



BlueCoreä01

Falcon / BTL040

BlueTest Instruction Manual

AN047

July 2001



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 **Bluetooth** Qualified

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Introduction

BlueTest is a program that controls the on-chip built-in-self-test (BIST) software for RF testing. This document explains the facilities offered by the BIST. BlueTest does not execute any of these tests. It sends commands to **BlueCore01** and/or enables the on-chip BIST, then reports any results.

The tests fall into six categories:

- Simple RF tests; used for PCB de-bug and optimisation
- Quantitative tests for transmit and receive; used to establish the performance of the Bluetooth device.
- Loopback test modes; used for qualification and regulatory testing
- Configuration commands to set parameters for other tests
- Built-in self-test routines
- Miscellaneous test routines

Further details about commands, parameters and packet types are included in the appendices following the tests.

Running a Test

In a BlueTest dialog select the **Standard** button to display the entire test. This applies to all of the tests except for the BIT ERR1 and BIT ERR2 tests. Click on **Bit Error** to display these results in a column format.

When running the tests, the results display in a dialog box.

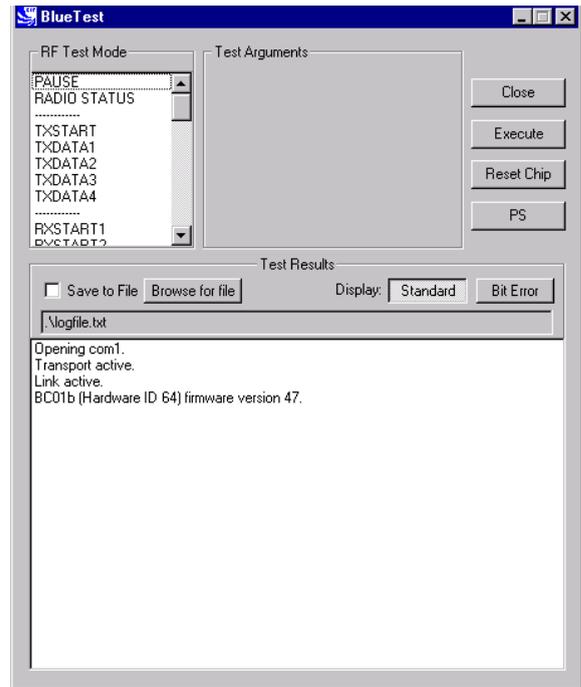
The default file name is `logfile.txt`. It is located in the current directory in which the program resides. Select **Browse for File** to create your own file name and path (using test examples provided).

To save test results to a file, tick **Save to File**.

Note: Some of these tests require two Bluetooth modules to function correctly. The PCM External Loopback test has notes specifically for use with CSR's Casira development kit.

All of the following tests are designed to run with CSR's firmware versions Beta 10.4 and above.

Several tests include entries for **Related Test Spec Name**. These refer to tests in the Bluetooth Special Interest Group (SIG) Test Specification for RF document, rev. 0.9r, dated 31 January 2000.



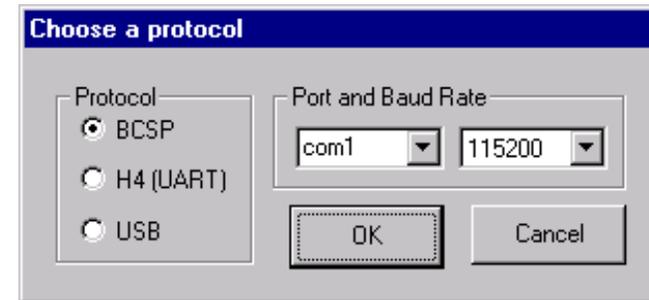
BlueTest Example Display

Getting Started

Run **Bluetest.exe**.

Select a Protocol (Default **BCSP**).

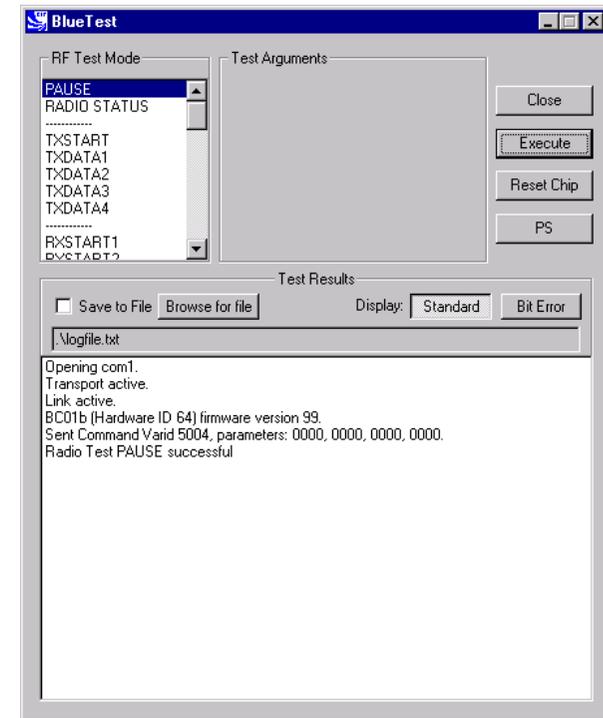
Select **Port and Baud Rate** (Default com1, 115200).



Simple Tests

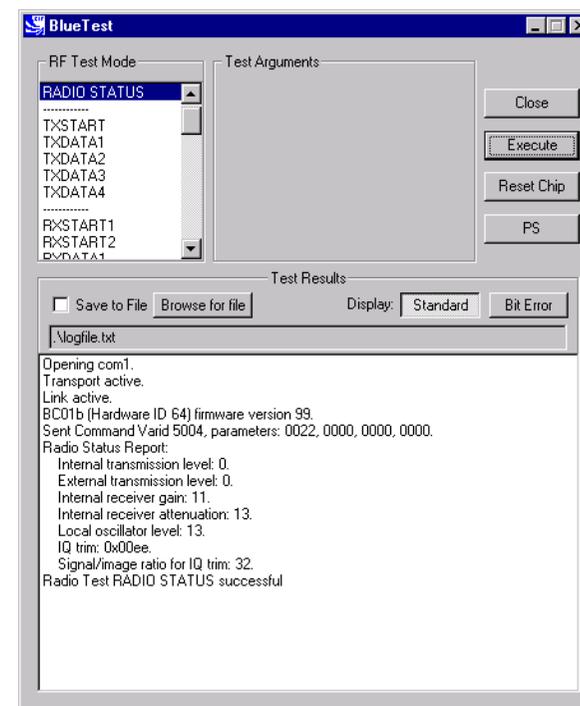
RF Test Mode

| | |
|-----------------------|--|
| Title | PAUSE |
| Summary | Halts the current test and stops any radio activity. |
| Test Arguments | None |
| Return Data | None |
| Exit | Click on Reset Chip or enter a new command. |



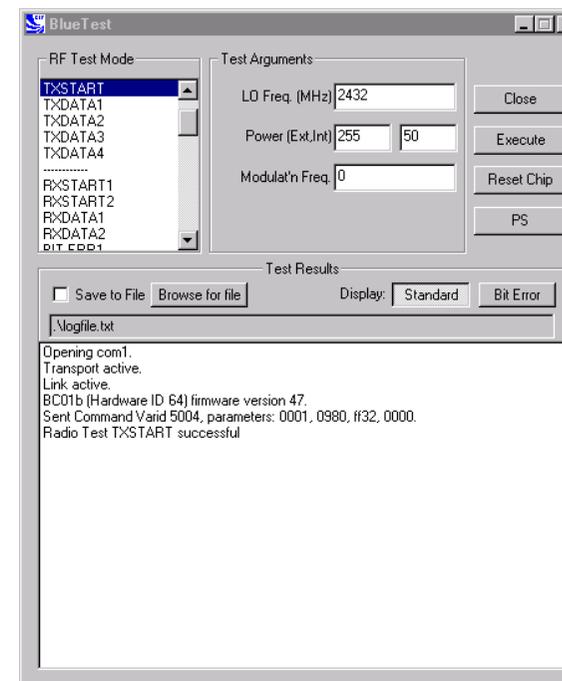
PAUSE Example Display

| | |
|-----------------------|--|
| Title | RADIO STATUS |
| Summary | Returns the values from the radio control registers. |
| Test Arguments | None |
| Return Data | <ul style="list-style-type: none"> Internal transmission level External transmission level Internal receiver gain Internal receiver attenuation Local oscillator level IQ trim Signal/image ratio for IQ trim |
| Exit | Click on Reset Chip . |

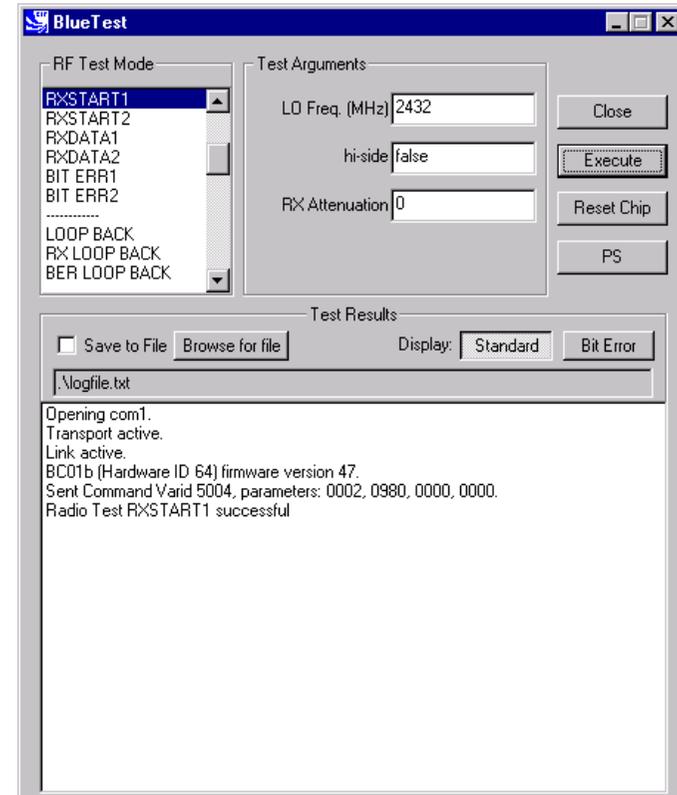


RADIO STATUS Example Display

| | |
|-----------------------|---|
| Title | TXSTART |
| Summary | Enables the transmitter in continuous transmission at a designated frequency (LO Freq) with a designated output Power (Ext, Int) and designated tone modulation frequency (Modulat'n Freq) . |
| Test Arguments | <p>LO Freq (Carrier Frequency in MHz) = 2402 to 2480</p> <p>Power (Ext, Int) = gain of external amplifier (if present) and internal amplifier. Ext value is specific to the design and Int value is 0 to 63 (Default = 50)</p> <p>Modulat'n Freq = -32768 to 32767 in units of 1/4096MHz</p> |
| Return Data | None Use RF Analyser to check carrier output. |
| Exit | Click on Reset Chip . |

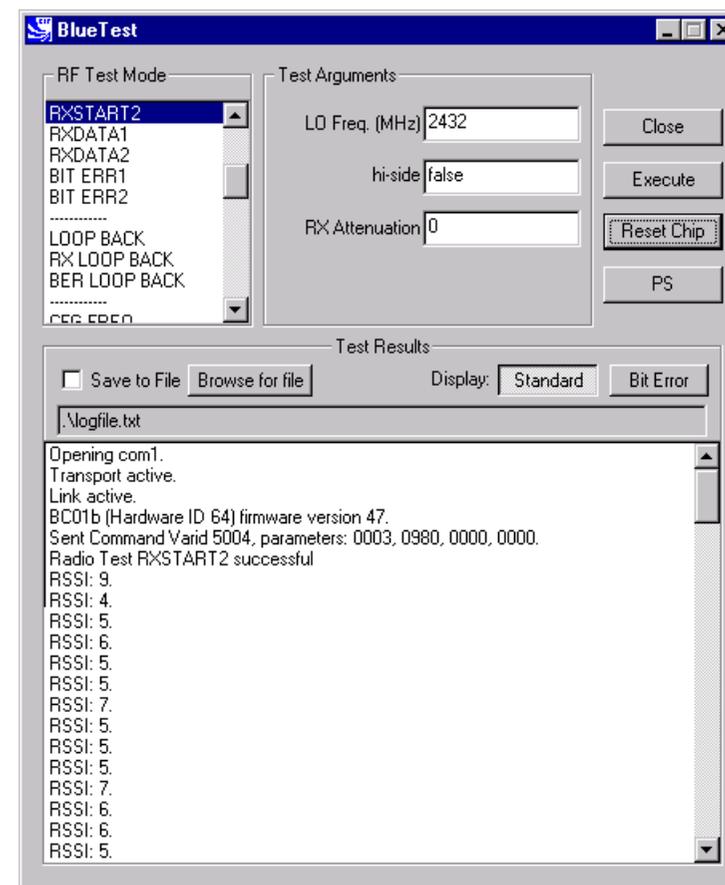

TXSTART Example Display

| | |
|-----------------------|--|
| Title | RXSTART1 |
| Summary | <p>Enables the receiver in continuous reception at a designated frequency (LO Freq) with a choice of low or high side modulation (hi-side) and with a designated attenuation setting (RX Attenuation). Requires a second unit to be running TXSTART.</p> <p>Routes final IF to TEST_A pin.</p> |
| Test Arguments | <p>LO Freq (Carrier Frequency MHz)= 2402 to 2480</p> <p>hi-side (default = False) set 0 or 1</p> <p>RX Attenuation = 0 to 15 (Default = 0)</p> |
| Return Data | None |
| Exit | Click on Reset Chip . |



RXSTART1 Example Display

| | |
|-----------------------|---|
| Title | RXSTART2 |
| Summary | Enables the receiver in continuous reception, at a designated frequency (LO Freq), with a choice of low or high side modulation (hi-side) and with a designated attenuation setting (RX Attenuation). Digitises the RSSI and sends report regularly to host. Requires a second unit to be running TXSTART . |
| Test Arguments | LO Freq (Carrier Frequency MHz) = 2402 to 2480 hi-side (default = false) set 0 or 1 RX Attenuation = 0 to 15 (Default = 0) |
| Return Data | RSSI values, as a uint16, sent over BCSP channel 3 at a rate of about 10 per second. Can be saved to log file. H4 and USB use manufacturer's extensions. |
| Exit | Click on Reset Chip . |



