

# RTX2254 Bluetooth RF Tester

## **Stand-alone Unit**



## **User Manual**

**V0216.3** MVC 2020.04.15



## General

Information contained in this document is subject to change without notice. RTX A/S makes no warranty of any kind regarding to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

RTX A/S shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishings, performance, or use of this material.

## Warranty

This instrument is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, RTX A/S will at its option, either repair or replace products, which prove to be defective. For warranty service or repair, this product must be returned to a service facility designated by RTX A/S. The Buyer shall prepay shipping charges to RTX A/S and RTX A/S shall pay shipping charges, duties, and taxes for products returned to RTX A/S from another country.

RTX A/S warrants that its software and firmware designated by RTX A/S for use with an instrument will execute its programming instructions when properly installed on that instrument.

RTX A/S does not warrant that the operation of the instrument or firmware will be uninterrupted or error-free.

## **Limitation of Warranty**

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED.

RTX A/S SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.



## **General information**

This document and the information contained herein, is property of RTX A/S, Denmark. Unauthorized copying is not allowed. The information in this document is believed to be correct at the time of writing. RTX A/S reserves the right at any time to change said content, circuitry and specifications.

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

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

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

## **Documentation Information**

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

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

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

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

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



## Safety Information

## General

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



**<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.



<u>DO NOT</u> 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.



## **TABLE OF CONTENTS**

1	INTRODU	CTION	8
2	WORD AN	D ABBREVIATION LIST	9
3	START TH	E APPLICATION	10
4	TAB MENU	JOVERVIEW	11
5	MAIN TAB	6	12
	5.1 Setup		14
		asure Mode	15
		R Test - Packet Parameters	15
		Number of Packets	15
		Payload Length	15
		Payload Type	15
		Gen. Power [dBm]	16
		lect RF Physical Channels	16
		en Interface	17
		T Port Selection	17
	5.1.5.1	RF Select	17
	5.1.5.2	Interface Select	17
	5.1.6 Set	ttings	17
	5.1.7 Sel	lect Tests to Run	18
	5.1.8 Tes	st Result	18
	5.1.9 Tes	st Run	19
	5.1.9.1	Start / Pause / Stop	19
	5.1.9.2	Loop Test Numbers	19
		Test Delay	19
	5.1.10	Test Status	20
	5.1.10.1	Current Channel	20
	5.1.10.2	Cable Loss	20
	5.1.10.3	Test Completed	20
		Test Limit Errors	20
		Time Out Errors	20
		Channel Test Time	20
	5.1.10.7	Total Test Time	21
6	DUT TAB		22
	6.1 DUT F	RF Setup	23
	6.1.1 Tx	– Mode	23
	6.1.1.1	Channel	23
	6.1.1.2	Payload Length	23
	6.1.1.3	, ,,	23
	6.1.2 Rx		24
	6.1.2.1	Channel	24
	6.1.2.2	Received Packets	24
	6.2 DUT F	Port Selection	25
	6.2.1.1	RF Select	25
	6.2.1.2	Interface Select	25
	6.3 DUT 9	Status	25
	6.3.1 Res	set RF Mode	25
	6.3.2 Res	set DUT	25
	6.4 Start	Tx Burst Mode	26



	6.5	Start Rx Burst Mode	27
7	TES	STER TAB	29
	7.1	Tester Setup – Burst Mode	30
		<b>1.1 Tx – Mode</b> 7.1.1.1 Channel	<b>30</b> 30
		7.1.1.2 Gen. Power [dBm]	31
		7.1.1.3 Payload Length	31
		7.1.1.4 Payload Type	31
		7.1.1.5 Number of Packets 7.1.1.6 Packets Sent	31 31
		1.2 Rx - Mode	32
		7.1.2.1 Channel	32
		7.1.2.2 Received Packets	32
	7.2	·····	33
		2.1 Tx – Mode 7.2.1.1 Channel	33 33
		7.2.1.2 Tx – Set Attenuation	34
	7.3	Tester RF Input Power	35
	7.4	Tester Analyzer Mode	36
	7.5	Tester Status	37
		5.1 Reset RF Mode	37
	-	5.2 Reset Tester 5.3 Reset Ana+Gen	37 37
	7.6	Start Tx Burst Mode	38
	7.7	Start TX Burst Mode	39
8		STEM TAB	41
•	8.1	System Status	41
	8.2	Manufacture Info	41
	8.3	System Option License	42
	8.4	Internal Temperature	42
	8.5	Firmware Update	43
	8.6	Manual Firmware Update	44
		6.1 Tester Firmware	44
	8.6	6.2 Analyzer Firmware	44
9	ME	ASURE LOGS TAB	45
10	) SET	ITINGS TAB	47
	10.1	How to find COM ports on Windows PC	48
		Tester Interface	48
		0.2.1 Tester - RTX BLE Tester Interface 0.2.2 Generator - RTX BLE Generator Interface	48 49
	-	0.2.3 Analyzer - RTX BLE Analyzer Interface	49 49
	10.3	DUT interface	50
	10	0.3.1 Automatically Setup of DUT COM ports	51
	10	0.3.2 Manually Setup of DUT COM ports	54
1:	L COI	NFIGURATION TAB	56
	11.1	Test Mode	57



11.2 Test Result Limits	57
11.3 DUT Configuration	57
11.3.1 Direct Test Mode	57
11.3.2 Advertising Mode	58
12 HOW TO SETUP AUTOMATED TESTING - DIRECT TEST MODE	59
12.1 DUT Test Limits	59
12.2 DUT Test Setup	60
12.3 Starting the DUT Test 12.3.1 DUT - Within Test Limits	61
12.3.1 DOT - Within Test Limits 12.3.2 DUT – Outside of the Test Limits	62 63
13 HOW TO SETUP AUTOMATED TESTING - ADVERTISING MODE	64
13.1 DUT Test Limits	64
13.2 DUT Test Setup	65
13.3 Starting the DUT Test	67
13.3.1 DUT - Within Test Limits	68
13.3.2 DUT – Outside of the Test Limits	69
14 HOW TO SETUP MANUAL TESTING	70
14.1 DUT Tab	70
14.1.1 For example, "Test DUT Tx power"	70
14.2 Tester Tab 14.2.1 For example, "Test DUT Tx power"	71 71
15 HOW TO RUN A RX SENSITIVITY TEST	72
16 HARDWARE DESCRIPTION	74
16.1 Test Interfaces	74
16.1.1 DUT RF Inputs	75
16.1.2 DUT Communication Interfaces 16.1.2.1 UART0 and UART1 Connector Pinout	<b>75</b> 75
16.1.2.2 2-Wire	75
16.1.2.3 USB0 and USB1 Connector Pinout	76
16.2 Test Protocols	76
17 TEST LIMITATIONS	77
17.1 Generator Output Power	77
17.2 Frequency Offset	78
17.3 PER Test	79
18 DEMO APPLICATION	80
18.1 Settings	80
18.2 Running the Demo Application	81
19 FREQUENTLY ASKED QUESTIONS	83



## **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
- POP-OP
   A smaller maller shown in window
   PPM
   Part Per Million
- RF
   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 – <version number>".

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 to show how to operate the RTX2254 Bluetooth RF tester. Advertising Mode is very similar and will be described in section 13 How 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:

DTM Burst	ackets     Payload Length       00 ÷     25 ÷		Gen. Power [dBm	Open Interface DUT Reset DUT	DUT Port S	ielect  Save T Click "Save" to
RF Channel 1 RF Channel 1 RF Channel 1 RF Channel 1 RF Cl	nannel 2 RF Channel :	Channel Mapping: Phy LL MHz Ch. 0 (37) = 240 Ch. 10 (10) = 240 Ch. 19 (17) = 244 Ch. 39 (39) = 248	2	DUT Info BT Address: 0x8	Select	o3AA - [ms]
lect Tests to Run	DUT Tx Tests			DUT Rx Te		
RF Channel 1 Frequency Offset [Hz]	RF Channel 2	RF Channel 3	RF Channel 1	ror Rate (DTM burst/A RF Channel red at Gen. Power [dBm]		RF Channel 3
- Hz	- Hz	- Hz	-	%	- %	- %
Frequency Offset [ppm] - ppm	- ppm	- ppm	OK Count	-	-	
DUT Tx Output Power	P.P.III	P.F	Error Count			
- dBm	- dBm	- dBm		-	-	-
			Gen. Power Level [d			
			- d	Bm -	dBm	- dBm
st Result		Start	t test			
st Run	Test Status					
Start Loop Test No Stop	Current Channel	Cable Loss Test Complet	ed Tx Pwr	D Time Out Errors		[ms] 0.00 Total Test Time [s] 0.00 0.000

#### **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** •

Packet Error Test (PER)

Measures the DUT output power.

Performs a packet error rate test on the DUT.

DTM Burst  5 Select RF Physical Channe	t - Packet Parameters Packets Payload Length 00  25  1  1  1  1  1  1  1  1  1  1  1  1  1	ALTBITS_10101010	Gen. Power [dBm]		store setup
		Bit Mapping           3         Phy LL MHz           Ch. 0 (37) = 2402           9 -         Ch. 1 (0) = 2404           Ch. 19 (17) = 2440           Ch. 39 (39) = 2480	DUT Info BT Add	ress: 0x84DD200	503AA - [ms]
	DUT Tx Tests			UT Rx Tests	
DUT Frequency Offset     RF Channel 1     Frequency Offset [Hz]	RF Channel 2	RF Channel 3	PER - Packet Error Rate ( RF Channel 1 Error Rate - Measured at Gen.	RF Channel 2	nly) RF 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	- dBm	- dBm
est Result		Start	- dBm	- dBm	- dBm
		Start	- dBm	- dBm	- dBm
est Run	Test Status	Start	- dBm		
est Run Start Loop Test No	Current Channel		- dBm	Ch. Test Tim	e [ms]
est Run Start Loop Test No Stop 1 ÷	Current Channel	Cable Loss Test Completer	- dBm	Out Errors Last	e [ms] 0.00 Total Test Time [s]
est Run Start Loop Test No	Current Channel	Cable Loss Test Complete 1.00 0	- dBm	Ch. Test Tim	e [ms]
est Run Start Loop Test No Stop 1 ± Test Delay (m	Current Channel	Cable Loss Test Complete 1.00	- dBm	Out Errors Last	e [ms] 0.00 Total Test Time [s]
est Run Start Loop Test No Stop 1 ± Test Delay (m	Current Channel	Cable Loss Test Complete 1.00	- dBm	Out Errors 0 Avg.	e [ms] 0.00 0.00 0.00 0.000



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

Status information for the test run.

