RWC5020x/5021x Application Program

Operation Manual

Version 1.331

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I. Getting Started

This chapter explains how to download and start the RWC5020x/5021x application program.

- 1.1 Download and Installation
- 1.2 Starting the Application
- 1.3 GUI Structure

1.1 Download and Installation

RWC5020x/5021x application program is provided through email or download link and the downloaded file can be unzipped into users' directory. The following figures show an example.

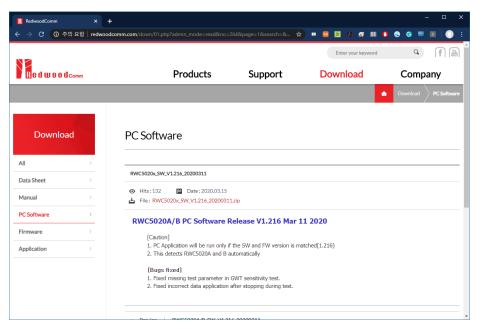


Fig 1.1 Downloading Zip file from the RedwoodComm website

Unzip the zip file and install the executable file as the install wizard guides. It is a 32bits application program and will be installed C:\Program Files (x86)\RWC\RWC5020x. It may be installed in other directories as users like as well.

i₽ RWC5020x — □ ×	i∰ RWC5020x — □ X
Welcome to the RWC5020x Setup With and Red w 0 0 d comm	Select Installation Folder
It guides you through the steps necessary to install RW/C5020x on your computer.	The installer will install RWC5020x to the following folder.
	To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse".
WARNING: This computer program is protected by copyright laws and international treates. Unauthorized reproduction or distribution of this program, in whole or in part, is strictly regulated by	Eolder: C:\Program Files (x86)\RWC\RWC5020x\Bar{Bjowse} Disk Cost Install RWC5020x for yourself, or for anyone who uses this computer:
civil and cirininal law, and is grounds for prosecution.	⊖ Everyone ⊛ Just <u>m</u> e
Cancel <back next=""></back>	Cancel < <u>B</u> ack <u>N</u> ext >

Fig 1.2 Installation wizard



After installation, you can see directories and files as follows (Figure 1.3)

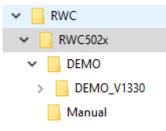


Fig 1.3 Installed directory structure

In directory RWC502x /

Executable file RWC502x_App.exe

Dll files

DEMO directory

Manual directory

In directory DEMO /

An example demo project data: DEMO_Vxxx0.prj and the same named directory

In directory DEMO_V1330/

Example DUTs : dut_name.ini and the same named directories

In directory manual

RWC502x LoRaWAN Tester Application Program manual (V1.xxx).pdf

RWC502x LoRaWAN Tester User Manual (Ver 1.xxx ENG).pdf

RWC502x PC APP Release Note.pdf

RWC502x Firmware Release Note.pdf

Note: PC's OS

- 1. Windows is supported, but Linux and IOS are not supported.
- 2. Users are recommended to use windows7 or later versions as OS.
- 3. If you want to avoid the authorization problem with your OS system, please install this application on a non-system disk, such as 'D drive'.

Language setup

- 1. Users are strongly recommended to use '.' than ',' for decimal symbols.
- 2. Users are strongly recommended to use ',' than '.' for digit grouping symbols.
- 3. Users are strongly recommended to use English over other languages.

1.2 Starting the Application

When you execute the application 'RWC502x_App.exe', it will start as shown in the figure 1.4.

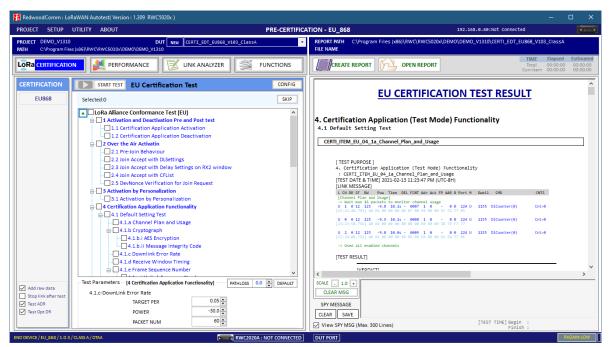


Fig 1.4 Initial screen of the application

1.2.1 Connection

Users need to make a connection between this application and the RWC5020x/5021x equipment. Connection means that the application recognizes if a correct equipment is connected, if it has validated licenses, and so on. After connection, the application shows the type of recognized equipment, the serial number, version of Firmware, and makes functions enabled according to the type of equipment and licenses.

👫 RedwoodComm : LoRaWAN Autotest(Version : 1.309 RWC5020B)

Fig 1.5 Title message of RWC502x application

In order to connect the application to RWC5020x/5021x, click on [SETUP/Connect RWC502x] menu or icon. This will bring up the pop-up window.

RWC502x C	DNTRO	L PORT		(×
CONNECT	via		00	OM	
IP ADDRESS	192	168	0	47	
Scan IP Connected	d with RV	VC502x			
SCAN					
192.168.0.	1	~	254	-	
	CL	OSE			

Fig 1.6 RWC502x CONTROL PORT WINDOW

There are two connection methods, LAN or COM. The connection via LAN means that the application controls equipment via wired LAN or WIFI. The connection via COM means that the application controls equipment via UART(RS232, VCOM). For safe connection, it is recommended to connect a PC to RWC 502x by a wired LAN method. For more detailed description, please refer to chapter 2.3.

1.2.2 Identification of RWC5020x/5021x

There are a couple of types of equipment operated with this RWC5020x/5021x application program, such as RWC5020A, RWC5020B, RWC5020M, and RWC5021P.

This application program detects the type of equipment automatically and limits some functions according to the equipment.

- RWC5020A(Discontinued for sales) : Stand-alone type equipment
- **RWC5020B** : Stand-alone type equipment. It has frequency measurement function and more accurate performance than RWC5020A.
- **RWC5020M** : Dongle type equipment. It has the same functions and performance accuracy as the RWC5020B.

RWC5021P : Dongle type protocol tester. It has limited functions such as pre-certification test, and link analyzer compared to the others.



a. RWC5020A/B

b. RWC5020M

c. RWC5021P

Fig 1.7 RWC5020x/5021x equipment series



1.3 GUI Structure

RWC5020x/5021x application program consists of three classified functional windows: Project menu windows, Test functions windows, and Report functions windows. In the following figure, the functions in the blue-colored box are project menu windows, and the windows in the red-colored box are test related ones, and the windows in the green-colored box are report related ones. The next chapters will include the detailed explanation about each window respectively.

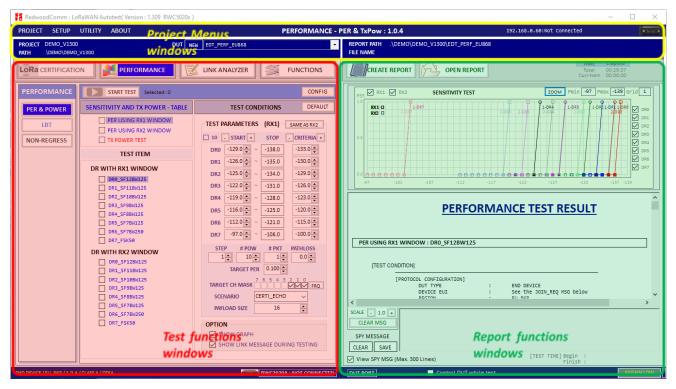


Fig 1.8 Function window classification

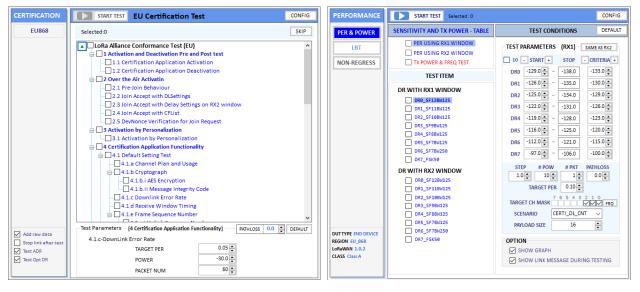
This application consists of 4 classified functions such as LoRaWAN[®] pre-certification test, performance test, Link analyzer, and functionalities (Fig 1.9). Clicking the one of the main menu buttons changes the test function window and report function window (Fig 1.10).



Fig 1.9 Main menu buttons

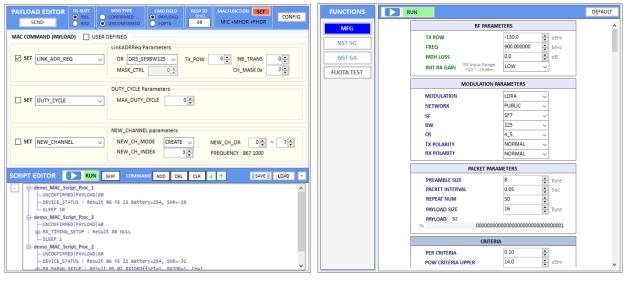


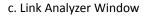
1.3.1 Test function windows



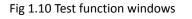
a. Pre-Certification Test Window

b. Performance Test Window



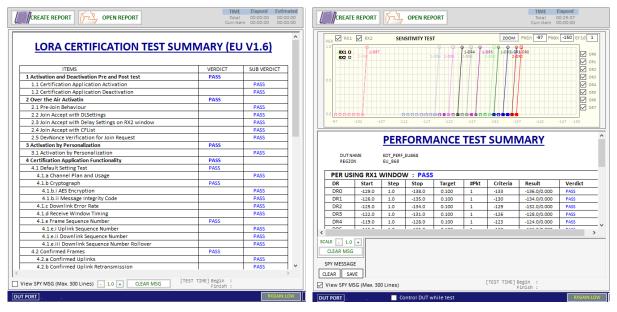


d. Functionality Test Window



1.3.2 Report function windows

The report function windows have different functions from the test functions. If you click on one of the main menu buttons, the test function window will appear on the left side and report function window will appear on the right side (figure 1.11).



a. Pre-Certification Report Window

b. Performance Report Window

Fig 1.11 Report function windows



II. Menus

This chapter explains how to handle a project, DUT, test condition and test environment. With the project menus, users can create, open a project file, delete the currently opened project, and create or delete DUT files. Users can also open the ready-made demo project.

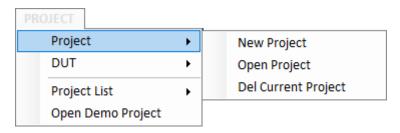
- 2.1 PROJECT
- 2.2 SETUP
- 2.3 UTILITY
- 2.4 ABOUT



2.1 PROJECT

2.1.1 Project Menu

With the project menus, users can create a new project file, open an existing project file, or delete the currently opened project. Users can also open the ready-made demo project. The [PROJECT] menu consists of three sub-menus: [New Project], [Open Project] and [Del Current Project].





2.1.1.1 New Project

To start any test, at least two basic works must be done; one is creating a project and the other is creating a DUT. When you create a new project, 'project_name.ini' file and the same named directory will be created. A project must have at least one DUT. A project may have many DUTs. When a project is created, the project name and directory information will be displayed in the project information windows.

PROJECT		
Project	•	New Project
DUT	۲	Open Project
Project List	►	Del Current Project
Open Demo Project		

Fig 2.2 Project Menu and sub menus

👫 New Project file						×
← → • ↑ <mark> </mark>	~ d	ata (E:) > LoraProject	ٽ ~	Search LoraP	roject	م
Organise 🔻 🛛 Ne	w fol	der				?
 Downloads Music Pictures Videos local (C:) PROJECT (D:) data (E:) 	^	Name	No items match		odified	Туре
DIS 10727 (F·)	¥	<				>
File <u>n</u> ame:	lora_	demo.prj				~
Save as <u>t</u> ype:	Proje	ect file (*.prj)				~
∧ Hide Folders				<u>S</u> ave	Cancel	

Fig 2.3 Creating a project window

PROJECT	lora_demo	DUT	NEW	-
PATH	D:\LoraProject\lora_demo			

Fig 2.4 Example of a new project (DUT empty)

2.1.1.2 Opening Project

Using the [Open project] menu, users can open one of the existing projects that were created by this application. When a project is opened, the last tested DUT file will also be opened automatically.

2.1.1.3 Deleting Current Project

Using the [Del Current Project] menu, you can delete the currently opened project including all DUT files in the project folder. All deleted projects or DUT files cannot be recovered. Be careful when deleting projects or DUTs. To prevent unwanted deletion, only the opened project can be deleted.

2.1.1.4 Project List

Project List menu shows the list of projects in the current directory. Just clicking one of the listed projects will open the project. Maximum of 7 project names will be saved.

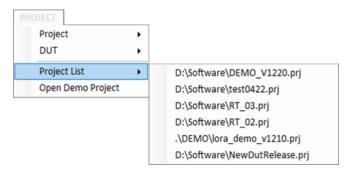


Fig 2.5 Project List Menu

2.1.1.5 Opening Demo Project

[Open Demo Project] opens the ready-made demo project.

The demo project is installed with the installation of the RWC5020x/5021x application in '.\DEMO\', the sub-directory of the application installation directory.

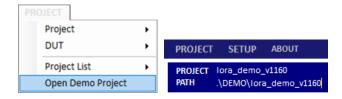


Fig 2.6 [Open Demo Project] menu and directory information

2.1.2 DUT menu

In this application, DUT means 'device name to be tested'. DUT is a member of a project. Before creating a new DUT, a project must be created or opened. If a project is created or opened, as many DUTs can be created in the project as users need. When a new DUT is created, a 'DUT_name.ini' file and the same named directory will be created.

2.1.2.1 New DUT

Clinking on the [New DUT] menu in the DUT Menu or NEW button brings the 'NEW DUT CREATION' popup window, which is designed to help you create a new DUT. Type a DUT name, select one of DUT types, select one of regions, and click the [CREATE] button.

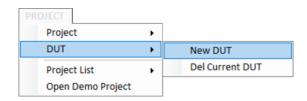


Fig 2.7 New DUT Menu

Before DUT file is created, users must select some parameters related to LoRaWAN protocols such as DUT type, region, LoRaWAN[®] version, Class, Operator(KR, CN), channel mode(AS), channel plan(CN) and Frequency offset(AS region) shown in the figure 2.8 as they want to test. Once a DUT file is created, the name of the DUT, and the parameters mentioned above cannot be modified. If you want to modify any of them, you must create a new one. The DAUTO NAMING will help you quickly name it.

NEW DUT	CREATION	AUTO NAMING	
NAME	EDT_AS923_V104_0	ClassA_LORAWAN_For	
DUT TYPE	END DEVICE ~		
REGION	AS_923	~	
LoRaWAN	1.0.4		
CLASS	Class A	~	
	OPERATOR	LoRaWAN \sim	
	CH MODE	AS_923-1 🗸 🗸	
	FREQ OFFSET	0.0000 🚔 MHz	
CRE	ATE	CANCEL	

Fig 2.8 Creating a new DUT

The list of DUT names that you created will be shown in the DUT list box as shown in the following figure.

DUT	NEW	EDT_CERTI_EU868	•
		EDT_CERTI_AS923	
		EDT_CERTI_EU868	
		EDT_CERTI_IN865	

Fig 2.9 List of DUT names

2.1.2.2 DEL Current DUT

Using [DEL Current DUT], you can delete the currently opened DUT file. Be careful when deleting DUTs because the deleted DUT file cannot be recovered. To prevent unwanted deletion, only the opened DUT can be deleted in this application.



Fig 2.10 Del Current DUT menu

2.2 SETUP

2.2.1 Connect RWC5020x/5021x

RWC5020x/5021x Application works under connection between users' PC and RWC5020x/5021x.

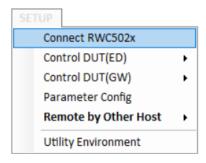


Fig 2.11 Connect RWC502x menu

2.2.1.1 Open RWC5020x/5021x CONTROL PORT window

Clicking on [Connect RWC502x] in SETUP Menu or clicking on icon will show the 'RWC502x CONTROL PORT' window which is designed to help you set up RWC5020x/5021x's IP. There are two ways to connect your PC and RWC5020x/5021x equipment via LAN and COM(RS232).

2.2.1.2 Connection via LAN

Set the IP address same as the RWC5020x/5021x's IP address connected to the PC and click the [CONNECT] button. If your PC recognizes an RWC5020x/5021x, the status [CONNECT] will be changed to [CONNECTED]. After connection, the application's title bar will show the version, equipment types (RWC5020A/B/M), and local PC's network IP. Some of the functionality or parameters will be limited according to the type of RWC5020x/5021x.

The PC's IP information is useful to set up the server information when you test Gateway's Non-regression performance.

CONNECT	via		00	MO
IP ADDRESS	192	168	0	47

CONNECTED	via		0	сом
IP ADDRESS	192	168	0	47

a. Before connection

b. After connection

Fig 2.12 Make a connection between PC and RWC5020x/5021x via LAN

RedwoodComm : LoRaWAN Autotest(Version : 1.327 RWC5021P)

a. Information on the application title bar(SW version & equipment type)

192.168.0.74-RWC5021P,VER:1.327,SN:0X0000008

b. information of the FW(equipment type, version, serial number)

Fig 2.13 The information after connection with an RWC5020x,5021x equipment

In order to scan the IP that is connected with RWC502x equipment, click the [SCAN] button. It will scan all IPs by changing only the last IP addresses 1 upto 254 with "*IDN?" command. The first three addresses of the search target are the same as the IP address of the user-editable address. The result will be display win the SPY message window.



Scan IP function

a.

SCALE _ 1.0 +		^
CLEAD MCC	ACK Start scanning IPs, wait please.	
SPY MESSAGE	47 RWC5020A LORAWAN Tester, Ver=1.330,SN=RWC502018A0016 Elapsed time=00:00:19	
CLEAR SAVE		~

b. Result information



2.2.1.3 Connection via COM Port

Set the IP address same as the RWC5020x/5021x's IP address connected to the PC and click the [CONNECT] button. If the application recognizes an RWC5020x/5021x, the status [CONNECT] will be changed to [CONNECTED].

