RTX2254

Bluetooth RF Tester

Stand-alone Unit

User Manual

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The general safety precautions, according to the RTX2254 User Manual, must be observed during all phases of operation. RTX A/S assumes no liability for the user's/ customer's failure to comply with these requirements.

The purpose of the document is to provide guidance to users of the RTX2254 Bluetooth RF Test. The User Manual describes general functions of the tester and describes the use of the Windows® based interface, as well as interfacing with a production application program.

For further information about programming of the RTX2254 Bluetooth RF tester, please refer to the "Quick Guide" document

Documentation Information

This User Manual contains essential items of information needed for general-purpose use of the test equipment along with a detailed description for high throughput production purposes.

In this document, you will find valuable information on how to unpack, install and operate your RTX2254 Bluetooth RF tester using the supplied PC application or a test program using the available programming API.

The User Manual provides programming guidance to users of the RTX2254 Bluetooth RF tester who would like to write their own test programs.

Furthermore, you also find information on how to use the provided RTX2254 DLL file in a sample application to show with a few examples on how to use the DLL function calls in your source code are outlined.

However, please note that the examples and code fragments are included for informational reasons only and should only be used as a guidance to ease test program development. It is therefore strongly emphasized here that RTX A/S takes no responsibility for debugging and verification of the actual test program developed by the user/customer.

Safety Information

General

The following general safety precautions must be observed during all phases of operation and service of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. RTX A/S assumes no liability for the customer's failure to comply with these requirements.

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 fuse holders: 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 – it is therefore strongly emphasized here that operating personnel must not remove equipment covers or shields. Procedures involving the removal of covers and shields are for use by service-trained personnel at RTX A/S only.

Electrostatic Discharge

Electrostatic discharge (ESD) can damage electronic test equipment. Working with electronic components or test equipment should always be performed at a static-safe place.

High Voltage

Some power supplies can generate high voltage, which can damage any of the ports of the unit.

To prevent damage to the RTX2254 Bluetooth RF tester please make sure that the device is properly earthed. Connect the RF cable path before applying DC power to the test device. Be careful when connecting RF connectors, i.e. avoid touching any unearthed metal with the centre core.

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1 Introduction

The RTX2254 Bluetooth RF tester is a highly-optimized, automated test solution for calibration and functional test in the production of wireless Bluetooth Low Energy (BLE) devices. It supports Direct Test Mode (DTM) and optional Advertising Mode (ADV).

This User Manual will describe the different features and options which are available with the RTX2254 Bluetooth RF tester stand-alone unit, the configuration and some test scenarios using the RTX2254 application.

Please follow the instructions in the "RTX2254 Quick Installation Guide" on how to install the RTX2254 software and setup your RTX2254 tester.

The RTX2254 application uses the available API, i.e. it can be integrated into other test systems which can interface to Visual Studio C++ API's (standard DLL and header files).

The RTX2254 and RTX2300 BLE bundle API is described in the "BtTstInterface_V<*version number*>.pdf" document.

RTX2254 with DUT on USB

Note that
RTX2254 is available as a single ported tester for one DUT (RTX no. 95101347) or as a dual ported tester for two DUTs (RTX no. 95101348).

Advertising Mode is an option.

2 Word and Abbreviation List

The following words and abbreviations are used in this document:

- 2-Wire Bluetooth SIG specified test protocol where only Tx, Rx and GND is used and 16-bit commands and events
- ADV Advertising Mode, see the Bluetooth Low Energy (BLE) specification for a description of BLE advertising
- API Application programming interface
- BER Bit Error Rate
- BLE Bluetooth low energy
- BT Bluetooth
- BTLE Bluetooth low energy
- COM Serial communication port referred to by a number
- CW Continuous Waveform
- DLL Dynamic Link Library
- Driver SW that interfaces to a HW unit
- DTM Direct Test Mode, see the Bluetooth test specification
- DUT Device Under Test
- EAI Enterprise Application Integration
- ESD Electro-Static Discharge
- GND Ground
- GUI Graphical User Interface
- HCI Host Controller Interface
- HW Hardware
- ID Identification
- IRR Inquiry response rate
- ISM Industrial Scientific and Medical
- LL Link Layer
- LQ Link Quality
- MAC Media access control
- PC Personal Computer
- PDU Protocol data unit
- PER Packet Error Rate
- Pop-Up A smaller frame shown in windows
- PPM Part Per Million
- RF Radio frequency
- RS232 Serial port with +-12V signaling
- RSS Received Signal Strength
- RSSI Received signal strength indicator
- RTX2300 Test system with shielding, fixture and test HW
- Rx Receive
- SIG Special interest group for BT
- SW Software (Programs)
- TI Texas Instruments – Chip manufacturer
- Tx Transmission
- UART Serial port with logic level signaling (0-5V)
- USB Universal Serial Bus

3 Start the Application

After following the RTX2254 Quick Guide, you are now ready to start.

Make sure that the RTX2254 RF Bluetooth Tester is connected to your PC with the USB cable and power is on.

You can start the "**RTX2254 Bluetooth RF tester**" application by pressing the Windows start button and selecting:

"**Start → All programs → RTX → RTX2254 Bluetooth RF tester → V<*version number*> → RTX2254 Bluetooth RF tester**".

Or by clicking on the short cut on the desktop if the 'Short cut' option was enabled during installation.

This description will use Direct Test Mode. Advertising Mode is very similar and will be described in section 13How to Setup Automated Testing-
Advertising Mode.

Start-up screen:

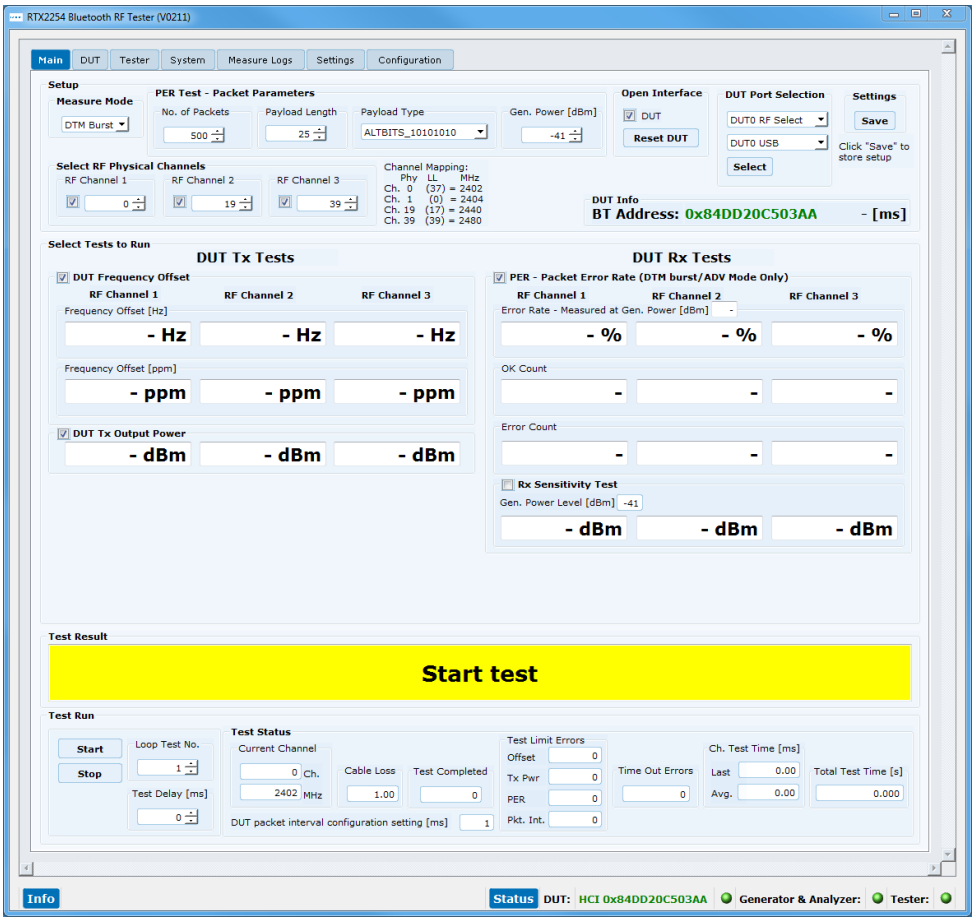
4 Tab Menu Overview

The RTX2254 Bluetooth RF tester application has the following tab menus with different pages to setup and control the tester:

- **[Main]** Different production tests which can be performed:
  - Frequency Offset measurement
  - Output Power measurement
  - Packet Error Test (PER)

- **[DUT]** Manual control of DUT part
- **[Tester]** Manual control of tester part
- **[System]** Information about the tester, e.g. firmware version
- **[Measure logs]** Log for the tests performed under the **[Main]** page
- **[Settings]** System setup, e.g. tester and DUT interface
- **[Configuration]** System configuration of tester limits and DUT setup compensations

First startup with default settings:



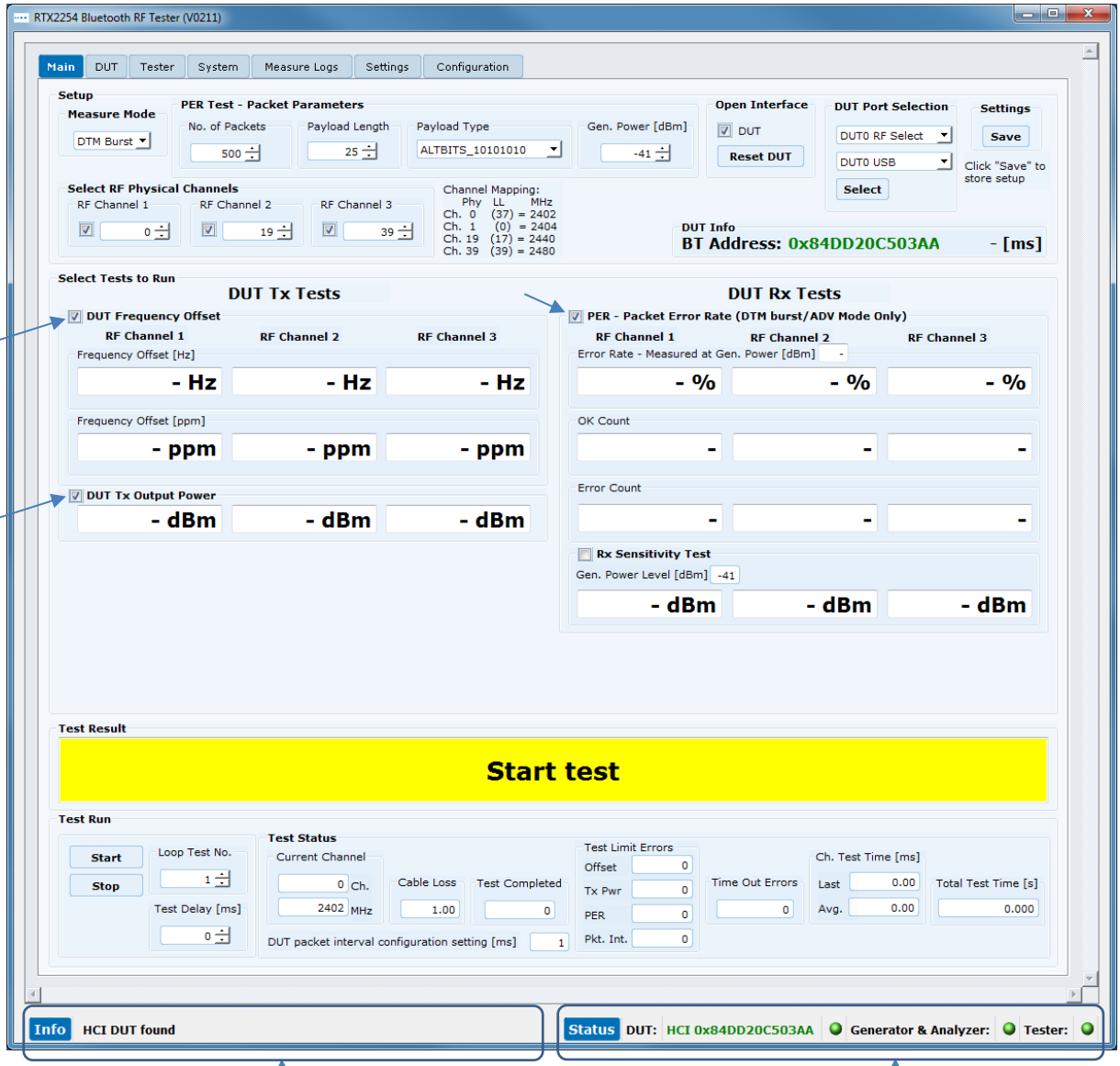
Please note that:
The window can be resized or maximized depending on your screen resolution.

At startup, the application will be resized to the size selected when the application was terminated.

5 Main Tab

On the **[Main]** page, you can perform the different tests with the settings suited for your DUT and your requirements:

- **Frequency Offset Measurement** Measures the channel frequency offset. This can be done on burst or CW signals.
- **Output Power Measurement** Measures the DUT output power.
- **Packet Error Test (PER)** Performs a packet error rate test on the DUT.

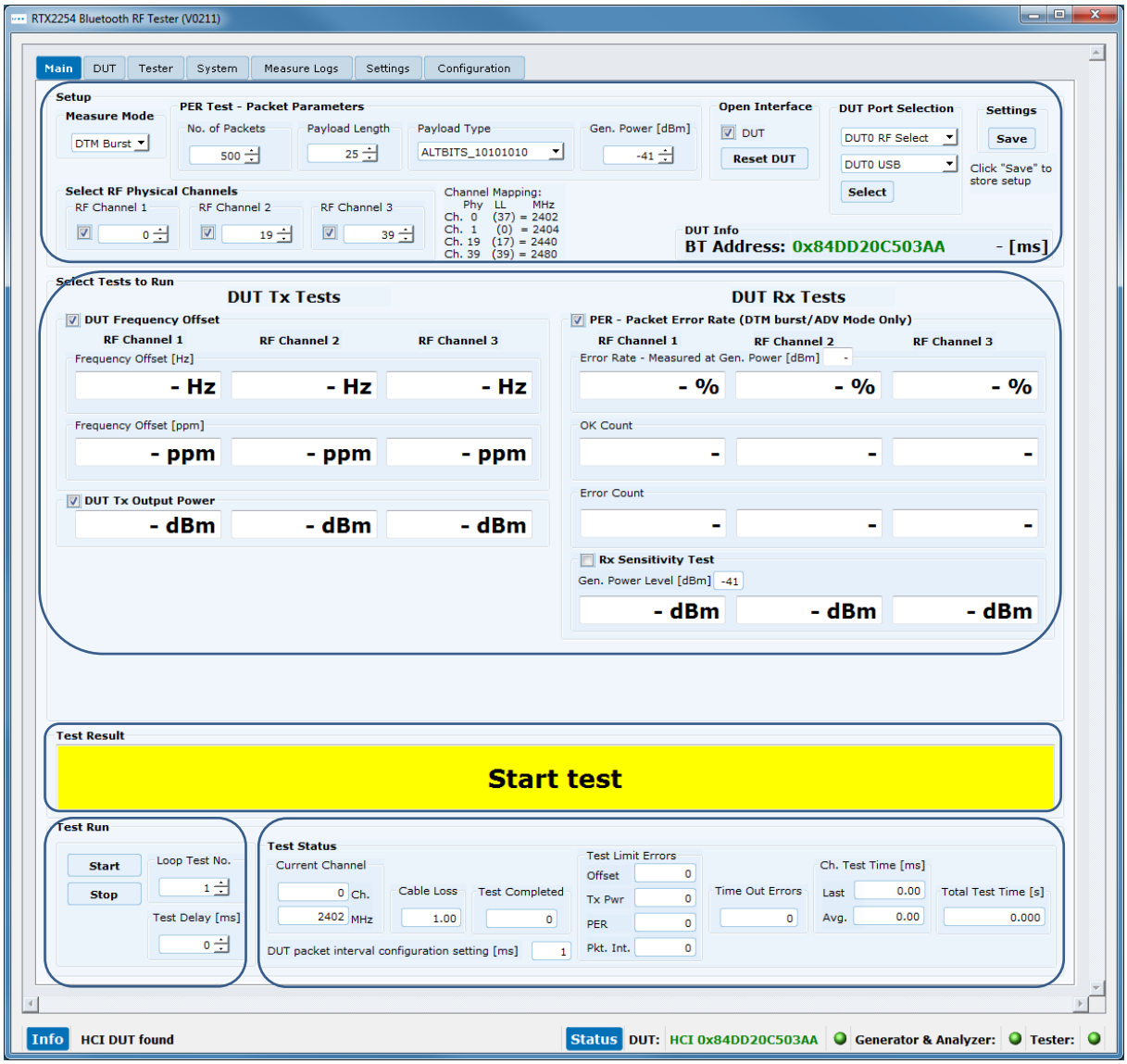


Info & error messages are shown here

Interface status with DUT address – all must be green

The **[Main]** page is divided into the following sub sections:

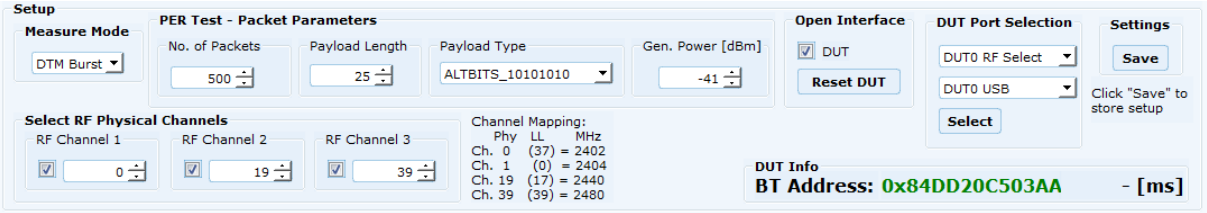
- **[Setup]** — Setup of parameters to use in the test. Set the parameters suited for your test and DUT info. Click save.
- **[Select Tests to Run]** — Enable the test measurements to perform. Check a test box to enable it.
- **[Start test]** — The overall status of the last test run.
- **[Test Run]** — Start/stop the test.
- **[Test Status]** — Status information for the test run.



Please note that:
Window is resized to the previous stored setting and the RTX2254 tester and DUT are connected and with default test parameters.

5.1 Setup

On the **[Main]** page, you can setup the following parameters to use during the test:



Overview:

- **[Measure Mode]** Select signal type to use: **[DTM Burst]** or **[DTM CW]** (Continues Wave). Default is **[DTM Burst]**.
- **[PER Test – Packet Parameters]** The parameters to use when running the PER test. See more details below.
- **[Select RF Physical Channels]** Enable up to 3 channels (RF1, RF2 and RF3). Select the channels to use for testing.
- **[Open Interface]** Check **[DUT]** box to open the DUT interface. If checked it will automatically open on next startup.
- **[DUT Port Selection]** Select the RF port and communication port to use with the DUT.
- **[Settings]** Click **[Save]** button to store the settings.
- **[DUT Info]** The Bluetooth address of the DUT.

5.1.1 Measure Mode

Select signal type to use **[DTM Burst]** or **[DTM CW]** (Continues Wave).

Please note that:
CW is chip vendor/customer specific and must be implemented by customer in the DUT API.

5.1.2 PER Test - Packet Parameters

The following BLE packets parameters are supported by the RTX2254 Bluetooth RF tester:

5.1.2.1 Number of Packets

[No. of Packets], the enter number of packets to send. Valid range between 100-65535.

5.1.2.2 Payload Length

[Payload Length], enter the number of bytes to send as payload in each packet. Valid range between 0-37.

5.1.2.3 Packet Type

[Packet Type], select one of the following BLE packets types, defined by Bluetooth SIG, to use.

Supported for HCI:

0x00 Pseudo-Random bit sequence 9 (PRBS9)
0x01 Pattern of alternating bits '11110000'
0x02 Pattern of alternating bits '10101010'
0x03 Pseudo-Random bit sequence 15
0x04 Pattern of All '1' bits
0x05 Pattern of All '0' bits
0x06 Pattern of alternating bits '00001111'
0x07 Pattern of alternating bits '0101'

Supported for 2-Wire:

0x00 Pseudo-Random bit sequence 9 (PRBS9)
0x01 Pattern of alternating bits '11110000'
0x02 Pattern of alternating bits '10101010'
0x03 Vendor Specific

5.1.2.4 Gen. Power [dBm]

[Gen. Power [dBm]], the generator power level used by the RTX2254 tester when transmitting the packets. Valid range between -40 to -100 dBm.

Please note that:
The generator power level range is compensated with the specified cable loss. However, it cannot go above -40 dBm, e.g. -40 dBm and cable loss = 1 dBm should give -39 dBm. This is not possible, and tester shows -41 dBm. In example, generator set to -50 dBm and cable loss = 1 dBm. Internally generator power is -49 dBm to give -50 dBm to the DUT.

5.1.3 Select RF Physical Channels

[Select RF Physical Channels], select the RF channel to use with test loop 1, 2 and 3, e.g. 0, 19 and 39.

Check the **[RF Channel x]** box to enable it in the test loop.

The following 40 RF channels for BLE is supported:

RF Channel	Frequency
0	2402 MHz
1	2404 MHz
2	2406 MHz
3	2408 MHz
4	2410 MHz
5	2412 MHz
6	2414 MHz
7	2416 MHz
8	2418 MHz
9	2420 MHz
10	2422 MHz
11	2424 MHz
12	2426 MHz
13	2428 MHz
14	2430 MHz
15	2432 MHz
16	2434 MHz
17	2436 MHz
18	2438 MHz
19	2440 MHz

RF Channel	Frequency
20	2442 MHz
21	2444 MHz
22	2446 MHz
23	2448 MHz
24	2450 MHz
25	2452 MHz
26	2454 MHz
27	2456 MHz
28	2458 MHz
29	2460 MHz
30	2462 MHz
31	2464 MHz
32	2466 MHz
33	2468 MHz
34	2470 MHz
35	2472 MHz
36	2474 MHz
37	2476 MHz
38	2478 MHz
39	2480 MHz

Please note that:
The channel number refers to the physical frequency and not the link layer (LL) channel.

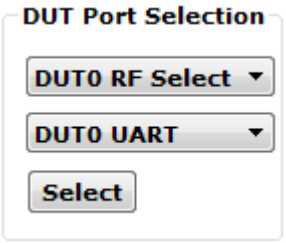
5.1.4 Open Interface

[Open Interface], check **[DUT]** box to open the DUT interface if not already opened manually. If checked and saved, the DUT interface will be automatically opened when you go to the **[Main]** page. It can also be used to temporarily close the DUT interface by removed in the check in the **[DUT]** box.

Click **[Reset DUT]** to send a reset command to the DUT.

5.1.5 DUT Port Selection

Select the RF port and communication port to use with the DUT.



5.1.5.1 RF Select

Select the RF port to use:

- **[DUT0 RF Select]**
- **[DUT1 RF Select]** (Dual port only)

5.1.5.2 Interface Select

Select the communication port to use:

- **[DUT0 UART]**
- **[DUT1 UART]** (Dual port only)
- **[DUT0 USB]**
- **[DUT1 USB]** (Dual port only)

Click **[Select]**, when you have selected the RF port and communication port to use.

Please note that:
RTX2254 is available as a single ported tester for one DUT (RTX no. 95101347) or as a dual ported tester for two DUTs (RTX no. 95101348).

5.1.6 Settings

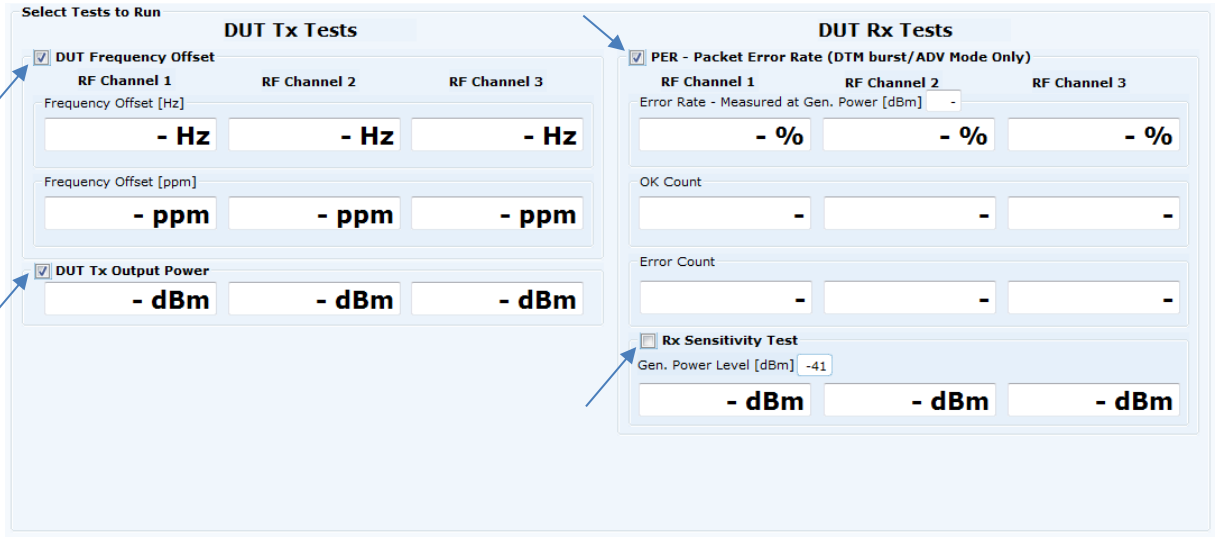
Click **[Save]** button to store the settings entered.

