

RWC5020x Application Program

Operation Manual

Version 1.30

August 17, 2020





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I. Getting Started

This chapter explains how to download and start RWC5020x application program.

- 1.1 Download and Installation
- 1.2 Starting the Application
- 1.3 Opening the Manual
- 1.4 Checking Upgrade
- 1.5 Checking License
- 1.6 GUI Structure

1.1 Download and Installation

RWC5020x 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.

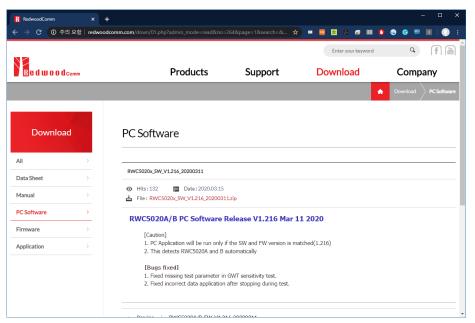


Fig 1.1 Downloading Zip file from the RedwoodComm website

Unzip the zip file and install the executable file as the install wizard guides. You can install it in other directories as you 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 RW/C5020x to the following folder. To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse". Eolder: C:\Program Files (x86)\PRWC\PRWC5020x\Program Browse Disk Cost Disk Cost |
| WARNING: This computer program is protected by copyright laws and international treaties. Unauthorized reproduction or distribution of this program, in whole or in part, is strictly regulated by civil and criminal law, and is grounds for prosecution. | Install RWC5020x for yourself, or for anyone who uses this computer: O Everyone |
| Cancel < Back Next > | Cancel < <u>B</u> ack <u>N</u> ext> |

Fig 1.2 Installation wizard

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

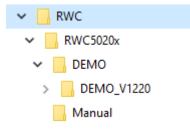


Fig 1.3 Installed directory structure

In directory RWC5020x /

Executable file RWC5020x_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_V1220/

Example DUTs : dut_name.ini and the same named directories

In directory manual

App_release_note.pdf

Fw_release_note.pdf

Application_manul.pdf

FW_manul.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 version as OS.
- 3. If you want to avoid the authorization problem with your OS system, please install this application on non-system disk, such as 'D drive'.

Language setup

- 1. Users are strongly recommended to use $\ref{eq:transformed}$ than $\ref{eq:transformed}$ for floating expression.
- 2. Users are strongly recommended to use ', than '.' for decimal expression.
- 3. Users are strongly recommended to use English over other languages.



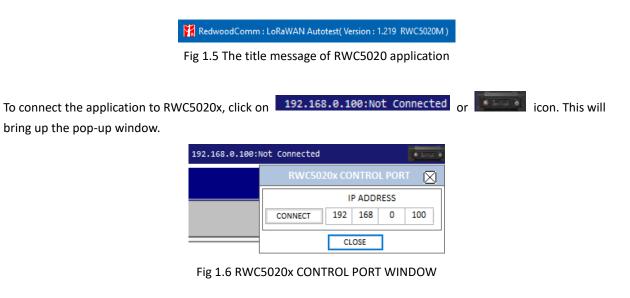
1.2 Starting the Application

When you execute the application 'RWC5020x_App.exe', it will start as shown in Fig 1.4.

| DJECT SETUP UTILITY ABOUT | PRE-CERTIFICATION - EU_868 | 192.168.0.8:Not Connected | |
|--|--------------------------------|--|---|
| DIECT NONE H _\ | DUT NAME NONE NEW FILE NAME | | |
| | | T OPEN REPORT | ME Elapsed Estimate otal 00:00:00 00:00:0 Item 00:00:00 00:00:0 |
| ERTIFICATION START TEST EU Certification Test | | ERTIFICATION TEST SUMMARY (EL | 1 \/1 5) |
| EU 868 Selected:0 | SKIP | EKTIFICATION TEST SOMMART (EC | / 1.5] |
| US 915 VICE LoRa Alliance Conformance Test (EU) | ITE | MS VERDICT | SUB VERDICT |
| I Test Mode Activation | 1 Test Mode Activ | | |
| AS 923 | 1.1 Test Mode A | ctivation | NOT TESTED |
| B 3 Over The Air Activation | 2 Test Application | Functionality NOT TESTED | |
| KR 920 4 Packet Error Rate RX2 default DR | 2.1 Test Echo Se | rvcie | NOT TESTED |
| 💿 🗖 5 Cryptography | 2.2 Test Downlin | nk Counter | NOT TESTED |
| IN 865 | 3 Over The Air Act | tivation NOT TESTED | |
| 7 Frame Sequence Number | 3.1 Over The Air | Activation | NOT TESTED |
| 8 DevStatusReg MAC Command | 4 Packet Error Rat | e RX2 default DR NOT TESTED | |
| 9 MAC Commands | 4.1 Packet Error | Rate | NOT TESTED |
| 10 NewChannelReg MAC command | 5 Cryptography | NOT TESTED | |
| 11 DIChannelReg MAC command | 5.1 AES Encrypti | on | NOT TESTED |
| 12 Confirmed packets | 5.2 Invalid Mes | sage Integrity Code | NOT TESTED |
| 13 RXParameterSetupReg MAC command | 6 Downlink Windo | | |
| 14 RXTimingSetupReg MAC command | 6.1 Test RX1 Do | wnlink at +20us | NOT TESTED |
| 15 LinkADRReg MAC command | 6.2 Test RX2 Do | | NOT TESTED |
| 16 Packet error rate RX1 Window | 6.3 Test RX1 Do | | NOT TESTED |
| 17 Packet error rate RX2 Window | 6.4 Test RX2 Dot | | NOT TESTED |
| The state of the s | 7 Frame Sequence | | |
| | | ence Number is Incrementing | NOT TESTED |
| | | jects a Frame with Decreasing Sequence Counter | NOT TESTED |
| | 8 DevStatusReg M | | |
| Test Parameters | | g MAC Command | NOT TESTED |
| Add raw data Stop link after test Tast ADR Tast Opt DR | ATHLOSS 0.0 DEFAULT | | |
| | | [TEST TIME] Begin : | |

Fig 1.4 Initial screen of the application

You can see the SW version and model name. When connected with the equipment, you can see the correct equipment type.



If there is no RWC5020x connected to exact IP, an alert message window will be pop up as shown in Fig 1.7



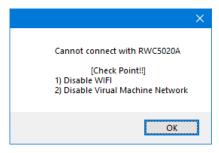


Fig 1.7 Pop-up Message for no connection alert

For safe connection, users are recommended to connect their PC to RWC 5020x via wired LAN.

If there is an RWC5020x connected to correct IP, you can see ID string that includes name, FW version, and serial.



Fig 1.8 ID string of RWC5020x

1.3 Opening the Manual

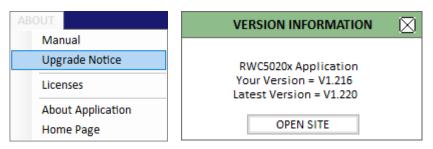
Clicking [Manual] will show the operation manual of this application

| ABOUT | |
|------------------------------|-------------------------------------|
| Manual 🕨 | RWC5020x Application Program Manual |
| Upgrade Notice | RWC5020x Tester User Manual |
| Licenses | PC APP Release Note |
| About Application Website | Firmware Release Note |

Fig 1.9 Opening the manual

1.4 Checking Upgrade

You can check the latest version of this application program using [Upgrade Notice] menu.





| → C ① 주의 요함 red | woodcomm.com/down/01.p | | □ Q ☆ ■ | 🔤 🚊 🖪 📾 🚺 🕻 | i i i i i i i i i i i i i i i i i i i | 📼 🔳 🔘 |
|--|---|---|--|--|---------------------------------------|---|
| | | | | Enter your keyword | C | a fi 🔚 |
| Redwood.comm | | Products | Support | Download | Cor | mpany |
| | | | | | • | Download All |
| Download | All | | | | | |
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| All > | | Select a document type | ▼ Select a category | T | | Q |
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| Data Sheet | No Document ty 103 Application | pe Solution Category | ocicero enegory | bject | Hits 90 | |
| Data Sheet > Manual > | | pe Solution Category | Introduction to RWC5020x | bject | | Date |
| Data Sheet > Manual > PC Software > | 103 Application | pe Solution Category | Introduction to RWC5020x | bject LoRaWAN Tester (Ver 1.22) in Brochure - RWC5020M/B & | 90 | Date 2020-04-21 |
| Data Sheet > Manual > PC Software > Firmware > | 103 Application 102 Data Sheet | Solution Category LoRa Test Solutions LoRa Test Solutions LoRa Test Solutions | Sulliver of the Sulliver Sulli | bject LoRaWAN Tester (Ver 1.22) In Brochure - RWC5020M/B & 20200311 | 90 112 | Date 2020-04-21 2020-04-21 |
| Data Sheet > Manual > PC Software > Firmware > | 103 Application 102 Data Sheet 101 Firmware | Solution Category LoRa Test Solutions LoRa Test Solutions LoRa Test Solutions | Introduction to RWC5020x LoRa/LoRaWAN Test Solutio RWC5020A/B_FW_V1216_ | bject LoRaWAN Tester (Ver 1.22) n Brochure - RWC5020M/B & 20200311 200311 | 90 112 109 | Date 2020-04-21 2020-04-21 2020-03-15 |

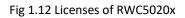
Clicking on [OPEN SITE] button will open up the download webpage of RedwoodComm.

Fig 1.11 Download page of RedwoodComm webpage

1.5 Checking License

After connecting with RWC5020x, users can see the licenses of RWC5020x by clicking on Licenses menu.

| Manual Upgrade Notice | |
|--------------------------|--------------------------------|
| Licenses > | Serial Number : RWC50201760007 |
| About Application | DefaultUtil(free):ON |
| Home Page | Performance(GW ED):ON |
| | FUNCTIONS OPT(ED):ON |
| | FUNCTIONS OPT(GW):ON |
| | FUNCTIONS OPT(NS):ON |
| | Certification(EU):ON |
| | Certification(US):ON |
| | Certification(AS):ON |
| | Certification(KR):ON |
| | Certification(SKT):ON |
| | Certification(IN):ON |





1.6 GUI Structure

RWC5020x 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 detail explanation about each window respectively.

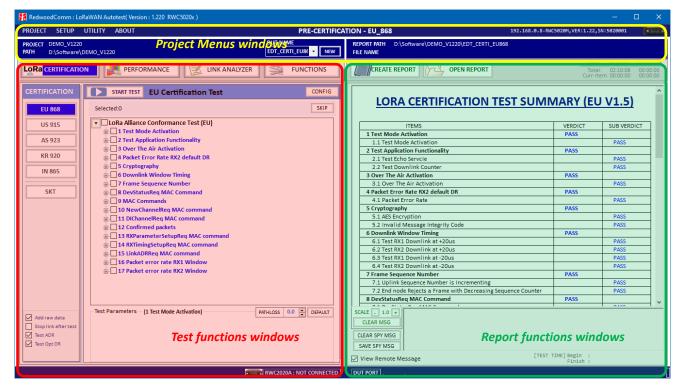


Fig 1.13 Function window classification

This application consists of 4 classified functions such as LoRaWAN pre-certification test, performance test, Link analyzer, and functionalities (Fig 1.14).



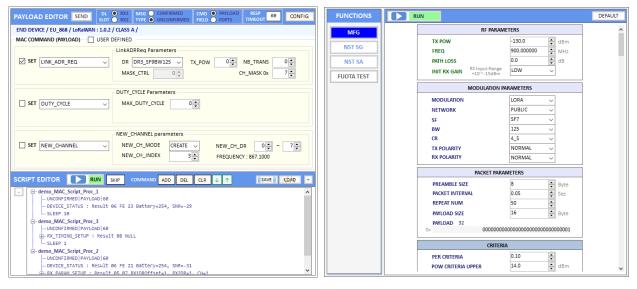
1.6.1 Test function windows

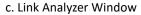
| CERTIFICATION | START TEST EU Certification Test CONFIG | PERFORMANCE | START TEST Selected : 0 | CONFIG |
|---|---|--|--|--|
| EU 868 | Selected:0 SKIP | PER & POWER | SENSITIVITY AND TX POWER - TABLE | TEST CONDITIONS DEFAULT |
| US 915 | LoRa Alliance Conformance Test (EU) H 1 Test Mode Activation | LBT | PER USING RX1 WINDOW | TEST PARAMETERS (RX1) SAME AS RX2 |
| AS 923 | 2 Test Application Functionality | NON-REGRESS | TX POWER & FREQ TEST | 10 - START + STOP - CRITERIA + |
| KR 920 | | | TEST ITEM | DR0 -129.0 -138.0 -133.0 -133.0 |
| IN 865 | S Cryptography G Downlink Window Timing Trame Sequence Number B DevStatusReq MAC Command S MAC Commands D NewChannelReq MAC command S 11 DichannelReq MAC command D 112 Confirmed packets D 13 RXParameter SetupReq MAC command D 14 RXTimingSetupReq MAC command D 15 LinkADRReq MAC command D 16 Packet error rate KXI Window | | DR WITH RX1 WINDOW DIB_5F1260125 DR_5F180125 DR_5F180125 DR_5F980125 DR_5F980125 DR_5F780259 DR_5F780259 DR_F5F589 DR_WITH RX2 WINDOW DB_5F1280125 | DR1 -1260 ⊕ ~ -1350 -1300 ⊕ DR2 -1250 ⊕ ~ -1350 -1200 ⊕ DR3 -1220 ⊕ ~ -1310 -1260 ⊕ DR4 -1190 ⊕ ~ -1280 -1280 ⊕ DR5 -1150 ⊕ ~ -1280 ± DR6 -1120 ⊕ ~ -1280 ± DR6 -1120 ⊕ ~ -1280 ± DR7 -970 ⊕ ~ -1060 ± DR7 -970 ⊕ ~ 100 ⊕ STEP #POW #PKT PATHLOSS |
| Add raw data Stop link after test Test ADR Test Opt DR | Test Parameters [4 Packet Error Rate RX2 default DR] PATHLOSS 0.0 (*) DEFAULT TARGET PER 0.05 (*) 0.0 (*) DEFAULT POWER -30.0 (*) PACKET NUM 60 (*) | DUT TYPE END DEVICE REGION EU 368 LoRaWAN 1.0.2 CLASS Class A | 011_5F1180125 022_5F180125 032_5F80125 054_5F80125 055_5F78125 066_5F780250 067_F5858 | TARGET PER 0.0 TARGET CH MASK 7 6 4 2 0 SCENARIO CERTI_DL_CNT PAYLOAD SIZE 16 2 OPTION SHOW GRAPH SHOW GRAPH SHOW LINK MESSAGE DURING TESTING |

