

RTX2254

Bluetooth RF Tester

Stand-alone Unit



Quick Installation Guide

V0216.3
PBB/MVC 2020.04.15

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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 quick installation guide will describe the basic hardware and software installation procedures for the **RTX2254 Bluetooth RF Tester** – Stand-alone unit, the configuration and the first test with a DUT supporting Direct Test Mode. However, Advertising Mode is very similar, but there is no communication interface available to control the DUT.

Please note that:

A test DUT must be available to complete this quick installation guide.

The DUT must be setup for production test (DTM) with either HCI or 2-Wire interface. A "Test DUT" with USB is used as example in this description.



RTX2254 with "Test DUT" on USB

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).

2 Word and Abbreviation List

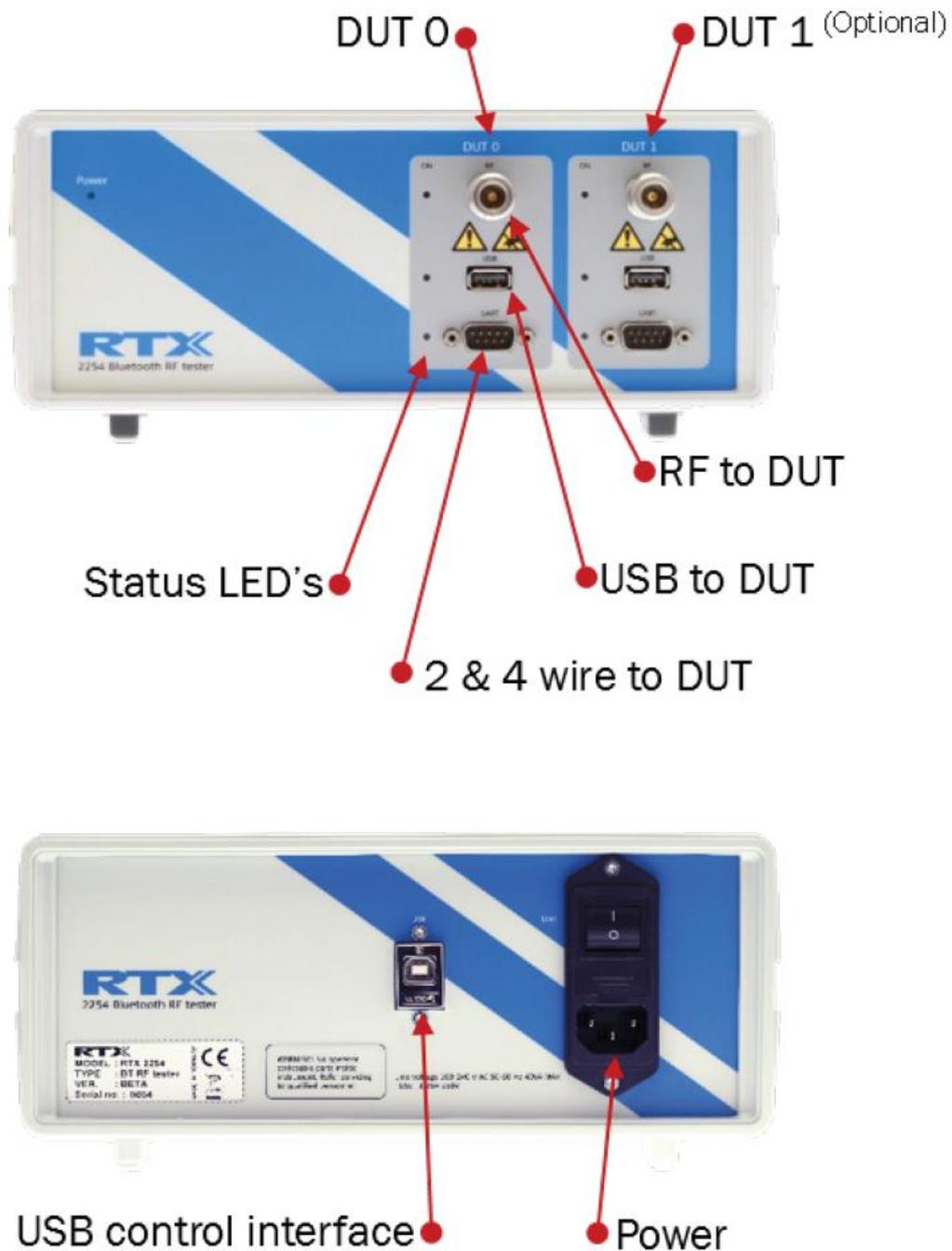
The following words and abbreviations are used in this document:

- 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 Hardware Installation Procedure

The section describes how to connect the RTX2254 Bluetooth RF tester.

3.1 Connection Overview



3.2 Installation

The RTX2254 test system comes preassembled and needs only the following:

1. Connect power cord (100-240 V)
2. Prepare, but do not connect a USB cable to PC
3. Turn on power on backside of RTX2254
4. Turn on PC



4 Software Installation Procedures

The RTX2254 SW package includes the necessary drivers and RTX2254 Bluetooth RF tester software. The following drivers and supporting Windows application are included:

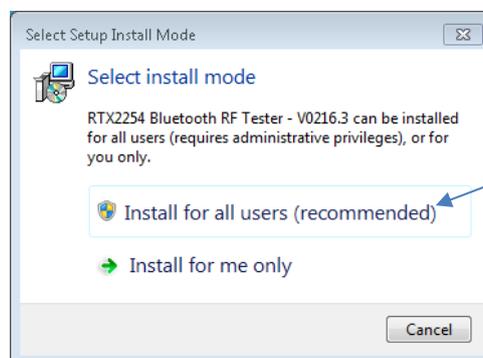
- RTX EAI Port Server
- RTX USB Bridge Driver (CP210x USB to UART Bridge)
- Microsoft Visual Studio C++ 2010 Runtime Library (.net)
- RTX2254 demo application (a sample application project)
- RTX2254 Bluetooth RF tester application

Please refer to the RTX2254 User Manual for more information on how to use the tester.

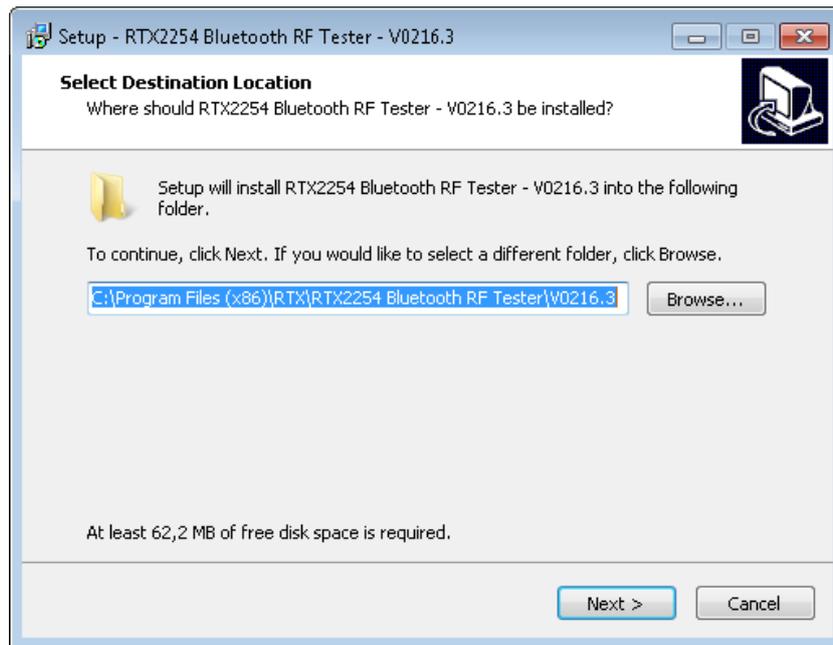
4.1 Software Installation File #1

4.1.1 RTX2254 Bluetooth RF Tester Software Installation

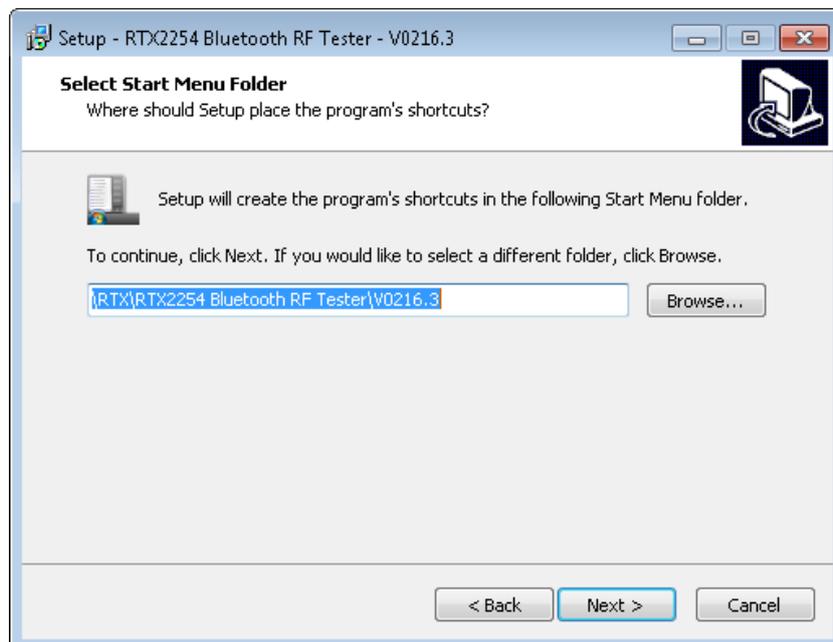
Locate the file: "**Setup_RTX2254_Bluetooth_RF_Tester_V0216.3.exe**" and execute it. The following pop-up will appear.



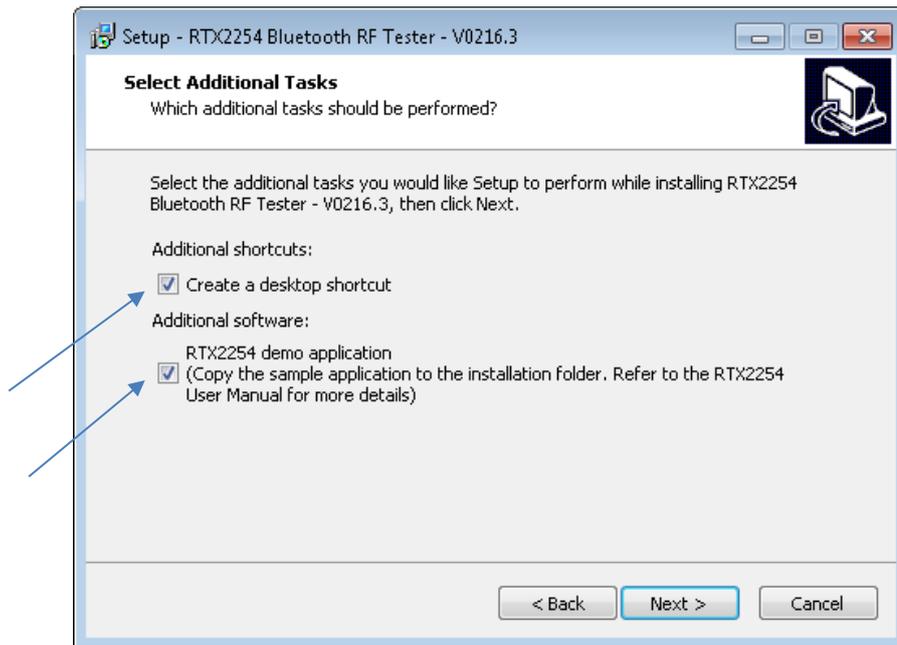
Select "Install for all users" or "Install for me only" as required.



Select the preferred installation folder or stick with the proposed one. Then click **[Next >]**.



Click **[Next >]** again to continue

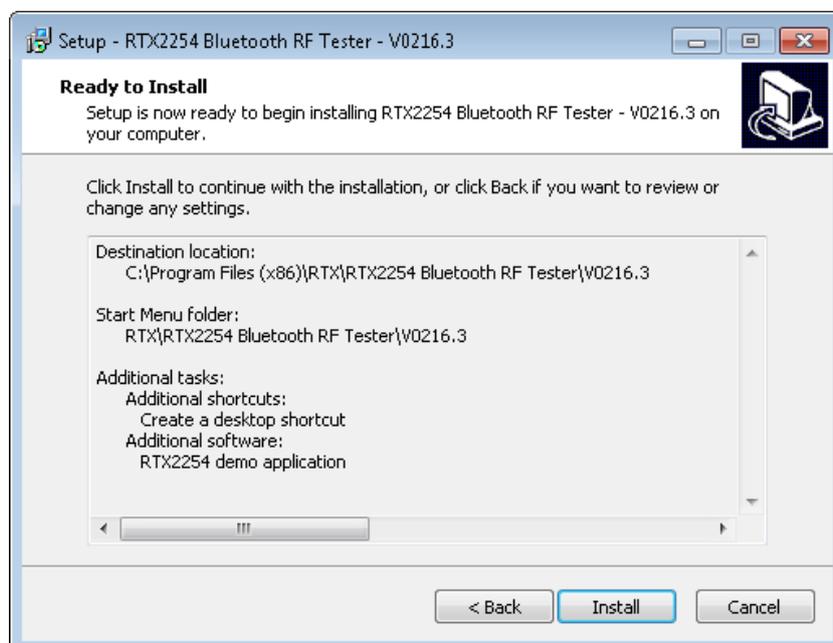


Select to add:

- An application shortcut to your desktop
- The RTX2254 demo application to your installation folder

Or deselect to skip item.

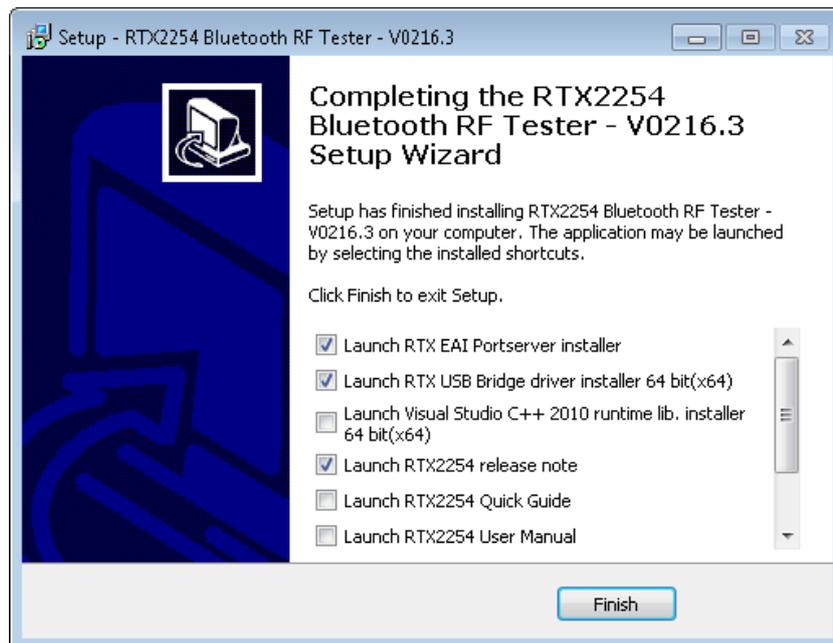
Then click **[Next >]**.