5.1.7 Select Tests to Run

[Select Tests to Run], enable the test measurements to perform:

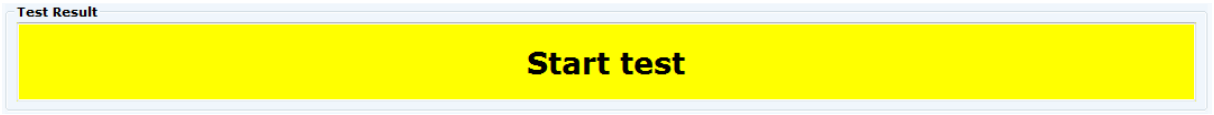
1) **DUT Frequency Offset**	Measures the frequency offset on selected channels.
2) **DUT Tx Output Power**	Measures the Tx output power on selected channels.
3) **PER – Packet Error Rate**	Performs a packet error rate test on selected channels.
Rx Sensitivity Test	A sub test to run together with the PER test. The tester will automatically adjust the generator power to find the DUT's Rx sensitivity level for the packet error rate level specified.

Check the test box to enable it in the test run.



5.1.8 Test Result

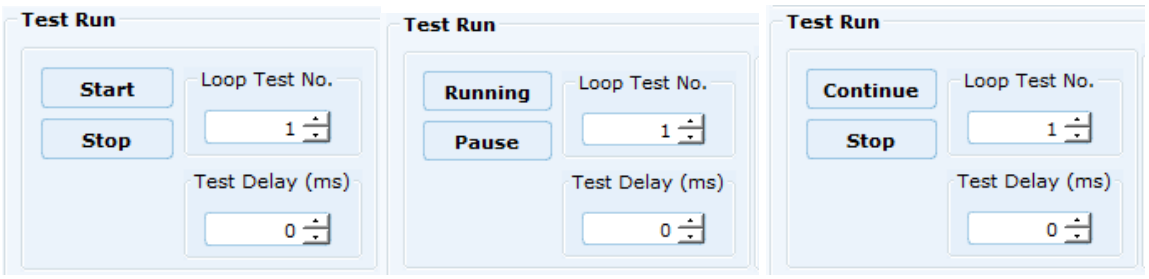
[Test Result], shows the overall result from the test run.



5.1.9 Test Run

Here you can specify how many test loops you want to run and if a delay is required between the test loops.

Step 1 -> Step 2 -> Step 3



5.1.9.1 Start / Stop

Step 1:

- **[Start]** — Click **[Start]** to start the test.
- **[Stop]** — No function – no test is running.

Step 2:

- **[Running]** — No function – test is already running.
- **[Pause]** — Click **[Pause]** to temporary pause the running test.

Step 3:

- **[Continue]** — Click **[Continue]** to continue a paused test.
- **[Stop]** — Click **[Stop]** to stop the test.

5.1.9.2 Loop Test Numbers

[Loop Test No.], enter how many test loops to run on DUT.

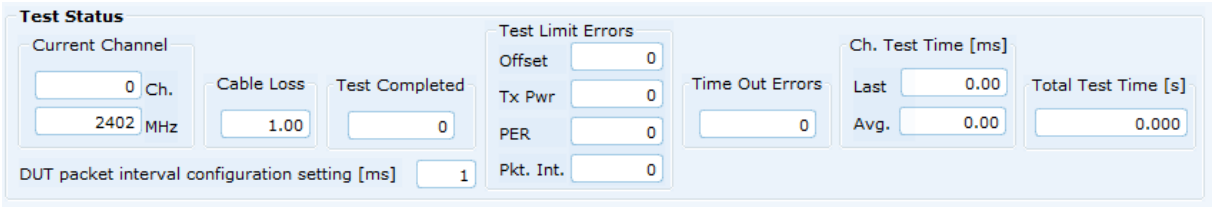
5.1.9.3 Test Delay

Set **[Test Delay]** to add a short delay between each channel test. Delay is in ms. Valid range is 0 to 30.000 ms.

Remember to setup the DUT testing requirements (limits). Refer to chapter 11 Configuration.

5.1.10 Test Status

The **[Test Status]** sub section is updated during the test run:



5.1.10.1 Current Channel

[Current Channel], shows the current channel tested as the physical channel number and the frequency in MHz.

5.1.10.2 Cable Loss

[Cable Loss], shows the current added cable loss. Refer to chapter 11 Configuration.

5.1.10.3 Test Completed

[Test Completed], shows the number of test loops completed including any faulty test loops.

5.1.10.4 Test Limit Errors

[Test Limit Errors], shows the number of test results outside the test limits set by user. Refer to chapter 11 Configuration.

Status error count for:

- **[Offset]** DUT Frequency Offset
- **[Tx Pwr]** DUT Tx Output Power
- **[PER]** Packet Error Rate
- **[Pkt. Int.]** Packet Interval (only used in Advertising Mode)

5.1.10.5 Time Out Errors

[Time Out Errors], shows the number of test loops which failed due to time out in the communication to tester or DUT.

5.1.10.6 Channel Test Time

[Ch. Test Time], the test time for one RF Channel:

- **[Last]** Time for last finished channel test
- **[Avg.]** The average channel test time for all completed test loops.

5.1.10.7 Total Test Time

[Total Test Time], the total time running the specified test loops.

This include any user added **[Test Delay]** time.

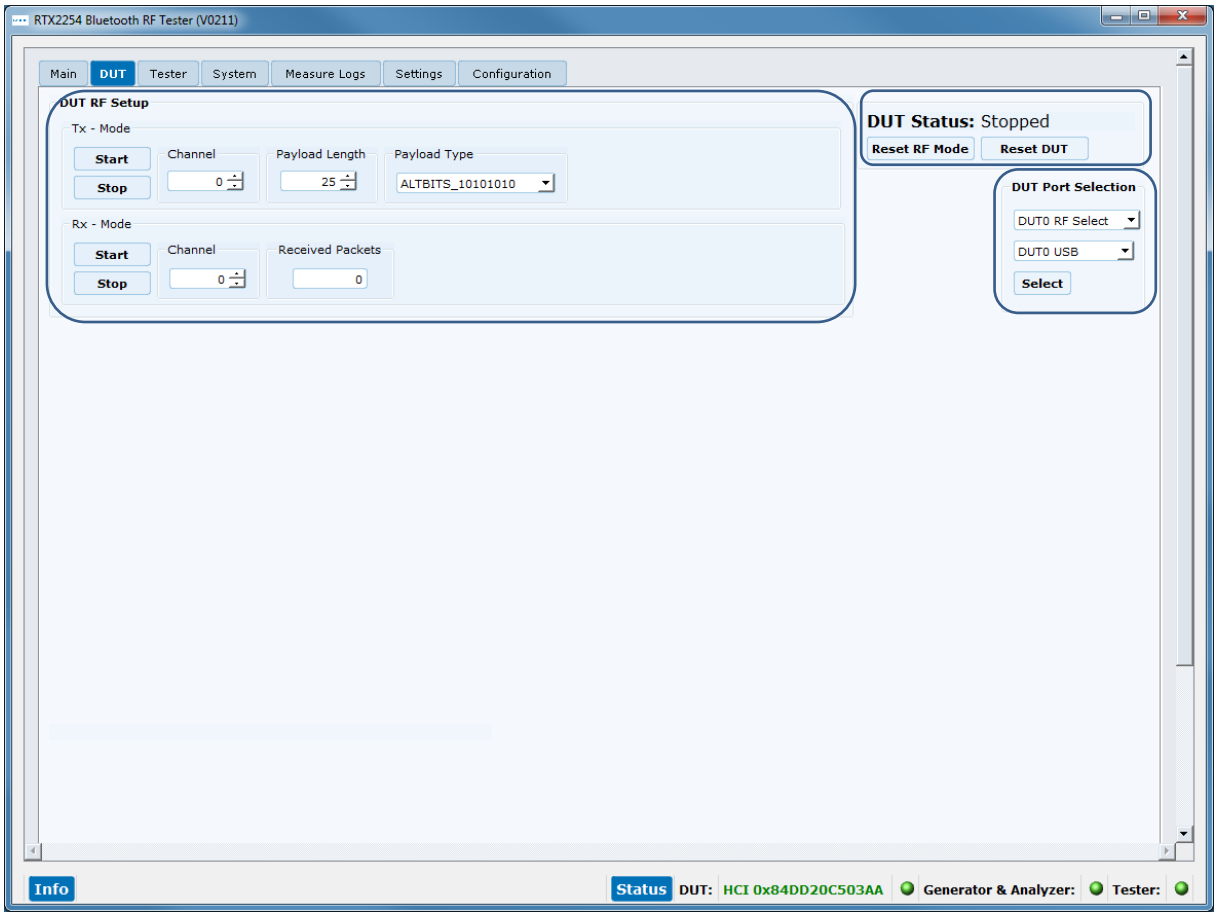
6 DUT Tab

On the **[DUT]** page, you can control the DUT manually. This page in conjunction with the **[Tester]** page allow you to run manual tests.

This means that you can start a DUT test in Tx or Rx burst mode, e.g. if you start a DUT Tx burst test, you must first start a Rx burst test on the **[Tester]** page.

Overview:

- **[DUT RF Setup]** Setup the test to perform.
- **[DUT Port Selection]** Select the RF port and communication port to use with the DUT.
- **[DUT Status]** The state of the DUT and reset RF mode and reset DUT options.



Please note that:
The DUT port selection is also available on the **[Main]** page.

6.1 DUT RF Setup

In this sub section, you can setup a DUT transmission (Tx) or receive (Rx) test to perform in burst mode.

6.1.1 Tx – Mode

Use the **[Tx – Mode]** sub section to perform a transmit test.

Click **[Start]** to start the test.

Click **[Stop]** to stop the test again.

Please note that:
The DUT Tx power used is the default by chip vendor. Use a vendor specific HCI command to set the Tx power as required. This can be done from vendor/third party tool.

The number of packets to send from DUT is not supported in Bluetooth DTM radio test.

6.1.1.1 Channel

[Channel], enter the physical RF channel to use in the test. Valid range 0-39.

6.1.1.2 Payload Length

[Payload Length], enter the number of bytes to send as payload in each packet. Valid range between 0-37.

6.1.1.3 Packet Type

[Packet Type], select one of the following BLE packets types, defined by Bluetooth SIG, to use.

Supported for HCI:

0x00 Pseudo-Random bit sequence 9 (PRBS9)
0x01 Pattern of alternating bits '11110000'
0x02 Pattern of alternating bits '10101010'
0x03 Pseudo-Random bit sequence 15
0x04 Pattern of All '1' bits
0x05 Pattern of All '0' bits
0x06 Pattern of alternating bits '00001111'
0x07 Pattern of alternating bits '0101'

Supported for 2-Wire:

0x00 Pseudo-Random bit sequence 9 (PRBS9)
0x01 Pattern of alternating bits '11110000'
0x02 Pattern of alternating bits '10101010'
0x03 Vendor Specific

6.1.2 Rx - Mode

Use the **[Rx – Mode]** sub section to perform a receive test.

Click **[Start]** to start the test.

Click **[Stop]** to stop the test again.

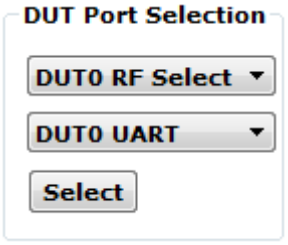
6.1.2.1 Channel

[Channel], select the physical RF channel to use in the test. Valid range 0-39.

6.1.2.2 Received Packets

[Received Packets], will be updated with the number of packets received when **[Stop]** is pressed.

6.2 DUT Port Selection



Select the RF port and communication port to use with the DUT.

6.2.1.1 RF Select

Select the RF port to use:

- **[DUT0 RF Select]**
- **[DUT1 RF Select]** (Dual port only)

6.2.1.2 Interface Select

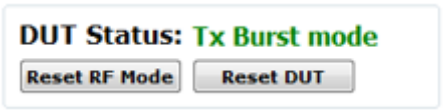
Select the communication port to use:

- **[DUT0 UART]**
- **[DUT1 UART]** (Dual port only)
- **[DUT0 USB]**
- **[DUT1 USB]** (Dual port only)

Click **[Select]**, when you have selected the RF port and communication port to use.

Please note that:
RTX2254 is available as a single ported tester for one DUT (RTX no. 95101347) or as a dual ported tester for two DUTs (RTX no. 95101348).

6.3 DUT Status



In the **[DUT Status]**, the current state of the DUT is shown, i.e. which function has been selected.

6.3.1 Reset RF Mode

Click **[Reset RF Mode]** to reset the application internal mode. The DUT is not reset.

This can be used if the DUT is power cycled and you want to restart the test.

6.3.2 Reset DUT

Click **[Reset DUT]** sends a reset command to the DUT to reset its internal state.

If this is not possible power cycle the DUT.

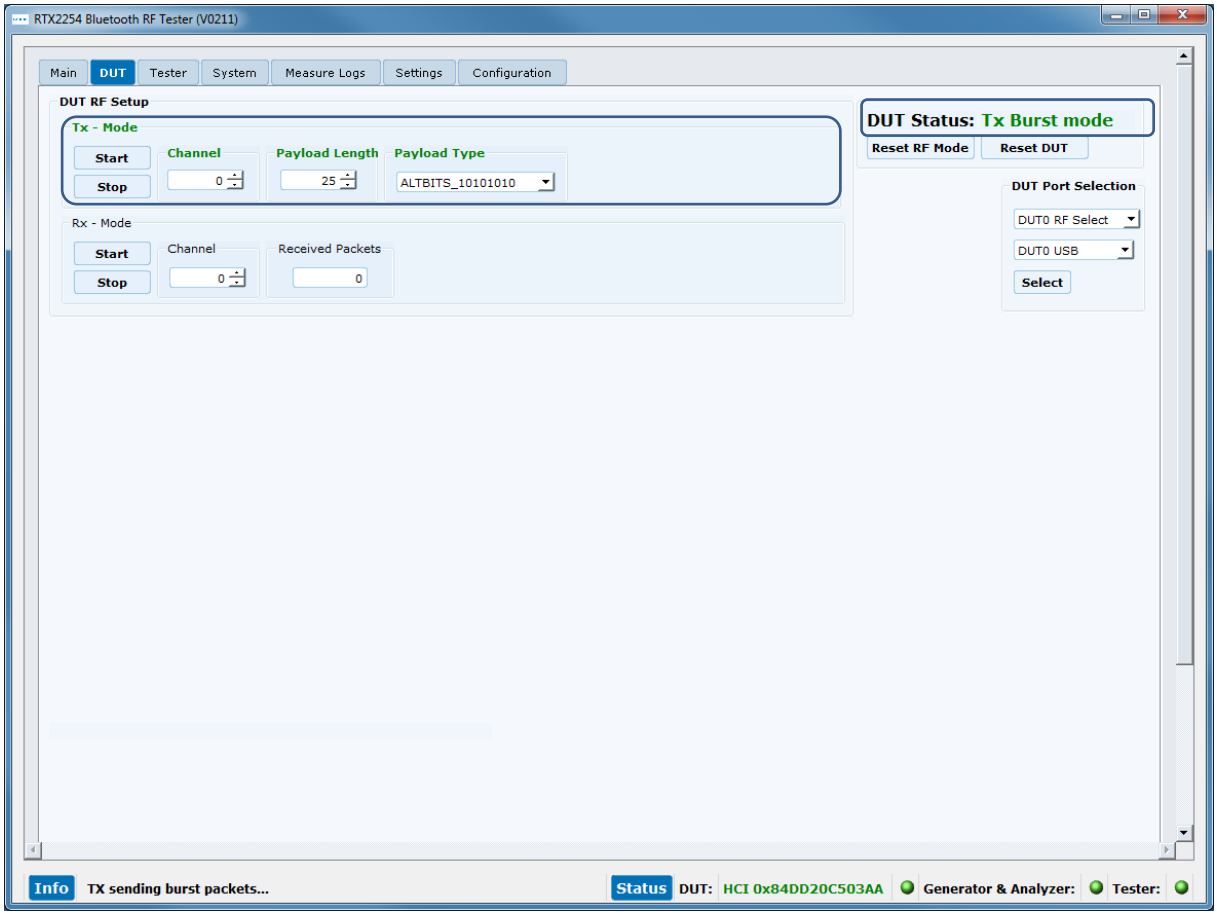
6.4 Start Tx Burst Mode

In **[Tx – Mode]** sub section, click **[Start]** to let the DUT start transmission of burst on the specified RF channel (Ch 0 = 2402 MHz) using the specified payload length and type.

The **[DUT Status]** is changed to "Tx Burst mode".

Please note that:
"Rx – Mode" must first be started in **[Tester]** page.

The DUT is in Tx burst mode. Click **[Stop]** to stop the Tx burst mode.

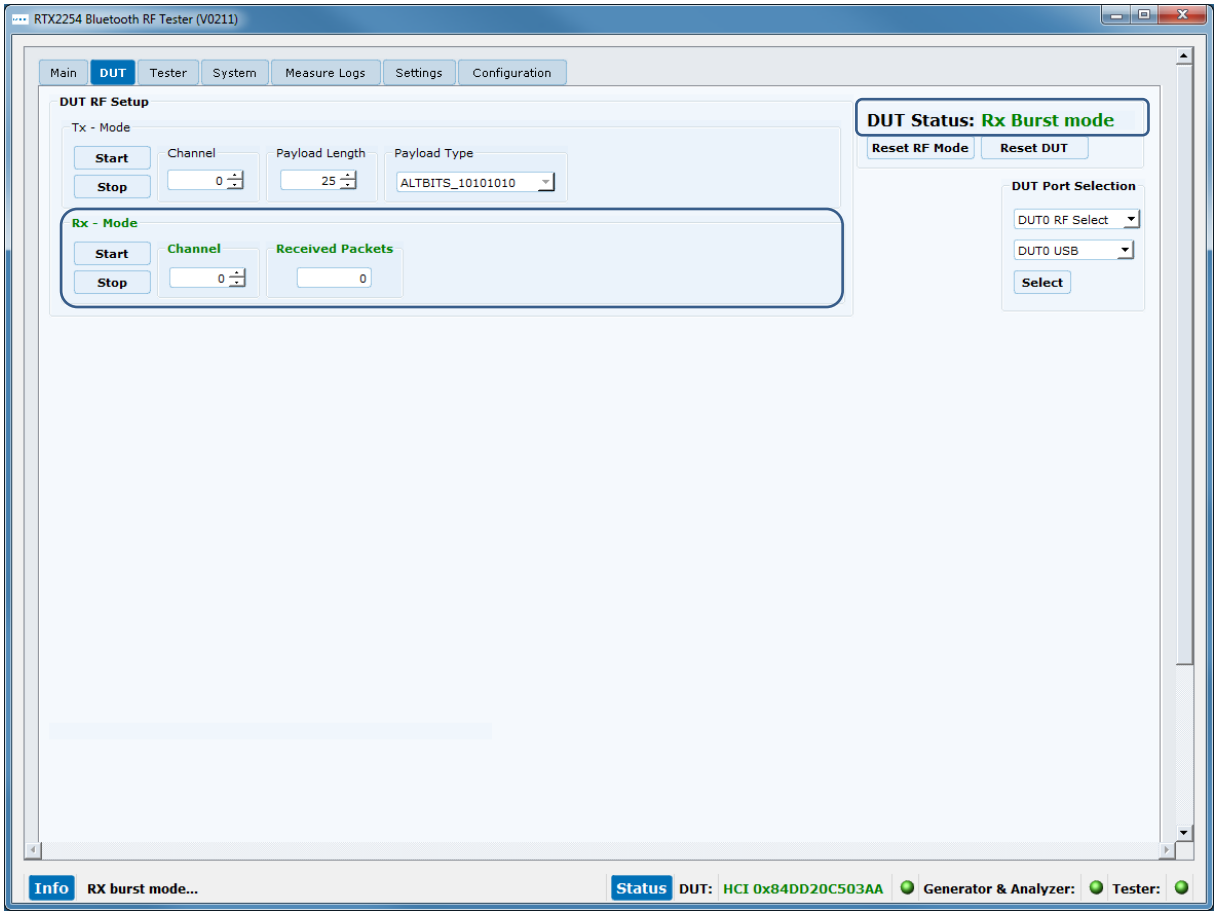


6.5 Start Rx Burst Mode

In **[Rx – Mode]** sub section, click **[Start]** to let the DUT start receiving burst packets on the specified RF channel (Ch 0 = 2402 MHz).

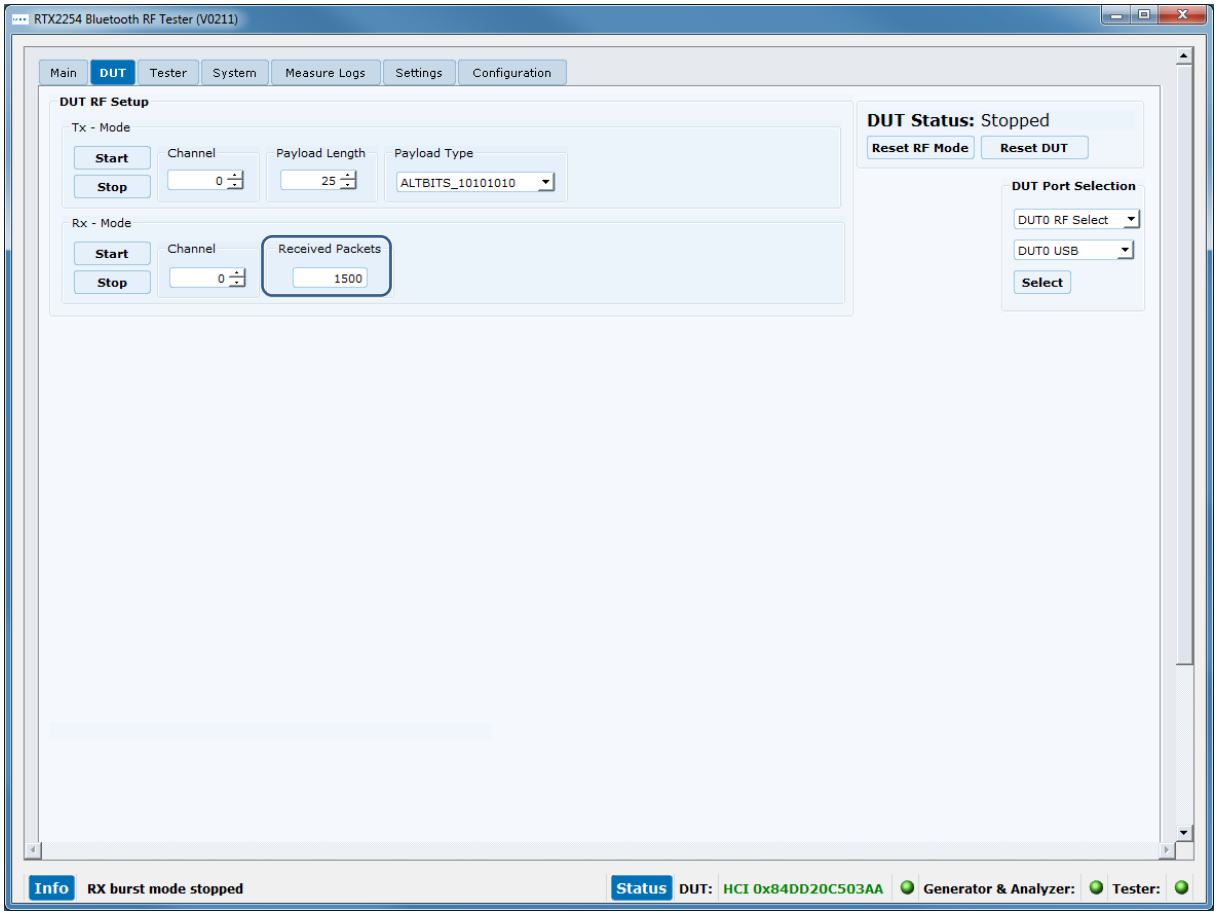
The **[DUT Status]** is changed to "Rx Burst mode".

