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```
Operation Status Register:  Status Byte Bit 7

## The OPERation status register set contains conditions which
## are part of the instrument's normal operation.

   condition register bit definitions:

    14 - PROGram running


Communication Status Register: Status Byte Bit 0,
                               Hardware 1 Status Register Bit 7

   condition register bit definitions:

    3 - Protocol Processor Communication Channel Failure
    2 - DSP Analyzer Communication Channel Failure
    1 - Hop Controller Communication Channel Failure
    0 - Communication failure with Signaling Board


CALibration Register: Status Byte Bit 3,
                      Questionable Data/Signal Status Register Bit 7

   condition register bit definitions:

    6  - Reference calibrate failure
    5  - AGC Open Loop cal failure
    3  - Voltmeter Self cal failure
    2  - Counter Self cal failure
    1  - Sampler Self cal failure
    0  - Spectrum Analyzer Self cal failure
```


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```
EMMI Status Register: Status Byte Bit 0,
                      Hardware 1 Status Register Bit 8

   event register BIT definitions:

    3 - Response timeout
    2 - Mobile XON timeout
    1 - NAK
    0 - ACK

##  The   STATus:EMMI:EVENt? queries the EMMI STATus buffer.  When an
##  EMMI:DATA <data entry> occurs, one of the above bits will be set.
##  Reading the status will clear all bits, subsequently setting the EMMI
##  status to idle.  Based on the above bits, the status buffer will return
##  one of five numbers indicating the status of the last EMMI message sent by
##  the HP8922G.
##     (0) There was no data sent since that last status check and there were
##         no events to report, or the last EMMI:DATA <data entry> had
##         improper format.
##     (1) A message was received and acknowledged by the mobile station.
##         Important: this does not mean that the mobile was able to understand
##         or perform the operation (ACK received).
##     (2) The HP 8922G attempted to send a message, but the mobile station
##         did not receive the message intact (NAK received).
##     (4) EMMI data was sent, but the XON timeout expired before the
##         acknowledge was received (EMMI:TIMEout:MS:XON).
##     (8) EMMI data was sent, but the Response timeout expired
##        (EMMI:TIMEout:MS:RESPonse).


## Condition register bits will hold their state until the condition changes.
## Event register bits will be cleared as soon as they are read.
##
```


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STAT is a symbol that designates the following list of optional commands that apply to given status subsystem.

Included in STAT are the following commands:

```
      :CONDition?
##     Queries the contents of the CONDition register associated
##       with the status structure defined in the command.

      :ENABle?
      :ENABle                              <value> | [INUM]
##     Sets/queries the ENABle mask which allows true conditions
##       in the event register to be reported in the summary bit.
##       If a bit is 1 in the enable register and its associated
##       event bit transitions to true, a positive transition will
##       occur in the associated summary bit.

     [:EVENt]?
##     Queries the contents of the EVENt register associated
##       with the status structure defined in the command.

      :NTRansition?
      :NTRansition                         <value> | [INUM]
##     Sets/queries the Negative TRansition filter.  Setting a bit in the
##       negative transition filter causes a 1 to 0 transition in the
##       corresponding bit of the associated CONDition register to cause a 1 to
##       be written in the associated bit of the corresponding EVENt register.

      :PTRansition?
      :PTRansition                         <value> | [INUM]
##     Sets/queries the Positive TRansition filter.  Setting a bit in the
##       positive transition filter causes a 0 to 1 transition in the
##       corresponding bit of the associated CONDition register to cause a 1 to
##       be written in the associated bit of the corresponding EVENt register.
```


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```
STATus

    :CALibration
        [STAT]

    :COMMunication
        [STAT]

    :EMMI
        [STAT]

    :HARDware1
        [STAT]

    :HARDware2
        [STAT]

    :OPERation
        [STAT]

    :QUEStionable
        [STAT]

    :PRESet
##  PRESet configures the status data structures such that device-
##    dependent events are reported through the status-reporting
##    mechanism.  The preset command affects only the enable register
##    and transition filter registers.  (Presets all registers except
##    event status registers, service request enable register,
##    event status enable register and condition register bits.)

## NOTE - see IEEE 488.2 Common Commands for additional status commands.
```


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System Subsystem

```
SYSTem

  [:ERRor]?
## Queries the SYSTem ERRor queue.  This returns an error number and
##   a corresponding quoted message string separated by a comma.
##   Once the error is queried, it is removed from the queue.  If the
##   error queue becomes full, then the earliest messages are removed.

##   Example: if a command parameter is given that is out of range, then
##   SYST:ERR? will return:
##        -200,"Execution error;Parameter value out of range."
```


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Trigger Subsystem

```
TRIGger

## TRIGger commands.

NOTE: ASTate, SOURce, MODE[:DSPanalyzer] and UMEMory
      apply to the following types of measurements:
        DSPanalyzer - Phase, Amplitude, Data Bits
        PULSe       - Pulse On/Off Ratio
        ORFSpectrum - Output RF Spectrum
      DELay and HTCH apply to Digital Demod and Bit Error Test
      as well as the above measurements.

NOTE: ABORt, [IMMediate], and MODE are remote-only commands and apply to the
      following types of measurements: AF Analyzer, CW Meas, OSCilloscope,
      and SANalyzer.

   :ABORt
##  ABORts TRIGgering of a measurement that has been triggered using
##    TRIGger:IMMediate.

   :ASTate?
   :ASTate                                  'ARM' | 'DISARM'
##  Selects/queries the Arm STate of the currently selected measurement.
##    This command is used for all appropriate measurements listed in the
##    MEASure subsystem.

   :BETest?
   :BETest                                  'SINGLE' | 'CONT'
##  Selects/queries the TRIGger for Bit Error Test measurements
##    for local operation.
##    SINGLE means each Bit Error Test measurement will just be made once
##      (based on each measurement's definition of number of bits to
##      make the measurement over).
##    CONT means make each Bit Error Test measurement continuously,
##      repeatedly, copying Intermediate results into Complete results as
##      one or more of the termination conditions are met.
```


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```
        :MODE?
        :MODE                                   'RUN' | 'STOP'
##       Selects/queries the Bit Error Test measurement TRIGger MODE.
##         RUN initializes the Bit Error Test measurements to start and
##           starts all Bit Error Test measurements.
##         STOP Bit Error Test measurements - this is useful in aborting
##           long Bit Error Test measurements.

    :DDEMod

        :ADJMode?
        :ADJMode                                'ENABLED' | 'DISABLED'
##       Selects/queries the Digital DEMod TRIGger ADJust Mode.
##         Trigger adjust mode enables the user to change TRIG:DEL even
##         while Demod is armed.  Some Demod triggers will be missed while
##         changing trigger delay.

        :ASTate?
        :ASTate                                 'ARM' | 'DISARM'
##       Selects/queries the Arm STate of the Digital DEMod TRIGger.
##         Must be on digital demod, cell configuration or cell control
##         screens to Arm Digital Demod.

        :SOURce?
        :SOURce                                 'EXT MEAS' | 'EXT DEMOD' | 'RF RISE'
##       Selects/queries the Digital DEMod TRIGger SOURce.
##         EXT DEMOD means Demod is triggered from an external trigger
##            signal that is normally intended for doing Demod.
##         RF RISE means the measurement is triggered automatically when a
##            rising edge is detected on the RF envelope of the input.
##         EXT MEAS means Demod is triggered from an external trigger
##            signal that is normally intended for doing measurements.

    :DELay?
    :DELay                                      <(value) [units]> | [FNUM]
##   Sets/queries the TRIGger DELay.  This applies to measurements
##     as well as Digital Demod.
##     HP-IB units are seconds (S), bit periods (T).
##     Default HP-IB unit is seconds (S).
##     Default display unit is bit periods (T).
```


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```
   :HTCH                              'SPECIFIC' | 'AUTO'
##  Selects/queries the Hopped TCH ARFCN Trigger control.
##    This only applies when TCH:MODE is 'HOPPED' and the Cell Configuration
##    is 'ACTIVATED' and the radio has been assigned to a TCH channel.

     :ARFCn

       [:SPECific]?
       [:SPECific]                          < value >
##          Sets/queries the SPECific ARFCn to use for a Hopping
##            TCH measurement when TRIGger:TCH is set to 'SPECIFIC'.

           :AUTO?
##          Queries the ARFCn that is being used for a Hopping
##            TCH measurement when TRIGger:TCH is set to  'AUTO'.
##            This value is the lowest ARFCN in the currently used
##            MA table (MA1 or MA2).

   :[IMMediate]
##  IMMediately TRIGgers the currently active measurement.

   :MODE

     [:DSP]?
     [:DSP]                                'SINGLE' | 'CONT'
##     Selects/queries the DSP TRIGger MODE as SINGLE or CONTinous.
##       This is used for Phase, Amplitude, Output RF Spectrum,
##       Pulse On/Off Ratio and Data Bits measurements.
##       NOTE: in CONTinous mode, the user does not manually arm
##             the instrument, but must provide a trigger in order
##             for the measurement to complete.
##       NOTE: This command is valid in both local and remote modes.

      :RETRigger?
      :RETRigger                          REPetitive | SINGle
##     Selects/queries the RETRigger MODE for the currently active
##       measurement.  Default setting is REPetitive.
##     IMPORTANT: The remote-only command will override local triggering
##          commands for continuous (repetitive) and single settings
##          for AF Analyzer, CW Meas, OSCilloscope, and SANalyzer.
```


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```
   :SOURce?
   :SOURce                                  'EXT MEAS' | 'EXT DEMOD' | 'RF RISE'
##   Selects/queries the measurement TRIGger SOURce.
##      EXT MEAS means the measurement is triggered from an external
##         trigger signal that is normally intended for doing measurements.
##      RF RISE means the measurement is triggered automatically when a
##         rising edge is detected on the RF envelope of the input.
##      EXT DEMOD means the measurement is triggered from an external
##         trigger signal that is normally intended for doing demod.


   :UMEMory
##  Executes the Use MEMory function.  This is the same as hitting the
##    USE MEM hardkey on the front panel.

      :SOURce?
      :SOURce                               'EXTERNAL' | 'BAD SYNC'
##     Selects/queries the USE MEM (Use MEMory) TRIGger SOURce.
##       BAD SYNC means that the UMEMory (USE MEM) memory will be
##         automatically filled when the Demod Sync Status changes from
##         'No Error' to 'Bad Sync' (DDEMod:SYNC:SSTatus?).
##       EXTERNAL means that the UMEMory (USE MEM) memory will be
##         automatically filled when an external line on the SYSTEM BUS
##         connector on the rear panel is in a particular state when a
##         valid demod trigger occurs.

      :STATus?
##     Returns 'No Data', 'New Data' or 'Old Data'.
##       NO DATA means that the UMEMory (USE MEM) memory contains
##         no valid data.
##       NEW DATA means that the UMEMory (USE MEM) memory contains
##         newly captured data from the most recent time demod was
##         armed (TRIGger:DDEMod:ASTate 'ARM') and bad synchronization
##         occurred (midamble did not exactly match the bits in the
##         defined midamble).
##       OLD DATA means that the UMEMory (USE MEM) memory contains
##         previously captured data from a previous time demod was
##         armed (TRIGger:DDEMod:ASTate 'ARM') or from a previous
##         DSP analyzer, Output RF Spectrum or Pulse On/Off Ratio
##         measurement (TRIGger:ASTate 'ARM').
```


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HP-IB Program Examples

The following examples illustrate control of the HP 8922G from an external controller through the HP-IB interface. There are eight examples:

1. Mobile station "camp" on.
2. HP 8922G originated call.
3. Mobile station originated call.
4. Ending a call.
5. Bit error test.
6. DSP Analyzer measurement during a call.
7. Pulse On/Off measurement without call processing.
8. High speed DSP Analyzer measurements.

The examples were written with few subprograms or subroutines to make the program listings easier to follow.

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Mobile Station Camp On Example

```
10    !
20    ! Example 01
30    !
40    ! Getting a Mobile Station to "Camp On":
50    !   Sets up the HP 8922G to output a broadcast channel and gets the
60    !   mobile station to camp on to the broadcast channel.
70    !
80    !*************************************************************************
90    ! System Configuration:
100   ! - Connect mobile station to the HP 8922G RF IN/OUT port.
110   !
120   !*************************************************************************
130   ! Declarations:
140   !
150   ASSIGN @Test_set TO 714          ! Assign an I/O path to the HP 8922G
160                                    ! at HP-IB address 714.
170   DIM Ba_table$[126]               ! Base station allocation table string
180                                    ! variable.
190   DIM System_error$[80]            ! System error message string variable.
200   !
210   ! System dependent parameters:
220   Ncc=1                            ! Network Color Code.
230   Bcc=5                            ! Base station Color Code.
240   Serving_arfcn=25                 ! Serving cell ARFCN.
250   Control_channel$="'SD/8'"        ! Control channel selection.
260   Cont_ch_arfcn=30                 ! Control channel ARFCN.
270   Cont_ch_tslot=2                  ! Control channel time slot.
280                                    ! Base station allocation table:
290   Ba_table$="'0000000000"          ! ARFCN 1 through 10.
300   Ba_table$=Ba_table$&"0000000000"! ARFCN 11 through 20.
310   Ba_table$=Ba_table$&"0000100000"! ARFCN 21 through 30.
320   Ba_table$=Ba_table$&"0000000000"! ARFCN 31 through 40.
330   Ba_table$=Ba_table$&"0000000000"! ARFCN 41 through 50.
340   Ba_table$=Ba_table$&"0000000000"! ARFCN 51 through 60.
350   Ba_table$=Ba_table$&"0000000000"! ARFCN 61 through 70.
360   Ba_table$=Ba_table$&"0000000000"! ARFCN 71 through 80.
370   Ba_table$=Ba_table$&"0000000000"! ARFCN 81 through 90.
380   Ba_table$=Ba_table$&"0000000000"! ARFCN 91 through 100.
390   Ba_table$=Ba_table$&"0000000000"! ARFCN 101 through 110.
400   Ba_table$=Ba_table$&"0000000000"! ARFCN 111 through 120.
410   Ba_table$=Ba_table$&"0000'"      ! ARFCN 121 through 124.
```


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```
420   Mcc=1                              ! Mobile Country Code.
430   Mnc=1                              ! Mobile Network Code.
440   Lac=1                              ! Location Area Code.
450   !
460   !*************************************************************************
470   !
480   !-------------------------------------------------------------------------
490   ! Set Up HP 8922G
500   !-------------------------------------------------------------------------
510   ! Instrument Preset.
520   OUTPUT @Test_set;"*RST"
530   !
540   ! Display the Cell Configuration screen.
550   OUTPUT @Test_set;"DISPLAY:SCREEN CCON"
560   !
570   ! Zero the power meter for future power measurements.
580   ! Turn down RF Generator amplitude first to avoid interference.
590   OUTPUT @Test_set;"RFGENERATOR:AMPLITUDE1 -127 dBm"
600   OUTPUT @Test_set;"CW:PMZERO"
610   !
620   ! Set RF Generator output amplitude.
630   OUTPUT @Test_set;"RFGENERATOR:AMPLITUDE1 -85 dBm"
640   !
650   ! Set the Network Color Code and the Base station Color Code.
660   OUTPUT @Test_set;"CCONFIGURE:SCELL:NCC ";Ncc
670   OUTPUT @Test_set;"CCONFIGURE:SCELL:BCC ";Bcc
680   !
690   ! Set the serving cell ARFCN.
700   OUTPUT @Test_set;"CCONFIGURE:SCELL:ARFCN ";Serving_arfcn
710   !
720   ! Set the base station allocation table.
730   OUTPUT @Test_set;"CCONFIGURE:BA "&Ba_table$
740   !
750   ! Set the control channel organization.
760   OUTPUT @Test_set;"CCONFIGURE:CCHANNEL "&Control_channel$
```


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```
770   !
780   ! Set the control channel ARFCN and timeslot.
790   OUTPUT @Test_set;"CCONFIGURE:CCHANNEL:SDCCH8:ARFCN ";Cont_ch_arfcn
800   OUTPUT @Test_set;"CCONFIGURE:CCHANNEL:SDCCH8:TSLOT ";Cont_ch_tslot
810   !
820   ! Set the Mobile Country Code, the Mobile Network Code, and the
830   ! Location Area Code.
840   OUTPUT @Test_set;"CCONFIGURE:LAI:MCCODE ";Mcc
850   OUTPUT @Test_set;"CCONFIGURE:LAI:MNCODE ";Mnc
860   OUTPUT @Test_set;"CCONFIGURE:LAI:LACODE ";Lac
870   !
880   ! Select the Cell Configure Activated state.
890   OUTPUT @Test_set;"CCONFIGURE:STAT 'ACTIVATED'"
900   !
910   !-------------------------------------------------------------------------
920   ! Wait for the HP 8922G to Output a Broadcast Channel
930   !-------------------------------------------------------------------------
940   ! Wait for up to 20 seconds for BCCH.
950   Time_out=20
960   Time_exceeded$="NO"              ! Timeout variable.
970   Start_time=TIMEDATE              ! Time reference for timeout.
980   !
990   ! Wait until BCCH is output.
1000  REPEAT
1010    ! Short wait to allow HP 8922G to process information.
1020    WAIT .2
1030    DISP "Waiting for HP 8922G to provide a BCCH..."
1040    ! Query the Cell Control radio resource signaling state.
1050    OUTPUT @Test_set;"CELL:CALL:STATUS:RR?"
1060    ENTER @Test_set;Call_status$
1070    !
1080    ! Check to see if time allotted has been exceeded.
1090    IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
1100    !
1110    ! Exit the loop if a BCCH is present or time allotted has been
1120    ! exceeded.
1130  UNTIL Call_status$="""BCCH""" OR Time_exceeded$="YES"
```


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```
1140  !
1150  !-------------------------------------------------------------------------
1160  ! Validate Results
1170  !-------------------------------------------------------------------------
1180  ! Check for system errors.
1190  ! Query all system errors that may be in the queue.
1200  REPEAT
1210    OUTPUT @Test_set;"SYSTEM:ERROR?"
1220    ENTER @Test_set;System_error$
1230    Sys_err_number=VAL(System_error$)
1240    !
1250    ! System error number 0 corresponds to NO ERROR.
1260    IF Sys_err_number<>0 THEN
1270      PRINT "Results are invalid."
1280      PRINT "System Error: "&System_error$
1290    END IF
1300    !
1310  UNTIL Sys_err_number=0
1320  !
1330  ! Check to see if time allotted was exceeded.
1340  IF Time_exceeded$="YES" THEN
1350    DISP "Camp failure. No BCCH is present."
1360  ELSE
1370    DISP "BCCH is present."
1380  END IF
1390  END
```


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HP 8922G Originated Call Example

```
10    !
20    ! Example 02
30    !
40    ! HP 8922G Originated Call:
50    !   Sets up the HP 8922G with information about the mobile station and
60    !   places a base station originated call.
70    !
80    !*************************************************************************
90    ! System Configuration:
100   ! - Connect mobile station to the RF IN/OUT port.
110   ! - MS should be camped (see example 01).
120   !
130   !*************************************************************************
140   ! Declarations:
150   !
160   ASSIGN @Test_set TO 714          ! Assign an I/O path to the HP 8922G
170                                    ! at HP-IB address 714.
180   DIM System_error$[80]            ! System error message string variable.
190   !
200   ! Mobile station dependent parameters:
210   Ms_tx_level=6                    ! Mobile station transmit level.
220   Imsi$="'001010000000001'"        ! Mobile station's International Mobile
230                                    ! Subscriber Identity (IMSI).
240   !
250   !*************************************************************************
260   !
270   !-------------------------------------------------------------------------
280   ! Set Up HP 8922G and Originate Call
290   !-------------------------------------------------------------------------
300   ! Display the Cell Control screen.
310   OUTPUT @Test_set;"DISPLAY:SCREEN CELL"
320   !
```


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```
330   ! Set the traffic channel  parameters.
340   ! Set traffic channel mode to non-hopped.
350   OUTPUT @Test_set;"CELL:TCH1:MODE 'SINGLE'"
360   !
370   ! Set the traffic channel to ARFCN 62.
380   OUTPUT @Test_set;"CELL:TCH1:ARFCN 62"
390   !
400   ! Set the traffic channel type to full rate speech.
410   OUTPUT @Test_set;"CELL:TCH1:TYPE 'FS'"
420   !
430   ! Set the traffic channel to time slot 4.
440   OUTPUT @Test_set;"CELL:TCH1:TSLOT 4"
450   !
460   ! Set the mobile station transmit level. Wait a maximum of 1 second to
470   ! allow the mobile to process the command.
480   OUTPUT @Test_set;"CELL:MS:TLEVEL ";Ms_tx_level
490   WAIT 1
500   !
510   ! Set RF Analyzer amplitude automatically based on the MS transmit level.
520   OUTPUT @Test_set;"RFANALYZER:AMPLITUDE:CONTROL 'MS TX LEV'"
530   !
540   ! Set the mobile station paging IMSI.
550   OUTPUT @Test_set;"MSINFO:PAGING:IMSI "&Imsi$
560   !
570   ! Originate the call.
580   OUTPUT @Test_set;"CELL:CALL:ORIGINATE"
590   !
600   !-------------------------------------------------------------------
610   ! Wait for the Call to be Connected
620   !-------------------------------------------------------------------
630   ! Wait up to 30 seconds for the call to connect.
640   Time_out=30
650   Time_exceeded$="NO"              ! Timeout variable.
660   Start_time=TIMEDATE              ! Time reference for timeout.
670   !
680   ! Wait for call to connect.
```