The programs are now ready to be installed.

Click **[Install]** to install the programs at the shown location.

4.1.2 Drivers Installation



By default, 2 different drivers and optionally the development environment can be installed. The installer will present 32 bit (X86) or 64 bit (x64) drivers depending on the used PC's operating system.

Furthermore 4 different documents can be automatically opened after installation:

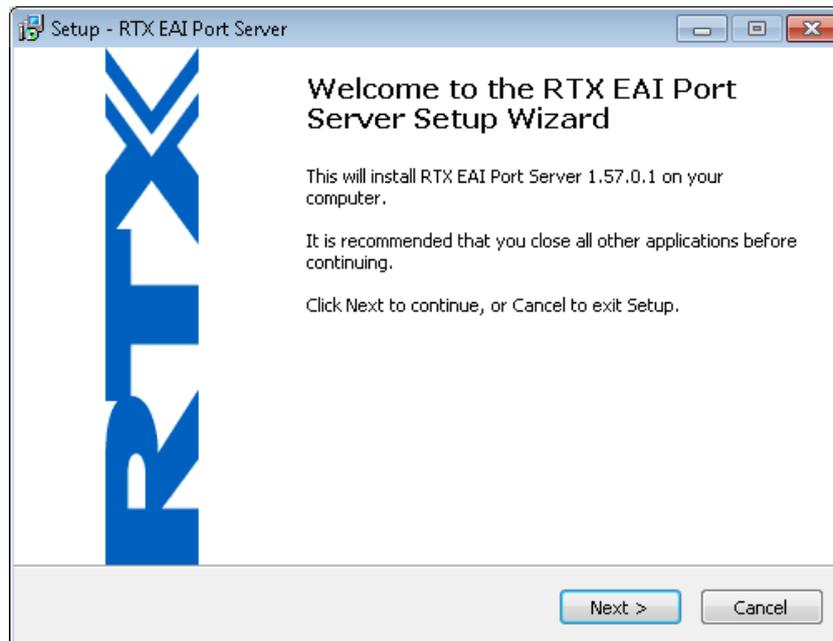
- Release note The latest changes and information about new firmware
- Quick Guide This quick guide to get you started
- User Manual A description of the tester's features, i.e. how to perform a test and a more detailed hardware description
- API Specification A description of the different functions in the API and the required parameters

Please select the ones you would like to read and then click **[Finish]**.

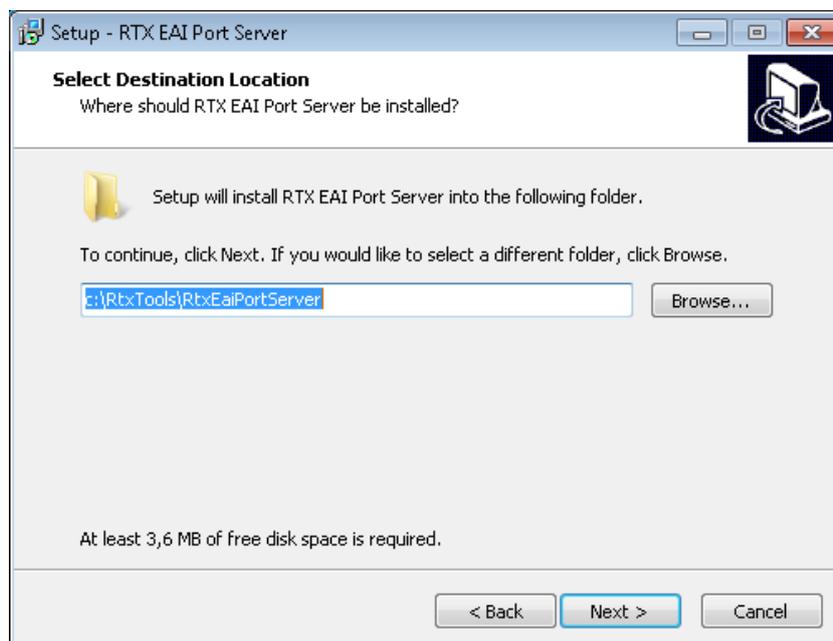
Please note that:

All the documents can be found in the installation folder.

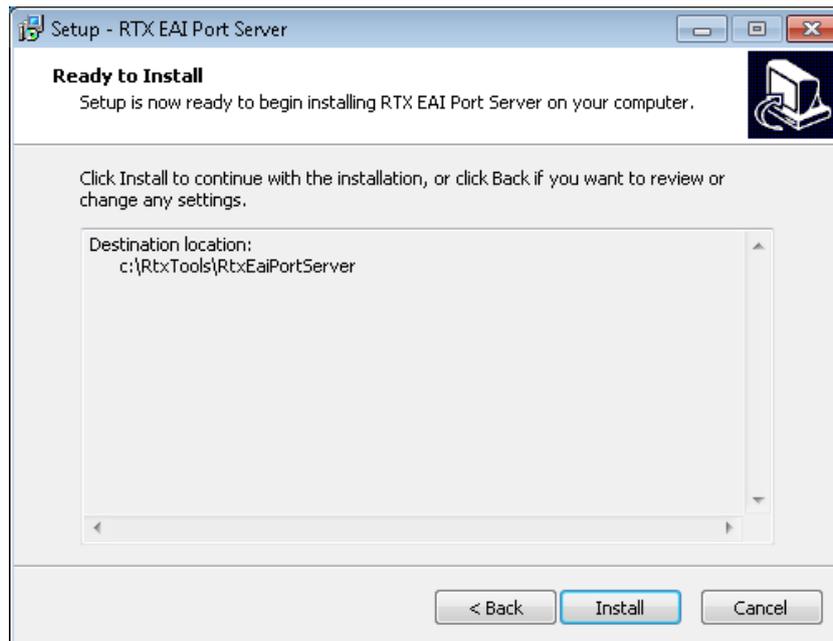
4.1.3 RTX EAI Port Server Installation



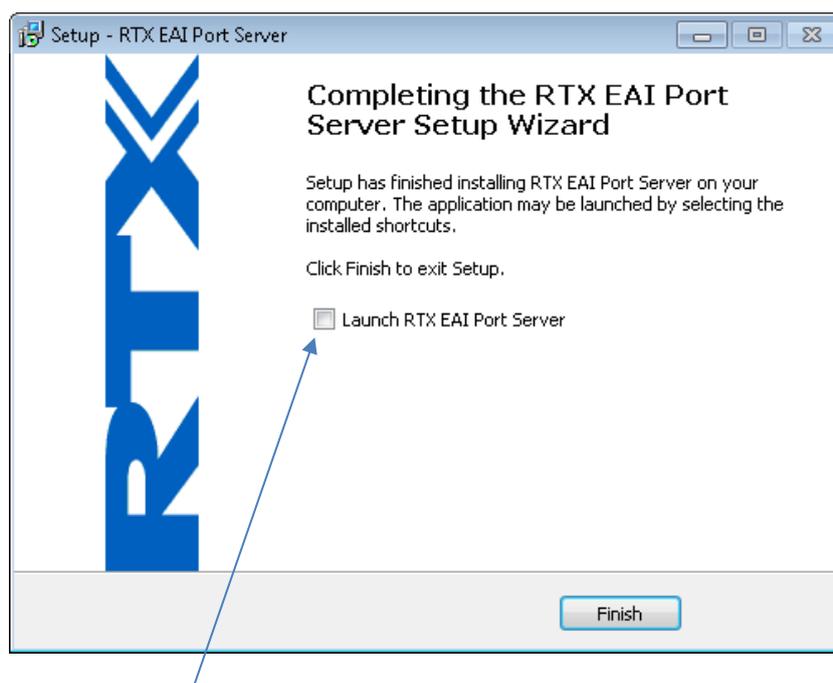
Now the EAI Port Server will be installed. Please click: **[Next >]**.



Select the preferred installation folder or stick with the proposed one. Then click **[Next >]**.



Now the EAI Port Server will be installed. Please click: **[Install >]**.



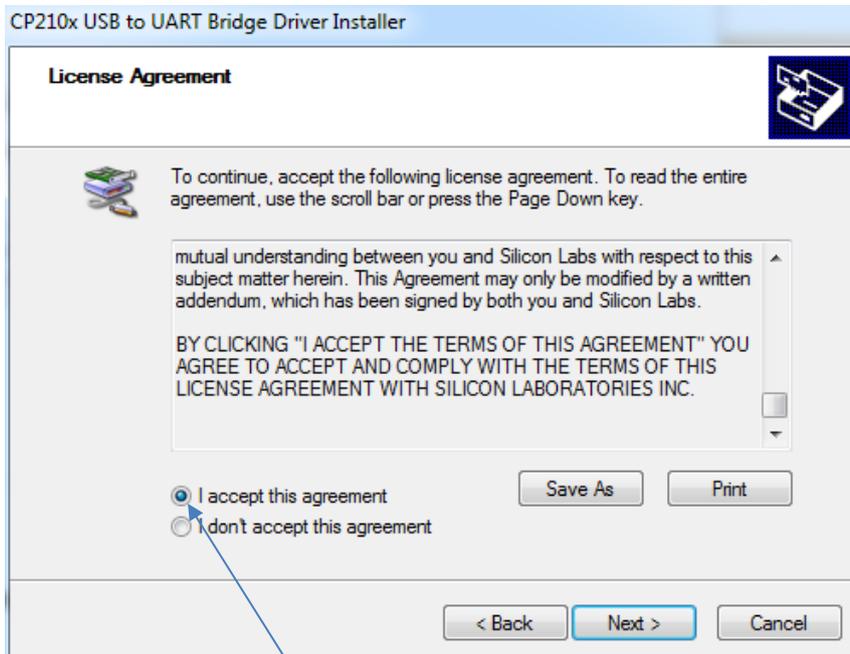
Remove the check mark in "Launch RTX EAI Port Server".

Now click **[Finish]**.

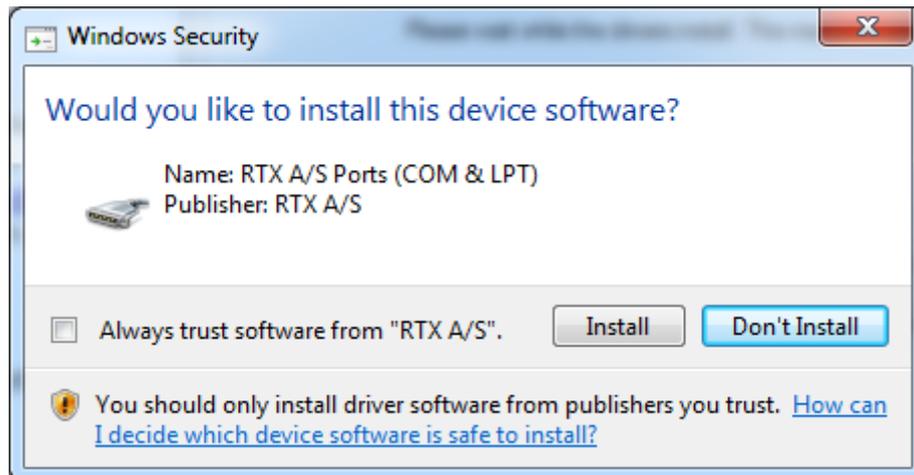
4.1.4 UART Bridge Driver Installation



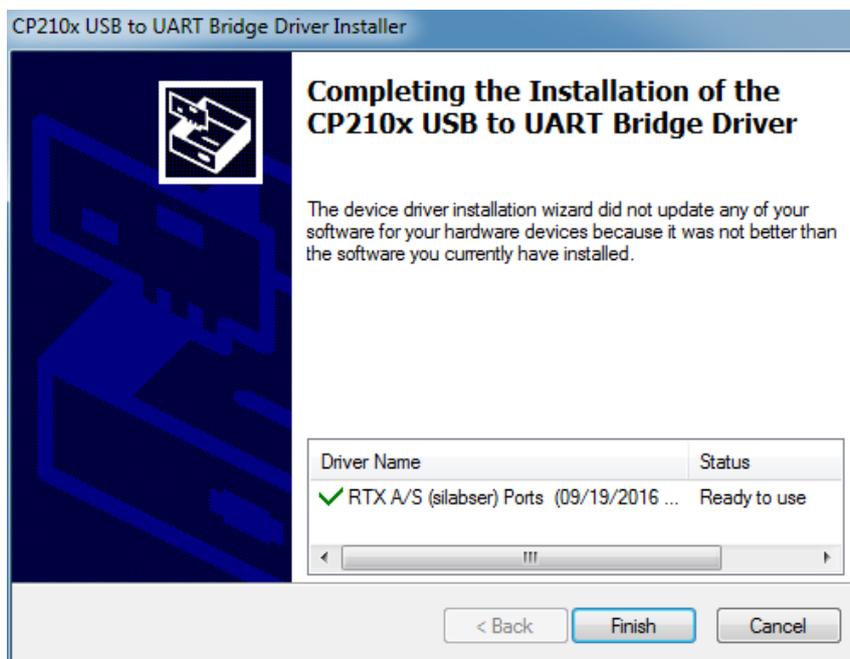
Now click **[Next >]**.



Please read and select the **[I accept this agreement]** and then click **[Next >]**.



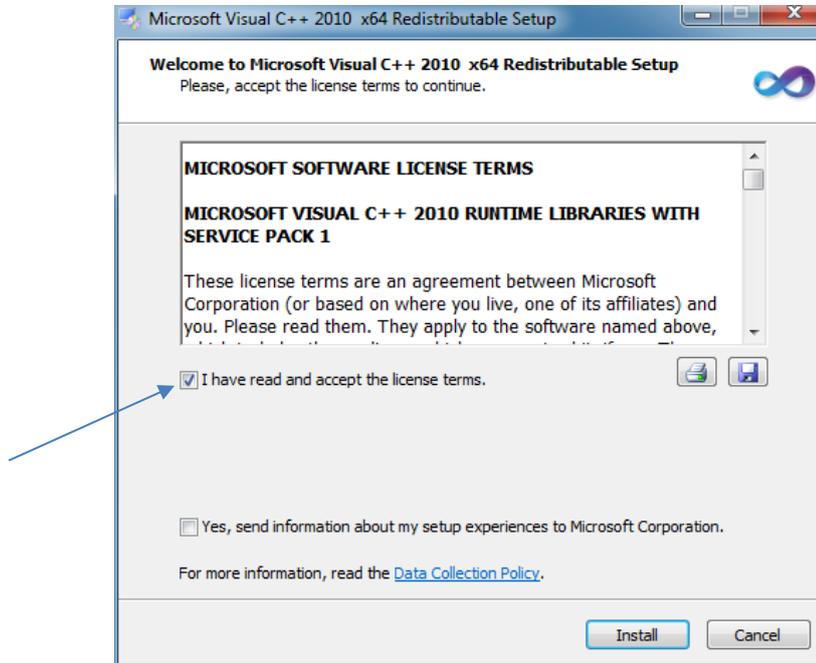
If this window appears, then please click **[Install]**.