"Tx – Mode" is started on **[Tester]** page.



The **[Stop]** button is clicked in the **[Rx – Mode]** sub section when the tester has completed sending the number of requested packets.

The **[Received packets]** is updated with the number of packets received by the DUT.



Please note that:
The **[Received packets]** has a maximum depending on the used protocol:

- HCI 65535 packets (wraps around every 40959 ms / ~41 seconds)
- 2-Wire 32767 packets (wraps around every 20479 ms / ~20.5 seconds)

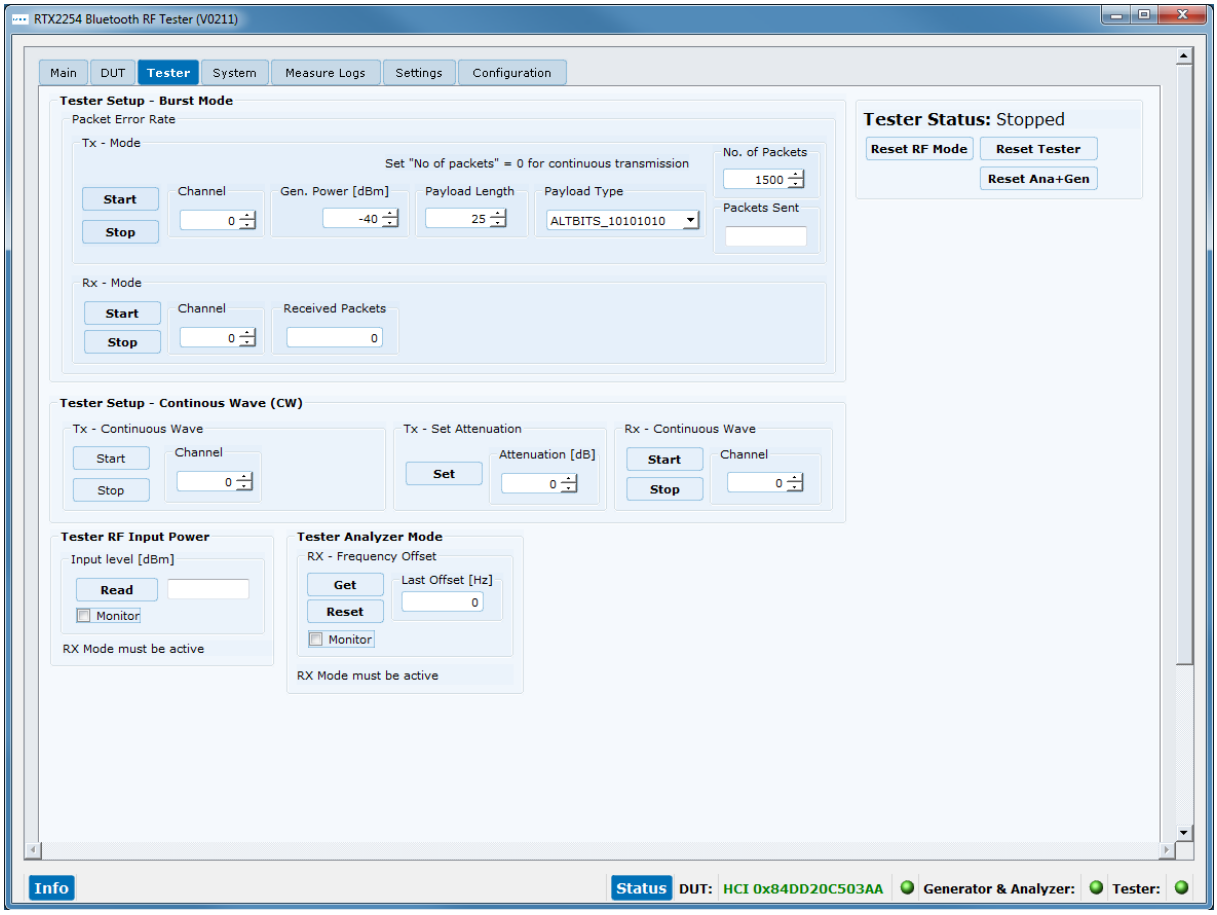
7 Tester Tab

On the **[Tester]** page, you can control the tester manually. This page in conjunction with the **[DUT]** page allow you to run manual tests.

This means that you can start DUT test in Tx or Rx burst mode, e.g. if you start a DUT Tx burst test, you must start a Rx burst test on the **[Tester]** page.

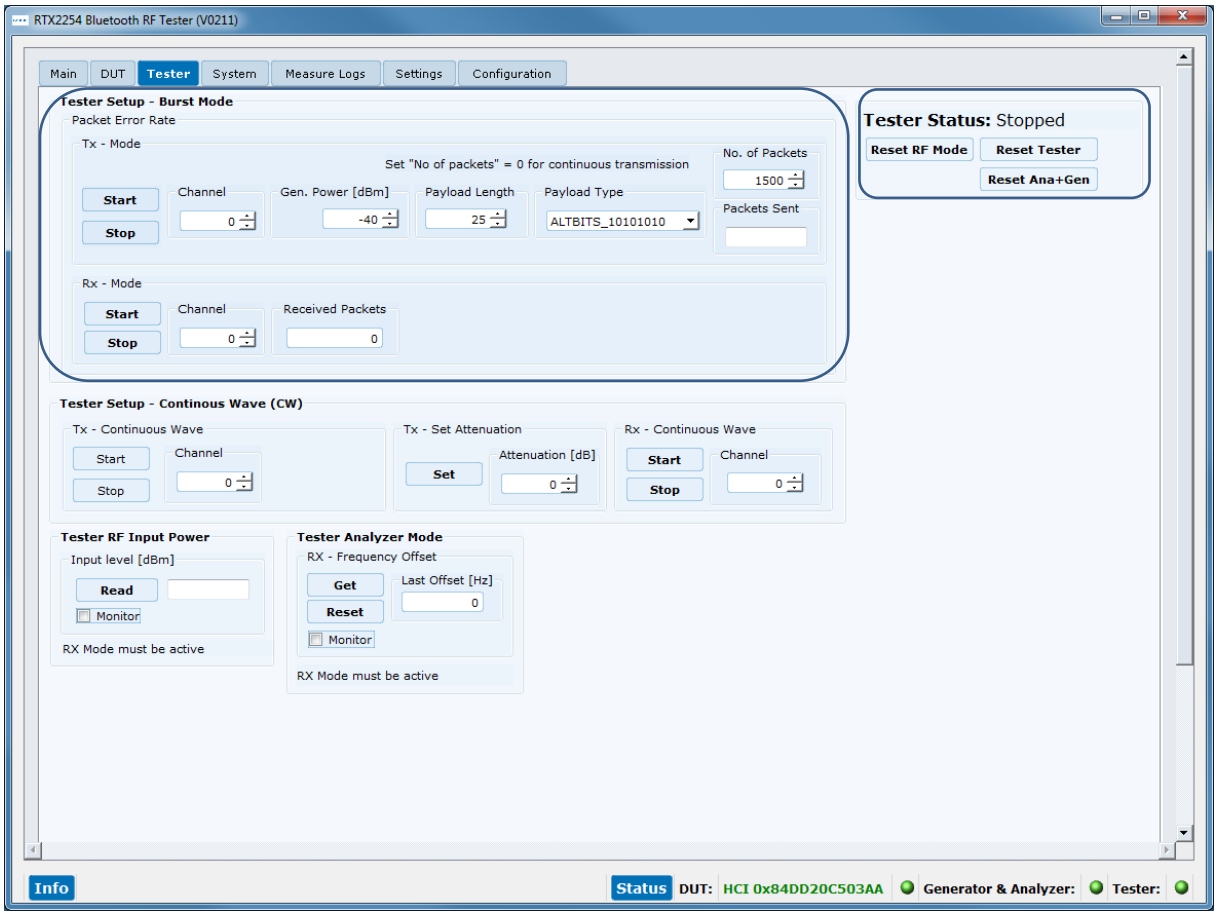
Overview:

- **[Tester Setup – Burst Mode]** Setup the Tx/Rx test to perform in burst mode.
- **[Tester Setup – Continuous Wave]** Setup the Tx/Rx test to perform in continuous wave mode.
- **[Tester RF Input Power]** Measure the power from the DUT.
- **[Tester Analyzer Mode]** Measure the DUT frequency offset.
- **[Tester Status]** The state of the Tester and reset RF mode and reset Tester, reset Analyzer and Generator options.



7.1 Tester Setup – Burst Mode

In this sub section, you can setup a transmission (Tx) or receive (Rx) test to perform in burst mode.



7.1.1 Tx – Mode

Use the **[Tx – Mode]** sub section to perform a transmit test.

Click **[Start]** to start the transmit test.

Click **[Stop]** to stop the transmit test again.

7.1.1.1 Channel

[Current Channel], select the RF channel to use in the test. Valid range 0-39.

7.1.1.2 Gen. Power [dBm]

[Gen. Power [dBm]], enter generator power level to use in the test. Valid range -40 to -100 dB.

Please note that:
The generator power level is not compensated for cable loss.

7.1.1.3 Payload Length

[Payload Length], enter the number of bytes to send as payload in each packet. Valid range between 0-37.

7.1.1.4 Packet Type

[Packet Type], select one of the following BLE packets types, defined by Bluetooth SIG, to use.

Supported for HCI:

0x00 Pseudo-Random bit sequence 9 (PRBS9)
0x01 Pattern of alternating bits '11110000'
0x02 Pattern of alternating bits '10101010'
0x03 Pseudo-Random bit sequence 15
0x04 Pattern of All '1' bits
0x05 Pattern of All '0' bits
0x06 Pattern of alternating bits '00001111'
0x07 Pattern of alternating bits '0101'

Supported for 2-Wire:

0x00 Pseudo-Random bit sequence 9 (PRBS9)
0x01 Pattern of alternating bits '11110000'
0x02 Pattern of alternating bits '10101010'
0x03 Vendor Specific

7.1.1.5 Number of Packets

[No. of Packets], enter the number of packets to send to DUT.

Enter '0' to start a continuous transmission. Click **[Stop]** to stop the transmission.

7.1.1.6 Packets Sent

[Packets Sent], the number of packets that were send to the DUT.

7.1.2 Rx - Mode

Use the **[Rx – Mode]** sub section to perform a receive test.

Click **[Start]** to start the receive test.

Click **[Stop]** to stop the received test again.

7.1.2.1 Channel

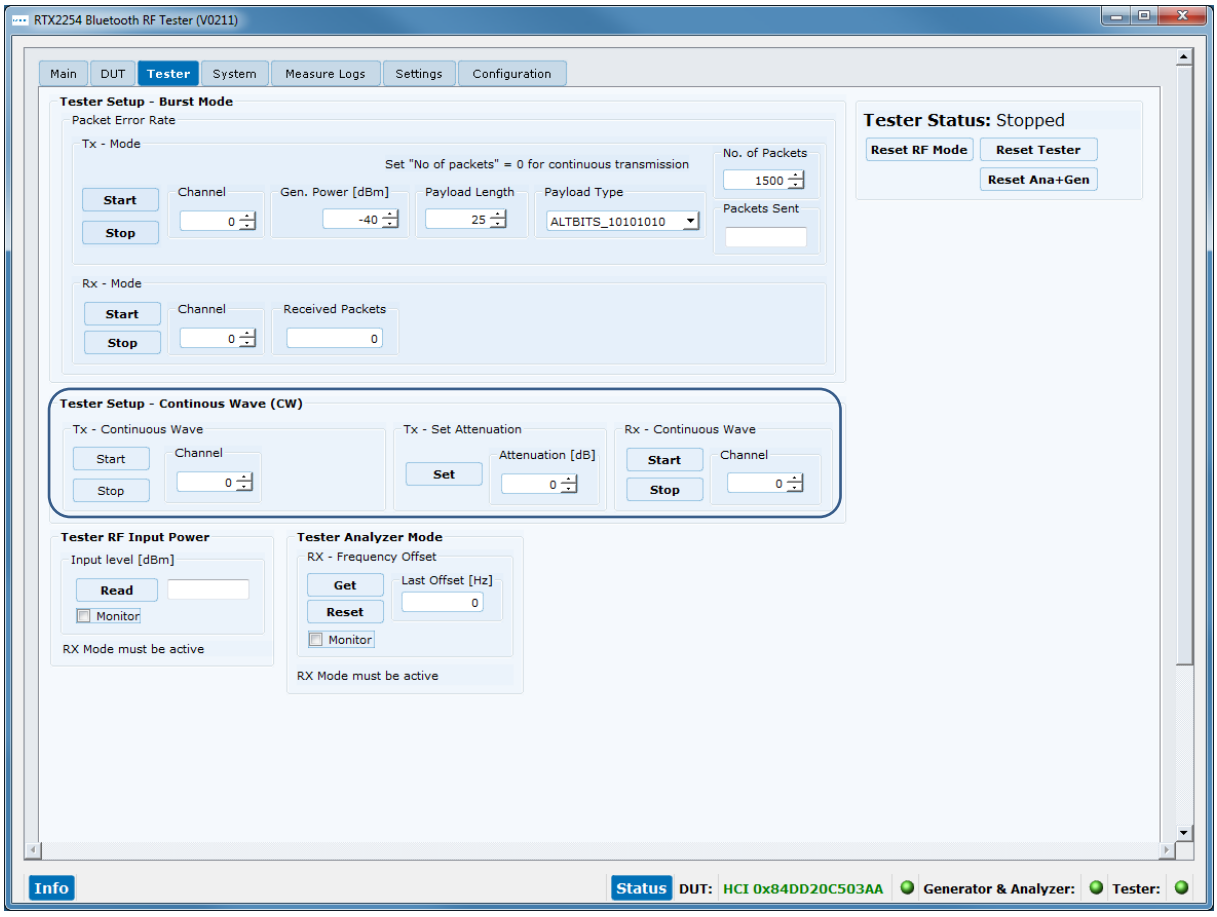
[Channel], select the physical RF channel to use in the test. Valid range 0-39.

7.1.2.2 Received Packets

[Received Packets], will be updated with the number of packets received when **[Stop]** is pressed.

7.2 Tester Setup – Continuous Wave

In this section, you can setup a transmission (Tx) or receive (Rx) test to perform in CW mode.



7.2.1 Tx – Mode

Use the **[Tx – Mode]** sub section to perform a transmit test.

Click **[Start]** to start the transmit test.

Click **[Stop]** to stop the transmit test again.

7.2.1.1 Channel

[Channel], select the physical RF channel to use in the test. Valid range 0-39.

7.2.1.2 Tx – Set Attenuation

[Tx – Set Attenuation], to set the generator power level send to the DUT.

The attenuator is in one dB steps. Valid range 0 to 93.

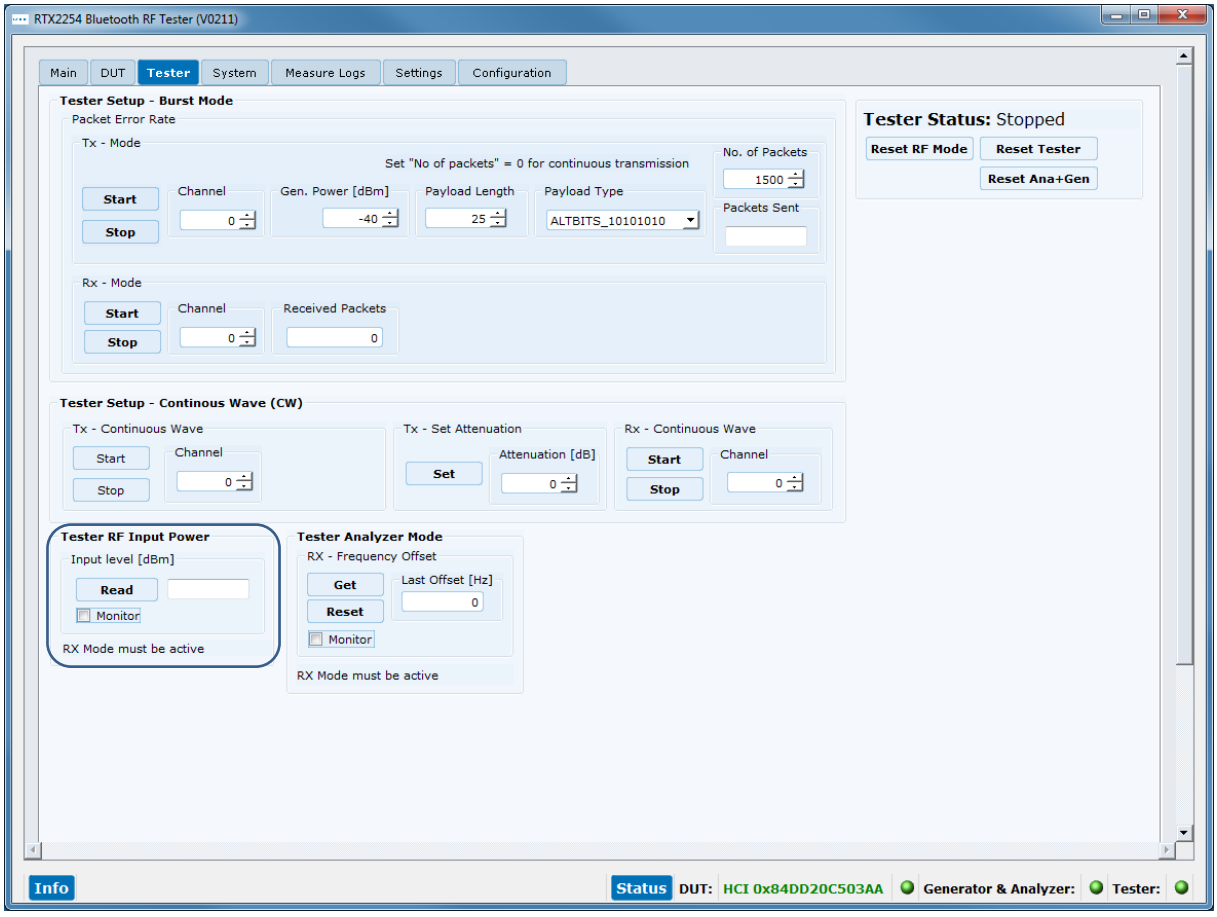
0 dB corresponds to –40 dBm generator output power.

60 dB corresponds to –100 dBm generator output power.

Please note that:
Values above 60, equivalent to -100 dBm, are not practically possible and outside specification.

7.3 Tester RF Input Power

In this section, you can measure the RF power on the input. A 'RX Mode', burst or CW must be active to perform this test.

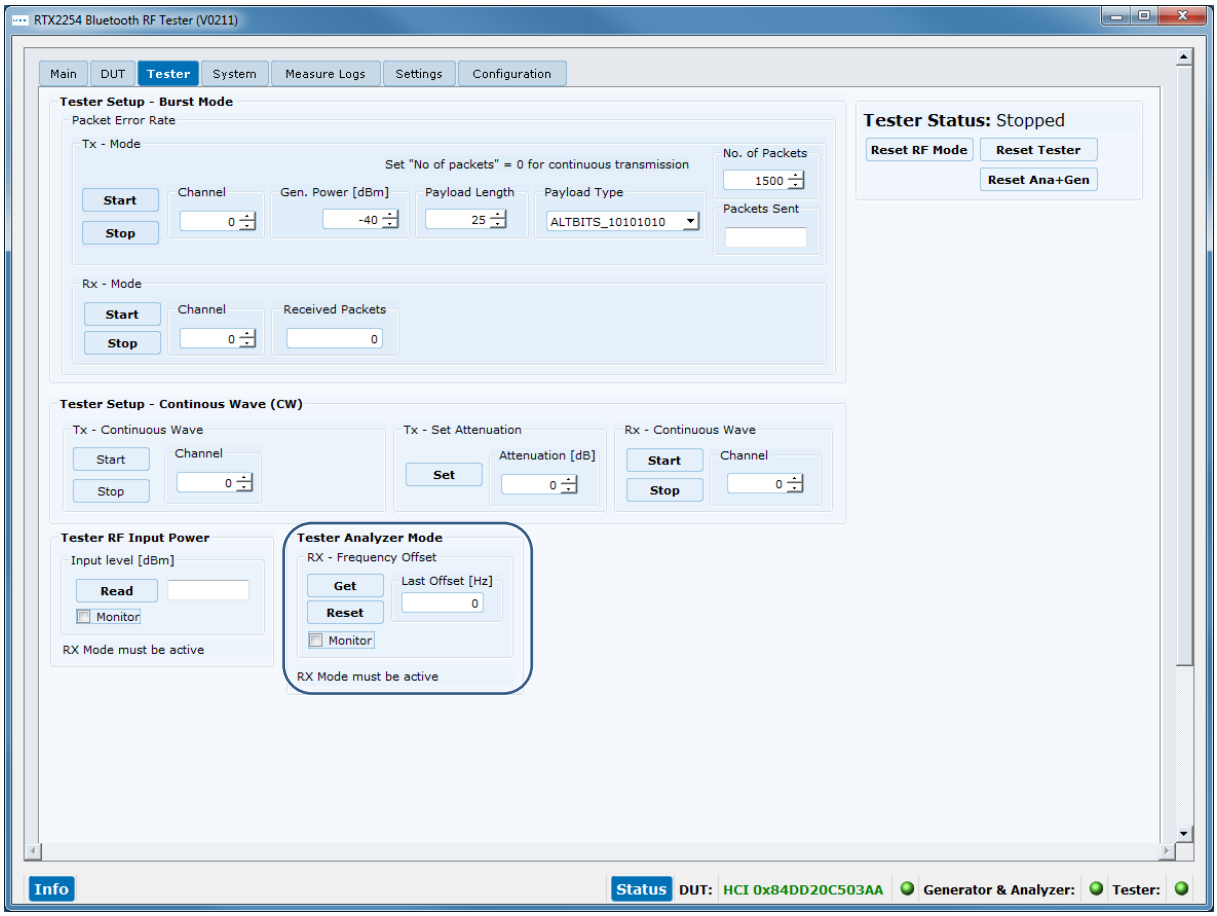


Click **[Read]** to get the measured input power.

As an option, check the **[Monitor]** box to start continuous readings.

7.4 Tester Analyzer Mode

In this section, you can measure the RF frequency offset. A 'RX Mode', burst or CW must be active to perform this test.

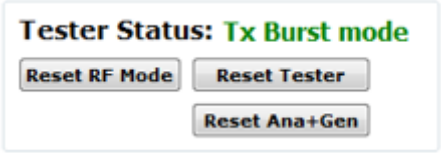


Click **[Get]** to read the measured frequency offset.

Click **[Reset]** to reset the frequency offset measurement while running.

As an option, check the **[Monitor]** box to start continuous readings.

7.5 Tester Status



In the **[Tester Status]**, the current state of the RTX2254 tester is shown, i.e. which function has been selected.

7.5.1 Reset RF Mode

Click **[Reset RF Mode]** to reset the application internal mode but not in the RTX2254 tester.

This can be used if the RTX2254 is power cycled and you want to restart the test.

7.5.2 Reset Tester

Click **[Reset Tester]** to send a reset command to the RTX2254 tester to reset its internal state.

Please note that:
It takes some time for the tester to reset and reestablish communication.

7.5.3 Reset Ana+Gen

Click **[Reset Ana+Gen]** to send a reset command to the RTX2254 tester to reset (only) the analyzer and generator internal state.