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```
690   REPEAT
700     ! Short wait to allow HP 8922G to process information.
710     WAIT .2
720     DISP "Waiting for mobile to answer..."
730     ! Query the call status state.
740     OUTPUT @Test_set;"CELL:CALL:STATUS:STATE?"
750     ENTER @Test_set;Call_status$
760     !
770     ! Check to see if time allotted has been exceeded.
780     IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
790     !
800     ! Exit the loop if the call is connected or time allotted has been
810     ! exceeded.
820   UNTIL Call_status$="""CONNECTED""" OR Time_exceeded$="YES"
830   !
840   !-------------------------------------------------------------------------
850   ! Validate Results
860   !-------------------------------------------------------------------------
870   ! Check for system errors.
880   ! Query all system errors that may be in the queue.
890   REPEAT
900     OUTPUT @Test_set;"SYSTEM:ERROR?"
910     ENTER @Test_set;System_error$
920     Sys_err_number=VAL(System_error$)
930     !
940     ! System error number 0 corresponds to NO ERROR.
950     IF Sys_err_number<>0 THEN
960       PRINT "Results are invalid."
970       PRINT "System Error: "&System_error$
980     END IF
990     !
1000  UNTIL Sys_err_number=0
1010  !
1020  ! Check to see if time allotted was exceeded.
1030  IF Time_exceeded$="YES" THEN
1040    DISP "Connection Failure. Call not connected."
1050  ELSE
1060    DISP "Call in process..."
1070  END IF
1080  END
```


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Mobile Station Originated Call Example

```
10    !
20    ! Example 03
30    !
40    ! Receive a Mobile Station Originated Call:
50    !   Sets up the HP 8922G to receive a mobile station originated call.
60    !
70    !*************************************************************************
80    ! System Configuration:
90    ! - Connect mobile station to the RF IN/OUT port.
100   ! - MS should be camped (see example 01).
110   !
120   !*************************************************************************
130   ! Declarations:
140   !
150   ASSIGN @Test_set TO 714          ! Assign an I/O path to the HP 8922G
160                                    ! at HP_IB address 714.
170   DIM System_error$[80]            ! System error message string variable.
180   DIM Ms_o_number$[22]             ! MS originated number string variable.
185   DIM Rach_cnt$[8]                 ! RACH count string variable.
190   !
200   ! Mobile station dependent parameters:
210   Ms_tx_level=6                    ! Mobile station transmit level.
220   !
230   !*************************************************************************
240   !
250   !-------------------------------------------------------------------------
260   ! Set Up the HP 8922G
270   !-------------------------------------------------------------------------
280   ! Display the Cell Control screen.
290   OUTPUT @Test_set;"DISPLAY:SCREEN CELL"
300   !
```


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```
310   ! Set the traffic channel parameters.
320   ! Use traffic channel 1 parameters.
330   OUTPUT @Test_set;"CELL:CALL:TCHCONTROL 'TCH1 ASGN'"
340   !
350   ! Set the traffic channel mode to non-hopped.
360   OUTPUT @Test_set;"CELL:TCH1:MODE 'SINGLE'"
370   !
380   ! Set the traffic channel to ARFCN 62.
390   OUTPUT @Test_set;"CELL:TCH1:ARFCN 62"
400   !
410   ! Set the traffic channel type to full rate speech.
420   OUTPUT @Test_set;"CELL:TCH1:TYPE 'FS'"
430   !
440   ! Set the traffic channel to time slot 4.
450   OUTPUT @Test_set;"CELL:TCH1:TSLOT 4"
460   !
470   ! Set the mobile station transmit level. Wait a maximum of 1 second to
480   ! allow the mobile to process the command.
490   OUTPUT @Test_set;"CELL:MS:TLEVEL ";Ms_tx_level
500   WAIT 1
510   !
520   ! Set RF Analyzer amplitude automatically based on the MS transmit
530   ! level.
540   OUTPUT @Test_set;"RFANALYZER:AMPLITUDE:CONTROL 'MS TX LEV'"
550   !
600   ! Set the audio speech configuration to echo speech back to the mobile.
610   ! Wait a maximum of 0.5 seconds to allow the HP 8922G to process the
620   ! commmand.
630   OUTPUT @Test_set;"CELL:AUDIO:SPEECH:CONFIGURE 'ECHO'"
640   WAIT .5
```


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```
650   !
660   ! Set the audio speech echo delay time to 1 second.
670   OUTPUT @Test_set;"CELL:AUDIO:SPEECH:EDELAY 1 S"
680   !
690   ! Reset the call count fields to zero and wait for reset to take place.
700   ! Wait a maximum of 1 second to allow the HP 8922G to process the
710   ! command.
720   OUTPUT @Test_set;"CELL:CALL:COUNT:RESET"
730   WAIT 1
740   !
750   !-------------------------------------------------------------------
760   ! Wait For Mobile to Originate Call
770   !-------------------------------------------------------------------
780   ! Wait up to 120 seconds for the mobile to begin the call.
790   Time_out=120
800   Time_exceeded$="NO"              ! Timeout variable.
810   Start_time=TIMEDATE              ! Time reference for timeout.
820   !
830   ! Wait for mobile to send a RACH.
840   REPEAT
850     ! Short wait to allow HP 8922G to process information.
860     WAIT .2
870     DISP "Waiting for mobile to call... Originate a call from the mobile."
880     ! Query call count for RACH received.
890     OUTPUT @Test_set;"CELL:CALL:COUNT:RACH?"
900     ENTER @Test_set;Rach_cnt
905     Rach_count=VAL(Rach_cnt$)
910     !
920     ! Check to see if time allotted has been exceeded.
930     IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
940     !
950     ! Exit loop if a RACH has been sent or time allotted has been
960     ! exceeded.
970   UNTIL Rach_count>=1 OR Time_exceeded$="YES"
```


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```
980   !
990   !-------------------------------------------------------------------------
1000  ! Validate Results and Continue
1010  !-------------------------------------------------------------------------
1020  ! Check for system errors.
1030  ! Query all system errors that may be in the queue.
1040  REPEAT
1050    OUTPUT @Test_set;"SYSTEM:ERROR?"
1060    ENTER @Test_set;System_error$
1070    Sys_err_number=VAL(System_error$)
1080    !
1090    ! System error number 0 corresponds to NO ERROR.
1100    IF Sys_err_number<>0 THEN
1110      PRINT "Results are invalid."
1120      PRINT "System Error: "&System_error$
1130    END IF
1140    !
1150  UNTIL Sys_err_number=0
1160  !
1170  ! Check to see if time allotted was exceeded.
1180  IF Time_exceeded$="YES" THEN
1190    DISP "Connection Failure. No RACH was received."
1200  ELSE
1210    !
1220    !-----------------------------------------------------------------------
1230    ! Wait For Call to Reach Alerting State
1240    !-----------------------------------------------------------------------
1250    ! Wait up to 20 seconds for the call to reach the alerting state.
1260    Time_out=20
1270    Time_exceeded$="NO"           ! Timeout variable.
1280    Start_time=TIMEDATE           ! Time reference for timeout.
1290    !
1300    ! Wait for call to reach alerting state.
```


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```
1310    REPEAT
1320      ! Short wait to allow HP 8922G to process information.
1330      WAIT .2
1340      DISP "Waiting for call to reach alerting state... "
1350      ! Query call status state.
1360      OUTPUT @Test_set;"CELL:CALL:STATUS:STATE?"
1370      ENTER @Test_set;Call_status$
1380      !
1390      ! Check to see if time allotted has been exceeded.
1400      IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
1410      !
1420      ! Exit loop if call status state reaches alerting or time allotted
1430      ! has been exceeded.
1440    UNTIL Call_status$="""ALERTING""" OR Time_exceeded$="YES"
1450    !
1460    !-------------------------------------------------------------------
1470    ! Validate Results and Receive Call
1480    !-------------------------------------------------------------------
1490    ! Check for system errors.
1500    ! Query all system errors that may be in the queue.
1510    REPEAT
1520      OUTPUT @Test_set;"SYSTEM:ERROR?"
1530      ENTER @Test_set;System_error$
1540      Sys_err_number=VAL(System_error$)
1550      !
1560      ! System error number 0 corresponds to NO ERROR.
1570      IF Sys_err_number<>0 THEN
1580        PRINT "Results are invalid."
1590        PRINT "System Error: "&System_error$
1600      END IF
1610      !
1620    UNTIL Sys_err_number=0
1630    !
1640    ! Check to see if time allotted was exceeded.
1650    IF Time_exceeded$="YES" THEN
1660      DISP "Connection Failure. Call did not reach alerting state."
1670    ELSE
1680      ! Receive the call.
1690      OUTPUT @Test_set;"CELL:CALL:RECEIVE"
```


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```
1700      !
1710      !-----------------------------------------------------------------
1720      ! Wait for the Call to be Connected
1730      !-----------------------------------------------------------------
1740      ! Wait up to 20 seconds for the call to connect.
1750      Time_out=20
1760      Time_exceeded$="NO"          ! Timeout variable.
1770      Start_time=TIMEDATE          ! Time reference for timeout.
1780      !
1790      ! Wait for call to connect.
1800      REPEAT
1810        ! Short wait to allow HP 8922G to process information.
1820        WAIT .2
1830        DISP "Waiting for call to be connected..."
1840        ! Query the call status state.
1850        OUTPUT @Test_set;"CELL:CALL:STATUS:STATE?"
1860        ENTER @Test_set;Call_status$
1870        !
1880        ! Check to see if time allotted has been exceeded.
1890        IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
1900        !
1910        ! Exit loop if the call is connected or time allotted has been
1920        ! exceeded.
1930      UNTIL Call_status$="""CONNECTED""" OR Time_exceeded$="YES"
1940      !
1950      !-----------------------------------------------------------------
1960      ! Validate Results and Print MS Parameters
1970      !-----------------------------------------------------------------
1980      ! Check for system errors.
1990      ! Query all system errors that may be in the queue.
2000      REPEAT
2010        OUTPUT @Test_set;"SYSTEM:ERROR?"
2020        ENTER @Test_set;System_error$
2030        Sys_err_number=VAL(System_error$)
2040        !
2050        ! System error number 0 corresponds to NO ERROR.
2060        IF Sys_err_number<>0 THEN
2070          PRINT "Results are invalid."
2080          PRINT "System Error: "&System_error$
2090        END IF
2100        !
```


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```
2110      UNTIL Sys_err_number=0
2120      !
2130      ! Check to see if time allotted was exceeded.
2140      IF Time_exceeded$="YES" THEN
2150        DISP "Connection Failure. Call not connected."
2160      ELSE
2170        DISP "Call in process..."
2180        ! Determine the mobile station parameters.
2190        ! Query and print the class mark power class.
2200        OUTPUT @Test_set;"MSINFO:MS:CMARK:PCLASS?"
2210        ENTER @Test_set;Power_class
2220        PRINT "MS Power Class is ";Power_class
2230        !
2240        ! Query and print the MS originated number.
2250        OUTPUT @Test_set;"MSINFO:MS:ONUMBER?"
2260        ENTER @Test_set;Ms_o_number$
2270        PRINT "MS Originated Number is ";Ms_o_number$
2280        !
2290        ! Query and print the MS IMSI.
2300        OUTPUT @Test_set;"MSINFO:MS:IMSI?"
2310        ENTER @Test_set;Imsi$
2320        PRINT "MS IMSI is ";Imsi$
2330        !
2340        ! Copy the MS IMSI to the MS paging IMSI for future base station
2350        ! originated calls.
2360        OUTPUT @Test_set;"MSINFO:MS:IMSI:SPAGING"
2370        !
2380        ! Request the IMEI from the MS.
2390        OUTPUT @Test_set;"MSINFO:MS:IMEI:REQUEST"
2400        !
2410        ! Query and print the IMEI.
2420        ! Wait for MS to respond to IMEI request.
2430        DISP "Waiting for mobile to send IMEI..."
2440        ! The mobile may take up to 10 seconds to send the IMEI. Normally
2450        ! the IMEI is sent in less than 2 seconds.
2460        WAIT 2
2470        ! Query the IMEI.
2480        OUTPUT @Test_set;"MSINFO:MS:IMEI?"
2490        ENTER @Test_set;Imei$
2500        PRINT "MS IMEI is ";Imei$
2510        !
2520        DISP "Call in progress..."
2530        !
2540      END IF
2550    END IF
2560  END IF
2570  END
```


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Ending A Call Example

```
10    !
20    ! Example 04
30    !
40    ! Ending a Call From the HP 8922G:
50    !
60    !*************************************************************************
70    ! System Configuration:
80    ! - Connect mobile station to the RF IN/OUT port.
90    ! - MS should be camped (see example 01).
100   ! - Call should be in progress (see example 02 or 03).
110   !
120   !*************************************************************************
130   ! Declarations:
140   !
150   ASSIGN @Test_set TO 714          ! Assign an I/O path to the HP 8922G
160                                    ! at HP-IB address 714.
170   DIM System_error$[80]            ! System error message string variable.
180   !
190   !*************************************************************************
200   !
210   !-------------------------------------------------------------------------
220   ! End the Call and Wait for Call Status State to Reach Inactive
230   !-------------------------------------------------------------------------
240   ! Display the Cell Control screen.
250   OUTPUT @Test_set;"DISPLAY:SCREEN CELL"
260   !
270   ! End the call.
280   OUTPUT @Test_set;"CELL:CALL:END"
290   !
300   ! Wait up to 20 seconds for the call to reach the inactive state.
310   Time_out=20
320   Time_exceeded$="NO"              ! Timeout variable.
330   Start_time=TIMEDATE              ! Time reference for timeout.
```


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```
340   !
350   ! Wait for call to reach inactive state.
360   REPEAT
370     ! Short wait to allow HP 8922G to process information.
380     WAIT .2
390     DISP "Waiting for call to end..."
400     ! Query call status state.
410     OUTPUT @Test_set;"CELL:CALL:STATUS:STATE?"
420     ENTER @Test_set;Call_status$
430     !
440     ! Check to see if time allotted has been exceeded.
450     IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
460     !
470     ! Exit loop if call status state reaches inactive or time allotted
480     ! has been exceeded.
490   UNTIL Call_status$="""INACTIVE""" OR Time_exceeded$="YES"
500   !
510   !-------------------------------------------------------------------
520   ! Validate the Results and Wait for Radio Resource State to Reach BCCH
530   !-------------------------------------------------------------------
540   ! Check for system errors.
550   ! Query all system errors that may be in the queue.
560   REPEAT
570     OUTPUT @Test_set;"SYSTEM:ERROR?"
580     ENTER @Test_set;System_error$
590     Sys_err_number=VAL(System_error$)
600     !
610     ! System error number 0 corresponds to NO ERROR.
620     IF Sys_err_number<>0 THEN
630       PRINT "Results are invalid."
640       PRINT "System Error: "&System_error$
650     END IF
660     !
```


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```
670   UNTIL Sys_err_number=0
680   !
690   ! Check to see if time allotted was exceeded.
700   IF Time_exceeded$="YES" THEN
710     DISP "Call End Failure. Call status is not 'INACTIVE'"
720   ELSE
730     ! Wait for up to 20 seconds for radio resource state to reach BCCH.
740     Time_out=20
750     Time_exceeded$="NO"           ! Timeout variable.
760     Start_time=TIMEDATE           ! Time reference for timeout.
770     !
780     ! Wait for radio resource state to reach BCCH.
790     REPEAT
800       ! Short wait to allow HP 8922G to process information.
810       WAIT .2
820       DISP "Waiting for call to end..."
830       ! Query the radio resource signaling state.
840       OUTPUT @Test_set;"CELL:CALL:STATUS:RR?"
850       ENTER @Test_set;Rr_status$
860       !
870       ! Check to see if time allotted has been exceeded.
880       IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
890       !
900       ! Exit loop if the radio resource signaling state is BCCH or time
910       ! allotted has been exceeded.
920     UNTIL Rr_status$="""BCCH""" OR Time_exceeded$="YES"
930     !
940     !-------------------------------------------------------------------
950     ! Validate the Results
960     !-------------------------------------------------------------------
970     ! Check for system errors.
980     ! Query all system errors that may be in the queue.
```


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```
990     REPEAT
1000      OUTPUT @Test_set;"SYSTEM:ERROR?"
1010      ENTER @Test_set;System_error$
1020      Sys_err_number=VAL(System_error$)
1030      !
1040      ! System error number 0 corresponds to NO ERROR.
1050      IF Sys_err_number<>0 THEN
1060        PRINT "Results are invalid."
1070        PRINT "System Error: "&System_error$
1080      END IF
1090      !
1100    UNTIL Sys_err_number=0
1110    !
1120    ! Check to see if time allotted was exceeded.
1130    IF Time_exceeded$="YES" THEN
1140      DISP "Call End Failure. Signaling status is not 'BCCH'"
1150    ELSE
1160      DISP "Call ended."
1170    END IF
1180  END IF
1190  END
```


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Bit Error Test Example

```
10    !
20    ! Example 05
30    !
40    ! Bit Error Test Example:
50    !   Runs a TYPE IA test and a Residual Type II test simultaneously
60    !   for 10,000 bits.
70    !   First determines the loopback loop delay for the design of the
80    !   mobile station under test. This only needs to be done once for a
90    !   given mobile station design. It will not change from mobile to
100   !   mobile.
110   !   Results for the first test are returned in terms of total bit
120   !   errors and ratio of frame erasures to total frames. Results for the
130   !   second test are returned in terms of bit error ratio and total
140   !   number of frame erasures.
150   !
160   !*************************************************************************
170   ! System Configuration:
180   ! - Connect mobile station to the RF IN/OUT port.
190   ! - MS should be camped (see example 01).
200   ! - A call should be in progress (see example 02 or 03).
210   !
220   !*************************************************************************
230   ! Declarations:
240   !
250   ASSIGN @Test_set TO 714          ! Assign an I/O path to the HP 8922G
260                                    ! at HP-IB address 714.
270   DIM System_error$[80]            ! System error message string variable.
280   !
290   !*************************************************************************
300   !
```


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```
310   !-----------------------------------------------------------------------
320   ! Measurement Setup
330   !-----------------------------------------------------------------------
340   ! Display the Cell Control screen.
350   OUTPUT @Test_set;"DISPLAY:SCREEN CELL"
360   !
370   ! Make sure digital demodulation is  armed.
380   OUTPUT @Test_set;"TRIGGER:DDEMOD:ASTATE 'ARM'"
390   !
400   ! Turn on loopback with frame erasure. Wait a maximum of 1 second to
410   ! allow the mobile to process the command.
420   OUTPUT @Test_set;"CELL:AUDIO:LOOPBACK:FE"
430   WAIT 1
440   !
450   ! Select the PRBS audio speech configuration. Wait a maximum of 2
460   ! seconds to allow the HP 8922G to process the command.
470   OUTPUT @Test_set;"CELL:AUDIO:SPEECH:CONFIGURE 'PRBS'"
480   WAIT 2
490   !
500   ! Display the Bit Error Test screen.
510   OUTPUT @Test_set;"DISPLAY:SCREEN BET"
520   !
530   ! Set the measurement number to be displayed on the left and right side
540   ! of the Bit Error Test screen
550   OUTPUT @Test_set;"DISPLAY:BETEST:MNUMBER:LEFT '1'"
560   OUTPUT @Test_set;"DISPLAY:BETEST:MNUMBER:RIGHT '2'"
570   !
580   ! Set the Bit Error Test type.
590   OUTPUT @Test_set;"BETEST:TYPE1 'TYPEIA' "
600   OUTPUT @Test_set;"BETEST:TYPE2 'RESTYPEII' "
610   OUTPUT @Test_set;"BETEST:TYPE3 'OFF' "
620   OUTPUT @Test_set;"BETEST:TYPE4 'OFF' "
630   !
640   ! Set the number of bits to test.
650   OUTPUT @Test_set;"BETEST:BITS1 10000"
660   OUTPUT @Test_set;"BETEST:BITS2 10000"
670   !
```


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```
680   ! Select the single measurement mode.
690   OUTPUT @Test_set;"TRIGGER:BETEST 'SINGLE'"
700   !
710   !-------------------------------------------------------------------
720   ! Begin a Partial Bit Error Test to Determine the Loopback Loop Delay
730   !-------------------------------------------------------------------
740   ! Set RF Generator output amplitude to a high level to minimize bit
750   ! errors.
760   OUTPUT @Test_set;"RFGENERATOR:AMPLITUDE1 -85 dBm"
770   !
780   ! Set the loopback loop delay automatically when the bit error tests
790   ! are started. Start with a value of 1. After the measurement check to
800   ! make sure the value changes. A valid loopback loop delay will always
810   ! be greater than one for a PRBS pattern.
820   OUTPUT @Test_set;"BETEST:LOOPBACK:LDELAY:MODE 'MANUAL'"
830   OUTPUT @Test_set;"BETEST:LOOPBACK:LDELAY 1"
840   OUTPUT @Test_set;"BETEST:LOOPBACK:LDELAY:MODE 'AUTO'"
850   !
860   ! Reset the call counts. The call counts will be used to check for
870   ! sync errors during the bit error test. Sync status is not used in
880   ! this case because bad syncs are common when a call is first
890   ! established. Resetting the call counts and then checking the number
900   ! of bad syncs after the measurement is complete checks for sync errors
910   ! during the measurement itself.
920   ! A wait is not used after the reset in this case because there is
930   ! enough time for the HP 8922G to process the command before the
940   ! call count query.
950   OUTPUT @Test_set;"CELL:CALL:COUNT:RESET"
960   !
970   ! Check for system errors that occurred prior to the bit error tests.
980   OUTPUT @Test_set;"SYSTEM:ERROR?"
990   ENTER @Test_set;System_error$
1000  Sys_err_number=VAL(System_error$)
1010  !
```