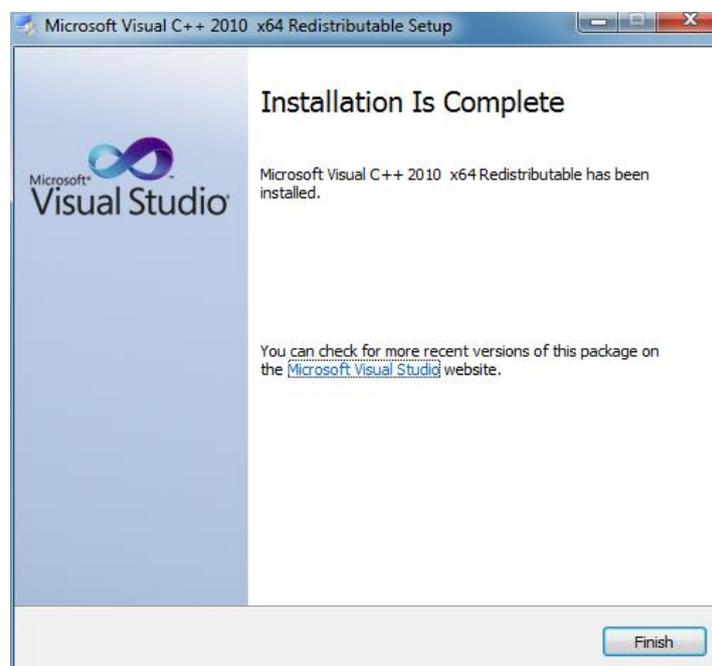
Now click **[Finish]**.

4.1.5 Microsoft Drivers Installation

The Microsoft C++ run time libraries might already be installed on the PC.



Please read and select the **[I have read and accept the license terms]** and then click **[Install]**.



Click **[Finish]**.

Now all needed programs and drivers are installed on your PC. Read the Release note more details about this release.

4.2 Software Installation File #2

This is a separate delivery containing a demo project which shows how the API is used in a production test system. Microsoft Visual Studio C++ must be installed.

Please note that:

This is not required for the RTX2254 Bluetooth RF Tester SW to function. If not needed you can skip this section.

4.2.1 RTX Demo Software Installation

Locate the file: "TestProj_RTX2254_BT-D0216.3.zip" in <installation folder>\RTX\RTX2254 Bluetooth RF Tester\V0216.3\Sample_app\".

Unpack the ZIP-file and copy it to your preferred folder.

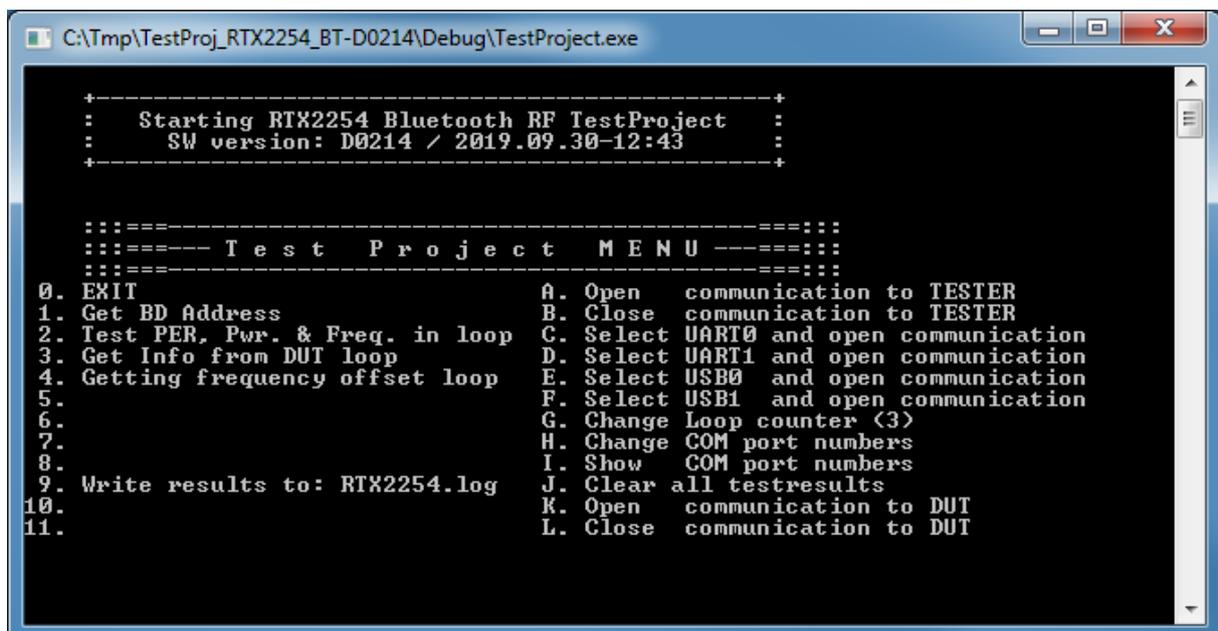
Please note that:

The most recent version will have the highest version number in the filename. Please use the newest one for best experience.

Microsoft Visual Studio C++ will automatically start when selecting the file "TestProj_RTX2254_BT.sln".

Please enter the COM port number for your system and recompile the project before running the example.

Refer to the RTX2254 User Manual for more info about the demo test project.



```

C:\Tmp\TestProj_RTX2254_BT-D0214\Debug\TestProject.exe
+-----+
: Starting RTX2254 Bluetooth RF TestProject :
: SW version: D0214 / 2019.09.30-12:43 :
+-----+

:::=====
:::----- Test Project MENU -----
:::=====

0. EXIT                               A. Open communication to TESTER
1. Get BD Address                     B. Close communication to TESTER
2. Test PER, Pwr. & Freq. in loop    C. Select UART0 and open communication
3. Get Info from DUT loop            D. Select UART1 and open communication
4. Getting frequency offset loop     E. Select USB0 and open communication
5.                                    F. Select USB1 and open communication
6.                                    G. Change Loop counter (3)
7.                                    H. Change COM port numbers
8.                                    I. Show COM port numbers
9. Write results to: RTX2254.log      J. Clear all testresults
10.                                    K. Open communication to DUT
11.                                    L. Close communication to DUT

```

Demo project

5 Software Configuration

The different USB COM port drivers should be configured as shown in the following:

With a powered RTX2254 Bluetooth RF tester and PC, please connect USB cable between them.

Now the drivers should automatically be installed. If not, then please use the options: **“No, not this time”** and **“Install the software automatically (Recommended)”**, when or if prompted.

5.1 Auto Configuration

The RTX2254 Application can automatically detect a connected RTX224 Bluetooth RF tester.

Please note that:

If your RTX2254 Bluetooth RF tester is not detected correctly. Go to section the 5.2 Manual Configuration to see how to manually setup the tester.

5.1.1 The First Test

To guide the user through the first test in Direct Test Mode, the following simple test are shown.

A test DUT, setup for production test, must be available. A DUT with USB is used in this description.

5.1.1.1 Set-up of HW for First Test

Please do the following:

1. Place tester and PC on a solid table
2. Connect power cables
3. Connect PC and Tester with a USB cable
4. Insert the **“Test DUT”** in appropriate DUT interface (UART / USB), e.g. USB0, see picture below
5. Connect RF cable from **“Test DUT”**, e.g. DUT0 RF port as shown in below picture.
6. Now turn on PC and the **RTX2254 Bluetooth RF tester** hardware.

Important!

Windows will now start to install the different COM ports for your RTX2254 Bluetooth RF tester.

Please let this process complete before continuing to the next step.



"Test DUT" is connected to DUT0 RF and USB

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).

5.1.1.2 Set-up of SW for First Test

All the required COM ports should now have been installed on your PC. To see the installed COM ports refer to section 5.2.1.1 Find the COM Port to use

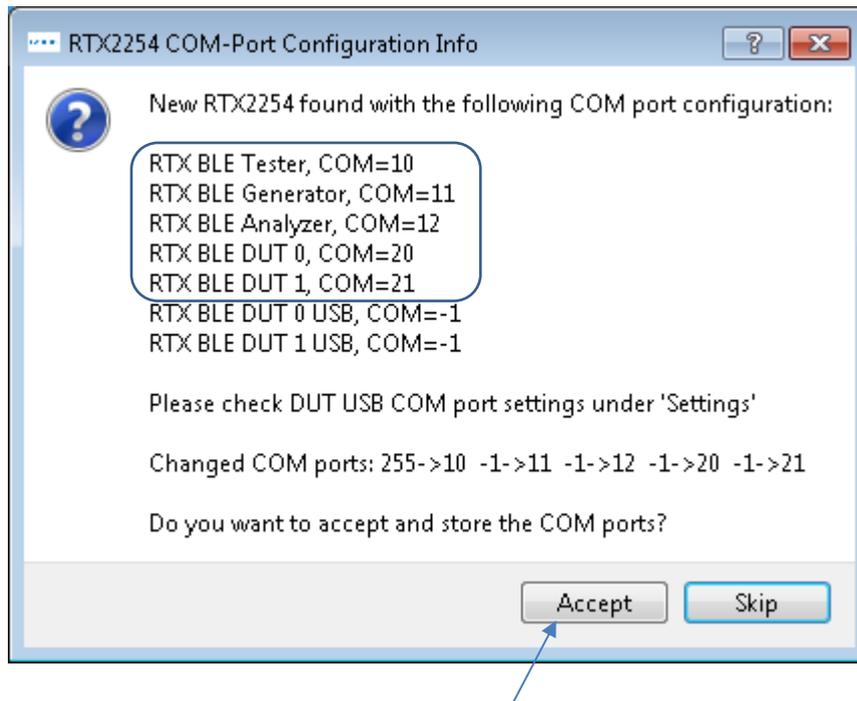
Start the **"RTX2254 Bluetooth RF tester"** application by clicking the Windows start button and selecting:

"Start → All programs → RTX → RTX2254 Bluetooth RF tester → V0216.3 → RTX2254 Bluetooth RF tester – V0216.3".

The below picture will be shown:



After a few seconds a pop-up message should be shown like below:



The RTX2254 application should find 4 COM ports for a RTX2254 single port version and 5 COM ports for a dual port version.

Click **[Accept]** to use the automatically detected COM ports.

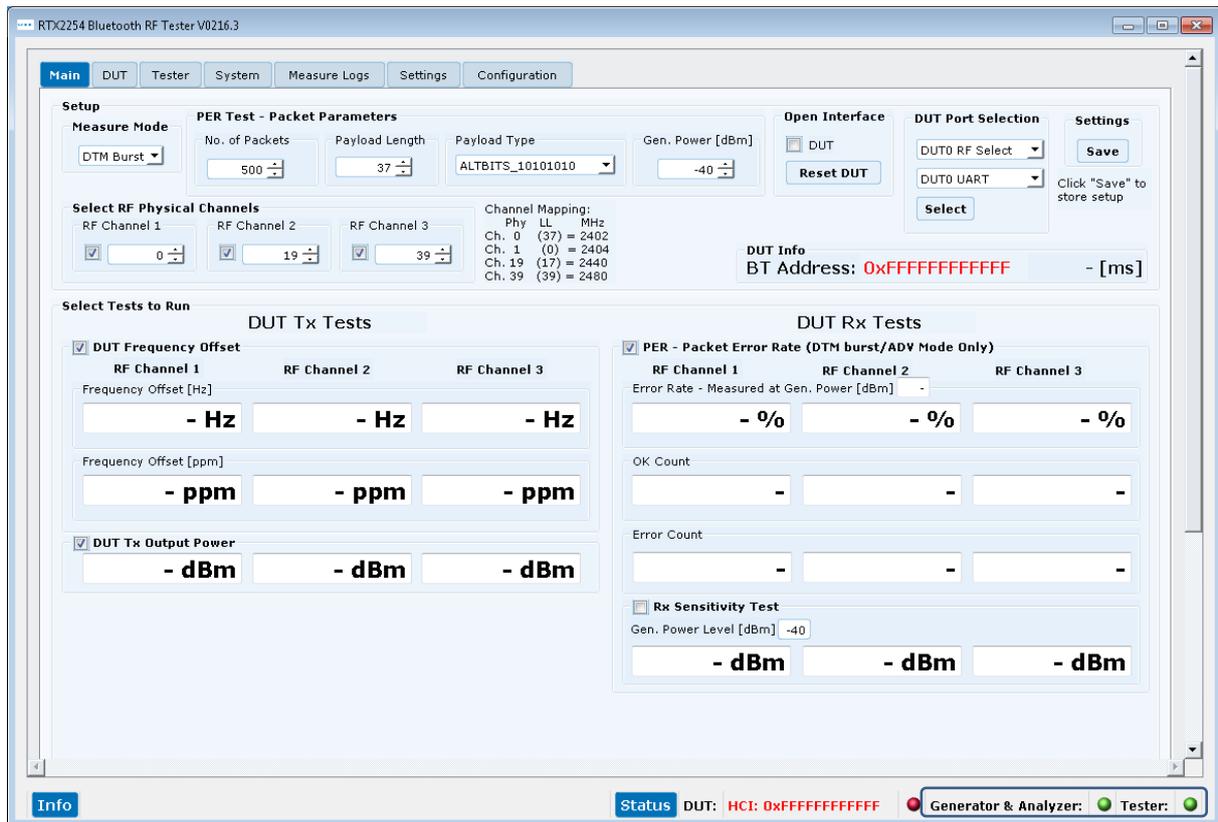
Please note that:

Click **[Skip]**. To make a manual setup of the COM ports. Refer to section 5.2 Manual Configuration for how to do this.

The below picture will be shown when you click **[Accept]**:



Next your screen should look like below



The interface status for the 3 internal instruments (Tester / Analyzer / Generator) should be green. The DUT has not been setup or opened and DUT status is red.

Resize the windows to see a full screen.

If you get the error message below, it was not possible to detect the RTX2254 during start-up.



Check that the RTX2254 tester is connected and USB drivers are installed.

Click **[Exit]** to close the RTX2254 Bluetooth test application or click **[Continue]** to continue and do a manual setup.

Please note that:

If you get any error messages or the status symbols are red. Close the RTX2254 Bluetooth RF tester application and restart the application.

If this doesn't solve the problem refer to section 5.2 Manual Configuration for more details on how to setup the COM ports manually.