You can select one of the test function windows using main menu buttons (Fig 1.15).

a. Pre-Certification Test Window

b. Performance Test Window





d. Functionality Test Window



1.6.2 Report function windows

The report function windows have different functions from the test functions. If you click on one of the main menu buttons, test function window will appear on the left side and report function window will appear on the right side. (Fig 1.16).

| LORA CERTIFICATION TEST SUMM | /IARY (E | <u>U V1.5)</u> | ^ | PER RX1 | RX2 1-DR7 2 DR7 | SEN | SITIVITY TES | r | 0 0 0 0 1 - DR 6 0 R 6 2 C | 200M | Pmin -97 Pmax 1-DR3 1-DR2 1-DR 2-DF2 2-DF1 2 | |
|---|----------|----------------|----------|--------------------------|-----------------------|-----------|--------------|----------|----------------------------------|-----------|--|-----------|
| ITEMS | VERDICT | SUB VERDICT | 1 | | | | | | | | | |
| 1 Test Mode Activation | PASS | | 1 | | | | | | | | | |
| 1.1 Test Mode Activation | | PASS | 1 | 0.5 | | | | | | | | DR. |
| 2 Test Application Functionality | PASS | | 1 | | | | | | | | | |
| 2.1 Test Echo Servcie | | PASS | 1 | | | | | | | | | |
| 2.2 Test Downlink Counter | | PASS | 1 | | | | | | | | | DR7 |
| 3 Over The Air Activation | PASS | | 1 | 0.0 0 0 0 0 | | | 000 | | | a 🖬 a 🖬 🛔 | a a a a a a a a | |
| 3.1 Over The Air Activation | | PASS | 1 | -97 | -102 | -107 | -112 | | | | -132 | -137 -139 |
| 4 Packet Error Rate RX2 default DR | PASS | | 1 | L | | | | | | | | |
| 4.1 Packet Error Rate | | PASS | 1 | | | DEDE | | ANICE | TECT | SUM | ANDV | |
| 5 Cryptography | PASS | | 1 | | | FEN | UNIVI | AIVCE | 1131 | 201011 | | |
| 5.1 AES Encryption | | PASS | 1 | DUT NA | ME | EDT_PERF_ | FI 1868 | | | | | |
| 5.2 Invalid Message Integrity Code | | PASS | 1 | REGIO | | EU_868 | | | | | | |
| 6 Downlink Window Timing | PASS | | 1 | | | | | | | | | |
| 6.1 Test RX1 Downlink at +20us | | PASS | 1 | PER USI | NG RX1 | WINDOV | V : PASS | | | | | |
| 6.2 Test RX2 Downlink at +20us | | PASS | 1 | DR | Start | Step | Stop | Target | #Pkt | Criteria | Result | Verdict |
| 6.3 Test RX1 Downlink at -20us | | PASS | | DRO | -129.0 | 1.0 | -138.0 | 0.1 | 1.0 | -133 | -135.0/0.000 | PASS |
| 6.4 Test RX2 Downlink at -20us | | PASS | | DR1 | -126.0 | 1.0 | -135.0 | 0.1 | 1.0 | -130 | -133.0/0.000 | PASS |
| 7 Frame Sequence Number | PASS | | | DR2 | -125.0 | 1.0 | -134.0 | 0.1 | 1.0 | -129 | -131.0/0.000 | PASS |
| 7.1 Uplink Sequence Number is Incrementing | | PASS | 1 | DR3 | -122.0 | 1.0 | -131.0 | 0.1 | 1.0 | -126 | -128.0/0.000 | PASS |
| 7.2 End node Rejects a Frame with Decreasing Sequence Counter | | PASS | 7 | DR4 | -119.0 | 1.0 | -128.0 | 0.1 | 1.0 | -123 | -125.0/0.000 | PASS |
| 8 DevStatusReq MAC Command | PASS | | | DR5 | -116.0 | 1.0 | -125.0 | 0.1 | 1.0 | -120 | -122.0/0.000 | PASS |
| LE - 1.0 + | 1 | 0.000 | <u> </u> | 000 | 1000 | 1.00 | 404.0 | | 1.00 | 1 | 400.0/0.000 | 0.000 |
| | | | | SCALE - 1.0 CLEAR MSG | | | | | | | | |

a. Pre-Certification Report Window

b. Performance Report Window

Fig 1.16 Report function window



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 currently opened project, and create or delete DUT file. Users can also open the ready-made demo project.

2.1 PROJECT

2.2 SETUP

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 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].

| PROJECT | SETUP | UTILITY | ABOUT |
|---------|----------|---------|---------------------|
| Projec | :t | • | New Project |
| DUT | | × | Open Project |
| Projec | t List | F | Del Current Project |
| Open | Demo Pro | ject | |

Fig 2.1 Project Menu

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 | SETUP | UTILITY | ABOUT |
|---------|----------|---------|---------------------|
| Proje | ct | • | New Project |
| DUT | | • | Open Project |
| Proje | ct List | F | Del Current Project |
| Open | Demo Pro | ject | |

Fig 2.2 Project Menu

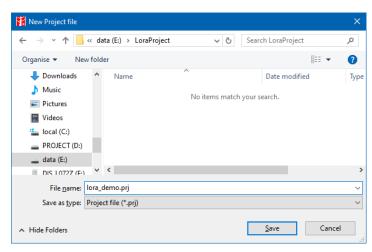


Fig 2.3 Creating a project



Fig 2.4 Example of a new project (DUT empty)

2.1.1.2 Opening Project

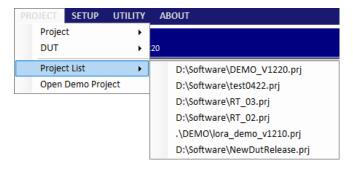
Using [Open project] menu, you can open an existing project file. When a project is opened, the last tested DUT file will be also opened automatically.

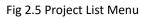
2.1.1.3 Deleting Current Project

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

2.1.1.4 Project List

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





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 RWC5020x application in '.\DEMO\', the sub-directory of the application installation directory.

| PROJEC | Т | SETUP | UTILITY | | | |
|--------|------|-----------|---------|---------|-----------|---------------|
| Pro | ojec | t | + | | | |
| DU | т | | • | PROJECT | SETUP | ABOUT |
| Pr | ojec | t List | + | PROJECT | lora_demo | _v1160 |
| Op | en | Demo Proj | ject | PATH | .\DEMO\lo | ra_demo_v1160 |

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, you must create a project first. If you created or opened a project, you can create a new DUT and you can create as many DUTs you need. When a new DUT is created, a 'DUT_name.ini' file and the same named directory will be created. If you want to test another DUT, you have to create a new DUT file and test.

2.1.2.1 New DUT

When you click [New DUT] in DUT Menu or NEW button, the 'NEW DUT CREATION' window will pop up, 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 [CREATE] button.

| PROJECT | SETUP | UTILITY | ABOUT |
|----------------|---------------------|-----------|-----------------|
| Projec | t | • | |
| DUT | | • | New DUT |
| Projec Open | t List Demo Proj |) ject | Del Current DUT |

Fig 2.7 New DUT Menu

| | NEW DUT CREATION | | | |
|----------|------------------|--|--|--|
| NAME | DUT_00 | | | |
| DUT TYPE | END DEVICE - | | | |
| REGION | EU_868 🗸 | | | |
| CREATE | | | | |

Fig 2.8 Creating a new DUT

Once created, you cannot change the name of the DUT, the type or region. If you want to modify any one of them, you must create new one.

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

| DUT NAME | |
|----------|---|
| DUT_00 | • |
| DUT_00 | |
| DUT_01 | |
| DUT_02 | |

Fig 2.9 List of DUT names

2.1.2.2 DEL Current DUT

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

| PROJECT | SETUP | UTILITY | ABOUT |
|---------|-----------|---------|-----------------|
| Projec | :t | • | |
| DUT | | • | New DUT |
| Projec | t List | • | Del Current DUT |
| Open | Demo Proj | ject | |

Fig 2.10 Del Current DUT menu

2.2 SETUP

2.2.1 Connect RWC5020x

RWC5020x Application works under Ethernet connection between users' PC and RWC5020x.

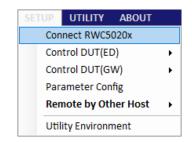


Fig 2.11 Connect RWC5020x menu



2.2.1.1 Open RWC5020x CONTROL PORT window

Clicking on [Connect RWC5020x] in SETUP Menu or clicking on icon will show the 'RWC5020x CONTROL PORT' window which is designed to help you set up RWC5020x's IP.

2.2.1.2 Setup IP

Set the IP address same as the RWC5020x's IP address connected to the PC and click [CONNECT] button. If your PC recognizes an RWC5020x, 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. The PC's IP information is useful to set up the server information when you test Gateway's Non-regression performance.

| RWC5020A CONTROL PORT 🛛 🔀 | RWC5020A CONTROL PORT 🛛 🔀 |
|---------------------------|---------------------------|
| IP ADDRESS | IP ADDRESS |
| CONNECT 192 168 0 163 | CONNECTED 192 168 0 163 |
| HELP CLOSE | HELP CLOSE |

a. Before connected

b. After connected

Fig 2.12 IP setup for connection



Fig 2.13 The type of RWC5020x and PC's IP address

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 SKT certification test.

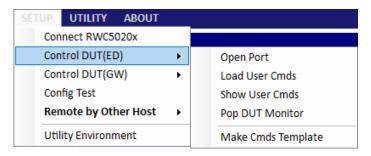


Fig 2.14 Control DUT Menu

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 [OPEN PORT] button within 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 'PORT No.' combo box, click on [RESCAN] button.



a. Before opening port

b. After opening port

Fig 2.15 DUT Control Port Setup

2.2.2.2 Load User Cmds

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

2.2.2.3 Show User Cmds

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 you don't have any user command file, click on [TEMPLATE] button to open a template and create your own command file.

| | Load File | Clear | USER COMMAND MAPPER | | \boxtimes |
|-----------|-----------|--------|------------------------|---------------|-------------|
| Referen | ce Action | | User Defined Cmd | Comment | ^ |
| set_class | s_a | AT+CLS | 5 0; | 0: A, 2: C | |
| set_class | s_b | AT+CLS | 5 1; | 0: A, 2: C | |
| set_class | s_c | AT+CLS | 5 2; | 0: A, 2: C | |
| set_ul_cy | vcle_off | AT+PRF | 1; | 0: off, 1: on | |
| set_ul_cy | cle_on | | | | |
| set_activ | vation | NONE; | | | |
| set_app_ | key | AT+AK | 0000000000000000000000 | 128 bit | |
| set_dev_e | eui | NONE; | | | |
| set_app_e | eui | NONE; | | | |
| set_apps | key | NONE; | | | |
| set_nwks | _key | NONE; | | | |
| set dev a | addr | NONE ; | | | ~ |
| < | | | | | > |

Fig 2.16 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 Moni | tor | | | — | | × |
|--------------------|-----------------|-----------|-----------|-------|------|---|
| COMPORT COM6 | BAUD RATE 38400 | Show time | Font Size | 9.0 🛓 | CLEA | R |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
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| | | | | | | |
| | | | | | | - |

Fig 2.17 DUT Monitor screen

2.2.2.5 Make Cmds 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 [Load User Cmds] menu.

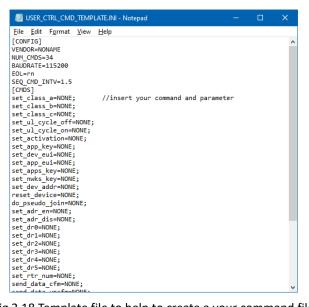


Fig 2.18 Template file to help to create a your command file

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 UTILITY ABOUT | | |
|----------------------|---|-----------|
| Connect RWC5020x | | |
| Control DUT(ED) | • | |
| Control DUT(GW) | • | Config IP |
| Parameter Config | | |
| Remote by Other Host | • | |
| Utility Environment | | |

Fig 2.19 [Control DUT(GW)/Config IP] menu

| SET | GW I | \boxtimes | |
|-------------|-------|--------------|---|
| GATEW | AY IP | 192.168.0.52 |] |
| SERVER PORT | | 1700 | |

Fig 2.20 [GW IP/HOST PORT] menu

If all parameters are set up correctly, RWC5020x application will start to wait for gateways messages. After receiving a JSON packet, this application will respond to gateway as a server.

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.

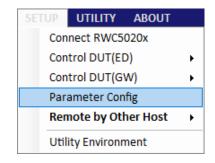
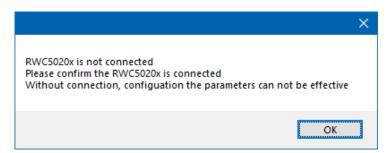
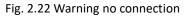


Fig 2.21 Parameter Config menu for displaying 'Parameter configuration' window

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





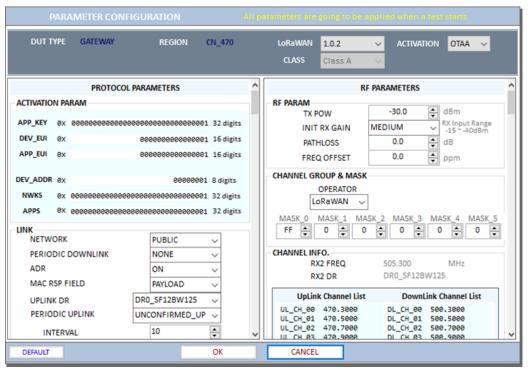


Fig 2.23 PARAMETER CONFIGURATION

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.

DUT_TYPE

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

REGION

RWC5020x supports various regions [EU 868, EU 433, US 915, AU 915, CN 470, KR 920, AS 923, IN 865, RU 864, KZ 865]. 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, CLAA) in the current version of firmware.

