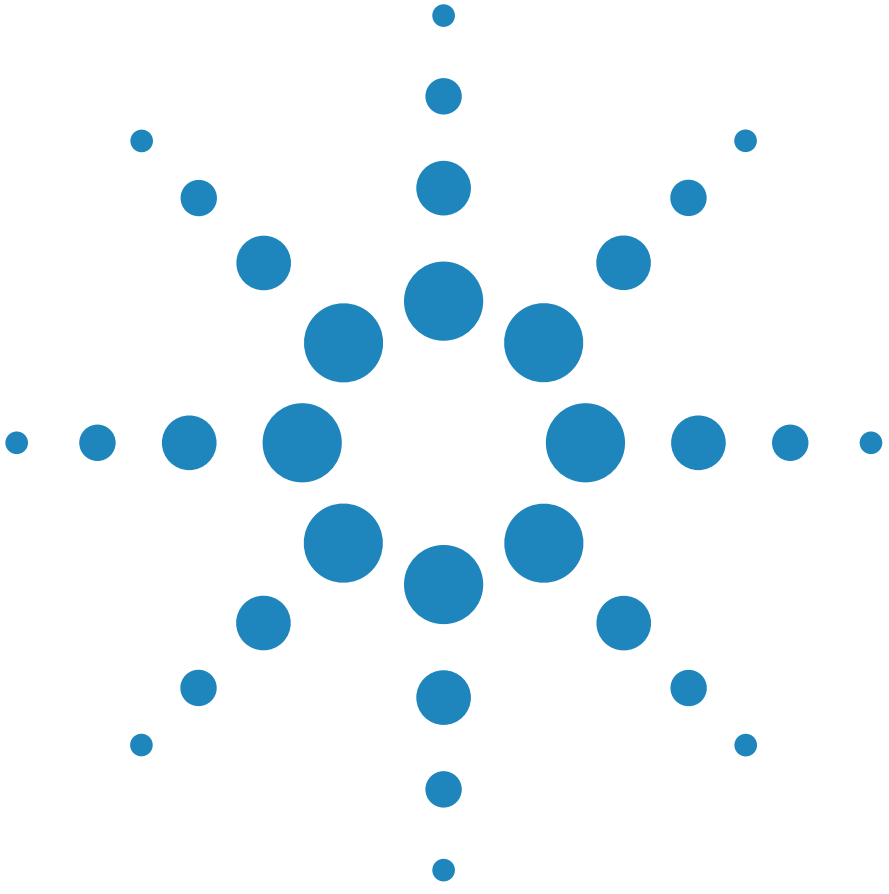
Agilent E1852B Bluetooth™ Test Set



Operating Guide

Release B.00.05

Agilent Technologies

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	Alternating current (AC)
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DO NOT operate the product in an explosive atmosphere or in the presence of flammable gasses or fumes.

DO NOT use repaired fuses or short-circuited fuseholders: For continued protection against fire, replace the line fuse(s) only with fuse(s) of the same voltage and current rating and type.

DO NOT perform procedures involving cover or shield removal unless you are qualified to do so: Operating personnel must not remove equipment covers or shields. Procedures involving the removal of covers and shields are for use by service-trained personnel only.

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DO NOT substitute parts or modify equipment: Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the product. Return the product to an Agilent Sales and Service Office for service and repair to ensure the safety features are maintained.

Welcome

Welcome to the E1852B Bluetooth Test Set *Operating Guide*!

The E1852B Bluetooth Test Set provides a low-cost, stand-alone route to proving the performance of Bluetooth devices with measurements on both the transmit and receive paths.

Using the supplied PC user interface you can quickly perform critical RF measurements such as:

- initial carrier frequency error
- FM deviation
- peak and average power
- Bit Error Rate (BER)

Functional testing includes:

- establishing a link using standard Bluetooth protocol
- using page mode for 1-second link set up
- using a frequency hopping source and receiver with known performance

More detailed analysis and fault finding is possible using:

- frequency versus time
- power versus time
- power versus channel number

The CVSD CODEC allows you to send and receive audio signals via rear panel connections and use external signal generators and analyzers to measure the audio performance of a DUT.

To help you develop your own applications, all the commands are logged when using the user interface in ‘debug’ mode. Using standard Windows’ tools, you can copy the commands and paste them into a program to quickly create an automated test sequence.

Test & Measurement E-mail Updates

Keep up to date with Agilent's free Test and Measurement E-mail Updates. As a subscriber, you will receive customized E-mail updates that match your subject and frequency interests. Your updates will include support, products and services, applications, promotions, events, and other areas.

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Documentation Information

This guide is only part of the information supplied. The documentation consists of:

- The *Installation Guide* - Shows you how to check your Bluetooth test set, switch it on and connect it to a Device Under Test. The *Installation Guide* is supplied as a printed book and as an Adobe Acrobat PDF (Portable Document Format) file on the supplied CD-ROM.
- The *Operating Guide - (this guide)* - Shows you how to operate your Bluetooth test set from the supplied PC User Interface or using the remote command set.

Conventions Used in this Guide

The following text conventions are used in this guide.

Run	used to represent the text in the PC interface
Parameter	used to represent a parameter, value or data in an entry field

Abbreviations Used in this Guide

The following abbreviations are used in this guide.

BD	Bluetooth enabled Device
EUT or DUT	Equipment or Device Under Test
NTP	Normally Transmitted Power or Average Burst Power
PTP	Peak Transmitted Power
BS	Bit Sequence

Specifications

Full specifications are listed in “Specifications and Characteristics” on page 189.

Contents

Introduction

Making Measurements

PC User Interface

DLL Interfacing

Programming Reference

Specifications and Characteristics

Maintenance

1 Introduction

What You'll Find In This Chapter

This Chapter introduces you to the E1852B Bluetooth Test Set.

It contains these sections:

Introduction

The E1852B Bluetooth Test Set supports a range of different tests as specified in the Bluetooth RF Test Specifications. It is a stand-alone piece of test equipment and can be used for high throughput manufacturing applications, and as a development or service tool.

For some test situations specified in the Bluetooth RF Test Specifications, additional test equipment, such as an Agilent ESA Spectrum Analyzer or Agilent ESG Signal Generator, can be used to compliment the E1852B bluetooth test set measurements. Consult Agilent Technologies for further details.

The test set is basically a Bluetooth Host Controller with added test capabilities. Used as a test set it acts as the Bluetooth master and the Device Under Test (DUT) acts as the Bluetooth slave.

You can operate the test set using the supplied PC user interface or by sending SCPI format commands, either in the Windows environment or from within a test executive.

The operation of the DUT is controlled via the Air Interface. Using the standard test mode commands, you can set the DUT into test mode and carry out Transmitter and Loop-back Tests.

Bluetooth RF components that are unable to establish a link can be tested using RF Analysis and RF Generator modes.

In addition to the RF IN/OUT port for connection with the DUT, several additional front and rear panel connections are provided. These are shown in the Installation Guide and in External Connections on page 13. With the Counter Input on the front panel, the test set can also be used as a frequency counter, measuring system frequencies of a Bluetooth device up to 15MHz.

External Connections

Rear Panel Connections

The E1852B Bluetooth Test Set provides rear panel input/outputs for the following functions:

External Reference	10 MHz timebase signal input
Slot Clock	A 1µs wide TTL trigger output at the Bluetooth frame rate (625µs)
Receive Data	Inverted analogue output of the demodulated signal
Receive Slot Sync	A 1µs wide TTL trigger output synchronized with the start of a received burst
Power Envelope	Analog output of the RF power
Audio In	Audio signal input
Audio Out	Recovered audio modulation signal output
Parallel Interface	25 pin male D-type connection for communication with a PC
Serial	9 pin female D-type for downloading firmware
GPIB	Standard GPIB connection for communication with a PC system controller

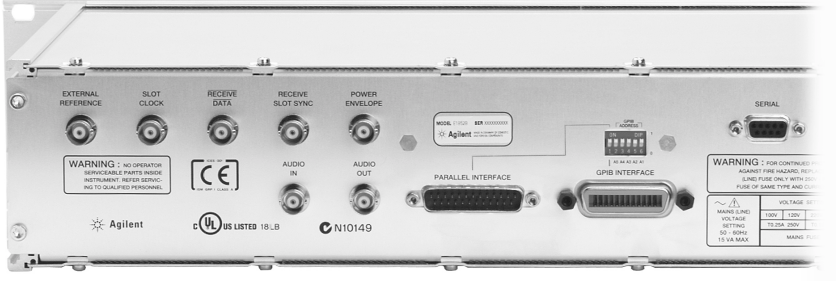


Figure 1 Rear Panel Connections

External Reference 10 MHz timebase signal input.

Figure 2 10 MHz Timebase Input

Slot Clock 1µs wide TTL level pulses at 625µs intervals (Bluetooth frame rate).

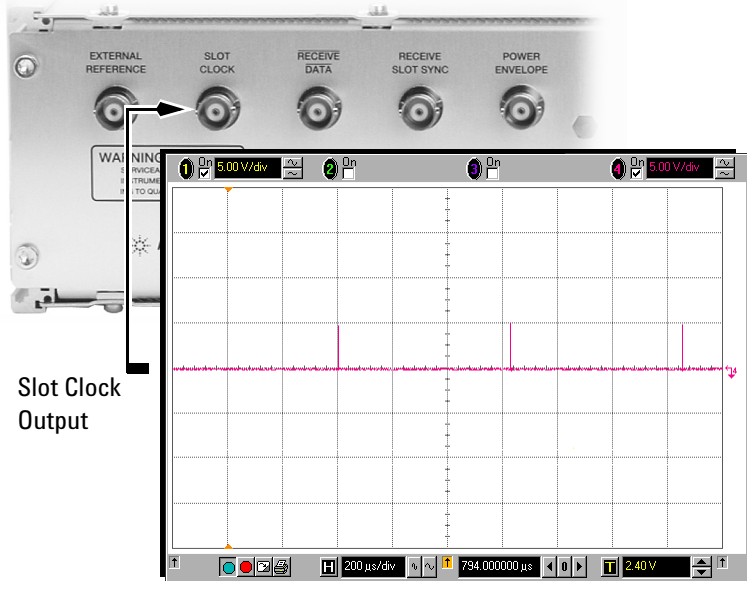


Figure 3 Slot Clock Output (with DH1 data)

Receive Data INVERTED analogue output of the demodulated signal.

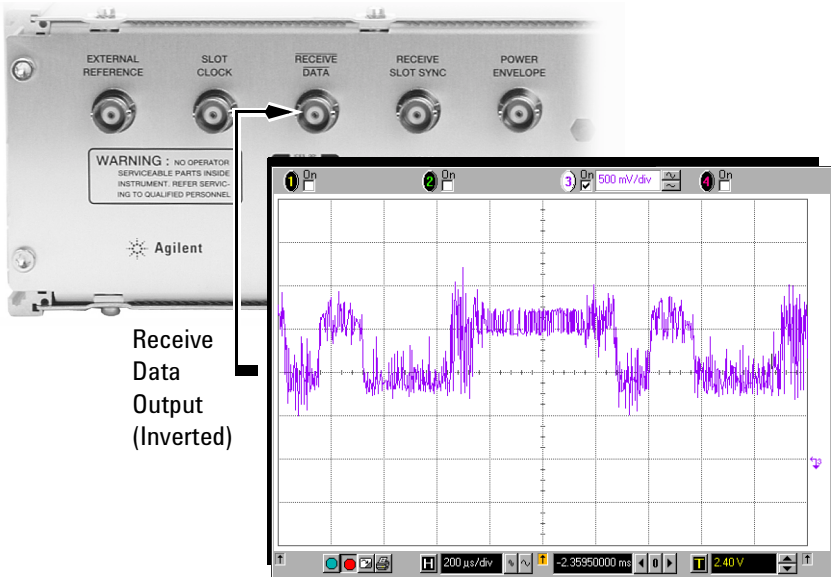


Figure 4 Receive Data Output

Receive Slot Sync

A 1µs wide TTL trigger output synchronized with the start of a received burst.

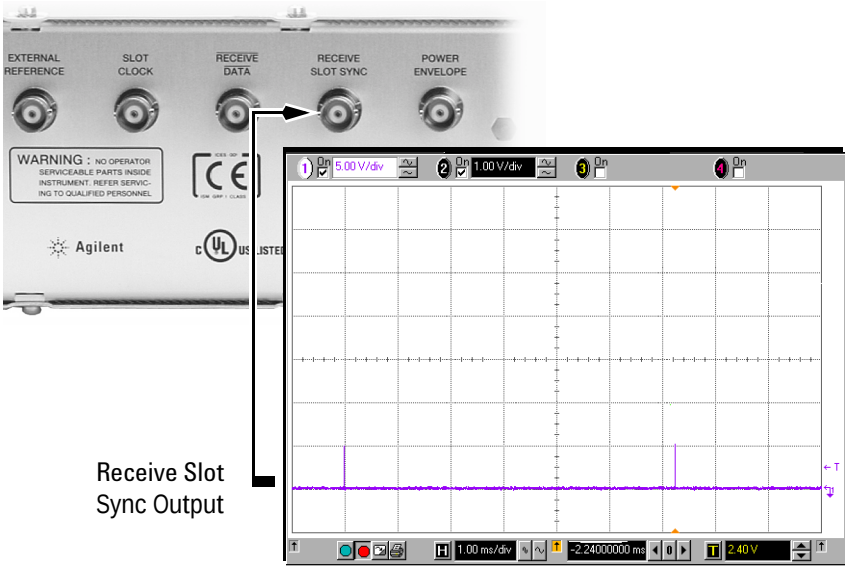


Figure 5 Receive Slot Sync Output

Power Envelope Analog output of the RF power.

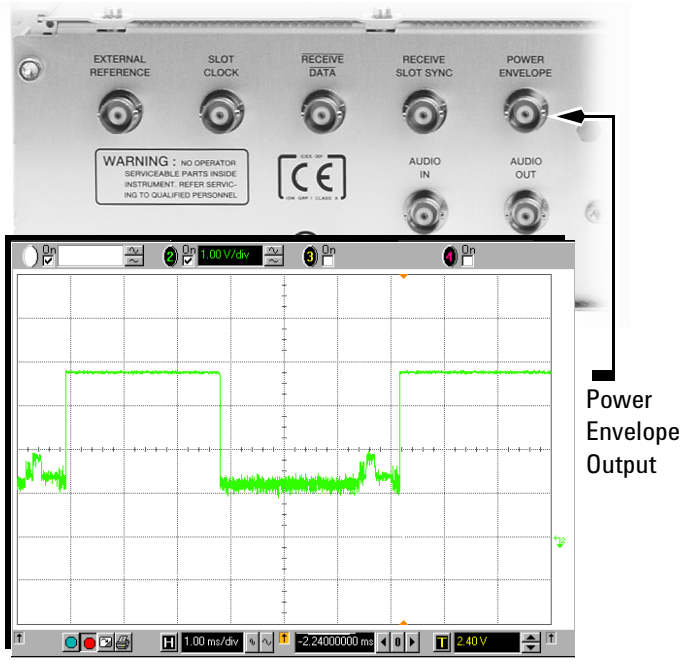
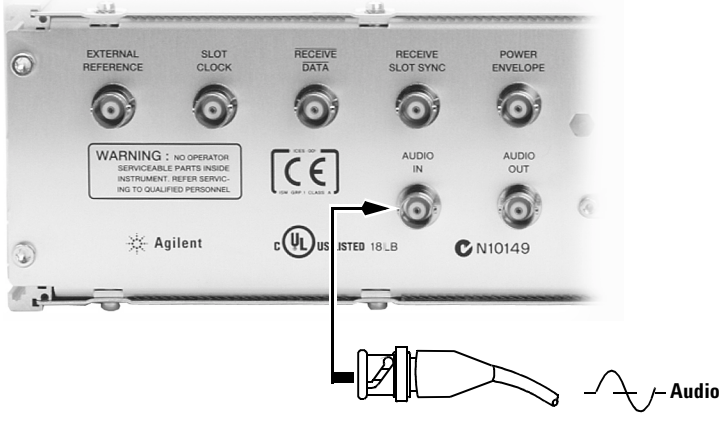
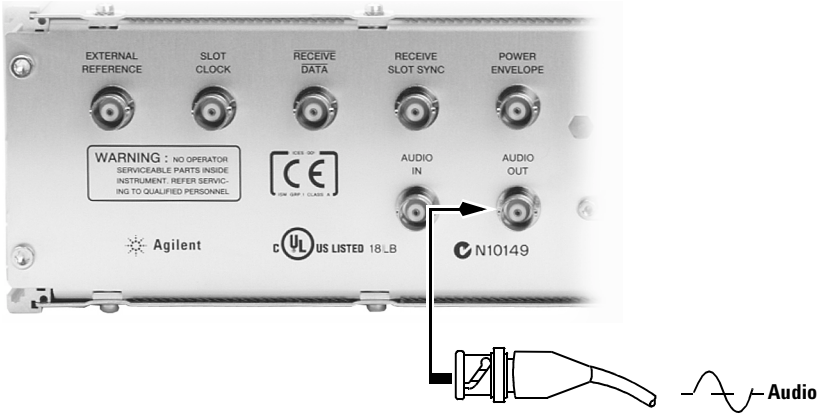


Figure 6 RF Power Envelope Output

Audio In Audio Input. The test set supports CVSD, A-Law, and μ-Law audio encoding.



Audio Out Audio Output. The test set supports CVSD, A-Law, and μ-Law audio decoding.



GPIB Interface Standard GPIB connection for communication with your PC.

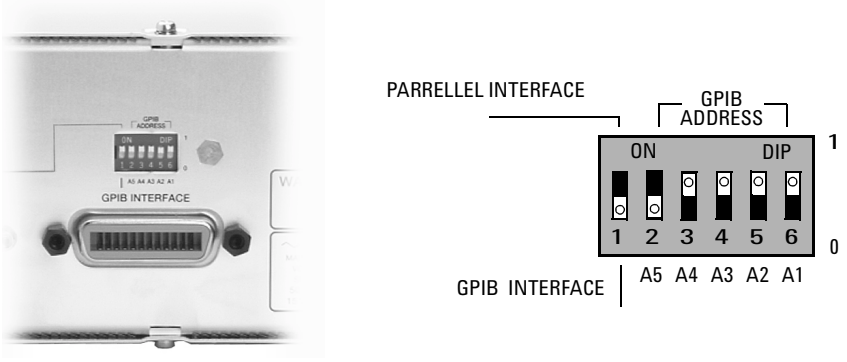


Figure 7 GPIB connector and interface/address switches

Parallel Interface 25 pin male D-type connection can be used for communication with your PC.

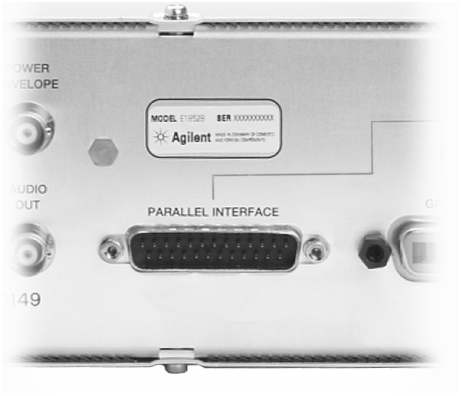


Figure 8 Parallel Interface

Serial 9 pin female D-type. The serial port is used for service purposes and to down-load new test set firmware. Only use the supplied cable for this purpose.

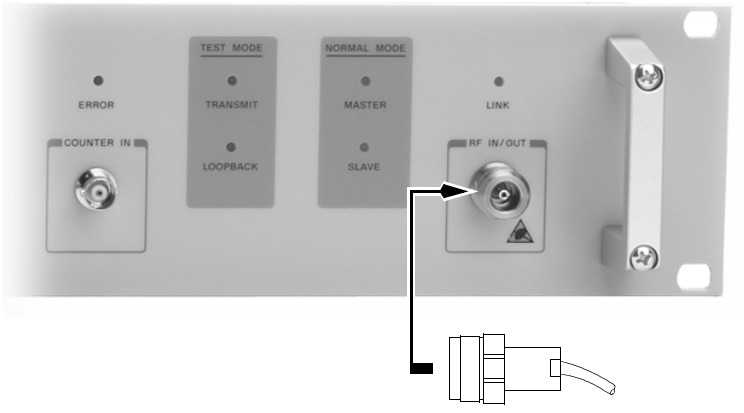
Front Panel Connections

The E1852B Bluetooth Test Set provides front panel input/outputs for the following functions:

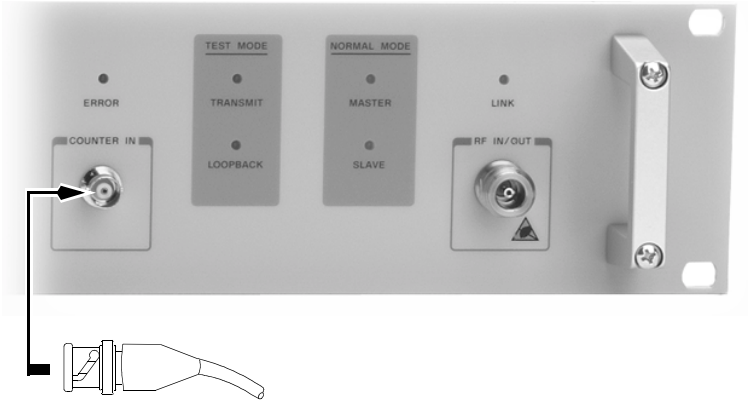
RF IN/OUT N-type 50Ω

COUNTER IN Use the counter to measure the frequency of signals up to 15 MHz.

1. Make an RF cable connection between DUT and the RF IN/OUT connector. (To maintain regulatory compliance, antenna coupling with the DUT must be carried out in a screened environment. Antenna coupled measurement results are uncalibrated.)



2. A 15 MHz counter is available on the front panel. (High impedance, 500mv rms sensitivity.)



2 Making Measurements

What You'll Find In This Chapter

This Chapter shows you how to set up the test set for measurements.

It contains these sections:

Configuring the System for Measurements

This chapter introduces the measurement capabilities of the E1852B Bluetooth Test Set.

General Operating Information

The E1852B Bluetooth Test Set is a rack-mounting system instrument and consequently has no front panel user interface or information display. All control of the test set takes place using the parallel or GPIB interfaces. The supplied Dynamic Link Library (DLL) forms an integral part of communication with the test set.

NOTE The DLL must be installed even if you only intend to control the test set using your own test application. Refer to “DLL Interface” on page 109 for more information.

To become familiar with the test set, or to operate it in a stand-alone manner, a PC based user interface is supplied. There are two versions of this interface, the ‘Debug’ version providing an additional window and entry line. You can use this window to observe the command and data transfer between your PC and test set. Use the entry line to send remote commands directly.

NOTE Control of the Delta F2 measurement algorithm and I.F. filter bandwidth can only be achieved by sending the associated remote commands directly. Use the ‘Debug’ version of the PC user interface or your own test application.

Getting started

Confirm all the required connections have been made between your PC and the test set. Also confirm that you have installed the supplied E1852B Install package from the CD-ROM. Connect the test set to the DUT using an RF cable.

NOTE To maintain regulatory compliance, antenna connection to the DUT must be carried out within a screened environment. Also, an antenna connection can introduce significant errors.

On the Windows Interface

Double click the E1852B Bluetooth Test Set icon on your PC desktop.

System Click the **System** tab:

- Use **Inquiry** or enter the value directly to ensure the **DUT BD address** is correct for the DUT in use.

Test Mode To configure a Bluetooth Test Mode connection with the DUT click the **Test Mode** tab:

- Select the required Bluetooth parameters such as **Frequency Hopping Mode**.
- Select **RF Level** of the test set.
- Select the DUT Mode – **Transmitter Test** or **Loopback**.
- Select the required **Modulation** pattern.
- Use the controls supplied for the DUT to ensure that it is setup to make a Bluetooth test mode connection.
- Click **Page** to make a Bluetooth connection in Test Mode.

NOTE The test set is configured at shipment for Bluetooth 1.1 compliant device testing. Refer to SYSTem:BT:VERS<version> on page 174 to configure the test set for version 1.0B. You must manually change back to Bluetooth 1.1 test set configurations

Normal Mode

To configure a Bluetooth Normal Mode connection with the DUT click the **Normal Mode** tab:

- Select **RF Level** of the test set to ensure sufficient signal power reaches the DUT input.
- Use the controls supplied for the DUT to ensure that it is setup to make a normal Bluetooth connection.
- Click **Page** to make a Bluetooth connection in Normal Mode.

RF Analyzer Mode

To configure RF Analyzer measurements click the **RF-Analyzer** tab:

- Select the DUT transmission channel in the **Carrier [0..78]** entry field
- Select modulated signal measurements (**Burst**) or
- Un-modulated signal (**CW**) measurements.
- If **Burst** is selected, choose the required parameters.

NOTE Changes to DUT settings can only be made using the application provided by your module or device supplier.

Measurement Filtering Techniques

The E1852B can apply several methods of filtering and algorithmic processing to the received Bluetooth signal during RF parametric measurements:

1. Selection of a 1.3 MHz narrow-band, or 2.5 MHz wide-band IF filter (1.3 MHz is currently recommended by the Bluetooth RF Test Specification)
2. Two types of algorithmic processing for deltaF2 measurements

NOTE These features are not available in the PC user interface and can only be accessed by sending the associated remote commands directly to the E1852B. You can use the 'debug' version of the PC user interface to do this or through the use of an external programming environment (such as the E1852B script executor).

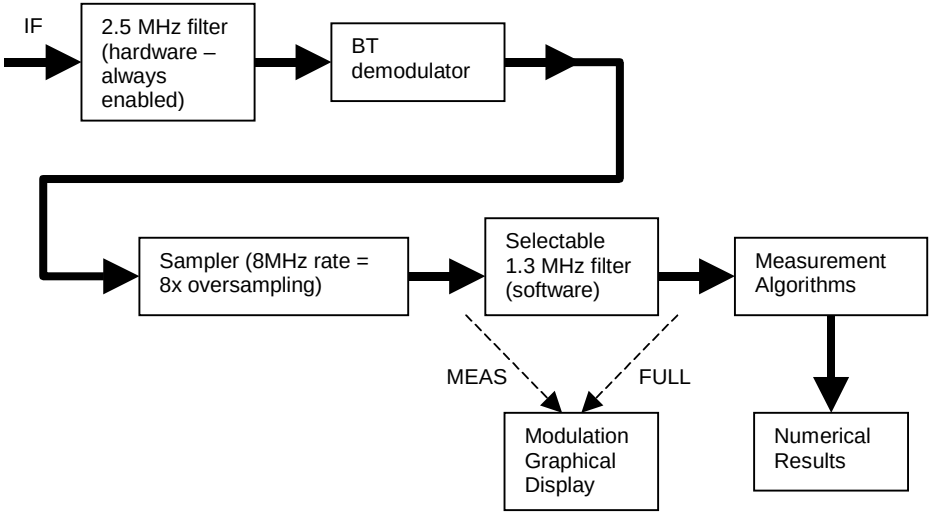


Figure 9 E1852B Measurement Path

1.3MHz and 2.5MHz IF filtering

The E1852B has two IF filters. The first is a 2.5 MHz wide-band filter implemented in hardware (which is always present in the IF path). The second is a 1.3 MHz narrow-band filter (selectable, and implemented digitally within the E1852B DLL software)

You can select 1.3 MHz narrow-band filtering by using the command `CONF:RF:FILT:BW 1.3` and the 2.5 MHz wide-band filtering by using the command `CONF:RF:FILT:BW 2.5`.

NOTE The default setting is 1.3 MHz.

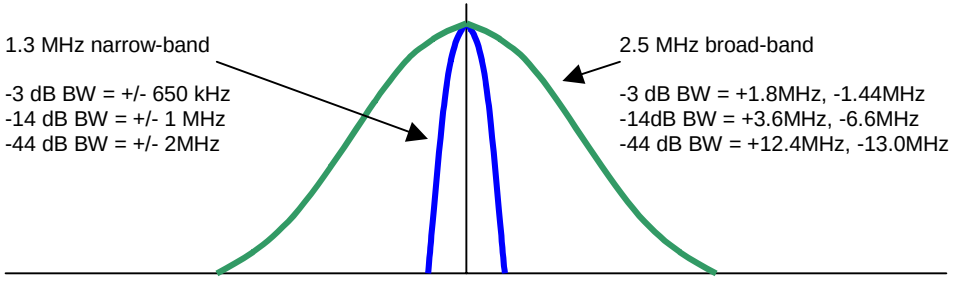


Figure 10 E1852B Filter Characteristics

When the 1.3 MHz narrow-band filter is selected the effects of spurious out-of-channel or intermodulation signals are largely eliminated from the E1852B measurement results. A 1.3 MHz narrow-band filter is recommended within the Bluetooth RF Test Specification and should be used when performing final production testing.

When the 2.5 MHz wide-band filter is selected, the E1852B measurement results include the effects of spurious out-of-channel or intermodulation signals. This can be a useful when evaluating the performance of the DUT design during product development.

When the 1.3 MHz narrow-band filter is selected the PC user interface Modulation window (graphical representation of packet data) can be configured to show the demodulated data pre, or post filtering.

Sending `CONF:RF:FILT:MODE MEAS` shows the demodulated data before 1.3 MHz filtering is applied.
`CONF:RF:FILT:MODE FULL` shows the demodulated data after 1.3 MHz filtering is applied.

DeltaF2 Algorithms

When making deltaF2 measurements, another method for reducing the effects of spurious out-of-channel or intermodulation signals is the use of alternative measurement algorithms.

When making deltaF2 measurements the Bluetooth RF Test Specification asks that the payload is split into blocks of 8-symbols, and for each of those blocks an average frequency is calculated. The average frequency is then used as the reference against which each symbol's deltaF2 deviation is calculated.

There are two methods of calculating the 8-symbol average frequency:

1. Use all samples of the signal during the calculation (the E1852B uses 8x oversampling, hence this calculation uses a total of 64 sample values for each 8-symbol calculation). This method is referred to as `SPEC`.
2. Use only the peak sample value of each symbol to calculate the 8-symbol average (i.e. only 8 values are used in the calculation). This method is referred to as `PEAK`.

Select the `SPEC` method by using the command `CONF:DELTA_F2_ALG SPEC`

Select the PEAK method by using the command `CONF:DELTA_F2_ALG PEAK`

NOTE Default setting is `PEAK`.

The wording of the Bluetooth RF Test Specification does not clearly state the type of averaging method to use for deltaF2 measurements. If the averaging method that is specified for deltaF1 measurements is to be used (all samples) select SPEC. Select PEAK when you are working with asymmetrical demodulation to reduce the effect of the asymmetry upon the calculated average frequency.