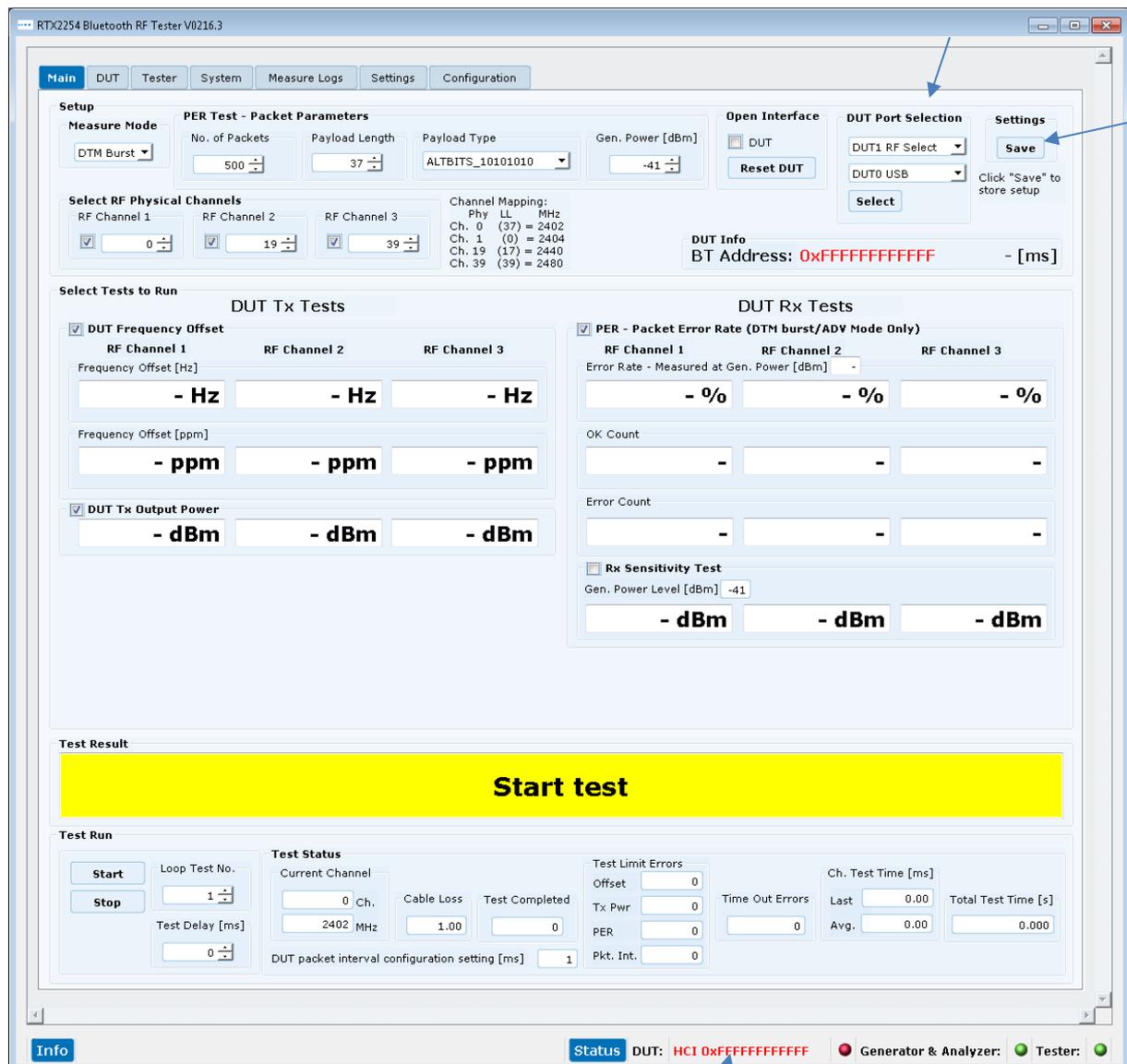
5.1.1.2.1 Select DUT Test Interface

Please select the **[Main]** tab.

In **[DUT Port Selection]** frame, please select the correct RF port and interface to use for tests. In this example we select "DUT1 RF Select" and "DUT0 USB".

Click **[Select]** to setup the RF and communication interface.

In **[Settings]**, click **[Save]** to store the configuration.



Please note that:

The DUT has not been opened yet and DUT status is red.

5.1.1.2.2 Select DUT Test Protocol

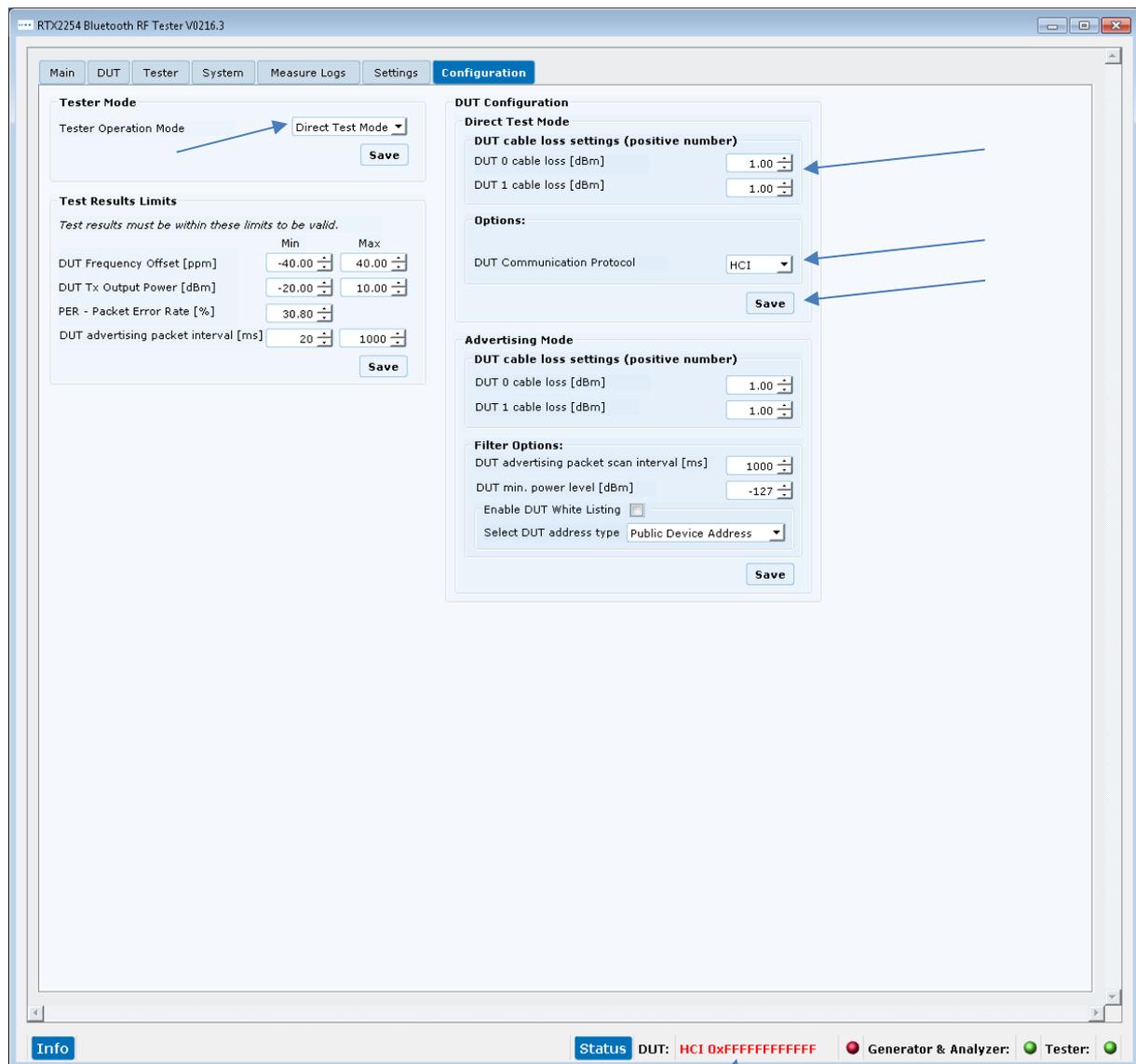
Please select the **[Configuration]** tab.

Check that the operation mode of tester is set to **"Direct Test Mode"**.

Set the limit numbers to meaningful values, like below picture shows.

The DUT cable loss depends on your selected cable, e.g. here it is set to 1 dBm loss.

Select the test protocol (HCI or 2-wire) to use with the **"Test DUT"**. In this example, HCI is selected as "DUT Communication Protocol".



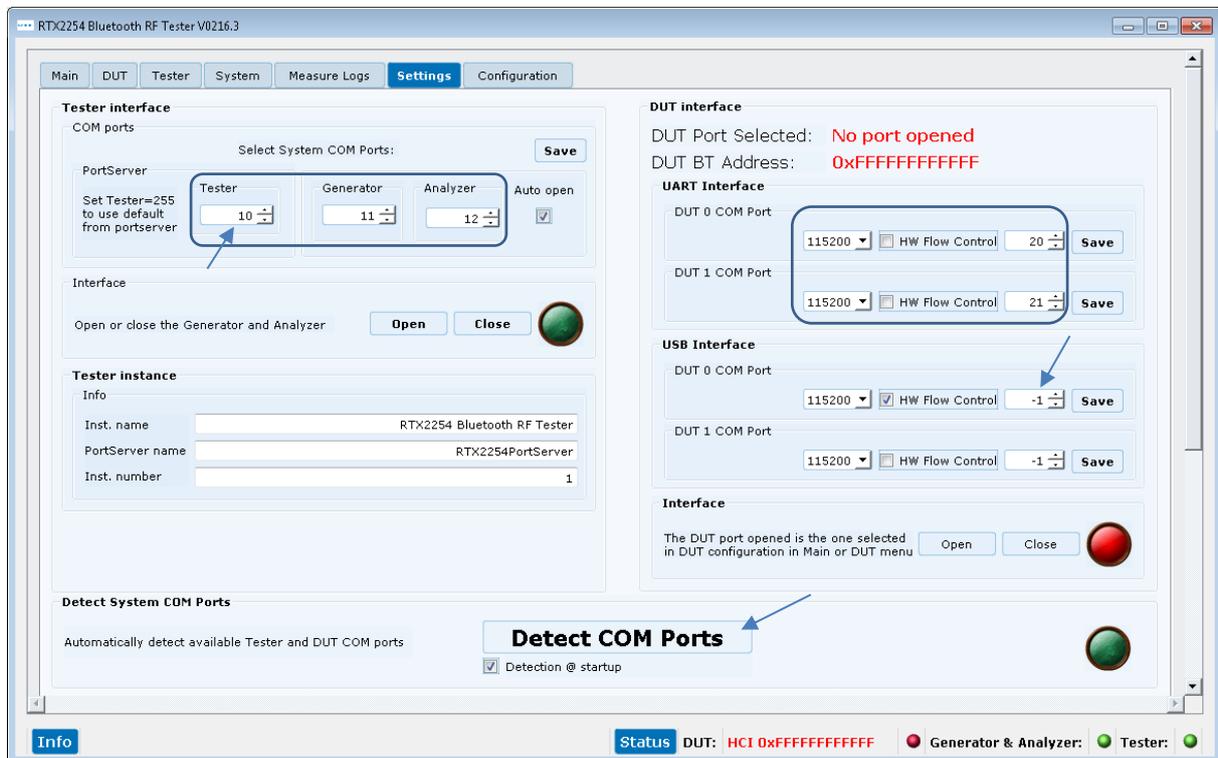
Click **[Save]** to store each selection.

Please note that:

The DUT has not been opened yet and DUT status is red.

5.1.1.2.3 Setup COM Ports

Under the **[Settings]** tab, verify the COM port values found earlier is correct for the 3 internal instruments (Tester / Analyzer / Generator) and for each of the 2 DUT UART interfaces.



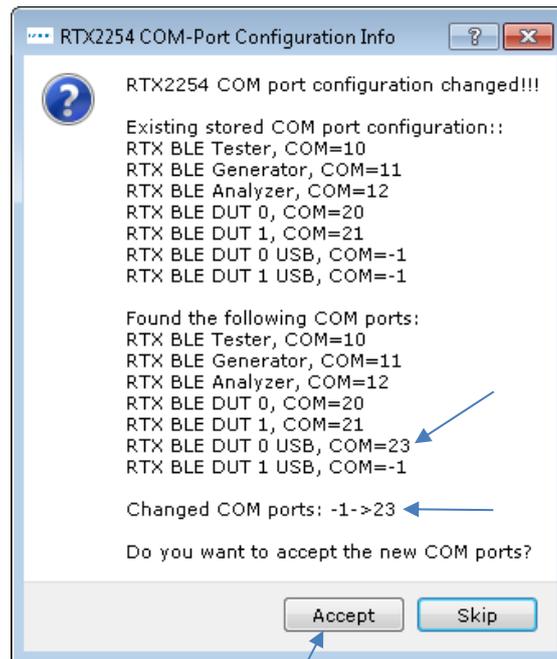
Click the **[Detect COM Ports]** to make a new COM port detection:

Please note that:

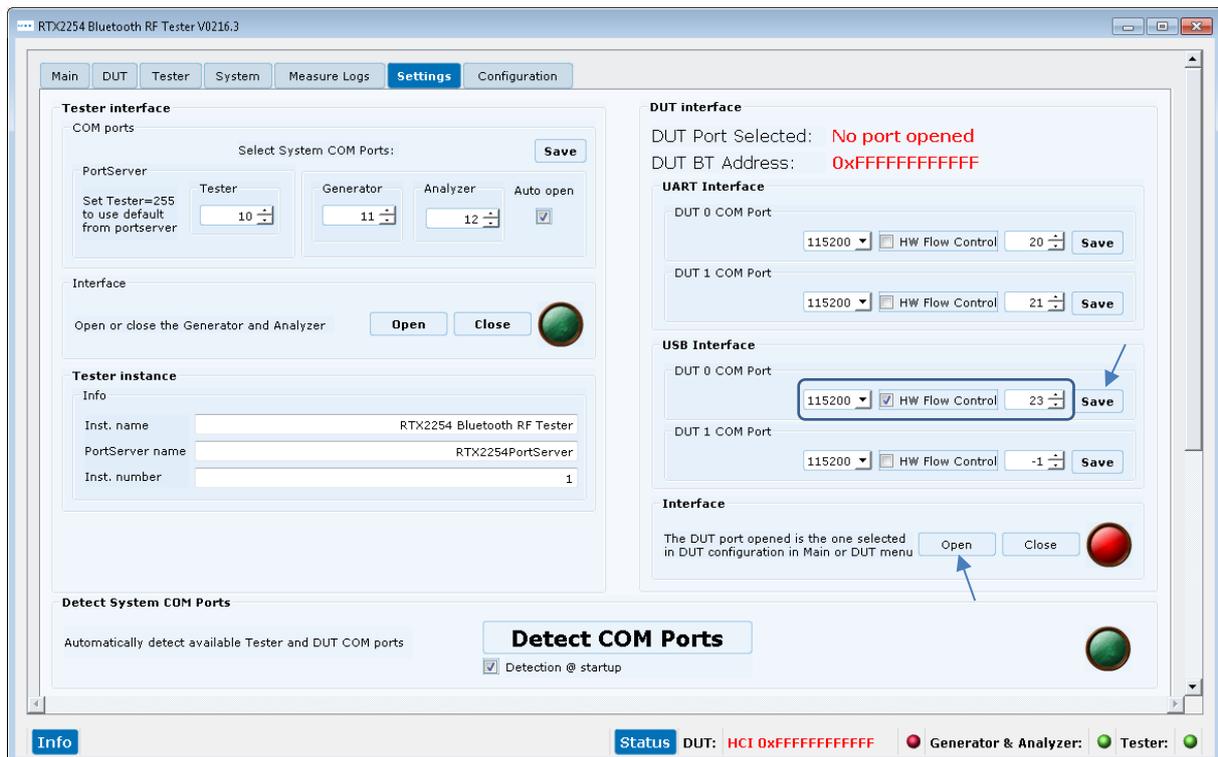
If Tester COM = 255 is entered, the COM port specified in the "RTX EAI Server" is used.