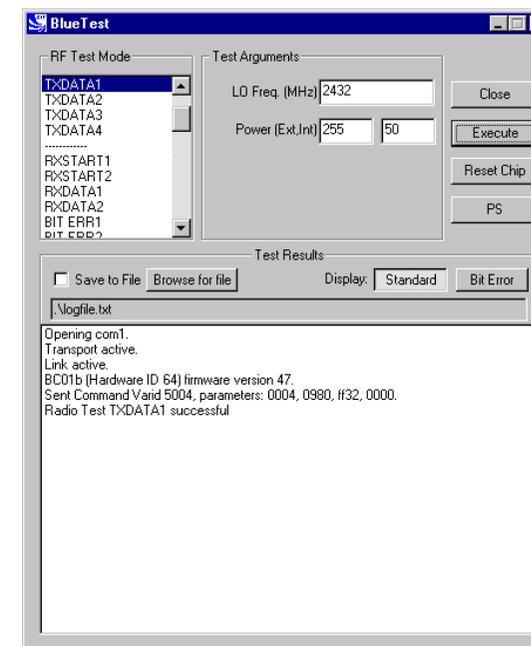
RXSTART2 Example Display

Quantitative Tests

Transmitter Only

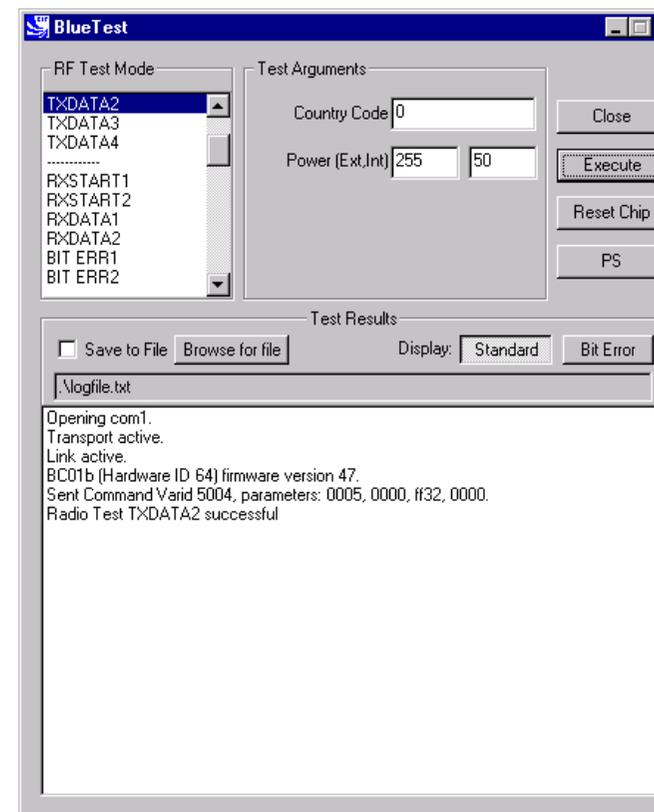
| | |
|-------------------------------|--|
| Title | TXDATA1 |
| Summary | <p>Enables the transmitter, with a designated frequency (LO Freq) and output Power (Ext, Int).</p> <p>Payload is PRBS9 data.</p> <p>Receiver is not operating.</p> <p>Packet type and duty cycle can be configured. Refer to Configuration Commands section.</p> |
| Related Test Spec Name | TRM/CA/03/C (power control), TRM/CA/04/C (Tx output spectrum – frequency range), TRM/CA/05/C (Tx output spectrum – 20dB bandwidth), TRM/CA/06/C (Adjacent channel power), TRM/CA/08/C (Initial carrier frequency tolerance), TRC/CA/01/C (Out-of-band spurious emissions). |
| Test Arguments | <p>LO Freq (Carrier Frequency MHz)= 2402 to 2480</p> <p>Power (Ext, Int) = gain of external amplifier (if present) and internal amplifier. Ext value is specific to the design and Int value is 0 to 63 (Default = 50).</p> |
| Return Data | <p>None</p> <p>Use an RF Analyser to check carrier output.</p> |
| Exit | Click on Reset Chip or select another TXDATA command. |

Note: TXDATA and RXDATA require the same Bluetooth address in each module for RXDATA to receive data transmitted by TXDATA. Use **CFG_UAP_LAP** to set the address used by the BIST.



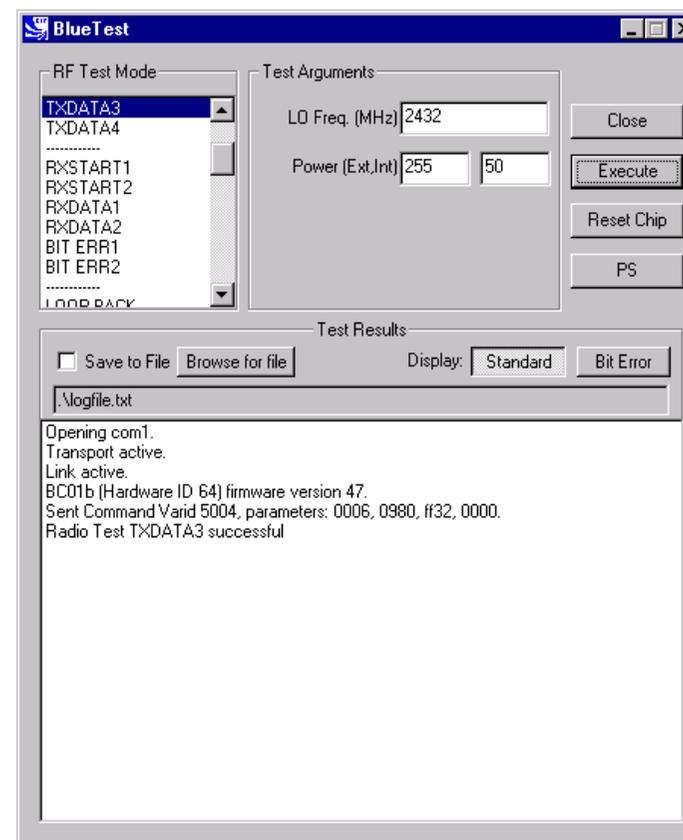
TXDATA1 Example Display

| | |
|-------------------------------|---|
| Title | TXDATA2 |
| Summary | <p>Enables the transmitter, with a simplified hop sequence designated by Country Code and sets output Power (Ext, Int).</p> <p>Payload is PRBS9 data (Default DH1).</p> <p>Receiver is not operating.</p> <p>Packet type and duty cycle can be configured. Refer to Configuration Commands section.</p> |
| Related Test Spec Name | TRM/CA/01/C (output power), TRM/CA/02/C (power density) |
| Test Arguments | Country Code = 0 to 3 (Default = 0) |
| Return Data | <p>None</p> <p>Use RF Analyser to check carrier output.</p> |
| Exit | Click on Reset Chip or select another TXDATA command. |



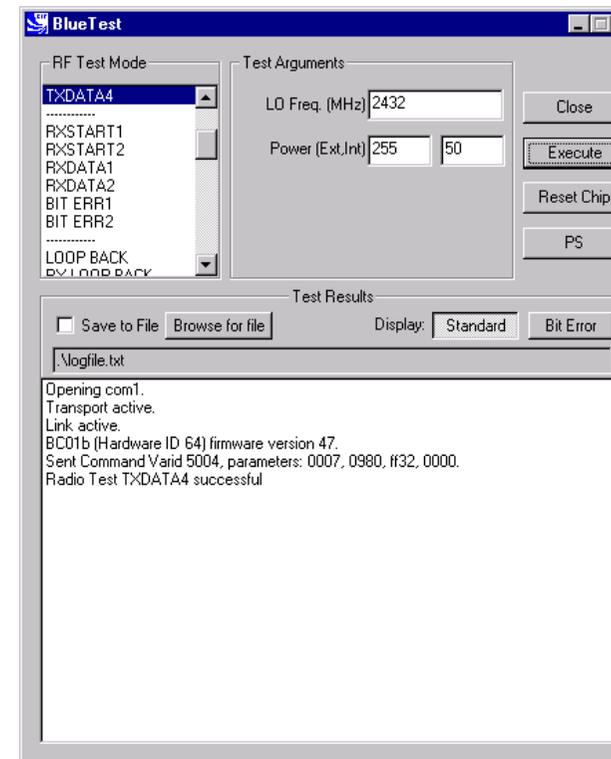
TXDATA2 Example Display

| | |
|-------------------------------|--|
| Title | TXDATA3 |
| Summary | <p>Enables the transmitter, with a designated frequency (LO Freq) and output Power (Ext, Int).</p> <p>Payload is sequence 101010....</p> <p>Receiver is not operating.</p> <p>Packet type and duty cycle can be configured. Refer to Configuration Commands section.</p> |
| Related Test Spec Name | TRM/CA/07/C (modulation characteristic), TRM/CA/09/C (carrier frequency drift) |
| Test Arguments | <p>LO Freq (Carrier Frequency MHz)= 2402 to 2480</p> <p>Power (Ext, Int) = gain of external amplifier (if present) and internal amplifier. Ext value is specific to the design and Int value is 0 to 63 (Default = 50).</p> |
| Return Data | <p>None</p> <p>Use RF Analyser to check out carrier</p> |
| Exit | Click on Reset Chip or select another TXDATA command. |



TXDATA3 Example Display

| | |
|-------------------------------|---|
| Title | TXDATA4 |
| Summary | <p>Enables the transmitter with a designated frequency (LO Freq) and output Power (Ext, Int).</p> <p>Payload is sequence 1111000011110000....</p> <p>Receiver is not operating.</p> <p>Packet type and duty cycle can be configured. Refer to Configuration Commands section.</p> |
| Related Test Spec Name | TRM/CA/07/C (modulation characteristic), TRM/CA/09/C (carrier frequency drift) |
| Test Arguments | <p>LO Freq (Carrier Frequency MHz) = 2402 to 2480</p> <p>Power (Ext, Int) = gain of external amplifier (if present) and internal amplifier. Ext value is specific to the design and Int value is 0 to 63 (Default = 50).</p> |
| Return Data | <p>None</p> <p>Use an RF Analyser to check out carrier.</p> |
| Exit | Click on Reset Chip or select another TXDATA command. |

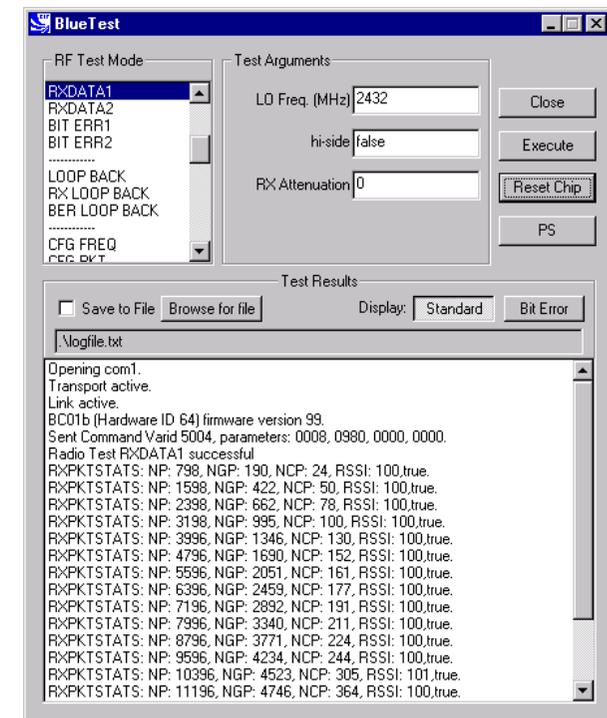


TXDATA4 Example Display

Receiver Only

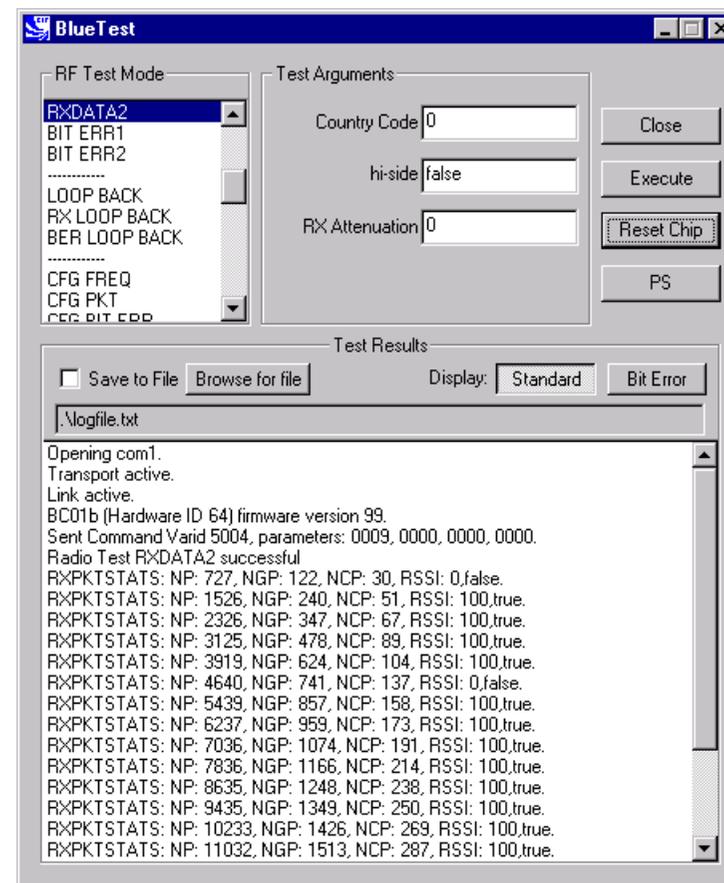
| | |
|-----------------------|---|
| Title | RXDATA1 |
| Summary | <p>Enables the receiver, at a designated frequency (LO Freq) with a choice of low or high side modulation (hi-side), and with a designated attenuation setting (RX Attenuation).</p> <p>The software counts the number of received packet and the number of payloads with correctable errors.</p> <p>The payload itself is thrown away. The time between receive slots and report frequency can be set. Refer to Configuration Commands section.</p> |
| Test Arguments | <p>LO Freq (Carrier Frequency MHz)= 2402 to 2480</p> <p>hi-side = 0 or 1 (default = 0)</p> <p>RX Attenuation = 0 to 15 (default = 0)</p> |
| Return data | <p>NP = number of packets</p> <p>NP = number of good packets,</p> <p>NCP = number of corrected packets</p> <p>RSSI = value as shown</p> <p>True = RSSI is reliable, otherwise false</p> <p>The numbers wrap, rather than being reset to 0.</p> |
| Exit | Click on Reset Chip . |

Note: TXDATA and RXDATA require the same Bluetooth address in each module for RXDATA to receive data transmitted by TXDATA. Use **CFG_UAP_LAP** to set the address used by the BIST.