 \boxtimes \boxtimes CONNECTED CONNECT via 🔿 LAN COM via ○ LAN ● COM SCAN COM COM14 SCAN COM COM14 Change Tester's IP via COM Change Tester's IP via COM GET SET GET SET STATIC STATIC TYPE DYNAMIC TYPE DYNAMIC 192.168.0.34 192.168.0.34 ADDRESS 192.168.0.34 ADDRESS 192.168.0.34 CLOSE CLOSE

After connection, all information will be displayed the same as the LAN connection case.

a. Before connection

b. After connection

Fig 2.15 Make a connection between PC and RWC5020x/5021x via COM

If RWC5020x/5021x is connected via COM, changing the address and type of IP is allowed. Users can get the current address and type of IP of RWC5020x/5021x by clicking the [GET] button. Users can set the address and type of IP as you want by clicking the [SET] button. Changing IP address is only available in STATIC mode.

Change Tester's IP via COM			Change Teste	er's IP via COM —		
	GET	SET		GET	SET	
ТҮРЕ	DYNAMIC	STATIC 🗸	TYPE	DYNAMIC	DYNAMIC 🗸	7
ADDRESS	192.168.0.74	192.168.0.34	ADDRESS	192.168.0.74	192.168.0.34	

a. Changing IP is allowed with STATIC mode

b. Changing IP is not allowed with DYNAMIC mode

Fig 2.16 Control window to change the address and type of IP.



Fig 2.17 The information after connection with an RWC5020x,5021x equipment via COM

2.2.2 Control DUT (ED)

This function is used to control DUT via RS232 while testing as needed.

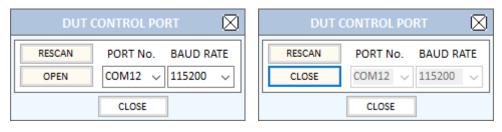
Control DUT menu consists of five sub menus: Open Port, Load User Cmds, Show User Cmds, Pop DUT Monitor, and Make Cmds Template. This function will be enabled in the SKT certification test.

SETUP		
Connect RWC502x		
Control DUT(ED)	•	Open Port
Control DUT(GW)	•	Load User Cmds
Config Test		Show User Cmds
Remote by Other Host	•	Pop DUT Monitor
Utility Environment		Make Cmds Template

Fig 2.18 Control DUT Menu

2.2.2.1 Open PORT

Clicking [Open PORT] will show a 'DUT CONTROL PORT' window that is designed to help set and open UART port for DUT control. After configuring its port number and baud rate, click the [OPEN PORT] button within the DUT Control Port window. If there is a valid RS232 port, [OPEN PORT] text will be changed to [CLOSE PORT] and 'PORT No.' and 'BAUD RATE' combo boxes will be disabled. If there are no items in the 'PORT No.' combo box, click on the [RESCAN] button.



a. Before opening port b. After opening port



2.2.2.2 Load User Commands

Clicking [Load User Cmds] will show 'Open File Window' for opening a DUT control file (.txt) which describes configuration and user commands. If you want to create your own command file, use the [Make Cmds Template] function which helps you create a template file.

2.2.2.3 Show User Commands

Clicking [Show User Cmds] will show the 'USER COMMAND MAPPER' window and show user-defined commands which are loaded in 2.2.2.2. If it is needed to create a new user command file, click on the [TEMPLATE] button to open a template and create a new one.

	Load File	Clear	USER COMMAND MAPPER) D	X
Refer	ence Action		User Defined Cmd	Comment		^
set_cla	ass_a	AT+CLS	; 0;	0: A, 2: C		
set_cla	ass_b	AT+CLS	; 1;	0: A, 2: C		
set_cla	ass_c	AT+CLS	; 2;	0: A, 2: C		
set_ul_	_cycle_off	AT+PRF	1;	0: off, 1: on		
set_ul_	_cycle_on					
set_act	tivation	NONE;				
set_app	o_key	AT+AK	00000000000000000000000	128 bit		
set_dev	/_eui	NONE;				
set_app	o_eui	NONE;				
set_app	os_key	NONE;				
set_nw	ks_key	NONE;				
set dev	/ addr	NONE;				~
<					>	

Fig 2.20 Example of USER COMMAND MAPPER

2.2.2.4 Show DUT Monitor

Clicking [Show DUT Monitor] will show a pop-up window to show the commands and DUT's responses.

🔛 DUT Control M	onitor		-	
COMPORT COM6	BAUD RATE 38400	Show time	Font Size 9.0 🛓	CLEAR

Fig 2.21 DUT Monitor screen

2.2.2.5 Make Commands Template

Clicking [Make Cmds Template] will create a template file that is designed to help create users' own control commands file. You can fill it up and save it as a text file (.txt) and load it onto 'USER COMMAND MAPPER' using the [Load User Cmds] menu.

USER_0	CTRL_CME	D_TEMP	LATE.INI - Notepad		×
<u>File</u> <u>E</u> dit	F <u>o</u> rmat	<u>V</u> iew	<u>H</u> elp		
[CONFIG] VENDOR=NC NUM_CMDS= BAUDRATE= EOL=rn SEQ_CMD_I [CMDS] set_class set	annone annone	; ; =NONE; ONE; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ;	//insert your command and parame	ter:	
<pre>set_dr0=N set_dr1=N set_dr2=N</pre>	IONE;				
set_dr3=N set_dr4=N	IONE;				
set_dr5=N	IONE;				
cot ntn n	um=NONE				

Fig 2.22 Template file to help to create a your command file

2.2.3 Control DUT (GW)

This application provides a simple server function for Gateway's non-regression test defined by SEMTECH. In order to communicate with DUT(Gateway) in JSON, users have to set the gateway's IP and server's port number. [Control DUT(GW)/Config IP] menu or [GW IP] button on NON-REGRESS tab of PERFORMANCE function tap shows 'GW IP/HOST PORT' window which will help you set the gateway's IP and the HOST(Server)'s port number.

SETUP		
Connect RWC502x		
Control DUT(ED)	•	
Control DUT(GW)	•	Config IP
Parameter Config		
Remote by Other Host	•	
Utility Environment		

Fig 2.23 [Control DUT(GW)/Config IP] menu

SET GW IP / HOST PORT 🛛						
GATEWAY IP SERVER PORT	192.168.0.75 1780					
SERVER IP : 192.168.0.10						
192.168.0.10:Realtek PCIe GbE Family Controller						

Fig 2.24 [GW IP/HOST PORT] menu

A selected IP address of the PC will be displayed as a SERVER IP at the bottom of the setup window.(ex. SERVER IP:192.168.0.10). Users must set the server IP same to the above SERVER IP in the setup file of Gateway. If all parameters are set up correctly, the RWC5020x/5021x application will start to wait for gateways messages. After receiving a JSON packet, this application will respond to the gateway as a server. All IP addresses and sockets of the user PC will be listed up. Users may select one of the lists.

2.2.4 Parameter Configuration

[Parameter Config] or CONFIGTEST shows a window in which users can set up the basic properties of DUT. This configuration is applied to all test functions of the application.

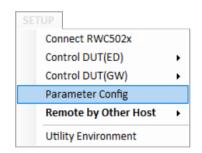
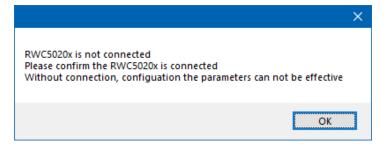
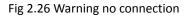


Fig 2.25 Parameter Config menu for displaying 'Parameter configuration' window

When you open the parameter configuration window without connection with the RWC5020x/5021x, a warning message box will appear to remind that all changed parameters will be adopted only after connection.





P.	PARAMETER CONFIGURATION				rameters are goi	ng to be ap	plied when a	test starts	
DUT T END D	YPE Device test			VERSION	1	CLASS Class A	ACTIVATIO OTAA	NN V	
	PRO	TOCOL PARAMETER	RS	^		RF F	PARAMETERS		^
- ACTIVATION	N PARAM tMode @Activ	ation 🗌 Ch	eck EUI		RF PARAM TX POW PATHLOSS		-30.0	dBm	
_	0x		000000001 32 digi 000000001 16 digi 000000001 16 digi	ts	- CHANNEL GROU	P & MASK	0.0	CH MASK 0x 7	
DEV_ADDR APPS NWKS	0x 0000000	000000000000000000000000000000000000000		ts	CHANNEL INFO. RX2 F RX2 D	REQ	869.525000 DR0_SF12BW	MHz 1125 V	
ADR MAC RS MAC RS DOWN	DRK DIC DOWNLINE SP FIELD SP SLOT LINK SLOT	RX1 NONE PAYLO RX1 RX1 ON	~	~	UpLink Ch UL_CH_00 86 UL_CH_01 86 UL_CH_02 86 UL_CH_03 86 UL_CH_03 86 UL_CH_05 86 UL_CH_06 86 UL_CH_07 86	58.3000 58.5000 57.1000 57.3000 57.5000 57.7000	DownL DL_CH_00 DL_CH_01 DL_CH_02 DL_CH_03 DL_CH_03 DL_CH_04 DL_CH_05 DL_CH_06 DL_CH_07	868.3000 868.5000 867.1000 867.3000 867.5000 867.7000	~
DEFAULT			ОК		CANCEL				

Fig 2.27 PARAMETER CONFIGURATION

2.2.4.1 Protocol Parameters

All parameters are defined in LoRaWAN[®] Alliance's specification. Some of the parameters will be changed according to the DUT type, region, LoRaWAN[®] version, activation method, and class.

<u>TestMode @Activation</u>

This parameter determines whether to force DUT to enter certification test mode by sending the Activated Test Mode command after the activation procedure. For LoRaWAN1.0.4 and LoRaWAN1.1, the TxPerChangeReq MAC command is used instead of the Activated Test Mode command. It will be shown in Link analyzer mode of EDT.

Check_EUI

This parameter decides whether or not to compare DEV_EUI and APP_EUI during activation. If this parameter is checked, RWC5020x/5021x (Gateway/Server) compares DEV_EUI and APP_EUI and accepts only if the value is equal to the same.

DUT_TYPE

There are two types of DUT, END DEVICE and GATEWAY. If the DUT type is END DEVICE, RWC5020x/5021x operates as a gateway. If the DUT type is GATEWAY, it operates as an end device.

REGION

RWC5020x/5021x supports various regions [EU 868, EU 433, US 915, AU 915, CN 470, KR 920, AS 923, IN 865, RU 864, KZ 865, IL 917]. Using this parameter, users could select the region to test.

OPERATOR

This parameter determines whether to enable LoRa operator-specific procedures and parameters. It is only applicable to South Korea (SKT) and China (ICA) in the current version of firmware.

PROTOCOL_VER

This parameter defines the version of LoRaWAN[®] protocol to be emulated by RWC5020x/5021x.

Supporting versions: 1.0.2 / 1.0.3 / 1.0.4 / 1.1

<u>CLASS</u>

There are three different classes in LoRa devices. Class A is Bi-directional End Devices, Class B is Bi-directional End Devices with scheduled receive slots, and Class C is Bi-directional End Devices with maximal receive slots. This parameter defines the class mode of RWC5020x/5021x.

ACTIVATION

LoRaWAN[®] defines two types of Activation procedures (OTAA, ABP). This parameter defines the activation mode of RWC5020x/5021x.

<u>APP_KEY</u>

The APP_KEY is an AES-128 root key specific to the End Device. Whenever an End Device joins a network via over-the-air activation, the APP_KEY is used to derive the session keys NwkSKey and AppSKey specific for that End Device to encrypt and verify network communication and application data. This parameter must be set to the same value as the APP_KEY on DUT.

DEV_EUI

The DEV_EUI is a globally unique End Device identifier. The DEV_EUI is stored in the End Device before the activation procedure is executed. If the CHECK_EUI is ON, this parameter must be set as the same value stored on the DUT.

APP EUI

The APP_EUI is a global application ID in IEEE EUI64 address space that uniquely identifies the entity able to process the Join-request frame. The APP_EUI is stored in the End Device before the activation procedure is executed. If the CHECK_EUI is ON, this parameter must be set as the same value stored on the DUT.

DEV_ADDR

During the activation, the gateway assigns DEV_ADDR value to the End Device. If activation mode is ABP, this parameter must be set as the same value stored on the DUT. If activation mode is OTAA, this parameter value is used to generate a Join-accept message.

<u>APPS_KEY</u>

APPS_KEY is used to encrypt and verify application data between Gateway and End Device. This value is derived from APP_KEY during OTAA. If activation mode is ABP, this parameter must be set as the same value stored on the DUT.

NWKS_KEY

NWKS_KEY is used to encrypt and verify network data between Gateway and End Device. This value is derived from APP_KEY during OTAA. If activation mode is ABP, this parameter must be set as the same value stored on the DUT.

UPDATE FCNT

This parameter determines the initial value of FCNT before activation procedure and also updates FCNT values after activation.

<u>ADR</u>

LoRa network allows the End Devices to individually use any of the possible data rates. This feature is used by the LoRaWAN[®] to adapt and optimize the data rate of static End Devices. This is referred to as Adaptive Data Rate (ADR) and when this is enabled the network will be optimized to use the fastest data rate possible.

DOWNLINK_SLOT

When RWC5020x/5021x emulates Gateway/Server mode (EDT), it could respond to the uplink frame by downlink frame using RX1 window or RX2 window. Using this parameter, users can select the RX window for testing the DUT.

<u>NET_ID</u>

The NET_ID is a network identifier to uniquely identify the network. This parameter value is used to generate a Join-accept message.

RX1_DR_OFFSET

This parameter sets the offset between the uplink data rate and the downlink data rate used to communicate with the End Device on the first reception slot (RX1). This parameter value is used to generate a Join-accept message.

RX2 DR

This parameter defines the data rate of a downlink using the second receive window. This parameter value is used to generate a Join-accept message.

RECEIVE_DELAY

The first receive window RX1 opens RECEIVE_DELAY seconds after the end of the uplink modulation. This parameter value is used to generate a Join-accept message.

LINK_MARGIN

This parameter is an 8-bit unsigned integer in the range of 0~254 indicating the link margin in dB of the last successfully received *LinkCheckReq* command. This parameter value is used to generate *LinkCheckAns* command.

GATEWAY_CNT

This parameter is the number of gateways that successfully received the last *LinkCheckReq*. This parameter value is used to generate *LinkCheckAns* command.

<u>YEAR</u>

This parameter indicates the year of RWC5020x/5021x time information. This parameter is used to generate *DeviceTimeAns* command and Beacon.

<u>MONTH</u>

This parameter indicates the month of RWC5020x/5021x time information. This parameter is used to generate *DeviceTimeAns* command and Beacon.

<u>DAY</u>

This parameter indicates the day of RWC5020x/5021x time information. This parameter is used to generate *DeviceTimeAns* command and Beacon.

<u>HOUR</u>

This parameter indicates the hour of RWC5020x/5021x time information. This parameter is used to generate *DeviceTimeAns* command and Beacon.

MINUTE

This parameter indicates the minute of RWC5020x/5021x time information. This parameter is used to generate *DeviceTimeAns* command and Beacon.

SECOND

This parameter indicates the second of RWC5020x/5021x time information. This parameter is used to generate *DeviceTimeAns* command and Beacon.

NETWORK

This parameter indicates the type of LoRa network, in other words the synchronization word to be used in LoRa modulation.

2.2.4.2 RF Parameters

RF parameters are related with RWC5020x/5021x's hardware, test environment, and control parameters.

TX POW

This parameter defines the output power of RWC5020x/5021x in dBm.

INIT_RX_GAIN

The RWC5020x/5021x has an AGC (Automatic Gain Control) function. So the RWC5020x/5021x will set appropriate RX gain after receiving a few packets from the DUT. This parameter defines the initial RX gain when the Link is started. It is very important to set this parameter correctly to get the proper test result quickly. Set to LOW if the expected input level from your DUT to RWC5020x/5021x is higher than -15dBm. Set to HIGH if the expected input level is lower than -40dBm. Otherwise set it to MIDDLE.

PATH_LOSS

Users can set the path loss between the RF port of RWC5020x/5021x and DUT RF port. RWC5020x/5021x's real output power will be increased by this value to compensate for path loss.

SYSCLK_OFFSET

This parameter defines the system clock frequency (32MHz) offset value in ppm. It modifies RF frequency as well as LoRa modulation signal.

FREQ_OFFSET

This parameter defines the RF frequency offset value in ppm.

TIME_OFFSET

This parameter defines the time offset value in us.

CH_MASK_0

This parameter defines the mask of channels to be used for LoRa communication, which is applicable only to regions of EU 868, EU 433, KR 920, AS 923, IN 865, RU 865, and KZ 865.

CH_GROUP

This parameter defines the mask of the channels to be used for LoRa communication, which is applicable only to regions of US 915, AU 915, and CN 470.

RX2 FREQ

This parameter defines the frequency of a downlink using the second receive window.

<u>RX2_DR</u>

This parameter defines the data rate of a downlink using the second receive window.

DL_CH_00 ~ DL_CH_07

This parameter defines the real channel frequency of each downlink channel index.

<u>UL_CH_00 ~ UL_CH_07</u>

This parameter defines the real channel frequency of each uplink channel index.

<u>UL_CH_64 ~ UL_CH_71</u>

This parameter defines the real channel frequency of each 500kHz uplink channel index.

2.2.5 Remote by Other host

This application provides a way to control itself by other controllers via RS232. This function is a quite limited way to control but is useful to test pre-certification remotely. For more detail, refer to the application note.

SETUP	
Connect RWC502x	
Control DUT(ED)	•
Control DUT(GW)	•
Parameter Config	
Remote by Other Host	•
Utility Environment	

Fig 2.28 [Config Remote Port] menu

RE	MOTE CONT	ROL 🔀
RESCAN	PORT No.	BAUD RATE
OPEN PORT	COM9 🗸	115200 🗸
	CLOSE]

Fig 2.29 REMOTE CONTROL setup window

To see the remote commands, click on the [Show Cmd List] menu.