Start/pause/stop the test.

RTX2254 Bluetooth RF Tester (V0216)									
					-				
Main DUT Tester System	n Measure Logs Settin	ngs Configuration							
Setup       PER Test - Packet Parameters       Open Interface       DUT Port Selection       Settings         DTM Burst        Soo $\frac{1}{2}$ 25 $\frac{1}{2}$ ALTBITS_1010100        Gen. Power (dBm) $\bigcirc$ DUT       DUT RF Select        Save         Select RF Physical Channels       Channel Mapping:       Phy LL       Mitz       Select       Select       Select       Select       Select       Select       Select       Select       Select       Sove store setup       Store setup									
Sefect Tests to Run	OUT Tx Tests	RF Channel 3	D V PER - Packet Error Rate RF Channel 1		F Channel 3				
Frequency Offset [Hz]			Error Rate - Measured at Gen	. Power [dBm] -					
- Hz	- Hz	- Hz	- %	- %	- %				
Frequency Offset [ppm]			OK Count						
- ppm	- ppm	- ppm	-	-	-				
DUT Tx Output Power			Error Count						
- dBm	- dBm	- dBm	-	-	-				
			Gen. Power Level [dBm] -41						
			- dBm	- dBm	- dBm				
Test Result Start test									
Test Run	$\mathbf{r}$								
Start Loop Test No. Stop 1	0 Ch.		Test Limit Errors Offset 0 Tx Pwr 0 PER 0	Ch. Test Time [ms Out Errors Last 0.00 0 Avg. 0.00	Total Test Time [s]				
Info HCI DUT found			Status DUT: HCI 0x84D	D20C503AA 🥥 Generator	& Analyzer: 🔍 Tester: 🕻				

#### 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:

etup Measure Mode	PER Test - Packet I	Parameters			Open Interface	DUT Port Selection	Settings
DTM Burst	No. of Packets	Payload Length	Payload Type	Gen. Power [dBm]	DUT Reset DUT	DUT0 RF Select	Save Click "Save" t
Select RF Physic RF Channel 1	al Channels RF Channel 2	RF Channel 3	Channel Mapping: Phy LL MHz Ch. 0 (37) = 2402			Select	store setup
0 🛨	19 🕂	39 🕂	Ch. 1 (0) = 2404 Ch. 19 (17) = 2440 Ch. 39 (39) = 2480		Address: 0x8	4DD20C503AA	- [ms]

### **Overview:**

[Measure Mode]

Select signal type to use: **[DTM Burst]** or **[DTM CW]** (Continuous 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.

#### Please note that:

You must click **[Save]** to store the system settings before selecting another tab page. If you leave the **[Main]** page without saving the settings, the last stored settings will be restored when selecting to the **[Main]** page again.



## **5.1.1 Measure Mode**

Select signal type to use **[DTM Burst]** or **[DTM CW]** (Continuous 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 Payload Type

**[Payload Type]**, select one of the following BLE payload/packet types, defined by Bluetooth SIG, to use.

### Direct Test Mode:

HCI Protocol: 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'

<u>2-Wire Protocol:</u> 0x00 Pseudo-Random bit sequence 9 (PRBS9) 0x01 Pattern of alternating bits '11110000' 0x02 Pattern of alternating bits '10101010' 0x03 Vendor Specific

### Advertising Mode:

0x00 NO\_SCAN\_RESPONSE 0x01 SCAN\_RESPONSE

Refer to section 13.2 DUT Test Setup for more details.



## 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.

For Direct Test Mode, the below 40 RF channels are supported. For Advertising Mode, the channels are locked to channels 0, 12 and 39:

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

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

#### Please note that:

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



## 5.1.4 Open Interface

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

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

## 5.1.5 DUT Port Selection

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

### 5.1.5.1 RF Select

Select the RF port to use:

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

## **5.1.5.2 Interface Select**

Select the communication port to use:

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

The **[Interface Select]** field is not available for Advertising Mode.

## 5.1.6 Settings

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

DUT Port Selection
DUT0 RF Select 🔻
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** 

Measures the Tx output power on selected 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.

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

Image: DUT Frequency Offset       RF Channel 1       RF Channel 2       RF Channel 3         Frequency Offset [Hz]       - Hz       - Hz       - Hz         - Hz       - Hz       - Hz       - 0%         Frequency Offset [ppm]       - ppm       - ppm         - dBm       - dBm       - dBm         - dBm       - dBm       - dBm         - Rx Sensitivity Test       Gen. Power Level [dBm]       -41	Select Tests to Run	DUT Tx Tests		N. <b>I</b>	OUT Rx Tests	
Frequency Offset [Hz]       In animal of the manual of the m	DUT Frequency Offs					nly)
- Hz       - Hz       - Hz         Frequency Offset [ppm]       - ppm       - ppm         - ppm       - ppm       - ppm         - dBm       - dBm       - dBm         - dBm       - dBm          - Rx Sensitivity Test       Gen. Power Level [dBm]		RF Channel 2	RF Channel 3			RF Channel 3
Frequency Offset [ppm]       - <td></td> <td></td> <td></td> <td></td> <td></td> <td>0/</td>						0/
- ppm - ppm - ppm - dBm - dBm - dBm - dBm - dBm - dBm - dBm 	- H2	2 - HZ	- HZ	- %	- %	- %
PUT Tx Output Power - dBm - dBm - dBm Rx Sensitivity Test Gen. Power Level [dBm] -41	Frequency Offset [ppm]			OK Count		
- dBm - dBm - dBm - dBm - dBm - dBm	- ppm	າ – ppm	- ppm	-	-	-
- dBm - dBm - dBm - dBm - dBm - dBm						
Rx Sensitivity Test Gen, Power Level [dBm] -41				Error Count		
Gen. Power Level [dBm] -41	- dBm	ı – dBm	- dBm	-	-	-
	,			Rx Sensitivity Test		
- dBm - dBm - dBm				Gen. Power Level [dBm] -41		
				- dBm	- dBm	- dBm

#### Please note that:

Refer to section 15 How to Run a Rx Sensitivity Test for more details on how to setup and run a Rx Sensitivity test.

## 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.     Pause   1 ÷	Continue Loop Test No.
Test Delay (ms)	Test Delay (ms)	Test Delay (ms)

## 5.1.9.1 Start / Pause / 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]
 [Stop]
 Click [Continue] to continue a paused test.
 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	t Errors				
Current Channel			Offset	0		Ch. Te	st Time [ms]	
<sup>0</sup> Ch.	-Cable Loss-	Test Completed			Time Out Errors	Last	0.00	Total Test Time [s]
Un.		rest completed	Tx Pwr	0		Lust (		fotal fest find [5]
2402 MHz	1.00	0	PER	0	0	Avg.	0.00	0.000
DUT packet interval c	onfiguration 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. The **[DUT]** tab is not available for Advertising Mode.

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

### **Overview:**

[DUT RF Setup]

Setup the test to perform.

- [DUT Port Selection] Select the RF port and communication port to use with the DUT.
- [DUT Status]

The state of the DUT and reset RF mode and reset DUT options.

### Please note that:

The DUT port selection is also available on the **[Main]** page.



## 6.1 DUT RF Setup

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

### 6.1.1 Tx - Mode

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

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

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

### Please note that:

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

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

## 6.1.1.1 Channel

**[Channel]**, enter the physical RF channel to use in the test. Valid range 0-39. Refer to section 5.1.3 Select RF Physical Channels for more details.

## 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 Payload Type

**[Payload Type]**, select one of the following BLE payload/packet types, defined by Bluetooth SIG, to use.

#### **Direct Test Mode:**

HCI Protocol: 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'

<u>2-Wire Protocol:</u> 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. Refer to section 5.1.3 Select RF Physical Channels for more details.

## 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:

The **[DUT Port Selection]** settings are not stored and will be set to the settings stored under the **[Main]** page if RTX2254 application is restarted. If the **[DUT Port Selection]** is changed on the **[DUT]** page, you must click **[Select]** on the **[Main]** page to set the DUT settings again.

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 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.

TX2254 Bluetooth RF Tester (V0211)	
Main DUT Tester System Measure Logs Settings Configuration	
DUT rester System measure Logs Settings Conniguration	
Tx - Mode	DUT Status: Tx Burst mode
Start Channel Payload Length Payload Type	Reset RF Mode Reset DUT
Stop 0 - 25 - ALTBITS_10101010 V	DUT Port Selection
Rx - Mode	DUTO RF Select 💌
Start Channel Received Packets	
Stop 0 1 0	Select
	<u>)</u>



## 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       Settings       Configuration         DUT RF Setup       Tx - Mode       Esset RF Mode       Reset DUT       Reset DUT         Stop       0	
DUT RF Setup Tx - Mode Start Channel Payload Length Payload Type Reset RF Mode Reset DUT DUT Port Selection DUT O RF Select  DUT O UTO RF Select  DUT O USB  UTO USB	
Tx - Mode     DUT Status: Rx Burst mode       Start     Channel       Stop     0 ÷       25 ÷     ALTBITS_1010101 v       Rx - Mode     DUT Port Selection       DUT0 RF Select     DUT0 USB v	
Start     Channel     Payload type       Stop     0 ÷     25 ÷       ALTBITS_10101010 ▼       Rx - Mode       Start     Channel       Received Packets	
Rx - Mode     DUT0 RF Select       Start     Channel       Received Packets     DUT0 USB	
Start Channel Received Packets	
Stop 0 2 0 Select	
	-1
Info RX burst mode Status DUT: HCI 0x84DD20C503AA 🔍 Generator & Analyzer: 🍳 Tester	•



Click the [Stop] button 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.