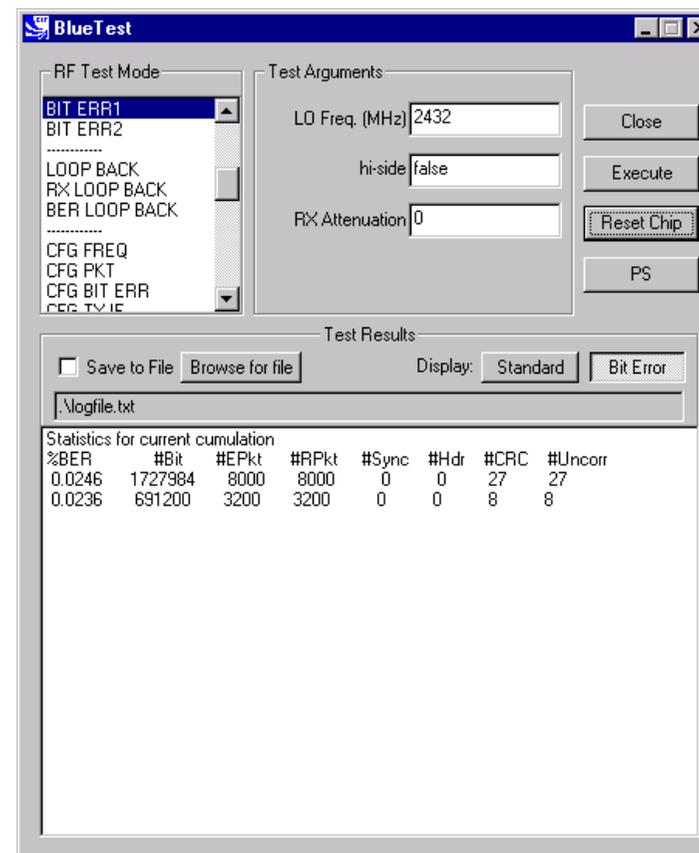
RXDATA1 example display

| | |
|-------------------------------|---|
| Title | RXDATA2 |
| Summary | <p>Enables the receiver with a simplified hop sequence designated by Country Code, with a choice of low or high side modulation (hi-side) and with a designated attenuation setting (RX Attenuation).</p> <p>The software counts the number of received packets and the number of payloads with correctable errors.</p> <p>The payload itself is thrown away. The time between receive slots and report frequency can be set. Refer to Configuration Commands Section.</p> |
| Related Test Spec Name | Standby mode spurious emissions (FCC test) |
| Test Arguments | <p>Country Code = 0 to 3 (default = 0)</p> <p>hi-side = 0 or 1 (default = 0)</p> <p>RX Attenuation = 0 to 15 (default = 0)</p> |
| Return Data | <p>NP = number of packets</p> <p>NG = number of good packets</p> <p>NCP = number of corrected packets</p> <p>RSSI = value as shown</p> <p>True = RSSI is reliable, otherwise false</p> <p>The numbers wrap, rather than being reset to 0.</p> |
| Exit | Click on Reset Chip . |



RXDATA2 Example Display

| Title | BIT ERR1 |
|-----------------------|---|
| <p>Summary</p> | <p>Enables the receiver at a designated frequency (LO Freq) with a choice of low or high side modulation (hi-side) and with a designated attenuation setting (RX Attenuation).</p> <p>Returns a set of reports to the host:</p> <ul style="list-style-type: none"> ■ Number of data bits received (payload excluding FEC and CRC) ■ Number of data bits that were in error. Assumes PRBS9 data starting with 1FF in each packet ■ Number of packets received ■ Number of packets expected, based on <code>txrx_freq</code> (default 12500) ■ Number of packets with header errors as reported by hardware ■ Number of packets with CRC errors ■ Number of packets with uncorrected errors (currently same as CRC errors) ■ Number of sync timeouts. Note that until a transmission is received a long timeout is used, so this does not reflect the number of packets expected <p>Each report has two uint32 values. First is value since last report, second is summed over the last <code>bits_count</code> (default = 1.6Mbits).</p> <p>Reports are sent according to <code>report_freq</code> set (default = 1 second). The times between receive slots and report frequency can be set, and the count reset. Refer to Configuration Commands section.</p> |

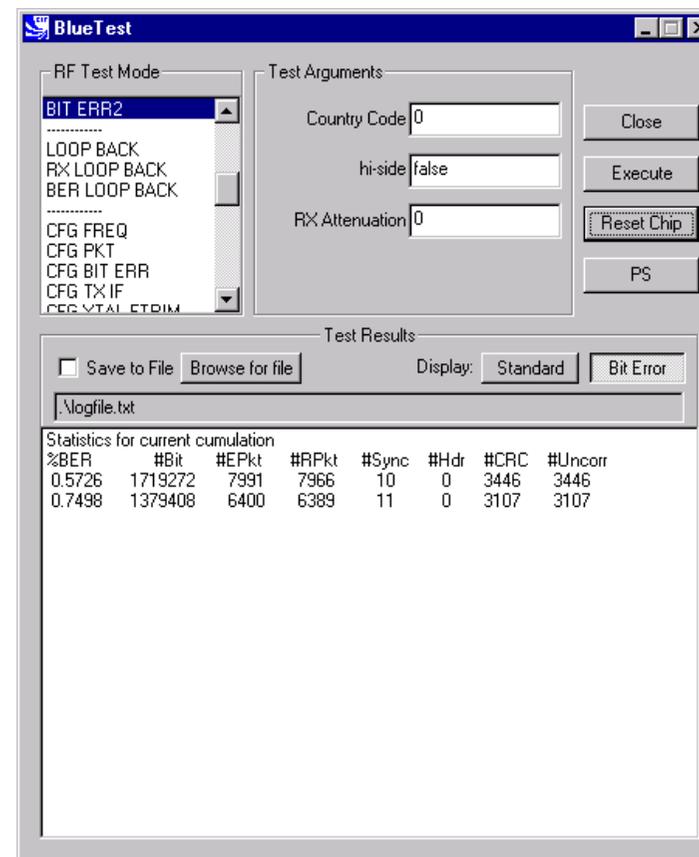


BIT ERR1 Example Display



| | |
|-------------------------------|--|
| Title | BIT ERR1 (Continued) |
| Related Test Spec Name | RCV/CA/01/C and RCV/CA/02/C (sensitivity), RCV/CA/03/C (C/I performance), RCV/CA/04/C (blocking performance), RCV/CA/05/C (intermodulation performance), RCV/CA/06/C (maximum input level) |
| Test Arguments | LO Freq (Carrier Frequency MHz) = 2402 to 2480 hi-side = 0 or 1 (default = 0) RX Attenuation = 0 to 15 (default = 0) |
| Note | With a second unit, execute CFG UAP/LAP to set the Bluetooth address. Execute TXDATA1 then execute CFG UAP/LAP to set the same Bluetooth address on the Equipment Under Test (EUT) before executing BIT ERR1 . |
| Return Data | Eight reports, each two uint32 values (refer to BIT ERR1 Summary). |
| Exit | Click on Reset Chip . |

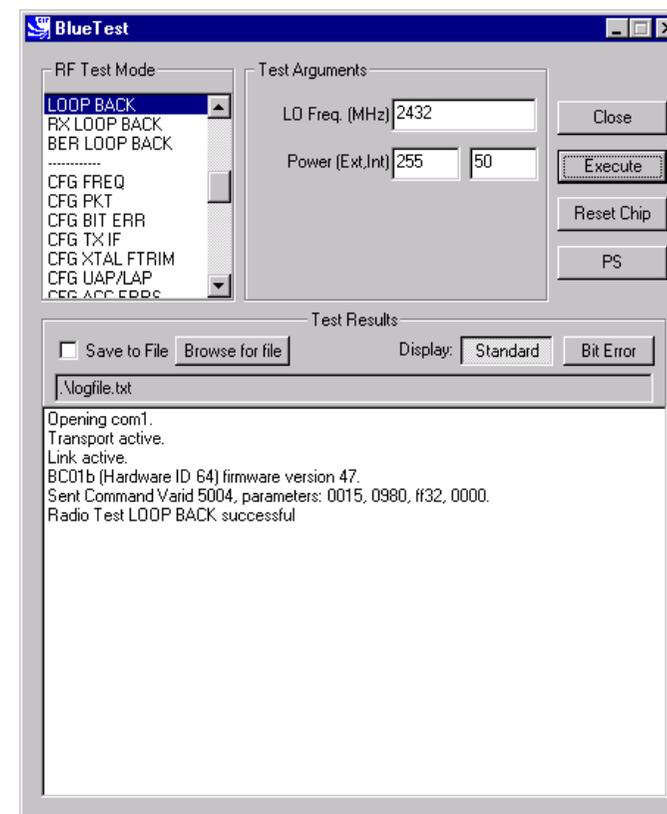
| | |
|-------------------------------|---|
| Title | BIT ERR2 |
| Summary | <p>Enables the receiver with simplified hopping defined by Country Code with a choice of low or high side modulation (hi-side), and with a designated attenuation setting (RX Attenuation) as for RXDATA2.</p> <p>Returns information on bit errors to the host as those given for BIT ERR1.</p> |
| Related Test Spec Name | <p>None, but note that this test allows (as in BIT ERR1) the tests RCV/CA/01/C and RCV/CA/02/C (sensitivity), RCV/CA/04/C (blocking performance) to be performed with hopping on. This is a more thorough test than that possible with the 7 Layers equipment.</p> |
| Test Arguments | <p>Country Code = 0 to 3 (default 0)</p> <p>hi-side = 0 or 1 (default = 0)</p> <p>RX Attenuation = 0 to 15 (default = 0)</p> |
| Note | <p>With a second unit, execute CFG UAP/LAP to set BT address then execute TXDATA2, then execute CFG UAP/LAP to set the same BT address on the Equipment under Test (EUT) before executing BIT ERR2.</p> |
| Return Data | <p>Nine reports, each two uint32 values as for BIT ERR1.</p> |
| Exit | <p>Click on Reset Chip.</p> |



BIT ERR2 Example Display

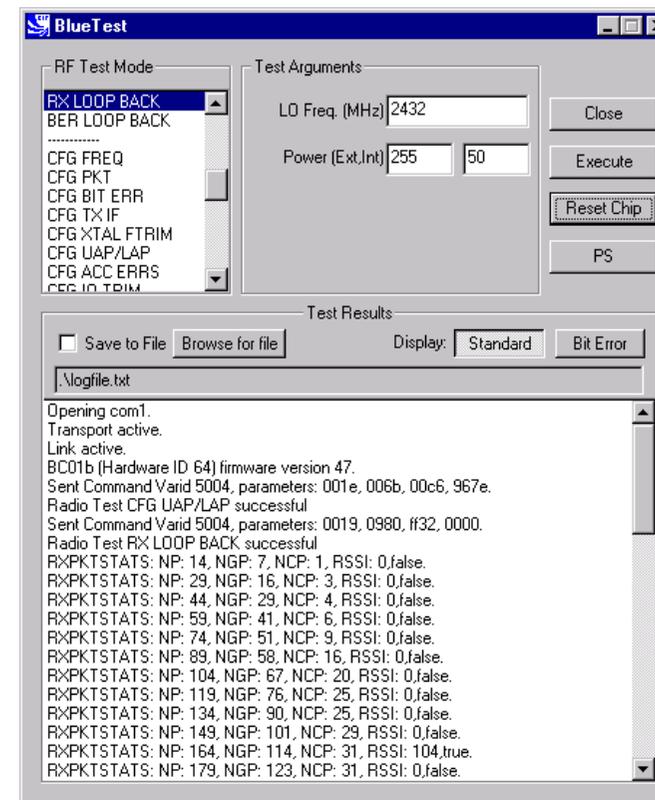
Loopback Test Mode

| | |
|-------------------------------|---|
| Title | LOOP BACK |
| Summary | Receives data on LO Frequency for data packets and then retransmits this data on the same channel at transmit level 'lv1'. Highside reception is off and attenuation is set to 0. Expected reception frequency, <code>txrx_freq</code> (default = 12500 microseconds) with single slot packets returned <code>lb_offs</code> after receipt (default = 1875 microseconds). Defaults can be changed. See Configuration Commands section. |
| Related Test Spec Name | None, but note that this test RCV/CA/01/C to RCV/CA/06/C to be performed in loopback without using the LMP commanded loopback test mode. RCV/CA/01/C to RCV/CA/06/C to be performed in loopback, but without using the LMP commanded loopback test mode. |
| Test Arguments | LO Freq (Carrier Frequency MHz)= 2402 to 2480 (default = 2432) Power (Ext, Int) = gain of external amplifier (if present) and internal amplifier. Ext value is specific to the design and Int value is 0 to 63 (Default = 50). |
| Return Data | None |
| Exit | Click on Reset Chip . |

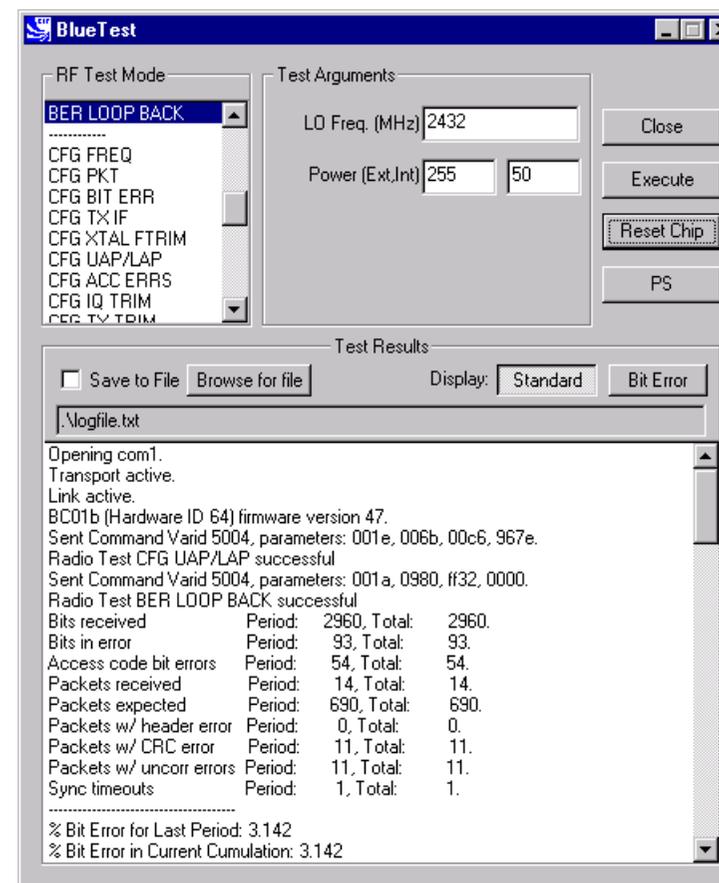


LOOP BACK Example Display

| | |
|-------------------------------|--|
| Title | RX LOOP BACK |
| Summary | Transmit PRBS9 data on LO Frequency at transmit level and listen for transmissions in the next slot but one. Sends reports as RXDATA1 back to the host once per second (configurable). Highside reception is off and attenuation is set to 0. Default is single-slot packets (configurable with <code>config_freq</code>). This is designed to be used with a second unit in LOOP_BACK test mode. |
| Related Test Spec Name | None, but note that this test allows transmission to and reception from Implementation under Test (IUT) in LOOP_BACK test mode with RSSI and BER calculated from FEC. |
| Test Arguments | LO Freq (Carrier Frequency MHz)= 2402 to 2480 Power (Ext, Int) = gain of external amplifier (if present) and internal amplifier. Ext value is specific to the design and Int value is 0 to 63 (Default = 50). |
| Note | With a second unit execute CFG UAP/LAP to set the Bluetooth address. Execute LOOP BACK then execute CFG UAP/LAP to set the same BT address on the Equipment under Test (EUT) before executing RX LOOP BACK . |
| Return Data | NP = Number of packets NGP = Number of good packets NCP = Number of corrected packets RSSI = Received Signal Strength Indication True = RSSI is reliable, otherwise false |
| Exit | Click on Reset Chip . |

