

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.



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General

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<u>DO NOT</u> operate the product in an explosive atmosphere or in the presence of flammable gasses or fumes.



<u>DO NOT</u> 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:

Select RF Phys RF Channel 1	PER Test No. of Pa 50 ical Channels RF Cha	- Packet Parameters ickets Payload Length 0 25 s snel 2 19 RF Channel 3 19 3	Payload Type ALTBITS_1010101 Channel Mappi Phy LL Ch. 0 (37) = Ch. 19 (17) = Ch. 19 (17) = Ch. 39 (39) =	Gen. Power [dBm] -41 ÷ 1Htz 2402 2440 2440 E	Open Interface	DUT Port Sel DUTO RF Sele DUTO USB Select 84DD20C503	ection Settings ect Save Click "Save" to store setup BAA - [ms]
elect Tests to F DUT Freque RF Chan	Run Ency Offset nel 1	OUT Tx Tests RF Channel 2	RF Channel 3	PER - Packet Erro RF Channel 1	DUT Rx To or Rate (DTM burst/ RF Channe ed at Gen, Power [dBm	ests ADV Mode Only) el 2 I	RF Channel 3
	- Hz	- Hz	- Hz	-	%	- %	- %
Frequency Offs	et [ppm]			OK Count			
-	· ppm	- ppm	- ppm		-	-	-
	•• ·		••	Same Count			
DUT Tx Out	put Power	d D	10	Error Count			
	abm	- aBm	- aBm		-	-	-
				Gen. Power Level [dB	est 8m] -41		
				- dE	Sm	- dBm	- dBm
est Result							
			Sta	art test			
est Run							
	Loop Test No.	Test Status		Test Limit Errors		Ch. Test Time for	e]
Chart			Cable Loss Test Cor	Offset 0	Time Out Errors	Last 0.0	o Total Test Time [s]
Start	1 × - 1			Tx Pwr 0		Avg. 0.0	0.000
Start Stop	Test Delay (ms	[] 2402 MHz	1.00	0 PER 0	0		

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.

Performs a packet error rate test on the DUT.

DTM Burst -	PER Test No. of Pa 50 sical Channels	- Packet Parameters	Payload Type ALTBITS_10101010 Channel Mapping:	Gen. Power [dBm]	Pen Interface DUT Pou DUT R Reset DUT Select	t Selection F Select SB Click "Save" to store setup
RF Channel 1	RF Cha	19 🛨 🕅 39	Ch. 0 $(37) = 2402$ Ch. 1 $(0) = 2404$ Ch. 19 $(17) = 2440$ Ch. 19 $(39) = 2480$		fo ddress: 0x84DD200	C503AA - [ms]
elect Tests to	Run)IIT Tx Tests			DUT Rx Tests	
V DUT Freque	ency Offset			V PER - Packet Error Rat	e (DTM burst/ADV Mode O)nly)
RF Chan Frequency Offs	nel 1 set [Hz]	RF Channel 2	RF Channel 3	RF Channel 1 Error Rate - Measured at G	RF Channel 2 en. Power [dBm] -	RF Channel 3
	- Hz	- Hz	- Hz	- %	- %	- %
Frequency Off	set [ppm]			OK Count		
	- ppm	- nnm	- nnm	_	_	
	Phil	- Phu	- hhiii			
DUT Tx Out	put Power			Error Count		
	- dBm	- dBm	- dBm	-	_	-
				Rx Sensitivity Test Gen. Power Level [dBm]	41	
				Rx Sensitivity Test Gen. Power Level [dBm] - dBm	- dBm	- dBm
est Result				Rx Sensitivity Test Gen. Power Level [dBm] - dBm	- dBm	- dBm
:st Result			Start	Rx Sensitivity Test Gen. Power Level [dBm] - dBm dBm	- dBm	- dBm
st Result			Start	en. Power Level (dBm) - dBm	41 - dBm	- dBm
est Result		Test Status	Start	en Rx Sensitivity Test Gen. Power Level (dBm) - - dBm	41 - dBm	- dBm
est Result est Run Start	Loop Test No.	Test Status Current Channel	Start	Rx Sensitivity Test Gen. Power Level [dBm] - dBm test Test Limit Errors Offset 0	41 - dBm Ch. Test Tin	- dBm
est Result est Run Start Stop	Loop Test No.	Test Status Current Channel 0 ch.	Start Cable Loss Test Completed	Rx Sensitivity Test Gen. Power Level [dBm] - dBm test Test Limit Errors Offset 0 Tx Pwr 0 Tir	41 - dBm me Out Errors Last	- dBm
est Result est Run Start Stop	Loop Test No.	Test Status Current Channel 0 Ch. 2402 MHz	Cable Loss 1.00 0	Rx Sensitivity Test Gen. Power Level [dBm] - dBm test Test Limit Errors Offset 0 Tx Pwr 0 Tx Pwr 0	41 - dBm me Out Errors 0 Avg.	- dBm
est Result est Run Start Stop	Loop Test No. 1 ÷ Test Delay [ms 0 ÷	Test Status Current Channel 0 ch. 2402 MHz DUT packet interval co	Cable Loss Test Completed	Rx Sensitivity Test Gen. Power Level [dBm] - dBm test Test Limit Errors Offset Tx Pwr PER PER Pkt. Int.	41 - dBm me Out Errors 0 Avg.	- dBm
est Result est Run Start Stop	Loop Test No.	Test Status Current Channel 0 Ch. 2402 MHz DUT packet interval co	Cable Loss Test Completed 1.00 0 0 nfiguration setting [ms] 1	Rx Sensitivity Test Gen. Power Level [dbm] - dBm test Test Limit Errors Offset 0 Tx Pwr 0 PER 0 Pkt. Int. 0	41 - dBm me Out Errors Ch. Test Tin Last Avg.	- dBm
ist Result ist Run Start Stop HCI DUT fo	Loop Test No. 1 ÷ Test Delay [ms 0 ÷	Current Channel Current Channel Ch. 2402 MHz DUT packet interval co	Cable Loss Test Completed	Rx Sensitivity Test Gen. Power Level [dbm] - dBm test Test Limit Errors Offset 0 Tx Pwr 0 PER 0 Pkt. Int. 0 Status DUT: HCI 0x844	41 - dBm me Out Errors Ch. Test Tin Last Avg. DD20C503AA Gene	- dBm
est Result est Run Start Stop HCI DUT for	Loop Test No. 1 ÷ Test Delay [ms 0 ÷ und	Test Status Current Channel 0 Ch. 2402 MHz DUT packet interval co	Cable Loss Test Completed 1.00 0 nfiguration setting [ms] 1	Rx Sensitivity Test Gen. Power Level [dBm] - dBm test Test Limit Errors Offset 0 Tx Pwr 0 PER 0 Pkt. Int. 0 Status DUT: HCI 0x84	41 - dBm me Out Errors 0 Ch. Test Tim Last Avg. DD200C503AA Q Gene	- dBm

Packet Error Test (PER)



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/stop the test.

- [Start test] The overall status of the last test run.
- [Test Run]
- [Test Status]

Status information for the test run.