In section 5.1.1.2.1 Select DUT Test Interface we selected "DUT1 RF Select" and "DUT0 USB". No COM port is setup for DUT0 USB interface yet, it shows -1.

After a few seconds a pop-up message should be shown like below:



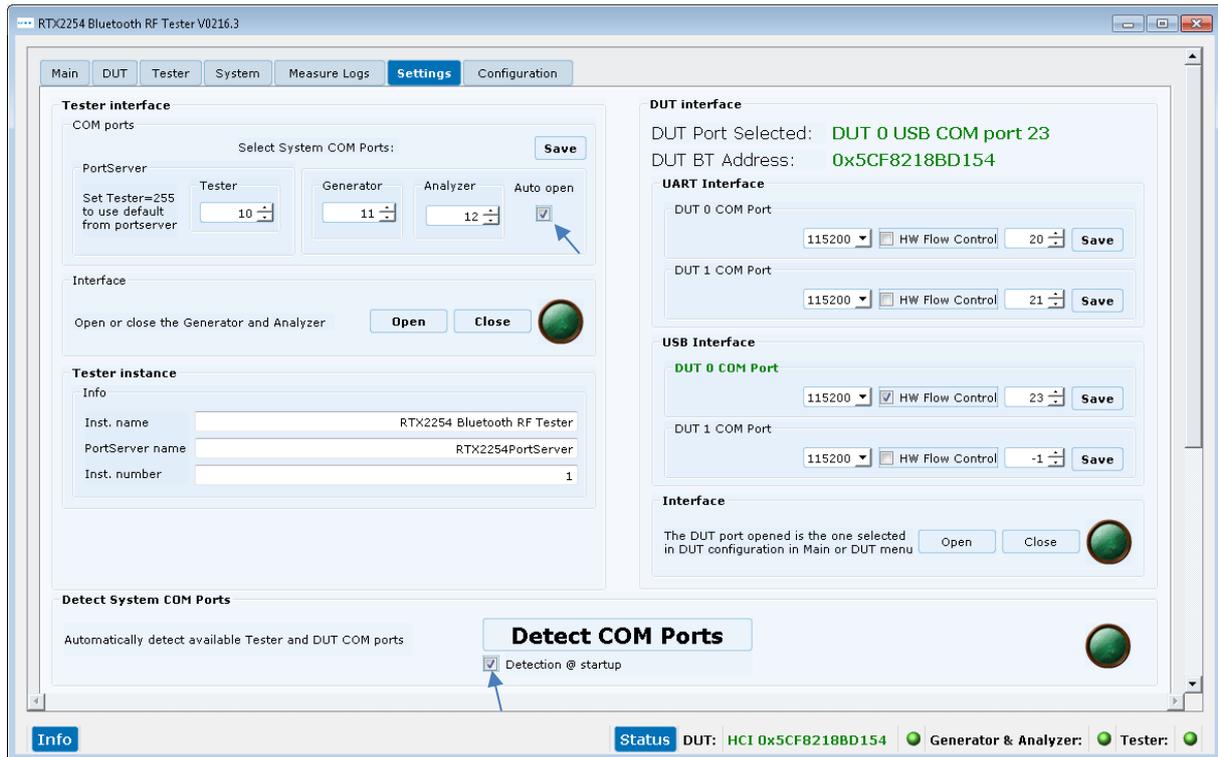
A new COM port for DUT0 USB has been found. Click **[Accept]** to update your settings.



Set the DUT configuration (baud rate, HW flow control) as required by your specific DUT.

Click **[Save]** for each section to store settings.

Click **[Open]** to open the ports.



Check the **[Auto open]** option to automatically open the Generator and Analyzer COM ports when starting the RTX2254 application. Uncheck to disable auto open.

Check the **[Detection @ startup]** option to automatically detect COM ports when starting the RTX2254 application. Uncheck to disable detection.

Then please select the tab called **[Main]** as in the following.

Please note that:

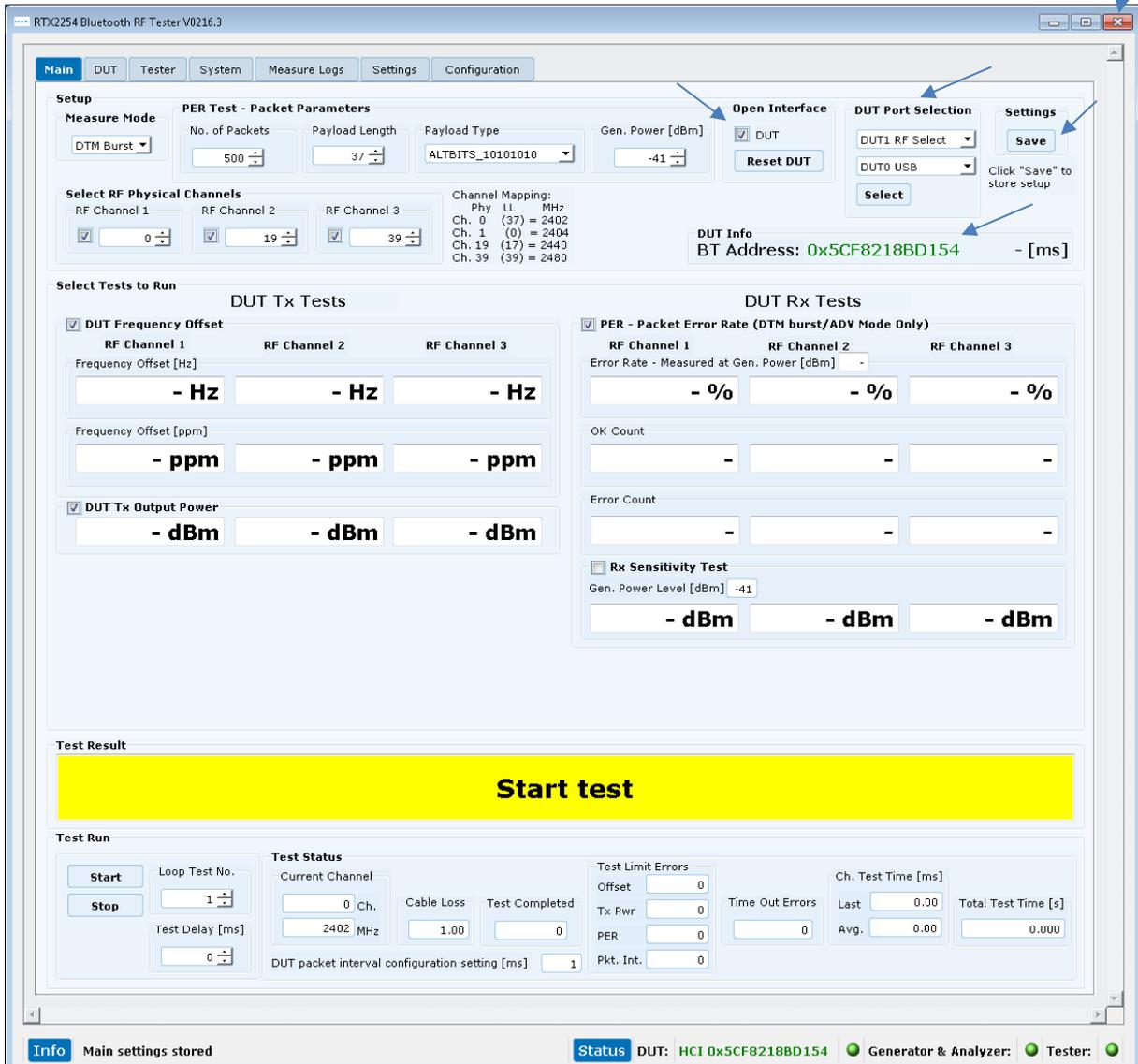
The firmware in the **RTX2254 Bluetooth RF tester** is automatically checked when starting the RTX2254 application. Please follow the instructions to update the firmware if required.

5.1.1.2.4 Setup DUT for Test

On **[Main]** page, in **[DUT Port Selection]** frame, please check that the correct RF port and interface to use for tests are selected.

Now check that **DUT** are checked in the **[Open interface]** box and that the 3 status LEDs are green in the lower, right frame.

To store the settings, click **[Save]**.



The **RTX2254 Bluetooth RF tester** is now configured and ready for testing.

Close the application by clicking the **[X]** in the upper right corner.

Please note that:

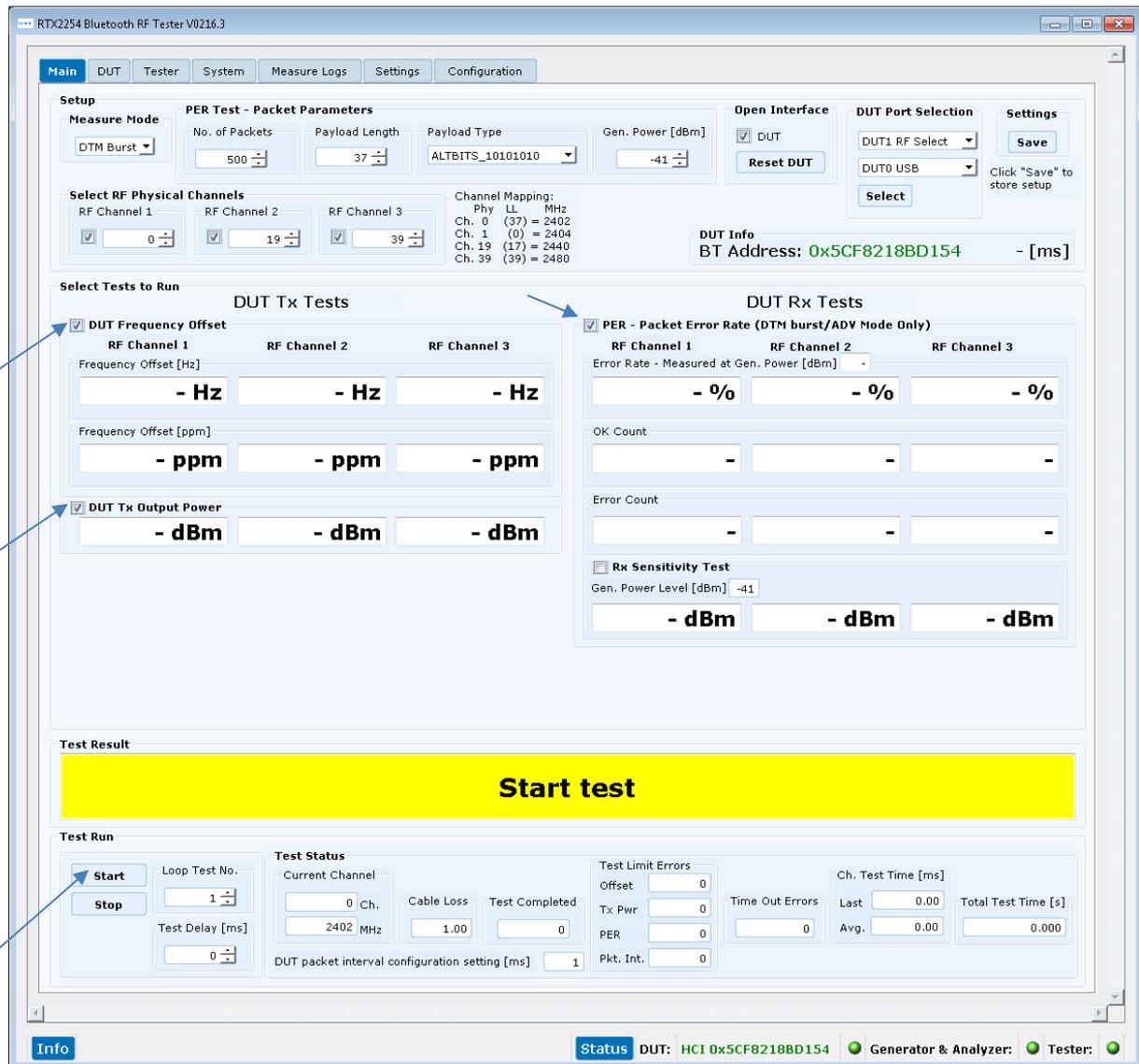
RTX2254 is available as a single ported tester for one DUT (RTX no. 95101347) or as a dual ported tester for two DUTs (RTX no. 95101348).

5.1.1.3 Starting the Test

Start the “**RTX2254 Bluetooth RF tester**” application by clicking the Windows start button and selecting:

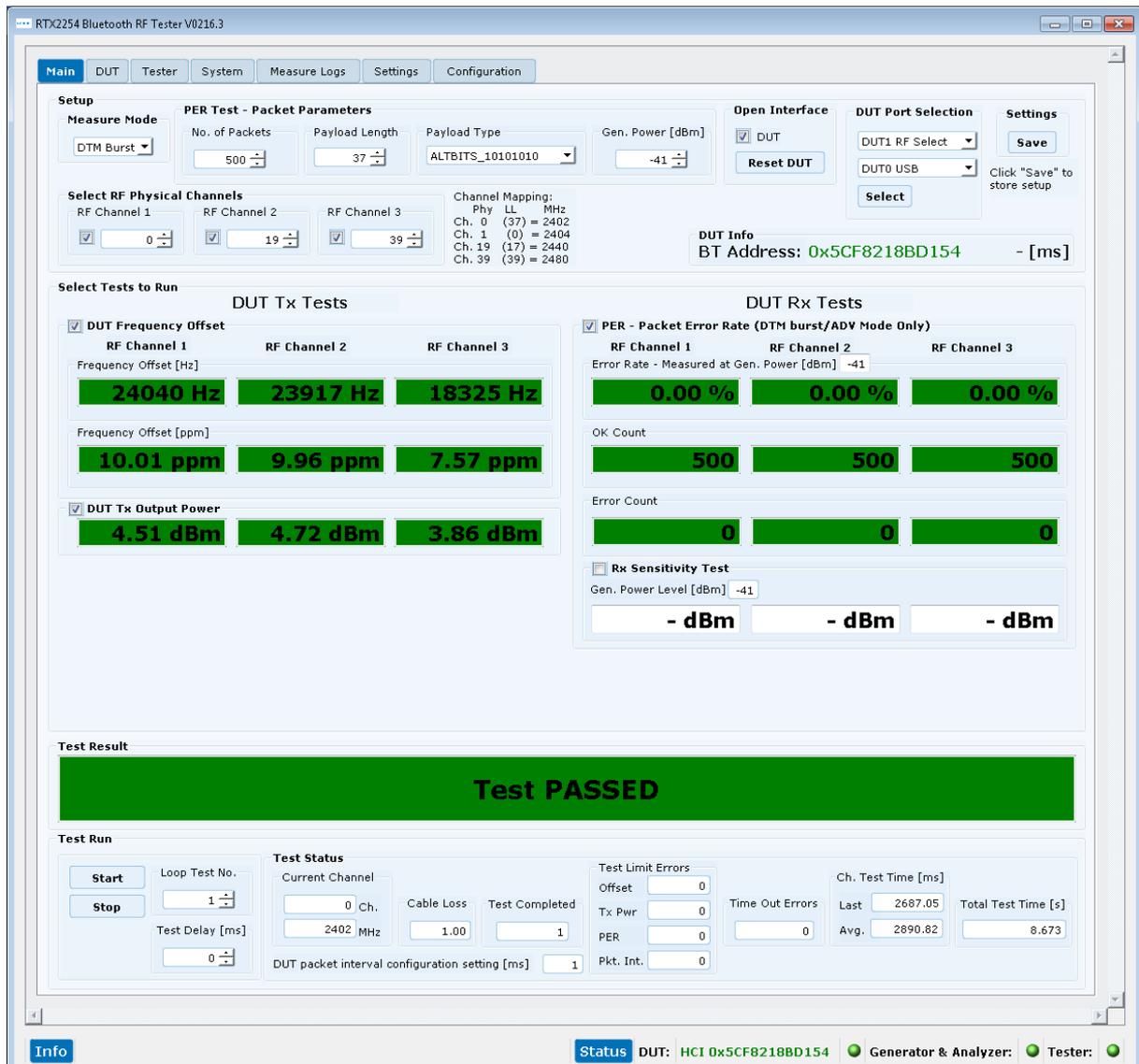
“**Start → All programs → RTX → RTX2254 Bluetooth RF tester → V0216.3 → RTX2254 Bluetooth RF tester – V0216.3**”.