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```
1020  IF Sys_err_number<>0 THEN
1030    PRINT "Measurement Results Invalid."
1040    PRINT "System Error: "&System_error$
1050    !
1060    ! Query all system errors that may be in the queue.
1070    REPEAT
1080      OUTPUT @Test_set;"SYSTEM:ERROR?"
1090      ENTER @Test_set;System_error$
1100      Sys_err_number=VAL(System_error$)
1110      !
1120      ! System error number 0 corresponds to NO ERROR.
1130      IF Sys_err_number<>0 THEN
1140        PRINT "System Error: "&System_error$
1150      END IF
1160      !
1170    UNTIL Sys_err_number=0
1180    !
1190    DISP "Bit Error Test Failure. System error prior to test."
1200    GOTO End_of_test
1210  END IF
1220  !
1230  ! Run the partial bit error tests.
1240  OUTPUT @Test_set;"TRIGGER:BETEST:MODE 'RUN'"
1250  !
1260  !-------------------------------------------------------------------------
1270  ! Wait for Bit Error Test to Complete 1000 Bits
1280  !-------------------------------------------------------------------------
1290  ! Wait up to 10 seconds for bit error test to complete 1000 bits.
1300  Time_out=10
1310  Time_exceeded$="NO"              ! Timeout variable.
1320  Start_time=TIMEDATE              ! Time reference for timeout.
1330  !
1340  ! Wait until 1000 bits have been tested.
```


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```
1350  REPEAT
1360    ! Short wait to allow HP 8922G to process information.
1370    WAIT .2
1380    !
1390    DISP "Waiting for bit error test to complete 1000 bits..."
1400    ! Query the number of bits tested.
1410    OUTPUT @Test_set;"MEASURE:BETEST:IBTESTED1?"
1420    ENTER @Test_set;Bits_tested
1430    !
1440    ! Check to see if time allotted has been exceeded.
1450    IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
1460    !
1470    ! Exit loop if 1000 bits have been tested or time allotted has been
1480    ! exceeded.
1490  UNTIL Bits_tested>=1000 OR Time_exceeded$="YES"
1500  !
1510  ! Stop Bit Error Test.
1520  OUTPUT @Test_set;"TRIGGER:BETEST:MODE 'STOP'"
1530  !
1540  !-------------------------------------------------------------------------
1550  ! Validate Measurement and Query Loopback Loop Delay
1560  !-------------------------------------------------------------------------
1570  ! Check call counts for errors that occurred while synchronizing to
1580  ! midamble of demodulated data.
1590  OUTPUT @Test_set;"CELL:CALL:COUNT:BSYNC?"
1600  ENTER @Test_set;Bad_syncs
1610  !
1620  ! Check for system errors that occurred during the bit error tests.
1630  OUTPUT @Test_set;"SYSTEM:ERROR?"
1640  ENTER @Test_set;System_error$
1650  Sys_err_number=VAL(System_error$)
1660  !
```


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```
1670  IF Bad_syncs>0 OR Sys_err_number<>0 THEN
1680    PRINT "Measurement Results Invalid."
1690    PRINT "Number of Bad Syncs: ";Bad_syncs
1700    PRINT "System Error: "&System_error$
1710    !
1720    ! Query all system errors that may be in the queue.
1730    REPEAT
1740      OUTPUT @Test_set;"SYSTEM:ERROR?"
1750      ENTER @Test_set;System_error$
1760      Sys_err_number=VAL(System_error$)
1770      !
1780      ! System error number 0 corresponds to NO ERROR.
1790      IF Sys_err_number<>0 THEN
1800        PRINT "System Error: "&System_error$
1810      END IF
1820      !
1830    UNTIL Sys_err_number=0
1840    !
1850    DISP "Bit Error Test Failure. Error during loop delay determination."
1860    GOTO End_of_test
1870    !
1880  END IF
1890  !
1900  ! Check to see if time allotted was exceeded.
1910  IF Time_exceeded$="YES" THEN
1920    DISP "BET Failure. Did not determine loop delay within allotted time."
1930    !
1940    GOTO End_of_test
1950    !
1960  ELSE
1970    !
1980    ! Query the loopback loop delay. This value will be constant for a
1990    ! given mobile station design. Once the value has been determined it
2000    ! can be used until the mobile design changes.
2010    OUTPUT @Test_set;"BETEST:LOOPBACK:LDELAY?"
2020    ENTER @Test_set;Loop_delay
2030    !
2040    ! Check loop delay to make sure it was changed from a value of 1 by
2050    ! the automatic loop delay process.
2060    IF Loop_delay<=1 THEN
2070      DISP "Bit Error Test Failure. Invalid Loopback Loop Delay."
2080      !
2090      GOTO End_of_test
2100      !
2110    END IF
2120  END IF
```


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```
2130  !
2140  ! Set the loopback loop delay to manual mode using the delay determined
2150  ! in auto mode.
2160  OUTPUT @Test_set;"BETEST:LOOPBACK:LDELAY:MODE 'MANUAL'"
2170  !
2180  !-------------------------------------------------------------------
2190  ! Begin the Bit Error Test
2200  !-------------------------------------------------------------------
2210  ! Reset the call counts. The call counts will be used to check for
2220  ! sync errors during the bit error test. Sync status is not used in
2230  ! this case because bad syncs are common when a call is first
2240  ! established. Resetting the call counts and then checking the number
2250  ! of bad syncs after the measurement is complete checks for sync errors
2260  ! during the measurement itself.
2270  ! A wait is not used after the reset in this case because there is
2280  ! enough time for the HP 8922G to process the command before the
2290  ! call count query.
2300  OUTPUT @Test_set;"CELL:CALL:COUNT:RESET"
2310  !
2320  ! Set RF Generator output amplitude to a low level for bit error test.
2330  OUTPUT @Test_set;"RFGENERATOR:AMPLITUDE1 -100 dBm"
2340  !
2350  ! Run the bit error tests.
2360  OUTPUT @Test_set;"TRIGGER:BETEST:MODE 'RUN'"
2370  !
2380  !-------------------------------------------------------------------
2390  ! Wait for Bit Error Test to Complete
2400  !-------------------------------------------------------------------
2410  ! Wait up to 10 seconds for bit error test to complete.
2420  Time_out=10
2430  Time_exceeded$="NO"              ! Timeout variable.
2440  Start_time=TIMEDATE              ! Time reference for timeout.
2450  !
2460  ! Wait until measurements have completed.
```


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```
2470  REPEAT
2480    ! Short wait to allow HP 8922G to process information.
2490    WAIT .2
2500    !
2510    DISP "Waiting for bit error test to end..."
2520    ! Query the bit error test mode.
2530    OUTPUT @Test_set;"TRIGGER:BETEST:MODE?"
2540    ENTER @Test_set;Bet_status$
2550    !
2560    ! Check to see if time allotted has been exceeded.
2570    IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
2580    !
2590    ! Exit loop if bit error test is completed or time allotted has been
2600    ! exceeded.
2610  UNTIL Bet_status$="""STOP""" OR Time_exceeded$="YES"
2620  !
2630  !-------------------------------------------------------------------------
2640  ! Validate Measurement and Print Results
2650  !-------------------------------------------------------------------------
2660  !
2670  ! Check call counts for errors that occurred while synchronizing to
2680  ! midamble of demodulated data.
2690  OUTPUT @Test_set;"CELL:CALL:COUNT:BSYNC?"
2700  ENTER @Test_set;Bad_syncs
2710  !
2720  ! Check for system errors that occurred during the bit error tests.
2730  OUTPUT @Test_set;"SYSTEM:ERROR?"
2740  ENTER @Test_set;System_error$
2750  Sys_err_number=VAL(System_error$)
2760  !
2770  IF Bad_syncs>0 OR Sys_err_number<>0 THEN
2780    PRINT "Measurement Results Invalid."
2790    PRINT "Number of Bad Syncs: ";Bad_syncs
2800    PRINT "System Error: "&System_error$
2810    !
2820    ! Query all system errors that may be in the queue.
```


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```
2830    REPEAT
2840      OUTPUT @Test_set;"SYSTEM:ERROR?"
2850      ENTER @Test_set;System_error$
2860      Sys_err_number=VAL(System_error$)
2870      !
2880      ! System error number 0 corresponds to NO ERROR.
2890      IF Sys_err_number<>0 THEN
2900        PRINT "System Error: "&System_error$
2910      END IF
2920      !
2930    UNTIL Sys_err_number=0
2940    !
2950  END IF
2960  !
2970  ! Check to see if time allotted was exceeded.
2980  IF Time_exceeded$="YES" THEN
2990    DISP "Bit Error Test Failure. Did not complete within allotted time."
3000    !
3010    ! Stop Bit Error Test.
3020    OUTPUT @Test_set;"TRIGGER:BETEST:MODE 'STOP'"
3030  ELSE
3040    !
3050    !-------------------------------------------------------------------
3060    ! Select How Test Results Will be Returned
3070    !-------------------------------------------------------------------
3080    ! Select how bit errors will be returned.
3090    OUTPUT @Test_set;"MEASURE:BETEST:BESELECT1 'BE COUNT'"
3100    OUTPUT @Test_set;"MEASURE:BETEST:BESELECT2 'BE RATIO'"
3110    !
3120    ! Set bit error ratio units for measurement 2 to percent.
3130    OUTPUT @Test_set;"MEASURE:BETEST:BERROR:RATIO2:UNITS PCT"
3140    !
3150    ! Set frame loss type and selection for both measurements.
3160    OUTPUT @Test_set;"MEASURE:BETEST:FLTYPE1 'FE'"
3170    OUTPUT @Test_set;"MEASURE:BETEST:FLSELECT1 'RATIO'"
3180    OUTPUT @Test_set;"MEASURE:BETEST:FLTYPE2 'CRC'"
3190    OUTPUT @Test_set;"MEASURE:BETEST:FLSELECT2 'COUNT'"
3200    !
3210    ! Set frame erasure ratio units for measurement 1 to parts per
3220    ! million.
3230    OUTPUT @Test_set;"MEASURE:BETEST:FERASURE:RATIO1:UNITS PPM"
3240    !
```


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```
3250    !-----------------------------------------------------------------------
3260    ! Query and Print the Measurement Results
3270    !-----------------------------------------------------------------------
3280    ! Number of bits tested for measurement 1.
3290    OUTPUT @Test_set;"MEASURE:BETEST:BTESTED1?"
3300    ENTER @Test_set;Bits_tested_1
3310    PRINT "Measurement 1: Bits tested = ";Bits_tested_1
3320    !
3330    ! Bit Error Count for measurement 1.
3340    OUTPUT @Test_set;"MEASURE:BETEST:BERROR:COUNT1?"
3350    ENTER @Test_set;Bet_count_1
3360    PRINT "                Bit Error Count = ";Bet_count_1
3370    !
3380    ! Frame Erasure ratio for measurement 1.
3390    OUTPUT @Test_set;"MEASURE:BETEST:FERASURE:RATIO1?"
3400    ENTER @Test_set;Frame_erasure_1
3410    PRINT "                Frame Erasure Ratio (ppm) = ";Frame_erasure_1
3420    PRINT
3430    !
3440    ! Number of bits tested for measurement 2.
3450    OUTPUT @Test_set;"MEASURE:BETEST:BTESTED2?"
3460    ENTER @Test_set;Bits_tested_2
3470    PRINT "Measurement 2: Bits tested = ";Bits_tested_2
3480    !
3490    ! Bit Error Ratio for measurement 2.
3500    OUTPUT @Test_set;"MEASURE:BETEST:BERROR:RATIO2?"
3510    ENTER @Test_set;Bet_ratio_2
3520    PRINT "                Bit Error Ratio (%) = ";Bet_ratio_2
3530    !
3540    ! CRC Count measurement 2.
3550    OUTPUT @Test_set;"MEASURE:BETEST:CRC:COUNT2?"
3560    ENTER @Test_set;Crc_count_2
3570    PRINT "                CRC Count = ";Crc_count_2
3580    !
3590    DISP "Bit Error Test Complete."
3600  END IF
3610 End_of_test: !
3620  END
```


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DSP Analyzer Measurement During a Call Example

```
10    !
20    ! Example 06
30    !
40    ! Measurement Setup with Call In Process.
50    !   Performs a phase error (RMS and Peak) and a frequency error
60    !   measurement on a mobile station after a call has been placed.
70    !
80    !
90    !*************************************************************************
100   ! System Configuration:
110   ! - Connect mobile station to the RF IN/OUT port.
120   ! - Mobile Station should be camped (see example 01).
130   ! - A call should be in progress (see example 02 or 03).
140   !
150   !*************************************************************************
160   ! Declarations:
170   !
180   ASSIGN @Test_set TO 714          ! Assign an I/O path to the HP 8922G
190                                    ! at HP-IB address 714.
200   DIM System_error$[80]            ! System error message string variable.
210   !
220   Traffic_arfcn=62                 ! Traffic channel ARFCN.
230   !
240   !*************************************************************************
250   !
260   !-------------------------------------------------------------------------
270   ! Measurement Setup
280   !-------------------------------------------------------------------------
290   ! Set the measurement to be made. Digital demodulation is automatically
300   ! disarmed when a measurement screen is displayed.
310   OUTPUT @Test_set;"DISPLAY:SCREEN DSP"
320   !
330   ! Make sure the RF Analyzer is not hopping.
340   OUTPUT @Test_set;"HOPCONTROL:RFANALYZER:TRIGGER:ASTATE 'DISARM'"
350   OUTPUT @Test_set;"HOPCONTROL:RFANALYZER:MODE 'NON-HOP'"
```


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```
360   !
370   ! Set the RF Analyzer frequency to the traffic channel ARFCN.
380   OUTPUT @Test_set;"RFANALYZER:FREQUENCY ";890+Traffic_arfcn*.2;" MHz"
390   !
400   !-------------------------------------------------------------------
410   ! Arm the Measurement and Wait for the Measurement to Complete.
420   !-------------------------------------------------------------------
430   ! Arm the measurement. Wait a maximum of 1 second to allow the
440   ! HP 8922G to begin the measurement.
450   OUTPUT @Test_set;"TRIGGER:ASTATE 'ARM'"
460   WAIT 1
470   !
480   ! Wait up to 20 seconds for the measurement to complete.
490   Time_out=20
500   Time_exceeded$="NO"              ! Timeout variable.
510   Start_time=TIMEDATE              ! Time reference for timeout.
520   !
530   ! Wait for the trigger arm state to reach disarmed.
540   REPEAT
550     ! Short wait to allow HP 8922G to process information.
560     WAIT .2
570     DISP "Waiting for measurement to complete..."
580     ! Query the trigger arm state.
590     OUTPUT @Test_set;"TRIGGER:ASTATE?"
600     ENTER @Test_set;Arm_state$
610     !
620     ! Check to see if time alloted for measurement has been
630     ! exceeded.
640     IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
650     ! Exit loop if measurement is complete or time allotted has been
660     ! exceeded.
670   UNTIL Arm_state$="""DISARM""" OR Time_exceeded$="YES"
```


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```
680   !
690   !-----------------------------------------------------------------------
700   ! Validate Measurement and Print Results
710   !-----------------------------------------------------------------------
720   ! Check sync status for error during the DSP Analyzer measurement.
730   OUTPUT @Test_set;"MEASURE:DSPANALYZER:SSTATUS?"
740   ENTER @Test_set;Sync_status$
750   ! For DSP Analyzer, Output RF Spectrum, and Pulse On/Off measurements,
760   ! the string returned for sync status is in mixed upper and lower case.
770   ! To avoid confusion, and ensure future software compatibility, set the
780   ! string to all upper case before making string comparisons using the
790   ! sync status for these measurements.
800   Sync_status$=UPC$(Sync_status$)
810   !
820   ! Check for system errors.
830   OUTPUT @Test_set;"SYSTEM:ERROR?"
840   ENTER @Test_set;System_error$
850   Sys_err_number=VAL(System_error$)
860   !
870   IF Sync_status$<>"""NO ERROR""" OR Sys_err_number<>0 THEN
880     PRINT "Measurement Results Invalid."
890     PRINT "Sync Status is: "&Sync_status$
900     PRINT "System Error: "&System_error$
910     !
920     ! Query all system errors that may be in the queue.
930     REPEAT
940       OUTPUT @Test_set;"SYSTEM:ERROR?"
950       ENTER @Test_set;System_error$
960       Sys_err_number=VAL(System_error$)
970       !
980       IF Sys_err_number<>0 THEN
990         PRINT "System Error: "&System_error$
1000      END IF
1010      !
1020    UNTIL Sys_err_number=0
1030    !
1040  END IF
```


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```
1050  !
1060  ! Check to see if time allotted was exceeded.
1070  IF Time_exceeded$="YES" THEN
1080    DISP "Measurement Failure. Did not complete within allotted time."
1090    !
1100    ! Disarm the measurement.
1110    OUTPUT @Test_set;"TRIGGER:ASTATE 'DISARM'"
1120  ELSE
1130    ! Query and print the measurement results.
1140    OUTPUT @Test_set;"MEASURE:DSPANALYZER:PHASE:ERROR:RMS?"
1150    ENTER @Test_set;Phase_err_rms
1160    PRINT "RMS Phase Error = ";Phase_err_rms
1170    !
1180    OUTPUT @Test_set;"MEASURE:DSPANALYZER:PHASE:ERROR:PEAK?"
1190    ENTER @Test_set;Phase_err_peak
1200    PRINT "Peak Phase Error = ";Phase_err_peak
1210    !
1220    OUTPUT @Test_set;"MEASURE:DSPANALYZER:PHASE:ERROR:FREQUENCY?"
1230    ENTER @Test_set;Freq_error
1240    PRINT "Frequency Error = ";Freq_error
1250    !
1260    DISP "Measurement complete."
1270    !
1280  END IF
1290  END
```


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Pulse On/Off Measurement without Call Processing Example

```
10    !
20    ! Example 07
30    !
40    ! Measurement Setup with No Call Placed.
50    !   Performs a pulse on/off measurement on a device under test
60    !   that does not have call processing capabilities.
70    !
80    !*************************************************************************
90    ! System Configuration:
100   ! - Connect Device Under Test to the RF IN/OUT port.
110   ! - Device Under Test should be set up to transmit as follows:
120   !         - RF output frequency: 902.4 MHz
130   !         - RF output amplitude:  31 dBm
140   !         - Midamble: TSC5
150   ! - A trigger signal should be provided that is synchronous with the
160   !   transmitted signal.
170   ! - The trigger signal's location, with respect to bit 0 of the burst
180   !   to be measured, must be known within +1.1 /-2.0 bits.
190   ! - Trigger signal should be connected to Front Panel MEASURE: TRIGGER
200   !   IN connector.
210   !
220   !*************************************************************************
230   ! Declarations:
240   !
250   ASSIGN @Test_set TO 714          ! Assign an I/O path to the HP 8922G
260                                    ! at HP-IB address 714.
270   DIM System_error$[80]            ! System error message strung variable.
280   !
290   ! Device Dependent Parameters:
300   Rf_an_ampl=31                    ! RF Analyzer amplitude (in dBm).
310   Rf_an_freq=902.4                 ! RF Analyzer frequency (in MHz).
320   Trigger_delay=0                  ! Location of trigger signal, relative
330                                    ! to the center of bit 0 of the burst
340                                    ! to be measured (in bit periods).
350   Tsc$="TSC5"                      ! Training sequence code.
360   Off_pos_rise=-28                 ! Measurement position for the rising
370                                    ! edge of the burst, relative to bit 0
380                                    ! (in microseconds).
```


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```
390   Off_pos_fall=28                 ! Measurement position for the falling
400                                   ! edge of the burst, relative to the
410                                   ! last bit of the burst (in
420                                   ! microseconds).
430   !
440   !-----------------------------------------------------------------------
450   ! Measurement Setup
460   !-----------------------------------------------------------------------
470   ! Instrument Preset.
480   OUTPUT @Test_set;"*RST"
490   !
500   ! Set the RF Analyzer amplitude (in dBm).
510   OUTPUT @Test_set;"RFANALYZER:AMPLITUDE1 ";Rf_an_ampl
520   !
530   ! Set the RF Analyzer frequency (in MHz).
540   OUTPUT @Test_set;"RFANALYZER:FREQUENCY ";Rf_an_freq;" MHz"
550   !
560   ! Set the measurement sync information:
570   ! Burst selected:
580   OUTPUT @Test_set;"MSYNC:SYNC:BSELECT '0'"
590   !
600   ! Burst type:
610   OUTPUT @Test_set;"MSYNC:BURST:TYPE0 '"&Tsc$&"'"
620   !
630   ! Set the trigger source.
640   OUTPUT @Test_set;"TRIGGER:SOUR 'EXT MEAS'"
650   !OUTPUT @Test_set;"TRIG:SOUR 'EXT DEMOD'"
660   !
670   ! Set the trigger delay.
680   OUTPUT @Test_set;"TRIGGER:DELAY ";Trigger_delay;" T"
690   !
700   ! Set the measurement to be made.
710   OUTPUT @Test_set;"DISPLAY:SCREEN PULSE"
720   !
730   ! Set the measurement position for the rising and falling edges of
740   ! the burst.
```


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```
750   OUTPUT @Test_set;"PULSE:OPOSITION:RISE ";Off_pos_rise;" US"
760   OUTPUT @Test_set;"PULSE:OPOSITION:FALL ";Off_pos_fall;" US"
770   !
780   ! Initiate a spectrum analyzer calibration.
790   ! HP 8922G will not process any new commands until the calibration
800   ! is complete.
810   OUTPUT @Test_set;"PULSE:SACALIBRATE"
820   !
830   !-------------------------------------------------------------------------
840   ! Arm the Measurement and Wait for the Measurement to Complete
850   !-------------------------------------------------------------------------
860   ! Arm the measurement. Wait a maximum of 1 second for the HP 8922 to
870   ! begin the measurement.
880   OUTPUT @Test_set;"TRIG:ASTATE 'ARM'"
890   WAIT 1
900   !
910   ! Wait up to 20 seconds for the measurement to complete.
920   Time_out=20
930   Time_exceeded$="NO"              ! Timeout variable.
940   Start_time=TIMEDATE              ! Time reference for timeout.
950   !
960   ! Wait for the trigger arm state to reach disarmed.
970   REPEAT
980     ! Short wait to allow HP 8922G to process information.
990     WAIT .2
1000    DISP "Waiting for measurement to complete..."
1010    ! Query the trigger arm state.
1020    OUTPUT @Test_set;"TRIGGER:ASTATE?"
1030    ENTER @Test_set;Arm_state$
1040    !
1050    ! Check to see if time alloted for measurement has been
1060    ! exceeded.
1070    IF TIMEDATE-Start_time>Time_out THEN Time_exceeded$="YES"
1080    ! Exit loop if arm state is 'DISARM' or time allotted has been
1090    ! exceeded.
```


