INIT:TXP;PFER"
!
! Step 6b: Determine If A Measurement Is Done:
!
LOOP
  OUTPUT Test_set;"INIT:DONE?"
  ENTER Test_set;Meas_done$
!
! Step 6c: Obtain Measurement Results
!
  SELECT Meas_done$
    CASE "TXP"
      OUTPUT Test_set;"FETC:TXP:POW?"
      ENTER Test_set;Avg_tx_power
    CASE "PFER"
      OUTPUT Test_set;"FETC:PFER:RMS?"
      ENTER Test_set;Max_rms_phas_er
  END SELECT
EXIT IF Meas_done$ = "NONE"
END LOOP
```

Things That Can Go Wrong

Measurement Integrity Always Returns a Value of 6

Background A measurement integrity value of 6 indicates that some characteristic of the input signal is under range. Typically this will be the amplitude (power) of the DUT signal. This low amplitude will cause the level of the DSP sampler to be below a threshold required by the measurement algorithm to produce results of specified accuracy.

Possible Cause One of the most likely causes of a measurement underrange condition is DUT signal loss caused by fixture loss or cable loss.

Suggested Workaround Fixture loss or cable loss can be compensated for by using the RF IN/OUT port’s amplitude offset parameter.

Example 4-48. Command Syntax:

```
SYSTem:CORRection:GAIN <numeric value>[<suffix>]

SYSTem:CORRection:STATe <1|ON|0|OFF>
```

Complex form of command (sets gain to <numeric value> and state to ON using single command):

```
SYSTem:CORRection:SGAin <numeric value>[<suffix>]
```

Example 4-49. Programming Example:

```
OUTPUT Test_set;"SYST:CORR:SGA -6"
```

would set the RF IN/OUT port’s amplitude offset to –6 dB and set the correction state to ON.

Step 6a: Start Set Of Concurrent Measurements

Starting Measurements

The INITiate command is used to start measurements. Each individual measurement in a test application can be started using the INITiate command. For starting measurements, the syntax of the INITiate command is as follows:

Example 4-50. Command Syntax:

```
INITiate:<meas-mnemonic>[:ON]
```

Table 4-5. shows the measurements available in the HP E1960A GSM mobile test application and their associated <meas-mnemonic> used in the INITiate command syntax.

Table 4-5. Measurement Mnemonics Used In The INITiate Subsystem

Measurement	<meas-mnemonic>
Transmit Power	TXPower
Power vs Time	PVTime
Phase & Frequency Error	PFERror
Output RF Spectrum	ORFSpectrum
Bit Error	BERRor
Fast Bit Error	FBERror
Decoded Audio	DAUDio
Analog Audio	AAUDio

Example 4-51. Programming Example:

```
OUTPUT Test_set;"INIT:TXP"
```

would start the transmitter power measurement.

Using Compound Commands to Start Multiple Measurements

More than one measurement can be started using a single INITiate command. For example:

```
OUTPUT Test_set;"INIT:TXP;PFER"
```

would start the transmit power measurement and the phase and frequency error measurement. These measurements would then run concurrently.

Step 6b: Determine if a Measurement Is Done

Background

After a set of concurrent measurements have been started, it is desirable that the control program be able to determine when individual measurement results are available so that the control program can request that measurement’s results without having to wait on other measurements which have not yet completed.

Overview

The INITiate:DONE? query command is used to determine which measurement is finished.

As the name implies, the query returns the name of whichever active measurement is done so that the control program can request that measurement’s results.

This command is query only and returns only one response per query. The responses returned and their meaning are shown in Table 4-6. on page 159.

Once a measurement is reported as being done via the INITiate:DONE? query it is removed from the done list (measurements are only reported as being done once). The design of the INITiate:DONE? query is predicated on the control program immediately fetching a measurement’s results once it is reported as being done.

Table 4-6. Responses Returned from INITiate:DONE? Query

Response	Meaning
TXP	The transmit power measurement is done.
PVT	The power versus time measurement is done.
PFER	The phase and frequency error measurement is done.
ORFS	The output RF spectrum measurement is done.
AAUD	The analog audio measurement is done.
DAUD	The decoded audio measurement is done.
BERR	The bit error measurement is done.
FBER	The fast bit error measurement is done.
WAIT	There are one or more measurements that are in progress, but none of those measurements are done yet.
NONE	No measurements are in progress.

Example 4-52. Command Syntax:

```
INITiate:DONE?
```

Example 4-53. Programming Example:

See "Programming Example:" on page 156.

Step 6c: Obtain a Set of Measurement Results

Background

In order to minimize bus traffic in the manufacturing environment the test set's high-level measurements have been designed to return multiple measured values in response to a single measurement request.

For example: if a transmit power measurement with averaging is initiated there will be five measurement results available as follows:

1. Measurement integrity value
2. Average value
3. Minimum value
4. Maximum value
5. Standard deviation value

The test set has been designed with the capability to return the measurement results in a variety of formats to suit the needs of the measurement environment. For example, the transmitter power measurement results can be returned as:

- Measurement integrity and average value

  OR

- Average value and minimum value and maximum value and standard deviation value

  OR

- Average value only

  OR

- Minimum value only

  OR

- Maximum value only

  OR

- Standard deviation value only

  OR

- Measurement integrity value only

The formats available for individual measurements can be found in the test set's FETCh? subsystem's HP-IB command syntax reference information.

Overview

The FETCh subsystem is used to query measurement results. The measurement results from each measurement in a test application can be queried using the FETCh subsystem. The general hierarchy of the FETCh command structure is as follows:

```
FETCh:<meas-mnemonic>:<result format>?
```

Table 4-7. shows the measurements available in the HP E1960A GSM mobile test application and their associated <meas-mnemonic> used in the FETCh command syntax.

The command syntax used to obtain the various measurement result formats (<result format>) for each measurement can be found in the test set's FETCh? subsystem's HP-IB command syntax reference information.

Table 4-7. Measurement Mnemonics Used In The FETCh Subsystem

Measurement	<meas-mnemonic>
Transmit Power	TXPower
Power vs Time	PVTime
Phase & Frequency Error	PFERror
Output RF Spectrum	ORFSpectrum
Bit Error	BERRor
Fast Bit Error	FBERror
Decoded Audio	DAUDio
Analog Audio	AAUDio

Example 4-54. Command Syntax:

```
FETCh:<meas-mnemonic>:<result format>?
```

Example 4-55. Programming Example:

```
OUTPUT Test_set;"FETCh:TXP:POW:MIN?"
```

would return the minimum value from the set of samples taken during the transmit power measurement (when averaging is turned on and number of samples taken >1).

Step 7: Perform an Intra-Cell Handover

Background

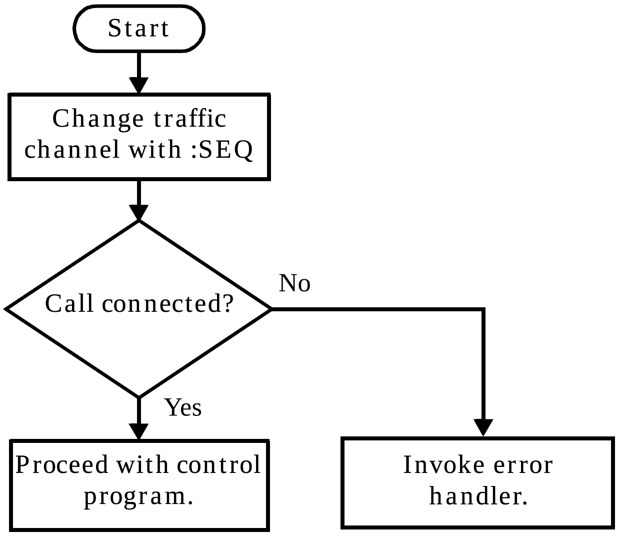
A handover is defined as assigning the mobile station to a new traffic channel. The test set is capable of performing two types of handovers:

- Intra-cell handover: assigning the mobile station to a new traffic channel within the currently active cell band
- Dual-band handover: assigning the mobile station to a traffic channel in a cell band which is different from the currently active cell band.

Performing an Intra-Cell Handover

An intra-cell handover is accomplished using the CALL:TCHannel command in conjunction with the :SEQ synchronization command. The recommended process for performing an intra-cell handover is shown in Figure 4-5.

Figure 4-5. Process for Performing an Intra-Cell Handover


Start
Change traffic channel with :SEQ
Call connected?
No
Yes
Proceed with control program.
Invoke error handler.

Example 4-56. Command Syntax:

```
CALL:TCHannel[:ARFCn][:SELected]:SEQ <numeric value>
```

OR

```
CALL:TCHannel[:ARFCn]:<PGSM|EGSM|DCS|PCS>:SEQ <numeric value>
```

Example 4-57. Programming Example:

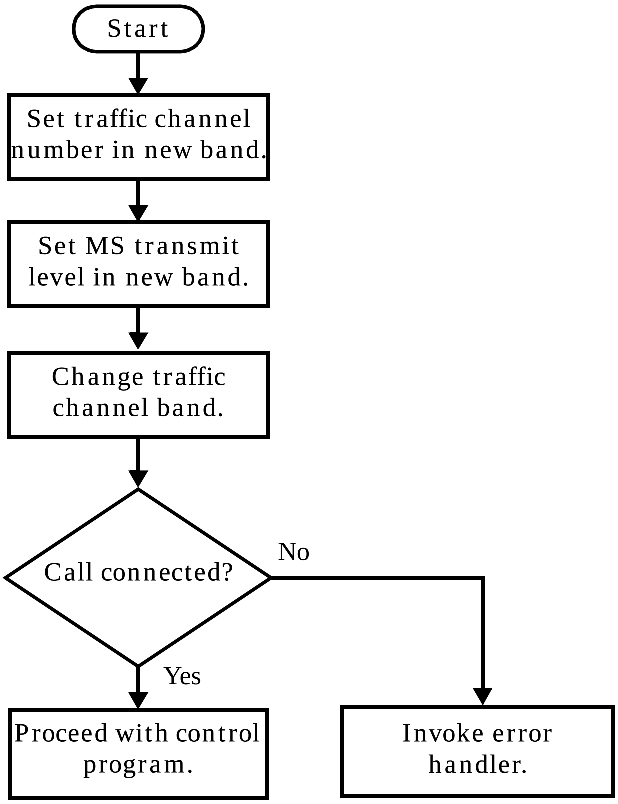
The following example illustrates how to use these commands to perform an intra-cell handover.

```
! existing conditions: a mobile station is connected to the test
! set, operating mode is set to active cell and a call is in the
! connected state.
! Step 1: Change the traffic channel number
OUTPUT Test_set;"CALL:TCH:SEQ 65"!Starts process of handing over MS
                                 !to new traffic channel 65.
                                 !No other commands will be processed
                                 !until this operation completes
                                 !because the :SEQ has been attached.
! Step #2: Check that the call is still in the connected state. It
          ! is possible that the MS did not successfully connect on the
          ! new channel.
OUTPUT Test_set;"CALL:STAT:STAT?"
ENTER Test_set;Call_status$
IF Call_status$ <> "CONN" THEN
! <put error handler here>
END IF
! Call is connected so proceed with control program
```

Performing a Dual-Band Handover

A dual-band handover is accomplished using the CALL:TCHannel:BAND command. The recommended process for performing a dual band handover is shown in Figure 4-6.

Figure 4-6. Process for Performing a Dual-Band Handover


Start
Set traffic channel number in new band.
Set MS transmit level in new band.
Change traffic channel band.
Call connected?
No
Yes
Proceed with control program.
Invoke error handler.

Example 4-58. Programming Example:

The following example illustrates how to use the CALL:TCHannel:BAND command to perform a dual-band handover.

```
! existing conditions: a mobile station is connected to the test
! set, MS TX Level = 11, Timeslot = 4, Timing Advance = 0,
! operating mode is set to active cell, a call is in the
! connected state, and active cell band is EGSM
! Step #1: Configure the traffic channel in the new cell band
OUTPUT Test_set;"CALL:TCH:DCS 556"
OUTPUT Test_set;"CALL:MS:TXL:DCS 4"
! Step #2: Change the traffic channel band
OUTPUT Test_set;"CALL:TCH:BAND DCS" !This is a sequential command so no
                               !other commands will be executed until
                               !the handover is complete (the
                               !MS has communicated to the BSE that it
                               !has successfully transitioned to the
                               !new channel OR a protocol timer has
                               !timed out).
! Step #3: Check that the call is still in the connected state. It
          ! is possible that the MS did not successfully connect on the
          ! new channel.
OUTPUT Test_set;"CALL:STAT:STAT?"
ENTER Test_set;Call_state$
IF Call_state$ <> "CONN" THEN
! <put error handler here>
END IF
! Call is connected so proceed with control program
```

Step 8: Disconnect the Mobile Station from the BSE

Overview

Terminating an active call with the mobile station when the test set is in active cell operating mode can be accomplished in one of two ways:

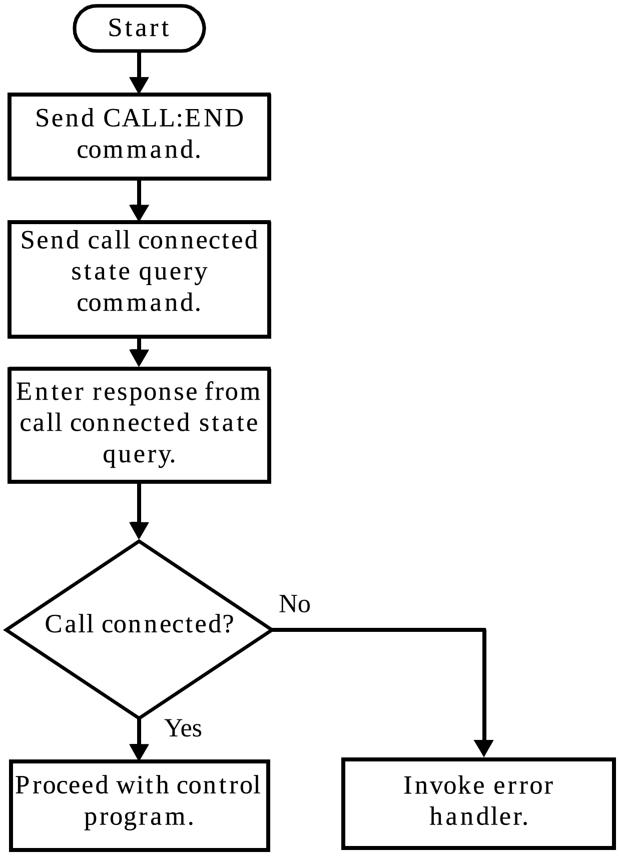
- Terminate the active call from the base station emulator
- Terminate the active call from the mobile station

Terminating an Active Call from the Base Station Emulator

The recommended process for terminating an active call from the base station emulator is shown in Figure 4-7. on page 167.

The CALL:END command is used to initiate a base station disconnect.

Figure 4-7. Process for Terminating an Active Call from the BSE


Start
Send CALL:END command.
Send call connected state query command.
Enter response from call connected state query.
Call connected?
No
Yes
Proceed with control program.
Invoke error handler.

Example 4-59. Programming Example:

```
!**********************************************************************
! Step 8: Disconnect Mobile Station From BSE
!**********************************************************************
!
OUTPUT Test_set;"CALL:END"        ! Initiate a base station disconnect.
OUTPUT Test_set;"CALL:CONN:STAT?" ! Initiate call connect state query.
ENTER Test_set;Call_connected     ! Program will hang here until state
                                  ! change or timer expires.
IF Call_connected THEN            ! Check if disconnect successful
! <put error handler here>
END IF
! Call is disconnected so proceed with control program
```

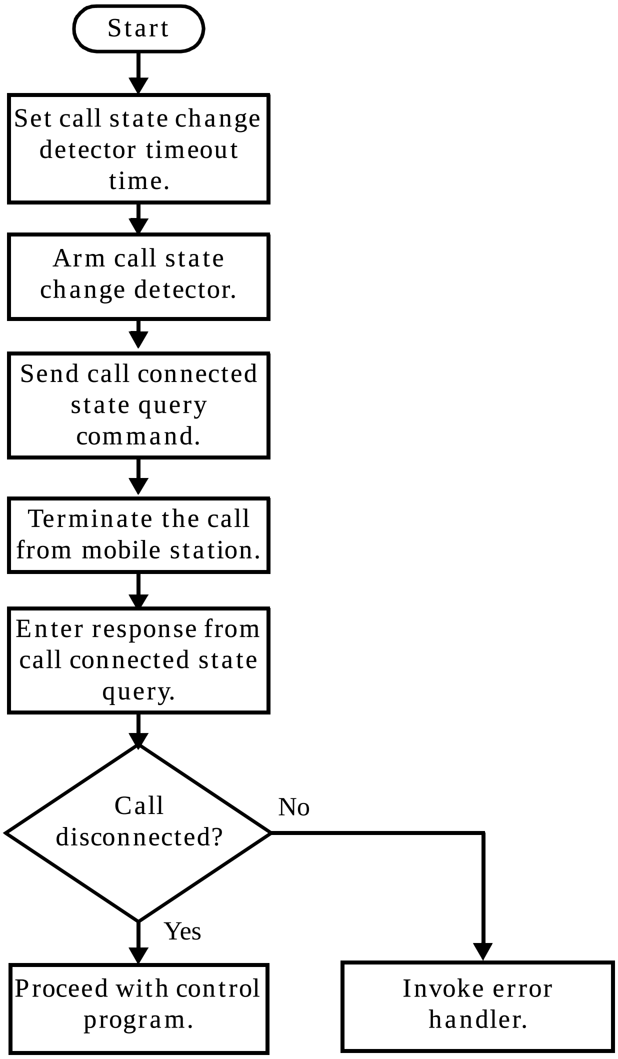
Terminating an Active Call from the Mobile Station

The process for terminating an active call from the mobile station is shown in Figure 4-8. on page 169.

There is no facility in the test set to initiate a call disconnect from the mobile station. This must be accomplished manually or through a test bus built into the mobile station.

For mobile station terminated calls where the call is terminated by physically pushing a button on the phone (as opposed to using a test bus) ensure that the call-state-change-detector timeout time is long enough to allow a human to push the button.

Figure 4-8. Process for Terminating an Active Call from the Mobile Station


Start
Set call state change detector timeout time.
Arm call state change detector.
Send call connected state query command.
Terminate the call from mobile station.
Enter response from call connected state query.
Call disconnected?
No
Yes
Proceed with control program.
Invoke error handler.

Example 4-60. Programming Example:

```
OUTPUT Test_set;"CALL:CONN:TIM 5" !Set timeout time to 5 seconds.
OUTPUT Test_set;"CALL:CONN:ARM"   !Arm the change detector.
OUTPUT Test_set;"CALL:CONN:STAT?" !Initiate call connect state query.
DISP "Terminate the call from the mobile station."
ENTER Test_set;Call_connected     !Program will hang here until state
                                  !change or timer expires.
IF Call_connected THEN            !Check if disconnect successful.
! <put error handler here>
END IF
! Call is disconnected so proceed with control program
```

Comprehensive Program Example

This section presents two example programs for making measurements using the test set. The first program follows the task flow presented at the beginning of the programming note (see Figure 4-1. on page 128) and which is discussed throughout the programming guide. The second program is basically the same as the first but comments have been removed and the coding reflects the use of compound commands and complex commands to achieve coding efficiency.

Example Program With Comments

```
10    ! Prog Name: com_man_ex.txt     Rev: A.0.2      Date Code: 12/18/98
20    !
30    ! Configure the BASIC environment, dimension and initialize variables.
40    ! These actions are unrelated to programming the HP 8960.
50    !
60    OPTION BASE 1
70    COM /Address/ Test_set
80    ! Allocate arrays to hold ORFS switching & modulation frequency offsets.
90    DIM Swit_offs$[255],Mod_offs$[255]
100   ! Allocate arrays to hold measurement results.
110   REAL Txpower(4)
120   Test_set=714  ! Test set’s HP-IB address.
130   PRINTER IS CRT
140   CLEAR SCREEN
150   !
160   ! Reset test set to start from a known state. Not always necessary to do full
170   ! preset in a manufacturing environment but desireable in programming example.
180   !
190   OUTPUT Test_set;"*RST"
200   !
210   ! Turn on the HP-IB debugger.  This is optional but very helpful for debugging
220   ! HP-IB commands when developing new code.
230   !
240   OUTPUT Test_set;"SYST:COMM:GPIB:DEB:STAT ON"
250   !
260   ! Check error message queue and STOP if any errors present. This ensures that
270   ! the example program starts with no error conditions present in the test set.
```

```
280   !
290   CALL Chk_err_msg_que
300   !
310   !*****************************************************************************
320   ! Step 1: Set Test Set’s Operating Mode to Active Cell
330   !*****************************************************************************
340   !
350   OUTPUT Test_set;"CALL:OPER:MODE CELL"
360   !
370   !*****************************************************************************
380   ! Step 2: Configure the Base Station Emulator (BSE)
390   !*****************************************************************************
400   !
410   ! Set RF IN/OUT port’s amplitude offset to compensate for fixture loss of MS.
420   ! After setting offset, cell power settings reflect RF power at the MS antenna
430   ! input.
440   !
450   OUTPUT Test_set;"SYST:CORR:SGA -6"    ! MS has a -6 dB fixture loss.
460   !
470   OUTPUT Test_set;"CALL:CELL:BAND PGSM" ! Set active cell band to PGSM.
480   OUTPUT Test_set;"CALL:ACT OFF"        ! Deactivate cell to set network parms.
490   OUTPUT Test_set;"CALL:CELL:MCC 1;LAC 1;MNC 1;NCC 1;BCC 5" ! Set network parms.
500   OUTPUT Test_set;"CALL:ACT ON"         ! Reactivate the cell.
510   OUTPUT Test_set;"CALL:BCH 20"         ! Set broadcast channel to 20.
520   OUTPUT Test_set;"CALL:POW:SAMP -85"   ! Set cell power to -85 dBm and cell
530                                         ! power state to ON with complex command.
540   OUTPUT Test_set;"CALL:TCH 45"         ! Set traffic channel to 45.
550   OUTPUT Test_set;"CALL:TCH:TSL 4"      ! Set timeslot to 4.
560   !
570   !*****************************************************************************
580   ! Step 3: Configure the Measurement Execution Parameters
590   !*****************************************************************************
600   !
610   ! Configure ORFS Measurement:
620   !
630   OUTPUT Test_set;"SET:ORFS:SWIT:COUN 5" ! Examples of using complex commands to
```

```
640   OUTPUT Test_set;"SET:ORFS:MOD:COUN 10" ! set multi-meas state and count at
650                                          ! same time.
660   OUTPUT Test_set;"SET:ORFS:TRIG:SOUR AUTO"  ! Set trig source to AUTO.
670   OUTPUT Test_set;"SET:ORFS:CONT OFF"        ! Set trig mode to single.
680   OUTPUT Test_set;"SET:ORFS:TIM 60"          ! Set timeout time to 60 seconds.
690   ! Put switching and modulation offsets to be tested into string variables.
700   Swit_offs$="400KHZ,-400KHZ,600KHZ,-600KHZ,1200KHZ,-1200KHZ,1800KHZ,-1800KHZ"
710   Mod_offs$=".2MHZ,-.2MHZ,.4MHZ,-.4MHZ,.6MHZ,-.6MHZ,.8MHZ,-.8MHZ,1MHZ,-1MHZ"
720   OUTPUT Test_set;"SET:ORFS:SWIT:FREQ "&Swit_offs$
730   OUTPUT Test_set;"SET:ORFS:MOD:FREQ "&Mod_offs$
740   !
750   ! Configure TX Power Measurement:
760   !
770   OUTPUT Test_set;"SET:TXP:COUN 3"
780   OUTPUT Test_set;"SET:TXP:TRIG:SOUR RISE;QUAL ON"
790   OUTPUT Test_set;"SET:TXP:CONT OFF"
800   OUTPUT Test_set;"SET:TXP:TIM 20"
810   !
820   ! Configure Phase & Frequency Error Measurement:
830   !
840   OUTPUT Test_set;"SET:PFER:COUN 8"
850   OUTPUT Test_set;"SET:PFER:TRIG:SOUR PROT;QUAL ON"
860   OUTPUT Test_set;"SET:PFER:CONT OFF"
870   OUTPUT Test_set;"SET:PFER:TIM 30"
880   OUTPUT Test_set;"SET:PFER:BSYN MID"
890   !
900   !****************************************************************************
910   ! Step 4: Establish an Active Link with the Mobile Station
920   !****************************************************************************
930   !
940   OUTPUT Test_set;"CALL:PAG:IMSI ’001012345678901’"  ! Set paging IMSI.
950   OUTPUT Test_set;"CALL:PAG:REP OFF"  ! Set paging repeat state to off.
960   !
970   ! This example uses a BSE originated call. The MS must be camped to the BSE
980   ! in order for the BSE to originate a call. The following code will try to
990   ! originate a call 50 times and then STOP the program. This should give
```

```
1000  ! adequate time for the MS to camp to the BSE.
1010  !
1020  ! NOTE: This technique will cause the following error to be displayed on the
1030  !       test set’s display and be put in the error message queue each time
1040  !       that the call fails to connect.  This is normal for this technique.
1050  ! ’GSM call disconnected; No response to page (Timer T3113 expiry)’
1060  !
1070  Tries=1
1080  LOOP
1090    OUTPUT Test_set;"CALL:ORIG"        ! Originate a call.
1100    OUTPUT Test_set;"CALL:CONN:STAT?"  ! CALL:CONNected hanging HP-IB query.
1110    ENTER Test_set;Call_connected  ! Program will hang here until origination
1120                                   ! process completes.  If successful and
1130                                   ! the call is connected the query will
1140                                   ! return a 1.  If unsuccessful and the call
1150                                   ! is not connected the query returns 0.
1160  EXIT IF Call_connected
1170    OUTPUT Test_set;"CALL:END"
1180    IF Tries=50 THEN
1190      BEEP
1200      DISP ""
1210      PRINT "Call did not connect after";Tries;". Program terminated."
1220      STOP
1230    END IF
1240    DISP "Call has not connected after";Tries;"attempts. Trying again."
1250    Tries=Tries+1
1260  END LOOP
1270  DISP ""
1280  !
1290  !****************************************************************************
1300  ! Step 5: Set the Mobile Station’s Operating Conditions
1310  !****************************************************************************
1320  !
1330  OUTPUT Test_set;"CALL:MS:DTX OFF"             ! Turn DTX off for all MS tests.
1340  !
1350  FOR Traf_chan=120 TO 124 STEP 2               ! Test channels 120, 122 & 124.
```

```
1360    OUTPUT Test_set;"CALL:TCH:SEQ ";Traf_chan   ! Use :SEQ to force sequential
1370                                                ! execution of the TCH command.
1380    OUTPUT Test_set;"CALL:STAT:STAT?"     ! Verify that the call is still in
1390    ENTER Test_set;Call_status$           ! the connected state after handover.
1400    IF Call_status$<>"CONN" THEN
1410      PRINT "Call handover failed. New channel assignment =";Traf_chan
1420      PRINT "Program terminated."
1430      STOP
1440    END IF
1450    FOR Ms_pwr_lvl=5 TO 15 STEP 5               ! Test power levels 5, 10 & 15.
1460      OUTPUT Test_set;"CALL:MS:TXL:SEQ ";Ms_pwr_lvl ! Use :SEQ to force
1470                                                    ! sequential execution of
1480                                                    ! the TXLevel command.
1490  !
1500  !*****************************************************************************
1510  ! Step 6: Make Measurements
1520  !*****************************************************************************
1530  !
1540  ! Step 6a: Start a set of concurrent measurements:
1550  !
1560      OUTPUT Test_set;"INIT:TXP;PFER;ORFS"
1570  !
1580  ! Step 6b: Determine if a measurement is done:
1590  !
1600      LOOP
1610        OUTPUT Test_set;"INIT:DONE?"
1620        ENTER Test_set;Meas_done$
1630  !
1640  ! Step 6c: Obtain measurement results: Each measurement illustrates a
1650  !          different way of reading in results. There is no one right way. The
1660  !          method used is application dependent. Note that the examples do not
1670  !          show all possible ways.
1680  !
1690        SELECT Meas_done$
1700  !
1710        CASE "TXP"  ! TX Power measurement done.
```

```
1720         OUTPUT Test_set;"FETC:TXP:INT?;POW:ALL?"
1730         ENTER Test_set;Integrity,Txpower(*)
1740         IF (Integrity=0) THEN  ! Always check integrity value.
1750           PRINT "TX Power results: TCH =";Traf_chan;"and TXL =";Ms_pwr_lvl
1760           PRINT USING "5X,""Minimum:"",M2D.2D,"" dBm""";Txpower(1)
1770           PRINT USING "5X,""Maximum:"",M2D.2D,"" dBm""";Txpower(2)
1780           PRINT USING "5X,""Average:"",M2D.2D,"" dBm""";Txpower(3)
1790           PRINT USING "5X,""Std Dev:"",M2D.2D,"" dB""";Txpower(4)
1800         ELSE
1810           GOSUB Bad_measurement
1820         END IF
1830  !
1840       CASE "PFER"  ! Phase & Frequency Error measurement done.
1850         OUTPUT Test_set;"FETC:PFER:ALL?"
1860         ENTER Test_set;Integrity,Rms_phas_err,Peak_phas_err,Worst_freq_err
1870         IF (Integrity=0) THEN
1880           PRINT "PFERror results: TCH =";Traf_chan;"and TXL =";Ms_pwr_lvl
1890           PRINT USING "5X,""RMS Phase Error:"",M2D.2D,"" deg""";Rms_phas_err
1900           PRINT USING "5X,""Peak Phase Error:"",M2D.2D,"" deg""";Peak_phas_err
1910           PRINT USING "5X,""Worst Freq Error:"",M3D.2D,"" Hz""";Worst_freq_err
1920         ELSE
1930           GOSUB Bad_measurement
1940         END IF
1950  !
1960       CASE "ORFS"  ! ORFS measurement done.
1970       !
1980       ! This code illustrates a more ’generic’ approach to reading measurement
1990       ! results. By using the capabilities designed into high-level
2000       ! measurements, routines that access measurement results do not have to
2010       ! explicitly know what the measurement execution conditions were.  That
2020       ! information can be determined at the time the measurement results are
2030       ! queried.
2040       !
2050         OUTPUT Test_set;"FETC:ORFS:INT?"        ! Check measurement integrity.
2060         ENTER Test_set;Integrity
2070         IF (Integrity=0) THEN
```

```
2080            OUTPUT Test_set;"SET:ORFS:SWIT:FREQ:POIN?" ! Get number of offsets
2090                                                       ! tested.
2100            ENTER Test_set;Points
2110            IF Points THEN  ! Only query if one or more offsets tested.
2120              ALLOCATE Orfs_swit_res(Points),Orfs_swit_offs(Points)
2130              OUTPUT Test_set;"SET:ORFS:SWIT:FREQ?"  ! Get measurement offsets.
2140              ENTER Test_set;Orfs_swit_offs(*)
2150              OUTPUT Test_set;"FETC:ORFS:POW?;:FETC:ORFS:SWIT?" ! Get results.
2160              ENTER Test_set;Tx_power,Orfs_swit_res(*)
2170              PRINT "ORFS Swit Results: TCH =";Traf_chan;"and TXL =";Ms_pwr_lvl
2180              PRINT USING "19X,""TX Power ="",M2D.2D,"" dBm""";Tx_power
2190              PRINT "     Offset(kHz)          Level(dBm)"
2200              PRINT "     -----------          ----------"
2210 Orfs_image:  IMAGE 6X,M4D.2D,12X,M4D.2D
2220              FOR J=1 TO Points
2230                PRINT USING Orfs_image;(Orfs_swit_offs(J)/1.E+3),Orfs_swit_res(J)
2240              NEXT J
2250              DEALLOCATE Orfs_swit_res(*),Orfs_swit_offs(*)
2260            END IF
2270            OUTPUT Test_set;"SET:ORFS:MOD:FREQ:POIN?" ! Get number of offsets
2280                                                      ! tested.
2290            ENTER Test_set;Points
2300            IF Points THEN ! Only query if one or more offsets tested.
2310              ALLOCATE Orfs_mod_res(Points),Orfs_mod_offs(Points)
2320              OUTPUT Test_set;"SET:ORFS:MOD:FREQ?" ! Get measurement offsets.
2330              ENTER Test_set;Orfs_mod_offs(*)
2340              OUTPUT Test_set;"FETC:ORFS:POW?;:FETC:ORFS:MOD?" ! Get results.
2350              ENTER Test_set;Tx_power,Pwr_30khz,Orfs_mod_res(*)
2360              PRINT "ORFS Mod Results: TCH =";Traf_chan;"and TXL =";Ms_pwr_lvl
2370              PRINT USING "18X,""30 KHz BW Power ="",M2D.2D,"" dBm""";Pwr_30khz
2380              PRINT "     Offset(kHz)          Level(dB)"
2390              PRINT "     -----------          ---------"
2400              FOR J=1 TO Points
2410                PRINT USING Orfs_image;(Orfs_mod_offs(J)/1.E+3),Orfs_mod_res(J)
2420              NEXT J
2430              DEALLOCATE Orfs_mod_res(*),Orfs_mod_offs(*)
```

```
2440            END IF
2450          ELSE
2460            GOSUB Bad_measurement
2470          END IF
2480        END SELECT
2490      EXIT IF Meas_done$="NONE"
2500      END LOOP  ! If 'WAIT' is returned from 'INIT:DONE?' query, it just falls
2510                ! through the loop.
2520    NEXT Ms_pwr_lvl
2530  !
2540  !*****************************************************************************
2550  ! Step 7: Perform an Intra-cell Handover
2560  !*****************************************************************************
2570  !
2580  NEXT Traf_chan  ! The handover is performed at the top of the FOR loop at line
2590                  ! 1300
2600  !
2610  !*****************************************************************************
2620  ! Step 8: Disconnect the Mobile Station From the BSE
2630  !*****************************************************************************
2640  !
2650  OUTPUT Test_set;"CALL:END"
2660  OUTPUT Test_set;"CALL:CONN:STAT?"
2670  ENTER Test_set;Call_connected
2680  IF Call_connected THEN
2690    BEEP
2700    PRINT "Unable to complete BS termination. Program terminated."
2710    STOP
2720  END IF
2730  PRINT "Program completed."
2740  STOP
2750  !
2760 Bad_measurement: !
2770  PRINT "Measurement error: "&Meas_done$
2780  PRINT "Measurement Integrity value =";Integrity
2790  RETURN
```

```
2800  !
2810  END  ! End of program
2820  !
2830  SUB Chk_err_msg_que
2840    COM /Address/ Test_set
2850    DIM Error_message$[255]
2860    Error_flag=0
2870    LOOP
2880      OUTPUT Test_set;"SYST:ERR?"
2890      ENTER Test_set;Error_number,Error_message$
2900    EXIT IF Error_number=0
2910      IF Error_number=-350 THEN
2920        Error_flag=1
2930        PRINT "Error Message Queue overflow. Error messages have been lost."
2940      ELSE
2950        Error_flag=1
2960        PRINT Error_number,Error_message$
2970      END IF
2980    END LOOP
2990    IF NOT Error_flag THEN
3000      PRINT "No errors in Error Message Queue."
3010      SUBEXIT
3020    END IF
3030    STOP
3040  SUBEND
```

Example Program Without Comments

The following program is basically the same as the example program presented in "Example Program With Comments" on page 170 but comments have been removed and the coding reflects the use of compound commands and complex commands to achieve coding efficiency.

```
10    ! Prog Name: sim_man_ex.txt     Rev: A.0.2      Date Code: 12/18/98
20    OPTION BASE 1
30    COM /Address/ Test_set
40    DIM Swit_offs$[255],Mod_offs$[255]
50    REAL Txpower(4)
60    Test_set=714
70    PRINTER IS CRT
80    CLEAR SCREEN
90    OUTPUT Test_set;"*RST;SYST:COMM:GPIB:DEB:STAT ON"
100   CALL Chk_err_msg_que
110   OUTPUT Test_set;"CALL:OPER:MODE CELL;:SYST:CORR:SGA -6"
120   OUTPUT Test_set;"CALL:CELL:BAND PGSM;BCH 20;POW:SAMP -85;:CALL:TCH:ARFC 45;TSL 4"
130   OUTPUT Test_set;"CALL:CELL:ACT OFF;MCC 1;LAC 1;MNC 1;NCC 1;BCC 5;ACT ON"
140   OUTPUT Test_set;"SET:ORFS:SWIT:COUN 5;:SET:ORFS:MOD:COUN 10"
150   OUTPUT Test_set;"SET:ORFS:CONT OFF;TIM 60;TRIG:SOUR AUTO"
160   Swit_offs$="400KHZ,-400KHZ,600KHZ,-600KHZ,1200KHZ,-1200KHZ,1800KHZ,-1800KHZ"
170   Mod_offs$=".2MHZ,-.2MHZ,.4MHZ,-.4MHZ,.6MHZ,-.6MHZ,.8MHZ,-.8MHZ,1MHZ,-1MHZ"
180   OUTPUT Test_set;"SET:ORFS:SWIT:FREQ "&Swit_offs$&";:SET:ORFS:MOD:FREQ "&Mod_offs$
190   OUTPUT Test_set;"SET:TXP:COUN 3;CONT OFF;TIM 20;TRIG:SOUR RISE;QUAL ON"
200   OUTPUT Test_set;"SET:PFER:COUN 8;CONT OFF;TIM 30;BSYN MID;TRIG:SOUR PROT;QUAL ON"
210   OUTPUT Test_set;"CALL:PAG:REP OFF;IMSI ’001012345678901’"
220   Tries=1
230   LOOP
240     OUTPUT Test_set;"CALL:ORIG;CONN:STAT?"
250     ENTER Test_set;Call_connected
260   EXIT IF Call_connected
270     OUTPUT Test_set;"CALL:END"
280     IF Tries=50 THEN
290       BEEP
300       DISP ""
310       PRINT "Call did not connect after";Tries;". Program terminated."
320       STOP
```

```
330     END IF
340     DISP "Call has not connected after";Tries;"attempts. Trying again."
350     Tries=Tries+1
360   END LOOP
370   DISP ""
380   OUTPUT Test_set;"CALL:MS:DTX OFF"
390   FOR Traf_chan=120 TO 124 STEP 2
400     OUTPUT Test_set;"CALL:TCH:SEQ ";Traf_chan;";:CALL:STAT:STAT?"
410     ENTER Test_set;Call_status$
420     IF Call_status$<>"CONN" THEN
430       PRINT "Call handover failed. New channel assignment =";Traf_chan
440       PRINT "Program terminated."
450       STOP
460     END IF
470     FOR Ms_pwr_lvl=5 TO 15 STEP 5
480       OUTPUT Test_set;"CALL:MS:TXL:SEQ ";Ms_pwr_lvl;";:INIT:TXP;PFER;ORFS"
490       LOOP
500         OUTPUT Test_set;"INIT:DONE?"
510         ENTER Test_set;Meas_done$
520         SELECT Meas_done$
530         CASE "TXP"
540           OUTPUT Test_set;"FETC:TXP:INT?;POW:ALL?"
550           ENTER Test_set;Integrity,Txpower(*)
560           IF (Integrity=0) THEN
570             PRINT "TX Power results: TCH =";Traf_chan;"and TXL =";Ms_pwr_lvl
580             PRINT USING "5X,""Minimum:"",M2D.2D,"" dBm""";Txpower(1)
590             PRINT USING "5X,""Maximum:"",M2D.2D,"" dBm""";Txpower(2)
600             PRINT USING "5X,""Average:"",M2D.2D,"" dBm""";Txpower(3)
610             PRINT USING "5X,""Std Dev:"",M2D.2D,"" dB""";Txpower(4)
620           ELSE
630             GOSUB Bad_measurement
640           END IF
650         CASE "PFER"
660           OUTPUT Test_set;"FETC:PFER:ALL?"
670           ENTER Test_set;Integrity,Rms_phas_err,Peak_phas_err,Worst_freq_err
680           IF (Integrity=0) THEN
```

```
690             PRINT "PFERror results: TCH =";Traf_chan;"and TXL =";Ms_pwr_lvl
700             PRINT USING "5X,""RMS Phase Error:"",M2D.2D,"" deg""";Rms_phas_err
710             PRINT USING "5X,""Peak Phase Error:"",M2D.2D,"" deg""";Peak_phas_err
720             PRINT USING "5X,""Worst Freq Error:"",M3D.2D,"" Hz""";Worst_freq_err
730           ELSE
740             GOSUB Bad_measurement
750           END IF
760         CASE "ORFS"
770           OUTPUT Test_set;"FETC:ORFS:INT?"
780           ENTER Test_set;Integrity
790           IF (Integrity=0) THEN
800             OUTPUT Test_set;"SET:ORFS:SWIT:FREQ:POIN?"
810             ENTER Test_set;Points
820             IF Points THEN
830               ALLOCATE Orfs_swit_res(Points),Orfs_swit_offs(Points)
840               OUTPUT Test_set;"SET:ORFS:SWIT:FREQ?;:FETC:ORFS:POW?;:FETC:ORFS:SWIT?"
850               ENTER Test_set;Orfs_swit_offs(*),Tx_power,Orfs_swit_res(*)
860               PRINT "ORFS Swit Results: TCH =";Traf_chan;"and TXL =";Ms_pwr_lvl
870               PRINT USING "19X,""TX Power ="",M2D.2D,"" dBm""";Tx_power
880               PRINT "     Offset(kHz)          Level(dBm)"
890               PRINT "     -----------          ----------"
900 Orfs_image:   IMAGE 6X,M4D.2D,12X,M4D.2D
910               FOR J=1 TO Points
920                 PRINT USING Orfs_image;(Orfs_swit_offs(J)/1.E+3),Orfs_swit_res(J)
930               NEXT J
940               DEALLOCATE Orfs_swit_res(*),Orfs_swit_offs(*)
950             END IF
960             OUTPUT Test_set;"SET:ORFS:MOD:FREQ:POIN?"
970             ENTER Test_set;Points
980             IF Points THEN
990               ALLOCATE Orfs_mod_res(Points),Orfs_mod_offs(Points)
1000              OUTPUT Test_set;"SET:ORFS:MOD:FREQ?;:FETC:ORFS:POW?;:FETC:ORFS:MOD?"
1010              ENTER Test_set;Orfs_mod_offs(*),Tx_power,Pwr_30khz,Orfs_mod_res(*)
1020              PRINT "ORFS Mod Results: TCH =";Traf_chan;"and TXL =";Ms_pwr_lvl
1030              PRINT USING "18X,""30 KHz BW Power ="",M2D.2D,"" dBm""";Pwr_30khz
1040              PRINT "     Offset(kHz)          Level(dB)"
```

```
1050              PRINT "     -----------          ---------"
1060              FOR J=1 TO Points
1070                PRINT USING Orfs_image;(Orfs_mod_offs(J)/1.E+3),Orfs_mod_res(J)
1080              NEXT J
1090              DEALLOCATE Orfs_mod_res(*),Orfs_mod_offs(*)
1100            END IF
1110          ELSE
1120            GOSUB Bad_measurement
1130          END IF
1140        END SELECT
1150      EXIT IF Meas_done$="NONE"
1160      END LOOP
1170    NEXT Ms_pwr_lvl
1180  NEXT Traf_chan
1190  OUTPUT Test_set;"CALL:END;CONN:STAT?"
1200  ENTER Test_set;Call_connected
1210  IF Call_connected THEN
1220    BEEP
1230    PRINT "Unable to complete BS termination. Program terminated."
1240    STOP
1250  END IF
1260  PRINT "Program completed."
1270  STOP
1280  !
1290 Bad_measurement: !
1300  PRINT "Measurement error: "&Meas_done$
1310  PRINT "Measurement Integrity value =";Integrity
1320  RETURN
1330  !
1340  END
1350  !
1360  SUB Chk_err_msg_que
1370    COM /Address/ Test_set
1380    DIM Error_message$[255]
1390    Error_flag=0
1400    LOOP
```

```
1410      OUTPUT Test_set;"SYST:ERR?"
1420      ENTER Test_set;Error_number,Error_message$
1430    EXIT IF Error_number=0
1440      IF Error_number=-350 THEN
1450        Error_flag=1
1460        PRINT "Error Message Queue overflow. Error messages have been lost."
1470      ELSE
1480        Error_flag=1
1490        PRINT Error_number,Error_message$
1500      END IF
1510    END LOOP
1520    IF NOT Error_flag THEN
1530      PRINT "No errors in Error Message Queue."
1540      SUBEXIT
1550    END IF
1560    STOP
1570  SUBEND
```

5 HP-IB Command Syntax

Developing Code

It is recommended that you set the Test Set's operating enviroment to debug. To set the Test Set debug mode to "ON" use the following syntax:

```
SYSTem:COMMunicate:GPIB:DEBug ON
```

Units-of-Measure

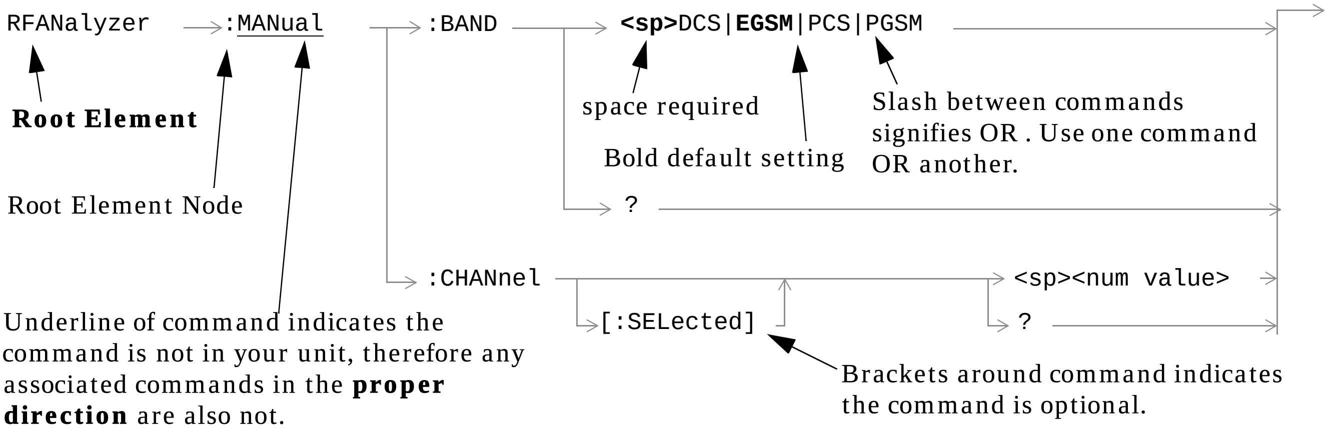
If you do not specifiy units-of-measure in your code the following table indicates the default units-of-measure that will be assumed.

Amplitude (linear)	V
Frequency	HZ
Power (logarithmic)	dBm
Time	S

Diagram Conventions

Use the following diagram to see the conventions used in the syntax diagrams.

Statement elements are connected by lines. Each line can be followed in only one direction, as indicated by the arrow at the end of the line. Any combination of statement elements that can be generated by starting at the **Root Element** and following the line the **proper direction** is syntactically correct. The drawings show the proper use of spaces. Where spaces are required they are indicated by **<sp>**, otherwise no spaces are allowed between statement elements.



Root Element

Root Element Node

space required

Bold default setting

Slash between commands signifies OR . Use one command OR another.

Underline of command indicates the command is not in your unit, therefore any associated commands in the **proper direction** are also not.

Brackets around command indicates the command is optional.

ABORt Subsystem

Description

The ABORt command causes a measurement cycle in progress to stop. If the measurement is not being continuously armed (single trigger) , the measurement will remain in the idle state after this event. If the measurement is being continuously armed, a new measurement cycle will begin after ABORt. If an ABORt command is issued from any measurement state other than measuring, the command is ignored. See "Measurement States"

Other Commands that Execute an ABORt Action

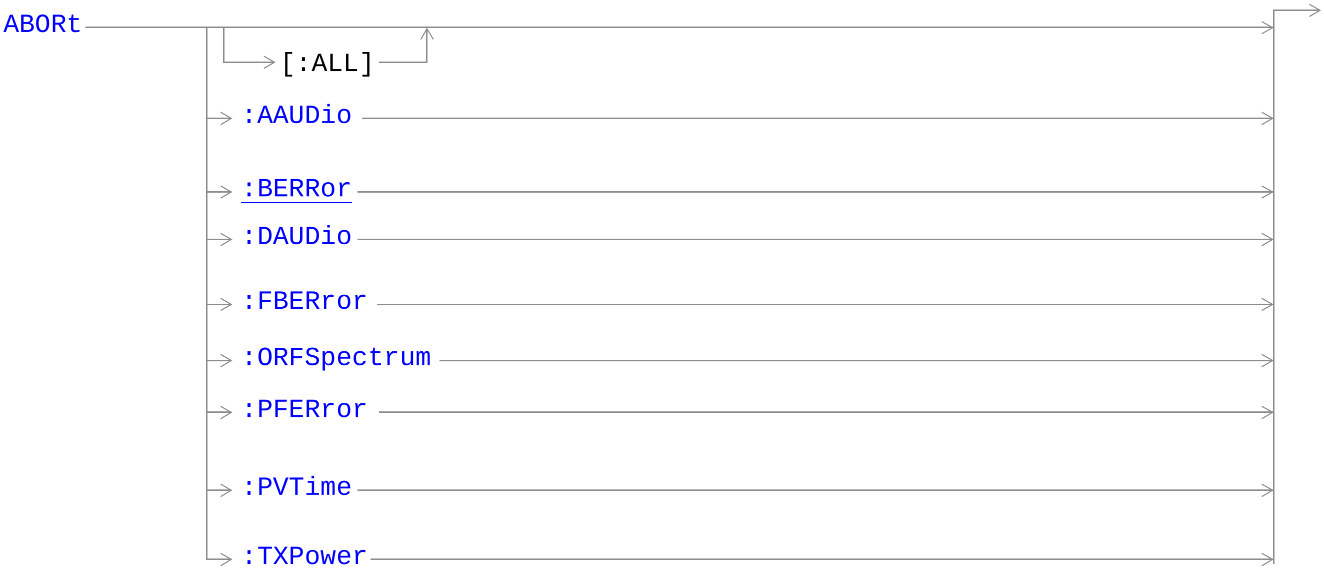
INITiate:<meas> will execute an ABORt:<meas> as part of the INITiate:<meas> command.

READ:<meas>? will execute an ABORt:<meas> action that aborts just one trigger sequence and then combines the INITiate and FETCh? commands.

Syntax Diagram and Command Descriptions

"ABORt"

ABORt


ABORt
[:ALL]
:AAUDio
:BERRor
:DAUDio
:FBERror
:ORFSpectrum
:PFERror
:PVTime
:TXPower

“Diagram Conventions” on page 187

ABORt[:ALL]

Function	Stops any and all measurements that are active. See "Measurement States" on page 123 If the trigger arm is set to single, see "Trigger Arm (Single or Continuous) Description" on page 123the measurments will go to the idle state. If the trigger arm is set to continuous the measurements will re-arm and iniatiate again.
Setting	Range • AAUDio • BERRor • DAUDio • FBERror • ORFSpectrum • PFERror • PVTime • TXPower
Program Example	OUTPUT 714;"ABORT:ALL" !aborts all active measurements in progress

ABORt:<meas-mnemonic>

Function	Stops the selected measurement if it is active. See "Measurement States" on page 123 If the trigger arm is set to single, see "Trigger Arm (Single or Continuous) Description" on page 123the measurments will go to the idle state. If the trigger arm is set to continuous the measurements will re-arm and iniatiate again.
Setting	Range • AAUDio • BERRor • DAUDio • FBERror • ORFSpectrum • PFERror • PVTime • TXPower
Program Example	OUTPUT 714;"ABORT:PVTIME" ! aborts a PvT measurement

AFGenerator Subsystem

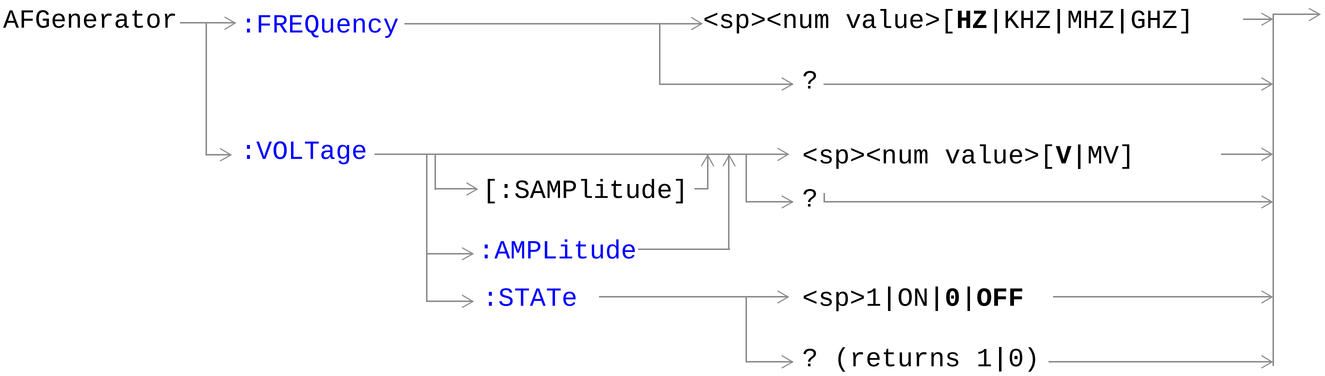
Description

The AFGenerator subsystem is used to control the audio source that is available at the Audio Output connector.

Syntax Diagram and Command Descriptions

"AFGenerator"

AFGenerator


AFGenerator
:FREQuency
<sp><num value>[**HZ**|KHZ|MHZ|GHZ]
?
:VOLTage
[:SAMPlitude]
:AMPLitude
:STATe
<sp><num value>[**V**|MV]
?
<sp>1|ON|**0**|**OFF**
? (returns 1|0)

"Diagram Conventions" on page 187

AFGenerator:FREQuency

Function	Sets/queries the frequency of the audio generator. The units (HZ|KHZ|MHZ|GHZ) are optional, if no units are specified then units default to HZ.
Setting	Range: 1 Hz to 20 kHz Resolution: .1 HZ
Query	Range: 1 Hz to 20 kHz Resolution: .1 HZ
*RST setting	1 KHZ
Program Example	OUTPUT 714;"AFGENERATOR:FREQUENCY 1000" ! sets the audio generator frequency to 1000 Hz.

AFGenerator:VOLTage[:SAMPlitude]

Function	Sets /queries the amplitude of the audio generator in volts and turns the state to on. The units (V|MV) are optional, if no units are specified then units default to V.
Seting	Range: 0 - 9 v pk. Resolution: • .5mv pk. <= 1v pk. output • 5mv pk. > 1v pk. output
Query	Range: 0 - 9 v pk. Resolution: • .5mv pk. <= 1v pk. output • 5mv pk. > 1v pk. output
*RST setting	zero volts
Program Example	OUTPUT 714;"AFGENERATOR:VOLTAGE 2.1" ! sets the state to on and the output voltage to 2.1 volts

AFGenerator:VOLTage:AMPlitude

Function	Sets/queries the amplitude for the audio generator when the audio generator state is on. The units (V|MV) are optional, if no units are specified then units default to V.
Seting	Range: 0 - 9 v pk. Resolution: • .5mv pk. <= 1v pk. output • 5mv pk. > 1v pk. output
Query	Range: 0 - 9 v pk. Resolution: • .5mv pk. <= 1v pk. output • 5mv pk. > 1v pk. output
*RST setting	zero volts
Program Example	OUTPUT 714;”AFGENERATOR:VOLTAGE:AMPLITUDE 1.414” ! sets the audio generator output voltage to 1.414 volts peak

AFGenerator:VOLTage:STATe

Function	Sets/queries the audio generator state
Setting	0 | OFF | 1 |ON
Query	0|1
*RST setting	0|off
Program Example	OUTPUT 714;”AFGENERATOR:VOLTAGE:STATE ON” ! set the audio generator state to ON.

CALibration Subsystem

Description

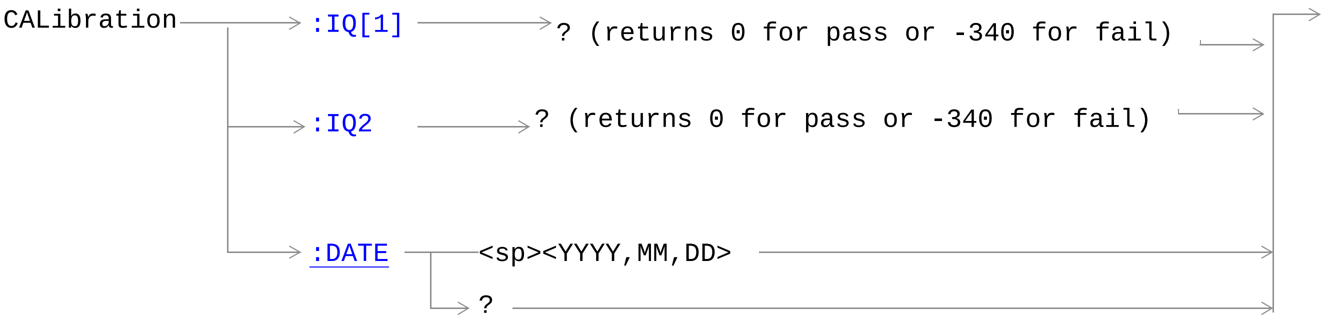
The CALibration subsystem allows the user to read from and write into RAM locations. These RAM locations contain tables or files with calibration data for hardware modules loaded in the Test Set. This command will hold the HP-IB bus while calibration is being performed.

The only user calibration that can be performed is for the IQ modulator. This calibration is required if the Baseband Generator or the Vector Output Modules are serviced or swapped. The CALibration:IQ subsystem should not be used as part of frequent (i.e. daily, weekly or monthly) Test Set calibration.

Syntax Diagram and Command Descriptions

“CALibration”

CALibration


CALibration
:IQ[1]
? (returns 0 for pass or -340 for fail)
:IQ2
? (returns 0 for pass or -340 for fail)
:DATE
<sp><YYYY,MM,DD>
?

"Diagram Conventions" on page 187

CALibration:IQ[:1]?

Function	Sets/queries the calibration of the IQ modulator for RF generator 1. It takes some time to complete and can't be aborted except by cycling the power switch. • Calibrates the IQ modulator for RF generator 1. • Returns a value indicating success or failure of calibration.
Query	Range • 0 = Pass • –340 = Fail
Program Example	OUTPUT 714;"CALIBRATION:IQ?" !performs a calibration of the IQ modulator for RF generator 1 and returns a value indicating success or failure

---

NOTE When the the calibration is done the test set display will display:

IQ Calibration completed successfully for modulator 1. Cycle power to continue.

CALibration:IQ2?

Function	Sets/queries the calibration of the IQ modulator for RF generator 2. It takes some time to complete and can’t be aborted except by cycling the power switch. • Calibrates the IQ modulator for RF generator 2. • Returns a value indicating success or failure of calibration.
Query	Range • 0 = Pass • –340 = Fail
Program Example	OUTPUT 714;"CALLIBRATION:IQ2?" !performs a calibration of the IQ modulator for RF generator 2 and returns a value indicating success or failure

---

NOTE When the the calibration is done the test set display will display:

IQ Calibration completed successfully for modulator 1. Cycle power to continue.

CALibration:DATE (future functionality)

Function	Sets/queries the date of the last systerm calibration done to the test set not the IQ calibration date. Returns a comma seperated list YYYY,MM,DD in that order.
Setting	Sets the system calibration date. Range • Year = 0000 to 9999 • Month = 01 to 12 • Day = 01 to 31
Query	Returns the date when system calibration was performed. Range • Year = 0000 to 9999 • Month = 01 to 12 • Day = 01 to 31
Program Example	OUTPUT 714;"CALIBRATION:DATE 1999,01,04" ! sets the date of the last system calibration year, month and day

CALL Subsystem

Description

The CALL subsystem handles all the call proccessing functions including mobile station (MS) and CELL setup,control and query functions.

Syntax Diagrams and Command Descriptions

"CALL:ACTivated" on page 199

"CALL:BA" on page 200

"CALL:BAND" on page 205

"CALL:BCCode" on page 206

"CALL:BCHannel" on page 207

"CALL:BURSt" on page 210

"CALL:CONNected" on page 211

"CALL:COUNt" on page 214

"CALL:END" on page 217

"CALL:FUNCtion" on page 220

"CALL:IMEI" on page 221

"CALL:LACode" on page 222

"CALL:MCCode" on page 223

"CALL:MNCode" on page 224

"CALL:MS" on page 225

"CALL:NCCode" on page 234

"CALL:OPERating" on page 235

"CALL:ORIGinate" on page 236

"CALL:PAGing" on page 237

"CALL:PMNCode" on page 238

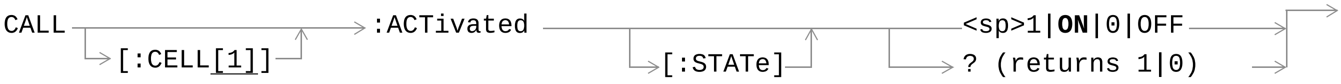
"CALL:POWer" on page 239

"CALL:RFGenerator" on page 240

"CALL:STATus" on page 243

"CALL:TCHannel" on page 245

CALL:ACTivated



“Diagram Conventions” on page 187

CALL[:CELL]:ACTivated[:STATe]

Function	Turns BS Emulator control of all signalling operations, uplink demodulation and downlink (BCH & TCH) generation on or off. Query form returns a 1 (state = on) or a 0 (state = off).
Setting	range: 1 | ON | 0 | OFF
Query	range: 1 | 0
*RST Setting	1 (state = ON)
Program Example	OUTPUT 714;”CALL:CELL:ACTIVATED:STATE OFF” ! Turns all signalling operations, uplink demodulation and downlink (BCH & TCH) generation off.

“Configuring the Broadcast Channel (BCH)” on page 410

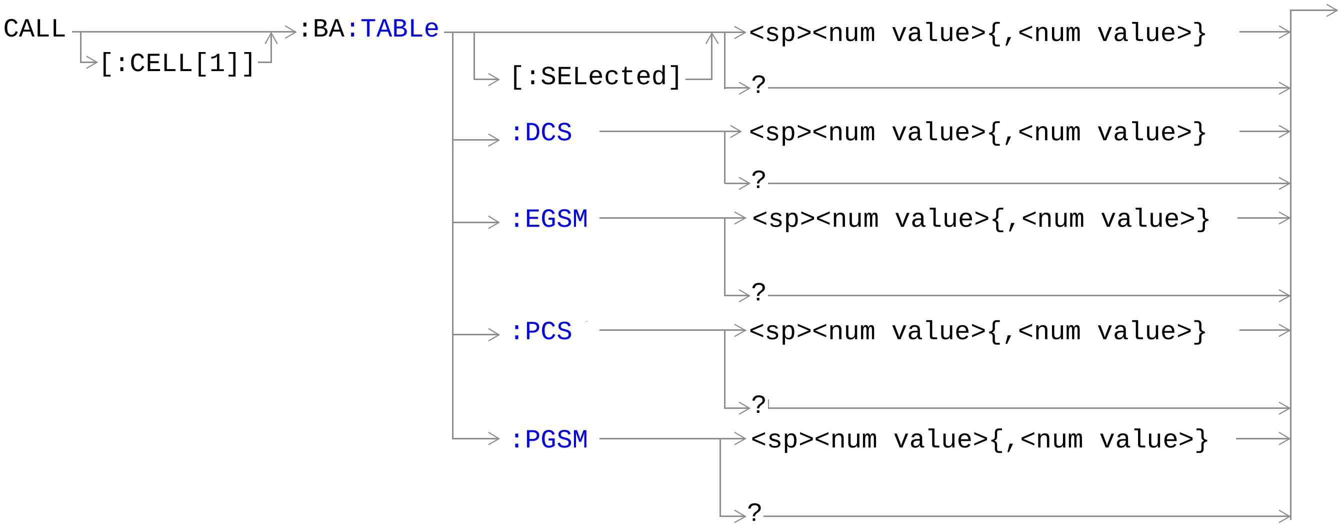
CALL:BA

Syntax Diagrams and Command Descriptions

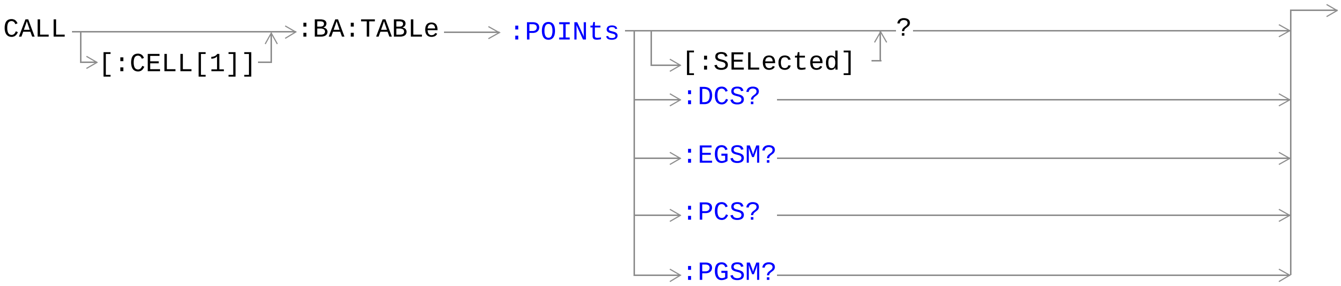
"CALL[:CELL]:BA:TABLe"

"CALL[:CELL]:BA:TABLe:POINts"

CALL[:CELL]:BA:TABLe


CALL
[:CELL[1]]
:BA:TABLe
[:SELected]
<sp><num value>{,<num value>}
?
:DCS
<sp><num value>{,<num value>}
?
:EGSM
<sp><num value>{,<num value>}
?
:PCS
<sp><num value>{,<num value>}
?
:PGSM
<sp><num value>{,<num value>}
?

CALL[:CELL]:BA:TABLe:POINts


CALL
[:CELL[1]]
:BA:TABLe
:POINts
?
[:SELected]
:DCS?
:EGSM?
:PCS?
:PGSM?

"Diagram Conventions" on page 187

CALL[:CELL]:BA:TABLe[:SELected]

Function	Sets/queries the BA Table entries for the selected broadcast band. Entries are set (value entered into table and state set to ON) using a comma separated list of 1 to 16 values. States of table entries not included in setting list are set to OFF. Sending a null list (no values) sets states of all table entries to OFF. Query returns a comma separated list of the table entries that are in the ON state. If states of all table entries are set to OFF, query returns 9.91E+37 (NAN).
Setting	Depends upon the selected broadcast band: range: • PGSM broadcast band range: 1 to 124 • EGSM broadcast band range: 0 to 124 | 975 to 1023 • DCS broadcast band range: 512 to 885 • PCS broadcast band range: 512 to 810 resolution: 1
Query	range: 0 to 9.91 E +37
*RST Setting	Depends upon the selected broadcast band: entries: • PGSM BA Table: 20, 975, 37, 124, 986, 1008, 1019, 7, 18, 30, 53, 64, 76, 87, 99, 110 • EGSM BA Table: 20, 1, 62, 124, 9, 18, 36, 45, 54, 63, 72, 81, 90, 99, 108, 117 • DCS BA Table:512, 698, 885, 537, 562, 587, 612, 637, 662, 712, 737, 762, 787, 812, 837, 862 • PCS BA Table:512, 660, 810, 530, 550, 570, 590, 610, 630, 650, 690, 710, 730, 750, 770, 790 states: • first entry = ON, all others = OFF
Program Example	OUTPUT 714;”CALL:CELL:BA:TABLE:SELECTED 512,689,885” ! Sets 3 table entries for the selected broadcast band. States of the remaining 13 entries are set to OFF. OUTPUT 714;”CALL:CELL:BA:TABLE:SELECTED” ! Sets states of all table entries to OFF.

CALL[:CELL]:BA:TABLe:DCS

Function	Sets/queries the BA Table entries for the DCS broadcast band. Entries are set (value entered into table and state set to ON) using a comma separated list of 1 to 16 values. States of table entries not included in setting list are set to OFF. Sending a null list (no values) sets states of all table entries to OFF. Query returns a comma separated list of the table entries that are in the ON state. If states of all table entries are set to OFF, query returns NAN (9.91E+37).
Setting	range: 512 to 885 resolution: 1
Query	range: 0 to 9.91E+37
*RST Setting	entries: 512, 698, 885, 537, 562, 587, 612, 637, 662, 712, 737, 762, 787, 812, 837, 862 states: 512 = ON, all others = OFF
Program Example	OUTPUT 714;”CALL:CELL:BA:TABLE:DCS 512,612,787” ! Sets three BA table entries for the DCS broadcast band. States of the remaining 13 entries are set to OFF. OUTPUT 714;”CALL:CELL:BA:TABLE:DCS” ! Sets states of all table entries to OFF.

CALL[:CELL]:BA:TABLe:EGSM

Function	Sets/queries the BA Table entries for the EGSM broadcast band. Entries are set (value entered into table and state set to ON) using a comma separated list of 1 to 16 values. States of table entries not included in setting list are set to OFF. Sending a null list (no values) sets states of all table entries to OFF. Query returns a comma separated list of the table entries that are in the ON state. If states of all table entries are set to OFF, query returns NAN (9.91E+37).
Setting	range: 0 to 124 | 975 to 1023 resolution: 1
Query	range: 0 to 9.91E+37
*RST Setting	entries: 20, 975, 37, 124, 986, 1008, 1019, 7, 18, 30, 53, 64, 76, 87, 99, 110 states: 20 = ON, all others = OFF
Program Example	OUTPUT 714;"CALL:CELL:BA:TABLE:EGSM 120,975,1012" ! Sets three BA table entries for the EGSM broadcast band. States of the remaining 13 entries are set to OFF. OUTPUT 714;"CALL:CELL:BA:TABLE:EGSM" ! Sets states of all table entries to OFF.

CALL[:CELL]:BA:TABLe:PCS

Function	Sets/queries the BA Table entries for the PCS broadcast band. Entries are set (value entered into table and state set to ON) using a comma separated list of 1 to 16 values. States of table entries not included in setting list are set to OFF. Sending a null list (no values) sets states of all table entries to OFF. Query returns a comma separated list of the table entries that are in the ON state. If states of all table entries are set to OFF, query returns NAN (9.91E+37).
Setting	range: 512 to 810 resolution: 1
Query	range: 0 to 9.91E+37
*RST Setting	entries: 512, 660, 810, 530, 550, 570, 590, 610, 630, 650, 690, 710, 730, 750, 770, 790 states: 512 = ON, all others = OFF
Program Example	OUTPUT 714;"CALL:CELL:BA:TABLE:PCS 660,710,790" ! Sets three BA table entries for the PCS broadcast band. States of the remaining 13 entries are set to OFF. OUTPUT 714;"CALL:CELL:BA:TABLE:PCS" ! Sets states of all table entries to OFF.

CALL[:CELL]:BA:TABLe:PGSM

Function	Sets/queries the BA Table entries for the PGSM broadcast band. Entries are set (value entered into table and state set to ON) using a comma separated list of 1 to 16 values. States of table entries not included in setting list are set to OFF. Sending a null list (no values) sets states of all table entries to OFF. Query returns a comma separated list of the table entries that are in the ON state. If states of all table entries are set to OFF, query returns NAN (9.91E+37).
Setting	range: 1 to 124 resolution: 1
Query	range: 0 to 9.91E+37
*RST Setting	entries: 20, 1, 62, 124, 9, 18, 36, 45, 54, 63, 72, 81, 90, 99, 108, 117 states: 20 = ON, all others = OFF
Program Example	OUTPUT 714;”CALL:CELL:BA:TABLE:PGSM 20,36,120” ! Sets three BA Table entries for the PGSM broadcast band. States of the remaining 13 entries are set to OFF. OUTPUT 714;”CALL:CELL:BA:TABLE:PGSM” ! Sets states of all BA Table entries to OFF.

CALL[:CELL]:BA:TABLe:POINts[:SELected]?

Function	Queries the number of entries that are in the ON state in the selected broadcast band’s BA Table. This is the number of values that will be returned from the CALL[:CELL]:BA:TABLe[:SELected]? query. A return value of zero indicates that there are no table entries in the ON state.
Query	range: 0 to 16 resolution: 1
*RST Setting	1
Program Example	OUTPUT 714;”CALL:CELL:BA:TABLE:POINTS:SELECTED?” ! Queries the number of entries that are in the ON state in the selected broadcast band’s BA Table.

CALL[:CELL]:BA:TABLe:POINts:DCS?

Function	Queries the number of entries that are in the ON state in the DCS broadcast band BA Table. This is the number of values that will be returned from the CALL[:CELL]:BA:TABLe:DCS? query. A return value of zero indicates that there are no table entries in the ON state.
Query	range: 0 to 16 resolution: 1
*RST Setting	1
Program Example	OUTPUT 714;”CALL:CELL:BA:TABLE:POINTS:DCS?” ! Queries the number of entries that are in the ON state in the DCS broadcast band BA Table.

CALL[:CELL]:BA:TABLe:POINts:EGSM?

Function	Queries the number of entries that are in the ON state in the EGSM broadcast band BA Table. This is the number of values that will be returned from the CALL[:CELL]:BA:TABLe:EGSM? query. A return value of zero indicates that there are no table entries in the ON state.
Query	range: 0 to 16 resolution: 1
*RST Setting	1
Program Example	OUTPUT 714;"CALL:CELL:BA:TABLE:POINTS:EGSM?" ! Queries the number of entries that are in the ON state in the EGSM broadcast band BA Table.

CALL[:CELL]:BA:TABLe:POINts:PCS?

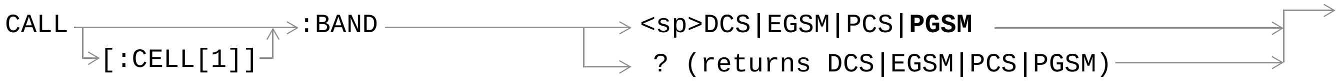
Function	Queries the number of entries that are in the ON state in the PCS cellband BA Table. This is the number of values that will be returned from the CALL[:CELL]:BA:TABLe:PCS? query. A return value of zero indicates that there are no table entries in the ON state.
Query	range: 0 to 16 resolution: 1
*RST Setting	1
Program Example	OUTPUT 714;"CALL:CELL:BA:TABLE:POINTS:PCS?" ! Queries the number of entries that are in the ON state in the PCS broadcast band BA Table.

CALL[:CELL]:BA:TABLe:POINts:PGSM?

Function	Queries the number of entries that are in the ON state in the PGSM broadcast band BA Table. This is the number of values that will be returned from the CALL[:CELL]:BA:TABLe:PGSM? query. A return value of zero indicates that there are no table entries in the ON state.
Query	range: 0 to 16 resolution: 1
*RST Setting	1
Program Example	OUTPUT 714;"CALL:CELL:BA:TABLE:POINTS:PGSM?" ! Queries the number of entries that are in the ON state in the PGSM broadcast band BA Table.

See "Configuring the Broadcast Channel (BCH)" on page 410

CALL:BAND



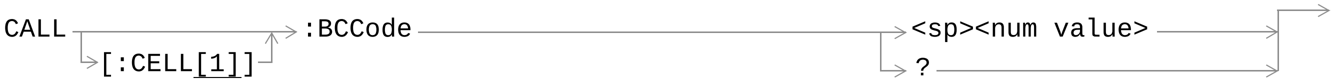
“Diagram Conventions” on page 187

CALL[:CELL]:BAND

Function	Defines which GSM-defined broadcast band the test set is configured for. This defines the kind of cell being emulated, either PGSM, EGSM, DCS or PCS. Setting the broadcast band will change the receiver control to auto. see “RFANalyzer:CONTrol:AUTO” on page 308
Setting	range: PGSM | EGSM | DCS | PCS
Query	range: PGSM | EGSM | DCS | PCS
*RST Setting	PGSM
Program Example	OUTPUT 714;”CALL:CELL:BAND PGSM” ! Configures the test set to emulate a PGSM cell.

See “Frequency Banded Parameters” on page 399

CALL:BCCode



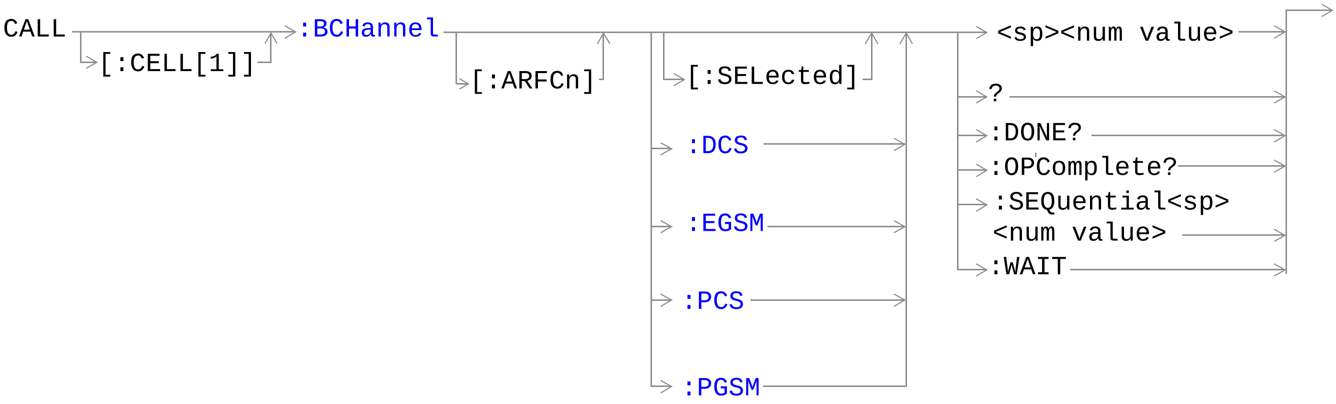
“Diagram Conventions” on page 187

CALL[:CELL]:BCCode

Function	Sets/querries the value of the Base Station Colour Code (BCC).
Setting	range: 0 to 7 resolution: 1
Query	range: 0 to 7 resolution: 1
*RST Setting	5
Program Example	OUTPUT 714;”CALL:CELL:BCCODE 4” ! Sets the cell’s base station color code to 4

See “Configuring the Broadcast Channel (BCH)” on page 410

CALL:BCHannel


CALL
[:CELL[1]]
:BCHannel
[:ARFCn]
[:SELected]
:DCS
:EGSM
:PCS
:PGSM
<sp><num value>
?
:DONE?
:OPComplete?
:SEQuential<sp>
<num value>
:WAIT

“Diagram Conventions” on page 187

CALL[:CELL]:BCHannel[:ARFCn][:SELected]

Function	Sets/queries the Broadcast Channel number for the currently active (that is, the selected) broadcast band.
Setting	Depends upon the selected broadcast band. range: • PGSM broadcast band range: 1 to 124 • EGSM broadcast band range: 0 to 124 | 975 to 1023 • DCS broadcast band range: 512 to 885 • PCS broadcast band range: 512 to 810 resolution: 1
Query	Depends upon the selected broadcast band. range: • PGSM broadcast band range: 1 to 124 • EGSM broadcast band range: 0 to 124 | 975 to 1023 • DCS broadcast band range: 512 to 885 • PCS broadcast band range: 512 to 810 resolution: 1
*RST Setting	20
Program Example	OUTPUT 714;"CALL:CELL:BCHANNEL:ARFCN:SELECTED 512" ! Sets BCH ARFCN for the selected broadcast band to channel 512.

CALL[:CELL]:BCHannel[:ARFCn]:DCS

Function	Sets/queries the Broadcast Channel number for the DCS broadcast band.
Setting	range: 512 to 885 resolution: 1
Query	range: 512 to 885 resolution: 1
*RST Setting	512
Program Example	OUTPUT 714;"CALL:CELL:BCHANNEL:ARFCN:DCS 810" ! Sets BCH ARFCN for DCS broadcast band to 810.

"Configuring the Broadcast Channel (BCH)" on page 410

CALL[:CELL]:BCHannel[:ARFCn]:EGSM

Function	Sets/queries the Broadcast Channel number for the EGSM broadcast band.
Setting	range: 0 to 124 | 975 to 1023 resolution: 1
Query	range: 0 to 124 | 975 to 1023 resolution: 1
*RST Setting	20
Program Example	OUTPUT 714;"CALL:CELL:BCHANNEL:ARFCN:EGSM 120" ! Sets BCH ARFCN for EGSM broadcast band to 120.

CALL[:CELL]:BCHannel[:ARFCn]:PCS

Function	Sets/queries the Broadcast Channel number for the PCS broadcast band.
Setting	range: 512 to 810 resolution: 1
Query	range: 512 to 810 resolution: 1
*RST Setting	512
Program Example	OUTPUT 714;"CALL:CELL:BCHANNEL:ARFCN:PCS 800" ! Sets BCH ARFCN for PCS broadcast band to 800.

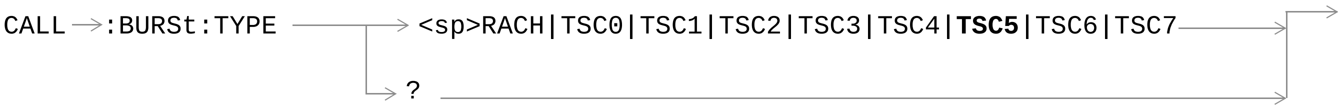
"Configuring the Broadcast Channel (BCH)" on page 410

CALL[:CELL]:BCHannel[:ARFCn]:PGSM

Function	Sets/queries the Broadcast Channel number for the PGSM broadcast band.
Setting	range: 1 to 124 resolution: 1
Query	range: 1 to 124 resolution: 1
*RST Setting	20
Program Example	OUTPUT 714;"CALL:CELL:BCHANNEL:ARFCN:PGSM 113" ! Sets BCH ARFCN for PGSM broadcast band to 113.

"Configuring the Broadcast Channel (BCH)" on page 410

CALL:BURSt



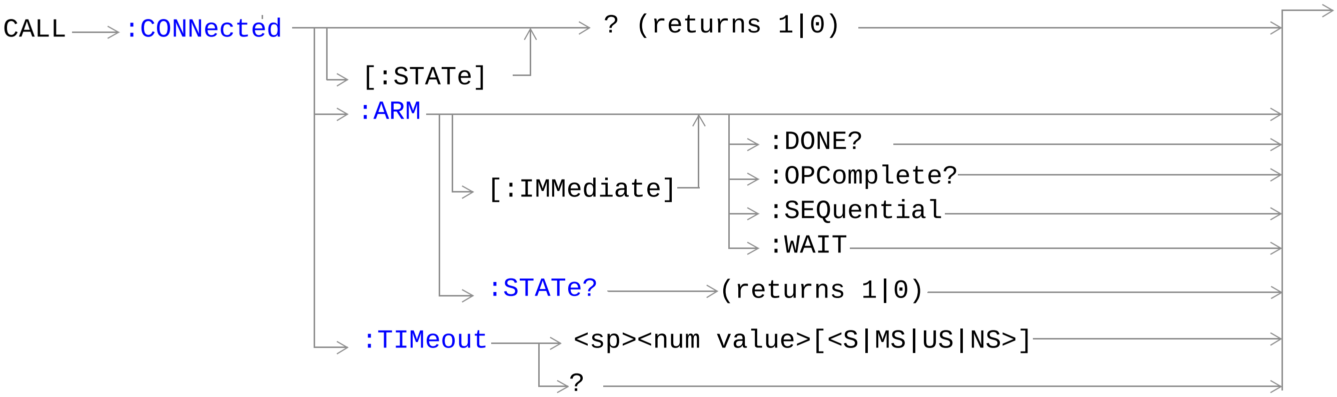
“Diagram Conventions” on page 187

CALL:BURSt:TYPE

Function	Sets/queries the burst type (midamble plus burst length) that will be used for measurement synchronization when the test set Operating Mode is set to Test mode or the Cell Activated State is set to OFF.
Setting	range: RACH | TSC0 | TSC1 | TSC2 | TSC3 | TSC4 | TSC5 | TSC6 | TSC7
Query	range: RACH | TSC0 | TSC1 | TSC2 | TSC3 | TSC4 | TSC5 | TSC6 | TSC7
*RST Setting	TSC5
Program Example	OUTPUT 714;”CALL:BURST:TYPE TSC2” ! Sets TSC2 as the measurement synchronization burst type for test mode operating mode and cell activated OFF state.

“Test Mode Operating Mode” on page 422

CALL:CONNected


CALL
:CONNected
? (returns 1|0)
[:STATe]
:ARM
[:IMMediate]
:DONE?
:OPComplete?
:SEQuential
:WAIT
:STATe?
(returns 1|0)
:TIMeout
<sp><num value>[<S|MS|US|NS>]
?

"Diagram Conventions" on page 187

CALL:CONNected[:STATe]?

Function	Queries the connected/disconnected state of the call. A 1 is returned if the call is in the connected state. A 0 is returned if the call is in the idle (that is, disconnected) state. If the call is in any state other than connected or idle, the query will hang until the call state transitions to the connected or idle state. When used in conjunction with the CALL:CONNected:ARM and CALL:CONNected:TIMeout commands, the CALL:CONNected:STATe? command allows the control program to synchronize to call connection/disconnection. See "Call Processing State Synchronization" on page 34.
Query	range: 0 | 1
*RST Setting	0
Program Example	OUTPUT 714;"CALL:CONNECTED:STATE?" ! Returns 1 if call connected, 0 if call disconnected.

CALL:CONNected:ARM[:IMMediate]

Function	Sets (arms) the call-state-change detector. Arming the call-state-change detector allows the control program to tell the test set that it is expecting a change to the state of a call prior to initiating the state change. Once armed, The detector remains armed until there is a call state change to Idle or Connected from one of the transitory states. The call-state-change-detector is not disarmed by a call state change to one of the transitory states, nor is it disarmed by any transitions from Idle to Idle, or Connected to Connected. When used in conjunction with the CALL:CONNected:STATe? and the CALL:CONNected:TIMeout commands, the CALL:CONNected:ARM command allows the control program to synchronize to call connection/disconnection. See "Call Processing State Synchronization" on page 34.
Program Example	OUTPUT 714;"CALL:CONNECTED:ARM:IMMEDIATE" ! Arms the call-state-change detector.

CALL:CONNected:ARM:STATe?

Function	Queries the arm state of the call-state-change detector. This command never hangs and immediately returns a 1 if the call-state-change detector is armed and a 0 if it is not armed. See "Call Processing State Synchronization" on page 34.
Query	Range: 0 | 1
*RST Setting	0
Program Example	OUTPUT 714;"CALL:CONNECTED:ARM:STATE?" ! Returns arm state of call-state-change detector.

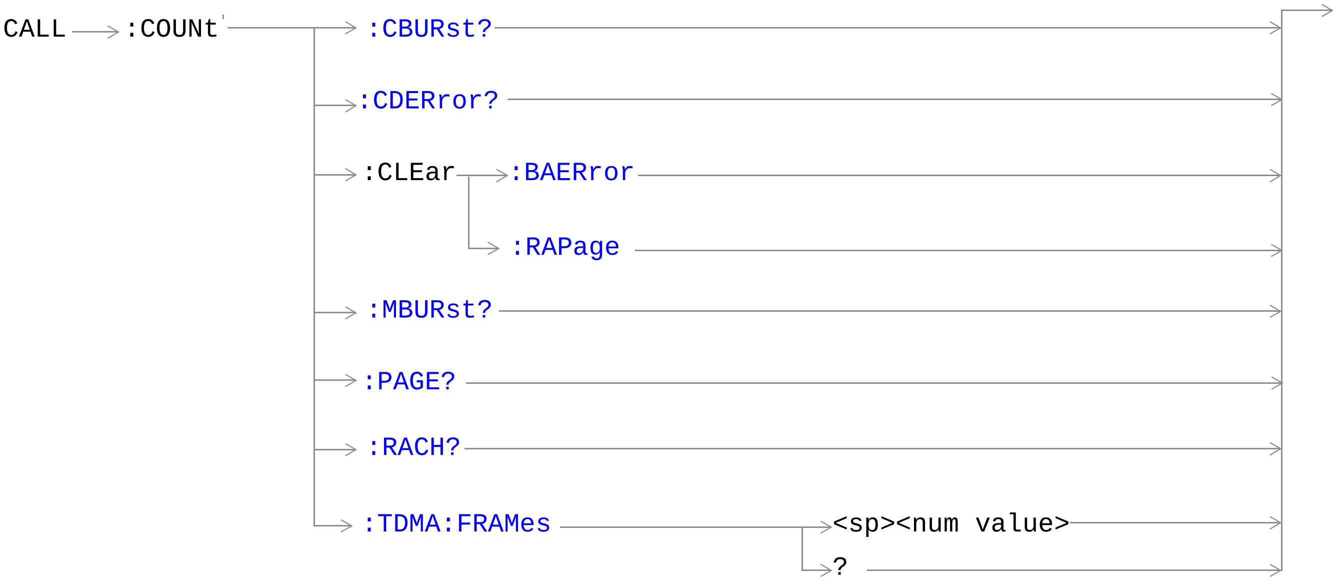
CALL:CONNected:TIMeout

Function	Sets/queries the maximum time the test set will wait for a hanging CALL:CONNected:STATe? query to complete. Default setting units are seconds. To set timeout time in units other than seconds include optional unit specifier in command string. A timeout timer is started whenever the call-state-change-detector becomes armed or gets rearmed when already armed. The duration of this timeout is a set using the CALL:CONNected:TIMeout command and should be greater than the maximum amount of time the control program needs/wants to wait between arming the call-state-change detector and the connect/disconnect operation starting. Once the process starts and the call state has moved into one of the transitory states the GSM defined protoocl timers take over and prevent the call state from staying in a transitory state forever. See “Call Processing State Synchronization” on page 34.
Setting	Range: 0 to 100 seconds Resolution: 0.1 seconds
Query	Range: 0 to 100 seconds Resolution: 0.1 seconds
*RST Setting	10 seconds
Program Example	OUTPUT 714;"CALL:CONNECTED:TIMEOUT 3" ! Sets the CALL:CONNected:STATe? query timeout time to 3 seconds.
	OUTPUT 714;"CALL:CONNECTED:TIMEOUT 500 MS" ! Sets the CALL:CONNected:STATe? query timeout time to 500 ms.

“Call Processing State Synchronization” on page 34

“Call Processing Event Synchronization” on page 30

CALL:COUNt


CALL
:COUNt
:CBURst?
:CDERror?
:CLEar
:BAERror
:RAPage
:MBURst?
:PAGE?
:RACH?
:TDMA:FRAMes
<sp><num value>
?

"Diagram Conventions" on page 187

CALL:COUNt:CBURst?

Function	Queries the corrupt burst counter. The corrupt burst counter keeps track of the number of uplink bursts where power was detected but the expected midamble could not be found.
Query	Range: 0 to 99999 Resolution: 1
*RST Setting	0
Program Example	OUTPUT 714;"CALL:COUNT:CBURST?" ! Queries the corrupt burst counter.

CALL:COUNt:CDERror?

Function	Queries the channel decode error counter. The channel decode error counter keeps track of how many channel decoder errors have occurred. Channel decode errors include convolutional, FIRE, and block errors, but not CRC errors.
Query	Range: 0 to 99999 Resolution: 1
*RST Setting	0
Program Example	OUTPUT 714;"CALL:COUNT:CDERROR?" ! Queries the channel decode error counter.

CALL:COUNt:CLEAr:BAERror

Function	Sets the corrupt burst, missing burst, and decode error counters' count to zero.
Program Example	OUTPUT 714;"CALL:COUNT:CLEAR:BAERROR"

CALL:COUNt:CLEAr:RAPage

Function	Sets the RACH and page counters' count to zero.
Program Example	OUTPUT 714;"CALL:COUNT:CLEAR:RAPAGE"

CALL:COUNt:MBURst?

Function	Queries the missing burst counter. The missing burst counter keeps track of how many uplink bursts, that should have been there, were missing. The missing burst counter does not count idle frames as missing.
Query	Range: 0 to 99999 Resolution: 1
*RST Setting	0
Program Example	OUTPUT 714;"CALL:COUNT:MBURST?"

CALL:COUNt:PAGE?

Function	Queries the page counter. The page counter keeps track of the number of pages sent by the base station (BS) emulator during a BS originated call setup.
Query	Range: 0 to 9999 Resolution: 1
*RST Setting	0
Program Example	OUTPUT 714;"CALL:COUNT:PAGE?"

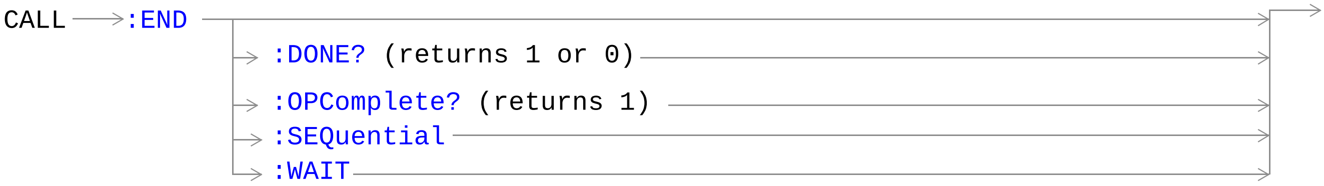
CALL:COUNt:RACH?

Function	Queries the RACH counter. The RACH counter keeps track of the number of RACH bursts received by the base station emulator during call setup attempts.
Query	Range: 0 to 9999 Resolution: 1
*RST Setting	0
Program Example	OUTPUT 714;"CALL:COUNT:RACH?"

CALL:COUNt:TDMA:FRAMes

Function	Sets/queries the Max Frames Allowed for Assignment field. The Max Frames Allowed for Assignment field specifies the maximum number of TDMA frames the mobile station is allowed to take, from the start of the assignment or handover command, for a channel assignment. This is only applicable to changes in TCH band, TCH ARFCN or TCH timeslot. Changes to any other TCH parameter will not cause an error to be generated if the number of frames taken to perform the change exceeds the setting of the Max Frames Allowed for Assignment field.
Setting	Range: 15 to 999 Resolution: 1
Query	Range: 15 to 999 Resolution: 1
*RST Setting	28
Program Example	OUTPUT 714;"CALL:COUNT:TDMA:FRAMES 15" ! Sets the number of TDMA frames allowed before transmitting the new TCH

CALL:END


CALL
:END
:DONE? (returns 1 or 0)
:OPComplete? (returns 1)
:SEQuential
:WAIT

“Diagram Conventions” on page 187

CALL:END

Function	Overlapped command used to terminate the active call.
Program Example	OUTPUT 714;"CALL:END" ! Terminate the active call.

CALL:END:DONE?

Function	Query only command which returns a 1 if the previously issued overlapped CALL:END command is done, or a 0 if the previously issued overlapped CALL:END command is not done. This command does not terminate the active call. This command is used to determine if a previously issued overlapped command is done or not.
Query	range: 0 | 1
*RST Setting	1

Program Example

```
OUTPUT 714;"CALL:END" ! Send command to terminate active call.
LOOP
OUTPUT 714;"CALL:END:DONE?" ! Send query to see if CALL:END command is done.
                          ! Returns 1 if CALL:END command is finished.
                          ! Returns 0 if CALL:END command is not finished.
ENTER 714; Callend_is_done
EXIT IF Callend_is_done
END LOOP
```

CALL:END:OPComplete?

Function	Query only command which places a 1 in the output queue when the previously issued overlapped CALL:END command is done. This command does not terminate the active call. This command is used to determine when a previously issued overlapped command is done.
Query	range: 1
*RST Setting	1

Program Example

```
OUTPUT 714;"CALL:END" ! Send command to terminate active call.
OUTPUT 714;"CALL:END:OPC?" ! Send query to determine when CALL:END command is
                         ! done.
ENTER 714; Callend_is_done ! Program hangs here until CALL:END command is finished.
                     ! When CALL:END is done a 1 is put in output queue, ENTER
                     ! is satisfied and program continues execution.
```

CALL:END:SEQuential

Function	Terminate the active call but force the overlapped CALL:END command to execute as a sequential command. This command does terminate the active call. The :SEQuential modifier forces an overlapped command to execute as a sequential command.

Program Example