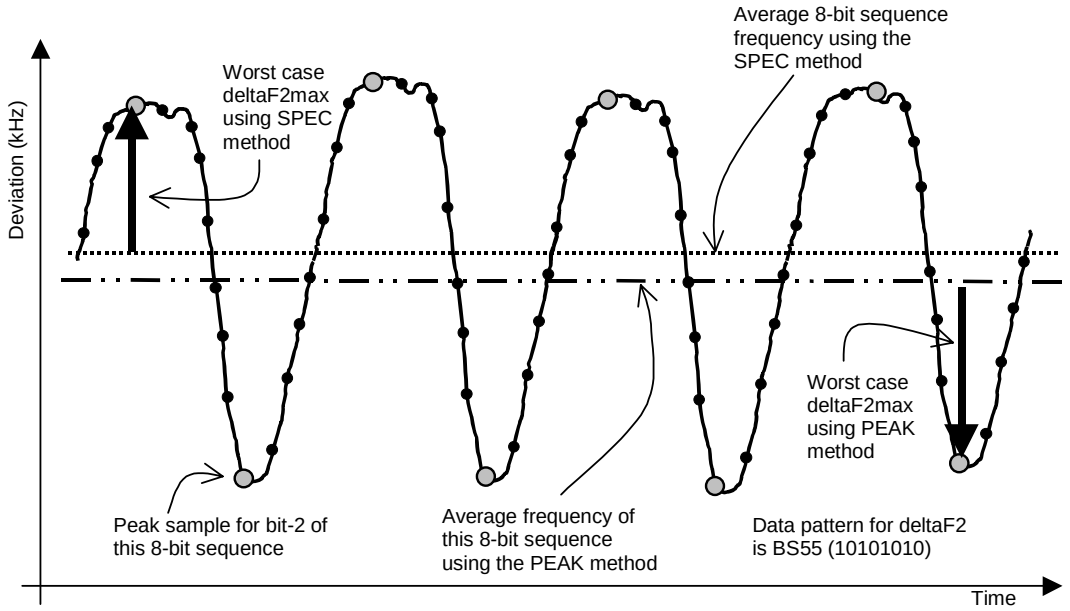


Figure 11 'PEAK' and 'SPEC'

Power Measurements

Peak and average RF Power of the DUT can be measured in both Normal and Test Modes.

Average Power - Normal Transmit Power (NTP)

Test Mode With a Test Mode connection, average power, is measured by sampling the power value over the main part of the full Bluetooth packet. The number of samples increases as the packet length increases. For best measurement speed, perform the NTP test with DH1 packets. Average power measurements can be obtained in transmitter tests as well as in receiver tests with selectable packet types and modulation patterns.

Normal Mode With a Normal Mode connection, average power is measured by sampling the power values within the Access Code part of the packet. There is no Bluetooth specification for average power with a Normal Mode connection.

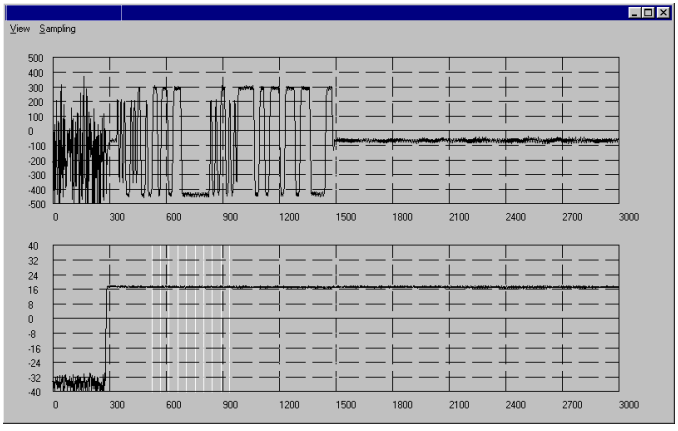


Figure 12 Average Power Measurement

Peak Power - Peak Transmit Power (PTP)

With both Normal and Test Mode connections, Peak Power is measured in the beginning of the packet, where the power peak is expected.

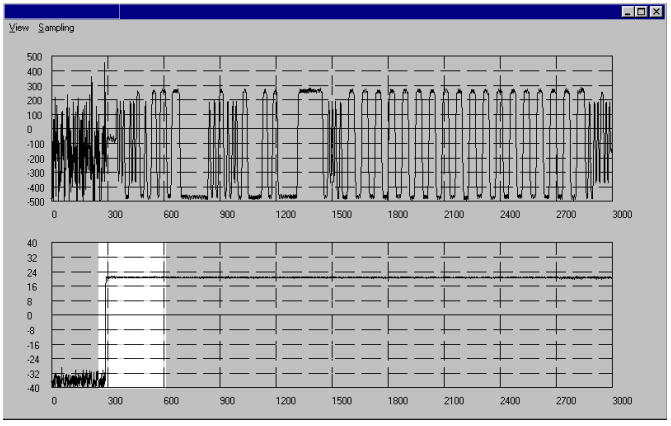


Figure 13 Sampled Modulation

Remote Commands

The power values can be read out by using the SCPI commands:

READ:NTP? For measuring Average Power and

READ:PTP? For measuring Peak Power.

Frequency and Modulation Measurements

Some frequency and modulation measurements can only be carried out in test mode when the correct packet type is selected.

- Frequency Drift - Both Normal and Test Mode
- Frequency Drift Rate - Test Mode only
- Frequency Deviation
- DELTA_F1
- DELTA_F2
- Frequency Offset

Frequency Drift Measurement

Test Mode

The frequency drift measurement is made with the modulation pattern BS55 (01010101) and with packet types DH1/DH3/DH5.

The average frequency of each 10 bits of the payload is calculated. Each calculation is compared with the average frequency of the 4 preamble bits. The greatest difference (worst case) is used as the measurement result.

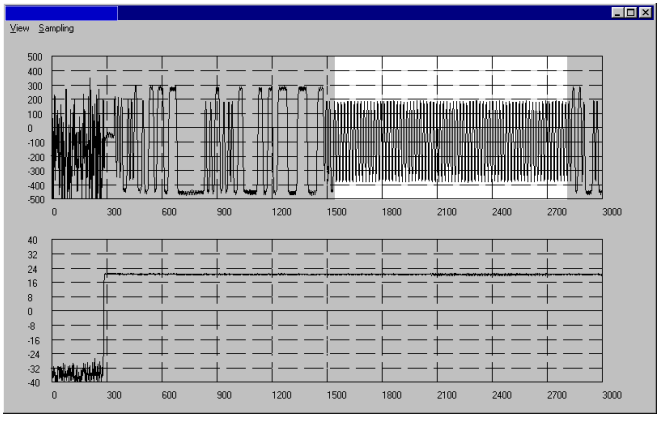


Figure 14 Test Mode - Frequency Drift Measurement

The frequency drift value can be read out by using the SCPI command: `READ:FREQ:DRIF:SPEC?`

Normal Mode

Sampling from the Access Code trailer part of the packet is used to give an approximation of frequency drift. The difference between this average frequency value and the frequency-offset value (measured at the preamble part) is the frequency drift.

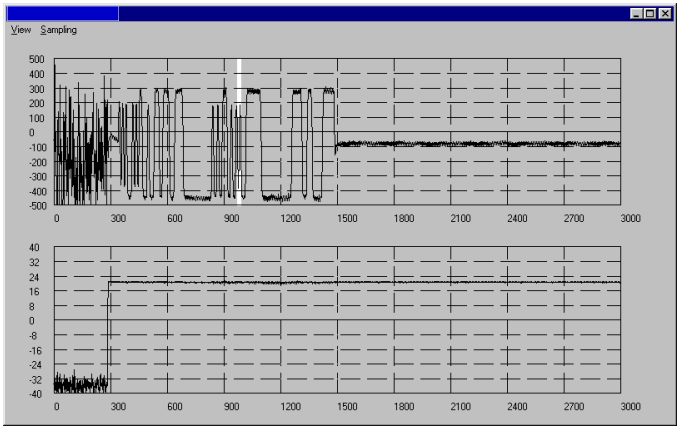


Figure 15 Normal Mode - Frequency Drift Measurement

Remote Commands

The frequency drift value can be read out by using the SCPI command:
`READ:FREQ:DRIF?`

Frequency Drift Rate Measurement

This measurement reuses the data from frequency drift measurement.

Test Mode

For every group of 10 bits, the measured frequency drift is compared with the 2 adjacent 10 bit groups. The differences found are the frequency drift rate. The maximum difference (worst case) is taken as the result of the measurement.

The frequency drift rate can be read back using the SCPI command:
`READ:FREQ:DRIF:SPEC:RATE?`

NOTE The drift and drift rate measurements are sensitive to noise from the DUT. Results can vary significantly between consecutive measurements.

Frequency Deviation

Normal Mode

It is not possible to measure the standard modulation characteristics Delta F1 and Delta F2 with a Normal Mode connection. Instead, this test uses the Access Code part of the burst. 111/000 patterns are used to approximate the Delta F1 result while the Delta F2 result is estimated using 101/010 patterns

The values can be read using the SCPI commands `READ:PSEUDO:DELTA_F1?` and `READ:PSEUDO:DELTA_F2?`

DeltaF1 Measurement

Test Mode

The measurement modulation pattern is BS0F (00001111 bits), and the packet type is DH1/DH3/DH5. There are three deltaF1 measurements available:

- min, deltaF1max (available only in 'Debug' mode)
- avg, deltaF1max
- max, deltaF1max (available only in 'Debug' mode)

The results are calculated as follows:

1. The average frequency of each '00001111' byte within the payload is calculated. This calculation uses all 8 symbols within the byte. This is referred to as: **`avg_byte_n`**.
2. The average frequencies of the 2nd, 3rd, 5th, and 6th symbols within the byte are calculated. These are referred to as: **`avg_symbol_2`**, **`avg_symbol_3`**, **`avg_symbol_5`**, and **`avg_symbol_6`**.
3. The relative deviation of each of those symbols is calculated, referring to each as δ**`F1max`**.
   symbol_2: Δ**`F1max`** = (**`avg_symbol_2`**) - (**`avg_byte_n`**)
   symbol_3: Δ**`F1max`** = (**`avg_symbol_3`**) - (**`avg_byte_n`**)
   symbol_5: Δ**`F1max`** = (**`avg_symbol_5`**) - (**`avg_byte_n`**)
   symbol_6: Δ**`F1max`** = (**`avg_symbol_6`**) - (**`avg_byte_n`**)

4. This is repeated for all bytes within the payload to produce an array of δF1max values. For example, a DH5 packet of 339 bytes in length requires a total of 1,356 (339 x 4) Δ**F1max** values.
5. The deltaF1max values, within payload, reported by the E1852B Bluetooth Test Set are as follows:
   - **min, deltaF1max** - the minimum Δ**F1max** value (READ:DELTA_F1_LOw?)
   - **avg, deltaF1max** - average of all Δ**F1max** values (READ:DELTA_F1?)
   - **max, deltaF1max** - the maximum Δ**F1max** value (READ:DELTA_F1_HIgh?)

NOTE The result is used as part of the 'delta F1/delta F2' measurement.

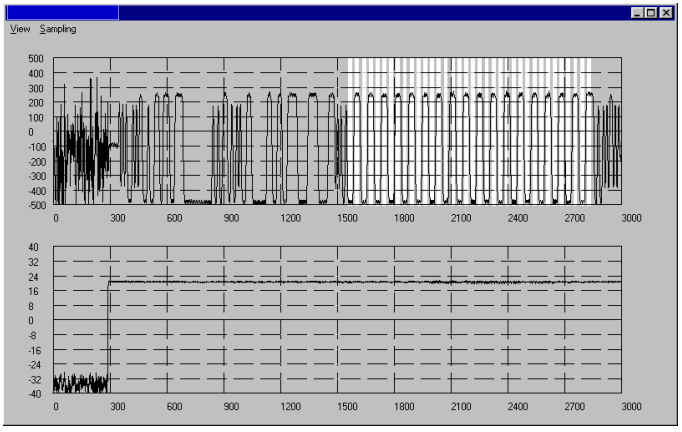


Figure 16 DeltaF1 Measurement

Delta F2 Average Measurement

Test Mode The measurement modulation pattern is BS55 (01010101 bits), and the packet type is DH1/DH3/DH5.

NOTE To comply with the Bluetooth RF Test Specification a DH5 packet of length 339 must be used. (it is also recommended that you use a 1.3 MHz narrow band measurement filter - `CONF:RF:FILT:BW 1.3`)

The deltaF2max measurement identifies the smallest positive or negative frequency deviation from the average frequency within the 8 bits of each byte of the payload. The average for all bytes is then taken as the Delta F2max Average value. There are three deltaF2 measurements available:

- min, deltaF2max (available only in 'Debug' mode)
- avg, deltaF2max
- max, deltaF2max (available only in 'Debug' mode)

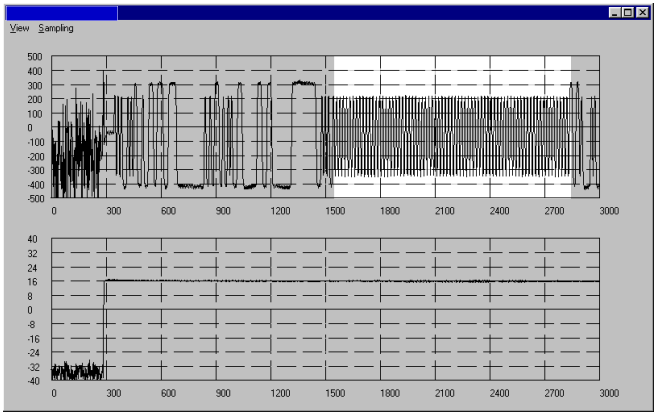


Figure 17 Delta F2 Measurement

NOTE The Bluetooth Test Specification refers to avg, delta F2max as Δ**F2avg**.

The results are calculated as follows:

1. Starting with the second symbol of the payload, the payload is divided into 8-symbol sequences.
2. For each 8-symbol sequence (10101010) an average frequency is calculated. This average is referred to as **avg_seqn_n**.
3. The maximum deviation from this average is calculated. The value is called Δ**F2max**.

   Within each 8-symbol sequence the calculation is performed as follows:
   1st symbol: **deviation = ABS(symbol_1) - (avg_seqn_n)**
   2nd symbol: **deviation = ABS(symbol_2) - (avg_seqn_n)**
   .
   .
   .
   8th symbol: **deviation = ABS(symbol_8) - (avg_seqn_n)**

   Δ**F2max** of this 8-symbol sequence is the maximum of the eight calculated deviations.
4. Steps 2 and 3 are repeated for all 8-symbol sequences within the payload, producing an array of Δ**F2max** values.
   For example, in a DH5 packet of length 339 bytes, a total of 338 Δ**F2max** values are calculated.
5. Within each payload the deltaF2max results reported by the test set are as follows:
   min, deltaF2max - minimum Δ**F2max** value (READ:DELTA_F2_LOw?)
   avg, deltaF2max - average of all Δ**F2max** values (READ:DELTA_F2?)
   max, deltaF2max - maximum Δ**F2max** value (READ:DELTA_F2_HIgh?)

NOTE The **avg, deltaF2max** result is used as part of the delta F2/delta F1 measurement.

Measurement Algorithms

The E1852B Bluetooth Test Set offers two methods of evaluating the minimum value of deltaF2 max. The default method uses only the peak value of each symbol (it uses 8 discrete values per 8-symbol sequence). This method can be selected using the SCPI command:
`CONF:DELTA_F2_ALG PEAK`.

The second method uses all samples of the 8-symbol sequence (the test set uses 8x oversampling which results in 64 discrete samples per 8-symbol sequence). This method can be selected using the SCPI command:
`CONF:DELTA_F2_ALG SPEC`.

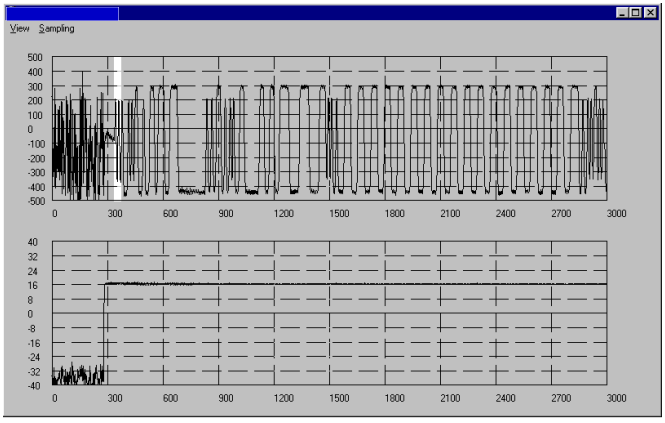
Refer to “Measurement Filtering Techniques” on page 25 for more information.

NOTE To comply with the Bluetooth RF Test Specification 99.9% of all Δ**F2max** results must be ≥115kHz. The E1852B Bluetooth Test Set measurement filter default value is 1.3MHz but 2.5MHz can be selected if required. (refer to CONFigure:RF:FILTer:BW <numeric value> for more information)

Frequency Offset Measurement (ICFT)

Normal and Test Modes

This measurement is carried out by identifying the preamble part of a BS55 packet. The preamble is sampled and the average value gives the Frequency Offset value.



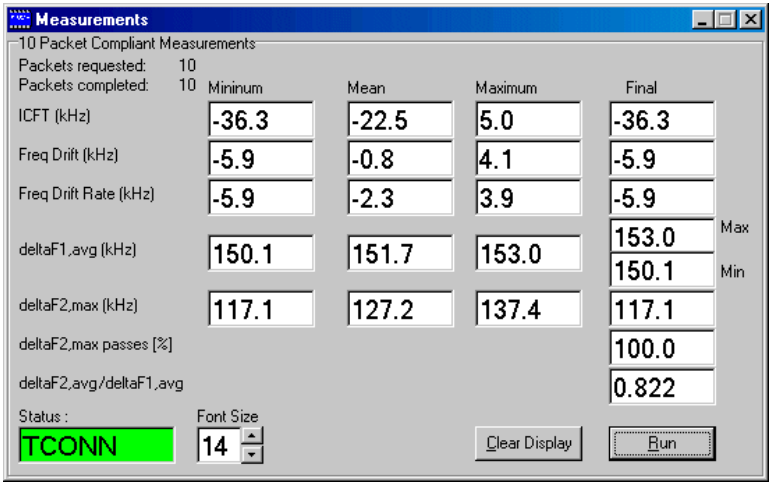
The Frequency Offset value can be read out by using the SCPI command: `READ:FREQ:OFFS?`

NOTE On some types of devices results can vary significantly between consecutive measurements.

NOTE This measurement must be carried out on a BS55 modulated packet

10 Packet Bluetooth Compliant Display

Test Mode only The 10 packet Bluetooth Compliant measurements are available only in Test Mode.



ICFT The ICFT measurement is carried out by identifying the preamble part of a BS55 Bluetooth burst. The preamble is sampled and the values displayed. The **Final** column shows the largest numerical value measured in the 10 packets.

Frequency Drift The frequency drift measurement is made with the modulation pattern BS55 (01010101) and with packet types DH1/DH3/DH5. The average frequency of each 10 bits of the payload is calculated. Each calculation is compared with the average frequency of the 4 preamble bits. The **Final** column shows the largest numerical value measured in the 10 packets.

Frequency Drift Rate For every group of 10 bits, the measured frequency drift is compared with the 2 adjacent 10 bit groups. The differences found are the frequency drift rate. The maximum difference (worst case) is taken as the result of the measurement. The **Final** column shows the largest numerical value measured in the 10 packets.

deltaF1 average

This measurement is made with a modulation pattern of BS0F (00001111 bits), with packet types DH1/DH3/DH5.

For each byte within the payload, the frequency deviation is calculated for the bits 2, 3 and 6,7 (deltaF1 max. values). The average for all bytes is then taken as the delatF1 average value. The **Final** column shows both maximum and minimum values measured in the 10 packets.

deltaF2 maximum

The measurement modulation pattern is BS55 (01010101 bits), and the packet type is DH1/DH3/DH5.

For each byte within the payload, the maximum frequency deviation is calculated for the 8 bits (delta F2 max. value). The **Final** column shows the lowest value measured in the 10 packets.

deltaF2 max passes

The Bluetooth Test Specification states that at least 99.9% of all deltaF2max results must be greater than 115 kHz. The **Final** column shows the percentage of packets with deltaF2max results greater than 115 kHz within the 10 packet measurement.

deltaF2 max / deltaF1avg

This ratio measurement requires that you change the modulation pattern to obtain results for both. You can use the BS0F pattern to generate deltaF1 results the select BS55 to generate deltaF2 results.

Sensitivity Measurements

The sensitivity of the DUT is determined using a Bit Error Rate (BER) or a Packet Error Rate test.

Bit Error Rate

This sensitivity measurement is carried out in Test Mode. The measurement is made by examining every bit in the received payload. The payload used is SPSR (Static Pseudo Random, PN9).

The Bit Error Rate measurement is available with 'running' measurements, where the received payload is measured continuously, and in a static measurement where you can define the number of bits to be used. If a packet is counted as NACK, a Packet Error, it is ignored and not used in the Bit Error Rate calculation.

The Bit Error Rate values can be read out by using the SCPI commands:

`PROC:BER:START <numeric value>`

This command erases all previous BER data and starts a new measurement. Hence this command should be used when a parameter is changed during a BER test. (To specify the number of bits to be used in the measurement).

`READ:BER?`

This query is used to measure the Bit Error Rate (BER) of the DUT. The measurement is calculated using the specified quantity of bits.

The BER measurement may take a long time, depending on the number of bits used (set by the `PROC:BER:START` command). Your application must poll the test set for a measurement result. When the response is different from Not A Number (NAN), the required number of bits has been transmitted and the measurement is complete. Use the `FETCH:BER` command if a continuous response is required.

`FETCH:BER?`

This query is used to continuously measure the Bit Error values of the DUT. It returns the number of bits transferred, erroneous bits detected and running BER%. The data is returned prior to the completion of the measurement and so is only an indication of the BER. Use the `READ:BER?` command for the measurement result.

Packet Error Rate

This test is a sensitivity measurement used in both Normal Mode and Test Mode.

The test measures the number of erroneous packets compared to the total number of packets transmitted. Erroneous packets are defined as those with Not Acknowledged (NACK) in the packet header.

The Packet Error Rate values can be read out by using the SCPI commands:

`PROC:NACK:START <numeric value>`

This command is used to start an unacknowledged (NACK) count measurement. A NACK measurement can be used as an alternative to the BER measurement. The NACK measurement can be made in Normal mode, whereas you can only make a BER measurement in Testmode.

`READ:NACK?`

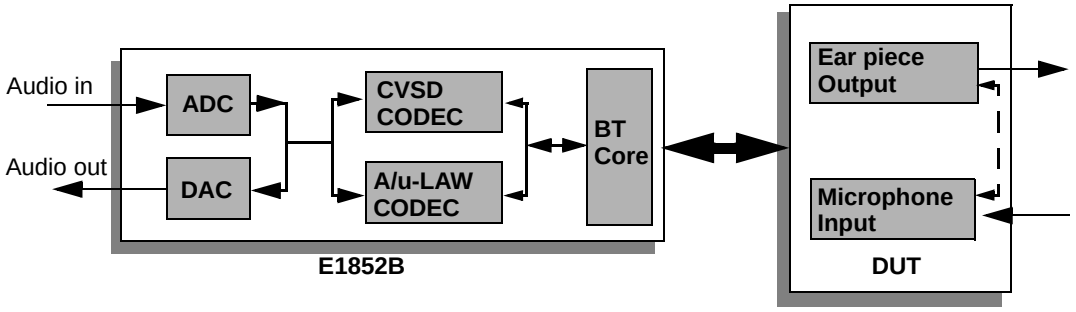
This query is used to measure the Packet Error Rate of the DUT. The NACK count measurement may take a long time, depending on the number of packets used (set by the `PROC:NACK:START` command). Therefore your application must poll the test set for a measurement result. When the response is different from Not A Number (NAN), the required number of packets has been transmitted and the measurement is complete.

FETCH:NACK?

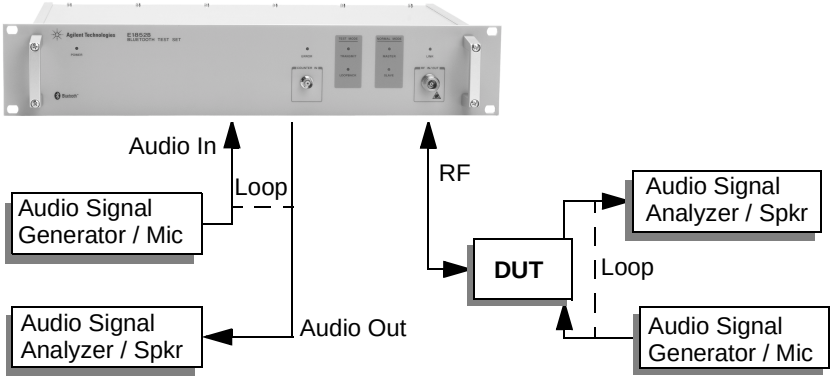
This query is used to continuously measure the Packet Error Rate values of the DUT. The data is returned prior to the completion of the measurement and so is only an indication of the PER. Use the READ:NACK? command for the true measurement.

Audio Measurements

The Audio In and Audio Out rear-panel connectors provide a path for an audio frequency signal to be transported to and from the DUT using a Normal Synchronous Connection Oriented (SCO) Link. CVSD, A-Law, and μ-Law CODECs are supported.

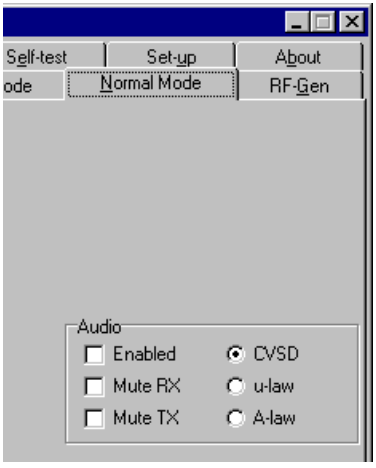


Using the audio functions, you can send a signal from a known, calibrated audio source via the test set and use an audio analyzer to make measurements such as SINAD, frequency response, gain, noise, and distortion on the recovered audio signal from the DUT. Similarly, the reverse signal path may be tested with the audio signal injected at the DUT, recovered from the test set, and measured.



If supported, the audio signal can be looped back by the DUT and recovered and measured from the test set Audio Out port. Additional audio connections to the DUT are not required. The internal audio signal paths within test set enable you to determine any additional distortion, noise, or gain added by the E1852B CODECs.

The audio format is selected on the **Normal Mode** connection panel or by specifying the required format using the remote command: `CONFigure:AUDIO_AIRCODING <value>`. The default is CVSD.



Measurement Setups

Quick Check

You can quickly check the operation of the complete Bluetooth connection and audio path using a Bluetooth headset or audio enabled DUT and conventional telephony headset.

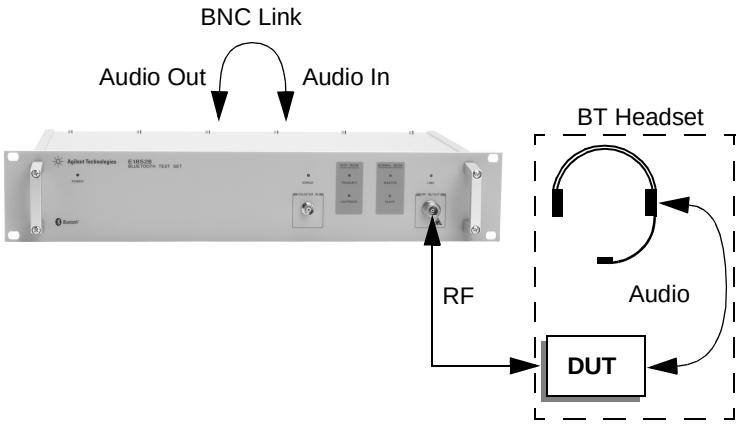


Figure 18 Quick Check

Make the connections shown in Figure 18.

- Connect the Audio In and Out rear panel connectors together using a short BNC cable
- Establish a Normal Mode connection (`PROCedure:CONNection:SETup`)
- Configure the test set with the type of CODEC required for the DUT (`CONFigure:AUDIO_AIRCODING <value>`)
- Enable the audio connections in the E1852B Bluetooth Test Set (`CONFigure:AUDIO_CONNection ON`)
- Enable the audio connections in the DUT
- Speak into the headset microphone
- Listen to your own voice in the ear piece to determine the overall system integrity

DUT Receive Path

To test the audio performance of the receive signal path of the DUT, send a calibrated audio signal via the test set Audio In connection when a Normal Mode connection is established and make measurements on the recovered audio signal from the DUT output.

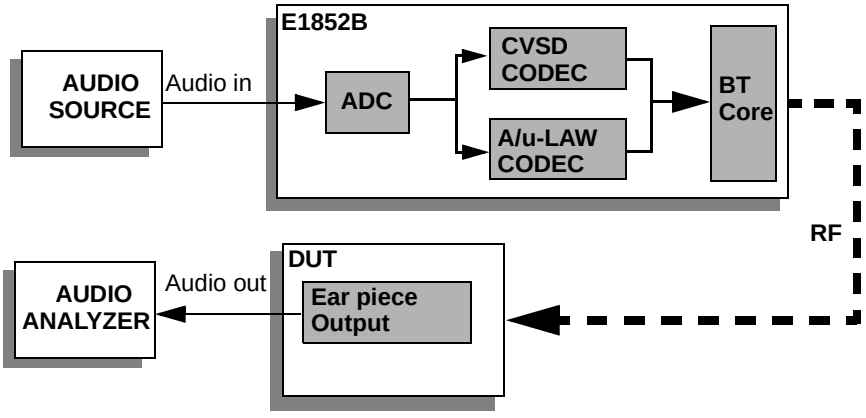


Figure 19 Receive Path Audio Setup

Make the connections shown in Figure 19.

- Establish a Normal Mode connection (`PROCedure:CONNection:SETup`)
- Configure the test set with the type of CODEC required for the DUT (`CONFigure:AUDIO_AIRCODING <value>`)
- Enable the audio connections in the E1852B Bluetooth Test Set (`CONFigure:AUDIO_CONNection ON`)
- Enable the audio connections in the DUT
- Make measurements on the recovered audio signal

NOTE You can configure zero audio signal conditions whilst maintaining the link by switching the E1852B Bluetooth Test Set audio transmit path off - `CONFigure:AUDIO_MUTE:TX ON` - and back on again - `CONFigure:AUDIO_MUTE:TX OFF` - as required.