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```
1100  UNTIL Arm_state$="""DISARM""" OR Time_exceeded$="YES"
1110  !
1120  !-------------------------------------------------------------------------
1130  ! Validate the Measurement and Print Results
1140  !-------------------------------------------------------------------------
1150  ! Check sync status for errors during the DSP Analyzer measurement.
1160  OUTPUT @Test_set;"MEASURE:PULSE:SSTATUS?"
1170  ENTER @Test_set;Sync_status$
1180  ! For DSP Analyzer, Output RF Spectrum, and Pulse On/Off measurements,
1190  ! the string returned for sync status is in mixed upper and lower case.
1200  ! To avoid confusion, and ensure future software compatibility, set the
1210  ! string to all upper case before making string comparisons using the
1220  ! sync status for these measurements.
1230  Sync_status$=UPC$(Sync_status$)
1240  !
1250  ! Check for system errors.
1260  OUTPUT @Test_set;"SYSTEM:ERROR?"
1270  ENTER @Test_set;System_error$
1280  Sys_err_number=VAL(System_error$)
1290  !
1300  IF Sync_status$<>"""NO ERROR""" OR Sys_err_number<>0 THEN
1310    PRINT "Measurement Results Invalid."
1320    PRINT "Sync Status is: "&Sync_status$
1330    PRINT "System Error: "&System_error$
1340    !
1350    ! Query all system errors that may be in the queue.
1360    REPEAT
1370      OUTPUT @Test_set;"SYSTEM:ERROR?"
1380      ENTER @Test_set;System_error$
1390      Sys_err_number=VAL(System_error$)
1400      !
1410      ! System error number 0 corresponds to NO ERROR.
1420      IF Sys_err_number<>0 THEN
1430        PRINT "System Error: "&System_error$
1440      END IF
```


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```
1450      !
1460    UNTIL Sys_err_number=0
1470    !
1480  END IF
1490  !
1500  ! Check to see if time allotted was exceeded.
1510  IF Time_exceeded$="YES" THEN
1520    DISP "Measurement Failure. Did not complete within allotted time."
1530    !
1540    ! Disarm the measurement.
1550    OUTPUT @Test_set;"TRIGGER:ASTATE 'DISARM'"
1560    !
1570  ELSE
1580    ! Query and print the measurement results.
1590    PRINT "Pulse On/Off:"
1600    !
1610    OUTPUT @Test_set;"MEASURE:PULSE:OORATIO:RISE?"
1620    ENTER @Test_set;Ooratio_rise
1630    !
1640    PRINT "   Rise Position = ";Off_pos_rise;" uSec"
1650    ! Check for "No Measurement Results" indication.
1660    ! Number returned of approximatley 1.7E+308 indicates there are no
1670    ! results available for the query.
1680    IF Ooratio_rise>1.E+300 THEN
1690      PRINT "   On/Off Ratio = ---- dB"
1700    ELSE
1710      PRINT "   On/Off Ratio = ";Ooratio_rise;" dB"
1720    END IF
1730    PRINT
1740    !
1750    OUTPUT @Test_set;"MEASURE:PULSE:OORATIO:FALL?"
1760    ENTER @Test_set;Ooratio_fall
1770    !
1780    PRINT "   Fall Position = ";Off_pos_fall;" uSec"
1790    ! Check for "No Measurement Results" indication.
1800    ! Number returned of approximatley 1.7E+308 indicates there are no
1810    ! results available for the query.
1820    IF Ooratio_fall>1.E+300 THEN
1830      PRINT "   On/Off Ratio = ---- dB"
1840    ELSE
1850      PRINT "   On/Off Ratio = ";Ooratio_fall;" dB"
1860    END IF
1870    PRINT
1880    !
1890    DISP "Measurement Complete."
1900    !
1910  END IF
1920  END
```


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High Speed DSP Analyzer Measurement Example

```
10    !
20    ! Example 08
30    !
40    ! Fast Characterization of Phase Noise with No Call Placed.
50    !   Performs a statistical analysis of many phase error measurements
60    !   on a device under test that does not have call processing
70    !   capabilities.
80    !
90    !   Phase and frequency error measurements of a device under test
100   !   will result in varying answers.  This is primarily due to the
110   !   windowing effect of the time during which the measurement is
120   !   made.  Larger low frequency phase noise will tend to make these
130   !   measurements more variable.  By performing a statistical analysis
140   !   of many measurements, the user can be more certain if a change
150   !   in measurement results is due to a change in radio performance
160   !   or due to the random nature of these measurements.
170   !
180   !*************************************************************************
190   ! System Configuration:
200   ! - Connect Device Under Test to the RF IN/OUT port
210   ! - Device Under Test should be set up to transmit as follows:
220   !         - RF output frequency: 902.4 MHz
230   !         - RF output amplitude:  31 dBm
240   !         - Midamble: TSC0
250   ! - A trigger signal should be provided that is synchronous with the
260   !   transmitted signal.
270   ! - The trigger signal's location, with respect to bit 0 of the burst
280   !   to be measured, must be known within +50 /-20 bits.
290   ! - Trigger signal should be connected to Front Panel MEASURE: TRIGGER
300   !   IN connector.
310   !*************************************************************************
320   !
```


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```
330   ! Declarations:
340   INTEGER N,Meas_number,Error_flag,Error_count
350   DIM A$[30]
360   ASSIGN @Test_set TO 714          ! Assign an I/O path to the HP 8922 at
370                                    ! HP-IB address 714.
380   ON TIMEOUT 7,30 CALL Hpib_abort ! Call an error reporting subroutine
390                                    ! if HP-IB is not working or if
400                                    ! triggers are not present.
410                                    ! The interface select code is 7 and
420                                    ! a 30 second timeout is used.
430   !
440   ! Device Dependent Parameters:
450   Rf_an_ampl=31                    ! RF Analyzer amplitude (in dBm).
460   Rf_an_freq=902.4                 ! RF Analyzer frequency (in MHz).
470   Trigger_delay=0                  ! Location of trigger signal, relative
480                                    ! to the center of bit 0 to be
490                                    ! measured (in bit periods).
500   Tsc$="TSC0"                      ! Training sequence code.
510   Meas_number=20                   ! Number of measurements to take.
520                                    ! The standard deviation of the mean
530                                    ! decreases as the square root of
540                                    ! the number of measurements.
550   !
560   !-------------------------------------------------------------------------
570   ! Measurement Setup
580   !-------------------------------------------------------------------------
590   CLEAR SCREEN
600   !
610   !
620   ! Instrument Preset.
630   OUTPUT @Test_set;"*RST"
640   !
650   ! Set the RF Analyzer amplitude (in dBm).
660   OUTPUT @Test_set;"RFANALYZER:AMPLITUDE1 ";Rf_an_ampl
670   !
680   ! Set the RF Analyzer frequency (in MHz).
690   OUTPUT @Test_set;"RFANALYZER:FREQUENCY ";Rf_an_freq;" MHz"
```


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```
700   !
710   ! Set the midamble.
720   OUTPUT @Test_set;"MSYNC:BURST:TYPEO '"&Tsc$&"'"
730   !
740   ! Set the trigger source.
750   OUTPUT @Test_set;"TRIGGER:SOURCE 'EXT MEAS'"
760   !
770   ! Set the trigger delay.
780   OUTPUT @Test_set;"TRIGGER:DELAY ";Trigger_delay;" T"
790   !
800   ! Set the measurement to be made.
810   OUTPUT @Test_set;"DISPLAY:SCREEN:DSP:VIEW 'PHASEMAIN'"
820   OUTPUT @Test_set;"DISPLAY:SCREEN DSP"
830   !
840   ! This is an optional line that will save 50 milliseconds per
850   ! measurement.  It saves the time that would be used to update the
860   ! DSP phase screen.
870   OUTPUT @Test_set;"DISPLAY RFG"
880   !
890   !-------------------------------------------------------------------------
900   ! Initialize statistics variables
910   !-------------------------------------------------------------------------
920   Spk=0
930   Spk2=0
940   Srms=0
950   Srms2=0
960   Sfreq=0
970   Sfreq2=0
980   Error_count=0
```


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```
990   !
1000  !-----------------------------------------------------------------------
1010  ! Make Meas_number measurements of phase and frequency error.
1020  !-----------------------------------------------------------------------
1030  DISP "Making";Meas_number;"measurements..."
1040  FOR N=1 TO Meas_number
1050    !
1060    ! Measure peak phase, RMS phase, and frequency.
1070    ! Allow this set of measurements to complete even with occasional
1080    ! detection errors.  Consider a detection error to be likely if
1090    ! peak phase is greater than 55 degrees or the sync status reports
1100    ! an error.
1110    REPEAT
1120      OUTPUT @Test_set;"TRIG:AST 'ARM'"          ! Arm measurement.
1130      OUTPUT @Test_set;"MEAS:DSP:PHASE:PEAK?"    ! Query peak phase.
1140      ENTER @Test_set;Peak
1150      OUTPUT @Test_set;"MEAS:DSP:SSTATUS?"       ! Query error status.
1160      ENTER @Test_set;A$
1170      A$=UPC$(A$)                                ! Convert to upper case.
1180      Error_flag=0
1190      !
1200      ! Check for detection error.
1210      IF Peak>55 OR A$<>"""NO ERROR""" THEN
1220        Error_flag=1
1230        Error_count=Error_count+1
1240        IF Error_count>=Meas_number THEN
1250          DISP
1260          PRINT "Measurement aborted due to";Error_count;"detection errors."
1270          STOP
1280        END IF
1290      END IF
1300    UNTIL Error_flag=0
```


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```
1310    OUTPUT @Test_set;"MEAS:DSP:PHASE:RMS?"     ! Query RMS phase.
1320    ENTER @Test_set;Rms
1330    OUTPUT @Test_set;"MEAS:DSP:PHASE:FREQ?"    ! Query frequency error.
1340    ENTER @Test_set;Freq
1350    !
1360    ! Update statistics variables
1370    Srms=Srms+Rms
1380    Srms2=Srms2+Rms*Rms
1390    Spk=Spk+Peak
1400    Spk2=Spk2+Peak*Peak
1410    Sfreq=Sfreq+Freq
1420    Sfreq2=Sfreq2+Freq*Freq
1430  NEXT N
1440  !
1450  !-------------------------------------------------------------------------
1460  ! Calculate and output results.
1470  !-------------------------------------------------------------------------
1480  DISP
1490  !
1500  ! Calculate average phase and frequency errors.
1510  Srms=Srms/Meas_number
1520  Spk=Spk/Meas_number
1530  Sfreq=Sfreq/Meas_number
1540  !
1550  ! Calculate standard deviations.
1560  Srmsdev=SQRT((Srms2-Meas_number*Srms*Srms)/(Meas_number-1))
1570  Spkdev=SQRT((Spk2-Meas_number*Spk*Spk)/(Meas_number-1))
1580  Sfreqdev=SQRT((Sfreq2-Meas_number*Sfreq*Sfreq)/(Meas_number-1))
1590  Sqrt_n=SQRT(Meas_number)
1600  Srmsmeandev=Srmsdev/Sqrt_n
1610  Spkmeandev=Spkdev/Sqrt_n
1620  Sfreqmeandev=Sfreqdev/Sqrt_n
1630  !
1640  ! Output results.
1650  PRINT "                        RMS phase         peak phase     frequency"
1660  A$="18A,7D.3D,15D.3D,11D.2D"
1670  PRINT USING A$;"mean               ",Srms,Spk,Sfreq
1680  PRINT USING A$;"standard deviation",Srmsdev,Spkdev,Sfreqdev
1690  PRINT USING A$;"stan dev of mean  ",Srmsmeandev,Spkmeandev,Sfreqmeandev
1700  END
1710  SUB Hpib_abort
1720    DISP
1730    PRINT "Measurement aborted due to HP-IB timeout."
1740    PRINT "This will occur if HP-IB is not working or if triggers are"
1750    PRINT "not present."
1760    STOP
1770  SUBEND
```


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Transient Settling Times

The following transient settling (wait times) should be considered when executing HP-IB programs from an external controller or using the built-in IBASIC controller to execute programs.

Note



During query loops (especially for IBASIC applications), it is recommended to use a WAIT statement like WAIT Delta_t, where Delta_t is user defined (i.e. WAIT 0.5 ! wait 0.5 seconds).

1. Each of the following operations requires checking that a certain state has been reached before continuing with other HP-IB commands:

   a. Ending a Call. Wait for CELL CONTROL Call Status to be 'INACTIVE'and then check for Call Status RR to be 'BCCH'.

```
OUTPUT 714;"CELL:CALL:END"
REPEAT
  WAIT Delta_t
  OUTPUT 714;"CELL:CALL:STATUS:STATE?"    ! Query the Call Status
  ENTER 714;Query$
UNTIL Query$="""INACTIVE"""
IF (Query$="""INACTIVE""")
   REPEAT
     WAIT Delta_t
     OUTPUT 714;"CELL:CALL:STAT:RR?"     ! Query the RR Call Status
     ENTER 714;Query$
   UNTIL Query$="""BCCH"""
END IF
```

   b. Originating a Call. Must wait for CELL CONTROL Call Status to be 'CONNECTED':

```
OUTPUT 714;"CELL:CALL:ORIG"
! Answer call when the mobile rings
REPEAT
  WAIT Delta_t
  OUTPUT 714;"CELL:CALL:STATUS:STATE?"    ! Query the Call Status
  ENTER 714;Query$
UNTIL Query$="""CONNECTED"""
```

   c. Setting the HP 8922G to an Activated state. Must wait for the CELL CONTROL Signaling (RR) Call Status to be 'BCCH'.

```
OUTPUT 714;"DISP CCON"
OUTPUT 714;"CCON:STAT 'ACTIVATED'"
DISP "Waiting for HP 8922G to provide BCCH. . ."
REPEAT
  WAIT Delta_t
  OUTPUT 714;"CELL:CALL:STAT:RR?"     ! Query the RR Call Status
  ENTER 714;Query$
UNTIL Query$="""BCCH"""
```

   d. Setting the HP 8922G back to a Settable state. Must wait for the field to change its state.

```
OUTPUT 714;"CCON:STAT 'SETTABLE'"
REPEAT
  WAIT Delta_t
  OUTPUT 714;"CCON:STAT?"     ! Query the Cell Configure state
  ENTER 714;Query$
UNTIL Query$="""SETTABLE"""
```


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e. Doing a PRESET (*RST). Must make sure the call is ended (See (a)).

f. Running a Bit Error Test measurement. Must wait for STOP after a RUN is executed to query any measurement results.

```
OUTPUT 714;"DISP BET"
OUTPUT 714;"TRIG:BET:MODE 'RUN'"
REPEAT
  WAIT Delta_t
  OUTPUT 714;"TRIG:BET:MODE?"      ! Query the Bit Error Test Trigger mode
  ENTER 714;Query$
UNTIL Query$="""STOP"""
```

g. Querying measurements in SINGLE or CONT (continous) mode. Refer to the section for querying measurements through HP-IB.

2. The following operations may affect how much wait time is needed between HP-IB or IBASIC commands.

   a. IBASIC operation - especially tight query loops

   b. Continous measurements

      i. DSP Analyzer - Phase, Amplitude and Data Bits measurements

      ii. Output RF Spectrum measurements

      iii. Pulse On/Off Ratio measurements

      iv. Spectrum Analyzer measurements

      v. Oscilloscope measurements

      vi. CW measurements

      vii. AF Analyzer measurements

   c. Signaling operations:

      i. SACCH measurements

      ii. Intercell Handovers

      iii. Intracell Handovers

      iv. Trace views are active

3. When performing the following operations, include a wait statement, for a maximum of the period of time given, before issuing the next command.

   a. Executing Loopback functions - loopback on and off: 1 second

```
OUTPUT 714,"CELL:AUD:LOOP:OFF"  ! loopback off
   WAIT 1

OUTPUT 714,"CELL:AUD:LOOP:FE"   ! on with frame erasure
   WAIT 1

OUTPUT 714,"CELL:AUD:LOOP:NOFE" ! on without frame erasure
   WAIT 1
```

   b. Changing Audio Speech Configurations to 'NONE' or 'UNCOND' or 'COND' or 'ECHO': 0.5 second

```
OUTPUT 714,"CELL:AUD:SPE:CONF  'COND'
   WAIT 0.5
```


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c. Changing Audio Speech Configurations to 'PRBS': 2 seconds

```
OUTPUT 714,"CELL:AUD:SPE:CONF  'PRBS'
   WAIT 2
```

d. Setting the MS TX power Level: 1 second

```
OUTPUT 714,"CELL:MS:TLEV 7"
   WAIT 1
```

e. Arming DSP Analyzer, Output RF Spectrum or Pulse On/Off measurements in Single mode from IBASIC - after sending the Arm command wait approximately 1 second.

```
OUTPUT 714,"TRIG:ASTate 'ARM'"
   WAIT 1
```

f. Executing a Reference Oscillator calibration: 10 second

```
OUTPUT 714,"CONF:ROSC:CAL"
   WAIT 10
```

g. IMEI Request: 10 second

```
OUTPUT 714,"MSIN:MS:IMEI:REQ"
  - WAIT 10
```

h. TMSI Reallocation: Query TMSI value (should change within 10 seconds)

i. Read TMSI string `OUTPUT 714,"MSIN:PAG:TMSI?"`

ii. Send TMSI Reallocation command `OUTPUT 714,"MSIN:PAG:TMSI:REAL"`

iii. Wait until `OUTPUT 714,"MSIN:PAG:TMSI?"` returns a new string

1) 10 seconds maximum

We expect users, operating remotely, to make measurements in single mode, mainly for speed reasons. However, if you operate in continuous (CONT) measurement mode and you change a parameter that affects the measurement result, then (at a maximum) the third measurement result queried will be an outcome of the new setup and not the previous setup.

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8

EMMI (Electrical Man Machine Interface)

The EMMI interface is a half-duplex communication link between the HP 8922G and a mobile station. GSM 11.10 Aspect III describes pin assignments, logic levels, and timing requirements of EMMI connectors.

This chapter provides descriptions of the EMMI and HP-IB programming examples for using the EMMI.

You can use the EMMI program codes to do these things:

- Simulate keystrokes on the handset's keypad.
- Set operating states of the mobile station that aren't controlled by the handset's keypad.
- Report the mobile station's operating state.

Refer to GSM 11.10 Aspect III for message structure.

Variables used in the descriptions and examples are as follows:

```
DIM Data$[255], Err$[255]

REAL Xontime, Resptime

INTEGER Baud, Stat
```


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Using the Status Subsystem (HP-IB) with EMMI

The Status subsystem can be used to find out whether EMMI messages were sent or received successfully. (For more information about the Status subsystem, refer to chapter 7, HP-IB.)

STATus:EMMI:EVENT?

`STATus:EMMI:EVENT?` queries a status buffer. The status buffer will return one of five numbers indicating the status of the last EMMI message sent by the HP 8922G.

(0) EMMI Idle	There was no data sent since the last status check, and there were no events to report.
(1) Message Acknowledged	A message was received and acknowledged by the mobile station. Important: This does not mean the mobile was able to understand or perform the operation.
(2) Message Not Acknowledged	The HP 8922G attempted to send a message, but the mobile station did not receive it.
(4) Mobile XOF	The timer that waits for the mobile station to send XON expired (see EMMI:TIMEout:MS:XON)
(8) Timeout	The timer that waits for the mobile station to send an ACK or NACK expired (see EMMI:TIMEout:MS:RESPonse).

EMMI Status Event Programming Example

```
OUTPUT 714; "stat:emmi:event?"   Check status of last data write.

ENTER 714;Stat
PRINT Stat
+1                               Last message sent was received and
                                 acknowledged by the mobile station.
```


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Using the EMMI Subsystem (HP-IB)

The EMMI subsystem is used to read and write messages to the mobile station or to read the status of the mobile station. (For more information about the EMMI subsystem, refer to chapter 7, HP-IB.)

RESet

RESet will erase all messages that are in the HP 8922G's EMMI message buffer. When a reset is sent, the HP 8922G will also send an XON (ready to receive) frame to the mobile station.

EMMI Reset Programming Example

```
OUTPUT 714;"emmi:reset"   Clear HP 8922G EMMI message buffer
                          and send XON to the mobile
```

EMMI:BRATe:

`EMMI:BRATe:` sets the baud rate of the HP 8922G EMMI port. The baud rate of the HP 8922G must be set to the same baud rate as the mobile station.

These are the allowable baud rates:

- 600 bits per second
- 1200 bits per second
- 2400 bits per second
- 4800 bits per second
- 9600 bits per second (default value)

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EMMI:BRATe?:

EMMI:BRATe? queries the baud rate of the HP 8922G EMMI port.

EMMI Baud Rate Programming Example

```
OUTPUT 714;"emmi:brat?"          Query the HP 8922G for its current
                                 EMMI baud rate
ENTER 714;Baud
PRINT Baud
"9600"                           Current EMMI baud rate
OUTPUT 714;"emmi:brat '4800'"    Set the HP 8922G's EMMI baud rate
                                 to match the mobile's EMMI baud rate
OUTPUT 714;"emmi:brat?"          Query the HP 8922G for its current
                                 EMMI baud rate
ENTER 714:Baud
PRINT Baud
"4800"                           Current EMMI baud rate
```

EMMI:DATA <data entry>

EMMI:DATA sends a message to the mobile station. The data entry following the DATA keyword must be entered in the form shown in figure 8—1.

1. Determine the hexadecimal pairs in the message (a message identifier, possibly followed by additional hexadecimal pairs).

   Example: 3a 33 34 35 14
2. Count the number of hexadecimal characters in the message (this must be an even number).

   Example: 10
3. Determine the number of digits in the hex character count.

   Example: 2
4. Prefix the message with #.