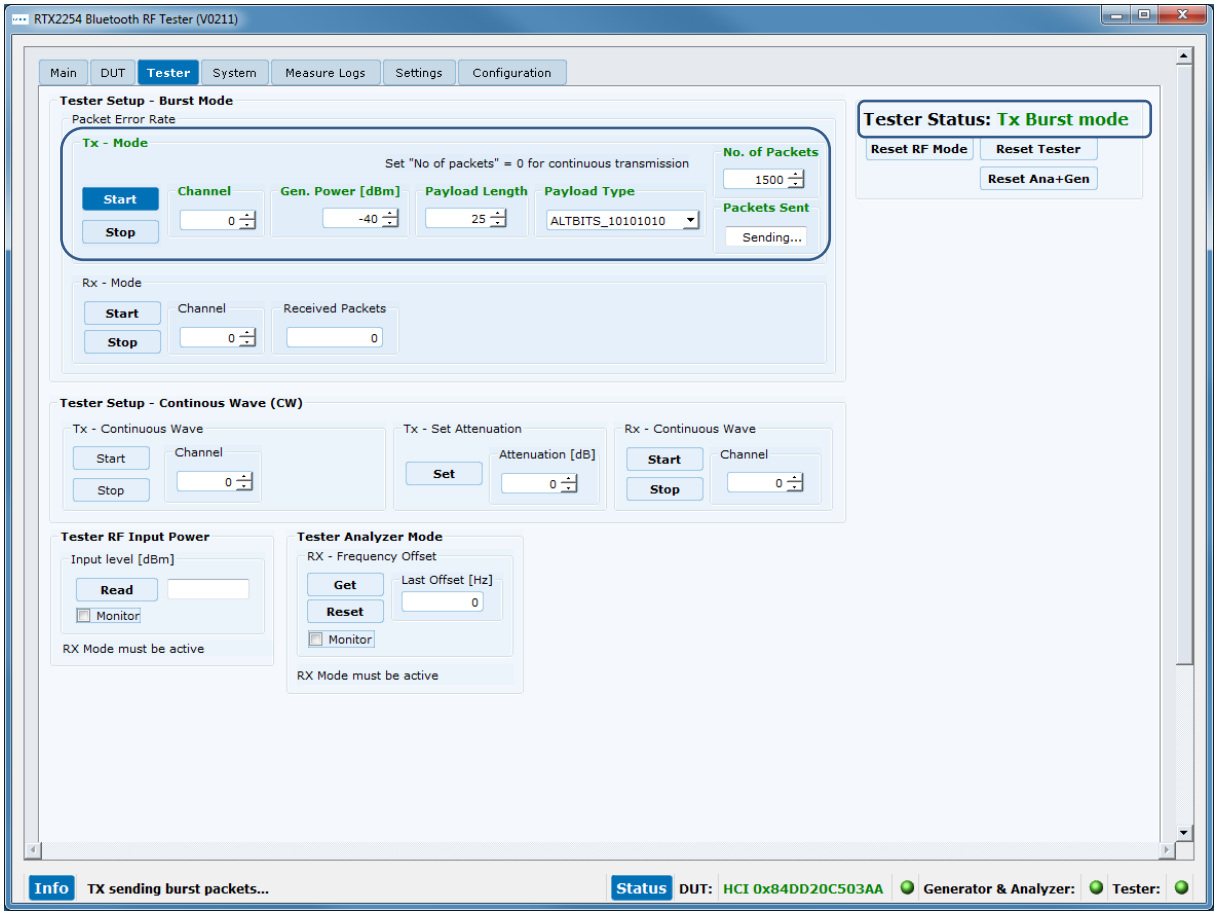
Please note that:
It takes some time for the tester to reset and reestablish communication.

7.6 Start Tx Burst Mode

In **[Tx – Mode]** sub section, click **[Start]** to let the Tester start transmission of burst on the specified RF channel (Ch 0 = 2402 MHz) using the specified power level, payload length and type.

The Tester Status is changed to "Tx Burst mode". Start **[Rx – Mode]** on **[DUT]** tab.

The Tester is in Tx burst mode. The tester stops when the specified number of packets have been sent.

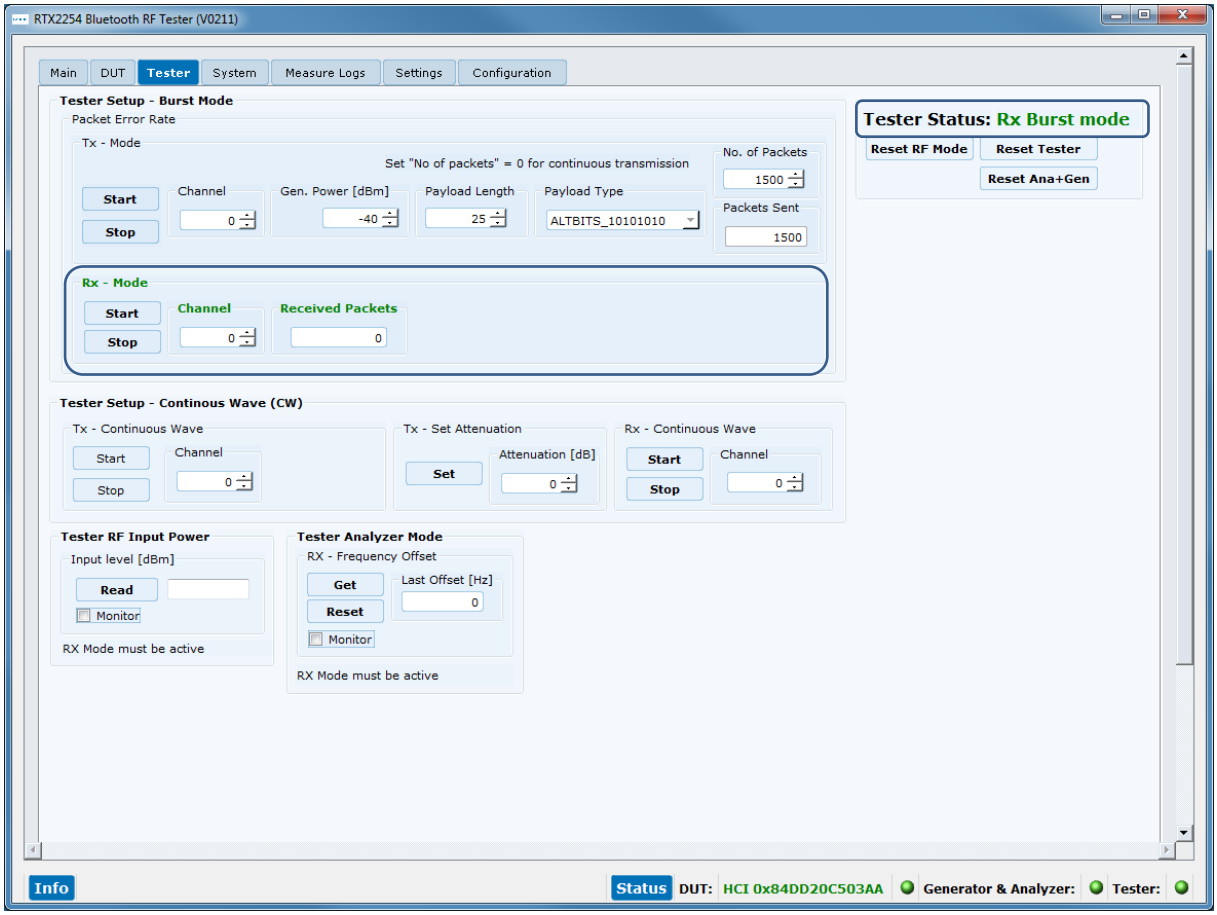


Please note that:
Specify packet number = 0 for continuous transmission of packets. Click **[Stop]** to stop the Tx burst mode again.

7.7 Start Rx Burst Mode

In **[Rx – Mode]** sub section, click **[Start]** to let the Tester start receiving burst packets on the specified RF channel (Ch 0 = 2402 MHz).

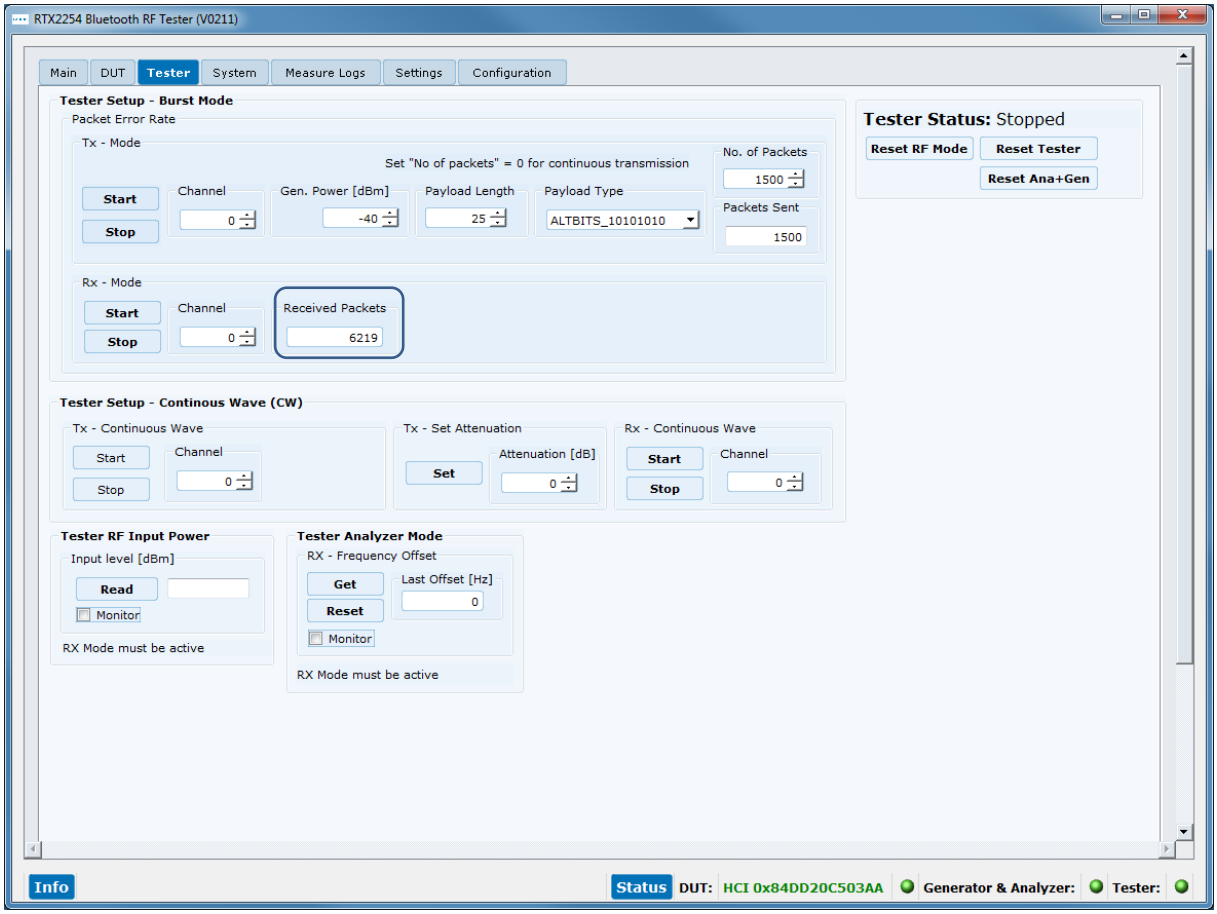
The Tester Status is changed to "Rx Burst mode". Start **[Tx – Mode]** on **[DUT]** tab.



"Tx – Mode" is started on **[DUT]** page to send packets.

Click the **[Stop]** button in **[Rx – Mode]** to get the number of packets sent by the DUT.

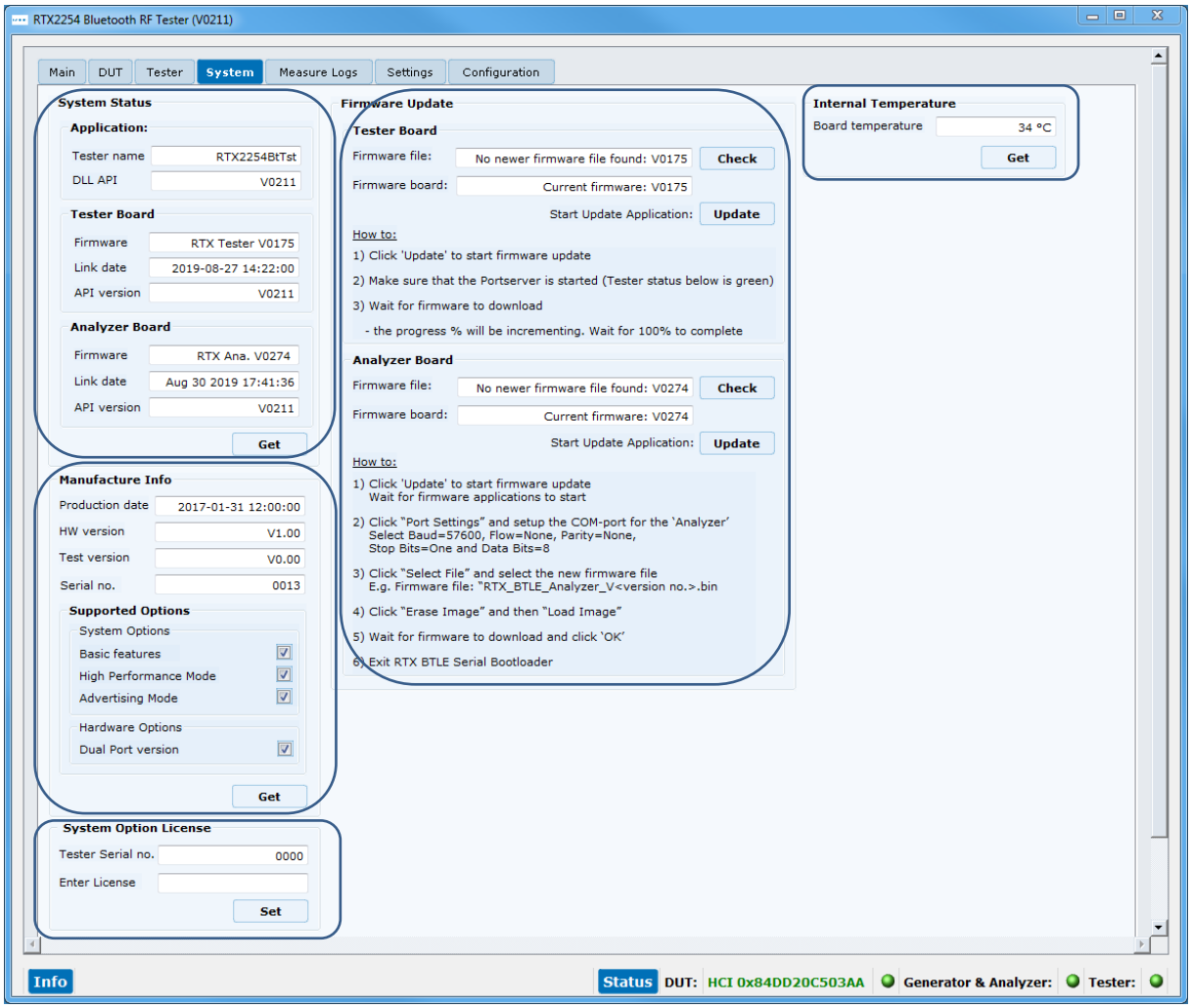
The **[Received packets]** is updated with the number of packets received by the Tester.



Please note that:
The **[Received packets]** has a maximum of 4294967295 packets (unsigned 32 bit).

8 System Tab

On the **[System]** page, you can get information about the RTX2254 tester.



8.1 System Status

[System Status] contains information about the application, supported API version and firmware for the tester board and analyzer board.

Click the **[Get]** button to update the information.

8.2 Manufacture Info

[Manufacture Info] contains production information about the RTX2254, e.g. hardware version, serial number and the installed supported features.

Click the **[Get]** button to update the information.

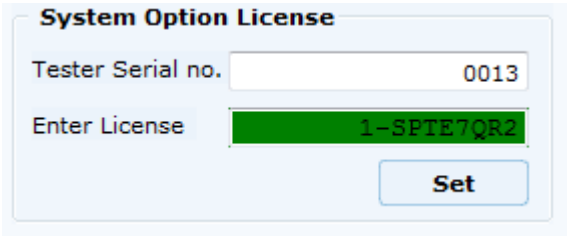
8.3 System Option License

[System Option License] makes it possible to enter a license number to enable a new feature in the RTX2254 tester. One license enables one new feature.

The license number is entered in the "Enter License" field.

Click the **[Set]** button to set the license. The testers serial number is shown in the "Tester Serial No." field.

The "Enter License" field becomes green if the license is valid.



8.4 Internal Temperature

[Internal Temperature] gives information about the tester's internal temperature.

Click the **[Get]** button to update the information.

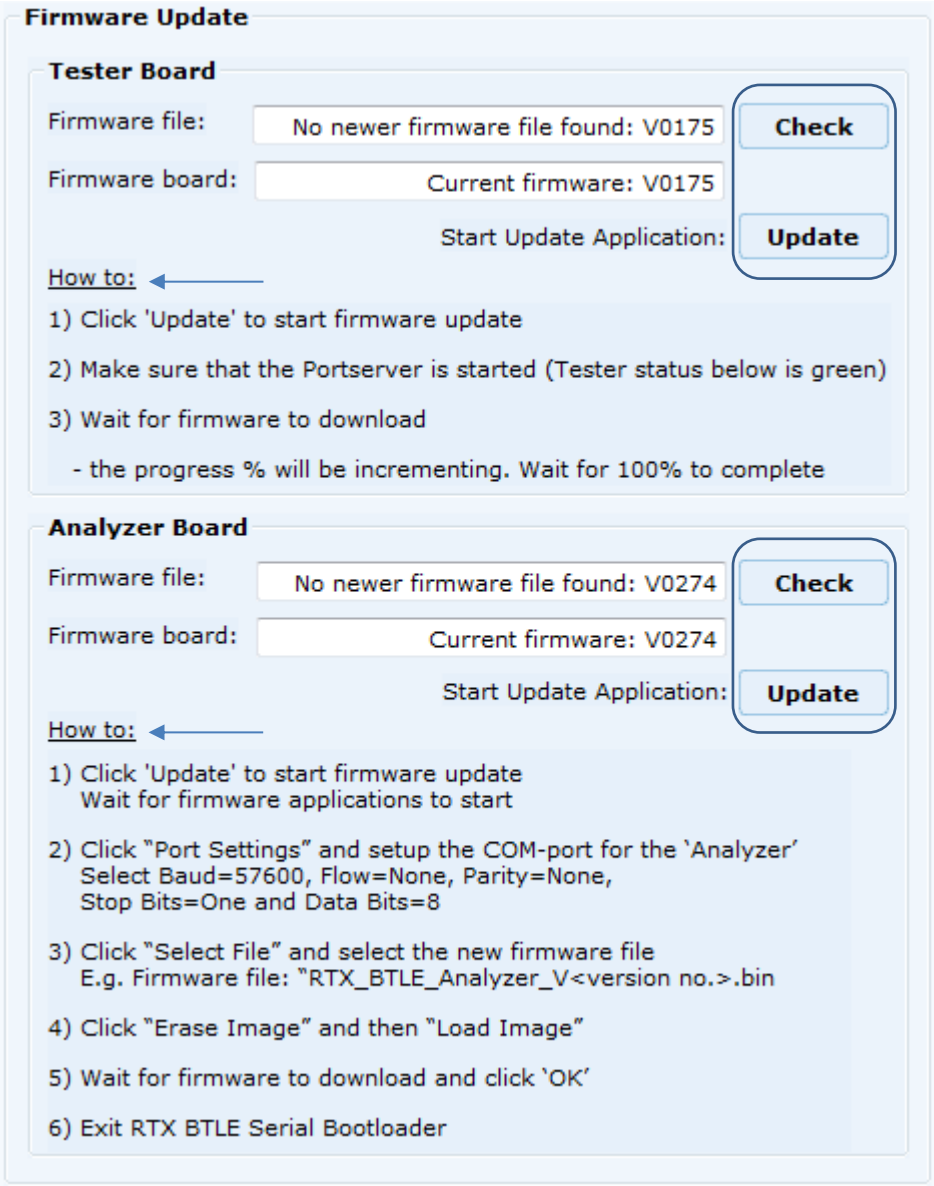
8.5 Firmware Update

The **[Firmware Update]** sub section allow you to check for new firmware releases for the tester (compared to the already installed firmware) and an option to update the firmware. Follow the "**How to:**" step by step shown.

The firmware can also be manually updated, see chapter 8.6 Manual Firmware Update.

Click **[Check]** button in **[Tester Board]** or **[Analyzer Board]** to check for new firmware delivered with the last installed version of the RTX2254 Bluetooth Tester application.

The firmware file found with the newest version number is shown under **[Firmware file:]** and the currently installed firmware is shown under **[Firmware board:]**:



Click **[Update]** to update the firmware.

8.6 Manual Firmware Update

If the firmware does not update automatically it is possible to update the firmware manually, i.e. not using the RTX2254 application.

HWx refers to the hardware version of the tester. Please see the version no. on the label on the back side. V1 is HW1 and V2 is HW2 etc.:

8.6.1 Tester Firmware

How to:

- 'Tester' firmware must be updated to Vxxxx: BtTst_Vxxxx.fwu

  The file is located in the folder: .\RTX\RTX2254 Bluetooth RF Tester\Vxxxx\Tools\HWx\Tester\

- Make sure that the Portserver is started and open with the "Tester" COM port active
- Run the "Tester_Stand_Alone_Prog.bat" from firmware location
- Wait for firmware to download

  Note! It can be necessary to run the batch file more times due to timing with USB enumeration sync on the PC.

8.6.2 Analyzer Firmware

How to:

- 'Analyzer' firmware must be updated to Vxxxx: RTX_BTLE_Analyzer_Vxxxx.bin

  The file is located in the folder: .\RTX\RTX2254 Bluetooth RF Tester\Vxxxx\Tools\HWx\Analyzer\

- Start the tool "RTX BTLE Serial Bootloader.exe" application from firmware location
- Click "Port Settings" and setup the COM-port for the 'Analyzer' interface and select Baud=57600, Flow=None, Parity=None, Stop Bits=One and Data Bits=8
- Click "Select File" and select the file "RTX_BTLE_Analyzer_Vxxxx.bin"
- Click "Erase Image" and then "Load Image"
- Wait for firmware to download and click 'OK'.
- Exit RTX BTLE Serial Bootloader application

9 Measure Logs Tab

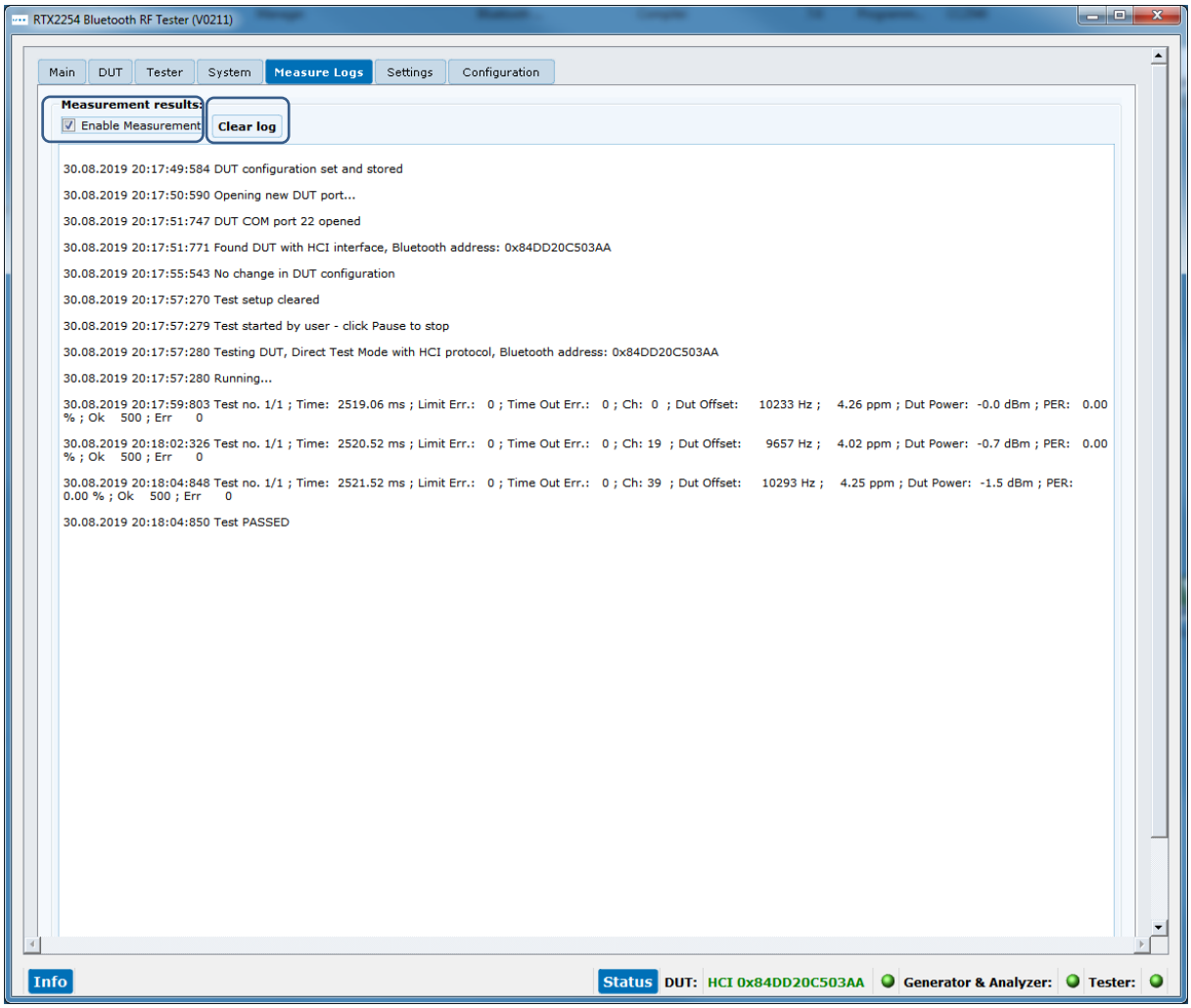
On the **[Measure Logs]** page, you can get a log of the tests performed if enabled.