RTX2254 Bluetooth RF Tester (V0211)	
	*
Main DUT Tester System Measure Logs Settings Configuration	
Setup PER Test - Packet Parameters Measure Mode No. of Packets Payload Length Payload Type DTM Burst ▼ 500 ÷ 25 ÷ ALTBITS_1010101	Open Interface DUT Port Selection Settings 0 ▼ -41 ÷ Reset DUT DUT0 RF Select Save
Select RF Physical Channels Channel Mapp RF Channel 1 RF Channel 2 RF Channel 3 Phy Li Phy Li Ch. 0 (37) Ch. 10 (17) Ch. 10 (17) Ch. 10 (17) Ch. 14 (10) Ch. 15 (10)	ing: Mitz 2402 2404 2400 BT Address: 0x84DD20C503AA - [ms]
Select Tests to Run DUT Tx Tests DUT Frequency Offset	DUT Rx Tests
RF Channel 1 RF Channel 2 RF Channel 3 Frequency Offset [Hz]	RF Channel 1 RF Channel 2 RF Channel 3 Error Rate - Measured at Gen. Power [dBm] -
- Hz - Hz - Hz	z - % - %
Frequency Offset [ppm]	OK Count
- ppm - ppm - ppm	
V DUT Tx Output Power	Error Count
- dBm - dBm - dBm	n
	Rx Sensitivity Test Gen. Power Level [dBm] -41
	- dBm - dBm - dBm
(Tast Downh	
Sta	art test
Test Run	
Start Loop Test No. Stop 1 ± Test Delay [ms] 0 Ch. 0 ± 0 ± DUT packet interval configuration setting [ms]	Test Limit Errors Ch. Test Time [ms] Offset 0 Tx Pwr 0 PER 0 PK. Int. 0
Info HCI DUT found	Status DUT: HCI 0x84DD20C503AA

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:

Setup Measure Mode DTM Burst 💌	PER Test - Packet P No. of Packets	Payload Length	ayload Type ALTBITS_10101010	- Gen. Power [dBm]	Open Interface	DUT Port Selection	Settings Save
Select RF Physics RF Channel 1	al Channels RF Channel 2	RF Channel 3	Channel Mapping: Phy LL MHz Ch. 0 (37) = 2402 Ch. 1 (0) = 2404	DUT	Info	Select	Click "Save" to store setup
			Ch. 19 (17) = 2440 Ch. 39 (39) = 2480	ВТ	Address: 0x8	4DD20C503AA	- [ms]

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	Frequency
Channel	
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.

DUT Port Selection					
DUT0 RF Select V					
DUTO UART -					
Select					



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**
- 3) **PER Packet Error Rate**

Rx Sensitivity Test

channels. Performs a packet error rate test on selected channels. 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.

Measures the Tx output power on selected

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

	Select	lests to kun	DUT Tx Tests	Ň	DUT Rx Tests
	_ 🗸 D	UT Frequency Offset			PER - Packet Error Rate (DTM burst/ADV Mode Only)
	×	RF Channel 1	RF Channel 2	RF Channel 3	RF Channel 1 RF Channel 2 RF Channel 3
	Free	quency Offset [Hz]			Error Rate - Measured at Gen. Power [dBm] -
<i>_</i>		- Hz	- Hz	- Hz	- % - %
	Free	quency Offset [ppm]			OK Count
		- ppm	- ppm	- ppm	
		UT Tx Output Power			Error Count
		- dBm	- dBm	- dBm	
/					Rx Sensitivity Test
					Gen. Power Level [dBm] -41
				· · · · · · · · · · · · · · · · · · ·	- dBm - dBm - dBm

5.1.8 Test Result

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

Test Result

Start test



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

Test Run		Test Run	Test Run
Start	Loop Test No.	Running Loop Test No.	Continue Loop Test No.
Stop	1 🛨	Pause 1 ÷	Stop
	Test Delay (ms)	Test Delay (ms)	Test Delay (ms)
	0 🛨	0 1	0 🛨

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]]
-------------------------------	---

```
    [Pause]
```

No function – test is already running. 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:

Test Status								
			-Test Limi	it Errors —				
Current Channel			Offset	0		Ch. Te	st Time [ms]	
0 65	- Cable Loss -	Test Completed			Time Out Errors	Last	0.00	Total Test Time [s]
Un.		rest completed	Tx Pwr	0		Lust (fotal fest fille [5]
2402 MHz	1.00	0	PER	0	0	Avg.	0.00	0.000
DUT packet interval	configuration set	ting [ms] 1	Pkt. Int.	0				

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.

··· RTX2254 Bluetooth RF Tester (V0211)	
TXX2254 Bluetooth RF Tester (V0211) Main DUT Tester System Measure Logs Settings Configuration UT Tester System Measure Logs Settings Configuration TX - Mode Start Channel Payload Length Payload Type Rx - Mode 25 - ALTBITS_1010100 Image: Configuration Image: Configuration Rx - Mode Start Channel Received Packets Image: Configuration Stop 0 0 Image: Configuration Image: Configuration Image: Configuration	DUT Status: Stopped Reset RF Mode Reset DUT DUT Port Selection DUT0 USB Select
Info Status DUT: HCI 0x84DD20C50	3AA Q Generator & Analyzer: Q Tester: Q

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.

DUT Port Selection
DUT0 RF Select -
DUTO UART -
Select

DUT Status: Tx Burst mode
Reset RF Mode Reset 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.

lain DUT Tester System Measure Logs Settings Configuration	
Tester System Measure Lugs Settings Configuration	
DUT RE Setup	
Tx - Mode	DUT Status: Tx Burst mode
Start Channel Payload Length Payload Type	Reset RF Mode Reset DUT
Stop 0 ÷ 25 ÷ ALTBITS_10101010	DUT Port Selection
Rx - Mode	DUT0 RF Select 💌
Start Channel Received Packets	
Stop 0 1 0	Select
	2
o TX sending burst packets	Status DUT: HCI 0x84DD20C503AA Generator & Analyzer: Generator & Tester:



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.

Main DUT Tester System Measure Logs Configuration DUT RF Setup Tx - Mode Exact Channel Payload Length Payload Type Stop 0 ± 25 ± ALTBITS_101010 • DUT Port Selection DUT0 UF RF Select DUT0 UF Select • DUT0 USB • Stop 0 ± 0 Select	• ×						Tester (V0211)	2254 Bluetooth R
DUT RF Setup DUT Status: Rx Burst mode Start Channel Payload Length Payload Type Stop 0 ÷ 25 ÷ ALTBITS_101010 ▼ Rx - Mode But Payload Type DUT Port Selection DUTO RF Select DUTO USB ▼ Stop 0 ÷ 0	<u> </u>			Configuration	Settings	Measure Logs	ester System	ain DUT
Tx - Mode Start Channel Payload Length Payload Type Stop 0 ÷ 25 ÷ ALTBITS_10101010 v DUT Status: Rx Burst mode Rx - Mode Start Channel Received Packets DUT OUT OUT Selection Stop 0 ÷ 0 Select Select				Configuration	Jocumps		cater _ System	DUT RF Setup
Start Channel Payload Length Payload lype Stop 0 ÷ 25 ÷ ALTBITS_10101010 ° Rx - Mode DUT ORF Select ° DUTO USB ° Stop 0 ÷ 0 Select		DUT Status: Rx Burst mode Reset RE Mode Reset DUT	L					Tx - Mode
Stop 0 Stop 0 Stop 0 Select		-DIIT Port Selection		10101010 -	ALTBITS	25 ÷		Start
Start Channel Received Packets		DUTO RF Select						Px - Mode
Stop 0 d Select	j l				ts	Received Packe	Channel	Start
		Select				0	٥÷	Stop
Info RX burst mode Status DUT: HCI 0x84DD20C503AA Generator & Analyzer: Tester	ster: 🔾	3AA 🗕 Generator & Analyzer: 🎱 Teste	Status DUT: HCI 0x84DD20C503				node	o RX burst



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.

Main DUT Tester System Measure Logs Settings Configuration	
DUT RF Setup Tx - Mode Start Channel Payload Length Payload Type	DUT Status: Stopped Reset RF Mode Reset DUT
Stop 0 25 ALTBITS_10101010 Rx - Mode Start Channel Received Packets Stop 0 1500	DUT Port Select

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.