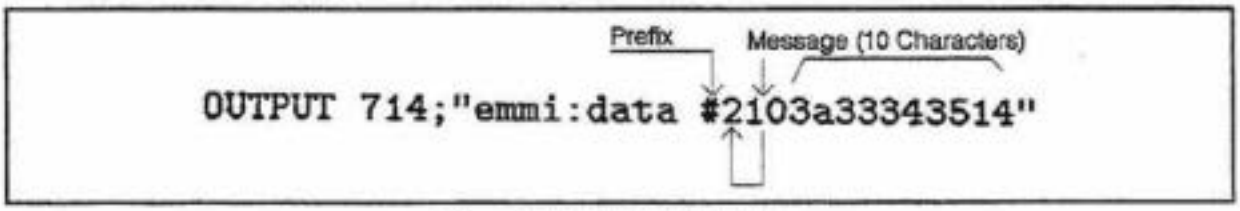


Figure 8-1. EMMI Data Entry

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EMMI Data Programming Example

```
OUTPUT 714;"emmi:data #2103a33343514"
```
Initiate a mobile originated call using the station keys 345:
3a = Perform keystrokes
33 = Key 3
34 = Key 4
35 = Key 5
14 = Send (function)

```
OUTPUT 714;"stat:emmi:event?"
```
Check status of last data write

```
ENTER 714;Stat
PRINT Stat
+1
```
Last message sent was received and acknowledged by the mobile

---

Note EMMI data format errors (no message sent) will result in `system:error`.



```
OUTPUT 714;"emmi:data #12abc"
```
Num-data-chars does not match data

```
OUTPUT 714;"emmi:data:#12xy"
```
Non hex characters

```
OUTPUT 714;"emmi:data #121g"
```
Non hex character

```
OUTPUT 714;"emmi:data #1512345"
```
Odd number of characters in the message portion of the data

```
OUTPUT 714;stat:emmi:event?"
```
Check status of last data write

```
ENTER 714;Stat
PRINT Stat
+0
```
EMMI idle, no data sent since last status check

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EMMI:DATA?

EMMI:DATA? reads a response message sent by the mobile station.

Response messages are stored in a message buffer in the HP 8922G.

You can do the following:

- Read all the messages in the message buffer by sending DATA? commands until #10 (no data) is returned. (Messages are read first-in-first-out.)
- Clear the message buffer by sending RESet.

To monitor error messages, it is recommended that you routinely read the message buffer after each request is sent to the mobile station.

EMMI:DATA? Programming Example

```
OUTPUT 714;"emmi:data #1237      Send request for the mobile's power
                                 level: $7 = Request for power level
OUTPUT 714;"stat:emmi:event?"    Check status of last data write

ENTER 714;Stat
PRINT Stat
+1                               Last message sent was received and
                                 acknowledged by the mobile
OUTPUT 714;"emmi:data?"          Read message buffer

ENTER 714;Data$
PRINT Data$
#145D02
                                 Returned data from the mobile:
                                 5D = Response, power level
                                 02 = power level
```

EMMI:TIMEout:MS:RESPonse

EMMI:TIMEout:MS:RESPonse adjusts the time allowed for the mobile station to send an ACK or NACK to the HP 8922G.

The following events will happen if the response timeout expires:

- The HPIB bus is released (another message can now be attempted).
- The STATus:EMMI:EVENT command will return an 8 (Response Timeout Exceeded).

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EMMI TIMEout MS RESPonse Programming Example

```
OUTPUT 714;"emmi:time:ms:resp?"     Query current mobile response timeout

ENTER 714:Resptime
PRINT Resptime
+1.00000000E+000                    Mobile response timeout is 1 second

OUTPUT 714;"emmi:time:ms:resp 3"    Set current mobile response timeout to
                                    3 seconds
```

EMMI:TIMEout:MS:XON

EMMI:TIMEout:MS:XON adjusts a timer that provides the time delay needed when the EMMI bus is attempting to send a message before the mobile station or 8922G are ready. Without this time delay, a message would be rejected immediately if certain events have not occured.

Example: If the mobile station sends an XOF to the HP 8922G, the HP 8922G cannot send any messages to the mobile station until XON is received. Also, XON must be received within the length of time specified by EMMI:TIMEout:MS:XON.

The following events will happen if time expires:

- The HPIB bus is released (another message can now be attempted).
- The STATus:EMMI:EVENT command will return a 4 (Mobile XOF).

EMMI TIMEout MS XON Programming Example

```
OUTPUT 714;"emmi:time:ms:xon?"      Query current xon timeout

ENTER 714;Xontime
PRINT Xontime
+1.00000000E+000                    Current xon timeout is 1 second

OUTPUT 714;"emmi:time:ms:xon 1.5"   Set current xon timeout to 1.5 seconds
```


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Example EMMI Program

Start with the mobile station camped on:

```
2350!
2360 Wait_2_camp:SUB Wait_2_camp
2370    COM /Addr_22/ @Addr_22
2380    COM /String/ String$[50]
2390    INTEGER Timeout
2400    Timeout=40
2410    PRINT "Polling EMMI until the radio is camped."
2420    ON DELAY Timeout GOTO No_camp
2430! repeat until camped
2440    REPEAT
2450 ! give the mobile a chance to do something
2460       WAIT 1
2470 ! empty the emmi receive buffer
2480       Empty_emmi_b
2490 ! request status indication
2500       OUTPUT @Addr_22;"emmi:data #1236"
2510 ! determine status of the emmi data write
2520       OUTPUT @Addr_22;"status:emmi:event?"
2530       ENTER @Addr_22;String$
2540       PRINT String$
2550       IF (String$="+8") THEN
2560         PRINT "EMMI INTERFACE IS DEAD"
2570         STOP
2580       END IF
2590       IF (String$="+4") THEN
2500         PRINT "Mobile is in XOFF state."
2610         STOP
2620       END IF
2630       IF (String$="+2") THEN
2640         PRINT "Max retries exceeded"
2650         STOP
2660       END IF
2670       IF (String$="0") THEN
2680         PRINT "CHECK DATA ENTRY"
2690         STOP
2700       END IF
2710 ! read status indication
2720       OUTPUT @Addr_22;"emmi:data?"
2730       ENTER @Addr_22;String$
2740    UNTIL (String$="#145C01")
2750    OFF DELAY
2760    GOTO Bye_camp
2770 No_camp:!
2780    PRINT "ERROR: unable to camp after ";Timeout;"seconds"
2790 Bye_camp:SUBEND
2800 !
```


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9

Messages

Messages can be reviewed by pressing (SHIFT) (MEAS SYNC).

See Also

Screens: Message

Communication Failures

The following messages require you to cycle power on the instrument to continue any operation.

- DSP Analyzer Communication Failure
- Hop Controller Communication Channel Failure
- Protocol Processor Communication Channel Failure
- Communication failure with Signaling Board

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Measurement Summary

The Measurement Summary field on the DSP Analyzer Ampl Main screen displays whether HI/LO limits set for the measurement display fields, (Ampl1-12, pk+ flatness, or pk- flatness) were exceeded in the last measurement. The possible Measurement Summary displays are:

Failed

One or more measurement limit was exceeded.

Passed

No measurement limits were exceeded.

- - - -

No measurement limits are set, or, all of the Ampl and Pk measurement displays are turned off.

A blank field

The blank field is displayed when the measurement is armed. It will remain blank until the measurement is complete.

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Sync Status

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

Bad Sync (for demodulation only)

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

Possible causes of Bad Sync are:

- Useful bits occurred while power was too low.
- Demodulation trigger too early or too late.
- FM (bit) errors found while synchronizing to desired midamble.
- RF overload.

FM Error

At least one bit error was detected when comparing the measured midamble to the selected Midamble or User Defined Sync Pattern, (Sync Mode=Midamble only).

Level Late

The amplitude of the burst did not rise until after the first few bits were received.

Level Short

The amplitude of the burst fell before the last few bits were received.

Low Level

The DSP analyzer's RF level did not rise high enough to make a valid measurement.

No Error

No synchronization error occurred.

RF Ovrload

The measurement hardware overloaded during the measurement. (Increase RF Analyzer Amplitude setting to correct).

ShortBurst

The amplitude envelope was shorter than the expected burst.

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Protocol Error Messages

A prototcol error may be generated by one of six sources.

- Expiry of a timer
- An error detected by the physical hardware interface layer (PH)
- An error detected by the Data Link layer (DL)
- An error detected by the Radio Resource sublayer (RR)
- An error detected by the Mobility Management sublayer (MM)
- An error detected by the Call Control sublayer (CC)

The error may be fatal or nonfatal. Fatal errors will cause the call to be cleared and will display an error message containing the timer name or the abbreviation for the layer or sublayer (PH, DL, RR, MM, CC), and an error code. Nonfatal errors may only be observed by inspecting the signaling log.

Errors are fatal for calls in progress or signalling being attempted.

Timer names are taken from GSM Rec. 04.06, 04.08 and 05.08, with the exception of T3299, which is HP unique.

T100 has been disabled on the HP 8922. Normally this failure results in a radio link timeout (loss of SACCH uplink), but this has been disabled on the HP 8922 so that measurements may be made without clearing the call.

The timer expiry appears at the top of the display and is of the form:

```
"Call disconnected: timer T??? expired."
```

An unknown timer is reported as:

```
"Call disconnected: cause unknown."
```


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Timers

The following is a brief description of the timers.

Physical Layer Timer

T100 Radio Link Failure [Disabled in HP 8922]
"Loss of SACCH on uplink."

Data Link Layer Timers

T200 Data Link Failure
"Failed to receive RR or other acknowledgement of an I frame."

Radio Resource Management Timers.

T3101 IMMEDIATE ASSIGNMENT timer
"MS failed to seize the assigned channel."

T3103 HANDOVER timer
"MS failed to seize the assigned channel."

T3105 Physical information repetition timer

T3107 ASSIGNMENT COMMAND timer
"MS failed to seize the assigned channel."

T3109 Loss of communication timer

T3111 Channel deactivation delay timer.

T3113 PAGING REQUEST timer
"MS did not respond to page."

TT01 TCH loopback timer.

Mobility Management Timers.

T3250 TMSI_REAL_CMD or LOC_UPD_ACC timer
"MS failed to acknowledge a new TMSI."

T3260 AUTHENT_REQUEST timer
"MS failed to authenticate."

T3270 IDENTITY_REQUEST timer
"MS failed to identify."

T3299 HP Unique timer: CIPHER_REQUEST
"HP 8922 failed to configure for ciphering."

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Call Control Timers.

T301 Call Received timer
"MS failed to connect."

T303 Call Present timer
"MS failed to respond to SETUP with CALL_CONF or REL_COMP."

T305 Disconnect Indication timer
"MS failed to respond to DISC with REL or DISC."

T306 Disconnect Indication Tone timer
"MS failed to respond to DISC with REL or DISC."

T308 Release Request timer
"MS failed to respond to REL with REL_COMP or REL."

T310 Incoming call proceeding timer
"MS failed to ALERT, CONN or DISC on incoming call."

T313 Connect Indication timer
"MS failed to respond to CON with CON_ACK."

T323 Modify Request timer
"MS failed to respond to MOD with MOD_COMP or MOD_REJ."

Timer Values

The timer values have been set as follows:

Timer Values

Timer	Value (ms)	Timer	Value (ms)	Timer	Value (ms)
T200	0[1]	T3113	8000	T301	20000
		TT01	2000	T303	10000
T3101	5000			T305	10000
T3103	5000	T3250	5000	T306	10000
T3105	50	T3260	5000	T308	10000
T3107	5000	T3270	5000	T310	10000
T3109	5000	T3299	5000	T313	10000
T3111	500			T323	10000

1 varies with channel type; see Rec. 04.06 Table 9

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Disconnects

Physical Layer Disconnects

Physical Hardware interface layer error codes are proprietary to the HP 8922. The defined error codes are as follows:

```
"Call disconnected: PH Error: 0x00??"

Causes:
   0x0096 - 0x009c    Channel or Speech coder failure.
   0x009d             Channel coder auto recovery to BCCH. [Non-fatal]
   0x009e             Channel coder failed, cycle power to recover. [Fatal]
   0x00a0             Channel coder failure.
   0x00a1             Speech coder failure.
   0x00a5             Invalid GSM Protocol Processor ROMS.
   0x00a6             RTI failed to configure.
   0x00a7             Channel or Speech coder failed to boot.
   0x00aa             Channel or Speech coder I/O overloaded.
   0x00ab             T100 expired.
   0x00ac             Protocol Message Allocation failed.
```

Data Link Layer Disconnects

Data Link layer error codes are proprietary to the HP 8922. The defined error codes are as follows:

```
"Call disconnected: DL Error: 0x00??"

Causes:
   0x00c8             SAPI incorrect.
   0x00c9             Timer T200 expired.
   0x00ca             Re-establish link.
   0x00cb             Unexpected UA response.
   0x00cc             Unexpected DM response.
   0x00cd             Unexpected DM response in multiframe.
   0x00ce             Unexpected S frame.
   0x00cf             Frames out of sequence.
   0x00d0             Bad parameters in U frame.
   0x00d1             Bad parameters in S frame.
   0x00d2             Bad M bit in I frame.
   0x00d3             I frame length incorrect.
   0x00d4             Invalid frame.
   0x00d5             Unexpected SABM.
   0x00d6             SABM in I frame.
   0x00d7             Unexpected release.
```


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Radio Resource Layer Disconnects

The RR sub-layer only generates timer expiry error codes.

```
"Call disconnected: RR Error: 0x00??"

Causes:
   No RR reports are supported.
```

Mobility Management Layer Disconnects

Mobility Management sub-layer error codes are proprietary to the HP 8922. The defined error codes are as follows:

```
"Call disconnected: MM Error: 0x00??"

Causes:
   0x0001          Authorization procedure failed.
   0x0002          MS rejected.
```


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Call Control Layer Disconnects

Call Control sub-layer error codes are actually CC cause values as defined by Rec. 04.08 Table 10.53. The cause values used by the HP 8922are as follows:

```
"Call disconnected: CC Cause: 0x00??"

Causes:
   0x0001     Unassigned number.
   0x0002     No route to specified transit network.
   0x0003     No route to destination.
   0x0005     Channel unacceptable.
   0x0010     Normal call clearing.
   0x0011     User busy.
   0x0012     User not responding.
   0x0013     User no answer.
   0x0015     Call rejected no good reason.
   0x0016     Number changed.
   0x001b     Destination out of order.
   0x001c     Invalid number.
   0x001e     Response to STATUS_ENQUIRY.
   0x001f     Normal, unspecified.
   0x0022     No circuit/channel available.
   0x0026     Network out of order.
   0x0029     Network temporary failure.
   0x002a     Switching equipment congestion.
   0x002b     Access information discarded.
   0x002c     Requested circuit/channel not available.
   0x002f     Resource unavailable, unspecified.
   0x0039     Bearer capability not authorized.
   0x003a     Bearer capability not available.
   0x003f     Service or option not available, unspecified.
   0x0041     Bearer service not implemented.
   0x0046     Only restricted digital information bearer capability
              is available.
   0x004f     Service or option not implemented, unspecified.
   0x0051     Invalid call reference value.
   0x0058     Incompatible destination.
   0x005f     Invalid message, unspecified.
   0x0060     Mandatory information element error.
   0x0061     Message type non-existent or not implemented.
   0x0062     Message not compatible with call state or message type
              non-existent or not implemented.
   0x0063     Information element non-existent or not implemented.
   0x0064     Invalid information element contents.
   0x0065     Message not compatible with call state.
   0x0066     Recovery on timer expiry.
   0x006f     Protocol error, unspecified.
   0x007f     Interworking, unspecified.
```


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Host I/O Error:

"Call disconnected: Host I/O Error."

Operating System Error:

"Call disconnected: Operating System Error."

Unknown Errors:

"Call disconnected: 0x00??"

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10

Instrument BASIC

HP 8922 Instrument BASIC Overview

The HP 8922 contains an HP Instrument BASIC computer that can run programs to control the HP 8922 and any connected HP-IB equipped instruments. This provides a powerful test instrument and test system controller in one package.

Programs can be written on an external computer and loaded into the HP 8922, or can be typed directly into the HP 8922's Instrument BASIC computer. Programs can then be stored on memory cards.

IBASIC



The rest of this section of the manual refers to the HP Instrument BASIC Language simply as **IBASIC**.

In This Chapter

The information in this chapter is divided into two broad categories: general information about IBASIC, and information about IBASIC programming using the TESTS subsystem.

The general information category contains for sections:

Configuration and Instrument Control .....Page 10—3

Loading, Storing, and Running .....Page 10—9

Entering and Editing Programs .....Page 10—14

Memory Cards .....Page 10—18

The IBASIC programming category contains information on structuring IBASIC programs to run in the TESTS subsystem and some of the features of the TESTS subsystem that can be used in writing programs.

The IBASIC programming category contains one section:

Programming and Using the TESTS Subsystem .....Page 10—29

The TESTS Subsystem and IBASIC

The HP 8922's IBASIC computer is the "core" of an automated test environment referred to as the TESTS subsystem. This environment is available by accessing the **TESTS** screen.

Programs can also be written that do not use the special TESTS subsystem capabilities, using only the IBASIC computer core.

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Programs That Use the TESTS Subsystem

The TESTS subsystem's capabilities were designed to allow the operator to "pick and choose" the tests and parameters they need from a larger set, eliminating unnecessary tests and reducing test time. This is especially helpful when a very large program has been written containing several tests and a multitude of associated specifications, test parameters and frequencies.

Writing programs to run in this environment requires you to understand and adhere to the program structure and syntax required by the TESTS subsystem.

Programs That Do Not Use the TESTS Subsystem

If you have a common test routine that uses the same tests and parameters every time it is run, it may be easier to write your test program to run directly in the IBASIC computer without using the TESTS subsystem.

These programs are much like any stand-alone program, and development of these programs will not be covered by this chapter. All of the general information sections of this chapter can be applied to these types of IBASIC programs.

By writing tests that do not use the TESTS subsystem, you lose the ability to easily access and change the test order and associated parameters with the subsystem's editing screens (although you can write your program to provide operator input during the test to change parameters).

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Configuration and Instrument Control

Controlling HP 8922 Functions

The HP 8922's IBASIC computer acts much like a system controller connected by an HP-IB cable to the HP 8922; but instead of a cable, the HP 8922 has its own internal control bus connected to the IBASIC controller.

The internal bus address is **8xx**. (xx is any valid HP-IB address.) When you write programs to run on the HP 8922's IBASIC computer to address HP 8922 functions, you must use the "8xx" address to output commands.

For example, if you want a program in the IBASIC computer to reset the HP 8922 at the start of a test procedure, the program code to do this would be written

```
OUTPUT 814;"*RST"
```

Controlling Connected Instruments

When the HP 8922's HP-IB **Mode** field, on the Configure screen is set to `Control`, it takes on the role of system controller. This allows it to control other test instruments connected by HP-IB cables.

Instruments controlled by the HP 8922 use the normal **7xx** HP-IB address prefix.

For example, if two HP 8922's are used in a test system, and the second instrument's HP-IB address is 715, a program running in the *controlling* HP 8922 would output the command

```
OUTPUT 715;"*RST"
```

to reset the *controlled* HP 8922.

Multiple Controllers



Only one system controller can be connected to the bus at any time. If the HP 8922 is used in a test system that has its own controller, the HP 8922 can not be used as a controller unless the system controller is turned off or disconnected from the bus.

If an HP 8922 is used as a controller in a system with another HP 8922, the HP-IB **Mode** of the non-controller HP 8922 must be set to `Talk&Listen`.

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Hardware Connections and HP 8922 Configuration

HP 8922 provides an RS-232 Serial port and an HP-IB port for a variety of uses:

- Controlling the HP 8922 using a connected controller
- Controlling connected instruments using the HP 8922's IBASIC computer
- Printing screen images and test results
- Entering and editing IBASIC programs

The HP 8922's **CONFIGURE** screen is used to configure these ports for the desired use.

HP-IB Configuration For Programming

1. Access the HP8922's **CONFIGURE** screen.
2. Set the `HP-IB Adrs` to the desired address.
3. Set the `Mode` field to `Talk&Lstn`.
4. Enter the `Print Adrs` if an HP-IB printer is connected.
   a. Set the `Print To` field to `HPIB`.
5. Connect HP-IB cables to other instrument(s).

This configuration prepares the HP 8922 to be controlled by a system controller, allowing program transfers over the bus. Refer to *Entering and Editing Programs*, to start programming or editing.

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Serial Port Configuration for Programming

Connecting the Serial Port

1. Connect an RJ-11/RS-232 adapter (HP P/N 98642-66508) to the 25-pin RS-232 connector of your terminal or personal computer (PC). (If your PC has a 9-pin RS-232 port, use the appropriate adapter and use the table below to varify connections.)
2. Connect a 4-conductor RJ-11 cable (HP P/N 98642-66505) from the adapter to the Serial Port of the HP 8922.

RJ-11 Connectors

RJ-11 cables and adapters can be wired differently. If you buy a cable or adapter from a supplier other than HP, verify the connections for the pins indicated in the following table before connecting cables to the instruments.

HP 8922 RJ-11 Serial Port		Terminal/PC 25-Pin RS-232		Terminal/PC 9-Pin RS-232
Pin 2 (RX)	to	pin 2 (TX)	or	pin 3 (TX)
Pin 5 (TX)	to	pin 3 (RX)	or	pin 2 (RX)
Pin 4 (GND)	to	pin 7 (GND)	or	pin 5 (GND)

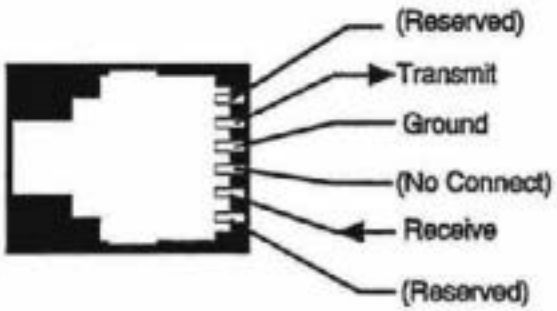


Figure 10-1. Serial Port Connections

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Configuring the HP 8922

1. Access the HP8922's **CONFIGURE** screen.
2. Set `Serial In` field to `Inst` to allow the HP 8922's IBASIC controller to accept characters from a PC or ASCII terminal.
3. Set `IBASIC Echo` to `On`.
4. Set `Inst Echo` to `On`.
5. Set the `Serial Baud` to 4800. (Baud can be altered as required by your terminal.)
6. Set `Parity` field to `None`.
7. Set `Data Length` to `8 bits`.
8. Set `Stop Length` to `1 bit`.
9. Set `Rcv Pace` to `None`.
10. Set `Xmt Pace` to `Xon/Xoff`.

Configuring Your Terminal or PC

Configuring an ANSI Terminal

1. Select **ANSI** operating mode.
2. Set **Baud Rate** to **4800** (if this rate is not available on your terminal, set it to a rate that can be selected on the HP 8922's **CONFIGURE** screen.
3. Set **Parity** to **none.**
4. Set **Data Bits** to **8.**
5. Set **AnqAck** to **no** (or **none**).
6. Set **Receive/Transmit Pacing** to match the HP 8922's settings.