PROTOCOL_VER

This parameter defines the version of LoRaWAN protocol to be emulated by RWC5020x.

CLASS

There are three different classes in LoRa device. Class A is Bi-directional End Devices, Class B is Bidirectional 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.

ACTIVIATION

LoRaWAN defines two types of Activation procedures (OTAA, ABP). This parameter defines the activation mode of RWC5020x.

APP_KEY

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.

CHECK_EUI

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

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 Join-accept message.

APPS_KEY

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 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 RX window for testing the DUT.

NET_ID

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

YEAR

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

<u>MONTH</u>

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

DAY

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

<u>HOUR</u>

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

MINUTE

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

SECOND

This parameter indicates the second of RWC5020x 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's hardware, test environment, and control parameters.

TX_POW

This parameter defines the output power of RWC5020x in dBm.

INIT_RX_GAIN

The RWC5020x has an AGC (Automatic Gain Control) function. So the RWC5020x 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 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 RF port of RWC5020x and DUT RF port. RWC5020x's real output power will be increased by this value to compensate 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.

RX2_DR

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

DL_CH_00 ~ DL_CH_07

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

<u>UL_CH_00 ~ UL_CH_07</u>

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

UL_CH_64 ~ UL_CH_71

This parameter defines 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 controller via RS232. This function is a quite limited way to control but is useful to test pre-certification remotely. For more detail, refer the application note.



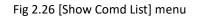
Fig 2.24 [Config Remote Port] menu

| REMOTE CONTROL | | | | | | |
|----------------|----------|--------|--------|--|--|--|
| RESCAN | PORT No. | BAUD R | ATE | | | |
| OPEN PORT | COM9 🗸 🗸 | 115200 | \sim | | | |
| | CLOSE | | | | | |

Fig 2.25 REMOTE COTROL setup window

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

| SETUP | UTILITY | ABOUT | | |
|------------------|---------------------------|----------|---|--------------------|
| Connect RWC5020x | | | | |
| Control DUT(ED) | | • | | |
| Control DUT(GW) | | • | | |
| Parameter Config | | | | |
| Ren | note b <mark>y</mark> Otł | ner Host | • | Config Remote Port |
| Util | ity Environn | nent | | Show Cmd List |



| REMOTE COMMANDS LIST | × |
|---|---|
| PC:CONF:MODE [PARAM] PARAM=CERT/PERF/UTIL/LINK | |
| PC:CONF:CERT:EU_CERT [PARAM] PARAM=SEL_ALL/DESEL_ALL | |
| PC:CONF:CERT:US_CERT [PARAM] PARAM=SEL_ALL/DESEL_ALL | |
| PC:CONF:CERT:AS_CERT [PARAM] PARAM=SEL_ALL/DESEL_ALL | |
| PC:CONF:CERT:KR_CERT [PARAM] PARAM=SEL_ALL/DESEL_ALL | |
| PC:CONF:CERT:IN_CERT [PARAM] PARAM=SEL_ALL/DESEL_ALL | |
| PC:CONF:CERT:REGION [PARAM] PARAM=EU/US/AS/KR/IN | |
| PC:READ:IDN? | |
| PC:READ:RWC5020X_SERIAL? | |
| PC:READ:COMMANDS? | |
| PC:READ:CERT_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 STOP | |
| PC:EXEC:CON_RWC5020 [PARAM] PARAM=123.123.123.123 | |
| | |

Fig 2.27 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.

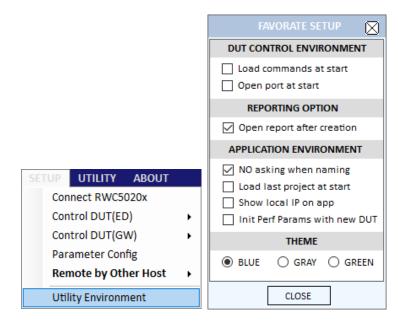


Fig 2.28 [Utility Environment] menu

REPORTONG 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.

□ Init perf 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.

<u>THEME</u>

O BLUE

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

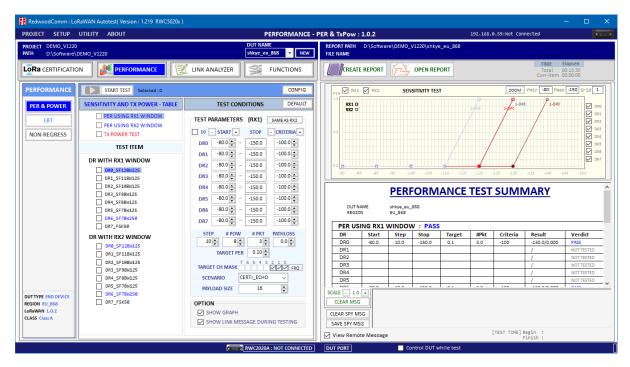


Fig 2.29 Blue theme of RWC5020x application

o GRAY

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

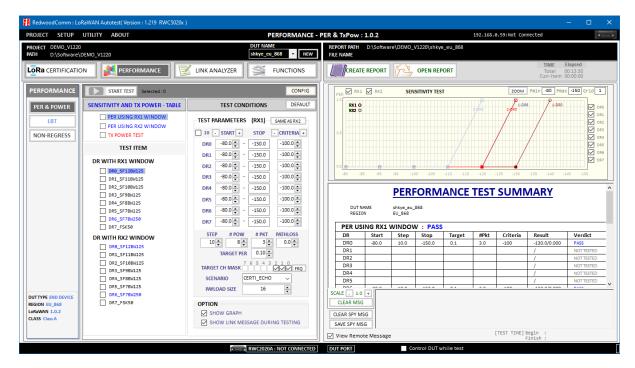


Fig 2.30 Gray theme of RWC5020x application

O GREEN

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

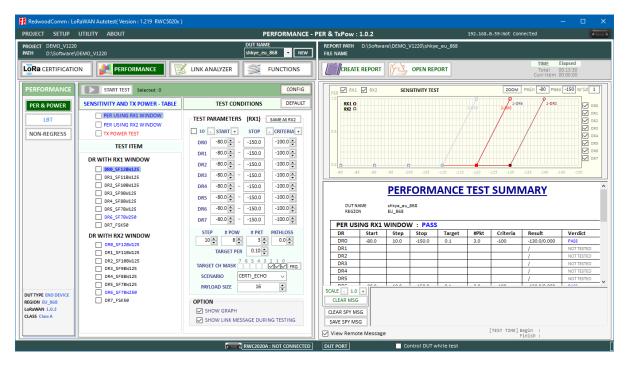


Fig 2.31 Green theme of RWC5020x application



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 tests, handle test operation, and set up test environment.

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



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.

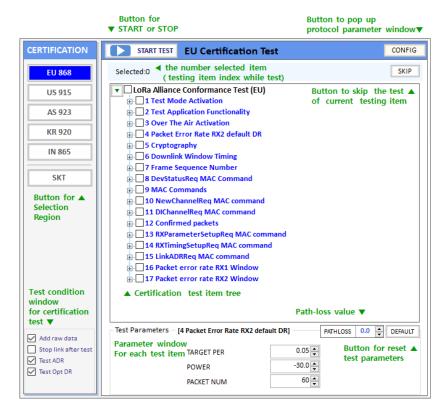


Fig 3.1 Test function window for LoRaWAN pre-certification.

3.1.1 LoRaWAN Certification

This application provides five LoRaWAN Certification functions such as EU, US/CA, AS, KR, and IN. Other regional certification functions will be added as soon as published. If you select one of the certification functions, regional parameters will be configured automatically according to the certification.



Fig 3.2 Buttons for Selection of Region for LoRaWAN Certification Test

3.1.2 Operator Certification

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



| SKI |
|-----|
|-----|

Fig 3.3 Button for Selection of Region for Operator Certification Test (Customized)

3.1.3 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 items.

| 1 Test Mode Activation | 5.1 AES Encryption | • • • • • • • • • • • • • • • • • • • | 15 LinkADRReq MAC command 15.1 Test ADR bit | | | |
|-------------------------------|---------------------------|---------------------------------------|---|--|--|--|
| Blue : PASSED | Red : FAILED | Black : NOT_TESTED | Gray :not selected option. | | | |
| Fig 3.4 Colored text items | | | | | | |

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 [16 Packet error rate KX1 window] PathLoss 0.0 | | | | | | |
|--|--|--|--|--|--|--|
| 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 RWC5020x application program will automatically overwrite the result after each item is tested without asking whether 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 command 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 DUT control monitor window. Click the DUT Monitor button and a large DUT control monitor will pop up.

| 🔜 DUT Control Monitor | | | | — | | × |
|------------------------------|---------------------------------|-----------|-----------|-------|------|---|
| COMPORT COM6 | BAUD RATE 115200 | Show time | Font Size | 9.0 🛓 | CLEA | R |
| ΟΤΑΑ | | | | - | | |
| DevEui= 34-31-37-32-74-3 | 6-7A-0F | | | | | |
| AppEui= 01-01-01-01-01-01-01 | | | | | | |
| АррКеу= 2В 7Е 15 16 28 A | E D2 A6 AB F7 15 88 09 CF 4F 3C | | | | | |
| VERSION: 44021110 | | | | | | |
| txDone | | | | | | |
| txDone | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Fig 3.6 DUT Control Monitor

COMPORT and BAUDRATE 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 COMPORT and BAUDRATE 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 result window.

| a <mark>CERTIFICATIO</mark> | DN PERFORMANCE 🔀 LINK ANALYZER 💥 FUN | | L | CREATE REPORT | TIME Tota Curr-It | Elapsed Esti 02:10:08 00: em 00:00:28 00: |
|-----------------------------|---|----------------|-----|---|-------------------------|---|
| TIFICATION | START TEST EU Certification Test Selected.0 | CONFIG SKIP | | LORA CERTIFICATION TEST SUMM | IARY (EU | J V1.5) |
| US 915 | LoRa Alliance Conformance Test (EU) | ^ | 11 | ITEMS | VERDICT | SUB VERDICT |
| | I Test Mode Activation | | | 1 Test Mode Activation | PASS | |
| AS 923 | 1.1 Test Mode Activation | | | 1.1 Test Mode Activation | | PASS |
| | 2 Test Application Functionality | | 111 | 2 Test Application Functionality | PASS | |
| KR 920 | - 2.1 Test Echo Servcie | | | 2.1 Test Echo Servcie | | PASS |
| IN 865 | 2.2 Test Downlink Counter | | | 2.2 Test Downlink Counter | | PASS |
| IN 865 | 3 Over The Air Activation | | | 3 Over The Air Activation | PASS | |
| | 3.1 Over The Air Activation | | | 3.1 Over The Air Activation | | PASS |
| SKT | - 4 Packet Error Rate RX2 default DR | | | 4 Packet Error Rate RX2 default DR | PASS | |
| | 4.1 Packet Error Rate | | | 4.1 Packet Error Rate | | PASS |
| | E S Cryptography | | | 5 Cryptography | PASS | |
| | 5.1 AES Encryption | | | 5.1 AES Encryption | | PASS |
| | 5.2 Invalid Message Integrity Code | | | 5.2 Invalid Message Integrity Code | | PASS |
| | ⊖ 6 Downlink Window Timing | | | 6 Downlink Window Timing | PASS | |
| | - 6.1 Test RX1 Downlink at +20us | | | 6.1 Test RX1 Downlink at +20us | | PASS |
| | - 6.2 Test RX2 Downlink at +20us | | | 6.2 Test RX2 Downlink at +20us | | PASS |
| | - 6.3 Test RX1 Downlink at -20us | | | 6.3 Test RX1 Downlink at -20us | | PASS |
| | 6.4 Test RX2 Downlink at -20us | | | 6.4 Test RX2 Downlink at -20us | | PASS |
| | G.4 Test RX2 Downlink at -2005 | | | 7 Frame Sequence Number | PASS | |
| | | | | 7.1 Uplink Sequence Number is Incrementing | | PASS |
| | - 7.1 Uplink Sequence Number is Incrementing | | | 7.2 End node Rejects a Frame with Decreasing Sequence Counter | | PASS |
| | 7.2 End node Rejects a Frame with Decreasing Sequence Counter | ~ | | 8 DevStatusReq MAC Command | PASS | |
| | Test Parameters [1 Test Mode Activation] PATHLOSS 0.0 | DEFAULT | | 8.1 DevStatusReg MAC Command | | PASS |
| ld raw data | Mathross 0.0 | DEMOLT | | 9 MAC Commands | PASS | |
| op link after test | | | | 9.1 MAC Commands | | PASS |
| st ADR | | | | 10 NewChannelReg MAC command | PASS | |
| st Opt DR | | | | 10.1 Try to modify read-only default channels, try to remove CH 0-2 | | PASS |
| | | | | 10.2 Adding Multiple Channels | | PASS |

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

| | N DEFORMANCE | TIME Elapoed Estimated Topia 02:108 000000 Curriter 00:03:13 00:00:00 |
|---|--|---|
| CERTIFICATION | START TEST EU Certification Test CONFIG Selected:0 SKIP | EU CERTIFICATION TEST RESULT |
| US 915 AS 923 KR 920 | LORa Alliance Conformance Test [EU] D 1 Test Mode Activation C 2 Test Application Functionality D 2 Over The Air Activation D 4 Packet Error Rate RX2 default DR | 3 Over The Air Activation |
| IN 865 | ⊕ □ S Cryptography ⊕ □ S Cownink Window Timing ⊕ □ Frame Sequence Number ⊕ □ B DevStatusReg MAC Command ⊕ □ B NewChannelReg MAC command ⊕ □ 10 NewChannelReg MAC command | [TEST FURPOSE] To test over the air activation : cest]_ITEM_SUB_0_0_OVER_THE_AIR_ACTIVATION [LINK MESSAGE] L OID 85 F BM FRW Time DEL FOIT Air Act FP AN 8 Fort N Dwell OND ONTS 0 8 4 6 11 155 - 0.5 8 1.5 0.5 0.6 8 1 0 - 0 0 2.2 4 0 1555 02/conter(2) Cot-2 |
| | ⊕ 11 Ork-Immed packets ⊕ 12 Confirmed packets ⊕ 13 RKParameter/setupReg MAC command ⊕ 14 RKIningSetupReg MAC command ⊕ 14 StinkAPRIkeg MAC command ⊕ 14 Packet error rate RX1 Window ⊕ 14 7 Packet error rate RX2 Window | [Decirity EC1 and DC2 doubling permeters (C241)] 0 1 2 12 5 - 56 2 - 56 - 56 - 56 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 |
| Add raw data Stop link after test Test ADR Test Opt DR | Test Parameters - [3 Over The Air Activation] | 0 0 |

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 fig 3.10 for an example.