SETUP		
Connect RWC502x		
Control DUT(ED)	•	
Control DUT(GW)	•	
Parameter Config		
Remote by Other Host	•	Config Remote Port
Utility Environment		Show Cmd List

Fig 2.30 [Show Comd List] menu

PC:CONF:MODE [PARAM] PARAM=CERT/PERF/UTIL/LINK PC:CONF:CERT:EU_CERT [PARAM] PARAM=SEL_ALL/DESEL_ALL PC:CONF:CERT:AS_CERT [PARAM] PARAM=SEL_ALL/DESEL_ALL PC:CONF:CERT:AS_CERT [PARAM] PARAM=SEL_ALL/DESEL_ALL PC:CONF:CERT:AS_CERT [PARAM] PARAM=SEL_ALL/DESEL_ALL PC:CONF:CERT:IN_CERT [PARAM] PARAM=SEL_ALL/DESEL_ALL PC:CONF:CERT:IN_CERT [PARAM] PARAM=SEL_ALL/DESEL_ALL PC:CONF:CERT:REGION [PARAM] PARAM=SEL_ALL/DESEL_ALL PC:CONF:CERT:REGION [PARAM] PARAM=EU/US/AS/KR/IN PC:CEAD:RWC5020X_SERIAL? PC:READ:COMMANDS? PC:READ:CORT_STAT? PC:READ:CERT_CURR? PC:EXEC:CREATE_DUT [PARAM] PARAM=DUT_NAME(just) PC:EXEC:OPEN_DUT [PARAM] PARAM=DUT_NAME(just) PC:EXEC:CREATE_PRJ [PARAM] PARAM=PRJ_NAME(should be full path including drive name) PC:EXEC:CERT START PC:EXEC:CERT START PC:EXEC:CERT START	REMO	DTE COMMANDS LIST	\boxtimes
PC:EXEC:CREATE_DUT [PARAM] PARAM=DUT_NAME(just) PC:EXEC:OPEN_DUT [PARAM] PARAM=DUT_NAME(just) PC:EXEC:CREATE_PRJ [PARAM] PARAM=PRJ_NAME(should be full path including drive name) PC:EXEC:CRET START	PC:CONF:CERT:EU_CERT [PARAM] PC:CONF:CERT:US_CERT [PARAM] PC:CONF:CERT:AS_CERT [PARAM] PC:CONF:CERT:KR_CERT [PARAM] PC:CONF:CERT:IN_CERT [PARAM] PC:CONF:CERT:REGION [PARAM] PC:READ:IDN? PC:READ:RWC5020X_SERIAL? PC:READ:COMMANDS? PC:READ:CERT_STAT?	PARAM=SEL_ALL/DESEL_ALL PARAM=SEL_ALL/DESEL_ALL PARAM=SEL_ALL/DESEL_ALL PARAM=SEL_ALL/DESEL_ALL PARAM=SEL_ALL/DESEL_ALL	
PC:EXEC:CERTISTOP PC:EXEC:CON_RWC5020 [PARAM] PARAM=123.123.123.123	PC:EXEC:CREATE_DUT [PARAM] PC:EXEC:OPEN_DUT [PARAM] PC:EXEC:CREATE_PRJ [PARAM] including drive name) PC:EXEC:CERT START PC:EXEC:CERT STOP	PARAM=DUT_NAME(just) PARAM=PRJ_NAME(should be full path	

Fig 2.31 Remote commands list for controlling PC application program

2.2.6 Utility Environment

This function is for user convenience. All options are saved and reloaded automatically

DUT CONTROL ENVIRONMENT

Load commands at start

This application remembers the last user command file name. If you check this option, it will load the last user command files when the application is started.

Open port at start

This application remembers the last opened RS232 port name. If you check this option, it will reconnect the last opened RS232 port when started. But be careful when using this option, because it could take longer to launch the application if there is no same port anymore.



Fig 2.32 [Utility Environment] menu

REPORTING OPTION

Open report after creation

If you check this option, the application will open the created report automatically when you create a report file. If not checked, the report will be created but not opened automatically.

APPLICATION ENVIRONMENT

 $\hfill\square$ NO asking when naming

If you check this option, the application will create or save files without opening a file wizard window.

Load last project at start

If you check this option, the application will open the last opened project when it starts.

□ Show local IP on app.

If you check this option, the application will show your PC's IP address on the top.

□ Initialize All Parameters with new DUT.

If you check this option, this application will initialize all test parameters as default without asking. If not checked, it will use them as it was.

MESSAGE MAXIMUM LINE NUMBER

• LINK ANALYZER

The maximum line number of the log window in the Link analyzer tab.

Range : 100 - 3000

 \circ NRT JSON

The maximum line number of the JSON log window in the non-regression test function tab.

Range : 100 - 3000

 \circ SPY MSG

The maximum line number of the SPY message window

Range : 100 - 1000

<u>THEME</u>

• BLUE

This option sets the color theme of the application as blue.

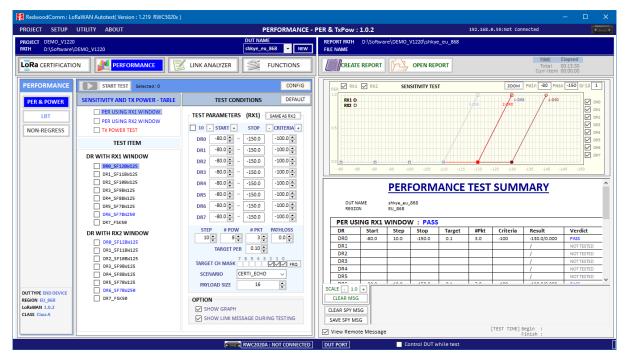


Fig 2.33 Blue theme of RWC5020x/5021x application

○ GRAY

This option sets the color theme of the application as gray.

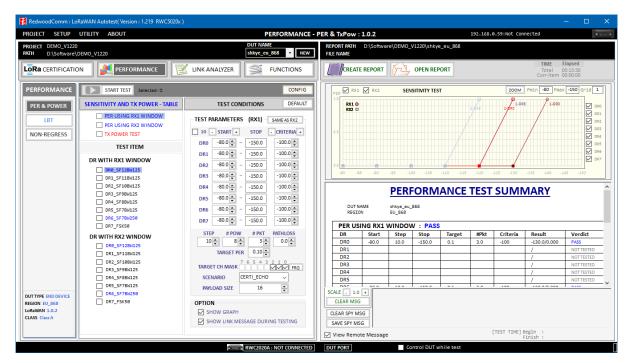


Fig 2.34 Gray theme of RWC5020x/5021x application

○ GREEN

This option sets the color theme of the application as green.

ROJECT SETUP	UTILITY ABOUT PERFORMANCE -					PER & TxPow : 1.0.2						192.168.0.59:Not Connected		
ROJECT DEMO_V1220 ATH D:\Software\D	DEMO_V1220	DUT NAM shkye_eu			eport Path Le name	D:\Softwar	e\DEMO_V	1220\shkye	e_eu_868					
ORa CERTIFICATIO		LINK ANALYZER	FUNCTIONS			REPORT	523	OPEN REP	ORT				lapsed 0:13:30 0:00:00	
PERFORMANCE	START TEST Selected : 0		CONFIG	1	PER 🗹 RX1	RX2	SENS	ITIVITY TES	т		ZOOM	Pmin -80 Pmax	-150 Grid 1	
PER & POWER	SENSITIVITY AND TX POWER - TABLE	TEST CONDITIONS	DEFAULT		RX1 O					2-10R6	1-DR	6 1-DRO		
LBT NON-REGRESS	PER USING RX1 WINDOW PER USING RX2 WINDOW TX POWER TEST	TEST PARAMETERS (RX1)	SAME AS RX2		0.5						/	/	DR1 DR2 DR3 DR4	
non neoneos	TEST ITEM	DR0 -80.0 ← ~ -150.0 DR1 -80.0 ← ~ -150.0	-100.0							/	/	/	DR4 DR5 DR5 DR6	
	DR WITH RX1 WINDOW DR0_51280425 DR1_5180425 DR2_510804125 DR2_510804125 DR3_579804225 DR5_57780425	DR2 80.0 ÷ - - 150.0 - 100.0 ÷ DR3 80.0 ÷ - - 150.0 - 100.0 ÷ DR4 80.0 ÷ - - 150.0 - 100.0 ÷ DR4 80.0 ÷ - - 150.0 - 100.0 ÷ DR5 -80.0 ÷ - - 150.0 - 100.0 ÷ DR6 -80.0 ÷ - - 150.0 - 100.0 ÷			DUT NAME RECION shys_eu_866									
	DR6_SF78W250 DR7_FSK50	DR7 -80.0 -150.0	-100.0 🜩		PER USING RX1 WINDOW : PASS									
	DR WITH RX2 WINDOW 0 06_51280125 07L_5180125 07L_5180125 07L_55980125 07L_55980125 07L_55780125 07L_55780125 07L_55780125	STEP # POW # PKT 10 8 3 TARGET PER 0.10 3 TARGET CH MASK 5 4 SCENARIO CERTI_ECHO PAYLOAD SIZE 16	PATHLOSS 0.0 ÷ 2 1 0 ✓ ✓ ✓ ↓ ↓ ↓	s	DR DR0 DR1 DR2 DR3 DR4 DR5 CALE - 1.0		Step 10.0	Stop -150.0	Target 0.1	#Pkt 3.0	Criteria -100	Result -130.0/0.000 / / / / / / / / / / /	Verdict PASS NOT TESTED NOT TESTED NOT TESTED NOT TESTED NOT TESTED	
UT TYPE END DEVICE EGION EU_868 oRaWAN 1.0.2 LASS Class A	DR7_F5K50	OPTION SHOW GRAPH SHOW LINK MESSAGE DURI		CLEAR MSG CLEAR SPY MSG SAVE SPY MSG View Remote Message [TEST TIME] Begin : Finish :										

Fig 2.35 Green theme of RWC5020x/5021x application



2.3 UTILITY

It consists of 3 utility functions: DUT Control, Tester(RWC5020x/5021x) Control, and Screen capture. You can find them on the UTILITY menu tab at the top of the application. Screen Capture function will be enabled when it is available according to the type of equipment.

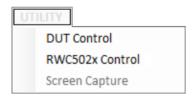


Fig 2.36 Utility menus

2.3.1 DUT Control

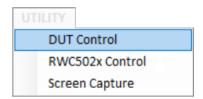


Fig 2.37 DUT control menu

This function is a simple terminal tool. It helps users control DUTs through RS232 using string command. Users can transmit DUT control commands all by one click or line-by-line.

2.3.1.1 How to Use

You can type your own remote control commands and click RWC5020x/5021x sequentially. Users can use a special command SLEEP which lets the PC wait for transmitting for the specified duration of time. The parameter of SLEEP is time in millisecond units, e.g., SLEEP 1000 makes PC wait for 1000ms.

DUT CONTROL	LER 🔀
RUN	USER CMD PORT
D:\Software\wisol_rmt_cmd_comments.txt	SAVE CLEAR VERIFY
1 LRW 48 0 2 LRW 48 1 3 LRW 32 5 5 LRW 32 5 5 LRW 35 0 6 LRW 35 1 7 LRW 37 8 8 LRW 30 otas 9 LRW 31 alb2c3 10 Cnf 1	

Fig 2.38 Sending commands of DUT Control function

2.3.1.2 Verify Commands

Clicking verify will verify the commands on the editor. Verifying criteria is based on the loaded user commands. Verified commands will be colored. The blue colored commands are user commands, and the grey colored ones are not user commands.

2.3.1.3 Transmission Methods

Clicking will start transmitting commands. Transmitting commands will be stopped when you click or once all commands are transmitted. Clicking send command will transmit the selected command. Clicking une by line will transmit listed commands line by line.

2.3.2 RWC5020x/5021x Control

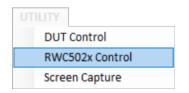


Fig 2.39 RWC5020x/5021x control menu



This function is a simple terminal tool. It helps users control RWC5020x/5021x through LAN using string commands. Users can transmit RWC5020x/5021x remote commands all by one click or line-by-line.

2.3.2.1 How to Use

Clicking will start transmitting commands on the command window sequentially. Users can use a special command SLEEP, which will make the PC wait until the next command transmission is ordered. The parameter of SLEEP is time in millisecond units, e.g., SLEEP 1000 makes the PC wait for 1000ms.

2.3.2.2 Template

Template functions will fill the commands window with ready-made commands sequence as an example.

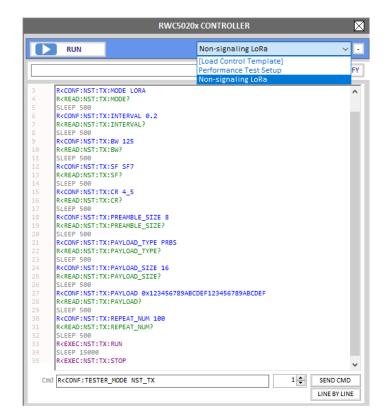


Fig 2.40 Sending commands of RWC5020x/5021x Control window

2.3.2.3 Sending commands

Clicking will start transmitting commands. Transmitting commands will be stopped if you click or once all commands are transmitted. Clicking send cmb will transmit the selected command. Clicking will transmit the listed commands line by line increasing the command number.

2.3.3 Screen Capture



Fig 2.41 Screen capture menu

Clicking **GET IMAGE** will capture and show the current screen of the connected RWC5020x/5021x and save it as a bmp file. If you click one of the listed-up files on the list window, the selected bmp file will be shown on the image window. It will be enabled with RWC5020A and B but not with RWC5020M.

									SC	REE	EN CA	PTURE		Σ
X	0)		GET	SCR	EEN							Capture	RWC2020	
FIL	ΕN	AM	E	.\DEN	//Olora	_demo	_v121	0\d	emo\	der	no_20	20-03-10_18_46_	_47.bmp	
GΑ	TE	ΝA	Υī	EST			EU	_86	8 / \	/1.0	0.2 / A	008)ETH(MD(RMT) EXT (CAP) [FN	FUNCTION
L	сн	DR	SF	вw	Pow	Time	FCnt	Ack	Port	м	dwell	CMD	Link	Link
U	0	0	12	125	-30.0	REF		0			1482	Join-request	Analyzer	Analyze
U	2	0	12	125	-30.0	REF		0			1482	Join-request		
υ	2	0	12	125	-30.0	REF		0			1482	Join-request	Devuer	Power
U	1	0	12	125	-30.0	REF		0			1482	Join-request	Power Measure	Time
υ	0	0	12	125	-30.0	REF		0			1482	Join-request	CH TIME	
U	1	0	12	125	-30.0	REF		0				Join-request		Power
U	2			125		REF		0				Join-request	Receiver	Chann
U	0			125	-30.0	REF		0				Join-request	Sensitivity	
U	2			125	-30.0	REF		0		-		Join-request	Scholervicy	Meas Sens
U	1	-			-30.0	REF		0				Join-request		Jens
in1	С	LEA	R		^{Fn2} MA	C_SEND		,	Activ	atin	E	_	LINK: Running	
lem lem lem lem	A CLEAR Fin2 MAC_SEND Activating LINK: Running APTURED IMAGE LIST 24 files													
dem dem dem dem dem	0_2 0_2 0_2 0_2 0_2 0_2	2020 2020 2020 2020 2020 2020	3-0) 3-0) 3-0) 3-0) 3-0) 3-0)	2-07 2-07 2-07 2-10 2-10 3-10	13_31 13_31 13_32 14_09 14_09 09_50	21.bi 248.bi 209.bi 546.bi 518.bi 340.bi 40.bi	np np np np np np							

Fig 2.42 Screenshot of the RWC5020A/B



2.4 ABOUT

It is not functional but informational menus. It consists of 5 menus : Manual, Upgrade Notice, Licenses, About application, and Website .

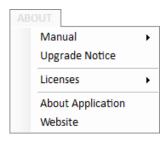


Fig 2.43 About menus

2.4.1 Manual

Clicking [Manual] will show the operation manual of this application. Clicking the name of each manual will open the Redwoodcomm's website to let users download the latest version of manuals.

ABOUT	
Manual 🕨	RWC502x Application Program Manual
Upgrade Notice	RWC502x Tester User Manual
Licenses	PC APP Release Note
About Application Website	Firmware Release Note

Fig 2.44 Opening the manual

RWC5020x Application Program Manual : The PC application operation manual RWC5020x Tester User Manual : The stand-alone equipment user manual including remote control commands PC APP Release Note : Release note for pc application release Firmware Release Note : Release note for firmware release

2.4.2 Upgrade Notice

Users can check the latest version of this application software using the [Upgrade Notice] menu.

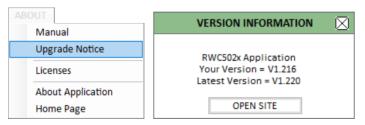


Fig 2.45 Upgrade Notice menu and information window

→ C ① 주의 요함 red	woodcomm.com	n /down/01.php		됴 익 ☆ ■	🔤 📓 🗵 📾 🛄 🕻	i 😔 G	🔤 🔳 I 🕕
					Enter your keyword	Q	
Redwoodcomm		Pr	oducts	Support	Download	Com	ipany
						•	Download A
Download	All						
All >			Select a document type	 Select a category 	v		Q
All > Data Sheet >			Select a document type	• Select a category	T		٩
	No	Document type	Select a document type Solution Category		v	Hits	Q Date
Data Sheet	No 103	Document type Application				Hits 90	
Data Sheet > Manual >			Solution Category	Introduction to RWC5020	Subject		Date
Data Sheet > Manual > PC Software >	103	Application	Solution Category	Introduction to RWC5020	Subject x LoRaWAN Tester (Ver 1.22) ion Brochure - RWC3020M/B &	90	Date 2020-04-21
Data Sheet > Manual > PC Software > Firmware >	103	Application Data Sheet	Solution Category LoRa Test Solutions LoRa Test Solutions	Introduction to RWC5020 LoRa/LoRaWAN Test Solut	Subject kLoRaWAN Tester (Ver 1.22) ion Brochure - RWC5020M/B & 5,20200311	90 112	Date 2020-04-21 2020-04-21
Data Sheet > Manual > PC Software > Firmware >	103 102 101	Application Data Sheet Firmware	Solution Category LoRa Test Solutions LoRa Test Solutions LoRa Test Solutions	Introduction to RWC5020 LoRa/LoRaWAN Test Solut RWC5020A/B_FW_V1210	Subject (Ver 1.22) ion Brochure - RWC5020M/B & 5,20200311	90 112 109	Date 2020-04-21 2020-04-21 2020-03-15

Clicking on [OPEN SITE] button will open up the download web page of RedwoodComm.

Fig 2.46 Download page of RedwoodComm web page

2.4.3 Licenses

After connecting the application to RWC5020x/5021x, users can see the included licenses by clicking on the Licenses menu. Available regional licenses can be different according to the version of software, policy of sales, or LoRaWAN version. If you want to add options, please contact to sales@redwoodcomm.com.