```
OUTPUT 714;"CALL:END:SEQUENTIAL" ! Terminate the active call with sequential
                               ! operation
```

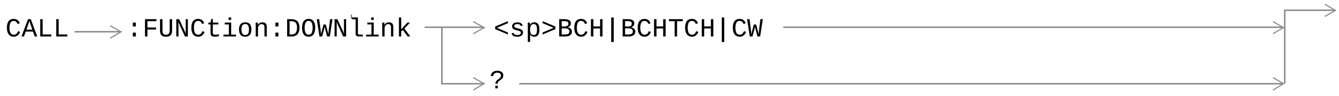
CALL:END:WAIT

Function	Terminate the active call but force the test set to process no more HP-IB commands until the previously issued overlapped CALL:END command is finished. This command does not terminate the active call. This command is used to halt processing of HP-IB commands from the test set's HP-IB input buffer until the previously issued overlapped command is finished.
Program Example	OUTPUT 714;"CALL:END" ! Terminate the active call. OUTPUT 714;"CALL:COUNT:CLEAR:BAERROR" ! Clear the burst and decode error ! counters. OUTPUT 714;"CALL:COUNT:CLEAR:RAPAGE" ! Clear the RACH and Page counters. OUTPUT 714;"CALL:END:WAIT" ! Wait here until CALL:END is finsihed. OUTPUT 714;"CALL:ORIGINATE" ! Originate a new call.

"Call Processing Event Synchronization" on page 30

"Call Processing State Synchronization" on page 34

CALL:FUNCtion



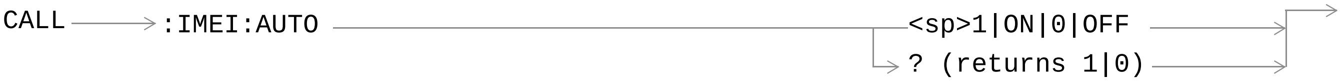
“Diagram Conventions” on page 187

CALL:FUNCtion:DOWNlink

Function	Sets/queries the downlink signal configuration when Operating Mode = Test mode.
Setting	Range: BCH | BCHTCH | CW
Query	Range: BCH | BCHTCH | CW
*RST Setting	BCH
Program Example	OUTPUT 714;"CALL:FUNCTION:DOWNLINK BCHTCH" ! Sets Test Mode downlink configuration to generate a broadcast channel (BCH) and a traffic channel (TCH).

“Test Mode Operating Mode” on page 422

CALL:IMEI



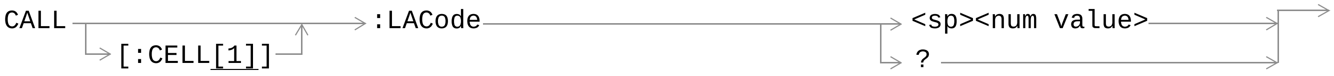
“Diagram Conventions” on page 187

CALL:IMEI:AUTO

Function	Sets/queries whether or not the base station emulator should request the international mobile equipment identity (IMEI) on call setup.
Setting	Range: 1 | ON | 0 | OFF
Query	Range: 1|0
*RST Setting	1
Program Example	OUTPUT 714;”CALL:IMEI:AUTO OFF” ! Sets automatically get IMEI state to OFF

“Configuring the Broadcast Channel (BCH)” on page 410

CALL:LACode



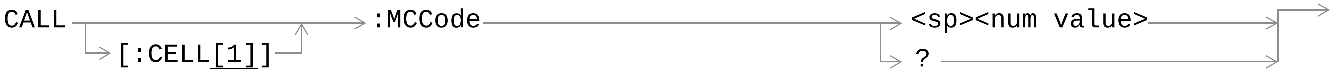
“Diagram Conventions” on page 187

CALL[:CELL]:LACode

Function	Sets/queries the value of the cell’s Location Area Code (LAC).
Setting	range: 0 to 65535 resolution: 1
Query	range: 0 to 65535 resolution: 1
*RST Setting	1
Program Example	OUTPUT 714;”CALL:CELL:LACODE 456” ! Sets the cell’s location area code 456

“Configuring the Broadcast Channel (BCH)” on page 410

CALL:MCCode



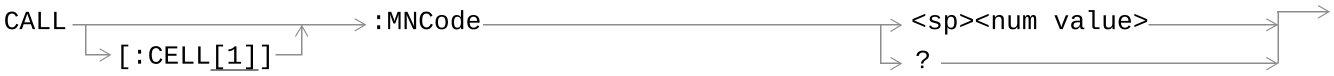
“Diagram Conventions” on page 187

CALL[:CELL]:MCCode

Function	Sets/querries the value of the Mobile Country Code (MCC).
Setting	range: 0 to 999 resolution: 1
Query	range: 0 to 999 resolution: 1
*RST Setting	1
Program Example	OUTPUT 714;”CALL:CELL:MCCODE 4” ! Sets the cell’s mobile country code to 4

“Configuring the Broadcast Channel (BCH)” on page 410

CALL:MNCode



“Diagram Conventions” on page 187

CALL[:CELL]:MNCode

Function	Sets/queries the value of the Mobile Network Code (MNC).
Setting	range: 0 to 99 resolution: 1
Query	range: 0 to 99 resolution: 1
*RST Setting	1
Program Example	OUTPUT 714;”CALL:CELL:MNCODE 45” ! Sets the cell’s mobile network code to 45

“Configuring the Broadcast Channel (BCH)” on page 410

CALL:MS

Syntax Diagrams and Command Descriptions

“CALL:MS:DTX” on page 225

“CALL:MS:REPorted<:CLEar | :IMEI? | :IMSI? | :LACode | :MCCode? | :MNCode? | :NEIGhbour>” on page 225

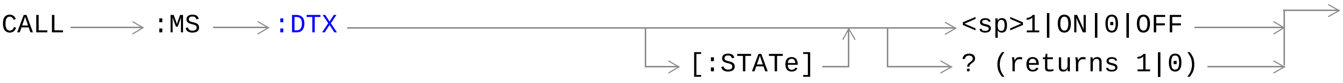
“CALL:MS:REPorted<:ONUMber? | :PCLass? | :REVision? | :RXLevel | :RXQuality>” on page 226

“CALL:MS:REPorted<:SBANd? | :TADVance | :TXLevel>” on page 226

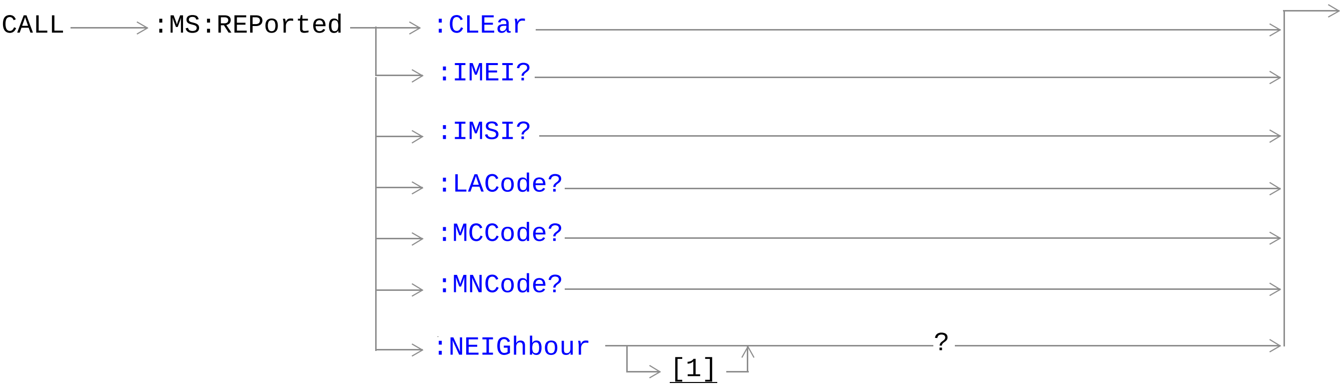
“CALL:MS:TADVance” on page 226

“CALL:MS:TXLevel” on page 227

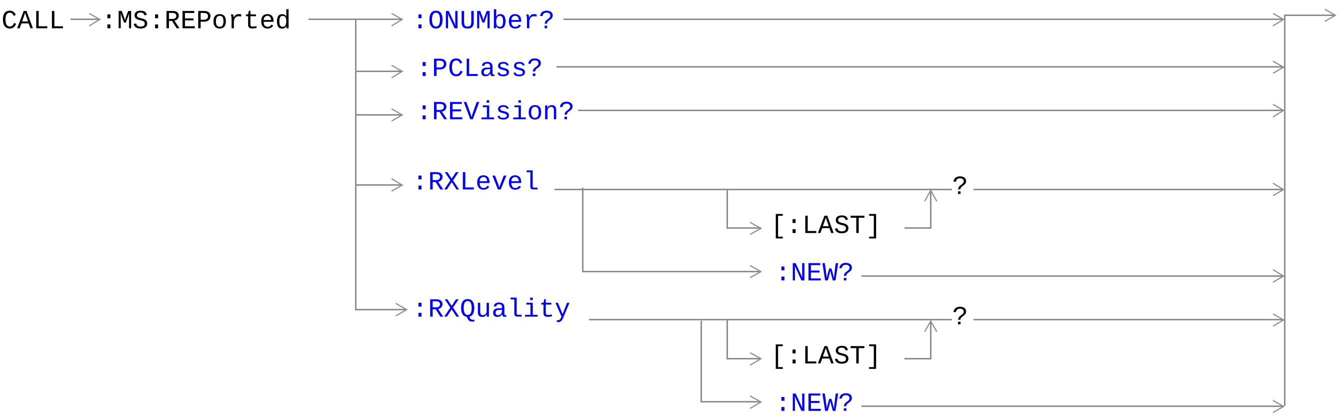
CALL:MS:DTX


CALL
:MS
:DTX
[:STATe]
<sp>1|ON|0|OFF
? (returns 1|0)

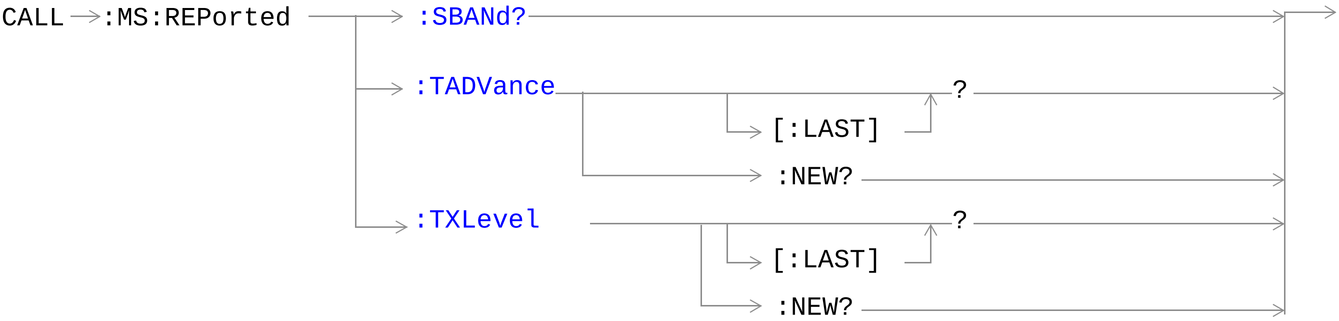
CALL:MS:REPorted<:CLEar | :IMEI? | :IMSI? | :LACode | :MCCode? | :MNCode? | :NEIGhbour>


CALL
:MS:REPorted
:CLEar
:IMEI?
:IMSI?
:LACode?
:MCCode?
:MNCode?
:NEIGhbour
[1]
?

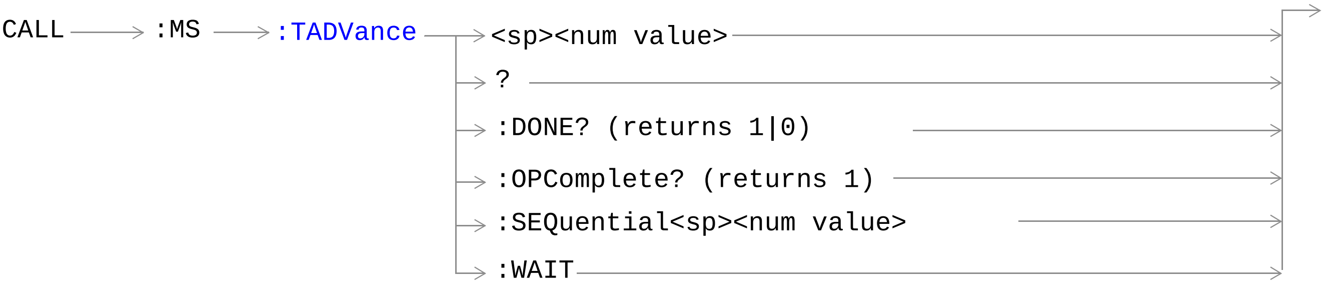
CALL:MS:REPorted<:ONUMber? | :PCLass? | :REVision? | :RXLevel | :RXQuality>


CALL
:MS:REPorted
:ONUMber?
:PCLass?
:REVision?
:RXLevel
?
[:LAST]
:NEW?
:RXQuality
?
[:LAST]
:NEW?

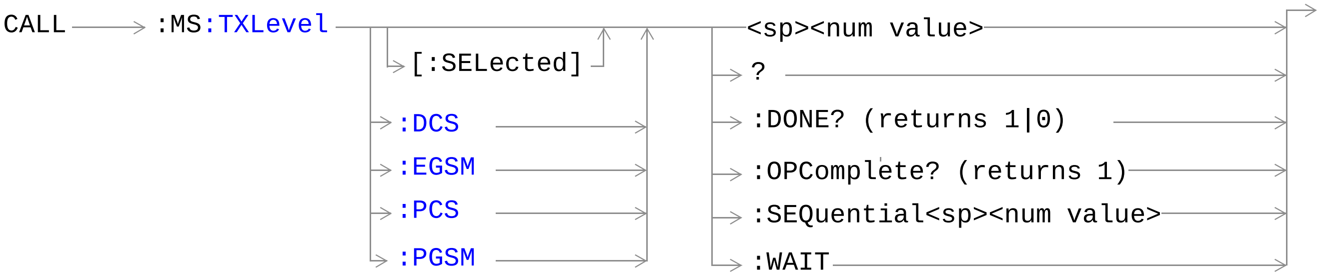
CALL:MS:REPorted<:SBANd? | :TADVance | :TXLevel>


CALL
:MS:REPorted
:SBANd?
:TADVance
?
[:LAST]
:NEW?
:TXLevel
?
[:LAST]
:NEW?

CALL:MS:TADVance


CALL
:MS
:TADVance
<sp><num value>
?
:DONE? (returns 1|0)
:OPComplete? (returns 1)
:SEQuential<sp><num value>
:WAIT

CALL:MS:TXLevel


CALL
:MS:TXLevel
[:SELected]
:DCS
:EGSM
:PCS
:PGSM
<sp><num value>
?
:DONE? (returns 1|0)
:OPComplete? (returns 1)
:SEQuential<sp><num value>
:WAIT

"Diagram Conventions" on page 187

CALL:MS:DTX[:STATe]

Function	Turns mobile station Discontinuous Transmission (DTX) on or off. Query form returns a 1 (state = on) or a 0 (state = off).
Setting	range: 1 | ON | 0 | OFF
Query	range: 0 | 1
*RST Setting	0 (state = OFF)
Program Example	OUTPUT 714;"CALL:MS:DTX OFF" ! Turns mobile station discontinuous transmission OFF.

"Configuring Mobile Station Operating Parameters" on page 415

CALL:MS:REPorted:CLEar

Function	Clears the mobile station SAACH reported items. The values of the four mobile reported items - that is, Timing Adv, Tx Level, Rx Level and Rx Qual - are set to 9.91E+37 (NAN).
Program Example	OUTPUT 714;"CALL:MS:REPORTED:CLEAR"

CALL:MS:REPorted:IMEI?

Function	Query of the International Mobile Equipment Identity of the ME. ME is an MS without a SIM.
Range	Null String or up to 15 decimal digits. (default: Null String)
Data Type	String
Program Example	OUTPUT 714;"CALL:MS:REPORTED:IMEI?"

CALL:MS:REPorted:IMSI?

Function	Query of the International Mobile Subscriber Identy of the SIM in the MS.
Range	Null String or up to 15 decimal digits. (default: Null String)
Data Type	String
Program Example	OUTPUT 714;"CALL:MS:REPORTED:IMSI?"

CALL:MS:REPorted:LACode?

Function	Query of the Last Location Area Code the MS was camped on.
Range	0 to 65535 (default: NAN)
Data Type	Real
Program Example	OUTPUT 714;"CALL:MS:REPORTED:LACODE?"

CALL:MS:REPorted:MCCode?

Function	Query of the Last Mobile Country Code the MS was camped on.
Range	0 to 999 (default: NAN)
Data Type	Real
Program Example	OUTPUT 714;"CALL:MS:REPORTED:MCCODE?"

CALL:MS:REPorted:MNCode?

Function	Query of the Last Mobile Network Code the MS was camped on.
Range	0 to 99 (default: NAN)
Data Type	Real
Program Example	OUTPUT 714;"CALL:MS:REPORTED:MNCODE?"

CALL:MS:REPorted:NEIGhbour[1]?

Function	This query will return 4 data items seperated by commas for the requested neighbour cell.
Range	1 to 1023 (default: NAN)
Data Type	Real,Real,Real,Real
Program Example	`OUTPUT 714;"CALL:MS:REPORTED:NEIGHBOUR?"! Returns ARFCN,RFLEVEL,NCC,BCC in that order`

CALL:MS:REPorted:ONUMber?

Function	Query the MS for the Originated NUMber keyed in on the MS.
Range	Null string or up to 21 characters ranging from ASCII 32 to ASCII 126 (default: Null string)
Data Type	String
Comments	Additional commands can be appended to aid in controller/Mobile Station synchronization.
Program Example	OUTPUT 714;"CALL:MS:REPORTED:ONUMBER?"

CALL:MS:REPorted:PCLass?

Function	Query the MS for its Power Class mark.
Range	1 to 5 | NAN (default: NAN)
Data Type	Real
Program Example	OUTPUT 714;"CALL:MS:REPORTED:PCLASS?

CALL:MS:REPorted:REVIsion?

Function	Query the MS to determine which Phase of GSM standards it complies with.
Query	Returns UNKNown | PHASe1 | PHASe2
Data Type	Character
Program Example	OUTPUT 714;"CALL:MS:REPORTED:REVISION?"

CALL:MS:REPorted:RXLevel[:LAST]?

Function	Received level of the TCH in dB (relative to -110 dBm) which the MS measured during the Last SACCH multiframe.
Range	0 to 63, (default: NAN)
Data Type	Real
Program Example	OUTPUT 714;"CALL:MS:REPORTED:RXLEVEL:LAST?"

CALL:MS:REPorted:RXLevel:NEW?

Function	A hanging query that will not return until the MS reports a new SACCH message to test set.
Range	0 to 68, (default: NAN)
Data Type	Real
Program Example	OUTPUT 714;"CALL:MS:REPORTED:RXLEVEL:NEW?"

CALL:MS:REPorted:RXQuality[:LAST]?

Function	The MS perceived quality of the signal used for the RX Level during the Last SACCH report.
Range	0 to 7, (default: NAN)
Data Type	Real
Program Example	OUTPUT 714;"CALL:MS:REPORTED:RXQUALITY:LAST?"

CALL:MS:REPorted:RXQuality:NEW?

Function	A hanging query that will not return until the MS reports a new SACCH message to BS Emulator.
Range	0 to 7, (default: NAN)
Data Type	Real
Program Example	OUTPUT 714;"CALL:MS:REPORTED:RXQUALITY:NEW?"

CALL:MS:REPorted:SBANd?

Function	Query for the frequency Band Supported by the MS.
Query	Returns a Null String | PGSM | EGSM | DCS | PCS. (default: null string)
Data Type	String
Program Example	OUTPUT 714;"CALL:MS:REPORTED:SBAND?"

CALL:MS:REPorted:TADVance[:LAST]?

Function	Query the MS for the Last TCH Timing Advance actually used by the MS.
Range	0 to 63, (default: NAN)
Data Type	Real
Program Example	OUTPUT 714;”CALL:MS:REPORTED:TADVANCE:LAST?”

CALL:MS:REPorted:TADVance:NEW?

Function	A hanging query that will not return until the MS reports a new SACCH message to BS Emulator.
Range	0 to 63, (default: NAN)
Data Type	Real
Program Example	OUTPUT 714;”CALL:MS:REPORTED:TADVANCE:NEW?”

CALL:MS:REPorted:TXLevel[:LAST]?

Function	Query the MS for the Last power control Level it is currently transmitting on.
Range	0 to 31, (default: NAN)
Data Type	Real
Program Example	OUTPUT 714;”CALL:MS:REPORTED

CALL:MS:REPORTED:TXLEVEL:NEW?

Function	A hanging query that will not return until the MS reports a new SACCH message to BS Emulator.
Range	0 to 31, (default: NAN)
Data Type	Real
Program Example	OUTPUT 714;”CALL:MS:REPORTED

CALL:MS:TADVance

Function	Commands the MS what TCH Timing Advance to use on the uplink.
Range	0 to 63 (default: 0)
Data Type	Integer
Comments	Additional commands can be appended to aid in controller/Mobile Station synchronization.
Program Example	`OUTPUT 714;”CALL:MS:TADVANCE 3”! Sets the MS TCH Timing Advance to 3 on the uplink`

CALL:MS:TXLevel[:SELected]

Function	Selects the MS uplink power control level for the band already Selected.
Default Setting	PGSM
Data Type	Integer
Comments	Additional commands can be appended to aid in controller/Mobile Station synchronization.
Program Example	OUTPUT 714;”CALL:MS:TXLEVEL :SELECTED 10”

CALL:MS:TXLevel:DCS

Function	Selects the MS uplink power control level.
Range	0 to 31 (default: 10)
Data Type	Integer
Comments	Additional commands can be appended to aid in controller/Mobile Station synchronization.
Program Example	OUTPUT 714;”CALL:MS:TXLEVEL:DCS 8”

CALL:MS:TXLevel:EGSM

Function	Selects the MS uplink power control level.
Range	0 to 31 (default: 15)
Data Type	Integer
Comments	Additional commands can be appended to aid in controller/Mobile Station synchronization.
Program Example	OUTPUT 714;”CALL:MS:TXLEVEL:EGSM 20”

CALL:MS:TXLevel:PCS

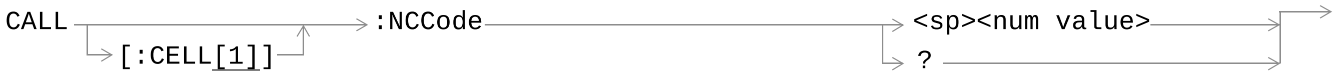
Function	Selects the MS uplink power control level.
Range	0 to 31 (default: 10)
Data Type	Integer
Comments	Additional commands can be appended to aid in controller/Mobile Station synchronization.
Program Example	`OUTPUT 714;”CALL;MS;TXLEVEL:PCS 31”`

CALL:MS:TXLevel:PGSM

Function	Selects the MS uplink power control level.
Range	0 to 31, (default: 15)
Data Type	Integer
Comments	Additional commands can be appended to aid in controller/Mobile Station synchronization.
Program Example	OUTPUT 714;”CALL:MS:TXLEVEL:PGSM 22”

“Frequency Banded Parameters” on page 399

CALL:NCCode



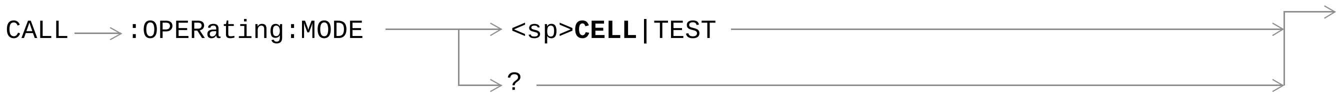
“Diagram Conventions” on page 187

CALL[:CELL]:NCCode

Function	Network color code selection.
Range	0 to 7 (default: 1)
Data Type	Integer
Program Example	OUTPUT 714;”CALL:CELL:NCCODE 2”

“Configuring the Broadcast Channel (BCH)” on page 410

CALL:OPERating



“Diagram Conventions” on page 187

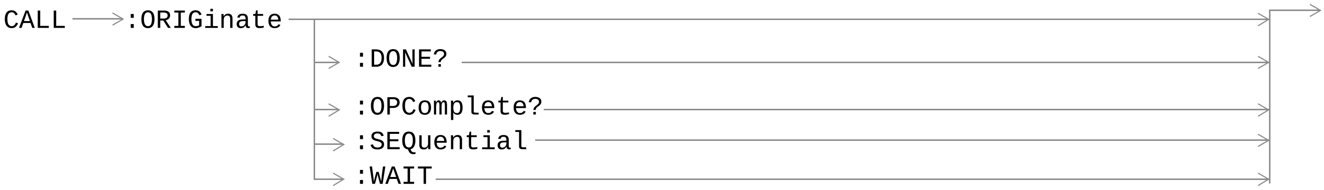
CALL:OPERating:MODE

Function	Defines the Operating Mode (behavior) of the test set.
Default Setting	CELL
Data Type	Character
Program Example	`OUTPUT 714;”CALL:OPERATING:MODE TEST”! Places the Test Set into Test Mode`

“Test Mode Operating Mode” on page 422

“Active Cell Operating Mode” on page 408

CALL:ORIGinate



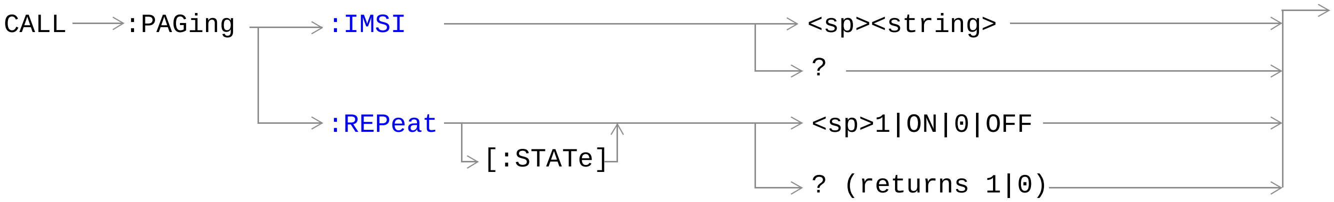
“Diagram Conventions” on page 187

CALL:ORIGinate

Function	BS Originated call.
Comments	Additional commands can be appended to aid in controller/Mobile Station synchronization.
Program Example	`OUTPUT 714;”CALL:ORIGINATE:SEQUENTIAL”! Orignates a base station call. Appending SEQUENTIAL to this command causes the command to be performed sequentially.See “Call Processing Event Synchronization” on page 30`

“Call Processing Event Synchronization” on page 30

CALL:PAGing



"Diagram Conventions" on page 187

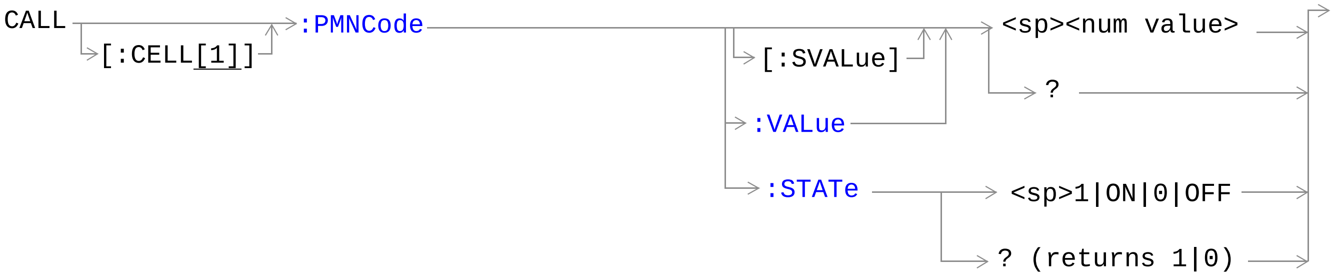
CALL:PAGing:IMSI

Function	Define the International Mobile Subscriber Identity used for Paging the MS.
Range	15 digits (default: 001012345678901)
Data Type	String
Program Example	`OUTPUT 714;"CALL:PAGing:IMSI '01012345678901'"! Set paging IMSI to 01012345678901`

CALL:PAGing:REPeat[:STATe]

Function	If ON, repeat paging if the BS Emulator does not receive a RACH before the paging timer expires.
Range	1 | ON or 0 | OFF (default: OFF)
Data Type	Boolean
Program Example	`OUTPUT 714;"CALL:PAGING:REPEAT:STATE ON"! Turns paging repeat ON`

CALL:PMNCode



"Diagram Conventions" on page 187

CALL[:CELL]:PMNCode[:SVALue]

Function	3 digit mobile network code for PCS band only
Range	0 to 999 (default = 1)
Data Type	Integer
Program Example	OUTPUT 714;"CALL:CELL:PMNCODE:SVALUE 798"! This is a complex command that turns on 3 digit MNCode for PCS 1900 and sets it to 798

CALL[:CELL]:PMNCode:VALue

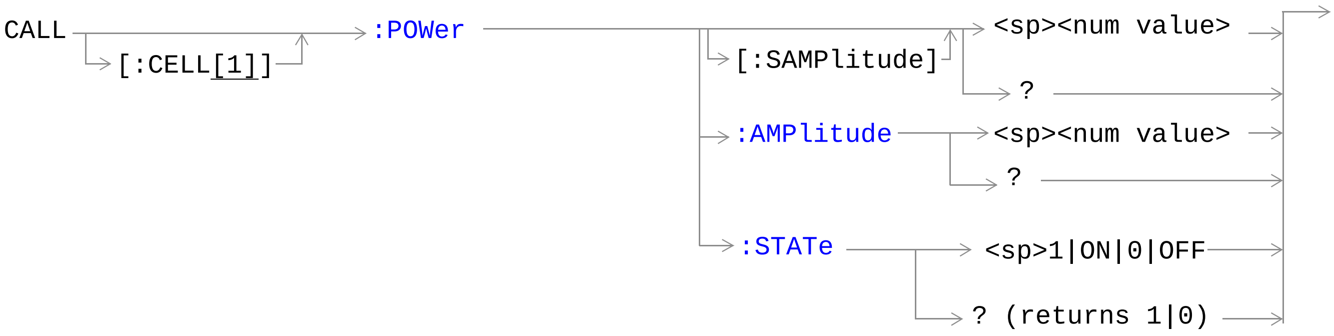
Function	3 digit mobile network code for PCS band only
Range	0 to 999 (default = 1)
Data Type	Integer
Program Example	OUTPUT 714;"CALL:CELL:PMNCODE 798"! Sets the 3 digit MNCode for PCS 1900 to 798

CALL[:CELL]:PMNCode:STATe

Function	Configures the PCS MNC state
Range	0|OFF or 1|ON (default = OFF)
Data Type	Boolean
Program Example	OUTPUT 714;"CALL:CELL:PMNCODE:STATE ON"

"3 Digit MNC for PCS" on page 412

CALL:POWer



"Diagram Conventions" on page 187

CALL[:CELL]:POWer:AMPLitude[:SAMPlitude]

Function	Sets the output power of the test set, this is the same for BCH and TCH.
Range	-10 dBm to -127 dBm [The suffix dBm is optional] (default: -85 dBm)
Data Type	Real
Program Example	OUTPUT 714;"CALL:CELL:POWER:SAMPLITUDE -50dBm"! This is a complex command that turns on the RF Cell Power and sets the output power from test set to -50dBm

CALL[:CELL]:POWer:AMPLItude

Function	Sets the output power of the test set, this is the same for BCH and TCH.
Range	-10 dBm to -127 dBm [The suffix dBm is optional] (default: -85 dBm)
Data Type	Real
Program Example	OUTPUT 714;"CALL:CELL:POWER:AMPLITUDE -50dBm"! Set the output power from test set to -50dBm

CALL[:CELL]:POWer:STATe

Function	Turns the RF Power for the Cell ON or OFF.
Range	1|ON or 0|OFF (default: ON)
Data Type	Boolean
Program Example	OUTPUT 714;"CALL:CELL:POWER:STATE ON"

"Cell Power" on page 410

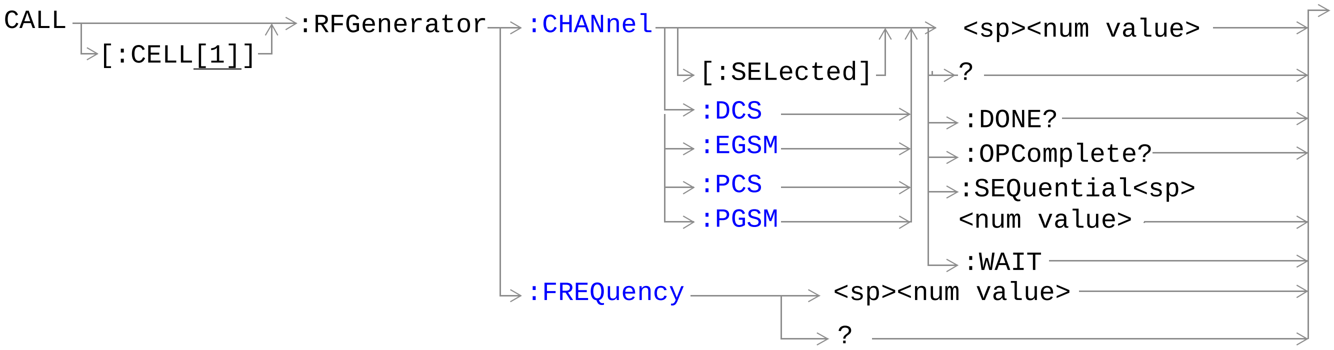
CALL:RFGenerator

Syntax Diagrams and Command Descriptions

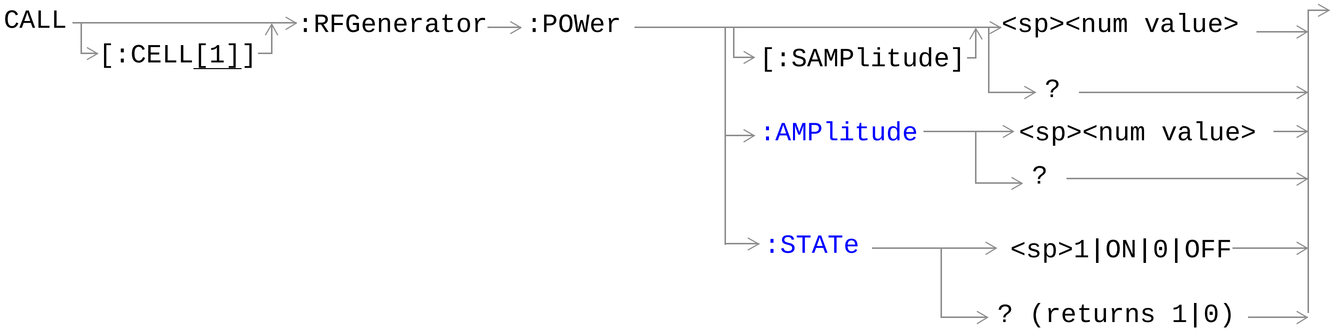
"CALL:RFGenerator<:CHANnel | :FREQuency>" on page 240

"CALL:RFGenerator:POWer" on page 240

CALL:RFGenerator<:CHANnel | :FREQuency>


CALL
[:CELL[1]]
:RFGenerator
:CHANnel
[:SELected]
:DCS
:EGSM
:PCS
:PGSM
<sp><num value>
?
:DONE?
:OPComplete?
:SEQuential<sp>
<num value>
:WAIT
:FREQuency
<sp><num value>
?

CALL:RFGenerator:POWer


CALL
[:CELL[1]]
:RFGenerator
:POWer
[:SAMPlitude]
<sp><num value>
?
:AMPlitude
<sp><num value>
?
:STATe
<sp>1|ON|0|OFF
? (returns 1|0)

"Diagram Conventions" on page 187

CALL[:CELL]:RFGenerator:CHANnel[:SELected]

Function	Downlink Channel for the Selected band.
Range	DCS | EGSM | PCS | PGSM bands
Data Type	Integer
Comments	Additional commands can be appended to aid in controller/Mobile Station synchronization.
Program Example	OUTPUT 714;"CALL:CELL:RFGENERATOR:CHANNEL:SELECTED 512"! Sets the RF Generator channel to 512 for the band already selected

CALL[:CELL]:RFGenerator:CHANnel:DCS

Function	Downlink channel for DCS using the RF Generator.
Range	512 to 885 (default: 512)
Data Type	Integer
Comments	Additional commands can be appended to aid in controller/Mobile Station synchronization.
Program Example	OUTPUT 714;"CALL:CELL:RFGENERATOR:CHANNEL:DCS 512"

CALL[:CELL]:RFGenerator:CHANnel:EGSM

Function	Downlink channel for EGSM using the RF Generator.
Range	0 to 124 | 975 to 1023 (default: 20)
Data Type	Integer
Comments	Additional commands can be appended to aid in controller/Mobile Station synchronization.
Program Example	OUTPUT 714;"CALL:CELL:RFGENERATOR:CHANNEL:EGSM 124"

CALL[:CELL]:RFGenerator:CHANnel:PCS

Function	Downlink channel for PCS using the RF Generator.
Range	512 to 810 (default: 512)
Data Type	Integer
Comments	Additional commands can be appended to aid in controller/Mobile Station synchronization.
Program Example	OUTPUT 714;"CALL:CELL:RFGENERATOR:CHANNEL:PCS 512"

CALL[:CELL]:RFGenerator:CHANnel:PGSM

Function	Downlink channel for PGSM using the RF Generator.
Range	1 to 124 (default: 20)
Data Type	Integer
Comments	Additional commands can be appended to aid in controller/Mobile Station synchronization.
Program Example	OUTPUT 714;"CALL:CELL:RFGENERATOR:CHANNEL:PGSM 124"

CALL[:CELL]:RFGenerator:FREQuency

Function	Downlink frequency selection. Operating mode = Test Mode and Downlink Function = CW.
Range	45 MHz to 2700 MHz [The suffix MHz is optional] (default: 939.2MHz)
Data Type	Real
Program Example	OUTPUT 714;"CALL:CELL:RFGENERATOR:FREQUENCY 896.2MHZ"

CALL[:CELL]:RFGenerator:POWer[:SAMPLitude]

Function	Complex command that turns on the Downlink power and sets a level using the RF Generator.
Range	-10 to -100 dBm[The suffix DBM is optional] (default: -85 dBm)
Data Type	Real
Program Example	OUTPUT 714;"CALL:CELL:RFGENERATOR:POWER:SAMPLITUDE -50DBM"

CALL[:CELL]:RFGenerator:POWer:AMPLItude

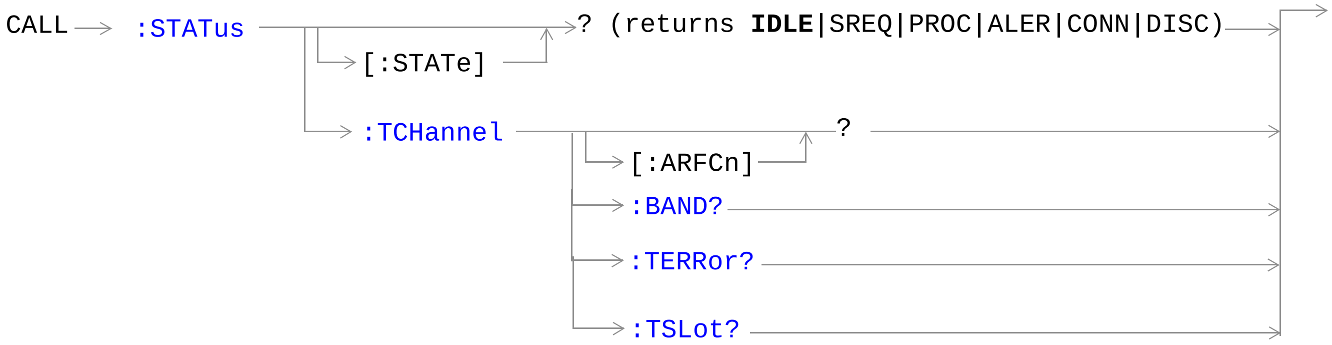
Function	Sets the level of the Downlink power using the RF Generator.
Range	-10 to -100 dBm[The suffix DBM is optional] (default: -85 dBm)
Data Type	Real
Program Example	OUTPUT 714;"CALL:CELL:RFGENERATOR:POWER:AMPLITUDE -50DBM"

CALL[:CELL]:RFGenerator:POWer:STATe

Function	Sets the Downlink RF Power State to ON or OFF.
Range	0|OFF or 1|ON (default = ON)
Data Type	Boolean
Program Example	OUTPUT 714;"CALL:CELL:RFGENERATOR:POWER:STATE OFF"

"Test Mode Operating Mode" on page 422

CALL:STATus


CALL
:STATus
? (returns IDLE|SREQ|PROC|ALER|CONN|DISC)
[:STATe]
:TCHannel
?
[:ARFCn]
:BAND?
:TERRor?
:TSLot?

“Diagram Conventions” on page 187

CALL:STATus[:STATe]?

Function	Query returns the Status of the call.
Range	IDLE | SREQ | PROC | ALER | CONN | DISC (default: IDLE)
Data Type	Character

“Call Processing State Synchronization” on page 34

CALL:STATus:TCHannel[:ARFCN]?

Function	Query returns the Status of the call.
Range	0 to 1023 {depending on the current TCH Band} (default: NAN)
Data Type	Real

“Call Processing Event Synchronization” on page 30

CALL:STATus:TCHannel:BAND?

Function	Query the current TCh band.
Range	DCS | EGSM | PCS | PGSM bands
Data Type	Real

“Call Processing Event Synchronization” on page 30

“Configuring the Traffic Channel (TCH)” on page 419

CALL:STATus:TCHannel:TERRor?

Function	Query returns error (relative to TCH Timing Advance parameter) in MS uplink timing in .25 T increments.
Range	-8 to +30 T [T=48/13,000,000 seconds]
Data Type	Real

CALL:STATus:TCHannel:TSLot?

Function	Query the Timeslot that the BS Emulator is using for the TCH. Only valid when on a call.
Range	3 | 4 | 5 | NAN (default: NAN)
Data Type	Real

“Configuring the Traffic Channel (TCH)” on page 419

CALL:TCHannel

Syntax Diagrams and Command Descriptions

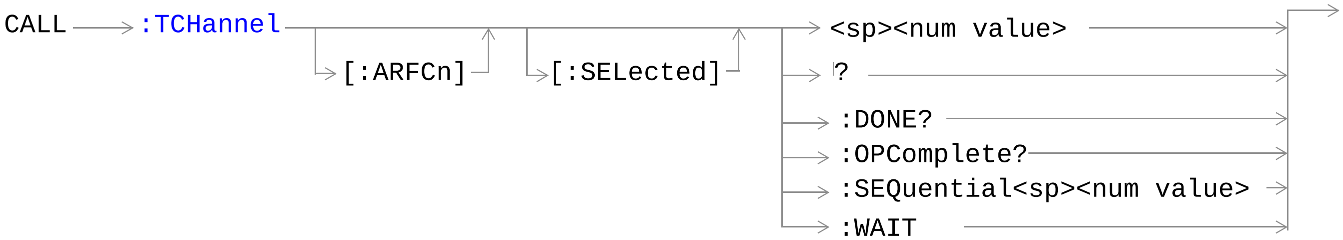
“CALL:TCHannel” on page 245

“CALL:TCHannel<:DCS | :EGSM | :PCS | :PGSM>” on page 245

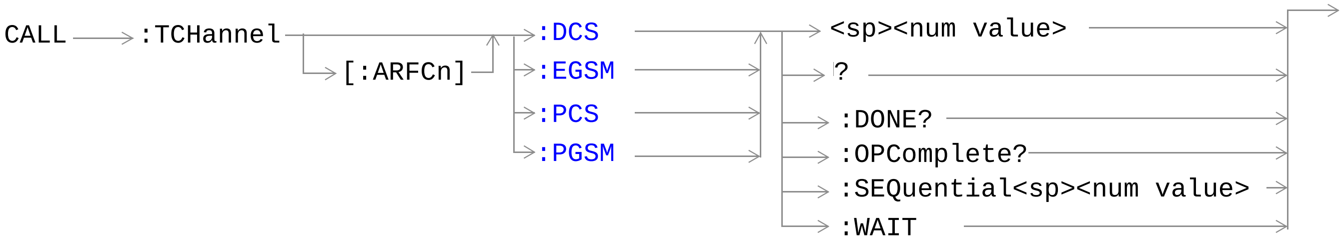
“CALL:TCHannel:BAND” on page 245

“CALL:TCHannel<:DOWNlink | :LOOPback | :TSLot>” on page 246

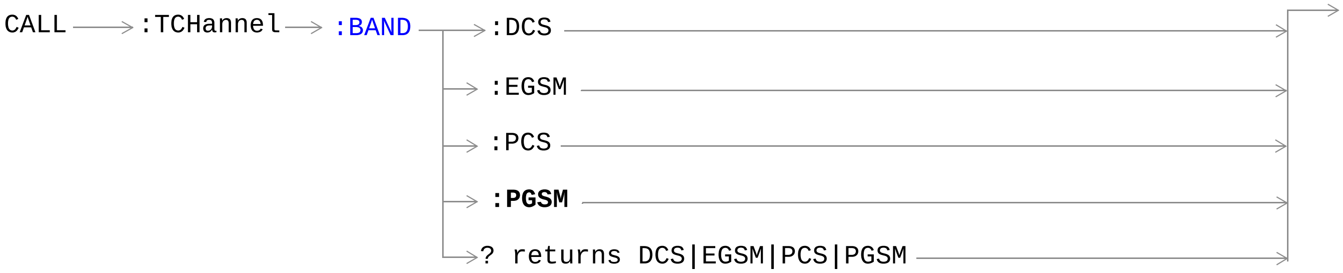
CALL:TCHannel


CALL
:TCHannel
[:ARFCn]
[:SELected]
<sp><num value>
?
:DONE?
:OPComplete?
:SEQuential<sp><num value>
:WAIT

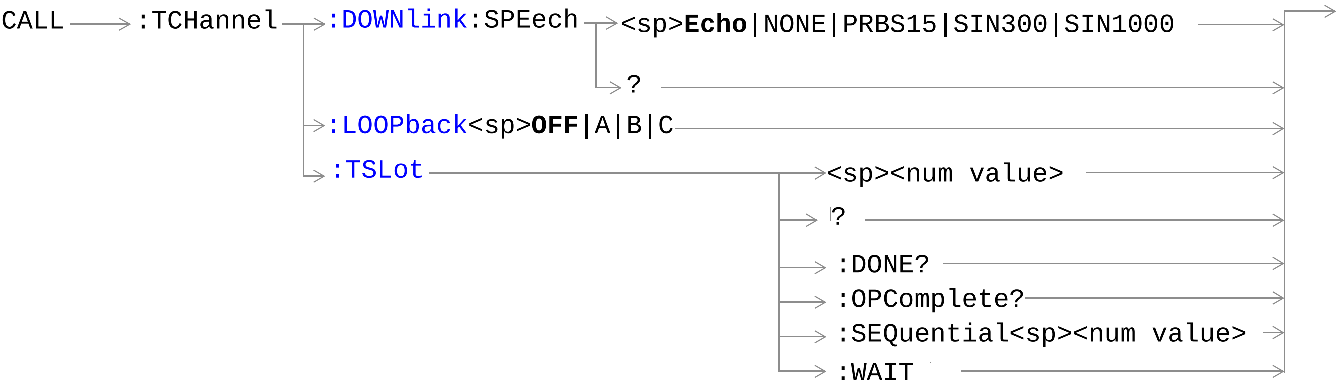
CALL:TCHannel<:DCS | :EGSM | :PCS | :PGSM>


CALL
:TCHannel
[:ARFCn]
:DCS
:EGSM
:PCS
:PGSM
<sp><num value>
?
:DONE?
:OPComplete?
:SEQuential<sp><num value>
:WAIT

CALL:TCHannel:BAND


CALL
:TCHannel
:BAND
:DCS
:EGSM
:PCS
:PGSM
? returns DCS|EGSM|PCS|PGSM

CALL:TCHannel<:DOWNlink | :LOOPback | :TSLot>


CALL
:TCHannel
:DOWNlink:SPEech
<sp>Echo|NONE|PRBS15|SIN300|SIN1000
?
:LOOPback<sp>OFF|A|B|C
:TSLot
<sp><num value>
?
:DONE?
:OPComplete?
:SEQuential<sp><num value>
:WAIT

"Diagram Conventions" on page 187

CALL:TCHannel[:ARFCn][:SELected]

Function	Sets/queries the channel number of downlink and uplink TCH for the band already selected.
Setting	Range: DCS | EGSM | PCS | PGSM bands
Query	Range: DCS | EGSM | PCS | PGSM bands
*RST setting	
Program Example	`OUTPUT 714;"CAL:TCHANNEL:ARFCN:SELECTED 512" ! selects ARFCN of 512 on the test set`

CALL:TCHannel[:ARFCn]:DCS

Function	Sets/Queries the channel number for downlink and uplink TCH.
Setting	Range: 512 to 885 (default: 698) Resolution: 1
Query	Range: 512 to 885 (default: 698) Resolution: 1
*RST setting	
Program Example	`OUTPUT 714;"CALL:TCHANNEL:ARFCN:DCS 512"`

"Configuring the Traffic Channel (TCH)" on page 419

CALL:TCHannel[:ARFCn]:EGSM

Function	Set channel number for downlink and uplink TCH.
Range	0 to 124 | 975 to 1023 (default: 30)
Data Type	Integer
Program Example	`OUTPUT 714;"CALL:TCHANNEL:ARFCN:EGSM 124"`

“Configuring the Traffic Channel (TCH)” on page 419

CALL:TCHannel[ARFCN]:PCS

Function	Set channel number for downlink and uplink TCH.
Range	512 to 810 (default: 698)
Data Type	Integer
Program Example	`OUTPUT 714;"CALL:TCHANNEL:ARFCN:PCS 512"`

CALL:TCHannel[:ARFCn]:PGSM

Function	Set channel number for downlink and uplink TCH.
Range	1 to 124 (default: 30)
Data Type	Integer
Program Example	`OUTPUT 714;"CALL:TCHANNEL:ARFCN:PGSM 124"`

“Configuring the Traffic Channel (TCH)” on page 419

CALL:TCHannel:BAND

Function	Defines which GSM band the BS Emulator should use for the TCH.
Default Setting	:DCS | :EGSM | :PCS | :PGSM bands
Data Type	Character
Program Example	`OUTPUT 714;"CALL:TCHANNEL:BAND:DCS"`

CALL:TCHannel:DOWNlink:SPEech

Function	Set what kind of Speech data is transmitted on the downlink TCH.
Range	ECHO | NONE | PRBS15 | SIN300 | SIN1000
Data Type	Character
Program Example	`OUTPUT 714;"CALL:TCHANNEL:DOWNLINK:SPEECH ECHO"`

"Configuring the Traffic Channel (TCH)" on page 419

"Fast Bit Error Measurement Description" on page 61

"Test Mode Operating Mode" on page 422

CALL:TCHannel:LOOPback

Function	Sets traffic channel loopback state and type. see "Fast Bit Error Measurement Description" on page 61
Range	• OFF - Sets the TCH Loop state for the MS to OFF. The loop back is open. • A- Sets the TCH Loop state for the MS to type A. Full-rate speech TCH loopback with signaling of erased frames. • B- Sets the TCH Loop state for the MS to type B. Full-rate speech TCH loopback without signalling of erased frames. • C - Sets the TCH Loop state for the MS to type C. TCH burst by burst loopback.
Default Setting	OFF
Data Type	Character
Program Example	OUTPUT 714;"CALL:TCHANNEL:LOOPBACK C" ! sets loopback type

CALL:TCHannel:TSLot

Function	Sets the Timeslot number used for downlink and uplink Traffic Channel.
Range	3 | 4 | 5 (default: 4)
Data Type	Integer
Program Example	`OUTPUT 714;"CALL:TCHANNEL:TSLOT 3"`

"Configuring the Traffic Channel (TCH)" on page 419

DISPlay Subsystem

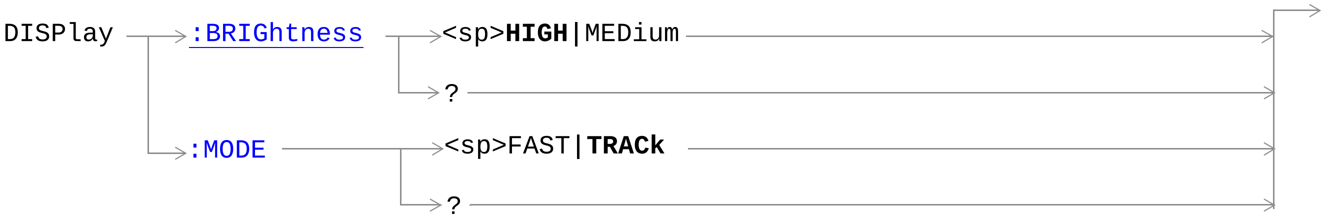
Description

The DISplay subsystem is used to configure the display mode, view or color scheme of the Test Set display. Use of the DISPlay subsystem is not required to set or query any data or results.

Syntax Diagram and Command Descriptions

"DISPlay"

DISPlay



“Diagram Conventions” on page 187

DISPlay:BRIGhtness (future functionality)

Function	Sets/queries the test set’s display brightness.
Setting	Range: MEDium | HIGH
Query	Range: MED | HIGH
Factory setting	HIGH (this parameter is not affected by any reset operation and can only be changed by direct user access)
Program Example	OUTPUT 714;”DIPLAY:BRIGHTNESS MEDIUM” ! sets display brightness to medium

DISPlay:MODE

Function	Sets/queries the test set’s display mode. see “Configuring the Test Set’s Look and Feel” on page 447
Range	FAST|TRACK
Query	FAST | TRAC
*RST setting	TRACK
Program Example	`OUTPUT 714;”DISPLAY:MODE FAST” ! sets display mode to fast`

FETCh Subsystem

Description

The FETCh? query is a function that allows users to query results from a measurement that was previously INITiated or READ. It does NOT begin a measurement. If no measurement is in progress it will return the integrity and measurement values from the last measurement made, or return an integrity of No Result Available and results of NAN. If a measurement is in process, the query will hang until the results are available, or the measurement fails or times out. The exact results returned with a FETCh? will depend on the specific measurement. A measurement may have a number of different results or combination of results for a FETCh?. The FETCh? queries are intended to be used to provide overlapped operation access to measurement results from the Test Set. When used along with SETup and INITiate commands , FETCh? is the primary way for the user to retrieve measurement results. In order to use the Test Set's concurrent test capabilities the overlapped commmands of INITiate and FETCh? must be used. Overlapped commands allow the user to send commands and not wait for completion.

Syntax Diagrams and Command Descriptions

"FETCh:AAUDio" on page 252

"FETCh:BERRor" on page 256

"FETCh:DAUDio" on page 261

"FETCh:FBERror" on page 265

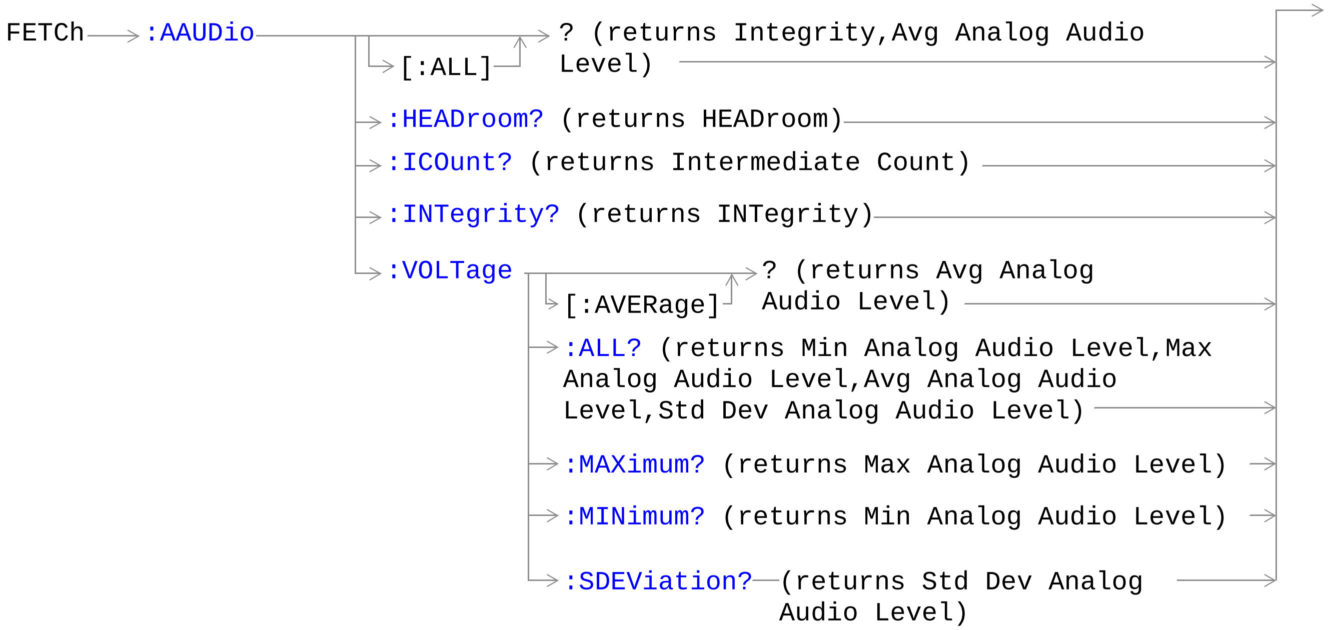
"FETCh:ORFSpectrum" on page 268

"FETCh:PFERror" on page 276

"FETCh:PVTime" on page 282

"FETCh:TXPower" on page 290

FETCh:AAUDio


FETCh
:AAUDio
[:ALL]
? (returns Integrity,Avg Analog Audio Level)
:HEADroom? (returns HEADroom)
:ICOunt? (returns Intermediate Count)
:INTegrity? (returns INTegrity)
:VOLTage
[:AVERage]
? (returns Avg Analog Audio Level)
:ALL? (returns Min Analog Audio Level,Max Analog Audio Level,Avg Analog Audio Level,Std Dev Analog Audio Level)
:MAXimum? (returns Max Analog Audio Level)
:MINimum? (returns Min Analog Audio Level)
:SDEViation? (returns Std Dev Analog Audio Level)

“Diagram Conventions” on page 187

FETCh:AAUDio[:ALL]?

Function	Queries the analog audio measurement results. This query returns an integrity indicator and average analog audio level. Values are returned in a comma-separated list. If the analog audio multi-measurement count field is off, the level returned by this command is displayed in the Analog Audio Audio In Level field. If the analog audio multi-measurement count is on, the level returned by this command is displayed in the Analog Audio Average field.
Query	Integrity indicator • Range: 0 to 15 • Resolution: 1 Analog audio level • Range: 10 mV_{rms} to 20 V_{rms} • Resolution: 0.1 mV_{rms}

FETCh:AAUDio:HEADroom?

Function	Queries the analog audio measurement headroom. The value returned indicates how much greater (in dB) the last analog audio measurement could have been without causing the measurement to over-range. Headroom value is only an estimate. If 9.91 E+37 (NAN) is returned, the test set has no useful information about how far out of range the last measurement was. This value is not displayed on the test set.
Query	Range: 0 to 100 dB and 9.91 E+37 Resolution: 0.1 dB

FETCh:AAUDio:ICOunt?

Function	Queries the intermediate count of analog audio multi-measurements completed. This value is not displayed on the test set.
Query	Range: 1 to 999 Resolution: 1

FETCh:AAUDio:INTegrity?

Function	Queries the integrity indicator for the last analog audio measurement completed. Zero indicates a normal measurement. See "Integrity Indicator" on page 98 for descriptions of non-zero integrity indicators.
Query	Range: 0 to 15 Resolution: 1

FETCh:AAUDio:VOLTage[:AVERage]?

Function	Queries the average analog audio level. Value is returned in units of V_{rms}. If the analog audio multi-measurement count field is off, the level returned by this command is displayed in the Analog Audio Audio In Level field. If the analog audio multi-measurement count is on, the level returned by this command is displayed in the Analog Audio Average field
Query	Range: 10 mV_{rms} to 20 V_{rms} Resolution: 0.1 mV_{rms}

FETCh:AAUDio:VOLTage:ALL?

Function	Queries the analog audio multi-measurement minimum,maximum, average and standard deviation. Values are returned in a comma-separated list The values returned are displayed in the Analog Audio Minimum, Maximum, Average, and Std. Dev. fields, which are displayed when the Analog Audio multi-measurement count is not off.
Query	Minimum • Range: 10 mV_{rms} to 20 V_{rms} • Resolution: 0.1 mV_{rms} Maximum • Range: 10 mV_{rms} to 20 V_{rms} • Resolution: 0.1 mV_{rms} Average • Range: 10 mV_{rms} to 20 V_{rms} • Resolution: 0.1 mV_{rms} Standard deviation • Range: 0 V to 14.14214 V • Resolution: 0.01 mV

FETCh:AAUDio:VOLTage:MAXimum?

Function	Queries the analog audio multi-measurement maximum analog audio voltage. The value returned is displayed in the Analog Audio Maximum field, which is displayed when the analog audio multi-measurement count is not off.
Query	Range: 10 mV_{rms} to 20 V_{rms} Resolution: 0.1 mV_{rms}

FETCh:AAUDio:VOLTage:MINimum?

Function	Queries the analog audio multi-measurement minimum analog audio voltage The value returned is displayed in the Analog Audio Minimum field, which is displayed when the analog audio multi-measurement count is not off.
Query	Range: 10 mV_{rms} to 20 V_{rms} Resolution: 0.1 mV_{rms}

FETCh:AAUDio:VOLTage:SDEViation?

Function	Queries the analog audio multi-measurement standard deviation. The value returned is displayed in the Analog Audio Std Dev. field, which is displayed when the Analog Audio multi-measurement count is not off.
Query	Range: 0 V to 14.14214 V Resolution: 0.01 mV

FETCh:BERRor

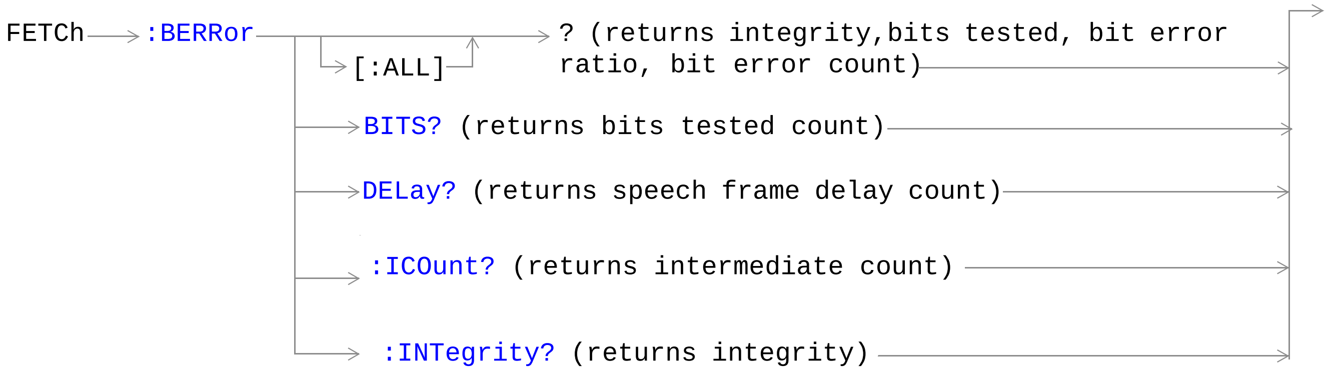
Syntax Diagrams and Command Descriptions

“FETch:BERRor<:BITS | :DELay | :COunt | :INTegrity>?” on page 256

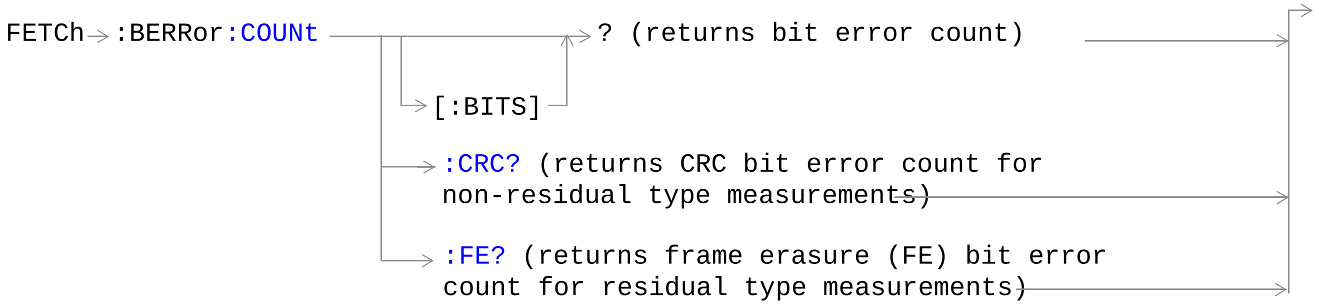
“FETCh:BERRor:COUNt” on page 256

“FETCH:BERRor:RATio” on page 257

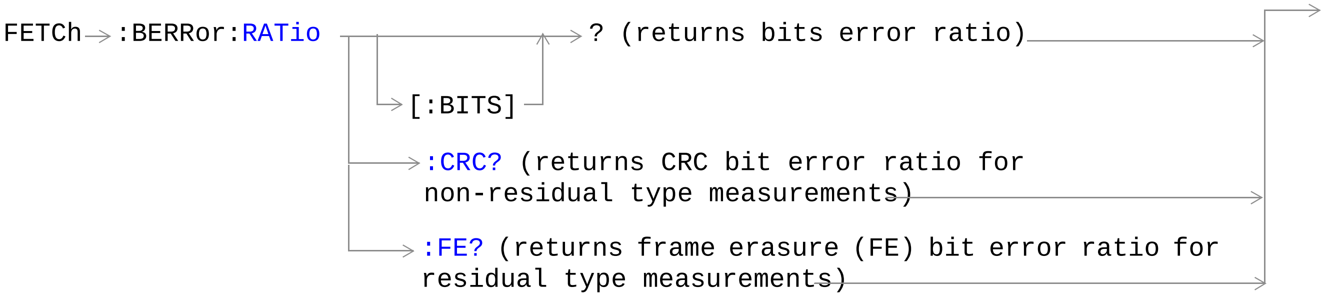
FETch:BERRor<:BITS | :DELay | :COunt | :INTegrity>?


FETCh
:BERRor
[:ALL]
? (returns integrity,bits tested, bit error ratio, bit error count)
BITS? (returns bits tested count)
DELay? (returns speech frame delay count)
:ICOunt? (returns intermediate count)
:INTegrity? (returns integrity)

FETCh:BERRor:COUNt


FETCh
:BERRor
:COUNt
? (returns bit error count)
[:BITS]
:CRC? (returns CRC bit error count for non-residual type measurements)
:FE? (returns frame erasure (FE) bit error count for residual type measurements)

FETCH:BERRor:RATio


FETCh
:BERRor:RATio
? (returns bits error ratio)
[:BITS]
:CRC? (returns CRC bit error ratio for non-residual type measurements)
:FE? (returns frame erasure (FE) bit error ratio for residual type measurements)

“Diagram Conventions” on page 187

FETCh:BERRor[:ALL]?

Function	Queries the bit error measurement. Query returns integrity indicator, bits tested, bit error ratio, and bit error count. See “Bit Error Measurement Description” on page 50
Query	Integrity indicator • Range: 0 to 15 • Resolution: 1 Bits tested • Range: 0 to 999,131 and 9.91 E+37 (NAN) • Resolution: 1 Bit error ratio • Range: 0 to 100 and 9.91 E+37 (NAN) • Resolution: 0.01 Bit error count • Range: 1 to 999,131 and 9.91 E+37 (NAN) • Resolution: 1

FETCh:BERRor:BITS?

Function	Queries the number of bits actually tested. The number of bits actually tested will exceed the number requested because the test set rounds up the number requested to the nearest number that results in an integral number of speech frames. One speech frame is 132 bits. The test set measures complete a speech frame and it is queried for bits. See "Bit Error Measurement Description" on page 50
Query	Bits tested • Range: 0 to 999,131 and 9.91 E+37 (NAN) • Resolution: 1
*RST Setting	10,000

FETCh:BERRor:DELay?

Function	Queries the delay (in speech frames) that the test set used during the last bit error measurement to correlate uplink information bits with downlink information bits. This value is displayed in the Speech Frames Delay field. This value can be determined automatically, or manually set by the user. See "SETup:BERRor:MANual:DELay" on page 323 and "SETup:BERRor:LDControl:AUTO" on page 322. Refer also to the "Bit Error Measurement Description" on page 50 for a description of frame delay and how it is used in the bit error measurement.
Query	Range: 0 to 15 and 9.91 E+37 (NAN) Resolution: 1
*RST Setting	Auto

FETCh:BERRor:ICOunt?

Function	Queries the intermediate count of bits tested (measurement progress report). See "Measurement Progress Report" on page 108
Query	Range: 0 to 999 Resolution: 1

FETCh:BERRor:INTegrity?

Function	Returns the integrity indicator value for the last bit error measurement performed. Zero indicates a normal result. See "Integrity Indicator" on page 98 for descriptions of non-zero integrity indicators.
Query	Range: 0 to 15 Resolution: 1

FETCh:BERRor:COUNt[:BITS]?

Function	Queries the number of bits that were in error during the last bit error test. See "Bit Error Measurement Description" on page 50 The manual user must set the measurement unit to count.
Query	Range: 1 to 999,131 and 9.91 E+37 (NAN) Resolution: 1

FETCh:BERRor:COUNt:CRC?

Function	Queries the number of bad cyclic redundancy checks (CRCs) for a non-residual measurement type, loopback type B test. See "Bit Error Measurement Description" on page 50 The mobile station re-transmits the CRC it received from the test set on the uplink. A bad CRC occurs when the CRC transmitted by the test set does not match what is received back from the mobile station. The manual user must set the measurement unit to count.
Query	Range: 0 to 19,980 and 9.91 E+37 (NAN) Resolution: 1

FETCh:BERRor:COUNt:FE?

Function	Queries the number of frames erased during a residual measurement type, looback type A test. The manual user must set the measurement's unit to count.
Query	Range: 0 to 19,980 and 9.91 E+37 (NAN) Resolution: 1

FETCh:BERRor:RATio[:BITS]?

Function	Queries the ratio of bits in error to the number of bits tested during the last bit error test and returns it as a percentage. See "Bit Error Measurement Description" on page 50 The manual user must set the measurement unit to %.
Query	Range: 1 to 100 and 9.91 E+37 (NAN) Resolution: 0.01

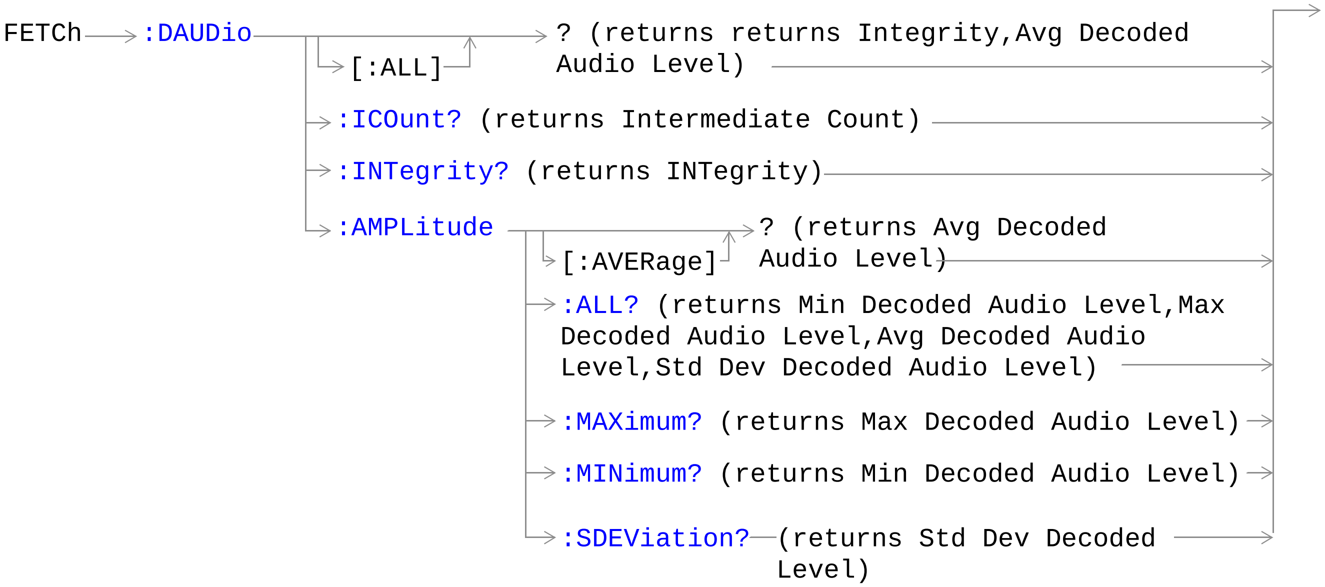
FETCh:BERRor:RATio:CRC?

Function	Queries the ratio of bad cyclic redundancy checks (CRCs) to the total number of CRCs received for a non-residual measurement type, looback type B test and returns it as a percentage. See "Bit Error Measurement Description" on page 50 The mobile station re-transmits the CRC it received from the test set on the uplink. A bad CRC occurs when the CRC transmitted by the test set does not match what is received back from the mobile station. The manual user must set the measurement's unit to %.
Query	Range: 0 to 100 and 9.91 E+37 (NAN) Resolution: 0.01

FETCh:BERRor:RATio:FE?

Function	Queries the ratio of erased frames to the total number of frames received received for a residual measurement type, looback type A test and returns them as a percentage. See "Bit Error Measurement Description" on page 50 The manual user must set the measurement's unit to %.
Query	Range: 0 to 100 and 9.91 E+37 (NAN) Resolution: 0.01

FETCh:DAUDio


FETCh
:DAUDio
[:ALL]
? (returns returns Integrity,Avg Decoded Audio Level)
:ICOunt? (returns Intermediate Count)
:INTegrity? (returns INTegrity)
:AMPLitude
[:AVERage]
? (returns Avg Decoded Audio Level)
:ALL? (returns Min Decoded Audio Level,Max Decoded Audio Level,Avg Decoded Audio Level,Std Dev Decoded Audio Level)
:MAXimum? (returns Max Decoded Audio Level)
:MINimum? (returns Min Decoded Audio Level)
:SDEViation? (returns Std Dev Decoded Level)

“Diagram Conventions” on page 187

FETCh:DAUDio[:ALL]?

Function	Queries integrity indicator and average decoded audio results. Values are returned in a comma-separated list.
Query	Integrity indicator: • Range = 0 to 15 • Resolution = 1 Decoded audio: • Range = 0 to 100% • Resolution = 0.01% FS

FETCh:DAUDio:ICOunt?

Function	Queries the intermediate count of decoded audio multi-measurements completed. This value is not displayed on the test set.
Query	Range = 1 to 999 Resolution = 1

FETCh:DAUDio:INTegrity?

Function	Queries the integrity indicator for the last decoded audio measurement completed. Zero indicates a normal measurement. See “Integrity Indicator” on page 98 for descriptions of non-zero integrity indicators.
Query	Range = 0 to 15 Resolution = 1

FETCh:DAUDio:AMPLitude[:AVERage]?

Function	Queries the average decoded audio result from an uplink speech level measurement in percent full scale. If the decoded audio multi-measurement count field is off, the level returned by this command is displayed in the Decoded Audio Level field. If the decoded audio multi-measurement count is on, the level returned by this query is displayed in the Average field
Query	Range = 0 to 100% Resolution = 0.01% FS

FETCh:DAUDio:AMPLitude:ALL?

Function	Queries the decoded audio multi-measurement minimum,maximum, average and standard deviation. Values are returned in a comma-separated list. The values returned are displayed in the Minimum, Maximum, Average, and Std. Dev. fields, which are displayed when the decoded audio multimeasurement count is not off.
Query	Minimum: • Range = 0 to 100% • Resolution = 0.01% FS Maximum: • Range = 0 to 100% • Resolution = 0.01% FS Average: • Range = 0 to 100% • Resolution = 0.01% FS Standard deviation: • Range = 0 to 71% • Resolution = 0.001% FS

FETCh:DAUDio:AMPLitude:MAXimum?

Function	Queries the decoded audio multi-measurement maximum decoded audio voltage. The value returned is displayed in the Decoded Audio Maximum field, which is displayed when the decoded audio multi-measurement count is not off.
Query	Range = 0 to 100% Resolution = 0.01% FS

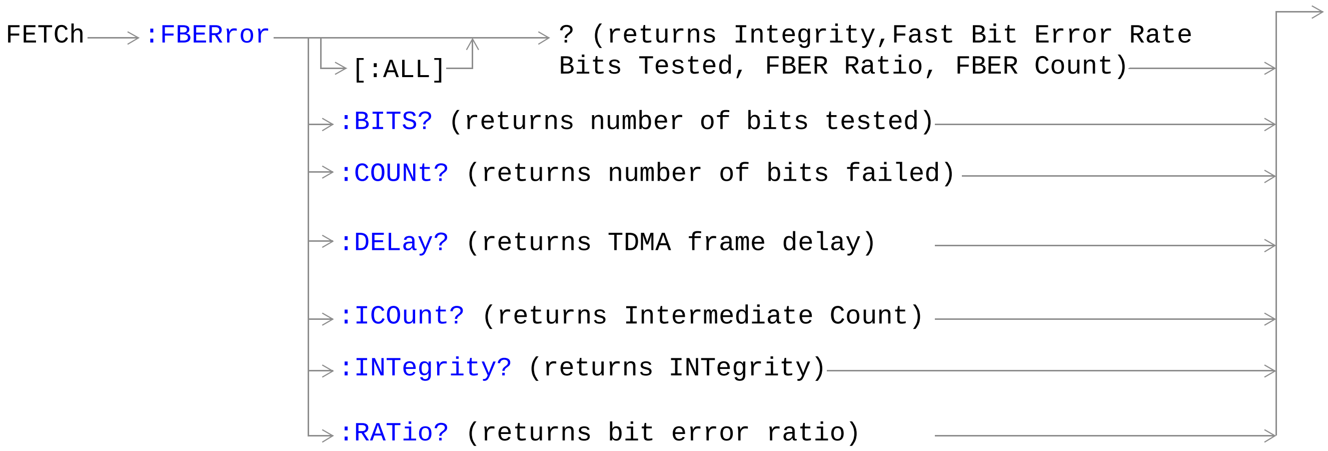
FETCh:DAUDio:AMPLitude:MINimum?

Function	Queries the decoded audio multi-measurement minimum decoded audio voltage The value returned is displayed in the Decoded Audio Minimum field, which is displayed when the decoded audio multi-measurement count is not off.
Query	Range = 0 to 100% Resolution = 0.01% FS

FETCh:DAUDio:AMPLitude:SDEViation?

Function	Queries the decoded audio multi-measurement standard deviation. The value returned is displayed in the Decoded Audio Std Dev. field, which is displayed when the Decoded Audio multi-measurement count is not off.
Query	Range = 0 to 71% Resolution = 0.001% FS

FETCh:FBERror


FETCh
:FBERror
[:ALL]
? (returns Integrity,Fast Bit Error Rate
Bits Tested, FBER Ratio, FBER Count)
:BITS? (returns number of bits tested)
:COUNt? (returns number of bits failed)
:DELay? (returns TDMA frame delay)
:ICOunt? (returns Intermediate Count)
:INTegrity? (returns INTegrity)
:RATio? (returns bit error ratio)

“Diagram Conventions” on page 187

FETCh:FBERror[:ALL]?

Function	Queries the fast bit error rate measurement. Query returns integrity indicator, bits tested, bit error ratio, and bit error count. Bit error ratio is displayed in the Fast Bit Error field. The other values returned by this query are not available on the front panel display.
Query	Integrity indicator: • Range = 0 to 15 • Resolution = 1 Bits tested: • Range = 1 to 999,455 and 9.91 E+37 (NAN) • Resolution = 1 Bit error ratio: • Range = 0 to 100 and 9.91 E+37 (NAN) • Resolution = 0.01 Fast bit error count: • Range = 1 to 999,455 and 9.91 E+37 (NAN) • Resolution = 1

FETCh:FBERror:BITS?

Function	Queries the total number of information bits tested during the last fast bit error rate measurement. See "SETup:FBERror:COUNt" on page 331
	Queries the total number of information bits tested during the last fast bit error rate measurement. See "SETup:FBERror:COUNt" on page 331 This value is not available on the front panel display.
Query	Range = 1 to 999,455 and 9.91 E+37 (NAN) Resolution = 1

FETCh:FBERror:COUNt?

Function	Queries the number of information bits that were deemed errors during the last fast bit error rate test. This value is not available on the front panel display.
Query	Range = 1 to 999,455 and 9.91 E+37 (NAN) Resolution = 1

FETCh:FBERror:DELay?

Function	Queries the delay (in TDMA frames) the test set used during the last fast bit error rate measurement to correlate uplink information bits with downlink information bits. This value is displayed in the TDMA Frame Delay field. This value can be determined automatically, or set by the user. See “SETup:FBERror:MANual:DELay” on page 332 and “SETup:FBERror:LDControl:AUTO” on page 331 for setting this value manually. Refer also to the “Fast Bit Error Measurement Description” on page 61 for a description of frame delay and how it is used in the fast bit error rate measurement.
Query	Range: 0 to 26 and 9.99 E+37 Resolution: 1

FETCh:FBERror:ICOunt?

Function	Queries the intermediate count (measurement progress report) of bits tested
Query	Range: 0 to 999,455 and 99.9 E+37

FETCh:FBERror:INTegrity?

Function	Returns the integrity indicator value for the last fast bit error rate measurement performed. Zero indicates a normal result. See “Integrity Indicator” on page 98 for descriptions of non-zero integrity indicators.
Query	Range: 0 to 15 Resolution: 1

FETCh:FBERror:RATio?

Function	Queries the ratio of bits deemed bad to total bits tested during the last fast bit error rate measurement performed.
Query	Range: 0 to 100 and 9.99 E+37 Resolution: 0.01

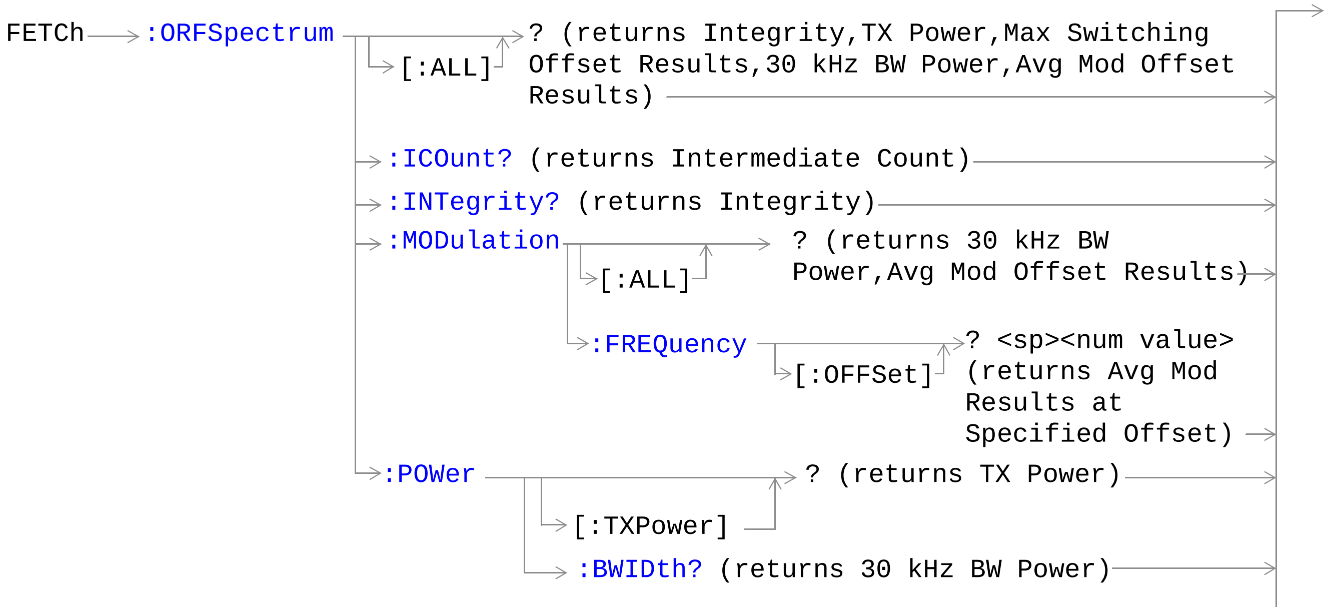
FETCh:ORFSpectrum

Syntax Diagrams and Command Descriptions

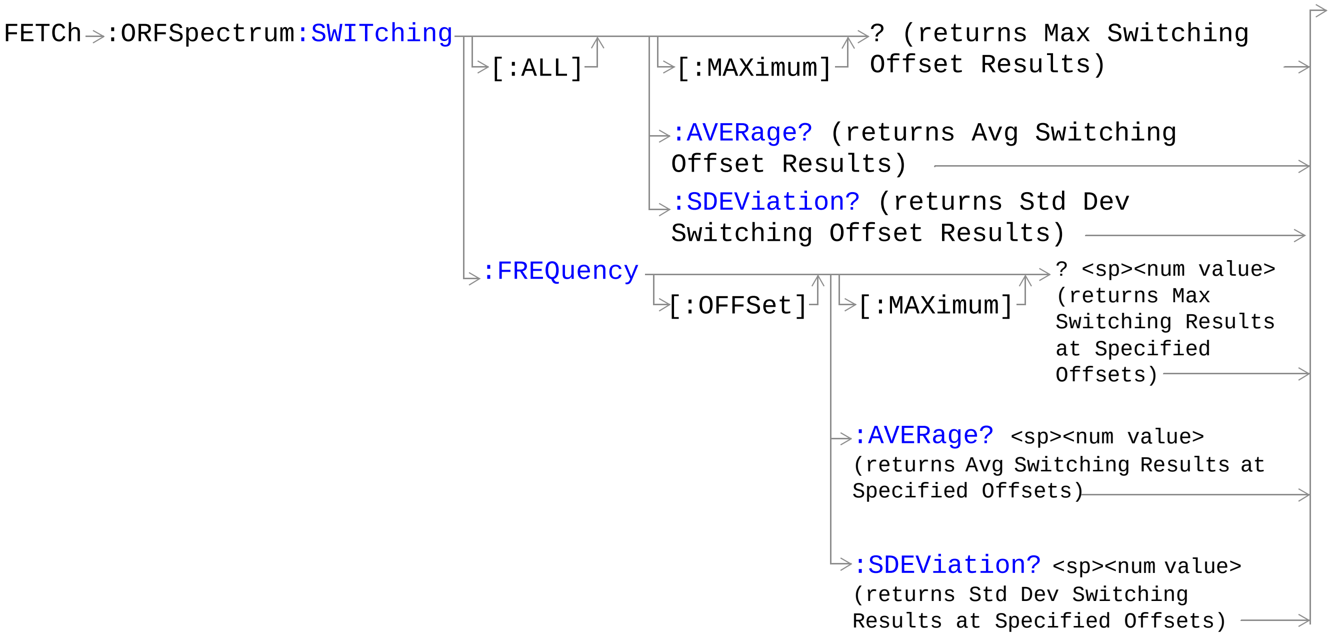
"FETCh:ORFSpectrum<:ICOunt | :INTegrity | :MODulation | :POWer>?" on page 268

"FETCh:ORFSpectrum:SWITching" on page 269

FETCh:ORFSpectrum<:ICOunt | :INTegrity | :MODulation | :POWer>?


FETCh
:ORFSpectrum
[:ALL]
? (returns Integrity,TX Power,Max Switching Offset Results,30 kHz BW Power,Avg Mod Offset Results)
:ICOunt? (returns Intermediate Count)
:INTegrity? (returns Integrity)
:MODulation
[:ALL]
? (returns 30 kHz BW Power,Avg Mod Offset Results)
:FREQuency
[:OFFSet]
? <sp><num value> (returns Avg Mod Results at Specified Offset)
:POWer
[:TXPower]
? (returns TX Power)
:BWIDth? (returns 30 kHz BW Power)

FETCh:ORFSpectrum:SWITching


FETCh
:ORFSpectrum:SWITching
[:ALL]
[:MAXimum]
? (returns Max Switching Offset Results)
:AVERage? (returns Avg Switching Offset Results)
:SDEViation? (returns Std Dev Switching Offset Results)
:FREQuency
[:OFFSet]
[:MAXimum]
? <sp><num value> (returns Max Switching Results at Specified Offsets)
:AVERage? <sp><num value> (returns Avg Switching Results at Specified Offsets)
:SDEViation? <sp><num value> (returns Std Dev Switching Results at Specified Offsets)

“Diagram Conventions” on page 187

FETCh:ORFSpectrum[:ALL]?

Function	Queries integrity indicator, TX carrier power, up to eight comma-separated output RF spectrum due to switching (max) results, 30 kHz bandwidth power, and up to 22 output RF spectrum due to modulation (average) results. The "SETup:ORFSpectrum:SWITching:FREQuency[:OFFSet]" command sets up the number of output RF spectrum due to switching offsets that are turned on and their frequency values. The "SETup:ORFSpectrum:SWITching:FREQuency:POINts?" queries the number of output RF spectrum due to switching points that are turned on, indicating the number of output RF spectrum due to switching (max) values to expect when you FETCh results. The "SETup:ORFSpectrum:MODulation:FREQuency[:OFFSet]" command sets up the number of output RF spectrum due to modulation offsets that are turned on and their frequency values. The "SETup:ORFSpectrum:MODulation:FREQuency:POINts?" command queries the number of output RF spectrum due to modulation points that are turned on, indicating the number of output RF spectrum due to modulation (average) values to expect when you FETCh results.
Query	Integrity indicator • Range: 0 to 15 • Resolution: 1 TX Carrier Power • Range: –100 dBm to +100 dBm and 9.91 E+37 • Resolution: 0.01 dB Output RF Spectrum Due to Switching (Max) • Range: –100 dBm to +100 dBm and 9.91 E+37 • Resolution: 0.01 dB 30 kHz Bandwidth Power • Range: –100 dBm to +100 dBm and 9.91 E+37 • Resolution: 0.01 dB Output RF Spectrum due to Modulation (Average) • Range: –200 dB to +100 dB and 9.91 E+37 • Resolution: 0.01 dB

FETCh:ORFSpectrum:ICOunt?

Function	Queries the intermediate count of ORFS multi-measurements completed. This number will climb to the number returned by " SETup:ORFSpectrum:ICOunt:MAXimum?" on page 336.
Query	Range: 0 to 29971 Resolution: 1

FETCh:ORFSpectrum:INTegrity?

Function	Queries the integrity indicator for the output RF spectrum analyzer measurement. Zero indicates a normal result. See "Integrity Indicator" on page 98 for descriptions of non-zero integrity indicators.
Query	Range: 0 to 15 Resolution: 1

FETCh:ORFSpectrum:MODulation[:ALL]?

Function	Queries TX Carrier Power, 30 kHz BW Power, and up to 22 comma-separated output RF spectrum due to modulation (average) results The "SETup:ORFSpectrum:MODulation:FREQuency[:OFFSet]" command sets up the number of output RF spectrum due to modulation offsets that are turned on and their frequency values. The "SETup:ORFSpectrum:MODulation:FREQuency:POINts?" command queries the number of output RF spectrum due to modulation points that are turned on, indicating the number of output RF spectrum due to modulation (average) values to expect when you FETCh output RF spectrum due to modulation results.
Query	TX Carrier Power • Range: –100 dBm to +100 dBm and 9.91 E+37 • Resolution: 0.01 dB 30 kHz Bandwidth Power • Range: –100 dBm to +100 dBm and 9.91 E+37 • Resolution: 0.01 dB Output RF Spectrum due to Modulation (Average) • Range: –200 dB to +100 dB and 9.91 E+37 • Resolution: 0.01 dB

FETCh:ORFSpectrum:MODulation:FREQuency[:OFFSet]?

Function	Queries the ORFS due to modulation measurement, allowing frequency offset values to be appended to the command. Returns ORFS due to modulation (average) measurements at the frequencies listed, in the order they are listed. Frequencies must have a one-to-one correspondence to ORFS due to modulation frequency offsets that are currently turned on. Frequencies must be separated by commas. (See "SETup:ORFSpectrum:MODulation:FREQuency[:OFFSet]" for the command that turns on frequency offsets.) Each frequency value is (optionally) followed by: HZ | KHZ | MHZ | GHZ . The default units are HZ (hertz).
Query	Range: –200 dB to +100 dB and 9.91 E+37 Resolution: 0.01 dB
Program Example	OUTPUT 714;"FETCH:ORFSPECTRUM:MODULATION:FREQUENCY:OFFSET? 200 KHZ, 400 KHZ" !returns the ORFS due to modulation (average) measurement results at the 200 kHz and 400 kHz offsets only, assuming these offsets are turned on.

FETCh:ORFSpectrum:POWer?

Function	Returns the TX carrier power measurement result from the last ORFS measurement. This measurement is made using the method described in the "Transmit Power Measurement Description" on page 84.
Query	Range: –100 dBm to +100 dBm and NAN. Resolution: 0.01 dB
Program Example	OUTPUT 714;FETCH:ORFSPECTRUM:POWER:TXPOWER? !returns TX carrier power

FETCh:ORFSpectrum:POWer:BWIDth?

Function	Queries the ORFS 30 kHz bandwidth power measurement. See "Output RF Spectrum Measurement Description" on page 66
Query	Range: –100 dBm to +100 dBm and NAN. Resolution: 0.01 dB

FETCh:ORFSpectrum:SWITChing[:ALL][:MAXimum]?

Function	Queries output RF spectrum due to switching (maximum) measurement results at all frequency offsets currently turned on (there can be up to eight). The “SETup:ORFSpectrum:SWITching:FREQuency[:OFFSet]” command sets up the number of output RF spectrum due to switching offsets that are turned on and their frequency values. The “SETup:ORFSpectrum:SWITching:FREQuency:POINts?” queries the number of output RF spectrum due to switching points that are turned on, indicating the number of output RF spectrum due to switching (max) values to expect when you FETCh results.
Query	Range: –100 dBm to +100 dBm and 9.91 E+37 Resolution: 0.01 dB
Program Example	OUTPUT 714;“FETCH:ORFSPECTRUM:SWITCHING:ALL:MAXIMUM?”. !returns the ORFS due to switching (maximum) measurement results at all frequency offsets currently turned on.

FETCh:ORFSpectrum:SWITChing[:ALL]:AVERage?

Function	Queries output RF spectrum due to switching (average) measurement results at all frequency offsets currently turned on (there can be up to eight). The “SETup:ORFSpectrum:SWITching:FREQuency[:OFFSet]” command sets up the number of output RF spectrum due to switching offsets that are turned on and their frequency values. The “SETup:ORFSpectrum:SWITching:FREQuency:POINts?” queries the number of output RF spectrum due to switching points that are turned on, indicating the number of output RF spectrum due to switching values to expect when you FETCh results.
Query	Range: –100 dBm to +100 dBm and 9.91 E+37 Resolution: 0.01 dB
Program Example	OUTPUT 714;“FETCH:ORFSPECTRUM:SWITCHING:ALL:AVERAGE?”. !returns the ORFS due to switching (average) measurement results at all frequency offsets currently turned on.

FETCh:ORFSpectrum:SWITChing:FREQuency[:OFFSet][:MAXimum]?

Function	Queries the ORFS due to switching measurement, allowing frequency offset values to be appended to the command. Returns ORFS due to switching (maximum) measurements at the frequencies listed, in the order they are listed. Frequencies must have a one-to-one correspondence to ORFS due to switching frequency offsets that are currently turned on. Frequencies must be separated by commas. (See "SETup:ORFSpectrum:SWITching:FREQuency[:OFFSet]" for the command that turns on frequency offsets.) Each value is (optionally) followed by: HZ | KHZ | MHZ | GHZ . The default units are HZ (hertz).
Query	Range: –100 dB to +100 dB and 9.91 E+37 Resolution: 0.01 dB
Program Example	OUTPUT 714;"FETCH:ORFSPECTRUM:SWITCHING:FREQUENCY:OFFSET:MAXIMUM? 200 KHZ, 400 KHZ" !returns the ORFS due to switching (maximum) measurement results at the 200 kHz and 400 kHz offsets only, assuming these offsets are turned on.

FETCh:ORFSpectrum:SWITChing:FREQuency[:OFFSet]:AVERage?

Function	Queries the ORFS due to switching measurement, allowing frequency offset values to be appended to the command. Returns ORFS due to switching (average) measurements at the frequencies listed, in the order they are listed. Frequencies must have a one-to-one correspondence to ORFS due to switching frequency offsets that are currently turned on. Frequencies must be separated by commas. (See "SETup:ORFSpectrum:SWITching:FREQuency[:OFFSet]" for the command that turns on frequency offsets.) Each value is (optionally) followed by: HZ | KHZ | MHZ | GHZ . The default units are HZ (hertz).
Query	Range: –100 dB to +100 dB and 9.91 E+37 Resolution: 0.01 dB
Program Example	OUTPUT 714;"FETCH:ORFSPECTRUM:SWITCHING:FREQUENCY:OFFSET:AVERAGE? 200 KHZ, 400 KHZ" !returns the ORFS due to switching (average) measurement results at the 200 kHz and 400 kHz offsets only, assuming these offsets are turned on.

FETCh:ORFSpectrum:SWITChing:FREQuency[:OFFSet]:SDEViation?

Function	Queries the ORFS due to switching measurement, allowing frequency offset values to be appended to the command. Returns ORFS due to switching (standard deviation) measurements at the frequencies listed, in the order they are listed. Frequencies must have a one-to-one correspondence to ORFS due to switching frequency offsets that are currently turned on. Frequencies must be separated by commas. (See "SETup:ORFSpectrum:SWITching:FREQuency[:OFFSet]" for the command that turns on frequency offsets.) Each value is (optionally) followed by: HZ | KHZ | MHZ | GHZ . The default units are HZ (hertz).
Query	Range: 0 dB to +150 dB and 9.91 E+37 Resolution: 0.001 dB
Program Example	OUTPUT 714;"FETCH:ORFSPECTRUM:SWITCHING:FREQUENCY:OFFSET:STDEVIATION? 200 KHZ, 400 KHZ" !returns the ORFS due to switching (standard deviation) measurement results at the 200 kHz and 400 kHz offsets only, assuming these offsets are turned on.

FETCh:ORFSpectrum:SWITChing[:ALL]:SDEViation?

Function	Queries output RF spectrum due to switching (standard deviation) measurement results at all frequency offsets currently turned on (there can be up to eight). The "SETup:ORFSpectrum:SWITching:FREQuency[:OFFSet]" command sets up the number of output RF spectrum due to switching offsets that are turned on and their frequency values. The "SETup:ORFSpectrum:SWITching:FREQuency:POINts?" queries the number of output RF spectrum due to switching points that are turned on, indicating the number of output RF spectrum due to switching values to expect when you FETCh results.
Query	Range: –100 dBm to +100 dBm and 9.91 E+37 Resolution: 0.01 dB
Program Example	OUTPUT 714;"FETCH:ORFSPECTRUM:SWITCHING:ALL:SDEVIATION?". !returns the ORFS due to switching (standard deviation) measurement results at all frequency offsets currently turned on.

FETCh:PFERror

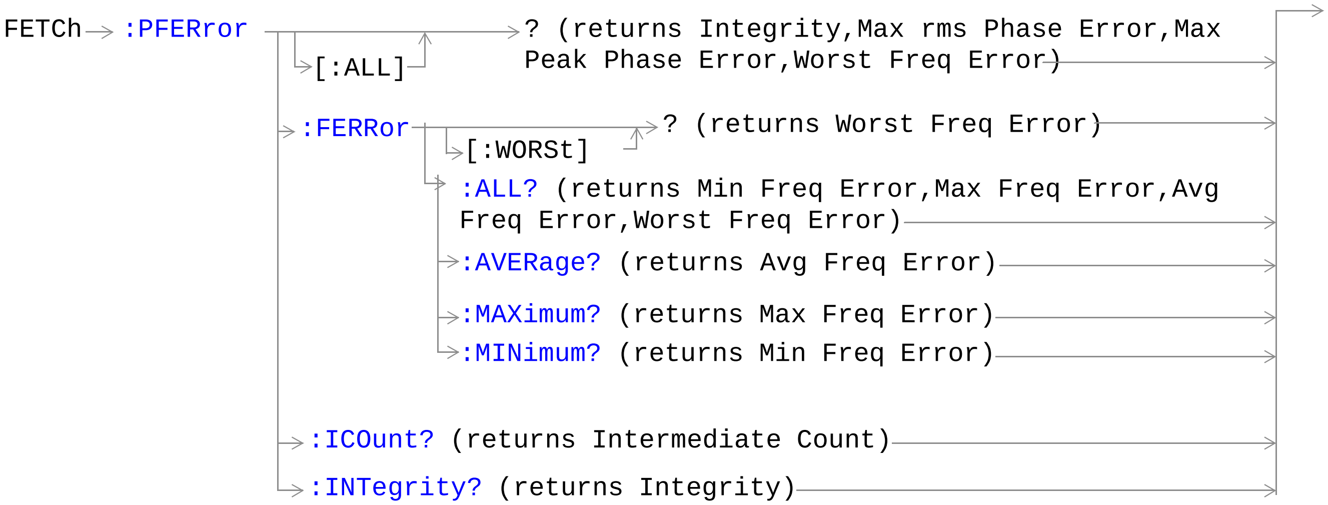
Syntax Diagrams and Command Descriptions

"FETCh:PFERror<:FERRor | :ICOunt | :INTegrity>?" on page 276

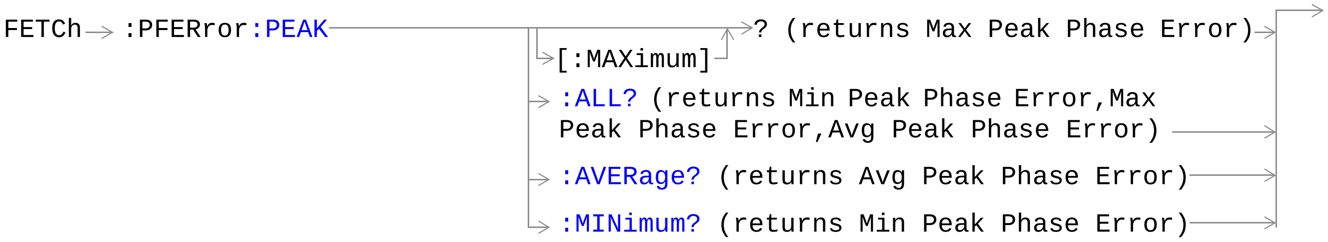
"FETCh:PFERror:PEAK" on page 276

"FETCh:PFERror:RMS" on page 276

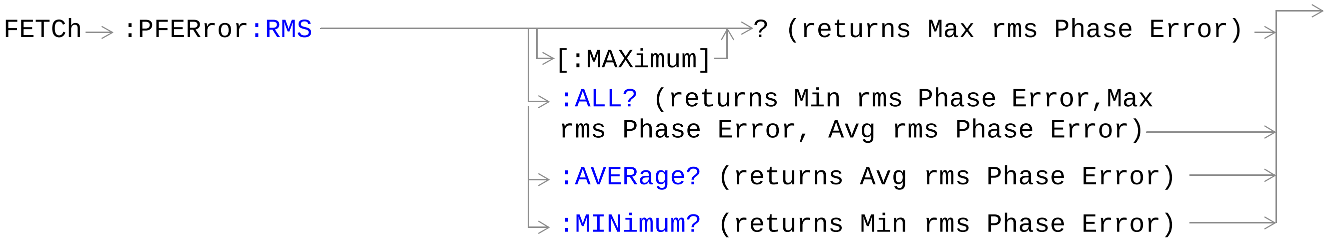
FETCh:PFERror<:FERRor | :ICOunt | :INTegrity>?


FETCh
:PFERror
[:ALL]
? (returns Integrity,Max rms Phase Error,Max Peak Phase Error,Worst Freq Error)
:FERRor
[:WORSt]
? (returns Worst Freq Error)
:ALL? (returns Min Freq Error,Max Freq Error,Avg Freq Error,Worst Freq Error)
:AVERage? (returns Avg Freq Error)
:MAXimum? (returns Max Freq Error)
:MINimum? (returns Min Freq Error)
:ICOunt? (returns Intermediate Count)
:INTegrity? (returns Integrity)

FETCh:PFERror:PEAK


FETCh
:PFERror:PEAK
[:MAXimum]
? (returns Max Peak Phase Error)
:ALL? (returns Min Peak Phase Error,Max Peak Phase Error,Avg Peak Phase Error)
:AVERage? (returns Avg Peak Phase Error)
:MINimum? (returns Min Peak Phase Error)

FETCh:PFERror:RMS


FETCh
:PFERror:RMS
[:MAXimum]
? (returns Max rms Phase Error)
:ALL? (returns Min rms Phase Error,Max rms Phase Error, Avg rms Phase Error)
:AVERage? (returns Avg rms Phase Error)
:MINimum? (returns Min rms Phase Error)

"Diagram Conventions" on page 187

FETCh:PFERor[:ALL]?

Function	Queries integrity indicator, maximum rms phase error, maximum peak phase error, worst frequency error, and burst timing error measurement results.
Query	Integrity indicator • Range: 0 to 15 • Resolution: 1 Maximum rms Phase Error • Range: 0 degrees to 180 degrees and 9.91 E+37 (NAN) • Resolution: 0.01 degrees Maximum Peak Phase Error • Range: 0 degrees to 180 degrees and 9.91 E+37 (NAN) • Resolution: 0.01 degrees Worst Frequency Error • Range: –750 kHz to +750 kHz and 9.91 E+37 (NAN) • Resolution: 0.1 kHz Burst Timing Error • Range: –8 to +30 T (where T = 1 bit period) and 9.91 E+37 (NAN) • Resolution: 0.25 T (where T = 1 bit period)
Program Example	OUTPUT 714;"FETCH:PFERROR:ALL?" !returns integrity, maximum rms phase error,maximum peak phase error and worst frequency error

FETCh:PFERror:FERRor[:WORSt]?

Function	Queries the frequency error from the individual multi-measurements that is furthest from 0 Hz. If the most positive and the most negative frequency errors are the same, the positive value will be returned.
Query	Range: –750 kHz to +750 kHz and 9.91 E+37 (NAN) Resolution: 0.1 kHz

FETCh:PFERror:FERRor:ALL?

Function	Queries minimum, maximum, average, and worst frequency error, in Hz. The minimum frequency error is the value closest to negative infinity from the last multi-measurement cycle. The maximum frequency error is the value closest to positive infinity from the last multi-measurement cycle.

Query	Minimum frequency error • Range: –750 kHz to +750 kHz and 9.91 E+37 (NAN) • Resolution: 0.1 kHz Maximum frequency error • Range: –750 kHz to +750 kHz and 9.91 E+37 (NAN) • Resolution: 0.1 kHz Average frequency error • Range: –750 kHz to +750 kHz and 9.91 E+37 (NAN) • Resolution: 0.1 kHz Worst frequency error • Range: –750 kHz to +750 kHz and 9.91 E+37 (NAN) • Resolution: 0.1 kHz
Program Example	OUTPUT 714;"FETCH:PFERROR:FERROR:ALL?" !returns minimum, maximum, average and worst frequency error results.

FETCh:PFERror:FERRor AVERage?

Function	Queries the single or average (from a multi-measurement) frequency error measurement result, in Hz.
Query	Range: –750 kHz to +750 kHz and 9.91 E+37 (NAN) Resolution: 0.1 kHz

FETCh:PFERror:FERRor: MAXimum?

Function	Queries the maximum (from a multi-measurement) frequency error measurement result, in Hz.
Query	Range: –750 kHz to +750 kHz and 9.91 E+37 (NAN) Resolution: 0.1 kHz

FETCh:PFERror:FERRor:MINimum?

Function	Queries the minimum (from a multi-measurement) frequency error measurement result, in Hz.
Query	Range: –750 kHz to +750 kHz and 9.91 E+37 (NAN) Resolution: 0.1 kHz

FETCh:PFERror:ICOunt?

Function	Queries the intermediate count of phase and frequency multi-measurements completed. This number will increase to the value returned by “SETup:PFERror:COUNt:NUMBer” on page 345.
Query	Range: 0 to 999 Resolution: 1

FETCh:PFERror:INTegrity?

Function	Queries the integrity indicator for the phase and frequency error measurement. Zero indicates a normal result. See “Integrity Indicator” on page 98 for descriptions of non-zero integrity indicators.
Query	Range: 0 to 15 Resolution: 1

FETCh:PFERror:PEAK[:MAXimum]?

Function	Queries the maximum (from a multi-measurement) peak phase error result, in degrees.
Query	Range: 0 degrees to 180 degrees and 9.91 E+37 (NAN) Resolution: 0.01 degrees

FETCh:PFERror:PEAK:ALL?

Function	Queries the minimum, maximum, and average peak phase error measurement result, in degrees.
Query	Minimum Peak Phase Error • Range: 0 degrees to 180 degrees and 9.91 E+37 (NAN) • Resolution: 0.01 degrees Maximum Peak Phase Error • Range: 0 degrees to 180 degrees and 9.91 E+37 (NAN) • Resolution: 0.01 degrees Average Peak Phase Error • Range: 0 degrees to 180 degrees and 9.91 E+37 (NAN) • Resolution: 0.01 degrees
Program Example	OUTPUT 714;"FETCH:PFERROR:PEAK:ALL?" !returns minimum, maximum, and average peak phase error results.

FETCh:PFERror:PEAK:AVERage?

Function	Queries the single or average (from a multi-measurement) peak phase error measurement result, in degrees.
Query	Range: 0 degrees to 180 degrees and 9.91 E+37 (NAN) Resolution: 0.01 degrees

FETCh:PFERror:PEAK:MINimun?

Function	Queries the minimum (from a multi-measurement) peak phase error measurement result, in degrees.
Query	Range: 0 degrees to 180 degrees and 9.91 E+37 (NAN) Resolution: 0.01 degrees

FETCh:PFERror:rms[:MAXimum]?

Function	Queries the Maximum (from a multi-measurement) rms phase error measurement result, in degrees.
Query	Range: 0 degrees to 180 degrees and 9.91 E+37 (NAN) Resolution: 0.01 degrees
Program Example	OUTPUT 714;"FETCH:PFERROR:rms:MAXIMUM?" !returns the maximum rms phase error

FETCh:PFERror:rms:ALL?

Function	Queries the minimum, maximum, and average rms phase error measurement result, in degrees.
Query	Minimum rms Phase Error • Range: 0 degrees to 180 degrees and 9.91 E+37 (NAN) • Resolution: 0.01 degrees Maximum rms Phase Error • Range: 0 degrees to 180 degrees and 9.91 E+37 (NAN) • Resolution: 0.01 degrees Average rms Phase Error • Range: 0 degrees to 180 degrees and 9.91 E+37 (NAN) • Resolution: 0.01 degrees
Program Example	OUTPUT 714;"FETCH:PFERROR:rms:ALL?" !returns minimum, maximum, and average rms phase error.

FETCh:PFERror:rms:AVERage?

Function	Queries the single or average (from a multi-measurement) rms phase error measurement result, in degrees.
Query	Range: 0 degrees to 180 degrees and 9.91 E+37 (NAN) Resolution: 0.01 degrees

FETCh:PFERror:rms:MINimum?

Function	Queries the minimum (from a multi-measurement) rms phase error measurement result, in degrees.
Query	Range: 0 degrees to 180 degrees and 9.91 E+37 (NAN) Resolution: 0.01 degrees

FETCh:PVTime

Syntax Diagrams and Command Descriptions

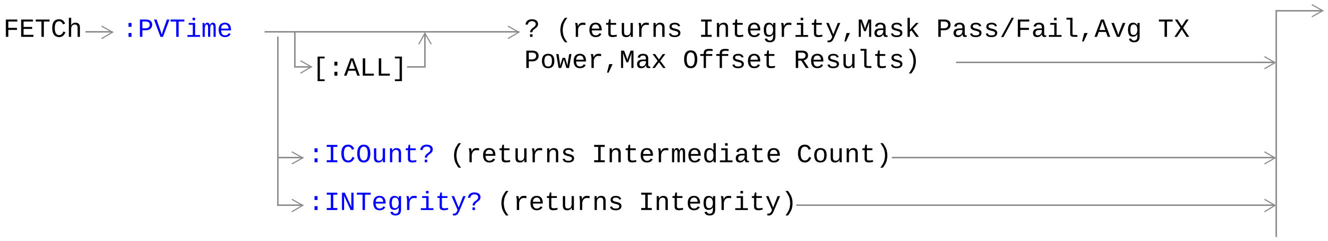
"FETCh:PVTime<:ICOunt | :INTegrity>?" on page 282

"FETCh:PVTime:TXPower" on page 282

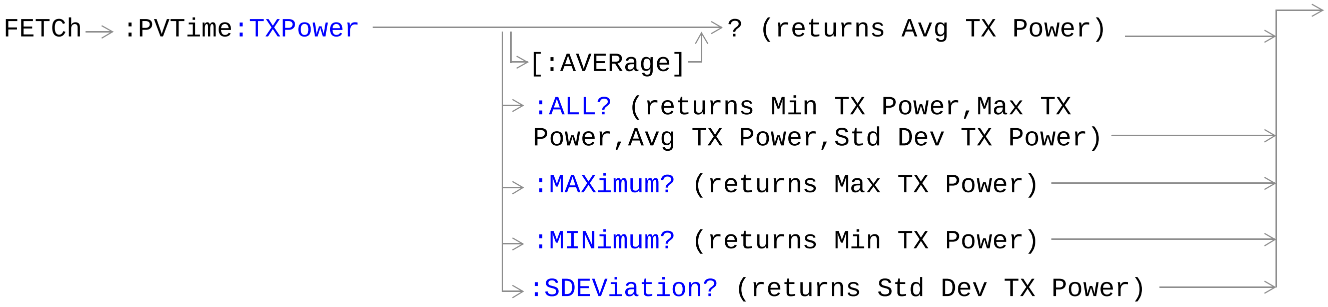
"FETCh:PVTime:MASK" on page 283

"FETCh:PVTime:POWer" on page 283

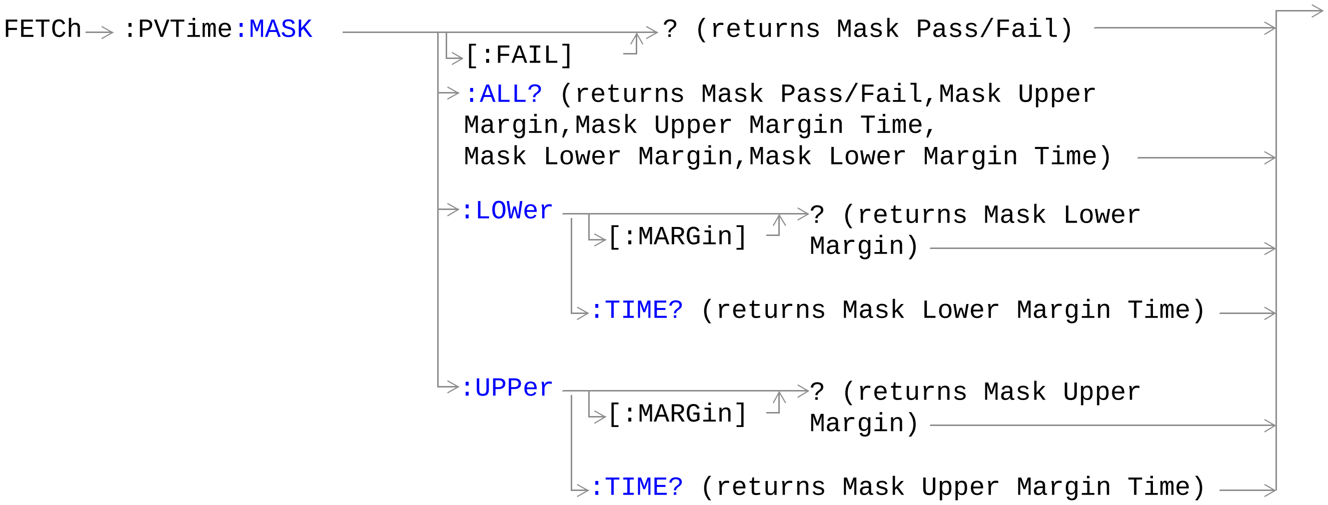
FETCh:PVTime<:ICOunt | :INTegrity>?


FETCh
:PVTime
[:ALL]
? (returns Integrity,Mask Pass/Fail,Avg TX Power,Max Offset Results)
:ICOunt? (returns Intermediate Count)
:INTegrity? (returns Integrity)

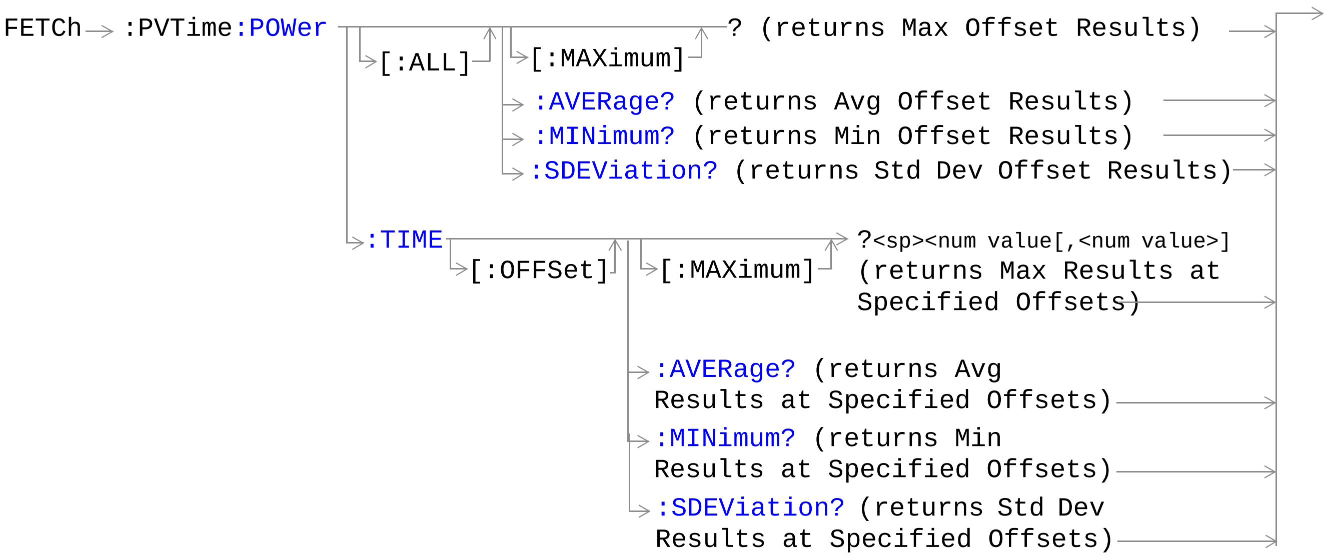
FETCh:PVTime:TXPower


FETCh
:PVTime:TXPower
[:AVERage]
? (returns Avg TX Power)
:ALL? (returns Min TX Power,Max TX Power,Avg TX Power,Std Dev TX Power)
:MAXimum? (returns Max TX Power)
:MINimum? (returns Min TX Power)
:SDEViation? (returns Std Dev TX Power)

FETCh:PVTime:MASK


FETCh
:PVTime:MASK
? (returns Mask Pass/Fail)
[:FAIL]
:ALL? (returns Mask Pass/Fail,Mask Upper Margin,Mask Upper Margin Time, Mask Lower Margin,Mask Lower Margin Time)
:LOWer
[:MARGin]
? (returns Mask Lower Margin)
:TIME? (returns Mask Lower Margin Time)
:UPPer
[:MARGin]
? (returns Mask Upper Margin)
:TIME? (returns Mask Upper Margin Time)

FETCh:PVTime:POWer


FETCh
:PVTime:POWer
[:ALL]
[:MAXimum]
? (returns Max Offset Results)
:AVERage? (returns Avg Offset Results)
:MINimum? (returns Min Offset Results)
:SDEViation? (returns Std Dev Offset Results)
:TIME
[:OFFSet]
[:MAXimum]
?<sp><num value[,<num value>]
(returns Max Results at Specified Offsets)
:AVERage? (returns Avg Results at Specified Offsets)
:MINimum? (returns Min Results at Specified Offsets)
:SDEViation? (returns Std Dev Results at Specified Offsets)

“Diagram Conventions” on page 187

FETCh:PVTime[:ALL]?

Function	Returns Integrity Indicator, Mask pass/fail indicator, Tx Carrier Power (Average), and Power vs. Time Power (Maximum) at up to 12 time offsets.
Data Type	Integrity Indicator = Integer Mask pass/fail = Real Tx Carrier Power = Real Power vs. Time Power (Maximum) = Real (can be up to 12 values) in dBc
Comments	Maximum based on Multimeasurement State = ON. The number of time offsets returned is set up using the SETup:TIME[:OFFSet] command.

FETCh:PVTime:TXPower:ALL?

Function	Returns TX Carrier Power (Average), TX Carrier Power (Minimum), TX Carrier Power (Maximum), TX Carrier Power (Standard Deviation) levels.
Range	Average, Minimum, Maximum = -100 dBm to +100 dBm and NAN. Standard Deviation = 0 dB to +100 dB and NAN.
Data Type	Real

FETCh:PVTime:TXPower:MINimum?

Function	Returns TX Carrier Power (Minimum) level.
Range	-100 dBm to +100 dBm and NAN
Data Type	Real

FETCh:PVTime:TXPower:MAXimum?

Function	Returns TX Carrier Power (Maximum) level.
Range	-100 dBm to +100 dBm and NAN
Data Type	Real

FETCh:PVTime:TXPower?

Function	Returns the Power vs. Time TX Carrier Power (Average) level.
Range	-100 dBm to +100 dBm and NAN
Data Type	Real
Comments	This measurement is identical to the TX Carrier Power measurement, except that the measurement can be synchronized to the burst midamble.

FETCh:PVTime:TXPower:SDEViation?

Function	Returns TX Carrier Power (Standard Deviation) level.
Range	0 dBm to +100 dB and NAN
Data Type	Real

FETCh:PVTime:MASK:ALL?

Function	Returns Power versus Time Measurement Mask pass/fail indicator and the following worst case Margins: Upper Limit Margin Time, Upper Limit Margin Result, Lower Limit Margin Time, Lower Limit Margin Result.
Range	Mask: 0 = Pass 1 = Fail Upper Limit Margin Time = -50 µs to 593 µs and NAN. Upper Limit Margin Result = -100 dB to 1 dB below mask upper limit and NAN. Lower Limit Margin Time = -50 µs to 593 µs and NAN. Lower Limit Margin Result = -100 dB to 1 dB above mask lower ilimit and NAN.
Data Type	Real
Comments	Margin Result is the difference between the measured power and the power level boundary specified by the Power vs. Time mask Margin Time is the time (relative to burst bit 0) that the worst case measurement (least difference between the measured power and the power level boundary specified by the Power vs. Time mask) occurred.

FETCh:PVTime:MASK?

Function	Returns Power versus Time Measurement Mask pass/fail indicator.
Range	0|1 and NAN 0 = Pass 1 = Fail
Data Type	Real

FETCh:PVTime:MASK:UPPer?

Function	Returns Power versus Time Measurement Upper Limit Margin Result.
Range	-100 dB to 1 dB below mask upper limit and NAN.
Data Type	Real

FETCh:PVTime:MASK:UPPer:TIME?

Function	Returns Power versus Time Measurement Upper Limit Margin Time.
Range	-50 µs to 593 µs and NAN.
Data Type	Real
Comments	Margin Time is the time (relative to burst bit 0) that the worst case measurement (least difference between the measured power and the power level boundary specified by the Power vs. Time mask) occurred.

FETCh:PVTime:MASK:LOWer?

Function	Returns Power versus Time Measurement Lower Limit Margin Result.
Range	-100 dB to 1 dB above mask upper limit and NAN.
Data Type	Real

FETCh:PVTime:MASK:LOWer:TIME?

Function	Returns Power versus Time Measurement Lower Limit Margin Time.
Range	-50 µs to 593 µs and NAN.
Data Type	Real

FETCh:PVTime:POWer[:ALL]:MINimum?

Function	Returns up to 12 power level (Minimum) measurements at each time offset, relative to the Power vs. Time TX Carrier Power level.
Range	Up to 12 comma-separated Power vs. Time Power (Minimum) measurements ranging from -100 dBm to +100 dBm and NAN
Data Type	Real
Comments	The "SETup:PVTime:TIME[:OFFSet]" command sets up the number of offsets that are turned on and their time values. The "SETup:PVTime:TIME:POINts?" queries the number of offset points that are turned on, indicating the number of values to expect when you send this command.

FETCh:PVTime:POWer[:ALL][:MAXimum]?

Function	Returns up to 12 power level (Maximum) measurements at each time offset, relative to the Power vs. Time TX Carrier Power level.
Range	Up to 12 comma-separated Power vs. Time Power (Maximum) measurements ranging from -100 dBm to +100 dBm and NAN
Data Type	Real
Comments	The “SETup:PVTime:TIME[:OFFSet]” command sets up the number of offsets that are turned on and their time values. The “SETup:PVTime:TIME:POINts?” queries the number of offset points that are turned on, indicating the number of values to expect when you send this command.

FETCh:PVTime:POWer[:ALL]:AVERage?

Function	Returns up to 12 power level (average) measurements at each time offset, relative to the Power vs. Time TX Carrier Power level.
Range	Up to 12 comma-separated Power vs. Time Power (average) measurements ranging from -100 dBm to +100 dBm and NAN
Data Type	Real
Comments	The “SETup:PVTime:TIME[:OFFSet]” command sets up the number of offsets that are turned on and their time values. The “SETup:PVTime:TIME:POINts?” queries the number of offset points that are turned on, indicating the number of values to expect when you send this command.

FETCh:PVTime:POWer[:ALL]:SDEViation?

Function	Returns up to 12 power level (standard deviation) measurements at each time offset, relative to the Power vs. Time TX Carrier Power level.
Range	Up to 12 comma-separated Power vs. Time Power (standard deviation) measurements ranging from -100 dBm to +100 dBm and NAN
Data Type	Real
Comments	The “SETup:PVTime:TIME[:OFFSet]” command sets up the number of offsets that are turned on and their time values. The “SETup:PVTime:TIME:POINts?” queries the number of offset points that are turned on, indicating the number of values to expect when you send this command.

FETCh:PVTime:POWer:TIME[OFFSet]:MINimum?

Function	Allows time values to be appended to the Power vs. Time FETCh query. Returns a subset of the Power vs. Time (Minimum) measurements that are currently on. Measurement values are returned in the same order as time offsets listed in this command.
Range	Comma-separated time values with a one-to-one correspondence to time offsets that are currently turned on. (See “SETup:PVTime:TIME[:OFFSet]” for setting up time offsets.) Each value is (optionally) followed by: S | MS | US | NS . The default value is S (seconds).
Data Type	Real
Program Example	OUTPUT 714;”FETCH:PVTIME:POWER:TIME:OFFSET:MINIMUM? 0 US, 570.8 US” would return the power vs. time (minimum) measurements at the 0.0 µs and 570.8 µs offsets.
Comments	The time values do not have to be listed in any particular order.

FETCh:PVTime:POWer:TIME[:OFFSet][:MAXimum]?

Function	Allows time values to be appended to the Power vs. Time FETCh query. Returns a subset of the Power vs. Time (Maximum) measurements that are currently on. Measurement values are returned in the same order as time offsets listed in this command.
Range	Comma-separated time values with a one-to-one correspondence to time offsets that are currently turned on. (See “SETup:PVTime:TIME[:OFFSet]” for setting up time offsets.) Each value is (optionally) followed by: S | MS | US | NS . The default value is S (seconds).
Data Type	Real
Program Example	OUTPUT 714;”FETCH:PVTIME:POWER:TIME:OFFSET:MAXIMUM? 0 US, 570.8 US” would return the maximum of power vs. time measurements at the 0.0 µs and 570.8 µs offsets.
Comments	The time values do not have to be listed in any particular order.

FETCh:PVTime:POWer:TIME[:OFFSet]:AVERage?

Function	Allows time values to be appended to the Power vs. Time FETCh query. Returns a subset of the Power vs. Time (Average) measurements that are currently on. Measurement values are returned in the same order as time offsets listed in this command.
Range	Comma-separated time values with a one-to-one correspondence to time offsets that are currently turned on. (See “SETup:PVTime:TIME[:OFFSet]” for setting up time offsets.) Each value is (optionally) followed by: S | MS | US | NS . The default value is S (seconds).
Data Type	Real
Program Example	OUTPUT 714;”FETCH:PVTIME:POWER:TIME:OFFSET:AVERAGE? 0 US, 570.8 US” would return the average of power vs. time measurements at the 0.0 µs and 570.8 µs offsets.
Comments	The time values do not have to be listed in any particular order.

FETCh:PVTime:POWer:TIME[:OFFSet]:SDEViation?

Function	Allows time values to be appended to the Power vs. Time FETCh query. Returns a subset of the Power vs. Time (standard deviation) measurements that are currently on. Measurement values are returned in the same order as time offsets listed in this command.
Range	Comma-separated time values with a one-to-one correspondence to time offsets that are currently turned on. (See "SETup:PVTime:TIME[:OFFSet]" for setting up time offsets.) Each value is (optionally) followed by: S | MS | US | NS . The default value is S (seconds).
Data Type	Real
Program Example	OUTPUT 714;"FETCH:PVTIME:POWER:TIME:OFFSET:SDEVIATION? 0 US, 570.8 US" would return the standard deviation of power vs. time measurements at the 0.0 µs and 570.8 µs offsets.
Comments	The time values do not have to be listed in any particular order.

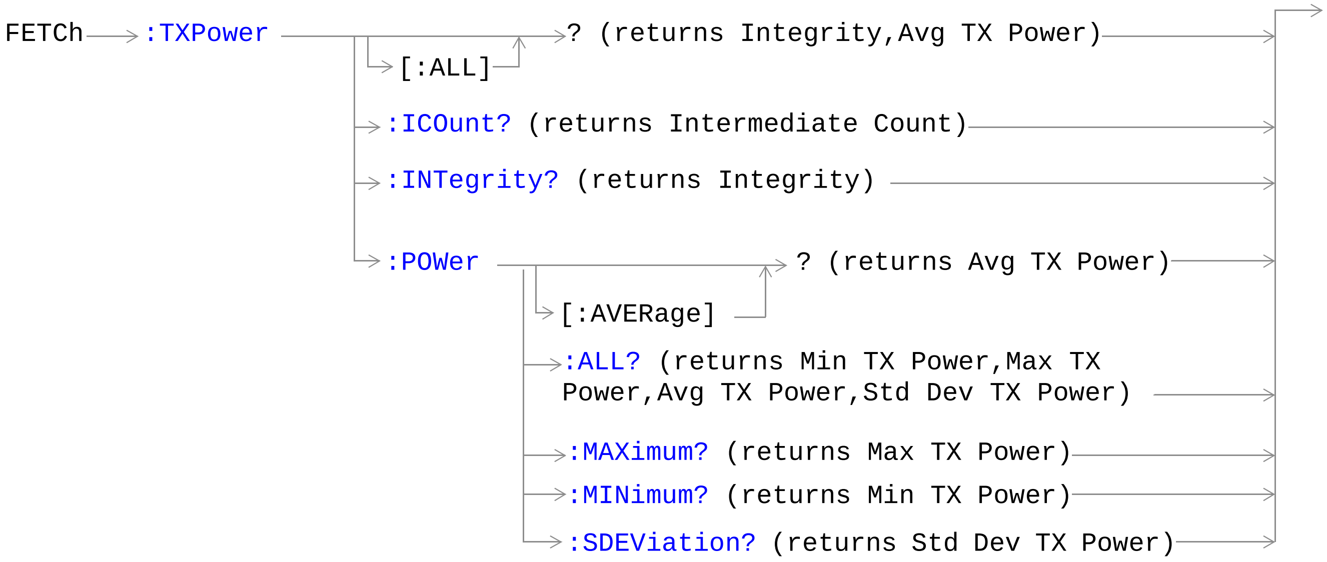
FETCh:PVTime:ICOunt?

Function	Returns a single value in the Progress Report indicating intermediate count of Power vs. Time measurements.
Range	0 to 999
Data Type	Integer

FETCh:PVTime:INTegrity?

Function	Returns Integrity Indicator for the Power vs. Time measurement.
Range	0 to 15
Data Type	Integer

FETCh:TXPower


FETCh
:TXPower
? (returns Integrity,Avg TX Power)
[:ALL]
:ICOunt? (returns Intermediate Count)
:INTegrity? (returns Integrity)
:POWer
? (returns Avg TX Power)
[:AVERage]
:ALL? (returns Min TX Power,Max TX Power,Avg TX Power,Std Dev TX Power)
:MAXimum? (returns Max TX Power)
:MINimum? (returns Min TX Power)
:SDEViation? (returns Std Dev TX Power)

“Diagram Conventions” on page 187

FETCh:TXPower?

Function	Returns Integrity, Average TX Power.
Data Type	Integrity = Integer, Average = Real

FETCh:TXPower:ICOunt?

Function	Returns (in the Progress Report) the Intermediate Count of measurements completed
Data Type	Integer

FETCh:TXPower:INTegrity?

Function	Returns a number 0 - 15 indicating if the measurement is usable.
Data Type	Integer

FETCh:TXPower:POWer?

Function	Returns a single or Average (from a multi-measurement) TX Power, in dBm.
Data Type	Real

FETCh:TXPower:POWer:ALL?

Function	Returns minimum, maximum and standard deviation TX Power results, in dBm.
Data Type	Minimum = Real, Maximum = Real, Standard Deviation = Real

FETCh:TXPower:POWer:MAXimum?

Function	Returns the maximum (from a multi-measurement) TX Power result, in dBm.
Data Type	Real

FETCh:TXPower:MINimum?

Function	Returns the minimum (from a multi-measurement) TX Power result, in dBm.
Data Type	Real

FETCh:TXPower:SDEViation?

Function	Returns the Standard Deviation (from a multi-measurement) TX Power result, in dB.
Data Type	Real

INITiate Subsystem

Descriptions

“INITiate Command Functions” on page 292

“INITiate Programming Examples (how INIT commands are used)” on page 293

“What Happens When a Measurement is INITiated?” on page 294

Syntax Diagrams and Command Descriptions

“INITiate:<measurement mnemonic>” on page 295

“INITiate:<COUNt? | :DONE | :ON?>” on page 295

INITiate Command Functions

The INITiate HP-IB command subsystem is used to:

- Start (activate) individual or multiple (concurrent) measurements.
- Turn individual measurements off.
- Determine the number of measurements currently active (INIT:COUNT?).
- Determine the names of the measurements currently active (INIT:ON?).
- Determine which measurements are finished (INIT:DONE?). See “INITiate:DONE?” on page 109.

Table 13. Measurement Function Mnemonics

Measurement mnemonic	Measurement Function
AAUD	Analog Audio
DAUD	Decoded Audio
FBER	Fast Bit Error Rate
BERR	Bit Error Rate
PFER	Phase/Frequency Error
PVT	Power versus Time
ORFS	Output RF Spectrum
TXP	TX Power
WAIT	Measurement(s) pending
NONE	No measurements currently in process

INITiate Programming Examples (how INIT commands are used)

INITiate commands allow multiple measurements to be started without waiting for other measurement processes to complete. For example, the following code starts the TXPower and PFERror measurements, and then uses the INITiate:DONE? command in a loop to query the status of these measurements. When the measurements are done, the FETCh command is used to acquire the results, and the results are entered into variables in the controlling application. The program ends when the INITiate:DONE? command returns the string “NONE”.

NOTE Trigger arming for each measurement is controlled in the SETup subsystem. The choices are single or continuous. The best practice (during remote operation) is to use single measurement mode. This simplifies the tasks of starting concurrent measurements, then using the INIT subsystem commands to determine which measurements are ready to be FETChed.