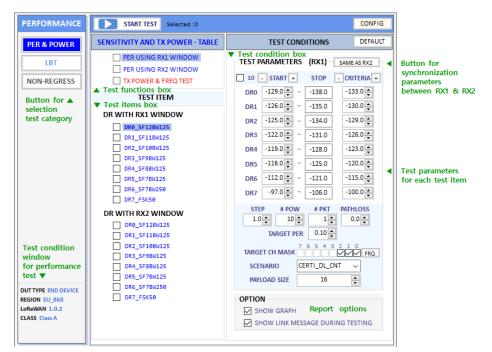


Fig 3.10 Test parameters and conditions

3.2.1 PER & POWER

This function allows RWC5020x 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 PARAMETER CONFIGURATION window.

3.2.1.1 Selection item

Select or deselect each item that you want to test by clicking each check box in 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 test function box. Whenever you click on each test item, its test conditions will be shown in test condition box. If you want to change the displayed item, click each test title in 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 functions window.

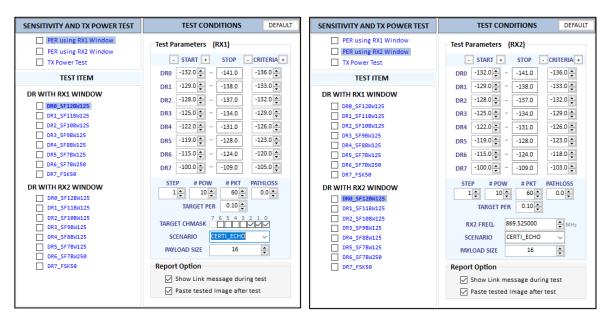


Fig 3.11 Test Conditions for PER using RX1 and RX2 Window

Parameters for PER test using RX1 and RX2 Window

SCENARIO

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.

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 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.

TARGET_DL_CH_00~07

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

DOWNLINK_SLOT

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

TARGET_DR

This is a parameter to determine the DR by sending MAC command before before 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 '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 payload in hexadecimal format.

Parameters of TX Power Test

MODE

It determines 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.

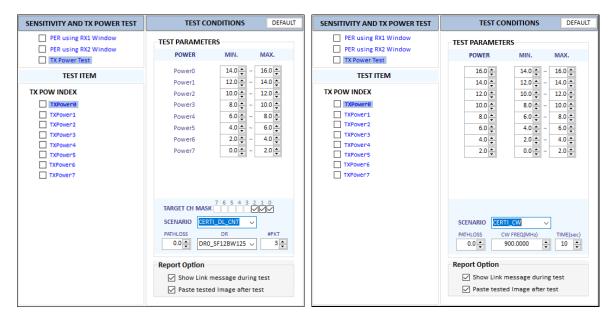


Fig 3.12 Test Conditions for TX Power Test using Lora signal or CW

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 measure 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.

UL_DR

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

ADR_POWER

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

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 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.

CW_POW

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

| PARAMETER CONF | IGURATION | All parameters are going to be applied when a test starts |
|--|-----------------------------|---|
| DUT TYPE END DEVICE | REGION EU_868 | LoRaWAN 1.0.2 V ACTIVATION OTAA V CLASS Class A V |
| PROTOCOL | PARAMETERS | RF PARAMETERS |
| ACTIVATION PARAM | Check EUI | RF PARAM TX POW -30.0 CM INIT RX GAIN MEDIUM X For ender |
| - | 0000000000000001 32 digits | PATHLOSS 0.0 C |
| APP_EUI Øx | 000000000000001 16 digits | |
| | 00000001 8 digits | ts Ox 7 |
| | 00000000000000001 32 digits | CHANNEL INFO. |
| NETWORK PERIODIC DOWNLINK | PUBLIC V | RX2 FREQ 869.525 MHz RX2 DR DR0_SF12BW125 |
| ADR | ON ~ | UpLink Channel List DownLink Channel List |
| MAC RSP FIELD MAC RSP SLOT DOWNLINK SLOT | PAYLOAD ~ RX1 ~ RX1 ~ | UL_CH_08 856.1000 DL_CH_08 858.1000 UL_CH_01 856.3000 DL_CH_01 858.3000 UL_CH_02 856.3000 DL_CH_02 856.3000 UL_CH_02 856.1000 DL_CH_02 856.3000 UL_CH_03 857.1000 DL_CH_03 857.3000 |
| DEFAULT | ОК | CANCEL |

Fig 3.13 Parameter configuration window

3.2.1.4 Start Test

Click on the **START TEST** button and the selected test items will be tested sequentially.

3.2.1.5 Test Result – Summary Table

If you clink on the **SENSITIVITY AND TX POWER - TABLE** title, you can see the test result summary table.

| DUTI | NAME | EDT_PERF | _EU868 | | | | | | |
|--------|----------|----------|-----------|--------|------|-------|-----|--------------|---------|
| PER US | SING RX1 | WINDO | N : PAS | s | | | | | |
| DR | Start | Step | Stop | Target | #Pkt | Crite | ria | Result | Verdict |
| DRO | -129.0 | 1.0 | -138.0 | 0.100 | 1 | -133 | | -135.0/0.000 | PASS |
| DR1 | -126.0 | 1.0 | -135.0 | 0.100 | 1 | -130 | | -133.0/0.000 | PASS |
| DR2 | -125.0 | 1.0 | -134.0 | 0.100 | 1 | -129 | | -131.0/0.000 | PASS |
| DR3 | -122.0 | 1.0 | -131.0 | 0.100 | 1 | -126 | | -128.0/0.000 | PASS |
| DR4 | -119.0 | 1.0 | -128.0 | 0.100 | 1 | -123 | | -125.0/0.000 | PASS |
| DR5 | -116.0 | 1.0 | -125.0 | 0.100 | 1 | -120 | | -122.0/0.000 | PASS |
| DR6 | -112.0 | 1.0 | -121.0 | 0.100 | 1 | -115 | | -120.0/0.000 | PASS |
| DR7 | -97.0 | 1.0 | -106.0 | 0.100 | 1 | -100 | | -101.0/0.000 | PASS |
| PER US | SING RX2 | WINDO | N : PAS | S | | | | | |
| DR | Start | Step | Stop | Target | #Pkt | Crite | ria | Result | Verdict |
| DRO | -129.0 | 1.0 | -138.0 | 0.100 | 1 | -133 | | -136.0/0.000 | PASS |
| DR1 | -126.0 | 1.0 | -135.0 | 0.100 | 1 | -130 | | -133.0/0.000 | PASS |
| DR2 | -125.0 | 1.0 | -134.0 | 0.100 | 1 | -129 | | -131.0/0.000 | PASS |
| DR3 | -122.0 | 1.0 | -131.0 | 0.100 | 1 | -126 | | -127.0/0.000 | PASS |
| DR4 | -119.0 | 1.0 | -128.0 | 0.100 | 1 | -123 | | -125.0/0.000 | PASS |
| DR5 | -116.0 | 1.0 | -125.0 | 0.100 | 1 | -120 | | -123.0/0.000 | PASS |
| DR6 | -112.0 | 1.0 | -121.0 | 0.100 | 1 | -115 | | -119.0/0.000 | PASS |
| DR7 | -97.0 | 1.0 | -106.0 | 0.100 | 1 | -100 | | -102.0/0.000 | PASS |
| TX PO | WER && I | FREQ TES | ST : FAII | | | | | | |
| POW | CH0 | CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | 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

3.2.1.6 Test Result

If you click on

PER using RX1 Window you can see all tested results in the result window from SF12 to SF7

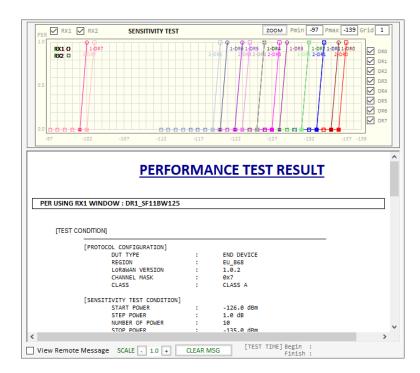


Fig 3.15 Test Result – Detail Report

3.2.1.7 showing link messages during test

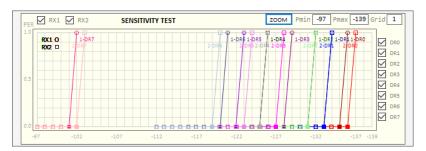
If you check DSHOW LINK MESSAGE DURING TEST, all link messages will be added in report.

| [LINK | ME | SSA | \GE |] | | | | | | | | | |
|--------|----|-----|------------|-----|--------|-------|------|-----|-------|-----|---|-----------------|-----------------------|
| | | | | | | | | | | | | | |
| | L | CH | SF | BW | POW | TIME | FCNT | Adr | Ack B | FP | N | 1 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 - | 002 | U | DataUp | ByteLen=16 |
| | D | 2 | 12 | 125 | -30.0 | | 0001 | 0 | 0 - | 224 | U | ActivateTM | |
| | U | 1 | 12 | 125 | 11.9 | 8.44s | 0001 | 0 | 0 - | 224 | U | DownlinkCounter | Cnt=0 |
| | D | 1 | 12 | 125 | -30.0 | | 0002 | 0 | 0 - | 666 | U | LinkADRReq | Pow=1,DR=0,Mask=07h,N |
| | U | 1 | 12 | 125 | 11.8 | 5.18s | 0002 | 0 | 0 - | 224 | U | LinkADRAns | Pow=1, DR=1, Mask=1 |
| | D | 1 | 12 | 125 | -30.0 | | 0003 | 0 | 0 - | 224 | U | EchoRequest | EchoLen=16 |
| | U | 0 | 12 | 125 | 11.8 | 5.35s | 0003 | 0 | 0 - | 224 | U | EchoResponse | Echo PASS |
| | D | 0 | 12 | 125 | -132.0 | | 0004 | 0 | 0 - | 224 | U | EchoRequest | EchoLen=16 |
| | U | 2 | 12 | 125 | 11.8 | 5.02s | 0004 | 0 | 0 - | 224 | U | EchoResponse | Echo PASS |

Fig 3.16 Link Messages attached in Test Report

3.2.1.8 Showing graph

If you check DSHOW GRAPH, it will show PER curve or TX power graph in report function window.



a. The result graph of PER test

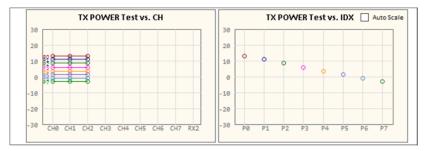




Fig 3.17 Show Result Graph of PER and TX Power

3.2.1.9 Viewing Remote commands

If \Box View Remote Message box is checked, it will show remote control commands and responses between the application and RWC5020x.

| | CONF:PROTOCOL:REGION EU_868 ACK READ:RF:UL_CH? 3 867.100000 |
|---------------|--|
| View Remote M | essage [TEST TIME] Begin : Finish : |

Fig 3.18 Remote Message

3.2.2 LBT TEST

RWC5020x application provides LBT (listen before talk) test function. An RWC2020A is required for this test. In this test, RWC5020x application assumes an RWC2020A is connected as an interferer.

Connect RWC5020x and RWC2020A with RS232 cable. RWC2020A will be controlled by RWC5020x through RS232 cable during LBT test. RWC2020A will make interference signals as you set up this application program. RWC2020A can make multi-interferer signals up to 8 the same time. Users can check whether RWC2020A is connected or not with this icon and message **RWC2020A : NOT CONNECTED**

3.2.2.1 Checking the connection to RWC2020A

User 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 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 signal.

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 | N-SHE |
| | Wanted Signal Pathloss 4.1 🛓 dB Unwanted Signal Pathloss 4.1 🗼 dB | ((Y I)) |
| | CHANNEL MODE PARAMETER TEST TIME 10 Min -80 dBm +1 +1 -3 | CH04 CH05 CH06 CH07 |
| | BURST MODE PARAMETERS | |
| | TEST TIME DURATION 10 - Iteration POWER NORMAL POWER DURATION -83 - dBm 10 - Sec | DURATION POWER BURST POWER DURATION -79 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 signal. If you set channel relative powers same as fig 3.20, RWC2020A will generate eight interference channels and set the absolute powers same as the values shown in the Fig 3.20.

| TEST TIME REF POW | CH00 | CH01 | CH02 | CH03 | CH04 | CH05 | CH06 | CH07 |
|--------------------|------|------|------|------|------|------|------|------|
| 10 ★ Min -80 ★ dBm | +1 ~ | +1 ~ | +1 ~ | -3 🗸 | +1 ~ | +1 ~ | +1 ~ | +1 ~ |

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.

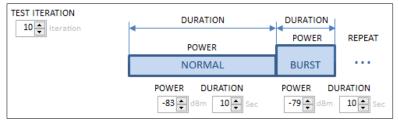


Fig 3.21 LBT Burst channel configuration

3.2.2.5 Starting LBT test and result

Click on **NOT** and RWC5020x will start the communication with DUT and RWC2020A will generate interference signal. While testing, RWC5020x 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 gateways, and it will be activated in gateway type of DUT.

Generally, a gateway plays the role as a bridge between end-devices and the network server in LoRaWAN network. Moreover, a gateway is close to a part of the physical layer of the network server. Therefore, there have been limited test methods in testing gateways; their performances had to be tested in non-signaling mode (so called 'a test mode') without connecting to their network server. Their software functions need be verified together with their network server as well.

This application 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.

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

sensitivity, frequency error tolerance, and CW interferer immunity test. RWC5020x Application provides minimal amount of server functionality to respond to the request from a gateway.