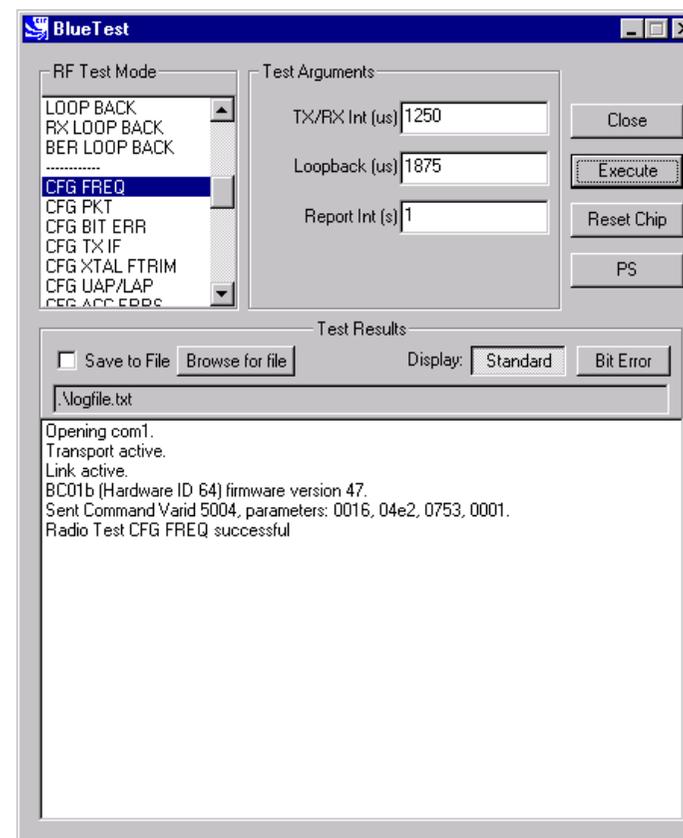

RX LOOP BACK Example Display

| | |
|-------------------------------|--|
| Title | BER LOOP BACK |
| Summary | Transmit PRBS9 data on LO Frequency at transmit level and listen for transmissions in the next slot but one. Sends reports as BIT ERR1 back to the host once per second (configurable). Highside reception is off and attenuation is set to zero Default is single slot packets (configurable with <code>config_freq</code>). Designed to be used with a second unit in <code>loop_back</code> test mode. |
| Related Test Spec Name | None, but note that this test allows transmission to and reception from IUT in loopback test mode, with calculation of BER to BT specification. |
| Called via | BCSP channel 2 |
| Test Arguments | LO Freq (Carrier Frequency MHz)= 2402 to 2480 Power (Ext, Int) = gain of external amplifier (if present) and internal amplifier. Ext value is specific to the design and Int value is 0 to 63 (Default = 50). |
| Note | With a second unit execute CFG UAP/LAP to set BT address then execute LOOP BACK , then execute CFG UAP/LAP to set the same BT address on the EUT before executing BER LOOP BACK . |
| Return Data | Nine reports as for BIT ERR1 . |
| Exit | Click on Reset Chip . |


BER LOOP BACK Example Display

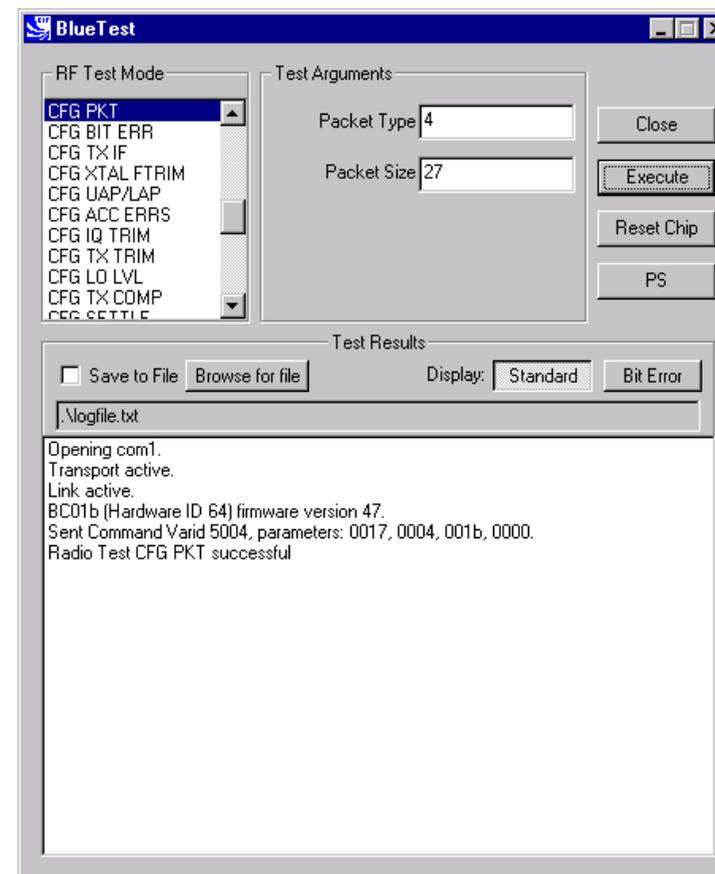
Configuration Commands

| Title | CFG FREQ |
|------------------------|--|
| Summary | <p>Sets three values used in deciding timing details of tests.</p> <p>Tx/Rx Int (<code>txrx_freq</code>) sets the period in microseconds between TX and RX events in RXDATA, TXDATA, BIT ERR and LOOP BACK test modes. Default is 1250 (20 slots), maximum 65536. If passed as 0, current value unchanged.</p> <p>Loopback (<code>lb_offs</code>) sets the offset in microseconds between a reception event and retransmission of the data in loopback. Default is 1875 (two slots later), must be less than TX/Rx Int (<code>txrx_freq</code>). If passed as zero current value unchanged.</p> <p>Report Int (<code>report_freqs</code>) sets the time in seconds between reports to host sent by RXDATA and BIT ERR functions. Default 1, if passed as 0 current value unchanged.</p> |
| Related Test Spec Name | None |
| Test Arguments | <p>TX/RX Int (μS) = 1 to 65535 (default = 1250)</p> <p>Loopback (μS) = 1 to 65535 (default = 1875)</p> <p>Report Int (S) = 1 to 65535 (default = 1)</p> |
| Return Data | None. |
| Exit | Click on Reset Chip . |



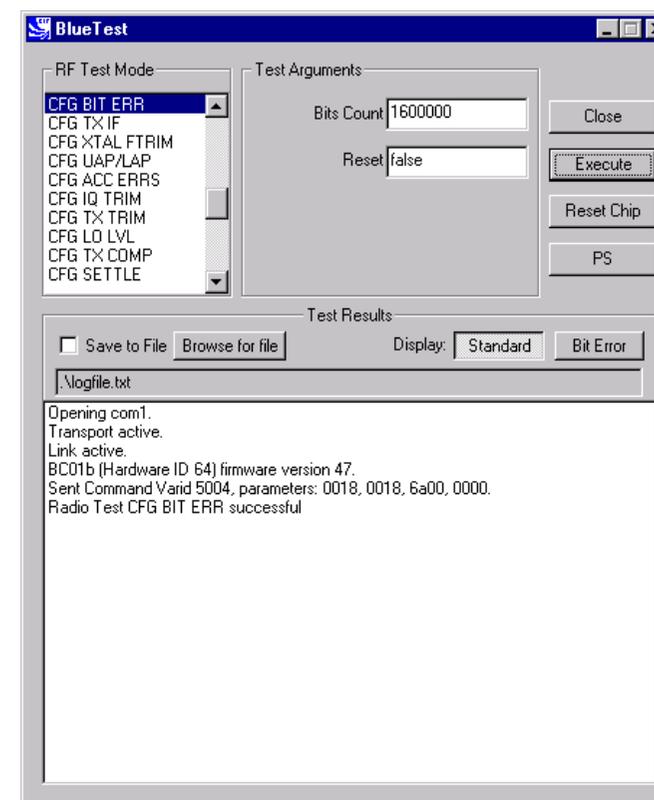
CFG FREQ Example Display

| Title | CFG PKT |
|-------------------------------|--|
| Summary | <p>Sets packet type and size for transmitter tests. It has no effect on RX or LOOP BACK tests.</p> <p>Packet Type (<code>pkt-type</code>) is the standard Bluetooth packet type, 0-15 (12-13 not allowed). Any other number sets default: DM5 for TXDATA1/2, DH5 for TXDATA3/4.</p> <p>Packet Size (<code>pkt_size</code>) is the size of data in packet, from one to maximum for type. If zero sets default: 20 bytes for TXDATA1/2, 192 bytes for TXDATA3/4.</p> <p>Since the two values are connected both values must be set – no default is inferred.</p> |
| Related Test Spec Name | None |
| Test Arguments | <p>Packet Type = 0 to 15 (default = 4) (see Appendix 5)</p> <p>Packet Size = 0 to 339 (default = 27)</p> |
| Return data | None |
| Exit | Click on Reset Chip . |



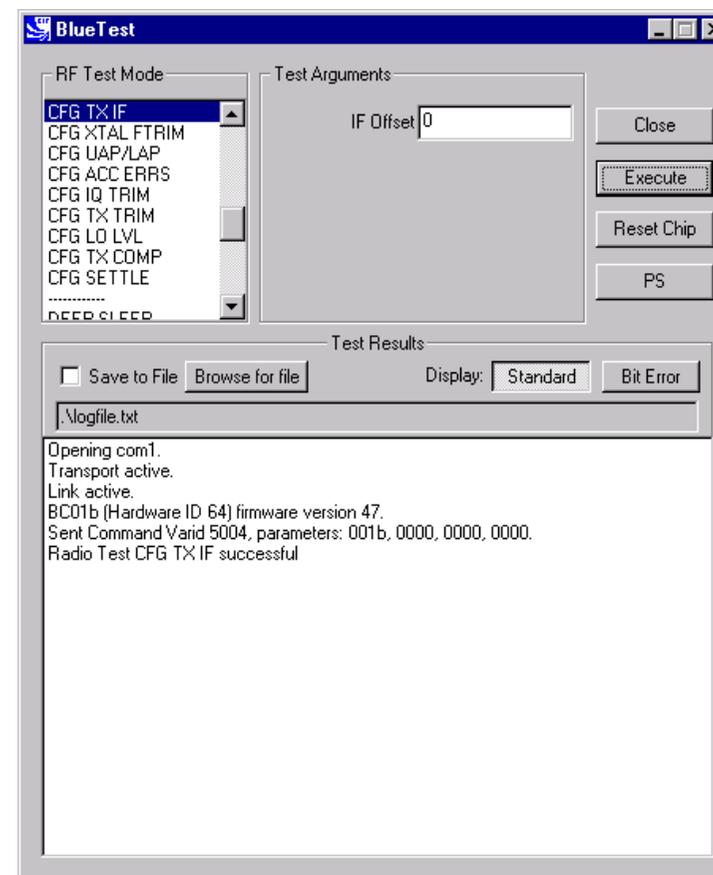
CFG PKT Example Display

| | |
|-------------------------------|---|
| Title | CFG BIT ERR |
| Summary | <p>Sets two values used in bit error measurements.</p> <p>If Bits Count (<code>bits_count</code>) is non-zero, the target for total counters is set to this and total count resets at this value. If passed as 0 current value, unchanged.</p> <p>If Reset is not <code>false</code> and BIT ERR/2 is active, immediately resets the counters for the total statistics, but not over the last report period.</p> |
| Related Test Spec Name | None |
| Test Arguments | <p>Bits Count = 1 to 4.2×10^9 (default = 1600000 Bit)</p> <p>Reset = <code>false</code> (0) or <code>true</code> (1) (default = <code>false</code>)</p> |
| Return Data | None |
| Exit | Click on Reset Chip . |



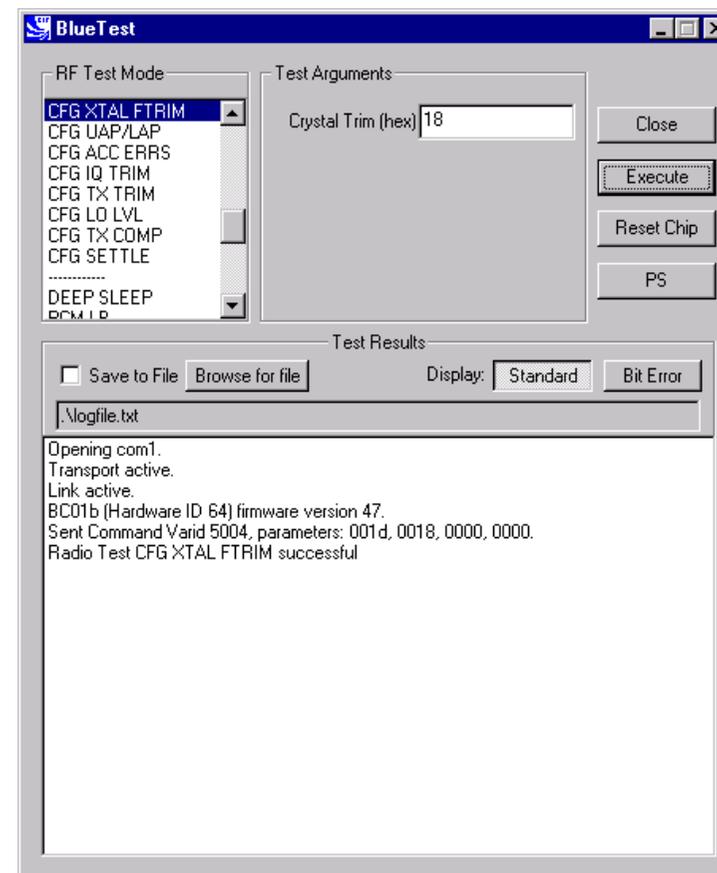
CFG BIT ERR Example Display

| | |
|-------------------------------|--|
| Title | CFG TX IF |
| Summary | <p>Sets the IF frequency used in transmit test modes. The target is zero, but the stack currently uses a default of -1MHz.</p> <p>Offset is a signed integer with a range from $+5$ to -5, in units of 0.5MHz.</p> |
| Related Test Spec Name | None |
| Test Arguments | IF Offset = -5 to $+5$ (default = 0) |
| Return data | None |
| Exit | Click on Reset Chip . |