```
10 OUTPUT 714;”SETup:ALL:CONTinuous:OFF” ! selects single measurement mode
20 OUTPUT 714;”INITiate:TXPower;PFERror” ! starts TX Power/Phase Freq Error meas
30 LOOP
40 OUTPUT 714;”INITiate:DONE?” !query to find out if any measurements are done
50 ENTER 714;Meas_complete$
60 SELECT Meas_complete$
70 CASE “TXP” !tests for the string “TXP” which would indicate TX Power measurement is done
80 OUTPUT 714;”FETCh:TXPower:POWer?” !Queries Average TX Power measurement
90 ENTER 714;Avg_tx_power
100 CASE “PFER”!tests for the string “PFER” which would indicate Phase/Freq Error
measurement is done
110 OUTPUT 714;”FETCh:PFERror:RMS?” !Queries PFER Maximum Phase Error measurement
120 ENTER 714;Max_phs_error
130 END SELECT
140 EXIT IF Meas_complete$ = “NONE”
150 END LOOP
160 END
```

INITiate commands should be sent only when the Test Set has finished performing any operations, such as handovers, that require settling. For example, the following code performs a handover to a new traffic channel using the :SEQ (sequential) appendage, then initiates a TX Power measurement.

```
OUTPUT 714;”CALL:TCH:SEQ 65” !Hands over traffic channel to channel 65, waits for process
to complete before accepting next command
OUTPUT 714;”INITiate:TXPower” !Initiates TX Power command
```

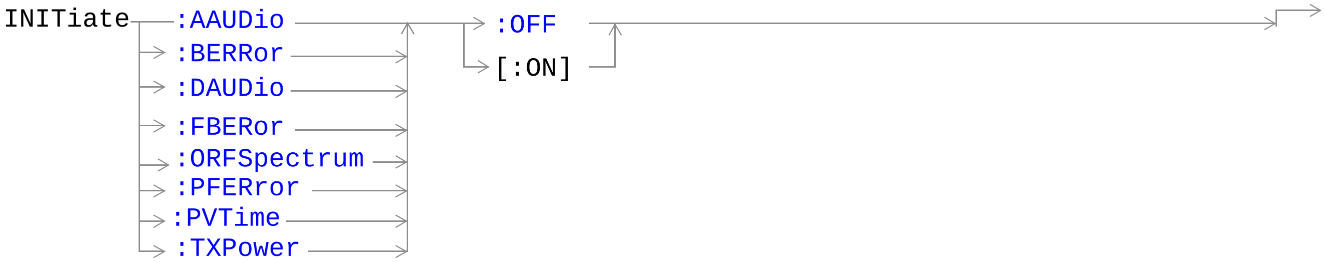
What Happens When a Measurement is INITiated?

When a measurement is started using INITiate commands, a new measurement cycle is started. If the selected measurement is currently in a measurement cycle, it is ABORted. Also, if a timeout is specified, the timeout period is begun.

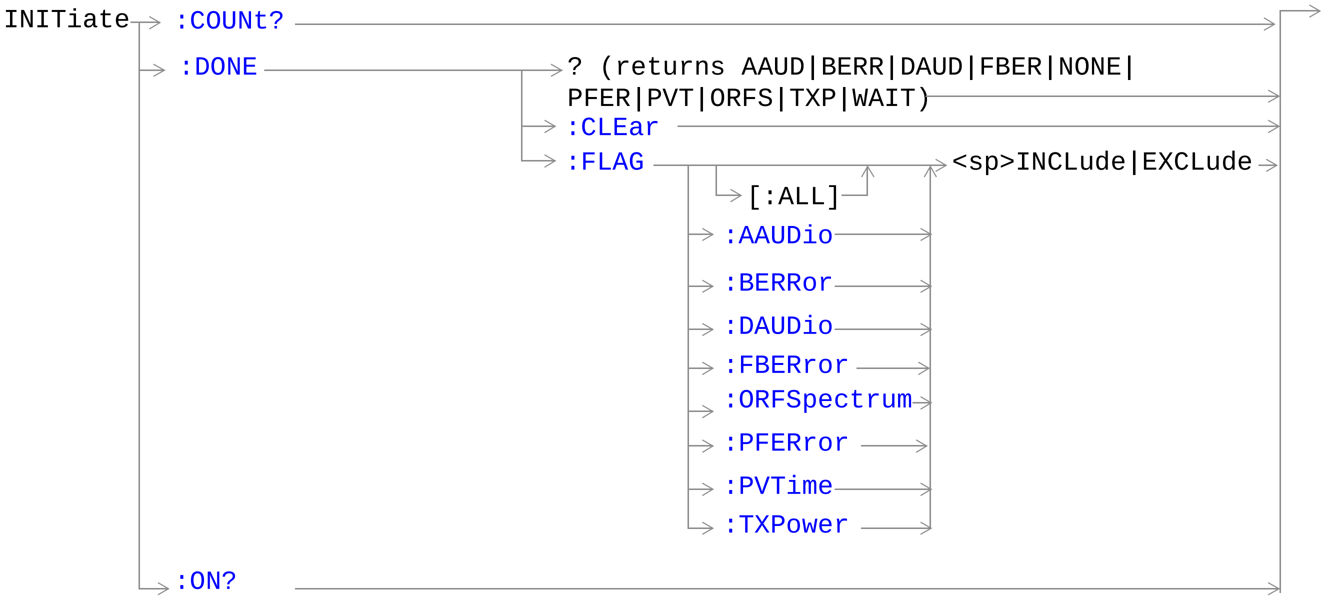
NOTE The INITiate subsystem is derived from SCPI, but has some modifications to make it more compatible with the manual operation of the Test Set. Most notably, the choice of single or continuous measurement triggering is made using the SETup subsystem.

INITiate

INITiate:<measurement mnemonic>


INITiate
:AAUDio
:BERRor
:DAUDio
:FBERor
:ORFSpectrum
:PFERror
:PVTime
:TXPower
:OFF
[:ON]

INITiate:<COUNt? | :DONE | :ON?>


INITiate
:COUNt?
:DONE
? (returns AAUD|BERR|DAUD|FBER|NONE|
PFER|PVT|ORFS|TXP|WAIT)
:CLEar
:FLAG
[:ALL]
:AAUDio
:BERRor
:DAUDio
:FBERror
:ORFSpectrum
:PFERror
:PVTime
:TXPower
<sp>INCLude|EXCLude
:ON?

"Diagram Conventions" on page 187

INITiate:<measurement mnemonic>[:ON]

Function	Starts measurements with the test set. The INITiate command is associated with the SETup command, and the FETCh? command, see "SETup Subsystem" on page 315 and "FETCh Subsystem" on page 251. One or more measurements may be initiated on the same program line. See "Concurrent Measurements" on page 97. This command is also used to activate a measurement. See "INITiate Programming Examples (how INIT commands are used)" on page 293.
Program Example	OUTPUT 714;"INITIATE:TXPOWER:ON" ! initiates a TX Power measurement
	OUTPUT 714;"INITIATE:TXPOWER;PFERROR:ON" ! initiates TX power and phase and frequency error measurements
	OUTPUT 714;"INITIATE:PVTIME;ORFSPECTRUM;FBERROR:ON" ! initiates power versus time, output RF specturm, and fast bit error rate measurements

INITiate:<measurement mnemonic>:OFF

Function	Deactivates the selected measurement. See "Measurement States" on page 123. Only one measurement can be deactivated at a time, to stop one or more measurements and leave them in the active state, see "ABORt" on page 189.
Program Example	OUTPUT 714;"INITIATE:TXPOWER:OFF" ! deactivates TX power measurement

INITiate:COUNt?

Function	Queries the number of measurements that have been initiated (that are activate). See "Measurement States" on page 123.
Query	Range: NONE to 8 Resolution: 1

INITiate:DONE?

Function	Queries (one at a time) which measurements are available or have timed out. See "Measurement States" on page 123.
Query	Range: NONE | TXP | PVT | PFER | ORFS | AAUD | DAUD | FBER | BERR | WAIT

INITiate:DONE:CLEar

Function	Clears the done flag from all measurements. See“INITiate:DONE?” on page 296.
Program Example	OUTPUT 714;”INITIATE:DONE:CLEAR” ! clears done flag

INITiate:DONE:FLAG[:ALL]

Function	Specifies that all measurements are considered, (included or excluded) when the DONE? query is sent. If a measurements trigger arm, see “Trigger Arm (Single or Continuous) Description” on page 123, has been left in continuous mode, the done flag for that measurement will toggle between DONE and WAIT, see “INITiate:DONE?” on page 109. The INITiate:DONE? query will probably not be able to catch the measurement at the instant it is done, therefore the measurement will never appear to be done. If a measurement trigger arm must be left in continuous mode the user should (exclude) it, using this command, from the INITiate:DONE? query results. Once the INITiate:DONE:FLAG has been set to EXCLude for a measurement, the user must send the INCLude command for that measurement in oder to query that measurement with, the INITiate:DONE? query. The test set will not reset any (excluded measurement) to be an (included measurement) with any form of preset, see “Pre-Defined Instrument States” on page 431.
Setting	Range • INCLude: include all measurements • EXCLude: exclude all measurements
Program Example	OUTPUT 714;”INITIATE:DONE:FLAG:ALL EXCLUDE” !excludes all measurements from contributing the INIATIATE:DONE? query, see “INITiate:DONE?” on page 296.

INITiate:DONE:FLAG<measurement mnemonic>

Function	Specifies which measurements are considered, (included or excluded) when the DONE? query is sent. If a measurements trigger arm, see “Trigger Arm (Single or Continuous) Description” on page 123, has been left in continuous mode, the done flag for that measurement will toggle between DONE and WAIT, see “INITiate:DONE?” on page 109. The INITiate:DONE? query will probably not be able to catch the measurement at the instant it is done, therefore the measurement will never appear to be done. If a measurement trigger arm must be left in continuous mode the user should (exclude) it, using this command, from the INITiate:DONE? query results. Once the INITiate:DONE:FLAG has been set to EXCLude for a measurement, the user must send the INCLude command for that measurement in oder to query that measurement with, the INITiate:DONE? query. The test set will not reset any (excluded measurement) to be an (included measurement) with any form of preset, see “Pre-Defined Instrument States” on page 431.
Setting	Range • INCLude :AAUDio| :BERRor | :DAUDio | :FBERror | :ORFSpectrum | :PFERror | :PVTime |:TXPower • EXCLude :AAUDio| :BERRor | :DAUDio | :FBERror | :ORFSpectrum | :PFERror | :PVTime |:TXPower
Program Example	OUTPUT 714;”INITIATE:DONE:FLAG:AAUDIO EXCLUDE” ! excludes AAUDIO measurements from contributing the INIATIATE:DONE? query, see “INITiate:DONE?” on page 296.

INITiate:ON?

Function	Queries the names of the measurements (none, one, or more than one) that are ON in a comma separated list of measurement mnemonics. See “INITiate:<measurement mnemonic>[:ON]” on page 296.
Query	Range: AAUD | BERR | DAUD | FBER | ORFS | PFER | PVT | TXP | NONE

READ? Subsystem

Description

The READ? command subsystem is used to start a measurement and obtain results using a single command.

READ? commands can be used only for performing measurements sequentially.

Sending a READ? command is equivalent to an INITiate/FETCh cycle.

Some advantages of using the READ? commands to obtain measurement results, as opposed to the INITiate/FETCh method are:

- It is simpler. Fewer commands are required to obtain measurement results
- It does not matter if the Test Set's measurement mode is Continuous On or Continuous Off (single trigger).

Some disadvantages of using READ? over INITiate/FETCh are:

- The Test Set does not process any additional HP-IB commands until the requested measurement results are available. This is sometimes referred to as "hanging" the bus.
- The Test Set does not provide all of the measurement results, such as statistics, that are available using the INITiate/FETCh method. In fact, the READ? commands have pre-defined measurement results.

Syntax Diagram and Command Descriptions

"READ"

READ? Programming Examples

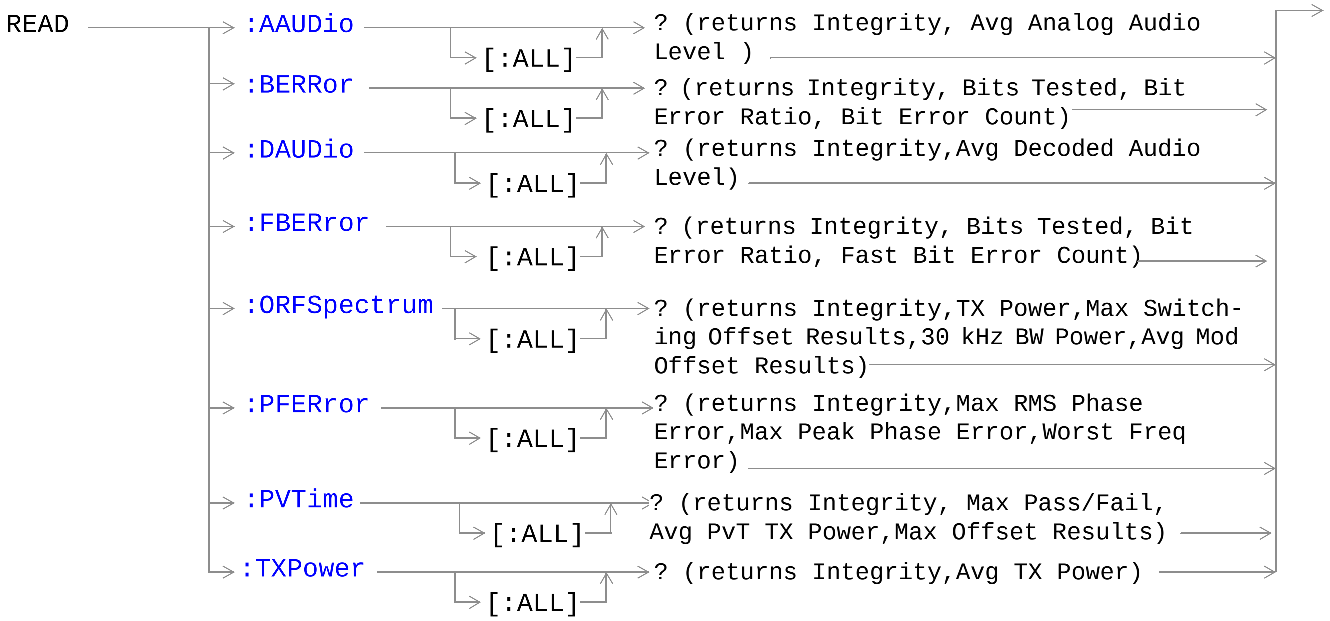
READ query commands provide a simplified way of obtaining measurement results in a sequential manner.

NOTE Trigger arming for each measurement is controlled in the SETup subsystem. The choices are single or continuous. Although the best practice (during remote operation) is to use Single (Continuous Off) measurement mode, the READ? commands will also work when the Test Set has Continuous measurement mode turned on. This is because the READ? command aborts the specified measurement (if the specified measurement is in process), initiates a new measurement, and FETChes the measurement result without providing the option of querying the availability of the measurement result, as with INIT:DONE?. It is important to note that READ? "hangs" the HP-IB bus until a measurement result is available.

```
OUTPUT 714;"READ:TXPower?" ! starts TX Power measurement. As soon as the measurement cycle
has completed, the Test Set provides the TX Power measurement results to the controlling
application.
```