Tx - Mode     D       Start     Channel       Stop     0 ÷       25 ÷     ALTBITS_1010101 •	
Start Channel Received Packets	UT Status: Stopped eset RF Mode Reset DUT
	DUTO RF Select   DUTO USB  Select
	P

### 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. The **[Tx - Mode]** and **[Tester Setup – Continuous Wave (CW)]** sections are not available for Advertising Mode.

### **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.

X2254 Bluetooth RF Tester (V0211)				
Main DUT Tester System	Measure Logs Settings Configuration			
Tester Setup - Burst Mode	Measure Logs Settings Configuration			
Packet Error Rate			Tester Statu	s: Stopped
Tx - Mode		No. of Packets	Reset RF Mode	Reset Tester
	Set "No of packets" = 0 for continuou	us transmission		
Start	Gen. Power [dBm] Payload Length Payload T			Reset Ana+Gen
0÷	-40 - 25 - ALTBITS	10101010		
Stop				
Rx - Mode				
	Received Packets			
start				
Stop 0 🛨	0			
Tester Setup - Continous Wave	(cw)			
Tx - Continuous Wave	Tx - Set Attenuation	Rx - Continuous Wave		
Start	Attenuation [dB]	Start		
Stop 0 ÷	Set 0 🛨	Stop 0 ÷		
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			
KA MOUE MUSL DE ACTIVE	RX Mode must be active			
	KA MOUE MUST DE active			
fo		Status DUT: HCI 0x84DD20C5	03AA 🍳 Generat	or & Analyzer: 🍳 Tester:



## 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.

Main       Duit       Tester       System       Measure Logs       Settings       Configuration         Facket       First Setup       Burst Mode       Set "No of packets" = 0 for continuous transmission       No. of Packets         Start       Channel       Gen. Power (dBm)       Payload Length       Packets Sent         Stop       -40       25       ALTBITS_101010       Packets Sent         Reset AF Mode       Reset Vertex       Reset Aras+Gen         Stop       -3       0       Reset Aras+Gen         Tester Setup - Continuous Wave         Stop       0       Reset Aras+Gen         Tester Setup - Continuous Wave (CW)         Tx - Continuous Wave       Tx - Set Attenuation       Kx - Continuous Wave         Start       Channel       Set       0       Start         Stop       0       Start       Channel       Start         Stop       0       Start       Channel       Reset The Continuous Wave         Reset RF Input Power       Tester Analyzer Mode       Start       Channel       Start         Inout level (dBm)       Exter Mode must be active       RX Mode must be active       RX Mode must be active       RX Mode must be active	RTX2254 Bluetooth RF Tester (V0211)	- • • ×
Packet Error Rate         Tx - Mode       Set "No of packets" = 0 for continuous transmission         Istart       Channel         Gen. Power [dBm]       Payload Length         Packets Sent       Packets Sent         Stop       -40 - 25 - ALTBITS_101010 v         Packets Sent       Packets Sent         Stop       -40 - 25 - ALTBITS_101010 v         Packets Sent       Packets Sent         Stop       - 0 - 0         Tx - Continuous Wave (CW)       Tx - Continuous Wave (CW)         Tx - Continuous Wave       Tx - Set Attenuation [dB]         Start       O - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 - 0 -	Main DUT Tester System Measure Logs Settings Configuration	<u>*</u>
Start       Channel       Received Packets         Stop       0       0         Tester Setup - Continous Wave (CW)       Tx - Set Attenuation [dB]       Rx - Continuous Wave         Start       Channel       Start       Channel         Stop       0       Image: Set of the	Packet Error Rate         Tx - Mode         Start       Set "No of packets" = 0 for continuous transmission         Start       Channel         Gen. Power [dBm]       Payload Length         Payload Type       Packets Sent         Packets Sent       Packets Sent	Ξ Ι
Tx - Continuous Wave       Tx - Set Attenuation         Start       Channel         Stop       Image: Start         Stop       Image: Start         Tester RF Input Power       Tester Analyzer Mode         Input level [dBm]       Rx - frequency Offset         Get       Last Offset [Hz]         Rx Mode must be active       Image: Monitor	Start Channel Received Packets	
Input level [dBm]     RX - Frequency Offset       Read     Get     Last Offset [Hz]       Monitor     0       RX Mode must be active     Monitor	Tx - Continuous Wave     Tx - Set Attenuation     Rx - Continuous Wave       Start     Channel     Attenuation [dB]     Start       Start     Channel     O	
	Input level [dBm]     RX - Frequency Offset       Read     Get       Monitor     0       RX Mode must be active     Monitor	_

## 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.

#### Please note that:

The **[Tx - Mode]** section is not available for Advertising Mode.

## 7.1.1.1 Channel

**[Current Channel]**, select the RF channel to use in the test. Valid range 0-39. Refer to section 5.1.3 Select RF Physical Channels for more details.



## 7.1.1.2 Gen. Power [dBm]

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

### 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 Payload Type

**[Payload Type]**, select one of the following BLE payload/packet types, defined by Bluetooth SIG, to use.

### Direct Test Mode:

HCI Protocol: 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'

<u>2-Wire Protocol:</u> 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.

### Please note that:

For Direct Test Mode all 40 RF channels are supported. For Advertising Mode only channels 0, 12 and 39 should be used. Refer to section 5.1.3 Select RF Physical Channels for more details.

## 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.

### Please note that:

The **[Tester Setup – Continuous Wave (CW)]** section is not available for Advertising Mode.

TX2254 Bluetooth RF Tester (V02)	11)	
Main DUT Tester St	ystem Measure Logs Settings Configuration	
Tester Setup - Burst Mod Packet Error Rate Tx - Mode Start Stop	Set "No of packets" = 0 for continuous transmission No. of Packets 1500 Reset RF Mode Reset Ana+Gen Reset Ana+Gen	
Rx - Mode Start Channe Stop	0 ÷ 0	
Tester Setup - Continuous Tx - Continuous Wave Start Start Channel	Tx - Set Attenuation Rx - Continuous Wave	
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 DUT: HCI 0x84DD20C503AA 🥥 Generator & 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. Refer to section 5.1.3 Select RF Physical Channels for more details.



## 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 Statu	s: Stopped
Tx - Mode Start Stop	Set "No of packets" = 0 for continuous transmission Gen. Power [dBm] Payload Length Payload Type ALTBITS_10101010	No. of Packets 1500 ÷ Packets Sent	Reset RF Mode	Reset Tester Reset Ana+Gen
Rx - Mode Start Stop	Received Packets			
Start Stop - Continuous Wave	Tx - Set Attenuation     Rx - Continuo       Set     0 ÷       Stop	Channel		
Input Power Input level [dBm] Read Monitor K 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.

ester Setup - Burst Mode		
Packet Error Rate		Tester Status: Stopped
Tx - Mode Start Channel	Set "No of packets" = 0 for continuous transmission	Packets     Reset RF Mode     Reset Tester       1500 $\stackrel{\cdot}{\cdot}$ Reset Ana+Gen
Stop 0 ÷	-40 ÷ 25 ÷ ALTBITS_1010101 ▼	ets Sent
Rx - Mode Start Channel Stop 0 -	Received Packets	
Tx - Continuous Wave           Start         Channel           Stop         0 ÷	Tx - Set Attenuation     Rx - Continuous Wave       Set     Attenuation [dB]       Stop	
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	

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. Refer to section

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.

Packet Error Rate		Test	er Status: Tx Burst mode
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 Sending	t RF Mode Reset Tester Reset Ana+Gen
Rx - Mode Start Channel Stop 0 ÷	Received Packets		
Tester Setup - Continuous Wave Tx - Continuous Wave Start Channel 0 ±	(CW) Tx - Set Attenuation Set 0 ÷ Start Stop	Wave Channel	
Tester RF Input Power	Tester Analyzer Mode RX - Frequency Offset Get Last Offset [Hz]		
Input level [dBm] Read Monitor RX Mode must be active	Reset 0 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 Channel	Set "No of packets" = 0 for continuous transmission ien. Power [dBm] Payload Length Payload Type	
Start 0 ÷	-40 ÷ 25 ÷ ALTBITS_10101010 ¥ Packets Sent	
Rx - Mode Start Channel Stop 0 ÷	eceived Packets	
Tester Setup - Continuous Wave ( Tx - Continuous Wave Start Channel	Tx - Set Attenuation Rx - Continuous Wave Attenuation [dB] Start Channel	
Stop 0 ÷	Tester Analyzer Mode	
Input level [dBm] Read Monitor	RX - Frequency Offset           Get         Last Offset [Hz]           Reset         0	
RX Mode must be active	Monitor  RX Mode must be active	
fo	Status DUT: HCI 0x84DD20C503AA	er:

"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)		- C X
Main DUT Tester System	Measure Logs Settings Configuration	<u>^</u>
Tester Setup - Burst Mode Packet Error Rate Tx - Mode Start Stop	Set "No of packets" = 0 for continuous transmission       No. of Packets         Gen. Power [dBm]       Payload Length         -40 $\div$ 25 $\div$ ALTBITS_1010101 •       Packets Sent         1500       1500	
Rx - Mode Start Channel	Received Packets 6219	
Tester Setup - Continuous Wave ( Tx - Continuous Wave Start Stop	Tx - Set Attenuation     Rx - Continuous Wave       Set     0 ÷       Start     Channel       Stop     0 ÷	
Tester RF Input Power Input level [dBm] Read Monitor	Tester Analyzer Mode RX - Frequency Offset Get Reset 0	
RX Mode must be active	RX Mode must be active	
4		-
Info	Status DUT: HCI 0x84DD20C503AA O Generator & Analyzer: O	Tester: 🥥