Your terminal may have additional fields available for different configurations, but should be able to communicate with the HP 8922 if these settings are made.

Configuring an IBM-Compatible PC With HP AdvanceLink

HP AdvanceLink is a popular PC terminal emulator used to emulate a variety of terminals. If you are using a different terminal emulator program on a PC, configure it using the above settings.

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1. Load and run HP AdvanceLink on your PC.
2. Set the *Global Configuration* settings.
   a. Keyboard: USASCII
   b. Personality: HP
   c. Language: ENGLISH
   d. Terminal Mode: Alphanumeric
   e. Remote To: (Enter your PC's serial port number.)
   f. Printer I/F: None
   g. Memory Size: 32K
   h. Plotter I/F: None
   i. HP Mode: Yes
   j. Video Type: (Select your display type.)
   k. Forms Path: (Enter path if used.)
   l. Screen Size: (Enter the size.)
3. Set the *Terminal Configuration* settings.
   a. Terminal ID: 2392A
   b. Local Echo: OFF
   c. CapsLock: OFF
   d. Start Col: 01
   e. Bell: ON
   f. XmitFnctn(A): NO
   g. SPOW(B): NO
   h. InhEolWrp(C): NO
   i. Line/Page(D): LINE
   j. InhHndShk(G): No
   k. Inh DC2(H): NO
   l. Esc Xfer(N): YES
   m. ASCII 8 Bits: YES
   n. FldSeperator: US
   o. BlkTerminator: RS
   p. ReturnDef: CR
   q. Copy: Fields
   r. Type Ahead: No
   s. ROW Size: 80
   t. Host Prompt Character: D1
   u. Horiz. Scrolling Increment: 08
   v. Large [+] Key: +
4. Set the *Remote Configuration* settings
   a. Baud Rate: 4800
   b. Parity/Data Bits: None/8
   c. Eng Ack: No
   d. Asterisk: OFF
   e. Chk Parity: NO
   f. SR(CH): LO
   g. Recv Pace: None
   h. Xmit Pace: None
   i. CS(CB)Xmit: No

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Verifying Serial Port to IBASIC Operation

1. Access the HP 8922's **TESTS** screen.
2. Select `IBASIC` from the `Test Function` field to access the **IBASIC Controller** screen.
3. Position the cursor in the top left corner of the screen. (The top of the screen contains two command lines for entering commands and editing code.)
4. Type `SCRATCH`, [Enter] :**Note** - *this clears any existing programs in memory.*
5. Type `10 PRINT "HELLO WORLD"`, [Enter].
6. Type `20 END`, [Enter].
7. Press [k1] on the HP 8922 (or type RUN, [Enter] on your terminal) to run this two line program.
8. HELLO WORLD should be displayed on the HP 8922 and the terminal/PC's screen.

After the cable and adapter have been connected, and the HP 8922 and terminal (or PC) have been configured, you should be able to type on your terminal's keyboard and "talk" to the HP 8922.

As you type each command, the letters appear on the HP 8922's command lines and the terminal/PC screen. The letters appear on the terminal/PC screen because the `Inst Echo` field in the **CONFIGURE** screen is set to `On`.

When the program is run, HELLO WORLD appears on the HP 8922's display area and on the terminal/PC's screen because the `IBASIC Echo` field in the **CONFIGURE** screen is `On`. Any non-graphic character that is printed to the HP 8922's display area during a "print-to- screen" operation (CAT, LIST, PRINT,..) is also printed to the terminal/PC.

Refer to *Entering and Editing Programs*, to start programming or editing.

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Loading, Storing, and Running

This section describes loading, storing, and running both IBASIC programs and test procedures using the TESTS subsystem.

Loading An IBASIC Program From A Memory Card

1. Insert the memory card.
2. Access the **IBASIC Controller** screen from the Test Function field on the **TESTS** screen.
3. Using the knob, select the field and enter the following command to load your program:

```
GET "<filename>:INTERNAL"
```

Loading an IBASIC Program From An HP-IB Disk Drive

1. Insert the disk into the drive.
2. Access the IBASIC controller screen from the Test Function field on the TESTS screen.
3. Using the knob, select the field and enter the following command to load your program:

```
LOAD "<filename>:7xx,x"
```

Downloading An IBASIC Program Into the HP 8922

This procedure downloads an IBASIC program from your connected IBASIC computer to the HP 8922's IBASIC Controller. This procedure assumes your HP 8922's HP-IB address is set to 14.

1. Access the HP 8922's **IBASIC Controller** screen.
2. Load your IBASIC program into your connected IBASIC computer.
3. Enter the following commands on your IBASIC computer to copy the program into the HP 8922's IBASIC Controller:

   a. `OUTPUT 714;"PROG:DEL" <enter>`

   b. `OUTPUT 714;"PROG:DEF #0" <enter>`

   c. `LIST #714 <enter>`

   d. `OUTPUT 714;" "END <enter>`

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Storing IBASIC Programs On Memory Cards

1. Use the previous procedure to download your program into the HP 8922's RAM.
2. Press [LOCAL], [SHIFT], [CANCEL] on the HP 8922 to perform an IBASIC reset.
3. If your memory card has not been initialized, insert your memory card into the HP 8922 and enter the following command on your computer:

```
OUTPUT 714;"PROG:EXEC 'INITIALIZE"":INTERNAL""'"
```

4. Insert the initialized memory card into the HP 8922.
5. Define the memory card as the Mass Storage device by entering the following command on your computer:

```
OUTPUT 714;"PROG:EXEC 'MSI "":INTERNAL""'"
```

6. Save your program to the memory card by entering the following command on your computer:

```
OUTPUT 714;"PROG:EXEC 'SAVE ""<filename>""'"
```

7. Press [LOCAL].

Storing an IBASIC Program On An HP-IB Disk Drive

1. Insert the disk into the drive.
2. Access the IBASIC controller screen from the Test Function field on the TESTS screen.
3. Using the knob, select the field and enter the following command to save your program:

```
STORE "<filename>:7xx,x"
```

Running Your Program

Once the program is loaded into the **IBASIC Controller's** RAM, it can be run by using the knob to enter the `RUN` command, or by selecting the `Run` field in the top right corner of the screen.

Loading a Test Procedure

A Test Procedure file includes all the user defined channels, frequencies, limits, and values from the Test Executive for the radio under test. You can make as many Test Procedure files as needed for the different radios you are testing.

1. Press the front-panel [TESTS] key and select the `Location` field. Refer to item (1) in figure 10—2.
2. Choose the location (Card, ROM, RAM, or Disk) where the Test Procedure is found. Refer to item (2) in figure 10—2. (The location you select appears in the field (1) area.)

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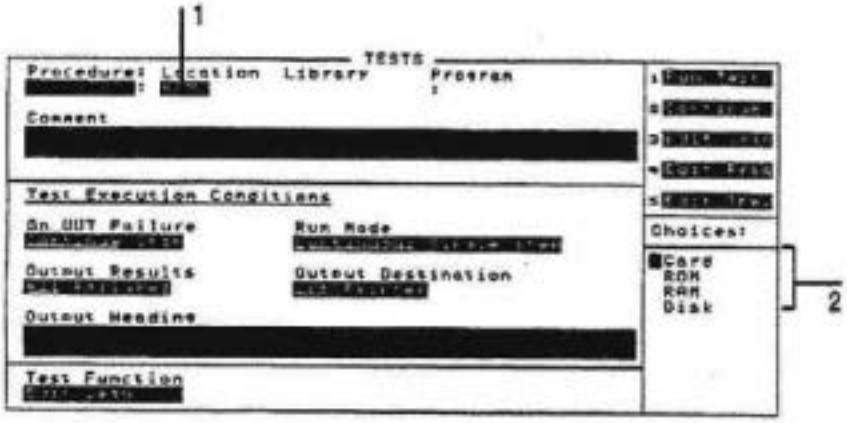


Figure 10-2. Loading a Test Procedure (1 of 2)

3. Select the **Procedure** field. Refer to item (**3**) in figure 10—3.
4. Choose the Test Procedure file that you want to download. Refer to item (**4**) in figure 10—3. (The Test Procedure you select appears in the field (**3**) area.)
5. Read the **Comment** field to ensure that the loaded Test Procedure file is the one you want. Refer to item (**5**) in figure 10—3.

Note

The Test Procedure file should have a Test Library file with the same name. Refer to the *Programming and Using the TEST Subsystem* for descriptions of Test Procedure and Library files, and how these files relate to the program's code file.

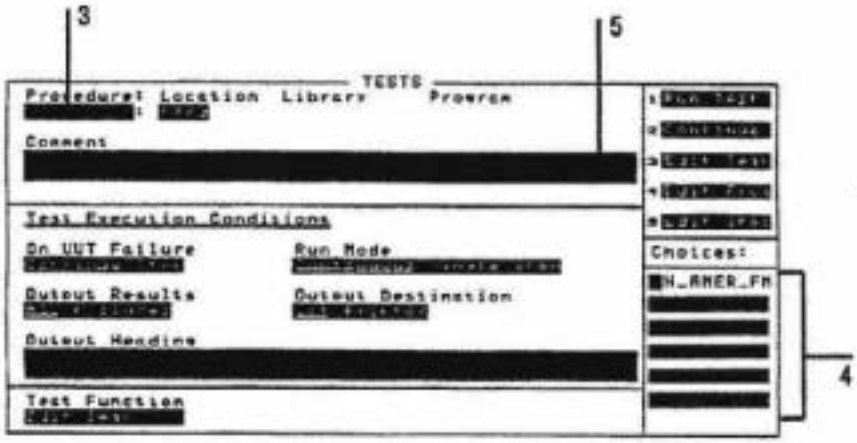


Figure 10-3. Loading a Test Procedure (2 of 2)

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Making or Deleting Test Procedure Files

1. Select the front-panel (TESTS) key, and then select the Test Function field shown by item (1) in figure 10—4.
2. Select Proc Mngr shown by item (2) in figure 10—4.

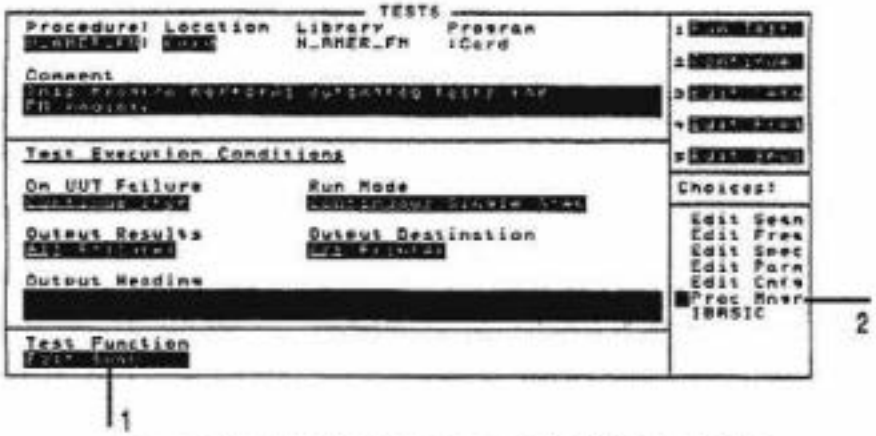


Figure 10-4. Test Procedure and Test Library Files

3. Select the Procedure field shown by item (3) in figure 10—5.
4. Enter the Test Procedure filename that you want to make or delete by using the alpha/numeric list of characters shown by item (4) in figure 10—5.
5. Select the Location to Make or Delete field shown by item (5) in figure 10—5, then select the file's location to be on memory card, RAM, or Disk from the list of choices shown in item (4).
6. Enter up to two lines of comments to identify the new Test Procedure. Refer to item (6) in figure 10—5.
7. Select whether the new Test Procedure will use the current Test Library or if it will use no library as shown by item (7) in figure 10—5. (All HP 11807A Test Procedures must be tied to a Test Library, other IBASIC programs may not require an associated library file.)
8. Select where the program for the Test Procedure is to be found. Refer to item (8) in figure 10—5.
9. Select the Make Procedure field or the Delete Procedure field as shown in item (9).

Use the Pass Number *field in the lower-right corner of the Procedure Manager menu to un-secure a Test Procedure file. The ROM program* SECURE_IT *is used to secure Test Procedure files.*

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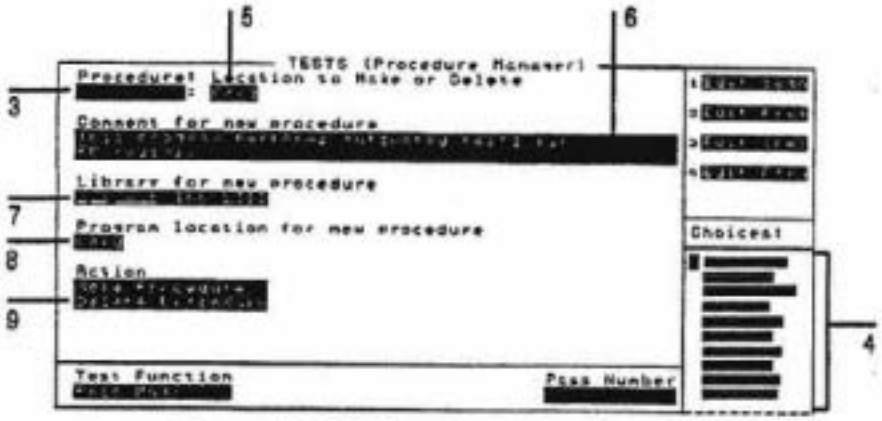


Figure 10-5. Making a Test Procedure File

Running a Test Sequence

1. Select the `Run Test` field.
2. Follow directions and prompts on the HP 8922 screen according to the test sequence being run.
3. When testing is complete, the HP 8922 will respond to front panel or remote input. If at any time you need to stop testing, press the front-panel (CANCEL) key.

Note

A program takes up to 3 minutes to load into the HP 8922 and is loaded when the `Run Test` field is first pressed.

Press the front-panel (SHIFT) (CANCEL) keys to abort from an error condition or to abort from the program. When you abort from loading the program, you'll need to clear HP 8922 RAM memory in order to correctly re-load the program at a later time.

To clear HP 8922 RAM, select and run the ROM program `COPY_PL` from the Procedure field in the TESTS menu. (Running `COPY_PL` deletes all **SAVE/RECALL** registers. So instead you may want to load another program, run it, and then re-load the original program that was aborted.

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Entering and Editing Programs

The **IBASIC Controller** screen is the "computer" for the TESTS subsystem. You enter and edit programs just like any other IBASIC computer, with the exceptions that the HP 8922 does not have a computer keyboard connected directly to it, and full screen editing does not yet exist.

Programs can be entered into the IBASIC computer's RAM using a variety of methods:

- Using the IBASIC Controller screen and the Cursor Control knob.
- Using an external IBASIC controller connected to the HP 8922 by HP-IB.
- Using an external ASCII terminal or Personal Computer (PC) connected to the HP 8922 by RS-232.

Accessing the HP 8922's IBASIC Controller

1. Access the **TESTS** screen by pressing [TESTS].
2. Select the `Test Function` field at the bottom of the screen to display a list of choices.
3. Select `IBASIC` to display the **IBASIC Controller** screen.

Using the Knob

After accessing the **IBASIC Controller** screen, position the cursor in front of the command line at the top of the screen and press the Cursor Control knob. A list of characters is displayed that you select from to enter your commands. A maximum of 100 characters may be entered into the command line. After the command is entered on the command line, select 'Done' at the top of the list of characters to execute it.

Commands and program lines are entered just as you would enter them using a keyboard. For example, to set the default mass storage device to the memory card slot, you would enter the command

```
MSI ":INTERNAL"
```

and select 'Done'

To list the contents of the default mass storage device, enter

```
CAT
```

and select 'Done'.

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Using HP-IB

The easiest way to enter and edit a program is to create it on your computer, using your computer's editing features, and then download it into the HP 8922. The usual development sequence is:

1. Write the program on your computer to control the HP 8922 using the normal 7xx HP-IB address.
2. Run the program to verify that it controls the HP 8922 correctly.
3. Change the HP 8922's HP-IB address in your program to 8xx.
4. Download the program into the HP 8922. (See Downloading a Program Into the HP 8922.)
5. Run the program on the HP 8922 to verify correct operation.
6. Copy the program to a memory card for future use.

PROGram Interface Commands

The HP 8922's IBASIC Controller has a special Program Interface it uses to communicate with other computers over HP-IB. When sending a command to the HP 8922 from another computer, you must use a 'PROG' command to tell the HP 8922 you need it to perform an operation.

In the following list, 'Addr' is the address of the HP 8922, and '<filename>' represents the name of the file you are saving or retrieving.

Note



For more information on memory cards, see the Memory Cards section.

To initialize a memory card use this command:

```
OUTPUT Addr;"PROG:EXEC 'INITIALIZE "":INTERNAL""'"
```

To change the default Mass Storage device use this command:

```
OUTPUT Addr;"PROG:EXEC 'MSI "":INTERNAL""'"
```

To save a file to the default Mass Storage device, use this command:

```
OUTPUT Addr;"PROG:EXEC 'SAVE ""<filename>""'"
```

To retrieve a file from the default Mass Storage device, use this command:

```
OUTPUT Addr;"PROG:EXEC 'GET ""<filename>""'"
```


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Other PROG Commands

Two additional PROG Commands are used to prepare the HP 8922's IBASIC Controller RAM for receiving programs.

```
OUTPUT Addr;"PROG:DEL"
```

deletes any programs currently residing in RAM.

```
OUTPUT Addr;"PROG:DEF #0"
```

defines the address in RAM where a downloaded program will be stored.

Preparing the HP 8922 to Receive Programs

1. Configure the HP-IB port as described in section 2 (*HP-IB Configuration*).
2. Access the **IBASIC Controller** screen.

Downloading A Program Into the HP 8922

This procedure assumes your HP 8922's HP-IB address is **14**. If it is not, change the address in the following procedure to match your instrument's address.

1. Load the IBASIC program to be downloaded into your controller.
2. Enter these commands to transfer the program to the HP 8922:

```
10   DIM LINE$[200], FILE_NAME$[120]
20   Addr=714
30   INPUT "NAME OF (ASCII) IBASIC FILE TO DOWN-LOAD?", FILE_NAME$
40   ASSIGN @FILE TO FILE_NAME$; FORMAT ON
50   ON END @FILE GOTO DONE
60   OUTPUT Addr;"PROG:DEL"
70   OUTPUT Addr;"PROG:DEF #0"
80   WHILE (1)
90   ENTER @FILE; LINE$
100  OUTPUT Addr; LINE$
110  END WHILE
120  DONE: !
130  OUTPUT Addr; " " END
140  PRINT "Done with down-load"
150  END
```

Figure 10-6. Download Program for Computers using HP-IB

To verify that your code was downloaded, type in the command-
`OUTPUT 714;"PROG:EXEC 'LIST '"`.
Your program should be listed on the HP 8922's **IBASIC Controller** screen.

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Line-by-line Entry and Editing

Program lines in the HP 8922's RAM can be entered and edited one line at a time from your computer using the PROG command -

```
OUTPUT Addr;"PROG:EXEC '<program line/command> '"
```

with <program/command> representing any command or program line you want to enter.

For example, to enter or change line 20 of a program to '20 A=3.14', you would enter the following command on your computer

```
OUTPUT Addr;"PROG:EXEC '20 A=3.14 '"
```

Quoted strings, such as those used in PRINT commands, must use double quotes. Example -

```
OUTPUT Addr;"PROG:EXEC '30 PRINT ""TEST"" '"
```

Using a Terminal

A connected terminal, or PC using a terminal emulator, is used to enter characters directly into the HP 8922 IBASIC Controller's command line.

Editing a program line requires you to re-enter the full line with corrections.

Configuring your terminal/PC for this operation is explained in section 2, *Serial Port Configuration for Programming*.

Entering Commands

When program lines or commands are entered, you press the ENTER key on your terminal to execute the command. For example, to LIST a program in RAM you would type
LIST, (ENTER)

This differs from using the Cursor Control knob to enter characters where you select 'Done' to execute the command.

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Memory Cards

This section contains information about memory cards and about programming the HP 8922. Programs may be either "user written", or taken from the HP 11807A Radio Test Software. You are also shown how to connect a radio to the HP 8922 in order to run automated tests from the main radio-test screen (referred to as the "Test Executive").

This section covers:

- *Using the Memory Card* – Inserting and removing memory cards, setting write protection, backing up programs, and changing memory-card batteries.
- *Programming the HP 8922* – Using HP Instrument BASIC, entering programs, downloading programs over HP-IB, editing programs line-by-line over the serial port, and using HP 11807A software.
- *Automated Radio Testing* – Connecting radios to the HP 8922, and using the HP 8922 Test Executive to test radios.

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Using Memory Cards

Figure 6-1 illustrates how to insert a memory card into the HP 8922 front panel. To remove a memory card, simply pull it out.
Pay attention to memory-card orientation as it's inserted; otherwise, the card will not be seated correctly in the slot. The memory-card label is marked with an arrow that must be inserted on the same side as the arrow shown on the front-panel slot.

Memory cards may be inserted and removed with the HP 8922 powered on or off.