```
ENTER 714;integrity, tx_carrier_power ! Enters the Integity Indicator and Tx Carrier Power
measurement into controlling application
```

READ


READ
:AAUDio
[:ALL]
? (returns Integrity, Avg Analog Audio Level)
:BERRor
[:ALL]
? (returns Integrity, Bits Tested, Bit Error Ratio, Bit Error Count)
:DAUDio
[:ALL]
? (returns Integrity,Avg Decoded Audio Level)
:FBERror
[:ALL]
? (returns Integrity, Bits Tested, Bit Error Ratio, Fast Bit Error Count)
:ORFSpectrum
[:ALL]
? (returns Integrity,TX Power,Max Switching Offset Results,30 kHz BW Power,Avg Mod Offset Results)
:PFERror
[:ALL]
? (returns Integrity,Max RMS Phase Error,Max Peak Phase Error,Worst Freq Error)
:PVTime
[:ALL]
? (returns Integrity, Max Pass/Fail, Avg PvT TX Power,Max Offset Results)
:TXPower
[:ALL]
? (returns Integrity,Avg TX Power)

“Diagram Conventions” on page 187

READ:AAUDio[:ALL]?

Function	Queries (initiates and fetches) one analog audio measurement as a sequential operation. Returns Integrity Indicator, see “Integrity Indicator” on page 98 and analog audio (average). The FETCh command should be used to obtain other measurement results. See “FETCh:AAUDio” on page 252.
Query	Integrity indicator • Range: 0 to 15 • Resolution: 1 Analog audio (average) • Range: 0 to 20 volts • Resolution: 0.1mv

READ:BERRor[:ALL]?

Function	Queries (initiates and fetches) one RX bit error measurement as a sequential operation. Returns Integrity Indicator see “Integrity Indicator” on page 98, Bits Tested, Bit Error Ratio and Bit Error Count. The FETCh command should be used to obtain other measurement results. See “FETCh:BERRor” on page 256.
Query	Integrity indicator • Range: 0 to 15 • Resolution: 1 Bits tested • Range: 0 to (<RX bits to test +131) and 9.91E+37 (NAN) • Resolution: 1 Bit error ratio • Range: 0 to 100 and 9.91E+37 (NAN) • Resolution: 1 Bit error count • Range: 0 to (<RX bits to test +131) and 9.91E+37 (NAN) • Resolution: 1

READ:DAUDio[:ALL]?

Function	Queries (initiates and fetches) one decoded audio (uplink speech level) measurement as a sequential operation. Returns Integrity Indicator see “Integrity Indicator” on page 98 and decoded audio (average). The FETCh command should be used to obtain other measurement results. See “FETCh:DAUDio” on page 261.
Query	Integrity indicator • Range: 0 to 15 • Resolution: 1 Decoded audio (average) • Range: 0 to 100% FS (full scale) • Resolution: 0.01% FS

READ:FBERror[:ALL]?

Function	Queries (initiates and fetches) one fast bit error measurement as a sequential operation. Returns Integrity Indicator see “Integrity Indicator” on page 98, Bits Tested, Bit Error Ratio, and Fast Bit Error Count using mobile station burst-by-burst looback (type C loopback). The FETCh command should be used to obtain other measurement results. See “FETCh:FBERror” on page 265.
Query	Integrity indicator • Range: 0 to 15 • Resolution: 1 Bits tested • Range: 0 to (RX Fast BER bits to test + 455) and 9.91E+37 (NAN) • Resolution: 1 Bit error ratio • Range: 0 to 100 and 9.91E+37 (NAN) • Resolution: 1 Fast bit error count • Range: 0 to (RX Fast BER bits to test + 455) and 9.91E+37 (NAN) • Resolution: 1

READ:ORFSpectrum[:ALL]?

Function	Queries (initiates and fetches) one output RF spectrum measurement as a sequential operation. Returns Integrity Indicator see "Integrity Indicator" on page 98, TX Power, Output RF Spectrum due to Switching (Max), 30 kHz Bandwidth Power, and Output RF Spectrum due to Modulation (Average). The FETCh command should be used to obtain other measurement results. See "FETCh:ORFSpectrum" on page 268.
Query	Integrity indicator • Range: 0 to 15 • Resolution: 1 TX power • Range: –100 to +100 dBm and 9.91E+37 (NAN) • Resolution: 0.01 dB Output RFspectrum due to switching (Max) • Range: 0 to 8 comma separated values –100 to +100 dBm and 9.91E+37 (NAN) • Resolution: 0.01 dB 30 kHz bandwidth power • Range: –100 to +100 dBm and 9.91E+37 (NAN) • Resolution: 0.01 dB Output RF spectrum due to modulation (average) • Range: 0 to 22 comma separated values –200 to +100 dBm and 9.91E+37 (NAN) • Resolution: 0.01 dB

READ:PFERror[:ALL]?

Function	Queries (initiates and fetches) one Phase and Frequency Error measurement as a sequential operation. Returns Integrity Indicator see “Integrity Indicator” on page 98, RMS Phase Error (Max), Peak Phase Error(Max), Frequency Error (Worst). The FETCh command should be used to obtain other measurement results. See “FETCh:PFERror” on page 276. Worst frequency error (negative or positive) is the value furthest from zero.
Query	Integrity indicator • Range: 0 to 15 • Resolution: 1 rms phase error (max) • Range: 0 to 180 degrees and 9.91E+37 (NAN) • Resolution: 0.01 dB Peak phase error (max) • Range: 0 to 180 degrees and 9.91E+37 (NAN) • Resolution: 0.01 degrees Frequency error (worst) • Range: –750 kHz to +750 kHz and 9.91E+37 (NAN) • Resolution: 0.01 Hz

READ:PVTime?

Function	Queries (initiates and fetches) one power versus time measurement as a sequential operation. Returns Integrity Indicator see "Integrity Indicator" on page 98, Mask pass/fail, power versus time transmit power and up to 12 power versus time offset (max) results. The FETCh command should be used to obtain other measurement results. See "FETCh:PVTime" on page 282.
Query	Integrity indicator • Range: 0 to 15 • Resolution: 1 Mask pass/fail • Range: 0 | 1 and 9.91E+37 (NAN) Power versus time transmit power • Range: –100 to +100 dBm and 9.91E+37 (NAN) • Resolution: 0.01 dB Power versus time offset (max) • Range: Up to 12 comma-separated power versus time values returned with max power = –100 dBc to +100 dBc (relative to power versus time carrier power) and 9.91E+37 (NAN) • Resolution: 0.01 dB

READ:TXPower[:ALL]?

Functions	Queries (initiates and fetches) one TX power measurement as a sequential operation. Returns Integrity Indicator see "Integrity Indicator" on page 98 and transmit power (average). The FETCh command should be used to obtain other measurement results. See "FETCh:TXPower" on page 290.
Query	Integrity indicator • Range: 0 to 15 • Resolution: 1 Transmit power (average) • Range: –100 to +100 dBm and 9.91E+37 (NAN) • Resolution: 0.01 dB

RFANalyzer Subsystem

Description

The RFANalyzer command subsystem performs “lower-level” functions that control the Test Set's measuring receiver. Most of these functions are normally controlled indirectly by commands in other subsystems. One exception would be when operating in Test Mode. For example, the command CALL:TCHannel:<channel number> would set the RFANalyzer:EXPected:FREQuency parameter to the frequency that maps to the uplink traffic channel specified.

Syntax Diagrams and Command Descriptions

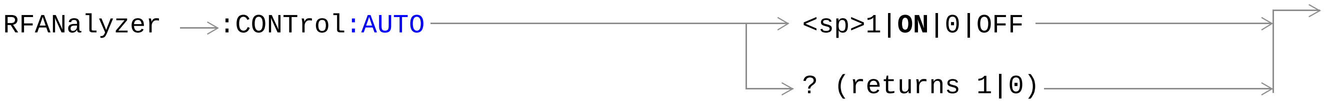
“RFANalyzer:CONTrol” on page 307

“RFANalyzer:EXPected” on page 307

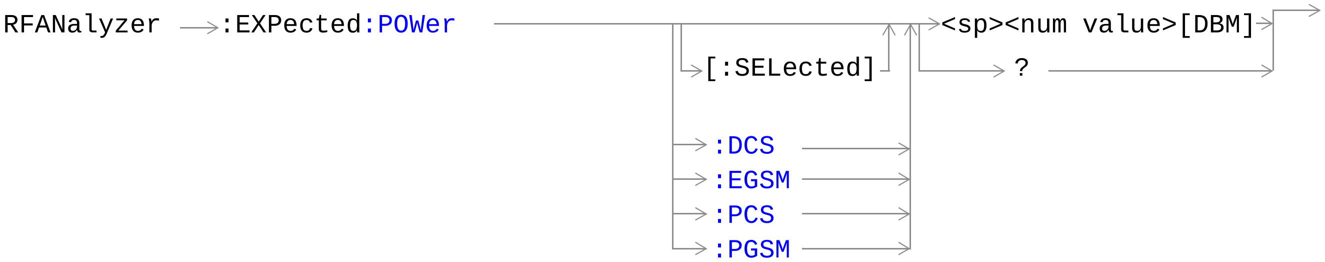
“RFANalyzer:MANual” on page 307

RFANalyzer

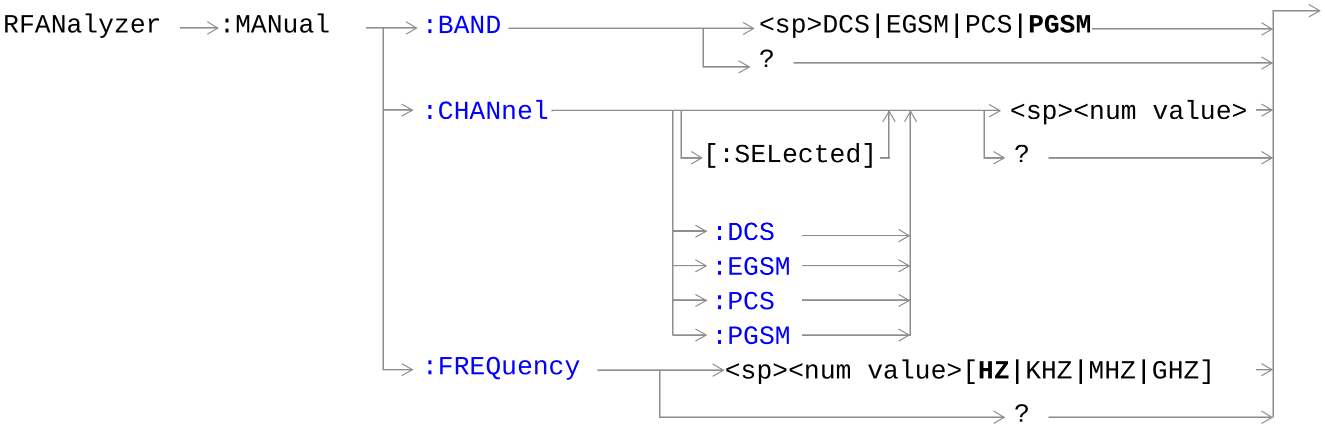
RFANalyzer:CONTrol


RFANalyzer
:CONTrol:AUTO
<sp>1|**ON**|0|OFF
? (returns 1|0)

RFANalyzer:EXPected


RFANalyzer
:EXPected:POWer
[:SELected]
:DCS
:EGSM
:PCS
:PGSM
<sp><num value>[DBM]
?

RFANalyzer:MANual


RFANalyzer
:MANual
:BAND
<sp>DCS|EGSM|PCS|**PGSM**
?
:CHANnel
[:SELected]
:DCS
:EGSM
:PCS
:PGSM
<sp><num value>
?
:FREQuency
<sp><num value>[**HZ**|KHZ|MHZ|GHZ]
?

“Diagram Conventions” on page 187

RFANalyzer:CONTrol:AUTO

Function	Sets/queries the test set’s receiver control. The measuring receiver is under the control of the test set’s base station emulator (auto) or under the control of the user (manual). see “Receiver Control” on page 417 Setting the manual band will change the receiver control to manual. see “RFANalyzer:MANual:BAND” on page 311 Setting the manual channel in the band that is currently active will change the receiver control to manual. see“RFANalyzer:MANual:CHANnel[:SELected]” on page 311 Setting the manual frequency will change the receiver control to manual. see “RFANalyzer:MANual:FREQuency” on page 314 Setting the broadcast band will change the receiver control to auto. See “CALL:BAND” on page 205
Setting	Manual = 0 | OFF , Auto = 1 | ON (default ON)
Query	0 | 1
*RST setting	0 | on
Program Example	OUTPUT 714;”RFANALYZER:CONTROL:CONTROL:AUTO 0” ! sets receiver control to manual

RFANalyzer:EXPected:POWer[:SELected]

Function	Sets/queries the power level in DBM that the mobile station is expected to transmit for the selected band. The units DBM are optional. The test set will set up its input signal path to measure this power level when a user is in manual control. see “Receiver Control” on page 417
Setting	Range: -60 to +53 dBm, after the Amplitude Offset (optional) has been factored in. see “Measurement Related Configuration” on page 451 Resolution: .01 DBM
Query	Range: -60 to +53 dBm, after the Amplitude Offset (optional) has been factored in. see “Measurement Related Configuration” on page 451 Resolution: .01 DBM
*RST setting	Sets the receiver control to auto Band: PGSM Expected Power: +13DBM
Program Example	OUTPUT 714;”RFANALYZER:EXPECTED:POWER:SELECTED 10” ! sets the test set expected input level to 10 DBM

RFANalyzer:EXPected:POWer:DCS

Function	Sets/queries the power level in DBM that the mobile station is expected to transmit at. The units DBM are optional. The test set will set up its input signal path to measure this power level. see “Receiver Control” on page 417
Setting	Range: -60 to +53 dBm, after the Amplitude Offset (optional) has been factored in. see “Measurement Related Configuration” on page 451 Resolution: .01 DBM
Query	Range: -60 to +53 dBm, after the Amplitude Offset (optional) has been factored in. see “Measurement Related Configuration” on page 451 Resolution: .01 DBM
*RST setting	Sets the receiver control to auto Band: PGSM Expected Power: +13DBM
Program Example	OUTPUT 714;”RFANALYZER:EXPECTED:POWER:DCS -10” ! sets expected power in DCS band to -10 DBM

RFANalyzer:EXPected:POWer:EGSM

Function	Sets/queries the power level in DBM that the mobile station is expected to transmit at. The units DBM are optional. The test set will set up its input signal path to measure this power level. see “Receiver Control” on page 417
Setting	Range: -60 to +53 dBm, after the Amplitude Offset (optional) has been factored in. see “Measurement Related Configuration” on page 451 Resolution: .01 DBM
Query	Range: -60 to +53 dBm, after the Amplitude Offset (optional) has been factored in. see “Measurement Related Configuration” on page 451 Resolution: .01 DBM
*RST setting	Sets the receiver control to auto Band: PGSM Expected Power: +13DBM
Program Example	OUTPUT 714;”RFANALYZER:EXPECTED:POWER:EGSM -10” ! sets expected power in EGSM band to -10 DBM

RFANalyzer:EXPected:POWer:PCS

Function	Sets/queries the power level in DBM that the mobile station is expected to transmit at. The units DBM are optional. The test set will set up its input signal path to measure this power level. see “Receiver Control” on page 417
Setting	Range: -60 to +53 dBm, after the Amplitude Offset (optional) has been factored in. see “Measurement Related Configuration” on page 451 Resolution: .01 DBM
Query	Range: -60 to +53 dBm, after the Amplitude Offset (optional) has been factored in. see “Measurement Related Configuration” on page 451 Resolution: .01 DBM
*RST setting	Sets the receiver control to auto Band: PGSM Expected Power: +13DBM
Program Example	OUTPUT 714;”RFANALYZER:EXPECTED:POWER:PCS -10” ! sets expected power in PCS band to -10 DBM

RFANalyzer:EXPected:POWer:PGSM

Function	Sets/queries the power level in DBM that the mobile station is expected to transmit at. The units DBM are optional. The test set will set up its input signal path to measure this power level. see “Receiver Control” on page 417
Setting	Range: -60 to +53 dBm, after the Amplitude Offset (optional) has been factored in. see “Measurement Related Configuration” on page 451 Resolution: .01 DBM
Query	Range: -60 to +53 dBm, after the Amplitude Offset (optional) has been factored in. see “Measurement Related Configuration” on page 451 Resolution: .01 DBM
*RST setting	Sets the receiver control to auto Band: PGSM Expected Power: +13DBM
Program Example	OUTPUT 714;”RFANALYZER:EXPECTED:POWER:PGSM -10” ! sets expected power in PGSM band to -10 DBM

RFANalyzer:MANual:BAND

Function	Sets/queries the frequency band that the test set will expect the mobile station to operate on. This setting is used by the test set to map an expected channel (ARFCN) to an uplink frequency. see “Receiver Control” on page 417 The receiver control is set to manual when a manual band is selected. see “RFANalyzer:CONTrol:AUTO” on page 308 The manual band must be set before manual channel will update.
Setting	Range: DCS | EGSM | PCS | PGSM
Query	Range: DCS | EGSM | PCS | PGSM
*RST setting	PGSM
Program Example	OUTPUT 714;”RFANALYZER:MANUAL:BAND DCS” ! sets the band in manual receiver control

RFANalyzer:MANual:CHANnel[:SELected]

Function	Sets/queries the ARFCN that the mobile station is expected to transmit o for the band selected. The test set will tune to the corresponding uplink frequency for the frequency band currently selected. see “Receiver Control” on page 417 The manual band must be set before manual channel will update.
Setting	Any ARFCN within the currently selected frequency band.
Query	Any ARFCN within the currently selected frequency band.
*RST setting	Sets the receiver control to auto Band: PGSM Traffic Channel: 30
Program Example	OUTPUT 714;”RFANALYZER:MANUAL:SELECTED 512” ! configures the test set to ARFCN 512

RFANalyzer:MANual:CHANnel:DCS

Function	Sets/queries the ARFCN that the mobile station is expected to transmit on. The test set will tune to the corresponding uplink frequency for the DCS frequency band. see "Receiver Control" on page 417 The manual band must be set before manual channel will update. see"RFANalyzer:MANual:BAND" on page 311
Setting	Range: 512 to 885 Resolution: 1
Query	Range: 512 to 885 Resolution: 1
*RST setting	Sets the receiver control to auto Band: PGSM Traffic Channel: 30
Program Example	OUTPUT 714;"RFANALYZER:MANUAL:CHANNEL:DCS 512" ! sets ARFCN for DSC in manual receiver mode

RFANalyzer:MANual:CHANnel:EGSM

Function	Sets /queries the ARFCN that the mobile station is expected to transmit on. The test set will tune to the corresponding uplink frequency for the EGSM frequency band. see "Receiver Control" on page 417 The manual band must be set before manual channel will update. see "RFANalyzer:MANual:BAND" on page 311
Setting	Range: 0 to 124 and 975 to 1023 Resolution: 1
Query	Range: 0 to 124 and 975 to 1023 Resolution: 1
*RST setting	Sets the receiver control to auto Band: PGSM Traffic Channel: 30
Program Example	OUTPUT 714;"RFANALYZER:MANUAL:CHANNEL:EGSM 975" ! sets ARFCN for EGSM in manual receiver mode

RFANalyzer:MANual:CHANnel:PCS

Function	Sets/queries the ARFCN that the mobile station is expected to transmit on. The test set will tune to the corresponding uplink frequency for the PCS frequency band. see “Receiver Control” on page 417 The manual band must be set before manual channel will update. see “RFANalyzer:MANual:BAND” on page 311
Setting	Range: 512 to 810 Resolution: 1
Query	Range: 512 to 810 Resolution: 1
*RST setting	Sets the receiver control to auto Band: PGSM Traffic Channel: 30
Program Example	OUTPUT 714;”RFANALYZER:MANUAL:CHANNEL:PCS 512” ! sets ARFCN for PCS in manual receiver mode

RFANalyzer:MANual:CHANnel:PGSM

Function	Sets/queries the ARFCN that the mobile station is expected to transmit on. The test set will tune to the corresponding uplink frequency for the PGSM frequency band. see “Receiver Control” on page 417 The manual band must be set before manual channel will update. see “RFANalyzer:MANual:BAND” on page 311
Setting	Range: 1 to 124 Resolution: 1
Query	Range: 1 to 124 Resolution: 1
*RST setting	Sets the receiver control to auto Band: PGSM Traffic Channel: 30
Program Example	OUTPUT 714;”RFANALYZER:MANUAL:CHANNEL:PGSM 124” ! sets ARFCN for PGSM in manual receiver mode

RFANalyzer:MANual:FREQuency

Function	Sets/queries the frequency that the mobile station is expected to transmit on. see "Receiver Control" on page 417 The units (HZ | KHZ | MHZ | GHZ) are optional, if no units are specified then units default to HZ. Setting the manual frequency changes the receiver control to manual. see "RFANalyzer:CONTrol:AUTO" on page 308
Range	Range: 293 MHZ to 2700 MHZ Resolution: .01 HZ
Query	Range: 293 MHZ to 2700 MHZ Resolution: .01 HZ
*RST setting	896 MHZ
Program Example	OUTPUT 714;"RFANALYZER:MANUAL:FREQUENCY 942.6MHZ" ! sets the expected frequency to 942.6 MHZ in manual receiver mode

SETup Subsystem

Description

The SETup subsystem is used to configure the Test Set for each measurement. Typical settings include:

- Specifying whether a measurement will run continuously or need to be INITiated.
- How a measurement is triggered
- How many measurements will be made each time a measurement is INITiated

NOTE Trigger arming for each measurement is controlled in the SETup subsystem. The choices are single or continuous. In most cases, it is a best practice (during remote operation) to use “single” measurement mode. This simplifies the tasks of starting concurrent measurements, using the INIT subsystem commands to determine which measurements are ready to be fetched, then using the FETCh subsystem to obtain results. The command “SETup:CONTinuous:OFF sets all measurements to “single” trigger mode.

Syntax Diagrams and Command Descriptions

“SETup:CONTinuous” on page 325

“SETup:AAUDio” on page 316

“SETup:BERRor” on page 320

“SETup:DAUDio” on page 326

“SETup:FBERror” on page 330

“SETup:ORFSpectrum” on page 334

“SETup:PFERror” on page 343

“SETup:PVTime” on page 348

“SETup:TXPower” on page 354

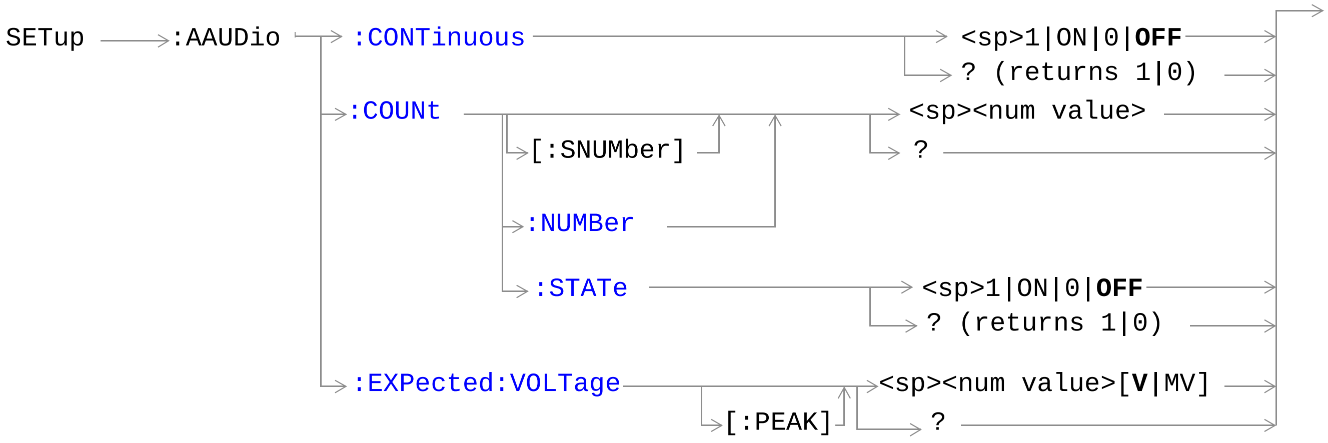
SETup:AAUDio

Syntax Diagrams and Command Descriptions

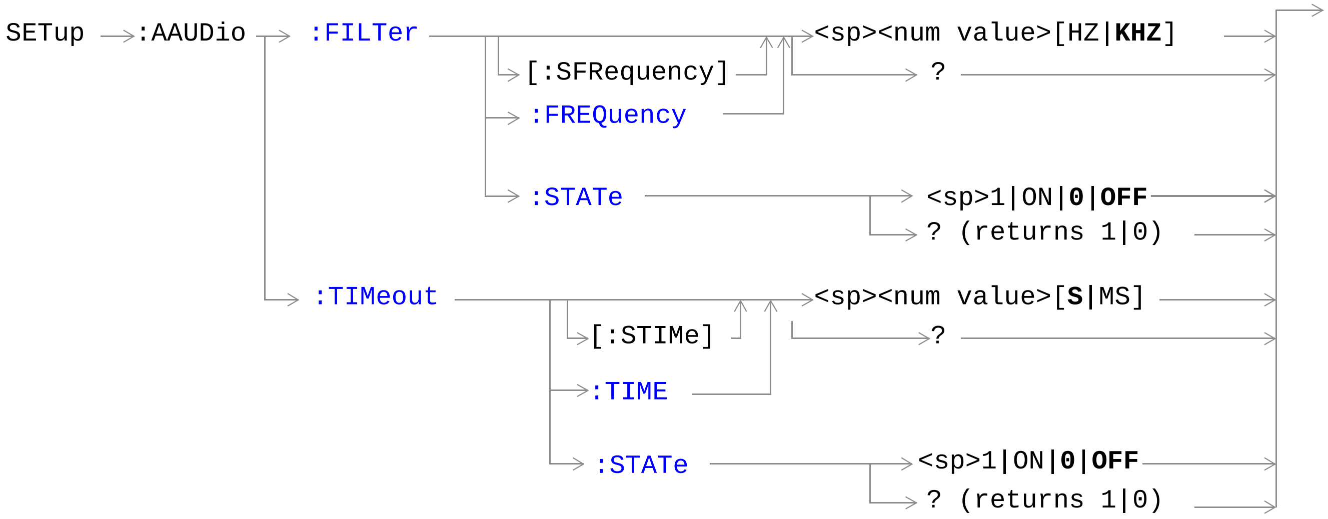
"SETup:AAUDio<:CONTinuous | :COUNt | :EXPected>" on page 316

"SETup:AAUDio<:FILTer | :TIMeout>" on page 316

SETup:AAUDio<:CONTinuous | :COUNt | :EXPected>


SETup
:AAUDio
:CONTinuous
<sp>1|ON|0|**OFF**
? (returns 1|0)
:COUNt
<sp><num value>
?
[:SNUMber]
:NUMBer
:STATe
<sp>1|ON|0|**OFF**
? (returns 1|0)
:EXPected:VOLTage
<sp><num value>[**V**|MV]
[:PEAK]
?

SETup:AAUDio<:FILTer | :TIMeout>


SETup
:AAUDio
:FILTer
<sp><num value>[HZ|**KHZ**]
[:SFRequency]
?
:FREQuency
:STATe
<sp>1|ON|**0**|**OFF**
? (returns 1|0)
:TIMeout
<sp><num value>[**S**|MS]
[:STIMe]
?
:TIME
:STATe
<sp>1|ON|**0**|**OFF**
? (returns 1|0)

"Diagram Conventions" on page 187

SETup:AAUDio:CONTinuous

Function	Selects/queries the trigger arm state for Analog Audio measurements.
Setting	Continuous trigger arm mode = 1|ON| Single trigger arm mode = 0|OFF
Query	0|1
*RST setting	Single
Program Example	OUTPUT 714;"AAUDIO:COUNTINUOUS OFF" ! selects single trigger mode

SETup:AAUDio:COUNt[:SNUMber]

Function	Selects the number of Analog Audio multi-measurements the Test Set will make and sets the count state to ON.
Setting	range 1 to 999 / resolution 1
*RST setting	OFF
Program Example	OUTPUT 714;"AAUDIO:COUNT :SNUMBER 5" ! sets the value to 5 and the state to on

SETup:AAUDio:COUNt:NUMBer

Function	Selects/queries the number of Analog Audio measurements the Test Set will make when the "SETup:AAUDio:COUNt:STATe" is on.
Setting	range 1 to 999 / resolution 1
Query	range 1 to 999 / resolution 1
*RST setting	10
Program Example	OUTPUT 714;"SETUP:AAUDIO:COUNT:NUMBER 10" ! sets the audio multi-measurement count number

SETup:AAUDio:COUNt:STATe

Function	Selects/queries the Analog Audio multi-measurement count state.
Setting	1|ON | 0|OFF
Query	1|0
*RST setting	0|OFF
Program Example	OUTPUT 714;"SETUP:AAUDIO:COUNT:STATE ON" !Turns the analog audio measurement multi-measurement count state on

SETup:AAUDio:EXPected:VOLTage

Function	Sets/queries the maximum expected peak voltage (clipping level) of the Analog Audio signal to be measured. The units (V|MV|UV) are optional, if no units are specified then units default to V. see "SETup:AAUDio" on page 316
Setting	range 10 mV to 20 V peak / resolution 0.1 mV
Query	range 10 mV to 20 V peak / resolution 0.1 mV
*RST setting	20V
Program Example	OUTPUT 714;"SETUP:AAUDIO: EXPECTED:VOLTAGE 5 V" !sets the clipping level of Analog Audio measurements to +5 volts

SETup:AAUDio:FILTer[:SFRequency]

Function	Sets/queries the state to on and the center frequency for the 100 Hz bandpass filter applied to Analog Audio measurements. Units (KHZ|HZ) are optiona, if no units are specified then units default to Hz. see"Analog Audio Measurement Description" on page 46
Setting	range 200 Hz to 8.0 kHz / resolution 1 Hz
Query	range 200 Hz to 8.0 kHz / resolution 1 Hz
*RST setting	1000 Hz
Program Example	OUTPUT 714;"SETUP:AAUDIO:FILTER :SFREQUENCY 1000" !this is a complex command that sets the aaudio filter state to on and sets the bandpass filter frequency to 1 kHz.

SETup:AAUDio:FILTer:FREQuency

Function	Sets/queries the center frequency for the 100 Hz bandpass filter applied to Analog Audio measurements. Units (KHZ|HZ) are optional, if no units are specified then units default to Hz. see "SETup:AAUDio" on page 316
Setting	range 200 Hz to 8.0 kHz / resloution 1 Hz
Query	range 200 Hz to 8.0 kHz / resolution 1 Hz
*RST setting	1 kHZ
Program Example	OUTPUT 714;"SETUP:AAUDIO:FREQUENCY 217HZ"! set aaudio bandpass filter to 217 hz

SETup:AAUDio:FILTer:STATe

Function	Selects/queries the state of the Analog Audio bandpass filter. see "SETup:AAUDio" on page 316
Setting	1|ON |0 |OFF
Query	1 | 0
*RST setting	0|OFF
Program Example	OUTPUT 714;"SETUP:AAUDIO:FILTER:STATE ON" ! sets filter state on

SETup:AAUDio:TIMEout[:STIME]

Function	Selects/queries the timeout value in seconds that will be used for Analog Audio measurements and sets the timeout state to ON. Units (S|MS) are optional, if no units are specified then units default to S.
Setting	range 1 to 999 / resolution 1
Query	range 1 to 999 / resolution 1
*RST setting	10
Program Example	OUTPUT 714;"SETUP:AAUDIO:TIMEOUT:STIME 3" ! a complex command that sets timeout state to on and sets the timeout value

SETup:AAUDio:TIMEout:STATe

Function	Selects/queries the Analog Audio measurement timeout state.
Setting	1|ON|0|OFF
Query	1 | 0
*RST setting	0|OFF
Program Example	OUTPUT 714;"SETUP:AAUDIO:TIMEOUT:STATE ON" ! sets timeout state to on

SETup:AAUDio:TIMEout:TIME

Function	Selects/queries the timeout value in seconds that will be used for Analog Audio measurements when the timeout state is ON. Unit (S|MS) are optional, if no units are specified then units default to S.
Setting	range 1 to 999 / resolution 1
Query	range 1 to 999 / resoluton 1
*RST setting	10
Program Example	OUTPUT 714;"SETUP:AAUDIO:TIMEOUT:TIME 5" ! sets timeout value to 5 seconds

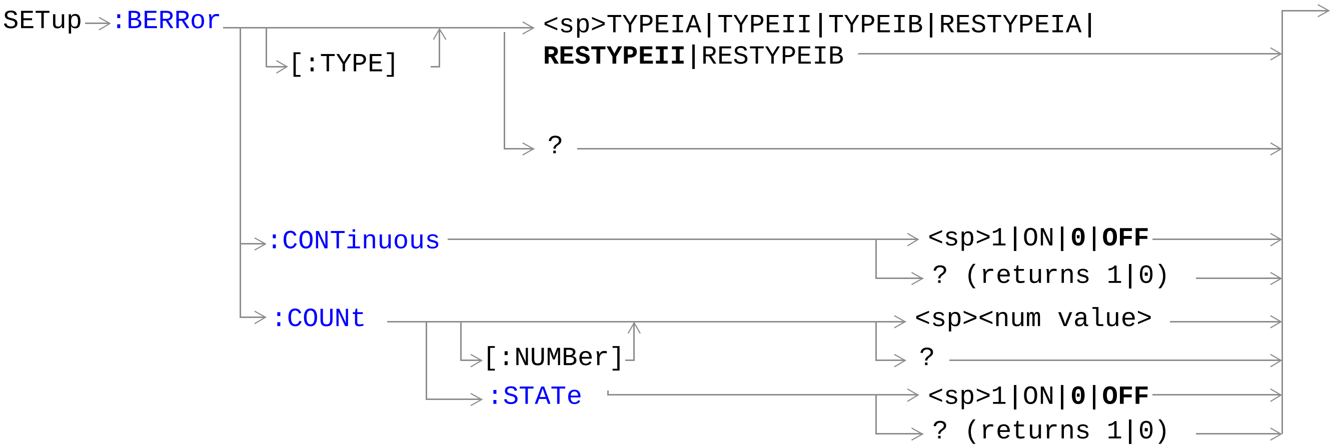
SETup:BERRor

Syntax Diagrams and Command Descriptions

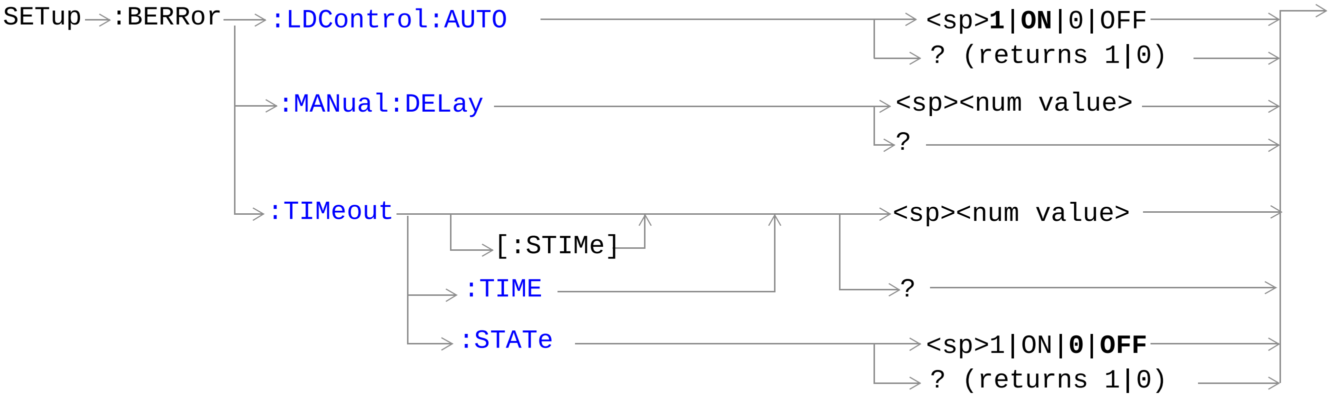
“SETup:BERRor<[:TYPE] | :CONTinuous | :COUNt>” on page 320

“SETup:BERRor<:LDControl | :MANual | :TIMeout>” on page 320

SETup:BERRor<[:TYPE] | :CONTinuous | :COUNt>


SETup
:BERRor
[:TYPE]
<sp>TYPEIA|TYPEII|TYPEIB|RESTYPEIA|
RESTYPEII|RESTYPEIB
?
:CONTinuous
<sp>1|ON|**0**|**OFF**
? (returns 1|0)
:COUNt
[:NUMBer]
<sp><num value>
?
:STATe
<sp>1|ON|**0**|**OFF**
? (returns 1|0)

SETup:BERRor<:LDControl | :MANual | :TIMeout>


SETup
:BERRor
:LDControl:AUTO
<sp>**1**|**ON**|0|OFF
? (returns 1|0)
:MANual:DELay
<sp><num value>
?
:TIMeout
[:STIMe]
:TIME
<sp><num value>
?
:STATe
<sp>1|ON|**0**|**OFF**
? (returns 1|0)

“Diagram Conventions” on page 187

SETup:BERRor[:TYPE]

Function	Sets the measurement type for BER measurements including Type A (residual) and Type B (non-residual).
Setting	TYPEIA | TYPEII |TYPEIB | RESTYPEIA | RESTYPEII | RESTYPEIB
Query	TYPEIA | TYPEII |TYPEIB | RESTYPEIA | RESTYPEII | RESTYPEIB
*RST Setting	RESTYPEII
Program Example	OUTPUT 714;"SETUP:BERROR:TYPE TYPEIA" ! sets type of BER measurement

SETup:BERRor:CONTinuous

Function	Sets/queries the trigger state for BER measurement.
Setting	Single trigger mode = 0|OFF | Continuous trigger mode = 1|ON
Query	0|1
*RST Setting	0|off
Program Example	OUTPUT 714;"BERROR:CONTINUOUS OFF" ! sets BER measurement to single trigger mode

SETup:BERRor:COUNt[:NUMBer]

Function	Sets/queries the number of BER measurements the test set will make when the count state is on
Seting	Range: 1 to 999,000 Resolution: 1
Query	Range: 1 to 999,000 Resolution: 1
*RST Setting	10,000
Program Example	OUTPUT 714;"SETUP:BERROR:COUNT:NUMBER 880" ! set BER multi-measurement count to 880

SETup:BERRor:COUNt:STATe

Function	Sets/queries the BER multi-measurement count state.
Setting	0|OFF | 1|ON
Query	0|1
*RST Setting	1|on
Program Example	OUTPUT714;"SETUP:BERROR:COUNT:STATE OFF" ! turns the BER measurement multi-measurement count state off

SETup:BERRor:LDControl:AUTO

Function	Sets/queries speech frames delay control mode. If speech frames delay control mode is automatic (Auto), the test set will determine the frame delay value that will allow correlation between uplink information bits with downlink information bits. If speech frames delay control mode is manual (not Auto), the test set will use the frame delay value entered in the Speech Frames Delay field. Refer to. see"SETup:BERRor:MANual:DELay" on page 323 Refer also to the "Bit Error Measurement Description" on page 50 for a description of frame delay and its use in the BER measurement.
Setting	0|OFF | 1|ON
Query	0|1
*RST Setting	1|auto
Program Example	OUTPUT 714;"SETUP:BERROR:LDCONTROL:AUTO OFF" ! sets BER delay to manual the user must select the manual frame delay number see "SETup:BERRor:MANual:DELay" on page 323

SETup:BERRor:MANual:DELay

Function	Sets/queries the number of frames the test set will use to correlate uplink information bits with downlink information bits when loop delay control mode is manual (AUTO OFF). To set the delay mode to manual, refer to "SETup:BERRor:LDControl:AUTO" on page 322. This value is displayed in the Speech Frames Delay field when Auto is not diplayed. (If you want to display this value and Auto is currently displayed, press the front-panel key labeled OFF). Refer to "Bit Error Measurement Description" on page 50 for a description of frame delay and how it is used in this measurement.
Setting	Range: 1 to 15 Resolution : 1
Query	Range: 1 to 15 Resolution : 1
*RST Setting	5
Program Example	OUTPUT 714;"SETUP:BERROR:MANUAL:DELAY 4" ! set delay of 4 speech frames

SETup:BERRor:TIMeout[:STIMe]

Function	Sets/queries the timeout value in seconds for the trigger state during BER measurements and turns the timeout state on. The units (S | MS) are optional, if no units are specified than units default to S.
Setting	Range: 1 to 999 Resolution: 1
Query	Range: 1 to 999 Resolution: 1
*RST Setting	10 seconds
Program Example	OUTPUT 714;"SETUP:BERR:TIMEOUT:STIME 8" ! sets BER measurement timeout to 8 seconds and the state to on

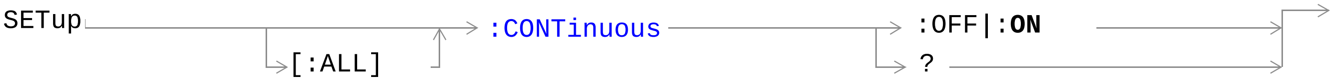
SETup:BERRor:TIMeout:TIME

Function	Sets/queries the timeout value in seconds for the trigger state during BER measurements. The units (S|MS) are optional, if no units are specified than units default to S (seconds).
Setting	Range: 1 to 999 Resolution: 1
Query	Range: 1 to 999 Resolution: 1
*RST Setting	10 seconds
Program Example	OUTPUT 714;"SETUP:BERR:TIMEOUT:TIME 8" ! sets BER measurement timeout to 8 seconds

SETup:BERRor:TIMeout:STATe

Function	Sets/queries the timeout state for BER measurements.
Setting	0|OFF | 1|ON
Query	0|1
*RST Setting	0|off
Program Example	OUTPUT 714;"SETUP:BERR0R:TIMEOUT:STATE ON" ! sets the timeout state to on

SETup:CONTinuous



“Diagram Conventions” on page 187

SETup:CONTinuous

Function	Sets the Continuous trigger mode to “Off” or “On” for all measurements.
Range	Continuous trigger = ON | Single trigger = OFF
Default	Power on = Continuous Manual user Full Preset = Continuous Remote user Full Preset = Single Partial Preset = no change
Data Type	Character
Program Example	`OUTPUT 714;”SETUP:ALL:CONTINUOUS:OFF” !sets all measurements to “single” trigger mode.`

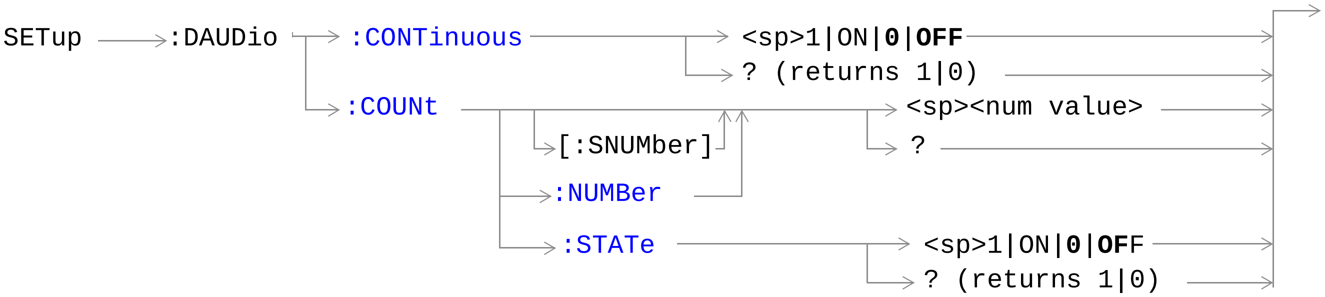
SETup:DAUDio

Syntax Diagrams and Command Descriptions

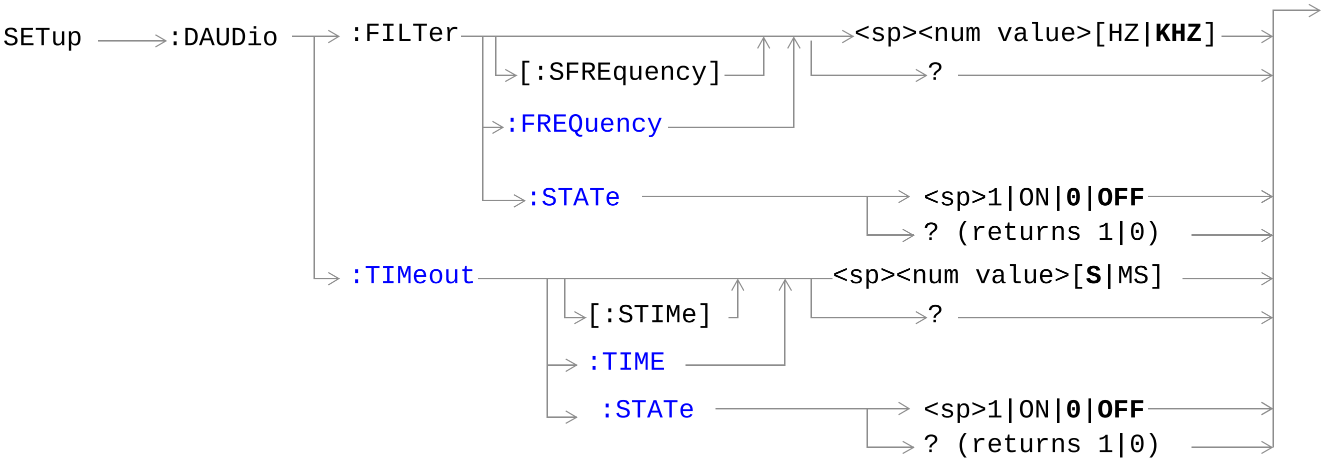
“SETup:DAUDio<:CONTinuous | :COUNT>” on page 326

“SETup:DAUDio<:FILTler | :TIMeout>” on page 326

SETup:DAUDio<:CONTinuous | :COUNT>


SETup
:DAUDio
:CONTinuous
<sp>1|ON|0|OFF
? (returns 1|0)
:COUNt
[:SNUMber]
:NUMBer
<sp><num value>
?
:STATe
<sp>1|ON|0|OFF
? (returns 1|0)

SETup:DAUDio<:FILTler | :TIMeout>


SETup
:DAUDio
:FILTer
[:SFREquency]
:FREQuency
<sp><num value>[HZ|KHZ]
?
:STATe
<sp>1|ON|0|OFF
? (returns 1|0)
:TIMeout
[:STIMe]
:TIME
<sp><num value>[S|MS]
?
:STATe
<sp>1|ON|0|OFF
? (returns 1|0)

“Diagram Conventions” on page 187

SETup:DAUDio:CONTinuous

Function	Selects/queries the trigger state for Decoded Audio measurements.
Setting	Continuous 1|ON|Single 0|OFF
Query	1|0
*RST setting	0|single
Program Example	OUTPUT 714;"SETUP:DAUDIO:CONTINUOUS OFF" ! set DAUDIO measurement to single trigger mode

SETup:DAUDio:COUNt[:SNUMber]

Function	Selects/queries the number of Decoded Audio multi-measurements the Test Set will make. This command sets the count state to ON.
Setting	range 1 to 999 / resolution 1
Query	range 1 to 999 / resolution 1
*RST setting	10
Program Example	OUTPUT 714;"SETUP:DAUDIO:COUNT:SNUMBER 10" ! sets the value to 10 and the state to on

SETup:DAUDio:COUNt:NUMBer

Function	Selects/queries the number of Decoded Audio measurements the test set will make when the multi-measurement count state is on.
Setting	range 1 to 999 / resolution 1
Query	range 1 to 999 / resolution 1
*RST setting	10
Program Example	OUTPUT 714;"SETUP:DAUDIO:COUNT:NUMBER 25" ! sets the number of DAUDIO measurements that will be made

SETup:DAUDio:COUNt:STATe

Function	Selects/queries the Decoded Audio multi-measurement count state.
Setting	1|ON | 0|OFF
Query	1|0
*RST setting	0 |OFF
Program Example	OUTPUT 714;"SETUP:DAUDIO:COUNT:STATE OFF" ! sets trigger state for DAUDIO measurement

SETup:DAUDio:FILTer [:SFREquency]

Function	Sets/queries the center frequency for the 100 Hz bandpass filter applied to Decoded Audio measurements. This command sets the count state to ON. The units (HZ|KHZ) are optional, if no units are specified then units default to KHZ. see "Decoded Audio Measurement Description" on page 56
Setting	range 200 Hz to 3.6 kHz / resolution 1 HZ
Query	range 200 Hz to 3.6 kHz / resolution 1 HZ
*RST setting	1000 HZ
Program Example	OUTPUT 714;"SETUP:DAUDIO:FILTER:SFREQUENCY 2.2KHZ" ! this is a complex command that sets the value and the state to on

SETup:DAUDio:FILTer:FREQuency

Function	Sets/queries the center frequency for the 100 Hz bandpass filter applied to Decoded Audio measurements. The units (HZ|KHZ) are optional, if no units are specified then units default to KHZ. see "Decoded Audio Measurement Description" on page 56
Setting	range 200 Hz to 3.6 kHz / resolution 1 HZ
Query	range 200 Hz to 3.6 kHz / resolution 1 HZ
*RST setting	1000 HZ
Program Example	OUTPUT 714;"DAUDIO:FILTER:FREQUENCY 217HZ" ! sets bandpass filter frequency

SETup:DAUDio:FILTer:STATe

Function	Selects/queries the Decoded Audio bandpass filter state. see "Decoded Audio Measurement Description" on page 56
Setting	1|ON |0|OFF
Query	1|0
*RST setting	0|OFF
Program Example	OUTPUT 714;"SETUP:DAUDIO:FILTER:STATE OFF" ! sets bandpass filter state to off

SETup:DAUDio:TIMeout[:STIMe]

Function	Selects/queries the timeout value in seconds that will be used for Decoded Audio measurements. This command sets the timeout state to ON. The units (S|MS) are optional, if no units are specified then units default to S.
Setting	range 1 to 999 / resolution 1
Query	range 1 to 999 / resolution 1
*RST setting	10 seconds
Program Example	OUTPUT 714;"SETUP:DAUDIO:TIMEOUT:STIME 6" ! sets the value to 6 seconds and the state to on

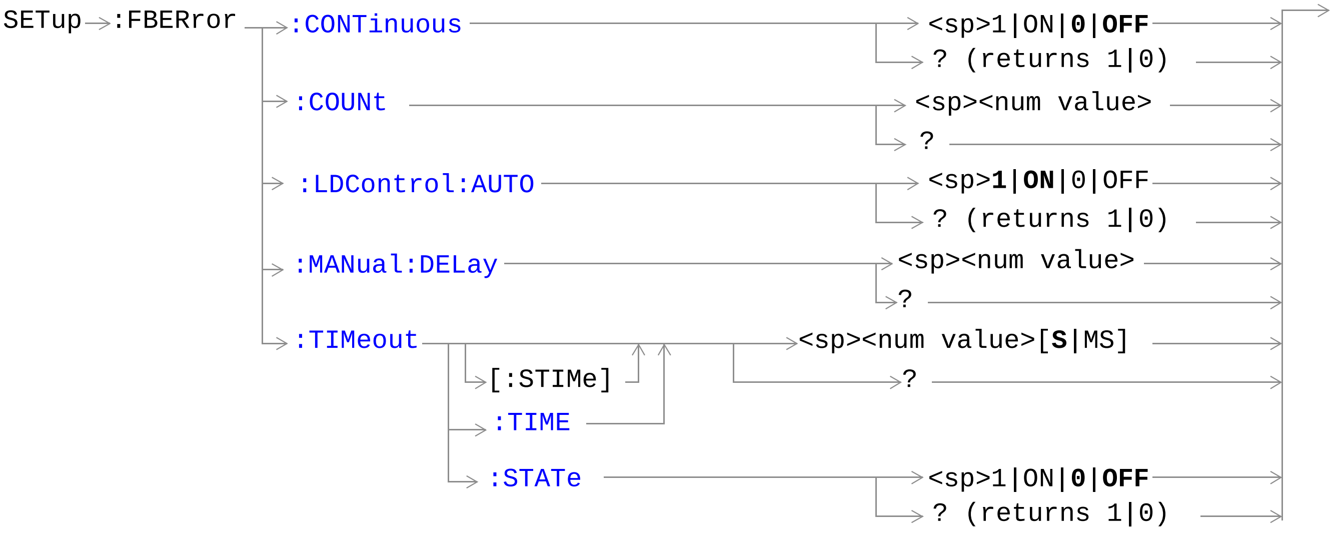
SETup:DAUDio:TIMeout:TIME

Function	Selects/queries the timeout value used for Decoded Audio measurements when the timeout state is ON. The units (S|MS) are optional, if no units are specified then units default to S.
Setting	range 1 to 999 / resolution 1
Query	range 1 to 999 / resolution 1
*RST setting	10 seconds
Program Example	OUTPUT 714;"SETUP:DAUDIO:TIMEOUT:TIME 15" ! sets timeout value to 15 seconds

SETup:DAUDio:TIMeout:STATe

Function	Selects/queries the Decoded Audio measurement timeout state.
Setting	1|ON | 0|Off
Query	1|0
*RST setting	0|OFF
Program Example	OUTPUT 714;"SETUP:DAUDIO:TIMEOUT:STATE ON" ! sets timeout state to on

SETup:FBERror


SETup
:FBERror
:CONTinuous
<sp>1|ON|0|OFF
? (returns 1|0)
:COUNt
<sp><num value>
?
:LDControl:AUTO
<sp>1|ON|0|OFF
? (returns 1|0)
:MANual:DELay
<sp><num value>
?
:TIMeout
[:STIMe]
:TIME
<sp><num value>[S|MS]
?
:STATe
<sp>1|ON|0|OFF
? (returns 1|0)

“Diagram Conventions” on page 187

SETup:FBERror:CONTinous

Function	Selects/queries the trigger state for Fast Bit Error Rate tests.
Setting	Continuous trigger mode = 1|ON | Single trigger mode = 0|OFF
Query	1|0
*RST	0|single
Program Example	OUTPUT 714;"SETUP:FBERROR:CONTINUOUS 0" ! specifies single trigger mode for Fast BER measurements.

SETup:FBERror:COUNt

Function	Sets/queries the number of bits to test during each Fast Bit Error Rate test.
Setting	range 1 to 999,000 / resolution 1
Query	range 1 to 999,000 / resolution 1
*RST	10,000
Comments	The actual number of bits that are tested will be determined by the number of frames tested, and will be at least as great as this count
Program Example	OUTPUT 714;"SETUP:FBERROR:COUNT 10000" ! specifies the number of Fast BER bits to test at 10,000 bits.

SETup:FBERror:LDControl:AUTO

Function	Sets/queries loopback delay control mode. If loopback control mode is automatic (auto on), the test set will determine the frame delay value that will allow correlation between uplink information bits with downlink information bits. . If loopback delay control mode is manual (auto off) , the test set will use the frame delay value entered in the TDMA Frames Delay field. Refer to "SETup:FBERror:MANual:DELay" on page 332 . Refer also to the "Fast Bit Error Measurement Description" on page 61 for a description of frame delay and its use in the fast bit error rate measurement.
Setting	1|ON | 0|OFF
Query	1|0
*RST	1|auto
Program Example	OUTPUT 714;"SETUP:FBERROR:LDCONTROL:OFF" ! set delay control to manual the user must select the manual frame delay number see "SETup:FBERror:MANual:DELay" on page 332

SETup:FBERror:MANual:DELay

Function	Sets/queries the number of frames the test set will use to correlate uplink information bits with downlink information bits when loopback delay control mode is manual (auto off). To set the loopback delay mode to manual, refer to "SETup:FBERror:LDControl:AUTO" on page 331. This value is displayed in the TDMA Frames Delay field when Auto is not diplayed. (If you want to display this value and Auto is currently displayed, press the front panel key labeled MANUAL). Refer to "Fast Bit Error Measurement Description" on page 61 for a description of frame delay and how it is used in this measurement.
Setting	range 0 to 26 / resolution 1
Query	range 0 to 26 / resolution 1
*RST	5 (loopback delay control is reset to automatic (auto on).
Program Example	OUTPUT 714;"SETUP:FBERROR:MANUAL:DELAY 6" ! set frame delay to 6 frames, see "SETup:FBERror:LDControl:AUTO" on page 331

SETup:FBERror:TIMeout[:STIMe]

Function	Selects/queries the timeout value in seconds for the trigger state during Fast Bit Error measurements and sets the timeout state to ON. The units (S | MS) are optional, if no units are specified than units default to S.
Setting	range 1 to 999 / resolution 1
Query	range 1 to 999 / resolution 1
*RST	10 seconds
Program Example	OUTPUT 714;"SETUP:FBERROR:TIMEOUT:STIME 20" ! sets the time out value to 20 seconds and the state to on

SETup:FBERror:TIMeout:TIME

Function	Selects/queries the timeout value in seconds for the trigger state during Fast Bit Error measurements. The units (S | MS) are optional, if no units are specified than units default to S.
Setting	range 1 to 999 / resolution 1
Query	range 1 to 999 / resolution 1
*RST	10 seconds
Program Example	OUTPUT 714;"SETUP:FBERROR:TIMEOUT:TIME 20" ! sets the time out value to 20 seconds

SETup:FBERror:TIMeout:STATe

Function	Sets/queries the timeout state for Fast BER measurements.
Setting	0|OFF | 1|ON
Query	0|1
*RST	0|off
Program Example	OUTPUT 714;"SETUP:FBERROR:TIMEOUT:STATE ON" ! sets the timeout state to on

SETup:ORFSpectrum

Syntax Diagrams and Command Descriptions

"SETup:ORFSpectrum<:CONTinuous | : COUNt | :ICOunt>" on page 334

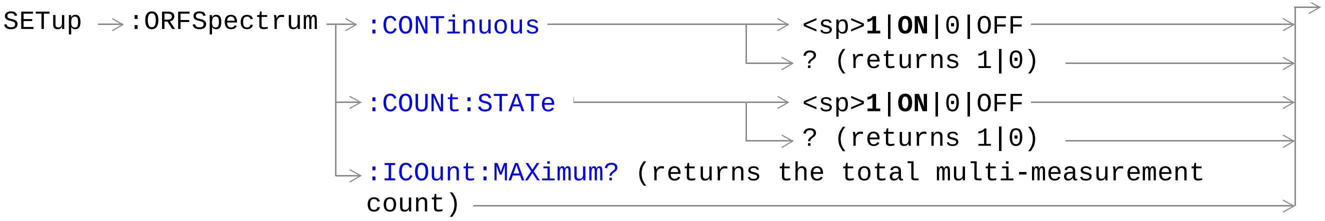
"SETup:ORFSpectrum:MODulation" on page 334

"SETup:ORFSpectrum:SWITching" on page 335

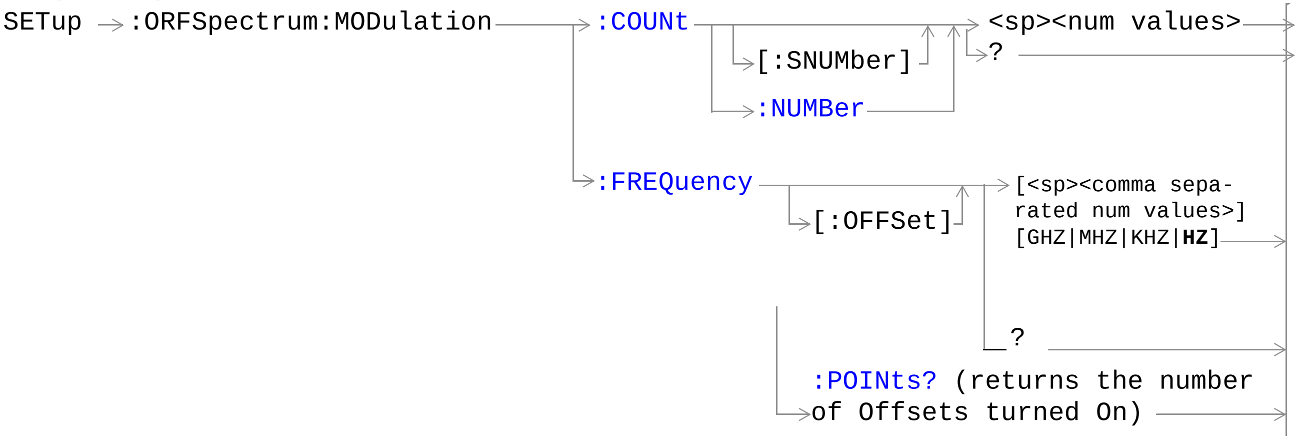
"SETup:ORFSpectrum:TIMeout" on page 335

"SETup:ORFSpectrum:TRIGger" on page 335

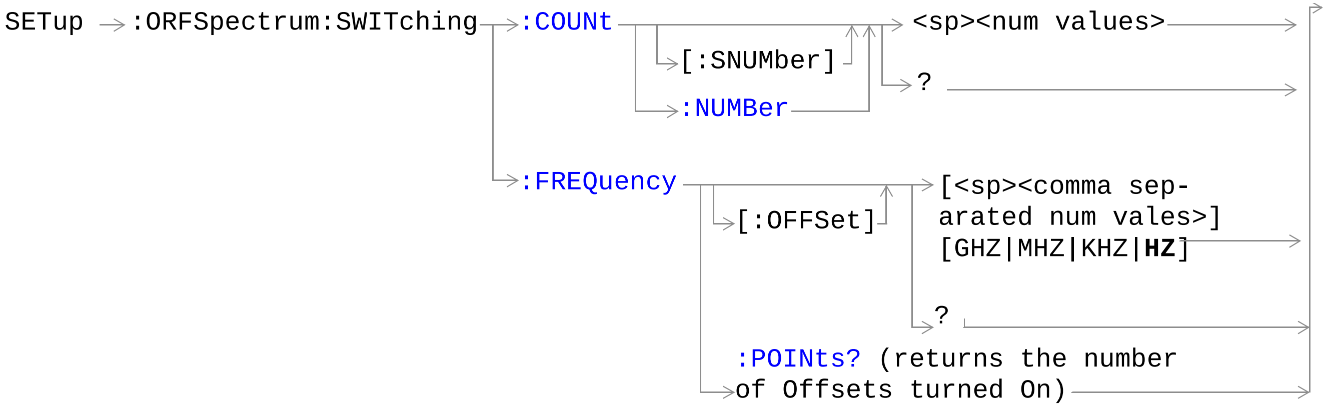
SETup:ORFSpectrum<:CONTinuous | : COUNt | :ICOunt>


SETup
:ORFSpectrum
:CONTinuous
<sp>1|ON|0|OFF
? (returns 1|0)
:COUNt:STATe
<sp>1|ON|0|OFF
? (returns 1|0)
:ICOunt:MAXimum? (returns the total multi-measurement count)

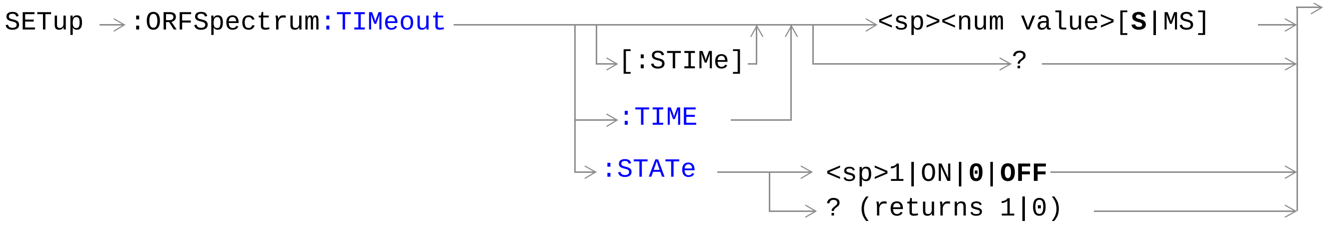
SETup:ORFSpectrum:MODulation


SETup
:ORFSpectrum:MODulation
:COUNt
[:SNUMber]
:NUMBer
<sp><num values>
?
:FREQuency
[:OFFSet]
[<sp><comma separated num values>] [GHZ|MHZ|KHZ|HZ]
?
:POINts? (returns the number of Offsets turned On)

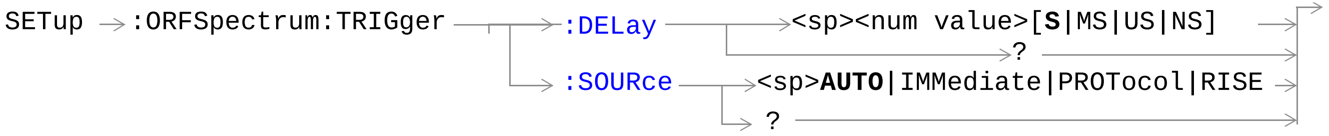
SETup:ORFSpectrum:SWITching


SETup
:ORFSpectrum:SWITching
:COUNt
[:SNUMber]
:NUMBer
<sp><num values>
?
:FREQuency
[:OFFSet]
[<sp><comma sep-
arated num vales>]
[GHZ|MHZ|KHZ|HZ]
?
:POINts? (returns the number
of Offsets turned On)

SETup:ORFSpectrum:TIMeout


SETup
:ORFSpectrum:TIMeout
[:STIMe]
:TIME
<sp><num value>[S|MS]
?
:STATe
<sp>1|ON|0|OFF
? (returns 1|0)

SETup:ORFSpectrum:TRIGger


SETup
:ORFSpectrum:TRIGger
:DELay
<sp><num value>[S|MS|US|NS]
?
:SOURce
<sp>AUTO|IMMediate|PROTocol|RISE
?

"Diagram Conventions" on page 187

SETup:ORFSpecturm:CONTinuous

Function	Selects/queries the trigger state for output RF spectrum measurements.
Range	Continuous trigger mode: 1 | ON Single trigger mode: 0 | OFF
Query Setting	1 | 0
*RST	1 | on
Program Example	OUTPUT 714;"SETUP:CONTINUOUS OFF" ! sets trigger mode to single for an ORFS measurement

SETup:ORFSpectrum:COUNt:STATe

Function	Selects/queries output RF spectrum due to switching and modulation multi-measurement count state.
Setting	0 | OFF | 1 | ON
Query Setting	0 | 1
*RST	1 | on
Program Example	OUTPUT 714;"SETUP:ORFSPECTRUM:COUNT:STATE ON" ! sets count state for both ORFS due to switching and modulation measurements

SETup:ORFSpectrum:ICOunt:MAXimum?

Function	Queries the total number measurements made each time an ORFS measurement is initated. This number will vary depending on the number of offsets and number of multi-measurements the user chooses. The total number of measurements is calculated using the following formula: ICO MAX = 1 + M + S *Where:* M= (*the number of modulation offsets*) × (*the number of multi-measurements for ORFS due to modulation*). S= (*the number of switching offsets*) × (*the number of multi-measurements for ORFS due to switching*) . See “Output RF Spectrum Measurement Description” on page 66 for a description of modulation and switching offsets.
Query	Range: 1 to 29971 Resolution: 1

SETup:ORFSpectrum:MODulation:COUNt[:SNUMber]

Function	Sets/queries the number of output RF spectrum due to modulation multi-measurements the test set will make. This command sets the count state to ON.
Setting	Range: 1 to 999 Resolution: 1
Query	Range: 1 to 999 Resolution: 1
*RST Setting	20
Program Example	OUTPUT 714"SETUP:ORFSPECTRUM:MODULATION:COUNT:SNUMBER 99" ! sets the value to 99 multi-measurements and the state to on

SETup:ORFSpectrum:MODulation:COUNt:NUMBer

Function	Sets/queries the number of output RF spectrum due to modulation multi-measurements the test set will make when the multi-measurement count state is on. see "Output RF Spectrum Measurement Description" on page 66
Setting	Range: 1 to 999 Resolution: 1
Query	Range: 1 to 999 Resolution: 1
*RST Setting	20
Program Example	OUTPUT 714;"SETUP:ORFSPECTRUM:MODULATION:COUNT:NUMBER 75" ! sets the multi-measurement count number for ORFS due to modulation measurements to 75

SETup:ORFSpectrum:MODulation:FREQuency[:OFFSet]

Function	Specifies/queries the list of output RF spectrum due to modulation frequency offsets. Each offset listed in the command is turned on by default. If no frequency offsets (null list) are sent, the output RF spectrum due to modulation measurement will not be made. The units (GHZ|MHZ|KHZ|HZ) are optional, if no units are specified than units default to HZ. see “Output RF Spectrum Measurement Description” on page 66
Setting	Range: 0 to 22 comma-separated values ranging from –1.8 MHz to –10 Hz, and +10 Hz to +1.8 MHz Resolution: 10 Hz
Query	Range: 0 to 22 comma-separated values ranging from –1.8 MHz to –10 Hz, and +10 Hz to +1.8 MHz Resolution: 10 Hz
*RST Setting	Offset 1: 400.0 kHz Offset 2: 600.0 kHz Offsets 3 to 22: off
Program Example	OUTPUT 714;"SETUP:ORFSPECTRUM:MODULATION:FREQUENCY:OFFSET 400 KHZ, 700 KHZ" !Turns on the first two ORFS due to modulation measurement offsets and sets them to 400 kHz and 700 kHz offsets. All other offsets are in the off state.
	OUTPUT 714;"SETUP:ORFSPECTRUM:MODULATION:FREQUENCY:OFFSET 700 KHZ" !Turns on the first ORFS due to modulation measurement offset and sets it to a 700 kHz offset. All other offsets are in the off state.
	OUTPUT 714;"SETUP:ORFSPECTRUM:MODULATION:FREQUENCY:OFFSET" !Turns all offsets for ORFS due to modulation measurement to the off state.

SETup:ORFSpectrum:MODulation:FREQuency:POINts?

Function	Queries the number of frequency offsets currently on during an ORFS due to modulation measurement. See “Output RF Spectrum Measurement Description” on page 66
Query	Range: 0 to 22 Resolution: 1

SETup:ORFSpectrum:SWITching:COUNt[:SNUMber]

Function	Sets /queries the ORFS due to switching multi-measurement count value and turns the state on.
Setting	Range: 1 to 999 Resolution: 1
Query	Range: 1 to 999 Resolution: 1
*RST Setting	10
Program Example	OUTPUT 714;"SETUP:ORFSPECTRUM:SWITCHING:COUNT:SNUMBER 55" ! sets the multi-measurment value to 10 and the state to on

SETup:ORFSpectrum:SWITching:COUNt:NUMBer

Function	Sets/queries the ORFS due to switching multi-measurement count value. see “Output RF Spectrum Measurement Description” on page 66
Setting	Range: 1 to 999 Resolution: 1
Query	Range: 1 to 999 Resolution: 1
*RST Setting	10
Program Example	OUTPUT 714;"SETUP:ORFSPECTRUM:SWITCHING:COUNT:NUMBER 15" ! sets the multi-measurement count number for ORFS due to switching to 15

SETup:ORFSpectrum:SWITching:FREQuency[:OFFSet]

Function	Sets/queries the list of output RF spectrum due to switching frequency offsets. Each offset listed in the command is turned on by default. If no frequency offsets (null list) are sent, the output RF spectrum due to switching measurement will not be made. The units (GHZ|MHZ|KHZ|HZ) are optional, if no units are specified than units default to HZ. See "Output RF Spectrum Measurement Description" on page 66
Setting	Range: 0 to 8 comma-separated values ranging from –1.8 MHz to –10 Hz, and +10 Hz to +1.8 MHz Resolution: 10 Hz
Query	Range: 0 to 8 comma-separated values ranging from –1.8 MHz to –10 Hz, and +10 Hz to +1.8 MHz Resolution: 10 Hz
*RST Setting	Offset 1 = 400.0 kHz Offset 2 = 600.0 kHz Offsets 3 to 8 off
Program Examples	OUTPUT 714;"SETUP:ORFSPECTRUM:SWITCHING:FREQUENCY:OFFSET 400 KHZ, 700 KHZ" !Turns on the first two ORFS due to switching measurement offsets and sets them to 400 kHz and 700 kHz offsets. All other offsets are in the off state.
	OUTPUT 714;"SETUP:ORFSPECTRUM:SWITCHING:FREQUENCY:OFFSET 700 KHZ" !Turns on the first ORFS due to switching measurement offset and sets it to 700 kHz offsets. All other offsets are in the off state.
	OUTPUT 714;"SETUP:ORFSPECTRUM:SWITCHING:FREQUENCY:OFFSET" !Turns all of the ORFS due to switching measurements offsets to off.

SETup:ORFSpectrum:SWITching:FREQuency:POINts?

Function	Queries the number of frequency offsets currently on during an ORFS due to switching measurement. See "Output RF Spectrum Measurement Description" on page 66
Query	Range: 0 to 8 Resolution: 1

SETup:ORFSpectrum:TIMeout:TIME

Function	Selects/queries the timeout value in seconds that will be used for output RF spectrum measurements when the "SETup:ORFSpectrum:TIMeout:STATe" is ON. The units (S|MS) are optional, if no units are specified than units default to S.
Setting	Range: 1 to 999 Resolution: 1
Query	Range: 1 to 999 Resolution: 1
*RST Setting	10 seconds
Program Example	OUTPUT 714;"SETUP:ORFSPECTRUM:TIMEOUT:TIME 1" ! sets the timeout value to 15 seconds

SETup:ORFSpectrum:TIMeout[:STIMe]

Function	Sets/queries the timeout value in seconds that will be used for output RF spectrum measurements and turns the timeout state on. The units (S|MS) are optional, if no units are specified than units default to S.
Setting	Range: 1 to 999 Resolution: 1
Query	Range: 1 to 999 Resolution: 1
*RST Setting	10 seconds
Program Examples	OUTPUT 714;"SETUP:ORFSPECTRUM:TIMEOUT:STIME 12" ! sets the timeout value to 10 seconds and the state to on

SETup:ORFSpectrum:TIMeout:STATe

Function	Selects/queries output RF spectrum measurement timeout state.
Setting	0|OFF | 1|ON
Query	0|1
*RST Setting	0|off
Program Example	OUTPUT 714;"SETUP:ORFSPECTRUM:TIMEOUT:STATE ON" ! sets timeout state to on

SETup:ORFSpectrum:TRIGer:DELay

Function	Sets/queries the trigger delay for output RF spectrum measurements. The units (S | MS | US | NS) are optional, if no units are specified than units default to S.
Range	Range: –2.31 ms to +2.31 ms Resolution: 5 significant digits or 100 nanoseconds whichever is greater
Query	Range: –2.31 ms to +2.31 ms Resolution: 5 significant digits or 100 nanoseconds whichever is greater
*RST Setting	0 seconds
Program Example	OUTPUT 714;"SETUP:ORFSPECTRUM:TRIGGER:DELAY 1MS" ! sets the trigger delay value to 1 millisecond

SETup:ORFSpectrum:TRIGger:SOURce

Function	Selects/queries the trigger source for output RF spectrum measurements. See "Output RF Spectrum Measurement Description" on page 66.
Setting	Range: AUTO | IMMediate | PROTocol | RISE See "Measurement Triggering" on page 121.
Query	Range: AUTO | IMM | PROT | RISE
*RST Setting	AUTO
Program Example	OUTPUT 714;"SETUP:ORFSPECTRUM:TRIGGER:SOURCE AUTO" ! sets trigger source

SETup:PFERror

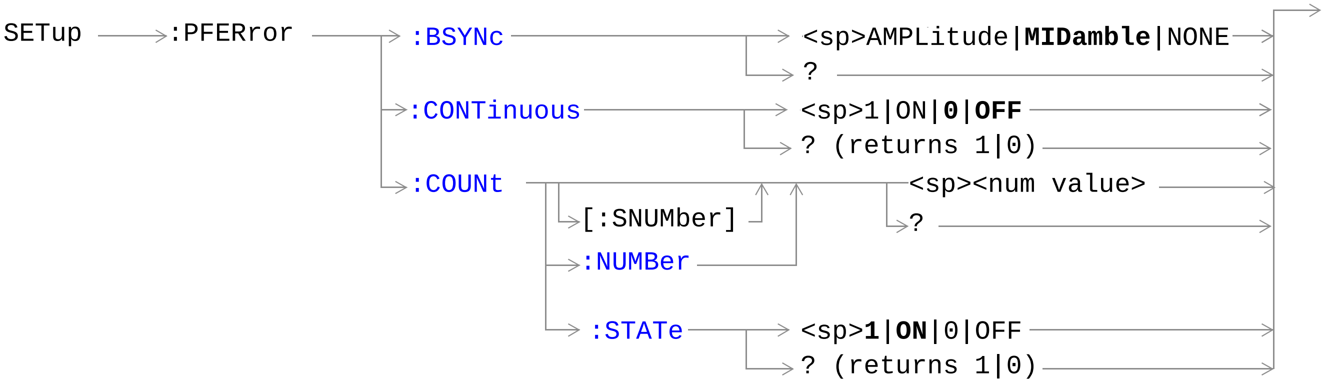
Syntax Diagrams and Command Descriptions

"SETup:PFERror<:BSYNc | :CONTinuous | :COUNt>" on page 343

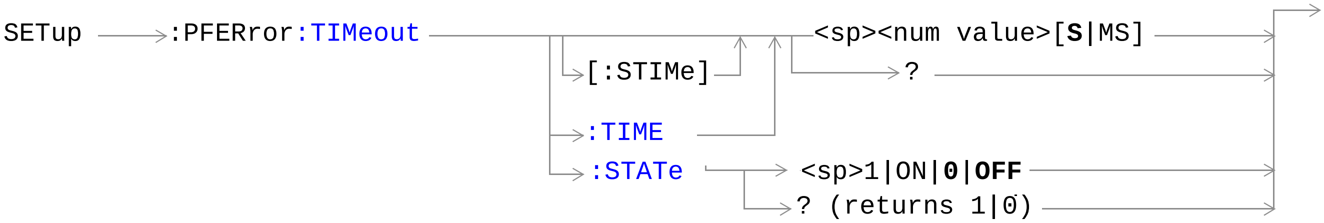
"SETup:PFERror:TIMeout" on page 343

"SETup:PFERror:TRIGger" on page 343

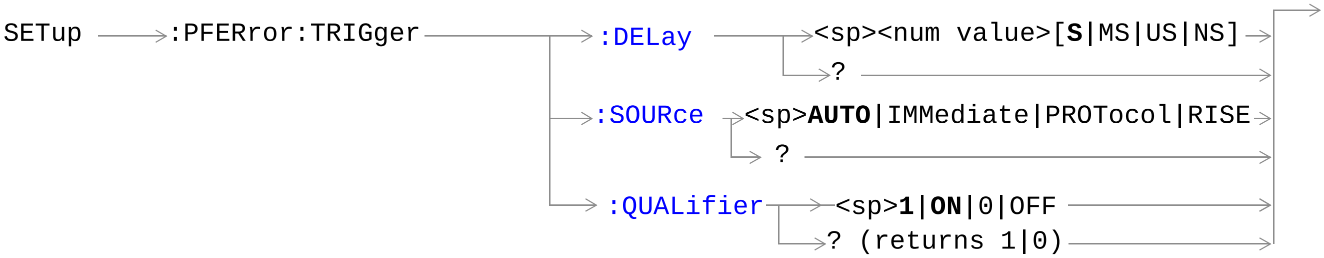
SETup:PFERror<:BSYNc | :CONTinuous | :COUNt>


SETup
:PFERror
:BSYNc
<sp>AMPLitude|**MIDamble**|NONE
?
:CONTinuous
<sp>1|ON|**0**|**OFF**
? (returns 1|0)
:COUNt
<sp><num value>
?
[:SNUMber]
:NUMBer
:STATe
<sp>**1**|**ON**|0|OFF
? (returns 1|0)

SETup:PFERror:TIMeout


SETup
:PFERror:TIMeout
<sp><num value>[**S**|MS]
[:STIMe]
?
:TIME
:STATe
<sp>1|ON|**0**|**OFF**
? (returns 1|0)

SETup:PFERror:TRIGger


SETup
:PFERror:TRIGger
:DELay
<sp><num value>[**S**|MS|US|NS]
?
:SOURce
<sp>**AUTO**|IMMediate|PROTocol|RISE
?
:QUALifier
<sp>**1**|**ON**|0|OFF
? (returns 1|0)

"Diagram Conventions" on page 187

SETup:PFERror:BSYNc

Function	Sets/queries the burst synchronization mode for Phase/Frequency Error measurements. see "Burst Synchronization of Measurements" on page 93.
Setting	Range MIDamble | AMPLitude | NONE
Query	Range MID | AMPL | NONE
*RST setting	MIDamble
Program Example	OUTPUT 714;"SETUP:PFERROR:BSYNC MIDAMBLE" ! sets the burst synchronization

SETup:PFERror:CONTinuous

Function	Sets/queries the trigger state for Phase/Frequency Error measurements.
Setting	Single trigger mode = 0 | OFF Continuous trigger mode = 1 | ON
Query	0 | 1
*RST setting	0 | off
Program Example	OUTPUT 714;"SETUP:PFERROR: CONTINUOUS OFF" ! specifies single trigger mode for Phase/Frequency Error measurements.

SETup:PFERror:COUNt[:SNUMber]

Function	Sets/queries the number of Phase/Frequency Error measurements the test set will make and turns the multi-measurement count state on.
Setting	Range 1 to 999 Resolution 1
Query	Range 1 to 999 Resolution 1
*RST setting	0 | off
Program Example	OUTPUT 714;"SETUP:PFERROR:COUNT:SNUMBER 100" ! sets the value to 100 and the state to on

SETup:PFERror:COUNt:NUMBer

Function	Sets/queries the number of Phase/Frequency Error measurements the Test Set will make when the multi-measurement count state is on.
Setting	Range 1 to 999 Resolution 1
Query	Range 1 to 999 Resolution 1
*RST setting	10
Program Example	OUTPUT 714;"SETUP:PFERROR:COUNT:NUMBER 55" ! sets the multi-measurement count value to 55

SETup:PFERror:COUNt:STATe

Function	Sets/queries the Phase/Frequency Error multi-measurement count state.
Setting	Range 0|OFF | 1|ON
Query	0|1
*RST setting	0|off
Program Example	OUTPUT 714;"SETUP:PFERROR:COUNT:STATE ON" ! turns on multi-measurement mode for the Phase/Frequency Error measurement.

SETup:PFERror:TIMeout[:STIMe]

Function	Sets/queries the Phase/Frequency Error measurement timeout value in seconds and sets the timeout state to on. The units (S|MS) are optional, if no units are specified then unit default to S.
Setting	Range 1 to 999 Resolution 1
Query	Range 1 to 999 Resolution 1
*RST setting	10 seconds
Program Example	OUTPUT 714;"SETUP:PFERROR:TIMEOUT:STIME 3" ! sets the timeout state to on and the timeout value to 3 seconds

SETup:PFERror:TIMeout:TIME

Function	Sets/queries the timeout value in seconds that will be used for Phase/Frequency Error measurements when the timeout state is ON. The units (S|MS) are optional, if no units are specified then unit default to S.
Setting	Range 1 to 999 Resolution 1
Query	Range 1 to 999 Resolution 1
*RST setting	10 seconds
Program Example	OUTPUT 714;"SETUP:PFERROR:TIMEOUT:TIME 4" ! sets the timeout value to 4 seconds

SETup:PFERror:TIMeout:STATe

Function	Selects/queries the timeout state for a Phase/Frequency Error measurement.
Setting	0|OFF | 1|ON
Query	0|1
*RST setting	0|off
Program Example	OUTPUT 714;"SETUP:PFERROR:TIMEOUT:STATE ON" ! sets the timeout state to on for a Phase/Frequency measurement

SETup:PFERror:TRIGger:DELay

Function	Sets/queries the trigger delay time in seconds for a Phase/Frequency Error measurement. The units (S|MS|US|NS) are optional, if no units are specified then units default to S. see "Phase and Frequency Error Measurement Description" on page 72
Setting	Range -2.31 ms to +2.31 ms Resolution 5 significant digits or 100 ns, whichever is greater
Query	Range -2.31 ms to +2.31 ms Resolution 5 significant digits or 100 ns, whichever is greater
*RST setting	zero seconds
Program Example	OUTPUT 714;"SETUP:PFERROR:TRIGGER:DELAY 1.2MS" ! sets trigger delay time to 1.2 milli-seconds

SETup:PFERror:TRIGer:SOURce

Function	Sets/queries the trigger source for Phase/Frequency Error measurements. see “Phase and Frequency Error Measurement Description” on page 72
Range	AUTO | PROTocol | RISE | IMMediate see “Triggering of Measurements” on page 121
Query	AUTO | PROT | RISE | IMM
*RST setting	AUTO
Program Example	OUTPUT 714;"SETUP:PFERROR:TRIGGER:SOURCE AUTO" ! sets trigger source to AUTO

SETup:PFERror:TRIGger:QUALifier

Function	Selects/queries the trigger qualifier for Phase/Frequency Error measurements see “Trigger Qualifier Description” on page 124
Setting	Range 0 | OFF | 1 | ON
Query	0 | 1
*RST setting	1 | on
Program Example	OUTPUT 714;"SETUP:PFERROR:TRIGGER:QUALIFIER OFF" ! sets trigger qualifier state to off

SETup:PVTime

Syntax Diagrams and Command Descriptions

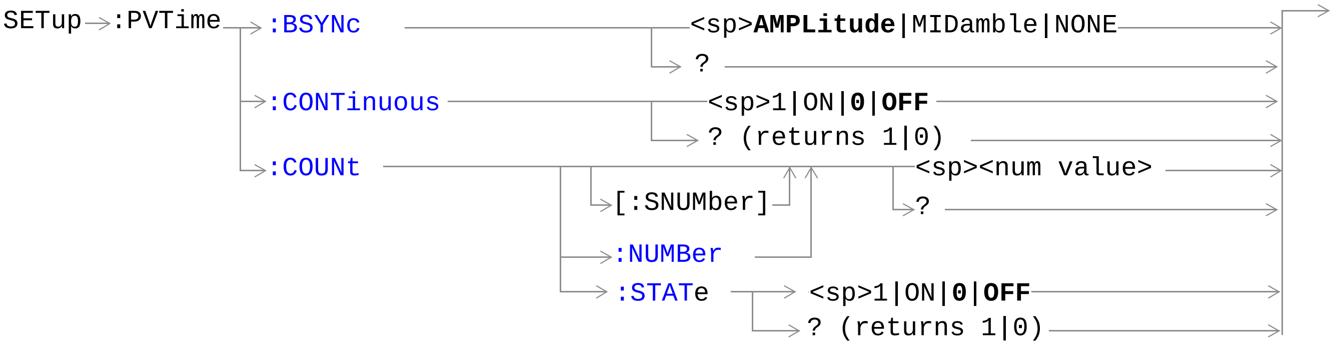
"SETup:PVTime<:BSYNc | :CONTinuous | :COUNt>" on page 348

"SETup:PVTime:TIME" on page 348

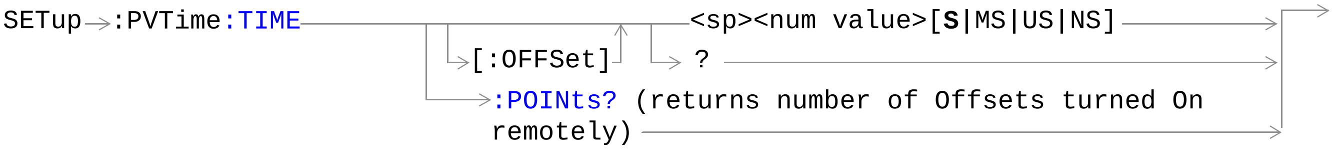
"SETup:PVTime:TIMeout" on page 348

"SETup:PVTime:TRIGger" on page 349

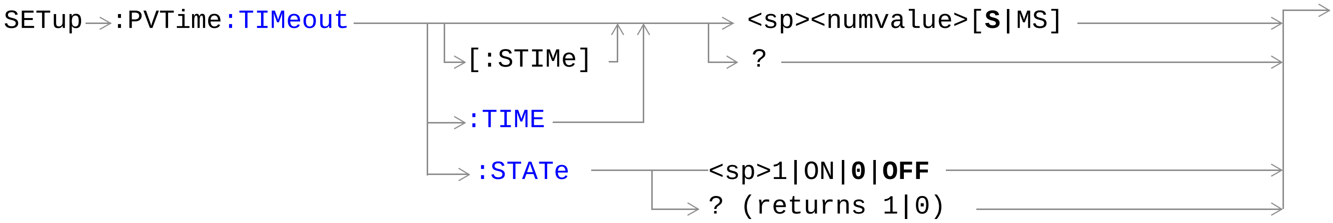
SETup:PVTime<:BSYNc | :CONTinuous | :COUNt>


SETup
:PVTime
:BSYNc
<sp>**AMPLitude**|MIDamble|NONE
?
:CONTinuous
<sp>1|ON|**0**|**OFF**
? (returns 1|0)
:COUNt
<sp><num value>
?
[:SNUMber]
:NUMBer
:STATe
<sp>1|ON|**0**|**OFF**
? (returns 1|0)

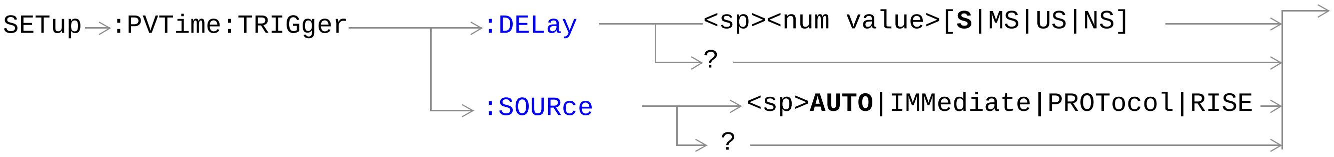
SETup:PVTime:TIME


SETup
:PVTime
:TIME
<sp><num value>[**S**|MS|US|NS]
?
[:OFFSet]
:POINts? (returns number of Offsets turned On remotely)

SETup:PVTime:TIMeout


SETup
:PVTime
:TIMeout
<sp><numvalue>[**S**|MS]
?
[:STIMe]
:TIME
:STATe
<sp>1|ON|**0**|**OFF**
? (returns 1|0)

SETup:PVTime:TRIGger



"Diagram Conventions" on page 187

SETup:PVTime:BSYNc

Function	Sets/queries the burst synchronization mode for power versus time measurements. See "Burst Synchronization of Measurements" on page 93.
Setting	MIDamble|AMPLitude|NONE
Query	MID | AMPL | NONE
*RST Setting	MID
Program Example	OUTPUT 714;"SETUP:PVTIME:BSYNC MIDAMBLE" ! selects burst synchronization to on midamble for power versus time measurements

SETup:PVTime:CONTinuous

Function	Sets/queries the trigger state for power versus time measurements. See "Measurement States" on page 123
Range	Single trigger mode = 0|OFF Continuous trigger mode = 1|ON
Query	0|1
*RST Setting	0|OFF
Program Example	OUTPUT 714;"SETUP:PVTIME: CONTINUOUS OFF" ! specifies single trigger mode for power versus time measurements.

SETup:PVTime:COUNt[:SNUMber]

Function	Sets/queries the number of power versus time measurements the test set will make and turns the multi-measurement count state on.
Setting	Range: 1 to 999 Resolution: 1
Query	Range: 1 to 999 Resolution: 1
*RST Setting	10
Program Example	OUTPUT 714;"SETUP:PVTIME:COUNT:SNUMBER 25" ! sets the state to on and the multi-measurement count value to 25

SETup:PVTime:COUNt:NUMBer

Function	Sets/queries the number of Power vs. Time measurements the test set will make when multi-measurement state is on.
Setting	Range: 1 to 999 Resolution: 1
Query	Range: 1 to 999 Resolution: 1
*RST Setting	10
Program Example	OUTPUT 714;"SETUP:PVTIME:COUNT:NUMBER 20" ! sets multi-measurement count value to 20

SETup:PVTime:COUNt:STATe

Function	Sets/queries power versus time multi-measurement count state.
Setting	0|OFF | 1| ON
Query	0|1
*RST Setting	0 |OFF
Program Example	OUTPUT 714;"SETUP:PVTIME:COUNT:STATE ON" ! sets multi-measurement count state to on

SETup:PVTime:TIME[:OFFSet]

Function	Sets/queries the time offsets in seconds for power vs time power measurement, (not the mask measurement). See "FETCh:PVTime:POWer" on page 283 All 12 time offsets are set to on by default. If less than 12 values are sent with this command, the remaining offsets are turned off, see "Power versus Time Measurement Description" on page 77. These values are referenced to the occurrence of bit 0 in a normal burst. The units (S | MS | US | NS) are optional, if no units are specified then units default to S.
Setting	Range: 0 to 12 comma-separated values ranging from: –50 us to 593 µs Resolution: 1 ns
Query	Range: 0 to 12 comma-separated values ranging from: –50 us to 593 µs and 9.91E+37 if no offsets are specified Resolution: 1 ns
*RST Setting	Time offsets 1 through 12 are on and set to these values: time offset 1 = –28 µs time offset 2 = –18 µs time offset 3 = –10 µs time offset 4 = 0 µs time offset 5 = 321.2 µs time offset 6 = 331.2 µs time offset 7 = 339.2 µs time offset 8 = 349.2 µs time offset 9 = 542.8 µs time offset 10 = 552.8 µs time offset 11 = 560.8 µs time offset 12 =570.8 µs
Program Example	OUTPUT 714;"SETUP:PVTIME:TIME:OFFSET –28.0 US, –18.0 US, –10.0 US, 0" !configures the first four time offset points and turns the remaining eight off. Using the query form of this command would return four time offset values.
	OUTPUT 714;"SETUP:PVTIME:TIME:OFFSET –28.0 US" !configures the first time offset point and turns the remaining eleven off. Using the query form of this command would return one time offset value.
	OUTPUT 714;"SETUP:PVTIME:TIME:OFFSET" !turns all 12 offset points off. Using the query form of this command would return 9.91E+37 (NAN).

SETup:PVTime:TIME:POINts?

Function	Queries the number of Measurement Offset points that are turned on during a power versus time measurement.
Query	Range: 0 to 12 Resolution: 1
*RST Setting	12
Comments	This command is useful for determining how many time values will be returned in a comma-separated list when the "SETup:PVTime:TIME[:OFFSet]" query is sent, and how many power values will be returned when the "FETCh:PVTime:POWer[:ALL][:MAXimum]?" on page 287 command is sent.

SETup:PVTime:TIMeout[:STIMe]

Function	Sets/queries the timeout value in seconds that will be used for power versus time measurements. This command also sets the timeout state to on. The units (S | MS) are optional, if no units are specified then units default to S.
Setting	Range: 1 to 999 Resolution: 1
Query	Range: 1 to 999 Resolution: 1
*RST Setting	10 seconds
Prgram Example	OUTPUT 714;"SETUP:PVTIME:TIMEOUT:STIME 4" ! sets the state to on and the timeout value to 4 seconds

SETup:PVTime:TIMeout:TIME

Function	Sets/queries the timeout value in seconds that will be used for power versus time measurements. The units (S | MS) are optional, if no units are specified then units default to S.
Setting	Range: 1 to 999 Resolution: 1
Query	Range: 1 to 999 Resolution: 1
*RST Setting	10 seconds
Program Example	OUTPUT 714;"SETUP:PVTIME:TIMEOUT:TIME 6" ! sets the timeout value to 6 seconds

SETup:PVTime:TIMeout:STATe

Function	Sets/queries power versus time timeout state.
Setting	0 |OFF | 1 | ON
Query	0 | 1
*RST Setting	0 | OFF
Program Example	OUTPUT 714;"SETUP:PVTIME:TIMEOUT:STATE ON" ! sets timeout state to on

SETup:PVTime:TRIGger:DELay

Function	Selects/queries the trigger delay in seconds for power versus time measurements. The units (S | MS | US | NS) are optional, if no units are specified then units default to S.
Range	Range: –2.31 ms to +2.31 ms Resolution: 5 significant digits or 100 ns, whichever is greater
Query	Range: –2.31 ms to +2.31 ms Resolution: 5 significant digits or 100 ns, whichever is greater
*RST Setting	0 seconds
Program Example	OUTPUT 714;"SETUP:PVTIME:TRIGGER:DELAY 1.1MS" ! sets trigger delay value to 1.1 milli-seconds

SETup:PVTime:TRIGger:SOURce

Function	Selects/queries the trigger source for power versus time measurements. See "Triggering of Measurements" on page 121
Setting	AUTO | PROTocol | RISE | IMMediate
Query	AUTO | PROT | RISE | IMM
*RST Setting	AUTO
Program Example	OUTPUT 714;"SETUP:PVTIME:TRIGGER:SOURCE AUTO" ! sets trigger source to AUTO

SETup:TXPower

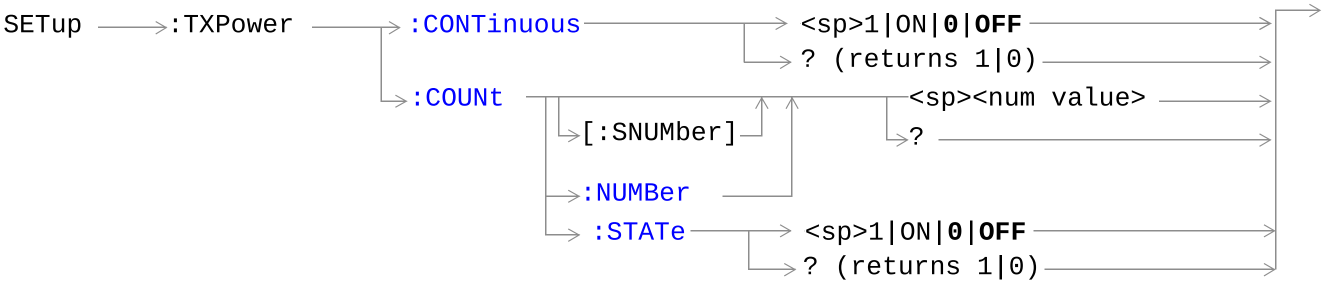
Syntax Diagrams and Command Descriptions

“SETup:TXPower<:CONTinuous | :COUNt>” on page 354

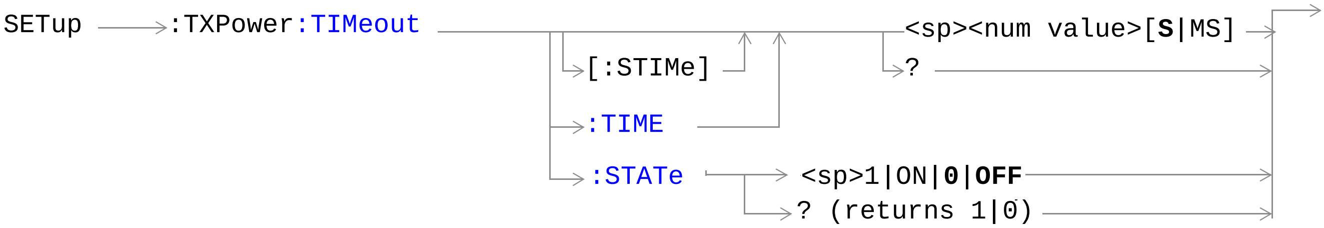
“SETup:TXPower:TIMeout” on page 354

“SETup:TXPower:TRIGger” on page 354

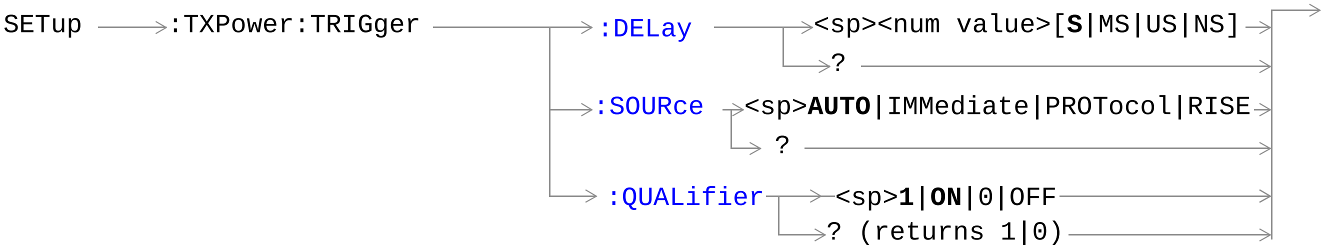
SETup:TXPower<:CONTinuous | :COUNt>


SETup
:TXPower
:CONTinuous
<sp>1|ON|0|OFF
? (returns 1|0)
:COUNt
<sp><num value>
[:SNUMber]
?
:NUMBer
:STATe
<sp>1|ON|0|OFF
? (returns 1|0)

SETup:TXPower:TIMeout


SETup
:TXPower:TIMeout
<sp><num value>[S|MS]
[:STIMe]
?
:TIME
:STATe
<sp>1|ON|0|OFF
? (returns 1|0)

SETup:TXPower:TRIGger


SETup
:TXPower:TRIGger
:DELay
<sp><num value>[S|MS|US|NS]
?
:SOURce
<sp>AUTO|IMMediate|PROTocol|RISE
?
:QUALifier
<sp>1|ON|0|OFF
? (returns 1|0)

“Diagram Conventions” on page 187

SETup:TXPower:CONTinuous

Function	Sets/queries the trigger state for TX Carrier Power measurements.
Setting	Single trigger mode = 0 | OFF Continuous trigger mode = 1 | ON
Query	0 | 1
*RST setting	0 | off
Program Example	OUTPUT 714;"SETUP:TXPOWER: CONTINUOUS OFF" ! specifies single trigger mode for TX Carrier Power measurements.

SETup:TXPower:COUNt[:SNUMber]

Function	Sets/queries the number of TX Carrier Power measurements the test set will make and turns the multi-measurement count state on.
Setting	Range: 1 to 999 Resolution: 1
Query	Range: 1 to 999 Resolution: 1
*RST setting	10
Program Example	OUTPUT 714;"SETUP:TXPOWER:COUNT:SNUMBER 99" ! sets the state to on and the multi-measurement count value to 99

SETup:TXPower:COUNt:NUMBer

Function	Sets/queries the number of TX Power measurements the test set will make when the multi-measurement state is on.
Setting	Range: 1 to 999 Resolution: 1
Query	Range: 1 to 999 Resolution: 1
*RST setting	10
Program Example	OUTPUT 714;"SETUP:TXPOWER:COUNT:NUMBER 5" ! sets the TX Power multi-measurement count number to 5.

SETup:TXPower:COUNt:STATe

Function	Sets/queries the TX Power multi-measurement count state.
Setting	0 | Off | 1 | On
Query	0 | 1
*RST setting	0 | off
Program Example	OUTPUT 714;"SETUP:TXPOWER:COUNT:STATE ON" ! sets the multi-measurement count state to on

SETup:TXPower:TIMeout[:STIMe]

Function	Sets/queries TX Carrier Power measurement timeout value and also sets the state to on. The units (S | MS) are optional, if no units are specified then units default to S.
Setting	Range: 1 to 999 Resolution: 1
Query	Range: 1 to 999 Resolution: 1
*RST setting	10 seconds
Program Example	OUTPUT 714;"SETUP:TXPOWER:TIMEOUT:STIME 20" ! sets the state to on and the timeout value to 20 seconds

SETup:TXPower:TIMeout:TIME

Function	Sets/queries the timeout value in seconds that will be used for TX Power measurements. The units (S | MS) are optional, if no units are specified then units default to S.
Setting	Range: 1 to 999 Resolution: 1
Query	Range: 1 to 999 Resolution: 1
*RST setting	10 seconds
Program Example	OUTPUT 714;"SETUP:TXPOWER:TIMEOUT:TIME 20" ! sets the TX Power measurement timeout to 20 seconds.

SETup:TXPower:TIMeout:STATe

Function	Selects/queries TX Carrier Power measurement timeout state.
Setting	0 | OFF | 1 | ON
Query	0 | 1
*RST setting	o | off
Program Example	OUTPUT 714;"SETUP:TXPOWER:COUNT:STATE 1" ! turns the TX carrier power timeout state on.

SETup:TXPower:TRIGger:DELay

Function	Sets/queries the trigger delay in seconds for TX Carrier Power measurements. The units (S | MS | US | NS) are optional, if no units are specified then units default to S.
Setting	Range: -2.31 ms to +2.31 ms Resolution: 5 significant digits or 100 ns, whichever is greater
Query	Range: -2.31 ms to +2.31 ms Resolution: 5 significant digits or 100 ns, whichever is greater
*RST setting	zero seconds
Program Example	OUTPUT 714;"SETUP:TXPOWER:TRIGGER:DELAY 1.5MS" ! set trigger delay time to 1.5 mill-seconds

SETup:TXPower:TRIGger:SOURce

Function	Selects/queries the trigger source for TX Carrier Power measurements. see "Triggering of Measurements" on page 121
Setting	AUTO | PROTocol | RISE | IMMediate
Query	AUTO | PROT | RISE | IMM
*RST setting	AUTO
Program Example	OUTPUT 714;"SETUP:TXPOWER:TRIGGER:SOURCE AUTO" ! sets trigger source to AUTO

SETup:TXPower:TRIGger:QUALifier

Function	Sets/queries the trigger qualification for TX Carrier Power measurements. When ON, an automatic trigger re-arm occurs if a measurement is triggered when no valid signal (burst) is present. see “Trigger Qualifier Description” on page 124
Setting	0|OFF | 1|ON
Query	0|1
*RST setting	1|on
Program Example	OUTPUT 714;”SETUP:TXPOWER:TRIGGER:QUALIFIER ON” ! sets trigger qualifier state to on

HP-IB STATus Subsystem

Description

The STATus subsystem is used to communicate current test set status information to the controlling application program.

Syntax Diagrams and Command Descriptions

“STATus:OPERation” on page 360

“STATus:PRESet” on page 366

“STATus:QUEStionable” on page 367

“Standard Event Status Register” on page 377

“Status Byte Register” on page 376

Status Register Bit Definitions

“Status Byte Register Bit Assignments” on page 376

“Standard Event Status Register Bit Assignment” on page 378

“STATus:QUEStionable Condition Register Bit Assignment” on page 370

“STATus:QUEStionable:CALL Condition Register Bit Assignment” on page 371

“STATus:QUEStionable:ERRors Condition Register Bit Assignment” on page 373

“STATus:QUEStionable:HARDware Condition Register Bit Assignment” on page 375

“STATus:OPERation Condition Register Bit Assignment” on page 362

“STATus:OPERation:CALL Condition Register Bit Assignment” on page 363

“STATus:OPERation:NMRReady Condition Register Bit Assignment” on page 365

STATus:OPERation

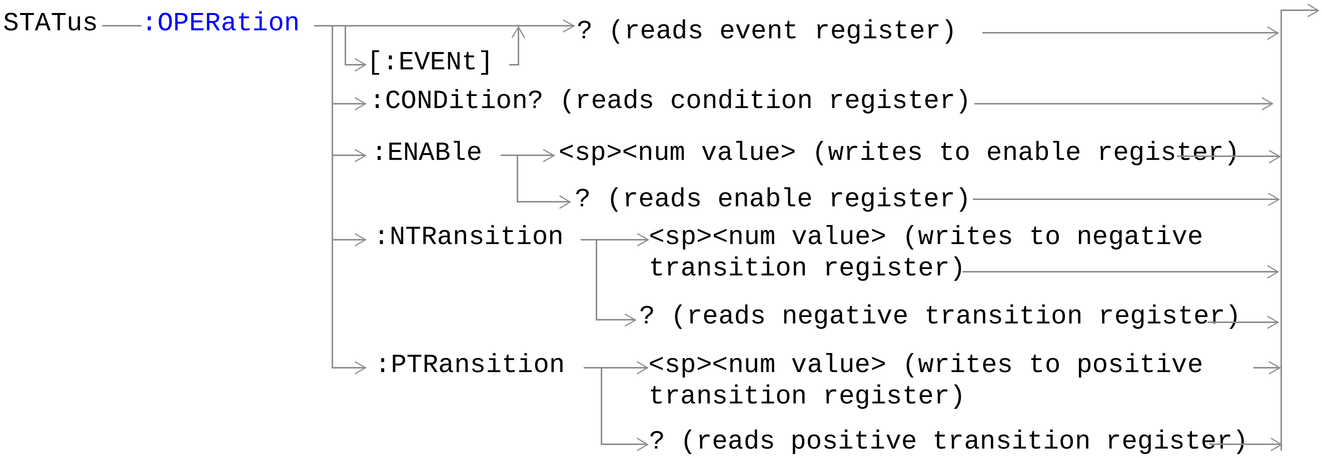
Syntax Diagrams and Command Descriptions

“STATus:OPERation” on page 360

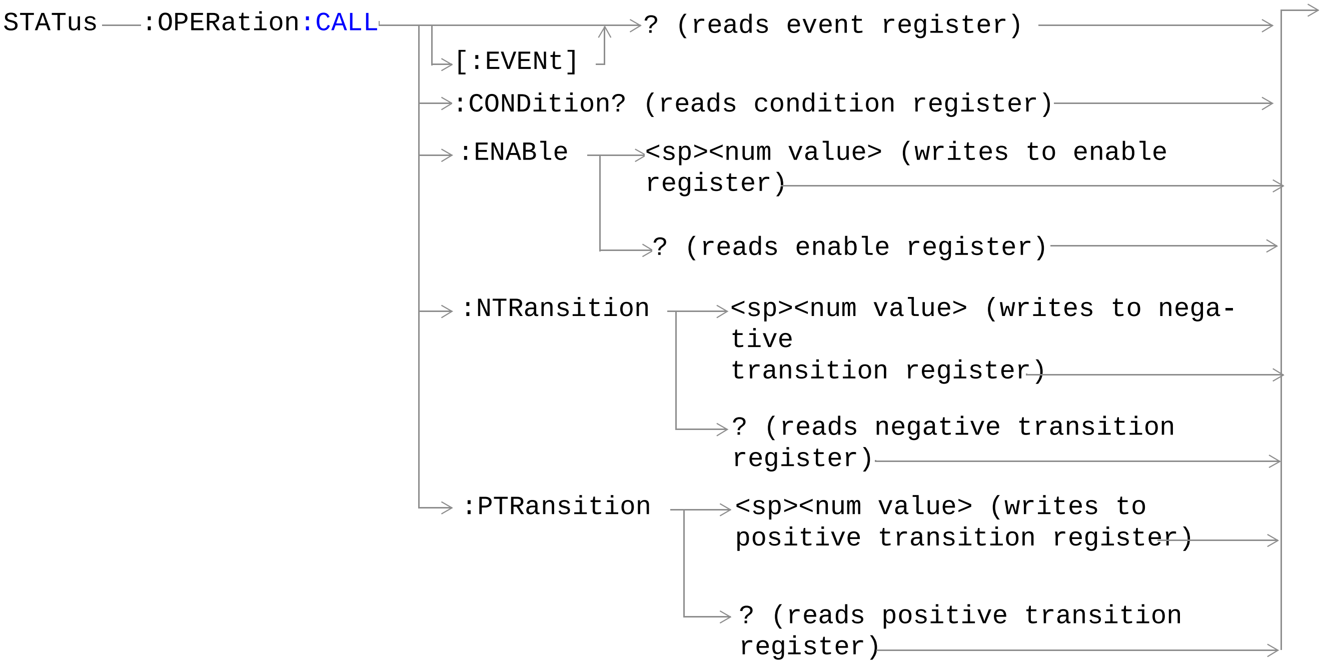
“STATus:OPERation:CALL” on page 361

“STATus:OPERation:NMRReady” on page 361

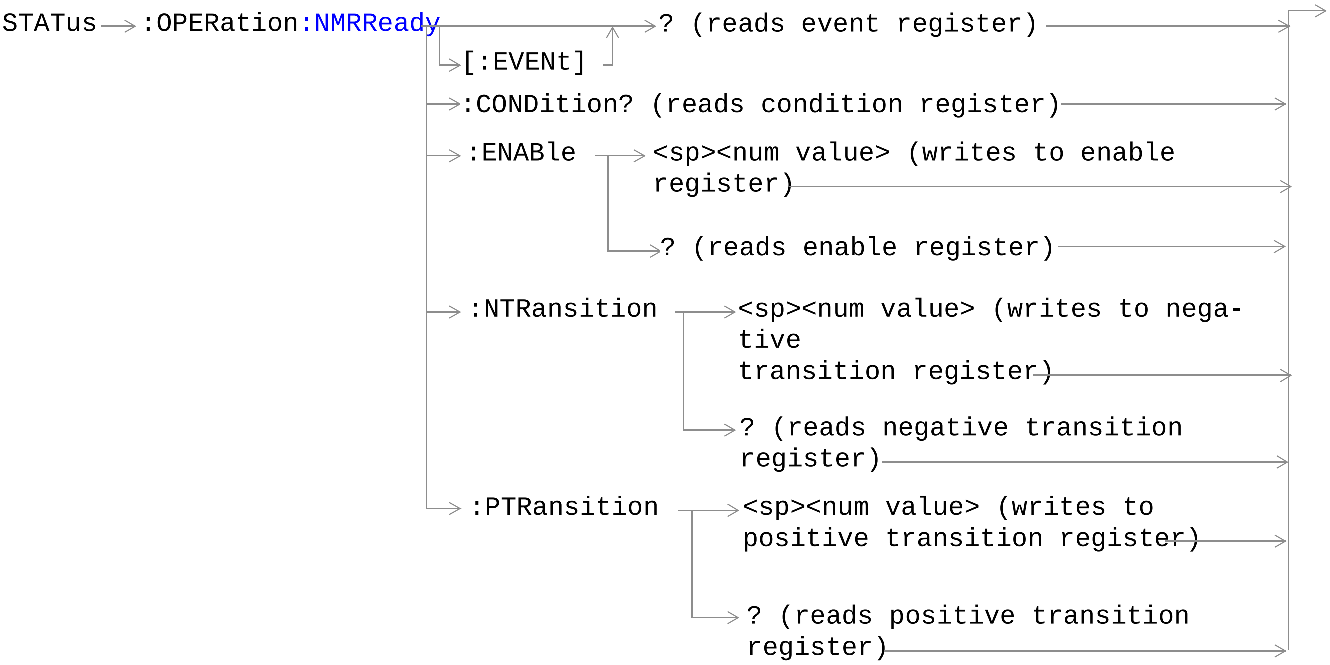
STATus:OPERation


STATus
:OPERation
? (reads event register)
[:EVENt]
:CONDition? (reads condition register)
:ENABle
<sp><num value> (writes to enable register)
? (reads enable register)
:NTRansition
<sp><num value> (writes to negative transition register)
? (reads negative transition register)
:PTRansition
<sp><num value> (writes to positive transition register)
? (reads positive transition register)

STATus:OPERation:CALL


STATus
:OPERation:CALL
? (reads event register)
[:EVENt]
:CONDition? (reads condition register)
:ENABle
<sp><num value> (writes to enable register)
? (reads enable register)
:NTRansition
<sp><num value> (writes to negative transition register)
? (reads negative transition register)
:PTRansition
<sp><num value> (writes to positive transition register)
? (reads positive transition register)

STATus:OPERation:NMRReady


STATus
:OPERation:NMRReady
? (reads event register)
[:EVENt]
:CONDition? (reads condition register)
:ENABle
<sp><num value> (writes to enable register)
? (reads enable register)
:NTRansition
<sp><num value> (writes to negative transition register)
? (reads negative transition register)
:PTRansition
<sp><num value> (writes to positive transition register)
? (reads positive transition register)

“Diagram Conventions” on page 187

STATus:OPERation Condition Register Bit Assignment

The OPERation status register set contains bits which give an indication of conditions that are part of the test set’s normal operation.

Bit Number	Binary Weighting	Condition	Description
15	32768	Not Used. Defined by SCPI.	This bit will always be 0.
14	16384	Reserved for future use.	This bit will always be 0.
13	8192	Reserved for future use.	This bit will always be 0.
12	4096	Processing SYSTem:SYNChronized Command	This condition bit will be “pulsed” by the SYSTem:SYNChronized command. This will allow the status system to indicate that the input buffer is synchronized to the point where this command is parsed and that all prior sequential commands are completed and all prior overlapped commands have started.
11	2048	Reserved for future use	This bit will always be 0.
10	1024	CALL Summary	This bit is the summary bit for the OPERation:CALL register.
9	512	NMRReady (New Measurement Result Ready) Summary	This bit is the summary bit for the OPERation:NMRReady register.
8	256	Reserved for future use.	This bit will always be 0.
7	128	Reserved for future use.	This bit will always be 0.
6	64	Reserved for future use.	This bit will always be 0.
5	32	Reserved for future use.	This bit will always be 0.
4	16	Reserved for future use.	This bit will always be 0.
3	8	Reserved for future use.	This bit will always be 0.
2	4	Reserved for future use.	This bit will always be 0.
1	2	Reserved for future use.	This bit will always be 0.
0	1	Extension Bit	This bit will always be 0.