DUT Transmit Path

To test the audio performance of the transmit signal path of the DUT, send a calibrated audio signal via the DUT Audio connection when a Normal Mode connection is established and make measurements on the recovered Audio Output from the test set.

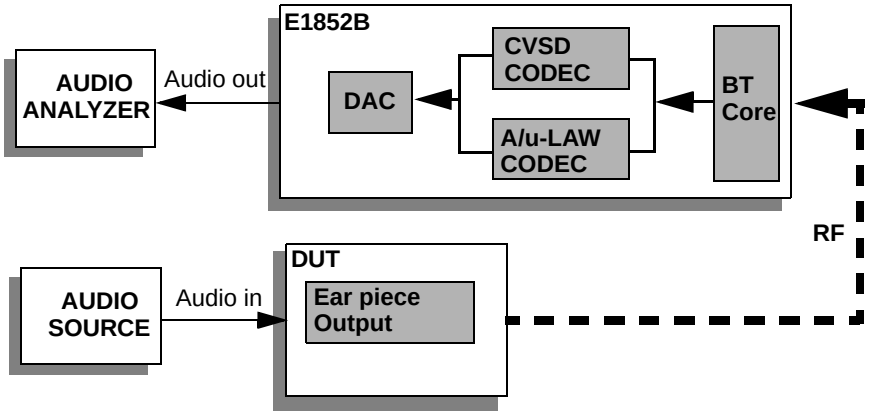


Figure 20 Transmit Path Audio Setup

Make the connections shown in Figure 20.

- Establish a Normal Mode connection (`PROCedure:CONNection:SETup`)
- Configure the test set with the type of CODEC required for the DUT (`CONFigure:AUDIO_AIRCODING <value>`)
- Enable the audio connections in the E1852B Bluetooth Test Set (`CONFigure:AUDIO_CONNection ON`)
- Enable the audio connections in the DUT
- Make measurements on the recovered audio signal

NOTE You can configure zero audio signal conditions whilst maintaining the link by switching the E1852B Bluetooth Test Set audio receive path off - `CONFigure:AUDIO_MUTE:RX ON` - and on again - `CONFigure:AUDIO_MUTE:RX OFF` - as required.

Complete DUT Audio Path

To test the performance of both the transmit and receive audio paths of the DUT, a calibrated audio signal is sent to the DUT on a Normal Mode connection, internally or externally looped at the DUT, and transmitted back to the test set. Measurements are made on the recovered audio signal from the test set Audio Out port.

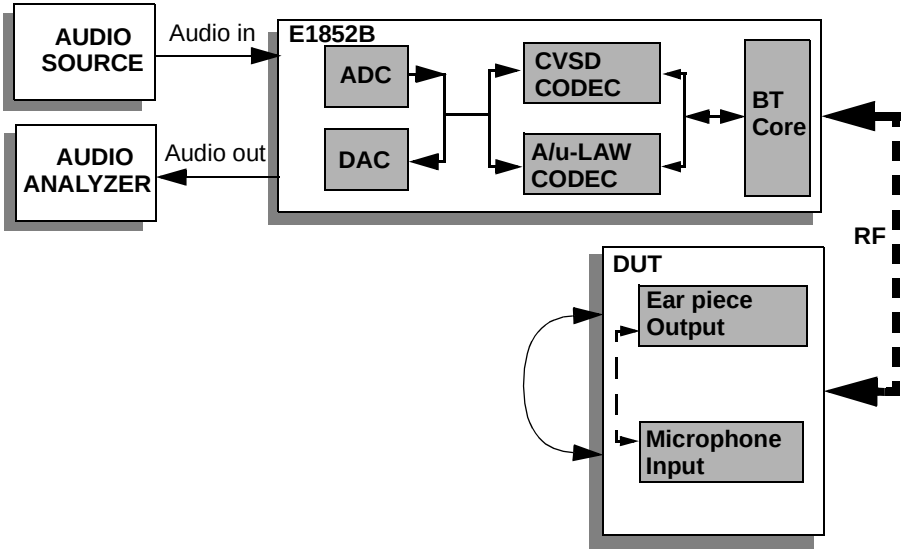


Figure 21 Complete Path Audio Setup

Make the connections shown in Figure 21.

- Establish a Normal Mode connection (`PROCedure:CONNection:SETup`)
- Configure the test set with the type of CODEC required for the DUT (`CONFigure:AUDIO_AIRCODING <value>`)
- Enable the audio connections in the E1852B Bluetooth Test Set (`CONFigure:AUDIO_CONNection ON`)
- Enable the loopback audio connections in the DUT
- Make measurements on the recovered audio signal

Test Set Contribution

To improve the accuracy of this measurement you can quantify the noise, distortion, and gain contribution of the test set. This is acheived by looping the audio signal within the test set.

With the configuration shown in Figure 21, CODEC selected, audio enabled (`CONF:AUDIO_CONN ON`), and a Normal Mode connection established, send the command: `CONFigure:AUDIO_LOOPback ON` to establish the audio signal path shown in Figure 22.

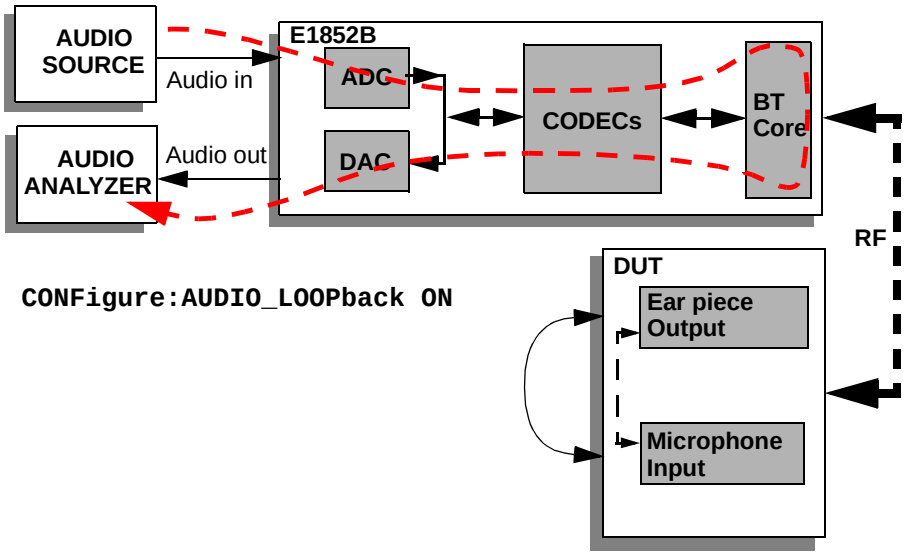


Figure 22 Audio Loopback On

Disable the audio loopback within the test set (`CONFigure:AUDIO_LOOPback OFF`) and subtract the previously obtained audio loopback results from the new system results to identify only the DUT contribution.

Audio Performance

The following performance characteristics can be expected of the CVSD CODEC:

Level: 0dBm0 translates to 775 mVrms analog level, likewise 775 mVrms analog level translates to 0dBm0

Frequency Range: 300 to 3400 Hz

Frequency Response[1]: +0.5dB –1.5dB

Variation of Gain with Input Level[1]: ±<0.5dB

Idle Noise[2]: –64 dBm0 (encoder)
0.5 mV (decoder)

Out of Band Attenuation[3]: –40dB relative to in-band signal

A-Law and μ-Law CODECs generally give better performance than CVSD.

[1]In the CVSD linear amplitude range, –50dBm0 to –15dBm0

[2]Psophometric weighted (ITU-T rec. 0.41)

[3]Signals in the frequency range >4 kHz to 32 kHz

To determine the characteristics of the test set at the frequencies and levels of interest, you can loop an Audio Input signal, via the ADC, CODEC, and DAC, to the Audio Output by sending the `CONFigure:AUDIO_LOOPback ON` command.

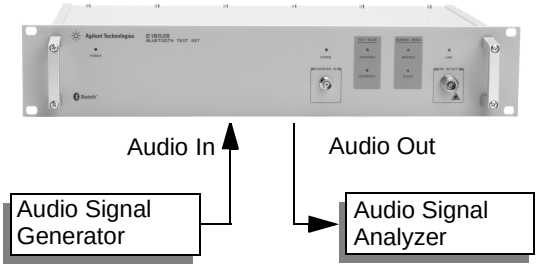


Figure 23 Determining Test Set Contribution

3 PC User Interface

What You'll Find In This Chapter

This chapter shows you the features of the PC user interface.

It contains these sections:

Introduction

The E1852B Bluetooth Test Set can be controlled by the supplied PC user interface or by use of the SCPI compliant remote command set. The PC interface is intended for easy use in development and service situations. The interface requires only a small amount of desktop space by using tab dividers to partition each major system mode. The program supports installation in Windows 95/98/2000 and Windows NT. Please refer to installation guide for further information.

Installation

If you have not already done so, install the PC interface and connect your PC by following the procedure detailed in “Install the User Interface” in the E1852B Bluetooth Test Set *Installation Guide*.

NOTE For optimum measurement speed, especially when viewing graphical results windows, you should use the parallel interface connection.

Starting the User Interface

You can start the user interface by double-clicking the desktop icon:

or by selecting E1852B **Bluetooth Tester** from the **Start, Programs** menu:

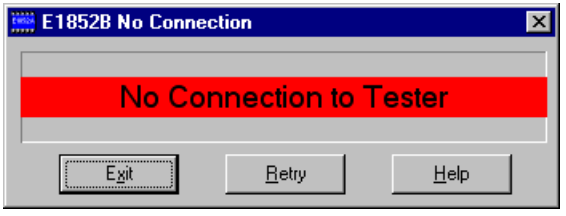
NOTE Selecting E1852B **Debug** starts the interface with additional window showing the remote command dialogue between your computer and bluetooth test set. The dialogue can be captured in a log file and may be of use if you intend to develop your our control programs. Some additional frequency deviation measurements are also provided in debug mode.

Start Up

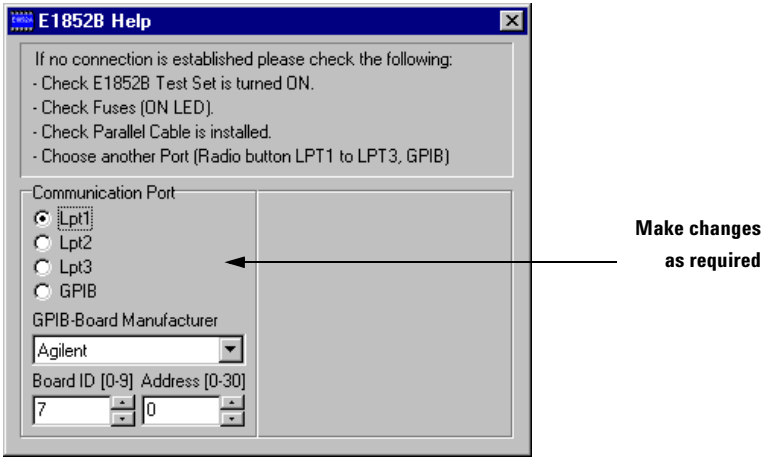
During start-up the following message is displayed:

No Connection

If the PC cannot establish communication with your test set the **No Connection** message window is displayed.



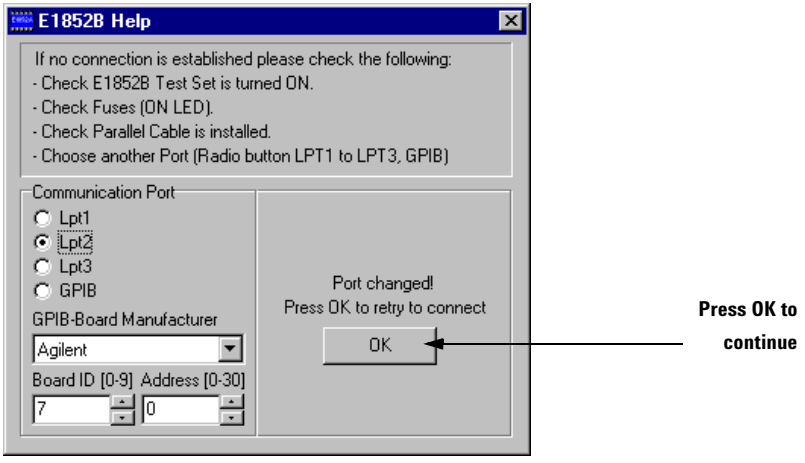
Press Help Pressing **Help** displays the connection help window



The dialog panel gives you diagnostic hints. You can also change the Communication Port settings including GPIB parameters.

NOTE For optimum measurement speed, especially when viewing graphical results windows, use the parallel interface connection.

.



Any changes you make are identified in the dialog panel. The **OK** button is presented for you press when you are ready to continue.

System Page

The **System** Page contains all the settings required for communication between a PC and the test set, and between the test set and the DUT.

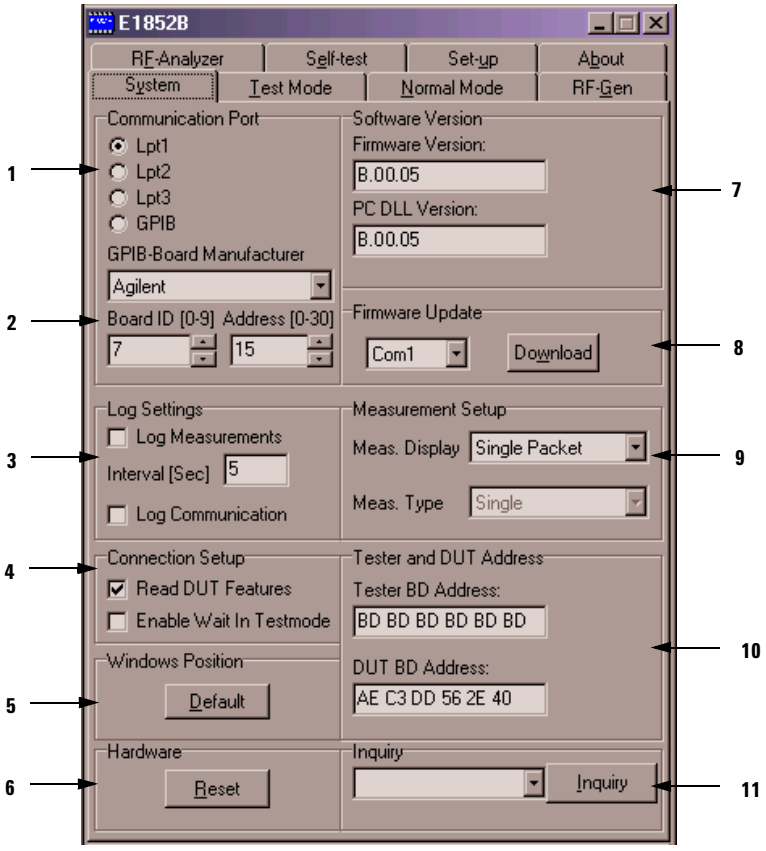


Figure 24 System Page (Debug Mode)

System Page structure

The user interface always opens with the **System** page displayed. It contains the following panels:

1. Communication Port

The radio buttons on the **Communication Port** panel are used to select the PC port you want to use for control of the test set.

2. GPIB Configuration

The **GPIB-Board Manufacturer** scroll button is used to identify the type of card you have fitted to your computer. If you have an Agilent card, select **7** using the **Board ID** scroll buttons, otherwise use **0.**

Select the GPIB address of the test set (default factory setting 15) using the **Address** scroll buttons.

3. Log Settings

The user interface can be configured to store measurement information from the test set at set intervals. The default interval is 5 seconds and can be changed by entering the interval in the **Logging Interval (Sec.)** Field.

Clicking the **Log Measurements** check box opens a dialog box where you can choose the filename and path.

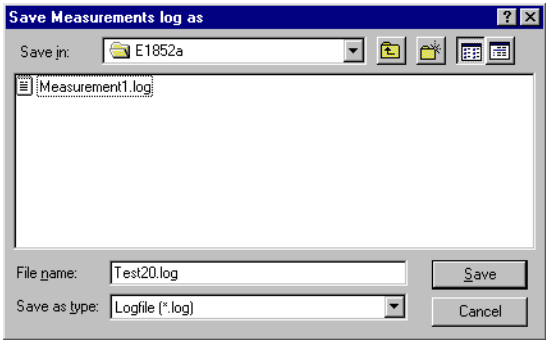


Figure 25 Save Measurement Log

The saved file contains measurements regarding the specific Bluetooth measurement. For example, in loop back measurements, with a 5 second interval, the BER values are logged into the file as shown in Figure 26. This type of text-only file can easily be imported into a spreadsheet for analysis.

NTP, or Normally Transmitted Power, is the average power whereas PTP, Peak Transmitted Power, is the peak power measured.

```
09:58:58;   TestMode
09:58:58;   NTP;      PTP;      FrqOff;   FrqDft;   FrqDev;   dAvg;     dMax;
09:59:00;   20.51;    21.00;    4.4;      ---;      ---;      ---;      ---;
09:59:05;   20.56;    21.60;    -30.2;    ---;      ---;      ---;      ---;
09:59:10;   -14.17;   -40.40;   -38.2;    ---;      ---;      ---;      ---;
09:59:15;   0.63;     -40.30;   -20.6;    ---;      ---;      ---;      ---;
09:59:20;   6.84;     -41.30;   55.4;     ---;      ---;      ---;      ---;
09:59:25;   -13.69;   -39.40;   -3.1;     ---;      ---;      ---;      ---;
09:59:30;   -13.51;   -39.90;   68.7;     ---;      ---;      ---;      ---;
09:59:35;   -12.60:   -43.00:   25.5:     ---:      ---:      ---:      ---:
```

```
dMin;     BER;          PER
---;      81000 0 0.000000;       376 0 0.000000;
---;      512784 0 0.000000;      2376 0 0.000000;
---;      668736 1193 0.178396;   4380 1262 28.812786;
---;      7128 845 11.854658;     6383 3213 50.336834;
---;      14256 1737 12.184343;   8385 5161 61.550388;
---;      22032 2669 12.114198;   10388 7114 68.482864;
---;      29808 3545 11.892780;   12404 9080 73.202194;
---:      37584 4516 12.015752:   14408 11038 76.610214:
```

Figure 26 Log File Content

NOTE You can use **Log Communication** (only available in in Debug mode) to capture all of the data traffic, including the commands.

4. Connection Setup

Read DUT Features

When enabled, the test set polls the DUT on connection and displays the DUT Bluetooth features.

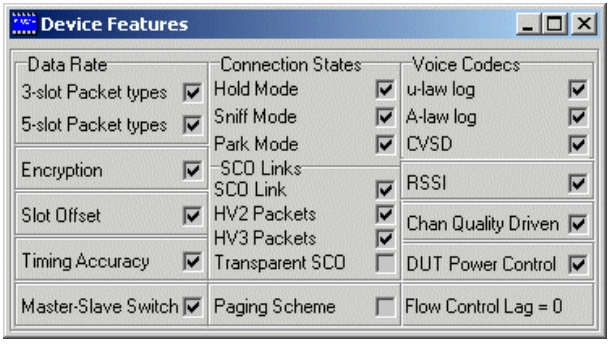


Figure 27 DUT Features (sample)

Enable Wait in Test mode

This command sets the test set to wait in test mode before sending the test activate message to the DUT. This is required by some DUTs. It does not apply to a normal mode connection.

5. Windows Position

Clicking **Default** places the user interface window in the upper left corner of your PC display.

6. Hardware

Press **Reset** to initialize the test set. All prior test set configurations are retained.

7. Software Version

When the test set is started and the user interface program is launched, the test set returns information about the firmware version and the PC Dynamic Link Library (DLL) file.

8. Firmware Update (Debug Mode Only)

The Firmware Update panel is used to set the required communication port and initiate the firmware download process. This is only available in debug mode and you should refer to the instructions on the E1852B Software Home Page. (The URL can be found on the **About** page of the user interface.)

NOTE The user interface software and the test set software must be the same version. If they differ an error message is displayed. Refer to Firmware Download on page 203.

9. Measurement Setup

The Measurement Setup panel offers you the choice of configuring Bluetooth compliant 10 packet measurements when in **Test Mode** on or a variety of measurements on single packets in **Test Mode**, **Normal Mode**, and **RF Analyzer**.

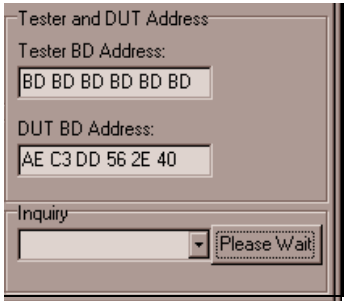
10. Tester and DUT address

The 12 digit hexadecimal (hex) BD address of the test set is displayed in the **Tester BD Address:** field. You can choose a new address and save it in the test set memory by entering the new address in the **Tester BD Address:** field and pressing **Reset**. This address may require changing for specific module application programs.

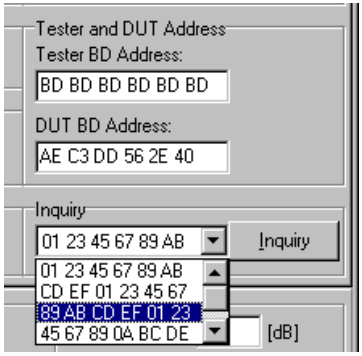
To enable communication between the test set and the DUT, the unique DUT BD address must be entered in the **DUT BD Address:** field.

11. Address Inquiry

The **Inquiry** function can be used to find any Bluetooth devices in the vicinity of the test set. Press the **Inquiry** button to start the process.



During the inquiry process, the **Inquiry** button changes to **Please Wait**.



When the Inquiry is complete you can scroll through the displayed addresses and select the required device. **[None]** is displayed if no devices are found.

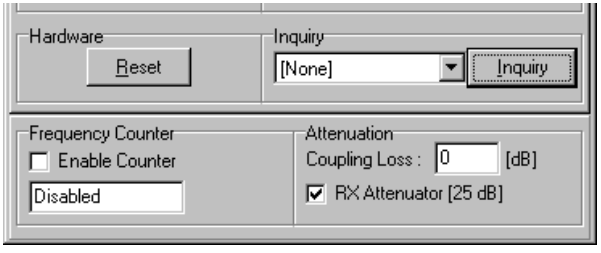


Table 1 System Page - Panel Summary

	Panel	Parameters	Description
1.	Communication Port	Lpt1 Lpt2 Lpt3	PC parallel ports for control of the test set. Lpt1 is default
2.	GPIB Configuration	GPIB card GPIB address	Used to configure the GPIB system for communication with the test set
3.	Log Settings	Log Measurement	Log file containing all the measurements
		Interval (Sec.)	Length of time between data logging events in seconds
		Log Communication	In Debug mode only, log file containing all the measurements and commands
4.	Connection Setup	Read DUT Features	Displays the DUT enabled Bluetooth features
		Enable Wait in Testmode	The test set pauses during a testmode setup as required by some DUTs
5.	Windows Position	Default	Pressing Default places the user interface in the top left corner of your PC desktop
6.	Hardware	Reset	Pressing Reset initiates a 'warm start' reset of the test set
7.	Software Version	Firmware Version	The test set is polled and the Firmware version is displayed
		PC DLL Version	Displays the DLL version held on the PC
8.	Firmware Update	Com1 to Com 9	Used to download new firmware to the test set
9.	Measurement Setup		
	Meas. Display	Single/10Pkt. Compliant	Selects single packet measurements or Bluetooth compliant 10 packet measurements
	Meas. Type	Single/Rolling /Sequential	Choice of measurement updates when 10 Packet compliant measurements selected

Table 1 System Page - Panel Summary

	Panel	Parameters	Description
10.	Tester and DUT address	Tester BD Address	Entry and display of the BD address of the test set
		DUT BD Address	Entry and display of the BD address of the DUT
11.	Address Inquiry	DUT BD Addresses	Used to find out addresses of any BD in the vicinity of the test set

Frequency Counter and Attenuation

The **Frequency Counter** and **Attenuation** panels are always displayed below the currently selected page.

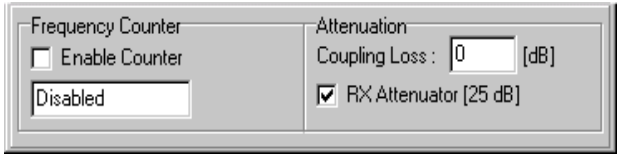


Figure 28 Frequency Counter and Attenuation Panels

Frequency Counter

Clicking the **Enable Counter** check box enables the counter. The frequency of the signal present at the **COUNTER IN** BNC connector on the test set front panel is measured and displayed. (The input parameters are described in “General Specifications” on page 195.)

Attenuation

If the coupling loss at the RF IN/OUT connector is known, the value can be entered in the **Coupling Loss:** field. The test set factors the loss into the measurement results.

Clicking the **RX Attenuator** box adds 25 dB attenuation to the signal in the test set receive direction.

NOTE Switch the RX attenuator on when testing Class I devices to ensure the E1852B Bluetooth Test Set receiver operates within its linear range.

Switch the attenuator off for Class II and Class III devices.

NOTE Do not connect a signal to the front panel during a measurement.

Communication window (Debug Only)

The Communication window is only displayed when you start the user interface in debug mode (**Start**, **Programs**, **Agilent Technologies**, E1852B **Debug**).

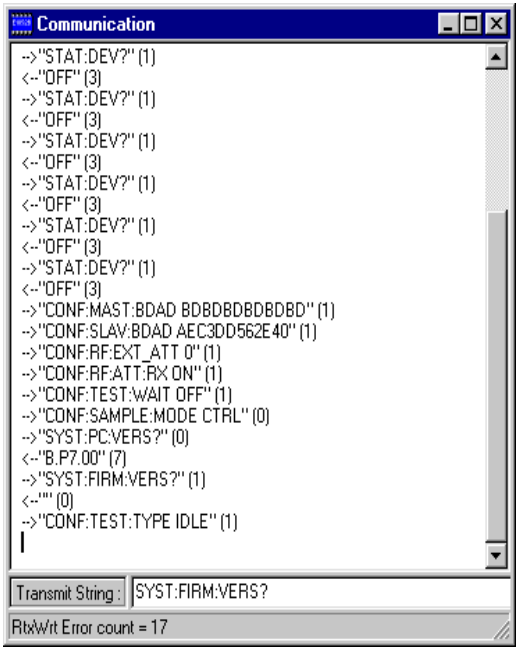


Figure 29 Communication Window

You can use this window to view and record the communication between your PC and test set, and send one command at a time in the **Transmit String** line. For more information about this feature refer to “Command Structure” on page 181.

Test Mode Page

The **Test Mode** Page contains the settings required for making measurements in Bluetooth Test Mode[1].

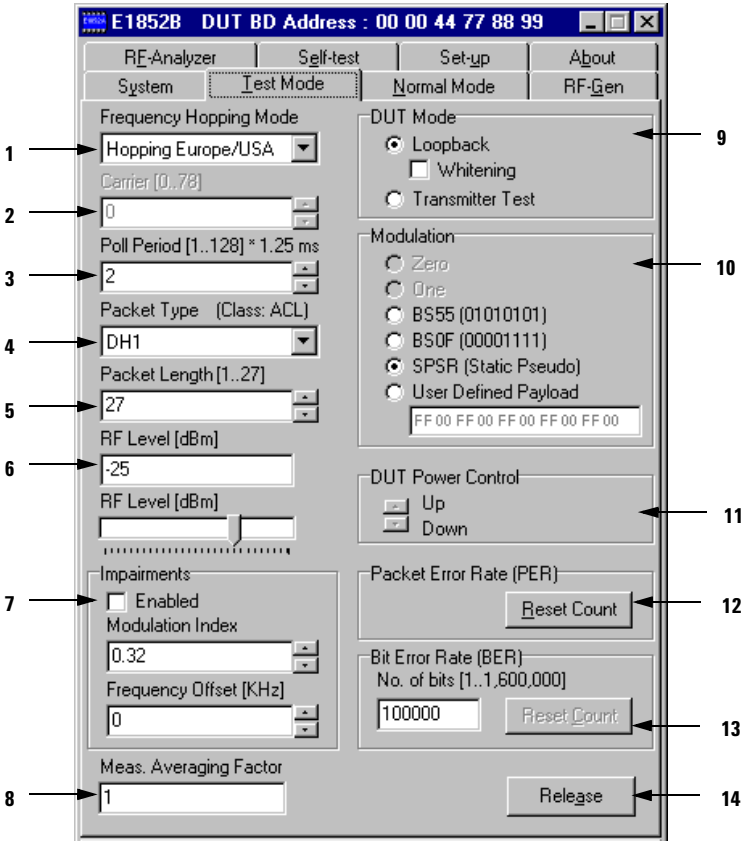


Figure 30 Test Mode Page

[1] There are variations in Bluetooth Test Mode between suppliers. Contact your Agilent support if you have questions or experience problems

Test Mode Page structure

The **Test Mode** page contains the following panels and entry fields:

1. Frequency Hop Mode

In **Test Mode**, you can choose to make measurements on a specific channel or in Bluetooth frequency hopping mode. Use this selection field to select Single Frequency or Hopping Europe/USA.

2. Carrier

The **Carrier** entry field is only enabled if you have chosen to make measurements in a single channel. You can select any one of the 79 channels on the ISM band (channel 0 – 78 ~ 2.402 – 2.480 GHz).

Channel 40 is the mid frequency at 2.442 GHz.

3. Poll Period

The time period for transmitting Bluetooth test packets in Transmitter or loop back mode.

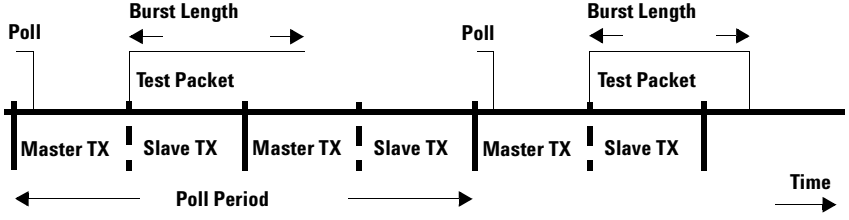


Figure 31 Transmitter Test Mode

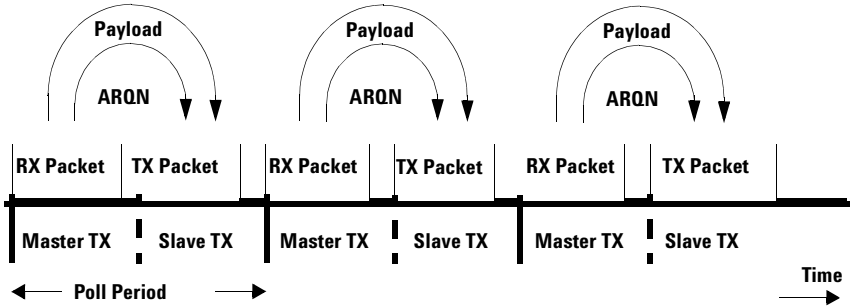


Figure 32 Loopback Test Mode

4. Packet Types

You can select a Bluetooth specific single or multi slot packet. The supported packet types are **DH1**, **DH3**, **DH5**, **HV3**, and **AUX1**. DH (Data High Rate) packets are asynchronous whereas HV (Human Voice) packets are synchronous. Most Bluetooth tests use the DH packets as no error correction is applied to these packets thus the fundamental RF performance is more visible.