(2254 Bluetooth RF Tester (V0211)						
Main DIIT Tester System Me	easure Logs Settings Configurat	ion				
Tester Setup - Burst Mode						
Packet Error Rate				Tester Status	: Stopped	
Ix - Mode	Set "No of packets" = 0 fr	or continuous transmission	No. of Packets	Reset RF Mode	Reset Tester	
Channel Ge	n. Power [dBm] Pavload Length	Pavload Type	1500 🛨		Reset Ana+Gen	
Start 0 -	-40 + 25 +		Packets Sent			
Stop						
Dec. Mada						
KX - Mode	ceived Packets					
Start Chamber 10						
Stop	0)					
Tester Setup - Continous Wave (CW)					
Tx - Continuous Wave	Tx - Set Attenuation	Rx - Continuou	s Wave			
Start	Set	Start	Channel			
Stop		Stop	· ·			
Tester RF Input Power	Tester Analyzer Mode					
Input level [dBm]	RX - Frequency Offset					
Read	Get Last Offset [Hz]					
Monitor	Reset					
RX Mode must be active	Monitor					
	RX Mode must be active					
						Þ
0		Status DUT:	HCI 0x84DD20C5	03AA 🤍 Generat	or & Analyzer: 🍑 Te	ster:



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.

RTX2254 Bluetooth RF Tester (V0211)		- · ×
Main DIIT Tester System Measure Loss	Settings Configuration	<u> </u>
Tester Setup - Burst Mode Packet Error Rate Tx - Mode Start Channel Gen. Power [dBm Stop	Set "No of packets" = 0 for continuous transmission im] Payload Length 0 \div 25 \div ALTBITS_10101010 \checkmark Packets Sent Packets Sent	er Gen
Rx - Mode Start Channel Received Packet Stop 0 - 0	ets 0	
Tester Setup - Continuous Wave (CW) Tx - Continuous Wave Start Channel Stop	Tx - Set Attenuation Rx - Continuous Wave Set 0 ÷ Stop 0 ÷	
Tester RF Input Power Tester Analy Input level [dbm] RX - Frequer Read Get Monitor Monitor RX Mode must be active RX Mode must	Ivzer Mode ency Offset Last Offset [Hz]	
۲ Info	Status DUT: HCI 0x84DD20C503AA 🥥 Generator & Analyze	r: • Tester: •

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.

RTX2254 Bluetooth RF Tester (V0211)				
Main DUT Tester System	Measure Logs Settings Configuration			
Tester Setup - Burst Mode Packet Error Rate Tx - Mode Start Stop	Set "No of packets" = 0 for continuous transmission Gen. Power [dBm] Payload Length Payload Type -40 \div 25 \div ALTBITS_10101010 \checkmark	No. of Packets 1500 ÷ Packets Sent	Tester Statu Reset RF Mode	s: Stopped Reset Tester Reset Ana+Gen
Rx - Mode Start Channel Stop 0 ÷	Received Packets			
Tester Setup - Continous Wave (Tx - Continuous Wave Start Stop Channel 0 ÷	Tx - Set Attenuation Attenuation [dB] Set 0 : Stop	Channel		
Tester RF Input Power Input level [dBm] Read Monitor RX Mode must be active	Tester Analyzer Mode RX - Frequency Offset Get Last Offset [Hz] Reset 0 Monitor RX Mode must be active			
				,
nfo	Status DU	: HCI 0x84DD20C5	03AA 🥥 Generat	tor & Analyzer: 🕥 Tester:

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.

Packet Error Rate	Tester Status: Stopped			
Tx - Mode Start Channel Stop 0 ÷	Set "No of packets" = 0 for continuous transmis Gen. Power [dBm] Payload Length Payload Type -40 ÷ 25 ÷ ALTBITS_10101010	No. of Packets	Reset RF Mode	Reset Tester Reset Ana+Gen
Rx - Mode Start Channel	Received Packets			
Start Channel Stop 0 ÷	Tx - Set Attenuation Rx - C Set 0 ÷ St St	ontinuous Wave		
aster RF Input Power Input level [dBm] Read Monitor X Mode must be active	Tester Analyzer Mode RX - Frequency Offset Get Last Offset [Hz] Reset 0 Monitor RX Mode must be active			

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.

The Marke	Rate						Tester Statu	s: Stopped	
Start Stop	Channel	Gen. Power [dBm]	Set "No of packets" = 0] Payload Length \div 25 \div	for continuous t Payload Type ALTBITS_1(transmission e 0101010 <u>–</u>	No. of Packets	Reset RF Mode	Reset Tester Reset Ana+Gen	
Rx - Mode Start Stop	Channel	Received Packets							
ester Setup Tx - Continuo Start Stop	Continous Wave us Wave Channel	: (CW)	Tx - Set Attenuation	nuation [dB]	Rx - Continuou Start Stop	Us Wave Channel			
ester RF Inp Input level [dl Read Monitor	Jt Power 3m]	RX Hode must	zer Mode cy Offset Last Offset [Hz]						

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.

Tester Status: Tx Burst mode				
Reset RF Mode	Reset Tester			
	Reset Ana+Gen			

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.

Tester Setup - Burst Mode Packet Error Rate			Tester Status: Tx Burst mode
Tx - Mode Start Stop	Set "No of packets" = 0 for continuous transmission Gen. Power [dBm] Payload Length -40 25 ALTBITS_10101010	No. of Packets	Reset RF Mode Reset Tester Reset Ana+Gen
Rx - Mode Start Channel Stop 0	Received Packets		
Tester Setup - Continuous Wave Tx - Continuous Wave Start Channel Stop	(CW) Tx - Set Attenuation Attenuation [dB] Set 0 ÷ Stop	Channel	
Tester RF Input Power	Tester Analyzer Mode RX - Frequency Offset		
Input level [dBm] Read Monitor RX Mode must be active	Get Last Offset [Hz] Reset Monitor		

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.

X2254 Bluetooth RF Tester (V0211)		
Main DUT Tester System	Measure Logs Settings Configuration	
Tester Setup - Burst Mode Packet Error Rate Tx - Mode Start Channel	Set "No of packets" = 0 for continuous transmission No. of Packets Tester Status: Rx Burst model Gen. Power [dBm] Payload Length Payload Type Payload Type -40 ÷ 25 ÷ ALTBITS_1010101 v Packets Sent	de
Rx - Mode Start Channel	Received Packets	
Tester Setup - Continous Wave (cw)	
Tx - Continuous Wave Start Channel Stop 0 ÷	Tx - Set Attenuation Rx - Continuous Wave Attenuation [dB] Start 0 ÷ Stop	
Tester RF Input Power	Tester Analyzer Mode	
Read	Get Last Offset [Hz]	
RX Mode must be active	Monitor BX Mode must be active	
		Þ
fo	Status DUT: HCI 0x84DD20C503AA 🍳 Generator & Analyzer: 🍳	Tester:

"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.

RTX2254 Bluetooth RF Tester (V0211)		
Main DUT Tester System Mea:	ure Logs Settings Configuration	<u> </u>
Tester Setup - Burst Mode Packet Error Rate Tx - Mode Start O ± Rx - Mode Start Channel Rx - Mode	Set "No of packets" = 0 for continuous transmission Power [dBm] Payload Length Payload Type -40 \div 25 \div ALTBITS_1010101 \checkmark Packets Sent 1500 ved Packets	Tester Status: Stopped Reset RF Mode Reset Tester Reset Ana+Gen
Stop 0 ± Tester Setup - Continuous Wave Tx - Continuous Wave Start Channel Stop 0 ±	6219 Tx - Set Attenuation Set 0 \div Stop 0 \div	
Tester RF Input Power Input level [dBm] Read Monitor RX Mode must be active	Ster Analyzer Mode X - Frequency Offset Get Last Offset [Hz] Reset Monitor Mode must be active	
د Info	Status DUT: HCI 0x84DD	20C503AA 🔍 Generator & Analyzer: 🍳 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.