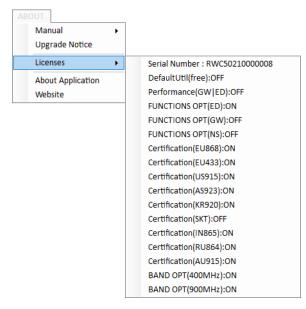


Fig 2.47 An example of included licenses in the RWC5020x



2.4.4 About Application

This function shows the SW version and Image of which is connected equipment



Fig 2.48 About image of RWC5020x/5021x

2.4.5 Website

This function launches a web browser and opens the RedwoodComm's website <u>https://Redwoodcomm.com</u> automatically.



III. Test Functions

This chapter explains how to use pre-certification tests, RF performance tests, Link Analyzer, other functions and utilities. With test functions, you can select one of the tests, handle test operation, and set up a test environment.

- 3.1 Pre-Certification Test
- 3.2 Performance Test
- 3.3 Link Analyzer
- 3.4 Functions

3.1 Pre-Certification Test

This application provides the LoRaWAN[®] pre-certification test functions. Refer to the fig 3.1 for simple operation of the function. It has 4 test condition \Box add raw data, \Box stop link after test, \Box test ADR, \Box test Opt DR.

□Add raw data : Test option for adding raw data or not in test test result

□**Stop link after test** : Test option for sending "EXEC:LINK:STOP" command to break join after pre-certification Test. By unchecking the option, there is no need to reset the DUT when users do the pre-certification test again. □**Test ADR** : Option for enabling test items related with ADR

Test Opt DR : Option for enabling test items related to optional DR in every region.

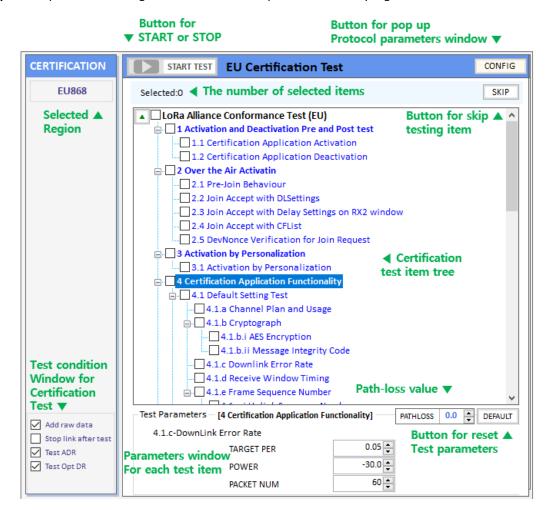
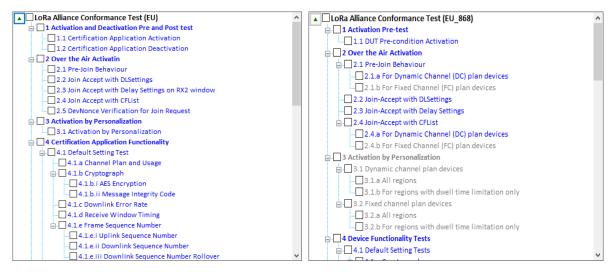


Fig 3.1 Test function window for LoRaWAN[®] pre-certification.

3.1.1 LoRaWAN[®] Pre-Certification

This application provides a test function which is compatible with the LoRaWAN[®] protocol test. We named it LoRaWAN[®] Pre-certification. It is available in the version of '1.0.2/1.0.3' and '1.0.4'. For the version '1.0.2/1.0.3' it

provides 5 regions such as EU, US/CA, AS, KR, and IN. For the version '1.0.4' it provides 9 regional pre-certification tests such as EU868, EU433, US/CA, AS, KR, IN, RU, AU, and IL. Other regional certification functions will be added as soon as they are published. If you select the region and version of LoRaWAN[®] when you create a new DUT file, all regional parameters and test items will be configured automatically according to the certification.



a. LoRaWAN[®] Version 1.0.2/1.0.3

b. LoRaWAN[®] Version 1.0.4

Fig 3.2 Two different pre-certification test a.to the versions of LoRaWAN[®] (EU case)

3.1.2 Operator Certification

There is an Operator Certification option, SKT. Other private certifications could be added according to further requests.

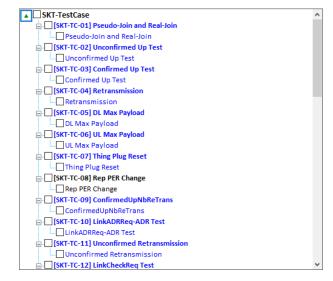


Fig 3.3 A special operator's certification test (SKT)



3.1.3 Pre-Certification Test Items

3.1.3.1 Meaning of Text Colors

Each color has the meaning of verdict; the blue-colored items mean PASSED, the red-colored items mean

FAILED, the black-colored items mean NOT_TESTED, and the grey-colored ones mean Not-selected OPTIONAL

ite	ms.	
-----	-----	--

Test Mode Activation	5.1 AES Encryption	- 9 MAC Commands	15 LinkADRReq MAC command
Blue : PASSED	Red : FAILED	Black : NOT TESTED Gr	ay : NOT SUPPORTED.

Fig 3.4 Colored text in pre-certification test window

3.1.3.2 Selection and Test Parameter Configuration

Select the test items to be tested by clicking the check boxes in front of the subtitles. If you click a test item, its test parameters will be shown at the bottom of test items.

Test Parameters — [4 Certification Application Fun	Test Parameters — [4 Certification Application Functionality]					
4.1.c-DownLink Error Rate						
TARGET PER	0.05 🔹					
POWER	-30.0 🜲					
PACKET NUM	60 💂					

Fig 3.5 Configuration of Test Parameters

3.1.3.3 Start Test

If you click **START TEST** button, all selected items will be tested sequentially. Keep in mind the RWC5020x/5021x application program will automatically overwrite the result after each item is tested without asking whether the selected item was tested previously or not. In other words, the application will always keep the recent test results.

3.1.3.4 Control DUT

If you want to control DUT while testing, have the box Control DUT checked. Then this application will send control commands according to the loaded user control command file. Refer to 2.2.2 for DUT control. You can see the transmitted commands and received responses to/from DUT respectively on the DUT control monitor window. Click the DUT Monitor button and a large DUT control monitor will pop up.

🔜 DUT Control Monito	r		—	
COMPORT COM6	BAUD RATE 115200	Show time	Font Size 9.0 🜲	CLEAR
ΟΤΑΑ			-	
DevEui= 34-31-37-32-74-	36-7A-0F			
AppEui= 01-01-01-01-01-	01-01-01			
AppKey= 2B 7E 15 16 28 /	AE D2 A6 AB F7 15 88 09 CF 4F 3C			
VERSION: 44021110				
txDone				
txDone				

Fig 3.6 DUT Control Monitor

COM PORT and BAUD RATE information of the current control port will be displayed as follows.

🛃 DUT Control	Monitor	🔜 DUT Control Monitor			
COMPORT	BAUD RATE	COMPORT COM6	BAUD RATE 115200		
	a. Before connection	b. After connection			

Fig 3.7 COM PORT and BAUD RATE after connection.

3.1.3.5 Test Result – Summary Table

If you click on the certification title, you can see the test summary table on the result window.

DIECT SETUP	UTILITY ABOUT	PRE-CERTIFICATION - EU_868	192.168.0.60:Not Connected	
UECT DEMO_V1310 H C:\Program File	DUT NEW CERTI_EDT_EU868_V103_Class es (x86)\RWC\RWC5020x\DEMO\DEMO_V1310	SA REPORT PATH C:\Program Files (x86)\RWC FILE NAME	C\RWC5020x\DEMO\DEMO_V1310\CERTI_EDT_EU868	_V103_ClassA
Ra CERTIFICATIO	N PERFORMANCE LINK ANALYZER			ME Elapsed Estimat tal 00:00:00 00:00:00 -Item 00:00:00 00:00:00
RTIFICATION	START TEST EU Certification Test		TION TEST SUMMARY (E	U V1.6)
EU868	Selected:0	SKIP	· · ·	
	LoRa Alliance Conformance Test (EU)	^ ITEMS	VERDICT	SUB VERDICT
		1 Activation and Deactivation Pre and		
	- 1.1 Certification Application Activation	1.1 Certification Application Active		PASS
	1.2 Certification Application Deactivation	1.2 Certification Application Deact	tivation	PASS
	2 Over the Air Activatin	2 Over the Air Activatin	PASS	
		2.1 Pre-Join Behaviour		PASS
	2.2 Join Accept with DLSettings	2.2 Join Accept with DLSettings		PASS
	2.3 Join Accept with Delay Settings on RX2 window	2.3 Join Accept with Delay Settings	on RX2 window	PASS
		2.4 Join Accept with CFList		PASS
	2.5 DevNonce Verification for Join Request	2.5 DevNonce Verification for Join	Request	PASS
	3 Activation by Personalization	3 Activation by Personalization	PASS	
	3.1 Activation by Personalization	3.1 Activation by Personalization		PASS
	A Certification Application Functionality	4 Certification Application Functional	lity PASS	
	4.1 Default Setting Test	4.1 Default Setting Test	PASS	
	4.1.a Channel Plan and Usage	4.1.a Channel Plan and Usage		PASS
	□ 4.1.b Cryptograph	4.1.b Cryptograph	PASS	
		4.1.b.i AES Encryption		PASS
		4.1.b.ii Message Integrity Code	e	PASS
	4.1.b.ii Message Integrity Code	4.1.c Downlink Error Rate		PASS
		4.1.d Receive Window Timing		PASS
		4.1.e Frame Sequence Number	PASS	
	👜 🛄 4.1.e Frame Sequence Number			0.00
Add raw data	Test Parameters [4 Certification Application Functionality] PATHLOSS	0.0 - DEFAULT SCALE . 1.0 +		
Stop link after test		CLEAR MSG		
Test ADR				
		SPY MESSAGE		
Test Opt DR		CLEAR SAVE		
		View SPY MSG (Max. 300 Lines)	[TEST TIME] Begin :	
		with art was (wax, sou titles)	Finish :	

Fig 3.8 Displaying Test Result – Summary Table

3.1.3.6 Test Result – Detail Report

If you click on the sub test item title text, you can see the detailed test result on result window

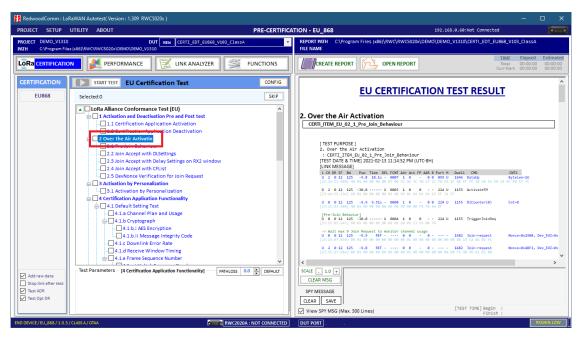


Fig 3.9 Displaying Test Result – Detail Report



3.2 Performance Test

Performance test function consists of PER & POWER, LBT, and NON-REGRESS test. Refer to the figure 3.10 for an example. It has a "

Stop link after test" option.

□**Stop link after test** : Test option for sending "EXEC:LINK:STOP" command to break join after performance test. By unchecking the option, there is no need to reset the DUT when users do the performance test again.

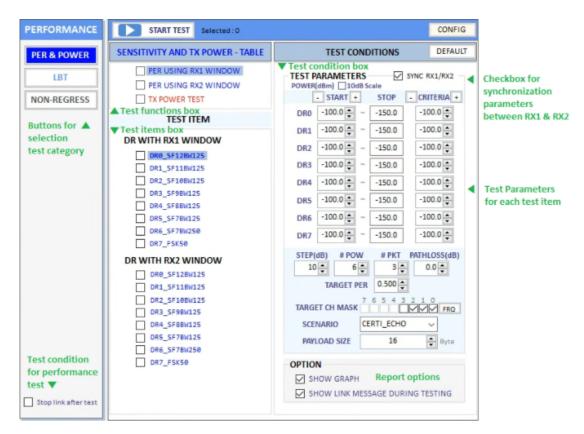


Fig 3.10 Test parameters and conditions

3.2.1 PER & POWER

This function allows RWC5020x/5021x to search the sensitivity level by measuring the PER (Packet Error Rate) and measure TX power of DUT according to the test parameters and conditions. You can modify test conditions and parameters. If you click on the [CONFIG] menu, you can set protocol parameters in the PARAMETER CONFIGURATION window.

3.2.1.1 Selection item

Select or deselect each item that you want to test by clicking each checkbox in the test items box. If you want to add or remove all test items at once, have the check box of the title checked or unchecked in the test function box. Whenever you click on each test item, its test conditions will be shown in the test condition box. If you want to change the displayed item, click each test title in the test function box.

3.2.1.2 Test conditions

All test condition parameters such as start power, power step, number of power, and number of packets can be set up in the functions window.

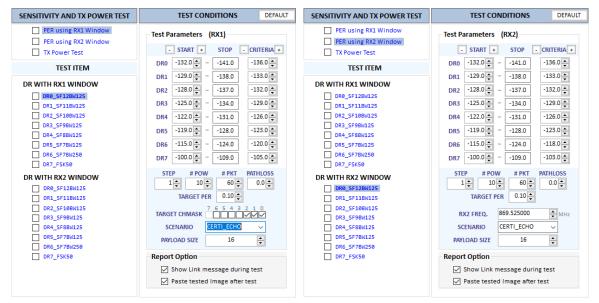


Fig 3.11 Test Conditions for PER using RX1 and RX2 Window

Parameters for PER test using RX1 and RX2 Window

<u>SCENARIO</u>

This is the test scenario of the sensitivity test. In 'NORMAL_UL', DUT should send unconfirmed or confirmed uplink messages periodically <u>and the Tester sends confirmed</u> downlink messages and checks the flag of acknowledgement in DUT frames in order to count errors. In 'CERTI_ECHO', DUT should enter the test mode by the Tester's activation command and the Tester will use EchoRequest/EchoResponse in order to count errors. In 'CERTI_DL_CNT', DUT should enter the test mode by the Tester's activation command and the test mode by the Tester's activation command and the test mode by the Tester's activation command and the test mode by the Tester's activation command and the test mode by the Tester's activation command and the test mode by the Tester's activation command and the test mode by the Tester's activation command and the test mode by the Tester's activation command and the Tester will use DL_Counter value in order to count errors.

For Version 1.0.2/1.0.3, it supports NORMAL_UL, CERTI_ECHO, CERTI_DL_CNT For Version 1.0.4, it supports NORMAL_UL only

PACKET_NUM

This is the packet number of tests at each test point. <u>Increasing it the test result</u> may have higher resolution but the testing time may become longer.

START_POW

This defines the start value of POWER sweep.

STOP_POW

This defines the stop value for POWER sweep (read only).

STEP_POW

This defines the step value for POWER sweep.

NUM_POW

This defines the number of power values for POWER sweep.

TARGET_PER

This is a parameter to set the user's target PER. The test sweeps fully in the range of POWER until DUT does not satisfy TARGET_PER.

TARGET_CH_MASK

This parameter encodes the channels usable for uplink access. A bit in the CH_MASK field set to 1 means that the corresponding channel can be used for uplink transmissions.

<u>TARGET_DL_CH_00~07</u>

This parameter redefines DL channel frequencies for sensitivity test. Tester will use the DL_CHANNEL_REQ MAC command to modify downlink channel frequencies.

DOWNLINK_SLOT

This is a parameter to select the RX window for testing the DUT.

TARGET_DR

This is a parameter to determine the DR by sending MAC commands before the Sensitivity Test starts. *LinkADRReq* will be sent in case of RX1 and *RXParamSetReq* will be sent in case of RX2.

DL_PACKET

This is a parameter to define the contents of downlink packets to be used in the 'NORMAL_UL' scenario.

FPORT

This parameter defines the FPort number of a user-defined MAC Command.

PAYLOAD_SIZE

This parameter defines the size of payload of a user-defined MAC Command.

PAYLOAD

This parameter defines the content of the payload in hexadecimal format.

Parameters of TX Power Test

<u>MODE</u>

It determines the test method of Power Measurement. If it is set at SYNC_TO_LINK, Power measurement is fully synchronized with Link Analyzer. Power Measure displays all Received packets while Link Analyzer is running. If it is set as SCENARIO, Power Measure function measures TX power of DUT using special scenarios which is selected by SCENARIO parameter.

SCENARIO

It has three different scenarios to activate DUT to measure power of DUT. NORMAL_UL scenario mode just receives any packet from DUT and measures the power. CERTI_DL_CNT scenario will set the DUT as Test mode at the beginning stage and measure the power of DL_counter packets from DUT. CERTI_CW scenario will set the DUT as Test mode and transmit CW_ENABLE MAC command to transmit CW signal by DUT and measure this CW signal power. If you are using RWC5020B, this scenario mode also measures CW frequency value. For Version 1.0.2/1.0.3, it supports NORMAL_UL, CERTI_DL_CNT, CERTI_CW For Version 1.0.4, it supports NORMAL_UL, CERTI_CW

SENSITIVITY AND TX POWER TEST	TEST CONDITIONS	DEFAULT	SENSITIVITY AND TX POWER TEST	TEST CONDITIONS	DEFAULT
PER using RX1 Window PER using RX2 Window	TEST PARAMETERS		PER using RX1 Window	TEST PARAMETERS	
TX Power Test	POWER MIN.	MAX.	TX Power Test	POWER MIN.	MAX.
TEST ITEM TX POW INDEX TXPower0 TXPower1 TXPower2 TXPower3	Power0 14.0 € ~ Power1 12.0 € ~ Power2 10.0 € ~ Power3 8.0 € ~ Power4 6.0 € ~ Power5 4.0 € ~	16.0 • 14.0 • 12.0 • 10.0 • 8.0 • 6.0 •	TEST ITEM TX POW INDEX TXPower0 TXPower1 TXPower2	$\begin{array}{c c} 16.0 & & \\ \hline & 14.0 & \\ \hline & 14.0 & \\ \hline & 12.0 & \\ \hline & 10.0 & \\ \hline & & 8.0 & \\ \hline & & 8.0 & \\ \hline & & 6.0 & \\ \hline & & 6.0 & \\ \hline \end{array}$	$ \sim \frac{16.0 + 1}{14.0 + 1} $ $ \sim \frac{12.0 + 1}{14.0 + 1} $ $ \sim \frac{12.0 + 1}{14.0 + 1} $ $ \sim \frac{10.0 + 1}{14.0 + 1} $ $ \sim \frac{10.0 + 1}{14.0 + 1} $
TXPower4 TXPower5 TXPower6 TXPower7	Power6 2.0 ↔ ~ Power7 0.0 ↔ ~	4.0 ÷	TXPOwer3 TXPOwer4 TXPOwer5 TXPOwer6 TXPOwer7	4.0 ÷ 2.0 ÷ 0.0 ÷	~ 4.0 + ~ 2.0 +
		#РКТ] ЗФ		SCENARIO CERTI_CW PATHLOSS CW FREQ(MHz) 0.0 900.0000	TIME(sec)
	Report Option Show Link message during test Paste tested image after test			Report Option Show Link message dur Paste tested Image after	-

a. Test condition for TX Power test using LoRa Signal b. Test condition for TX Power test using CW Fig 3.12 Test Conditions for TX Power Test

<u>UL_DR</u>

This parameter is the requested data rate of End Device for uplink messages.