5. Packet length

The length of the packets can be varied:

DH1	**1** to **27**
DH3	**1** to **183**
DH5	**1** to **339**
HV3	fixed at **30** bytes
AUX1	**1** to **29**

6. RF Level

The RF power level in the test set transmit direction can be adjusted for sensitivity measurements. The power level is continuously variable from –85 to 0dBm in 1 dB increments. The power level can be entered directly in the **RF Level [dBm]** field or adjusted by moving the **RF Level** slider.

7. Impairments

In this panel you can select signal impairments. Enabled only in **Loopback** Mode, you can adjust the **Modulation Index** and the **Frequency Offset** to determine the DUT tolerance of poor transmitter performance. Modulation index values range from 0.28 to 0.35 while frequency offset range is ±75 kHz.

8. Meas. Averaging Factor

You can choose to make measurements on single packets or average the results over a number of packets up to a maximum of 999. A lower number updates the measurement more frequently. The default setting of 1 is often the optimum value.

9. DUT Mode

In this panel you can choose **Loopback** or **Transmitter Test**. Choosing **Loopback** mode enables **Bit Error Rate (BER)** measurements.

Various modulation patterns (**Modulation** panel) are available when **Transmitter Test** mode is selected. In this mode the test set instructs the DUT to transmit the specified patterns. You can specify your own data payload by entering hexadecimal values in the **User Defined Payload** edit line only when in Loopback mode with Data Whitening off. Payload checking occurs on all payload types.

All modulation patterns are available in **Loopback** but **Data Whitening** can only be applied to the **SPSR** data payload.

NOTE Not all devices support this function.

10. Modulation

When **Loopback** is the selected **DUT Mode**, all modulation patterns are available (**Zero**, **One**, **BS55**, **BS0F**,and **SPSR** and **User Defined Payload**). For example, BS55 specifies a 01010101 bit pattern. The modulation patterns are shown in Figure 33, Figure 34, Figure 35, Figure 36, and Figure 37.

The static pseudo random modulation (**SPSR**) is the only pattern available in **Loopback** with **Whitening** on.

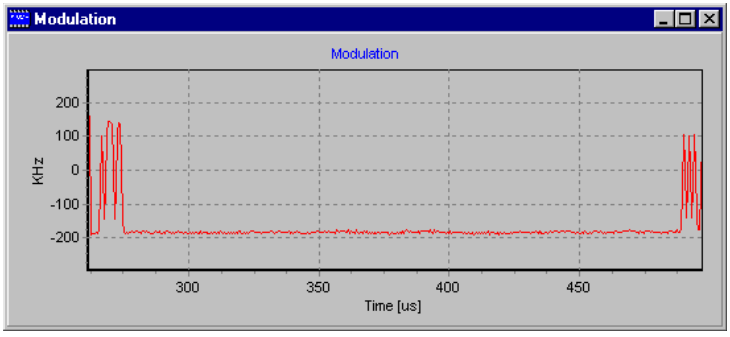


Figure 33 Modulation Pattern ‘Zero’

NOTE All ‘0’ or all ‘1’ payloads can be useful for checking for interference on the DUT transmission. Specific radio types may not function correctly or support these payloads.

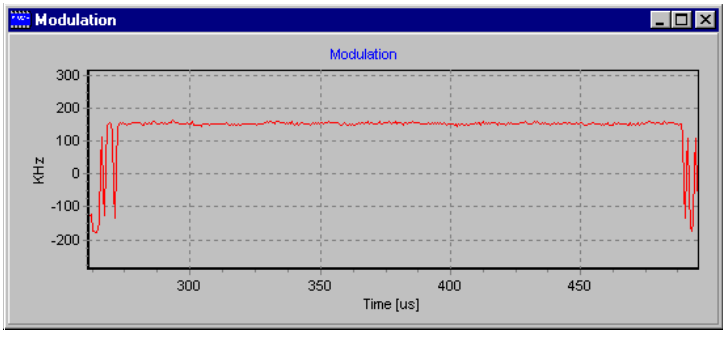


Figure 34 Modulation Pattern ‘One’

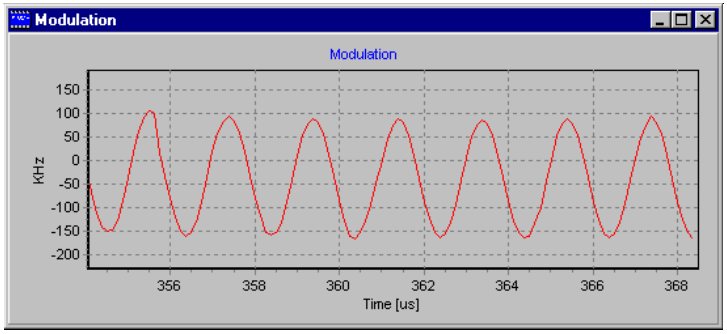


Figure 35 Modulation Pattern ‘BS55 (01010101)’

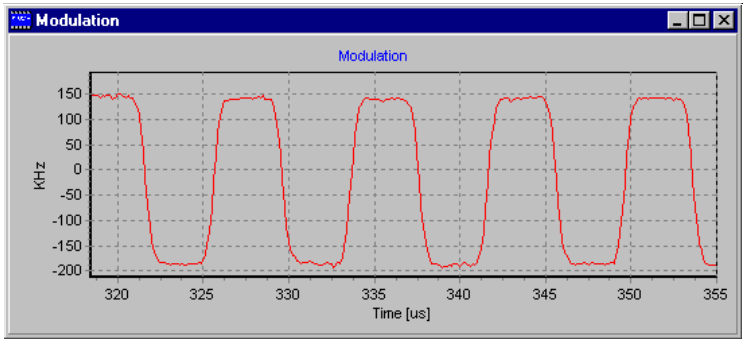


Figure 36 Modulation Pattern ‘BS0F (00001111)’

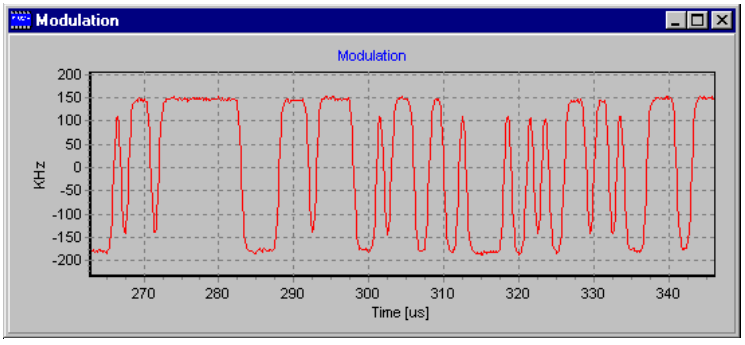


Figure 37 Modulation Pattern ‘SPSR (Static Pseudo)’

11. DUT Power Control

If the DUT supports this feature, you can use the up/down buttons to control its RF output level.

12. Packet Error Rate (PER)

You can reset the running Packet Error Rate by pressing **Reset Count**.

13. Bit Error Rate (BER)

You can enter the number of bits to be used in measuring the **Bit Error Rate** in the entry field. The valid range is 1 to 1,600,000 bits.

The Bit Error Rate can be seen to change rapidly with small changes in RF level. A change from 0.01% to over 1% is possible due to a 5dB level change.

14. Page/Release

Clicking **Page/Release** opens or closes a Bluetooth RF connection between the test set and the DUT. Clicking **Page** opens a **Measurements** window. Also the **Page** button changes to **Release**. Clicking **Release** closes the connection.

NOTE Closing the **Measurements** window also releases the connection.

NOTE In Test Mode release is executed using **`LMP-detach`**. The E1852B test set does not yet support the **`LPM-test_control`** with scenario **`exit test mode`**.

Table 2 Test Mode Page - Panel Summary

	Panel	Parameters	Description
1.	Frequency Hop Mode	Single Frequency or Hopping Europe/ USA	Selects Frequency Hopping on or off
2.	Carrier	0 to 78	Entry and display of the ISM band channel number (0 to 78, 2.402 to 2.480 GHz)
3.	Poll Period	1 to 255	Selects the time period for transmitting test packets - depends on packet type
4.	Packet Types	DH1 to DH5, HV3 and AUX1	Selects the data packet type
5.	Packet Length	1-27 for DH1 1-183 for DH3 1-339 for DH5 AUX1 (fixed) HV3 (fixed)	Selects the packet length
6.	RF Level	-85 to 0dBm	Entry field or slider control
7.	Impairments	Mod. Index 0.28 to 0.35 Freq. Offset ±75kHz	Simulates poor transmitter performance.
8.	Meas. Averaging Factor	1 to 999	Selects the number of packets to be used for the measurement
9.	DUT Mode	Loopback or Transmitter Test	Selects the test mode required for the DUT - Loopback enables PER and BER measurements, various modulation patterns can be used with Transmitter Test
10.	Modulation	Zero, One, BS55, BS0F, SPSR, User Defined	Selects the modulation required for the Transmitter Tests
11.	DUT Power Control	variable	Enables adjustment of DUT RF level (if supported by DUT)
12.	PER		Running Packet Error Rate
13.	BER	1 to 1,600,000	Selects the required bits for the BER measurement (Loopback test)
14.	Page/Release		Opens and closes the Bluetooth connection to the DUT

Test Mode Measurement Windows

When a Bluetooth connection is established, a **Measurements** window is displayed. There are two types of measurement window; **Single Packet Measurements** and **10 Packet Measurements**. The **10 Packet Measurements** window is only displayed when you have selected the **10 Pkt. Compliant** measurement type from the **System Panel** and established a **Test Mode** connection to the DUT. In all other configurations the **Single Packet Measurements** window is displayed.

	Measurement Window	
Configuration	**10 Packet**	**Single Packet**
Test Mode connection	•	•
Normal Mode connection	×	•
RF Analyzer	×	•

Single Packet Measurement Windows

The measurement results are continuously updated and shown in the display fields of this window. Associated with each result is a red/green bar with a small indicator in black which are described in detail in the section Set-up Page on page 101.

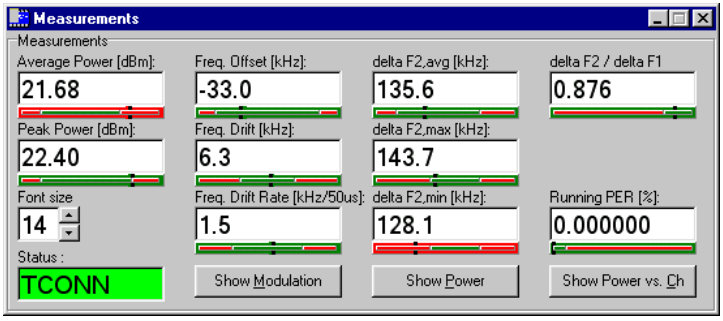


Figure 38 Transmitter Test Measurements Window (BS55 Modulation Selected)

NOTE Due to the large amount of data traffic used to generate and refresh these displays, GPIB performance may be slowed.

RF Measurements in Transmitter Test DUT Mode

The following parameters are displayed in the **Single Measurements** window during **Transmitter Test**:

- **Average Power**
- **Peak Power**
- **Frequency Offset**
- **Frequency Drift** - 0101 pattern only
- **Frequency drift Rate** - 0101 pattern only
- **Delta F2 Average** - Delta F1 average with 00001111 pattern
- **Delta F2 Max** - using Debug version of user interface only
- **Delta F2 Min** - using Debug version of user interface only
- **Delta F2 / Delta F1**
- **Delta F1 Average**
- **Delta F1 Max**
- **Delta F1 Min**
- **Running PER**

RF measurement parameters in Loopback DUT Mode.

The following parameters are displayed in the **Measurements** window during **Loopback Test**:

- **Average Power**
- **Peak Power**
- **Frequency Offset**
- **Running BER**
- **BER**
- **Packet Error Rate**

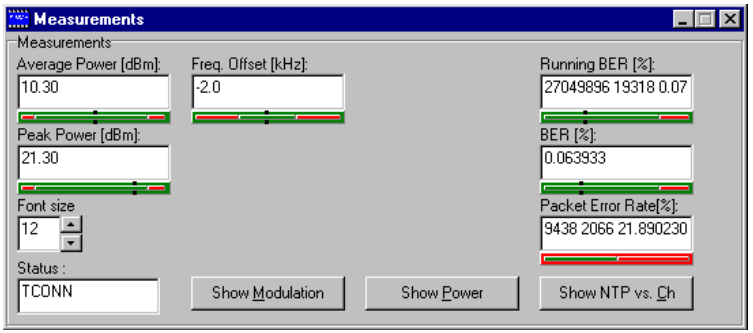


Figure 39 Loopback Test Measurements Window

NOTE Some extra measurements, not in the Bluetooth specification, using remote commands. (Refer to Chapter 5, “Programming Reference” on page 119.)

Font size

To view the measurements results from a greater distance you can change the displayed size of text on the **Measurements** window. The font size is selectable from 12 to 18. (Default is 18.)

Status

The status display line shows the state of the test set or if the connection is off. Colour coding is also used to indicate the state. (Refer to Chapter 5, “Programming Reference” on page 119 about the SCPI states).

Show/Close Measurement Graphs

When a Bluetooth connection is established, the graph windows can be opened and/or closed. Pressing **Show Modulation**, **Show Power**, and **Show Power vs. Ch** displays the graphs as shown in Figure 40, Figure 41, and Figure 42. When a graph is displayed, the associated button changes to **Close**.

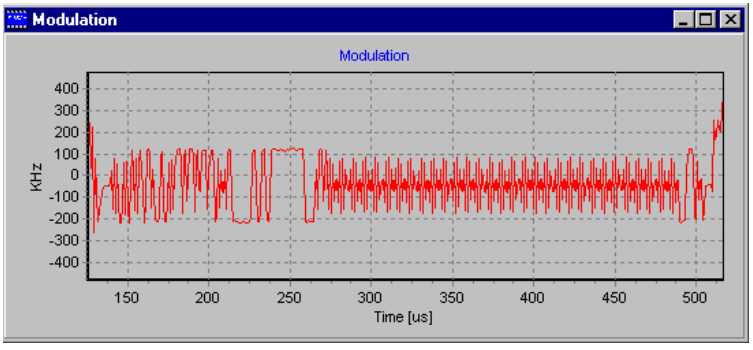


Figure 40 Modulation Display

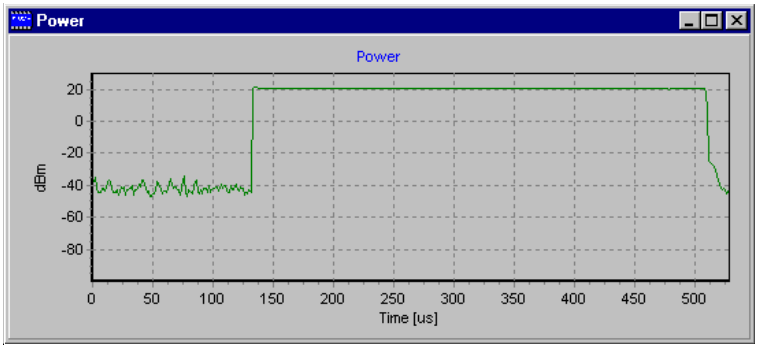


Figure 41 Power Display

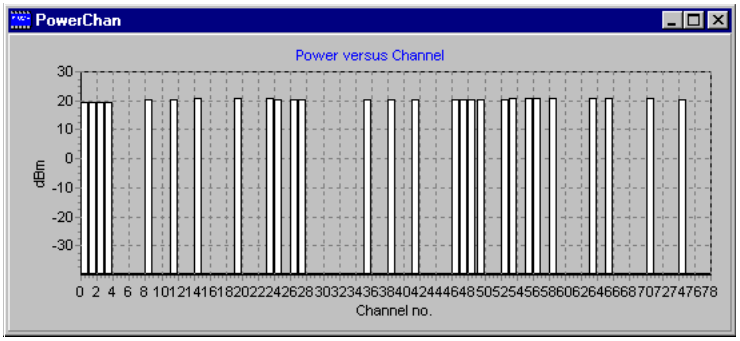


Figure 42 Power vs. Ch Display

NTP (average power) is measured for each channel. PTP (peak power) cannot be obtained from this measurement. The Power vs. Channel display can be captured even when the DUT is in frequency hopping mode. Simply wait for the channels to be visited

Zoom function in the graph windows

You can zoom in and out on the three graph windows by left clicking and dragging the mouse.

Begin in the upper left corner of the graph. Left click and drag a rectangle to the lower right and release the mouse button.

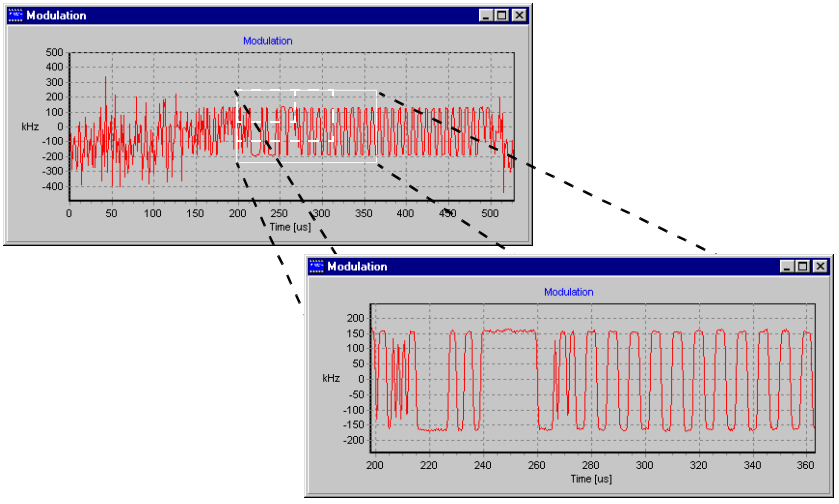


Figure 43 Zooming into a trace

Now right click in the display and slide the graph to view the area of interest.

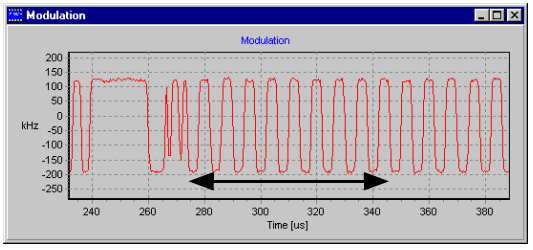


Figure 44 Scrolling through a trace

Left click in the lower right and drag to the upper left to return to the normal viewing.

NOTE Only a small amount of the available data is used to generate the graphical displays. The displays should be regarded only as a close approximation.

10 Packet Measurement Window

The **10 Packet Compliant Measurements** window is displayed when you select **10 Pkt. Compliant** and a **Test Mode** connection is made. The **Meas. Type** scroll box offers the choice of **Single**, **Rolling**, and **Sequential**.

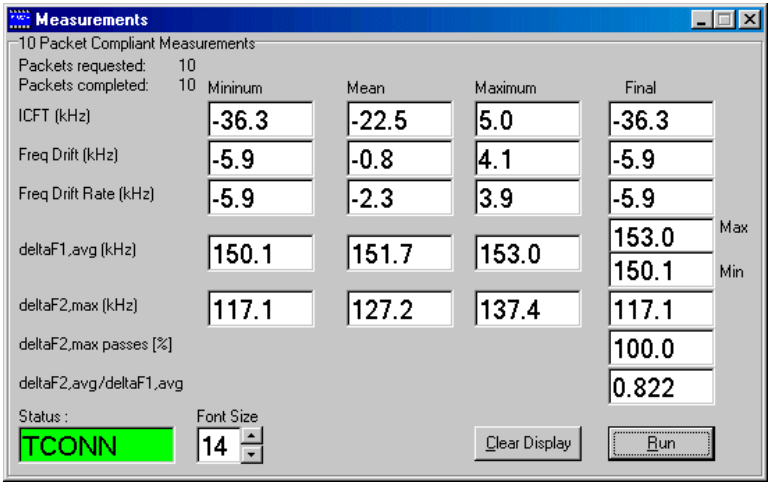


Figure 45 10 Packet Measurements Window - Single Mode (BS0F Modulation Selected)

- **Single** - This is the single shot mode - the measurements are made on packets 1 to 10 and the results displayed. The measurement is then halted. Pressing **Run** re-starts the measurement
- **Rolling** - The measurements are made on packets 1 to 10 and displayed. On receipt of packet 11 the results for packets 2 to 11 are displayed. This continues with results for packets 3 to 12, 4 to 13, and so on updating the results fields until you stop the measurements.
- **Sequential** - This can be likened to the single shot measurement running continuously. The measurements are made on packets 1 to 10 and the results displayed. The measurements continue and the results are updated with results for packets 11 to 20, 21 to 30 and so on until you halt the measurement.

You can clear all the results at any time by pressing **Clear Display**.

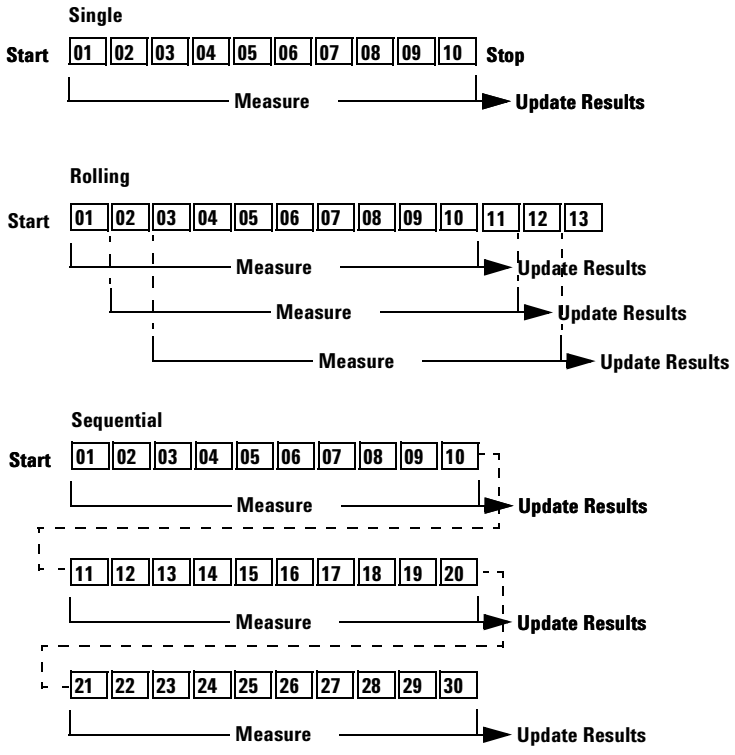


Figure 46 Single, Rolling, and Sequential Measurements

Compliant Measurements in Transmitter Test Mode

The following parameters are displayed in the **10 Pkt. Measurements** window during **Transmitter Test**:

- **ICFT (Initial Carrier Frequency Tolerance)**
- **Frequency Drift**
- **Frequency Drift Rate**
- **Delta F1, avg**
- **Delta F2, max**
- **Delta F2, max passes**
- **Delta F2, max/deltaF1, avg**

Normal Mode Page

Normal Mode is used to make RF measurements in a Bluetooth connected link where the Bluetooth test mode is not required or is not supported in the DUT. This mode is also use for audio tests. **Normal Mode** test facilities can be used to quickly determine the performance of the DUT before implementing more comprehensive measurements in Bluetooth Test Mode.

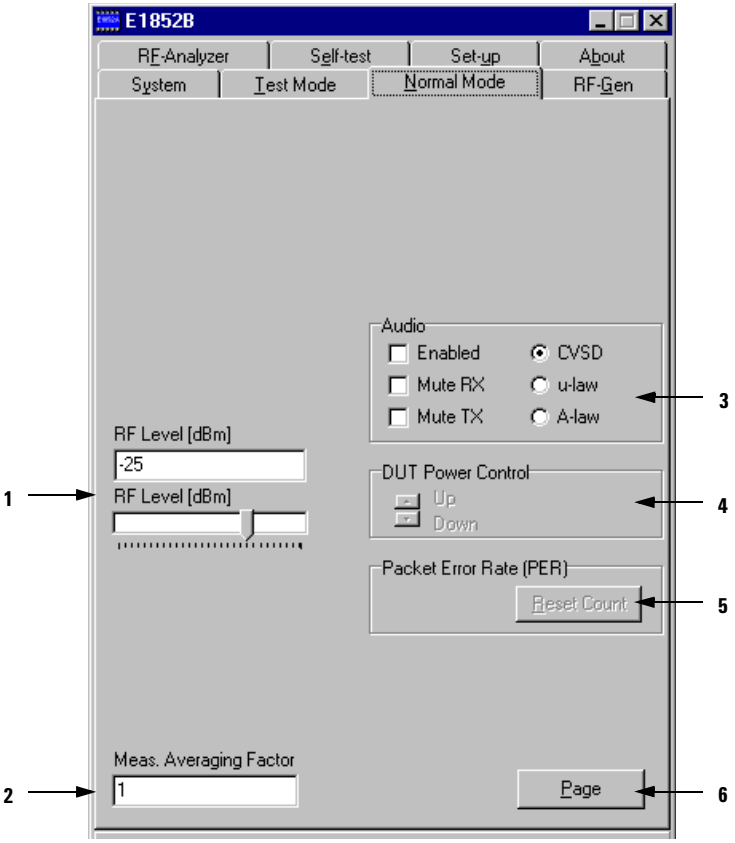


Figure 47 Normal Mode Page

Normal Mode Page structure

The **Normal Mode** page contains the following panels and entry fields:

1. RF Level

The RF power level in the test set transmit direction can be adjusted for sensitivity measurements.

The power levels can be adjusted from –85 to 0dBm.

The power level can be entered directly in the **RF Level [dBm]** field or adjusted by moving the **RF Level** slider.

2. Meas. Averaging Factor

You can choose to make measurements on single packets or average the results over a number of packets up to a maximum of 999. A lower number updates the measurement more frequently.

3. Audio

The test set currently supports the CVSD audio CODEC.

4. DUT Power Control

If the DUT supports this feature, you can use the up/down buttons to control its RF output level.

5. Packet Error Rate (PER)

The running Packet Error Rate is displayed on the Normal Mode **Measurements** window.

6. Page/Release

The **Page/Release** button opens or closes a Bluetooth RF connection between the test set and the DUT. Clicking **Page** opens a **Measurements** window. When a Bluetooth connection is established, the **Measurements** window is displayed. Also the **Page** button changes to **Release**.

Clicking **Release** closes the connection.

NOTE Closing the **Measurements** window also releases the connection to the DUT

Normal Mode Measurement Window

When a **Normal Mode** Bluetooth connection is established, the **Single Packet Measurement** window opens.

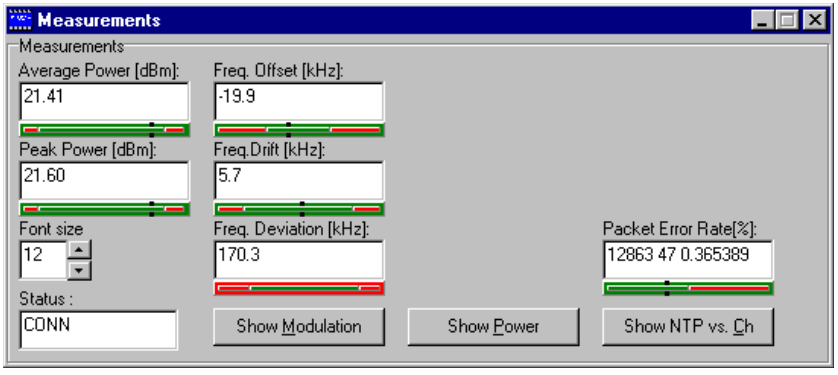


Figure 48 Normal Mode Measurements Window

RF measurement parameters in Normal Mode.

- **Average Power**
- **Peak Power**
- **Frequency Offset**
- **Frequency Drift**
- **Frequency Deviation**
- **Packet Error Rate**

NOTE Frequency Drift and Frequency Deviation are good indicators of the DUT performance. They cannot be made in exactly the same way as Testmode because the payload is different.

Table 3 Normal Mode Page - Panel Summary

	Panel	Parameters	Description
1.	RF Level	0 to -85 dBm	Entry field or slider to control the RF level
2.	Meas. Averaging Factor	1 to 999	Selects the number of packets to be used for the measurement
3.	Audio	Enabled, Mute RX, and Mute TX	Enables the audio input and output signal paths to the rear panel. Only CVSD CODEC supported at present.
4.	DUT Power Control	variable	Enables adjustment of DUT RF level (if supported by DUT)
5.	PER		PER is displayed on the Measurements window. Pressing Reset Count resets and restarts the running count
6.	Page/Release		Opens and closes the Bluetooth connection to the DUT

RF-Gen Page

The **RF-Gen** (RF-Generator) page is used to generate RF signals from the test set on a selected channel within the specified Bluetooth radio band. It can be useful to check a DUT that cannot establish a link or to calibrate a parameter such as Receive Signal Strength Indication (RSSI).