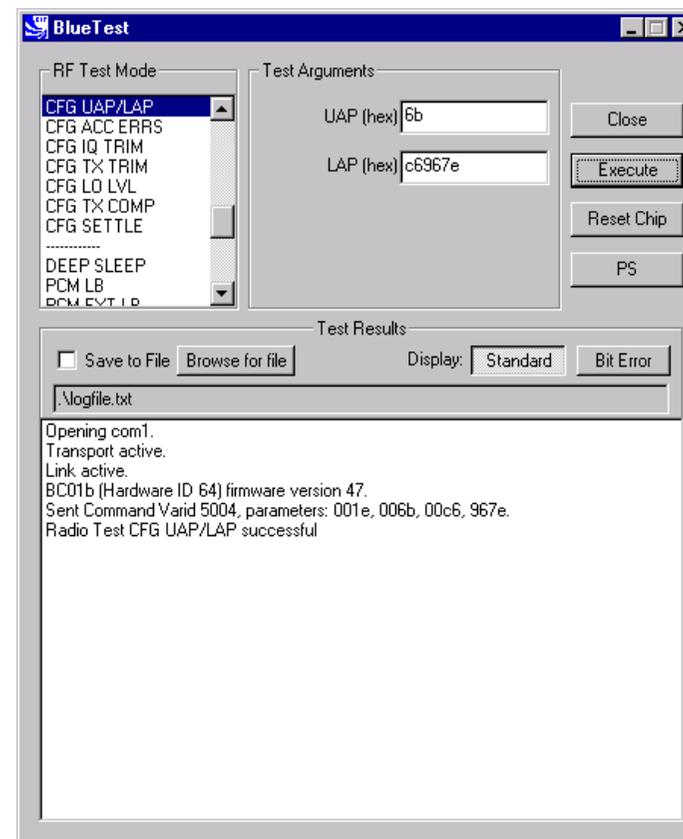
CFG TX IF Example Display

| | |
|-------------------------------|--|
| Title | CFG XTAL FTRIM |
| Summary | <p>Timing for BlueCore01 is controlled by a crystal. This requires trimming for new hardware. This command can be used to set a new trim value either before a radiotest command is started or while a test is already in operation; the change takes effect immediately.</p> <p>Crystal Trim (xtal_ftrim) is a number between 0 and 63 inclusive. This is not a permanent change.</p> |
| Related Test Spec Name | None |
| Test Arguments | Crystal Trim = 0 to 63 (typical = 27) |
| Note | With Crystal Trim set to 0, the current settings will not change. |
| Return data | None |
| Exit | Click on Reset Chip . |



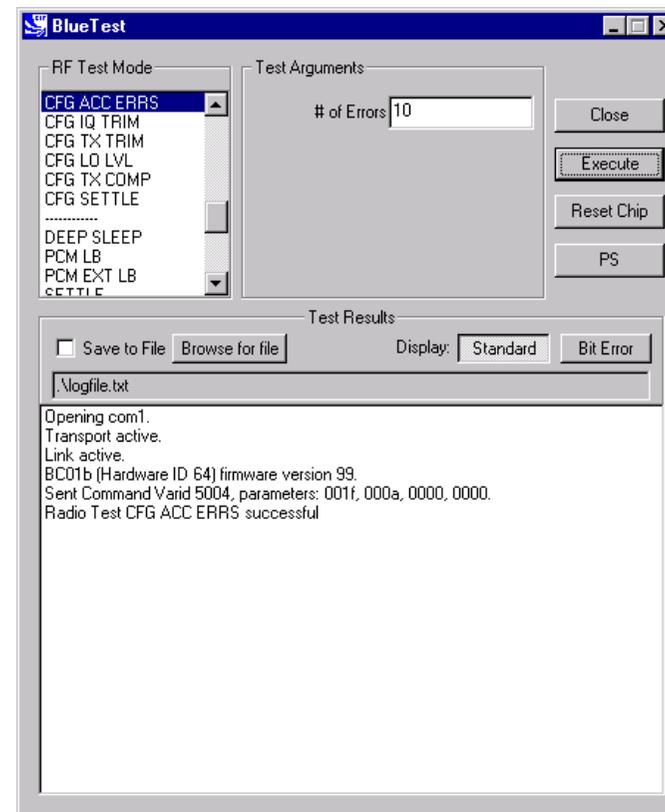
CFG XTAL FTRIM Example Display

| | |
|-------------------------------|---|
| Title | CFG UAP/LAP |
| Summary | Sets the UAP and LAP to be used in tests. BlueCore01 usually uses its own Bluetooth Device address to determine the access sync code, as if it is master of a piconet. The UAP and LAP are the only parts used. This command allows a special UAP and LAP to be used only in the test modes. |
| Related Test Spec Name | None |
| Test Arguments | Bluetooth Address: UAP = 0 to FF (Default = 6b) LAP = 0 to FFFFFFFF (Default = c6967e) |
| Return Data | None |
| Exit | Click on Reset Chip . |



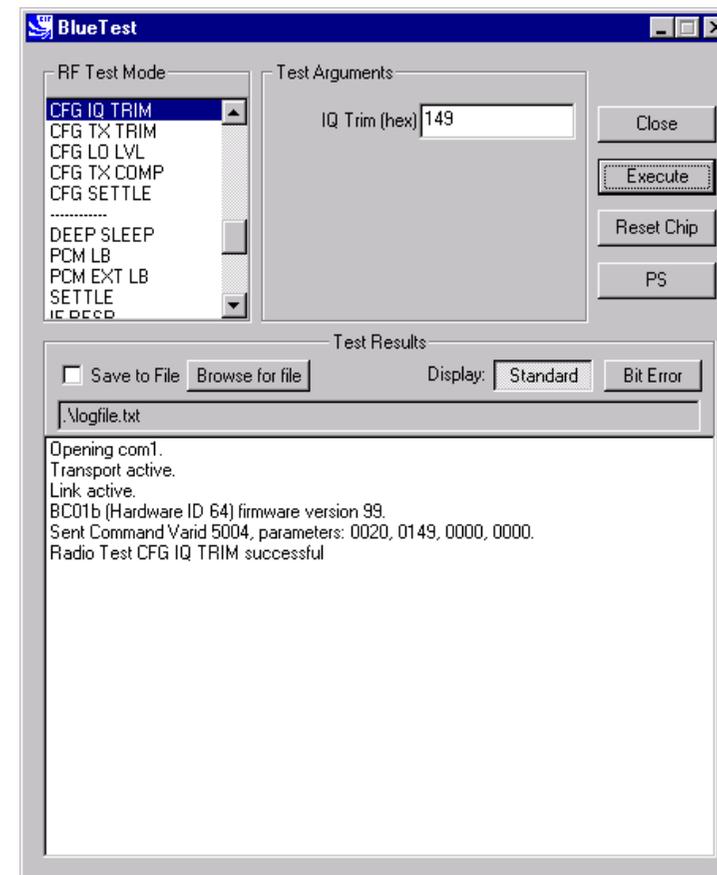
CFG UAP/LAP Example Display

| | |
|-------------------------------|--|
| Title | CFG ACC ERRS |
| Summary | The receiver uses a sliding correlator to determine that it has matched the start of a packet. The receiver allows up to # of errors (n_errs) before a match is rejected. |
| Related Test Spec Name | None |
| Test Arguments | # of errors = 0 to 15 (default = 10) |
| Return Data | None |
| Exit | Click on Reset Chip . |



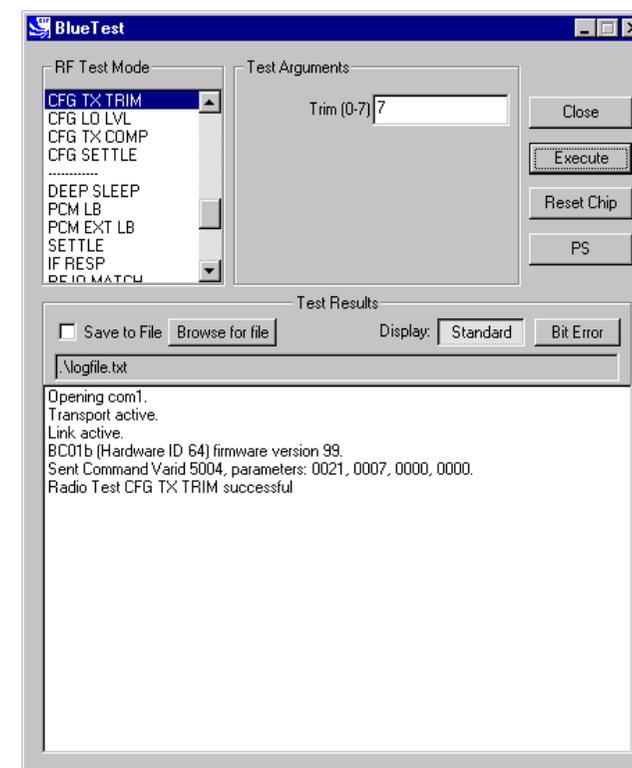
CFG ACC ERRS Example Display

| | |
|-------------------------------|---|
| Title | CFG IQ TRIM |
| Summary | Sets the IQ Trim (<code>trim</code>) value overriding the value calculated by the internal calibration algorithm. This command is not executed in normal use. |
| Related Test Spec Name | None |
| Test Arguments | IQ Trim = 0 to 511 (default 149 (hex)) |
| Return Data | None |
| Exit | Click on Reset Chip . |



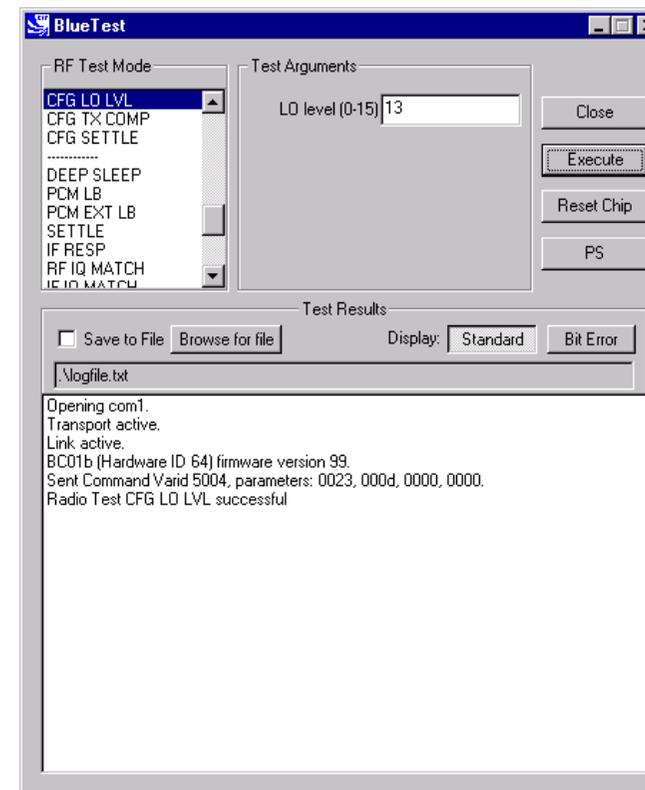
CFG IQ TRIM Example Display

| | |
|-------------------------------|--|
| Title | CFG TX TRIM |
| Summary | Sets the Active Member Address (<code>am_addr</code>) for the device to be used in the header of all test transmissions to <code>am_addr</code> . If the transmitter and receiver are used for the same test, both devices will normally have to be set to the same <code>am_addr</code> . |
| Related Test Spec Name | None |
| Test Arguments | Trim (<code>am_addr</code>) = 0 to 7, Default = 7 |
| Return Data | None |
| Exit | Click on Reset Chip . |



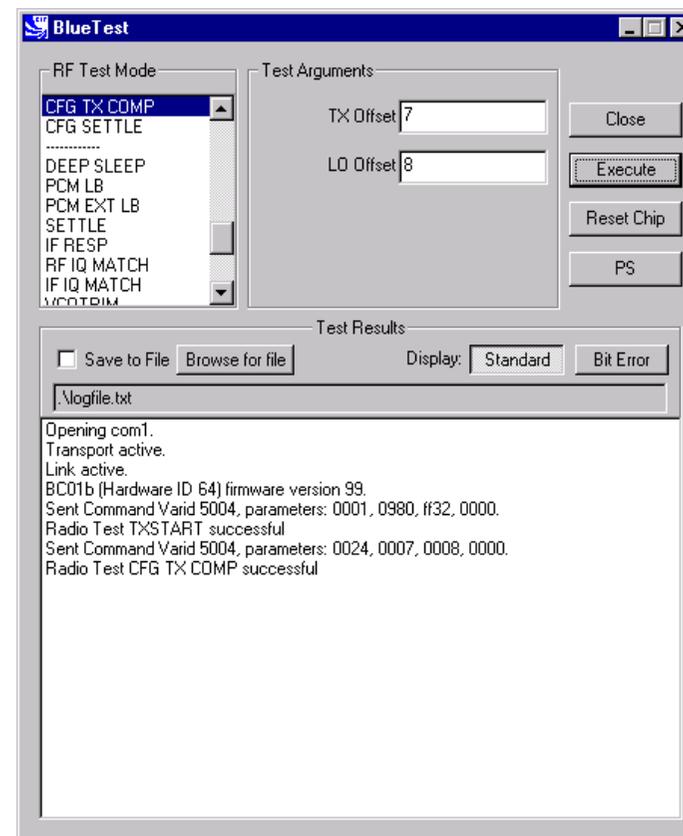
CFG TX TRIM Example Display

| | |
|-------------------------------|--|
| Title | CFG LO LVL |
| Summary | Sets the value of the Analogue Local Oscillator output level to LO level (lvl) , overriding the value calculated by the internal calibration algorithm. This command is not executed in normal use. |
| Related Test Spec Name | None |
| Test Arguments | LO level = 0 to 15 (default = 13) |
| Return Data | None |
| Exit | Click on Reset Chip . |