ADR_POWER

This parameter is the requested output power of End Device for uplink messages.

TARGET_CH_MASK

This parameter encodes the channels usable for uplink access. A bit in the CH_MASK field set to 1 means that the corresponding channel can be used for uplink transmissions.

<u>#PKT</u>

This parameter defines the minimum packet number for power measurement on each channel which is defined by TARGET_CH_MASK.

CW_TIMEOUT

This parameter indicates the timeout for CW transmission.

CW_FREQ

This parameter indicates the frequency of CW signal.

<u>CW_POW</u>

This parameter indicates the power of CW signal.

3.2.1.3 Protocol Parameters

If you want to modify more details of protocol parameter such as keys, network, channel mask, and so on, click on **CONFIG** button and the parameter configuration window will appear as shown in Fig 3.13. Listed protocol parameters will be changed according to the functions such as certification, performance, and link analyzer.

PARAMETER CONFIGURATION				A	II para	ameters are going to be a	applied when a	test starts	
DUT ⁻ END	TYPE Device test	REGION EU_868	PROT-OP LoRaWAN		SION 4	CLASS Class A		ON V	
	PR	OTOCOL PARAM	ETERS		^	R	F PARAMETERS		^
- Activatio	n Param		Check EUI			RF PARAM TX POW RX GAIN	-30.0 LOW	dBm	
APP_KEY DEV_EUI	ex 0000000	000000000000000000000000000000000000000	00000000000000000000000000000000000000	-		RX GAIN WARNING TO	60 0.0	🖨 min	
APP_EUI			000000000000000000000000000000000000000			PATHLOSS FREQ OFFSET	0.0	↓ ppm	
DEV_ADDR	0x		00000001	8 digits		TIME OFFSET	0	us	
APPS NWKS		000000000000000000000000000000000000000		_		CHANNEL GROUP & MASK			
	9X 9999999	000000000000000000000000000000000000000	000000000000000000000000000000000000000	32 digits				0x 7	
LINK NETWO	DRK	PU	JBLIC	~		CHANNEL INFO.			_
PERIO		NK N	ONE	~		UpLink Channel List	Down	Link Channel List	
ADR		0		~		UL_CH_00 868.1000 UL CH 01 868.3000	DL_CH_00 DL_CH_01	868.1000 868.3000	
			~		UL_CH_02 868.5000	DL_CH_02	868.5000		
	SP SLOT ILINK SLOT	R) R)		~	~	UL_CH_03 867.1000 UL_CH_04 867.3000 UL_CH_05 867.5000	DL_CH_04	867.1000 867.3000 867.5000	~
DEFAULT		·		ок		CANCEL			

Fig 3.13 Parameter configuration window

3.2.1.4 Start/Stop Test

If you click on the **START TEST** button, the selected test items will be tested sequentially. Anytime you can stop the test by clicking the same button. It can take a long time to save the tested data. During the test, you can uncheck the selected test items that are still not tested yet. But for tested items, unchecking is not effective.

3.2.1.5 Tested Result

If you clink on the

SENSITIVITY AND TX POWER - TABLE

title, you can see the test result summary table.

DUT REGI	NAME ION	EDT_PERF EU_868	_EU868							
PER U	SING RX1	WINDO	N : PAS	s						
DR	Start	Step	Stop	Target	t #Pkt	Cr	iteria	Re	sult	Verdict
DRO	-129.0	1.0	-138.0	0.100	1	-13	3	-13	5.0/0.000	PASS
DR1	-126.0	1.0	-135.0	0.100	1	-13	0	-13	3.0/0.000	PASS
DR2	-125.0	1.0	-134.0	0.100	1	-12	9	-13	1.0/0.000	PASS
DR3	-122.0	1.0	-131.0	0.100	1	-12	6	-12	8.0/0.000	PASS
DR4	-119.0	1.0	-128.0	0.100	1	-12	3	-12	5.0/0.000	PASS
DR5	-116.0	1.0	-125.0	0.100	1	-12	0	-12	2.0/0.000	PASS
DR6	-112.0	1.0	-121.0	0.100	1	-11	.5	-12	0.0/0.000	PASS
DR7	-97.0	1.0	-106.0	0.100	1	-10	0	-10	1.0/0.000	PASS
PER U	SING RX2	WINDO	N : PAS	s						
DR	Start	Step	Stop	Target	t #Pkt	Cr	iteria	Re	sult	Verdict
DRO	-129.0	1.0	-138.0	0.100	1	-13	3	-13	6.0/0.000	PASS
DR1	-126.0	1.0	-135.0	0.100	1	-13	0	-13	3.0/0.000	PASS
DR2	-125.0	1.0	-134.0	0.100	1	-12	9	-13	1.0/0.000	PASS
DR3	-122.0	1.0	-131.0	0.100	1	-12	6	-12	7.0/0.000	PASS
DR4	-119.0	1.0	-128.0	0.100	1	-12	3	-12	5.0/0.000	PASS
DR5	-116.0	1.0	-125.0	0.100	1	-12	0	-12	3.0/0.000	PASS
DR6	-112.0	1.0	-121.0	0.100	1	-11	.5	-11	9.0/0.000	PASS
DR7	-97.0	1.0	-106.0	0.100	1	-10	0	-10	2.0/0.000	PASS
ТХ РО	WER && F	REQ TES	ST : FAIL							
POW	CHO	CH1	CH2	CH3	CH4	CH5	CHE	5	CH7	Verdict
0	-27.4									FAIL
1	-27.4									FAIL
2	-27.5									FAIL
3	-27.5									FAIL

Fig 3.14 Test Result – Summary Table

PER using RX1 Window you can see all tested results in detail in the result window from SF12

to SF7

If you click on

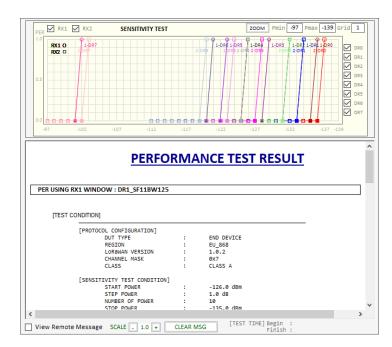


Fig 3.15 Test Result – Detail Report



3.2.1.6 PER Performance test functionality condition

Synchronization PER test parameters between RX1 and RX2

When you check
SYNC RX1/RX2, test condition parameters such as START, CRITERIA, STEP, #POW,
#PKT, TARGET PER of RX1 and RX2 will be the same.

Test parameter value changing Unit

When you check \Box 10, START and CRITERIA parameters will be changed in the 10dB unit when you change these values using arrow buttons. Without checking they will be changed in 1dB units.

Showing link message during test

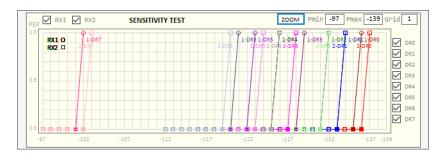
When you check
SHOW LINK MESSAGE DURING TEST, all link messages will be added in report.

[LINK	MES	SSA	GE]										
	L	СН	SF	BW	POW	TIME	FCNT	Adr	Ack	BF	FP	M	I CMD	
	U	0	7	125	11.6	REF		0	0 -			-	Join-request	Nonce=4195
	D	0	7	125	-30.0			0	0 -			-	Join-accept	RX1DROffset=0, RXDela
	U	2	12	125	11.8	7.80s	0000	0	0 -	00	32	U	DataUp	ByteLen=16
	D	2	12	125	-30.0		0001	0	0 -	22	24	U	ActivateTM	
	U	1	12	125	11.9	8.44s	0001	0	0 -	22	24	U	DownlinkCounter	Cnt=0
	D	1	12	125	-30.0		0002	0	0 -	00	30	U	LinkADRReq	Pow=1,DR=0,Mask=07h,N
	U	1	12	125	11.8	5.18s	0002	0	0 -	22	24	U	LinkADRAns	Pow=1, DR=1, Mask=1
	D	1	12	125	-30.0		0003	0	0 -	22	24	U	EchoRequest	EchoLen=16
	U	0	12	125	11.8	5.35s	0003	0	0 -	22	24	U	EchoResponse	Echo PASS
	D	0	12	125	-132.0		0004	0	0 -	22	24	U	EchoRequest	EchoLen=16
	U	2	12	125	11.8	5.02s	0004	0	0 -	22	24	U	EchoResponse	Echo PASS

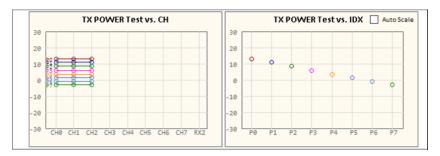
Fig 3.16 Link Messages attached in Test Report

Showing graph

When you check \square SHOW GRAPH, it will show PER curve or TX power graph in report function window.



a. The result graph of PER test



b. The result graph of power test

Fig 3.17 Show Result Graph of PER and TX Power

3.2.1.7 Viewing Remote commands

If DView SPY MSG is checked, it shows remote control commands and responses between the application and RWC5020x/5021x equipment.

SCALE - 1.0 + CLEAR MSG SPY MESSAGE CLEAR SAVE	CONF:PROTOCOL:REGION EU_868 ACK READ:RF:UL_CH? 3 867.100000		
View SPY MSG	Max. 300 Lines)	[TEST TIME] Begin : Finish :	

Fig 3.18 Remote Message

3.2.2 LBT TEST

RWC5020x/5021x application provides LBT (listen before talk) test function. An RWC2020A is required for this test. In this test, RWC5020x/5021x application assumes an RWC2020A is connected as an interferer. Connect RWC5020x/5021x and RWC2020A with RS232 cable. RWC2020A will be controlled by RWC5020x/5021x through RS232 cable during LBT test. RWC2020A will make interference signals as you set up this RWC5020x/5021x application program. RWC2020A can make single or multi-interferer signals up to 8 at the same time. Users can check whether RWC2020A is connected or not with this message.

3.2.2.1 Checking the connection to RWC2020AUsers must check whether RWC2020A is connected or not before LBT test.LBT test will not be run without RWC2020A LBT interferer.

3.2.2.2 Test Scenarios

The application provides two scenarios; channel and burst mode test.

In the channel mode test, RWC2020A transmits a single tone to each channel that users selected simultaneously. Users can set the test duration, reference power, and relative sub-channel power of RWC2020A interfering signals.

In the burst mode test, RWC2020A alternatively transmits multi-tones according to the time schedule. Users can set up the time duration of each signal burst.

PERFORMANCE	RUN Save link message	CONFIG
PER & POWER LBT NON-REGRESS	TEST ITEM CHANNEL MODE TEST BURST MODE TEST	No. Company
	Wanted Signal Pathloss 4.1 🚔 dB Unwanted Signal Pathloss 4.1 🚔 dB	ACCESS OF
	CHANNEL MODE PARAMETER TEST TIME REF POW CH00 CH01 CH02 CH03 CH04 (10 - Min -80 - dBm +1 v +1 v +1 v -3 v +1 v +1 BURST MODE PARAMETERS	CH05 CH06 CH07 1 v +1 v +1 v
	TEST TIME DURATION DUR 10 - Iteration POWER DURATION BU POWER DURATION POWER	REPEAT URST ER DURATION dBm 10 Sec

Fig 3.19 LBT Scenario configuration window

3.2.2.3 Channel mode test

Users can configure the reference power and relative sub channel power of RWC2020A interfering signals. If you set channel relative powers the same as figure 3.20, RWC2020A will generate eight interference channels and set the absolute powers same as the values shown in the figure 3.20.

a. Relative channel powers									
СН	CH00	CH01	CH02	CH03	CH04	CH05	CH06	CH07	
Actual Power(dBm)	-79	-79	-79	-83	-79	-79	-79	-79	

b. Absolute channel power table

Fig 3.20 LBT Channel power configuration

3.2.2.4 Burst mode test

In burst mode test, users can configure the power and the duration of each burst signal as well as test iteration. RWC2020A alternatively transmits two burst signals according to the power and duration.



Fig 3.21 LBT Burst channel configuration

3.2.2.5 Starting LBT test and result

Click on AWC5020x/5021x will start the communication with DUT and RWC2020A will generate an interference signal. While testing, RWC5020x/5021x will count up received packets per channel and display the result. The DUT shall not use channels whose interference signal is above the reference value.

3.2.3 NON-REGRESSION TEST

This test function is only for gatewa	ملمصيب اممعمينا فممم مطالانينية اممرم منيم	a the anatomic trunce of DUIT toot
This test function is only for gatewa	ivs and it will be activated unde	r the gateway type of DUT test
This test function is only for Batem	ys, and it will be detivated ande	the gatemay type of DO I test.

RedwoodComm : Lo	RaWAN Autotest(Version : 1.309 RWC5020x)	– – ×
PROJECT SETUP	UTILITY ABOUT PERFORMANCE - NO	ON-REGRESSION OF GW 192.168.0.60:Not Connected
PROJECT DEMO_V1310 PATH D:\project\LoR	DUT NEW GNT_EU868_V103_ClassA_NRT	REPORT PATH D:\project\LoRa\gui\DEMO_V1310\DEMO_V1310\GWT_EU868_V103_ClassA_NRT FILE NAME
	DN	Comparison of the second
PERFORMANCE PER & POWER LBT NON-REGRESS	RUN SKIP GW IP TEST ITEM TX OUT POWER MEASUREMENT EXSERVACE EREMANDERSING FREQUENCY ERROR TOLEBANCE W INTERFERE INMUNITY FREQUENCY SF PATHLOSS RWC5020x RWC2020A	RESULTIVEO_PER/RESULTIVEO_FER/RESULTIVEO \$172.654.4000 \$177.554.4000 \$172.654.4000 PRECUENCY 12.864.4000 \$17.554.4000 \$172.554.4000 \$172.554.4000 • Serie vs. Power Praced-acces \$193.554.4000 \$197.554.4000 \$197.554.4000 • Serie vs. Power Putterse - cases \$197.554.4000 \$197.554.4000 \$197.554.4000 • Serie vs. Power Putterse - cases \$197.554.4000 \$197.554.4000 \$197.554.4000 • Serie vs. Power Putterse - cases \$197.554.4000 \$197.554.4000 \$197.554.4000 • Serie vs. Power Putterse - cases \$197.554.4000 \$197.554.4000 \$197.554.4000 • Serie vs. Power Putterse - cases \$197.574.4000 \$197.574.4000 \$197.574.4000 • Serie vs. Power Putterse - cases \$197.574.4000 \$197.574.4000 \$197.574.4000 • Serie vs. Power Putterse - cases \$197.574.4000 \$197.574.4000 \$197.574.4000 • Serie vs. Power Putterse - cases \$197.574.4000 \$197.574.4000 \$197.574.4000 • Serie vs. Power Putterse - cases
	V 868.3000 ÷ V 97789V125 97180V125 0 868.3000 ÷ 97889V125 97189V125 97189V125 868.7000 ÷ 97189V125 97128V125 1X INTERNAL 964.7000 ÷ 97889V150 97128V125 0.2 ÷ 964.7000 ÷ 97889V150 97128V125 0.2 ÷ 964.7000 ÷ 97889V150 97128V125 0.2 ÷ 964.7000 ÷ 10 ÷ 10 ÷ 10 ÷	а - 19 - 19
	MONITOR Show Result Values Show XRNT Sure CLEAR	RSI CH MEAN DVTHOT_COMB_VIEW_(i = ISS CH EMOR DVTHOT_COMB_VIEW DVTHOT_COMB_VIEW_(i = ISS CH EMOR DVTHOT_COMB_VIEW_(i = ISS CH EMOR DVTHOT_COMB_VIEW DVTHOT_COMB_VIEW DVTHOT_COMB_VIEW_(i = ISS CH EMOR DVTHOT_COMB_VIEW_(i = ISS CH EMOR DVTHOT_COMB_VIEW_(i = ISS CH EMOR DVTHOT_COMB_VIEW DVTHOT_COMB_VIEW_(i = ISS CH EMOR DVTHOT_COMB_VIEW_(i = ISS CH EMOR DVTHOT_COMB_VIEW
	TEST CONDITION A DUT WAVE ONT_EUB68_V103_ClassA_NRT TEST EQUIPMENT R ML5020K PATLOSOFS 4 NAMBER OF PACETS 10 PAVLOSOFSIZE 16 PONER SIEP 108 LAPSED T2NE 03107131	
GATEW AY / EU_868 / 1.0.3 / C	CLASS A / OTAA RWC2020A : NOT CONNECTED	DUT PORT Control DUT while test RXGAIN-LOW

Fig 3.22 Non-regression test control and parameters window

RWC5020x/5021x application program provides a new test method to verify gateway's RF performance without an external network server, which is a part of non-regression tests for gateways defined by SEMTECH. You do not need to connect your gateway to any other network server because the RWC5020x application works as a network server. The test concept is shown in the fig 3.23.

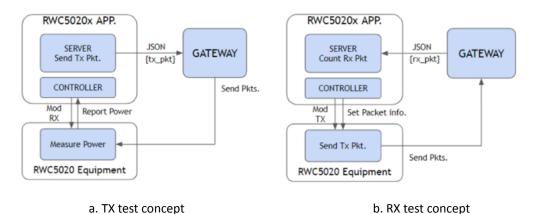


Fig 3.23 Test concept of the Non-regression test with RWC5020x/5021x

Users need to connect the DUT with the RWC5020x/5021x measurement equipment, and RWC2020A interference signal if needed, and the PC that runs the RWC5020x/5021x application program acting as a server and a measurement controller, as shown in Figure 3.24 below.