```
OUTPUT 714;”STATUS:QUESTIONABLE:ERRORS:EVENT?” !Queries the Operation Event Register.
```

STATus:OPERation:CALL Condition Register Bit Assignment

The STATus:OPERation:CALL register bits will be used to indicate status of processes that occur during normal call processing operations.

Bit Number	Binary Weighting	Condition	Description
15	32768	Not Used. Defined by SCPI.	This bit will always be 0.
14	16384	Reserved for future use.	This bit will always be 0.
13	8192	Reserved for future use.)	This bit will always be 0.
12	4096	Reserved for future use.	This bit will always be 0.
11	2048	Reserved for future use.	This bit will always be 0.
10	1024	Reserved for future use.	This bit will always be 0.
9	512	Reserved for future use.	This bit will always be 0.
8	256	BS Disconnecting	This bit will be a 1 when: • Active Cell mode - the call processing state reaches (or is in) the idle state • Test mode - the test set has noted a base station termination.
7	128	BS Originating	This bit will be a 1 when: • Active Cell mode - the call processing state leaves the idle state • Test mode - the test set has noted a base station origination.
6	64	Call Control Status Changing	This bit is set to a 1 when the call control status change detector has been disarmed.
5	32	TCH Assignment in Progress	This bit will be a 1 when: • The channel assignment is successfully completed (when a call is established). • The test set notes a change in the TCH ARFCN, cell band, TCH timeslot, or mobile station timing advance. • An error message is generated.
4	16	BCH Changing	This bit will be a 1 when: • The downlink signal is transmitting on the new broadcast channel. • The test set has noted a change in cell band.
3	8	Call Control Status Alerting	This bit will be a 1 when the test set is in the call alerting state (ringing).

Bit Number	Binary Weighting	Condition	Description
2	4	Call Control Status Connected	This bit will be a 1 when the test set is in the call connected state.
1	2	Call Control Status Idle	This bit will be a 1 when the test set is in the call idle state.
0	1	Extension Bit	This bit will always be 0.

```
OUTPUT 714;"STATUS:OPERATION:CALL:EVENT?" !Queries the Operation Call Event Register.
```

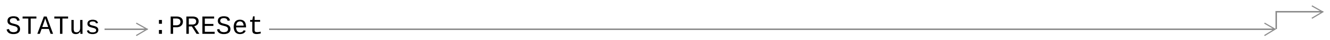
STATus:OPERation:NMRReady Condition Register Bit Assignment

The STATus:OPERation:NMRReady register bits indicate when a measurement has been completed and new measurement results are available.

Bit Number	Binary Weighting	Condition	Description
15	32768	Not Used. Defined by SCPI.	This bit will always be 0.
14	16384	Reserved for future use.	This bit will always be 0.
13	8192	Reserved for future use.	This bit will always be 0.
12	4096	Reserved for future use.	This bit will always be 0.
11	2048	Reserved for future use.	This bit will always be 0.
10	1024	Reserved for future use.	This bit will always be 0.
9	512	Reserved for future use.	This bit will always be 0.
8	256	BERRor New Measurement Result Ready	This bit will be a 1 if the measurement has produced new results
7	128	FBERror New Measurement Result Ready	This bit will be a 1 if the measurement has produced new results
6	64	DAUDio New Measurement Result Ready	This bit will be a 1 if the measurement has produced new results
5	32	AAUDio New Measurement Result Ready	This bit will be a 1 if the measurement has produced new results
4	16	ORFSpectrum New Measurement Result Ready	This bit will be a 1 if the measurement has produced new results
3	8	PFERror New Measurement Result Ready	This bit will be a 1 if the measurement has produced new results
2	4	PVTime New Measurement Result Ready	This bit will be a 1 if the measurement has produced new results
1	2	TXPower New Measurement Result Ready	This bit will be a 1 if the measurement has produced new results
0	1	Extension Bit	This bit will always be 0.

```
OUTPUT 714;”STATUS:OPERATION:NMRREADY:EVENT?” !Queries the New Measurement Results Ready
Event Register.
```

STATus:PRESet



“Diagram Conventions” on page 187

STATus:PRESet

Function	Presets the Status Subsystem Sets all Enable Registers to 0 (not enabled). Sets all Positive Transition Registers (PTR) to 1 (positive transitions enabled). Sets all Negative Transition Registers (NTR) to 0 (negative transitions disabled)

STATus:QUEStionable

Syntax Diagrams and Command Descriptions

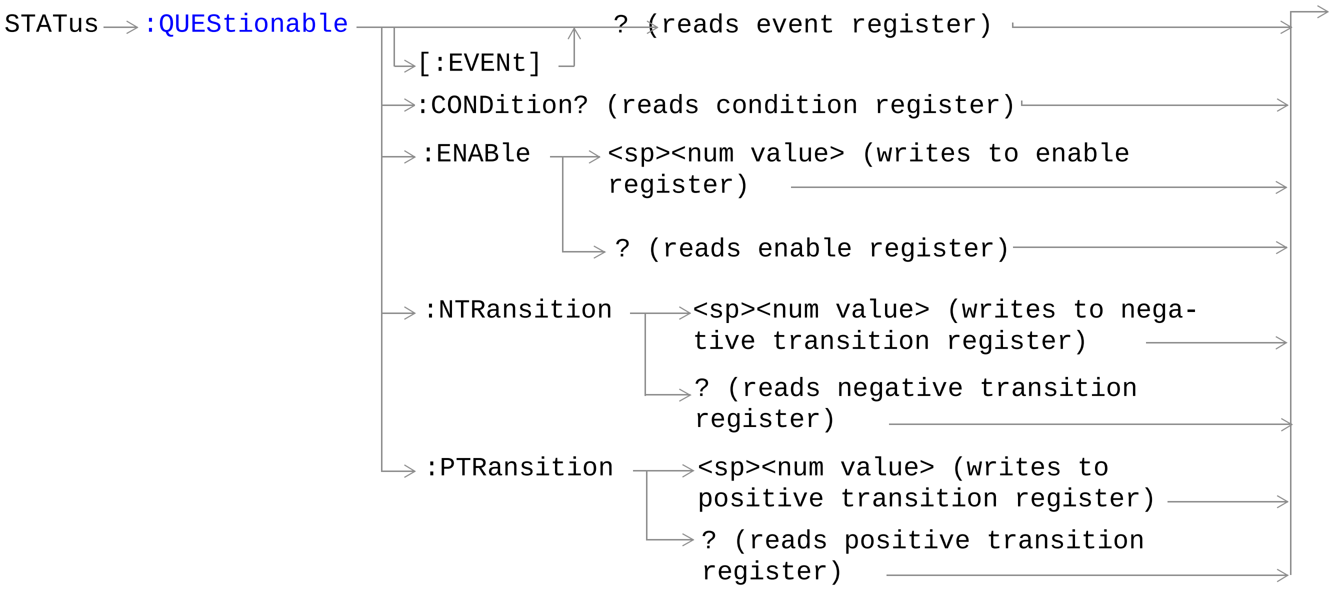
"STATus:QUEStionable" on page 367

"STATus:QUEStionable:CALL" on page 368

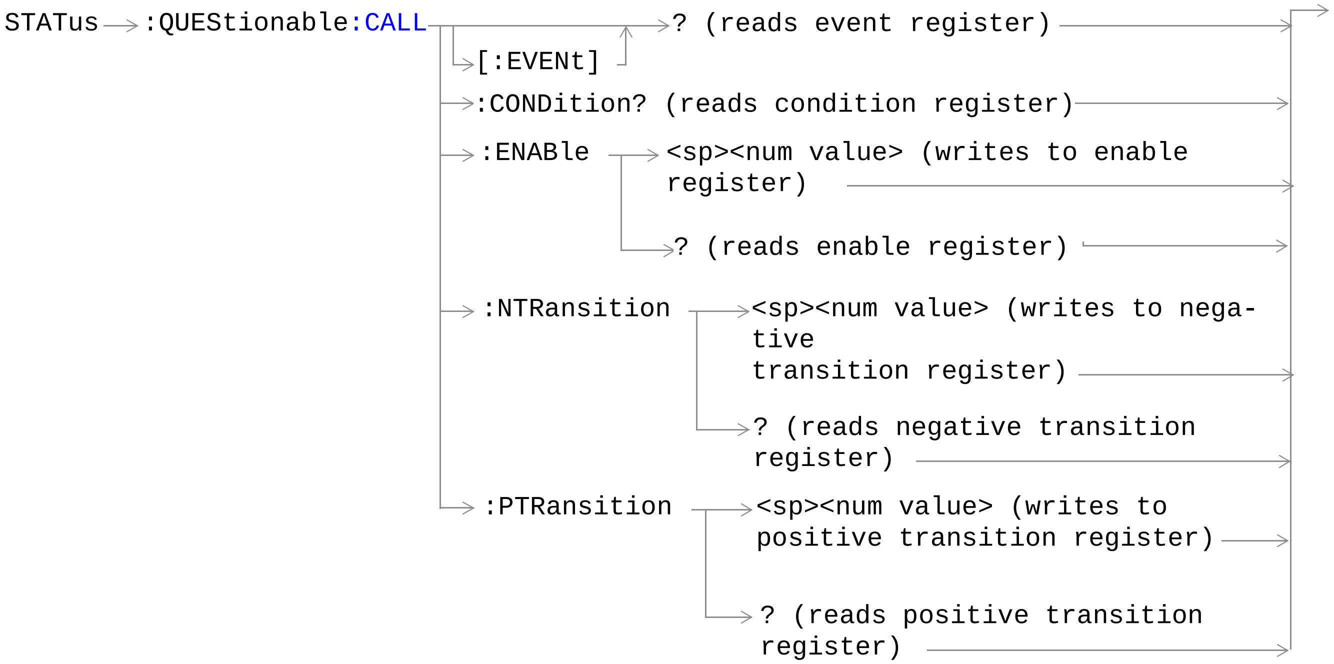
"STATus:QUEStionable:ERRors" on page 368

"STATus:QUEStionable:HARDware" on page 369

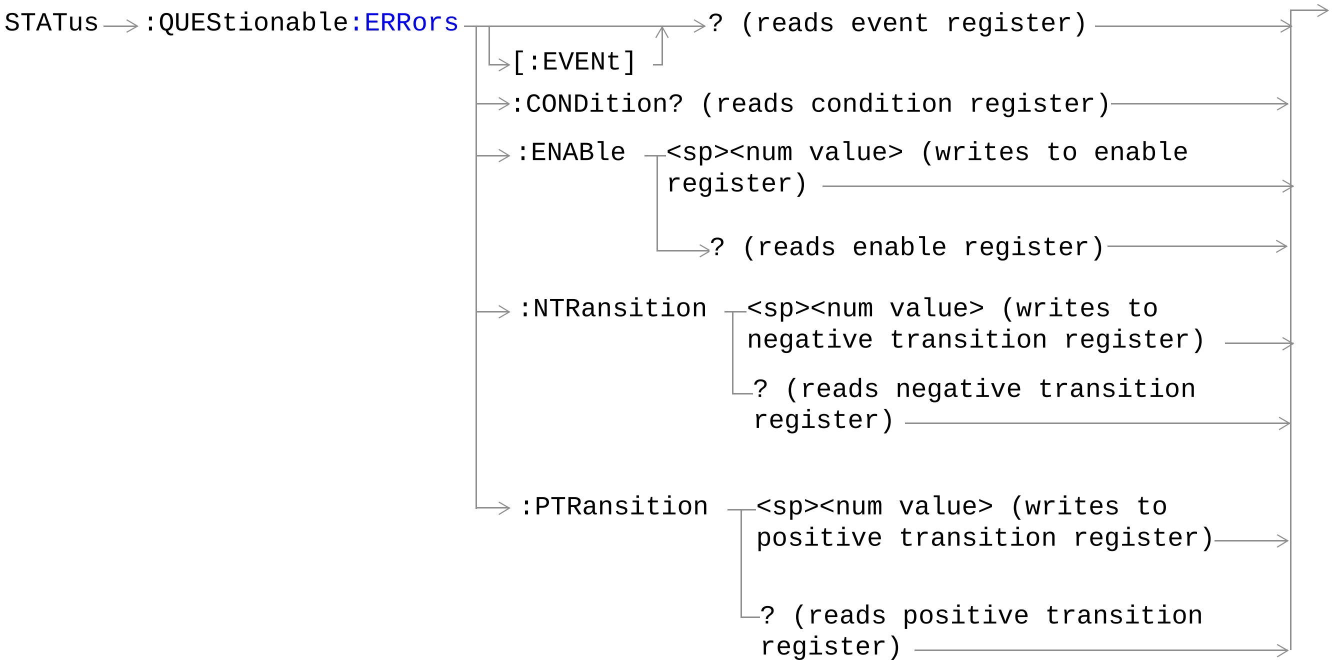
STATus:QUEStionable


STATus
:QUEStionable
[:EVENt]
? (reads event register)
:CONDition? (reads condition register)
:ENABle
<sp><num value> (writes to enable register)
? (reads enable register)
:NTRansition
<sp><num value> (writes to negative transition register)
? (reads negative transition register)
:PTRansition
<sp><num value> (writes to positive transition register)
? (reads positive transition register)

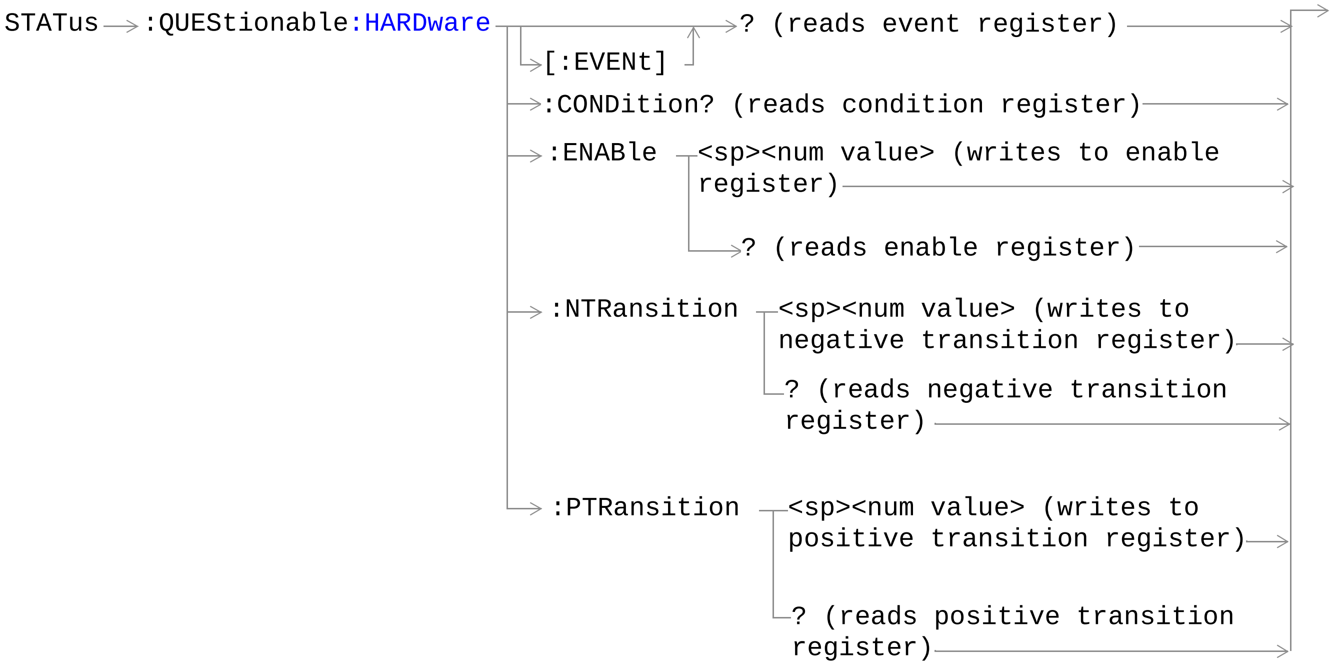
STATus:QUEStionable:CALL


STATus
:QUEStionable:CALL
? (reads event register)
[:EVENt]
:CONDition? (reads condition register)
:ENABle
<sp><num value> (writes to enable register)
? (reads enable register)
:NTRansition
<sp><num value> (writes to negative transition register)
? (reads negative transition register)
:PTRansition
<sp><num value> (writes to positive transition register)
? (reads positive transition register)

STATus:QUEStionable:ERRors


STATus
:QUEStionable:ERRors
? (reads event register)
[:EVENt]
:CONDition? (reads condition register)
:ENABle
<sp><num value> (writes to enable register)
? (reads enable register)
:NTRansition
<sp><num value> (writes to negative transition register)
? (reads negative transition register)
:PTRansition
<sp><num value> (writes to positive transition register)
? (reads positive transition register)

STATus:QUEStionable:HARDware


STATus
:QUEStionable:HARDware
? (reads event register)
[:EVENt]
:CONDition? (reads condition register)
:ENABle
<sp><num value> (writes to enable register)
? (reads enable register)
:NTRansition
<sp><num value> (writes to negative transition register)
? (reads negative transition register)
:PTRansition
<sp><num value> (writes to positive transition register)
? (reads positive transition register)

“Diagram Conventions” on page 187

STATus:QUEStionable Condition Register Bit Assignment

The STATus:QUEStionable register contains bits which give an indication that the data currently being acquired or generated is of questionable quality due to some condition affecting the parameter associated with that bit.

Bit Number	Binary Weighting	Condition	Description
15	32768	Not Used. Defined by SCPI.	This bit will always be 0.
14	16384	Reserved for future use.	This bit will always be 0.
13	8192	Reserved for future use.	This bit will always be 0.
12	4096	Reserved for future use.	This bit will always be set to 0.
11	2048	QUEStionable:HARDware summary	This bit is the summary bit for the QUEStionable:HARDware register.
10	1024	QUEStionable:CALL summary	This bit is the summary bit for the QUEStionable:CALL register.
9	512	Reserved for future use.	This bit will always be 0.
8	256	Reserved for future use.	This bit will always be 0.
7	128	Reserved for future use.	This bit will always be 0.
6	64	Reserved for future use.	This bit will always be 0.
5	32	Reserved for future use.	This bit will always be 0.
4	16	Reserved for future use.	This bit will always be 0.
3	8	Reserved for future use.	This bit will always be 0.
2	4	Reserved for future use.	This bit will always be 0.
1	2	QUEStionable:ERRors summary	This bit is the summary bit for the QUEStionable:ERRors register.
0	1	Reserved for future use.	This bit will always be 0.

```
OUTPUT 714;”STATUS:QUESTIONABLE:EVENT?” !Queries the Questionable Event Register
```

STATus:QUEStionable:CALL Condition Register Bit Assignment

The STATus:QUEStionable:CALL registers will contain information about which event(s) occurred during call processing that indicate why the call processing procedure failed

Bit Number	Binary Weighting	Condition	Description
15	32768	Not Used. Defined by SCPI.	This bit will always be 0.
14	16384	Reserved for future use.	This bit will always be 0.
13	8192	Reserved for future use.	This bit will always be 0.
12	4096	Reserved for future use.	This bit will always be 0.
11	2048	Reserved for future use.	This bit will always be 0.
10	1024	Reserved for future use.	This bit will always be 0.
9	512	Reserved for future use.	This bit will always be 0.
8	256	Identification failure	This bit is a 1 if the identity request timer (T3270) has expired. The timer expires if the mobile does not respond to identity request message, within 5 seconds.
7	128	Channel Assignment exceeded specified number of frames	This bit is a 1 if the channel assignment exceeded the specified number of frames.
6	64	Call disconnected: No Response to Page	This bit is a 1 if the paging timer (T3113) has expired. The timer expires if the mobile does not respond to a paging request message, within 5 seconds.
5	32	Call disconnected: Handover Failure	This bit is a 1 if the physical information timer (T3105) has expired. The timer expires if the mobile does not respond to a physical information message, within 50 ms. If the timer has expired and correctly decoded data or a TCH frame has not been received, newly allocated channels are released.
4	16	Call disconnected: Channel Assignment Failure	This bit is a 1 if the channel assignment timer (T3107) has expired. The timer expires if the mobile does not respond to an assignment command message within 3 seconds.
3	8	Call disconnected: Immediate Assignment Failure	This bit is a 1 if the immediate assignment timer (T3101) has expired. The timer expires after 1 second if a signaling link is not established when an immediate assignment or immediate assignment extended message is sent. If the timer expires, newly allocated channels are released.

Bit Number	Binary Weighting	Condition	Description
2	4	Call disconnected: Radio Link Failure	This bit is a 1 if the radio link timeout (T100) has expired. The timer expires if a radio link is not detected within four SACCH mulitframes (1.92 seconds if no SACCH is present).
1	2	Call disconnected: Data Link Failure	This bit is a 1 if the data link timer (T200) has expired. This timer is used for retransmission on the data link. The expiration period of the timer depends on the message type (for FACCH, 155 ms).
0	1	Extension Bit	This bit will always be 0.

```
OUTPUT 714;"STATUS:QUESTIONABLE:CALL:CONDITION?" !Queries the Questionable Call Condition
Register.
```

STATus:QUEStionable:ERRors Condition Register Bit Assignment

The STATus:QUEStionable:ERRors register bits will be used to indicate information about test set device-specific errors (positive error numbers).

Bit Number	Binary Weighting	Condition	Description
15	32768	Not Used. Defined by SCPI.	This bit will always be 0.
14	16384	Reserved for future use.	This bit will always be 0.
13	8192	Reserved for future use.	This bit will always be 0.
12	4096	Reserved for future use.	This bit will always be 0.
11	2048	Reserved for future use.	This bit will always be 0.
10	1024	Reserved for future use.	This bit will always be 0.
9	512	+900 Errors	The condition bit will be pulsed to a 1 and immediately back to 0 if an error in the +900 to +999 range occurs. Query the Event Register to find out if one of these errors occurred.
8	256	+800 Errors	The condition bit will be pulsed to a 1 and immediately back to 0 if an error in the +800 to +899 range occurs. Query the Event Register to find out if one of these errors occurred.
7	128	+700 Errors	The condition bit will be pulsed to a 1 and immediately back to 0 if an error in the +700 to +799 range occurs. Query the Event Register to find out if one of these errors occurred.
6	64	+600 Errors	The condition bit will be pulsed to a 1 and immediately back to 0 if an error in the +600 to +699 range occurs. Query the Event Register to find out if one of these errors occurred.
5	32	+500 Errors	The condition bit will be pulsed to a 1 and immediately back to 0 if an error in the +500 to +599 range occurs. Query the Event Register to find out if one of these errors occurred.
4	16	+400 Errors	The condition bit will be pulsed to a 1 and immediately back to 0 if an error in the +400 to +499 range occurs. Query the Event Register to find out if one of these errors occurred.
3	8	+300 Errors	The condition bit will be pulsed to a 1 and immediately back to 0 if an error in the +300 to +399 range occurs. Query the Event Register to find out if one of these errors occurred.

Bit Number	Binary Weighting	Condition	Description
2	4	+200 Errors	The condition bit will be pulsed to a 1 and immediately back to 0 if an error in the +200 to +299 range occurs. Query the Event Register to find out if one of these errors occurred.
1	2	+100 Errors	The condition bit will be pulsed to a 1 and immediately back to 0 if an error in the +100 to +199 range occurs. Query the Event Register to find out if one of these errors occurred.
0	1	Extension Bit	This bit will always be 0.

```
OUTPUT 714;”STATUS:QUESTIONABLE:ERRORS:EVENT?” !Queries the Questionable Errors Event
Register.
```

STATus:QUEStionable:HARDware Condition Register Bit Assignment

The STATus:QUEStionable:HARDware register bits give an indication that the data/signals currently being aquired or generated are of questionable quality.

Bit Number	Binary Weighting	Condition	Description
15	32768	Not Used. Defined by SCPI.	This bit will always be 0.
14	16384	Reserved for future use.	This bit will always be 0.
13	8192	Reserved for future use.	This bit will always be 0.
12	4096	Reserved for future use.	This bit will always be 0.
11	2048	Reserved for future use.	This bit will always be 0.
10	1024	Reserved for future use.	This bit will always be 0.
9	512	Reserved for future use.	This bit will always be 0.
8	256	Reserved for future use.	This bit will always be 0.
7	128	Reserved for future use.	This bit will always be 0.
6	64	Reserved for future use.	This bit will always be 0.
5	32	Reserved for future use.	This bit will always be 0.
4	16	Power-up Self Test(s) Failed	This bit will be a 1 if the power-up self tests failed.
3	8	Reserved for future use.	This bit will always be 0.
2	4	Reserved for future use.	This bit will always be 0.
1	2	Reserved for future use.	This bit will always be 0.
0	1	Extension Bit.	This bit will always be 0.

```
OUTPUT 714;”STATUS:QUESTIONABLE:HARDWARE:CONDITION?” !Queries the Questionable Hardware
Condition Register.
```

Status Byte Register

*STB?

*STB?

NOTE The Status Byte Register can also be read with a serial poll. For example, the command "Status_byte = SPOLL(714)" would perform a serial poll of the Status Byte Register, returning and releasing RQS (bit 6).

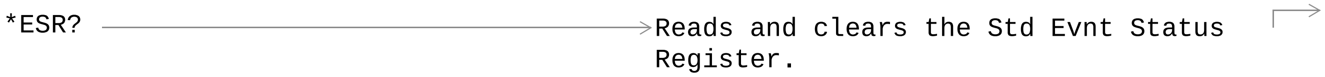
Status Byte Register Bit Assignments

Bit Number	Binary Weighting	Label	Description
7	128	STATus: OPERation	Summarizes the STATus: OPERation Status Register, which fans out to the NMRReady and CALL Status Registers.
6	64	RQS (SRQ TRUE?)/Master Summary Status	RQS is read by a serial poll (SPOLL) Master Summary Status is read by a *STB? query - defined by IEEE 488.2
5	32	Standard Event Status Register	Summarizes the Standard Event Status Register
4	16	Message Available	SCPI - Defined
3	8	STATus: QUEStionable Status Register	Summary Message comes from the STATus: QUEStionable Status Register, which fans out to the CALL and HARDware Status Registers
2	4	Error/ Event Queue	SCPI - Defined
1	2	Reserved	
0	1	Reserved	

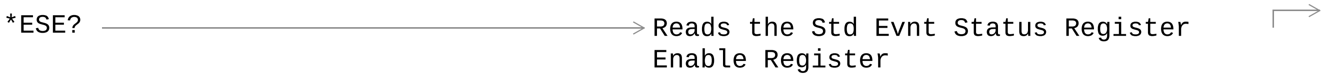
```
OUTPUT 714;”*STB?” ! Queries the Status Byte
```

Standard Event Status Register

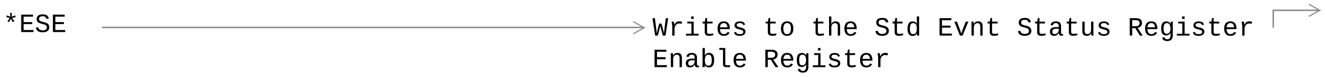
*ESR?


*ESR? → Reads and clears the Std Evnt Status Register.

*ESE?


*ESE? → Reads the Std Evnt Status Register Enable Register

*ESE


*ESE → Writes to the Std Evnt Status Register Enable Register

"Diagram Conventions" on page 187

Standard Event Status Register Bit Assignment

Bit Number	Binary Weighting	Condition	Description
15	32768	Reserved by IEEE.	This bit will always be 0.
14	16384	Reserved by IEEE.	This bit will always be 0.
13	8192	Reserved by IEEE.	This bit will always be 0.
12	4096	Reserved by IEEE.	This bit will always be 0.
11	2048	Reserved by IEEE.	This bit will always be 0.
10	1024	Reserved by IEEE.	This bit will always be 0.
9	512	Reserved by IEEE.	This bit will always be 0.
8	256	Reserved by IEEE.	This bit will always be 0.
7	128	Power On	This bit is set to 1 if the power supply has been turned off and on since the last time this register was read or otherwise cleared. Defined in "IEEE Std. 488.2-1992",11.5.1.1.2
6	64	Reserved for future use.	This bit will always be 0.
5	32	Command Error	This bit is set to 1 if the test set detects an error while trying to process a command. The following events cause a command error: • An IEEE 488.2 syntax error. The test set received a message that did not follow the syntax defined by the standard. • A semantic error. For example the test set recieved anincorrectly spelled command. • The test set received a group execution trigger (GET) inside a program message
4	16	Execution Error	This bit is set to 1 if the test set detects an error while trying to execute a command. The following events cause a execution error: • A <PROGRAM DATA> element received in a command is outside the legal range for the test set, or it is inconsistent with the operation of the test set. • The test set could not execute a valid command due to some test set hardware/firmware condition.

Bit Number	Binary Weighting	Condition	Description
3	8	Device Dependent Error	This bit is set to 1 if a test set operation does not execute properly due to an internal condition (such as, overrange). This bit indicates that the error was not a command, query, or execution error.
2	4	Query Error	This bit is set to 1 if an error has occurred while trying to read the test set's output queue. The following events cause a query error: • An attempt is made to read data from the output queue when no data is present or is pending. • Data in the output queue has been lost. An example of this would be an output queue overflow.
1	2	Reserved for future use.	This bit will always be 0.
0	1	Operation Complete	This bit is set to 1 when the test set has completed all pending operations and is ready to accept new commands. This bit is only generated in response to the *OPC IEEE 488.2 common command.