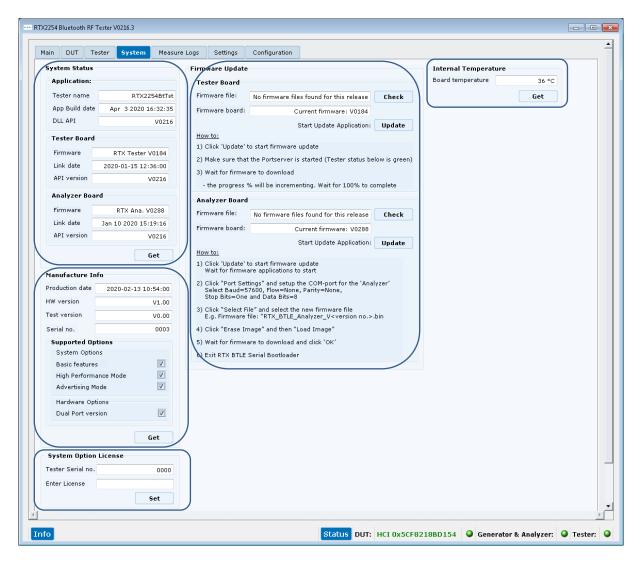
#### Please note that:

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:

<ul> <li>System Option I</li> </ul>	License		
Tester Serial no.	0003	Warning	
Enter License	1-626VNDQA		ense is valid - option enable X2254 application
	Set		ОК

A pop-up message is also shown

If the license is invalid or is for another serial number:

System Option License		
Tester Serial no.	0003	
Enter License	1-644VNQF	
	Set	

🚥 Warn	ing 💌
<u> </u>	Entered license is invalid - option not enabled
	ОК

A pop-up message is also shown

# 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:]:

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

m RTX2254 Bluetooth RF Tester (V0211)	×
	<b>_</b>
Main DUT Tester System Neasure Logs Settings Configuration	,
Measurement results	
Enable Measurement Clear log	
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 9 Generator & Analyzer: 9 Tester:	

#### Please note that:

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



#### Log file example:

📴 Lister - [c:\Users\All Users\RTX2254.Log\RTX2554.Log\RTX2555.Log\RTX2555.Log\RTX2555.Log\RTX2555.Log\RTX2555.Log\RTX2555.Log\RTX2555.Log\RTX2555.Log\RTX2555.Log\RTX2555.Log\RTX2555.Log\RTX2555.Log\RTX2555.Log\RTX25555.Log\RTX25555.Log\RTX255555.Log\RTX25555.Log\RTX255555555.Log\RTX25555.Log\RTX255555.Log\	2
File Edit Options Encoding Help	100
RT%2254 Bluetooth RF Tester build date: Tue Aug 27 13:26:40 2019	
System sleep periode 1 ms	
Log file for saving measurement data.	
30.08.2019 20:17:38:989 Log opened	
30.08.2019 20:17:39:001 No change in DUT configuration	
30.08.2019 20:17:40:284 Tester Interface COM ports opened	
30.08.2019 20:17:40:685 Tester interface communication opened	
30.88.2019 20:17:44:061 No change in DUT configuration	
30.08.2019 20:17:45:061 Reset current DUT configuration	
30.88.2019 20:17:45:861 Reset current DUT configuration	
38.08.2019 20:17:89:584 DUT configuration set and stored 38.08.2019 20:17:50:590 Openion ew DUT port	
30.08.2019 2017/51750590 Opening new DOI port 30.08.2019 2017/51747 DUI COM port 22 opened	
30.08.2017 20:17:51:747 Boun DUT with HCI interface, Bluetooth address: 0x84DD20C503AA	
30.08.2019 20:17:55:543 No change in DUT configuration	
30.48.2019 20:17:57:270 Test setus cleared	
30.08.2019 20:17:57:279 Test started by user - click Pause to stop	
38.88.2019 20:17:57:280 Testing DUT, Direct Test Mode with HCI protocol, Bluetooth address: 0x84DD20C503AA	
39.88.2019 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 %; 0k 500; Err
30.08.2019 20:18:02:326 Test no. 1/1 ; Time: 2520.52 ms ; Linit Err.: 0 ; Time Out Err.: 0 ; Ch: 19 ; Dut Offset: 9657 Hz ; 4.02 ppm ; Dut Power: -0.7 dBm ;	
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 %; 0k 500; Err
30.08.2019 20:18:04:850 Test PASSED	
4	

#### 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 RTX2254 Bluetooth RF tester has 3 main communication interfaces: **[Tester]**, **[Generator]** and **[Analyzer]** which must be opened for the tester to work.

In Direct Test Mode, it must also have an open DUT communication interface to let the RTX2254 Bluetooth RF tester control the DUT.

When the RTX2254 Bluetooth RF tester application is opened it will detect the presence of a connected RTX2254 tester (if option **[Detection @ startup]** is marked). If the RTX2254 tester has been assigned new COM ports, it will prompt the user to accept the new COM port settings or to skip the changes.

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

RTX2254 Bluetooth RF Tester V0216.3	
Main DUT Tester System Measure Logs Settings Configuration	-
Tester interface         COM ports       Save         PortServer       Tester       Generator       Analyzer       Auto open         Set Tester=255       10 ÷       11 ÷       12 ÷       Image: Set Tester         Interface       Interface       Open       Close       Image: Set Tester	DUT Interface DUT Port Selected: DUT 0 USB COM port 23 DUT BT Address: 0x5CF8218BD154 UART Interface DUT 0 COM Port 115200 • HW Flow Control 20 ÷ Save DUT 1 COM Port 115200 • HW Flow Control 21 ÷ Save
Open or close the Generator and Analyzer Open Close Tester instance Info Inst. name RTX2254 Bluetooth RF Tester PortServer name RTX2254PortServer Inst. number 1	USB Interface DUT 0 COM Port 115200 V HW Flow Control 23 Save DUT 1 COM Port 115200 V HW Flow Control -1 Save
Detect System COM Ports Automatically detect available Tester and DUT COM ports Detection @ startu	The DUT port opened is the one selected Open Close
Info	Status DUT: HCI 0x5CF8218BD154

**[Detect COM Ports]** can be used to re-detect the COM ports in the system. You will be asked to accept or skip any new settings.

**[Detection @ startup]** set mark to enable automatically COM port detection at startup. Unmark to disable this functionality.

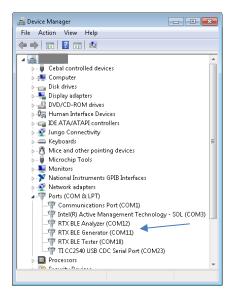
Refer to section 10.1 How to find COM ports on Windows for more details.



# **10.1** How to find COM ports on Windows PC

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>.



# **10.2 Tester Interface**

The RTX2254 Bluetooth RF tester has 3 main communication interfaces: **[Tester]**, **[Generator]** and **[Analyzer]** which must be opened for the tester to work.

The RTX2254 application should automatically have setup the correct COM port to use. See below how to make changes to the settings if necessary.

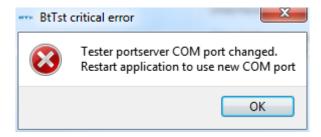
## 10.2.1 Tester - RTX BLE Tester Interface

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

Option:

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

The RTX2254 application must be restarted if the COM port for the RTX 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         COM#       10       C 1 stop bit         Speed (bps)       115200       C 2 stop bits         RTS input flow control       C None       C None         C Manual (RTS High)       C Odd       C Even	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
Output flow control         UART CTS       Timeout [ms]         Packet based       No Of Retrans.	Shared Memory Name RTX2254PortServer Stop Server
Use Window Based Flow Control	Log Options Log Binary Data To File Show Data in Log Window Log data from the Log Window to file
Default <u>D</u> K <u>C</u> ancel	Default <u>O</u> K Cancel

## **10.2.2 Generator - RTX BLE Generator Interface**

Setup the COM-ports for the **[Generator]** interface for your installation.

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

Click **[Save]** to store the settings. The interface must be closed before saving a new value.

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

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

#### **10.2.3** Analyzer - RTX BLE Analyzer Interface

Setup the COM-ports for the **[Analyzer]** interface for your installation.

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

Click **[Save]** to store the settings. The interface must be closed before saving a new value.

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

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



# **10.3 DUT interface**

The RTX2254 has 2x2 DUT communication interfaces for a dual port version and 1x2 DUT communication interfaces for a single port version:

UART Interface:

- [DUT0 UART]
- [DUT1 UART]

USB Interface:

- [DUT0 USB]
- [DUT1 USB]

Typically, RTX2254 can automatically detect the available COM ports for connected DUTs on a Windows PC.

#### Please note that:

RTX2254 Bluetooth RF tester can only detect a DUT COM port if the DUT is connected to one of the DUT connectors on the front of the tester.

Furthermore, the DUT must be a "simple" USB device with a virtual COM port (VCP), i.e. the USB device will appear as an additional COM port available on the PC, for it to be automatically detected.

If it is a more complex type with more device types than a COM port it must be manually setup. Refer to section 10.1 How to find COM ports on Windows PC  $\,$ 



## **10.3.1** Automatically Setup of DUT COM ports

Automatically setup of DUT COM port number after the RTX2254 application has been started, e.g. a new DUT is connected or the DUT interface has been changed from UART to USB.

If the DUT COM port is not found, e.g. is it connected to a USB port on the PC, please refer to section 10.3.2 Manually Setup of DUT COM ports.