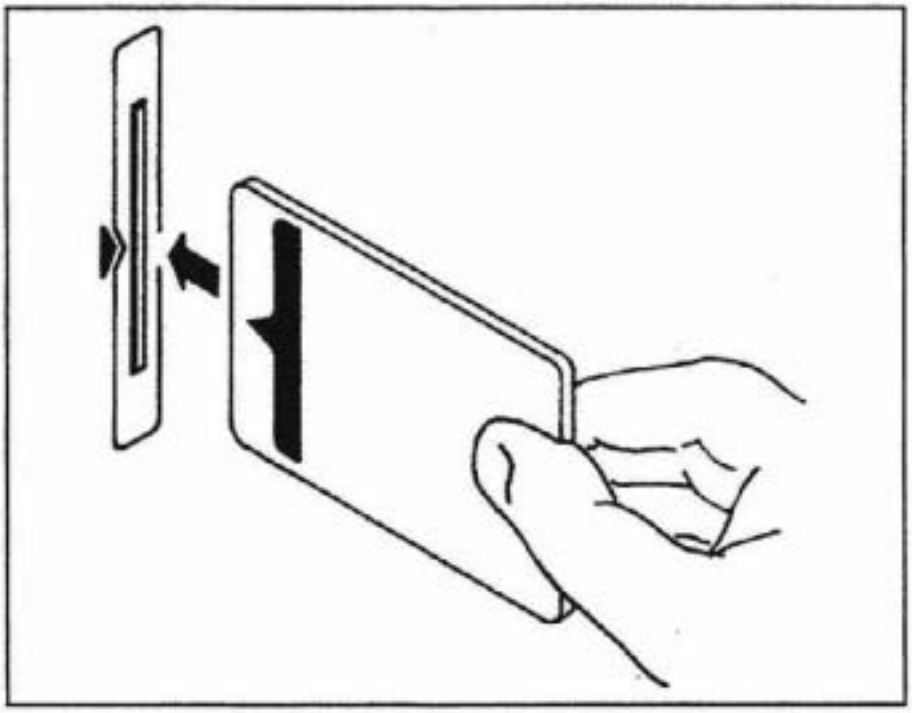


Figure 10-7. Inserting a Memory Card

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Types of Memory Cards

Two types of memory cards may be purchased from Hewlett-Packard as shown in table 6-1:

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

Table 10-1. Memory Card Part Numbers

Memory	Type	Part Number
32 kilobytes	SRAM	HP 85700A
128 kilobytes	OTP	HP 85701A
128 kilobytes	SRAM	HP 85702A
256 kilobytes	OTP	HP 85703A
256 kilobytes	SRAM	HP 85704A
512 kilobytes	SRAM	HP 85705A
512 kilobytes	OTP	HP 85706A

SRAM memory cards require a battery to maintain stored information. OTP memory cards do not require a battery and will maintain stored information indefinitely.

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Initializing an SRAM Memory Card

An SRAM memory card must be initialized before it can be used. Initialize the SRAM memory card by using the COPY_PL program (which at the same time you can copy Test Procedure and Test Library files to the memory card). Otherwise, initialize the SRAM card using the IBASIC computer as follows:

1. Press the front-panel (TESTS) key and then select the Test Function field (lower-left corner of screen).
2. Choose IBASIC from the Choices menu.
3. Select the IBASIC field, then use the knob to type:

   ```
   INITIALIZE ":INTERNAL"
   ```

   Then select Done.

   The initialization process takes only a second to complete.
4. Ensure that the SRAM memory card is initialized. Select the IBASIC field, then use the knob to type:

   ```
   CAT
   ```

   Then select Done.

   Information for the initialized memory card should appear on the screen.

If the error message "ERROR 85 Medium uninitialized" appears on the screen, check the SRAM battery to ensure that it's charged and that its polarity is correctly oriented in the battery holder.

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Setting the Write-Protect Switch

The SRAM memory card's write-protect switch lets you secure its contents from being accidentally overwritten or erased. The switch has two positions as illustrated in figure 6-2:

- *Read-write* – The memory-card contents can be changed or erased, and new files may written on the card.
- *Read-only* – The memory-card contents can be read by the HP 8922, but cannot be changed or erased.

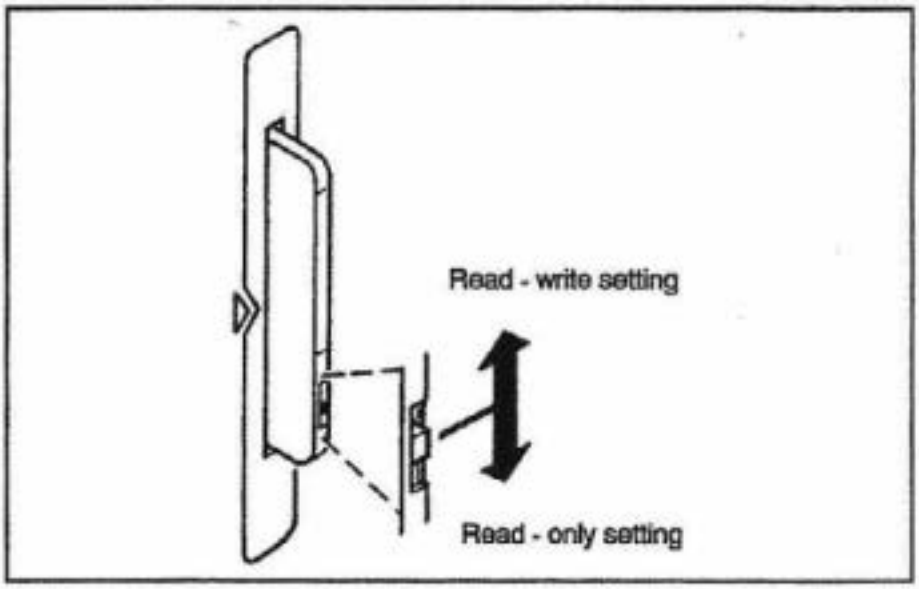


Figure 10-8. Setting the SRAM Write-Protect Switch

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Backing Up the Memory-Card Programs

SRAM memory cards contain a battery to preserve its contents when the HP 8922 is turned off or when the card is removed. Memory-card contents may be backed up using the following procedure:

Procedure for Backing Up a Memory Card

The program COPY_PL on HP 8922 ROM backs up Test Procedure and Test Library files onto a SRAM memory card. The program COPY_PL also lets you to initialize the SRAM memory card. (Code files should reside on OTP memory cards; an external "device programmer" is required to download code files into an OTP memory card.)

Note

Test Procedure files are identified in the IBASIC screen when a catalog (CAT) is done. A lowercase "p" is prefixed to a Test Procedure filename. Test Library filenames are prefixed with a lowercase "l."

1. Press the front-panel (TESTS) key.
2. Select the program COPY_PL from ROM in the Procedure field, and then select the Run Test field. (Refer to *Loading a Test Procedure* on page 6-18 for help.)
3. Select the Run Test field.
4. Read the instructions on the screen and continue with the copy program when you are ready. (Directions are provided on the screen as you continue.)
5. Press the front-panel (PREV) key to exit the screen.

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The Memory Card Battery

A memory-card battery should last between 3 and 5 years depending on its use. Write the date a battery is installed in the memory card. The date is important for determining when to replace the battery.

When the battery needs replacing, insert the card into the HP 8922 and turn the **POWER** switch on. An inserted memory card takes power from the HP 8922 preventing the card's contents from being lost.

Replace the battery as shown in figure 6-3 with a 3 volt 2016 coin cell. *Hold the card in with your other hand while pulling the battery out. Also, be sure to install the battery with the side marked "+" on the same side marked "+" on the battery holder.*

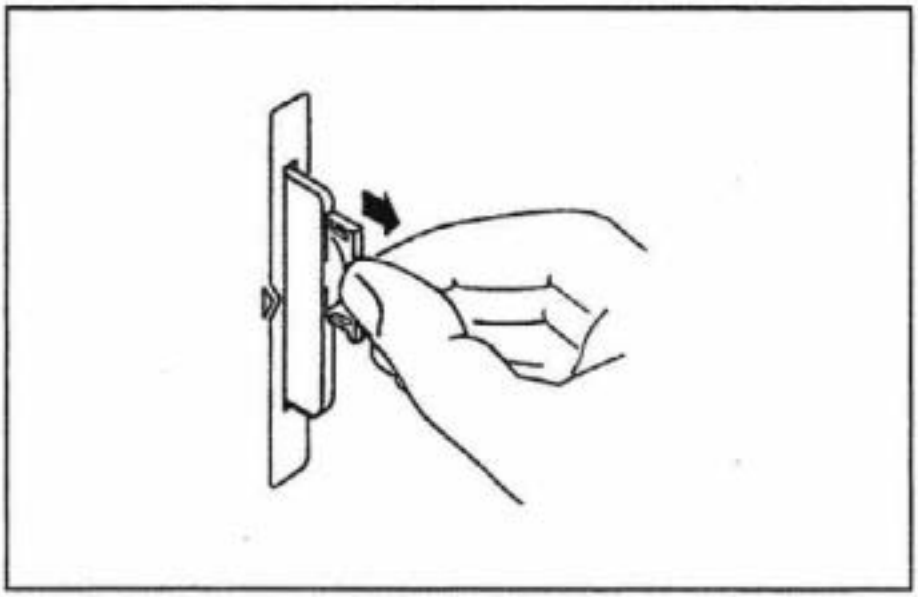


Figure 10-9. Replacing the Memory-Card Battery

Avoid touching the flat sides of the battery when replacing it. Finger oils may contaminate battery contacts in the memory-card.

Warning

Do not mutilate, puncture, or dispose of batteries in fire. The batteries can burst or explode, releasing hazardous chemicals. Discard unused batteries according to the manufacturer's instructions.

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Programming and Using the TESTS Subsystem

This section describes the concepts and tasks associated with the TESTS subsystem. It is intended to help the experienced programmer develop programs, or modify existing programs.

TESTS Subsystem File Descriptions

Three types of files are used in the TESTS subsystem to store different types of information.

Code Files

The first aspect of an automated definition is the code itself. This is just a standard IBASIC Code file that can reside either on the Memory card, on an external disk drive connected to the HP-IB port of the HP 8922, or in an internal RAM disk. The name of this file is preceded by a lower case 'c'. This tells the TESTS subsystem that this particular file contains program code.

Library Files

A Library indicates all of the available test subroutines in the code, the set of all parameters that might be entered using the user-interface screens, and all specifications that might be used by the subroutines in the code to decide if a test point passes or fails.

Only one Library is defined for each Code file. The name of this file is preceded by a lower case 'l', telling the TESTS system that this is a Library file. Also, both the Library and Code file should have the same base name to indicate the relationship between them.

A Library is required if you want to use the user-interface screen functions of the TESTS subsystem. If the program is simple enough that there is no need for user-input, or if all the user-input is simple enough to be accomplished through INPUT statements, then a [NO LIB] option is available.

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Procedure Files

A Procedure allows the user to define which of the test subroutines, parameters, and specifications defined in the Library will be used to test a specific Radio. There may be many Procedures defined that use the same IBASIC Code and Library, each using a different subset of the choices available in the Library. These files are preceded with a lower case 'p', but are *not* required to have the same base name as either the Library or the Code. The name of the corresponding Library (if any) is stored in each Procedure file.

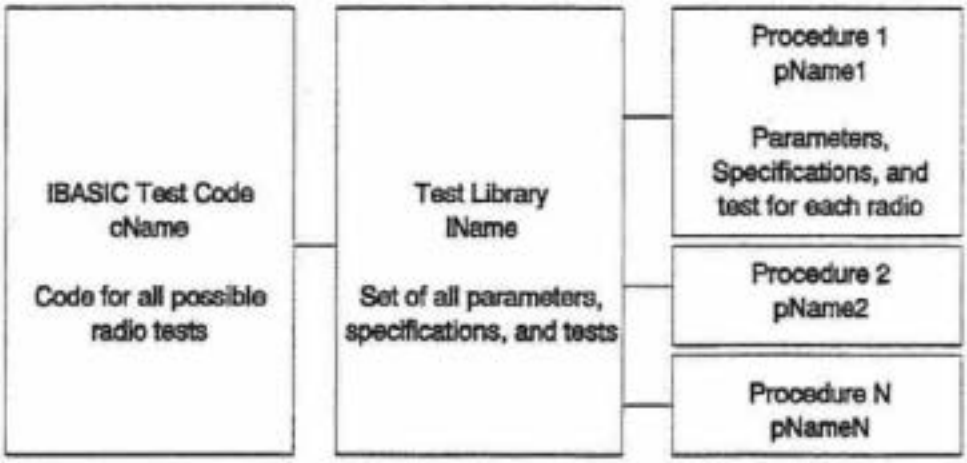


Figure 10-10. TESTS Subsystem File Relationship

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TESTS Subsystem Screens

The TESTS subsystem uses several screens to create, select, and copy files, and to run tests.

The Main TESTS Subsystem Screen

Refer to figure 10—11.

The Main TESTS screen is accessed by pressing the front panel (TESTS) key. Notice that the first line shows the currently selected Procedure. The associated Library is listed, as well as the location of the code.

The comment area is simply available to give the user a more complete explanation of this particular Procedure.

To view all the Procedures available on the selected media, simply select the Procedure field. A menu will appear in the lower right corner of the screen, displaying all the Procedures are available. This is not a listing of the full contents of the disk; it is only a list of the Procedures that have been stored.

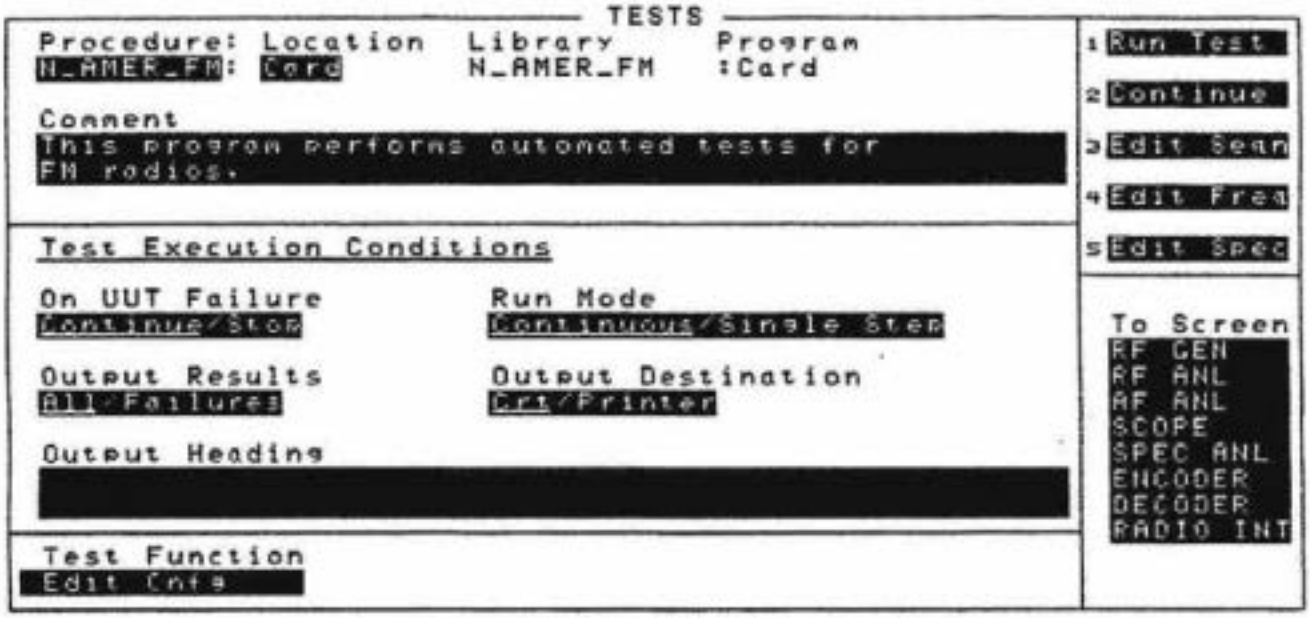


Figure 10-11. The Main TESTS Subsystem Screen

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TESTS Subsystem User-Interface Screens

The TESTS subsystem allows the user to easily modify the test subroutines, parameters, specifications and configuration to correspond to the requirements of a specific Radio. There are several user-interface screens that allow the user to do this.

To access any of these screens, select the `Test Function` field at the bottom of the main TESTS screen to display the screen choices.

- The *Edit Sequence* screen lets you select the desired test(s) from the full set of available tests in the default Procedure file.
- The *Edit Specifications* screen defines the specifications used to generate pass/fail messages during testing.
- The *Edit Parameters* screen is used to define instrument settings and characteristics to match those of the radio being tested (audio load impedance, audio power, power supply voltage,..etc.).
- The *Edit Configuration* screen identifies all connected HP-IB equipped instruments and their HP-IB addresses.
- The *Procedure Manager* screen is used to make or delete Procedures.

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IBASIC Programming

IBASIC gives you control over the internal functionality of the HP 8922, as well as control over any external instruments connected to the HP-IB.

Refer to the HP 8922 *HP Instrument BASIC Programmer's Guide* for details about IBASIC. The manual contains important information about the IBASIC programming-language code, Test Procedure and Test Library file structures, and programming and interfacing techniques.

Program Status

A single-character "run indicator" is displayed in the upper-right corner of the screen to indicate program status:

- If the screen is blank, the program is stopped.
- An asterisk "*", indicates the program is running or doing other input/output.
- A dash "-" indicates the program is paused.
- A question mark "?" indicates the program is awaiting user input.

Three alpha characters are also displayed in the upper-right corner of the screen to indicate status:

- An "R" indicates the HP 8922 is in remote operation; the absence of an "R" means the HP 8922 has changed to local operation.
- An "T" indicates the HP 8922 is "talking" on the HP-IB.
- An "L" indicates the HP 8922 is "listening" on the HP-IB.

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Setting Up the Test Execution Conditions.

Five Test Execution Condition fields are shown in figure 10—12. Set up each field according to your testing needs.

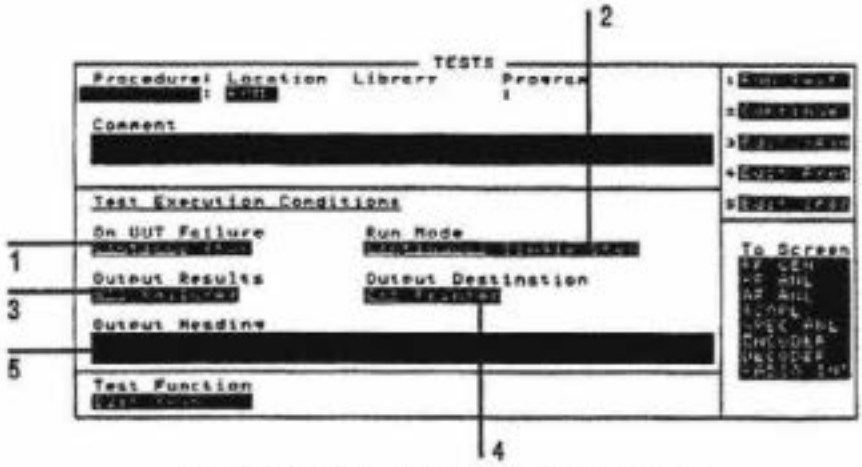


Figure 10-12. Test Execution Conditions

To Have Testing Stop or Continue on a UUT Failure

Refer to item (1) in figure 10—12.

On UUT Failure ..... Continue

Testing continues whenever the UUT (Unit Under Test) fails to meet its test specification limits. When this occurs, an error is listed on the test-results printout and/or is displayed on the CRT.

On UUT Failure ..... Stop

Testing stops whenever the UUT fails to meet test specification limits.

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To Continue or Pause After Each Test

Refer to item (2) in figure 10—12.

Run Mode ..... Continuous

All tests run in sequence. Testing pauses only if the operator is required to interact with the UUT or HP 8922; interaction such as changing UUT channels, setting squelch, changing audio level, and so forth, cause testing to pause.

Run Mode ..... Single Step

The program stops running at the completion of each test. The test-system operator is prompted to select `Continue` to proceed with testing.

To Select Printing Conditions

Refer to item (3) in figure 10—12.

Output Results ..... All

All test results are shown on the output device (CRT and/or printer). Printouts include a "banner" listing the test conditions, measured values, lower and upper limits, and whether the test passed or failed. The `Comment` field is shown at the top along with any identifying information from the `Output Heading` field. Date, and time is also output.

Output Results ..... Failures

Test results are shown only when a UUT failure or software error occurs. Printouts include a "banner" listing the test conditions, measured values, and lower and upper limits of the failed test. The `Comment` field and any identifying information from the `Output Heading` field is also output.

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To Have Test Results Appear on a CRT or Printer

Refer to item (4) in figure 10—12.

Output Destination ..... Crt

Test results are output to the HP 8922 CRT screen only.

Output Destination ..... Printer

Test results are output to the CRT and printer. A printer must be correctly configured in order to get a printout.

- To configure an RS-232 printer, refer to chapter 3 for **CONFIGURE** screen descriptions.
- To configure an HP-IB printer, refer to the instructions in the following section titled *Configuring External Instruments for HP-IB Control*.

To Enter Comments in the Output Heading Field

Refer to item (5) in figure 10—12.

1. Select the `Output Heading` field. (An alpha/numeric list of characters appears in the lower-right corner of the screen.)
2. Select characters one at a time using the knob in order to compose the comment you want to make. (Two lines of comments, 50 characters in length, may be entered.)
3. Select `Done` when you are finished.

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Making a Test Sequence

The Test Sequence menu lets you select radio tests and the order you want them performed.

1. Select the `Edit Seqn` field. A test-sequence screen similar to that shown in figure 10—13 appears.
2. Select the `Insrt Stp` field or `Delet Stp` field as needed to insert or delete tests on the screen. Refer to item (1) in figure 10—13.
3. Select the **Step #** field and turn the knob to the test you want to change. Refer to item (2) in figure 10—13. (As you turn the knob, the test's step number, name, and description changes. Refer to item (3) in figure 10—13.)
4. Select the **Test Name** field and turn the knob to select the desired test. Refer to item (4) in figure 10—13. (As you turn the knob, the test name and description changes along with the test number shown in the **Choices** menu. Refer to item (5) in figure 10—13.)
5. Select the `Yes/No` field and decide if the test is to be run on all channels (select **Yes**), or if the test is to be run on prime channels only (select **No**). Refer to item (6) in figure 10—13. (Prime channels are selected from the `Edit Freq` field.)
6. Repeat steps 3–5 as needed for each test. When finished, select the next Test Function you want.

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Four factors determine how long it takes to test a radio:

- The number of tests selected in the sequence.
- The kind of tests that are selected.
- The order in which the tests are selected.
- The number of points measured in a test. (This is determined by the start, stop, and step values in certain test parameters.)

Tests can be selected in any order; but to reduce testing time, you should strategically organize the test sequence. Tests requiring operator intervention (changing volume, channels, and so forth) should be grouped together.