```
OUTPUT 714;”*ESR?” ! Queries (reads) the Standard Event Status Register
```

SYSTem Subsystem

Description

The SYSTem subsystem performs system configuration and non-measurement related functions such as:

- Setting the HP-IB and LAN addresses
- Setting Date and Time
- Correcting for RF path loss
- Presetting the Test Set

Syntax Diagrams and Command Descriptions

"SYSTem:BEEPer" on page 381

"SYSTem:COMMunicate" on page 382

"SYSTem:CORRection" on page 384

"SYSTem:CURRent (future functionality)" on page 386

"SYSTem:ERRor" on page 387

"SYSTem:FTRigger (future functionality)" on page 388

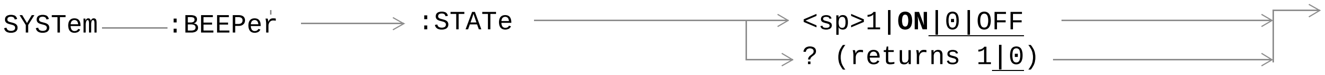
"SYSTem:MEASurement" on page 390

"SYSTem:PRESet" on page 391

"SYSTem:ROSCillator" on page 392

"SYSTem:SYNChronized" on page 393

SYSTem:BEEPer

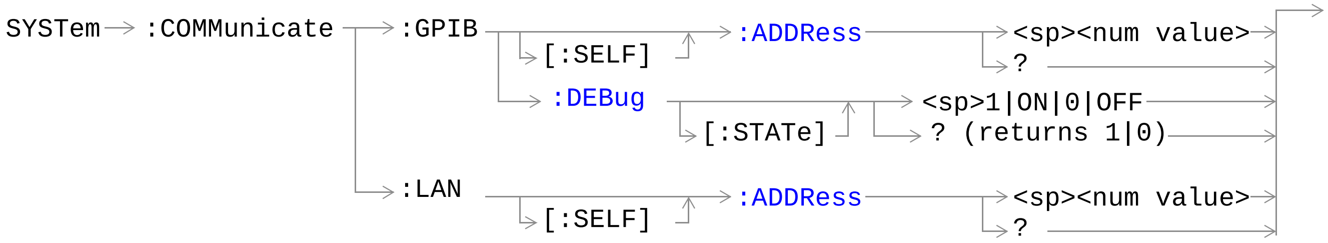


“Diagram Conventions” on page 187

SYSTem:BEEPer:STATe

Function	Sets/queries the beeper state of the test set.
Setting	0|OFF | 1|ON
Query	0|1
*RST Setting	1|on
Program Example	OUTPUT 714;"SYSTEM:BEEPER:STATE OFF" ! sets beeper state to off

SYSTem:COMMunicate


SYSTem
:COMMunicate
:GPIB
[:SELF]
:ADDRess
<sp><num value>
?
:DEBug
[:STATe]
<sp>1|ON|0|OFF
? (returns 1|0)
:LAN
[:SELF]
:ADDRess
<sp><num value>
?

“Diagram Conventions” on page 187

SYSTem:COMMunicate:GPIB:[:SELF]:ADDRess

Function	Sets/queries the test set’s HP-IB address.
Setting	Range: 0 to 30 Resolution: 1
Query	Range: 0 to 30 Resolution: 1
Factory setting	14 (this parameter is not affected by any reset operation and can only be changed by direct user access)
Program Example	`OUTPUT 714;”SYSTEM:COMMUNICATE:GPIB:SELF:ADDRESS 14” !sets the HP-IB address to 14`

“HP-IB” on page 450

SYSTem:COMMunicate:GPIB:DEBug

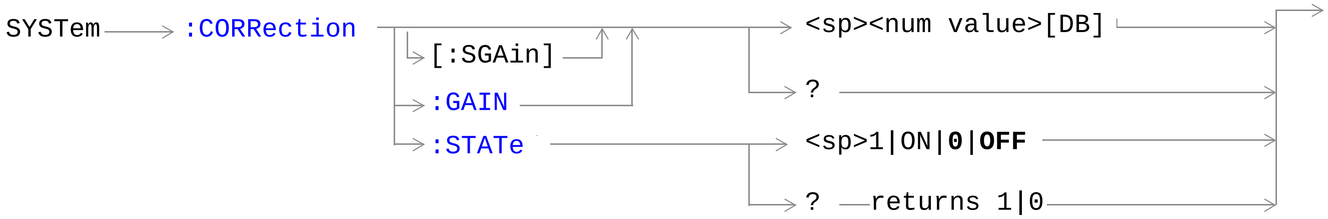
Function	Sets/queries the test set's SCPI debugger state.
Setting	Range: 0|OFF | 1|ON
Query	0|1
*RST setting	0|off
Program Example	OUTPUT 714;"SYSTEM:COMMUNICATE:GPIB:DEBUG:STATE ON" ! sets debugger to on

SYSTem:COMMunicate:LAN[:SELF]:ADDRess

Function	Sets/queries the test set's LAN ip address.
Setting	Range: 15 characters formatted as follows: A.B.C.D where A= 0 to 223 B,C,D = 0 to 255 (no embedded spaces)
Query	Range: 15 characters formatted as follows: A.B.C.D where A= 0 to 223 B,C,D = 0 to 255 (no embedded spaces)
Factory setting	0.0.0.0 (this parameter is not affected by any reset operation and can only be changed by direct user access)
Program Example	`OUTPUT 714;"SYSTEM:COMMUNICATE:LAN:SELF:ADDRESS '200.015.156.255'" !sets the LAN ip address`

“LAN” on page 450

SYSTem:CORRection


SYSTem
:CORRection
[:SGAin]
:GAIN
:STATe
<sp><num value>[DB]
?
<sp>1|ON|**0|OFF**
? returns 1|0

“Diagram Conventions” on page 187

SYSTem:CORRection[:SGAin]

Function	Sets/queries the amplitude offset value in dB, used to correct for RF path loss and also turns the STATe ON. See “Measurement Related Configuration” on page 451. The units, dB, are optional, if no units are specified then units default to dB.
Setting	Range: –100 to +100 Resolution: .1
Query	Range: –100 to +100 Resolution: 0.1
*RST Setting	0 dB
Program Example	OUTPUT 714;"SYSTEM:CORRECTION:SGAIN 6" ! sets an amplitude offset of 6 dB

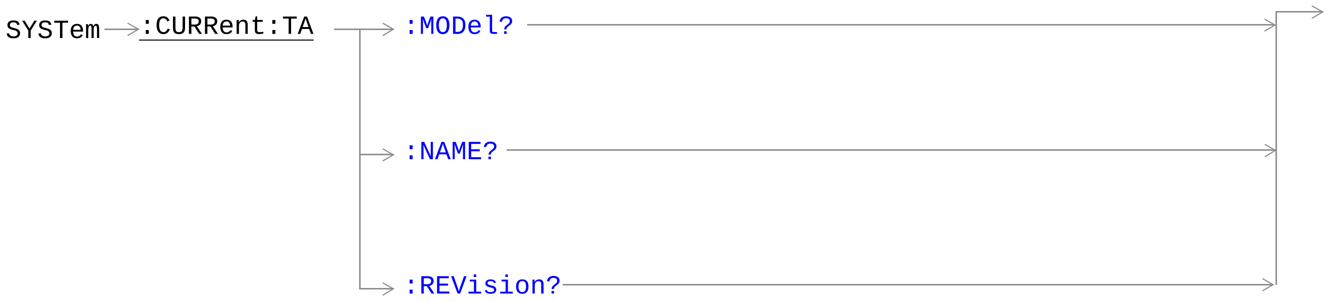
SYSTem:CORRection:GAIN

Function	Sets/queries the amplitude offset value in DB, used to correct for RF path loss when the correction state is on. See “Measurement Related Configuration” on page 451 The units DB are optional, if no units are specified then units default to DB.
Setting	Range: –100 to +100 Resolution: .1
Query	Range: –100 to +100 Resolution: .1
*RST Setting	0 dB
Program Example	OUTPUT 714;"SYSTEM:CORRECTION:GAIN 6" ! sets an amplitude offset of 6 dB

SYSTem:CORRection:STATe

Function	Sets/queries the amplitude offset state. See “Measurement Related Configuration” on page 451
Setting	0|OFF | 1|ON
Query	0|1
*RST Setting	0|off
Program Example	OUTPUT 714;"SYSTEM:CORRECTION:STATE ON" ! sets amplitude offset state on

SYSTem:CURRent (future functionality)



“Diagram Conventions” on page 187

SYSTem:MODel? (future functionality)

Function	$$
Data Type	character

SYSTem:CURRent:NAME? (future functionality)

Function	$$.
Data Type	character

SYSTem:CURRent:REVision? (future functionality)

Function	$$.
Data Type	character

SYSTem:ERRor

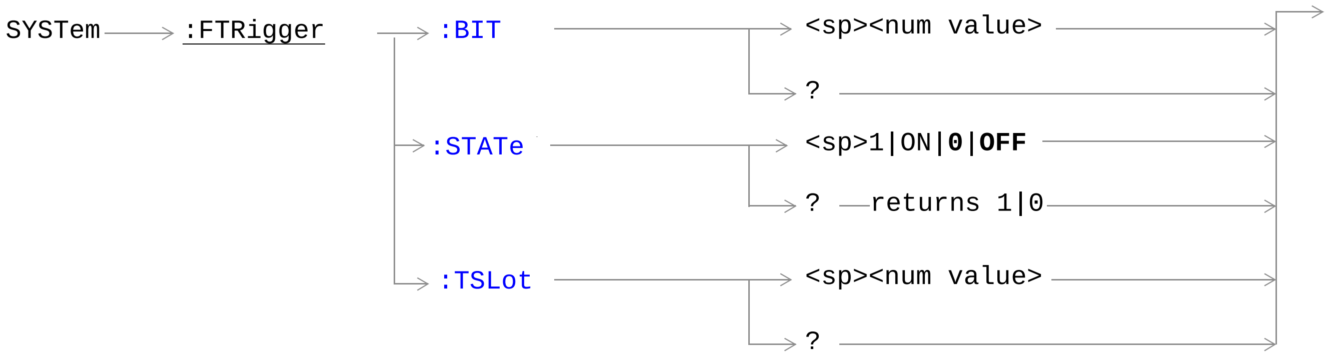
`SYSTem` → `:ERRor?` →

“Diagram Conventions” on page 187

SYSTem:ERRor?

Function	Querries the contents of the error/event queue. The error/event queue may contain one or more messages with an error or event description. see “Error Message List and Summary” on page 459
Query	Range: 0 to 100 messages up to 255 characters in length

SYSTem:FTRigger (future functionality)



"Diagram Conventions" on page 187

SYSTem:FTRigger:BIT (future functionality)

Function	Selects/queries which bit after zero will be used for rear-panel frame trigger pulse positioning. see "Setting Frame Trigger Parameters" on page 413
Setting	Range: 0 to 1250 Resolution: 1
Query	Range: 0 to 1250 Resolution: 1
*RST setting	zero
Program Example	OUTPUT 714;"SYSTEM:FRTIGGER:BIT 14" !would cause external frame trigger pulses to occur 14 bits after bit 0 of the selected timeslot.

SYSTem:FTRigger:STATe (future functionality)

Function	Sets/queries the rear-panel frame trigger state. see "Setting Frame Trigger Parameters" on page 413
Setting	0|OFF | 1|ON
Query	0|1
*RST setting	0|off
Program Example	OUTPUT 714;"SYSTEM:FRTIGGER:STATE ON" ! set frame trigger state to on

SYSTem:FTRigger:TSLot (future functionality)

Function	Selects/queries the timeslot for rear-panel frame trigger pulse positioning. see "Setting Frame Trigger Parameters" on page 413
Setting	Range: 0 to 7 Resolution: 1
Query	Range: 0 to 7 Resolution: 1
*RST setting	zero
Program Example	OUTPUT 714;"SYSTEM:FRTIGGER:TSLOT 5" ! sets timeslot to 5 for frame trigger

SYSTem:MEASurement

```
SYSTem ──> :MEASurement:RESet ──────────────────────────────>
```

“Diagram Conventions” on page 187

SYSTem:MEASurement:RESet

Function	Sets all measurements to abort, if the trigger arm is set to continuous the measurements will begin a new measurement cycle. see “Trigger Arm (Single or Continuous) Description” on page 123 Any measurement results are cleared and the Integrity Indicator is set to 1 (No_Result_Available). see “Integrity Indicator” on page 98
Setting	These results are set to their default values: • RACH Count • Page Count • Missing Burst Count • Corrupted Burst Count • Channel Decoder Error Count • MS TX Level Reported • TCH Timing Advance Reported • RX Level • RX Qual
Program Example	`OUTPUT 714;”SYSTEM:MEASUREMENT:RESET” ! resets all measurements`

SYSTem:PRESet

```
SYSTem → :PRESet[1]|PRESet2|PRESet3 →
```

"Diagram Conventions" on page 187

SYSTem:PRESet[1]

Function	Performs a partial preset. Any call in process is disconnected and all measurements are aborted. A partial preset will not modify any measurement settings including trigger arm. see "Trigger Arm (Single or Continuous) Description" on page 123
Program Example	OUTPUT 714;"SYSTEM:PRESET" ! partial preset

SYSTem:PRESet2

Function	Performs a full preset the same as using *RST. All parameters are set to their default values. All measurements are aborted the trigger arm is set to single. see "Trigger Arm (Single or Continuous) Description" on page 123
Program Example	OUTPUT 714;"SYSTEM:PRESET2" ! full preset
Program Example	OUTPUT 714;"*RST" ! full preset

SYSTem:PRESet3

Function	Performs a partial preset. Any call in process is disconnected and all measurements are aborted. The Operating Mode is set to Active Cell, see "Active Cell Operating Mode" on page 408. The Call Control Status is set to idle, see "Measurement States" on page 123. A partial preset will not modify any measurement settings including trigger arm. see "Trigger Arm (Single or Continuous) Description" on page 123
Program Example	OUTPUT 714;"SYSTEM:PRESET3" ! partial preset

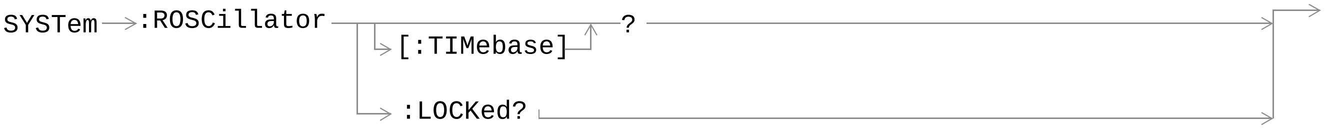
Related Topics

****

"Preset descriptions" on page 431

****

SYSTem:ROSCillator



"Diagram Conventions" on page 187

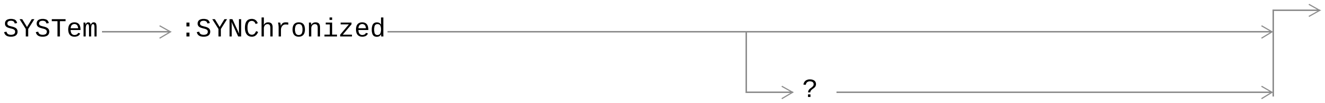
SYSTem:ROSCillator[:TIMebase]?

Function	Query to indicate if the test set's internal source or a suitable external source has been chosen to drive the test set's time base. A suitable external source must have: • an output level of 0 to +13DBM • frequency of .5 to 30MHZ
Query	INT | EXT

SYSTem:ROSCillator:LOCKed?

Function	Query the status of the reference oscillator and indicate if it is locked or unlocked.
Query	0 = Unlocked | 1 = Locked

SYSTem:SYNChronized



"Diagram Conventions" on page 187

SYSTem:SYNChronized

Function	Sets/queries the test set that all prior sequential commands have completed and all prior overlapped commands have started indicating that the input buffer is synchronized. (See "Call Processing Event Synchronization" on page 30.)
Setting	Bit 12 of the status operation condition register is pulsed. See "STATus:OPERation Condition Register Bit Assignment" on page 362.
Query	1
Program Example	OUTPUT 714;"SYSTEM:SYNCHRONIZED" ! pulses bit 12 of the status operation condition register. See "Status Subsystem Overview" on page 114.
	OUTPUT 714;"SYSTEM:SYNCHRONIZED?" ! returns a 1 indicating all prior sequential commands have completed and all overlapped commands have started. See "Call Processing Event Synchronization" on page 30.

HP-IB IEEE 488.2 Common Commands

"*CLS" on page 394

"*ESE" on page 394

"*ESE?" on page 394

"*ESR?" on page 394

"*IDN?" on page 395

"*OPC" on page 395

"*OPC?" on page 395

"*OPT?" on page 395

"*RST" on page 395

"*SRE" on page 396

"*SRE?" on page 396

"*STB?" on page 396

"*WAI" on page 396

*CLS

The *CLS, clear status command, is defined in "IEEE Std 488.2-1992", 10.3. This command will also clear and close the error message screen on the test set's display.

*ESE

The *ESE, standard event status enable command, is defined in "IEEE Std 488.2-1992", 10.10.

*ESE?

The *ESE?, standard event status enable query, is defined in "IEEE Std 488.2-1992", 10.11.

*ESR?

The *ESR?, standard event status register query, is defined in "IEEE Std 488.2-1992 ",10.12.

*IDN?

The *IDN?, identification query, is defined in “IEEE Std 488.2-1992”, 10.14.*IDN? is used to retrieve information about the test set in ASCII format. (See “Obtaining Identification Information *IDN?” on page 449.)

*IDN?, returns ASCII codes 32 through 126 excluding comma and semicolon in four comma separated fields. Field 1 returns the manufacturer, field 2 returns the instrument model number, field 3 returns the serial number, field 4 returns 0.

For revision information on the currently installed test application, see “SYSTem:CURRent (future functionality)” on page 386.

*OPC

The *OPC, operation complete command, is defined in “IEEE 488.2-1992”, 10.18. *OPC causes the test set to continuously sense the No Operation Pending flag. When the No Operation Pending flag becomes TRUE, the OPC event bit in the standard event status register (ESR) is set to indicate that the state of all pending operations is completed. The *OPC common command is not recommended, see “Call Processing Event Synchronization” on page 30 for the recommended overlapped commands.

*OPC?

The *OPC?, operation complete query, is defined in “IEEE Std 488.2-1992”, 10.19. The *OPC? query allows synchronization between the controller and the test set using either the message available (MAV) bit in the status byte, or a read of the output OPC?. The *OPC? query does not effect the OPC event bit in the Standard Event Status Register (ESR). The *OPC? common command is not recommended, see “Call Processing Event Synchronization” on page 30 for the recommended overlapped commands.

*OPT?

The *OPT?, option identification 2uery, is defined in “IEEE Std 488.2-1992”, 10.20. Each option will have a unique name, that name will be retuned with the query.

*RST

The *RST command is defined in “IEEE Std 488.2-1992”, 10.32. The *RST command is a full preset, which restores a majority of settings to their default values. See “Descriptions of Partial Preset and Full Preset, Power-On Preset, Status Preset and Save/Recall Registers” .

Affects of Sending the *RST Command

- All pending operations are aborted.
- Measurement triggering is set to single.
- Any previously received operation complete command (*OPC) is cleared.
- Any previously received operation complete query (*OPC?) is cleared.
- The power-up self-test diagnostics are not performed.
- The contents of the save/recall registers are not affected.
- Calibration data is not affected.
- The HP-IB interface is not reset (any pending service request is not cleared).
- All enable registers are unaffected: service request, standard event, communicate, hardware #1, hardware #2, operation, calibration, and questionable data/signal.
- All megative transition filter registers are unaffected: communicate, hardware #1, hardware #2, operation, calibration, and questionable data/signal.
- All positive transition filter registers are unaffected: communicate, hardware #1, hardware #2, operation, calibration, and questionable data/signal.
- The contents of the RAM memory are unaffected.
- The contents of the output queue are unaffected.
- The contents of the error queue are unaffected.

*SRE

The *SRE, service request enable command, is defined in “IEEE Std 488.2-1992”, 10.34. The parameter range for this command is 0 through 255.

*SRE?

The *SRE?, service request enable query, is defined in “IEEE Std 488.2-1992”, 10.35. Values returned by this query range from 0 through 255.

*STB?

The *STB?, read status byte query, is defined in “IEEE Std 488.2-1992”, 10.36. Values returned by this query range from 0 through 255.

*WAI

The *WAI, wait-to-continue command, is defined in “IEEE Std 488.2-1992”, 10.39. The *WAI command prevents the test set from executing any further commands or queries until all pending operation flags are false. The *WAI common command is not recommended, see “Call Processing Event Synchronization” on page 30 for the recommended overlapped commands.

6 General Usage

Frequency Banded Parameters

The majority of test set's parameters cover all four GSM frequency bands. There are, however, 6 exceptions. These exceptions are the frequency banded parameters. Frequency banded parameters take on the value assigned to them for the currently active frequency band. The Cell Band parameter and TCH Band parameters determine the currently active frequency band.

Only one set of frequency banded parameters is active at any one time. If settings are made to an inactive frequency banded parameter the test set will store the setting for future use. The setting is made regardless of whether the frequency banded parameter is active or inactive and can be queried at any time through HP-IB. If the user does not specify a frequency band when setting frequency banded parameters, settings to the parameter will be made in the currently active band.

Cell Band Parameter

The cell band parameter selects the currently active broadcast channel and traffic channel frequency bands. (Changing this parameter when there is an active link established between the test set and mobile station will disconnect the call.)

Example 12.

```
OUTPUT 714;”CALL:CELL:BAND EGSM”!Sets the broadcast channel and traffic channel bands to
EGSM.
```

Traffic Chan Band Parameter

Changing the traffic channel band parameter selects the currently active traffic channel band by performing a dualband handover. This operation can only be performed when an active link is established between the test set and a mobile station. See “Programming a Dualband Handover” on page 94.

Example 13.

```
OUTPUT 714;”CALL:TCHANNEL:BAND DCS”!Sets the traffic channel band to DCS.
```

List of Frequency Banded Parameters

For control of the broadcast channel:

- Broadcast Chan see “CALL:BCHannel” on page 207
- BA Table (broadcast allocation table) see “CALL:BA” on page 200

For control of the traffic channel:

- Traffic Channel see “CALL:TCHannel” on page 245
- MS TX Level (mobile station transmit level) see “CALL:MS” on page 225

For control of the base station emulator's receiver:

- Manual Channel see “RFANalyzer:MANual:CHANnel[:SELected]” on page 311
- Expected Power see “RFANalyzer:EXPected:POWer[:SELected]” on page 308

HP-IB Examples

```
OUTPUT 714;”CALL:CELL:BCHANNEL:ARFCN:DCS 512”!Sets broadcast channel to 512 for DCS.
```

```
OUTPUT 714;”CALL:CELL:BA:TABLE:EGSM 20,37,124,975,986,1008,1019”!Sets BA table to 7 of 16
possible channels.
```

```
OUTPUT 714;”CALL:TCHANNEL:ARFCN:PGSM 124”!Sets traffic channel to 124 for PGSM band.
```

```
OUTPUT 714;”CALL:MS:TXLEVEL:PGSM 7”!Set the mobile station uplink power control level to 7.
```

```
OUTPUT 714;”RFANALYZER:MANUAL:BAND PCS”!Manually set the RF analyzer to PCS also sets
receiver control to manual.
```

! The bands available for the test set are PGSM, EGSM, DCS and PCS. Only one band can be active at a time.

```
OUTPUT 714;”RFANALYZER:MANUAL:CHANNEL:EGSM 24”!Manually sets the RF analyzer to EGSM
channel 24.
```

```
OUTPUT 714;”RFANALYZER:EXPECTED:POWER:PGSM -15DBM”!Sets the RF analyzer’s input power to
-15 dbm.
```

! See “Amplitude Offset (RF In/Out port)” on page 451

Related Topics

****

“Programming a Dualband Handover” on page 94

“Configuring the Broadcast Channel (BCH)” on page 410

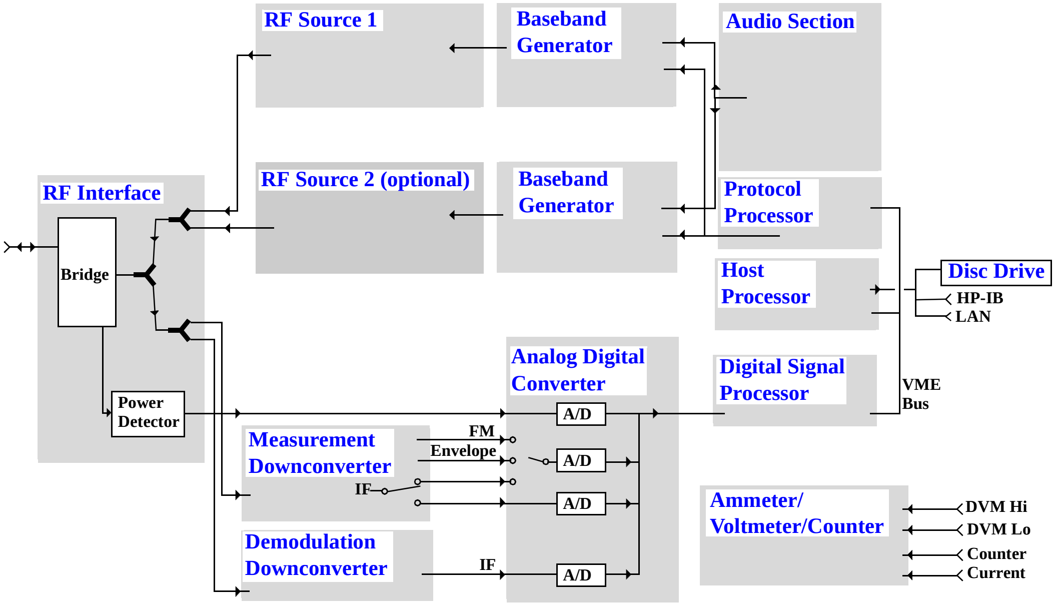
“Configuring the Traffic Channel (TCH)” on page 419

“Receiver Control” on page 417

****

Block Diagram

The hardware architecture of the Test Set provides a number of parallel signal paths through the instrument. This parallel architecture allows the measurement hardware to run some measurements concurrently. See “Concurrent Measurements” on page 97.


RF Source 1
Baseband Generator
Audio Section
RF Interface
RF Source 2 (optional)
Baseband Generator
Protocol Processor
Bridge
Host Processor
Disc Drive
HP-IB
LAN
Analog Digital Converter
Digital Signal Processor
VME Bus
Power Detector
A/D
Measurement Downconverter
FM
Envelope
IF
A/D
A/D
Ammeter/ Voltmeter/Counter
DVM Hi
DVM Lo
Counter
Current
Demodulation Downconverter
IF
A/D

RF Interface Module

Input and output signals are routed through the RF Interface module. The RF Interface module consists of a directional bridge for sampling incoming power and hybrid power splitters which create 4 bidirectional ports, two receiver ports, two source ports, RF amplifiers, video gain circuits, and fast and slow power detectors.

The sampled input power from the directional bridge is routed to a fast power detector. The fast power detector has a response time of several microseconds and can measure power during the bursts of TDMA systems.

The RF Interface module provides two identical RF Source path connections to the In/Out port of the instrument. There is about 25 dB of isolation between the two source paths. There is about 35 dB of isolation between the source paths and either receiver path. The RFIO module has nominally 23 dB of insertion loss in the source path. A temperature sensing circuit facilitates compensation for path loss variation with temperature.

The sampled input power from the directional bridge can be amplified by as many as two 18 dB range amplifiers and then can be directed to the fast detector, the slow detector, or passed on to the measurement Downconverter via the SCal Out port.

The input power to the fast detector is detected by a diode detector that is part of a feedback loop. The input to the slow detector is measured in a bridge using a pair of RMS thermal detectors in a feedback loop.

Signals from the fast and slow power detectors are calibrated with Gain DAC's, video gain can be applied in 6 dB and 1.5 dB steps.

Signal Downconversion

The Test Set's downconversion receiver section has two downconversion modules; a high performance Measurement Downconversion Module for making measurements, and a Demodulation Downconversion Module for maintaining the radio link.

Measurement Downconverter Module

The Measurement Downconverter module is used as part of the demodulation receiver to provide high quality (wide dynamic range, spurious free) signals to the Analog To Digital Converter module's measurement sampler input. These signals are:

- 1 KHz - 5 MHz Intermediate Frequency signal

— this path is switchable between the multiplexed A/D converter and a stand alone A/D converter

- detected envelope of the Intermediate Frequency signal
- discriminated FM modulation from the RF carrier

The Measurement Downconverter module is designed for very high performance operation to ensure accurate and repeatable measurement results. The Measurement Downconverter module contains two downconversion stages, two local oscillators, a logarithmic IF envelope detector and an FM discriminator. Both first- and second-LO synthesizers are tunable. The first LO is used when tuning to the RF input frequency, and the second LO is used when setting second-IF frequency, which is fed to the measurement sampler on the Analog To Digital Converter module.

Demodulation Downconverter Module

The Demodulation Downconverter module is used as part of the demodulation receiver to maintain the radio link of a given RSAD. This is accomplished by providing demodulated bits to the protocol subsystem. Those bits allow the Protocol Processor module to set up a call with the DUT so that testing can be performed on the radio.

The Demodulation Downconverter module is also used as part of the BER testing path. For bit error ratio measurements the bits tested by the Protocol Processor module are taken from this path. The demodulated bits provided to the Protocol Processor contain the data that will be checked for errors.

In addition, power versus time type measurements use the Demodulation Downconverter module demodulation path to obtain timing information used in measurements that need to be synchronized with bursted signals.

Analog To Digital Converter Module

Following the Measurement Downconverter and Demodulation Downconverter modules is the Analog to Digital Converter module. The purpose of the Analog to Digital Converter module is to convert the downconverted analog signals into digital bit streams which can be processed by the Digital Signal Processing module.

In order to maintain the radio link of a given RSAD, the downconversion path through the Demodulation Downconverter module has a dedicated A/D conversion path.

In order to optimize measurement throughput, the fast RF power detector also has a single dedicated A/D path. This allows power measurements, in many cases, to be made concurrently with other measurements. The three outputs from the Measurement Downconverter module, the fast ammeter input and the Audio In signal share a single multiplexed A/D path.

The outputs of the various analog to digital converters on the Analog to Digital Converter module share a common data bus to the Digital Signal Processing module.

Digital Signal Processing Module

The Digital Signal Processing (DSP) module is responsible for a variety of tasks within the overall Test Set architecture. These tasks are:

- demodulating data from the radio under test (data received from the Demodulation Downconverter module) and sending the demodulated data bits to the Protocol Processor module
- for some systems, perform audio measurements using audio information sent to the DSP module from the Protocol Processor module
- execute a variety of signal processing algorithms to perform measurements on the radio system of the currently loaded RSAD (data received from the power detector ADC, the measurement ADC and, in some cases, data received from the Demodulation Downconverter ADC)

The DSP processor communicates with the Host Processor and the Protocol Processor, as well as controlling the configuration and synchronization of the Analog To Digital Converter module.

Protocol Processor Module

The Protocol Processor module is responsible for maintaining the radio link between the Test Set and the mobile station under test. The primary tasks of the Protocol Processor module are:

- generating the protocol messaging necessary for the forward channel and sending that protocol stream to the Test Set’s RF source for transmission to the mobile station
- decoding the protocol messaging received from the mobile station under test on the reverse channel
- computing measurement results which are associated with data bits contained within the mobile stations messaging, such as bit error ratio

Host Processor Module

The Host Processor module is responsible for a variety of tasks within the overall Test Set architecture. These tasks include:

- control of the manual user interface (MUI)
- executing commands and processing data received from the LAN interface
- executing commands and processing data received from the HP-IB interface
- controlling disk access
- control of all RF and audio hardware modules
- routing measurement results received form the Digital Signal Processing and Protocol Processor modules to the appropriate output device (display, HPIB, LAN, serial, etc.)

Ammeter/Voltmeter/Counter

Voltmeter

The voltmeter is primarily used to measure external DC & AC voltages. A secondary purpose is to measure internal AC voltages for instrument self-diagnostics.

The external voltmeter is capable of measuring DC voltages up to + 50 VDC and AC voltages up to 50 Vpk. A true RMS detector is used for measuring AC voltages. For internal AC measurements, a switch routes the diagnostic MUX output to the Voltmeter 1 path.

Frequency Counter

The Frequency Counter is used primarily to measure external frequencies from the front panel BNC connector. The external input can receive a signal between 20 Hz and 50 MHz, with a level from 25 mV to 8 V rms.

The counter circuit is based on the METRON IC. This IC contains a reciprocal counter. A reciprocal counter functions by counting the input signal and a reference signal simultaneously during a selected gate period. At the end of this period, the counting is stopped and the values of the signal and reference counters are read. The ratio of these values is used to calculate the input signal frequency.

Ammeter

The Ammeter is used primarily to measure the current being drawn by the mobile station under test.

The ammeter consists of several subsystems, including the sense resistors, input section, programmable 0 / +20 dB amplifier, slow ADC, and fast ADC (located on the Analog To Digital Converter module). The rear panel circuit board contains two series-connected resistors which convert the measured current to an equivalent voltage. A programmable 0 / +20 dB amplifier increases the ADC sensitivity factor when needed. There are two possible sensitivity settings for each sense resistance value, one with the amplifier at unity gain, and one with the amplifier at +20 dB. This gives a total of four ammeter ranges.

There are two ammeter modes which share the common input section. The slow ADC (CW) mode is typically used for analog RSADs, while the fast ADC (burst) mode is primarily intended for digital RSADs. The slow ADC mode is optimized for accuracy, while the fast ADC mode is optimized for measurement speed.

For burst measurements (peak, average, I vs. T capability), the fast Analog To Digital Converter module ADC is used. For non-bursted measurements the slow ADC is used.

Audio Section

Audio Analysis Path

Externally applied audio signals can be analyzed through the Test Set’s DSP module for such characteristics as AC level, SINAD, or distortion.

The audio signal to be analyzed is input to the Test Set using the front panel Audio In connector. The signal is then routed to the Analog To Digital Converter module’s measurement sampler for analysis by the DSP module.

The Audio In connector accepts signals from 20 Hz to 15 KHz, at input levels from 10 mV to 20 Vpk.

Audio 1 Path

The Audio 1 path provides analog baseband signals used for frequency modulation of the Test Set’s RF sources. Up to four separate audio sources may be summed together in any combination to provide the composite Audio 1 output. These include the external FM input, internal direct digital synthesis (DDS,) regenerated SAT, and audio echo input.

The external FM input accepts an externally supplied audio signal with a peak voltage between 0.25 and 2 Vpk.

The internal DDS generates low distortion audio signals from DC to 20 KHz with 0.1 Hz resolution. One to four signals may be generated and internally summed, with independent level control of each waveform.

The SAT regeneration circuit outputs a signal which is phase-locked to a received SAT signal. This is useful for testing situations where the Test Set needs to emulate a mobile station.

The audio echo input is used for retransmitting the received audio after a selectable time delay, to check both radio transmit and receive paths simultaneously.

For most applications, only one or two of these Audio 1 path sources are enabled at any given time.

Audio 2 Path

The Audio 2 path provides a secondary means for sending analog baseband signals to the FM modulator. Audio 2 contains only one source, a DDS similar to that used for Audio 1.

Typically, the Audio 2 path DDS is used for cases where multiple signals must be summed together with the lowest possible distortion. Another potential use of Audio 2 would be to obtain higher output levels than Audio 1 is capable of (up to twice as much), assuming the two outputs are set to the same frequency and phase, and then summed together at the Baseband Generator module.

Audio 2 is rarely used in practice because the DDS used for Audio 2 is the same DDS that is used for the front panel audio output.

Audio Out Path

Any one of three inputs may be coupled to the front panel audio output connector. These include a 4 channel DDS (shared with Audio 2), receiver discriminator audio from the Demodulation Downconverter module, and audio echo from the Analog To Digital Converter module.

The front panel output is capable of providing signal levels up to 9 Vpk into > 600 ohm loads, and up to 0.8 Vpk into an 8 ohm load (e.g. speaker). The output level is calibrated only for the DDS and audio echo modes. For the receiver audio mode, an uncalibrated volume control is provided due to the high tolerances involved.

Typically the DDS mode is used to feed the MIC input of a radio, or it may simply be used as a general purpose low distortion function generator. Possible waveforms include sine wave, square wave, triangle wave, ramp, uniform noise, gaussian noise, and DC. The DDS frequency range is DC to 20 KHz in 0.1 Hz increments, while the output level range is 0 to 1 Vpk with 0.5 mV resolution or 1 to 9 Vpk with 5.0 mV resolution.

Demodulated audio can be selected from the Demodulation Downconverter. 300 - 3000 Hz BPF, 750 usec de-emphasis, and expandor circuits can be individually applied to the receiver audio, or bypassed.

Audio echo can be selected to route the received audio to the front panel audio output connector.

RF Sources

The Test Set can contain two identical RF sources. The RF sources are used to provide analog or digitally modulated RF carriers for use in parametric testing of mobile stations encompassing a variety of cellular radio formats. In general, the sources have a frequency range of 45 MHz to 2.7 GHz and an amplitude range of -13 dBm to -135 dBm.

The RF sources consist of a Synthesized Signal Generator module followed by a Vector Output module and an RF Attenuator module. Baseband modulation information is supplied to the RF sources from a Baseband Generator module preceded by an Audio Section module. The various components which make up the Test Set source system are described in the following sections.

Baseband Generators

The purpose of the Baseband Generator module is to provide, for the modulation type currently in effect, properly formatted baseband signals to the modulation circuits on the RF Source modules.

The Baseband Generator performs several functions related to the generation and processing of these base-band modulation signals. These are:

- Transform data and clock signals from the Protocol Processor module into base-band analog I-Q modulation signals for the I-Q modulator in the Vector Output module
- Transform data from the Protocol Processor module into baseband FSK modulation for the FM modulator in the Signal Generator module
- Provide baseband FM path source selection, gain adjustment and summing node for analog FM signals from the Audio module and internally generated baseband FSK signals which are output to the FM modulator in the Signal Generator module
- Transform burst and adjacent timeslot signals from the Protocol Processor module into baseband burst modulation signals for the burst modulator in the Vector Output module

Active Cell Operating Mode

The test set can operate in two different operating modes (active cell mode or test mode). The operating modes changes the way in which the test set interacts with the mobile station. Active cell mode is the default operating mode and is used when emulating a normal GSM cell. Test mode is used when it is not possible, or not desired, to communicate via over the-the-air signaling with the mobile station (MS), but downlink stimulus and uplink measurements are still needed. see “Test Mode Operating Mode” on page 422

Associated with the active cell operating mode is the cell activated state parameter. This parameter turns on and off the test set’s control of the uplink and downlink.

Trying to set any of the network configuration parameters while the cell is in the active state will generate the following error:

```
GSM operation rejected; Attempting to set <MCC|MNC|LAC|NCC|BCC> while generating a BCH
```

Active Cell Features

The basic features provided by active cell operating mode are:

- Generation of a broadcast channel (BCH) without traffic channel (TCH).
- Support for location updating.
- Call setup, both mobile station and base station emulator (BSE) originated.
- Changing TCH parameters during a call using over-the-air signaling.
- BSE initiated and mobile station initiated call disconnection.
- All measurements supported in the test application are available.
- The BSE automatically controls the test set’s demodulation receiver.

Setting the Test Set’s Operating Mode to Active Cell Mode

The test set’s operating mode is set using the CALL:OPERating:MODE, which is a sequential command.

Example 14. Command Syntax:

```
CALL:OPERating:MODE <CELL|TEST>
```

Example 15. Programming Example:

```
!**********************************************************************
! Step 1: Set Test Set Operating Mode To Active Cell
!**********************************************************************
!
OUTPUT 714;"CALL:OPER:MODE CELL"
```

Setting the Active Cell Mode State

The active/inactive state of the test set operating in active cell mode is controlled using the cell activated state command. Cell activated is only available when Operating Mode = Test Mode.

Example 16. Command Syntax:

```
CALL[:CELL[1]]:ACTivated[:STATe]<ON|1|OFF|0>
```

Example 17. Programming Example:

```
OUTPUT 714;"CALL:ACT ON"
```

Related Topics

****

“Configuring the Broadcast Channel (BCH)” on page 410

“CALL:OPERating” on page 235

“Configuring the Traffic Channel (TCH)” on page 419

****

Configuring the Broadcast Channel (BCH)

The broadcast channel parameters are configured using the following call processing subsystem commands.

For complete command syntax, refer to HP-IB commands for the CALL subsystem.

BCH Parameters

- Cell Band
- Cell Power
- Cell Power State
- Broadcast Chan (ARFCN) "Frequency Banded Parameters" on page 399
- Mobile Country Code (MCC)
- Mobile Network Code (MNC)
- Location Area Code (LAC)
- Network Color Code (NCC)
- Base Station Color Code (BCC)
- Paging IMSI
- Repeat Paging
- Get IMEI at Call Setup
- BA Table "Frequency Banded Parameters" on page 399
- 3 Digit MNC for PCS

HP-IB Examples:

Cell Band

```
OUTPUT 714;"CALL:BAND PGSM"
```

would set the cell to the PGSM band. see "CALL:BAND" on page 205

Cell Power

```
OUTPUT 714;"CALL:POW -85 DBM"
```

would set the cell's RF transmitter power to –85 dBm. see "CALL:POWer" on page 239

Cell Power State

```
OUTPUT 714;"CALL:POW:STAT ON"
```

would turn on the cell's RF transmitter on.

Broadcast Chan

```
OUTPUT 714;"CALL:BCH 50"
```

would set the broadcast channel to 50 for the selected (active) cell band. see “CALL:BCHannel” on page 207

`OUTPUT 714;"CALL:BCH:DCS 556"`

would set the broadcast channel to 556 for the DCS cell band.

Mobile Country Code

`OUTPUT 714;"CALL:MCC 5"`

would set the cell’s mobile country code to 5. see “CALL:MCCode” on page 223

NOTE Can only be set when Cell Activated State = OFF.

Mobile Network Code

`OUTPUT 714;"CALL:MNC 3"`

would set the cell’s mobile network code to 5. see “CALL:MNCode” on page 224

NOTE Can only be set when Cell Activated State = OFF.

Location Area Code

`OUTPUT 714;"CALL:LAC 4"`

would set the cell’s location area code to 4. see “CALL:LACode” on page 222

NOTE Can only be set when Cell Activated State = OFF.

Network Color Code

`OUTPUT 714;"CALL:NCC 1"`

would set the cell’s network color code to 1. see “CALL:NCCode” on page 234

NOTE Can only be set when Cell Activated State = OFF.

Base Station Color Code

`OUTPUT 714;"CALL:BCC 5"`

would set the cell’s base station color code to 5. see “CALL:BCCode” on page 206

NOTE Can only be set when Cell Activated State = OFF.

Paging IMSI

`OUTPUT 714;"CALL:PAG:IMSI ““001012345678901”""`

would set the paging IMSI to 001012345678901. see “CALL:PAGing” on page 237

Repeat Paging

```
OUTPUT 714;"CALL:PAG:REP OFF"
```

would turn repeat paging off. see "CALL:PAGing" on page 237

Get IMEI at Call Setup

```
OUTPUT 714;"CALL:IMEI:AUTO ON"
```

would cause the test set to automatically request the mobile station's IMEI at call setup. see "CALL:IMEI" on page 221

BA Table (broadcast allocation table)

```
OUTPUT 714;”CALL:BA:TABLE:DCS 512,612,787"
```

would set the first three DCS base allocation table entries to 512, 612, 787. The remaining 13 would be turned off. see "CALL:BA" on page 200

3 Digit MNC for PCS

```
OUTPUT 714;”CALL:PMNCODE:STATE ON"
```

configures the PCS BCCH to use the PCS, 3-digit MNC when the current cell band is PCS. see "CALL:PMNCode" on page 238

NOTE Can only be set when Cell Activated State = OFF.

Operating Considerations

There are a number of parameters for the broadcast channel and the traffic channel that can be configured, however the test set's default parameters should allow a properly functioning mobile station to successfully camp on the cell and make a call under most circumstances.

Parameters can be queried from the test set's the front panel regardless of the state of the test set.

If the test set is in active cell operating mode, parameters MCC, MNC, LAC, NCC, and BCC can not be set unless the Cell Activated State is OFF.

If the test set is in test mode operating mode, any BCH parameter can be set at any time.

The 3 Digit MNC for PCS parameter defines if the PCS BCCH should be configured using the standard 2-digit MNC (J-STD-007 coding), or the PCS 3-digit MNC (J-STD-007A coding, section 2.10.5.1.3). The PCS 3-digit MNC is used on the PCS BCCH instead of the 2-digit MNC only when the current cell band is PCS and the 3 Digit MNC for PCS parameter is set to on.

Related Topics

****

"Frequency Banded Parameters" on page 399

****

Setting Frame Trigger Parameters

Frame Trigger Parameters

The test set provides a frame trigger for synchronizing test equipment to a measurement. The frame trigger is a positive-going TTL compatible pulse that is one GSM bit wide and is available at the rear-panel TRIG OUT connector.

The frame trigger has 3 parameters that the user must set. See "SYSTem:FTRigger (future functionality)" on page 388.

- External Trigger State (on or off)
- External Trigger Timeslot (0 to 7)
- External Trigger Bit (0 to 1250)

HP-IB Examples

External Trigger State

```
OUTPUT 714;"SYSTEM:FTRIGGER:STATE ON"
```

would set the external frame trigger ON.

External Trigger Timeslot

```
OUTPUT 714;"SYSTEM:FTRIGGER:TSLOT 3"
```

would cause external frame trigger pulses to align with timeslot three.

External Trigger Bit

```
OUTPUT 714;"SYSTEM:FTRIGGER:BIT 100"
```

would cause external frame trigger pulses to occur 100 bits after bit 0 of the selected timeslot.

Operating Considerations

Each frame is made up of 8 time slots. Time slots are defined in "ETSI GSM 05.10 Ver. 4.9.0 Section 5. Time slots 0 and 4 are 157 bit periods long, time slots 1, 2, 3, 5, 6, 7 are 156 bit periods long, the average time slot is 156.25 bits in duration. The external trigger timeslot can be set to any time slot 0 through 7, the external trigger bit position can be set from 0 through 1250. If the trigger bit position is set to 1250, that is one full frame beyond the setting of the external trigger timeslot, (156.25 * 8 = 1250).

When the cell activated state is OFF, the frame trigger output is disabled (set to 0 volts) since there is no reference downlink TDMA frame structure available.

The frame trigger can be set manually from the system configuration screen by pressing the External Trigger Setup soft key.

Frame trigger state is not affected by changes to cell activated state.

Related Topics

****

“SYSTem:FTRigger (future functionality)” on page 388

****

Configuring Mobile Station Operating Parameters

The mobile station operating parameters are configured using the following call processing subsystem commands.

For a complete list of command syntax, refer to HP-IB commands CALL subsystem.

Mobile Station Operating Parameters

- MS TX Level (mobile station transmit level) "Frequency Banded Parameters" on page 399
- Timing Advance
- Mobile DTX State (mobile station discontinuous transmit state)

HP-IB Examples:

MS TX Level

```
OUTPUT 714;"CALL:MS:TXL 15"
```

would set the active cell mobile station transmit power level to 15. see "CALL:MS" on page 225

```
OUTPUT 714;"CALL:MS:TXL:DCS 13"
```

would set the DCS cell mobile station transmit power level to 13.

Timing Advance

```
OUTPUT 714;"CALL:MS:TADV 5"
```

would set the timing advance of the mobile station to 5.

Mobile DTX State

```
OUTPUT 714;"CALL:MS:DTX ON"
```

would set the discontinuous transmission state in the mobile station to on. see "CALL:MS" on page 225

Operating Considerations

There are a number of parameters for the broadcast channel and the traffic channel that can be configured, however the test set's default parameters should allow a properly functioning mobile station to successfully camp on the cell and make a call under most circumstances.

When Operating Mode = Active Cell, if a call is connected, changes to these parameters, **including a change to the value of the parameter's current setting**, causes signaling on the downlink to automatically initiate the change. No separate command is necessary to initiate the change. If a call is not connected, changes to the parameter are stored for when the next call **is** established

The MS TX Level parameter, besides informing the mobile station what uplink power to transmit to the test set, also updates the Expected Power parameter. See "RFANalyzer" on page 307.

Parameters can be queried from the test set's front panel regardless of the state of the test set.

Related Topics

****

"CALL:MS" on page 225

****

Receiver Control

The user may want to control the internal receiver parameters rather than allow the test set to control them. Manual receiver control is accomplished through the use of receiver control parameters.

Selecting Manual or Automatic Receiver Control

Receiver control defines whether the test set (auto) or the user (manual) is in control of receiver's frequency, power, and burst type.

- Setting a manual band, manual frequency, or manual channel causes receiver control to be set to manual control mode.
- Setting the broadcast band or any reset operation causes the receiver control to be set to auto control mode.

HP-IB Example

```
OUTPUT 714;”RFANALYZER:CONTROL:AUTO OFF”!Allows manual control of receiver parameters.
```

Manual Receiver Control Parameters

When receiver control is set to auto, test set's protocol controls the parameters. When receiver control is set to manual there are five parameters that the user will control, they are listed here.

- Manual Band
- Manual Freq
- Manual Channel
- Expected Power
- Expected Burst

HP-IB Examples:

Manual Band

The frequency bands available for the test set are PGSM, EGSM, DCS and PCS. Only one band can be active at a time. The frequency band must be selected in order to define the frequencies where measurements are to be made.

```
OUTPUT 714;”RFANALYZER:MANUAL:BAND PCS”!Sets the frequency Band to PCS.
```

Manual Freq

Manual frequency is used to tune the test set's measuring receiver. None of the “Manual Channel” on page 418 parameters are affected by changes to manual frequency.

```
OUTPUT 714;”RFANALYZER:MANUAL:FREQUENCY 942.6MHZ”!Sets the input frequency to 942.6MHz.
```

Manual Channel

Manual channel is used to tune the test set’s measuring receiver. “Manual Freq” on page 417 is affected by changes to manual channel.

```
OUTPUT 714;”RFANALYZER:MANUAL:CHANNEL:EGSM 24”!Sets the channel to EGSM 24.
```

Expected Power

Expected power defines the expected input power at the RF IN OUT connector on the front panel of the test set. The range of expected power is beyond the capability of the test set’s hardware. This is because expected power is intended to reflect the potential range of RF power at the DUT. This range of RF power is meant to accommodate the use of a gain or loss network between the DUT and the test set.

If the user sets expected power to +52 dBm and the amplitude offset = –3 dB, the calculated receiver power will be 49 dBm but the test set shall be set to +43 dBm, the upper limit of the hardware. If the calculated value of receiver power goes below –25 dB, the lower limit of the hardware, the test set shall be set to –25 dB.

Expected power is always overwritten by settings made to the MS TX Level parameter.

Setting the expected power will not set receiver control to manual.

```
OUTPUT 714;”RFANALYZER:MANUAL:POWER:PGSM -15DBM”!Set input power to –15 dbm. see
“RFANalyzer:EXPected:POWer:PGSM” on page 310
```

Expected Burst

This parameter is only used when Operating Mode = Test Mode or Cell Activated State = OFF. It defines which Burst Type (Midamble + Burst Length) to look for in the signal from the mobile station. When Operating Mode = Active Cell and Cell Activated State = ON, the test set chooses the correct burst type.

```
OUTPUT 714;”CALL:BURST:TYPE TSC5”!Defines burst type for test mode and cell activated state
OFF.
```

Related Topics

****

“RFANalyzer” on page 307

“CALL:BURSt” on page 210

“Active Cell Operating Mode” on page 408

“Test Mode Operating Mode” on page 422

****

Configuring the Traffic Channel (TCH)

The traffic channel parameters are configured using the following call processing subsystem commands. For complete command syntax, see “CALL Subsystem” on page 198.

TCH Parameters

- Traffic Channel Band
- Traffic Channel (ARFCN) “Frequency Banded Parameters” on page 399
- Timeslot
- Mobile Loopback
- Speech
- Max Frames Allowed for Assignment

HP-IB Examples:

Traffic Chan Band

```
OUTPUT 714;"CALL:TCH:BAND DCS"
```

would set the cell’s traffic channel band to the DCS band. see “CALL:BAND” on page 205

Traffic Channel

```
OUTPUT 714;"CALL:TCH 45"
```

would set the active cell’s traffic channel number to 45. see “Configuring the Traffic Channel (TCH)” on page 419

```
OUTPUT 714;"CALL:TCH:DCS 65"
```

would set DCS cell’s traffic channel number to 65.

Timeslot

```
OUTPUT 714;"CALL:TCH:TSL 4"
```

would set the traffic channel timeslot to 4.

Mobile Loopback

```
OUTPUT 714;"CALL:TCH:LOOP OFF"
```

would turn off loopback of the traffic channel data. see “Configuring the Traffic Channel (TCH)” on page 419

Speech

```
OUTPUT 714;"CALL:TCH:DOWN:SPE SIN1000"
```

would set the traffic channel downlink speech source to 1 kHz.

Max Frames Allowed for Assignment

```
OUTPUT 714;"CALL:COUNT:TDMA:FRAMES 20"
```

would set the maximum number of frames allowed during channel assignments to 20 frames. see "CALL:COUNt" on page 214

Operating Considerations

When configuring the base station emulator (BSE) you must configure the broadcast channel (BCH) and the traffic channel (TCH). There are a number of parameters for the BCH and the TCH that can be configured; however, the test set's default parameters should allow a properly functioning mobile station to successfully camp on the cell and make a call under most circumstances.

When Operating Mode = Active Cell, if a call is connected, changes to the traffic channel number (ARFCN) or traffic channel timeslot, **including a change to the value of the parameter's current setting**, causes signaling on the downlink FACCH to initiate a channel reassignment. This configures the TCH to use the new parameter. If a call is not connected, changes to the parameter are stored for when the next call **is** established

When Operating Mode = "Test Mode", if Test Mode Downlink Function = "BCH+TCH", changes to the traffic channel number (ARFCN) or traffic channel timeslot will reconfigure the downlink TCH accordingly, but there will be no signaling initiated. The change will be immediate. If a TCH is not being generated, changes to the parameter are stored for when the next call is established

Downlink speech controls what kind of speech data is transmitted on the downlink TCH. A TCH with speech data is generated when call control status is connected, or when in test mode with downlink function set to BCH+TCH.

When an FBER measurement is activated PRBS15 is transmitted on the downlink TCH, over riding the user setting of downlink speech source. Any changes to downlink speech source will be accepted and saved but not applied until FBER become inactive.

There are 5 different settings for the downlink speech source.

- Echo retransmits the uplink speech frames back to the downlink with a non-selectable delay of about 1 second.
- PRBS15 the 260 speech frame bits (prior to channel coding) are generated using a pseudo random bit sequence.
- SIN300 the sequence of 260 speech bit frames represent a sine wave at 300 Hz.
- SIN1000 the sequence of 260 speech bit frames represent a sine wave at 1000 Hz.

Traffic channel loopback type cannot be set to type C if the traffic channel band is PGSM.

The Max Frames Allowed for Assignment parameter, is used to specify the maximum number of TDMA frames the mobile station is allowed to take for a channel assignment. This is only applicable to changes in TCH band, traffic channel, or TCH timeslot. Changes to any other TCH parameter will not cause an error to be generated if, the number of frames taken to perform the change exceeds the setting of the maximum frames allowed for assignment. If the mobile station does not complete the channel assignment within the specified number of frames, the test set will generate an error message, but this will not cause a call to drop. If the mobile DTX state (discontinuous transmission) parameter is on (see “CALL:MS” on page 225), the error is not generated, because when a mobile station is in discontinuous transmission mode, it is not required to transmit on the new channel, at least not until a SACCH, FACCH, or SID frame is ready. In this case, the mobile station may actually have changed channels in the correct time, but had nothing to transmit.

Related Topics

****

“Configuring the Broadcast Channel (BCH)” on page 410

“Configuring Mobile Station Operating Parameters” on page 415

“Receiver Control” on page 417

“Frequency Banded Parameters” on page 399

“CALL:TCHannel” on page 245

“Fast Bit Error Measurement Description” on page 61

****

Test Mode Operating Mode

The test set can operate in two different operating modes (active cell mode or a test mode). Active cell mode is the default operating mode and is used when emulating a normal GSM cell. Test mode (see "CALL:OPERating" on page 235for HP-IB syntax) is used when it is not possible, or not desired, to communicate via over-the-air signalling with the mobile station, but downlink stimulus and uplink measurements are still needed. When test mode is selected, the choices of downlink stimulus (Test Function) are:

- BCH (broadcast channel) (see "BCH Test Function Behavior" on page 423)
- BCH + TCH (broadcast channel + traffic channel) (see "BCH + TCH Test Function Behavior" on page 426)
- CW (continuous wave) (see "CW Test Function Behavior" on page 427)

See "CALL:FUNCtion" on page 220 for test function HP-IB syntax.

Test Mode Operation

When the test set's operating mode is test mode:

- No over the air signaling is available.
- No capability to demodulate and decode uplink RACH bursts is available.
- Test mode features are determined by the test function: BCH, BCH + TCH, or CW.
- When the operating mode is set to test mode, auto triggering sets the trigger source to RF Rise. See "RF Rise Trigger Source:" on page 121.

Uplink measurements can be made on the frequencies that the test set expects the mobile station to transmit (auto), or the test set's receiver can be controlled manually (manual). If the Receiver Control field is set to Auto (see "RFANalyzer:CONTrol" on page 307), the test set's receiver frequency is set according to the fields or HP-IB commands in Table on page 422:

Table 14. Test Set Receiver Frequencies (Receiver Control = Auto)

Test Function	Receiver Frequency Fields	HP-IB Command
BCH	Broadcast Chan[a]	"CALL:BCHannel" on page 207
BCH + TCH	Traffic Channel[b]	"CALL:TCHannel[:ARFCn][:SELected]" on page 246
CW	RF Gen Channel	"CALL:RFGenerator<:CHANnel | :FREQuency>" on page 240

[a] Actual frequency depends on current broadcast band (PGSM, EGSM, PCS, or DCS), and is defined in GSM as the uplink frequency.

[b] Actual frequency depends on current traffic channel band (PGSM, EGSM, PCS, or DCS), and is defined in GSM as the uplink frequency.

If the Receiver Control field is set to Manual (see "RFANalyzer:CONTrol" on page 307), the test set's receiver frequency is set according to the fields or HP-IB commands in Table :

Table 15. Test Set Receiver Frequencies (Receiver Control = Manual)

Test Function	Receiver Frequency Fields	HP-IB Command
Don't Care	Manual Channel[a]	"RFANalyzer:MANual:CHANnel[:SELected]" on page 311
	Manual Frequency	"RFANalyzer:MANual:FREQuency" on page 314

[a] Actual frequency is defined in GSM as the uplink frequency.

NOTE "Setting the Active Cell Mode State" on page 409 has no effect during test set operation in test mode.

BCH Test Function Behavior

- The test set generates a BCH without a TCH. BCH configuration and timeslot configuration are the same as when the operating mode is set to active cell.
- Cell power is set using the "CALL:POWer" on page 239command.
- By default, the test set expects the mobile station to transmit on the uplink BCH. The test set's receiver frequency can be set manually, which de-couples the automatic setting.
- Changes to the MS TX level will couple to the expected power, and the MS TX Level parameter will be transmitted on the downlink BCCH.
- All measurements are available to the user, the same as if the operating mode was set to active mode.

Example 18. BCH Test Function Using Auto Receiver Control

The following example shows how to set up a test mode measurement using the BCH test function. In this example the test set is configured to transmit a BCH on PGSM channel 21, and receive the mobile station on PGSM channel 21 at a power level of 12.

1. Select test mode.

   ```
   OUTPUT 714;”CALL:OPERATING:MODE TEST”
   ```

2. Select PGSM as the broadcast band.

   ```
   OUTPUT 714;”CALL:CELL:BAND PGSM”
   ```

3. Select BCH as the test function.

   ```
   OUTPUT 714;”CALL:FUNCTION:DOWNLINK BCH”
   ```

4. Configure the receiver control to auto.

   ```
   OUTPUT 714;”RFANALYZER:CONTROL:AUTO ON”
   ```

5. Set the BCH to channel 21.

   ```
   OUTPUT 714;”CALL:BCH:PGSM 21”
   ```

6. Set the MS TX level to 12.

   ```
   OUTPUT 714;”CALL:MS:TXLEVEL 12”
   ```

7. To make the measurement, set up the mobile station to transmit on PGSM channel 21 at a power level of 12.

Example 19. BCH Test FunctionUsing Manual Receiver Control

The following example shows how to set up a test mode measurement using the BCH test function. In this example the test set is configured to transmit a BCH on PGSM channel 21. Manual receiver control is used to configure the test set to measure a signal from the mobile station at 895 MHz and 14 dBm. Note that the frequency can also be tuned by channel number.

1. Select test mode.

   `OUTPUT 714;”CALL:OPERATING:MODE TEST”`

2. Select PGSM as the broadcast band.

   `OUTPUT 714;”CALL:CELL:BAND PGSM”`

3. Select BCH as the test function.

   `OUTPUT 714;”CALL:FUNCTION:DOWNLINK BCH”`

4. Set the BCH to channel 21.

   `OUTPUT 714;”CALL:BCH:PGSM 21”`

5. Configure the receiver control to manual.

   `OUTPUT 714;”RFANALYZER:CONTROL:AUTO OFF”`

6. Configure the test set’s receiver frequency to 895 MHz.

   `OUTPUT 714;”RFANALYZER:MANUAL:FREQUENCY 895 MHZ”`

   If tuning by channel number, see “RFANalyzer:MANual:CHANnel[:SELected]” on page 311

7. Set the receiver’s expected power level to 14 dBm.

   `OUTPUT 714;”RFANALYZER:EXPECTED:POWER 14 DBM”`

8. To make the measurement, set up the mobile station to transmit at 895 MHz and at a power level of 14 dBm.

BCH + TCH Test Function Behavior

- The test set generates BCH + TCH on the downlink path. The BCH + TCH burst modulation is the same as when the operating mode is set to active cell.
- Cell power is set using the “CALL:POWer” on page 239command.
- Manually synchronizing the mobile station to the BCCH is not under direct control of the test set, it is the user’s responsibility.
- Changes to the TCH timeslot and TCH ARFCN will reconfigure the downlink (although no channel assignment signaling will take place).
- By default, the test set’s receiver is configured to receive the mobile station’s signal at the TCH uplink frequency. The test set’s receiver frequency can be set manually, which decouples the automatic setting.
- Changes to the MS TX level will couple to the expected power, and the MS TX Level parameter will be transmitted on the downlink BCCH and SACCH.
- Changes to TCH timing advance will also appear on the downlink SACCH. Whether the mobile station makes use of these parameters is a function of the mobile station.
- All measurements are available to the user, the same as if operating mode was active mode.

Example 20. BCH + TCH Test Function Using Auto Receiver Control

The following example shows how to set up a test mode measurement using the test function BCH + TCH. In this example the test set is configured to transmit a BCH on PGSM channel 21, a TCH on PGSM channel 31, and receive the mobile station on PGSM channel 31 at a power level of 12.

1. Select test mode.

   ```
   OUTPUT 714;”CALL:OPERATING:MODE TEST”
   ```

2. Select PGSM as the broadcast band (traffic channel band will automatically be set to this band).

   ```
   OUTPUT 714;”CALL:CELL:BAND PGSM”
   ```

3. Select BCH as the test function.

   ```
   OUTPUT 714;”CALL:FUNCTION:DOWNLINK BCHTCH”
   ```

4. Configure the receiver control to auto.

   ```
   OUTPUT 714;”RFANALYZER:CONTROL:AUTO ON”
   ```

5. Set the BCH to channel 21.

   ```
   OUTPUT 714;”CALL:BCH:PGSM 21”
   ```

6. Set the TCH to channel 31.

   ```
   OUTPUT 714;”CALL:TCH:PGSM 31”
   ```

7. Set the MS TX Level to 12.

   ```
   OUTPUT 714;”CALL:MS:TXLEVEL 12”
   ```

8. To make the measurement, set the mobile station to transmit on PGSM channel 31 at a power level of 12.

Example 21. BCH + TCH Test Function Using Manual Receiver Control

The following example shows how to set up a test mode measurement using the test function BCH + TCH. In this example the test set transmits a BCH on PGSM channel 21 and a TCH on PGSM channel 31. Manual receiver control is used to configure the test set to measure a signal from the mobile station at 895 MHz and 14 dBm. Note that the frequency can also be tuned by channel number.

1. Select test mode.

   ```
   OUTPUT 714;"CALL:OPERATING:MODE TEST"
   ```

2. Select PGSM as the broadcast band (the TCH will automatically be set to this band).

   ```
   OUTPUT 714;"CALL:CELL:BAND PGSM"
   ```

3. Select BCH + TCH as the test function.

   ```
   OUTPUT 714;"CALL:FUNCTION:DOWNLINK BCHTCH"
   ```

4. Set the BCH to channel 21.

   ```
   OUTPUT 714;"CALL:BCH:PGSM 21"
   ```

5. Set the TCH to channel 31.

   ```
   OUTPUT 714;"CALL:TCH:PGSM 31"
   ```

6. Configure the receiver control to manual.

   ```
   OUTPUT 714;"RFANALYZER:CONTROL:AUTO OFF"
   ```

7. Configure the test set's receiver frequency to 895 MHz.

   ```
   OUTPUT 714;"RFANALYZER:MANUAL:FREQUENCY 895 MHZ"
   ```

   If tuning by channel number, see "RFANalyzer:MANual:CHANnel[:SELected]" on page 311

8. Set the receivers expected power level to 14 dBm.

   ```
   OUTPUT 714;"RFANALYZER:EXPECTED:POWER 14 DBM"
   ```

9. To make the measurement, set up the mobile station to transmit at 895 MHz and at a power level of 14 dBm.

CW Test Function Behavior

- Generates an unmodulated CW downlink signal. This allows the test set to operate like a signal generator with level and frequency control.
- The RF generator's power is set using the "CALL[:CELL]:RFGenerator:POWer[:SAMPLitude]" on page 242 command.
- The downlink frequency is controlled by the RF Gen Channel and RF Gen Freq fields. The RF Gen Channel field sets the generator to the frequency corresponding to the channel number in the current RF Gen Band field.
- By default, the test set's receiver is configured to receive the mobile station's signal at the current RF generator channel setting. The test set's receiver frequency can be set manually, which decouples the automatic setting.
- No uplink demodulation or channel decoding is available. BER and uplink audio measurements will not return any results.

Example 22. CW Test Function Using Auto Receiver Control

The following example shows how to set up a test mode measurement using the CW test function. In this example the test set transmits a CW signal on PGSM channel 50, and receives the mobile station on PGSM channel 50 at a power level of 15 dBm.

1. Select test mode.

   ```
   OUTPUT 714;”CALL:OPERATING:MODE TEST”
   ```

2. Select PGSM as the RF generator band.

   ```
   OUTPUT 714;”CALL:CELL:BAND PGSM”
   ```

3. Select CW as the test function.

   ```
   OUTPUT 714;”CALL:FUNCTION:DOWNLINK CW”
   ```

4. Configure the receiver control to auto.

   ```
   OUTPUT 714;”RFANALYZER:CONTROL:AUTO ON”
   ```

5. Set the RF generator channel to 50.

   ```
   OUTPUT 714;”CALL:RFGENERATOR:CHANNEL 50”
   ```

6. Set the expected power to 15 dBm.

   ```
   OUTPUT 714;”RFANALYZER:EXPECTED:POWER 15”
   ```

7. To make the measurement, set up the mobile station to transmit on PGSM channel 50 at a power level of 15 dBm.

Example 23. CW Test Function Using Manual Receiver Control

The following example shows how to set up a test mode measurement using the CW test function. In this example the test set transmits a CW signal at 900 MHz, and receives the mobile station at 900 MHz, and at a power level of 15 dBm.

1. Select test mode.

   `OUTPUT 714;”CALL:OPERATING:MODE TEST”`

2. Select PGSM as the RF generator band.

   `OUTPUT 714;”CALL:CELL:BAND PGSM”`

3. Select CW as the test function.

   `OUTPUT 714;”CALL:FUNCTION:DOWNLINK CW”`

4. Set the RF generator frequency to 900 MHz.

   `OUTPUT 714;”CALL:RFGENERATOR:FREQUENCY 900MHZ”`

   `If tuning by channel number, see “CALL[:CELL]:RFGenerator:CHANnel:PGSM” on page 242`

5. Configure the receiver control to manual.

   `OUTPUT 714;”RFANALYZER:CONTROL:AUTO OFF”`

6. Configure the test set’s receiver frequency to 900 MHz.

   `OUTPUT 714;”RFANALYZER:MANUAL:FREQUENCY 900 MHZ”`

   If tuning by channel number, see “RFANalyzer:MANual:CHANnel[:SELected]” on page 311

7. Set the expected power to 15 dBm.

   `OUTPUT 714;”RFANALYZER:EXPECTED:POWER 15”`

8. To make the measurement, set up the mobile station to transmit at 900 MHz, and at a power level of 15 dBm.

Related Topics

****

“Configuring the Broadcast Channel (BCH)” on page 410

“Configuring the Traffic Channel (TCH)” on page 419

“CALL:OPERating” on page 235

“Receiver Control” on page 417

****

Pre-Defined Instrument States

Descriptions of Partial Preset and Full Preset, Power-On Preset, Status Preset and Save/Recall Registers

Preset descriptions

During a preset operation, while changing from the previous state to the new state, at no time will the cell's power (transmitted power) exceed the last user setting of the cell power. The expected power (input power) will not be set to any value lower than the last user setting of the expected power. This is to avoid power spikes on the output and possible receiver damage on the input during transitions associated with preset operations.

Partial Preset

Full Preset

Table 16. Full Preset Behavior

Function	Remote Result	Manual Result
Parameters	all set to defaults	all set to defaults
Measurements	all aborted and inactivated	all aborted and inactivated
Trigger arm	single	continuous
Cell power state	default state	default state
Measurement results	NAN	NAN
Measurement integrity indicator	1 = no result available	1 = no result available

Example