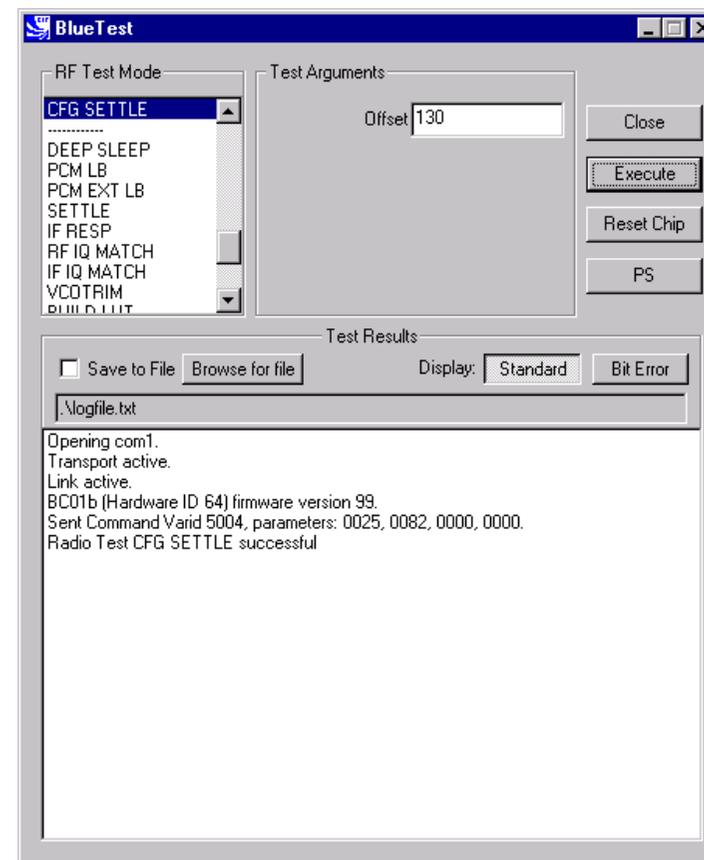
CFG LO LVL Example Display

| | |
|-------------------------------|---|
| Title | CFG TX COMP |
| Summary | Sets TX Offset (tx_offset) and LO Offset (lo_offset) for the firmware's algorithm, which sets the maximum power. Run TXSTART before executing CFG TX COMP , otherwise there is no transmit power to set. |
| Related Test Spec Name | None |
| Test Arguments | TX Offset , minimum = 0 (default = 7) LO Offset , minimum = 0 (default = 8) |
| Return Data | None |
| Exit | Click on Reset Chip . |



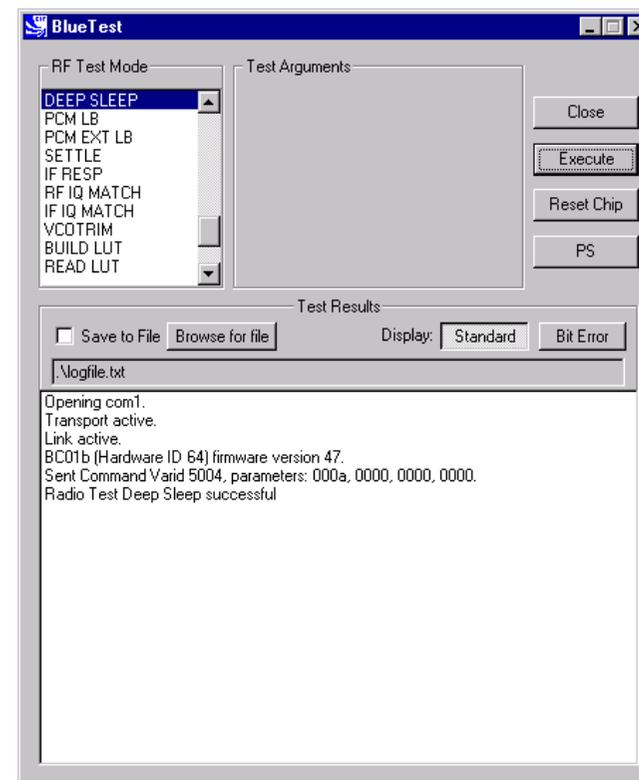
CFG TX COMP Example Display

| | |
|-------------------------------|---|
| Title | CFG SETTLE |
| Summary | Sets the period (<code>radio_on_offset</code>) in microseconds between turning the radio on and starting to transmit. |
| Related Test Spec Name | None |
| Test Arguments | Offset , minimum = 0 (default = 130) |
| Return Data | None |
| Exit | Click on Reset Chip . |


CFG SETTLE Example Display

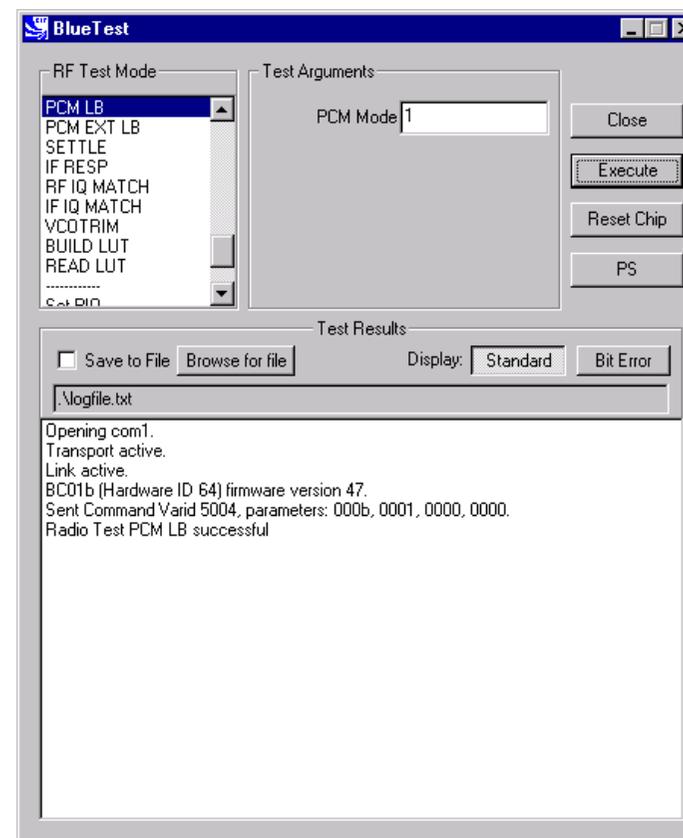
Built-in-Self Test (BIST) Routines

| | |
|--------------------|---|
| Title | Deep Sleep |
| Summary | Puts the chip into deep-sleep after a delay of half a second until woken by reset or any activity on USB or UART interface. |
| Return Data | None |
| Exit | Click on Reset Chip or another routine being called. |



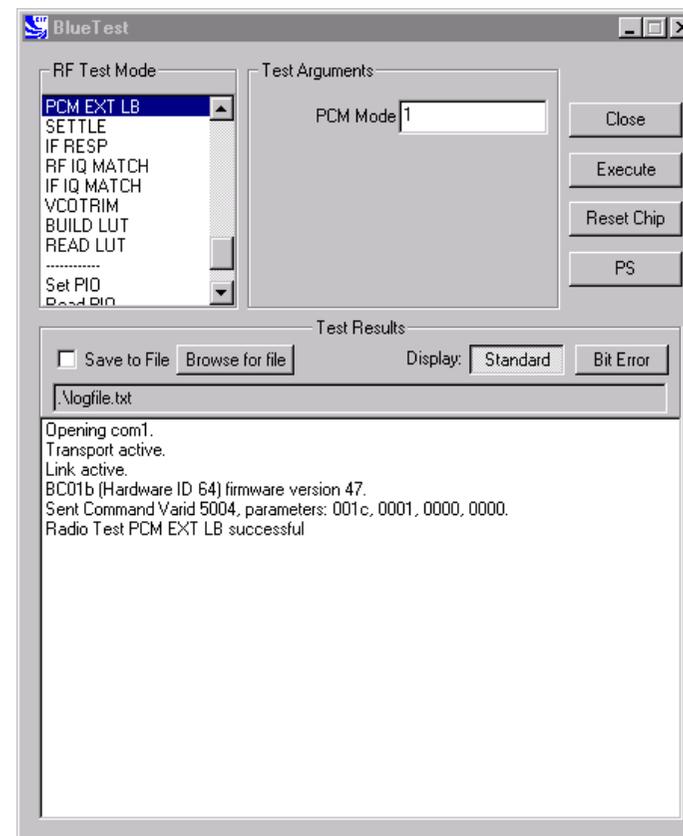
Deep Sleep Example Display

| Title | PCM LB |
|-----------------------|---|
| Summary | <p>Sets the PCM into LOOP BACK mode, whereby the data read from the PCM input is output again on the PCM out pin. The LOOP BACK is via software and the buffers so there is a pipeline delay. The PCM port mode is selectable.</p> <p>If PCM Mode = 0, BlueCore01 is slave in normal 4-wire configuration</p> <p>If PCM Mode = 1, BlueCore01 is master in normal 4-wire configuration</p> <p>If PCM Mode = 2, BlueCore01 is master in Manchester encoded, 2-wire configuration.</p> |
| Test Arguments | PCM Mode = 0 to 2 (default = 1) |
| Return Data | None |
| Exit | Click on Reset Chip or another routine being called. |



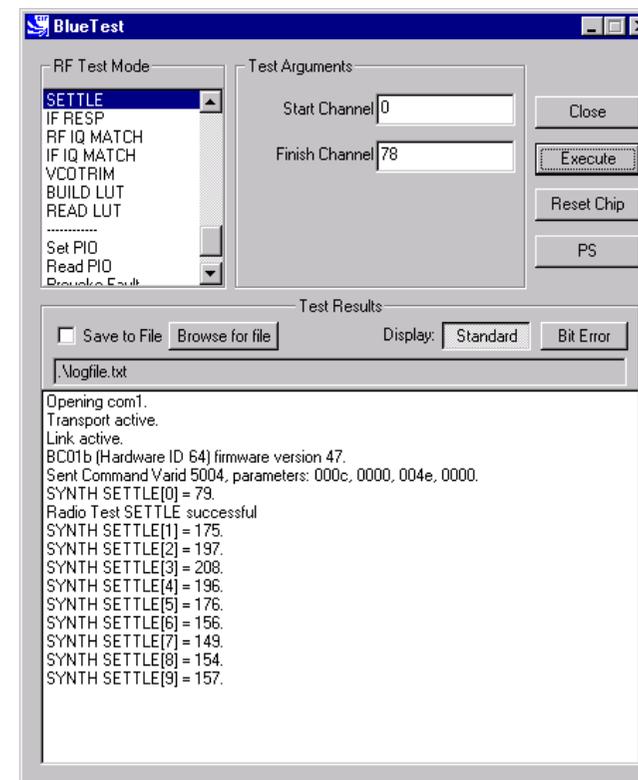
PCM LB Example Display

| | |
|-------------------------------|---|
| Title | PCM EXTERNAL LOOPBACK |
| Summary | <p>Sets the PCM into external LOOPBACK mode, whereby the data written to the PCM output is read again on the input pin. A check is made that the data read back is the same (up to usual codec transformations) as that written. The LOOP BACK consists of 512 bytes of random data.</p> <p>The PCM port mode is selectable as PCM Mode (<code>pcm_mode</code>), which is the same as for PCM LB (<code>radiotest_pcm_loop_back</code>)</p> <p>The external LOOP BACK may be a simple wire.</p> |
| Related Test Spec Name | None |
| Note | On the Casira under test, set CN8 jumper to Codec BYP and on header CN12 link pins 10 and 11. |
| Test Arguments | PCM Mode = 0 to 2 (default = 1) |
| Return Data | None |
| Exit | Click on Reset Chip . |



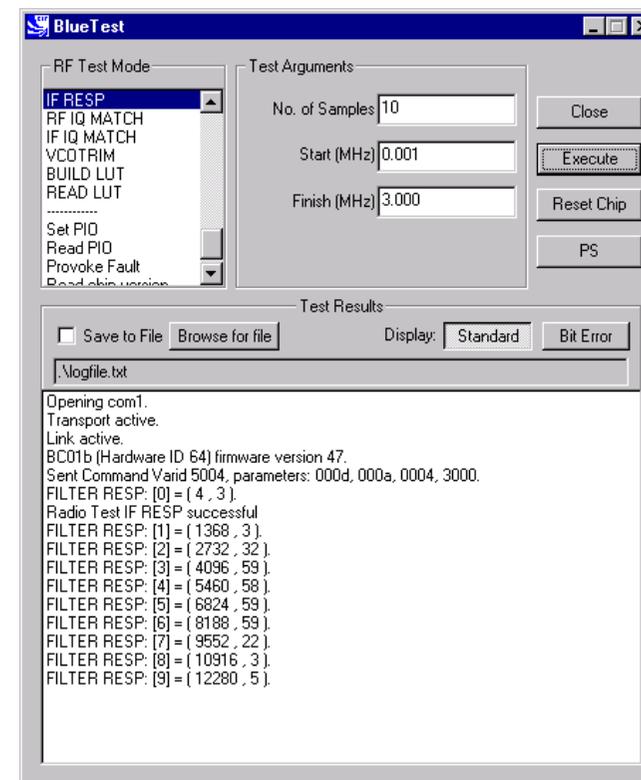
PCM EXT LB Example Display

| | |
|-----------------------|---|
| Title | SETTLE |
| Summary | Builds the LUT as normal, then does a step from Start Channel (chan1) to Finish Channel (chan2), while the synthesiser is running. It digitises the synthesiser (LO_TUNE) error voltage at intervals of 10 – 20µs over the next 200µs and writes the results to an array. |
| Test Arguments | Start Channel (chan1) = 0 to 78 (default 0) Finish Channel (chan2) = 0 to 78 (default 78) |
| Return Data | A sequence of ten reports of the synthesiser (LO_TUNE) error voltage over the next 200µs. |
| Exit | Click on Reset Chip or another routine being called. |



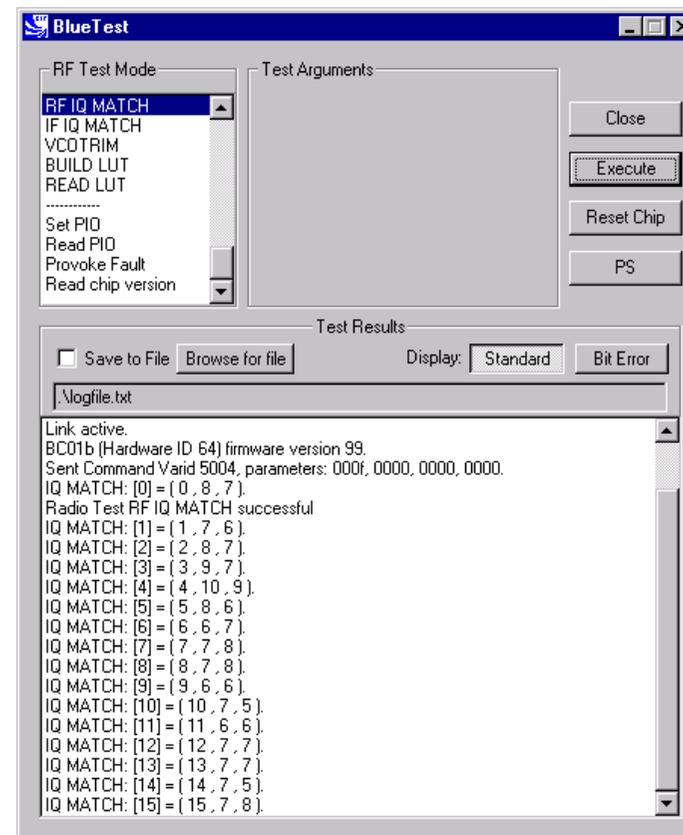
SETTLE Example Display

| Title | IF RESP |
|----------------|--|
| Summary | Sweeps transmit IF carrier frequency over designated number of samples (<code>n_samples</code>) within range (0-3MHz maximum) and measures RSSI. Returns table of RSSI value against frequency offset to characterise IF filter response. |
| Test Arguments | <p>No. of Samples (<code>n_samples</code>) = 0 to 65535 (default = 10)</p> <p>Start (<code>lo_offset</code>) = 0 to 3MHz (default 0.001 MHz)</p> <p>Finish (<code>hi_offset</code>) = 0 to 3 MHz (default = 3.000 MHz. Must be greater than <code>lo_offset</code>)</p> |
| Return Data | A sequence of reports of RSSI and frequency offset. |
| Exit | Click on Reset Chip . |