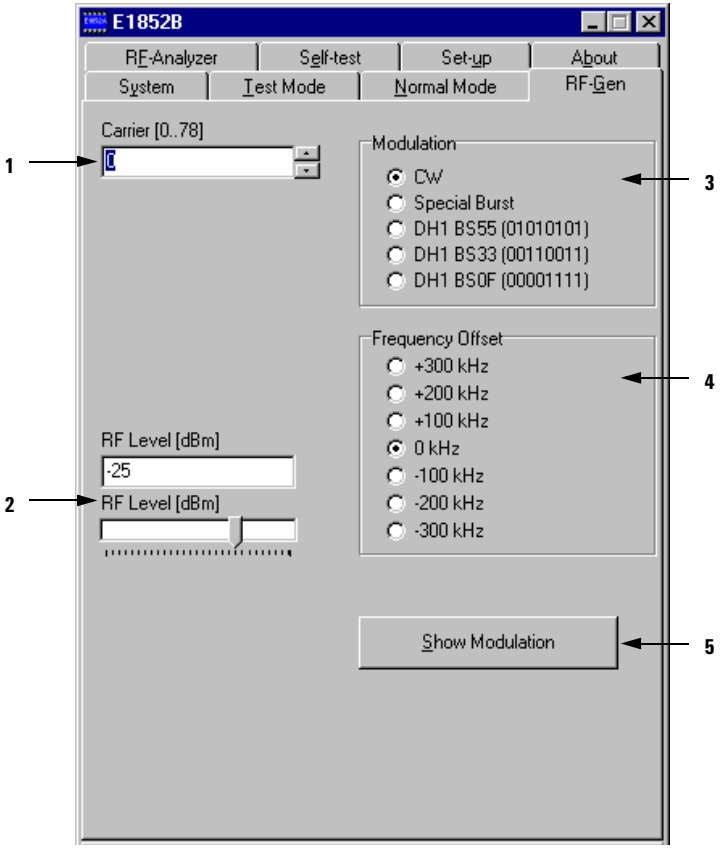


Figure 49 RF-Generator Page

RF-Gen Page structure

The **RF-Gen** page contains the following panels and entry fields:

1. Carrier

The carrier frequency can be chosen by selecting one of the 79 channels on the ISM band (channel 0 – 78 ~ 2.402 – 2.480 GHz).

Channel 40 is the mid frequency at 2.442 GHz.

2. RF Level

The RF power level in the test set transmit direction can be adjusted for sensitivity measurements.

The power levels can be adjusted from –85 to 0 dBm.

The power level can be entered directly in the **RF Level [dBm]** field or adjusted by moving the **RF Level** slider.

3. Modulation

5 modulation patterns are available (**CW**, **Special Burst**, **DH1 BS55**, **DH1 BS33**, and **DH1 BS0F**). The modulation patterns are shown in Figure 50, Figure 51, Figure 52, and Figure 53.

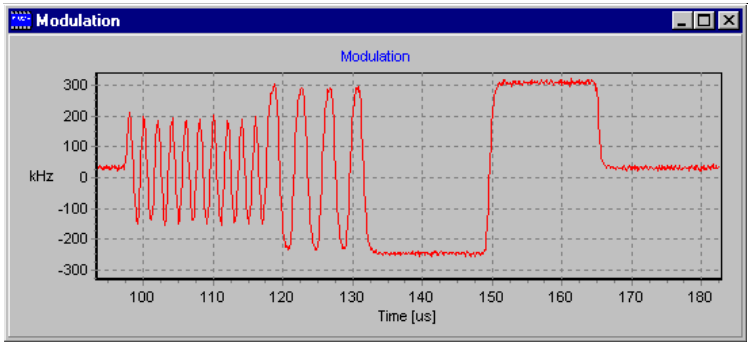


Figure 50 Special Burst

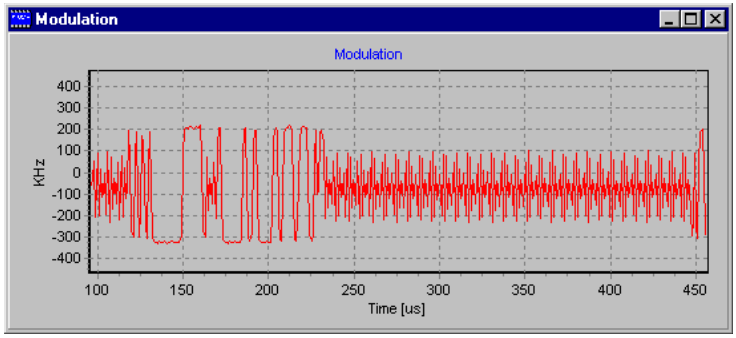


Figure 51 DH1 BS55

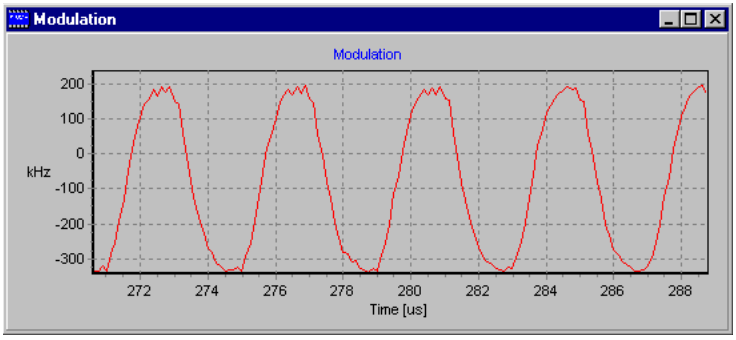


Figure 52 DH1 BS33

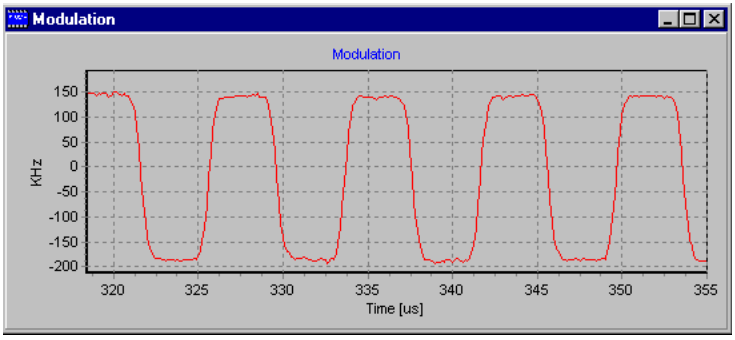


Figure 53 DH1 BS0F

4. Frequency Offset

You can apply an offset to the carrier signal from –300 kHz to +300 kHz in 100 kHz steps. This can be used to check how a receiver performs under extreme conditions.

5. Show Modulation

Clicking **Show Modulation** opens the **Modulation** graph window showing what is being transmitted.

NOTE To generate the transmitted modulation pattern display, a small amount of signal is picked off at the RF output of the test set. The amplitude of this signal is influenced by the output signal magnitude and the load/mismatch at the output connector. When the output is loaded correctly we do not recommend using the **Modulation** graph window below -10 dBm output signal levels.

Table 4 RF-Gen Page - Panel Summary

	Panel	Parameters	Description
1.	Carrier	0 to 78	Entry and display of the ISM band channel number (0-78, 2.402-2.480 GHz)
2.	RF Level	-85 to 0 dBm	Entry field or slider to control the RF level
3.	Modulation	CW, Special Burst, DH1 BS55, DH1 BS33, and DH1 BS0F	Selects the modulation pattern required.
4.	Frequency Offset	0 khz, ±100kHz, ±200 kHz and ±300 kHz	Selects the frequency offset required
5.	Show Modulation		Opens the Modulation Graph window

RF-Analyzer Page

The **RF-Analyzer** page can make RF measurements on the DUT without first establishing a Bluetooth connection. A Measurements window is displayed when the RF-Analyzer page is selected.

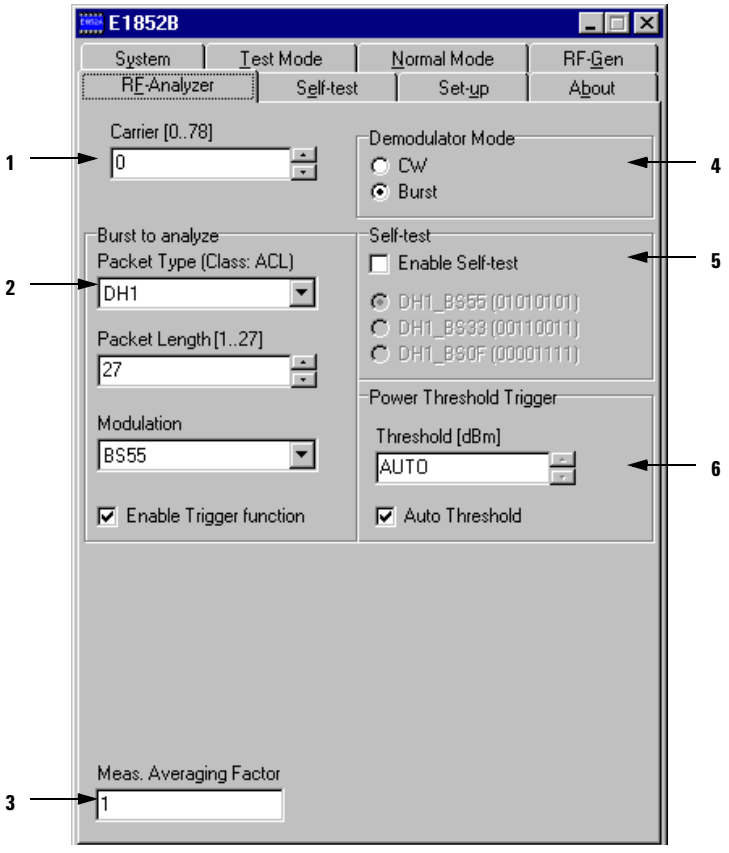


Figure 54 RF-Analyzer Page

RF-Analyzer Page structure

The **RF-Analyzer** page contains the following panels and entry fields:

1. Carrier

The carrier frequency can be chosen by selecting one of the 79 channels on the ISM band (channel 0 – 78 ~ 2.402 – 2.480 GHz).

Channel 40 is the mid frequency at 2.442 GHz.

2. Burst to analyze

The **RF-Analyzer** only requires the channel number to be specified if you are making measurements on a DUT transmitting a CW signal. If however, you want to measure a specific burst transmitted by the DUT, you must ensure the **RF-Analyzer** is configured with the same burst parameters. First configure the following:

- **Packet Type** - select the specific single or multi slot packet transmitted by the DUT. The supported packet types are:
  - **DH1**, **DH3**, and **DH5**
- **Packet Length** - select the packet length being transmitted by the DUT. Supported lengths are:
  - **1** to **27** for **DH1** single slot packets
  - **1** to **183** for **DH3** multi slot packets
  - **1** to **339** for **DH5** packets.
- **Modulation** - select the modulation pattern being transmitted by the DUT. Supported patterns are:
  - **BS0F**
  - **BS33**
  - **BS55**

3. Meas. Averaging Factor

You can choose to make measurements on single packets or average the results over a number of packets up to a maximum of 999. A lower number updates the measurement more often.

4. Demodulator Mode

To measure a CW signal only at the channel number specified, simply select **CW**. To make measurements on a DUT transmitting a burst as specified in the **Burst to analyze** panel, click Burst.

5. Self-test

The 'Enable Self-test' check-box allows you to make a limited measurement of the test set. The output signal is looped-back internally and the results displayed. This is a useful check of test set performance and can be used to gain familiarity with Bluetooth RF signals.

6. Power Threshold Trigger

You can set the threshold value for the power envelope of the bluetooth burst when the Burst Demodulator Mode is enabled. This value used when the measurement attempts to find the power envelope of the applied bluetooth signal.

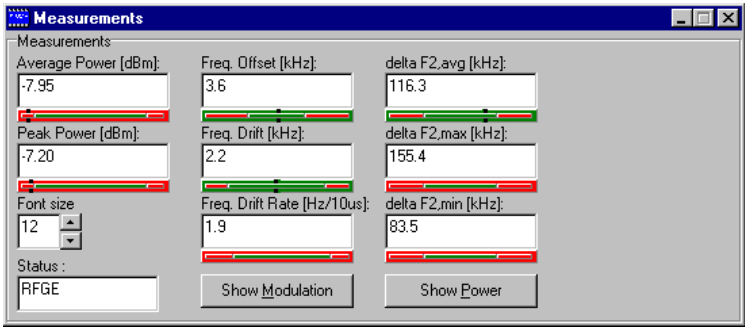


Figure 55 RF-Analyzer Measurements - BS55 Modulation Pattern

Table 5 RF-Analyzer Page - Panel Summary

	Panel	Parameters	Description
1.	Carrier	0 to 78	Entry and display of the ISM band channel number (0-78, 2.402-2.480 GHz)
2.	Burst to analyze	Packets DH1 to DH5, HV3 and AUX1 Packet Lengths 1 to 27 for DH1, 1 to 183 for DH3, 1 to 339 for DH5 Modulation patterns BS0F, BS33, BS55	Entry and display fields for information required when making measurements in Burst Mode
3.	Meas. Averaging Factor	1 to 999	Selects the number of packets to be used for the measurement
4.	Demodulator Mode	CW or Burst	Selects the required measurement method
5.	Self Test	DH1_BS55 DH1_BS33 DH1_BS0F	Selects Self Test mode and the data packet/modulation to be measured
6.	Power Threshold Trigger	variable	Specifies the burst power trigger level

Self-test Page

Using the **Self-test** page you can quickly verify the operating status of the test set.

NOTE Ensure any connection to the **RF IN/OUT** port is removed.

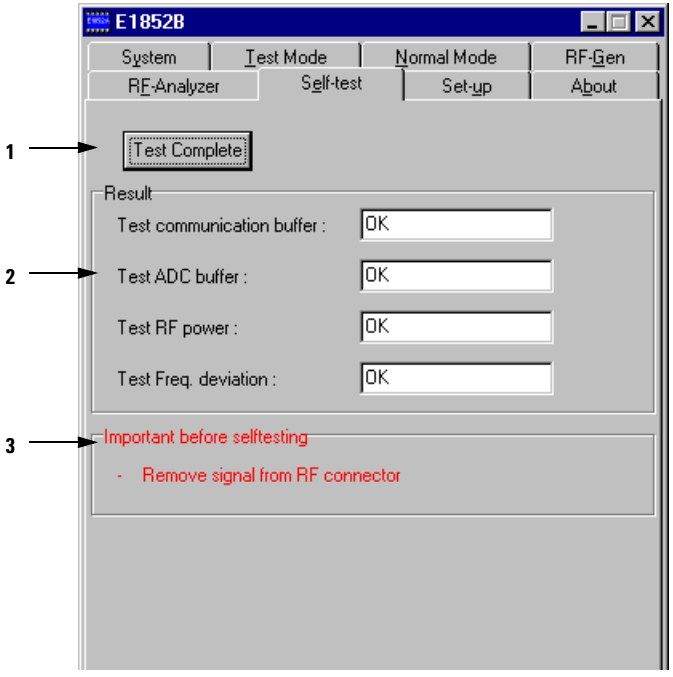


Figure 56 Self-test page

Self-test Page structure

The **Self-test** page contains the following panels and entry fields:

1. Start

Click the **Start** button to begin verification of the test set.

2. Result

The four self-test results are displayed in the associated fields.

- **Test communication buffer:**
- **Test ADC buffer:**
- **Test RF power:**
- **Test Freq. deviation:**

OK is shown in the display fields when each test has been completed successfully. If a test fails, an error message is displayed. When an error condition occurs first power cycle the test set and rerun the tests. If the error condition persists contact your nearest Agilent Technologies Sales and Service Office (see Contacting Agilent Technologies on page 207.)

3. Reminder

You are reminded to remove any connection to the **RF IN/OUT** port.

Set-up Page

The **Set-up** page provides a limits matrix where you can enter pass and fail values for the measurement parameters. You can quickly configure parameters using the save/recall function to setup previously saved settings. The data entered in this page is used to specify the scale of the red/green bar indicators on the **Measurements** windows.

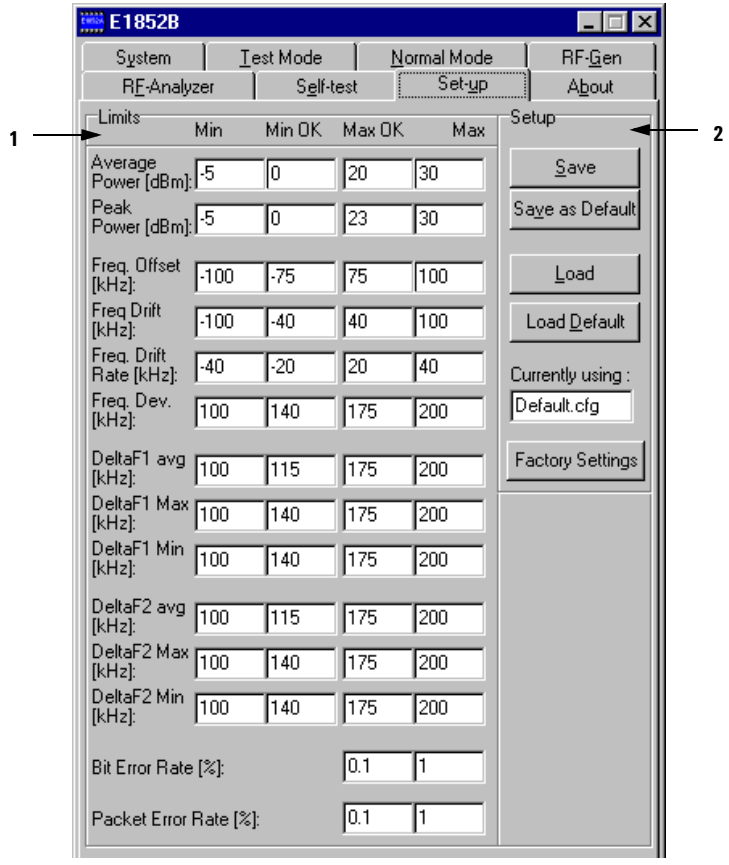


Figure 57 Set-up Page

Set-up Page structure

The **Set-up** page contains the following panels and entry fields:

1. Limits

You can use the entry fields to enter and display the required limits. The parameters are as follows:

- **NTP**
- **PTP**
- **Frequency Offset**
- **Frequency Drift**
- **Frequency Drift Rate**
- **Frequency Deviation**
- **Delta F1 avg**
- **Delta F1 Max**
- **Delta F1 Min**
- **Delta F2 avg**
- **Delta F2 Max**
- **Delta F2 Min**
- **Bit Error Rate**
- **Packet Error Rate**

How the Limits are used

Four limits are required for each parameter. **Min**, **Min OK**, **Max OK**, and **Max** are used to scale the red/green bars for each of the associated parameters on the **Measurements** windows. (see Figure 58 on Page 103)

- **Min** and **Max** limits set the end points of the bar.
- **Min OK** and **Max OK** limits set the position and size of the green 'OK' or 'Pass' section.
- Sections of the bar between the **Min OK** and **Max OK** regions are colored red to indicate a 'Fail'.
- The measurement result is shown numerically in the display field. It is also indicated along the length of the bar by a marker.
- The background area is red when the result is outside the 'OK' limits and changes to green when within the 'OK' limits. (see Figure 58 and Figure 59 on Page 104)

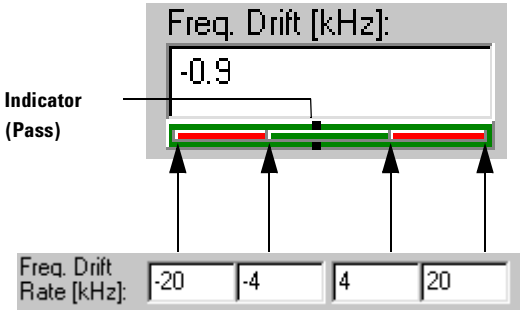


Figure 58 Frequency Drift Limits and Display Bar (Pass)

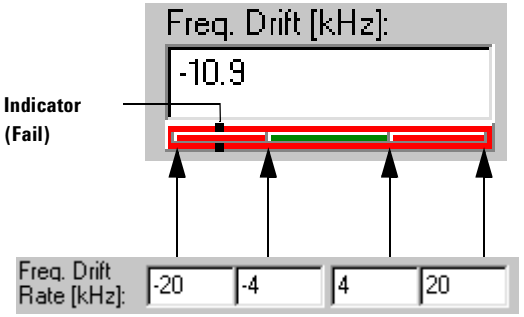


Figure 59 Frequency Drift Limits and Display Bar (Fail)

2. Setup

Setup files provide a convenient and quick method of changing the values in the **Limits** fields. All the values you have entered in the **Limits** fields can be saved in a setup file (.cfg file extension). A setup file can be loaded again to reconfigure the limits to the required values. The name of the set-up file in use is displayed in the **Currently using:** display line.

Saving and loading setup files

Clicking **Save** opens a dialog window where you can choose the file and path name to create a setup file of the current values. Save these in a folder other than the test set application folder to prevent them being lost if the application folder is uninstalled.

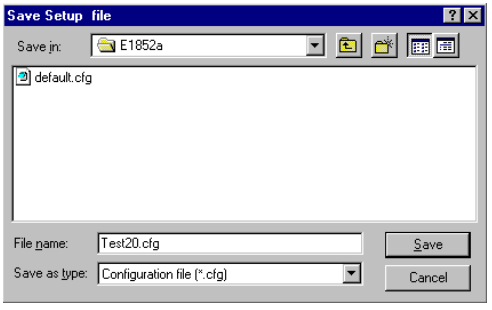


Figure 60 Save Setup dialog window

Clicking **Load** opens a dialog window for you to choose the required file.

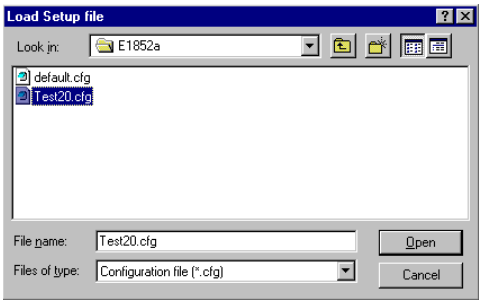


Figure 61 Load Setup dialog window

Saving and loading the default setup file

You can save the current set of **Limits** as the default configuration by clicking **Save as Default**. the current configuration is saved as default.cfg. To restore the Limits to your chosen default configuration click **Load Default**.

In addition, you can return all the settings to the factory default values by pressing **Factory Settings**.

About Page

The **About** page details the version and date of the user interface.

This information can be useful when support from Agilent Technologies is required.

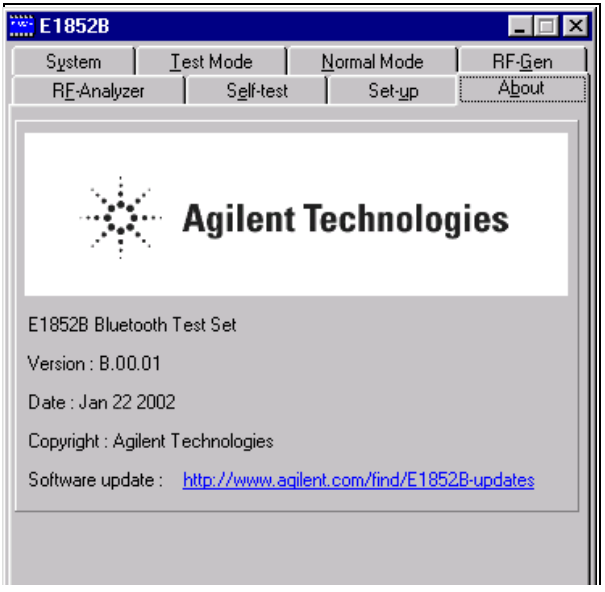


Figure 62 'About' page

4 DLL Interfacing

What You'll Find In This Chapter

This chapter shows you how the Dynamic Link Library (DLL) is used to communicate with the test set.

It contains these sections:

Introduction

The purpose of this chapter is to help the you develop your own Bluetooth test applications in the test executive you intend to use. In order to successfully control the E1852B Bluetooth Test Set using the SCPI command set, you must first understand how to link to the supplied E1852B Dynamic Link Library (DLL).

Once this is understood, consult the Programming Reference on page 119 for information on the functionality provided by the DLL.

Microsoft Windows provides ways to use dynamic link libraries and various programming/compiler tools adopt slightly different approaches to DLL linking. In this chapter the most common ways to perform DLL linking using Windows WIN32 C++ API are described. Minor adaptations may be necessary when other programming tools are used.

Terms Used

DLL: Windows Dynamic Link Library

API: Application Program Interface

DLL Interface

The parallel port is used to communicate with the E1852B Bluetooth test set. The commands required for parallel port operation are primitive, involving the use of ‘peek’ and ‘poke’ commands to transfer data and functions. The Dynamic Link Library (DLL) acts as a translator between the SCPI commands and the parallel interface commands. An overview of the DLL Interface function is shown in Figure 63. The commands are also routed through the DLL for GPIB operation.

The DLL is available for use by your own test application as shown in the section Calling Convention on page 110.

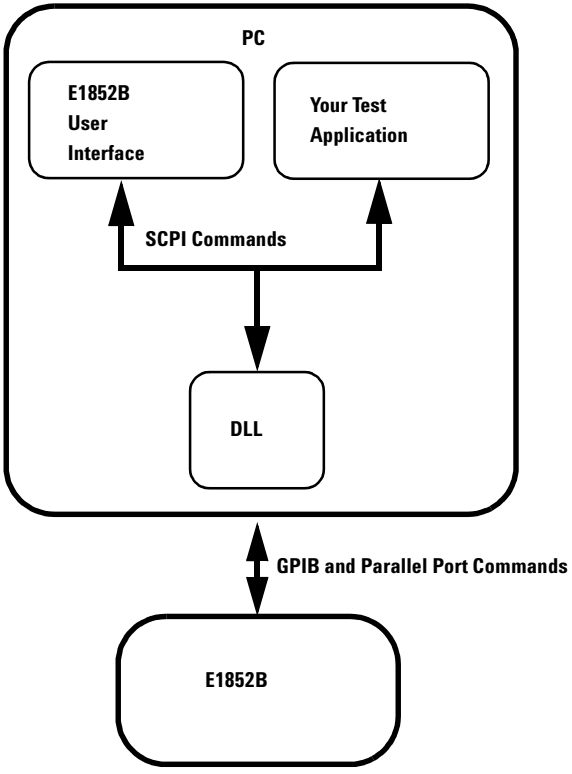


Figure 63 The E1852B Dynamic Link Library (DLL)

Calling Convention

Different programming languages and compilers use different approaches when performing subroutine calls. The methods used to store parameters, return addresses, and so on, on the stack vary. This is called *the calling convention.*

Since the Application may not have been created in the same programming language as the DLL, it becomes necessary to know the calling convention to use when DLL functions are called.

The calling convention used by the E1852B test set DLL is the **__stdcall**.

When C++ is used as the Application Programming language, the calling convention is explicitly specified by the **__stdcall** keyword in the interface header file E1852Bdll.h.

DLL Filename and Location

filename E1852B.dll

location

Windows NT:	C:\WINDOWS\system32
Windows 98/2000	C:\WINDOWS\system32

General Format

The general command format is:

```
RtxWrt(command-string)
```

More commands may be concatenated into one call:

```
RtxWrt(command-string1; command-string2; .. ;
command-string N)
```

A query can be performed using the format:

```
RtxWrt(query-string?) followed by a RtxRd(result-
string)
```

NOTE `RtxWrt` is a function call to the DLL.

The command consists of a sequence of abbreviations for some words. It is only necessary to enter the upper-case part of the words.

All commands are structured in a way analogous to the SCPI description. The upper-case letters indicate the short form of the command. The E1852B Bluetooth test set only accepts this short form as an abbreviation (according to SCPI), otherwise the long form is used.

Explicit DLL Linking

With *Explicit Linking,* the Application only requires the interface header file E1852Bdll.h and the DLL itself. All DLL linking is done explicitly by the application program.

Using this approach you must first load the DLL module using the WIN API function:

- LoadLibrary(DLL filename)

Thereafter you must retrieve the addresses for each DLL function explicitly.

- functionPtr = GetProcAddress(DllHandle, function name)

An example is shown below:

```
//--------------------------------------------------------------------
//  Microsoft Visual C++ 6.0 Win32 Console Demo Application
//  demonstrating how to use the dll-interface of the E1852B.
//
//  Agilent Technologies, 2001
//--------------------------------------------------------------------
/
*********************************************************************
*                          Include files
*********************************************************************
/
#define E1852B_VARS   // Tells the E1852Bdll.h that we want to
                      // declare the Dll interface functions as
                      // function-pointers, which are then loaded
                      // explicitly.
#include "E1852Bdll.h"
#include "Win32Err.h"
#include "stdio.h"

/*********************************************************************
*                          Macro definitions
*********************************************************************
/
#define E1852B_DLL_NAME "E1852B.Dll"
#define LOADFUNC(fname) \
  fname = GetProcAddress(DllHandle, #fname); \
```

```
  if (fname == NULL) \
  { \
    ShowWin32Error(#fname " not found in " E1852B_DLL_NAME); \
    return FALSE; \
  }
/
*****************************************************************
*                     Enumerations/Type definitions/Structs
*****************************************************************
/
/
*****************************************************************
*                      Global variables/const
*****************************************************************
/
/
*****************************************************************
*                      Local variables/const
*****************************************************************
/
static HINSTANCE DllHandle;
char ScpiStr[200];
char ResponseStr[200]
/
*****************************************************************
*                     Local Function prototypes
*****************************************************************
/
/
*****************************************************************
*                           Implementation
*****************************************************************
/
/
*****************************************************************
* DESCRIPTION:
*****************************************************************
/
boolean LoadDll(void)
{
  // First load the DLL library
  if (DllHandle == NULL)
  {
    DllHandle = LoadLibrary(E1852B_DLL_NAME);
    if (DllHandle == NULL)
```

```
      DllHandle = LoadLibrary("." E1852B_DLL_NAME);
    if (DllHandle == NULL)
    {
      ShowWin32Error(E1852B_DLL_NAME);
      return FALSE;
    }
// Then setup function pointers.
    #ifdef __BORLANDC__
    #pragma warn -8075
// Avoid Borland warning
    #endif
    #pragma warning( disable : 4057)  // Avoid Microsoft VC warning
    #pragma warning( disable : 4133)  // Avoid Microsoft VC warning
    #pragma warning( disable : 4113)  // Avoid Microsoft VC warning
LOADFUNC(RtxWrt);
LOADFUNC(RtxRd);
  }
  return TRUE;
}
/
*********************************************************************
* DESCRIPTION:
*********************************************************************
/
void UnloadDll(void)
{
  if (DllHandle != NULL)
  {
    FreeLibrary(DllHandle);
    DllHandle = NULL;
  }
}
// End of file.
/
*********************************************************************
* DESCRIPTION:
*********************************************************************
/
void SendScpiCommand(char* ScpiStr)
{
  uint16 Errors;
// Send SCPI command
  printf("SCPI command        : %s",ScpiStr);
  Errors = RtxWrt((far int8 *)ScpiStr);
```

```
  printf("\nSCPI Errors detected: %d",Errors);
// Read the response
  RtxRd((int8 *)ResponseStr);
  printf("\nSCPI response       : %s\n\n",ResponseStr);
}
/
*********************************************************************
* DESCRIPTION:
*********************************************************************
/
int main(int argc, char *argv[])
{
  printf("\nAgilent Technologies, 2001\n");
  printf("\nMicrosoft Visual C++ 6.0 Win32 Console Demo
Application.");
  printf("\nDemonstrating how to use the dll-interface of the
E1852B.\n\n");
  if(LoadDll())
  {
// Demonstrate different SCPI commands
    SendScpiCommand("SYST:PC:VERS?");
    SendScpiCommand("SYST:FIRM:VERS?");
    SendScpiCommand("STAT:DEV?");
  }
  return 0;
}
```

Implicit DLL Linking

With *Implicit Linking* the Application requires the interface header file E1852Bdll.h **plus** the E1852Bdll.lib file (and the DLL itself).