System Option License			
Tester Serial no.	0013		
Enter License	1-SPTE7QR2		
	Set		

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:]:

irmware Update					
Tester Board					
Firmware file:	No newer firmware file found: V0175	Check			
Firmware board:	e board: Current firmware: V0175				
	Start Update Application:	Update			
How to:	-				
1) Click 'Update' to	o start firmware update				
2) Make sure that	the Portserver is started (Tester status be	low is green)			
3) Wait for firmwa	re to download				
- the progress %	6 will be incrementing. Wait for 100% to co	omplete			
Analyzer Board					
Firmware files	5 5 5 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				
rinnware nie.	No newer firmware file found: V0274	Check			
Firmware board:	Current firmware: V0274				
	Start Update Application:	Update			
How to:	-				
 Click 'Update' to start firmware update Wait for firmware applications to start 					
 Click "Port Settings" and setup the COM-port for the 'Analyzer' Select Baud=57600, Flow=None, Parity=None, Stop Bits=One and Data Bits=8 					
 Click "Select File" and select the new firmware file E.g. Firmware file: "RTX_BTLE_Analyzer_V<version no.="">.bin</version> 					
4) Click "Erase Im	age" and then "Load Image"				
5) Wait for firmwa	re to download and click `OK'				
6) Exit RTX BTLE S	Gerial Bootloader				

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.

RTX2254 Bluetooth RF Tester (V0211)
Main DUT Tester System Measure Logs Settings Configuration
Measurement results
30.08.2019 20:17:49:584 DUT configuration set and stored
30.08.2019 20:17:50:590 Opening new DUT port
30.08.2019 20:17:51:747 DUT COM port 22 opened
30.08.2019 20:17:51:771 Found DUT with HCI interface, Bluetooth address: 0x84DD20C503AA
30.08.2019 20:17:55:543 No change in DUT configuration
30.08.2019 20:17:57:270 Test setup cleared
30.08.2019 20:17:57:279 Test started by user - click Pause to stop
30.08.2019 20:17:57:280 Testing DUT, Direct Test Mode with HCI protocol, Bluetooth address: 0x84DD20C503AA
30.08.2019 20:17:57:280 Running
30.08.2019 20:17:59:803 Test no. 1/1 ; Time: 2519.06 ms ; Limit Err.: 0 ; Time Out Err.: 0 ; Ch: 0 ; Dut Offset: 10233 Hz ; 4.26 ppm ; Dut Power: -0.0 dBm ; PER: 0.00 % ; Ok 500 ; Err 0
30.08.2019 20:18:02:326 Test no. 1/1 ; Time: 2520.52 ms ; Limit Err.: 0 ; Time Out Err.: 0 ; Ch: 19 ; Dut Offset: 9657 Hz ; 4.02 ppm ; Dut Power: -0.7 dBm ; PER: 0.00 % ; Ok 500 ; Err 0
30.08.2019 20:18:04:848 Test no. 1/1; Time: 2521.52 ms; Limit Err.: 0; Time Out Err.: 0; Ch: 39; Dut Offset: 10293 Hz; 4.25 ppm; Dut Power: -1.5 dBm; PER: 0.00 %; Ok 500; Err 0
30.08.2019 20:18:04:850 Test PASSED
Info Status DUT: HCI 0x84DD20C503AA O Generator & Analyzer: O Tester: O

Please note that:

The DUT Bluetooth address is written to log file when [Start] is clicked.



Log file example:

📄 Lister - (cl/Users/WII Users/RT/2254_Llog/RT/2254_Llog_Date_30-8-2019_Time_201738.log]	
File Edit Options Encoding Help	100 %
RTX2254 Bluetooth RF Tester build date: Tue Aug 27 13:26:40 2019	
System sleep periode 1 ms	
Log file for saving measurement data.	
38.08.2019 20:17:38:989 Log opened	
30.08.2019 20:17:39:001 No change in DUT configuration	
30. UB.2019 2017/2012084 Tester interface COM ports opened	
30.08.2019 2017/140:065 lester interface communication opened	
38 08 2010 2017-2015 661 Recent runnent III Fond junzation	
38,08,2019 20:17:45:861 Reset current DUT configuration	
30.08.2019 20:17:49:584 DUT configuration set and stored	
30.08.2019 20:17:50:590 Opening new DUT port	
30.08.2019 20:17:51:747 DUT COM port 22 opened	
30.08.2019 20:17:51:771 Found DUT with HCl interface, Bluetooth address: 0x840D20C503AA	
30.00.2019 20:17:55:54 NO CHANGE IN DOT CONTINUEALUN 20.00.2010 20:47:72:201 Total cature claused	
38. 88. 2019 20:17:57:270 Tost started hu user - click Pause to ston	
39.08.2019 20:17:57:280 Testing DUT, Direct Test Mode with HCI protocol. Bluetooth address: 0x84DD200503AA	
30.08.2019 20:17:57:280 Running	
30.08.2019 20:17:59:803 Test no. 1/1 ; Time: 2519.06 ms ; Limit Err.: 0 ; Time Out Err.: 0 ; Ch: 0 ; Dut Offset: 10233 Hz ; 4.26 ppm ; Dut Power: -0.0 dBm ; PER: 0.00 % ; Ok	500 ; Err
30.08.2019 20:18:02:326 Test no. 1/1 ; Time: 2520.52 ms ; Limit Err.: 0 ; Time Out Err.: 0 ; Ch: 19 ; Dut Offset: 9657 Hz ; 4.02 ppm ; Dut Power: -0.7 dBm ; PER: 0.00 % ; Ok	500 ; Err
30.08.2019 20:18:04:848 Test no. 1/1; Time: 2521.52 ms; Limit Err.: 0; Time Out Err.: 0; Ch: 39; Dut Offset: 10293 Hz; 4.25 ppm; Dut Power: -1.5 dBm; PER: 0.00 %; Ok	500 ; Err
30.00.2017 20:18:04:050 ISPL LH22ED	
	F

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>.

👍 De	vice Manager
File	Action View Help
(= =	» 🖬 📓 🖬 🦓
4.4	IT-02529
Þ	👰 Computer
j j	👝 Disk drives
Þ	📲 Display adapters
Þ	DVD/CD-ROM drives
j j	🕼 Human Interface Devices
j j	IDE ATA/ATAPI controllers
Þ	📲 Jungo Connectivity
Þ	- Keyboards
Þ	Mice and other pointing devices
Þ	- Monitors
Þ	National Instruments GPIB Interfaces
Þ	- 👰 Network adapters
- 4	- Ports (COM & LPT)
	🐨 RTX BLE Analyzer (COM12)
	🖤 RTX BLE Tester (COM10)
	TI CC2540 USB CDC Serial Port (COM22)

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.

			DUT Interface		
	Select System COM Ports:	Save	DUT Port Selected	0x84DD20C503AA	
Set Tester=255 to use default from portserver	Generator	Analyzer Auto open	UART Interface DUT 0 COM Port		
			DUT 1 COM Det	115200 V HW Flow Control 20 Save	
Interface			DUT I COM POR	115200 V IV HW Flow Control 21 - Save	
	Οp		USB Interface		
Tester instance			DUT 0 COM Port		
Info				115200 V HW Flow Control 22 Save	
Inst. name	R	TX2254 Bluetooth RF Tester	DUT 1 COM Port		
Inst. number		RTX2254PortServer		115200 V HW Flow Control 23 - Save	
			Interface		
			The DUT port opened is in DUT configuration in I	the one selected Open Close	



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).

RTX EAI Port Server Configuration	RTX EAI Port Server Configuration
General UART Socket USB HID Port Stop bits CDM# 10 C 1 stop bit Speed (bps) 115200 C 2 stop bits RTS input flow control Parity C None C Manual (RTS High) C 0dd C Veen Output flow control C Even 1000	General UART Socket USB HID Transport Layer UART USB (Using RTX UniUsb driver) USB (Using RTX FlexUsb Driver) USB HID REPS Client (PC Simulation) Loopback Socket Disabled
□ Packet based No Of Retrans. 4 Image: Construction Image: Construction □ Default <u>D</u> K <u>C</u> ancel	BIX2254PortServer Stop Server Log Options

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.