All the test results are also written into the RTX2254 log file. The log file is stored in the folder: "c:\Users\All Users\RTX2254\Log\". This folder can be hidden on some Windows installations.

Log files are named: "RTX2254_Log_Date_<date>_Time_<time of start>.log"

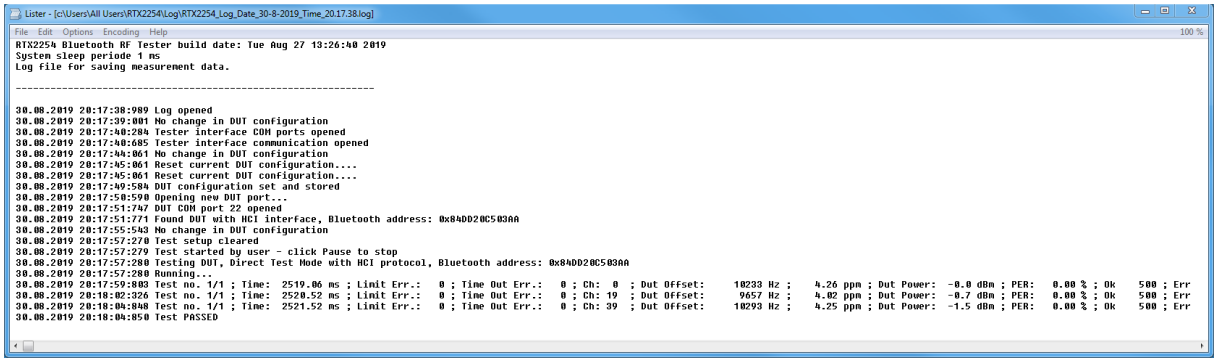
Check the **[Enable Measurement]** box if you wish to save the measurements in the log window and log file.

Click the **[Clear log]** to clear the log screen, i.e. the log file is not erased.



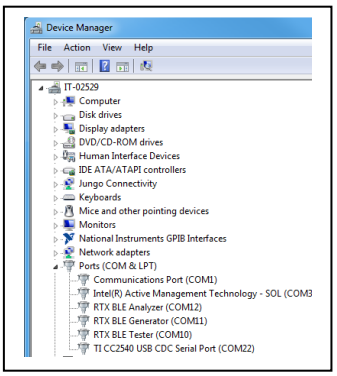
Please note that:
The DUT Bluetooth address is written to log file when **[Start]** is clicked.

Log file example:



Please note that:
The measurements are ';' separated and can be imported to a spread sheet for further analysis.

10 Settings Tab



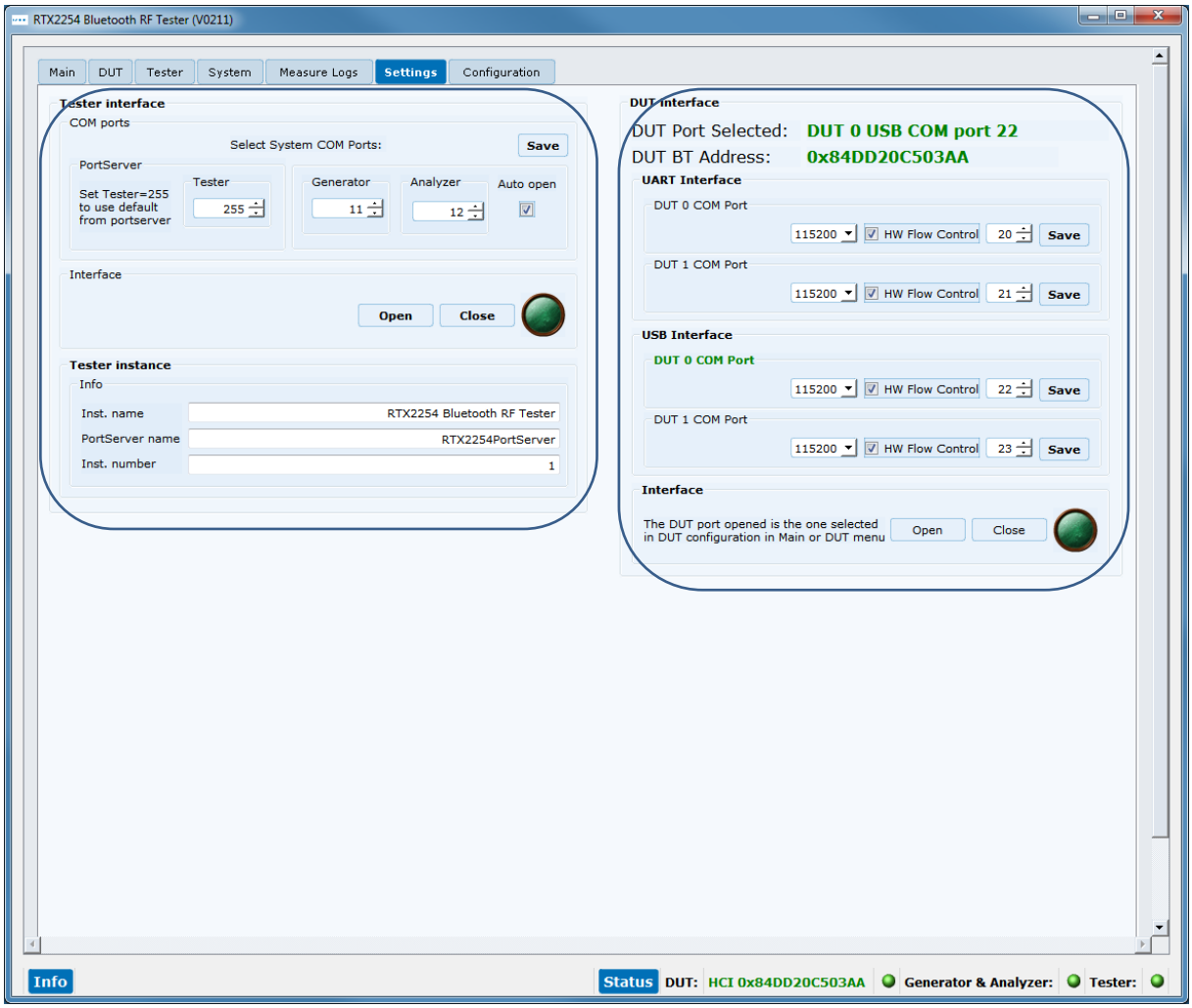
On the **[Settings]** page, you can setup the communication parameters for the tester and DUT.

The COM ports can be found using the Windows "Device Manager".

It can be started from the Windows 'Run' or 'Search programs and files' menu. Type: devmgmt.msc and press <Enter>.

The RTX2254 has 3 communication interfaces: **[Tester]**, **[Generator]** and **[Analyzer]**.

Refer to the RTX2254 Quick Installation Guide" for more information about the initial system setup.

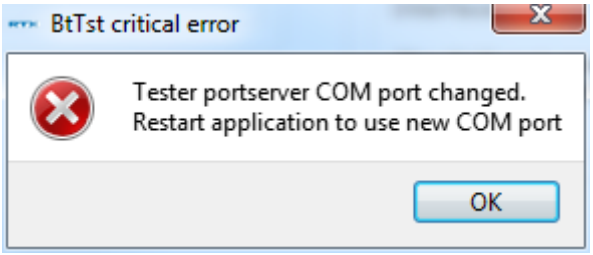


10.1 Tester Interface

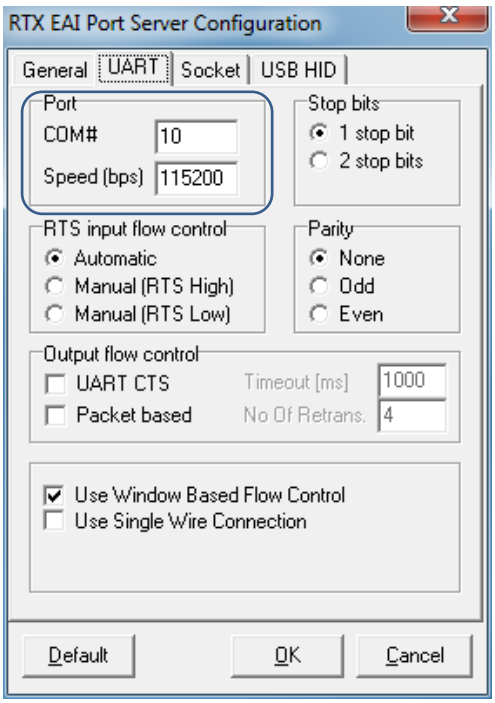
The **[Tester]** uses the Portserver. In **[Tester interface]**, setup the PortServer COM port to use.

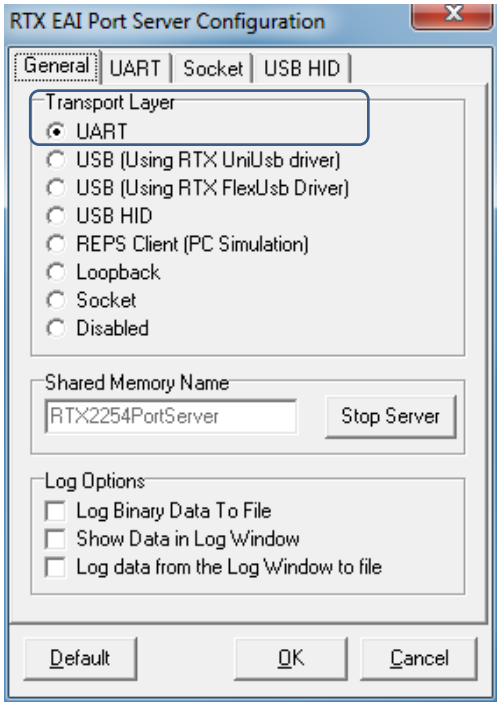
Setup a specific COM port to use with Portserver or enter 255 to use the manually setup COM port in Portserver application. Click [Save] to store the settings.

The RTX2254 application must be restarted if the COM port for Portserver is changed.



Please note that:
The RTX port server can be setup before starting the application (If COM port = 255).





Setup the COM-ports for **[Generator]** and **[Analyzer]**.

The **[Auto open]** option can be set (checked) to automatically open the interfaces for Generator and Analyzer when the application is started.

Setup the COM port numbers for your installation. Click **[Save]** to store the settings.

Click **[Open]** to open the tester interface.

Click **[Close]** to close the tester interface again.

10.2 DUT interface

The RTX2254 has 2x2 DUT communication interfaces:

UART Interface:

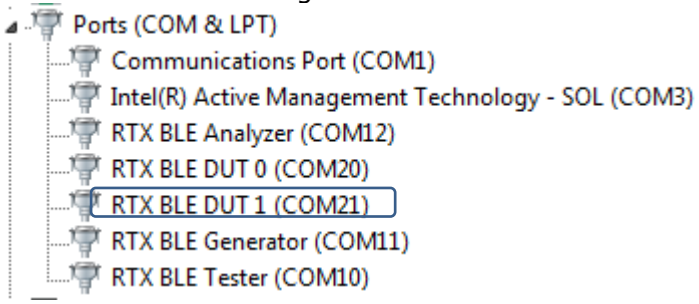
- **[DUT0 UART]**
- **[DUT1 UART]**

USB Interface:

- **[DUT0 USB]**
- **[DUT1 USB]**

Setup the COM port numbers for your installation, e.g. COM 21 for UART DUT 1

Windows "Device Manager":



Click **[Save]** to store the settings.

Click **[Open]** to open the specified DUT interface.

Please note that:
The active DUT port to open is selected on the **[Main]** or **[DUT]** page.

Click **[Close]** to close the DUT interface again.

In **[DUT interface]**, the current DUT port selected and status with the Bluetooth address of the DUT is shown.

Please note that:
Bluetooth address is only available with HCI protocol.

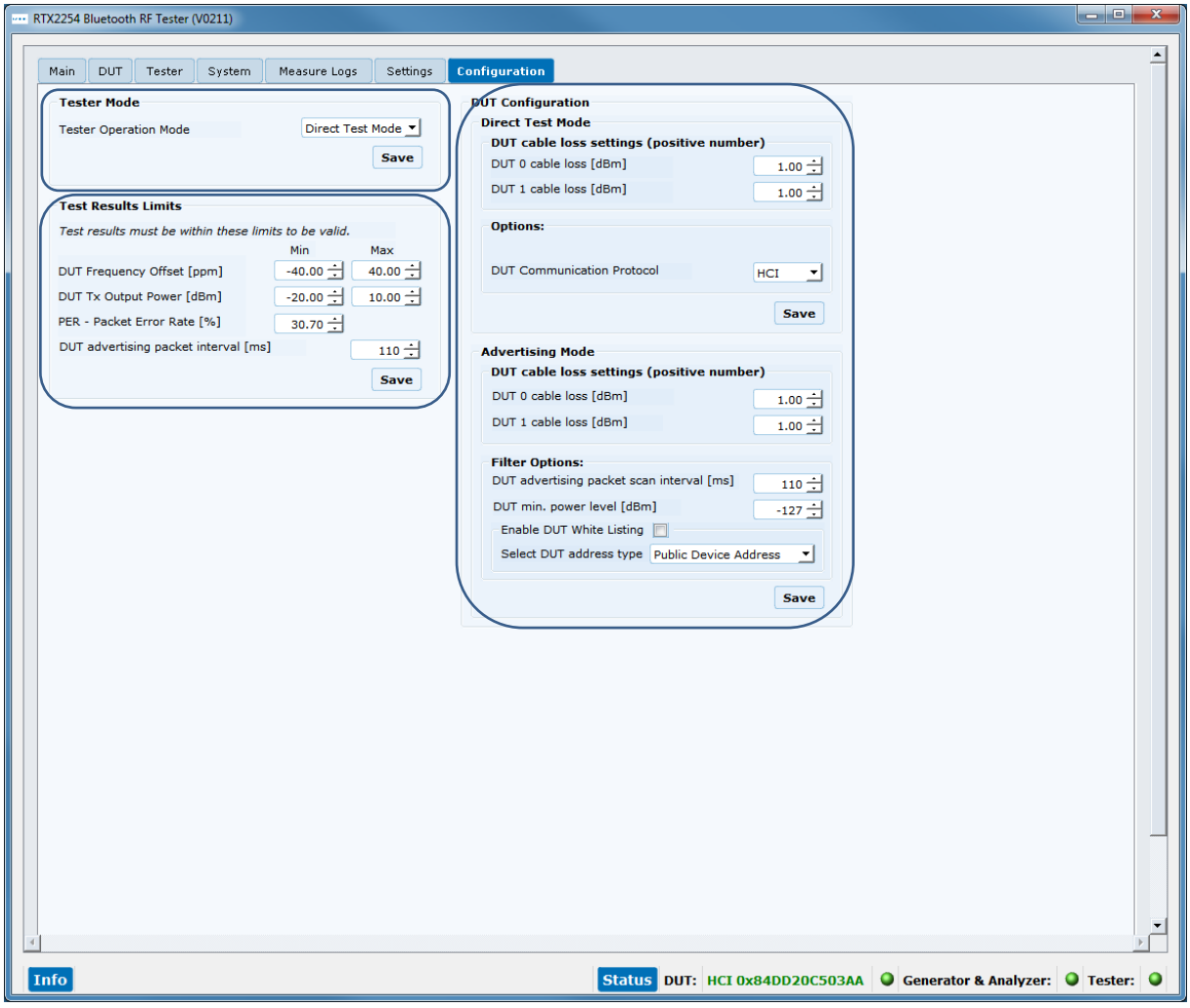
11 Configuration Tab

On the **[Configuration]** page, you can setup the tester mode, test limits and DUT configurations for Direct Test Mode and Advertising Mode.

[Tester Mode] is used to select either "Direct Test Mode" or "Advertising Mode". "Advertising Mode" requires that the RTX2254 has "Advertising Mode" option installed.

[Test Result Limits] contains the limits for the tests performed on the **[Main]** page, i.e. the valid range the test results must be within for a successful DUT test.

[DUT configuration] contains DUT configuration values for "Direct Test Mode" and "Advertising Mode", e.g. the cable loss and communication protocol.



Please note that:
The default values are the max. limits specified by Bluetooth SIG.

[DUT 1 cable loss (dBm)] will be dimmed for RTX2254 with a single DUT port.

11.1 Test Mode

Select either tester operation mode

- Direct Test Mode
- Advertising

Please note that:
"Advertising Mode" requires that the RTX2254 has "Advertising Mode" option installed.

11.2 Test Result Limits

Setup the limits for a valid test result in **[Test Result Limits]**. If test results are inside these limits the test is marked as "Test PASSED" else "Test FAILED".

- DUT Frequency Offset (ppm) Valid range -40 to 40 ppm
- DUT Tx Output Power (dBm) Valid range -100 to 50 dBm
- PER – Packet Error Rate (%) Valid range 0 to 100 %
- DUT advertising packet interval [ms] Valid range 0 to 65535 ms

Please note that:
It is for "DUT advertising packet interval [ms]" recommended to set this value a little bit higher than specified for the DUT to handle jitter (0-10 ms), e.g. for 20 ms advertising select min. 25 ms and 100 ms select 110. Adjust this value as required.

The DUT packet interval verification test can be disabled by setting the "DUT advertising packet interval [ms]" limit to 0.

Click **[Save]** to store the results.

11.3 DUT Configuration

[DUT Configuration] setup DUT configuration for "Direct Test Mode" and "Advertising Mode".

11.3.1 Direct Test Mode

Setup a DUT cable compensation loss, i.e. the signal loss in the cable connected to the front (RF DUT 0 or RF DUT 1) of the RTX2254 tester and the DUT.

The cable loss is a positive value.

- DUT 0 cable loss (dBm) Valid range -100 to 100 dBm
- DUT 1 cable loss (dBm) Valid range -100 to 100 dBm

Please note that:
Only generator power level and test results on the **[Main]** page will be compensated with these values.

Select the DUT communication protocol to use.

- DUT Communication Protocol HCI or 2-Wire

Click **[Save]** to store the results.

11.3.2 Advertising Mode

Setup a DUT cable compensation loss, i.e. the signal loss in the antenna and cable connected to the front (RF DUT 0 or RF DUT 1) of the RTX2254 tester and the DUT.

The cable loss is a positive value.

- DUT 0 cable loss (dBm) Valid range -100 to 100 dBm
- DUT 1 cable loss (dBm) Valid range -100 to 100 dBm

Please note that:
Only generator power level and test results on the **[Main]** page will be compensated with these values.

In the **[Filter Options]** some filter values can be set.

- DUT advertising packet scan interval [ms] Set according to DUT
- DUT min. power level [dBm] — All advertising packets below this value is skipped. Set -127 to get all packets.
- Enable DUT White Listing — Enable to filter out advertising packet not coming from the DUT, e.g. the DUT address on the **[Main]** page. If enable, set "Select DUT address type" to either "Public Device Address" or "Random Device Address" according to the DUT specification.

Click **[Save]** to store the results.

12 How to Setup Automated Testing - Direct Test Mode

This chapter describes how you can setup the test parameters for automated testing in Direct Test Mode on the **[Main]** page.

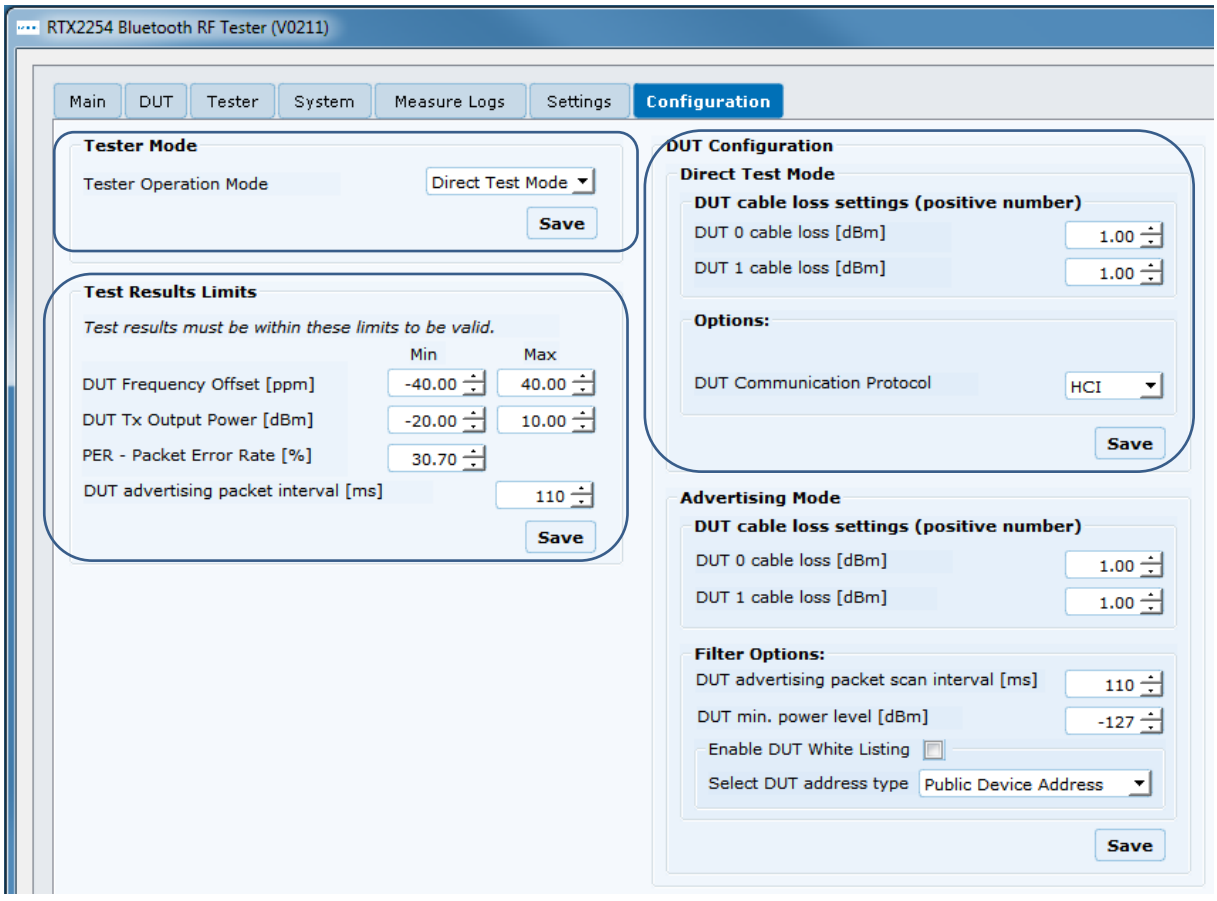
12.1 DUT Test Limits

Go to the **[Configuration]** page to input the DUT test limits and cable compensation. Refer to section 11 Configuration Tab for a detailed description of the parameters.

In **[Tester Mode]** select "Direct Test Mode".

Click **[Save]** to store the values.

For example:



12.2 DUT Test Setup

On the **[Main]** page, you can input the required parameters for your testing.