The DLL linking is now done implicitly by the compiler used for creating the Application program. The compiler will recognize this because of the keyword **__declspec(dllimport)** specified in the interface header file. The information needed for the compiler to perform this linking is included in the .lib file. The lib file shall therefore be included in the source file list of the Application project.

Unfortunately there seems to be compiler differences between .lib formats. **Therefore it is recommended to use the implicit DLL linking method only with Borland compilers**. In other cases (e.g. Microsoft), the explicit DLL linking method is recommended.

Agilent Vee Pro DLL Linking

When using the DLL with an Agilent Vee Pro Application it is necessary to use a special interface header file. The Agilent Vee Pro cannot interpret the conditional compiler directives within E1852Bdll.h. The special interface header file, is therefore basically a stripped down version of the E1852Bdll.h file.

5 Programming Reference

What You'll Find In This Chapter

This Chapter lists and describes the remote command set.

It contains these sections:

Introduction to the SCPI language

The SCPI (standard commands for programmable instruments) command language is recommended when you want to use the test set in high throughput manufacturing environments where the PC user interface is not suitable.

The SCPI commands used with the test set is similar in structure to the SCPI commands used with other Agilent Technologies instruments.

The SCPI language for the test set comprises three levels set up in a hierarchy.

Example:

```
CONF  First level
       :TEST   Second level
                 :TYPE BT  Third level
```

The commands should be placed in the corresponding way in accordance with the three command levels. The condition of many of the commands can be queried by adding a '?' to the end of the string.

Example:

```
CONF:TEST:TYPE ?
```

returns `IDLE`, `BT`, `TESTMODE` or `RFGE`.

System States

The test set has 12 states. The remote command set and the PC interface are used to change the state according to the required task. `IDLE` for example, is the state immediately after power-on, system reset, or following disconnection from the DUT. In `BT` state, a normal Bluetooth connection is made to the DUT. Likewise, `TESTMODE` is the state required for a Bluetooth Test connection to the DUT. The `RFGE` state is used for other measurements such as power level.

Table 6 E1852B states

System State	Description
IDLE	**Idle State**
RFGE	**RF Generator Mode**
BT	**Bluetooth Normal Mode - no connection**
PAGE	**Bluetooth Normal Mode - paging the DUT**
CONN	**Bluetooth Normal Mode - connection made to DUT**
DISC	**Bluetooth Normal Mode - disconnected from DUT**
TESTMODE	**Bluetooth Testmode Mode - no connection**
TPAGE	**Bluetooth Testmode Mode - paging the DUT**
TACTIVATE	**Bluetooth Testmode Mode - awaiting Test Activate accept from the DUT**
TCONTROL	**Bluetooth Testmode Mode - awaiting Test Control accept from DUT**
TCONN	**Bluetooth Testmode Mode - connection made to DUT**
TDISC	**Bluetooth Testmode Mode - disconnected from DUT**

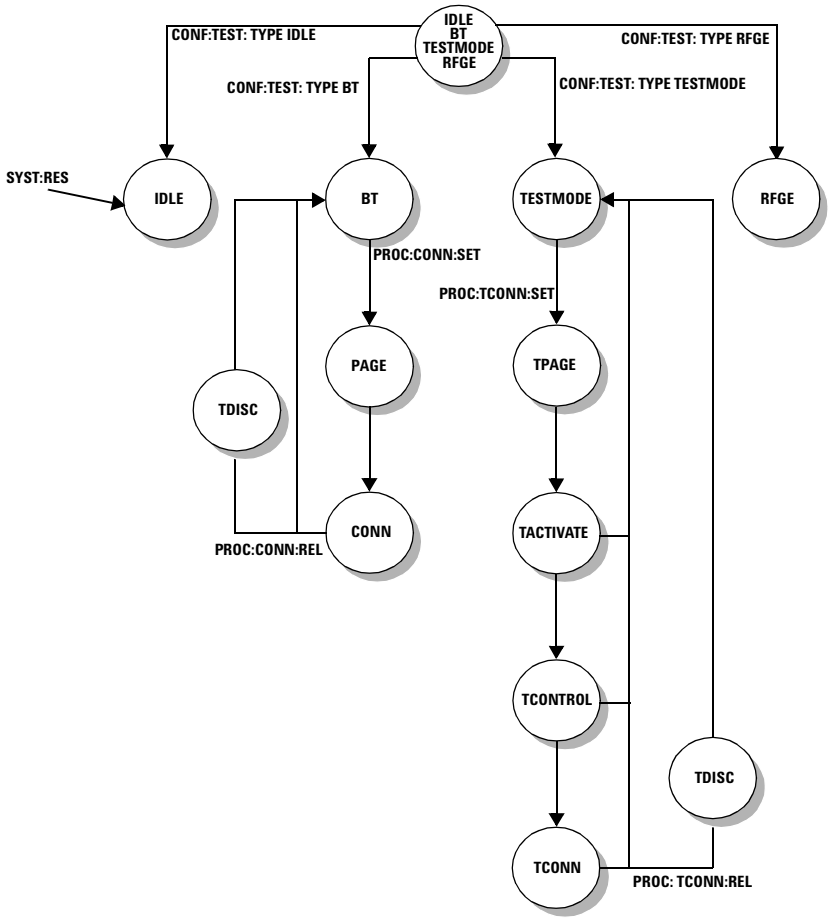


Figure 64 SCPI States

Configuring the Remote Interface

Interface selection

You can choose to control the test set remotely using either the GPIB or parallel interfaces.

Use the rear panel DIP switch to select the remote interface type. Refer to Rear Panel Connections on page 13 or the E1852B Bluetooth Test Set *Installation Guide* for more detail.

Dynamic Link Library (DLL)

The DLL is an integral part of communication with the E1852B Bluetooth Test Set. Even if you intend to only use the remote command set the User Interface and DLL software must be installed on your PC. You must send all commands to the DLL. Do not send commands directly to the parallel or GPIB ports on your PC. Refer to DLL Interface on page 109 for more information.

GPIB Address

Each device on the GPIB (IEEE-488) interface must have a unique address. The address is set on the rear panel DIP switches A1 to A5. The switches are used to set the address in binary format. A1 is the least significant bit, A5 the most. You can set the test set address to any value between 0 and 31.

Your GPIB bus controller has its own address. Avoid using the bus controller's address for any instrument on the interface bus. Controllers generally use address 21.

A specific address is not required for parallel port operation.

Factory Default

When shipped from the factory, the DIP switches are configured for address 15.

Test Mode Connection

When an active Test Mode connection is established, it is highly recommended that a `Stat:DEV?` command is sent immediately following any command that causes the test set to send a Link Management Protocol (LMP) transaction.

Continue to send `Stat:DEV?` until `TCONN` is returned indicating the connection is re-established and the system is ready to proceed.

For example:

```
WRT(CONF:PACK:TYPE DH5)
REPEAT
   WRT_RD(STAT:DEV?)
UNTIL TCONN
```

Use this method with the following commands:

```
CONF:FREQ <value>
CONF:HOP <value>
CONF:MOD <value>
CONF:PACK:LEN <value>
CONF:PACK:TYPE <value>
CONF:POLL:PER <value>
CONF:TEST:MODE <value>
CONF:WHITENING <value>
```

NOTE You must send the `Stat:DEV?` command immediately following the `CONF:MOD <value>` command otherwise the connection may not reestablish.

SCPI Command overview

Table 7 SCPI Command Summary

Command	Default value	Page
CONFigure:AUDIO_AIRCODING <value>	CVSD	129
CONFigure:AUDIO_CONNection <value>	Off	129
CONFigure:AUDIO_LOOPback <value>	Off	129
CONFigure:AUDIO_MUTE:RX <value>	Off	130
CONFigure:AUDIO_MUTE:TX <value>	Off	131
CONFigure:AVERage:BURst <value>	1	131
CONFigure:DELTA_F2_ALGorithm <value>	Peak	132
CONFigure:FREQuency <value>	0	132
CONFigure:HOP <value>	Europe	133
CONFigure:MASTer:BDADdr <value>	Last set value	134
CONFigure:MODulation <value>	BSOF	135
CONFigure:MODulation FILE <filename>	Not Applicable	136
CONFigure:PACKet:LENgth <value>	27	137
CONFigure:PACKet:TYPE <value>	DH1	138
CONFigure:POLL:PERiod <value>	6	139
CONFigure:RF:ATT:RX <value>	Off	140
CONFigure:RF:DIRTY_TX <value>	Off	141
CONFigure:RF:DIRTY_TX:OFFSet <value>	0	141
CONFigure:RF:EXT_ATT <numeric value>	0.00	142
CONFigure:RF:FILTer:BW <numeric value>	1.3	142
CONFigure:RF:FILTer:MODE <value>	Meas	143
CONFigure:RF:LEVel <numeric value>	-35.00	143
CONFigure:RF:TXMODulation:INDEX <value>	0.32	144
CONFigure:RF:TXMODulation:SCALED <value>	70	144
CONFigure:RFGEnerator:DEMODulation <mode>	CW	145
CONFigure:RFGEnerator:DEMODulation:THRESHold <value>	Auto	146
CONFigure:RFGEnerator:MODulation <value>	CW	147
CONFigure:RFGEnerator:TUNE <value>	0	148
CONFigure:SAMPLE:MODE <setting>	Auto	148
CONFigure:SLAVe:BDADdr <value>	202020202020	149
CONFigure:TESTmode:MODE <value>	Tran	149

Command	Default value	Page
CONFigure:TESTmode:STOPping <value>	On	150
CONFigure:TESTmode:TYPE <value>	Idle	150
CONFigure:TESTmode:WAIT <setting>	Off	151
CONFigure:WHITENING <setting>	On	152
FETCH:BER?	Not Applicable	153
FETCH:NACK?	Not Applicable	153
PROCedure:BER:START <numeric value>	Not Applicable	154
PROCedure:CONNection:RELease	Not Applicable	154
PROCedure:CONNection:SETup	Not Applicable	155
PROCedure:INQuiry:START <value>	Not Applicable	155
PROCedure:INQuiry:STOP	Not Applicable	156
PROCedure:NACK:START <numeric value>	Not Applicable	156
PROCedure:NTP_CHAN:INIT	Not Applicable	157
PROCedure:POWer:SETup <value>	Not Applicable	157
PROCedure:SAMPLE:FORCE	Not Applicable	158
PROCedure:TCONNection:CONTinue	Not Applicable	158
PROCedure:TCONNection:RELease	Not Applicable	159
PROCedure:TCONNection:SETup	Not Applicable	159
READ:BER?	Not Applicable	160
READ:CHAN?	Not Applicable	160
READ:DELTA_F1?	Not Applicable	161
READ:DELTA_F2?	Not Applicable	161
READ:DELTA_F1_HIgh?	Not Applicable	162
READ:DELTA_F1_LOw?	Not Applicable	162
READ:DELTA_F2_HIgh?	Not Applicable	163
READ:DELTA_F2_LOw?	Not Applicable	163
READ:DELTA_F2_F1_RATIO?	Not Applicable	164
READ:DEViation?	Not Applicable	165
READ:FEATURES?	Not Applicable	166
READ:FREQuency_COUNT?	Not Applicable	167

Command	Default value	Page
READ:FREQ:DRIFt?	Not Applicable	167
READ:FREQ:DRIFt:SPEC?	Not Applicable	168
READ:FREQ:DRIFt:SPEC:RATE?	Not Applicable	168
READ:FREQ:OFFSet?	Not Applicable	169
READ:INQuiry?	Not Applicable	169
READ:NACK?	Not Applicable	170
READ:NTP?	Not Applicable	170
READ:NTP_CHAN? <chan no.>	Not Applicable	171
READ:PSEUDO:DELTA_F1?	Not Applicable	171
READ:PSEUDO:DELTA_F2?	Not Applicable	172
READ:PTP?	Not Applicable	172
STATus:DEVice?	Not Applicable	173
SYSTem:BT:VERS<version>	1.1	174
SYSTem:COMMunication:PORT <value>	Not Applicable	175
SYSTem:ERRor?	Not Applicable	175
SYSTem:FIRMware:VERSion?	Not Applicable	176
SYSTem:PCdriver:VERSion?	Not Applicable	176
SYSTem:RESet	Not Applicable	177
SYSTem:TEST:ADC_BUF?	Not Applicable	178
SYSTem:TEST:COMM_BUF?	Not Applicable	178
SYSTem:TEST:DEViation?	Not Applicable	179
SYSTem:TEST:PoWeR?	Not Applicable	179
SYSTem:WARM_START	Not Applicable	180

Detailed Command Descriptions

The following section lists the available commands and parameters in the individual states. The commands are listed by subsystem in alphabetical order.

Default Values are the values configured when the test set is reset.

CONFigure Subsystem

CONFigure:AUDIO_AIRCODING <value>

Configure audio status

Syntax:	`CONFigure:AUDIO_AIRCODING <value>`		
Value Range:	A_LAW	sets coding format to A-Law	Default Value:
	CVSD	sets coding format to CVSD	CVSD
	MU_LAW	sets coding format to u-Law	
Applicable in State:	Set: All Query: All		
Description:	This command is used to set the audio encoding and decoding format of an Synchronous Connection Oriented (SCO) link.		
Examples:	`CONF:AUDIO_AIRCODING A_LAW`		Selects A-Law format
	`CONF:AUDIO_AIRCODING?`		Returns current setting

CONFigure:AUDIO_CONNection <value>

Configure audio status

Syntax:	`CONFigure:AUDIO_CONNection <value>`		
Value Range:	ON	Enables Audio in an SCO link	Default Value:
	OFF	Disables Audio	OFF
Applicable in State:	Set: All Query: All		
Description:	This command is used to enable or disable the use of the rear panel Audio Input and Output signal paths.		
Examples:	`CONF:AUDIO_CONN ON`		Sets audio on
	`CONF:AUDIO_CONN?`		Returns current setting

CONFigure:AUDIO_LOOPback <value>

Configure audio status

Syntax:	CONFigure:AUDIO_LOOPback <value>		
Value Range:	ON	Enables Audio loopback	Default Value:
	OFF	Disables Audio loopback	OFF
Applicable in State:	Set: All		
	Query: All		
Description:	This command is used to loop the audio signal within the testset. The signal presented to the Audio Input is encoded in the selected CODEC and passed via the Bluetooth core back to the CODEC. The recovered audio signal is presented at the Audio Output. You can use this to quantify any noise, gain, or distortion added by the test set audio path.		
Examples:	CONF:AUDIO_LOOP ON		Sets audio on
	CONF:AUDIO_LOOP?		Returns current setting

CONFigure:AUDIO_MUTE:RX <value>

Control audio in the receive direction

Syntax:	CONFigure:AUDIO_MUTE:RX <value>		
Value Range:	ON	Mutes audio in the receive direction	Default Value: OFF
	OFF	Un-mute audio in the receive direction	
Applicable in State:	Set: All		
	Query: All		
Description:	This command is used to mute or un-mute the audio signal in the receive direction.		
Examples:	CONF:AUDIO_MUTE:RX ON		Sets mute on
	CONF:AUDIO_MUTE:RX?		Returns current setting

CONFigure:AUDIO_MUTE:TX <value>

Control audio in the transmit direction

Syntax:	`CONFigure:AUDIO_MUTE:TX <value>`		
Value Range:	`ON`	Mutes audio in the receive direction	Default Value: `OFF`
	`OFF`	Un-mute audio in the receive direction	
Applicable in State:	Set: All Query: All		
Description:	This command is used to mute or un-mute the audio signal in the transmit direction.		
Examples:	`CONF:AUDIO_MUTE:TX OFF`		Sets mute off
	`CONF:AUDIO_MUTE:TX?`		Returns current setting

CONFigure:AVERage:BURst <value>

Number of bursts used for Measurements

Syntax:	`CONFigure:AVERage:BURst <value>`		
Value Range:	`1 to 200`	Number of bursts	Default Value: `1`
Applicable in State:	Set: All Query: All		
Description:	This command is used to configure the number of bursts used for averaging when measuring NTP, PTP, Freq.Offset, Freq.Drift and Deviation. A higher number gives more stable and precise measurements but also increases the duration of the measurements.		
Examples:	`CONF:AVER:BUR 10`		Sets loopback test mode
	`CONF:AVER:BUR?`		Returns current setting

CONFigure:DELTA_F2_ALGorithm <value>

Delta F2 measurement algorithm selection

Syntax:	`CONFigure:DELTA_F2_ALGorithm <value>`		
Value Range:	SPEC	Selects 'SPEC' algorithm	Default Value:
	PEAK	Selects 'PEAK' algorithm	`Peak`
Applicable in State:	Set: RFGE, TESTMODE		
	Query: RFGE, TESTMODE, TCONN		
Description:	This command is used to change the algorithm for the DeltaF2max measurement. Refer to Delta F2 Average Measurement (avg, deltaF2 max) on page 74 for more detailed information		
Examples:	`CONF:DELTA_F2_ALG SPEC`		Selects the 'Spec' algorithm
	`CONF:DELTA_F2_ALG?`		Queries current value

CONFigure:FREQuency <value>

Single Frequency Selection

Syntax:	`CONFigure:FREQuency <value>`		
Value Range:	0 to 78	0 = 2402 MHz	Default Value:
			`0`
Applicable in State:	Set: RFGE, TESTMODE		
	Query: RFGE, TESTMODE, TCONN		
Description:	This command configures the channel used when the test set is configured as RF Generator, or when the Hop Mode is set to single frequency in Testmode. **Note:** It is highly recommended that you send Stat:DEV? immediately following this command until TCONN is returned to indicate the connection is re-established and the system is ready to proceed.		
Examples:	`CONF:FREQ 50`		Sets channel 50
	`CONF:FREQ?`		Returns current setting

CONFigure:HOP <value>

Hop Mode selection

Syntax:	`CONFigure:HOP <value>`		
Value Range:	`Europe`	Switches hopping on	Default Value:
	`Single`	Switches hopping off	`Europe`
Applicable in State:	Set: All Query: All		
Description:	This command configures the Hop Mode used in Testmode. **Note:** It is highly recommended that you send Stat:DEV? immediately following this command until TCONN is returned to indicate the connection is re-established and the system is ready to proceed.		
Examples:	`CONF:HOP EUROPE`		Sets Hopping on
	`CONF:HOP?`		Returns current setting

CONFigure:MASTer:BDADdr <value>

Master Bluetooth Device Address (test set)

Syntax:	`CONFigure:MASTer:BDADdr <value>`	
Value Range:	12 digits in hex format	Default Value: Last set value
Applicable in State:	Set: All except CONN, and TCONN Query: All	
Description:	This command configures the Bluetooth Device Address of the test set Note: This command must be followed by a SYST:WARMSTART to take effect.	
Examples:	`CONF:MAST:BDAD AEC3DD56310F`	Sets address
	`CONF:MAST:BDAD?`	Returns current setting

CONFigure:MODulation <value>

Modulation Scheme Test Mode

Syntax:	`CONFigure:MODulation <value>`		
Value Range:	BS55	Bit sequence 01010101 (=55 hex)	Default Value:
	BS0F	Bit sequence 00001111 (=0F hex)	BS0F
	ONE	Constant 1	
	20-character Hexadecimal string	User defined data payload.	
	SPSR	Pseudo-random bit pattern	
	ZERO	Constant 0	
Applicable in State:	Set: All Query: All		
Description:	This command configures the modulation used in Testmode and Transmitter test. Note, when Loopback is selected, SPSR modulation is always selected. To use `Payload`, first select Loopback Testmode and whitening off by sending `CONF:TEST:MODE LOOP` and `CONF:WHITENING OFF` (in that order).		
Examples:	`CONF:MOD SPSR`		Selects pseudo-random bit pattern
	`CONF:MOD A78D782D99FF930289E3`		Sends Hex data
	`CONF:MOD?`		Returns current setting

NOTE You must send the `Stat:DEV?` command immediately following this command otherwise the connection may not re-establish. Also, all payloads are checked following LMP changes. A valid payload and testmode connection are indicated when `Stat:DEV?` returns `TCONN.`

CONFigure:MODulation FILE <filename>

Specify the payload data file name.

Syntax:	`CONFigure:MODulation FILE <filename>`	
Value Range:	File contains 12 digits in hex format	Default Value: `N/A`
Applicable in State:	Set: All Query: All	
Description:	The data in the Transmitter payload buffer is overwritten with the contents of the file. If the selected packet length is greater than the number of data bytes in the file, the data is repeated to fill the packet. If the selected packet length is less, the surplus data is discarded.	
Examples:	`CONF:MOD FILE MYMOD.TXT`	Places the contents of the file "mymod.txt" in the TX buffer
	`CONF:MOD FILE C:\SETTINGS\MOD.TXT`	Specifies the pathname of the file to be used
	`CONF:MOD?`	Returns current filename

CONFigure:PACKet:LENgth <value>

Packet Length selection

Syntax:	`CONFigure:PACKet:LENgth <value>`		
Value Range:	`1 to 339`	Restrictions: AUX1: 1 to 29 bytes DH1: 1 to 27 bytes DH3: 1 to 183 bytes DH5: 1 to 339 bytes HV3: 30 bytes	Default Value: `27`
Applicable in State:	Set: All Query: ALL		
Description:	This command configures the length of the packet sent when in test mode. The command is only applicable when using ACL packet mode. If the specified value is outside the restrictions, the value used is limited to a valid value and the ErrorCode is set to -221, settings conflict. **Note:** It is highly recommended that you send Stat:DEV? immediately following this command until TCONN is returned to indicate the connection is re-established and the system is ready to proceed.		
Examples:	`CONF:PACK:LEN 20`		Sets a 20 byte packet
	`CONF:PACK:LEN?`		Returns current setting

CONFigure:PACKet:TYPE <value>

Packet Type selection

Syntax:	`CONFigure:PACKet:TYPE <value>`		
Value Range:	AUX1		Default Value:
	DH1	single width TX packet	DH1
	DH3		
	DH5		
	HV3		
Applicable in State:	Set: All		
	Query: All		
Description:	This command configures the type of packet used in test mode.		
	Note: It is highly recommended that you send Stat:DEV? immediately following this command until TCONN is returned to indicate the connection is re-established and the system is ready to proceed.		
Examples:	`CONF:PACK:TYPE DH1`		Configures a DH1 packet
	`CONF:PACK:TYPE?`		Returns current setting

CONFigure:POLL:PERiod <value>

Poll Period (Transmitter Test Modes)

Syntax:	`CONFigure:POLL:PERiod <value>`		
Value Range:	`1 to 255`	Poll period [1.25 ms]	Default Value: 6
Applicable in State:	Set: All Query: All		
Description:	This command configures how often the DUT is polled by the test set in order to transmit a packet. The poll period is only used when running transmitter test, in Testmode. **Note:** It is highly recommended that you send Stat:DEV? immediately following this command until TCONN is returned to indicate the connection is re-established and the system is ready to proceed.		
Examples:	`CONF:POLL:PER 10`		Sets Poll period to 10 (12.5 ms)
	`CONF:POLL:PER?`		Returns current setting

CONFigure:RF:ATT:RX <value>

Control RF attenuator in the receive direction

Syntax:	`CONFigure:RF:ATT:RX <value>`		
Value Range:	ON	Receive path Attenuation (25 dB)	Default Value: OFF
	OFF	Zero path attenuation.	
Applicable in State:	Set: All Query: All		
Description:	Use this command to add attenuation in the receive signal path by turning the 25 dB attenuator on. Sending the switch 'OFF' sets the attenuation to 0 dB. Note: 0dB attenuation increases the input impedance of test set.		
Examples:	`CONF:RF:ATT:RX ON`		Places 25 dB attenuation in the receive signal path
	`CONF:RF:ATT:RX?`		Returns current setting

NOTE Switch the RX attenuator on (`CONF:RF:ATT:RX ON`) when testing Class I devices to ensure the E1852B Bluetooth Test Set receiver operates within its linear range.

Switch the attenuator off (`CONF:RF:ATT:RX OFF`) for Class II and Class III devices.

CONFigure:RF:DIRTY_TX <value>

Set Impairments

Syntax:	`CONFigure:RF:DIRTY_TX <value>`		
Value Range:	ON	Enable dirty transmitter mode	Default Value:
	OFF	Disable dirty transmitter.	OFF
Applicable in State:	Set: All Query: All		
Description:	Use this command to add the dirty transmitter impairments `RF:DIRTY_TX:OFFSet` and `RF:TXMODulation:INDEX` to the transmitted signal.		
Examples:	`CONF:RF:ATT:DIRTY_TX ON`		Switches dirty transmitter mode on
	`CONF:RF:ATT:DIRTY_TX?`		Returns current setting

CONFigure:RF:DIRTY_TX:OFFSet <value>

Control

Syntax:	`CONFigure:RF:DIRTY_TX:OFFSet <value>`		
Value Range:	`-75 to 75`	[kHZ]	Default Value: `0`
Applicable in State:	Set: All Query: All		
Description:	Use this command to specify the dirty transmitter frequency offset impairment. The offset is disabled when the `RF:DIRTY_TX <value>` is set to OFF.		
Examples:	`CONF:RF:ATT:DIRTY_TX:OFFS 50`		Sets a 50 kHz offset
	`CONF:RF:ATT:DIRTY_TX:OFFS?`		Returns current setting

CONFigure:RF:EXT_ATT <numeric value>

External RF attenuation compensation

Syntax:	`CONFigure:RF:EXT_ATT <numeric value>`		
Value Range:	`1 to 100`	[dB]	Default Value: `0.00`
Applicable in State:	Set: All Query: All		
Description:	This command states the amount of attenuation, caused by cable and connectors, applied to the RF signal between the test set and the DUT. The test set compensates for this attenuation in the measurement results.		
Examples:	`CONF:RF:EXT_ATT 0.2`		Sets 0.2 dB
	`CONF:RF:EXT_ATT?`		Returns current setting

CONFigure:RF:FILTer:BW <numeric value>

Select the RF filter bandwidth

Syntax:	`CONF:RF:FILTer:BW <numeric value>`		
Value Range:	`1.3 and 2.5`	[MHz]	Default Value: `1.3`
Applicable in State:	Set: All Query: All		
Description:	This command configures the RF filter bandwidth to either 1.3 MHz or 2.5 MHz. When the 1.3 MHz filter is selected, post filter processing is applied to the selected samples.		
Examples:	`CONF:RF:FILT:BW 2.5`		Sets 2.5 MHz filter bandwidth
	`CONF:RF:FILT:BW?`		Queries current value

CONFigure:RF:FILTer:MODE <value>

Select the RF filter bandwidth

Syntax:	`CONF:RF:FILTer:BW <numeric value>`	
Value Range:	`FULL, MEAS`	Default Value: MEAS
Applicable in State:	Set: All Query: All	
Description:	This command is only applicable when the `FILTer` bandwidth is set to `1.3` MHz. When set to `Full`, all the read functions use the filtered data. Using the MEAS only applies the filtering to the measurement samples and consequently speeds up the measurement graph displays.	
Examples:	`CONF:RF:FILT:MODE FULL`	Sets `FULL` mode
	`CONF:RF:FILT:MODE?`	Queries current value

CONFigure:RF:LEVel <numeric value>

RF output level of the test set

Syntax:	`CONFigure:RF:LEVel <numeric value>`		
Value Range:	-85 to 0	sets test set RF output [dBm]	Default Value: `–35.00 dBm`
Applicable in State:	Set: All Query: All		
Description:	This command configures the output power of the test set. When used in the RF Generator mode, (RFGE) it is necessary to wait approximately 200ms. before the new output level is valid.		
Examples:	`CONF:RF:LEV –60`		Sets RF level to –60 dBm
	`CONF:RF:LEV?`		Returns current setting

CONFigure:RF:TXMODulation:INDEX <value>

Transmitter modulation deviation

Syntax:	`CONFigure:RF:TXMODulation:INDEX <value>`		
Value Range:	0.28 to 0.35	Steps of 0.01	Default Value: 0.32
Applicable in State:	Set: All Query: All		
Description:	This command configures the modulation deviation. One step (of 0.01) results in a change in deviation of 5 kHz. In the Bluetooth RF test specification, modulation indices of 0.28 to 0.35 are used.		

Modulation Index	Deviation
0.29	145 kHz
0.31	155 kHz
0.35	175 kHz

Examples:	`CONF:RF:TXMOD:INDEX 0.28`	Sets 140 kHz modulation deviation
	`CONF:RF:TXMOD:INDEX?`	Returns current setting

CONFigure:RF:TXMODulation:SCALED <value>

Transmitter modulation deviation

Syntax:	`CONFigure:RF:TXMODulation:SCALED <numeric value>`		
Value Range:	51 to 100	[%]	Default Value: 70 (%)
Applicable in State:	Set: All Query: All		
Description:	This command configures the modulation deviation in 1% steps from 51 to 100%. One step corresponds to approximately 1.5 kHz.		