The below or similar screen will appear after a short time.



Make sure that the requested tests are enabled “**DUT Frequency Offset**”, “**DUT Tx Output Power**” and “**PER – Packet Error Rate**”.

Now click **[Start]** and the testing will commence.

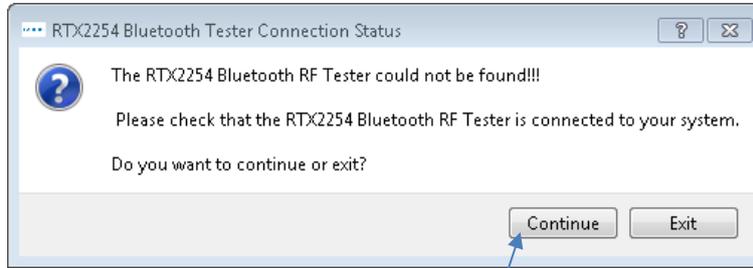


When the test has completed the following picture should look like the above.

Please refer to the instructions in the "RTX2254 User Manual" for how to use other features of the RTX2254 Bluetooth RF tester and a more detailed hardware description.

5.2 Manual Configuration

If you get the error message below, it was not possible to detect the RTX2254 during start-up.



Click **[Continue]** to continue and do a manual setup.

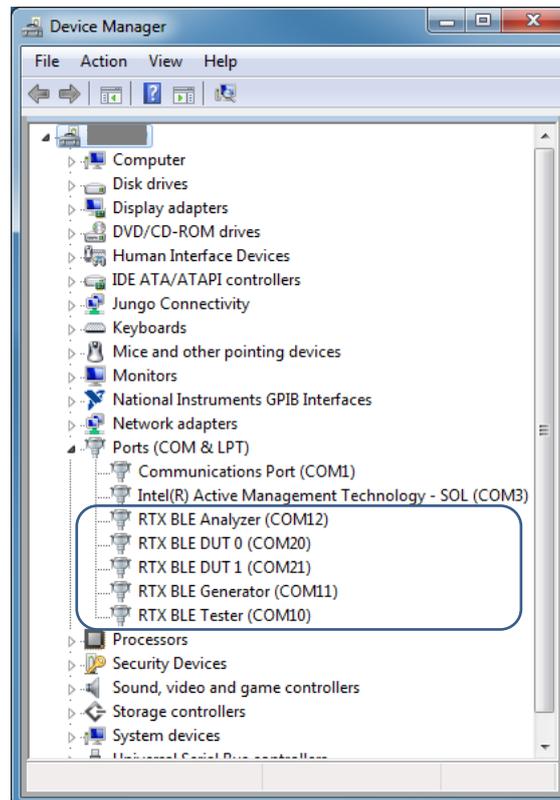
5.2.1 Configuration of RTX EAI Server

It is strongly emphasized here that it is crucial to configure the RTX EAI Port Server correctly. Hence, if an error is encountered when launching the RTX2254 Bluetooth RF tester application it is most likely related to an erroneous configuration of the port server. Please configure it as described below.

5.2.1.1 Find the COM Port to use

Open the “**Device Manager**” by selecting “**Control Panel**” from the Windows main menu or type “devmgmt.msc” in Windows search.

Then unfold the “**Ports (COM & LPT)**” line. The COM port numbers shown are system specific and vary from PC to PC:



RTX2254 COM port 10,11,12
DUT UART COM 20 and 21

The “**RTX EAI Port Server**” needs the communication port number from: “**RTX BLE Tester (COM10)**” line
– please note this no. “10” for later use.

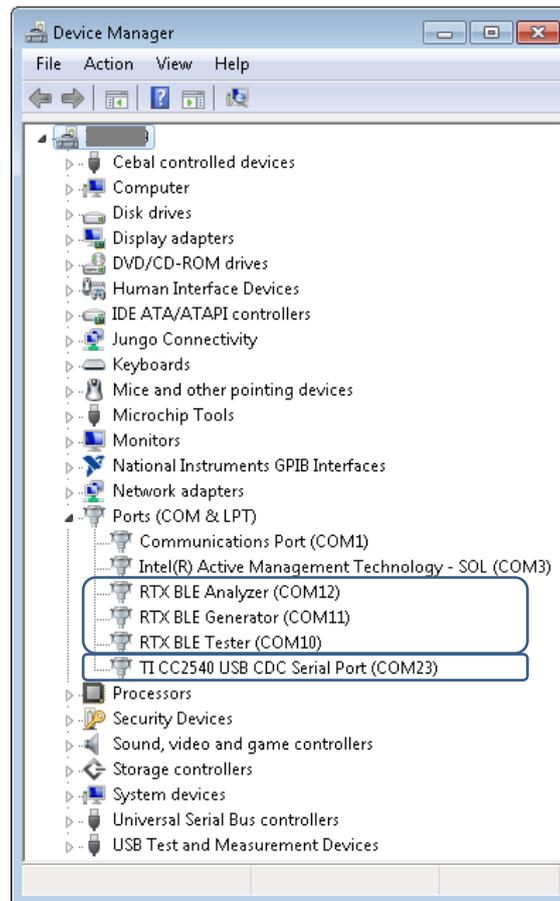
The “**RTX2254 Bluetooth RF tester SW**” needs the communication port number from: “**RTX BLE generator (COM11)**” line for the generator communication
– please note this no. “11” for later use.

The “**RTX2254 Bluetooth RF tester SW**” needs the communication port number from: “**RTX BLE Analyser (COM12)**” line for the analyser communication
– please note this no. “12” for later use.

Please note that:

The 2 UART COM ports are shown (See picture above with DUT 0 and DUT 1 as COM20 and COM21). UART is selected by default.

The 2 USB Ports (here only one “Test DUT” is connected as COM22) are only shown when the USB interface is selected in the RTX2254 application.



RTX2254 COM port 10,11,12
 "Test DUT" on USB COM 23

Direct Test Mode

Direct Test Mode requires a minimum of 4 COM port numbers; 3 COM ports (Tester / Analyzer / Generator) for the RTX2254 internal instruments and 1 COM port for a test DUT is required when configuring the RTX2254 tester later.

Advertising Mode

Advertising Mode only requires the 3 COM ports (Tester / Analyzer / Generator) for the RTX2254 internal instruments but no COM port for the DUT.

Please note that:

You must first setup the 3 COM ports (Tester / Analyzer / Generator) to be able to select USB as DUT interface to get the test DUT COM port.

5.2.1.2 Setup the RTX EAI Server

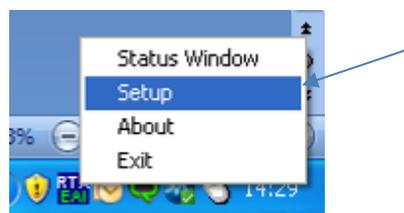
Please check that the icon “**RTX EAI**” is present in the task bar, like below picture:



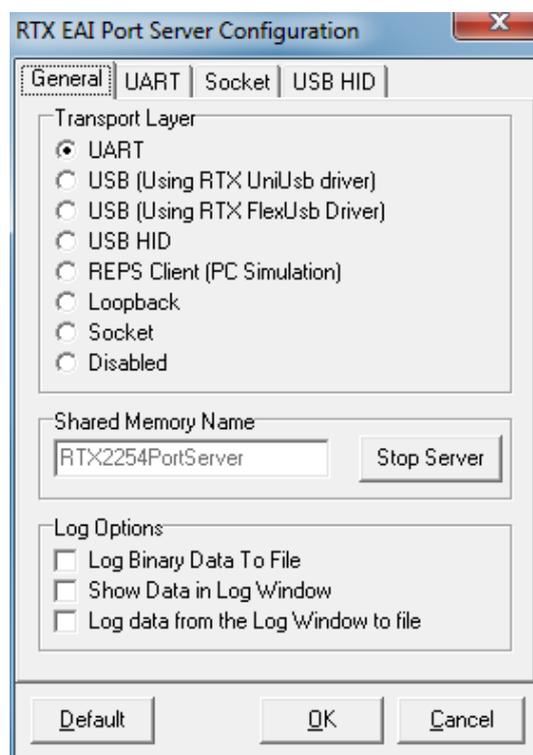
If not started, then start it manually from Windows start button:

“**Start → All programs → RTX Telecom → RTX EAI Port Server**”

Now right click on the icon on the task bar and select the Setup window (see below).



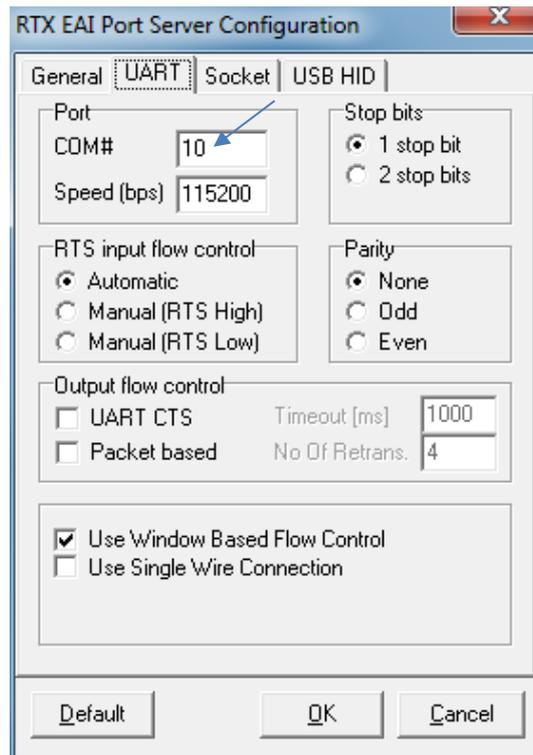
When selecting the **Setup** line, the following window will pop-up.



Please note that:

The **Transport Layer** will be set to **Disabled** if communication is not possible. In that case – go here, correct the HW problem and enable it again.

Now please set the “**UART**” window as shown below.



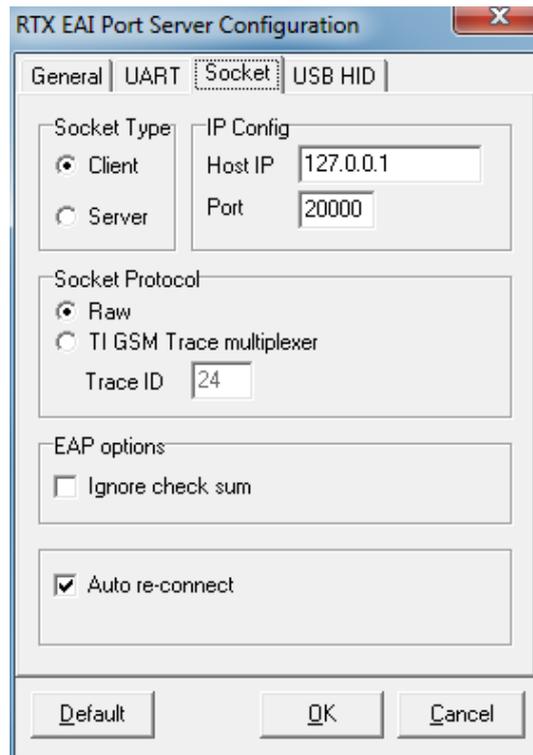
Please enter the COM port number from “**Device Manager**” page. Here it is 10 and be sure to check that the other fields are set as shown above.

The same apply for the following 2 pages.

Please note that:

The Tester interface COM port number can also be setup in the RTX2254 application.

In RTX2254 application, set Tester COM = 255 to use the manually setup COM port in the RTX Portserver application above.



Now click **[OK]**. This will save the current setup configuration.

It can be found in the file: "**c:\Program Files (x86)\RTX\RTX2254 Bluetooth RF Tester\Vxxxx\RtxEaiPortServer.ini**"

5.2.2 The First Test

To guide the user through the first test in Direct Test Mode, the following simple test are shown.

A test DUT, setup for production test, must be available. A DUT with USB is used in this description.

5.2.2.1 Set-up of HW for First Test

Please do the following:

7. Place tester and PC on a solid table
8. Connect power cables
9. Connect PC and Tester with a USB cable
10. Insert the **"Test DUT"** in appropriate DUT interface (UART / USB), e.g. USB0
11. Connect RF cable from **"Test DUT"**, e.g. DUT0 RF port as shown in below picture.
12. Now turn on PC and the **RTX2254 Bluetooth RF tester** hardware.



"Test DUT" is connected to DUT0 RF and USB

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).

5.2.2.2 Set-up of SW for First Test

Start the “**RTX2254 Bluetooth RF tester**” application by clicking the Windows start button and selecting:

“**Start → All programs → RTX → RTX2254 Bluetooth RF tester → V0216.3 → RTX2254 Bluetooth RF tester – V0216.3**”.

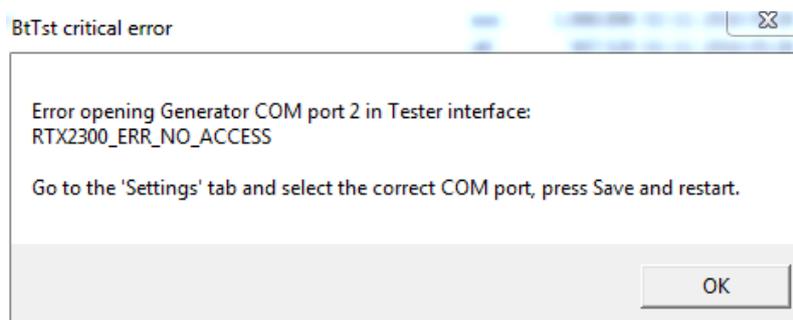
The below picture will be shown:



If it doesn't disappear then an error probably has occurred. The error pop-up could be hidden below the splash screen and can be shown in the following way:

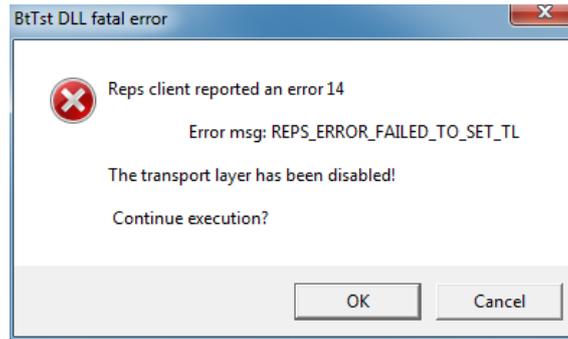
- Press **[ALT]** + **[TAB]** until error pop-up has been selected
- Press **[ALT]** + **[SPACE]** once
- Press **[M]** for move window
- Press **[Arrow-down]** several times
- When fully visible press **[ENTER]**

The first time, you will see the below error – because the RTX2254 tester has not been configured yet.