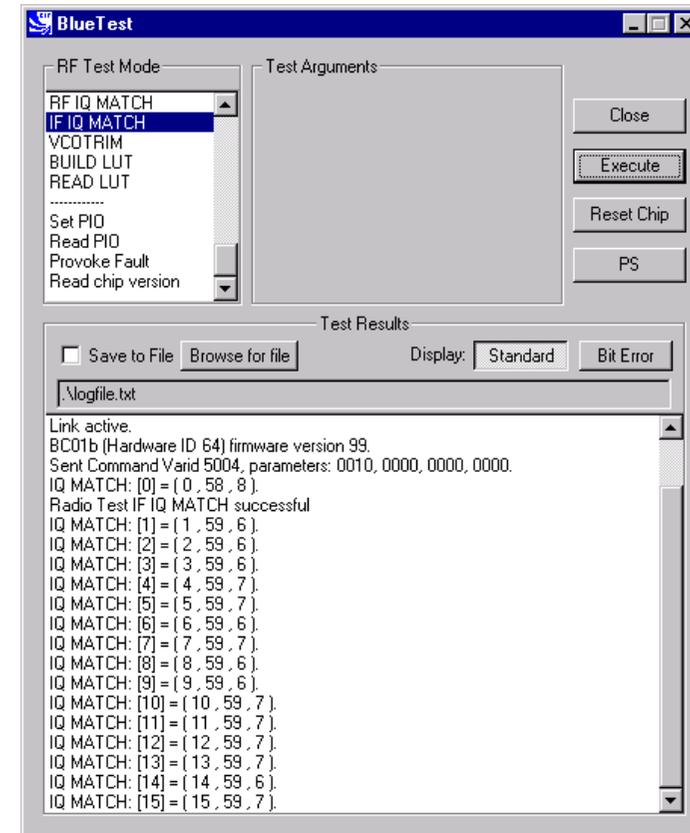
IF RESP Example Display

| | |
|--------------------|--|
| Title | RF IQ MATCH |
| Summary | Measures RF IQ match by injecting test signal, sweeping IQ trim and measuring RSSI for on-channel and image. Returns array of IQ measurements against IQ trim. |
| Return Data | An array of 16 IQ measurements against IQ trim. |
| Exit | Click on Reset Chip . |



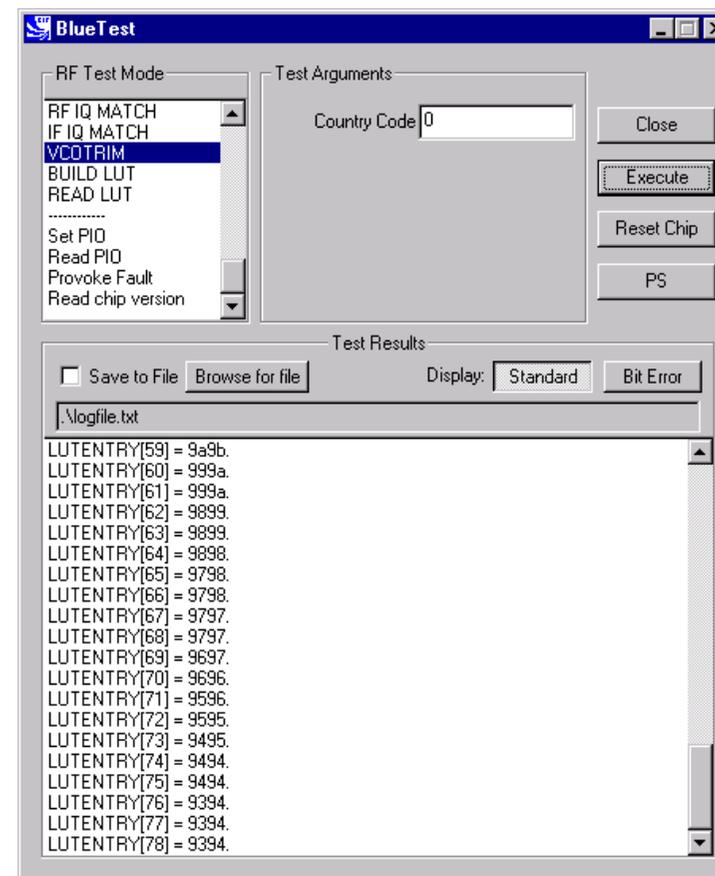
RF IQ MATCH Example Display

| | |
|--------------------|--|
| Title | IF IQ MATCH |
| Summary | Measures IF IQ match by injecting test signal, sweeping IQ trim and measuring RSSI for on-channel and image. Returns array of IQ measurements against IQ trim. |
| Return Data | An array of 16 IQ measurements against IQ trim. |
| Exit | Click on Reset Chip . |



IF IQ MATCH Example Display

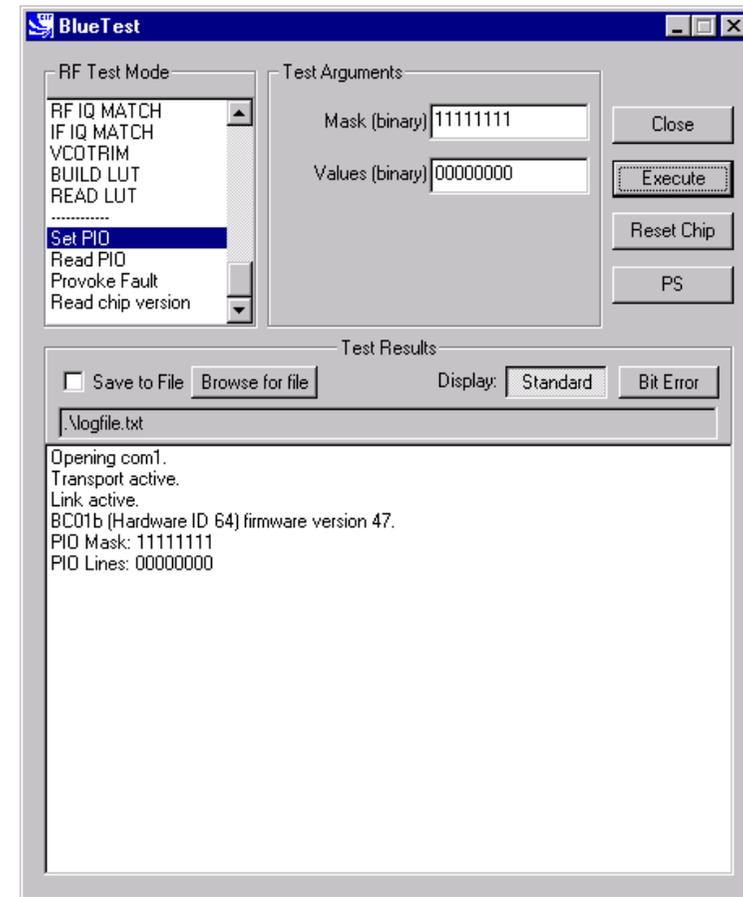
| | |
|-----------------------|--|
| Title | VCO TRIM |
| Summary | Produces look up table of VCO trim versus hop frequencies for a designated country hop sequence. |
| Test Arguments | Country Code (cc) = 0 to 3 (default = 0) |
| Return Data | An array of 79 values for VCO trim if Country Code is 0 otherwise 23 values. |
| Exit | Click on Reset Chip . |



VCO TRIM Example Display

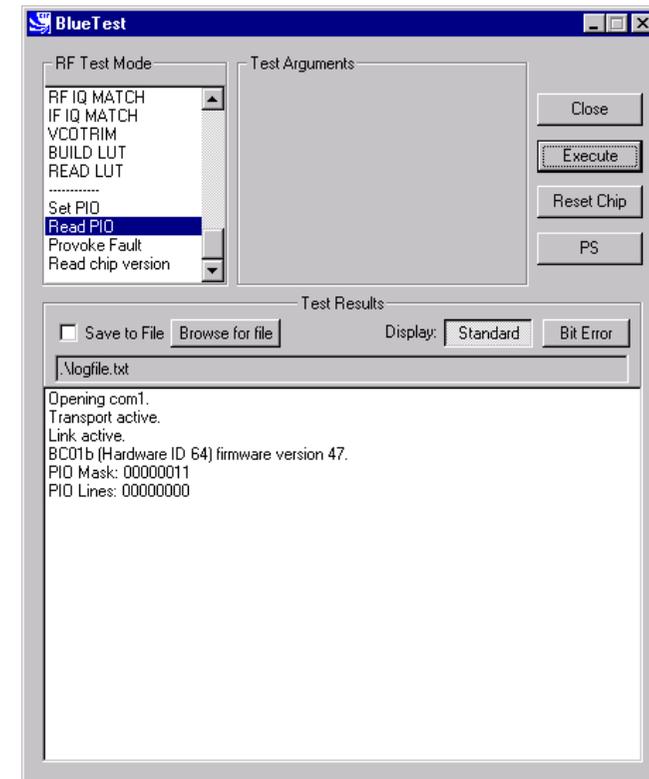
Miscellaneous Test Routines

| | |
|-----------------------|--|
| Title | Set PIO |
| Summary | Enables designated PIO lines as outputs and sets them as desired. To be used with caution since it over-rides previous settings. Bit 0 corresponds to PIO[0], and a logic one enables it as an output. |
| Test Arguments | Mask (default = 11111111) Values (default = 00000000) |
| Return Data | None |
| Exit | Click on Reset Chip . |



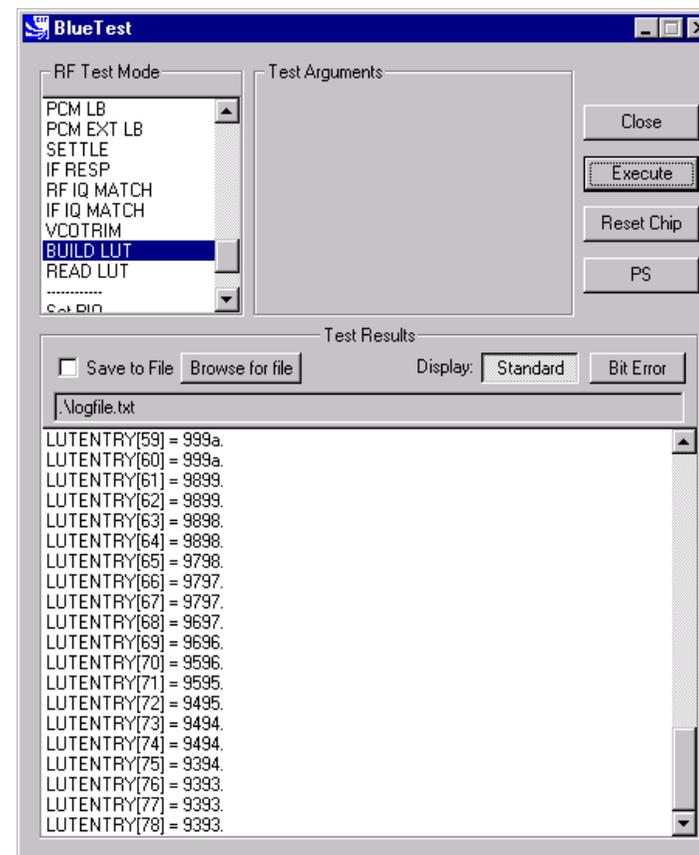
Set PIO Example Display

| | |
|--------------------|---|
| Title | Read PIO |
| Summary | Reads the logic state of the PIO pins. Valid whether they are inputs or outputs. |
| Return Data | PIO Lines (uint8) sent over BCSP channel 3, giving the logic level at each of the pins. |
| Exit | Click on Reset Chip . |

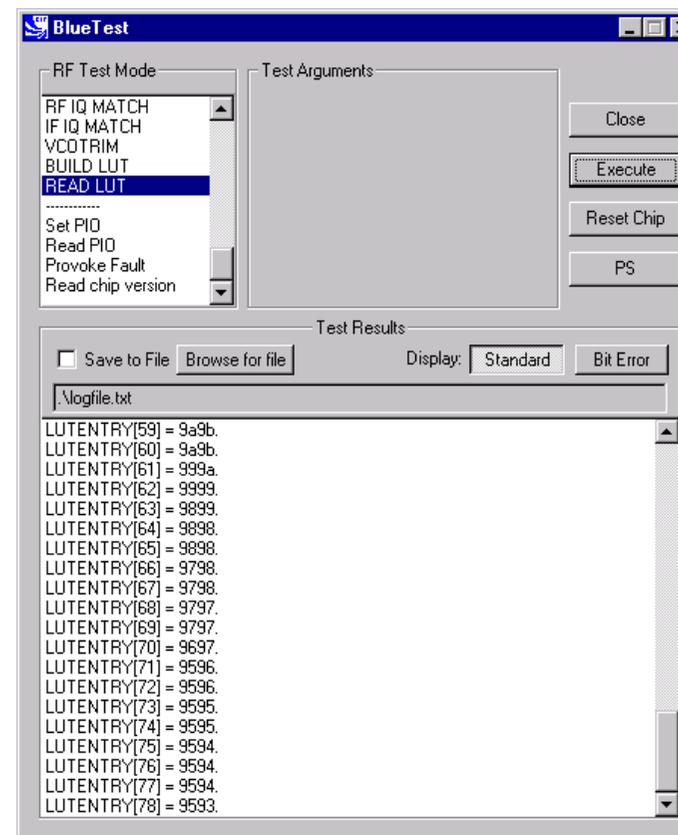


READ PIO Example Display

| | |
|--------------------|---|
| Title | BUILD LUT |
| Summary | Builds the radio's channel LO_TRIM frequency look-up table then returns it to the host. |
| Return Data | A sequence of 79 uint16 numbers, containing the calibration data just generated. |
| Exit | Click on Reset Chip . |