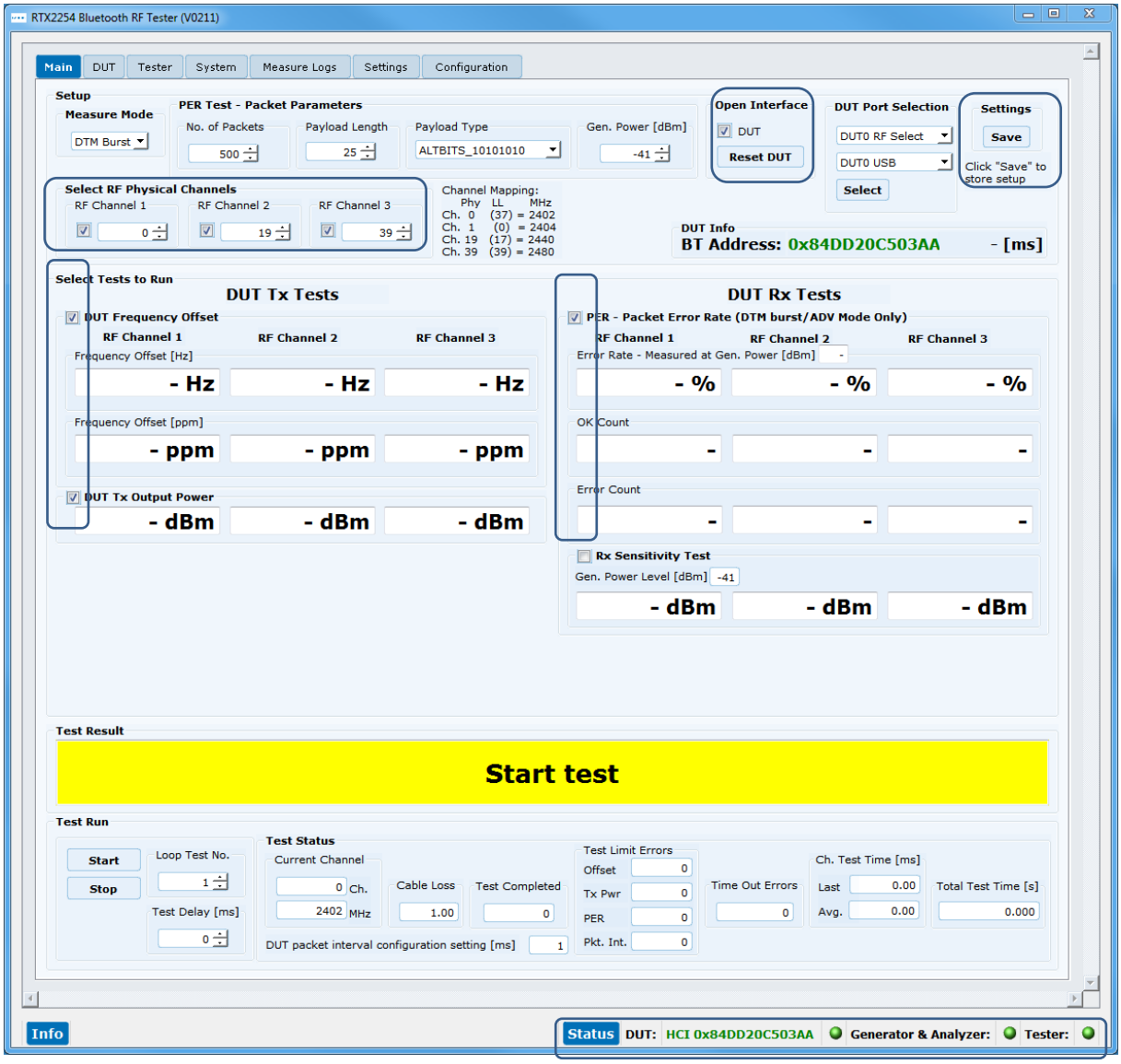
In **[DUT Port Selection]**, select the correct RF port and DUT interface to use for the test. Then press **[Select].**

Now check that the 3 status LEDs in the lower, right "Status" frame are green. If not, check **[DUT]** in the **[Open Interface]** box to open the DUT interface.

Enter the RF channels, e.g. 0, 19 and 39 to use in the test in **[Select RF Physical Channels]**.

Check the test boxes for "DUT Frequency Offset", "DUT Tx Output Power" and "PER – Packet Error Rate" in **[Select Tests to Run]** to enable the test in the test run.

Then press **[Save]** to store your settings.



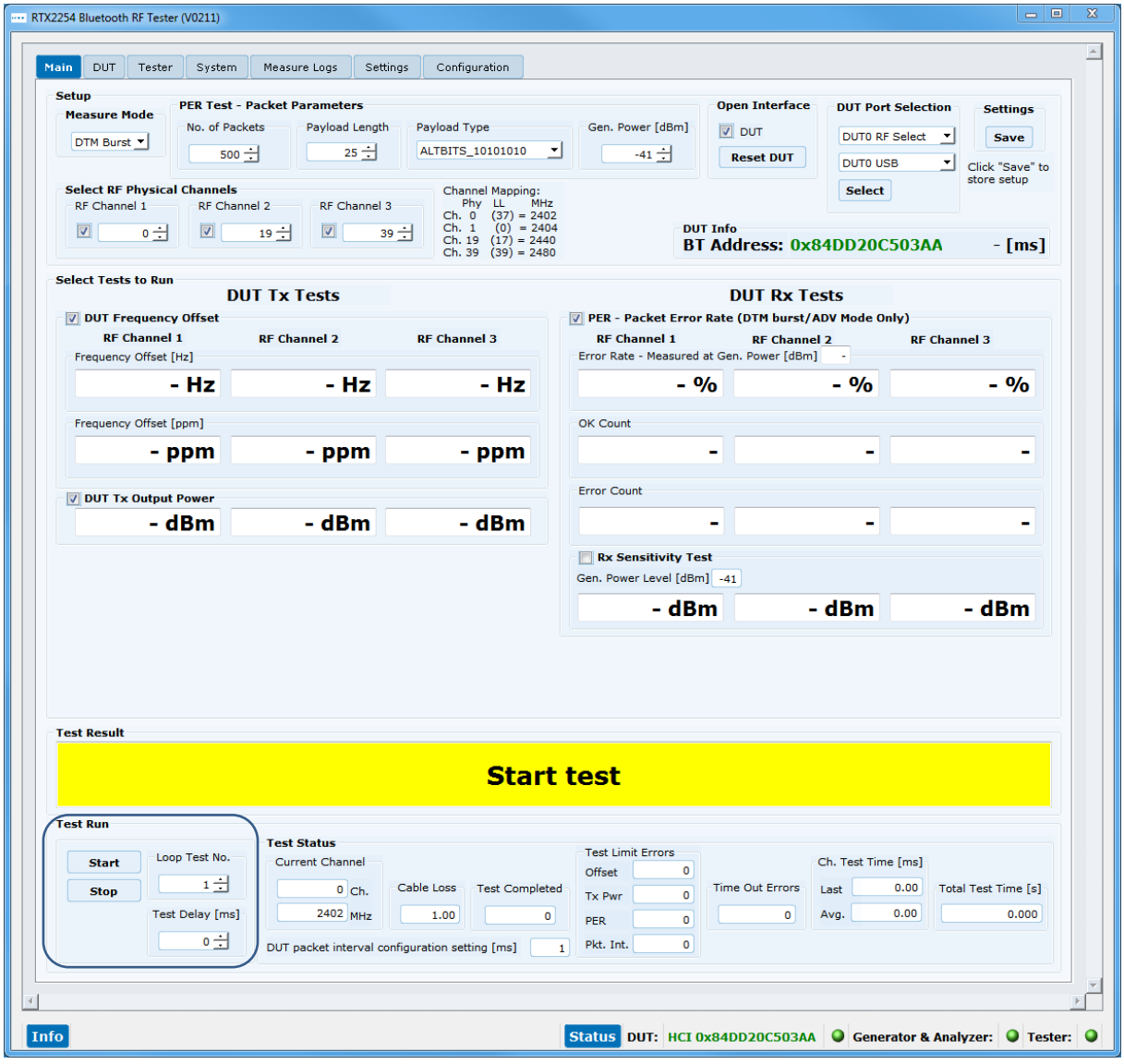
12.3 Starting the DUT Test

This chapter shows two examples of a test run.

The first one is with a DUT fulfilling the test limits and the second one is outside the required testing limits.

Go to the **[Main]** page.

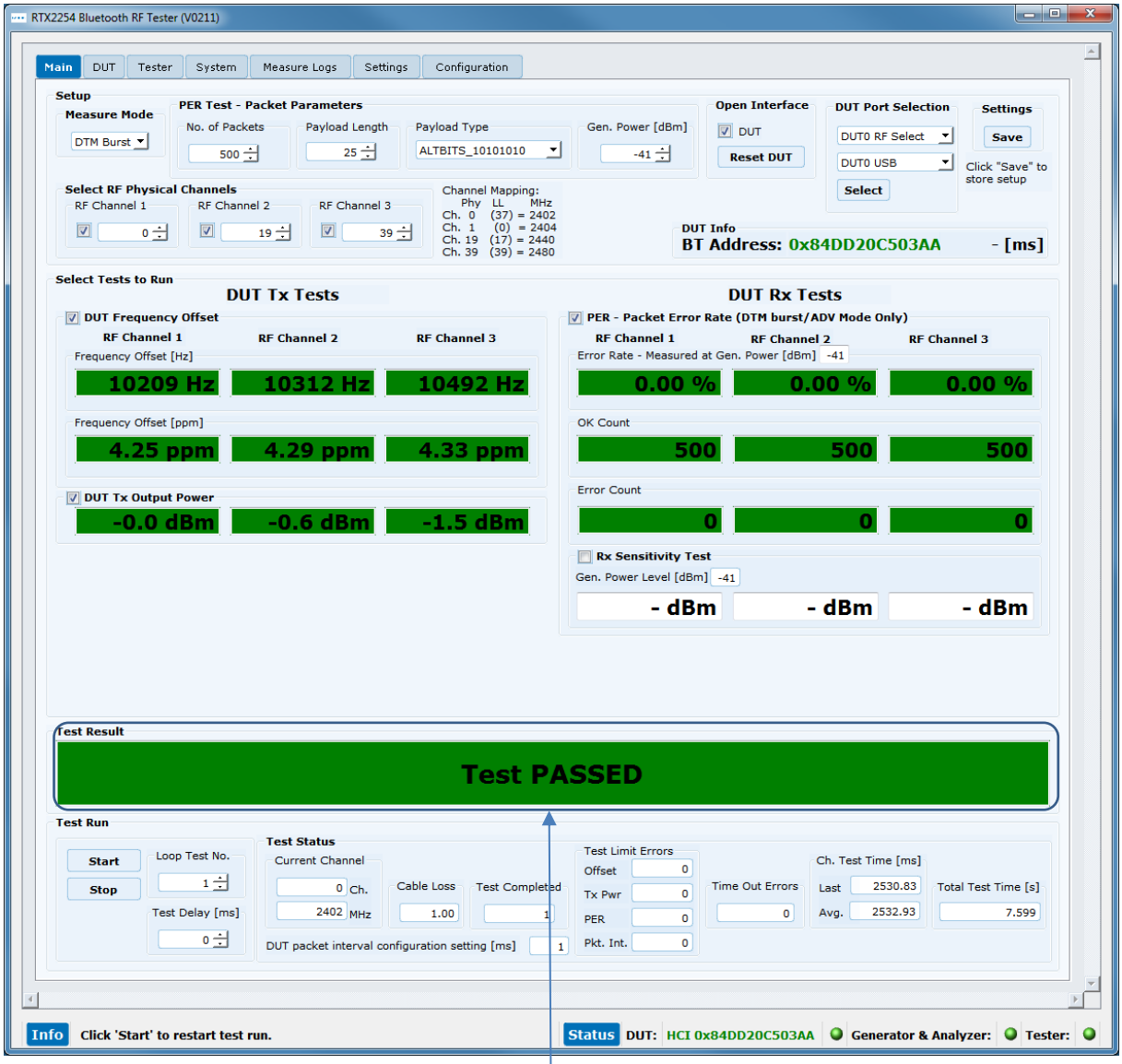
Click **[Start]** in the **[Test Run]** sub section.



12.3.1 DUT - Within Test Limits

In this example, all the tests are within the specified test limits and the DUT passes.

When the test is finished, your screen should look similar to this:



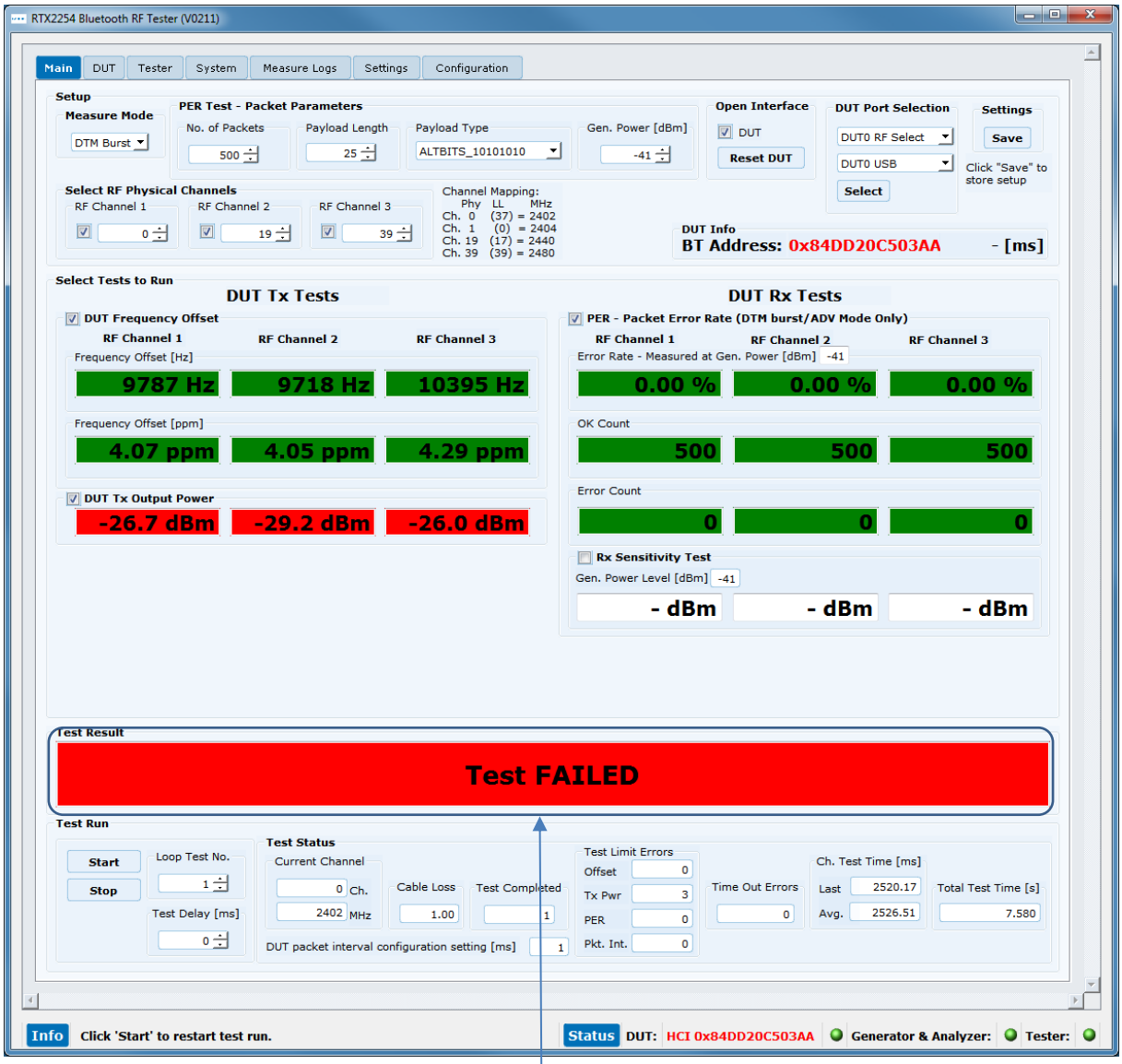
All tests are within the limits

12.3.2 DUT – Outside of the Test Limits

In this example, the DUT fails on the Tx output power because it is outside of the specified test limit for **[DUT Tx Output Power]**.

A failing test case will be marked red during the test run.

When the test has completed. The overall test status will be red and your screen should look similar to this:



All Tx power tests are outside the test limits and failed

13 How to Setup Automated Testing- Advertising Mode

This chapter describes how you can setup the test parameters for automated testing in Advertising Mode on the **[Main]** page.

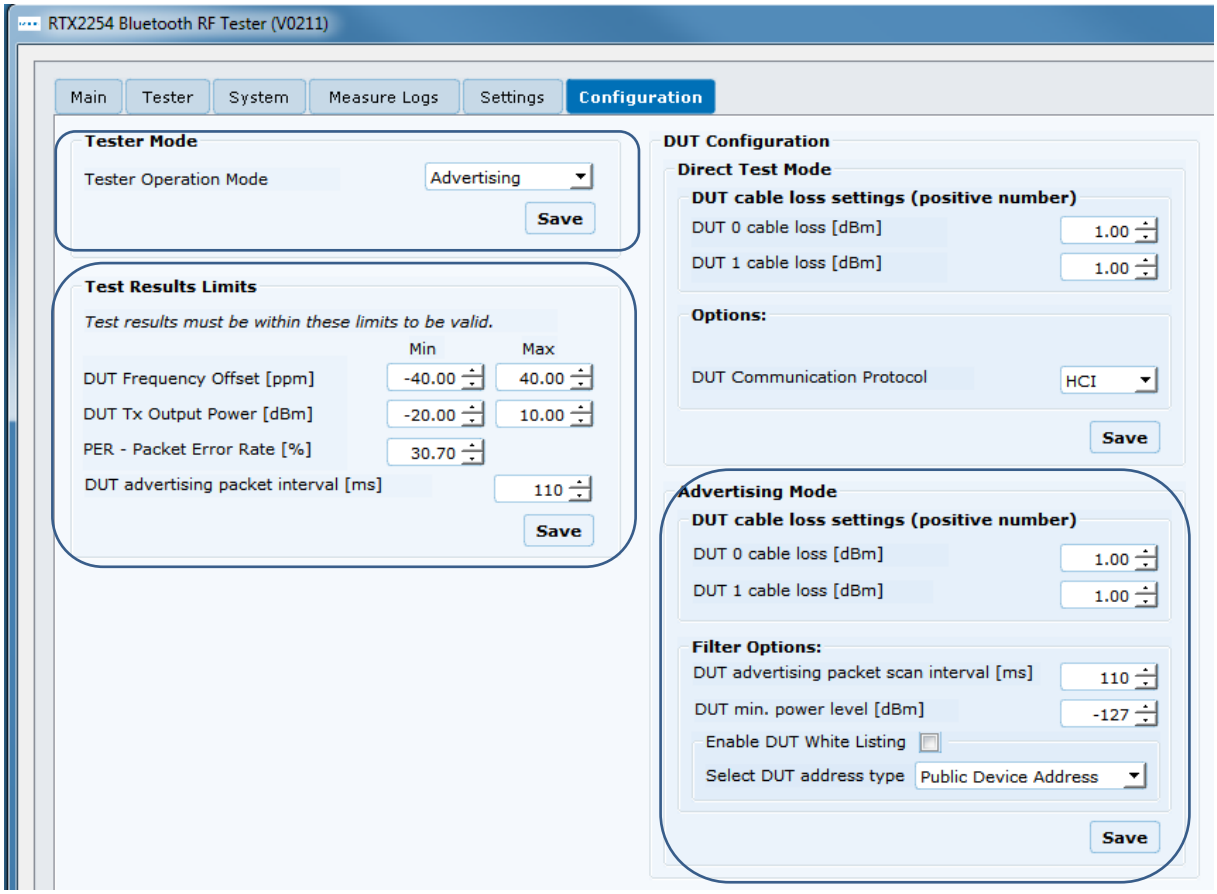
13.1 DUT Test Limits

Go to the **[Configuration]** page to input the DUT test limits and antenna and cable compensation. Refer to section 11 Configuration Tab for a detailed description of the parameters.

In **[Tester Mode]** select "Advertising".

Click **[Save]** to store the values.

For example:



13.2 DUT Test Setup

On the **[Main]** page, you can input the required parameters for your testing.

In the **[PER Test – Packet Parameters]** set the number of packets to use and the payload type. Payload Type is "SCAN_RESPONSE" or "NO_SCAN_RESPONSE".

- NO_SCAN_RESPONSE — This will scan for advertising packets from the DUT within the specified scan window, e.g. 5 packets every 100 ms => 500 ms scan window. In this time frame it is expected to receive 5 advertising packets.

  This packet type only tests DUT Tx.

- SCAN_RESPONSE — This is basically the same as "NO_SCAN_RESPONSE" but now RTX2254 will for each advertising packet request (scan request) an additional advertising packet from the DUT (scan response). So, by lowering the RTX2254 generator power it is possible to measure the DUT Rx sensitivity (PER test result < 30,7%), i.e. the DUT Rx is also tested.

  Please note that:
  Some DUTs are only advertisers (beacons) and "SCAN_RESPONSE" cannot be used.

Please note that:
The BLE specification states that advertising has a random delay of 0-10 ms, i.e. for a DUT with advertising interval every 100 ms the "DUT advertising packet interval [ms]" time should be set to 110-120 ms to account for this "jitter". If not, the last advertising packets might fall outside the scanning window. And fail.

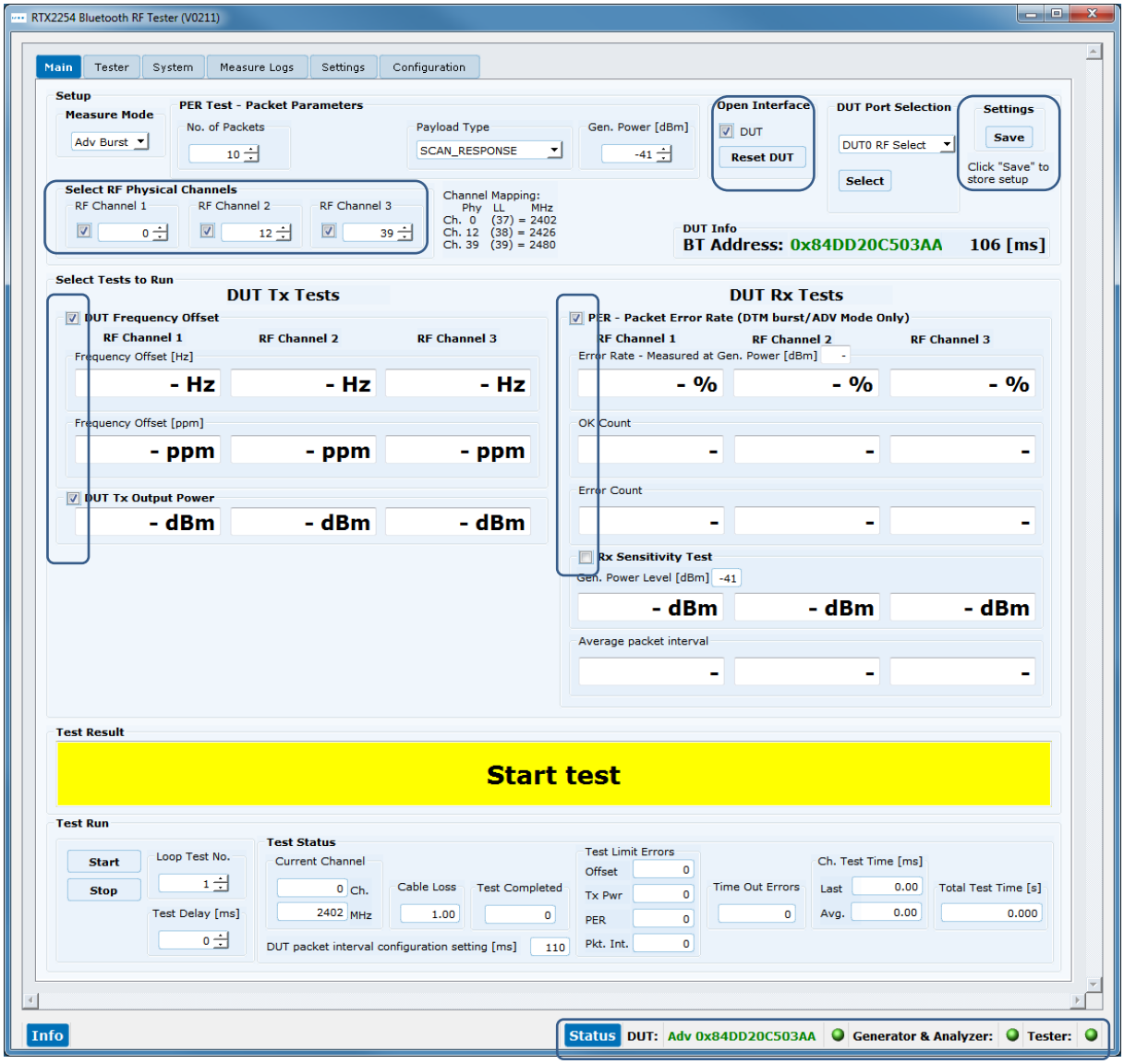
In **[DUT Port Selection]**, select the correct RF port and DUT interface to use for the test. Then press **[Select]**.