In order to let RWC5020x know the IP and the destination port of gateway, users have to set them manually.

| SET GW I | GW IP / HOST PORT | | | | | |
|-------------|-------------------|---|--|--|--|--|
| GATEWAY IP | 192.168.0.52 |] | | | | |
| SERVER PORT | 1700 |] | | | | |

Fig 3.22 The IP and PORT setup for non-regression 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 property table.

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

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

| - TX POWER CALIBRATIC | TX POWER CALIBRATION PARAMETERS | | | | | |
|-----------------------|---------------------------------|-------|----------|------------------|--|--|
| POW START | POW STEP | # POW | POW STOP | # ΡΔ (KFT | | |
| 13 de | 1 | | 10 10 | 10 | | |
| 13 🗖 🖪 | | • • | 10 dBm | 10 - | | |

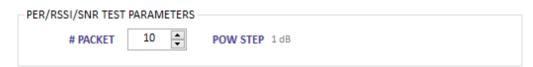
Fig 3.23 Parameters for TX PWER CALIBRATION

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 equipment transmits LoRa signal and RWC5020x application asks the gateway for RSSI, SNR and the number of received packets. RWC5020x 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.



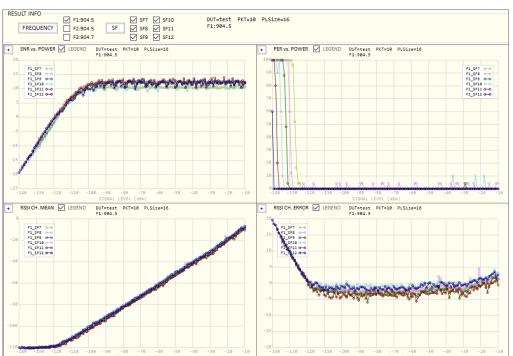


Fig 3.24 Parameters for PER/RSSI/SNR

Fig 3.25 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 equipment transmits LoRa signal and RWC5020x application asks the gateway for the number of received packet. RWC5020x 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 packet. More packets will make more reliable results.

| SENSITIVITY and F | SENSITIVITY and PER TEST PARAMETERS | | | | | | | |
|-------------------|-------------------------------------|--------------|--|--|--|--|--|--|
| # PACKET | 10 🛓 | POW STEP 1dB | | | | | | |
| | | | | | | | | |

Fig 3.26 Parameters for SENSITIVITY

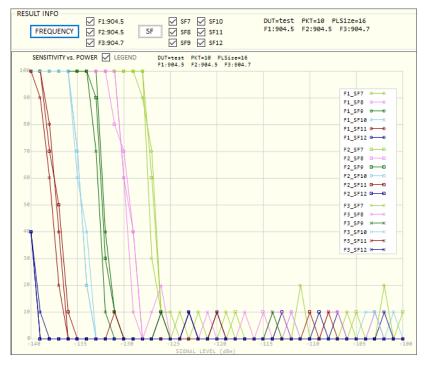


Fig 3.27 The test result of SENSITIVITY

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 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 is fixed at -100dBm and frequency offset step is fixed at 1.0 ppm. Users may modify the number of packets to be tested.

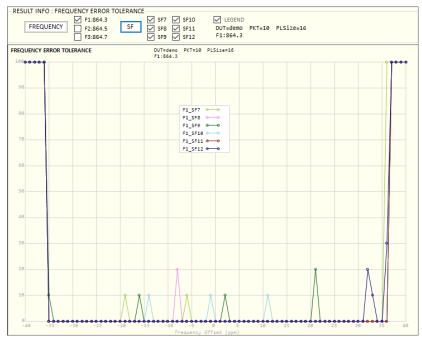


Fig 3.28 The test result of FREQUENCY ERROR TOLERANCE

3.2.3.5 CW immunity against the interferences with frequency offset.

This function measures the immunity properties of the gateway against interference signal. In this test, RWC5020x equipment transmits LoRa signal as a wanted signal, RWC2020A transmits CW as an interferer and RWC5020x application asks the gateway for the number of received packet while testing.

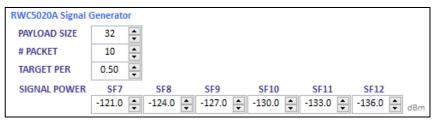


Fig 3.29 CW Interferer test parameters

RWC5020x 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 the each spreading factor respectively. Payload is fixed as all 0's in this

RWC2020A interferer generator is required to test CW interferer immunity as the figure below shows



Fig 3.30 Interferer test environment

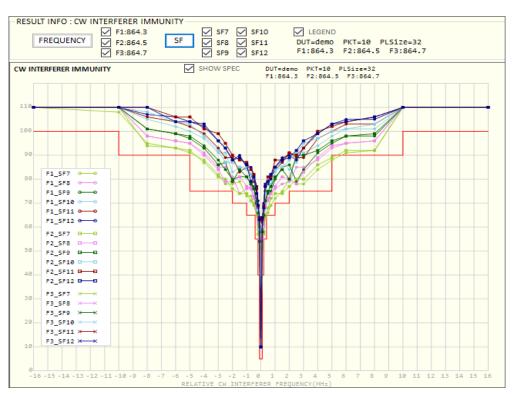


Fig 3.31 The test result of CW Interferer Immunity



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 while linking with DUT.

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

Using payload editor, users can send mac command(s) or user defined packet 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 A | NALYZER 1.0.x 192.168.0.60-Not Matched RWC5020x |
| PROJECT test_prj PATH D\project\tora\gui\test_prj edt_perf_cns78_2 | REPORT PATH D.\project\\ora\gui\test_prj\edt_perf_cn470_2 FILE NAME |
| | LINK MESSAGE Clear Before Dump Show raw data SAVE MSG |
| PAYLOAD EDITOR DUStor MSGTYPE CMD HELD RESP TO MALFUNCTION SET CONFIG | |
| - MAC COMMAND (PAYLOAD) USER DEFINED | L CH DR SF BW Pow Time Del FCnt Adr Ack FP AAR B Port M Dwell CMD CONTENTS |
| | |
| | |
| | |
| SCRIPT EDITOR NUN SKIP COMMAND ADD DEL CLR V A ISAVE I TCARO + | |
| | |
| | SCALE _ 1.0 + CLEAR MSG CLEAR SPY MSG |
| | SAVE SPY MSG SAVE SPY MSG View Remote Message [TEST TIME] Begin : Finish : |
| END DEVICE / CN_470 / LoRaWAN : 1.0. x / CLASS A / OTAA | DUT PORT |

Fig 3.32 Link Analyzer

3.3.1 Dumping link message

Click on start button in link message window and RWC5020x will start dumping all link messages between RWC5020x and DUT line by line. Clicking on stop button will stop RWC5020x from dumping. All link messages can be saved any time with time stamped file name by clicking on button.



3.3.2 Payload editor

3.3.2.1 Sending Commands

You can edit MAC commands in 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 equipment.

| PATH C\Program Files (x86)(RWC(RWCS020x),DEMO\Iora_demo_v1210 demo v NEW FILE NAME | 192.168.0.100-RwC5028A,VER:1.216,SN:8X18A0016 |
|--|--|
| PROJECT I OS-GUILTO VICTORIA CONTRACTORIA CO | |
| | Skip exist messages Show raw data SAVE MSG |
| | Start_2020-03-17_21_28_29.txt |
| PAYLOAD EDITOR SEND DL RAXI MSG CONFIRMED CMD PAYLOAD RESP 60 CONFIG | FCNT O Duty Cycler 11 96% |
| END DEVICE / EU_868 / LoRaWAN : 1.0.2 / CLASS A / | Pow Time Del FCnt Adr Ack FP AAR B Port M Dwell CMD CONTENTS |
| MAC COMMAND (PAVLOAD) User Defined 0 5 6 12 12 SET DEVICE_STATUS V 1 12 | |
| SET RX_PARAM_SETUP RX1_DR_OFF 1 + RX2_FREQ 869 525 + RX2_FREQ 0 0 0 12 125 | -30.0 2 0007 1 0 0 - 000 U 3130 Devistatuskoj RXParamastikoj 13.4 5.175 - 000F 1 0 - 0 0 224 U 318 (Devistatuskan) Battery=234, (RXParamastans) RXDD07fsst: |
| □ SET DEVICE_STATUS | 13.4 5.175 - 0011 1 0 - 0 0 224 U 1136 (XTIAngSetans) -30.0 2 000A 1 0 0 U 991 NoPPyload 13.3 4.0455 - 0032 1 0 - 0 0 224 U 1155 DiCounter(10) Cnt-10 13.4 10.15 003 1 0 - 0 0 224 U 1155 DiCounter(10) Cnt-10 13.4 10.055 - 0034 1 0 - 0 0 224 U 1155 DiCounter(10) Cnt-10 13.4 10.055 - 0043 1 0 - 0 0 224 U 1155 DiCounter(10) Cnt-10 13.4 10.055 - 0045 1 0 - 0 0 224 U 1155 DiCounter(10) Cnt-10 13.4 10.055 - 0045 1 0 - 0 0 224 U 1155 DiCounter(10) Cnt-10 - 0 0 224 U 115 DiCounter(10) Cnt-10 - 0 0 200 U 10 - 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 |
| SCRIPT EDITOR NUM SKIP COMMAND ADD DEL CLR ↓ ↑ ISAVE I/OAQ ▼ U 0 0 1 123 U 0 0 1 123 U 0 0 1 123 U 0 0 12 123 U 0 0 12 123 0 12 123 U 0 12 123 U 1 0 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 12 12 | 13.4 18.005 0017 0 -0 0.224 U 1155 Dicounter(10) Cnt=10 13.4 18.005 0018 1 0 -0 0.224 U 1155 Dicounter(10) Cnt=10 -30.0 |
| | ACC EXECTLINERAN EXECUTINERAN EXECUTINESTOP ACC |

Fig 3.33 Sending multiple commands in a single packet

When $\ensuremath{\boxtimes}$ User Defined is checked, user definable command edit window will appear.

| PAYLOAD | | DL SLOT ORX1 RX2 | O CONFI | S TYPE IRMED NFIRMED | CMD FIELD PAYLOAD FOPTS | RESP TO | MALFUNCTION NONE | SET | CONFIG |
|-----------|-------------|------------------------|------------|----------------------------|-------------------------------|---------|---|---------|------------|
| | IAND (FOPTS |) 🗸 🗸 | ISER DEFIN | ED | | | | | |
| | | | Use | r Defined I | MAC CMD Param | neters | | | |
| SET SET | | | F | OPTS SIZE | | 8 📮 | | | |
| FOPTS | 16(pos16) | | | | | | | 00000 | 0000000001 |
| MAC PAYLO | AD USER DAT | A | | | | | | | |
| | PAYLOAD SI | ZE | 16 🜲 | FPORT | 99 🌲 | | | | |
| PAYLOAD | 32(POS 0) | | | | | | 000000000000000000000000000000000000000 | 0000000 | 0000000001 |



3.3.2.3 Malfunction test

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



Fig 3.35 Malfunction status window in PAYLOAD EDITOR

Test Procedure

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

MAC command selection - Select a mac command referring 3.3.2.1

Malfunction Editing - Click [SET] button in MALFUNCTION area and select the types of error which you want to add like fig. 3.36. 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.

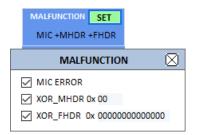


Fig 3.36 Malfunction configuration parameters

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

3.3.2.2 Mac Commander Parameters

DOWNLINK_SLOT

When RWC5020x 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 RX window for testing the DUT.



Fig 3.37 MESSAGE TYPE

MAC_CMD_TYPE

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



Fig 3.38 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 3.39 RESPONSE TIME OUT

RESP TIMEOUT

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



Fig 3.40 Response time out value

FOPTS_SIZE

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

FOPTS

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

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 message.

ADR_TXPOW

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

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 aggregated 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.

RX2_DR the data rate of a downlink using the second receive window

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 that 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 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: ACTIVATE_TM

This parameter is for sending *Activate test mode* command to DUT, which starts test mode when 4 bytes payload with value 0x01010101 is sent to DUT.

MAC_CMD: DEACTIVATE_TM

This parameter is for sending *Deactivate test mode* command to DUT, which stops test mode and the DUT goes back to normal applicative operation.

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.

CW_FREQ

This parameter indicates the frequency of CW signal.

CW_POW

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.

REJOIN_TYPE

This parameter is the type of Rejoin-Request.

REJOIN_RETRY

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 $32 \times 2^{\text{Period}} + \text{Rand}32$ 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.