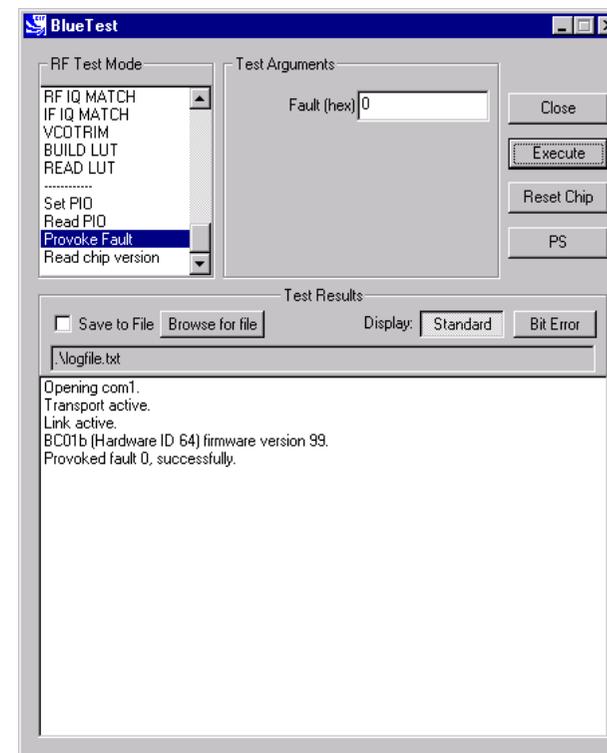

BUILD LUT Example Display

| | |
|--------------------|---|
| Title | READ LUT |
| Summary | Reports the radio's channel LO_TRIM frequency look-up-table (LUT) to the host. |
| Return Data | A sequence of 79 (uint16) numbers containing the contents of the look up table (LUT) for Europe and North America or a sequence of 23 (uint16) numbers for other countries. The upper byte contains the transmitter trim and the lower byte contains the receiver trim. |
| Exit | Click on Reset Chip . |



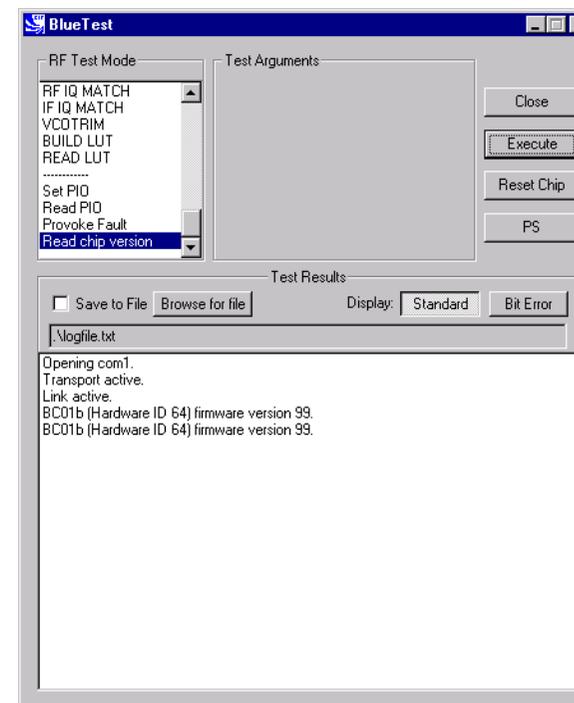
READ LUT Example Display

| | |
|-----------------------|--|
| Title | PROVOKE FAULT |
| Summary | Provokes a fault mode in the on-chip processor. |
| Return Data | None |
| Test Arguments | Fault (hex) = 0 to 2b (default = 0) Note: Contact CSR for more information about using fault modes. |
| Exit | Click on Reset Chip . |



PROVOKE FAULT Example Display

| | |
|--------------------|---|
| Title | READ CHIP VERSION |
| Summary | Reads the hardware ID and firmware version of device. |
| Return data | Hardware ID and firmware version. |



READ CHIP VERSION Example Display

Persistent Store Keys

Select **PS** from the main menu.

Enter a **Key** number.

To read a PS Key value, click on **Read**. The setting displays in the **Value** field.

To change a **PS** key setting, enter a different value in the **Value** field and click on **Set**.

To exit, click on **OK**.



PERSISTENT STORE KEY Example Display

Appendix 1

BIST Parameters

| Name | Type | Min | Max | Meaning |
|-----------------|--------|------|-------------------|---|
| lo_freq | uint16 | 2402 | 2480 | Bluetooth channel frequency in MHz |
| lxlvl | uint16 | 0 | 63 | Internal amplifier power setting. Use 50 for maximum power |
| mod_freq | uint16 | 0 | 65535 | Modulation frequency for modulated carrier transmit test in units of 1/4096 MHz |
| highside | bool | 0 | Non-zero | Receive IF setting, use false (0) |
| rx_attn | uint16 | 0 | 15 | Initial attenuation setting, overwritten by AGC |
| country_code | uint16 | 0 | 3 | Simplified hop sequence code, use country_code 0 for 79 hops |
| txrx_freq | uint16 | 1 | 65535 | Period in microseconds between RX and TX events; default 12500 (20 slots) |
| lb_offs | uint16 | 1 | 65535 | Offset in microseconds between receive and transmit in loopback |
| report_freq | uint16 | 1 | 65535 | Time in seconds between reports to host, default 1 |
| pkt_type | uint16 | 0 | 15 | Standard Bluetooth packet type (12-13 disallowed. 0, 1, 2 not useful) |
| pkt_size | uint16 | 0 | 339 | Size of payload for packet type |
| bits_count | uint32 | 1 | 4.2×10^9 | Target for total bits used in BER measurement; default 1.6 M bit |
| Reset | bool | 0 | 1 | 1 resets total count for BER measurement |
| offset_half_mhz | int16 | -5 | +5 | Transmit IF offset; default -2 |
| pcm_mode | uint16 | 0 | 2 | PCM loopback mode; 0 = 4-wire slave, 1 = 4-wire master, 2 = 2-wire slave |

| Name | Type | Min | Max | Meaning |
|-----------------|--------|-----|--------|--|
| chan1 | uint16 | 0 | 78 | Bluetooth channel number |
| chan2 | uint16 | 0 | 78 | Bluetooth channel number |
| n_samples | uint16 | 0 | 65535 | Number of samples in range from min to max for IF filter response test |
| lo_offset | uint16 | 0 | 65535 | Min offset in 1/4096MHz for IF filter response test |
| hi_offset | uint16 | 0 | 65535 | Max offset in 1/4096MHz for IF filter response test |
| output_mask | Uint8 | 0 | FF | Bit mask for PIO; 0=input, 1=output |
| output | Uint8 | 0 | FF | Bit values for PIO output |
| xtal_trim | Uint16 | 0 | 63 | Crystal trim value |
| uap | Uint16 | 0 | FF | Bluetooth address; Upper Address Part |
| Lap | | 0 | FFFFFF | Bluetooth address; Lower Address Part |
| Trim | Uint16 | 0 | 511 | Value for configuring IQ trim |
| n_errs | Uint16 | 0 | 15 | Number of errors |
| Lvl | Uint16 | 0 | 15 | Local oscillator output level |
| tx_offset | Uint16 | 0 | | Transmitter offset |
| lo_offset | Uint16 | 0 | | Local oscillator offset |
| radio_on_offset | Uint16 | 0 | | Time between turning radio on and starting to transmit in microseconds |

Appendix 2

Known Software Issue(s) in BlueTest Version 1.4

- (a) Pressing the **Reset Chip** button on the GUI while data is being transmitted sends a hardware reset command to the chip and restarts the serial stack software.

Closing the GUI sends a hardware reset command to the chip.

If the link fails, the connection can only be recreated by manually resetting the chip (power off/on) and by clicking on **Reset Chip** or closing down and restarting the GUI (both of which will restart the serial stack software).

The above will not occur if no data is visibly scrolling in the window.

The tests concerned are:

- VCOTRIM
 - BUILD LUT
 - READ
 - LUT
- (b) There is a race between command responses indicating that a test has started and the first data relating to that test. This does not affect the test results.
- (c) It is not possible to rouse the chip from Deep Sleep except by powering down the chip and restarting.

Appendix 3

Combining Tests Using a Second Unit

Several tests require a second **BlueCore01** unit to be operating to provide a test signal for the equipment under test. The following table provides a quick reference guide to tests that use a second unit.

| | SECOND UNIT | PAUSE | RADIO STATUS | TXSTART | TXDATA1 | TXDATA2 | TXDATA3 | TXDATA4 | RXSTART | RXSTART2 | RXDATA1 | RXDATA2 | BIT ERR1 | BIT ERR2 | LOOP BACK | RX LOOP BACK | BER LOOP BACK | DEEP SLEEP | PCM LB | PCM EXT LB | SETTLE | IF RESP | RF IQ MATCH | IF IQ MATCH | VCO TRIM | BUILD LUT | READ LUT | SET PIO | READ PIO | PROVOKE FAULT | READ CHIP VERSION |
|-----------------------------|-------------|-------|--------------|---------|---------|---------|---------|---------|---------|----------|---------|---------|----------|----------|-----------|--------------|---------------|------------|--------|------------|--------|---------|-------------|-------------|----------|-----------|----------|---------|----------|---------------|-------------------|
| EQUIPMENT UNDER TEST | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PAUSE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RADIO STATUS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TXSTART | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TXDATA1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TXDATA2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TXDATA3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TXDATA4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RXSTART | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RXSTART2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RXDATA1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RXDATA2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BIT ERR1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BIT ERR2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LOOP BACK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RX LOOP BACK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BER LOOP BACK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DEEP SLEEP | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PCM LB | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PCM EXT LB | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SETTLE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| IF RESP | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| RF IQ MATCH | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| IF IQ MATCH | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| VCO TRIM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BUILD LUT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| READ LUT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SET PIO | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| READ PIO | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PROVOKE FAULT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| READ CHIP VERSION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Appendix 4

Configuration Commands Available During Tests

Particular configuration commands are appropriate to use during certain tests. The following table is a quick reference guide to which configuration commands can be used during which tests.

| Configuration Commands | CFG FREQ | CFG PKT | CFG BIT ERR | CFG TXIF | CFG XTAL FTRIM | CFG UAP/LAP | CFG ACC ERRS | CFG IQ TRIM | CFG TX TRIM | CFG LO LVL | CFG TX COMP | CFG SETTLE |
|------------------------|----------|---------|-------------|----------|----------------|-------------|--------------|-------------|-------------|------------|-------------|------------|
| EQUIPMENT UNDER TEST | | | | | | | | | | | | |
| PAUSE | | | | | | | | | | | | |
| RADIO STATUS | | | | | | | | | | | | |
| TXSTART | | | | X | X | | | | | | X | |
| TXDATA1 | | X | | X | X | X | | | X | | | |
| TXDATA2 | | X | | X | X | X | | | X | | | |
| TXDATA3 | | X | | X | X | | | | | | | |
| TXDATA4 | | X | | X | X | | | | | | | |
| RXSTART1 | | | | | X | | | | | | | |
| RXSTART2 | | | | | X | | | | | | | |
| RXDATA1 | | | | | X | | | | | | | |
| RXDATA2 | | | | | X | | | | | | | |
| BIT ERR1 | | | X | | X | X | X | | X | | | |
| BIT ERR2 | | | X | | X | X | X | | X | | | |
| LOOP BACK | | | | | X | X | | | | | | |
| RX LOOP BACK | | | | | X | X | | | | | | |
| BER LOOP BACK | | | | | X | X | | | | | | |
| DEEP SLEEP | | | | | | | | | | | | |
| PCM LB | | | | | | | | | | | | |
| PCM EXT LB | | | | | | | | | | | | |
| SETTLE | | | | | | | | | | | | |
| IF RESP | | | | | | | | | | | | |
| RF IQ MATCH | | | | | | | | | | | | |
| IF IQ MATCH | | | | | | | | | | | | |
| VCO TRIM | | | | | | | | | | | | |
| BUILD LUT | | | | | | | | | | | | |
| READ LUT | | | | | | | | | | | | |
| SET PIO | | | | | | | | | | | | |
| READ PIO | | | | | | | | | | | | |
| PROVOKE FAULT | | | | | | | | | | | | |

Appendix 5

Bluetooth Packet Types

Use the **CFG FREQ** command to set the frequency as appropriate to the size of the packet type being used in the test.

| Segment | TYPE code $b_3b_2b_1b_0$ | Slot occupancy | SCO link | ACL link |
|---------|-----------------------------|----------------|-----------|-----------|
| 1 | 0000 | 1 | NULL | NULL |
| | 0001 | 1 | POLL | POLL |
| | 0010 | 1 | FHS | FHS |
| | 0011 | 1 | DM1 | DM1 |
| 2 | 0100 | 1 | undefined | DH1 |
| | 0101 | 1 | HV1 | undefined |
| | 0110 | 1 | HV2 | undefined |
| | 0111 | 1 | HV3 | undefined |
| | 1000 | 1 | DV | undefined |
| | 1001 | 1 | undefined | AUX1 |
| 3 | 1010 | 3 | undefined | DM3 |
| | 1011 | 3 | undefined | DH3 |
| | 1100 | 3 | undefined | undefined |
| | 1101 | 3 | undefined | undefined |
| 4 | 1110 | 5 | undefined | DM5 |
| | 1111 | 5 | undefined | DH5 |

Extracted from Packet Types section of Specification of the Bluetooth System, v1.1, dated 1 December 2000.

CSR's Life Support Policy and Use in Safety-Critical Applications

CSR's products are not authorised for use in life-support or safety-critical applications.

Trademarks and Patents

BlueCore is a trademark of CSR.

Bluetooth and the Bluetooth logos are trademarks owned by Bluetooth SIG Inc, USA and licensed to CSR.

CSR reserves the right to make technical changes to its products as part of its development programme.

For further information, refer to the following document(s):

| Document | Reference |
|---|---------------------------------|
| Bluetooth (SIG) Test Specification - RF | Rev 0.9r, dated 31 January 2000 |
| Specification of the Bluetooth System, v1.1 | Rev 1.1, dated 01 December 2000 |

Record of Changes

| Date: | Revision: | Reason for Change: |
|-----------|-----------|--|
| 13 SEP 00 | a | Original publication of this document (CSR reference: bc01-an-047a). |
| 16 JUL 01 | b | Revision and addition of tests and appendices |

BlueTest Instruction Manual

AN047

July 2001

◆ **Federal Communication Commission Interference Statement**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

IMPORTANT NOTE:

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance. To maintain compliance with FCC RF exposure compliance requirements, please follow operation instruction as documented in this manual.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

This device is intended only for OEM integrators under the following conditions:

1) The transmitter module may not be co-located with any other transmitter or antenna, As long as 1 condition above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

The final end product must be labeled in a visible area with the following: “Contains FCC ID: O9NPB”.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user’s manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Canadian Regulatory Wireless Notice

This device complies with RSS-210 of the Industry Canada Rules. Operation is subject to the following two conditions:

- 1) this device may not cause interference and
- 2) this device must accept any interference, including interference that may cause undesired operation of the device

IMPORTANT NOTE:

IC Radiation Exposure Statement:

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance. To maintain compliance with IC RF exposure compliance requirements, please follow operation instruction as documented in this manual.