In example, DUT0 UART is selected and DUT0 COM port 20 and DUT1 COM port 21 were automatically setup at startup:

D/2254 Bluetooth RF Tester V0216.3						
Main DUT Tester System Measure Logs Settings Configuration						
COM ports COM ports Select System COM Ports: Save	DUT interface DUT Port Selected: No port opened DUT BT Address: 0xFFFFFFFFFFF					
PortServer Set Tester=255 to use default from portserver	UART Interface DUT 0 COM Port 115200 - HW Flow Control 20 - Save					
Interface Open or close the Generator and Analyzer Open Close Close	DUT 1 COM Port					
Tester instance	USB Interface DUT 0 COM Port 115200 🗾 🛛 HW Flow Control 🔄 1 📩 Save					
Inst. name RTX2254 Bluetooth RF Tester PortServer name RTX2254PortServer Inst. number 1	DUT 1 COM Port					
	Interface The DUT port opened is the one selected in DUT configuration in Main or DUT menu Open Close					
Detect System CON Ports Automatically detect available Tester and DUT COM ports Detection @ startup Detection @ startup						
fo	Status DUT: HCI 0xFFFFFFFFF G Generator & Analyzer: Tester:					

In example, the **[DUT Port Selection]** on **[Main]** tab are now changed from DUT0 UART to DUT0 USB port.

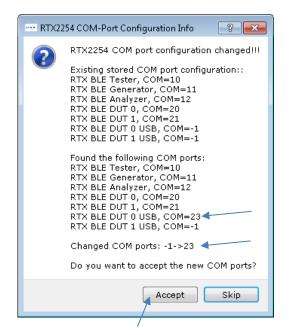
-DUT Port Selection-		-DUT Port Selection-
DUTO RF Select 💌	_	DUTO RF Select 💌
		DUTO USB 💌
Select		Select

Click on the **[Detect COM Ports]** button to re-detect the available COM ports.

#### Please note that

If a COM port is not setup for an interface, it shows -1 as COM port number.





A new DUT0 USB COM port has been found as COM 23.

Click **[Accept]** to set the automatically detected COM port number for DUT0 USB.

#### Please note that:

Click **[Skip]** to leave with existing COM port settings, i.e. not changes are made to the COM port settings.

lain DUT Tester System Measure Logs Settings Configuration					
Tester interface	DUT interface				
COM ports	DUT Port Selected: No port opened				
Select System COM Ports: Save	DUT BT Address: 0xFFFFFFFFFFF				
PortServer Generator Analyzer Auto open	UART Interface				
Set Tester=255 to use default 10 ÷ 11 ÷ 12 ÷ 🗹	DUT 0 COM Port				
	115200 🗾 📄 HW Flow Control 🛛 20 🕂 Save				
Interface	DUT 1 COM Port				
Internace	115200 - HW Flow Control 21 - Save				
Open or close the Generator and Analyzer Open Close					
	USB Interface				
Tester instance	DUT 0 COM Port				
Info	115200 🗾 📃 HW Flow Control 23 🛨 Save				
Inst. name RTX2254 Bluetooth RF Tester	DUT 1 COM Port				
PortServer name RTX2254PortServer					
Inst. number 1	115200 V 🔄 HW Flow Control -1 🛨 Save				
	Interface				
	The DUT port opened is the one selected Open Close				
Detect System COM Ports					
	COM Ports				
🔽 Detection @ star	tup				

The newly found DUT0 USB COM port number is added. Setup the required baud rate and HW flow control for the DUT. Click **[Save]**.



ain	DUT	Tester	System	Measure Logs	Settings	Configuration	
Tes	ter inter	face					DUT interface
-00	OM ports						DUT Port Selected: DUT 0 USB COM port 23
-	PortServe	r	Select	System COM Po	orts:	Save	DUT BT Address: 0x5CF8218BD154
			Tester	Generat	or Analyz	er Auto open	UART Interface
t	Set Teste to use de	fault	10 🛨	11	÷ –	12 🕂 🔽	DUT 0 COM Port
1	from port	server					115200 🗾 🥅 HW Flow Control 🛛 20 🕂 Save
							DUT 1 COM Port
-10	terface					-	115200 V HW Flow Control 21 + Save
0	pen or clo	ose the Ge	nerator and <i>i</i>	Analyzer	Open	Close	
							USB Interface
тε	ester ins	tance					DUT 0 COM Port
-1	Info						115200 💌 📃 HW Flow Control 23 🛨 Save
	Inst. nam	ne [			RTX2254 E	Bluetooth RF Tester	DUT 1 COM Port
	PortServ	er name			R	TX2254PortServer	115200 V 📕 HW Flow Control -1 🕂 Save
	Inst. num	ber				1	
							Interface
							The DUT port opened is the one selected Open Close
							in DUT configuration in Main or DUT menu
Det	ect Syst	em COM I	orts				
Aut	omaticall	y detect av	ailable Teste	r and DUT COM	ports	Detect (	COM Ports
						📝 Detection @ star	tup 🤍

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

The DUT interface is now opened and the DUT status is green.



## 10.3.2 Manually Setup of DUT COM ports

If the DUT COM port cannot be detected, e.g. if it is not connected to the RTX2254 tester it can be setup manually.

Tester interface		DUT interface
COM ports		DUT Port Selected: No port opened
	elect System COM Ports: Save	DUT BT Address: 0xFFFFFFFFFFF
PortServer Tester	Generator Analyzer Auto open	UART Interface
Set Tester=255 to use default 10	÷ 11÷ 12÷ 🔽	DUT 0 COM Port
from portserver		115200 T HW Flow Control 20 ÷ Save
Interface		DUT 1 COM Port
Internace	0	115200 - 🔲 HW Flow Control 21 🕂 Save
Open or close the Generator :	and Analyzer Open Close 🌘	
		USB Interface
Tester instance		DUT 0 COM Port
Info		115200 💌 📃 HW Flow Control 🛛 -1 🛨 Save
Inst. name	RTX2254 Bluetooth RF Tester	DUT 1 COM Port
PortServer name	RTX2254PortServer	115200 V HW Flow Control -1 + Save
Inst. number	1	
		Interface
		The DUT port opened is the one selected Open Close
		in DUT configuration in Main or DUT menu
Detect System COM Ports		
		COM Ports
Automatically detect available 1		Detection @ startup

In example, find and setup the COM port number for a DUT connected to a USB port on the PC.

In Windows "Device Manager":

- Ports (COM & LPT)
   Ormmunications Port (COM1)

  - 🖙 ПСС2540 USB CDC Serial Port (COM30)

The DUT is found as COM port number 30.



Enter the newly found DUT USB COM port number 30 as DUT 0 USB. Setup the required baud rate and HW flow control for the DUT.

in DUT	Tester	System	Measure Logs	Settings	Configuration	
ester interfa	ice					DUT interface
COM ports						DUT Port Selected: DUT 0 USB COM port 23
		Select	System COM P	orts:	Save	DUT BT Address: 0x5CF8218BD154
PortServer	_	Tester	Generat	or Analy	zer Auto open	UART Interface
Set Tester= to use defa	255	10 🛨		1 ÷		DUT 0 COM Port
from portse		10 -			12 🛨 🔍	
						115200 V 🕅 HW Flow Control 20 🔆 Save
Interface						DUT 1 COM Port
						115200 💌 📄 HW Flow Control 21 🛨 Save
Open or clos	e the Ger	nerator and A	Analyzer	Open	Close 🤇	
						USB Interface
Tester insta	nce					DUT 0 COM Port
Info						115200 💌 💟 HW Flow Control 30 🛨 Save
Inst. name				RTX2254	Bluetooth RF Tester	DUT 1 COM Port
PortServer	name			1	RTX2254PortServer	115200 🔻 🔲 HW Flow Control -1 🛟 Save
Inst. numb	er				1	
						Interface
						The DUT port opened is the one selected
						in DUT configuration in Main or DUT menu
etect Syster	n COM P	orts				
Automatically	letect av	ailable Teste	r and DUT COM	ports	Detect	COM Ports
					Detection @ star	
					E Statuti e sta	
нсі рит						Status DUT: HCI 0x5CF8218BD154

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.

TX2254 Bluetooth RF Tester V0216.3	
Main DUT Tester System Measure Logs Settings Configuration	<b>^</b>
Tester Made         Tester Operation Mode         Direct Test Mode         Save         Test Results Limits         Test results must be within these limits to be valid.         DUT Frequency Offset [pm]         40.00 ±         DUT To output Power [dbn]         Out To output Power [dbn]         Out To output Power [dbn]         DUT advertising packet interval [ms]         20 ±         DUT advertising packet interval [ms]         20 ±         DUT advertising packet scan interval [ms]         00 ±         DUT advertising packet scan interval [ms]         00 ±         DUT advertising packet scan interval [ms]         100 ±         Save	
Info Status DUT: HCI 0xFFFFFFFFF • Generator & Analyzer: •	) 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 100	)000 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]" maximum 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 [m	is] Set according to DUT. This value is also used during initial detection/scanning for a new DUT. Make sure that the value is set high enough for the 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 <b>[Main]</b> 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:

	min RTX2254 Bluetooth RF Tester (V0214)						
Г							
	Main DUT Tester System Measure Logs	Settings Configuration					
	Tester Mode         Tester Operation Mode         Direct Test         Test Results Limits         Test results must be within these limits to be valid.         Min         DUT Frequency Offset [ppm]	but Configuration         Direct Test Mode         DUT cable loss settings (positive number)         DUT 0 cable loss [dBm]         DUT 1 cable loss [dBm]         DUT 1 cable loss [dBm]         10.00 $\frac{1}{2}$ Max         40.00 $\frac{1}{2}$ DUT Communication Protocol         HCI •         I10 $\frac{1}{2}$ DUT cable loss settings (positive number)         DUT cable loss settings (positive number)         DUT cable loss settings (positive number)         DUT o cable loss [dBm] $1.00 \frac{1}{2}$ DUT o cable loss [dBm] $1.00 \frac{1}{2}$ DUT advertising mode $1.00 \frac{1}{2}$ DUT advertising packet scan interval [ms] $110 \frac{1}{2}$ DUT advertising packet scan interval [ms] $110 \frac{1}{2}$ DUT min. power level [dBm] $-127 \frac{1}{2}$ Enable DUT White Listing       Select DUT address type         Public Device Address       •					
		Save					