Now check that the 3 status LEDs in the lower, right "Status" frame are green. If not, check **[DUT]** in the **[Open Interface]** box to open the DUT interface.

The RF channels to use in the test in **[Select RF Physical Channels]** are fixed to 0, 12 and 39 in Advertising Mode.

Check the test boxes for "DUT Frequency Offset", "DUT Tx Output Power" and "PER – Packet Error Rate" in **[Select Tests to Run]** to enable the test in the test run.

Then press **[Save]** to store your settings.


RTX2254 Bluetooth RF Tester (V0211)
Main
Tester
System
Measure Logs
Settings
Configuration
Setup
Measure Mode
Adv Burst
PER Test - Packet Parameters
No. of Packets
10
Payload Type
SCAN_RESPONSE
Gen. Power [dBm]
-41
Open Interface
DUT
Reset DUT
DUT Port Selection
DUT0 RF Select
Select
Settings
Save
Click "Save" to store setup
Select RF Physical Channels
RF Channel 1
0
RF Channel 2
12
RF Channel 3
39
Channel Mapping:
Phy LL MHz
Ch. 0 (37) = 2402
Ch. 12 (38) = 2426
Ch. 39 (39) = 2480
DUT Info
BT Address: 0x84DD20C503AA
106 [ms]
Select Tests to Run
DUT Tx Tests
DUT Frequency Offset
RF Channel 1
RF Channel 2
RF Channel 3
Frequency Offset [Hz]
- Hz
Frequency Offset [ppm]
- ppm
DUT Tx Output Power
- dBm
DUT Rx Tests
PER - Packet Error Rate (DTM burst/ADV Mode Only)
Error Rate - Measured at Gen. Power [dBm]
- %
OK Count
Error Count
Rx Sensitivity Test
Gen. Power Level [dBm]
-41
Average packet interval
Test Result
Start test
Test Run
Start
Stop
Loop Test No.
1
Test Delay [ms]
0
Test Status
Current Channel
0 Ch.
2402 MHz
Cable Loss
1.00
Test Completed
0
DUT packet interval configuration setting [ms]
110
Test Limit Errors
Offset
Tx Pwr
PER
Pkt. Int.
Time Out Errors
Ch. Test Time [ms]
Last
0.00
Avg.
0.00
Total Test Time [s]
0.000
Info
Status
DUT:
Adv 0x84DD20C503AA
Generator & Analyzer:
Tester:

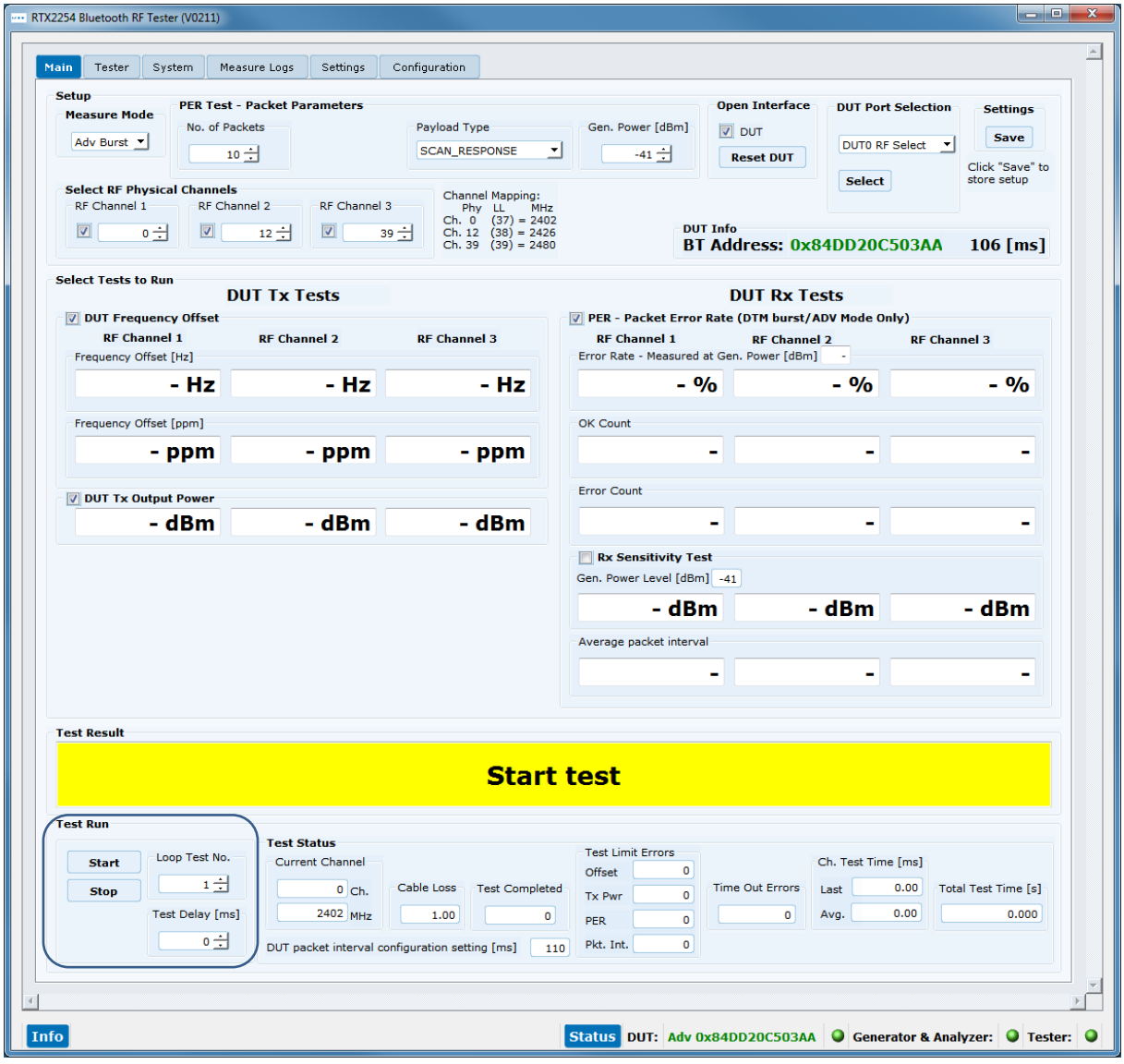
13.3 Starting the DUT Test

This chapter shows two examples of a test run.

The first one is with a DUT fulfilling the test limits and the second one is outside the required testing limits.

Go to the **[Main]** page.

Click **[Start]** in the **[Test Run]** sub section.



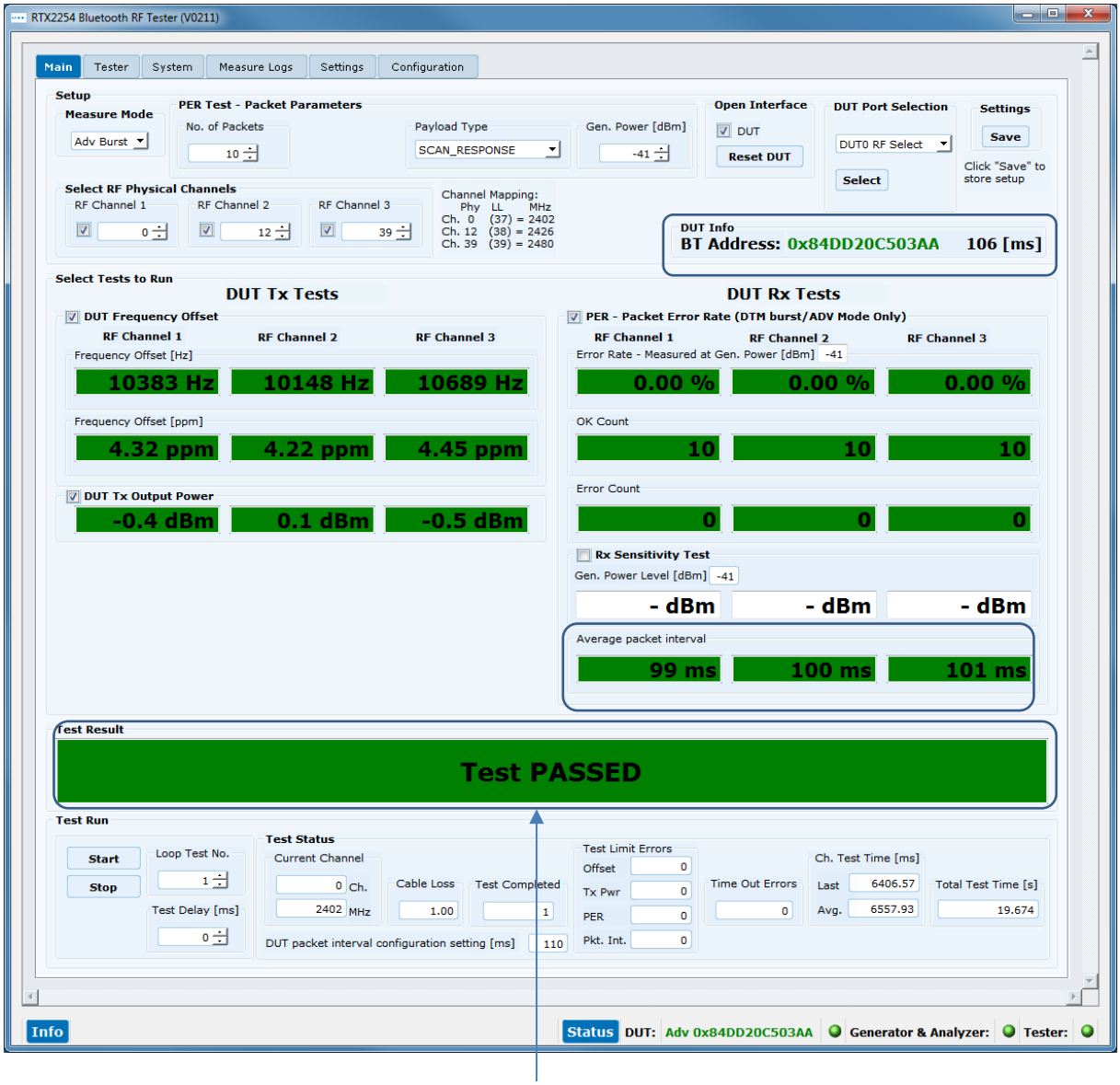
13.3.1 DUT - Within Test Limits

In this example, all the tests are within the specified test limits and the DUT passes.

The **[DUT Info]** shows the DUT Bluetooth address and the average time between the advertising packets from the DUT when DUT interface was opened.

The **[Average packet interval]** shows the average time between the advertising packets from the DUT for the Packet Error Rate test.

When the test is finished, your screen should look similar to this:



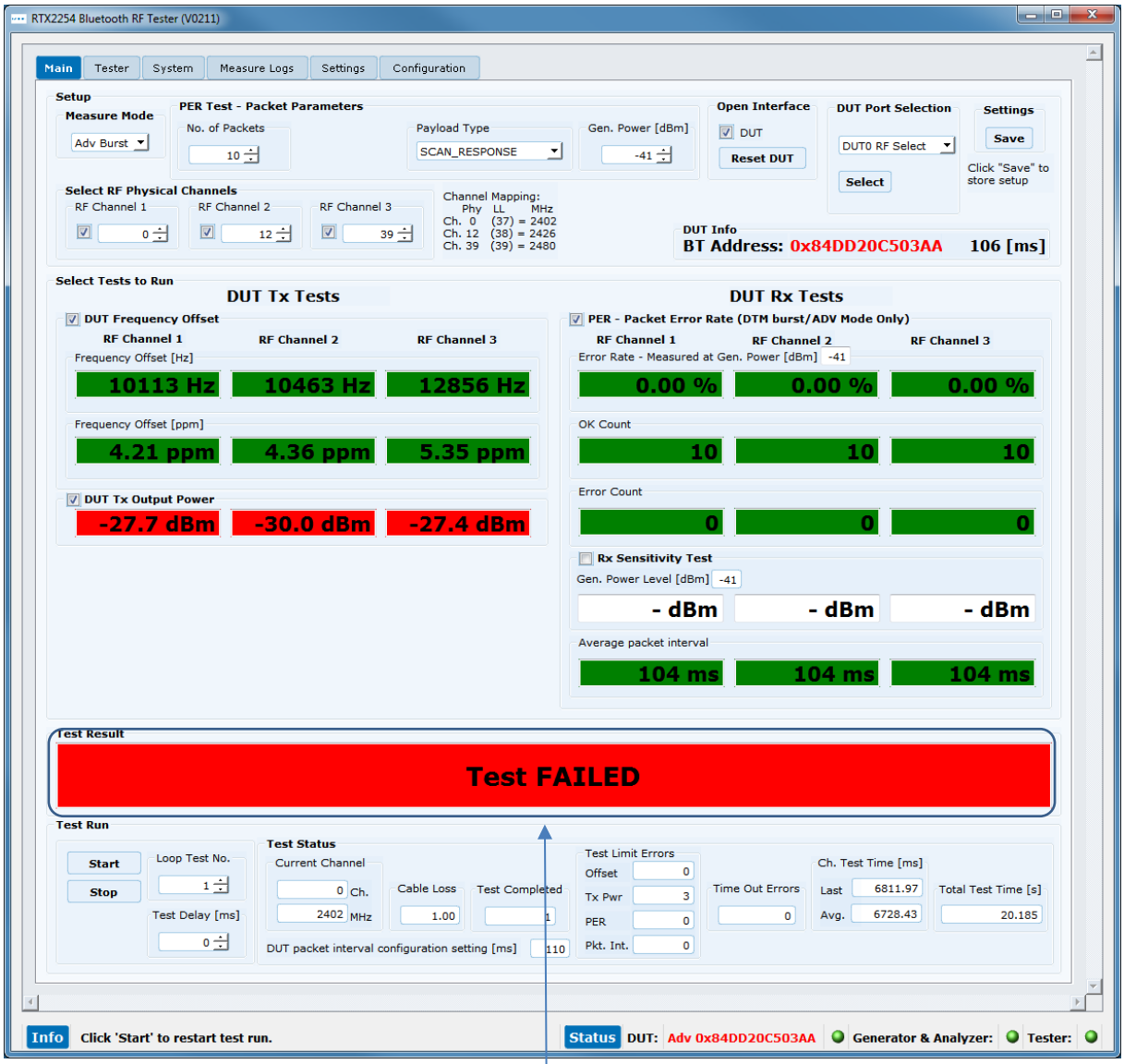
All tests are within the limits

13.3.2 DUT – Outside of the Test Limits

In this example, the DUT fails on the Tx output power because it is outside of the specified test limit for **[DUT Tx Output Power]**.

A failing test case will be marked red during the test run.

When the test has completed. The overall test status will be red and your screen should look similar to this:



All Tx power tests are outside the test limits and failed

14 How to Setup Manual Testing

This chapter describes how you can setup the test parameters for manual testing on the **[DUT]** and **[Tester]** pages.

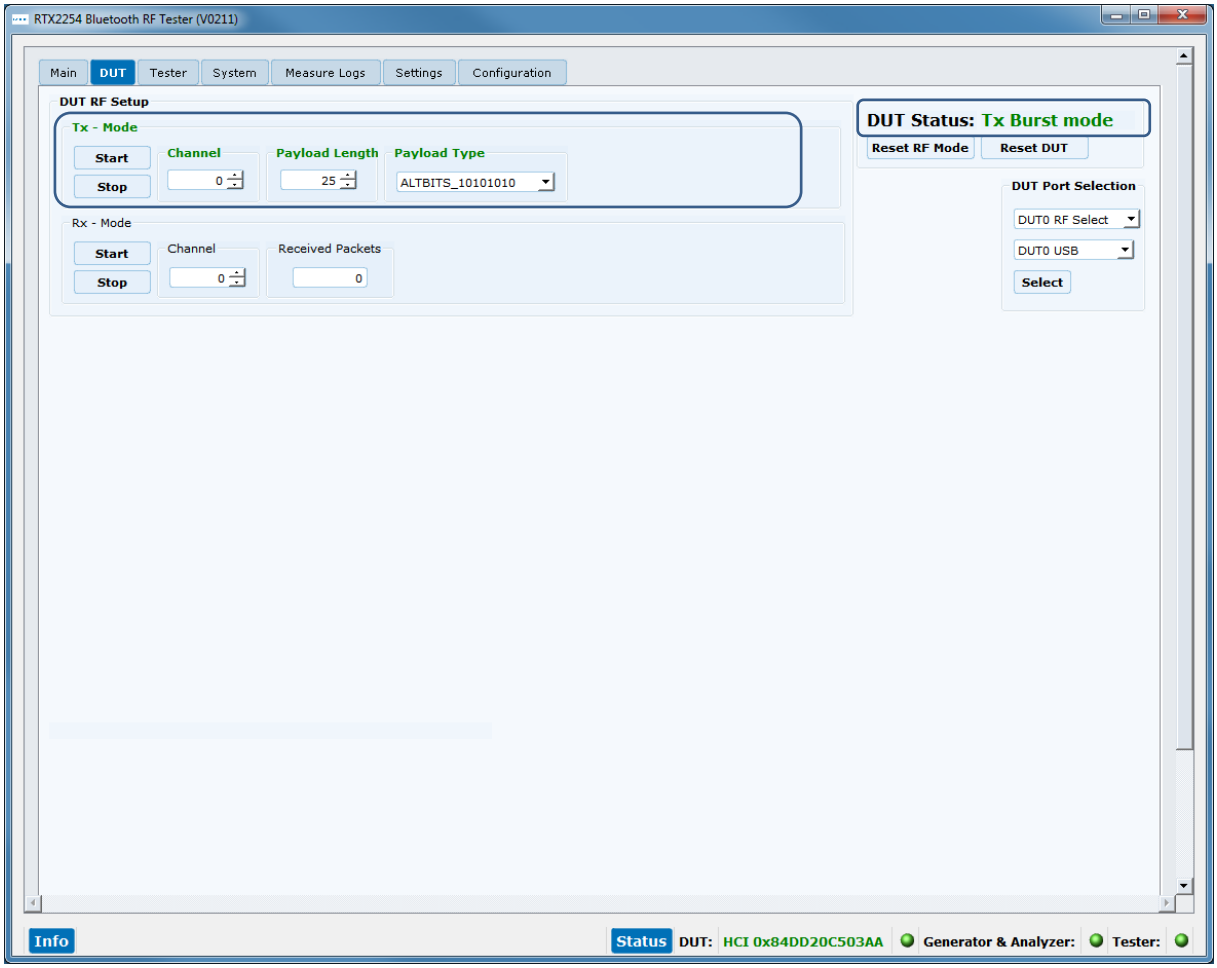
14.1 DUT Tab

On the **[DUT]** page you can control the DUT, i.e. start a radio transmit (Tx) or a receive (Rx) test.

14.1.1 For example, "Test DUT Tx power"

In **[Tx – Mode]**, select the channel, payload length and payload type to use.

Click **[Start]** to start transmitting. DUT now enters Tx burst mode.



14.2 Tester Tab

On the **[Tester]** page, you can control the tester, i.e. start a radio transmit (Tx) or a receive (Rx) test.

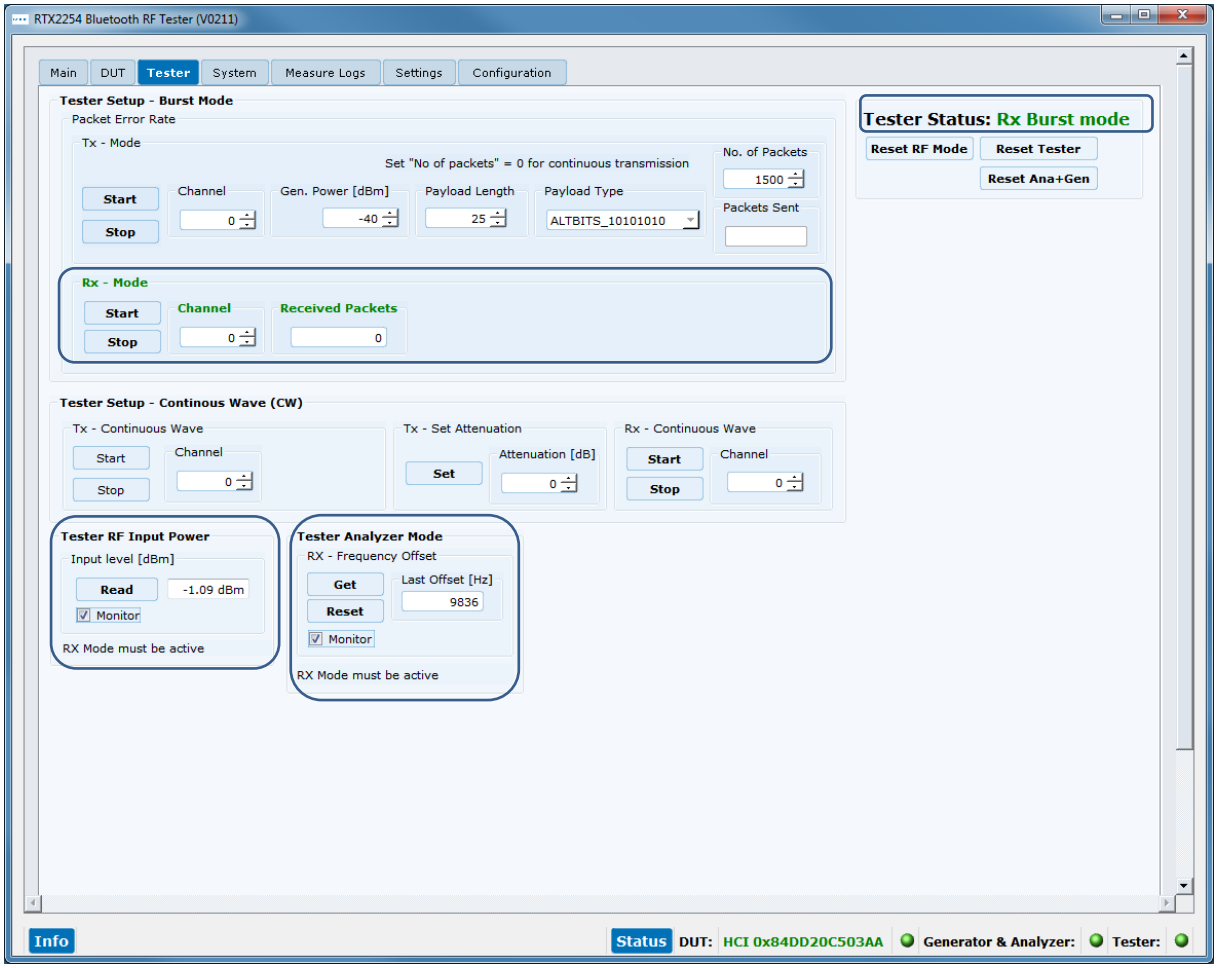
14.2.1 For example, "Test DUT Tx power"

In **[Rx – Mode]**, select the channel (select same channel as set on **[DUT]** page).

Click **[Start]** to start receiving. Tester now enters Rx burst mode.

As an option, in **[Tester RF Input Power]**, check the **[Monitor]** box to start continuous measuring.

As an option, in **[Tester Analyzer Mode]**, check the **[Monitor]** box to start continuous measuring.



Please note that:
The **[Tester RF Input Power]** field is not cable compensated.