REJOIN_MAX_TIME_N

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 includes 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 link script editor window using LADD DEL CLR J A 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 same commands could be added in single action. You must check whether it is intended or not by yourself.

| PAYLOAD EDITOR SEND | | MSG TYPE CONFIRMED UNCONFIRMED | CMD FIELD PAYLOAD FOPTS | RESP TO | MALFUNCTION NONE | SET | CONFIG | |
|--|------------------------------------|--------------------------------------|-------------------------------|---------|---------------------|------|--------|--|
| - MAC COMMAND (PAYLO | MAC COMMAND (PAYLOAD) USER DEFINED | | | | | | | |
| SET DEVICE_STAT | US 🗸 |] | | | | | | |
| | US 🗸 |] | | | | | | |
| SET DEVICE_STATI | US 🗸 |] | | | | | | |
| | RUN | SKIP COMMAN | ID ADD DEL | CLR ↓ | ↑ | SAVE | | |
| - edt_perf_cn47(- UNCONFIRM - DEVICE_ST. - SLEEP 1 | ED PAYLOAD 60 | | | | | | | |

Fig 3.39 Adding an action into Script Editor

| PAYLOAD EDITOR SEND | MSG TYPE CMD FIELD CONFIRMED PAYLOAD UNCONFIRMED FOPTS | RESP TO MALFUNCTION | | IFIG | | | | |
|--|---|---------------------|---|------|--|--|--|--|
| MAC COMMAND (FOPTS) | DEFINED LinkADRReq Parameters DR DR2_SF10BW125 V MASK_CTRL 0 | | TRANS 0 | | | | | |
| SET DUTY_CYCLE | DUTY_CYCLE Parameters MAX_DUTY_CYCLE | 0 🗘 | | | | | | |
| | | | | | | | | |
| MAC PAYLOAD USER DATA PAYLOAD SIZE 11 PAYLOAD 32(pos32) | 6 ← FPORT 99 ← | 0000000000 | 000000000000000000000000000000000000000 | 0001 | | | | |
| SCRIPT EDITOR RUN C edt_perf_cn470_2_MAC_Script, UNCONFIRMED[FOPTS]68 RV DEVICE_STATUS C MAC_PAYLOAD SLEEP 1 C edt_perf_cn470_2_MAC_Script, UNCONFIRMED[FOPTS]68 RV C UNCONFIRUNCONFIRMED[FOPTS]68 RV C UNCONFIRMED[FOPTS]68 RV C | _Proc_2 | CLR ↓ ↑ | SAVE TCÓÀQ | | | | | |

Fig 3.40 Adding an action that includes two commands

SLEEP function makes RWC5020x 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 unt buttons. At first select an action and move it.

| SLEEP 1 | ^ |
|---------------------------|---|
| 🖕 demo_MAC_Script_Proc_2 | |
| UNCONFIRMED PAYLOAD | |
| . LINK_ADR_REQ | |
| . DUTY_CYCLE | |
| SLEEP 1 | |
| demo_MAC_Script_Proc_3 | |
| UNCONFIRMED PAYLOAD | |
| - ACTIVATE_TM | |
| CLEED A | * |
| | |
| ⊡- demo_MAC_Script_Proc_3 | ^ |
| UNCONFIRMED PAYLOAD | |
| ACTIVATE_TM | |
| SLEEP 1 | |
| | |
| UNCONFIRMED PAYLOAD | |
| DEVICE_STATUS | |
| SLEEP 1 | |
| demo_MAC_Script_Proc_2 | |
| LINCONSTRAED RAVI OAD | • |

Fig 3.42 Moving an action.

3.3.3.3 Deleting actions

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



Fig 3.43 Deleting an action.

3.3.3.4 Renaming actions

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

Click 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 3.44 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 send MAC commands to DUT according to the script. Before running script, RWC5020x must be in running link analyzer. If it is not in running link analyzer, the application will let RWC5020x run link analyzer automatically while running script.

[RUN] button will be activated after creating a project and DUT and connection with RWC5020x 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.

| SCRIPT EDITOR SKIP COMMAND ADD DEL CLR J 1 | VE KOAD + |
|--|-----------|
| | Â |

Fig 3.45 Running script screen

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 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 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 and count the number of the packets received.

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

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

Whenever DUT transmits any frame RWC5020x measures the TX power of DUT and show the averaged value after receiving report packets.

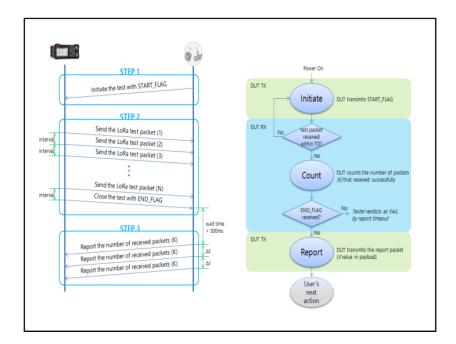


Fig 3.46 Test scenario for manufacturing

3.4.1.2 Protocol Parameters

MODULATION

This parameter defines the modulation type of MFG test; LoRa, FSK or CW.

DUT_TYPE

This parameter defines the DUT type of MFG test; End_device, Gateway, Unknow. TX/RX signal polarity and CR value will be set automatically depends on DUT type.

NETWORK

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

<u>BW</u>

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

<u>SF</u>

This parameter defines the spreading factor of a LoRa test frame to be used in MFG test. If this value

is set as ANY, RWC5020x receives any kind of SF packets and apply this SF value for TX packets.

<u>CR</u>

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

PREAMBLE_SIZE

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

PAYLOAD_SIZE

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

PAYLOAD

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

FM_DEVIATION

This parameter defines the FM deviation value for FSK modulation.

DATA_RATE

This parameter defines the data rate value for FSK modulation.

SYNC_WORD_SIZE

This parameter defines the Sync word size for FSK modulation

SYNC_WORD

This parameter defines the Sync word for FSK modulation

TX_POLARITY

This parameter defines the TX signal polarity.

RX_POLARITY

This parameter defines the RX signal polarity.

REPEAT_NUM

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

INTERVAL

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

PER_CRITERIA

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

POW_CRITERIA_UPPER

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

POW_CRITERIA_LOWER

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

TIME_OUT

This parameter defines the timeout until RWC5020x waits for a LoRa frame from DUT.

3.4.1.3 RF Parameters

TX_POW

This parameter defines the output power of RWC5020x in dBm.

PATH_LOSS

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

FREQ

This parameter defines the frequency of RWC5020x

3.4.1.4 Getting the result

Users can take measured result of the PER and 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.

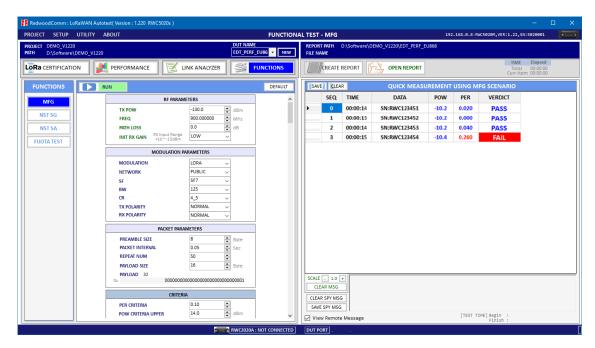


Fig 3.47 Example test using 4 DUTs(N=50, Target PER=0.1)

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.

| KedwoodComm : LoRaWAN Autotest(Version : 1.220 RWC5020x) | – 🗆 X |
|--|--|
| PROJECT SETUP UTILITY ABOUT FUNCTION | AL TEST - NST SG 192.168.0.8-RWC5020M, VER:1.22, SN:5020001 |
| PROJECT DEMO_V1220 DUT NAME PATH D\Software\DEMO_V1220 EDT_PERF_EUB6 NEW | REPORT PATH D.\Software\DEMO_V1220\EDT_PERF_EU868 FILE NAME |
| | CREATE REPORT OPEN REPORT |
| FUNCTIONS DEFAULT | NST MESSAGE |
| MFG RF PARAMETERS | SEQ SF BH POW Time Dwell Data |
| NST SG TX POW -130.0 tr dBm FREQ 900.000000 thHz NST SA PATH LOSS 0.0 thB | |
| FUOTA TEST MODULATION PARAMETERS | |
| MODULATION LORA ~ NETWORK PUBLIC ~ SF SF7 ~ BW 125 ~ CR 4.5 ~ TX POLARITY NORMAL ~ | |
| PACKET PARAMETERS | |
| PREAMBLE SZE 8 → Byte PACKET INTERNAL 0.05 ÷ Sec REFEAT NUM 50 → PATIOAD SIZE 16 ⇒ Byte WNLOAD 32 000000000000000000000000000000000000 | |
| | SCALE 10 - CLEAR MSG CLEAR SPY MSG SAVE SPY MSG SAVE SPY MSG View Remote Message (TEST TIME) Begin : FIRISH : |
| RWC2020A : NOT CONNECTED | |

Fig 3.48 NST SG parameters and report window

3.4.2.1 Protocol Parameters

MODULATION

This parameter defines the modulation type of Signal Generator; LoRa, FSK or CW.

DUT_TYPE

This parameter defines the DUT type of Signal Generator; End_device, Gateway, Unknow. TX signal polarity and CR value will be set automatically depends on DUT type.

NETWORK

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

<u>BW</u>

This parameter defines the bandwidth of a LoRa test frame.

<u>SF</u>

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

<u>CR</u>

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

PREAMBLE_SIZE

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

PAYLOAD_SIZE

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

PAYLOAD

This parameter defines the content of payload in hexadecimal format.

FM_DEVIATION

This parameter defines the FM deviation value for FSK modulation.

DATA_RATE

This parameter defines the data rate value for FSK modulation.

SYNC_WORD_SIZE

This parameter defines the Sync word size for FSK modulation

SYNC_WORD

This parameter defines the Sync word for FSK modulation

TX_POLARITY

This parameter defines the TX signal polarity.

REPEAT_NUM

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

INTERVAL

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

3.4.2.2 RF Parameters

TX_POW

This parameter defines the output power of RWC5020x in dBm.

PATH_LOSS

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

FREQ

This parameter defines the frequency of RWC5020x.

SYSCLK_OFFSET

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

3.4.3 NST SA (Signal Analyzer)

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

| RedwoodComm : LoRaWAN Autotest(Version : 1.300 RWC5020x) | | – 🗆 X |
|--|--|--------|
| PROJECT SETUP UTILITY ABOUT FL | FUNCTIONAL TEST - NST SA 192.168.0.60-Not Matched RWC5020 | c Read |
| PROJECT test_prj DUT LIST PATH D.\project\lora\gui\test_prj edt_perf_cn470_2 | 70_1 NEW REPORT PATH D.\project\lora\gui\test_prj\edt_perf_cn470_2 FILE NAME | |
| | ICTIONS | |
| | DEFAULT NST MESSAGE | |
| MFG RF PARAMETERS | SEQ SF BW POW Time Dwell Data | |
| FREQ 900.000000 WHz | | |
| PATH LOSS U.U U dB | | |
| | | |
| FUOTA TEST MODULATION PARAMETERS | | |
| NODULATION LORA V | | |
| SF SF7 V | | |
| BW 125 V | | |
| CR CRC V | | |
| RX POLARITY NORMAL PRFAMBLE SIZE 8 Pre- RX POLARITY PRFAMBLE SIZE | | |
| PREAMBLE SIZE 8 😄 Byte | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | POWER(dBm) Pmax 0 Pavg 0 Pmin 0 | |
| | SCALE - 1.0 + | |
| | CLEAR MSG | |
| | CLEAR SPY MSG | |
| | SAVE SPY MSG | |
| | View Remote Message [TEST TIME] Begin : Finish : | |
| END DEVICE / CN 470 / LoRa WAN : 1.0.x / CLASS A / OTAA | | |

Fig 3.49 NST SA parameters and report window

3.4.3.1 Protocol Parameters

MODULATION

This parameter defines the modulation type of Signal Analyzer; LoRa, FSK or CW.

DUT_TYPE

This parameter defines the DUT type of Signal Analyzer; End_device, Gateway, Unknow. RX signal polarity and CR value will be set automatically depends on DUT type.

NETWORK

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

<u>BW</u>

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

<u>SF</u>

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

DATA_RATE

This parameter defines the data rate value for FSK modulation.

SYNC_WORD_SIZE

This parameter defines the Sync word size for FSK modulation

SYNC_WORD

This parameter defines the Sync word for FSK modulation

RX_POLARITY

This parameter defines the RX signal polarity.

3.4.4 FUOTA Test

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

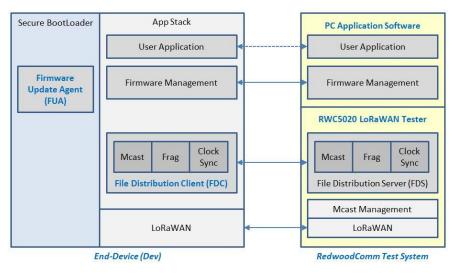


Fig 3.50 RedwoodComm test system for FUOTA Test

3.4.4.1 Test concept

Users can load the firmware binary file for FUOTA test. The application fragments, encodes, and transmits binaries to RWC5020x. 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.

| RedwoodComm : LoRaWAN Autotest(Version : 1.220 RWC5020x) | | | - • × |
|--|---|---|--|
| PROJECT SETUP UTILITY ABOUT PROJECT DEMO_V1220 PATH D:\Software\DEMO_V1220 | FUNCTIONAL T DUT NAME EDT_PERF_EU86 Vew | EST - FUOTA TEST REPORT PATH D:\Software\DEMO_V1220\EDT_PERF_EU86 FILE NAME | 192.168.0.8-RWC5020M,VER:1.22,SN:5020001 |
| | | CREATE REPORT OPEN REPORT | TiME Elapsed Total 00:00:00 Curr-Item 00:00:00 |
| | trerval 0.1 ♀ c Freq 868.1000 ♀ | | 0 - -201 U 226 Detadown Bytet 20 0.15 76 75 76 75 76 75 76 75 76 75 76 75 76 75 76 75 76 75 76 75 76 75 76 75 76 75 76 75 |
| | | View Remote Message | [TEST TIME] Begin : Finish : |

Fig 3.51 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.

ALGORITHM

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 group simultaneously. Therefore, all multicast related command 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.

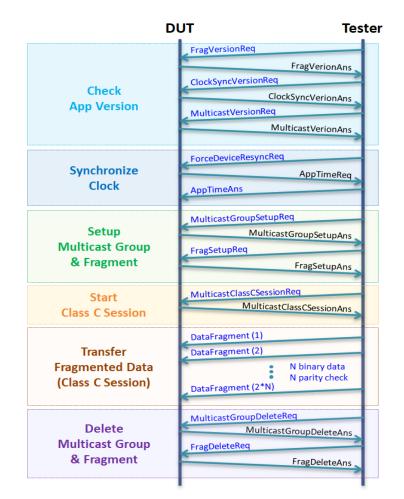


Fig 3.52 Multicast Test Procedure

3.5 Utilities

It consists of 3 utility functions: DUT Control, Tester(RWC5020x) Control, and Screen capture. You can find them on UTILITY menu tab at the top of the application.

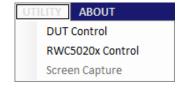


Fig 3.53 Utility menus

3.5.1 DUT Control

| UTILITY | ABOUT |
|---------|---------------|
| DUT | Control |
| RWC | 5020x Control |
| Scree | en Capture |

Fig 3.54 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.

3.5.1.1 How to Use

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

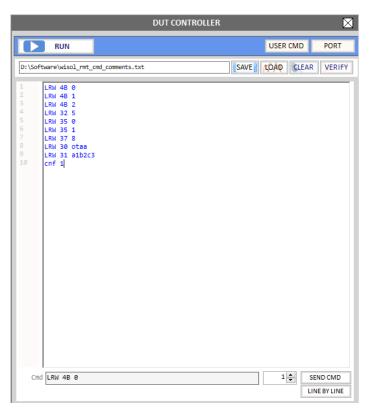


Fig 3.55 Sending commands of DUT Control function

3.5.1.2 Verify Commands

Clicking verify will verify the commands on 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.