# **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.

up pro t i			6		
easure Mode No. of Pa	- Packet Parameters	Deuland Turns		en Interface DUT Port Se	lection Settings
DTM Burst V		Payload Type ALTBITS_10101010		DUT DUT0 RF Sel	lect  Save
50	25 🛨	ALIBIIS_10101010	-41 <u>+</u>	DUTO UART	Click "Save" to
elect RF Physical Channels		Channel Mapping:	C	Select	store setup
RF Channel 1 RF Cha		Phy LL MHz Ch. 0 (37) = 2402			
	19 🕂 🗹 39	Ch. 1 (0) = 2404 Ch. 19 (17) = 2440		dress: 0x84DD20C50	3AA - [ms]
		Ch. 39 (39) = 2480			
ect Tests to Run	UT Tx Tests		<u> </u>	OUT Rx Tests	
DUT Frequency Offset			👿 PER - Packet Error Rate	(DTM burst/ADV Mode Only)	
RF Channel 1 Frequency Offset [Hz]	RF Channel 2	RF Channel 3	RF Channel 1 Error Rate - Measured at Ger		RF Channel 3
			- %	- %	- %
- Hz	- Hz	- Hz	- %	- %0	- %0
Frequency Offset [ppm]			OK Count		
- ppm	- ppm	- ppm	-	-	-
			E		
DUT Tx Output Power			Error Count		
J - dBm	- dBm	- dBm	-	-	-
			Rx Sensitivity Test		
			Gen. Power Level [dBm] -41		
			- dBm	- dBm	- dBm
t Result					
i kesuk					
		Start	test		
t Run	Test Status				
Start Loop Test No.	Current Channel		Test Limit Errors Offset 0	Ch. Test Time [n	ns]
Stop 1 ÷	0 ch.	Cable Loss Test Completed	Time	e Out Errors Last 0.0	00 Total Test Time [s]
		1.00 0	PER 0	0 Avg. 0.0	
Test Delay [ms			1 Pkt. Int. 0		
Test Delay [ms	DUT packet interval cor	Counting anthing [mail			



# 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.

DUT Tester System	n Measure Logs Setti	ngs Configuration				
easure Mode	- Packet Parameters			Open Interface	DUT Port Selecti	on Settings
DTM Burst			Gen. Power [dBm]	DUT	DUT0 RF Select	▼ Save
50		ALIBITS_10101010	-41 🕂	Reset DUT	DUTO UART	Click "Save" to
elect RF Physical Channel RF Channel 1 RF Ch	s annel 2 RF Channel 3	Channel Mapping: Phy LL MHz			Select	store setup
		Ch. 0 (37) = 240 Ch. 1 (0) = 240	2 4 <b>DUT</b>	Info		
		Ch. 19 (17) = 244 Ch. 39 (39) = 248	BT	Address: 0x8	4DD20C503A/	A - [ms]
ect Tests to Run					•	
DUT Frequency Offset	OUT Tx Tests		PER - Packet Error	DUT Rx Tes Rate (DTM burst/Al		
RF Channel 1	RF Channel 2	RF Channel 3	RF Channel 1	<b>RF</b> Channel		hannel 3
Frequency Offset [Hz]			Error Rate - Measured a			
- Hz	- Hz	- Hz	- 9	6	- %	- %
Frequency Offset [ppm]			OK Count			
- ppm	- ppm	- ppm		-	-	-
al <b></b>			Error Count			
DUT Tx Output Power	- dBm	- dBm		-	-	
- ubiii	- ubili	- ubiii			-	
			Gen. Power Level [dBm			
			- dBr		dBm	- dBm
			- abr	n -	авт	- abm
st Result		Start	t test			
st Run	$\mathcal{I}$					
Start Loop Test No.	Test Status Current Channel		Test Limit Errors	C	h. Test Time [ms]	
Stop 1 ÷	0 Ch.	Cable Loss Test Complete	Offset 0 Tx Pwr 0			Total Test Time [s]
Test Delay [m		1.00 0	TX PWF 0	0	Avg. 0.00	0.000
0 🕂	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 like below:

	m Measure Logs Se	ttings Configuration				
Measure Mode	t - Packet Parameters			Open Interface	DUT Port Selection	Settings
DTM Burst V			Gen. Power [dBm]	DUT	DUT0 RF Select	Save
50	00 <u>÷</u> 25 <u>÷</u>	ALTBITS_10101010	-41 🛨	Reset DUT	DUTO UART	Click "Save" to
Select RF Physical Channel		Channel Mapping:			Select	store setup
	annel 2 RF Channe	Ch. 0 (37) = 24	102	T Info		
	19 🕂 🔽	39 - Ch. 1 (0) = 2 Ch. 19 (17) = 24 Ch. 39 (39) = 24	40 81		4DD20C503AA	- [ms]
elect Tests to Run						
	DUT Tx Tests			DUT Rx Te		
DUT Frequency Offset RF Channel 1	RF Channel 2	RF Channel 3	PER - Packet Error RF Channel 1	Rate (DTM burst/A RF Channel		annel 3
Frequency Offset [Hz]			Error Rate - Measured			
-145 Hz	96 Hz	527 Hz	0.00	<u>0.0</u>	0 %	0.00 %
Frequency Offset [ppm]			OK Count			
-0.06 ppm	0.04 ppm	0.22 ppm	50		500	500
DUT Tx Output Power			Error Count			
-1.50 dBm	-1.97 dBm	-3.42 dBm		0	0	0
_1.50 dbiii		U				<b></b>
			Gen. Power Level [dBn			
					18	12
			- dB	m -	dBm	- dBm
est Result						
est Result		Test	DACCED			
est Result		Test I	PASSED			
est Result est Run		Test I	PASSED			
est Run	Test Status	Test I	PASSED			
est Run	Current Channel		Test Limit Errors Offset 0		Ch. Test Time [ms]	
est Run Start Loop Test No. Stop 1	Current Channel	Cable Loss Test Compl	Test Limit Errors Offset 0 Tx Pwr 0	Time Out Errors	Last 2515.69 T	otal Test Time [s]
est Run Start Loop Test No. Stop 1 ± Test Delay (m	Current Channel 0 Ch. s] 2402 MHz		Test Limit Errors Offset 0 Tx Pwr 0 1 PER 0	Time Out Errors		otal Test Time [s] 7.208
est Run Start Loop Test No. Stop 1	Current Channel 0 Ch. s] 2402 MHz	Cable Loss Test Compl	Test Limit Errors Offset 0 Tx Pwr 0	Time Out Errors	Last 2515.69 T	
est Run Start Loop Test No. Stop 1 ± Test Delay (m	Current Channel 0 Ch. s] 2402 MHz	Cable Loss Test Compl	Test Limit Errors Offset 0 Tx Pwr 0 PER 0	Time Out Errors	Last 2515.69 T	

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 like below:

PER Test - P							
Measure Mode	acket Parameters				Open Interfa	DUT Port Select	ion Settings
DTM Burst				Gen. Power [d	IBm] DUT	DUT0 RF Select	▼ Save
500 ÷	25 🛨	ALTBITS_101	.01010 -	-41	Reset DUT	DUTO UART	Click "Save" to
Select RF Physical Channels		Channel	Mapping:			Select	store setup
RF Channel 1 RF Channe	RF Channel 3	Phy	LL MHz (37) = 2402			builder	
	19 🕂 🗹 3	. <u>→</u> Ch. 1	(0) = 2404 (17) = 2440		DUT Info	0x84DD20C503A	A - [ms]
		Ch. 39	(39) = 2480		DT Auuress:	JX04DD20C303A	A - [IIIS]
elect Tests to Run	T Tx Tests				DUT Rx	Tests	
DUT Frequency Offset				V PER - Packet	Error Rate (DTM bur		
RF Channel 1	RF Channel 2	RF Channel		RF Channel	1 RF Cha	nnel 2 RF C	Channel 3
Frequency Offset [Hz]				Error Rate - Mea	asured at Gen. Power [d	Bm] -41	
-634 Hz	-89 Hz	-337	Hz	0.0	)0 %	0.00 %	0.00 %
Frequency Offset [ppm]				OK Count			
				OK Count	<b>F</b> 00	Tool IT	
-0.26 ppm	-0.04 ppm	-0.14 p	pm		500	500	500
				Error Count			
DUT Tx Output Power				Enter Count			
	DD CD CC	-22 14 d	<b>D</b>		0	0	0
-25.02 dBm -2	23.93 dBm	-22.14 u	BM				<u> </u>
-25.02 aBm		-22.14 u	BM	Rx Sensitiv	vity Test		<b>.</b>
-25.02 aBm	2 <b>3.93 dbiii</b> j	-22.14 u	<b>B</b> M	Gen. Power Leve		<b>•</b> ,	<b></b>
-25.02 dBm	23.93 <b>GB</b> III	-22.14 U	5m	Gen. Power Leve	el [dBm] -41	- dBm	- dBm
-25.02 dBm	23.93 UBIN	-22.14 U	<u>BM</u>	Gen. Power Leve		- dBm	- dBm
<u>-25.02 dBm</u>	2 <b>3.93 ubii</b>	-22.14 U	<u>sm</u>	Gen. Power Leve	el [dBm] -41	- dBm	- dBm
<u>-25.02 dBm</u>	23.93 dbm	-22.14 0	<u>sm</u>	Gen. Power Leve	el [dBm] -41	- dBm	- dBm
<u>-25.02 dBm</u> -	23.93 dbm	-22.14 0		Gen. Power Leve	el [dBm] -41	- dBm	- dBm
	23.93 dbm	-22.14 U		Gen. Power Leve	el [dBm] -41	- dBm	- dBm
	23.93 dbm	-22.34 0	Bm	Gen. Power Leve	el [dBm] -41	- dBm	- dBm
	23.93 dbm			Gen. Power Leve	el [dBm] -41	- dBm	- dBm
	23.93 dbm		est FA	Gen. Power Leve	el [dBm] -41	- dBm	- dBm
est Result				Gen. Power Leve	el [dBm] -41	- dBm	- dBm
est Result	Test Status			Gen. Power Leve	dBm		- dBm
est Result est Run Start Loop Test No.		Te		Gen. Power Leve	dBm	Ch. Test Time [ms]	- dBm
est Result	Test Status	Te		Gen. Power Leve - ILED Test Limit Erro	el (dBm) dBm	Ch. Test Time [ms]	- dBm
est Result est Run	Test Status Current Channel	Te	est FA	Gen. Power Leve - ILED Test Limit Erro Offset	dBm dBm	Ch. Test Time [ms]	
est Result est Run Start Loop Test No.	Test Status Current Channel 0 Ch. 2402 MHz	Cable Loss 1.00	est FA	Gen. Power Leve - ILED Test Limit Erro Offset Tx Pwr	dBm dBm	Ch. Test Time [ms] s Last 2505.66	Total Test Time [s]
est Result est Run Start Loop Test No. Stop 1: Test Delay [ms]	Test Status Current Channel	Cable Loss 1.00	est FA	Gen. Power Leve - ILED Test Limit Erro Offset Tx Pwr PER	rs 0 3 0 0	Ch. Test Time [ms] s Last 2505.66	Total Test Time [s]
est Result est Run Start Loop Test No. Stop 1 1 Test Delay [ms]	Test Status Current Channel 0 Ch. 2402 MHz	Cable Loss 1.00	est FA	Gen. Power Leve - ILED Test Limit Erro Offset Tx Pwr PER	rs 0 3 0 0	Ch. Test Time [ms] s Last 2505.66	Total Test Time [s]