15 How to Run a Rx Sensitivity Test

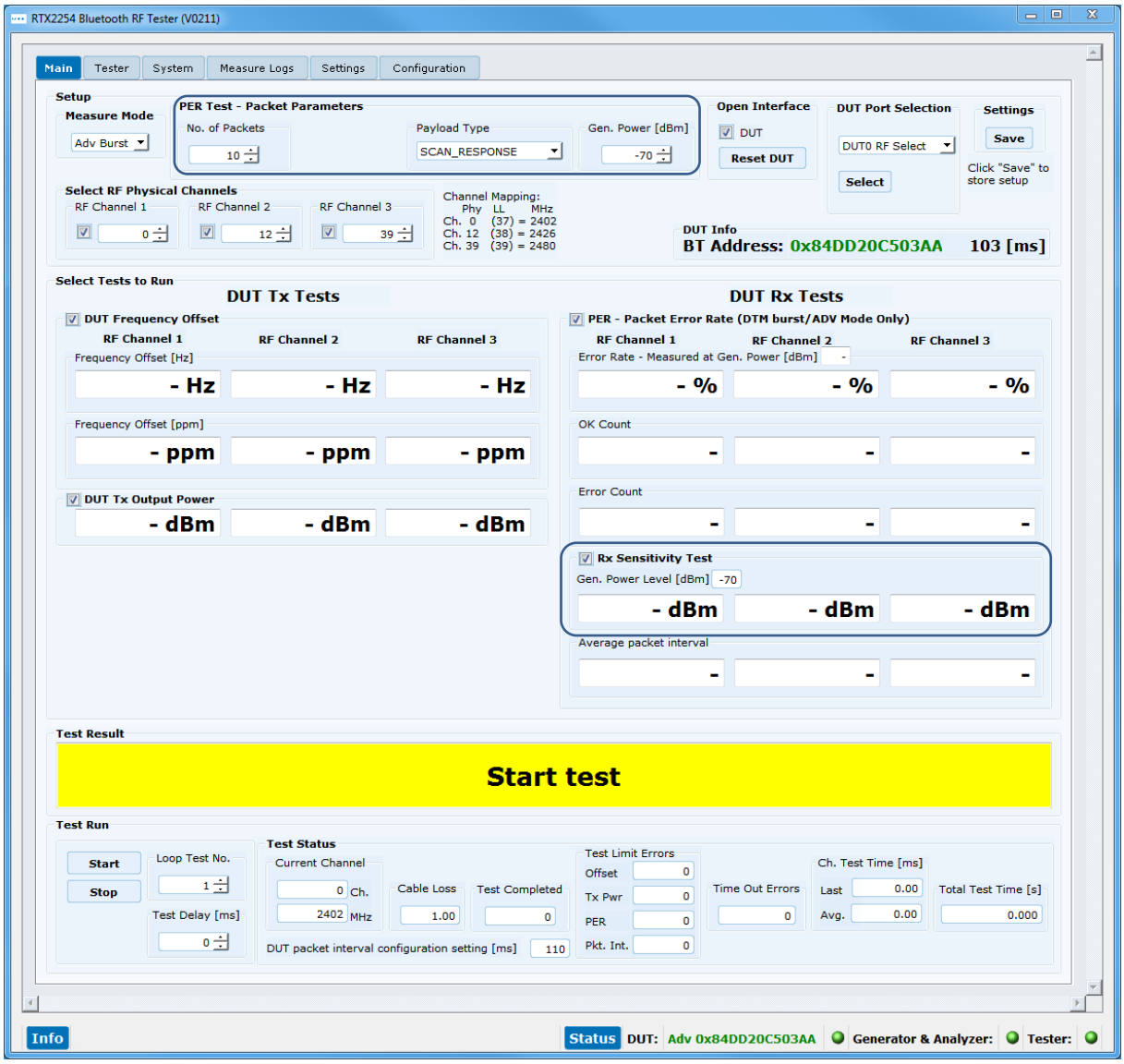
This chapter describes how you can run a DUT Rx sensitivity test. This can be done in "Direct Test Mode" and "Advertising Mode".

Refer to section 12 How to Setup Automated Testing - Direct Test Mode or section 13 How to Setup Automated Testing- Advertising Mode to setup the test conditions. Advertising Mode is used as example.

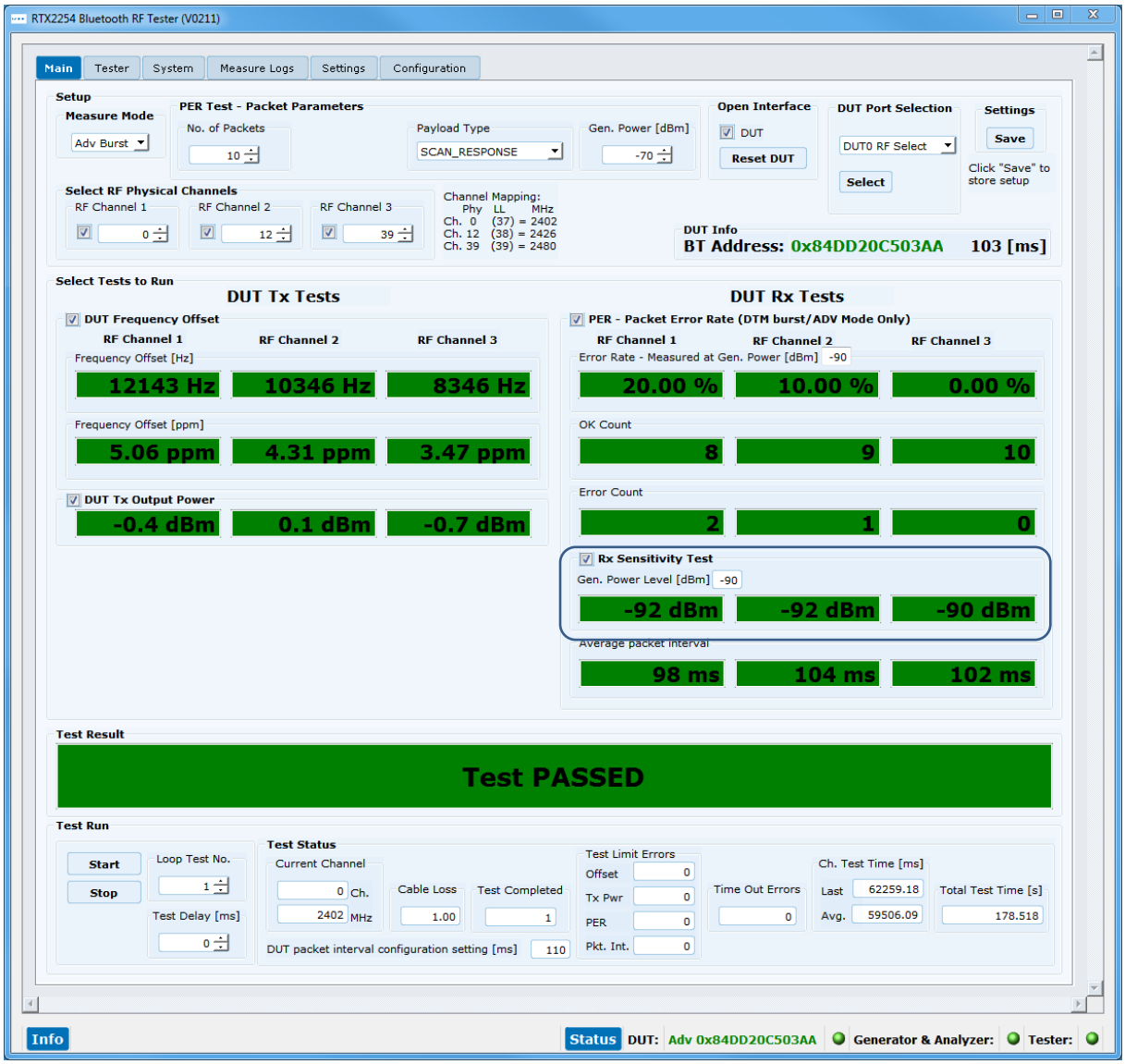
In **[PER – Packet Error Rate]** enable the **[Rx Sensitivity Test]** to run this test together with the PER test.

Set the no of packet to use in **[No. of Packets]**, packet type in **[Payload Type]** to "SCAN_RESPONSE" (required) and initial generator power is set under **[Gen. Power [dBm]]**.

Please note that:
The DUT must support scan response. DUT advertising packet interval limit errors will be cleared during the Rx sensitivity test. Set limit to 0 to disable limit check.



Test result using Advertising Mode.



16 Hardware Description

This chapter presents a description of the RTX2254 Bluetooth RF tester hardware, the DUT interfaces and supported protocols.

16.1 Test Interfaces

The RTX2254 Bluetooth RF tester supports one or two DUT interfaces depending on configuration.

RTX2254 Bluetooth RF tester front – Single DUT (RTX no. 95101347)

RTX2254 Bluetooth RF tester front – DUAL DUT (RTX no. 95101348)

16.1.1 DUT RF Inputs

The RTX2254 tester supports up to 2 RF inputs (50 Ω impedance) with N-type connector (dual version). A N-type to SMA converter can be used if using SMA-cables with the tester:

- **RF 0**
- **RF 1** (Dual port only)

16.1.2 DUT Communication Interfaces

The RTX2254 tester supports 2 x 2 DUT interfaces:

- **DUT 0** UART0 and USB0
- **DUT 1** UART1 and USB1 (Dual port only)

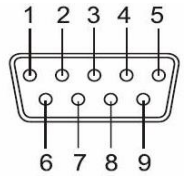
UARTx connected through a D-SUB9 connector on the front.

USBx connected through a USB-A connector on the front.

Please note that:
RTX2254 is available as a single ported tester for one DUT (RTX no. 95101347) or as a dual ported tester for two DUTs (RTX no. 95101348).

16.1.2.1 UART0 and UART1 Connector Pinout

The UART0 and UART1 voltage level will auto adjust to the voltage from the connected DUT, i.e. the highest voltage measured on input pins are used. DUT voltages from 1.8V to 5.0V are supported, i.e. an external voltage converter will normally not be required.



UART signals:	D-Sub 9 PIN
Tx	3
Rx	2
CTS	8
RTS	7
Ground	5

Other pins are not connected.

The interface supports the following parameters:

- Baud rate for DUT: 1200, 2400, 9600, 14400, 19200, 38400, 57600, 115200
- Number of data bits: 8
- No parity
- Stop bit: 1
- Flow control (RTS or CTS) enable or disable
- Signal voltages from 1.8V to 5.0V (auto config)

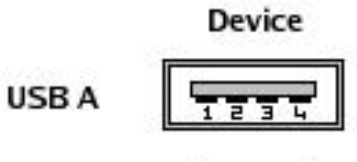
16.1.2.2 2-Wire

2-Wire signals:	D-Sub 9 PIN
Tx	3
Rx	2
Ground	5

The interface supports the following parameters:

- Baud rate for DUT: 1200, 2400, 9600, 14400, 19200, 38400, 57600, 115200
- Number of data bits: 8
- No parity
- Stop bit: 1
- No flow control (RTS or CTS)
- Signal voltages from 1.8V to 5.0V (auto config)

16.1.2.3 USB0 and USB1 Connector Pinout



USB signals:	USB A PIN
VBUS (5V)	1
D-	2
D+	3
Ground	4

16.2 Test Protocols

The RTX2254 Bluetooth RF tester supports the following test protocols:

- HCI Access to the HCI (PHY and LL layer)
- 2-Wire Access to the Non HCI (PHY and LL layer, host/application)

Refer to section 5.1.2.3 Packet Type for the full list of supported packet types.

Please note that:
The tester is transparent for other commands while the RF test commands are not used, i.e. the tester interfaces are not opened by the RTX2254 application.

17 Test Limitations

This chapter describes some testing limitations.

17.1 Generator Output Power

The generator output power when transmitting to the DUT.

The tester can use burst or CW mode in Direct Test Mode. In Advertising Mode is uses the advertising packet type from the DUT.

Main tab:

Parameter	**Value**
Packets (Burst)	0 – 65535
RF level output	-40 to -100 dBm
Frequency (channel)	Direct Test Mode: 2402 to 2480 MHz, 40 channels Advertising Mode: 2402, 2426 & 2480 MHz, 3 channels
Payload pattern	Direct Test Mode: 0 to 7 for HCI 0 to 3 for 2-Wire Advertising Mode: 0 to 1 for Advertising
Payload length	Direct Test Mode: 0-37 bytes Advertising Mode: Advertising packet from DUT

Please note that:
HCI has a receive max. of 64535 packets.
2-Wire has a receive max. of 32767 packets.
Advertising has a receive max. of 64535 packets.

Tester tab:

Please note that:
Advertising Mode not supported

Parameter	**Value**
Packets (Burst)	0 – 100000 or select 0 for continuous
RF level output	-40 to -100 dBm
Frequency (channel)	2402 MHz to 2480 MHz, 40 channels
Payload pattern	0 to 7 for HCI 0 to 3 for 2-Wire
Payload length	0 to 37

Please note that:
HCI has a receive max. of 64535 packets.
2-Wire has a receive max. of 32767 packets.

17.2 Frequency Offset

The frequency offset is the difference between the RF carrier frequency and the nominal Bluetooth channel frequency.

Main tab:

Parameter	**Value**
Packets	Direct Test Mode: Min. 740 Advertising Mode: Min. 20
RF level input	-50 to +10 dBm
Frequency (channel)	Direct Test Mode: 2402 to 2480 MHz, 40 channels Advertising Mode: 2402, 2426 & 2480 MHz, 3 channels
Payload pattern	Direct Test Mode: ALT. bits 10101010 (packet type 2) Advertising Mode: Advertising packet from DUT
Payload length	Direct Test Mode: 25 bytes Advertising Mode: Advertising packet from DUT

17.3 PER Test

The PER (Packet Error Rate) test measures the BLE receiver quality.

It is possible to specify the number of packages to send in the PER test and packet type.

Parameter	**Value**
Packets	0 – 65535
RF level input	-50 to +10 dBm
Frequency (channel)	Direct Test Mode: 2402 to 2480 MHz, 40 channels Advertising Mode: 2402, 2426 & 2480 MHz, 3 channels
Payload pattern	Direct Test Mode: PRBS9 (packet type 0) or selectable: 0 to 7 for HCI 0 to 3 for 2-Wire Advertising Mode: Advertising packet from DUT [1)]
Payload length	Direct Test Mode: 37 bytes or selectable 0 to 37 bytes Advertising Mode: Advertising packet from DUT

PER result = 0-100%.

[1)] Below the BLE PDU types supported in Advertising Mode:

- ADV_IND
  Known as Advertising Indications (ADV_IND), where a peripheral device requests connection to any central device.
- ADV_DIRECT_IND **– NOT SUPPORTED**
  The connection request is directed at a specific central device.
- ADV_NONCONN_IND
  A non-connectable device. Advertising information can be received by any listening device.
- ADV_SCAN_IND
  As ADV_NONCONN_IND, with the option to get additional information via scan responses.

18 Demo Application

This chapter shows some examples of how to use the RTX2254 Bluetooth RF tester with the available demo application "**TestProj_RTX2254_BT-Dxxxx.zip**".

Please note that:
This is separately delivered. However, updated DLLs and API header files are included in the "***Setup_RTX2254_Bluetooth_RF_Tester_Vxxxx.exe***" release.

Advertising Mode is not fully supported by the Demo Application in release V0211, V0212 & V0213 (TestProj_RTX2254_BT-D0212.zip).

The demo application has a command line interface. It can be built with Visual Studio 2010, 2013 or 2015.

The Demo Application supports DUT on UART0, UART1, USB0 and USB1.

Refer to the "Readme.txt" for some more details. Please check and update the settings to match your system.

18.1 Settings

Some settings can be customized when building the RTX2254 Demo Application. COM port numbers can be set when executing the Demo Application.

The RTX2254 operation mode: Direct Test Mode or Advertising Mode must be specified at compile time.

DUT_COM is by default UART0_0.

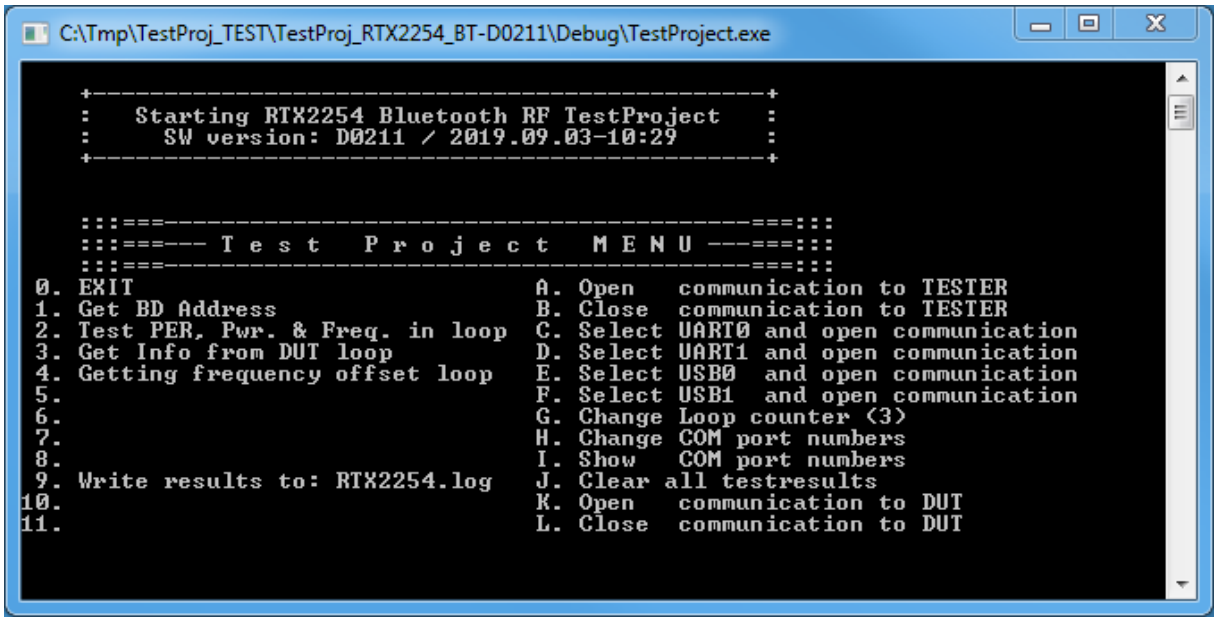
```
// Select the operation mode to use in test
#define USE_DTM_MODE
//#define USE_ADV_MODE

//-------------------------------------------------------------------------
//--- TESTER choice of number and front port selection

const char     PORTSERVER_NAME[]= "RTX2254PortServer";  // Name of PortServer
                                                           connected to TESTER
      rsuint16 TESTER_COM       = 10;                   // RTX BLE Tester
      rsuint16 GENERATOR_COM    = 11;                   // RTX BLE Generator
      rsuint16 ANALYZER_COM     = 12;                   // RTX BLE Analyzer
      rsuint16 UART0_COM        = 20;                   // UART-0 COM port
      rsuint16 UART1_COM        = 21;                   // UART-1 COM port
      rsuint16 USB0_COM         = 22;                   // USB-0 COM port
      rsuint16 USB1_COM         = 23;                   // USB-1 COM port
const rsbool   DUT_HWExchange   = TRUE;                 // DUT uses HW
                                                           handshake
const int      DUT_BAUD         = 115200;               // Dut Baudrate
      rsuint16 DUT_COM          = UART0_COM;            // Active DUT COM port
      rsbool   DUT_Comm_Open    = FALSE;                // TRUE if DUT communication
                                                           has been opened
      rsbool   TESTER_Comm_Open = FALSE;                // TRUE if TESTER
                                                          communication has been opened
```

18.2 Running the Demo Application

You can select the DUT interface to use, i.e. UART0, UART1, USB0 or USB1 by the commands C, D, E, F.

You can map other COM port numbers with the command H

Then you can run one of the test commands, e.g. select 2 to run the "Test PER, Pwr. & Freq. in loop" test.



In the below example, E is selected to use USB0 and then command 2 to run the "Test PER, Pwr. & Freq. in loop" test.

C:\Tmp\TestProj_TEST\TestProj_RTX2254_BT-D0211\Debug\TestProject.exe
:::===---------- T e s t P r o j e c t M E N U ---===:::
0. EXIT
1. Get BD Address
2. Test PER, Pwr. & Freq. in loop
3. Get Info from DUT loop
4. Getting frequency offset loop
5.
6.
7.
8.
9. Write results to: RTX2254.log
10.
11.
A. Open communication to TESTER
B. Close communication to TESTER
C. Select UART0 and open communication
D. Select UART1 and open communication
E. Select USB0 and open communication
F. Select USB1 and open communication
G. Change Loop counter (3)
H. Change COM port numbers
I. Show COM port numbers
J. Clear all testresults
K. Open communication to DUT
L. Close communication to DUT
E
Port Server open on COM: 10. Status = OK
Open and init connection to TESTER on COM: 10. Status = OK
Waiting 8000 ms for reset of Generator and Analyzer module...
Open and check connection to GENERATOR on COM: 11. Status = OK
Open and check connection to ANALYZER on COM: 12. Status = OK
Enable communication to TESTER. Status = OK
DUT Baudrate = 115200. Status = OK
Open connection to DUT on COM: 22. Status = OK
Opening and checking communication to DUT. Status = OK
Compleded opening of communication to COM: 22. Status = OK
:::===---------- T e s t P r o j e c t M E N U ---===:::
0. EXIT
1. Get BD Address
2. Test PER, Pwr. & Freq. in loop
3. Get Info from DUT loop
4. Getting frequency offset loop
5.
6.
7.
8.
9. Write results to: RTX2254.log
10.
11.
A. Open communication to TESTER
B. Close communication to TESTER
C. Select UART0 and open communication
D. Select UART1 and open communication
E. Select USB0 and open communication
F. Select USB1 and open communication
G. Change Loop counter (3)
H. Change COM port numbers
I. Show COM port numbers
J. Clear all testresults
K. Open communication to DUT
L. Close communication to DUT
2
Analyzer current operation mode 1=Direct Test Mode. Status = OK
Closing the communication to DUT. Status = OK
Close connection to DUT on COM: 22. Status = OK
DUT Baudrate = 115200. Status = OK
Open connection to DUT on COM: 22. Status = OK
Opening and checking communication to DUT. Status = OK
--- Loop no: 1 of 3
Packet error test of 1500 packets on channel 19. Status = OK
TxCount = 1500. Errors = 0. Status = OK
Tester freq offset read Statu
s = OK
Tester freq offset = 9140Hz
Tester measured powerlevel. Status = OK
Tester measured power: -1.66dBm
Tester temperature. Status = OK
Tester temperature = 32C (1291)
--- Loop no: 2 of 3
Packet error test of 1500 packets on channel 19. Status = OK
TxCount = 1500. Errors = 0. Status = OK
Tester freq offset read Statu
s = OK
Tester freq offset = 9314Hz
Tester measured powerlevel. Status = OK
Tester measured power: -1.68dBm
Tester temperature. Status = OK
Tester temperature = 32C (1291)
--- Loop no: 3 of 3
Packet error test of 1500 packets on channel 19. Status = OK
TxCount = 1500. Errors = 0. Status = OK
Tester freq offset read Statu
s = OK
Tester freq offset = 8763Hz
Tester measured powerlevel. Status = OK
Tester measured power: -1.64dBm
Tester temperature. Status = OK
Tester temperature = 32C (1291)
Completed the testloop of PER and Frequency offset. Status = OK

19 Frequently Asked Questions

This section presents some frequently asked questions and answers:

1) **If there is no connection to RTX2254 Bluetooth RF tester**
   a. Check that USB cable is connected to tester and PC
   b. Check power cable and that power is ON
   c. Check power fuse on the back
   d. Check that the Port Server is started and enabled with the correct COM-port

2) **If no "Green" status light**
   a. Check that the COM-port number for Tester, Analyzer and Generator are correct setup, refer to section 10 Settings Tab.

3) **Tester is not ready – Interfaces not open**
   a. Check that the COM-port number for Tester, Analyzer and Generator are correct setup, refer to section 10 Settings Tab.
   b. Check that the COM-port number for the selected DUT interface is correct setup, refer to section 10 Settings Tab.
   c. Check that the **[Auto open]** box is checked or click **[Open]** to open manually.

4) **My DUT is not working**
   a. Check that the COM-port number for DUT, baud rate and selected communication port type (USB/UART) is correct setup, refer to section 10 Settings Tab.
   b. Check that you have selected the correct communication protocol (HCI or 2-wire) for your DUT.

5) **Measurements are not in the log file**
   a. Check that the log feature is enabled on the **[Measure Logs]** page
   Refer to section 9 Measure Logs Tab.

6) **How to see the log files**
   a. The log files are stored in folder c:\Users\All Users\RTX2254\Log\ and can be opened with a normal text view like Notepad.
   Refer to section 9 Measure Logs Tab.

7) **My settings are not stored**
   a. Remember to click **[Save]** to store your settings.
   If new values are entered and you go to another tab, the old settings will be restored to the last stored when you go back.

8) **My tester does not show Advertising Mode**
   a. The Advertising Mode option must be installed with a license.