3.5.1.3 Transmission Methods

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

3.5.2 RWC5020x Control

| UTILITY | ABOUT | | | | | | |
|---------|------------------|--|--|--|--|--|--|
| DUT | Control | | | | | | |
| RWC | RWC5020x Control | | | | | | |
| Scree | en Capture | | | | | | |

Fig 3.56 RWC5020x control menu

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

3.5.2.1 How to Use

Clicking will start transmitting commands on 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 unit, e.g., SLEEP 1000 makes PC wait for 1000ms.

3.5.2.2 Template

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

| SLEEP 500 R <conf:nst:tx:bw 125<br="">R<read:nst:tx:sf 5f7<br="">R<read:nst:tx:sf 5f7<br="">R<read:nst:tx:sf 587<br="">R<read:nst:tx:cr 4_5<br="">R<read:nst:tx:preamble_size 8<br="">R<read:nst:tx:preamble_size 8<br="">R<read:nst:tx:payload_type pres<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<read:nst:tx:payload SLEEP 500 R<conf:nst:tx:payload 128<br="">SLEEP 500 R<conf:nst:tx:repeat_num 100<br="">R<read:nst:tx:repeat_num 2<br="">SLEEP 500</read:nst:tx:repeat_num></conf:nst:tx:repeat_num></conf:nst:tx:payload></read:nst:tx:payload </read:nst:tx:payload></read:nst:tx:payload_size></read:nst:tx:payload_size></read:nst:tx:payload_size></read:nst:tx:payload_type></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:cr></read:nst:tx:sf></read:nst:tx:sf></read:nst:tx:sf></conf:nst:tx:bw> | | Non-signaling LoRa | |
|--|--|--------------------------|--|
| Performance Test Setup Non-Signaling LoRa R <conf:nst:tx:mode lora<br="">R<read:nst:tx:interval 0.2<br="">R<read:nst:tx:interval 0.2<br="">R<read:nst:tx:interval 9.2<br="">R<read:nst:tx:interval 9<br="">R<conf:nst:tx:bw 125<br="">R<read:nst:tx:bw 125<br="">R<read:nst:tx:bw 2<br="">SLEEP 500 R<conf:nst:tx:ff sf7<br="">R<read:nst:tx:ff sf7<br="">R<read:nst:tx:framble_size 8<br="">R<read:nst:tx:payload_type prbs<br="">R<read:nst:tx:payload_type prbs<br="">R<read:nst:tx:payload_size 16<br="">R<rconf:nst:tx:payload_size 16<br="">R<read:nst:tx:rayload_size 16<br="">R<read:nst:tx:rayload 0x123456789abcdef123456789abcdef<br="">R<read:nst:tx:rayload SLEEP 500 R<com::nst:tx:repeat_num 100<br="">R<read:nst:tx:repeat_num 100<br="">R<read:nst:rx:repeat_num 100<br="">R<read:nst:rx:rn R<read:nst:rx:rn< td=""><td></td><td>[Load Control Template]</td><td></td></read:nst:rx:rn<></read:nst:rx:rn </read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:rx:repeat_num></read:nst:tx:repeat_num></com::nst:tx:repeat_num></read:nst:tx:rayload </read:nst:tx:rayload></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></read:nst:tx:rayload_size></rconf:nst:tx:payload_size></read:nst:tx:payload_size></read:nst:tx:payload_type></read:nst:tx:payload_type></read:nst:tx:framble_size></read:nst:tx:ff></conf:nst:tx:ff></read:nst:tx:bw></read:nst:tx:bw></conf:nst:tx:bw></read:nst:tx:interval></read:nst:tx:interval></read:nst:tx:interval></read:nst:tx:interval></conf:nst:tx:mode> | | [Load Control Template] | |
| R <conf:nst:tx:ndde lora<br="">R<read:nst:tx:ndde lora<br="">R<read:nst:tx:interval 0.2<br="">R<read:nst:tx:interval 0.2<br="">R<read:nst:tx:interval? SLEEP 500 R<conf:nst:tx:bw? SLEEP 500 R<conf:nst:tx:sf sf7<br="">R<read:nst:tx:freamble_size 8<br="">R<read:nst:tx:freamble_size 8<br="">R<read:nst:tx:preamble_size 8<br="">R<read:nst:tx:payload_type pres<br="">R<read:nst:tx:payload_type pres<br="">R<read:nst:tx:payload_size 16<br="">R<rconf:nst:tx:payload_size 16<br="">R<rconf:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 9<br="">R<conf:nst:tx:payload_size 9<br="">R<conf:nst:tx:payload_size 9<br="">R<conf:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<read:nst:tx:repeat_num 100<br="">R<read:nst:tx:repeat_num 100<br="">R<r< td=""><td></td><td></td><td></td></r<></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></conf:nst:tx:payload></conf:nst:tx:payload_size></conf:nst:tx:payload_size></read:nst:tx:payload_size></rconf:nst:tx:payload_size></rconf:nst:tx:payload_size></read:nst:tx:payload_size></read:nst:tx:payload_type></read:nst:tx:payload_type></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:preamble_size></read:nst:tx:freamble_size></read:nst:tx:freamble_size></conf:nst:tx:sf></conf:nst:tx:bw? </read:nst:tx:interval? </read:nst:tx:interval></read:nst:tx:interval></read:nst:tx:ndde></conf:nst:tx:ndde> | | | |
| R <read:nst:tx:mode? SLEEP 500 R<conf:nst:tx:interval 0.2<br="">R<read:nst:tx:interval? SLEEP 500 R<conf:nst:tx:bw 125<br="">R<read:nst:tx:bw? SLEEP 500 R<conf:nst:tx:sf? SLEEP 500 R<conf:nst:tx:framble_size 8<br="">R<read:nst:tx:preamble_size 8<br="">R<read:nst:tx:preamble_size 8<br="">R<read:nst:tx:preamble_size? SLEEP 500 R<conf:nst:tx:pramble_size? SLEEP 500 R<conf:nst:tx:payload_type prbs<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size? SLEEP 500 R<conf:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size? SLEEP 500 R<conf:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<read:nst:tx:payload SLEEP 500 R<conf:nst:tx:repeat_num 100<br="">R<read:nst:tx:repeat_num? SLEEP 500</read:nst:tx:repeat_num? </conf:nst:tx:repeat_num></read:nst:tx:payload </conf:nst:tx:payload></read:nst:tx:payload_size? </read:nst:tx:payload_size></conf:nst:tx:payload_size></read:nst:tx:payload_size? </read:nst:tx:payload_size></read:nst:tx:payload_size></read:nst:tx:payload_size></conf:nst:tx:payload_type></conf:nst:tx:pramble_size? </read:nst:tx:preamble_size? </read:nst:tx:preamble_size></read:nst:tx:preamble_size></conf:nst:tx:framble_size></conf:nst:tx:sf? </read:nst:tx:bw? </conf:nst:tx:bw></read:nst:tx:interval? </conf:nst:tx:interval></read:nst:tx:mode? | | Non-signaling LoRa | |
| R <read:nst:tx:mode? SLEEP 500 R<conf:nst:tx:interval 0.2<br="">R<read:nst:tx:interval? SLEEP 500 R<conf:nst:tx:bw 125<br="">R<read:nst:tx:bw? SLEEP 500 R<conf:nst:tx:sf? SLEEP 500 R<conf:nst:tx:framble_size 8<br="">R<read:nst:tx:preamble_size 8<br="">R<read:nst:tx:preamble_size 8<br="">R<read:nst:tx:preamble_size? SLEEP 500 R<conf:nst:tx:pramble_size? SLEEP 500 R<conf:nst:tx:payload_type prbs<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size? SLEEP 500 R<conf:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size? SLEEP 500 R<conf:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<read:nst:tx:payload SLEEP 500 R<conf:nst:tx:repeat_num 100<br="">R<read:nst:tx:repeat_num? SLEEP 500</read:nst:tx:repeat_num? </conf:nst:tx:repeat_num></read:nst:tx:payload </conf:nst:tx:payload></read:nst:tx:payload_size? </read:nst:tx:payload_size></conf:nst:tx:payload_size></read:nst:tx:payload_size? </read:nst:tx:payload_size></read:nst:tx:payload_size></read:nst:tx:payload_size></conf:nst:tx:payload_type></conf:nst:tx:pramble_size? </read:nst:tx:preamble_size? </read:nst:tx:preamble_size></read:nst:tx:preamble_size></conf:nst:tx:framble_size></conf:nst:tx:sf? </read:nst:tx:bw? </conf:nst:tx:bw></read:nst:tx:interval? </conf:nst:tx:interval></read:nst:tx:mode? | RZCONE:NST:TX:MODE LORA | | |
| SLEEP 500 RCCONF:NST:TX:INTERVAL 0.2 RCREAD:NST:TX:INTERVAL? SLEEP 500 RCCONF:NST:TX:SF SF7 RCREAD:NST:TX:SF SF7 RCREAD:NST:TX:SF? SLEEP 500 RCCONF:NST:TX:PREAMBLE_SIZE 8 RCREAD:NST:TX:PREAMBLE_SIZE 8 RCCONF:NST:TX:PREAMBLE_SIZE 8 RCCONF:NST:TX:PREAMBLE_SIZE 8 RCCONF:NST:TX:PREAMBLE_SIZE 8 RCCONF:NST:TX:PREAMBLE_SIZE 8 RCCONF:NST:TX:PREAMBLE_SIZE 8 RCCONF:NST:TX:PREAMBLE_SIZE 8 RCCONF:NST:TX:PREAMBLE_SIZE 8 RCCONF:NST:TX:PREAMBLE_SIZE 8 RCCONF:NST:TX:PREAMBLE_SIZE 8 RCCONF:NST:TX:PAYLOAD_TYPE PRBS RCCONF:NST:TX:PAYLOAD_TYPE PRBS RCCONF:NST:TX:PAYLOAD_SIZE 16 RCCONF:NST:TX:PAYLOAD_SIZE 16 RCCADF:NST:TX:PAYLOAD_SIZE? SLEEP 500 RCCONF:NST:TX:PAYLOAD 0x123456789ABCDEF123456789ABCDEF RCCADF:NST:TX:PAYLOAD SLEEP 500 RCCONF:NST:TX:REPEAT_NUM 100 RCCADF:NST:TX:REPEAT_NUM? SLEEP 500 | | | |
| <pre>R<conf:nst:tx:interval 0.2="" 0x123456789abcdef123456789abcdef="" 100="" 16="" 500="" 8="" k<read:nst:tx:interval="" pres="" r<conf:nst:tx:bw?="" r<conf:nst:tx:freamble_size="" r<rcadc:nst:run="" r<rcadc:nst:tx:run="" r<rcadn:nst:tx:repeat_num="" r<read:nst:tx:freamble_size="" r<read:nst:tx:payload="" r<read:nst:tx:payload_size="" r<read:nst:tx:payload_type="" r<read:nst:tx:preamble_size="" r<read:nst:tx:repeat_num="" r<read:nst:tx:repeat_num?="" sconf:nst:tx:freamble_size="" sleep="" sleep<="" td=""><td></td><td></td><td></td></conf:nst:tx:interval></pre> | | | |
| <pre>R<read:nst:tx:interval? SLEEP 500 R<rconf:nst:tx:bw 125<br="">R<read:nst:tx:bw? SLEEP 500 R<conf:nst:tx:sf sf7<br="">R<read:nst:tx:sf? SLEEP 500 R<conf:nst:tx:cr2 SLEEP 500 R<conf:nst:tx:preamble_size 8<br="">R<read:nst:tx:preamble_size 8<br="">R<read:nst:tx:preamble_size? SLEEP 500 R<conf:nst:tx:payload_type prbs<br="">R<read:nst:tx:payload_type prbs<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size? SLEEP 500 R<conf:nst:tx:payload_ox122456789abcdef123456789abcdef R<read:nst:tx:payload_size? SLEEP 500 R<conf:nst:tx:payload_ox123456789abcdef123456789abcdef R<read:nst:tx:repeat_num 100<br="">R<conf:nst:tx:repeat_num? SLEEP 500 R<read:nst:tx:repeat_num?< pre=""></read:nst:tx:repeat_num?<></conf:nst:tx:repeat_num? </read:nst:tx:repeat_num></conf:nst:tx:payload_ox123456789abcdef123456789abcdef </read:nst:tx:payload_size? </conf:nst:tx:payload_ox122456789abcdef123456789abcdef </read:nst:tx:payload_size? </read:nst:tx:payload_size></read:nst:tx:payload_size></read:nst:tx:payload_type></conf:nst:tx:payload_type></read:nst:tx:preamble_size? </read:nst:tx:preamble_size></conf:nst:tx:preamble_size></conf:nst:tx:cr2 </read:nst:tx:sf? </conf:nst:tx:sf></read:nst:tx:bw? </rconf:nst:tx:bw></read:nst:tx:interval? </pre> | | | |
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| R <conf:nst:tx:bw 125<br="">R<read:nst:tx:bw 125<br="">R<conf:nst:tx:sf sf7<br="">R<conf:nst:tx:sf? SLEEP 500 R<conf:nst:tx:freamble_size SLEEP 500 R<conf:nst:tx:preamble_size 8<br="">R<read:nst:tx:preamble_size 8<br="">R<read:nst:tx:preamble_size 8<br="">R<read:nst:tx:payload_type prbs<br="">R<read:nst:tx:payload_type prbs<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<read:nst:tx:payload SLEEP 500 R<conf:nst:tx:repeat_num 100<br="">R<read:nst:tx:repeat_num 200<br="">R<read:nst:tx:repeat_num 200<br="">R<</read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:repeat_num></conf:nst:tx:repeat_num></read:nst:tx:payload </read:nst:tx:payload></read:nst:tx:payload_size></read:nst:tx:payload_size></read:nst:tx:payload_size></read:nst:tx:payload_size></read:nst:tx:payload_size></read:nst:tx:payload_size></read:nst:tx:payload_size></read:nst:tx:payload_size></read:nst:tx:payload_size></read:nst:tx:payload_type></read:nst:tx:payload_type></read:nst:tx:preamble_size></read:nst:tx:preamble_size></conf:nst:tx:preamble_size></conf:nst:tx:freamble_size </conf:nst:tx:sf? </conf:nst:tx:sf></read:nst:tx:bw></conf:nst:tx:bw> | SLEEP 500 | | |