Examples:	`CONF:RF:TXMOD:SCALED 100`	Sets 100% modulation depth
	`CONF:RF:TXMOD:SCALED?`	Returns current setting

CONFigure:RFGEnerator:DEMODulation <mode>

RF Demodulator Mode

Syntax:	`CONF:RFGEnerator:DEMODulation <mode>`		
Value Range:	CW	CW mode	Default Value:
	BURST	Demodulation looks for Bluetooth burst	CW
Applicable in State:	Set: All Query: All		
Description:	This command specifies the demodulation mode. When CW is selected, simple Freq.Offset, NTP and Deviation measurements can be made. No synchronization to the signal is attempted. When Burst is selected, the standard test mode measurement can be made. (Frequency Offset, Delta F1, Delta F2, Freq.Drift) These measurements attempt to lock to the applied Bluetooth signal by searching for the power envelope and the P0 Bit. The various measurements use the normal parameters used for test mode (for example, packet length). See also the command: CONF:RFGE:DEMOD:THRESH.		
Examples:	`CONF:RFGE:DEMOD BURST`		Sets Burst Mode
	`CONF:RFGE:DEMOD?`		Returns current setting

CONFigure:RFGEnerator:DEMODulation:THRESHold <value>

RF Demodulator Power Threshold

Syntax:	CONF:RFGEnerator:DEMODulation:THRESHold <value>		
Value Range:	-100 to 100	Threshold value for the power envelope of the Bluetooth burst [dBm].	Default Value: Auto
	AUTO	Automatic search for max peak.	
Applicable in State:	Set: All Query: All		
Description:	This command specifies the threshold value for the power envelope of the Bluetooth burst when using the 'burst' demodulator mode. Hence this is the value used when the measurement attempts to find the power envelope of the applied Bluetooth signal. See also the command: CONF:RFGE:DEMOD:THRESH.		
Examples:	CONF:RFGE:DEMOD:THRESH 20		Sets 20 dBm threshold value
	CONF:RFGE:DEMOD:THRESH?		Returns current setting

CONFigure:RFGEnerator:MODulation <value>

Modulation Scheme for RF Generator

Syntax:	`CONFigure:RFGEnerator:MODulation <value>`		
Value Range:	`BS33`	Bit sequence 00110011 (=33 hex)	Default Value:
	`BS55`	Bit sequence 01010101 (=55 hex)	`CW`
	`BS0F`	Bit sequence 00001111 (=0F hex)	
	`BURST`	Special test burst	
	`CW`	Constant Wave (no modulation)	
	`DH1_BS55`	DH1 packet with payload BS55	
	`DH1_BS33`	DH1 packet with payload BS33	
	`DH1_BS0F`	DH1 packet with payload BS0F	
Applicable in State:	Set: All		
	Query: All		
Description:	This command configures the type of modulation used in RF Generator mode.		
Examples:	`CONF:RFGE:MOD CW`		Sets CW Modulation
	`CONF:RFGE:MOD?`		Returns current setting

CONFigure:RFGEnerator:TUNE <value>

RF Generator Tuning Frequency

Syntax:	CONF:RFGEnerator:TUNE <value>		
Value Range:	-3	Offset = –300KHz	Default Value:
	-2	Offset = –200KHz	0
	-1	Offset = –100KHz	
	0	Offset = 0KHz	
	1	Offset = 100KHz	
	2	Offset = 200KHz	
	3	Offset = 300KHz	
Applicable in State:	Set: All Query: Not Applicable		
Description:	This command enables fine tuning of the RF Generator frequency, with the specified offset. Only used for special purposes.		
Example:	CONF:RFGE:TUNE –2		Sets a –200 kHz offset

CONFigure:SAMPLE:MODE <setting>

Slave Bluetooth Device Address (DUT)

Syntax:	CONFigure:SAMPLE:MODE <setting>		
Value Range:	AUTO	Sampling handled automatically	Default Value:
	CTRL		AUTO
Applicable in State:	Set: All Query: All		
Description:	This command configures the sampling mode of the test set. When AUTO is selected sampling is occurs when a new measurement is requested. When CTRL is selected, sampling only occurs when triggered by the PROC:SAMPLE:FORCE command.		
Examples:	CONF:SAMPLE:MODE CTRL		Sets triggered mode
	CONF:SAMPLE:MODE?		Returns current setting

CONFigure:SLAVe:BDADdr <value>

Slave Bluetooth Device Address (DUT)

Syntax:	`CONFigure:SLAVe:BDADdr <value>`	
Value Range:	12 digits in hex format	Default Value: `202020202020`
Applicable in State:	Set: All except CONN, and TCONN Query: All	
Description:	This command configures the DUT address in the test set	
Examples:	`CONF:SLAV:BDAD AFC2DE56312F`	Sets address
	`CONF:SLAV:BDAD?`	Returns current setting

CONFigure:TESTmode:MODE <value>

Testmode Mode selection

Syntax:	`CONFigure:TESTmode:MODE <value>`		
Value Range:	`LOOPback`	Loopback test mode	Default Value:
	`TRANsmit`	Transmitter test mode	TRAN
Applicable in State:	Set: All Query: All		
Description:	This command configures either transmitter or loopback test mode operation of the test set and DUT. **Note:** It is highly recommended that you send Stat:DEV? immediately following this command until TCONN is returned to indicate the connection is re-established and the system is ready to proceed.		
Examples:	`CONF:TEST:MODE LOOP`		Sets loopback test mode
	`CONF:TEST:MODE?`		Returns current setting

CONFigure:TESTmode:STOPping <value>

Test mode selection

Syntax:	`CONFigure:TESTmode:STOPping <value>`		
Value Range:	ON	Stopping enabled	Default Value:
	OFF	No stopping enabled	ON
Applicable in State:	Set: All		
	Query: All		
Description:	Not all DUT types respond to an LMP command from the test set in the same way. Some types require Poll packets to be sent		
Examples:	`CONF:TEST:STOP OFF`		Disables stopping
	`CONF:TEST:STOP?`		Queries current value

CONFigure:TESTmode:TYPE <value>

Enable counter or Bluetooth testing

Syntax:	`CONFigure:TESTmode:TYPE <value>`		
Value Range:	BT	Bluetooth Normal mode	Default Value:
	IDLE	Disabled	Idle
	RFGE	RF generator	
	TESTMODE	Bluetooth Test mode	
Applicable in State:	Set: IDLE, RFGE, TESTMODE, BT		
	Query: All		
Description:	This command configures the required testing mode.		
Examples:	`CONF:TEST:TYPE BT`		Sets Normal Mode
	`CONF:TEST:TYPE?`		Returns current setting

CONFigure:TESTmode:WAIT <setting>

Testmode - wait in Setup

Syntax:	`CONFigure:TESTmode:WAIT <setting>`		
Value Range:	ON	Wait enabled	Default Value:
	OFF	Wait disabled	OFF
Applicable in State:	Set: All Query: All		
Description:	This command sets the test set to wait in test mode before sending the test activate message to the DUT. This is required by some DUTs. With wait enabled the test set makes a normal connection to the DUT when PROC:TCONN:SET is sent but waits for the PROC:TCONN:CONT message. When this is sent the test set sends the test activate message and the test control message to the DUT		
Examples:	`CONF:TEST:WAIT ON`		Sets Wait On
	`CONF:TEST:WAIT?`		Returns current setting

CONFigure:WHITENING <setting>

Enable and disable data whitening

Syntax:	`CONFigure:WHITENING <setting>`		
Value Range:	ON	Whitening enabled	Default Value:
	OFF	Whitening disabled	ON
Applicable in State:	Set: All Query: All		
Description:	Data whitening is a scrambling process applied to both the header and data. Data whitening is applied to minimize DC bias in the packet. **Note:** It is highly recommended that you send Stat:DEV? immediately following this command until TCONN is returned to indicate the connection is re-established and the system is ready to proceed.		
Examples:	`CONF:WHITENING ON`		Sets Whitening On
	`CONF:WHITENING?`		Returns current setting

FETCH Subsystem

FETCH:BER?

Query Bit Error Rate continuously

Syntax:	FETCH:BER?		
Value Range:	<value>	Number of bits transferred	Default Value:
	<value>	Number of erroneous bits detected	Not Applicable
	<value>	BER [%]	
Applicable in State:	Query: TCONN		
Description:	This query is used to continuously measure the Bit Error values of the DUT. The data is returned prior to the completion of the measurement and so is only an indication of the BER. Note that this is only applicable in loopback test mode.		
Example:	FETCH:BER?		

FETCH:NACK?

Query NACK Count continuously (Packet Error Rate)

Syntax:	FETCH:NACK?		
Value Range:	<value>	Number of packets transmitted	Default Value:
	<value>	Number of erroneous packets detected	Not Applicable
	<value>	NACK count [%]	
Applicable in State:	Query: CONN, TCONN		
Description:	This query is used to continuously measure the Packet Error Rate values of the DUT. The data is returned prior to the completion of the measurement and so is only an indication of the BER. Use the READ:NACK? command for the true measurement.		
Example:	FETCH:NACK?		

PROCedure Subsystem

PROCedure:BER:START <numeric value>

Start Bit Error Rate measurement

Syntax:	`PROCedure:BER:START <numeric value>`		
Value Range:	1 to 1.6E6	Number of bits used for the BER measurement	Default Value: Not Applicable
Applicable in State:	Set: TCONN Query: Not Applicable		
Description:	This command is used to start the Bit Error Rate (BER) measurement of the DUT. This command erases all previous BER data and starts a new measurement. Hence this command should be used when a parameter is changed during a BER test. Note that this is only applicable when in Loopback mode.		
Example:	`PROC:BER:START 1000`		Sets a value of 1000 bits for the measurement.

PROCedure:CONNection:RELease

Release Normal Connection

Syntax:	`PROCedure:CONNection:RELease`	
Value Range:	Not applicable	Default Value: Not Applicable
Applicable in State:	Set: CONN Query: Not Applicable	
Description:	This command closes (releases) the connection with the DUT. If there is no connection established, error code -221, “Settings Conflict” is returned.	
Example:	`PROC:CONN:REL`	Closes the connection

PROCedure:CONNection:SETup

Setup Normal Connection

Syntax:	`PROCedure:CONNection:SETup`		
Value Range:	Not applicable	Check with STAT:DEV to confirm connection established	Default Value: Not Applicable
Applicable in State:	Set: BT Query: Not Applicable		
Description:	This command initiates a normal Bluetooth connection (Page) with the DUT. If a connection is already established, error code -221, "Settings Conflict" is returned.		
Example:	`PROC:CONN:SET`		Initiates a connection attempt

PROCedure:INQuiry:START <value>

Scans for Bluetooth devices

Syntax:	`PROCedure:INQuiry:START <value>`		
Value Range:	1 to 48	Number of inquiry periods of 1.28 seconds	Default Value: Not Applicable
Applicable in State:	Set: IDLE, BT, TESTMODE Query: IDLE, BT, TESTMODE		
Description:	This command initiates an inquiry to find any Bluetooth devices in the vicinity of the test set.		
Example:	`PROC:INQ:START 20`		Initiates a scan for 20 inquiry periods

PROCedure:INQuiry:STOP

Halt the current inquiry scan

Syntax:	`PROCedure:INQuiry:STOP`	
Value Range:	Not Applicable	Default Value: Not Applicable
Applicable in State:	Set: IDLE, BT, TESTMODE Query: Not Applicable	
Description:	This command halts the current inquiry to find any Bluetooth devices in the vicinity of the test set.	
Example:	`PROC:INQ:STOP`	Halts the inquiry scan

PROCedure:NACK:START <numeric value>

Start NACK Count (Packet Error Rate)

Syntax:	`PROCedure:NACK:START <numeric value>`		
Value Range:	1 to 1.6E6	Number of packets used for calculating the NACK count	Default Value: Not Applicable
Applicable in State:	Set: CONN, TCONN Query: Not Applicable		
Description:	This command is used to start an unacknowledged (NACK) count measurement. A NACK measurement can be used as an alternative to the BER measurement. The NACK measurement can be made in Normal mode, whereas you can only make a BER measurement in Testmode. All unacknowledged packets are counted and compared the total number of packets sent.		
Example:	`PROC:NACK:START 1000`		Sets a value of 1000 packets

NOTE This command erases all previous NACK data and starts a new measurement. This command should hence be used when different parameters are configured during a NACK test.

PROCedure:NTP_CHAN:INIT

Reset the Normally Transmitted Power measurement

Syntax:	`PROCedure:NTP_CHAN:INIT`		
Value Range:	Not Applicable		Default Value: Not Applicable
Applicable in State:	Set: CONN, TCONN Query: Not Applicable		
Description:	This command is used to reset the Normally Transmitted Power (NTP) measurement over the 79 channels. Using this command allows you to change coupling losses or attenuators whilst maintaining a connection to the DUT.		
Example:	`PROC:NTP_CHAN:INIT`		Reset the NTP measurement

PROCedure:POWer:SETup <value>

DUT power level control

Syntax:	`PROCedure:POWer:SETup <value>`		
Value Range:	`INCR` `DECR`	Increase power one step Decrease power one step	Default Value: Not Applicable
Applicable in State:	Set: CONN, TCONN Query: Not Applicable		
Description:	This command is used to control the output power of the DUT. (This is only applicable if the DUT supports power control.)		
Example:	`PROC:POW:SET INCR`		Increments the DUT power level

PROCedure:SAMPLE:FORCE

Force ADC sampling

Syntax:	PROCedure:SAMPLE:FORCE	
Value Range:	Not applicable	Default Value: Not Applicable
Applicable in State:	Set: RFGEN, CONN, TCONN Query: Not Applicable	
Description:	This command is used as the trigger to initiate a new ADC sample when CONF:SAMPLE:MODE is set to CTRL.	
Example:	PROC:SAMPLE:FORCE	Triggers a new ADC sample

PROCedure:TCONNection:CONTinue

Continue the Testmode connection setup

Syntax:	PROCedure:TCONNection:CONTinue		
Value Range:	Not applicable	Check with STAT:DEV? if connection was established	Default Value: Not Applicable
Applicable in State:	Set: TACTIVATE Query: Not Applicable		
Description:	This command continues the setup sequence of a Testmode connection to the DUT. See also the CONF:TEST:WAIT command		
Example:	PROC:TCONN:CONT		Continue to make the connection

PROCedure:TCONNection:RELease

Release the Bluetooth test mode connection

Syntax:	PROCedure:TCONNection:RELease	
Value Range:	Not applicable	Default Value: Not Applicable
Applicable in State:	Set: TCONN, TACTIVATE, TCONTROL Query: Not Applicable	
Description:	This command closes a Testmode connection with DUT. If there is no connection established, error code -221, "Settings Conflict" is returned.	
Example:	PROC:TCONN:REL	Releases the connection

PROCedure:TCONNection:SETup

Setup a Bluetooth test mode connection

Syntax:	PROCedure:TCONNection:SETup		
Value Range:	Not applicable	Check with STAT:DEV if connection is made	Default Value: Not Applicable
Applicable in State:	Set: TESTMODE Query: Not Applicable		
Description:	This command initiates a Testmode connection with DUT. If there is a connection already established, error code -221, "Settings Conflict" is returned.		
Example:	PROC:TCONN:SET		Opens the connection

NOTE The test set checks all relevant test mode settings prior to the setup. If the settings are inconsistent, the ErrorCode is set to -221: 'Settings conflict'.

READ Subsystem

READ:BER?

Read back the Bit Error Rate

Syntax:	READ : BER?		
Value Range:	<value>	BER [%] "NAN" is returned when the measurement is incomplete	Default Value: Not Applicable
Applicable in State:	Query: TCONN		
Description:	This query is used to measure the Bit Error Rate (BER) of the DUT. The measurement is calculated using the specified quantity of bits. The BER measurement may take a long time, depending on the number of bits used (set by the PROC : BER : START command). Therefore your application must poll the test set for a measurement result. When the response is different from Not A Number (NAN), the required number of bits has been transmitted and the measurement is complete.Use the FETCH : BER command if a continuous response is required. Note that this is only applicable in Loopback mode.		
Example:	READ : BER?		

READ:CHAN?

Read back the channel number of the burst

Syntax:	READ : CHAN?		
Value Range:	<value>	Channel Number	Default Value: Not Applicable
Applicable in State:	Query: CONN, TCONN		
Description:	This query is used to read back the channel number of the sampled burst		
Example:	READ : CHAN?		

READ:DELTA_F1?

Query Delta F1 Average (Modulation Characteristics)

Syntax:	READ : DELTA_F1?		
Value Range:	<value>	Deviation [kHz]	Default Value: Not Applicable
Applicable in State:	Query: TCONN, RFGE		
Description:	This query measures the Delta F1 average value of the DUT according to the RF test specifications (Bluetooth Test specification ver. 0.9, chap. 5.1.9). Initial conditions for this command are: Hopping is off Modulation must be BS0F		
Example:	READ : DELTA_F1?		

READ:DELTA_F2?

Query Delta F2 Average (Modulation Characteristics)

Syntax:	READ : DELTA_F2?		
Value Range:	<value>	Deviation [kHz]	Default Value: Not Applicable
Applicable in State:	Query: TCONN, RFGE		
Description:	This query measures the Delta F2 average value of the DUT according to the RF test specifications (Bluetooth Test specification ver. 0.9, chap. 5.1.9). Initial conditions for this command are: Hopping is off Modulation must be BS55 Packet length must be >2		
Example:	READ : DELTA_F2?		

READ:DELTA_F1_HIgh?

Query Delta F1 Max High (Modulation Characteristics)

Syntax:	READ:DELTA_F1_HIgh?		
Value Range:	<value>	Deviation [kHz]	Default Value: Not Applicable
Applicable in State:	Query: TCONN, RFGE		
Description:	This query measures the highest Delta F1 value of the current Delta F1 measurement. Note: READ:DELTA_F1? must be issued prior to this query		
Example:	READ:DELTA_F1_HI?		

READ:DELTA_F1_LOw?

Query Delta F1 Max Low (Modulation Characteristics)

Syntax:	READ:DELTA_F1_LOw?		
Value Range:	<value>	Deviation [kHz]	Default Value: Not Applicable
Applicable in State:	Query: TCONN, RFGE		
Description:	This query measures the lowest Delta F1 value of the current Delta F1 measurement. Note: READ:DELTA_F1? must be issued prior to this query		
Example:	READ:DELTA_F1_LO?		

READ:DELTA_F2_HIgh?

Query Delta F2 Max High (Modulation Characteristics)

Syntax:	READ:DELTA_F2_HIgh?		
Value Range:	<value>	Deviation [kHz]	Default Value: Not Applicable
Applicable in State:	Query: TCONN, RFGE		
Description:	This query measures the highest Delta F2 value of the current Delta F2 measurement. Note: READ:DELTA_F2? must be issued prior to this query		
Example:	READ:DELTA_F2_HI?		

READ:DELTA_F2_LOw?

Query Delta F2 Max Low (Modulation Characteristics)

Syntax:	READ:DELTA_F2_LOw?		
Value Range:	<value>	Deviation [kHz]	Default Value: Not Applicable
Applicable in State:	Query: TCONN, RFGE		
Description:	This query measures the lowest Delta F2 value of the current Delta F2 measurement. Note: READ:DELTA_F2? must be issued prior to this query		
Example:	READ:DELTA_F2_LO?		

READ:DELTA_F2_F1_RATIO?

Query Delta F2 average versus Delta F1 average ratio

Syntax:	READ:DELTA_F2_F1_RATIO?	
Value Range:	<value>	Default Value: Not Applicable
Applicable in State:	Query: TCONN, RFGE	
Description:	This query is used to retrieve the current ratio between the Delta F2 average and the Delta F1 average, as specified in the Bluetooth Test Specification version 0.9, chapter 5.1.9. The most recent values of Delta F1 and Delta F2 averages are used in the calculation (the last results from the queries READ:DELTA_F2? and READ:DELTA F1? For a valid result both BS55 and BS0F modulation must be applied in test mode	
Example:	READ:DELTA_F2_F1 RATIO?	

READ:DEViation?

Query frequency deviation of the DUT

Syntax:	READ:DEViation?		
Value Range:	<value>	Deviation [kHz]	Default Value: Not Applicable
Applicable in State:	Query: CONN, TCONN		
Description:	This query measures the frequency deviation of the DUT.		
Example:	READ:DEV?		

READ:FEATURES?

Query DUT Features

Syntax:	READ : FEATURES?		
Value Range:	<F0 F1 F2 F3 F4 F5 F6 F7>	8 feature bytes, byte 0 to byte 7.	Default Value: Not Applicable
Applicable in State:	Query: CONN, TCONN		
Description:	This command is used to read back the features of the DUT. Response: F0 F1 F2 F3 F4 F5 F6 F7 where F0 is byte 0.		
	Byte 0 Bit	0: 3-slot packets	
		1: 5-slot packets	
		2: encryption	
		3: slot offset	
		4: timing accuracy	
		5: switch	
		6: hold mode	
		7: sniff mode	
	Byte 1 Bit	0: park mode	
		1: RSSI	
		2: channel quality driven data rate	
		3: SCO link	
		4: HV2 packets	
		5: HV3 packets	
		6: ulaw log	
		7: Alaw log	
	Byte 0 Bit	0: CVSD	
		1: paging scheme	
		2: power control	
		3: transparent SCO data	
		4: flow control lag (bit0)	
		5: flow control lag (bit1)	
		6: flow control lag (bit2)	
Example:	READ : FEATURES?		

READ:FREQuency_COUNT?

Query Frequency Count

Syntax:	READ:FREQuency_COUNT?		
Value Range:	<value>	Frequency [Hz]	Default Value: Not Applicable
Applicable in State:	Query: TCONN, RFGE		
Description:	This query is used to measure frequency of the signal applied to the frequency counter input connector (COUNT IN). This feature is in particular designed for easy measurement of the DUT crystal frequency.		
Example:	READ:FREQuency_COUNT?		

READ:FREQ:DRIFt?

Query Frequency Drift

Syntax:	READ:FREQ:DRIFt?		
Value Range:	<value>	Frequency drift [Hz/s]	Default Value: Not Applicable
Applicable in State:	Query: CONN, TCONN, RFGE		
Description:	This query is used to give an indication of the carrier frequency drift of the DUT. The measurement uses the Preamble and the Trailer part of the burst. This measurement can be used in normal mode. If you can operate the DUT in test mode, use the READ:FREQ:DRIF:SPEC command instead.		
Example:	READ:FREQ:DRIF?		

READ:FREQ:DRIFt:SPEC?

Query Frequency Drift Specification

Syntax:	READ:FREQ:DRIFt:SPEC?		
Value Range:	<value>	Frequency drift [kHz]	Default Value: Not Applicable
Applicable in State:	Query: TCONN, RFGE		
Description:	This query is used to measure the carrier frequency drift of the DUT according to the RF test specifications (Bluetooth Test specification ver. 0.9, chap.5.1.11). Initial conditions for this command are: PacketType must be DH1/DH3/DH5 Modulation must be BS55 Packet length must be > 2		
Example:	READ:FREQ:DRIF:SPEC?		

READ:FREQ:DRIFt:SPEC:RATE?

Query Frequency Drift Specification Rate

Syntax:	READ:FREQ:DRIFt:SPEC:RATE?		
Value Range:	<value>	Frequency drift [kHz/50µs]	Default Value: Not Applicable
Applicable in State:	Query: TCONN, RFGE		
Description:	This query is used to measure the carrier frequency drift rate of the DUT according to the RF test specifications (Bluetooth Test specification ver. 0.9, chap.5.1.11). Note: the READ:FREQ:DRIF:SPEC? query must be issued before this query.		
Example:	READ:FREQ:DRIF:SPEC:RATE?		

READ:FREQ:OFFSet?

Query Frequency Offset

Syntax:	READ:FREQ:OFFSet?		
Value Range:	<value>	Frequency offset [kHz]	Default Value: Not Applicable
Applicable in State:	Query: CONN, TCONN, RFGE		
Description:	This query is used to measure the DUT frequency offset.		
Example:	READ:FREQ:OFFS?		

READ:INQuiry?

Get results of inquiry scan

Syntax:	READ:INQuiry?	
Value Range:	Not Applicable	Default Value: Not Applicable
Applicable in State:	Query: IDLE ,BT,TESTMODE	
Description:	This command returns the inquiry results as 12 digit Bluetooth addresses. If several devices are found during the inquiry the addresses are concatenated and clearly separated in the return string. Until a device is found the command returns WAIT. IF no devices are found, the command returns STOPPED.	
Example:	READ:INQ?	Read back results of inquiry scan

READ:NACK?

Query NACK Count (Packet Error Rate)

Syntax:	READ : NACK?		
Value Range:	<value>	NACK [%] "NAN" is returned when the measurement is incomplete	Default Value: Not Applicable
Applicable in State:	Query: CONN, TCONN		
Description:	This query is used to measure the Packet Error Rate of the DUT. The NACK count measurement may take a long time, depending on the number of packets used (set by the PROC : NACK : START command). Therefore your application must poll the test set for a measurement result. When the response is different from Not A Number (NAN), the required number of packets has been transmitted and the measurement is complete. Use the FETCH : NACK command if a continuous response is required.		
Example:	READ : NACK?		

READ:NTP?

Query Normal Transmit Power (NTP)

Syntax:	READ : NTP?		
Value Range:	<value>	NTP [dBm]	Default Value: Not Applicable
Applicable in State:	Query: CONN, TCONN, RFGE		
Description:	This query is used to measure the Normally Transmitted Power (NTP), burst average power, of the DUT.		
Example:	READ : NTP?		

READ:NTP_CHAN? <chan no.>

Query Normally Transmitted Power (NTP) in a specific channel

Syntax:	READ:NTP_CHAN? <chan no.>		
Value Range:	<chan no.> <value>	Channel no. (0 to 78) NTP for channel no. [dBm]	Default Value: Not Applicable
Applicable in State:	Query: CONN, TCONN, RFGE		
Description:	This query is used to measure the Normally Transmitted Power (NTP), average power, of the DUT for a specified channel. The test set replies with the most recent NTP value for the specified channel If the NTP for this channel has not been previously measured NAN is returned.		
Example:	READ:NTP_CHAN? 40		

READ:PSEUDO:DELTA_F1?

Query Pseudo Delta F1 Average

Syntax:	READ:PSEUDO:DELTA_F1?		
Value Range:	<value>	Deviation [kHz]	Default Value: Not Applicable
Applicable in State:	Query: TCONN, RFGE		
Description:	This command initiates a pseudo delta F1 average measurement of the DUT. This is achieved by searching for 111/000 patterns in the access code part of the burst and using these to give an indication of the Delta F1 value. However, unlike the DELTA_F1? measurement, the PSEUDO:DELTA_F1? can be used with a normal connection		
Example:	READ:PSEUDO:DELTA_F1?		

READ:PSEUDO:DELTA_F2?

Query Pseudo Delta F2 Average

Syntax:	READ : PSEUDO : DELTA_F2?		
Value Range:	<value>	Deviation [kHz]	Default Value: Not Applicable
Applicable in State:	Query: TCONN, RFGE		
Description:	This command initiates a pseudo delta F2 average measurement of the DUT. This is achieved by searching for 101/010 patterns in the access code part of the burst and using these to give an indication of the Delta F2 value. However, unlike the DELTA_F2? measurement, the PSEUDO : DELTA_F2? can be used with a normal connection		
Example:	READ : PSEUDO : DELTA_F2?		

READ:PTP?

Query Peak Transmit Power (PTP)

Syntax:	READ : PTP?		
Value Range:	<value>	PTP [dBm]	Default Value: Not Applicable
Applicable in State:	Query: CONN, TCONN, RFGE		
Description:	This query is used to measure the Peak Transmitted Power (PTP) power of the DUT.		
Example:	READ : PTP?		

STATus Subsystem

STATus:DEVice?

Query Device Status

Syntax:	`STATus:DEVice?`	

Value Range:	`BT`
	`CONN`
	`DISC`
	`IDLE`
	`RFGE`
	`TCONN`
	`TDISC`
	`TESTMODE`
		Default Value:
		Not Applicable

Applicable in State:	Query: ALL	
Description:	This query returns the test set state .	
Example:	`STAT:DEV?`	

SYSTem Subsystem

SYSTem:BT:VERS<version>

Set Bluetooth Version in the test set

Syntax:	SYSTem:BT:VERS<version>		
Value Range:	1.0 B 1.1	1.0 B version 1.1 version	Default Value: 1.1
Applicable in State:	Set: All Query: All		
Description:	This command sets Bluetooth version 1.0 B or 1.1 within the test set. You should send a SYST:WARM_START command before proceeding. This command is unaffected by the SYSTem:RESet command.		
Examples:	SYST:BT:VERS 1.0B SYST:BT:VERS?		Sets Bluetooth standard 1.0B in the test set. Returns current setting

SYSTem:COMMunication:PORT <value>

Set System Communication Port

Syntax:	`SYSTem:COMMunication:PORT <value>`	

Value Range:	`LPT1`
	`LPT2`
	`LPT3`
	`numeric value`
	GPIB<vendor><Board ID><GPIB address>
		Default Value:
		Not Applicable

GPIB Value Range:	<NI, AGILENT, KEITHLY><0 to 9><0 to 30>	
Applicable in State:	Set: ALL Query: Not Applicable	
Description:	Use this command to specify the port you are using on your controller to communicate with the test set. If you are using GPIB, you need to specify the manufacturer, ID and the GPIB address of the card.	
Example:	`SYST:COMM:PORT LPT2`	Sets the port to LPT2

SYSTem:ERRor?

Query Last Error

Syntax:	`SYSTem:ERRor?`	
Value Range:	`+0` No Error `-102` Syntax Error `-221` Settings Conflict `-222` Data out of Range `-224` Parameter Not Allowed `-365` Time out Error `-366` Target Error `-420` Query Unterminated	Default Value: Not Applicable
Applicable in State:	Query: ALL	
Description:	This query returns the error status of the last command issued and clears the error.	
Example:	`SYST:ERR?`	

SYSTem:FIRMware:VERSion?

Query Firmware Version

Syntax:	SYSTem:FIRMware:VERSion?	
Value Range:	string containing firmware information	Default Value: Not Applicable
Applicable in State:	Query: ALL	
Description:	This query returns the version of the test set Firmware.	
Example:	SYST:FIRM:VERS?	

SYSTem:PCdriver:VERSion?

Query PC-driver Software Version

Syntax:	SYSTem:PCdriver:VERSion?	
Value Range:	String containing PC driver software information	Default Value: Not Applicable
Applicable in State:	Query: ALL	
Description:	This query returns the version of the test set PC-driver.	
Example:	SYST:PC:VERS?	

SYSTem:RESet

System Reset

Syntax:	SYSTem:RESet	
Value Range:	Not Applicable	Default Value: Not Applicable
Applicable in State:	Set: ALL Query: Not Applicable	
Description:	This command is used to reset the settings of the test set and requires 1-2 seconds to complete. Poll the status by issuing the SYSTem:STAT:DEV? command. Until the reset procedure is finished, the returned value is “OFF”. When finished the returned value is “IDLE”. The SYSTem:BT:VERS command is unaffected by the SYSTem:RESet command. See also SYST:WARM_START.	
Example:	SYST:RES	

SYSTem:TEST:ADC_BUF?

Self test of ADC Buffer

Syntax:	SYSTem:TEST:ADC_BUF?		
Value Range:	OK Error, xx	Test is OK Test failed. xx is the number of errors detected	Default Value: Not Applicable
Applicable in State:	Query: IDLE		
Description:	This selftest command tests that the PC is able to access the ADC buffer of the test set.		
Example:	SYST:TEST:ADC_BUF?		