Main DUT Tester System Measure Logs Settings Configuration	^
Main DUT Tester System Measure Logs Settings Tester Hode Tester Operation Mode Direct Test Mode DUT Configuration Tester Operation Mode Save DUT Configuration Test results Limits Test results must be within these limits to be valid. DUT 1 cable loss (dBm) 1.00 ⁺ . DUT Frequency Offset (ppm) 40.00 ⁺ . 40.00 ⁺ . DUT Communication Protocol HCL • DUT Tx Output Power (dBm) 20.00 ⁺ . 10.0 ⁺ . Save Advertising Mode DUT advertising packet interval [ma] 100 ⁺ . Save DUT cable loss (dBm) 1.00 ⁺ . DUT advertising packet interval [ma] 100 ⁺ . Save DUT cable loss (dBm) 1.00 ⁺ . DUT advertising packet interval [ma] 100 ⁺ . Save DUT advertising packet scan interval [ma] 1.00 ⁺ . DUT min. power level (dBm) 1.00 ⁺ . Save Save Save Save DUT advertising packet interval [ma] 1.00 ⁺ . 1.00 ⁺ . Save Save Save	
	•
Info Status DUT: HCI 0x84DD20C503AA Q Generator & Analyzer: Q Tester	: •

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 655	535 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:

Main DUT Tester System Measure Log	js Settings	Configuration
Tester Mode Tester Operation Mode Direct T Test Results Limits Test results must be within these limits to be valid. Min DUT Frequency Offset [ppm]	est Mode Save Max 40.00 ÷	DUT Configuration Direct Test Mode DUT cable loss settings (positive number) DUT 0 cable loss [dBm] 1.00 $\stackrel{\cdot}{\cdot}$ DUT 1 cable loss [dBm] 1.00 $\stackrel{\cdot}{\cdot}$ Options: DUT Communication Protocol
DUT Tx Output Power [dBm] -20.00 ÷ PER - Packet Error Rate [%] 30.70 ÷ DUT advertising packet interval [ms]		Save Advertising Mode DUT cable loss settings (positive number)
	Save	DUT 0 cable loss [dBm] 1.00 ÷ DUT 1 cable loss [dBm] 1.00 ÷
		Filter Options: DUT advertising packet scan interval [ms] 110 \div DUT min. power level [dBm] -127 \div Enable DUT White Listing Select DUT address type Public Device Address Faure



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.

Measure Mode DTM Burst Select RF Physical Cha RF Channel 1	Test - Packet Parameters of Packets Payload Length 500 ÷ 25 ÷ nnels RF Channel 2	ALTBITS_10101010 Channel Mapping: Phy LL MI Phy 2 Phy 2 P	Gen. Power [dBm]	DUT Port Se DUT OUTO RF Se DUTO USB Select	election lect Save Click "Save" to store setup
	V 19 ÷ V 3	9 \div Ch. 1 (0) = 24 Ch. 19 (17) = 24 Ch. 39 (39) = 24	40 BT Ad	。 dress: 0x84DD20C50	3AA - [ms]
elect Tests to Run	DUT Tx Tests			DUT Rx Tests	
DUT Frequency Offs RF Channel 1 Frequency Offset [Hz]	RF Channel 2	RF Channel 3	RF Channel 1 Error Rate - Measured at Ge	RF Channel 2 n. Power [dBm]) RF Channel 3
- H	z - Hz	- Hz	- %	- %	- %
Frequency Offset [ppm]			OK Count		
- ppr	n - ppm	- ppm	-	-	-
UT Tx Output Pow	er		Error Count		
🜙 – dBr	n – dBm	- dBm		-	-
			Rx Sensitivity Test		
			Gen. Power Level [dBm] -4	1	
			- dBm	- dBm	- dBm
est Result		Star	t test		
est Run					
	t No. Current Channel		Test Limit Errors Offset 0	Ch. Test Time [r	ns]
Start Loop Tes	1 📩 0 Ch.	Cable Loss Test Comple	Tx Pwr 0 Tin	ne Out Errors Last 0.	00 Total Test Time [s]
Start Loop Tes	v [ms] 2402 ····	1.00		U Avg. U.	0.000



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.

tup						
leasure Mode	t - Packet Parameters	Payload Type	Gan Power [dBm]	Open Interface DL	IT Port Selection	n Settings
DTM Burst		ALTBITS 10101010			UT0 RF Select	Save
					UTO USB	Click "Save" to store setup
elect RF Physical Channe RF Channel 1 RF Ch	annel 2 RF Channel 3	Channel Mapping: Phy LL MH	z	5	Select	
✓ 0 ÷	19 - 39	Ch. 0 $(37) = 240$ Ch. 1 $(0) = 240$	02 04 DUT 1	Info		
		Ch. 19 (17) = 244 Ch. 39 (39) = 248	BT	Address: 0x84DE	020C503AA	- [ms]
ect Tests to Run	DUIT Ty Tests			DIIT Dy Tests		
DUT Frequency Offset			V PER - Packet Error R	ate (DTM burst/ADV M	ode Only)	
RF Channel 1	RF Channel 2	RF Channel 3	RF Channel 1	RF Channel 2	RF Ch	annel 3
Frequency Offset [Hz]			Error Rate - Measured at	Gen. Power [dBm] -	0/	0/
- HZ	- HZ	- HZ	- %	- '	70	- %
Frequency Offset [ppm]			OK Count			
- ppm	- ppm	- ppm	-	-	-	-
			Error Count			
DUT Tx Output Power	dRm	dRm				
- abiii	- abiii	- ubiii			-	
			Rx Sensitivity Test Gen. Power Level [dBm]	-41		
			- dBm		m	dBm
			- ubii	- ub		- ubiii
st Result		Star	t test			
st Run						
	Test Status		Test Limit Errors	ch T	et Time [ms]	
Start Loop Test No		Cable Loss Test Complet	Offset 0	Time Out Errors	0.00 T	otal Test Time [s]
Start Loop Test No	2402 uu	1.00	Tx Pwr 0	0 Ava.	0.00	0.000
Start Loop Test No	S 2402 MH7		PER 0			
Start Loop Test No Stop 1 $\frac{1}{2}$ Test Delay [m 0 $\frac{1}{2}$	DUT packet interval co	nfiguration setting [ms]	1 Pkt. Int. 0			



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:

RTX2254 Bluetooth RF Tester (V0211)	
Main DUT Tester System Measure Logs Settings Configuration	<u>×</u>
Setup PER Test - Packet Parameters Measure Mode No. of Packets DTM Burst • Payload Length Solot 25 ÷ ALTBITS_1010101 Select RF Physical Channels RF Channel 3 RF Channel 1 RF Channel 2 Image: Parameters Channel Mapping: Phy LL MHz Ch. 0 (37) = 240 Ch. 1 (0) = 240	Gen. Power [dBm] -41 - DUT Port Selection Settings DUT O RF Select Save DUTO USB Click "Save" to Select Select DUTO USB Store setup
Select Tests to Run DUT Tx Tests DUT Tereguency Offset	DUT Rx Tests
RF Channel 1 RF Channel 2 RF Channel 3 Frequency Offset [Hz] 10209 Hz 10312 Hz 10492 Hz	RF Channel 1 RF Channel 2 RF Channel 3 Error Rate - Measured at Gen. Power [dBm] -41 0.00 % 0.00 % 0.00 %
Frequency Offset [ppm]	OK Count
Image: Second	Error Count
-U.U aBmU.6 aBm1.5 aBm	Rx Sensitivity Test Gen. Power Level [dBm] -41
	- dBm - dBm - dBm
Test Result	ASSED
Test Run	
Start Loop Test No. Stop 1 ÷ Test Delay [ms] 0 ch. Cable Loss Test Complet 2402 MHz 1.00 DUT packet interval configuration setting [ms]	Test Limit Errors Ch. Test Time [ms] Offset 0 Tx Pwr 0 PER 0 1 Pkt. Int.
Info Click 'Start' to restart test run.	Status DUT: HCI 0x84DD20C503AA O Generator & Analyzer: O Tester: O

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:

No. of Pac	Packet Parameters kets Payload Length	Payload Type	Gen. Power [dBm]	Open Interface	DUT Port Selection	Settings
DTM Burst 500	÷ 25÷	ALTBITS_10101010 •	-41 ÷	Reset DUT		Click "Save" to
RF Channel 1 RF Channel 1 RF Channel 1 RF Chan	RF Channel	Channel Mapping: Phy LL MHz Ch. 0 (37) = 2402 9 - Ch. 1 (0) = 2404 Ch. 39 (39) = 2480	DU BT	Info Address: 0x8	4DD20C503AA	- [ms]
elect Tests to Run D	UT Tx Tests			DUT Rx Te	sts	
DUT Frequency Offset RF Channel 1 Frequency Offset [Hz]	RF Channel 2	RF Channel 3	PER - Packet Error RF Channel 1 Error Rate - Measured	Rate (DTM burst/A RF Channel at Gen. Power [dBm]	DV Mode Only) 2 RF Cha -41	nnel 3
Frequency Offset [ppm]	4.05 ppm	4.29 ppm	OK Count	0	500	500
🖉 DUT Tx Output Power			Error Count			
-26.7 dBm	-29.2 dBm	-26.0 dBm	Rx Sensitivity Te	O st	0	0
			Gen. Power Level [dBm	J -41	dDaa	
			- dBı	n -	авт	- dBm
			- dBı	n -	авт	- dBm
est Result		Test F/	- dBr	n -	abm	- dBm
est Result est Run	Test Status	Test F/	- dBr	n -	abm	- dBm
est Result est Run Start Loop Test No.	Test Status Current Channel 0 ch.	Cable Loss Test Completed	- dBr	n –	Ch. Test Time [ms] Last 2520.17 To	- dBm
est Result est Run Start Loop Test No. Stop 1 ± Test Delay [ms] 0 ±	Test Status Current Channel 0 Ch. 2402 MHz DUT packet interval co	Cable Loss 1.00	- dBr	Time Out Errors	Ch. Test Time [ms] Last 2520.17 Avg. 2526.51	- dBm tal Test Time [s] 7.580

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:

Tester Mode		DUT Configuration	
Tester Operation Mode	Advertising -	Direct Test Mode	
rester operation mode		DUT cable loss settings (positive num	ber)
	Save	DUT 0 cable loss [dBm]	1.00 🛨
		DUT 1 cable loss [dBm]	1.00 -
Test Results Limits		Ontions:	
Test results must be within these limit	s to be valid. Min Max	options.	
DUT Frequency Offset [ppm]	-40.00 ÷ 40.00 ÷	DUT Communication Protocol	HCI 🔻
DUT Tx Output Power [dBm]	-20.00 🛨 10.00 🛨		
PER - Packet Error Rate [%]	30.70 ÷		Save
DUT advertising packet interval [ms]	110 ÷	Advertising Mode	
	Save	DUT cable loss settings (positive num	ber)
	Juit	DUT 0 cable loss [dBm]	1.00 ÷
		DUT 1 cable loss [dBm]	1.00 ÷
		Filter Options:	
		DUT advertising packet scan interval [ms]	110 主
		DUT min. power level [dBm]	-127 📩
		Enable DUT White Listing	
		Select DUT address type Dublic Device	I



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.



	Meddare Logs octaings	Configuration			
Measure Mode Adv Burst	est - Packet Parameters	Payload Type SCAN_RESPONSE	Gen. Power [dBm]	DUT Port Sele	Click "Save" to
Select RF Physical Char RF Channel 1 RF Channel 1	nels Channel 2 RF Channel	3 3 39 ↔ Channel Mapping: Phy LL MH Ch. 0 (37) = 240 Ch. 12 (38) = 242 Ch. 39 (39) = 248	Z 22 6 0 BT Address	s: 0x84DD20C503	AA 106 [ms]
Select Tests to Run	DUT Tx Tests		DUT	Rx Tests	
DUT Frequency Offse RF Channel 1 Frequency Offset [Hz]	RF Channel 2	RF Channel 3	PER - Packet Error Rate (DTM RF Channel 1 RF Error Rate - Measured at Gen. Powe	burst/ADV Mode Only) Channel 2 Ri er [dBm] -	Channel 3
- H2	· Hz	- Hz	- %	- %	- %
Frequency Offset [ppm]			OK Count		
- ppm	- ppm	- ppm		-	-
DUT Tx Output Powe	r		Error Count		
- dBm	- dBm	- dBm	-	-	-
			Rx Sensitivity Test		
			Gen. Power Level [dBm] -41		
			- aBm	- aBm	- aBm
			Average packet interval		
			-	-	-
est Result					
		Star	t test		
est Run					
Start Loop Test	No. Current Channel	Cable Loss Test Complet	Test Limit Errors Offset 0 Tx Pwr 0 Time Out E	Ch. Test Time [ms]	Total Test Time [s]
Test Delay	[ms] 2402 MHz	1.00 (PER 0	0 Avg. 0.00	0.000



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.

tun					
Adv Burst V	- Packet Parameters ackets 0 :	Payload Type SCAN_RESPONSE	Gen. Power [dBm] ▼ -41 ÷ Reset	DUT Port Select	Click "Save" to
Select RF Physical Channel: RF Channel 1 W 0	RF Channel 3	Channel Mapping: Phy LL MHz Ch. 0 (37) = 240 Ch. 12 (38) = 242 Ch. 39 (39) = 248	2 2 6 0 BT Addres	Select s: 0x84DD20C503/	store setup
elect Tests to Run	OUT Tx Tests		DUT	Rx Tests	
DUT Frequency Offset RF Channel 1 Frequency Offset [Hz]	RF Channel 2	RF Channel 3	PER - Packet Error Rate (DTM RF Channel 1 RF Error Rate - Measured at Gen. Pow	burst/ADV Mode Only) Channel 2 RF er [dBm] -	Channel 3
- Hz	- Hz	- Hz	- %	- %	- %
Frequency Offset [ppm]			OK Count		
- ppm	- ppm	- ppm	-	-	-
DUT Tx Output Power			Error Count		
- dBm	- dBm	- dBm	-	-	-
			Rx Sensitivity Test		
			Gen. Power Level [dBm] -41	dBm	dPm
			- abm	- abm	- abm
			Average packet interval		
			-	-	-
est Result					
		Star	t test		
st Run					
Start Loop Test No.	Current Channel		Test Limit Errors Offset 0	Ch. Test Time [ms]	
Stop 1	0 Ch.	Cable Loss Test Complete	ed Tx Pwr 0 Time Out	Errors Last 0.00	Total Test Time [s]
Test Delay [ms	DUT packet interval co	1.00 0	PER 0	0 Avg. 0.00	0.000



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.