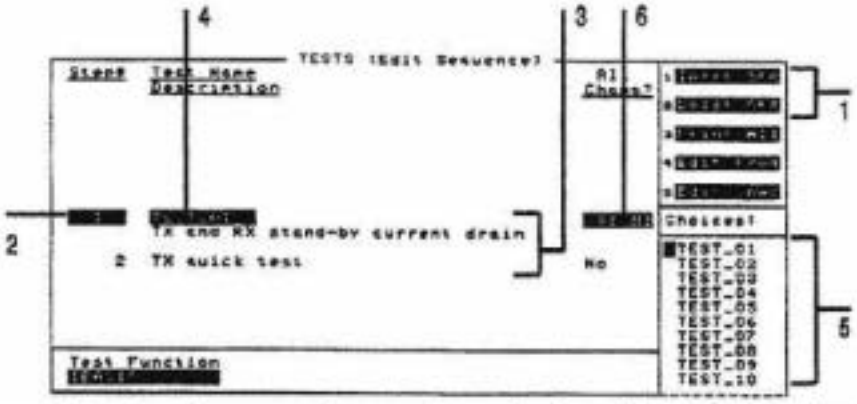


Figure 10-13. Test-Sequence Screen (Example from HP 11807A Option 001)

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Editing Test Specifications

Test Specifications are the upper and lower limit values that are used by the Test Executive to describe the manufactured specifications of the radio itself. For a radio to pass a test, the measured value must fall within the test's specified value (lower limit, upper limit, or both upper and lower limits).

1. Select the `Edit Spec` field. A test-specification screen similar to that shown in figure 10—14 appears.
2. Select the `Spec #` field and turn the knob to the specification you want to change. (Hint: If you know the specification that you want by number, key in the number, push the knob, and the specification you want appears.) Refer to item (1) in figure 10—14. (As you turn the knob, the test's specification number, description, and limits change.)
3. Select the `Lower Limit` or `Upper Limit` field you want to change. Refer to item (2) in figure 10—14. (The `Units` column show how the upper and lower limits will be terminated; for example, %, dBm, kHz, and so forth.)
4. Select the `Check` field. Refer to item (3) in figure 10—14.
5. Select whether the test will verify upper, lower, both, or none of the specified limits. Refer to item (4) in figure 10—14. (Selecting both upper and lower limits increases test time; however, this may be a necessary requirement.)
6. Repeat steps 2–5 as needed for each specification. When finished, select the next Test Function you want.

Note The tests you select determine the specifications that are required.

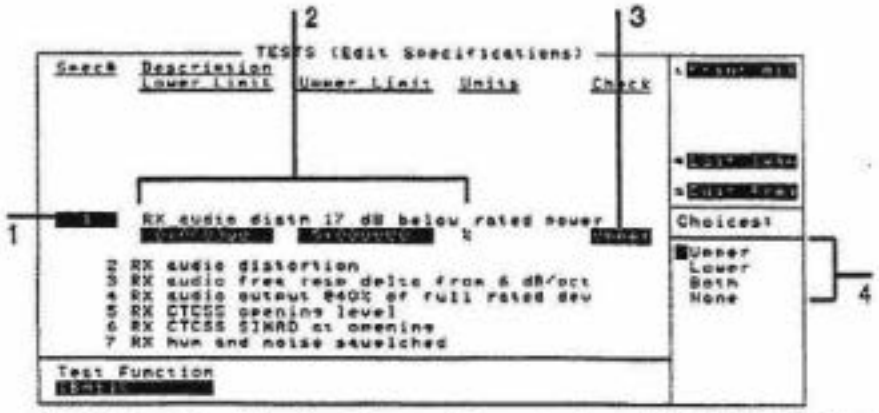


Figure 10-14. Test-Specification Screen (Example from HP 11807A Option 001)

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Editing Test Parameters

Test Parameters are used to set functions on the test-system instruments, and to change characteristics of the test-system instruments in order to match those of the radio being tested. For example, audio-load impedance, audio power, power-supply voltage, and so forth.

1. Select the Test Function `Edit Parm` (from the Test Executive lower-left corner). A test-parameter screen similar to that shown in figure 10—15 appears.
2. Select the **Parm #** field and turn the knob to the test parameter you want to change. (Hint: If you know the parameter that you want by number, key in the number, push the knob, and the parameter you want appears.) Refer to item (1) in figure 10—15. (As you turn the knob, the test parameter's number, description, and value changes.)
3. Select the **Value** field and change the parameter's value. Refer to item (2) in figure 10—15. (The **Units** column show how the value will be terminated; for example, %, dBm, kHz, and so forth.)
4. Repeat steps 2 and 3 as needed for each parameter. When finished, select the next Test Function you want.

Note

The tests you select determine the parameters that are required.

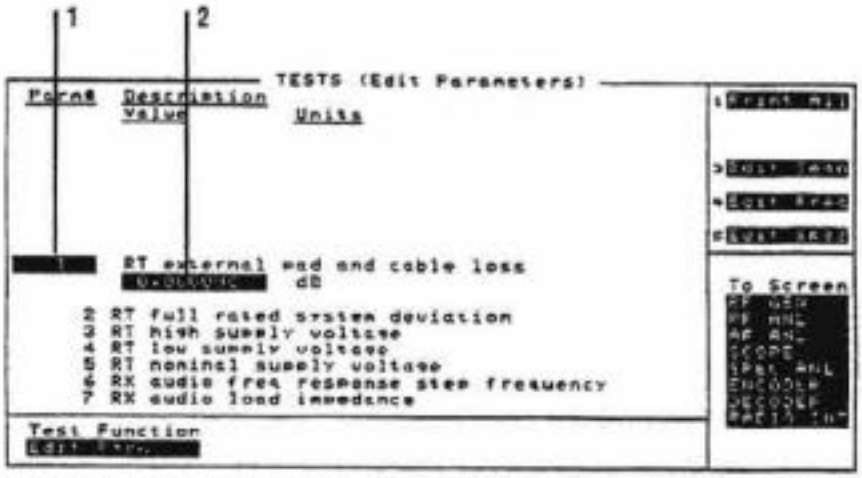


Figure 10-15. Test-Parameter Screen (Example from HP 11807A Option 001)

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Configuring External Instruments for HP-IB Control

Use the following instructions to configure the IBASIC computer to see external instruments on the HP-IB "700" bus.

1. Select the front-panel (TESTS) key, and then the `Test Function` `Edit Cnfg`. A configuration screen similar to that shown in figure 10—16 appears.
2. Select the `Calling Name` field and enter the instrument's name in upper-case letters. For example, `PRINTER`, `POWER SUPPLY`, `DATA COLLECTION`, and so forth. Refer to item (1) in figure 10—16.
3. Select the `Model` field and enter the instrument's model number. There is no specific syntax for entering model numbers into this field. Refer to item (2) in figure 10—16.
4. Select the `Addr` (address) field and turn the knob to enter the last two digits of the instrument's HP-IB address. Refer to item (3) in figure 10—16. (The RS-232 address must be 9, and the Data Collection address must be 1.)
5. Select the `Options` field (refer to item (4) in figure 6-16) and enter the instrument's option number(s) if any. This field may be left blank, or otherwise may include other calling name options, for example:

   Printer options – `LN=#,START,END`
   Where `#` is the number of lines on each page.
   Where `START` causes a form feed at the start of each printout.
   Where `END` causes a form feed at the end of each printout.
   Data collection option – `NN`
   Where `NN` is the number of records (file size) for the mass-storage location where data will be collected on disk or memory card. The default record size is "80".
6. Press the `Insrt Ins` field or `Delet Ins` field as needed or turn the knob to insert or delete as many instruments as needed. Refer to item (5) in figure 10—16.

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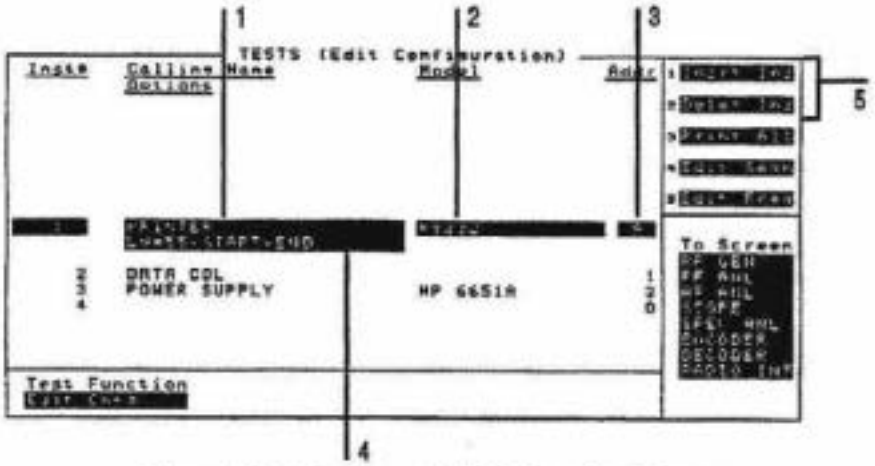


Figure 10-16. Instrument-Configuration Screen

Program Structure for TESTS Subsystem Programs

Writing programs that take advantage of the TESTS subsystem capabilities requires the programmer to understand how to structure the program to access the TESTS subsystem user-interface screens.

General Organization

Here are the steps to a basic algorithm that can be used to execute a number of test subroutines at a number of different frequencies:

```
BEGIN
SET UP (Set up the COM area to hold the global variables.)
REPEAT (for all Test Frequencies)
  REPEAT (for all Defined Tests)
    DO SUBROUTINE (defined Test)
  UNTIL (All Defined Tests Done)
UNTIL (All Test Frequencies Tested)
END
SUBROUTINE1 (Defined Test 1)
SUBROUTINE2 (Defined Test 2)
SUBROUTINE3 (Defined Test 3)
```


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Program Example

The following example IBASIC program uses the basic algorithm shown above and the TESTS subsystem to execute a number of test subroutines at a number of defined test frequencies. Also included are examples of how to interact with the user-interface to allow a user to access parameters, specifications, and configuration fields to define a specific set of test requirements.

An explanation of the program example is given at the end of the listing.

Note 

This program is not designed for the HP 8922.

Program Listing

```
10    ! DEMO_1
20    !
30    ! THE FIRST LINE MUST CONTAIN THE NAME OF THE LIBRARY
40    !
50    !-------------------------------------------------------
60    !
70    ! THIS PROGRAM IS A DEMO PROGRAM TO DEMONSTRATE THE USE
80    ! OF THE TEST SUBSYSTEM ON THE HP 8922G
90    !
100   ! REVISION: 1 APRIL, 1991
110   !-------------------------------------------------------
120   !
130   COM /I_o/ I_o$[470]
140   ! INPUT OUTPUT STRING
150   COM /Freq/ Rx_f,Tx_f
160   ! PRESENT RX AND TX FREQUENCIES IN MHZ
170   !
180   INTEGER Test_return
190   !  TITLE SCREEN FOR OUR TESTS
200   CLEAR SCREEN
210   PRINT TABXY(2,2),"___DEMO PROGRAM FOR THE TESTS SUBSYSTEM___"
220   !
230   !  SET UP A SOFT KEY TO HALT THE PROGRAM
240   ON KEY 1 LABEL "Stop Test",5 GOTO Stp_test
250   !
260   !  CLEAR THE INTERNAL HP 8922 BUS
270   CLEAR 800
280   !
290   ! NOW READ THE TEST FREQUENCIES IN ONE AT A TIME AND DO THE
300   ! SEQUENCE OF TESTS ON THEM
310   Ch=1
320   REPEAT
330     OUTPUT 800;"TESTS:FREQ? "&VAL$(Ch)
340     I_o$=""
```


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```
350     ENTER 800;I_o$
360     !                                   SET THE VALUE OF THE RX FREQUENCY
370     Rx_f=VAL(I_o$[4;12])
380     !                                   SET THE VALUE OF THE TX FREQUENCY
390     Tx_f=VAL(I_o$[30;12])
400     !                                   SET WHETHER TO TEST THIS FREQUENCY
410     T_it$=I_o$[56;1]
420     !                                 SET IF THIS IS A PRIME FREQUENCY
430     IF (LEN(I_o$)>57) THEN
440       Prime$=I_o$[58;1]
450     ELSE
460       Prime$="N"
470     END IF
480     !                                 IF THIS FREQUENCY IS TO BE TESTED
490     IF T_it$="Y" THEN
500       PRINT TABXY(2,6),"RX FREQUENCY = ",Rx_f
510       PRINT TABXY(2,7),"TX FREQUENCY = ",Tx_f
520       PRINT TABXY(2,8),"TEST THIS FREQUENCY ?",T_it$
530       Run_ts=1
540       !                               RUN THROUGH THE SEQUENCE OF TESTS
550       REPEAT
560         Done_t=0
570         !                             ENTER IN THE TEST SEQUENCE
580         OUTPUT 800;"TESTS:SEQN? "&VAL$(Run_ts)
590         I_o$=""
600         ENTER 800;I_o$
610         Tst=VAL(I_o$[4;2])
620         !                             IF THIS TEST IS TO BE SKIPPED THEN SET THIS
630         IF I_o$[7;1]="N" THEN Tst=-Tst
640         !                             IF THIS IS A PRIME FREQUENCY RUN THE TEST
650         IF Tst<0 AND Prime$="Y" THEN
660         !                             CALLS THE SUBROUTINE NAME T(ABS(Tst))
670           T(ABS(Tst),Test_return)
680           IF (Test_return=1) THEN GOTO Test_error
690           Done_t=1
700         END IF
710         !               IF THIS TEST IS TO BE DONE AND IS NOT A PRIME FREQUENCY
720         IF Tst>0 AND NOT Done_t THEN
730         !                             CALLS THE SUBROUTINE NAME T(ABS(Tst))
740           T(ABS(Tst),Test_return)
750           IF (Test_return=1) THEN GOTO Test_error
760         END IF
770         Run_ts=Run_ts+1
780       UNTIL Tst=0 OR Run_ts=51
790     END IF
800     Ch=Ch+1
810   UNTIL Ch=51 OR Tx_f=-1 OR Rx_f=-1
820 Stp_test:  !
830   CLEAR SCREEN
840   PRINT TABXY(2,10),"FINISHED TESTING"
```


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```
850   GOTO End_program
860 Test_error:  !
870   CLEAR SCREEN
880   PRINT TABXY(2,10),"PROGRAM STOPPED, TEST ",ABS(Tst),"FAILED"
890 End_program:  !
900   END
910 T01:SUB T01(Test_return)
920     COM /I_o/ I_o$
930     COM /Freq/ Rx_f,Tx_f
940     DIM Calling_name$[22],Model$[22],Options$[22]
950   !  TEST ROUTINE NUMBER 1
960     PRINT TABXY(2,12),"DOING TEST NUMBER 1 FOR FREQ ",Rx_f
970     !                                          GET THE PARAMETER 1 FOR THIS TEST
980     OUTPUT 800;"TESTS:PARM? "&VAL$(1)
990     I_o$=""
1000    ENTER 800;I_o$

1010    !                                     IF THERE IS NO PARAMETER THEN PAUSE
1020    IF I_o$[1;5]="Error" THEN
1030      PRINT TABXY(2,14),"ERROR IN RECALLING THE PARAMETERS FOR
TEST 1"
1040      Test_return=1
1050    END IF
1060    Parm_1=VAL(I_o$)
1070    !                                     GET CONFIGURATION 1 INFO FOR THIS TEST
1080    OUTPUT 800;"TESTS:CONF? "&VAL$(1)
1090    I_o$=""
1100    ENTER 800;I_o$
1110    Calling_name$=I_o$[4;21]
1120    Model$=I_o$[27;21]
1130    I1addr=VAL(TRIM$(I_o$[50]))
1140    Options$=I_o$[54]
1150    !                                     GET SPECIFICATION 1 FOR THIS TEST
1160    OUTPUT 800;"TESTS:SPEC? "&VAL$(1)
1170    I_o$=""
1180    ENTER 800;I_o$
1190    IF I_o$[1;5]="Error" THEN
1200      PRINT TABXY(2,14),"ERROR IN RECALLING THE SPECIFICATIONS FOR TEST 1"
1210      Test_return=1
1220    END IF
1230    Lower_limit=VAL(TRIM$(I_o$[4]))
1240    Upper_limit=VAL(TRIM$(I_o$[17]))
1250    Test$=TRIM$(I_o$[30])
1260  SUBEND
1270 T02:SUB T02(Test_return)
1280    COM /I_o/ I_o$
1290    COM /Freq/ Rx_f,Tx_f
1300  !  TEST ROUTINE NUMBER 2
1310    PRINT TABXY(2,13),"DOING TEST NUMBER 2 FOR FREQ ",Rx_f
1320  SUBEND
1330 T03:SUB T03(Test_return)
```


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```
1340     COM /I_o/ I_o$
1350     COM /Freq/ Rx_f,Tx_f
1360   !  TEST ROUTINE NUMBER 3
1370     PRINT TABXY(2,14),"DOING TEST NUMBER 3 FOR FREQ ",Rx_f
1380   SUBEND
1390  T:SUB T(N,Test_return)
1400     ! CALL THE PASSED TEST NUMBER (N)
1410     SELECT N
1420     CASE 1
1430       T01(Test_return)
1440     CASE 2
1450       T02(Test_return)
1460     CASE 3
1470       T03(Test_return)
             .
             .
             .
2380     CASE 49
2390       T49(Test_return)
2400     CASE 50
2410       T50(Test_return)
2420     END SELECT
2430   SUBEND
```


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Program Listing Explanation

10: This first line must contain the name of the Library and the program. This is checked by the TESTS subsystem when loading the program.

130: Establish a common L_o$ string for the ENTER statements.

150: Establish common Rx_f and Tx_f that can be used by the subprograms (tests).

180: The Integer Test_return is used by the subprograms to indicate the test ended with some error condition. The meaning of Test_return could be expanded to include the status of the test (ie PASS/FAIL).

200: Clears the IBASIC Screen.

210: Prints and indication that the Demo program is running.

240: Allows the User to stop the program using a softkey.

270: Clear the Internal Bus of the HP 8922G

310: Ch keeps track of which channel we are currently testing.

320: Now Repeat for all Frequencies:

330: Request all the channel values from the HP 8922G.

340: L_o$ gets the string return.

370: The Rx frequency is pulled from the string.

390: The Tx frequency is pulled from the string.

410: T_it$ gets either a "Y" or an "N" depending on whether this frequency is to be tested.

430: If a Prime channel has been specified then Prime$ gets a value of "Y".

490: If this frequency is to be tested:

500-520: Print out some information on the test about to be performed.

530: Run_ts holds the value of the test currently being run.

550: Repeat for all Specified Tests:

560: Done_t is initialized to not completed.

580: Get the Test specifier for the current Test.

590: Initialize L_o$ to a null string.

600: L_o$ holds the value of the return string.

610: Tst now hold the value of the current test. This value is equal to the index of the Test Name in the Test selection list shown on the Test Seqn screen.

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630: This tests whether this test is to be run for all channels. If not, the value is still kept around but is made negative. This will be used in later tests.

650: If the number of the test is indeed negative but the channel is prime, then the test is done.

670: This calls a subroutine that maps the number of the test with the subroutine that defines this test.

680: If there is an error, then the program stops and the error is reported.

690: Done_t is set to completed.

700: End this IF statement.

720: If Tst is suppose to be done, and has not yet been done, then now do it.

740: Again, This calls a subroutine that maps the number of the test with the subroutine that defines this test.

750: If there is an error, then the program stops and the error is reported.

760: End this IF statement.

770: Increment the step for the Test index.

780: If there are no more steps specified, or if the number of tests run is 51, then leave the test seqn loop.

790: End the Tst IF statement.

800: Increment the Channel number.

810: Stop stepping through the channels if the number of channels reaches 51, or if the Receive or Transmit frequencies are specified at -1.

820: The goto location for the stop test softkey.

830: Clear the screen

840: Indicate that the test is finished.

850: Goto the end statement.

860: The goto location if an error occurs in one of the subroutines.

870: Clear the screen.

880: Indicate that one of the tests have failed.

890: The goto for the end of the program.

900: End of the main program.

910: Subroutine T01-This corresponds with test #1. This subroutine illustrates how to enter values from the Parameters, Configuration, and Specification screens.

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920-930: Includes the common variables.

940: Dimension some variables that will be used to store values from the configure screen.

960: Indicate that the first test is now active.

980: Enter the value of the first Parameter. This is the value of the first parameter on the Parameter Screen.

990: Initialize the L_o$ string.

1000: Enter the value.

1020-1050: If there is no defined parameter this string will catch the error and return it to the main program.

1080: Get the information for the first instrument stored on the configure screen.

1090: Initialize the L_o$ string.

1100: Enter the string.

1110: Calling_name$ now holds the string associated with the Calling Name field on the configure screen.

1120: Model$ now holds the string associated with the Model field on the configure screen.

1130: Iladdr equals the value in the Addr field on the configure screen.

1140: Options$ now holds the string associated with the Options field on the configure screen.

1160: Get the information for the first Specification listed on the Specification system.

1170: Initialize the L_o$ string to null.

1180: ENTER the L_o$ string.

1190-1220: If there is no specification defined for this specification number, then an Error will appear in the L_o$ string. If this occurs, stop the test and return the error to the main program.

1230: Set the lower limit from the value in the string.

1240: Set the upper limit from the value in the string.

1250: Set Test$ to whether "Upper", "Lower", "Both", or "None" of the specs are to be tested.

1260: End of this subroutine.

1270-1380: These are the second and third subroutines. They are labeled T02 and T03 to correspond with the second and third test routines defined on the Test Seqn screen.

1390-2430: SUB T maps the calls from the main program to the correct subroutine. The mapping is quite simple, with the main

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program specifying which test to run and this subroutine calling the correct subroutine based on the SELECT statement.

Creating A Library And Default Procedure File

Once the Code file has been created, an associated Library and default Procedure file for the Code file can also be created.

Creating A Procedure File With No Library

If you do not want your program to use the different user-interface screens of the TESTS subsystem, you can create a Procedure from your Code file that does not have a Library associated with it. When the test information is defined, [NO LIB] is selected for the Library Name.

When creating a procedure to run without a Library, the first line of your Code file must be an exclamation point followed by the Code file name. For example, if your procedure is called 'FM_TESTS' the first line of your Code file must be-

```
1    ! FM_TESTS
```


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TAB 10

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