SYSTem:TEST:COMM_BUF?

Self test of Communication Buffer

Syntax:	SYSTem:TEST:COMM_BUF?		
Value Range:	OK Error, xx	Test is OK Test failed. xx is the number of errors detected	Default Value: Not Applicable
Applicable in State:	Query: IDLE		
Description:	This selftest command tests that the PC is able to access the communication buffer of the test set.		
Example:	SYST:TEST:COMM_BUF?		

SYSTem:TEST:DEViation?

Self test of Deviation

Syntax:	SYSTem:TEST:DEViation?		
Value Range:	OK Error, xx	Test is OK Test failed. xx is the measured deviation	Default Value: Not Applicable
Applicable in State:	Query: IDLE		
Description:	This selftest command checks the test set is able to both modulate and demodulate the RF carrier. Note: ensure no signals are applied at the RF connector. (if possible remove connections to the RF connector during the test).		
Example:	SYST:TEST:DEV?		

SYSTem:TEST:PoWeR?

Self test of Power

Syntax:	SYSTem:TEST:PoWeR?		
Value Range:	OK Error, xx	Test is OK Test failed. xx is the measured NTP	Default Value: Not Applicable
Applicable in State:	Query: IDLE		
Description:	This selftest command checks the test set is able to both transmit power and measure power. Note: ensure no signals are applied at the RF connector. (if possible remove connections to the RF connector during the test).		
Example:	SYST:TEST:PWR?		

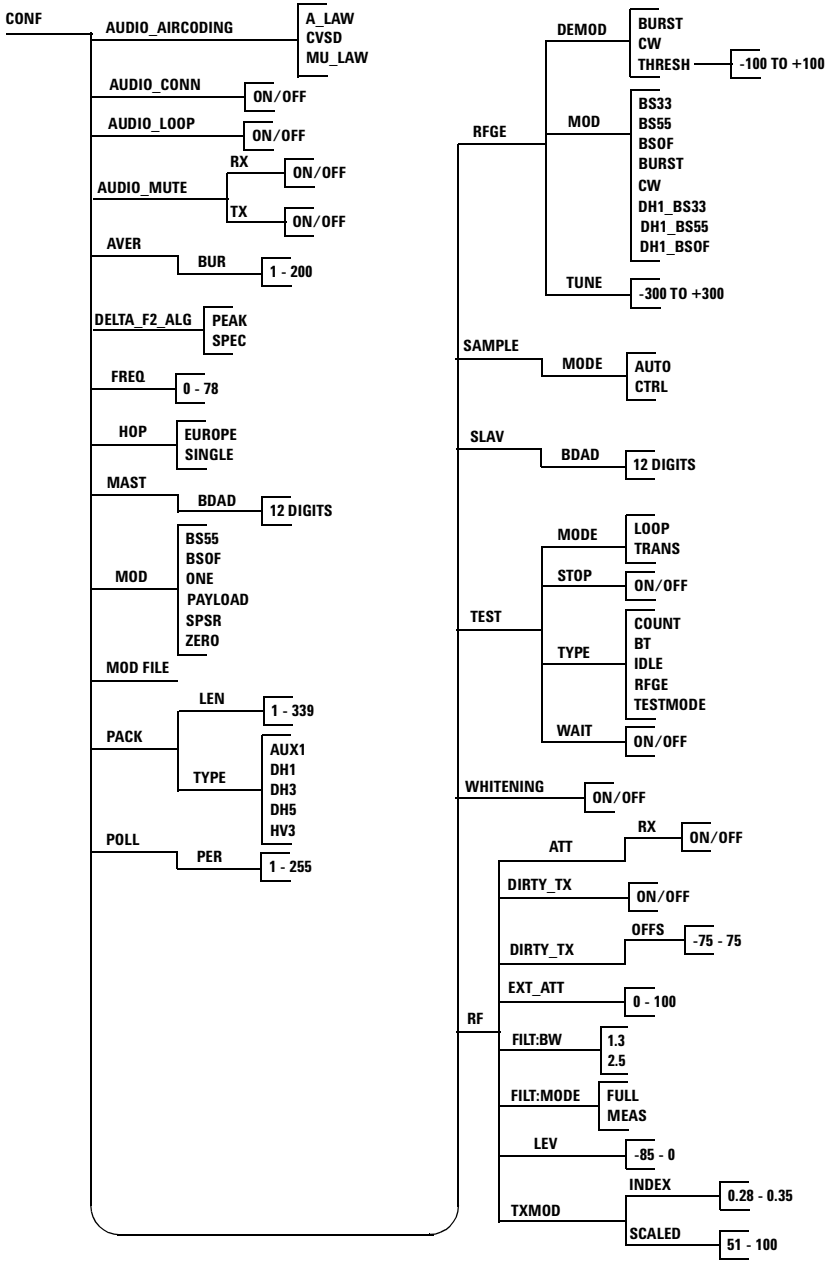
SYSTem:WARM_START

System Warm Start

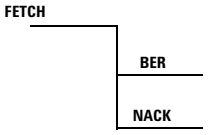
Syntax:	SYSTem:WARM_START	
Value Range:	Not Applicable	Default Value: Not Applicable
Applicable in State:	Set: All Query: Not Applicable	
Description:	This command is used to completely reset the test set. All buffers and data registers are cleared and the test set firmware restarted. Using this command is similar to cycling the power and requires approximately 4 seconds to complete. **Note:** Polling the test set with the STAT:DEV? command during the warm start procedure results in a target error. It is recommended that you add wait period to your test application for the duration of the warm start, approximately 4 seconds. When the WARM_START is complete, STAT:DEV? returns IDLE.	
Example:	SYST:WARM_START	

Command Structure

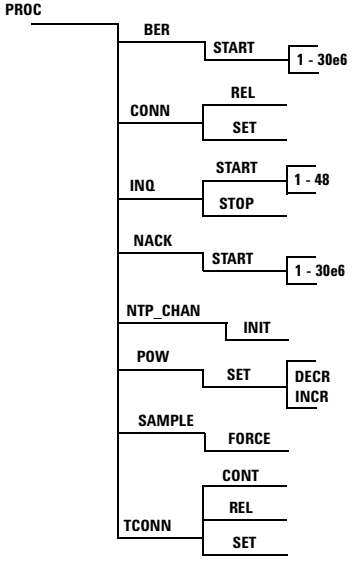
CONFigure



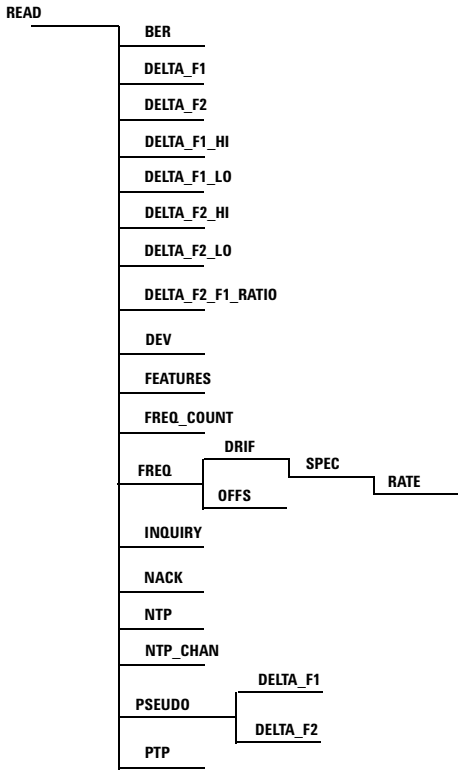
FETCH



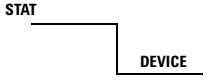
PROCedure



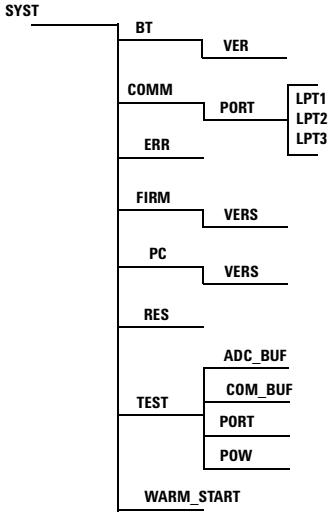
READ


READ
BER
DELTA_F1
DELTA_F2
DELTA_F1_HI
DELTA_F1_LO
DELTA_F2_HI
DELTA_F2_LO
DELTA_F2_F1_RATIO
DEV
FEATURES
FREQ_COUNT
FREQ
DRIF
SPEC
RATE
OFFS
INQUIRY
NACK
NTP
NTP_CHAN
PSEUDO
DELTA_F1
DELTA_F2
PTP

STATus

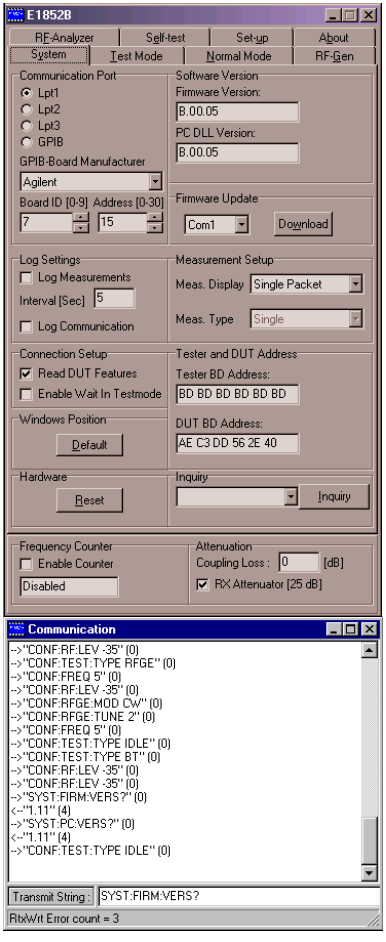

STAT
DEVICE

SYSTem


SYST
BT
VER
COMM
PORT
LPT1
LPT2
LPT3
ERR
FIRM
VERS
PC
VERS
RES
TEST
ADC_BUF
COM_BUF
PORT
POW
WARM_START

Sending Commands from the User Interface

The PC interface can be used as communication media for a SCPI command string. Starting in debug mode gives you access to a single line command field for testing and diagnostics. When starting in debug mode (**Start** > **Programs** > **Agilent Technologies** > **E1852B Debug**), a communication window appears below the main program.
The communication window contains an area showing the commands between the PC and the test set, and a single-line command field.



At the start of the commands showed in the communication area is a arrow showing the direction of the command e.g. an arrow pointing to the right `- - >` is communication from the PC and an arrow pointing to the left `< - -` is reply from the test set.

Switching between the page tabs shows the commands for configuring the system.

You can enter commands in the single line entry field. You can also capture the dialogue between your PC and test set when operating from the user interface. Saving this log file allows you to examine the commands and can help in the development of your own operating programs.

System Error Codes

Error Code	Error
+0	No Error
-102	Syntax Error
-221	Settings Conflict - the parameter you are trying to set is not within the current setting range or configuration of the test set. For example, you cannot request a packet length of 339 when the packet type is set to DH1 - the maximum packet length is for DH1 is 27.
-222	Data out of Range
-224	Parameter Not Allowed - The <value> or parameter you are using is not appropriate for the command type you are sending. For example, the command requires a numeric value/parameter and you are sending a string. Consider the CONF:POLL:PER <value> command. Sending CONF:POLL:PER 3 is valid, sending CONF:POLL:PER THREE is not.
-365	Time Out Error
-366	Target Error - this error is returned if you try to read from the test set while its communications interface (LPT or GPIB) is inactive. For example, during a WARM_START the communications interface is “locked” for approximately 4 seconds. To avoid this error place a 4 second delay between sending the WARM_START command and the first read command to follow it.
-420	Query Unterminated

Example Program

Setup for Bluetooth RF measurements

The command setup for a Bluetooth measurement is shown in the following example:

Initial setup for measuring In Bluetooth Test mode (IDLE)

```
CONF:TEST:TYPE TESTMODE
CONF:FREQ 10
CONF:HOP SINGLE
CONF:TEST:MODE TRAN
CONF:PACK:LEN 27
CONF:PACK:TYPE DH1
CONF:MOD BS55
CONF:RF:LEV -35
CONF:POLL:PER 2
CONF:PACK:LEN 27
CONF:PACK:TYPE DH1
```

Paging the Bluetooth DUT Query status of the system (TESTMODE)

```
PROC:TCONN:SET
STAT:DEV?
```

Query Bluetooth RF measurements (TCONN)

```
READ:PTP?
READ:NTP?
```

6 Specifications and Characteristics

What You'll Find in This Chapter

This Chapter describes the Specifications and Characteristics of your E1852B Bluetooth Test Set.

It contains the following sections:

Introduction

This chapter details the specifications and supplemental characteristics of the E1852B Bluetooth Test Set.

Specifications - describe the warranted performance and apply after a 60 minute warm-up. These specifications are valid over the operating and environmental range of the test set unless otherwise stated.

Supplemental characteristics - *shown in italics*, are intended to provide information useful in applying the test set by giving typical (expected), but nonwarranted performance parameters. These characteristics are shown in italics or denoted as “typical”, “nominal” or “approximate”.

Functionality

Test Mode with or without frequency hopping

Ability to act as a Bluetooth Master, perform Inquiry and establish a Paged connection (Bluetooth Specification 1.1) with a Bluetooth device.

DUT Mode:	Transmitter mode or loopback mode, with or without data whitening
Transmitter Measurements:	Provide the following results: Average Power Peak Power Frequency Offset Frequency Drift Frequency Drift Rate Frequency Deviation (0F calibrated) Graphical Results showing: frequency versus time, power versus time, power versus channel number
Receiver Measurements:	Number of test bits settable, up to 1.6 million Bit Error Rate Packet Error Rate
Results Averaging:	1 to 200
Poll Period:	1-255
Packet Types:	DH1 DH3 DH5 HV3 AUX1
Packet Length:	Variable, according to Bluetooth specifications for each packet type supported
Packet Payload:	00000000 11111111 01010101 00001111 Pseudo-random (PN9) User Defined Payload
Power Control:	Instruct Device Under Control (DUT) to increase/decrease RF output power

Normal Mode Ability to act as a Bluetooth Master, perform Inquiry and establish a Paged connection (Bluetooth Specification 1.1) with a Bluetooth device.

Transmitter Measurements:	Power and Frequency measurement results based on the use of a zero length payload. Graphical results showing: frequency versus time, power versus time, power versus channel number
Receiver Measurements:	Packet Error Rate
Results Averaging:	1 to 200
Poll Period:	1
Packet Payload:	No payload is present in this mode.
Power Control:	Instruct Device Under Test (DUT) to increase/decrease RF output power.

RF-Analyzer Transmitter measurements as described in Test Mode, but for use when no link is established (DH1, DH3 or DH5 packets and 01010101, 00110011 or 00001111 payloads only).

RF-Generator Burst or continuous signal on any channel, with selectable power output and frequency offset. 01010101, 00110011 and 00001111 payloads supported.

Performance

The test set will meet its specifications after 2 hours of storage within the operating temperature range, 60 minutes after turn on.

RF Generator

Frequency:

Range:	2402MHz - 2480MHz, 79 channels at 1 MHz spacing
Modulation:	Conforms to Bluetooth Radio Specification Version 1.1
Offset:	±300 kHz in 100 kHz increments

Output Power:

Range:	–85dBm to 0dBm
Resolution:	0.1dB
Level Accuracy over the ranges[1, 2]	
-85 to -10 dBm:	±1.0 dB at 25°C ±3°C, (±1.4 dB over full operating temperature)
>-10 to 0 dBm:	±1.1dB at 25°C ±3°C, (±1.9 dB over full operating temperature)

[1] A measurement uncertainty of 0.43 dB is included in these limits.

[2] This specification is not applicable above -24 dBm when used in frequency hopping mode.

RF Analyzer

Frequency:

Range: 2402 MHz - 2480 MHz, 79 channels at 1 MHz spacing

Demodulation: ±400 kHz maximum

Error: ±(Timebase error +5 kHz) (nominal)

Power Measurement:

Range: –55 dBm to +22 dBm

Resolution: 0.1 dB

Accuracy[3] over the input range -30 to +23 dBm: ±0.9 dB at 25°C ±3°C, (±1.3 dB over full operating temperature

Frequency Counter Input

Range: 10 kHz to 15 MHz

Frequency Error: ±(Timebase error + 100 Hz) (nominal)

Resolution: 1 Hz

Sensitivity: 0.5V RMS (nominal)

Frequency Reference

Internal Timebase:

Drift due to temperature: ±2.0 ppm

Ageing: ±1.0 ppm per year

Frequency Reference Input:

Frequency 10 MHz (nominal)

Sensitivity *150 mV into 50Ω (nominal)*

[3]A measurement uncertainty of 0.36 dB is included in these limits.

These uncertainty values are calculated using ISO TAG4, in line with the 'Guide to the Expression of Uncertainty in Measurement' and are based on a standard uncertainty multiplied by a coverage factor of k=2, providing a confidence level of approximately 95%

General Specifications

Impairments

Frequency Offset: -75 kHz to +75 kHz (settable in 1 kHz steps)

Modulation Index: 0.28 to 0.35 (settable in 0.01 steps)

Input /Output Connectors

RF In/Out N(f), *50Ω (nominal)*

Counter In BNC(f), high impedance

GPIB Connector, IEEE 488 Standard

Parallel Port 25-pin D-sub (m)

Serial Port [RS-232] 9-pin D-sub(f) used for firmware downloads

Frequency Reference Input, BNC (f) *50Ω (nominal)*

Audio, BNC (f)

- Audio Input, *130kΩ (nominal)*
- Audio Output, *50Ω (nominal)*

Analog Outputs, BNC(f), *50Ω (nominal)*

- Bluetooth Slot Clock (625µs interval)
- Receive Data (inverted)
- Receive Slot Sync, output synchronized to start of burst
- Power Envelope

Environmental Conditions

Operating Temperature: +15°C to +45°C

Operating Humidity Up to 95% relative humidity to 40°C (non-condensing)

Power Consumption

Supply Voltage 100-120VAC, 200-240VAC 50-60 Hz

30 VA maximum

Physical

Dimensions 92mm (H) x 280 mm (D) x 484 mm (W)

Designed for rack mounting

Weight 3.6 kg

Computer Requirements

The test set requires the use of a PC (not supplied), minimum requirements as follows:

- Pentium® Processor or higher, 32MB RAM or more, 200MB available on hard drive
- Windows® 95, Windows® 98, Windows 2000®, Windows NT® 4.0 (SP 3)
- Dedicated bi-directional parallel port
- GPIB or dedicated bi-directional parallel port
- 1024 x 768 color monitor resolution
- Microsoft Internet Explorer version 4.0 or higher/ Netscape Communicator Version 4.0 or higher required for software/firmware upgrades.

Regulatory Information

All regulatory information is contained in the E1852B Bluetooth Test Set *Installation Guide*.

7 Maintenance

What You'll Find in This Chapter

This chapter describes the built in tests, error messages, and general maintenance. It contains these sections:

Self Test

The test set has two self test modes:

- Power on self test - occurs automatically when you turn on the test set.
- Self-Test - a series of tests you can carry out as required using the PC interface or remote commands.

Power On Test

The power on self test is performed automatically when the test set is turned on and takes approximately 5 seconds to complete. As the power on self test takes place, all the front panel LEDs are lit. When completed, only the Power LED remains lit.

Self Test

You can carry out a self test from the PC interface or by using remote commands.

PC Interface

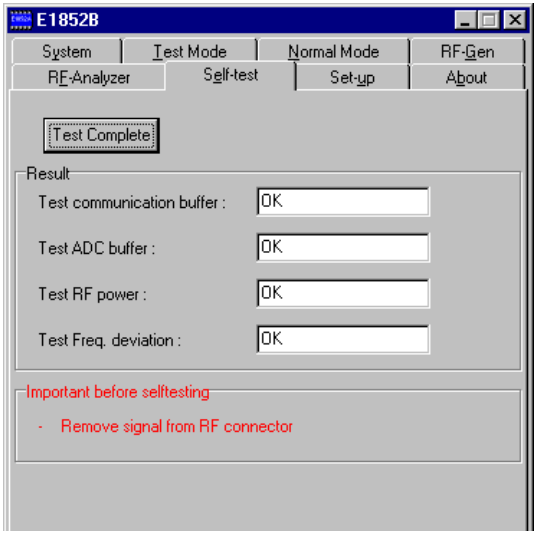


Figure 65 Self-test page

Ensure there is no connection made to the RF In/Out port and click **Start** to begin the self test. Refer to Self-test Page on page 99 for more information.

Remote Interface

To invoke the remote self tests, use the following commands:

- `SYST:TEST:COMM_BUF?`
- `SYST:TEST:ADC_BUF?`
- `SYST:TEST:PWR?`
- `SYST:TEST:DEV?`

LED Indicators

There are 7 LED indicators on the front panel of the E1852B Bluetooth Test Set. Table 8 shows the behavior of the LED indicators according to the mode of the test set. The Error LED is turned on if the last SCPI command issued was wrong. The Error LED is turned off again as soon as a correct SCPI command is received.

Table 8 LED Indicators and test set Mode

Measurement Mode	Power	Error	Transmit	Loopback	Master	Slave	Link
Off							
Initializing	ON	ON	ON	ON	ON	ON	ON
Idle Mode	ON	ON[1]					
RF-generator Mode	ON	ON[1]			ON	ON	
Demodulator Mode	ON	ON[1]			ON	ON	
Normal Mode - Master	ON	ON[1]			ON		ON[2]
Normal Mode – Slave	ON	ON[1]				ON	ON[2]
Transmitter Test Mode	ON	ON[1]	ON		ON		ON[2]
Loopback Test Mode	ON	ON[1]		ON	ON		ON[2]

[1] If wrong SCPI commands is being used

[2] Only if Connection is established

NOTE The Error LED turns on during the firmware download procedure. A problem is indicated only if the LED remains lit after the test set has been restarted.

Operator Maintenance

This section describes how to install new revisions of test set firmware. It also shows you how to replace the power line fuse and clean the test set.

Firmware Download

The PC interface and test set firmware revisions are matched. To install new test set firmware you must first install the new revision of PC interface software. To download new firmware the test set serial port and the supplied serial cable are used. You also need to run the PC interface in Debug mode.

Updated PC interface software and test set firmware can be obtained from the URL shown in the **About** page of the E1852B PC interface. You can use the <XREF this> Firmware Download Procedure but to ensure you have the latest information it is recommended that you use the E1852B Software home page and follow the displayed procedure to download and install the required files.

NOTE The Error LED turns on during the firmware download procedure. A problem is indicated only if the LED remains lit after the test set has been restarted.

Firmware Download Procedure

The installation procedure is in three parts:

- Un-install any previous E1852B software from your PC
- Install the PC User Interface on your PC
- Install firmware in the E1852B Bluetooth Test Set

Un-install

You only need to do this if you have any previously installed E1852B software on your PC. Proceed as follows:

1. On your PC, select **Start** > **Settings** > **Control Panel**.
2. Double click **Add/Remove Programs**.
3. Scroll through the list of programs and select the **E1852B** program.
4. Click **Remove**.

Follow any on screen instructions and when prompted, delete all files including the *.dll files.

PC Installation

If you have downloaded the latest firmware, PC user interface and DLL from the Agilent E1852B home page un-compress the package and save it to a temporary directory - **C:\WINDOWS\TEMP\E1852B** recommended.

1. Locate and double click the Setup.exe program icon.
2. Follow the on-screen instructions to complete the installation.

You have now installed the E1852B PC user interface and Dynamic Link Library (DLL).

E1852B Firmware Installation

To complete the installation, download the new firmware to your E1852B Bluetooth Test Set. Proceed as follows:

1. Connect the test set to your PC with the parallel cable provided.

NOTE Ensure the serial cable is not connected between the PC and test set at this stage.

2. On your PC select **Start** > **Programs** > **Agilent Technologies** > **E1852B Debug**.

3. Select the E1852B **System** tab.
4. In the **Firmware Update** panel use the scroll button to select the PC serial port.
5. Press **Download**.
6. Highlight the ***.bsf** file and click **Open**.

When prompted:

- Disconnect the parallel cable
- Connect the serial cable provided from your PC serial port and the E1852B serial port
- Cycle the test set power - switch the E1852B off and on again before clicking **OK**.

7. On completion, close the PC user interface and re-start in standard or Debug mode as required.

Replacing the Power Line Fuse

The power line fuse is located within the fuse holder and line switch assembly on the rear panel. For 110V to 120V operation the fuse is a T0.25 250V, for 220-240V operation the fuse is a T0.125 250V.

1 Remove the power cord from the test set.

2 Install the correct fuse in the “selected” position as shown in Figure 66.

3 Replace the fuse holder assembly in the rear panel.

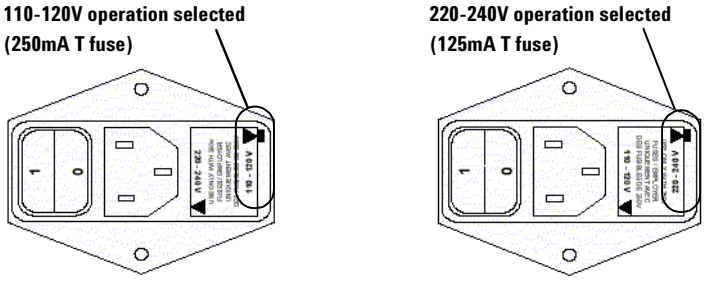


Figure 66 Replacing the Fuse

Cleaning

To clean the test set, disconnect it’s supply power and wipe with a damp cloth only.

Contacting Agilent Technologies

This section details what to do if you have a problem with your test set.

If you have a problem with your test set, first refer to the section. This chapter contains a checklist that will help identify some of the most common problems.

If you wish to contact Agilent Technologies about any aspect of the test set, from service problems to ordering information, refer to see Sales and Service Offices on page 209.

If you wish to return the test set to Agilent Technologies refer to see Returning Your Bluetooth Test Set for Service on page 210.

Before calling Agilent Technologies

Before calling Agilent Technologies or returning the test set for service, please make the checks listed in see Check the Basics on page 207. If you still have a problem, please read the warranty printed at the front of this guide. If your test set is covered by a separate maintenance agreement, please be familiar with the terms.

Agilent Technologies offers several maintenance plans to service your test set after warranty expiration. Call your Agilent Technologies Sales and Service Center for full details.

If the test set becomes faulty and you wish to return the faulty instrument, follow the description on how to return the faulty instrument in the section see Sales and Service Offices on page 209.

Check the Basics

Problems can be solved by repeating what was being performed when the problem occurred. A few minutes spent in performing these simple checks may eliminate time spent waiting for instrument repair. Before calling Agilent Technologies or returning the test set for service, please make the following checks:

- Check that the line socket has power.

- Check that the test set is plugged into the proper ac power source.
- Check that the test set is switched on.
- Check that the line fuse is in working condition.
- Check that the other equipment, cables, and connectors are connected properly and operating correctly.
- Check the equipment settings in the procedure that was being used when the problem occurred.
- Check that the test being performed and the expected results are within the specifications and capabilities of the test set.
- Check operation by performing the Self-test.

Instrument serial numbers

Agilent Technologies makes frequent improvements to its products to enhance their performance, usability and reliability. Agilent Technologies service personnel have access to complete records of design changes for each instrument. The information is based on the serial number of each test set.

Whenever you contact Agilent Technologies about your test set, have a complete serial number available. This ensures you obtain the most complete and accurate service information. The serial number can be obtained from the serial number label. The serial number label is attached to the rear of each instrument.

Sales and Service Offices

For more information about Agilent Technologies test and measurement products, applications, services, and for a current sales office listing, visit our web site: http://www.agilent.com

You can also contact one of the following centers and ask for a test and measurement sales representative.

UNITED STATES	Agilent Technologies (tel) 1 800 452 4844
CANADA	Agilent Technologies Canada Inc. Test & Measurement (tel) 1 877 894 4414
EUROPE	Agilent Technologies Test & Measurement European Marketing Organization (tel) (31 20) 547 9999
JAPAN	Agilent Technologies Japan Ltd. (tel) (81) 426 56 7832 (fax) (81) 426 56 7840
LATIN AMERICA	Agilent Technologies Latin America Region Headquarters, USA (tel) (305) 267 4245 (fax) (305) 267 4286
AUSTRALIA and NEW ZEALAND	Agilent Technologies Australia Pty Ltd. (tel) 1-800 629 485 (Australia) (fax) (61 3) 9272 0749 (Australia) (tel) 0-800 738 378 (New Zealand) (fax) (64 4) 802 6881 (New Zealand)
ASIA PACIFIC	Agilent Technologies, Hong Kong (tel) (852) 2599 7889 (fax) (852) 2506 9233

In any correspondence or telephone conversations, refer to the power sensor by its model number and full serial number. With this information, the Agilent Technologies representative can quickly determine whether your unit is still within its warranty period.

Calibration and Service

Routine calibration and performance testing of your E1852B Bluetooth Test Set should be carried out on a yearly basis. Contact your local Agilent sales and service office for details.

Returning Your Bluetooth Test Set for Service

Use the information in this section if you need to return your test set to Agilent Technologies.

Package the Bluetooth Test Set For Shipment

Use the following steps to package the test set for shipment to Agilent Technologies for service:

1 Fill in a blue service tag (available at the end of the *Installation Guide*) and attach it to the test set. Please be as specific as possible about the nature of the problem. Send a copy of any or all of the following information:

- Any error messages generated by the test set.
- Any information on the performance of the test set.

CAUTION Damage can result from using packaging materials other than those specified. Never use styrene pellets in any shape as packaging materials. They do not adequately cushion the test set or prevent it from shifting in the carton. Styrene pellets cause damage by generating static electricity.

2 Use the original packaging materials or a strong shipping container that is made of double-walled, corrugated cardboard with 159 kg (350 lb) bursting strength. The carton must be both large enough and strong enough to accommodate the test set and allow at least 3 to 4 inches on all sides of the test set for packing material.

3 Surround the test set with at least 3 to 4 inches of packing material, or enough to prevent the test set from moving in the carton. If packing foam is not available, the best alternative is SD-240 Air Cap ™ from Sealed Air Corporation (Commerce, CA 90001). Air Cap looks like a plastic sheet covered with 1-1/4 inch air filled bubbles. Use the pink Air Cap to reduce static electricity. Wrap the test set several times in the material to both protect the test set and prevent it from moving in the carton.

4 Seal the shipping container securely with strong nylon adhesive tape.

5 Mark the shipping container “FRAGILE, HANDLE WITH CARE” to ensure careful handling.

6 Retain copies of all shipping papers.