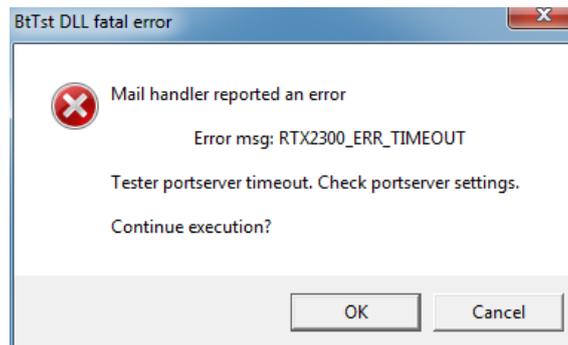


Click **[OK]** and the RTX2254 application will start.

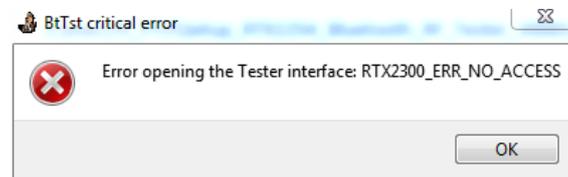
If the error pop-up looks like the following, then the RTX EAI Port Server are probably failing and you must configure it correctly.



Or



If the error pop-up looks like the following, then the RTX EAI Port Server are probably failing and you must configure it correctly.



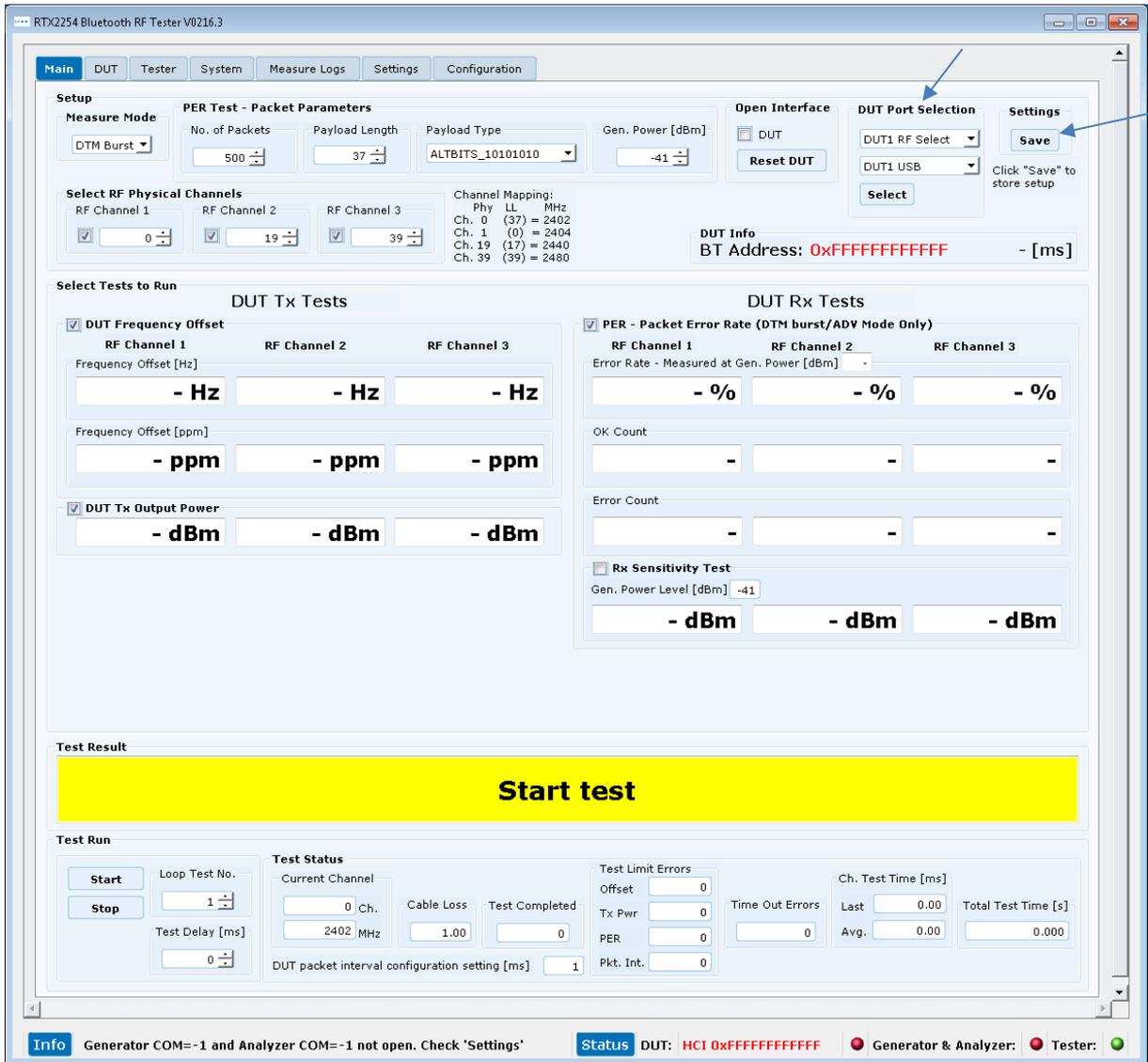
5.2.2.2.1 Select DUT Test Interface

Please select the **[Main]** tab.

In **[DUT Port Selection]** frame, please select the correct RF port and interface to use for tests.

Click **[Select]** to setup the RF and communication interface.

In **[Settings]**, click **[Save]** to store the configuration.



Please note that:

The Generator & Analyzer and DUT have not been opened yet and status is red.

5.2.2.2.2 Select DUT Test Protocol

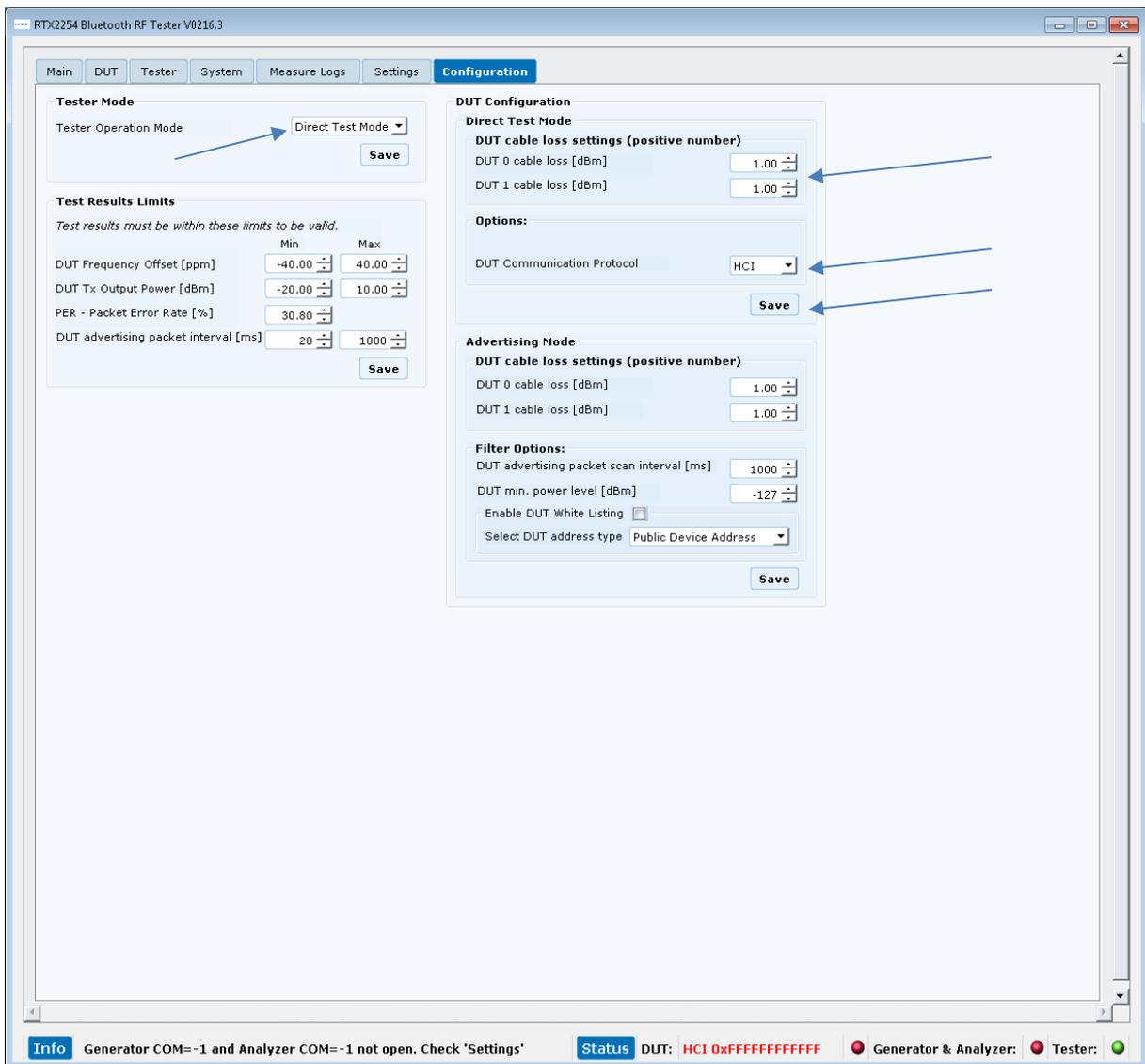
Please select the **[Configuration]** tab.

Check that the operation mode of tester is set to **"Direct Test Mode"**.

Set the limit numbers to meaningful values, like below picture shows.

The DUT cable loss depends on your selected cable, e.g. here it is set to 1 dBm loss.

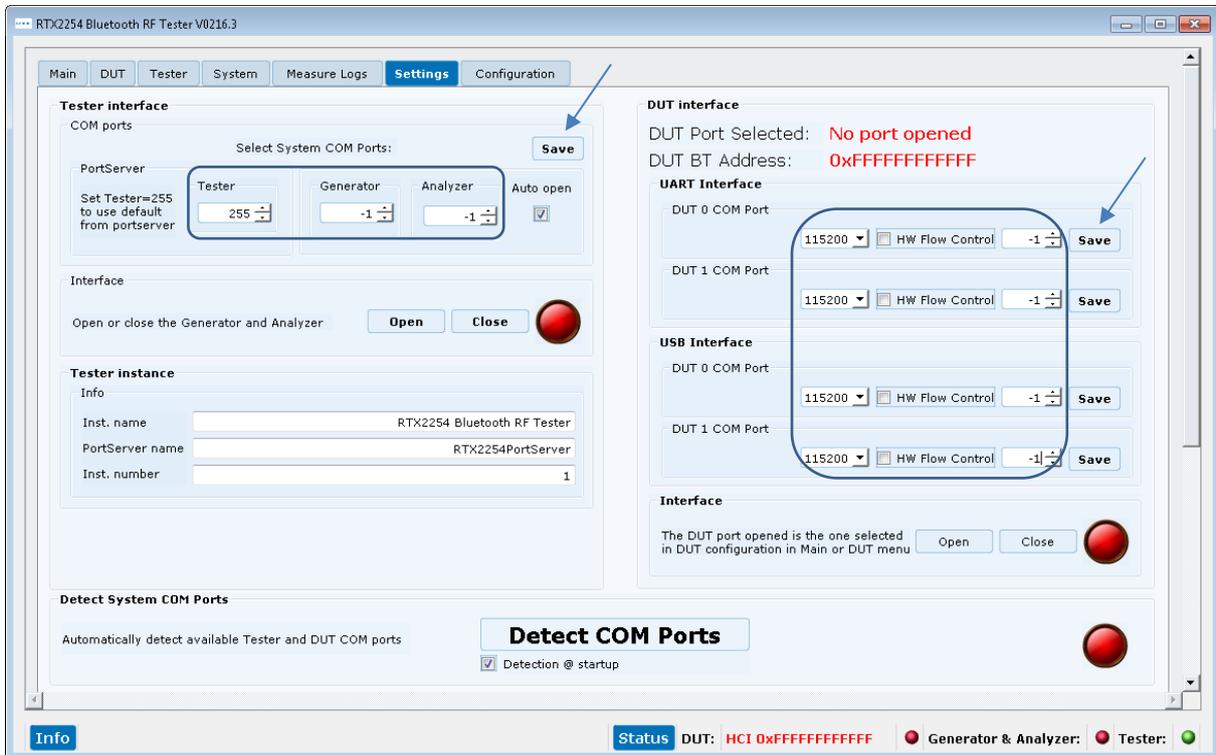
Select the test protocol (HCI or 2-wire) to use with the **"Test DUT"**. In this example, HCI is selected as "DUT Communication Protocol".



Click **[Save]** to store each selection.

5.2.2.2.3 Setup COM Ports

Under the **[Settings]** tab, setup the COM port values found earlier for the 3 internal instruments (Tester / Analyzer / Generator) and for each of the DUT interfaces required.