Fig 3.24 The Concept of non-regression test of gateways

In order to let RWC5020x/5021x know the IP and the destination port of the gateway, users have to set them manually. You can select the network adapter which has the actual IP address of the RWC5020x/5021x application running.

SET GW IP /	HOST PORT 🛛 🔀							
GATEWAY IP	192.168.0.2							
SERVER PORT	1780							
SERVER IP : 192.168.0.10								
192.168.0.10:Realtek PCIe GbE Family Controller								

Fig 3.25 The IP and PORT setup for non-regression test

Non-regression test consists of 5 automated test functions such as TX output power calibration, PER/RSSI/SNR,

sensitivity, frequency error tolerance, CW interferer immunity test, and inter-modulation immunity.

RWC5020x/5021x application program provides minimal amount of server functionality to respond to the request from a gateway.

If you set the \square Show JSON PKT checked, a monitor box appears and shows all JSON packets transmitted and received during the test.

3.2.3.1 TX output power calibration

This function measures TX output power of the DUT (gateway) and shows the power properties and makes a property table.

In this test, the RWC5020x/5021x application program makes DUT transmit signal according to the setup power through LAN with JSON and RWC5020x/5021x equipment measures the TX power of the DUT. Users can use this function as a calibrator for gateways.

Users can set up power start, power step, number of powers, and number of packets.

TX POW	TX POWER CALIBRATION PARAMETERS										
	POW ST	TART	POW S	STEP	# PO	w	POV	N STOP		# PACI	(ET
	13	dBm	1	dB	8	-		10	dBm	10	-

Fig 3.26 Parameters for TX POWER CALIBRATION

Users cannot change stop power. It will be calculated according to the power start and power step values automatically.

3.2.3.2 PER/RSSI/SNR

This function measures the PER (packet error rate), reads and shows the RSSI(Rx Signal Strength Indication) and SNR(Signal to Noise Ratio) information from the gateway using JSON.

In this test, RWC5020x/5021x equipment transmits a LoRa signal and RWC5020x/5021x application asks the gateway for RSSI, SNR and the number of received packets. RWC5020x/5021x application calculates PER using

the number of packets that equipment sent and the number of packets that gateway received and shows the result graphically.

Power step is fixed at 1dB and Power range is also fixed.

The transmit payload is 'all zeros'. Users cannot modify the payload.

PER/RSSI/SNR TEST	PARAM	ETERS-		
# PACKET	10	•	POW STEP 1dB	

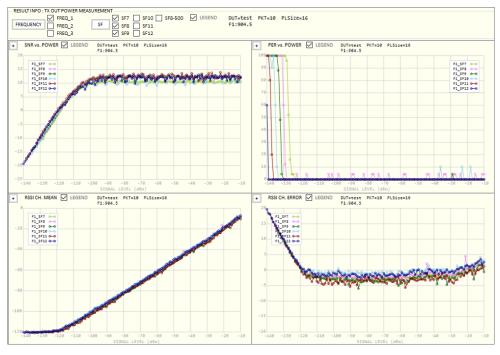


Fig 3.27 Parameters for PER/RSSI/SNR

Fig 3.28 The test result of PER/RSSI/SN

3.2.3.3 SENSITIVITY

This function measures the PER (packet error rate) with respect to the power and searches the sensitivity using the measured PER.

While testing, RWC5020x/5021x equipment transmits a LoRa signal and RWC5020x/5021x application asks the gateway for the number of received packets. RWC5020x/5021x application calculates PER using the number of packets that the equipment sent and the number of packets that the gateway received and shows the result graphically.

The power step is fixed at 1dB and power range is also fixed in range -140 to -100dBm.

Users may modify only the number of packets. More packets will make more reliable results.

The transmit payload is 'all zeros'. Users cannot modify the payload.

SENSITIVITY and PER	SENSITIVITY and PER TEST PARAMETERS							
# PACKET	10 🔺	POW STEP 1dB						



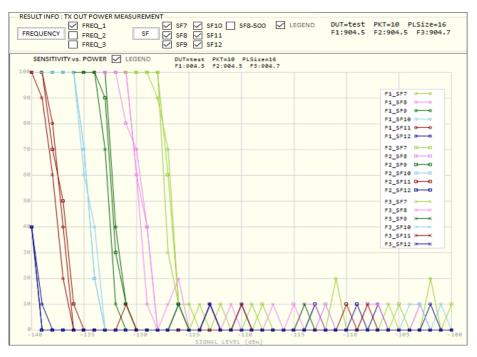


Fig 3.30 The test result of SENSITIVITY

3.2.3.4 Frequency error tolerance

This function measures the immunity properties with respect to the frequency error of the DUT (gateway) using the packet error rate. It is available only with RWC5020B and RWC5020M.

In this test, RWC5020B/M equipment transmits LoRa signal with frequency offset and RWC5020x/5021x application asks the gateway for the number of received packet and calculates PER using the number of packets that the equipment sent and the number of packets that DUT received. TX Power of RWC5020x/5021x is fixed at -100dBm and frequency offset step is fixed at 1.0 ppm. Users may modify the number of packets to be tested.

The transmit payload is 'all zeros'. Users cannot modify the payload.



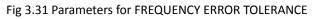




Fig 3.32 The test result of FREQUENCY ERROR TOLERANCE

3.2.3.5 CW immunity against the interferences with frequency offset.

This function measures the immunity properties of the gateway against interference signal of variant frequencies and powers.

In this test, RWC5020x/5021x equipment transmits LoRaWAN[®] signal as a wanted signal, RWC2020A transmits CW as an interference signal and RWC5020x/5021x application asks the gateway (DUT) for the number of received packet during the test.

CW INTERFERER PARN RWC5020x Signal Ger						
PAYLOAD	# PACKET	10 💂	T	ARGET PER	0.500	
SIGNAL POWER	SF7 -121.0	SF8 -124.0	SF9 -127.0	SF10 -130.0	SF11 -133.0	SF12 -136.0 💂 dBm
	SF8BW500	dBm				

Fig 3.33 CW Interferer test parameters

RWC5020x/5021x application finds the interferer power level of the PER that meets target PER while calculating PER using the number of packet gateway received. Users can set payload size, number of packets, target PER, and each power for each spreading factor respectively. The transmit payload is 'all zeros'. Users cannot modify the payload.

RWC2020A interferer generator is required to test CW interferer immunity shown in the figure 3.34.

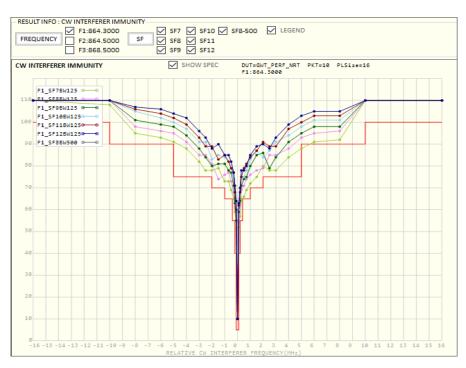


Fig 3.34 The test result of CW Interferer Immunity

Showing Result Values

^{3.2.3.6} Functionality condition

When you check \Box Show Result Values, all tested values will be shown in the result window. It can take a quite long time to display according to the result amount.

Showing JSON packets during test

When you check \Box Show JSON PKT, you can see JSON packets sending and receiving between SERVER and the DUT(Gateway) during the test.

Skipping current testing item

If you click the [SKIP] button during the test, the application will mark the current testing item as untested and

start testing the next SF item which is checked.



3.3 Link Analyzer

Using this function, you can monitor all operations of DUT and dump all link messages in user-friendly format from RWC5020x/5021x while linking with DUT.

Link analyzer consists of a Link message tool, script editor, and payload editor.

Using payload editor, users can send mac command(s) or user defined packets while linking.

In addition, using script editor addition, users can create a script and play it while linking. You can add or remove a group of commands named ACTION which includes single, multiple MAC commands, and user defined payload.

RedwoodComm : LoRaWAN Autotest(Version : 1.300 RWC5020x)		– 🗆 X
PROJECT SETUP UTILITY ABOUT	LINK ANALYZER 1.0.x	192.168.0.60-Not Matched RWC5020x
PROJECT test_prj PATH D:\project\lora\gui\test_prj	DUT UST REPORT PATH D:\proj edt_perf_cn470_1 NEW FILE NAME	ect\\ora\gui\test_prj\edt_perf_cn470_2
	FUNCTIONS	Clear Before Start 🗹 Show raw data START SAVING LIN+8
PAYLOAD EDITOR OLSUT ON THE OLS	FUNCTION SET CONFIG	
MAC COMMAND (PAYLOAD) USER DEFINED	L CH DR SF BW Pc	w Time Del FCnt Adr Ack FP AAR 8 Port M Dwell CMD CONTENTS
SET DEVICE_STATUS		
	SAVE TÓRO +	
	SCALE _ 1.0 +	
	CLEAR MSG CLEAR SPY MSG SAVE SPY MSG	
	View Remote Messa	age [TEST TIME] Begin : Finish :

Fig 3.35 Link Analyzer

3.3.1 Saving link message

Click on start button in the link message window and RWC5020x/5021x will start dumping all link messages between RWC5020x/5021x and DUT line by line. Clicking on stop button will stop RWC5020x/5021x from dumping. All link messages can be saved any time with time stamped file name by clicking on button. When you click the [START SAVING] button, the program starts saving the link message in real time, shows the saving status with a progress bar, and you can see the file name. Change the naming option in the environment menu to specify the desired file name.

3.3.2 Payload editor

3.3.2.1 Sending Commands

You can edit MAC commands in the link script editor window. You can select single or multiple commands by checking one, two, or three SET . When multiple SET are selected, multiple MAC commands are added in a single frame. The maximum number of multiple MAC commands in a frame is limited to 3 on RWC5020x/5021x equipment.

OJECT SETUP UTILITY ABOUT	LINK ANA	NALYZER 1.0.2 192.168.0.100-RWC5020A, VER:1.216, SN:0x18A0	916
OJECT lora_demo_v1210 TH C:\Program Files (x86)\RWC\RWC5020x\DEMO\lora_demo_v1210	DUT NAME demo • NEW	REPORT PATH C\Program Files (x86)\RWC\RWCS020x\DEMO\lora_demo_v1210\demo FILE NAME	
ORA CERTIFICATION		LINK MESSAGE Clear Before Start Show raw data START SAVING LIN	•0
AYLOAD EDITOR DLSLOT MSG TYPE CMD HELD (ms) SEND RX1 UNCOMFIRMED POPTS SEND RX2 UNCOMFIRMED F0PTS CONFIRMED F0PTS CMD HELD	NONE		J
	none	L CH DR SF BW Pow Time Del FCnt Adr Ack FP AAR B Port M Dwell CMD COM	ITENTS
V SET DEVICE_STATUS		U 0 0 12 125 13.4 9.845 - 0000 1 0 - 0 0 224 U 1155 DlCounter(6) Cnt=6	ry=254
RX PARAM SETUP Parameters		U 4 0 12 125 13.4 10.005 - 000E 1 0 - 0 0 224 U 1155 DlCounter(6) Cnt=6 D 4 0 12 125 -30.0 2 0007 1 0 0 000 U 1318 DevStatusReg	
	FREQ 869.525	U 6 0 12 125 13.4 5.175 - 000F 1 0 - 0 0 224 U 1318 (DeviSaturAns) EACH (RVSTaturAns) EACH (RVSTaturAns) EACH (RVSTaturAns) EACH	ry=25
RAZ.	DR DR0_SF128W125 V	0 6 0 12 125 -30.0 2 0008 1 0 0 U 991 NoPayload U 2 0 12 125 13.4 4.845 - 0010 1 0 - 0 0 224 U 1155 DlCounter(8) Cnt=8	
] SET DEVICE_STATUS		D 2 0 2 12 125 38.0	0 0 0 0
RIPT EDITOR RUN SKIP COMMAND ADD DEL CLR 🤟	↑ SAVE LÓÁD +	U 4 0 12 125 13.4 10.005 - 0016 1 0 - 0 0 224 U 1155 DlCounter(10) Cnt=1 U 6 0 12 125 13.4 10.005 - 0017 1 0 - 0 0 224 U 1155 DlCounter(10) Cnt=1 U 3 0 12 125 13.4 10.005 - 0018 1 0 - 0 0 224 U 1155 DlCounter(10) Cnt=1	0
Gerno_MAC_Script_Proc_1		D 3 0 2 125 -30.0 2 0000 1 0 - -000 U 135 Devictuussq U 4 0 22 15 1.4 1.55 -0010 1 10	1
		SCALE . 1.0 . ACC CLEAR MSG SPY MESSAGE CLEAR SAVE CLEAR SAVE	
L SLEEP 1		[TEST TIME] Begin : 2020-03-17 9:1	15:4

Fig 3.36 Sending multiple commands in a single packet

When 🗹 User Defined is checked, user definable command edit window will appear.

PAYLOAD E		DL SLOT RX1 RX2	O CONFI	TYPE RMED NFIRMED	CMD FIELD PAYLOAD FOPTS	RESP TO	MALFUNCTION	SET	CONFIG
MAC COMMAND (FOPTS)									
			Use	r Defined l	MAC CMD Paran	neters			
SET			FO	OPTS SIZE		8			
FOPTS	16(pos16)							00000	0000000001
								00000	000000001
MAC PAYLOAD	USER DAT	Α							
P	AYLOAD SIZ	E.	16 🌲	FPORT	99 🌲				
PAYLOAD 3	32(POS 0)								
							000000000000000000000000000000000000000	00000000	000000000000000000000000000000000000000



3.3.2.2 Malfunction test

Users can send the MAC commands which include errors intentionally inserted using malfunction. This function is also applied to GWT.



Fig 3.38 Malfunction status window in PAYLOAD EDITOR

Test Procedure

Activation – Start link analyzer and make an activation with DUT.

MAC command selection - Select a mac command referring 3.3.2.1

Malfunction Editing - Click the [SET] button in the MALFUNCTION area and select the types of error which you want to add like Fig 3.39. To generate an intentional MIC error, set MIC_ERROR to ON. To modify the MAC header part, set MHDR_ERROR to ON and configure the XOR_MHDR value. XOR_MHDR value is exclusive OR with MAC Header. To modify the Frame header part, set FHDR_ERROR to ON and configure the XOR_FHDR value. XOR_FHDR value is exclusive OR with Frame Header.

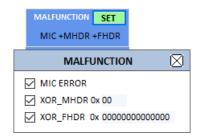


Fig 3.39 Malfunction configuration parameters

MAC command transmission - Clicking [SEND CMD] button will send MAC commands and malfunction setup commands to the equipment. Then RWC5020x/5021x will send the intentionally malfunctioned MAC command to the DUT.

3.3.2.3 MAC Commander Parameters

DOWNLINK_SLOT

When RWC5020x/5021x emulates Gateway/Server mode (EDT), it could respond to the uplink frame by downlink frame using RX1 window or RX2 window. Using this parameter, users can select the RX window for testing the DUT.



Fig 3.40 MESSAGE TYPE

MAC_CMD_TYPE

This parameter defines the type of MAC command to be transmitted: confirmed or unconfirmed.



Fig 3.41 COMMAND FILED

MAC_CMD_FIELD

This parameter defines the type of field where MAC command is stored in a frame: payload or option field.

COMMAND
PAYLOAD
FIELD
FOPTS

Fig 3.42 RESPONSE TIME OUT

RESP TIMEOUT

This parameter defines MAC answer time-out after sending MAC command.



Fig 3.43 Response time out value

FOPTS_SIZE

This parameter defines the size of the FOpts field. This parameter is shown if MAC_CMD_FIELD is set as FOPTION.

FOPTS

This parameter defines the content of FOpts in hexadecimal format. This parameter is shown if MAC_CMD_FIELD is set as FOPTION.

MAC_CMD: DEV_STATUS

This parameter is for sending *DevStatusReq* command to DUT, which expects *DevStatusAns* command from it. *DevStatusReq* command requests the status of the End Device and does not have any parameters.

MAC_CMD: LINK_ADR

This parameter is for sending *LinkADRReq* command to DUT, which expects *LinkADRAns* command from it. *LinkADRReq* command requests the End Device to change data rate, transmit power, repetition rate or channel.

ADR_DR

This parameter is the requested data rate of End Device for uplink messages.

ADR_TXPOW

This parameter is the requested output power of End Device for uplink messages.

ADR_CH_MASK

This parameter encodes the channels usable for uplink access. A bit in the CH_MASK field set to 1 means that the corresponding channel can be used for uplink transmissions.

ADR_MASK_CTRL

This parameter controls the interpretation of the previously defined CH_MASK bit mask. It controls the block of 16 channels to which the CH_MASK applies. It can also be used to globally turn on or off all channels using specific modulation.

ADR_NB_TRANS

This parameter is the number of transmissions for each uplink message.

MAC_CMD: DUTY_CYCLE

This parameter is for sending *DutyCycleReq* command to DUT, which expects *DutyCycleAns* command from it. *DutyCycleReq* command sets the maximum aggregate transmit duty-cycle of the End Device.

MAX_DUTY_CYCLE

This parameter is used by the network coordinator to limit the maximum aggregate transmit duty cycle of an End Device.

MAC_CMD: RX_PARAM_SETUP

This parameter is for sending *RXParamSetupReq* command to DUT, which expects *RXParamSetupAns* command from it. *RXParamSetupReq* command sets the reception slots parameters.

RX1_DR_OFFSET

This parameter sets the offset between the uplink data rate and the downlink data rate used to communicate with End Device on the first reception slot (RX1).

RX2_FREQ

This parameter defines the frequency of a downlink using the second receive window.

<u>RX2_DR</u>

This parameter defines the data rate of a downlink using the second receive window.

MAC_CMD: TX_PARAM_SETUP

This parameter is for sending *TXParamSetupReq* command to DUT, which expects *TXParamSetupAns* command from it. *TXParamSetupReq* command is used by the network server to set the maximum allowed dwell time and Max EIRP of End Device, based on local regulations.

MAX_EIRP

This parameter corresponds to an upper bound on the device's radio transmit power. The device is not required to transmit at that power, but shall never radiate more than this specified EIRP.

Coded Value	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Max EIRP (dBm)	8	10	12	13	14	16	18	20	21	24	26	27	29	30	33	36

UL_DWELL_TIME

This parameter corresponds to the maximum allowed dwell time for uplink transmissions.

DL_DWELL_TIME

This parameter corresponds to the maximum allowed dwell time for downlink transmissions.