n lester System Me	easure Logs Settings	Configuration				
etup Measure Mode Adv Burst 1 Select RF Physical Channel	acket Parameters ackets 0 ÷	Payload Type SCAN_RESPONSE Channel Mapping	Gen. Power [dBm]	Open Interface Image: Open Interface	DUT Port Selection	Save Click "Save" to store setup
RF Channel 1 RF Ch	annel 2 RF Channel	B 3 Phy LL M Ch. 0 (37) = 2 (37) = 2 (38) = 2 Ch. 39 (39) = 2 (39) = 2 (39) = 2	1Hz 402 426 480	OUT Info BT Address: 0x8	34DD20C503AA	106 [ms]
elect Tests to Run	OUT Tx Tests		Ĺ	DUT Rx Te	sts)
DUT Frequency Offset RF Channel 1 Frequency Offset [Hz]	RF Channel 2	RF Channel 3	PER - Packet Err RF Channel 1 Error Rate - Measur	or Rate (DTM burst/A RF Channel ed at Gen. Power [dBm]	DV Mode Only) 2 RF Ch -41	annel 3
10383 Hz Frequency Offset [ppm]	10148 Hz	10689 Hz	OK Count	%	00 %	0.00 %
4.32 ppm	4.22 ppm	4.45 ppm		10	10	10
DUIT To Output Down			Error Count			
-0.4 dBm	0.1 dBm	-0.5 dBm		0	0	0
-0.4 dBm	0.1 dBm	-0.5 dBm	. Rx Sensitivity Gen. Power Level [d	0 Test Bm] -41	0	0
-0.4 dBm	0.1 dBm	-0.5 dBm	Rx Sensitivity Gen. Power Level [d - d]	0 Test Bm] -41 Bm -	dBm	0 - dBm
-0.4 dBm	0.1 dBm	-0.5 dBm	Rx Sensitivity Gen. Power Level [d - d Average packet inte	0 Test Bm] -41 Bm - rval ms 10	dBm	0 - dBm 101 ms
est Result	0.1 dBm	-0.5 dBm	Rx Sensitivity Gen. Power Level [d - d] Average packet inte	0 Test Bm] -41 Bm - rval ms 10	dBm	0 - dBm 101 ms
est Result	0.1 dBm	-0.5 dBm Test I	Rx Sensitivity Gen. Power Level [d - d] Average packet inte 99	0 Test Bm] -41 Bm - rval ms 10	dBm	0 - dBm 101 ms
est Result	0.1 dBm	-0.5 dBm Test I	Rx Sensitivity Gen. Power Level [d - d] Average packet inte 99 PASSED	0 Test Bm] -41 Bm - rval ms 10	dBm	0 - dBm 101 ms
est Result est Run Loop Test No.	O.1 dBm	-0.5 dBm Test I	Rx Sensitivity Gen. Power Level [d - d] Average packet inte 99 PASSED	0 Test Bm] -41 Bm - rval ms 10	0 dBm 0 ms Ch. Test Time [ms]	0 - dBm 101 ms
est Result est Run Start Loop Test No. 1	O.1 dBm	-0.5 dBm	Rx Sensitivity Gen. Power Level [d Average packet inte 99 PASSED	O Test Bm] -41 Bm - rval ms 10 Time Out Errors	0 ms	- dBm 101 ms
est Result est Run Start Stop Test Delay [m	O.1 dBm Test Status Current Channel 0 ch. 2402 MHz DUT packet interval o	-0.5 dBm Test I Cable Loss Test Compl 1.00 Configuration setting [ms]	PASSED Test Limit Errors Offset Tx Pwr PER C IN PKt. Int. C R R Sensitivity Gen. Power Level [d Average packet inte 99	O Test Bm] -41 Bm - rval ms 10 Time Out Errors 0	0 ms	- dBm 101 ms
est Result Start Loop Test No. Stop 1 1 Test Delay [ma 0 1 1	O.1 dBm Test Status Current Channel O Ch. 2402 MHz DUT packet interval of	-0.5 dBm Test I Cable Loss 1.00 Cable Loss Test Compl 1.00	Test Limit Errors Offset 0 110 Pkt. Int. 0	O Test Bm] -41 Bm - rval ms 10 j Time Out Errors j 0	0 ms	- dBm 101 ms

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:

Measure Mode	Dacket Dagameters			Open Interface Dur	
Adv Burst	skets	Payload Type SCAN_RESPONSE	Gen. Power [dBm]	DUT DUT Reset DUT Sel	Port Selection Settings D RF Select Click "Save" to store setup
RF Channel 1 RF Channel 1 RF Channel 1 RF Channel 1 RF Channel 1 RF Channel 1	RF Channel 3	Channel Mapping: Phy LL MH: Ch. 0 (37) = 240 Ch. 12 (38) = 242 Ch. 39 (39) = 248	2 6 0 BT	^{info} Address: 0x84DD2	0C503AA 106 [ms]
Select Tests to Run D	UT Tx Tests			DUT Rx Tests	
DUT Frequency Offset RF Channel 1 Frequency Offset [Hz]	RF Channel 2	RF Channel 3	PER - Packet Error R RF Channel 1 Error Rate - Measured at	ate (DTM burst/ADV Mode RF Channel 2 Gen. Power [dBm] -41	e Only) RF Channel 3
10113 Hz	10463 Hz	12856 Hz	0.00 %	0.00 %	0.00 %
Frequency Offset [ppm]	4.36 ppm	5.35 ppm	OK Count	10	10
DUT Tx Output Power			Error Count		
-27.7 dBm	-30.0 dBm	-27.4 dBm			0
			Gen. Power Level [dBm]	-41	
			- dBm	- dBm	
			abii	u Di	n - aBm
			Average packet interval	104 ms	s 104 ms
rest Result			Average packet interval	104 m	1 - dBm
rest Result		Test F	Average packet interval	104 m	1 - dBm
fest Result Fest Run	Tant Chaine	Test F	Average packet interval	104 m	104 ms
Test Result Test Run Start Loop Test No.	Test Status Current Channel 0 Ch.	Test F	Average packet interval 104 ms AVERAGE AVERAG	104 ms	Time [ms] 6811.97 Total Test Time [s]
Test Run Start Loop Test No. Stop 1 ÷ Test Delay [ms] 0 ÷	Test Status Current Channel 0 Ch. 2402 MHz DUT packet interval co	Cable Loss 1.00 Test Comple	Average packet interval 104 ms AILED Test Limit Errors Offset 0 Tx Pwr 3 PER 0 Pkt. Int. 0	104 ms 104 ms Ch. Test Last 0 Avg.	Time [ms] 6811.97 6728.43 20.185

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.

··· RTX2254 Bluetooth RF Tester (V0211)	
Main DUT Tester System Measure Logs Settings Configuration DUT RF Setup	
Tx - Mode Start Channel Payload Length Payload Type Ston 0 \div 25 \div ALTBITS_10101010 V	DUT Status: Tx Burst mode Reset RF Mode Reset DUT DUT Port Selection
Rx - Mode Start Channel Received Packets Stop 0	DUTO RF Select DUTO USB Select
	_
Info Status DUT: HCI 0x84DD20C5	J3AA 🔍 Generator & Analyzer: 🔍 Tester: 🔍



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.

RTX2254 Bluetooth RF Tester (V0211)	
Main DUT Tester System Measure Logs Settings Configuration	
Packet Error Rate	Tester Status: Rx Burst mode
Tx - Mode	No. of Packets RF Mode Reset Tester
Channel Gen. Power [dBm] Pavload Length Pavload Type	Reset Ana+Gen
Start 0 ÷ -40 ÷ 25 ÷ ALTBITS 10	Packets Sent
Stop	
Rx - Mode	
Start Channel Received Packets	
Tester Setup - Continous Wave (CW)	
Tx - Continuous Wave Tx - Set Attenuation	Rx - Continuous Wave
	Зтор
Tester RF Input Power Tester Analyzer Mode	
Input level [dBm] Get Last Offset [Hz]	
V Monitor	
RX Mode must be active	
RX Mode must be active	
nfo	Status DUT: HCI 0x84DD20C503AA 🕥 Generator & Analyzer: 🚨 Tester

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.

Adv Burst	t - Packet Parameters ackets	Payload Type	Gen. Power [dBm]	DUT DUTO RF	Selection Select v Click "Save" to
Select RF Physical Channel RF Channel 1 RF Ch I	s annel 2 12 🔆 RF Channel	Channel Mapping: Phy LL MHz Ch. 0 (37) = 2402 Ch. 12 (38) = 2426 Ch. 39 (39) = 2480	DUT Inf	o dress: 0x84DD20C	503AA 103 [ms]
elect Tests to Run	DUT Tx Tests			DUT Rx Tests	
DUT Frequency Offset RF Channel 1	RF Channel 2	RF Channel 3	PER - Packet Error Rate RF Channel 1	CDTM burst/ADV Mode On RF Channel 2	RF Channel 3
- Hz	- Hz	- Hz	- %	- %	- %
Frequency Offset [ppm]			OK Count		
- ppm	- ppm	- ppm	-	-	-
DUT Tx Output Power			Error Count		
- dBm	- aBm	- aBm	-	-	-
			Gen. Power Level [dBm] -7	0	
			- dBm	- dBm	- dBm
			Average packet interval		
			-	-	-
est Result					
		Start	test		
est Run					
Start Loop Test No.	Test Status		Test Limit Errors	Ch. Test Time	• [ms]
Stop 1	0 Ch.	Cable Loss Test Complete	offset 0 Tx Pwr 0 Tim	e Out Errors Last	0.00 Total Test Time [s]
Test Delay [m	s] 2402 _{MHz}	1.00 0	PER 0	0 Avg.	0.00 0.000
0 ÷	DUT packet interval c	onfiguration setting [ms]	10 Pkt. Int. 0		



Test result using Advertising Mode.