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:

	tion
Save         Test Results Limits         Test results must be within these limits to be valid.         Min       Max         DUT Frequency Offset [ppm]       -40.00 ÷         DUT Tx Output Power [dBm]       -20.00 ÷	DUT Configuration Direct Test Mode DUT cable loss settings (positive number) DUT 0 cable loss [dBm] 1.00 $\div$ DUT 1 cable loss [dBm] 1.00 $\div$ Options: DUT Communication Protocol HCI  Save
PER - Packet Error Rate [%]       30.70 ÷         DUT advertising packet interval [ms]       90 ÷       110 ÷         Save	Advertising Mode DUT cable loss settings (positive number) DUT 0 cable loss [dBm] 1.00 ÷
	DUT 1 cable loss [dBm] 1.00 ÷ Filter Options: DUT advertising packet scan interval [ms] 115 ÷ DUT min. power level [dBm] -127 ÷ Enable DUT White Listing Select DUT address type Public Device Address ✓



# **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 channel 0, 12 and 39 in Advertising Mode but they can be enabled (marked) or disabled (unmarked).

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.



in Tester System Measure L	.ogs Settings C	onfiguration				
PER Test - Pack       Measure Mode     No. of Packets       ADV Burst ▼     5 ±       Select RF Physical Channels       RF Channel 1     RF Channel 2       ♥     0 ±     ♥     12	RF Channel 3	Payload Type NO_SCAN_RESPON: Channel Mappin Phy LL Ch. 0 (37) = Ch. 12 (38) =	g: MHz 2402 2426 DU	Open Interface	DUT Port Select	Save Click "Save" to store setup
UUT Frequency Offset	Tx Tests	Ch. 39 (39) =	PER - Packet Error	Address: 0x8 DUT Tx Te Rate (DTM burst/A RF Channe	s <b>ts</b> ADV Mode Only)	AA 107 [ms]
Frequency Offset [Hz]			Error Rate - Measured	at Gen. Power [dBm]		
- Hz	- Hz	- Hz		/0	- %	- %
Frequency Offset [ppm] - ppm	- ppm	- ppm	OK Count	-	-	-
UT Tx Output Power			Error Count			
- dBm	- dBm	- dBm		-	-	-
			Gen. Power Level [dBn			
			- dB	n -	dBm	- dBm
			Average packet interve	-	-	-
est Result		Sta	irt test			
est Run	ant Chatur					
Start Loop Test No.	Urrent Channel	Cable Loss Test Com	Pleted 115 Pkt. Int. 0	Time Out Errors	Ch. Test Time [ms Last 0.00 Avg. 0.00	
						2



# 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.

Tester System Me	asure Logs Settings	Configuration				
ADV Burst	- Packet Parameters	Payload Type NO_SCAN_RESPONSE	Gen. Power [dBm]	DUT D	UTO RF Select	Settings Save
RF Channel 1 RF Channel 1 RF Channel 1 RF Channel 1	annel 2 RF Channel 3	Channel Mapping: Phy LL MH Ch. 0 (37) = 240 Ch. 12 (38) = 242 Ch. 39 (39) = 248	2 6 DUT		D20C503AA	store setup 107 [ms]
lect Tests to Run	OUT Tx Tests			DUT Tx Tests		
DUT Frequency Offset			PER - Packet Error F	ate (DTM burst/ADV M	ode Only)	
RF Channel 1 Frequency Offset [Hz]	RF Channel 2	RF Channel 3	RF Channel 1 Error Rate - Measured at	RF Channel 2 t Gen. Power [dBm] -	RF Chan	nel 3
- Hz	- Hz	- Hz	- %	- ·	%	- %
Frequency Offset [ppm]			OK Count			
- ppm	- ppm	- ppm		-	-	-
DUT To Output Parman			Error Count			
DUT Tx Output Power - dBm	- dBm	- dBm		-	_	
- ubiii	- ubiii	- ubiii			-	_
			Gen. Power Level [dBm]			
			- dBn	ו - dB	m	- dBm
			Average packet interval			
				-	-	-
st Result						
		Star	t test			
st Run						
Loop Test No.	Test Status Current Channel		Test Limit Errors	. CL T	at Time [ma]	
Start		Cable Loss Test Complet	Offset 0	Time Out Errors	est Time [ms]	I Test Time [s]
Stop Test Delay [ms	0 Ch. 2402 MHz	1.00 (	Tx Pwr 0	0 Avg.	0.00	0.000
			PER 0	Avg.		0.000
<u> </u>	DUT packet interval co	nfiguration setting [ms]	115 PKL III. 0			



## **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.

PER Test - Packet Parameters           Measure Mode         No. of Packets           ADV Burst         5 ÷	Payload Type NO_SCAN_RESPONSE	Gen. Power [dBm] -50 ÷ Reset DU	DUTO RF Select	ettings Save
Select RF Physical Channels RF Channel 1 RF Channel 2 RF Channel RF Channel 1 I2 IV IV 0 IV 12 IV	el 3 Phy LL MHz Ch. 0 (37) = 2402 Ch. 12 (38) = 2426 Ch. 39 (39) = 2480	DUT Info BT Address:	Select store	"Save" to setup I [ms]
elect Tests to Run UUT Tx Tests UDJT Frequency Offset RF Channel 1 Frequency Offset [Hz] C-243 Hz RF Channel 2 Frequency Offset [pm] C-0.10 ppm DUT Tx Output Power C-1.50 dBm C-2.45 dBm	RF Channel 3 617 Hz 0.26 ppm -3.23 dBm	DUT T3 PER - Packet Error Rate (DTM bu RF Channel 1 RF Ch Error Rate - Measured at Gen. Power O.000 % OK Count Error Count Rx Sensitivity Test Gen. Power Level [dBm] -50 - dBm Average packet interval 103 ms	rst/ADV Mode Only) annel 2 RF Channel 3	5 0 Bm
est Result est Run Start Loop Test No. Stop 1 - 0 Ch. Test Delay [ms] 2402 MHz	Cable Loss Test Completed	Test Limit Errors Offset 0 Tx Pwr 0 Time Out Erro	Ch. Test Time [ms] Last 4617.14 Avg. 4761.32	Time [s] 14.284

When the test is finished, your screen should look like below:

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 like below:

· · ·	sure Logs Settings	Configuration				
ADV Burst	Packet Parameters	Payload Type NO_SCAN_RESPONSI	Gen. Power [dBm	Open Interface          Image: Dut mark         Reset DUT	DUT Port Selection	Settings Save
Select RF Physical Channels RF Channel 1 RF Chan RF Chan		3 Channel Mapping 9 Phy LL N Ch. 0 (37) = 2 Ch. 12 (38) = 2 Ch. 39 (39) = 2	1Hz 402 426	DUT Info BT Address: <mark>0x8</mark>	Select 4DD20C503AA	store setup
elect Tests to Run	JT Tx Tests			DUT Tx Te	sts	
DUT Frequency Offset RF Channel 1 Frequency Offset [Hz] 609 Hz	RF Channel 2	RF Channel 3	RF Channel 1	ror Rate (DTM burst/Al RF Channel red at Gen. Power [dBm]		nnel 3
Frequency Offset [ppm]	-0.11 ppm	0.26 ppm	OK Count	4	5	4
DUT Tx Output Power	22.70 dBm	-22.59 dBm	Error Count	1	0	1
			Gen. Power Level [	JBm] -50	dDua	d Days
			- a - Average packet int	erval	dBm	- dBm
est Result				iiis j 10	<u>/ III5</u>	
		Test	FAILED			
est Run Start Loop Test No.	Test Status Current Channel		Test Limit Errors	0	Ch. Test Time [ms]	
Stop 1 -	0 Ch. 2402 MHz	Cable Loss Test Comp	leted Tx Pwr	3 Time Out Errors	Last 4864.61 Tot Avg. 4696.85	al Test Time [s]
	DUT packet interval o	onfiguration setting [ms]	115 Pkt. Int.	0		
0 1						