MAC_CMD: NEW_CHANNEL

This parameter is for sending *NewChannelReq* command to DUT, which expects *NewChannelAns* command from it. *NewChannelReq* command creates or modifies the definition of a radio channel.

NEW_CH_MODE

This parameter can be used to either modify the parameters of an existing bidirectional channel

or to create a new one. To create or modify the channel, set this parameter as 'CREATE'. To delete the channel, set this parameter as 'DELETE'

NEW CH INDEX

This parameter is the index of the channel being created or modified.

NEW_CH_MAX_DR

This parameter designates the highest uplink data rate allowed on this channel.

NEW_CH_MIN_DR

This parameter designates the lowest uplink data rate allowed on this channel.

MAC_CMD: DL_CHANNEL

This parameter is for sending *DlChannelReq* command to DUT, which expects *DlChannelAns* command from it. *DlChannelReq* command sets the network to associate a different downlink frequency to the RX1 slot.

DL_CH_INDEX

This parameter is the index of the channel whose downlink frequency is modified.

DL CH FREQ

This parameter is the corresponding downlink frequency value of a 24 bits unsigned integer. The actual downlink frequency in Hz is 100 x DL_CH_FREQ.

MAC_CMD: RX_TIMING_SETUP

This parameter is for sending *RXTimingSetupReq* command to DUT, which expects *RXTimingSetupAns* command from it. *RXTimingSetupReq* command sets the timing of the reception slots.

RECEIVE_DELAY

The first receive window RX1 opens RECEIVE_DELAY seconds after the end of the uplink modulation.

MAC_CMD: USER_DEFINED

This parameter is for sending a user-defined command to DUT, which includes user-defined data of user-defined length.

FPORT

This parameter defines the FPort number of a user-defined MAC Command.

PAYLOAD_SIZE

This parameter defines the size of payload of a user-defined MAC Command.

PAYLOAD

This parameter defines the content of payload in hexadecimal format.

MAC CMD: CONFIRMED TM

This parameter is for sending *Confirmed frames* command to DUT, which requests DUT to send the consequent uplink packets with a message type 'Confirmed'. It may be meaningful only after certification test mode is enabled by *Activate test mode* command.

MAC_CMD: UNCONFIRMED_TM

This parameter is for sending *Unconfirmed frames* command to DUT, which requests DUT to send the consequent uplink packets with a message type 'Unconfirmed'. It may be meaningful only after certification test mode is enabled by *Activate test mode* command.

MAC CMD: ECHO REQUEST TM

This parameter is for sending *EchoRequest* command to DUT, which requests DUT to reply with *EchoResponse*. It may be meaningful only after certification test mode is enabled by *Activate test mode* command.

ECHO_LEN

This parameter indicates the length of payload in *EchoRequest* command.

PAYLOAD

This parameter defines the content of payload in hexadecimal format.

MAC CMD: TRIGGER JOIN REQ TM

This parameter is for sending *Trigger Join Request* command to DUT, which requests DUT to send *Join-request*. It may be meaningful only after certification test mode is enabled by *Activate test mode* command.

MAC_CMD: ENABLE_CW_MODE_TM

This parameter is for sending *Enable Continuous Wave Mode* command to DUT, which requests DUT to send continuous wave (CW) signal based on the values in the payload. It may be meaningful only

after certification test mode is enabled by Activate test mode command.

CW_TIMEOUT

This parameter indicates the timeout for CW transmission.

<u>CW_FREQ</u>

This parameter indicates the frequency of CW signal.

<u>CW_POW</u>

This parameter indicates the power of CW signal.

MAC_CMD: BEACON_FREQ

This parameter is for sending *BeaconFreqReq* command to DUT, which expects *BeaconFreqAns* command from it. *BeaconFreqReq* command sets the network to associate new beacon frequency

BEACON FREQ

This parameter is the corresponding beacon frequency value of a 24 bits unsigned integer.

MAC_CMD: PING_SLOT_CH_REQ

This parameter is for sending *PingSlotChannelReq* command to DUT, which expects *PingSlotFreqAns* command from it. *PingSlotChannelReq* command modifies the frequency and/or the data rate on which the end-device expects the downlink pings

PING DR

This parameter is the index of the Data Rate used for the ping-slot downlinks.

PING_FREQ

This parameter is the corresponding ping channel frequency value of a 24 bits unsigned integer. The actual ping channel frequency in Hz is 100 x PING_FREQ.

MAC CMD: FORCE REJOIN

This parameter is for sending *ForceRejoinReq* to DUT, which expects no answer from it. With the *ForceRejoinReq* command, the network asks a device to immediately transmit a Rejoin-Request Type 0 or type 2 message with a programmable number of retries, periodicity and data rate.

REJOIN DR

This parameter is the data rate of Rejoin-Request.

<u>REJOIN_TYPE</u>

This parameter is the type of Rejoin-Request.

<u>REJOIN_RETRY</u>

This parameter is the total number of times DUT will retry Rejoin-Request.

REJOIN_PERIOD

This parameter is the delay between retransmissions. The actual delay is 32×2^{Period} + Rand32 seconds, where Rand32 is a pseudo-random number in the [0:32] range.

MAC_CMD: REJOIN_SETUP

This parameter is for sending *RejoinParamSetupReq* command to DUT, which expects *RejoinParamSetupAns* command from it. *RejoinParamSetupReq* command sets the network to request DUT to periodically send a *RejoinReq* Type 0 message with a programmable periodicity defined as a time of a number of uplinks.

<u>REJOIN_MAX_TIME_N</u>

This parameter is the max time T. DUT must send a Rejoin-Request Type 0 at least every 2^{T+10} seconds.

REJOIN MAX CNT N

This parameter is the max count C. DUT must send a Rejoin-Request Type 0 at least every 2^{C+4} uplink messages.

MAC_CMD: ADR_SETUP

This parameter is for sending *ADRParamSetupReq* command to DUT, which expects *ADRParamSetupAns* command from it. *ADRParamSetupReq* command allows changing the ADR_ACK_LIMIT and ADR_ACK_DELAY parameters defining the ADR back-off algorithm.

ADR_LIMIT_EXP

This parameter is used to set ADR_ACK_LIMIT parameter value: $ADR_ACK_LIMIT = 2^{ADR_LIMIT_EXP}$

ADR_DELAY_EXP

This parameter is used to set ADR_ACK_DELAY parameter value: $ADR_ACK_DELAY = 2^{ADR_DELAY_EXP}$

3.3.3 Script editor

This function provides a method to create a scenario that sends mac commands sequentially. The scenario

consists of actions which include a single or multiple commands, information, and sleep time that creates wait times in between actions. Users can add, remove, or edit a single or multiple commands in an action and modify the wait time.

You can edit MAC commands in the link script editor window using buttons.

3.3.3.1 Adding commands

In order to add an action, have \Box SET checked with at least one command which you want to add. By clicking [add] button you can add commands and parameters in action format.

Script editor does not check if the commands are the same or not. It means the same commands could be added in single action. You must check whether it is intended or not by yourself.

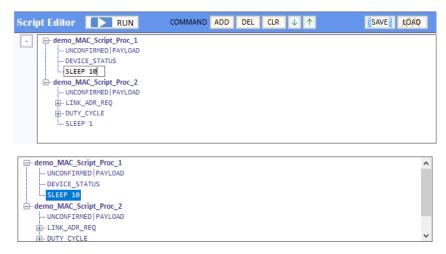
PAYLOAD EDITOR DL SLOT MSG TYPE CMD FIELD RESP TO MALFUNCTION SET SEND 0 XX2 0 UNCONFIRMED 0 60 NONE CONFIG
MAC COMMAND (PAYLOAD) USER DEFINED
SET DEVICE_STATUS
SET DEVICE_STATUS
SET DEVICE_STATUS
SCRIPT EDITOR NUN SKIP COMMAND ADD DEL CLR V A
edt_perf_cn470_2_MAC_Script_Proc_1 UNCONFIRMED PAYLOAD 60 RX1 DEVICE_STATUS SLEEP 1

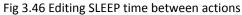
Fig 3.44 Adding an action into Script Editor

	MSG TYPE CONFIRMED UNCONFIRMED	CMD FIELD PAYLOAD FOPTS	RESP TO	MALFUNCTION NONE	SET	CONF	FIG
MAC COMMAND (FOPTS)	LinkADRReq P DR DR2_SF MASK_CTRL		TX_POW	0 ★ NB_TR CH_MAS			
SET DUTY_CYCLE	DUTY_CYCLE P		•				
SET DEVICE_STATUS	<u>.</u>						
MAC PAYLOAD USER DATA PAYLOAD SIZE PAYLOAD 32(pos32)	16 FPORT	99 🌩		000000000000000000000000000000000000000	0000000	0000000	0001
SCRIPT EDITOR RUN C edt_perf_cn470_2_MAC_Scrip UNCONFIRMED[FOPTS[60] DEVICE_STATUS MAC_PAYLOAD SLEEP 1 C edt_perf_cn470_2_MAC_Scrip UNCONFIRMED[FOPTS[60] D LINK_ADR_REQ D UNT_CYCLE MAC_PAYLOAD SLEEP 1	RX1 pt_Proc_2	ND ADD DEL	CLR 🗸	<u>↑</u> I	SAVE	(LÓÀQ	

Fig 3.45 Adding an action that includes two commands

The SLEEP function makes RWC5020x/5021x wait for a certain duration of time before sending the next command. The duration of wait time can be edited by the users.







3.3.3.2 Moving commands

You can move actions up or down using up to buttons. First, select an action and move it.

SLEEP 1	^
🚊 demo_MAC_Script_Proc_2	
UNCONFIRMED PAYLOAD	
. DUTY_CYCLE	
SLEEP 1	
emo_MAC_Script_Proc_3	
UNCONFIRMED PAYLOAD	
- ACTIVATE_TM	
CLEED 4	*
- demo_MAC_Script_Proc_3	^
UNCONFIRMED PAYLOAD	
ACTIVATE_TM	
SLEEP 1	
🚊 demo_MAC_Script_Proc_1	
UNCONFIRMED PAYLOAD	
DEVICE_STATUS	
SLEEP 1	
🚊 demo_MAC_Script_Proc_2	
UNCONSTRUCT DAVI OAD	•

Fig 3.47 Moving an action.

3.3.3.3 Deleting actions

You can delete actions by clicking the [DEL] button. Script editor will not ask whether you want to delete it or not. Therefore, use the [DEL] button carefully to not delete any commands.

Script Editor 🚺 RUN	COMMAND	ADD DEL	CLR ↓ ↑	SAVE KÓÁD
Orderno_MAC_Script_Proc_ UNCONFIRMED PAYLOA ACTIVATE_TM SLEEP 1 OFVICE_STATUS SLEEP 1 OFVICE_STATUS SUBSCRIPTION SU	0 1 0			^
DUTY_CYCLE SLEEP 1				~
Script Editor RUN	COMMAND	ADD DEL	CLR ↓ ↑	SAVE KOAQ
Output Constant Series Output Constant Series Output Constant Series Output O	2			



3.3.3.4 Renaming actions

You can edit the names of the actions or parameters and even commands.

Click the left mouse button to edit. The Application will not verify you whether they are actions, parameters or the commands. Rename very carefully not to rename the commands.



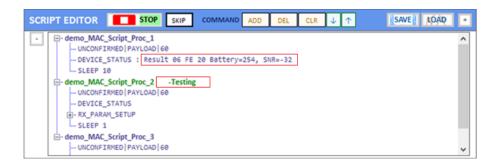
Fig 3.49 Renaming action title.

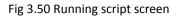
Define the PAYLOAD TYPE as UNCONFIRMED or CONFIRMED and define the CMD FIELD as PAYLOAD or FOPTION. You can verify what you selected from action's information UNCONFIRMED FOPTION 224

3.3.3.5 Running actions

Clicking Script Editor RUN will make RWC5020x/5021x send MAC commands to DUT according to the script. Before running the script, RWC5020x/5021x must be in the running link analyzer. If it is not in the running link analyzer, the application will let RWC5020x/5021x run the link analyzer automatically while running the script.

[RUN] button will be activated after creating a project and DUT and connection with RWC5020x/5021x is complete. While running, it indicates the item that is being tested and shows tested results beside the commands that have been sent as follows.





3.3.3.6 Saving Script

You can save the script to keep what you have edited. After modifying your script, click save and select a folder to decide where you want to save it.

3.3.3.7 Opening Script

You can recall the saved script you edited previously. Just click OPEN and select the saved script file.



3.4 Functions

It has four special functions such as MFG, NST SG(Signal Generator), NST SA(Signal Analyzer) and FUOTA TEST.

3.4.1 MFG (Manufacturing)

This function is for a quick test for manufacturing. It helps users measure PER and the TX power of DUT very fast and easily.

For this function, a special function has to be prepared in DUT first. In the special mode of DUT, transmitting MEAS_START_FLAG, counting packets, recognizing MEAS_STOP_FLAG, and transmitting three same report frames functions should be prepared.

For the DUT information, "user data" such as serial number can be added in the MEAS_START_FLAG packet.

Clicking on will make RWC5020x/5021x start waiting for the MEAS_START_FLAG MFG from DUT.

3.4.1.1 Test concept

MEAS_START_FLAG packet transmitted from DUT will make RWC5020x/5021x start transmitting packets to DUT at the power specified by users. After transmitting the MEAS_START_FLAG, DUT must switch to RX mode to receive packets from RWC5020x/5021x and count the number of the packets received.

After transmitting all packets, RWC5020x/5021x will transmit a MEAS_END_FLAG packet that stops DUT from counting and report the number of received packets.

After receiving the MESA_END_FLAG from RWC5020x/5021x, DUT must transmit a report frame including the number of received frames three times within TIMEOUT time.

Whenever DUT transmits any frame RWC5020x/5021x measures the TX power of DUT and shows the averaged value after receiving report packets.

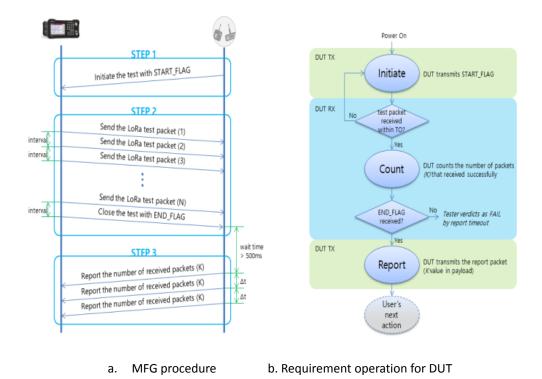


Fig 3.51 Test scenario for manufacturing

3.4.1.2 Protocol Parameters

MODULATION

This parameter defines the modulation type of the MFG test

LoRa / FSK / CW.

<u>NETWORK</u>

This parameter indicates the type of LoRa network (synchronization word) to be used in LoRa modulation in the MFG test.

PUBLIC / PRIVATE

<u>SF</u>

This parameter defines the spreading factor of a LoRa test frame to be used in the MFG test. If this value is set as ANY, RWC5020x/5021x receives any kind of SF packet and applies this SF value for TX packets.

SF7 / SF8 / SF9 / SF10 / SF11 / SF12 / ANY

<u>BW</u>

This parameter defines the bandwidth of a LoRa test frame to be used in the MFG test.

125 / 250 / 500

<u>CR</u>

This parameter defines the coding rate of a LoRa test frame to be used in the MFG test, which is applicable only when DUT_TYPE is 'GATEWAY'.

4_5 / 4_6 / 4_7 / 4_8 / NO_CRC

TX_POLARITY

This parameter defines the TX signal polarity.

NORMAL / INVERSE

RX_POLARITY

This parameter defines the RX signal polarity.

NORMAL / INVERSE

PREAMBLE_SIZE

This parameter defines the preamble size of a LoRa test frame to be used in the MFG test.

2 to 255

PAYLOAD_SIZE

This parameter defines the size of payload of the LoRa test frame in the MFG test.

0 to 250

PAYLOAD

This parameter defines the content of payload in hexadecimal format in the MFG test.

Hex value

FM_DEVIATION

This parameter defines the FM deviation value for FSK modulation.

1 to 100 kHz

DATA RATE

This parameter defines the data rate value for FSK modulation.

1.000 to 128.000 kbps

SYNC_WORD_SIZE

This parameter defines the Sync word size for FSK modulation

1 to 8

SYNC_WORD

This parameter defines the Sync word for FSK modulation

Hex value

<u>REPEAT_NUM</u>

This parameter defines the number of transmissions of a LoRa test frame to be used in the MFG test.

2 to 5000

INTERVAL

This parameter defines the time interval in the second unit between consecutive LoRa test frames to be used in MFG test.

0.5 to 1000 sec

PER_CRITERIA

This parameter defines the user's criteria of the result value of PER measurement in MFG test.

0.00 to 1.00

POW_CRITERIA_UPPER

This parameter defines the user's upper criteria of the result value of Power measurement in MFG test.

-50 to 30 dBm

POW_CRITERIA_LOWER

This parameter defines the user's lower criteria of the result value of Power measurement in MFG test.

-50 to 30 dBm

TIME_OUT

This parameter defines the timeout in the second unit until RWC5020x/5021x waits for a LoRa frame from DUT.

1 to 100 sec

3.4.1.3 RF Parameters

<u>TX_POW</u>

This parameter defines the output power of RWC5020x/5021x in dBm.

<u>FREQ</u>

This parameter defines the frequency of RWC5020x/5021x

PATH_LOSS

Users can set the path loss between the RF port of RWC5020x/5021x and DUT RF port. The measured power will be compensated with the defined path loss.

RX_GAIN

The RWC5020A/B has an AGC (Automatic Gain Control) function. So the RWC5020A/B will set appropriate RX gain after receiving a few packets from the DUT. This parameter defines the initial RX

gain when the Link is started. It is very important to set this parameter correctly to get the proper test result quickly. Set to LOW if the expected input level from your DUT to RWC5020A/B is higher than 15dBm. Set to HIGH if the expected input level is lower than -40dBm. Otherwise set it to MIDDLE.

HIGH / MEDIUM / LOW / LOWER(RWC5020M/B)

RX_GAIN WARNING TO

If RWC5020x/5021x does not receive RX packets for a while, RWC5020x/5021x assumes that RX_GAIN may be incorrect and displays a notification. This parameter defines the timeout period for this notification.