```
OUTPUT 714;”*RST”!Command for a full preset when user in remote operation.
```

```
OUTPUT 714;”SYSTEM:PRESET2”!Command for a full preset when user changing from remote
operation to manual operation.
```

Power-On Preset

The final state of the test set after a power-on is the same as after a manual full preset followed by a STATus:PRESet command.

Status Preset

The STATus:PRESet command will set the status system as defined in “SCPI 1995 Volume 2: Command Reference” section 20.7. Except the ENABle registers will be set to 0. All PTR registers will be set to 1, and all NTR registers will be set to 0.

Example

```
OUTPUT 714;”STATUS:PRESET”!Presets all the STATus subsystem.
```

Save/Recall

The save/recall registers allow a setting to be stored and recalled. They will be added in a later version of the test set.

Related Topics

****

“SYSTem:PRESet” on page 391

****

Instrument Selection

This section will describe how to select the individual instruments that are internal to the Test Set. This functionality is not available until a latter release.

Audio Source/Analyzer

Audio Source/Analyzer information

Spectrum Analyzer

Spectrum Analyzer information

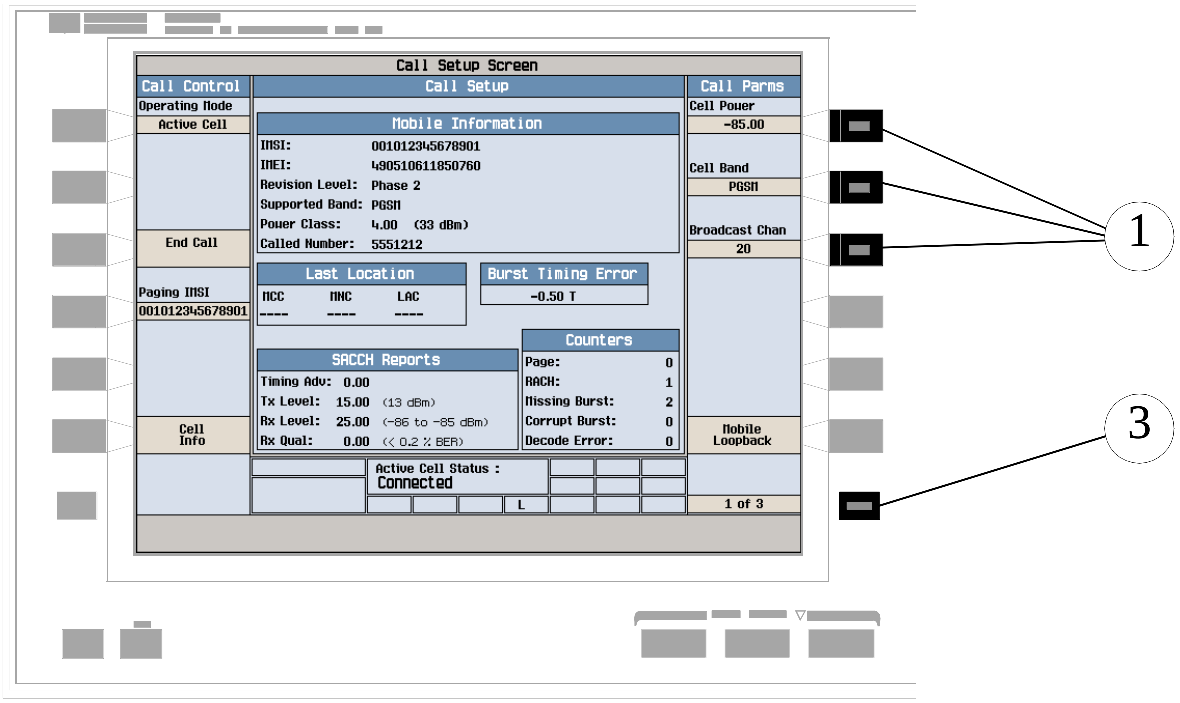
Current Meter, Voltmeter

Current meter and voltmeter information

RF Source

RF Source information

How Do I Change Call Parameters?



Call Setup Screen

Call Control

Operating Mode: Active Cell

End Call

Paging IMSI: 001012345678901

Cell Info

Call Setup

Mobile Information

IMSI:	001012345678901
IMEI:	490510611850760
Revision Level:	Phase 2
Supported Band:	PGSM
Power Class:	4.00 (33 dBm)
Called Number:	5551212

Last Location

MCC	MNC	LAC
----	----	----

Burst Timing Error

-0.50 T

SACCH Reports

Timing Adv:	0.00	
Tx Level:	15.00	(13 dBm)
Rx Level:	25.00	(-86 to -85 dBm)
Rx Qual:	0.00	(< 0.2 % BER)

Counters

Page:	0
RACH:	1
Missing Burst:	2
Corrupt Burst:	0
Decode Error:	0

Active Cell Status : Connected

L

Call Parms

Cell Power: -85.00

Cell Band: PGSM

Broadcast Chan: 20

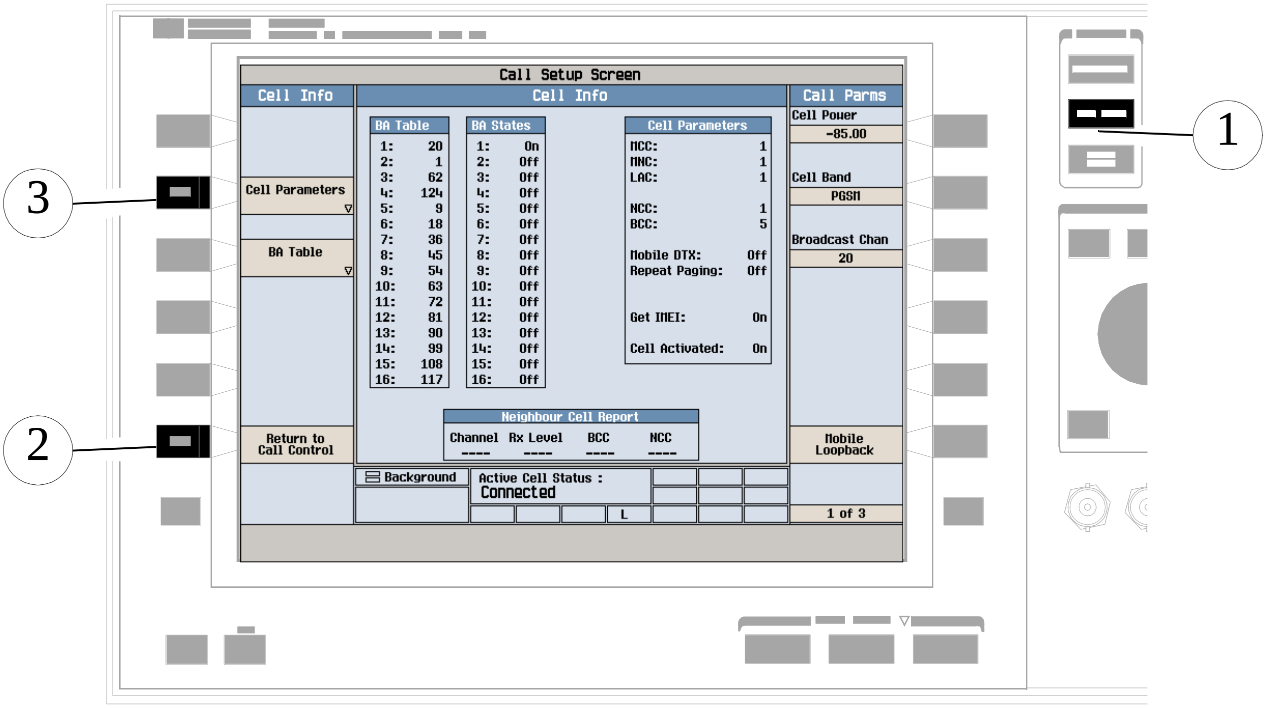
Mobile Loopback

1 of 3

1. Press F7, F8, or F9.
2. Enter a value or highlight a selection and press the knob.
3. Press the MORE key for additional call parameters (Call Parms). Note: For a dual-band handover, change Traffic Band selection (F7 on Call Parms menu 2 of 3).

How Do I Change Cell Parameters?

A. Select the cell parameters menu.



1
2
3
Call Setup Screen
Cell Info
Cell Info
Call Parms
Cell Parameters
BA Table
Return to Call Control
Mobile Loopback
Background
L

BA Table

1:	20
2:	1
3:	62
4:	124
5:	9
6:	18
7:	36
8:	45
9:	54
10:	63
11:	72
12:	81
13:	90
14:	99
15:	108
16:	117

BA States

1:	On
2:	Off
3:	Off
4:	Off
5:	Off
6:	Off
7:	Off
8:	Off
9:	Off
10:	Off
11:	Off
12:	Off
13:	Off
14:	Off
15:	Off
16:	Off

Cell Parameters

MCC: 1
MNC: 1
LAC: 1
NCC: 1
BCC: 5
Mobile DTX: Off
Repeat Paging: Off
Get IMEI: On
Cell Activated: On

Cell Power -85.00
Cell Band PGSM
Broadcast Chan 20

Neighbour Cell Report

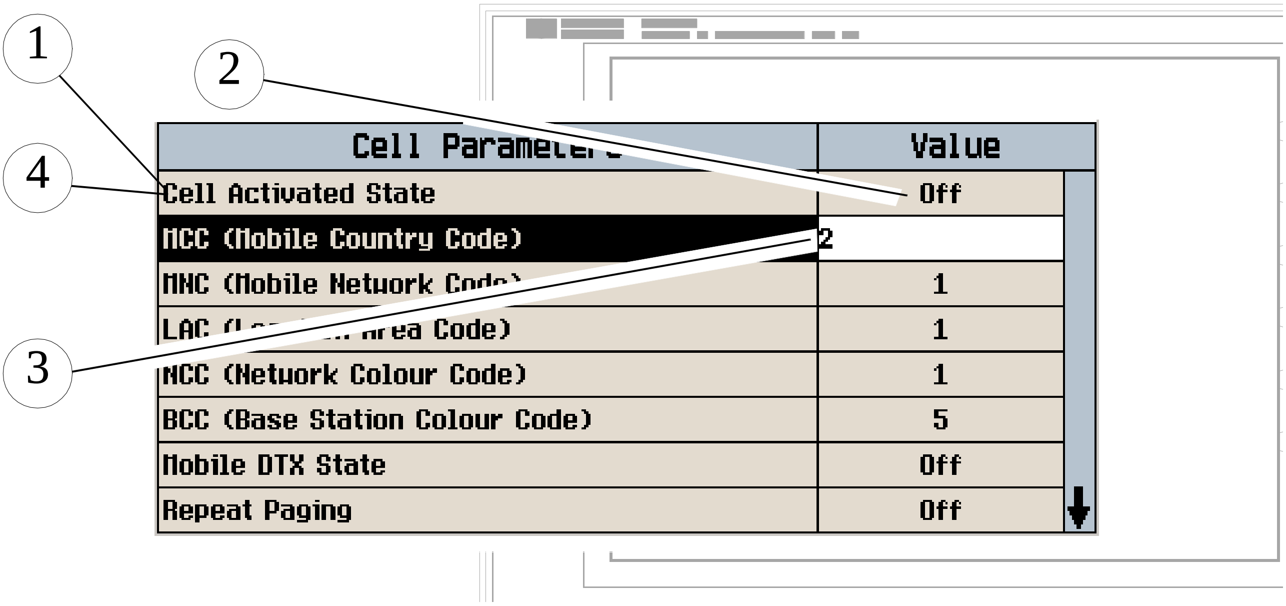
Channel	Rx Level	BCC	NCC
----	----	----	----

Active Cell Status : Connected

1 of 3

1. Press the CALL SETUP key.
2. Press Cell Info (F6).
3. Press Cell Parameters (F2).

B. Set a cell parameter.



Cell Parameters	Value
Cell Activated State	Off
MCC (Mobile Country Code)	2
MNC (Mobile Network Code)	1
LAC (Location Area Code)	1
NCC (Network Colour Code)	1
BCC (Base Station Colour Code)	5
Mobile DTX State	Off
Repeat Paging	Off

To Change “Network” cell parameters follow the instructions below. For all other cell parameters:

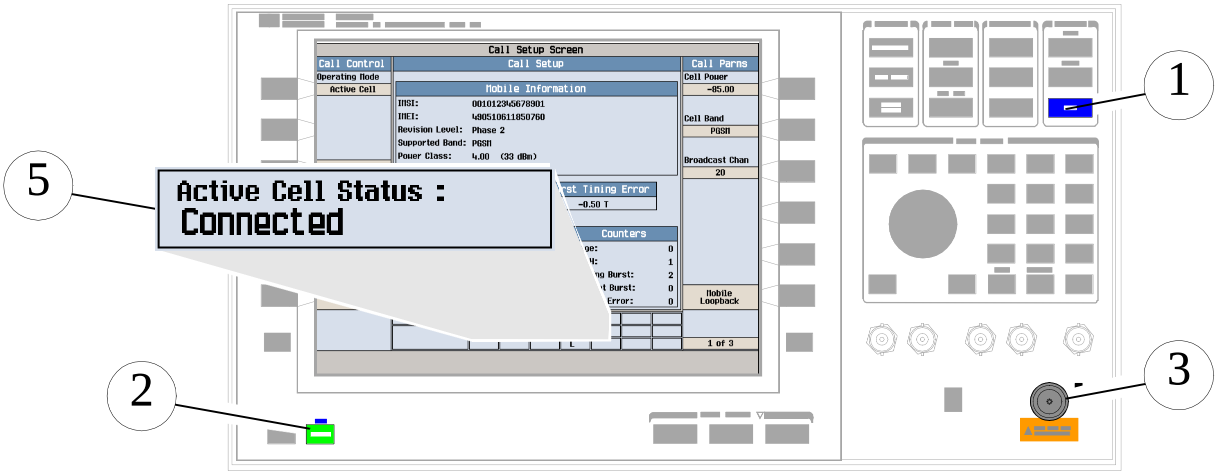
Highlight the parameter, press the knob, enter a value, and press the knob.

To Change “Network” cell parameters:

1. Highlight Cell Activated State and press the knob.
2. Set Cell Activated State to Off. (Highlight “Off” and press the knob.)
3. Set a cell parameter to the desired value. (Highlight the parameter, press the knob, enter a value, and press the knob.)
4. Set Cell Activated State to On.

How Do I Make Measurements on a Mobile?

A. Establish a call.

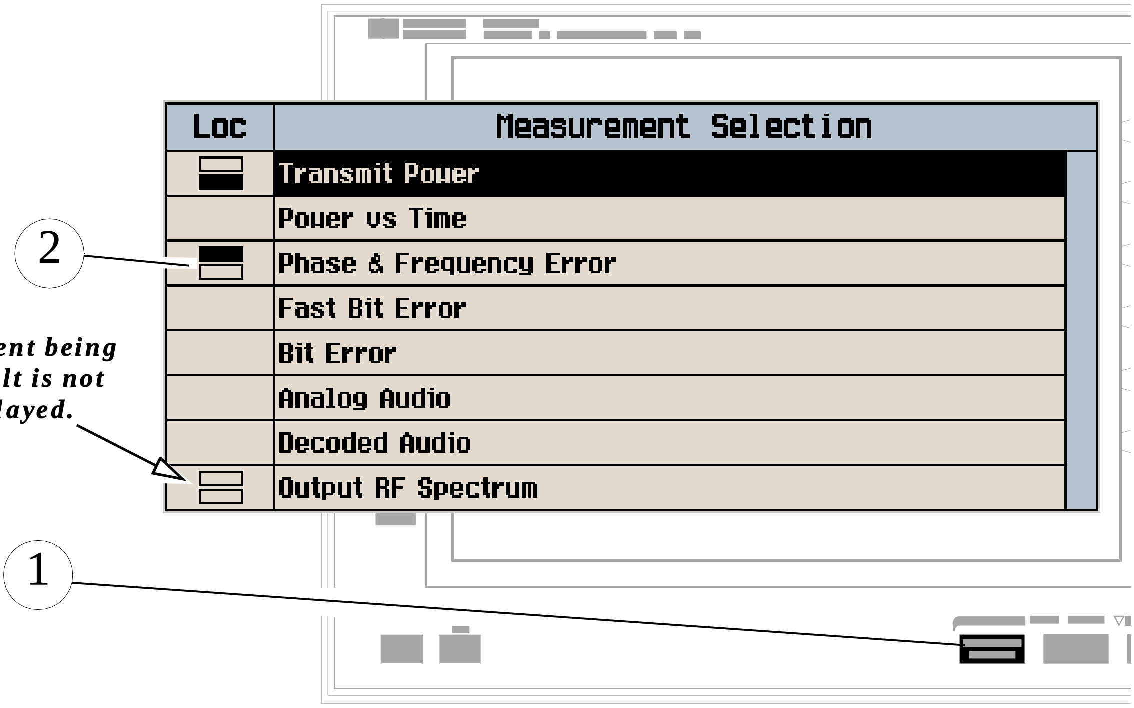


Call Setup Screen
Call Control
Operating Mode
Active Cell
Call Setup
Mobile Information
IMSI: 001012345678901
IMEI: 490510611850760
Revision Level: Phase 2
Supported Band: PGSM
Power Class: 4.00 (33 dBm)
Call Parms
Cell Power
-85.00
Cell Band
PGSM
Broadcast Chan
20
rst Timing Error
-0.50 T
Counters
ge: 0
H: 1
ng Burst: 2
t Burst: 0
Error: 0
Mobile Loopback
1 of 3

Active Cell Status :
Connected

1. Press the SHIFT key.
2. Press the PRESET key.
3. Connect the mobile. Note: Is the mobile camped? PGSM is default Cell Band setting.
4. On the mobile press 1, 2, 3, and then press send.
5. Check for “Connected” in the Active Cell Status field.

B. Select measurements.

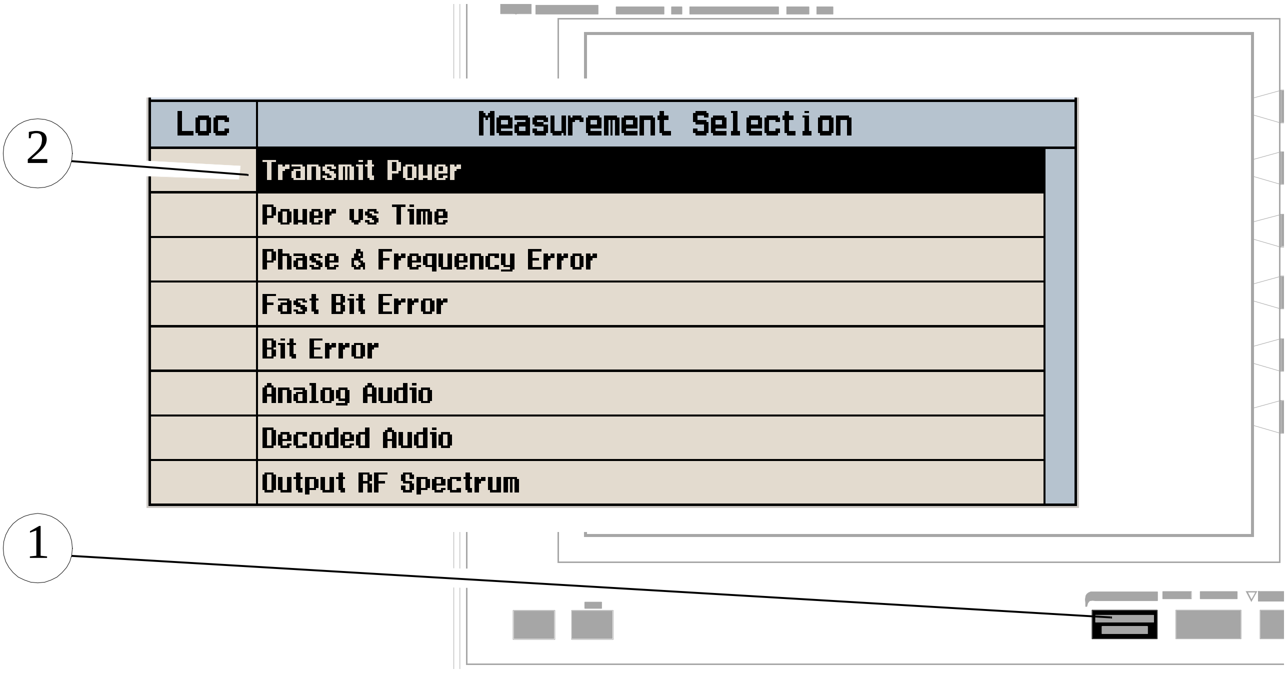

Loc
Measurement Selection
Transmit Power
Power vs Time
Phase & Frequency Error
Fast Bit Error
Bit Error
Analog Audio
Decoded Audio
Output RF Spectrum
2
1

Indicates measurement being made, result is not being displayed.

1. Press the MEASUREMENT SELECTION key.
2. Highlight a measurement and press the knob.
3. Repeat steps 1 and 2 to add measurements.

How Do I Change Measurement Setup?

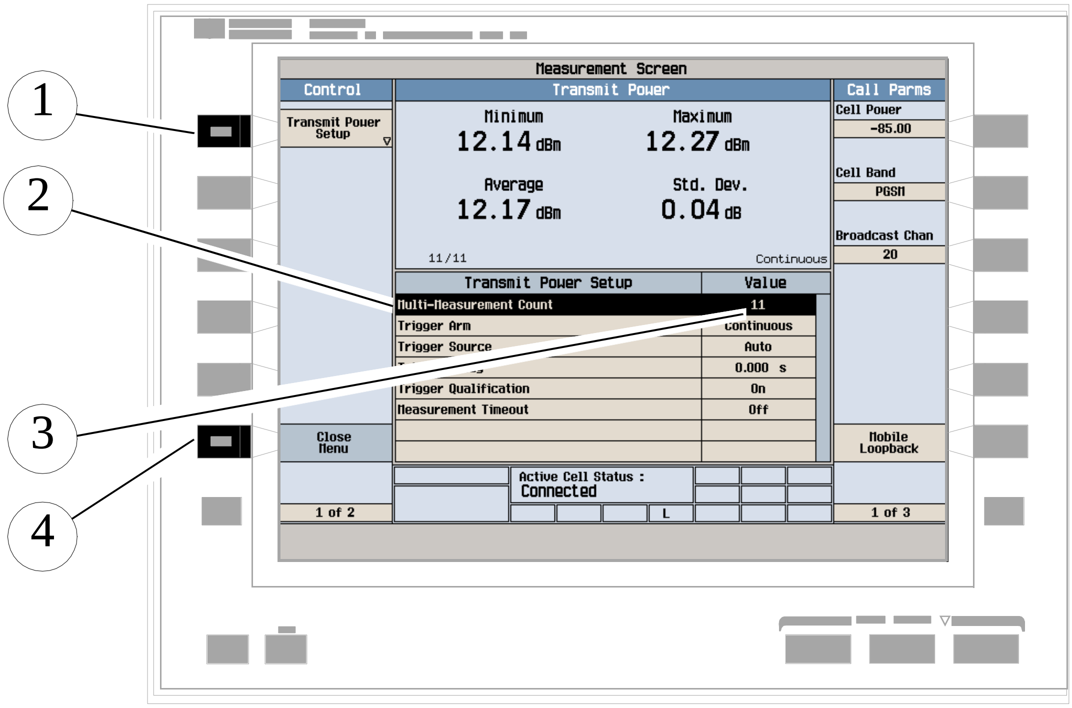
A. Select a measurement.



Loc	Measurement Selection
	Transmit Power
	Power vs Time
	Phase & Frequency Error
	Fast Bit Error
	Bit Error
	Analog Audio
	Decoded Audio
	Output RF Spectrum

1. Press the MEASUREMENT SELECTION key.
2. Highlight a measurement to setup and press the knob.

B. Set up the measurement.



Measurement Screen

Control: Transmit Power Setup

Transmit Power

Minimum 12.14 dBm
Maximum 12.27 dBm
Average 12.17 dBm
Std. Dev. 0.04 dB
11/11 Continuous

Transmit Power Setup	Value
Multi-Measurement Count	11
Trigger Arm	Continuous
Trigger Source	Auto
[illegible]	0.000 s
Trigger Qualification	On
Measurement Timeout	Off

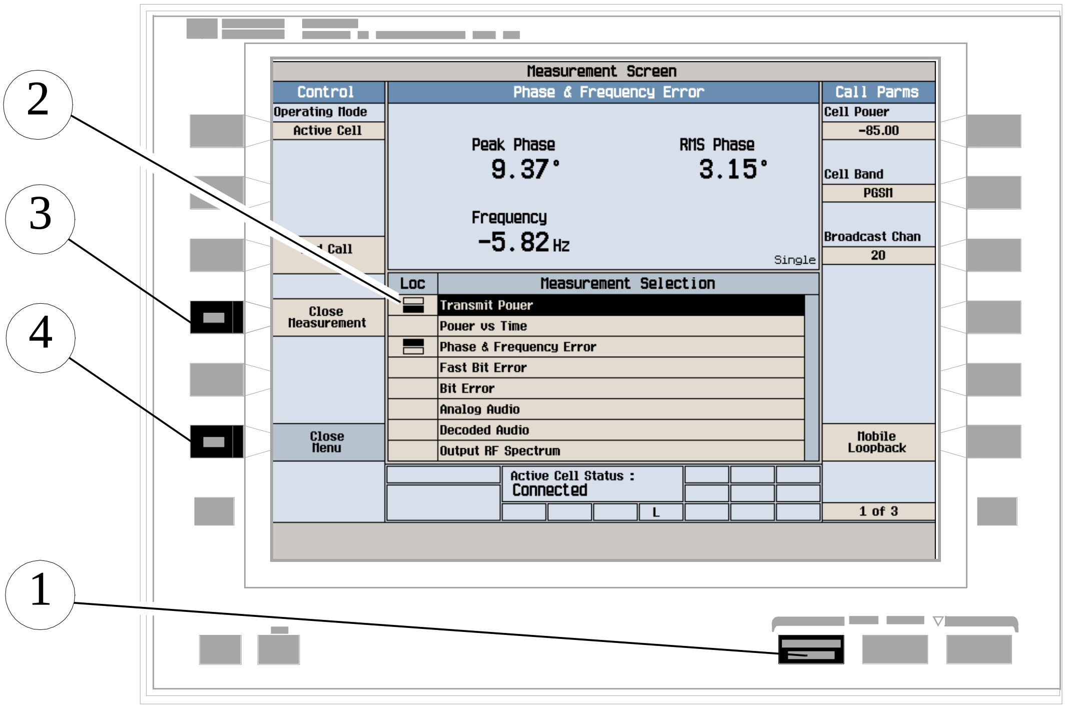
Call Parms
Cell Power -85.00
Cell Band PGSM
Broadcast Chan 20

Close Menu
Mobile Loopback
1 of 2
1 of 3

Active Cell Status : Connected

1. Press the setup key (F1).
2. Highlight a parameter and press the knob.
3. Enter a value or selection and press the knob. Note: For statistical measurement results, change the Multi-Measurement Count Number parameter from “Off” to a number >1.
4. Press Close Menu (F6).

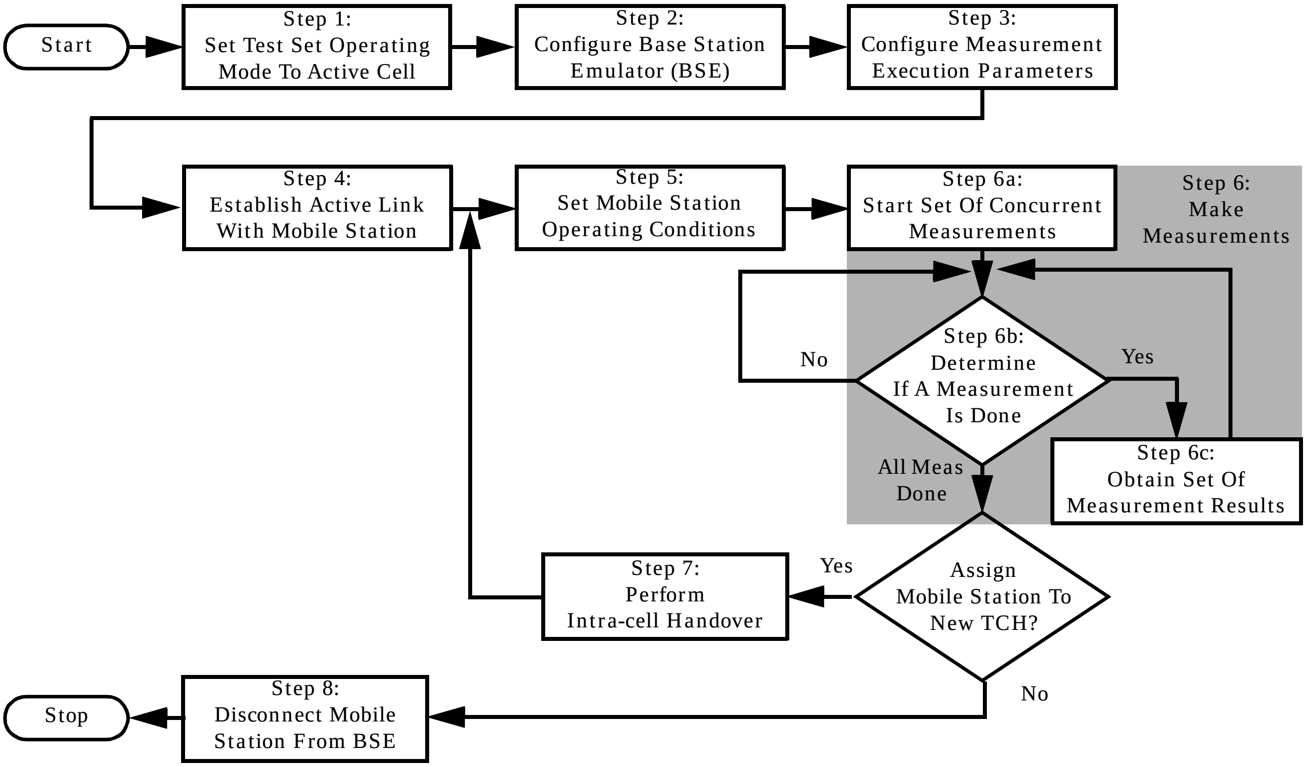
How Do I Turn Off a Measurement?


2
3
4
1
Measurement Screen
Control
Phase & Frequency Error
Call Parms
Operating Mode
Active Cell
Cell Power
-85.00
Peak Phase
9.37°
RMS Phase
3.15°
Cell Band
PGSM
Frequency
-5.82 Hz
Broadcast Chan
20
Single
Call
Loc
Measurement Selection
Close Measurement
Transmit Power
Power vs Time
Phase & Frequency Error
Fast Bit Error
Bit Error
Analog Audio
Decoded Audio
Output RF Spectrum
Close Menu
Mobile Loopback
Active Cell Status :
Connected
L
1 of 3

1. Press the MEASUREMENT SELECTION key.
2. Highlight the measurement you want to turn off.
3. Press Close Measurement (F4).
4. Press Close Menu (F6).

Programming Overview

Figure 8. Typical Flow Of Tasks Performed By Control Program


Start
Step 1:
Set Test Set Operating
Mode To Active Cell
Step 2:
Configure Base Station
Emulator (BSE)
Step 3:
Configure Measurement
Execution Parameters
Step 4:
Establish Active Link
With Mobile Station
Step 5:
Set Mobile Station
Operating Conditions
Step 6a:
Start Set Of Concurrent
Measurements
Step 6:
Make
Measurements
No
Step 6b:
Determine
If A Measurement
Is Done
Yes
All Meas
Done
Step 6c:
Obtain Set Of
Measurement Results
Step 7:
Perform
Intra-cell Handover
Yes
Assign
Mobile Station To
New TCH?
No
Stop
Step 8:
Disconnect Mobile
Station From BSE

Related Topics

****

"Programming a Phase and Frequency Error Measurement" on page 74

"Programming a Transmit Power Measurement" on page 86

"Programming an Output RF Spectrum Measurement" on page 69

"Programming a Power versus Time Measurement" on page 81

"Programming a Fast Bit Error Measurement" on page 63

"Establishing an Active Link with the Mobile Station" on page 28

****

7 Installation/Configuration

Configuring the Test Set’s Look and Feel

Beeper

An audible tone (beep) is generated when an error message is logged. If two errors are generated in quick succession, two beeps are generated to indicate that more than one error has been logged.
“SYSTem:BEEPer” on page 381

Example

```
OUTPUT 714;”SYSTEM:BEEPER:STATE OFF”
```

Screen Intensity

The screen intensity has two settings, medium and high. See “DISPlay” on page 250.

Example

```
OUTPUT 714;”DISPLAY:BRIGHTNESS MEDIUM” ! sets screen intensity to medium.
```

Screen Color

At this time, you cannot change the colors of the text or background shown test set’s display in this version of the Test Set.

Display On/Off (Track Mode/Fast Mode)

There are two display modes to select from when operating the test set remotely. These are described below.

FAST Mode

When operating remotely, there is often no need for the display to be updated as measurements are made. Using the FAST display mode will increase the speed of the Test Set when it is operated remotely.

- No screen or menu items are visible (except error messages).
- Error messages will be displayed in their normal location.
- “This instrument is being operated remotely” will be displayed at the bottom of the screen.

Example

```
OUTPUT 714;”DISPLAY:MODE FAST” !Selects fast mode
```

TRACK Mode

The track display mode is used to allow users to see what the test set is doing while it is being controlled remotely.

- Any changes made remotely will be updated on the screen if they are displayed.
- The Error message screen will be displayed as required when an error occurs.

Example

```
OUTPUT 714;”DISPLAY:MODE TRACK”!Selecte track mode
```

Related Topics

****

“DISPlay” on page 250

****

Obtaining Identification Information *IDN?

The identification query provides information about the origin, nature, and definition of the test set and is divided into four parts Manufacturer, Model Number, Serial Number, and Codeware Revision. *IDN? is defined in IEEE Std. 488.2-1992, 10.14.

***IDN? Programming example:**

```
DIM A$[100]

OUTPUT 714;”*IDN?”!returns manufacturer,model number, serial number and “0” separated by
commas

ENTER 714;A$

PRINT A$ ! would print, for example “HEWLETT-PACKARD, 8960 Series 10 E5515A,US38020105,0”
```

Manufacturer

Hewlett-Packard

Model Number

Printable ASCII characters excluding comma and semicolon up to a 22-character string.

Serial Number

Printable ASCII characters excluding comma and semicolon up to a 10-character string.

Codeware

Printable ASCII characters excluding comma and semicolon up to a 20-character string.

Related Topics

****

HP-IB Common Commands“*IDN?” on page 395

****

Configuring the Test Set's I/O

HP-IB

The HP-IB address is an integer between 0 and 30. The test set comes with a default address of 14 and may be set/queried using the SYSTem subsystem, see "SYSTem:COMMunicate:GPIB:[:SELF]:ADDRess" on page 382 or manually through the system configuration screen by selecting the parameter and changing the number with the knob or the keypad.

The HP-IB address is a non-volatile parameter. The HP-IB address is not affected by any reset operation and can only be changed by direct access to the parameter itself.

LAN

The LAN address is a 15-character string with a format of A, B, C, D, where A is between 0 and 223, and B, C, and D are between 0 and 255. No embedded spaces are allowed. The address may be manually set/viewed in the system configuration screen. The LAN address can be set/queried using the SYSTem subsystem. See "SYSTem:COMMunicate:LAN[:SELF]:ADDRess" on page 383.

The LAN address is a non-volatile parameter. The LAN address is not affected by any reset operation and can only be changed by direct access to the parameter itself.

For convenience the DATA port on the front panel may be configured as a LAN port. When a RJ45 jumper cable, (part number E5515-61160) is connected from the LAN PORT on the rear panel, to the ETHERNET TO FRONT PANEL port also on the rear panel, the user has LAN access from the front panel of the test set. Without the RJ45 jumper cable, the test set connection to a LAN is the rear-panel, LAN PORT connector.

Related Topics

****

"SYSTem:COMMunicate" on page 382

****

Measurement Related Configuration

Amplitude Offset (RF In/Out port)

Amplitude offset is provided in order to offset RF levels at the RF IN/OUT port of the test set and represent the power level at the device under test. The offset is the same for both transmit and receive power so the network being compensated for must have the same gain or loss in both directions. The Amplitude Offset value is found in the system configuration screen, Port Configuration F-key.

HP-IB Examples

The SYST:CORR:STAT command turns amplitude offset on or off. When SYST:CORR:STAT is ON the annunciator “Offset” will be shown on the display. see “SYSTem:CORRection” on page 384

```
OUTPUT 714;”SYSTem:CORRection:STATe ON” !Set amplitude offset state ON.
```

```
OUTPUT 714;”SYSTem:CORRection:GAIN -3DB” !Set amplitude offset to 3 dB loss in network.
```

```
OUTPUT 714;”SYSTem:CORRection:GAIN 6DB” !Set amplitude offset to 6 dB gain in network.
```

```
OUTPUT 714;”SYSTem:CORRection::SGAIN -2DB” !Set amplitude offset to ON and a 2 dB loss in
the network.
```

When the amplitude offset is nonzero, the measurements reflect the actual power at the connection to the device under test, known as the DUT plane. The test set Cell Power indicates a change to compensate for loss or gain in the network, however the Expected Power setting remains unchanged. see “CALL:POWer” on page 239 or see “Expected Power” on page 418

Transmitter example

For an amplitude offset other than zero, the Cell Power reflects the actual transmit power at the device under test. Only the value in the Cell Power field changes the actual power level at the test set RF IN/OUT does not change.

If the Cell Power setting is –85 dBm, and the SYST:CORR:SGAIN -6DB command is sent, the Cell Power setting indicates –91 dBm, which represents the cell power at the mobile station after a 6 dB loss in the network.

Receiver example

For an amplitude offset other than zero, the Expected Power setting reflects the actual receiver power at the device under test. This means the value displayed for Expected Power does not change, however the test set’s hardware changes internally to expect a level that includes the offset.

If the expected power setting is 12 dBm and then the SYST:CORR:SGAIN -3DB command is sent, the Expected Power remains unchanged at 12 dBm to reflect the level at the device under test, but the test set’s internal hardware changes to receive 9 dBm the actual power received at the test set’s RF IN/OUT connector.

Related Topics

****

“RFANalyzer” on page 307

****

Obtaining Configuration Information

The Test Set does not have the capability to report this information at this time.

Configuration Information provides the details of the elements inside the Test Set and is divided into three parts Hardware, Calibration and Codeware, these elements determine the functional characteristics of the Test Set.

Hardware

Codeware

Calibration

Selecting a Radio Personality

Radio personality description and process for selecting a new one when it becomes necessary. Not available in this version of the Test Set.

Timebase Description/Configuration

The user may query the test set to verify if it is using an external reference oscillator or an internal reference oscillator. The user may also query the test set to verify if the reference oscillator is locked. The reference oscillator functionality is controlled through the SYSTEM subsystem.

HP-IB Example

```
OUTPUT 714;"SYSTEM:ROSCILLATOR[:TIMEBASE]?"!Returns INT or EXT (internal or external)
timebase.
```

```
OUTPUT 714;"SYSTEM:ROSCILLATOR:LOCKED?"!Returns 1 or 0 (locked or unlocked) condition for
timebase.
```

Related Topics

****

"SYSTem:ROSCillator" on page 392

****

8 Error Messages

Error Message List and Summary

- "Error Message List" on page 460
- "Summary of Error Messages" on page 469

Error Message List

-440 Query UNTERMINATED after indefinite response

-430 Query DEADLOCKED

-420 Query UNTERMINATED

-410 Query INTERRUPTED

-400 Query error

-363 Input buffer overrun

-362 Framing error in program message

-361 Parity error in program message

-360 Communication error

-350 Queue overflow

-340 Calibration failed

-330 Self-test failed

-321 Out of memory

-320 Storage fault

-315 Configuration memory lost

-314 Save/recall memory lost

-313 Calibration memory lost

-312 PUD memory lost

-311 Memory error

-300 Device-specific error

-278 Macro header not found

-277 Macro redefinition not allowed

-276 Macro recursion error

-275 Macro definition too long

-274 Macro parameter error

-273 Illegal macro label

-272 Macro execution error

-271 Macro syntax error

-270 Macro error

-258 Media protected

-257 File name error

-256 File name not found

-255 Directory full

-254 Media full

-253 Corrupt media

-252 Missing media

-251 Missing mass storage

-250 Mass storage error

-241 Hardware missing

-240 Hardware error

-233 Invalid version

-231 Data questionable

-230 Data corrupt or stale

-226 Lists not same length

-225 Out of memory

-224 Illegal parameter value

-223 Too much data

-222 Data out of range <range message>

-221 Setting conflict

-220 Parameter error

-203 Command protected

-200 Execution error

-184 Macro parameter error

-183 Invalid inside macro definition

-181 Invalid output macro definition

-180 Macro error

-178 Expression data not allowed

-171 Invalid expression

-170 Expression error

-168 Block data not allowed

-161 Invalid block data

-160 Block data error

-158 String data not allowed

-151 Invalid string data

-150 String data error

-148 Character data not allowed

-144 Character data too long

-141 Invalid character data

-140 Character data error

-138 Suffix not allowed

-134 Suffix too long

-131 Invalid suffix

-130 Suffix error

-128 Numeric data not allowed

-124 Too many digits

-123 Exponent too large

-121 Invalid character in number

-120 Numeric data error

-114 Header suffix out of range

-113 Undefined header

-112 Program mnemonic too long

-111 Header separator error

-110 Command header error

-109 Missing parameter

-108 Parameter not allowed

-105 GET not allowed

-104 Data type error

-103 Invalid separator

-102 Syntax error

-101 Invalid character

-100 Command error

+101 Assert; Cycle power. Assert message<message1>

+102 Exception; Cycle power. Exception message<message2>

+103 Failure; No measurements or settings can be made

+104 Failure; No settling operations will take place

+105 Failure; No measurements or settings can be made for the function selected

+110 Input pacing; Internal communication queue overflow likely

+111 Input pacing; Internal communication queue overflow imminent. Pacing increased

+112 Internal error; Protocol error <message3>

+120 Warning; Receiver overrange due to present setting of Amplitude offset (SYST:CORR:GAIN)

+201 GSM call disconnected; Radio link failure (Timer T100 expiry)

+202 GSM call disconnected; Immediate assignment failure (Timer T3101 expiry)

+203 GSM call disconnected; Handover failure (Timer T3103 expiry)

+204 GSM call disconnected; Channel assignment failure (Timer T3107 expiry)

+205 GSM call disconnected; No response to page (Timer T3113 expiry)

+206 GSM call disconnected; No answer (Timer T301 expiry)

+207 GSM call disconnected; No response to setup (Timer T303 expiry)

+208 <deleted> - available for use

+209 <deleted> - available for use

+210 GSM call disconnected; No response to release 2 times (Timer T308 expiry)

+211 GSM call disconnected; No alert from mobile (Timer T310 expiry)

+212 GSM call disconnected; No response to connect (Timer T313 expiry)

+213 GSM call disconnected; Data link failure (Timer T200 expiry)

+214 GSM call disconnected; Physical information repetition failed (Timer T3105 expiry)

+215 <deleted> - available for use

+216 <deleted> - available for use

+217 GSM call disconnected; TMSI reallocation failed (Timer T3250 expiry)

+218 GSM call disconnected; Authentication failed (Timer T3260 expiry)

+219 <deleted> - Available for use

+220 GSM call processing failure; Call processing not available

+230 GSM operation rejected; Call processing disabled

+231 GSM operation rejected; Attempting to set MCC while generating a BCH

+232 GSM operation rejected; Attempting to set LAC while generating a BCH

+233 GSM operation rejected; Attempting to set BCC while generating a BCH

+234 GSM operation rejected; Attempting to set NCC while generating a BCH

+235 GSM operation rejected; Attempting to set MNC while generating a BCH

+236 GSM operation rejected; Only one call can be supported at a time

+237 GSM operation rejected; Requested TCH Band is invalid in current state

+250 GSM protocol failure; No response to disconnect (Timer T305 expiry)

+251 GSM protocol failure; No response to release (Timer T308 expiry)

+252 GSM protocol failure; Channel release failed (Timer T3109 expiry)

+253 GSM protocol failure; Identification failure (Timer T3270 expiry)

+254 GSM protocol failure; Unknown identity type received from mobile

+255 GSM protocol failure; Unexpected identity type received from mobile

+256 GSM protocol failure; Channel assignment exceeded specified number of frames

+257 GSM protocol failure; Invalid TMSI received from MS

+260 GSM RR Cause; <cause identifier>

+261 GSM MM Cause; <cause identifier>

+262 GSM CC Cause; <cause identifier>

+301 GSM data link failure; Unsolicited UA response

+302 GSM data link failure; Unsolicited DM response

+303 GSM data link failure; Unsolicited DM response, multiple frame established state

+304 GSM data link failure; Unsolicited supervisory response

+305 GSM data link failure; Re-establishment request

+306 GSM data link failure; Received SABM while in multiple frame operation

+307 GSM data link failure; SABM command with information field not allowed in present state

+308 <deleted> - available for use

+309 GSM data link failure; N(R) sequence error

+310 GSM data link failure; U frame with incorrect parameters

+311 GSM data link failure; S frame with incorrect parameters

+312 GSM data link failure; I frame with incorrect use of the M bit

+313 GSM data link failure; I frame with incorrect length

+314 GSM data link failure; Illegal frame. Frame not implemented

+315 <deleted> - available for use

+316 <deleted> - available for use

+400 Hardware failure; Hardware is not available

+401 Hardware failure; Protocol processor hardware is not responding

+402 Hardware failure; Demod receiver hardware is not responding

+403 Hardware failure; Measurement receiver hardware is not responding

+404 Hardware failure; RF source 1 hardware is not responding

+405 Hardware failure; RF source 1 digital modulation hardware is not responding

+406 Hardware failure; RF source 1 level hardware is not responding

+407 Hardware failure; DSP demod control hardware is not responding

+408 Hardware failure; 2nd demod receiver hardware is not responding

+409 Hardware failure; Base station emulator trigger hardware is not responding

+410 Hardware failure; Audio source hardware is not responding

+411 Hardware failure; RF source 2 hardware is not responding

+412 Hardware failure; Internal voltmeter hardware is not responding

+413 Hardware failure; Fixed timebase input is not responding

+414 Hardware failure; Fixed external reference output is not responding

+415 Hardware failure; Instrument reference is not responding

+416 Hardware failure; Bit clock A is not responding

+417 Hardware failure; RF source 2 frequency hardware is not responding

+418 Hardware failure; RF source 2 digital modulation hardware is not responding

+419 Hardware failure; RF source 2 level hardware is not responding

+420 Hardware failure; RF source hopping hardware is not responding

+421 Hardware failure; Digital demod hopping hardware is not responding

+422 Hardware failure; Misc VI hardware is not responding

+423 <deleted> - available for use

+424 <deleted> - available for use

+425 Hardware failure; Invalid EEPROM checksum <EEPROM board ID>

+426 Hardware failure; Unable to write to EEPROM <EEPROM board ID>

+427 Hardware failure; Unable to read from EEPROM <EEPROM board ID>

+428 Hardware failure; Board not identified <board ID>

+429 Hardware failure; Could not create board identification <board ID>

+430 Hardware failure; Control version not compatible with FW <board ID>

+431 Hardware failure; RF IO DAC cannot be calibrated due to present temperature

+500 to +599 No errors currently defined

+601 Instrument failure; Audio generator hardware is not responding

+621 Instrument warning; Audio generator instrument has been closed

+701 GSM measurement failure; TX power hardware is not responding

+702 GSM measurement failure; Power vs time hardware is not responding

+703 GSM measurement failure; Phase frequency error hardware is not responding

+704 GSM measurement failure; Output RF spectrum hardware is not responding

+705 GSM measurement failure; Fast bit error hardware is not responding

+706 GSM measurement failure; Bit Error hardware is not responding

+707 GSM measurement failure; Decoded audio hardware is not responding

+721 GSM measurement warning; TX power measurement has been closed

+722 GSM measurement warning; Power vs time measurement has been closed

+723 GSM measurement warning; Phase frequency error measurement has been closed

+724 GSM measurement warning; Output RF spectrum measurement has been closed

+725 GSM measurement warning; Fast bit error measurement has been closed

+726 GSM measurement warning; Bit error measurement has been closed

+727 GSM measurement warning; Decoded audio measurement has been closed

+801 Measurement failure; Analog audio hardware is not responding

+821 Measurement warning; Analog audio measurement has been closed

+901 Calibration error; Calibration system is busy

+902 Calibration error; Default data being used <cal file>

+903 Calibration error; Invalid data being used <cal file>

+904 Calibration error; Error occurred when writing data to EEPROM <cal file>

+905 Calibration error; Offset to calibration latch is 0 <cal file>

+906 Calibration error; File create error <cal file>

+907 Calibration error; File open error <cal file>

+908 Calibration error; File seek error <cal file>

+909 Calibration error; File close error <cal file>

+910 Calibration error; File fclose error <cal file>

+911 Calibration error; File write error <cal file>

+912 Calibration error; File seek and close error <cal file>

+913 Calibration error; File write and close error <cal file>

+914 Calibration error; File read and close error <cal file>

+915 Calibration error; File make directory error <cal file>

+916 Calibration error; File close directory error <cal file>

+917 Calibration error; File element index is invalid <cal file>

+918 Calibration error; File is invalid <cal file>

+919 Calibration error; File name is invalid <cal file>

+920 Calibration error; File size is invalid <cal file>

+921 Calibration error; Restore aborted for cal file <cal file>

+930 Hardware failure; Requested board name not supported for<1st 20 characters of board name sent>

+940 Temp error; No HR semantic defined for<message>

+950 Temp status; Call disconnected by user operation

+951 Temp status; Value clipped, setting not reflected in hardware

+952 Temp status; Value clipped, setting not reflected in hardware

+953 Temp status; Operation completed successfully

MUI1 The function you requested is not yet available.

MUI2 IQ Calibration completed successfully for modulator <N>. Preset the instrument to continue.

MUI3 IQ Calibration failed for modulator <N>. Preset the instrument to continue.

MUI4 The function you requested is not available in this test application

Summary of Error Messages

-400 to -499 Query Error

A Query error is generated either when data in the instrument's HP-IB output queue has been lost, or when an attempt is being made to read data from the output queue when no output is present or pending.

-300 to -399 SCPI Specified Device-Specific Error

A device-specific error indicates that the instrument has detected an error that occurred because some operations did not properly complete, possibly due to an abnormal hardware or firmware condition. For example, an attempt by the user to set an out of range value will generate a device specific error. When one of these errors is generated, the device specific error bit in the event status register is set. Refer to "Standard Event Status Register" on page 377 for information on this register.

-200 to -299 Execution Error

These errors are generated when something occurs that is incorrect in the current state of the instrument. These errors may be generated by a user action from either the remote or the manual user interface.

-100 to -199 Command Error

A command error indicates that the test set's HP-IB parser has detected an IEEE 488.2 syntax error.

When one of these errors is generated, the command error bit in the event status register is set. Refer to "Standard Event Status Register" on page 377 for information on this register.

+100 to +199 Core Device-Specific Error

A device-specific error indicates that the instrument has detected an error that occurred because some operations did not properly complete, possibly due to an abnormal hardware or firmware condition. For example, an attempt by the user to set an out of range value will generate a device specific error.

These are general errors generated by the core instrument. When one of these errors is generated, the '+100 errors' bit in the questionable error status register is set. Refer to "STATus:QUEStionable" on page 367 for information on this register.

+200 to +299 Call Processing Device-Specific Error

These errors are generated when a problem occurs maintaining the link between the test set and the DUT. These errors generally occur as a result of an problem on the link such as if the DUT did not respond to a message, or the user attempted to perform an invalid operation in the current instrument state.

Errors with a description beginning with "GSM call disconnected" mean that the call is dropped when the error occurs. Errors beginning with "GSM protocol failure" mean that the call is not necessarily dropped, these are informational messages.

+300 to +399 Link Control Device-Specific Error

These errors are generated when a problem occurs in maintaining the link between the test set and a DUT. These errors generally occur when a message is received from the DUT that is unexpected.

When one of these errors is generated, the ‘+300 errors’ bit in the questionable error status register is set. Refer to “Standard Event Status Register” on page 377 for information on this register.

+400 to +499 Core Hardware Device-Specific Error

These errors are generated when a problem occurs in one of the test set’s hardware modules that is part of the test set’s core instrument.

When one of these errors is generated, the ‘+400 errors’ bit in the questionable error status register is set. Refer to “Standard Event Status Register” on page 377 for information on this register.

+500 to +599 Test Application Hardware Device-Specific Error

These errors are generated when a problem occurs with a hardware module that is required for a particular test application.

When one of these errors is generated, the ‘+500 errors’ bit in the questionable error status register is set. Refer to “Standard Event Status Register” on page 377 for information on this register.

+600 to +699 Instrument Device-Specific Error

These errors are generated when a problem occurs that is specific to one of the test set’s instruments. These errors are part of the test set’s core. Note that these measurements may not be present in every test application and therefore, these errors may not be present in every test application. There is no plan at present to support test application specific instruments.

An instrument in this context refers to the measurement-like functionality such as the audio generator and not to the test set as a whole.

When one of these errors is generated, the ‘+600 errors’ bit in the questionable error status register is set. Refer to “Standard Event Status Register” on page 377 for information on this register.

+700 to +799 Test Application Measurement Device-Specific Error

These errors are generated when a problem occurs that is specific to one of the test set’s measurements (such as BER, or TX power). These are test application specific.

When one of these errors is generated, the ‘+700 errors’ bit in the questionable error status register is set. Refer to “Standard Event Status Register” on page 377 for information on this register.

+800 to +899 Core Measurement Device-Specific Error

These errors are generated when a problem occurs that is specific to one of the test set’s core measurements (such as analog audio). Note that these measurements may not be present in every test application and therefore, these errors may not be present in every test application.

When one of these errors is generated, the ‘+800 errors’ bit in the questionable error status register is set. Refer to “Standard Event Status Register” on page 377 for information on this register.

+900 to +999 Internal Errors, Calibration Device-Specific Error

These errors are generated when a problem with an area of functionality that is defined as ‘for factory use only’, or from a calibration problem.

When one of these errors is generated, the ‘+900 errors’ bit in the questionable error status register is set. Refer to “Standard Event Status Register” on page 377 for information on this register.

Error Message Log

When an error message is displayed, it is also logged in the error message log. This log is only accessible manually; it is not available through HP-IB. The error message log can have two pages it can be displayed by pressing the F7 menu key, Next Page and Previous Page controls are provided.

All errors and events that are generated are displayed in the error message log. When the log is full a new message is sent to the log and the oldest message is removed from the log. The log is cleared when the test set powers up or when the user presses F10 (Clear Error Message Log).

Related Topics

****

“Error Message List and Summary” on page 459

****

E1960A GSM Mobile Test Application Features

This document describes features and functionality that is part of the E1960A. This document contains the original features, as well as enhancements that have been added over time. Future enhancements and release dates are tentative and subject to change. The most recent, up-to-date version of this document is available on our website at: http://www.hp.com/HP8960support/

Last revision: 3/1999

Test Application Revision: A.01, 3/1999

Call Processing

- GSM 900 (Includes PGSM/EGSM), DCS1800, PCS1900
- MS and BS Originated Calls
- TCH, Timeslot, Timing Advance, MS Tx Level Assignments
- Dual-Band Handover
- Downlink Speech Source
- Test Mode - CW, BCH Only, BCH + TCH

Measurements

- Normal BER
- Tx Power
- Output RF Spectrum
- Power versus Time
- Phase / Frequency Error
- Burst Timing
- Analog Audio
- Uplink Speech Measurement (requires pulsed audio source)
- Burst by Burst BER (Fast BER)
- Pulsed Audio Source

Other

- Audio Source
- User settable amplitude offset

Test Application Revision A.02, Estimated 7/1999

Call Processing

- Status Registers

E1960A GSM Mobile Test Application, rev A.01
Known Error Conditions

This document describes known error conditions that have been identified in this codeware release.

HP8960 Known Error Conditions

The following table describes the known error conditions that may occur with the HP8960 and the operations necessary to recover from each error. Many of these will never be seen in normal operation.

Known Error	Description of Error Conditions	How to Recover
Turning cell activated state off while in a dual-band call will lock up instrument or create an assert message. Ref Hfw_1707	During a dual-band call, the second source is active for the TCH. The current Cell Activated State OFF operation does not work correctly when the second source is active.	Terminate the call before performing any changes to Cell Activated State.
Dual Band Handover not available when Cell Band = PGSM	A dual band handover is normally performed by establishing a call and then changing TCH BAND. This cannot be performed when Cell Band is set to PGSM.	Set the Cell Band to EGSM for all PhaseII GSM MS's. This will be added to A.01.xx firmware.
ORFS and PVT measurement shows dashes when changing views. Ref Hfw_1423	When running ORFS and PVT measurements in Continuous trigger, it is possible for the display to show all dashes, even though the results should be available. This is not an issue with Single triggering.	The next time the measurement completes, the display will be updated properly.
Measurements on RACH bursts may not display the results if the measurement is running in the background. Ref Hfw_1929	On the manual user interface, if a measurement is activated and then two additional measurements are initiated, the first measurement is placed in the display 'background'. If a RACH burst is received by the first measurement, the results may not be displayed when the measurement display is brought back into the foreground.	When trying to measure RACHs on the manual user interface, always make certain the measurement is in the display foreground before the RACH is received.
MS drops a call when Timing Advance set to high values (>50 bits) Ref Hfw_2049, Prot_398	On rare occasions, setting the timing advance to > 50 bits will cause the MS to drop a call or not complete the initial assignment at call set up.	It is unlikely this will happen, however if it does, the call will need to be re-established.
Measurement won't work with Test Mode and receiver control set to manual Ref Hfw_2044	When using test mode and setting the receiver control to manual tuning. The measurements won't complete.	Set tuning mode to manual, back to auto, then to manual. Repeat this each time the receiver control is set to manual.
Fast Bit Error Rate does not appear to provide accurate results	With a call set up, and Fast BER is initiated, the results do not seem reasonable.	The test set operates differently than the 8922. It is necessary to send MS Loopback Type C command after each call set up or assignment.

Unfavorable Operating Conditions

This section describes several operating conditions which may cause errors with the HP 8960. The conditions are described and any errors which may occur are noted.

5. Do not perform any HP-IB or front panel operations before the instrument is fully powered up.

   The instrument does not currently prevent a user from sending a remote command before it is completely powered up. This can cause various unforeseen performance problems and failures.

6. “End Call” followed immediately by “Originate Call” may cause the Origination to fail. It is believed that the speed at which the HP8960 protocol processor can “Disconnect” and “Re-originate” is significantly faster than most MS’s have the ability to respond to. This is not a common usage scenario, but this may be performed as part of an evaluation process. To avoid this situation, ensure that the MS is ready for a page before the HP8960 is asked to Originate a call.

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