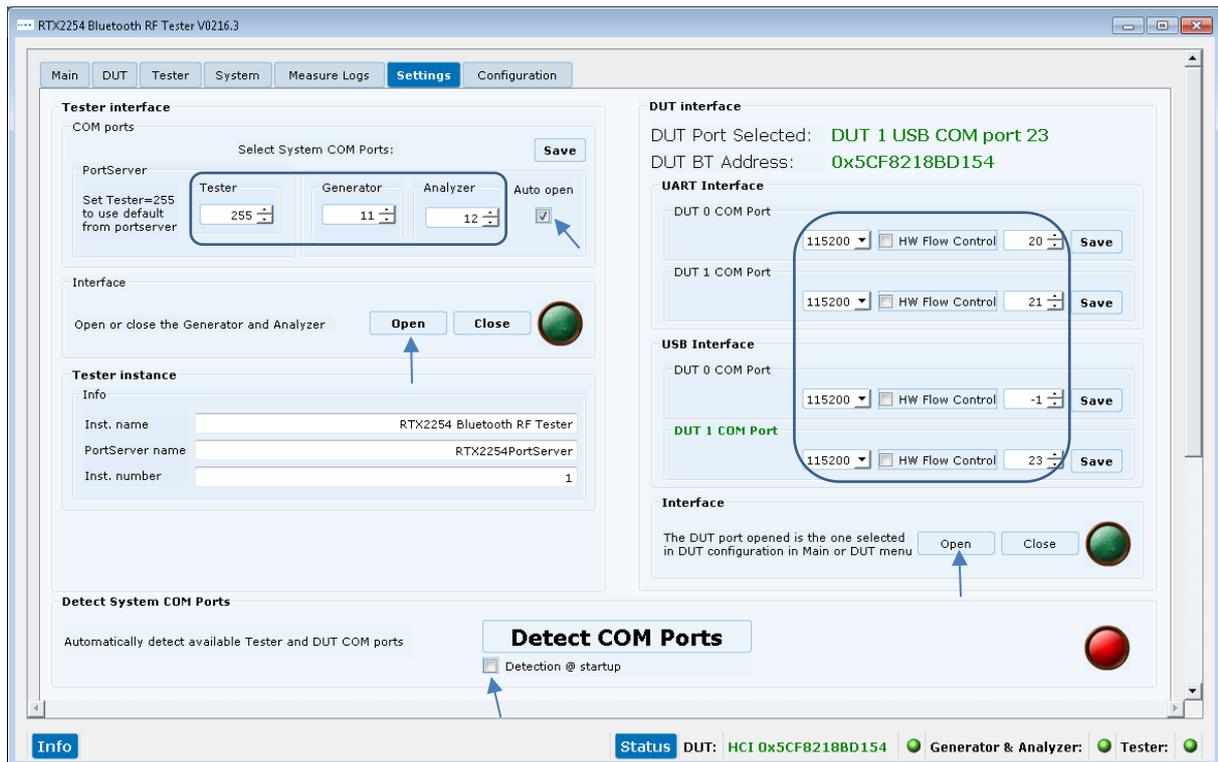


Enter the COM port number for the **[Tester interface]** and set the DUT configuration in the **[DUT Interface]** as required by your specific DUT.

Click **[Save]** for each section to store settings.

Please note that:

If Tester COM = 255 is entered, the COM port specified in the “RTX EAI Server” is used. Select the **[Auto open]** option to automatically open the RTX2254 tester COM ports.



Check the **[Auto open]** option to automatically open the Generator and Analyzer COM ports when starting the RTX2254 application. Uncheck to disable auto open.

Uncheck the **[Detection @ startup]** option to disable automatically COM ports detection when starting the RTX2254 application.

Click **[Open]** to open the ports.

Then please select the tab called **[Main]** as in the following.

Please note that:

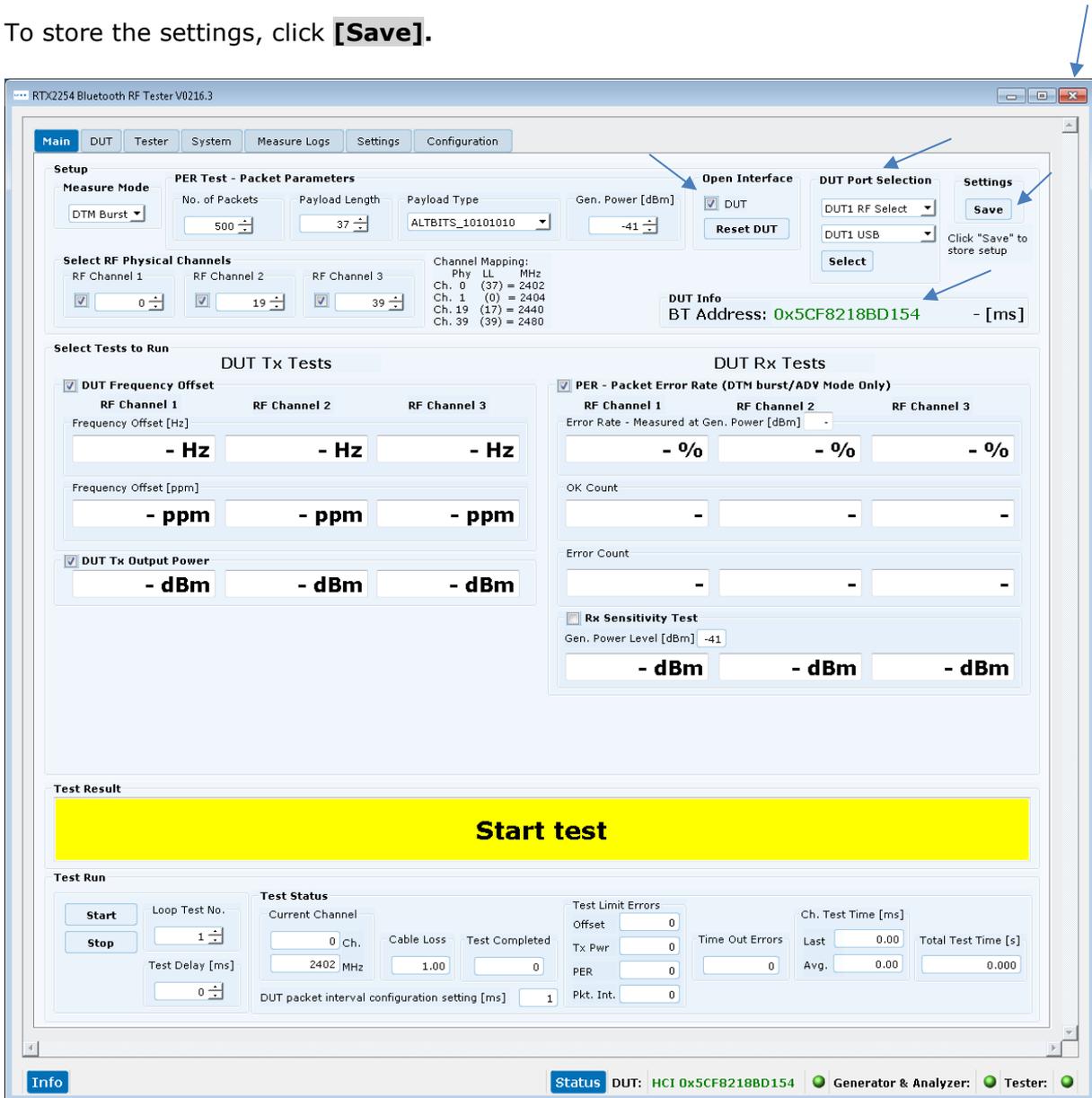
The firmware in the **RTX2254 Bluetooth RF tester** is checked when starting the application. Please follow the instructions to update the firmware if required.

5.2.2.2.4 Setup DUT for Test

On **[Main]** page, in **[DUT Port Selection]** frame, please check that the correct RF port and interface to use for tests are selected.

Now check that **DUT** are checked in the **[Open interface]** box and that the 3 status LEDs are green in the lower, right frame.

To store the settings, click **[Save]**.



The **RTX2254 Bluetooth RF tester** is now configured and ready for testing.

Close the application by clicking the **[X]** in the upper right corner.

Please note that:

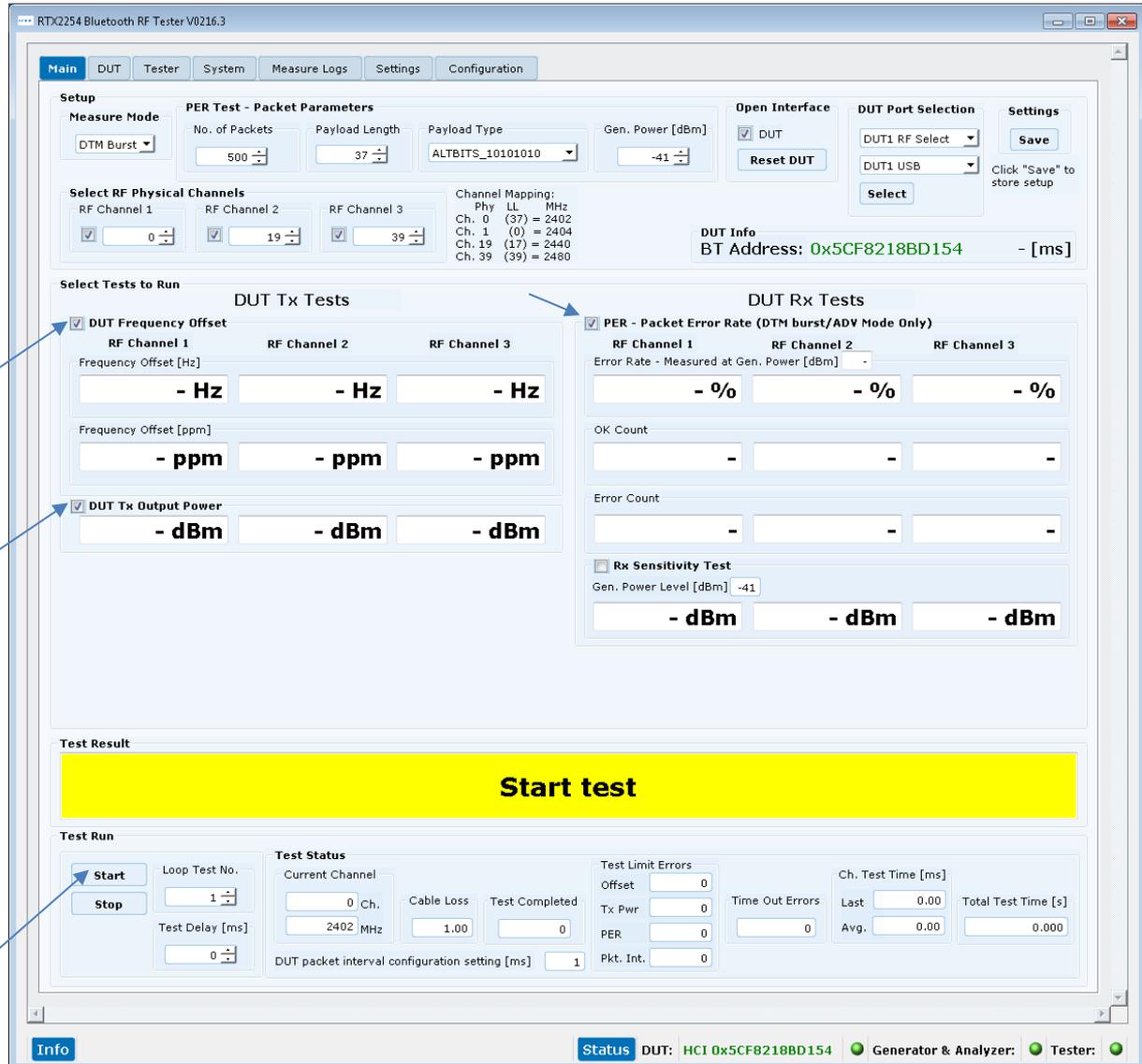
RTX2254 is available as a single ported tester for one DUT (RTX no. 95101347) or as a dual ported tester for two DUTs (RTX no. 95101348).

5.2.2.3 Starting the Test

Start the “RTX2254 Bluetooth RF tester” SW by clicking the Windows start button and selecting:

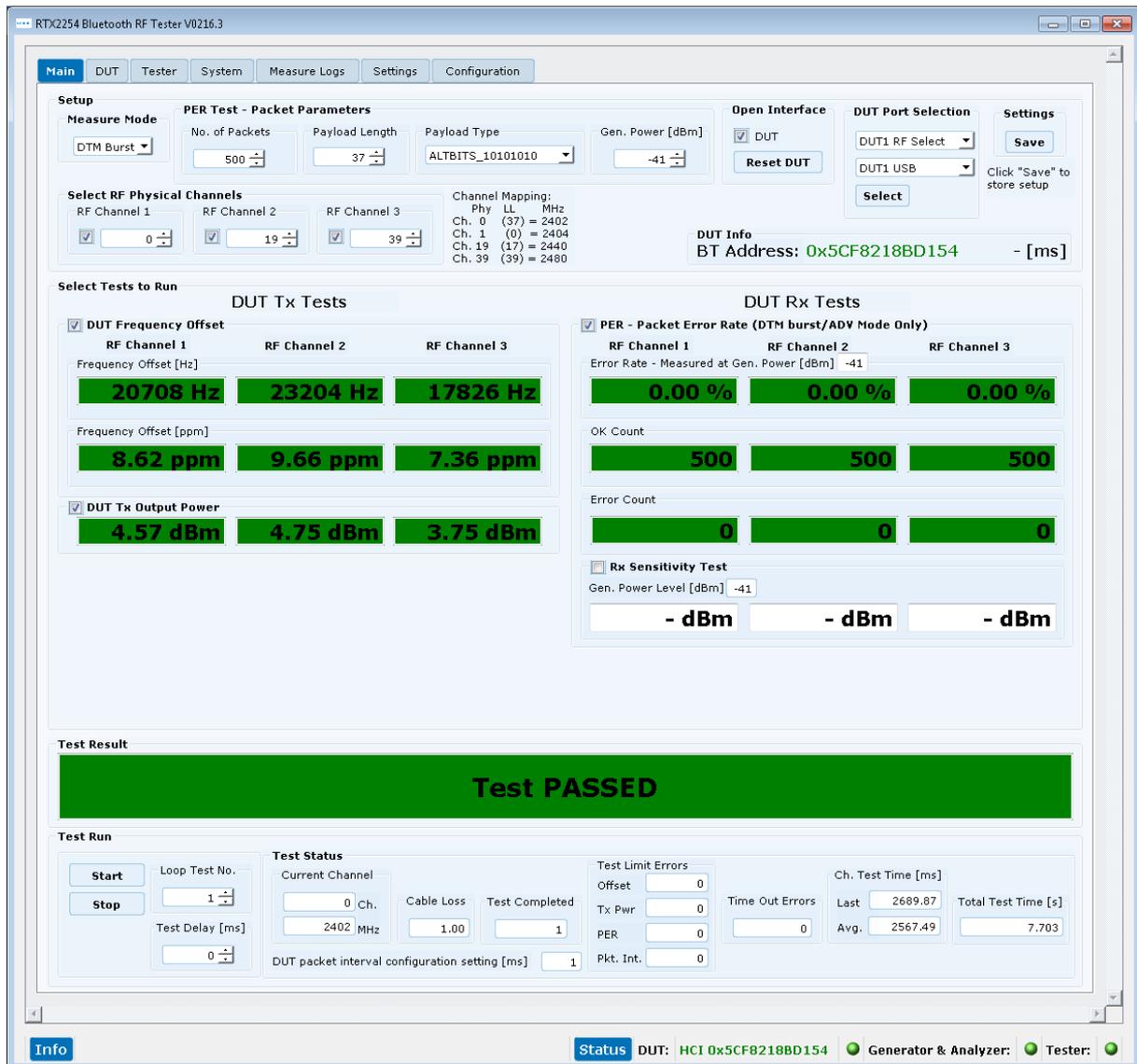
“Start → All programs → RTX → RTX2254 Bluetooth RF tester → V0216.3 → RTX2254 Bluetooth RF tester – V0216.3”.

The below or similar screen will appear after a short time.



Make sure that the requested tests are enabled “DUT Frequency Offset”, “DUT Tx Output Power” and “PER – Packet Error Rate”.

Now click **[Start]** and the testing will commence.



When the test has completed the following picture should look like the above.

Please refer to the instructions in the "RTX2254 User Manual" for how to use other features of the RTX2254 Bluetooth RF tester and a more detailed hardware description.

6 Safety Information

6.1 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.

6.2 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.

6.3 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.