	Measure Logs Settings	Configuration				
ietup PER Te Measure Mode No. of Adv Burst ▼ Select RF Physical Channel RF Channel 1 RF C	st - Packet Parameters Packets 10 ÷ bhannel 2 RF Channe	Payload Type SCAN_RESPONSE Channel Mapping: Phy LL MHz Ch. 0 (37) = 2402	Gen. Power [dBm]	Open Interface U DUT Reset DUT	DUT Port Selection DUT0 RF Select Select	Save Click "Save" to store setup
		Ch. 12 (38) = 2426 Ch. 39 (39) = 2480	B	T Address: 0x8	4DD20C503AA	103 [ms]
Select Tests to Run	DUT Tx Tests			DUT Rx Te	sts	
DUT Frequency Offset	b o r i n r co co		PER - Packet Erro	r Rate (DTM burst/Al	DV Mode Only)	
RF Channel 1	RF Channel 2	RF Channel 3	RF Channel 1	RF Channel	2 RF Char	nel 3
Frequency Offset [Hz]			Error Rate - Measured	d at Gen. Power [dBm]	-90	
12143 Hz	10346 Hz	8346 Hz	20.00	10.0	0 %	.00 %
Frequency Offset [ppm]			OK Count			
5 06 ppm	/ 21 nnm	2 47 ppm		•	0	10
	- HOL PPIN			•		
DUT Tx Output Power			Error Count			
-0 4 dBm	0 1 dBm	-0 7 dBm		2	1	0
		(Rx Sensitivity To	est		
			Gen. Power Lever [db	-90 - E		
			-92 dB	m -92	dBm9	<u>OdBm</u>
			Average packet interv	vai		
			98 m	ns 10	4 ms 1	02 ms
est Result		Test PA	SSED			
est Result						,
est kesuit						
est Run	Test Status					
est Run Start Loop Test N	D. Current Channel	1	Test Limit Errors	C	Ch. Test Time [ms]	
est Run Start Loop Test N	D. Test Status Current Channel	Cable Loss Test Completed	Test Limit Errors Offset 0	C Time Out Errors	Ch. Test Time [ms]	al Test Time [s]
est Run Start Loop Test N Stop 1 1	D. Current Channel 0 Ch. 1 2402 MHz	Cable Loss Test Completed	Test Limit Errors Offset 0 Tx Pwr 0	Time Out Errors	Ch. Test Time [ms] ast 62259.18 Tota	al Test Time [s] 178.518
est Run Start Loop Test N Stop 1 = Test Delay [0 =	Durrent Channel 0 Ch. 2402 MHz	Cable Loss Test Completed	Test Limit Errors Offset 0 Tx Pwr 0 PER 0 Pkt Int 0	Time Out Errors	Ch. Test Time [ms] ast 62259.18 Tota Avg. 59506.09	al Test Time [s] 178.518
est Run Start Loop Test N Stop 1 = Test Delay [0 =	D. Current Channel 0 Ch. 2402 MHz DUT packet interval	Cable Loss Test Completed 1.00 1 configuration setting [ms] 110	Test Limit Errors Offset 0 Tx Pwr 0 PER 0 Pkt. Int. 0	Time Out Errors	Ch. Test Time [ms] ast 62259.18 Tot: Avg. 59506.09	al Test Time [s] 178.518



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 UARTO 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.

1	2	34	5
p	0	0 C	0
L			₽
6	57	8	9

UART signals:	D-Sub 9 PIN
Тх	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

USB A

- 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
// RTX BLE Analyzer
// UART-0 COM port
// UART-1 COM port
// USB-0 COM port
// USB-1 COM port
// DUT uses Plu
                                                       // RTX BLE Generator
      rsuint16 ANALYZER_COM = 12;
      rsuint16 UART0 COM
                               = 20;
      rsuint16 UART1_COM
                              = 21;
     rsuint16 USB0_COM = 22;
      rsuint16 USB1_COM
                               = 23;
const rsbool DUT_HWExchange = TRUE;
                                                      // DUT uses HW
                                                            handshake
                                                     // Dut Baudrate
// Active DUT COM port
     int DUT_BAUD = 115200;
rsuint16 DUT_COM = UART0_COM
const int
                               = UART0_COM;
                                                        // TRUE if DUT communication
      rsbool DUT_Comm_Open = FALSE;
                                                            has been opened
                                                        // TRUE if TESTER
      rsbool TESTER_Comm_Open = FALSE;
```

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.

C:\Tmp\TestProj_TEST\TestProj_RTX2254_BT-D0211\Debug\TestProject.exe	
+	* III
:::=== T e s t P r o j e c t M E N U==::: :::=== T e s t P r o j e c t M E N U==::: :::=== T e s t P r o j e c t M E N U==::: :::=== T e s t P r o j e c t M E N U==::: :::=== T e s t P r o j e c t M E N U==::: :::=== T e s t P r o j e c t M E N U==::: :::=== T e s t P r o j e c t M E N U==::: :::=== T e s t P r o j e c t M E N U==::: ::::==	
	Ŧ

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		x
:::==Test Project MENU===:::		^
III ===	R cation cation cation cation	Ш
Port Server openon COM: 10. Status = OKOpen and init connection to TESTERon COM: 10. Status = OKWaiting 8000 ms for reset of Generator and Analyzer moduleOpen and check connection to GENERATORon COM: 11. Status = OKOpen and check connection to ANALYZERon COM: 11. Status = OKOpen and check connection to TESTER.Status = OKDUT Baudrate = 115200.Status = OKOpenconnection to DUTon COM: 22. Status = OKOpenconnection to DUTStatus = OKOpenconnection to DUTStatus = OKOpenconmunication to DUT.Status = OKOpening and checking communication toStatus = OKCompleded opening of communication toCOM: 22. Status = OK		
i:::===	R cation cation cation cation	
Analyzer current operation mode1=Direct Test Mode. Status = OK Status = OK Closing the connection to DUT. CloseStatus = OK Status = OK Status = OK OPENDUT Baudrate = 115200. Open Open Loop no:on COM: 22. Status = OK Status = OKOpen connection to DUT Open nc connection to DUT OPEN nc COM:on COM: 22. Status = OK Status = OK Status = OKOpen connection to DUT OPEN nc Loop no:on COM: 22. Status = OK Status = OKOpening and checking communication to DUT. Loop no:Status = OK Status = OK Status = OK Status = OK Status = OK OF Status = OK 	Sta	atu
s = 0KTester freq offset =9140HzTester measured powerlevel.Status = 0KTester measured power:-1.66dBmTester temperature.Status = 0KTester temperature =32C (1291) Loop no:2 of 3Packet error test of 1500 packets on channel 19.Status = 0KTxCount = 1500.Errors =0.		
Iester freq offset reads = 0KTester freq offset =9314HzTester measured powerlevel.Status = 0KTester measured power:-1.68dBmTester temperature.Status = 0KTester temperature =32C (1291) Loop no:3 ofPacket error test of 1500 packets on channel 19.Status = 0KTester 0KStatus = 0K	Sta	atu
Tester freq offset readØ.Status = OKs = OKTester freq offset =8763HzTester freq offset =8763HzTester measured powerlevel.Status = OKTester measured power:-1.64dBmTester temperature.Status = OKTester temperature =32C (1291)Completed the testloop of PER and Frequency offset.Status = OK	Sti	atu T



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 backd. 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 2wire) 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

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

7) My settings are not stored

Remember to click [Save] to store your settings. a. 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.