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       Stop     0 ÷       25 ÷     ALTBITS_10101010 ▼	DUT Status: Tx Burst mode Reset RF Mode Reset DUT DUT Port Selection
Rx - Mode Start Channel Received Packets Stop 0 1 0	DUTO RF Select  DUTO USB Select Select
Info Status DUT: HCI 0x84DD20C56	) J3AA O Generator & Analyzer: O Tester: O



# 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 Tester Setup - Burst Mode	
Packet Error Rate Tester Status:	Rx Burst mode
Tx - Mode Set "No of packets" = 0 for continuous transmission No. of Packets	Reset Tester
Channel Gen Power [dBm] Pavload Length Pavload Type 1500 ÷	eset Ana+Gen
Start         0	
Stop	
Rx - Mode	
Start Channel Received Packets	
Tester Setup - Continuous Wave (CW)	
Tx - Continuous Wave     Tx - Set Attenuation     Rx - Continuous Wave       Start     Channel     Attenuation [dB]     Start	
Stop 0 ÷ Set 0 ÷ Stop 0 ÷	
Tester RF Input Power           Input level [dBm]         RX - Frequency Offset	
Read -1.09 dBm Get Last Offset [Hz]	
W Monitor 9836	
RX Mode must be active	
RX Mode must be active	
	Þ
nfo Status DUT: HCI 0x84DD20C503AA 🥥 Generator 4	& 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.

Fatur	Measure Logs Settings	Configuration			
Measure Mode PER Te	st - Packet Parameters Packets 10 ÷	Payload Type SCAN_RESPONSE	Gen. Power [dBm]	DUT DUTO RF S	elect V Click "Save" to
Select RF Physical Channel RF Channel 1 RF C 0	Channel 2 RF Channel	3 Channel Mapping: 3 Phy LL MH Ch. 0 (37) = 240 Ch. 12 (38) = 242 Ch. 39 (39) = 248	DUT Info	Select	store setup
Select Tests to Run	DUT Tx Tests		D	UT Rx Tests	
DUT Frequency Offset RF Channel 1 Frequency Offset [Hz]	RF Channel 2	RF Channel 3	PER - Packet Error Rate ( RF Channel 1 Error Rate - Measured at Gen.	RF Channel 2	r) RF Channel 3
- Hz	- Hz	- Hz	- %	- %	- %
Frequency Offset [ppm] - ppm	- ppm	- ppm	OK Count	-	-
☑ DUT Tx Output Power			Error Count		
- dBm	- dBm	- dBm	- Rx Sensitivity Test	-	-
			Gen. Power Level [dBm] -70	- dBm	- dBm
			Average packet interval		
			-	-	-
Fest Result					
		Star	t test		
Fest Run					
Start Loop Test N	Carrent Channer	Cable Loss Test Complet	Test Limit Errors Offset 0 Tx Pwr 0 Time	Ch. Test Time [ Out Errors Last 0	ms] .00 Total Test Time [s]
Test Delay [1			PER         0           115         Pkt. Int.         0	0 Avg. 0	.00 0.000

User Manual V0216.3



Test result using Advertising Mode.

	System Measure	Logs Settings	Configuration					
etup Measure Mode ADV Burst 💌	PER Test - Pac No. of Packets	ket Parameters	Payload Type SCAN_RESPON	ISE 👤	Gen. Power [dBm]	Open Interface U DUT Reset DUT	DUT Port Selection	Save Click "Save" to
RF Channel 1	RF Channel 2			L MHz 37) = 2402 38) = 2426		UT Info BT Address: 0x8	Select 34DD20C503AA	store setup 107 [ms]
elect Tests to I		Tx Tests				DUT Rx Te	etc	
<b>V</b> DUT Freque		TX TESIS			PEP - Packet Err	or Rate (DTM burst//		
RF Chan	-	F Channel 2	RF Channel 3		RF Channel 1	RF Channe		annel 3
Frequency Offs	et [Hz]			E	rror Rate - Measure	ed at Gen. Power [dBm]		
20	68 Hz	-1553 Hz	3202	Hz	10.00	% 30.	00 %	0.00 %
Frequency Offs					K Count			
0.86	i ppm 📒 - (	0.65 ppm	1.33 pp	im j		9	7	8
					rror Count			
DUT Tx Out					inor count		_	
-1.50	dBm - 2	2.41 dBm	-3.19 dB	m j		1	3	2
				G	Rx Sensitivity	ſest		
				G	en. Power Level [di	8m] -88		
					-85 dE	3m -86	dBm -	88 dBm
				U				
				-A	verage packet inter	rval		
					103	ms 10	)9 ms	100 ms
est Result								
			Tes	st PAS	SED			
est Run								
		Test Status			Test Limit Errors			
Start	Loop Test No.	Current Channel			Offset 0		Ch. Test Time [ms]	
	1 🛨	0 Ch.	Cable Loss Test	Completed	Tx Pwr 0	Time Out Errors	Last 51340.92 To	otal Test Time [s]
Stop	Test Delay [ms]	2402 MHz	1.00	1	PER 0	0	Avg. 46355.71	139.067



# **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  $\Omega$  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	3	4	5	5
P	φ	φ	ę	φ	7
C	6	7	8	9	Ŋ

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

Other pins are not connected.

The interface supports the following parameters:

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



#### 16.1.2.2 2-Wire

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

The interface supports the following parameters:

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

#### 16.1.2.3 USB0 and USB1 Connector Pinout



U	SB	A

-	_	_		
1	г	з	Ч	
_				-

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 Payload 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) Direct Test Mode: 100 - 65535 Advertising Mode: 1 - 10000 -40 to -100 dBm RF level output 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.

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 <sup>1)</sup>
Payload length	Direct Test Mode:
	37 bytes or selectable 0 to 37 bytes
	Advertising Mode:
	Advertising packet from DUT

PER result = 0-100%.

<sup>1)</sup> 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.

Direct Test Mode and Advertising Mode are supported by the Demo Application (TestProj\_RTX2254\_BT-D0216.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.

//--- 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 Generator
// RTX BLE Analyzer
// UART-0 COM port
// UART-1 COM port
// USB-0 COM port
// USB-1 COM port
// DUT uses HW
bandsbake
      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;
                                                                  handshake
                                                           // Dut Baudrate
// Active DUT COM port
const int DUT_BAUD = 115200;
rsuint16 DUT_COM = UART0_COM
                                  = UART0_COM;
      rsbool DUT_Comm_Open = FALSE;
                                                              // TRUE if DUT communication
                                                                  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_RTX2254_BT-D0214\Debug\Tes	tProject.exe	
+ : Starting RTX2254 Bluetooth : SW version: D0214 / 2019. +	RF TestProject : 09.30-12:43 : 	•
3. Get Info from DUT loop	A. Open communication to TESTER B. Close communication to TESTER C. Select UARTØ and open communication D. Select UART1 and open communication E. Select USBØ and open communication F. Select USB1 and open communication G. Change Loop counter (3) H. Change COM port numbers I. Show COM port numbers	*

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_RTX2254_BT-D0214\Debug\TestProject.exe	- • ×
++ : Starting RTX2254 Bluetooth RF TestProject : : SW version: D0214 / 2019.09.30-12:43 : ++	
::::== 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==:::         0. EXIT       A. Open communication to TESTER         1. Get BD Address       B. Close communication to TESTER         2. Test PER, Pwr. & Freq. in loop       C. Select UART0 and open communication         3. Get Info from DUT loop       D. Select UART1 and open communicat         4. Getting frequency offset loop       E. Select USB0 and open communicat	ation _
4. detting frequency offset hopping in the predency offset hopping in the predency offset hopping in the predency of the preden	ation
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: 12. Status = OKDurn and check connection to TESTER.Status = OKDUT Baudrate = 115200.Status = OKOpen ing and checking communication to DUTon COM: 22. Status = OKOpening and checking communication to DUT.COM: 22. Status = OKCompleded opening of communication toCOM: 22. Status = OK	
::::==	ation ation
Analyzer current operation mode1=Direct Test Mode.Status = OKClosing the communication to DUT. Closeconnection to DUTon COM:22.Status = OKDUT Baudrate = 115200. Openconnection to DUTon COM:22.Status = OKOpen connection to DUTon COM:22.Status = OKOpening and checking communication to DUT. Loop no:1 of 3Status = OKPacket error test of 1500 packets on channel 19. Tester freq offset read Tester measured powerlevel. Tester measured powerlevel. Tester temperature. Tester temperature =Status = OKStatus = OK Status = OKStatus = OKStatus = OK Status = OKStatus = OKStatus = 0F Status = OKStatus = OKTester freq offset = Status = OKStatus = OKStatus = OK 	
Loop no: 2 of 3 Packet error test of 1500 packets on channel 19. Status = OK TxCount = 1500. Errors = 0. Status = OK Tester freq offset read Status = OK Tester freq offset = 10137Hz Tester measured powerlevel. Status = OK Tester temperature3.79dBm Tester temperature = 31C (1294) Loop no: 3 of 3 Packet error test of 1500 packets on channel 19. Status = OK	
TxCount = 1500. Errors =0.Status = 0KTester freq offset readStatus = 0KTester freq offset =10514HzTester measured powerlevel.Status = 0KTester measured power:-3.83dBmTester temperature.Status = 0KTester temperature =31C (1294)Completed the testloop of PER and Frequency offset.Status = 0K	~



# **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.

#### 9) My advertising DUT is not detected

- a. Make sure that the DUT is advertising. Some BLE devices only have fast advertising interval for the first 30 seconds. Restart advertising.
- b. Make sure that the "DUT advertising packet scan interval" in "Configuration" tab is high enough. You can set it to maximum 10240 ms. This will increase the detection/scanning time