1 to 10000

<u>RX_AGC</u>

This parameter determines whether RX Gain is automatically adjusted or not

ON / OFF

3.4.1.4 Getting the result

Users can take measured results of the PER and the TX Power of DUT using remote commands.

Commands for

Reading the measured power of DUT :	READ:NST:MFG:POW?
Reading the measured PER of DUT :	READ:NST:MFG:PER?
Reading the user data in MEAS_START_FLAG frame :	READ:NST:MFG:DUT_INFO?

For all other remote commands, refer to the Remote Control Programming manual.

In figure 3.52, you can find an example test result with the MFG function. And refer to the application note RAN502004R6 for more detailed operation and application with MFG.

RedwoodComm : Lo	RaWAN Autot	est(Version: 1.309 RWC5020x)									- [×
PROJECT SETUP	UTILITY #	BOUT		FUNCTIONA	L TEST - MFG			1	92.168.0.8-	RWC5020M,VER:1.	22,5N:5020001	· Internet
PROJECT DEMO_V1300 PATH .\DEMO\DEMO		DUT	EDT_PERF_EU868	•	REPORT PATH FILE NAME	.\DEMO\DEM	O_V1300\EDT_PERF_EU8	68				
	on 🚺	PERFORMANCE	LINK ANALYZER	FUNCTIONS		E REPORT		• w.r.t. • w.r.t.	Frequency (Frequency ar	W.r.t. ar	ME Elapsed otal 00:00:00 r-Item 00:00:00	
FUNCTIONS	R	UN		DEFAULT	SAVE CL	EAR	QUICK MEAS	SUREME	NT USING	MFG SCENAR	10	
MFG		RF PARA	METERS	^	SEQ	TIME	DATA	POW	PER	VERDICT		
		TX POW	-130.0 🗘 dBm	1	▶ 0	00:00:14	SN:RWC123451	-10.2	0.020	PASS		
NST SG		FREQ	900.000000 🚔 MHz		1	00:00:13	SN:RWC123452	-10.2	0.000	PASS		
NST SA		PATH LOSS	0.0 🖨 dB		2	00:00:14	SN:RWC123453	-10.2	0.040	PASS		
FUOTA TEST		RX GAIN	LOW V Range Over -15d8m		3	00:00:15	SN:RWC123454	-10.4	0.260	FAIL		
FUOTATEST		RX GAIN WARNING TO	60 🚔 min									
		RX AGC	ON ~									
		MODULATION	PARAMETERS									
		MODULATION	LORA v		SEQ							
		NETWORK	PUBLIC V									
		SF	SF7 v									
		BW	125 ~									
		CR	4_5 v									
		TX POLARITY	NORMAL V									
		RX POLARITY	NORMAL V									
		PACKET PAI	RAMETERS]								
		PREAMBLE SIZE	12 🗧 Byte									
		PACKET INTERVAL	0.05 🗢 Sec									
		REPEAT NUM	50 🜲		SCALE - 1.0							
		PAYLOAD SIZE	16 🖨 Byte		CLEAR MS							
		PAYLOAD 32										
		0x 000000	000000000000000000000000000000000000000		SPY MESSA							
		CRITE	RIA			AVE			[TEST	TIME] Begin :		
				*		ASG (Max. 300 L	ines)		0.001	Finish :		
END DEVICE / EU 868 / 1.0.4			BWC20204	: NOT CONNECTED	DUTPORT		Control DUT while	test			RX	GAIN-LOW

Fig 3.52 Example test using 4 DUTs(N=50, Target PER=0.1)

3.4.2 NST SG (Signal Generator)

Signal Generator is a function of transmitting the defined test waveform to DUT repeatedly. Three different modulations are provided: LoRa, FSK and CW.

RedwoodComm : Le	RaWAN Autotest(Version : 1.309 RWC5020x)						- 🗆 ×
PROJECT SETUP	UTILITY ABOUT		FUNCTIONAL	TEST - NST SG		192.168.0.60:Not Connected	
PROJECT DEMO_V1300 PATH .\DEMO\DEMO		W EDT_PERF_EU868	•	REPORT PATH .\DEMO\DE FILE NAME	MO_V1300\EDT_PERF_EU86	3	
		LINK ANALYZER	UNCTIONS	CREATE REPORT	OPEN REPORT	w.r.t. Frequency O w.r.t. SF w.r.t. Frequency and SF	
FUNCTIONS	RUN		DEFAULT		N	ST MESSAGE	
MFG	RF P/	ARAMETERS		SEQ SF BW PO	ow Time Dwell	Data	
NST SG	TX POW	-130.0 🖨 dBm					
NST SG	FREQ	900.000000 🗘 MHz					
NST SA	PATH LOSS	0.0 🗘 dB					
FUOTA TEST	MODULATI	ON PARAMETERS					
	MODULATION	LORA 🗸					
	NETWORK	PUBLIC 🗸					
	SF	SF7 v					
	BW	125 ~					
	CR	4_5 V					
	TX POLARITY	NORMAL					
	PACKET	PARAMETERS					
	PREAMBLE SIZE	8 🖨 Byte					
	PACKET INTERVAL	0.05 🗘 Sec					
	REPEAT NUM	50					
	PAYLOAD SIZE	16 🗘 Byte					
	PAYLOAD 32	000000000000000000000000000000000000000					
				SCALE - 1.0 +			
				SPY MESSAGE			
				CLEAR SAVE		[TEST TIME] Begin :	
	I			View SPY MSG (Max. 300		Finish :	
END DEVICE / EU_868 / 1.0.4	/ CLASS A / OTAA	RWC2020A :	NOT CONNECTED	DUT PORT	Control DUT while te	est	RXGAIN:LOW

Fig 3.53 NST SG parameters and report window

3.4.2.1 Protocol Parameters

MODULATION

This parameter defines the modulation type of Signal Generator

LoRa / FSK / CW.

NETWORK

This parameter indicates the type of LoRa network (synchronization word) to be used in LoRa modulation.

PUBLIC / PRIVATE

<u>SF</u>

This parameter defines the spreading factor of a LoRa test frame.

SF7 / SF8 / SF9 / SF10 / SF11 / SF12

<u>BW</u>

This parameter defines the bandwidth of a LoRa test frame.

125 / 250 / 500

<u>CR</u>

This parameter defines the coding rate of a LoRa test frame, which is applicable only when DUT_TYPE is 'GATEWAY'.

4_5 / 4_6 / 4_7 / 4_8 / NO_CRC

PREAMBLE_SIZE

This parameter defines the preamble size of a LoRa test frame.

2 to 255

PAYLOAD_SIZE

This parameter defines the size of the payload of the LoRa test frame.

0 to 250

PAYLOAD

This parameter defines the content of the payload in hexadecimal format.

Hex value

FM_DEVIATION

This parameter defines the FM deviation value for FSK modulation. 1 to 100 kHz $\,$

DATA_RATE

This parameter defines the data rate value for FSK modulation. 1.000 to 128 kbps

SYNC_WORD_SIZE

This parameter defines the Sync word size for FSK modulation

1 to 8

SYNC_WORD

This parameter defines the Sync word for FSK modulation

Hex value

TX_POLARITY

This parameter defines the TX signal polarity.

NORMAL / INVERSE

REPEAT_NUM

This parameter defines the number of transmissions of a LoRa test frame.

2 to 5000

INTERVAL

This parameter defines the time interval in the second unit between consecutive LoRa test frames.

0.05 to 1000 sec

3.4.2.2 RF Parameters

<u>TX_POW</u>

This parameter defines the output power of RWC5020x/5021x in dBm.

<u>FREQ</u>

This parameter defines the frequency of RWC5020x/5021x.

PATH_LOSS

Users can set the path loss between the RF port of RWC5020x/5021x and DUT RF port. RWC5020x/5021x's real output power will be increased by this value to compensate for path loss.

3.4.3 NST SA (Signal Analyzer)

Signal Analyzer is a function of analyzing LoRa frames received from DUT repeatedly.

	otest(Version : 1.309 RWC5020x)					
OJECT SETUP UTILITY			NAL TEST - NST SA		92.168.0.60:Not Connected	
OJECT DEMO_V1300 TH .\DEMO\DEMO_V1300	DUT NEW EDT_	ERF_EU868	REPORT PATH .\DEMO\DEMO_V130 FILE NAME	0\EDT_PERF_EU868		
	PERFORMANCE	ANALYZER			t. Frequency O w.r.t. SF t. Frequency and SF	
	RUN	DEFAULT		NST ME	SSAGE	
MFG	RF PARAMETER	S	SEQ SF BW POW 1	ime Dwell	Data	
NST SG NST SA FUOTA TEST	PATH LOSS D. RX GAIN WARNING TO BE MODULATION PARAM MODULATION F C NETWORK PR SF SF BW 12 CR C	W Arage ∨ Image min min ETERS BLC 7 ∨ 5 ∨				
			POWER(dBm)	Pmax O	Pavg 0 Pmin	1 0
			SPY MESSAGE CLEAR SAVE View SPY MSG (Max. 300 Lines)		[TEST TIME] Begin : Finish :	

Fig 3.54 NST SA parameters and report window

3.4.3.1 Protocol Parameters

MODULATION

This parameter defines the modulation type of Signal Analyzer

LoRa / FSK / CW

<u>NETWORK</u>

This parameter indicates the type of LoRa network (synchronization word) to be used in LoRa modulation.

PUBLIC / PRIVATE

<u>SF</u>

This parameter defines the spreading factor of a LoRa test frame to receive. If this value is set as ANY, RWC5020x/5021x receives any kind of SF packets

SF7/SF8/SF9/SF10/SF11/SF12/ANY

<u>BW</u>

This parameter defines the bandwidth of a LoRa test frame to receive.

125/250/500

DATA_RATE

This parameter defines the data rate value for FSK modulation.

1.000 to 128kbps

<u>CR</u>

This parameter indicates the coding rate of a receiving LoRa test frame

CRC or NO_CRC

SYNC_WORD_SIZE

This parameter defines the Sync word size for FSK modulation

1 to 8

SYNC WORD

This parameter defines the Sync word for FSK modulation

Hex value

RX_POLARITY

This parameter defines the RX signal polarity.

NORMAL / INVERSE

TEST INTERVAL

It is updating time interval time during measuring CW in second unit.

1.0 to 100.0 sec

FCNT AVG N

The number of average while measuring frequency of receiving CW signal.

1 to 10

3.4.3.2 RF Parameters

<u>TX_POW</u>

This parameter defines the output power of RWC5020x/5021x in dBm.

<u>FREQ</u>

This parameter defines the frequency of RWC5020x/5021x.

PATH_LOSS

Users can set the path loss between the RF port of RWC5020x/5021x and DUT RF port. RWC5020x/5021x's real output power will be increased by this value to compensate for path loss.

3.4.4 FUOTA Test

The application provides a special function for LoRaWAN[®] FUOTA test. RWC5020x/5021x emulates gateway/FDS and the application controls RWC5020x/5021x. The system block diagram is as follows

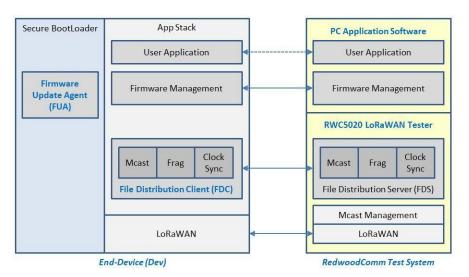


Fig 3.55 RedwoodComm test system for FUOTA Test

3.4.4.1 Test concept

Users can load the firmware binary file for the FUOTA test. The application fragments, encodes, and transmits

binaries to RWC5020x/5021x. Fragmentation parameters as well as Multicast parameters are editable using this GUI. The multicast function is optional. The clock Synchronization function will be performed automatically when Multicast function is selected.

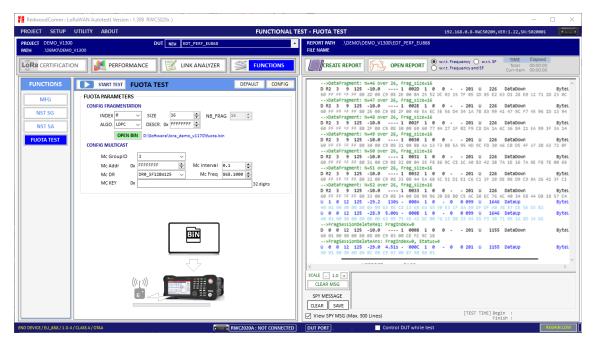


Fig 3.56 FUOTA test parameters and report window

3.4.4.2 Fragmentation Parameters

INDEX

This value identifies one of the 4 fragmentation sessions possible simultaneously. RWC supports only one fragmentation at a time.

<u>SIZE</u>

This value is the size in byte of each fragment. The number of fragments will be calculated and displayed automatically.

<u>ALGORITHM</u>

The LoRa Alliance proposes LDPC as a simple Forward Error Correction (FEC) code to be used for fragmented transport of large binary files over LoRaWAN[®].

DESCRIPTOR

This value is a freely allocated 4 byte field describing the file that is going to be transported through the

fragmentation session.

3.4.4.3 Multicast Parameters

OPTION

Select Unicast or Multicast method for FUOTA test.

<u>Mc Key</u>

Multicast Key value which will be distributed into the group of end-devices. The McAppSKey and McNetSKey are derived from the group's McKey.

Mc GroupID

An end-device may support being part of several multicast groups simultaneously. Therefore, all multicast related commands must always contain McGroupID of the multicast group being affected. RWC supports only one Multicast at a time.

<u>Mc Addr</u>

This value is the multicast group network address.

<u>Mc Freq</u>

This value is the frequency used for multicast.

<u>Mc Addr</u>

This value is the data rate used for multicast.

Mc Interval

This value is the interval between consecutive downlink messages within the multicast session to transmit user binary data.

3.4.4.4 Test Procedures

The message sequence charts are shown below for Multicast Test and Unicast Test respectively.

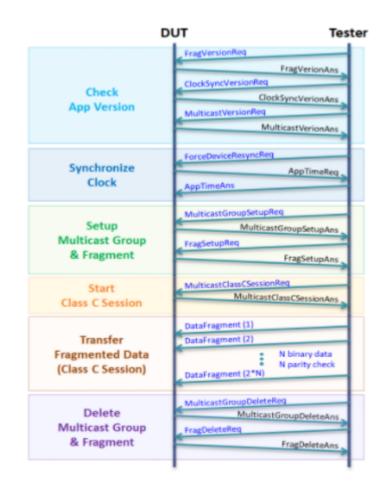


Fig 3.57 Multicast Test Procedure

IV. Report Functions

This chapter explains how to handle test reports for various kinds of test results. With report functions, users can see report messages while they test, create a report file after the test is finished and open it whenever users want to.

4.1 Report File Manager

4.1 Report File Manager

4.1.1 Creating Report

Clicking will open the save file window. You can change the file name and save the result document.

The result file will be saved as a word document. **WEATE REPORT** will be enabled on the Certification and Performance tab.

	ocal Disk (C:) > RWC5020A > 🗸 진	Search RWC5020A	م
Organize 🔻 New fold	der		• ?
\$SysReset ^	Name	Date modified	Туре
Brother	AppNote	3/21/2018 AM 11:10	File folde
Intel	lora_demo	3/22/2018 AM 11:14	File folde
Keil_v5	manual	3/21/2018 AM 11:10	File folde
MSOCache	📄 lora_demo.prj	3/22/2018 PM 2:06	PRJ File
OneDriveTemp	🖻 per.bmp	3/22/2018 PM 4:25	BMP File
PerfLogs	🖬 pow.bmp	3/22/2018 PM 4:25	BMP File
Program Files	pow2.bmp	3/22/2018 PM 4:25	BMP File
Program Files (🔄 rwc5020.ini	3/22/2018 PM 3:28	Configura
	🕵 RWC5020A PC APP Release Note.pdf	3/20/2018 PM 2:49	Foxit Rea
ProgramData	H RWC5020A_App.exe	3/22/2018 AM 11:17	Applicati
RWC5020A	<		>
File <u>n</u> ame: C:\R	WC5020A\lora_demo\DUT_00\DUT_00_ED_PERFO	RMANCE_TEST_RESULT.do	pc 🔹
Save as type:			`

Fig 4.1 Creation of Test Report File

A Special report option will appear when the NON-REGRESS test tab is selected.



Fig 4.2 Report option menu for NON-REGRESS test

• w.r.t. Frequency All NON-REGRESS test report will be created with respect to the tested frequency

• w.r.t. SF All NON-REGRESS test report will be created with respect to the tested Spreading Factor

(e) w.r.t. Frequency and SF All NON-REGRESS test report will be created with respect to both tested frequency and SF

After creating a report file, it will open automatically.

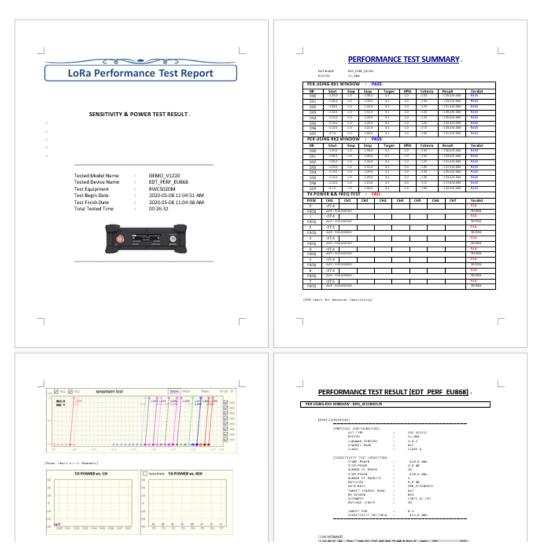


Fig 4.3 Created Report file (.doc)

4.1.2 How to Open the Saved Report File

Clicking Will open a REPORT LIST window. Double clicking on a file name will open the selected file. The reading tool is Microsoft Word installed on your PC. This list window will show only the files existing on the same directory of DUT.

REPORT LIST	\boxtimes
ST_CERTIFICATION_EU_TEST_RESULT.doc	
ST_CERTIFICATION_EU_TEST_RESULT2.doc	
ST_MICRON_CERTIFICATION_AS_TEST_RESULT.doc ST_MICRON_CERTIFICATION_EU_TEST_RESULT.doc ST_MICRON_PERFORMANCE_TEST_RESULT.doc ST_MICRON_PERFORMANCE_TEST_RESULT2.doc	:

Fig 4.4 The List of test report files



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