| R <read:nst:tx:bw? SLEEP 500 R<conf:nst:tx:sf sf7<br="">R<read:nst:tx:sf? SLEEP 500 R<conf:nst:tx:cr 4_5<br="">R<read:nst:tx:cr? SLEEP 500 R<conf:nst:tx:preamble_size 8<br="">R<read:nst:tx:preamble_size? SLEEP 500 R<conf:nst:tx:payload_type prbs<br="">R<read:nst:tx:payload_type? SLEEP 500 R<conf:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size? SLEEP 500 R<conf:nst:tx:payload_size? SLEEP 500 R<conf:nst:tx:payload_size? SLEEP 500 R<conf:nst:tx:payload_size? SLEEP 500 R<conf:nst:tx:repeat_num 100<br="">R<read:nst:tx:repeat_num? SLEEP 500 R<exec:nst:tx:rews< td=""><td>R<conf:nst:tx:bw 125<="" td=""><td></td><td></td></conf:nst:tx:bw></td></exec:nst:tx:rews<></read:nst:tx:repeat_num? </conf:nst:tx:repeat_num></conf:nst:tx:payload_size? </conf:nst:tx:payload_size? </conf:nst:tx:payload_size? </read:nst:tx:payload_size? </read:nst:tx:payload_size></conf:nst:tx:payload_size></read:nst:tx:payload_type? </conf:nst:tx:payload_type></read:nst:tx:preamble_size? </conf:nst:tx:preamble_size></read:nst:tx:cr? </conf:nst:tx:cr></read:nst:tx:sf? </conf:nst:tx:sf></read:nst:tx:bw? | R <conf:nst:tx:bw 125<="" td=""><td></td><td></td></conf:nst:tx:bw> | | |
| SLEEP 500 RCCONF:NST:TX:SF SF7 RREAD:NST:TX:SF? SLEEP 500 RCCONF:NST:TX:CR 4_5 RCCONF:NST:TX:PREAMBLE_SIZE 8 RCEAD:NST:TX:PREAMBLE_SIZE 8 RCCONF:NST:TX:PREAMBLE_SIZE? SLEEP 500 RCCONF:NST:TX:PAYLOAD_TYPE PRBS RCEAD:NST:TX:PAYLOAD_TYPE PRBS RCCONF:NST:TX:PAYLOAD_SIZE 16 RCCONF:NST:TX:PAYLOAD_SIZE 16 RCCADF:NST:TX:PAYLOAD_SIZE? SLEEP 500 RCCONF:NST:TX:PAYLOAD_SIZE? SLEEP 500 RCCONF:NST:TX:PAYLOAD 0x123456789ABCDEF123456789ABCDEF RCEAD:NST:TX:PAYLOAD_SIZE? SLEEP 500 RCCONF:NST:TX:REPEAT_NUM 100 RCEAD:NST:TX:REPEAT_NUM? SLEEP 500 RCEAD:ST:TX:REPEAT_NUM? SLEEP 500 | R <read:nst:tx:bw?< td=""><td></td><td></td></read:nst:tx:bw?<> | | |
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| SLEEP 500 RCCONF:NST:TX:CR 4_5 RCREAD:NST:TX:CR SLEEP 500 RCCONF:NST:TX:PREAMBLE_SIZE 8 RCREAD:NST:TX:PREAMBLE_SIZE? SLEEP 500 RCCONF:NST:TX:PAYLOAD_TYPE PRBS RCREAD:NST:TX:PAYLOAD_TYPE ? SLEEP 500 RCCONF:NST:TX:PAYLOAD_SIZE 16 RCREAD:NST:TX:PAYLOAD_SIZE 16 RCREAD:NST:TX:PAYLOAD_SIZE 16 RCREAD:NST:TX:PAYLOAD_SIZE? SLEEP 500 RCCONF:NST:TX:PAYLOAD 0x123456789ABCDEF123456789ABCDEF RCREAD:NST:TX:PAYLOAD 0x123456789ABCDEF123456789ABCDEF RCREAD:NST:TX:PAYLOAD 0x123456789ABCDEF123456789ABCDEF RCREAD:NST:TX:REPEAT_NUM 100 RCCONF:NST:TX:REPEAT_NUM 100 RCREAD:NST:TX:REPEAT_NUM? SLEEP 500 RCCNE:NST:TX:REPEAT_NUM? | R <conf:nst:tx:sf_sf7< td=""><td></td><td></td></conf:nst:tx:sf_sf7<> | | |
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| <pre>R<read:nst:tx:cr? SLEEP 500 R<conf:nst:tx:preamble_size 8<br="">R<read:nst:tx:preamble_size? SLEEP 500 R<conf:nst:tx:payload_type prbs<br="">R<read:nst:tx:payload_type prbs<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size? SLEEP 500 R<conf:nst:tx:payload_0x123456789abcdef123456789abcdef R<read:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<read:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<read:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<read:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<read:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<read:nst:tx:repeat_num 100<br="">R<rcadn:nst:tx:repeat_num 100<br="">R<read:nst:tx:repeat_num? SLEEP 500 R<r<exec:nst:tx:run SLEEP 500</r<exec:nst:tx:run </read:nst:tx:repeat_num? </rcadn:nst:tx:repeat_num></read:nst:tx:repeat_num></read:nst:tx:payload></read:nst:tx:payload></read:nst:tx:payload></read:nst:tx:payload></read:nst:tx:payload></conf:nst:tx:payload_0x123456789abcdef123456789abcdef </read:nst:tx:payload_size? </read:nst:tx:payload_size></read:nst:tx:payload_size></read:nst:tx:payload_type></conf:nst:tx:payload_type></read:nst:tx:preamble_size? </conf:nst:tx:preamble_size></read:nst:tx:cr? </pre> | SLEEP 500 | | |
| SLEEP 500 RxCONF:NST:TX:PREAMBLE_SIZE 8 RxCAD:NST:TX:PAYLOAD_TYPE PRBS RxCAD:NST:TX:PAYLOAD_TYPE PRBS RxCAD:NST:TX:PAYLOAD_SIZE 16 RxCAD:NST:TX:PAYLOAD_SIZE 16 RxCAD:NST:TX:PAYLOAD_0X123456789ABCDEF123456789ABCDEF RxCEAD:NST:TX:PAYLOAD_0X123456789ABCDEF123456789ABCDEF RxCEAD:NST:TX:PAYLOAD SLEEP 500 RxCCONF:NST:TX:REPEAT_NUM 100 RxCEAD:NST:TX:REPEAT_NUM | R <conf:nst:tx:cr 4_5<="" td=""><td></td><td></td></conf:nst:tx:cr> | | |
| R <conf:nst:tx:preamble_size 8<br="">R<read:nst:tx:preamble_size 8<br="">R<read:nst:tx:pruload_type prbs<br="">R<read:nst:tx:payload_type? SLEEP 500 R<conf:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size? SLEEP 500 R<conf:nst:tx:payload @x123456789abcdef123456789abcdef<br="">R<conf:nst:tx:payload @x123456789abcdef123456789abcdef<br="">R<conf:nst:nst:tx:payload @x123456789abcdef123456789abcdef<br="">R<conf:nst:nst:tx:payload @x1234577777777777<="" td=""><td>R<read:nst:tx:cr?< td=""><td></td><td></td></read:nst:tx:cr?<></td></conf:nst:nst:tx:payload></conf:nst:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></read:nst:tx:payload_size? </conf:nst:tx:payload_size></read:nst:tx:payload_type? </read:nst:tx:pruload_type></read:nst:tx:preamble_size></conf:nst:tx:preamble_size> | R <read:nst:tx:cr?< td=""><td></td><td></td></read:nst:tx:cr?<> | | |
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| SLEEP 500 R <conf:nst:tx:payload_type prbs<br="">R<read:nst:tx:payload_type prbs<br="">R<conf:nst:tx:payload_size 16<br="">R<conf:nst:tx:payload_size 16<br="">R<conf:nst:tx:payload_0x123456789abcdef123456789abcdef R<conf:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<conf:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<conf:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<conf:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<conf:nst:tx:repeat_num 100<br="">R<cead:nst:tx:repeat_num 100<br="">R<execon:st:tx:repeat_num 100<br="">R<execonst:tx:repeat_num 10<="" td=""><td>R<conf:nst:tx:preamble_size 8<="" td=""><td></td><td></td></conf:nst:tx:preamble_size></td></execonst:tx:repeat_num></execonst:tx:repeat_num></execonst:tx:repeat_num></execonst:tx:repeat_num></execonst:tx:repeat_num></execonst:tx:repeat_num></execonst:tx:repeat_num></execonst:tx:repeat_num></execonst:tx:repeat_num></execonst:tx:repeat_num></execonst:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></execon:st:tx:repeat_num></cead:nst:tx:repeat_num></conf:nst:tx:repeat_num></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload_0x123456789abcdef123456789abcdef </conf:nst:tx:payload_size></conf:nst:tx:payload_size></read:nst:tx:payload_type></conf:nst:tx:payload_type> | R <conf:nst:tx:preamble_size 8<="" td=""><td></td><td></td></conf:nst:tx:preamble_size> | | |
| R <conf:nst:tx:payload_type prbs<br="">R<read:nst:tx:payload_type p<br="">SLEEP 500 R<conf:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size? SLEEP 500 R<conf:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<read:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<read:nst:tx:payload? SLEEP 500 R<conf:nst:tx:repeat_num 100<br="">R<read:nst:tx:repeat_num? SLEEP 500 R<exec:nst:tx:run SLEEP 500</exec:nst:tx:run </read:nst:tx:repeat_num? </conf:nst:tx:repeat_num></read:nst:tx:payload? </read:nst:tx:payload></conf:nst:tx:payload></read:nst:tx:payload_size? </conf:nst:tx:payload_size></read:nst:tx:payload_type></conf:nst:tx:payload_type> | R <read:nst:tx:preamble_size?< td=""><td></td><td></td></read:nst:tx:preamble_size?<> | | |
| R <read:nst:tx:payload_type? SLEEP 500 R<conf:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size? SLEEP 500 R<conf:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<read:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<read:nst:tx:payload? SLEEP 500 R<conf:nst:tx:repeat_num 100<br="">R<read:nst:tx:repeat_num? SLEEP 500 R<exec:nst:tx:run SLEEP 500</exec:nst:tx:run </read:nst:tx:repeat_num? </conf:nst:tx:repeat_num></read:nst:tx:payload? </read:nst:tx:payload></conf:nst:tx:payload></read:nst:tx:payload_size? </conf:nst:tx:payload_size></read:nst:tx:payload_type? | SLEEP 500 | | |
| SLEEP 500 R <conf:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size 16<br="">R<conf:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<conf:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<conf:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<conf:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<conf:nst:tx:repeat_num 100<br="">R<conf:nst:tx:repeat_num 100<br="">R<exed:nst:tx:repeat_num 100<br="">R<exec:nst:tx:repeat_num 100<br="">R<exec:nst:tx:rum 100<br="">SLEEP 500</exec:nst:tx:rum></exec:nst:tx:repeat_num></exed:nst:tx:repeat_num></conf:nst:tx:repeat_num></conf:nst:tx:repeat_num></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></conf:nst:tx:payload></read:nst:tx:payload_size></conf:nst:tx:payload_size> | R <conf:nst:tx:payload_type prb<="" td=""><td>S</td><td></td></conf:nst:tx:payload_type> | S | |
| R <conf:nst:tx:payload_size 16<br="">R<read:nst:tx:payload_size? SLEEP 500 R<conf:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<read:nst:tx:payload? SLEEP 500 R<conf:nst:tx:repeat_num 100<br="">R<read:nst:tx:repeat_num? SLEEP 500 R<exec:nst:tx:run SLEEP 500</exec:nst:tx:run </read:nst:tx:repeat_num? </conf:nst:tx:repeat_num></read:nst:tx:payload? </conf:nst:tx:payload></read:nst:tx:payload_size? </conf:nst:tx:payload_size> | R <read:nst:tx:payload_type?< td=""><td></td><td></td></read:nst:tx:payload_type?<> | | |
| R <read:nst:tx:payload_size? SLEEP 500 R<conf:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<read:nst:tx:payload? SLEEP 500 R<read:nst:tx:repeat_num 100<br="">R<read:nst:tx:repeat_num? SLEEP 500 R<exec:nst:tx:run SLEEP 15000</exec:nst:tx:run </read:nst:tx:repeat_num? </read:nst:tx:repeat_num></read:nst:tx:payload? </conf:nst:tx:payload></read:nst:tx:payload_size? | SLEEP 500 | | |
| SLEEP 500 R <conf:nst:tx:payload 0x123456789abcdef123456789abcdef<br="">R<cread:nst:tx:payload? SLEEP 500 R<conf:nst:tx:repeat_num 100<br="">R<read:nst:tx:repeat_num? SLEEP 500 R<exec:nst:tx:run SLEEP 15000</exec:nst:tx:run </read:nst:tx:repeat_num? </conf:nst:tx:repeat_num></cread:nst:tx:payload? </conf:nst:tx:payload> | | | |
| R-CONF:NST:TX:PAYLOAD 0X123456789ABCDEF123456789ABCDEF R <read:nst:tx:payload SLEEP 500 R<conf:nst:tx:repeat_num 100<br="">R<read:nst:tx:repeat_num? SLEEP 500 R<exec:nst:tx:run SLEEP 15000</exec:nst:tx:run </read:nst:tx:repeat_num? </conf:nst:tx:repeat_num></read:nst:tx:payload | R <read:nst:tx:payload_size?< td=""><td></td><td></td></read:nst:tx:payload_size?<> | | |
| R <read:nst:tx:payload? SLEEP 500 R<comf:nst:tx:repeat_num 100<br="">R<read:nst:tx:repeat_num? SLEEP 500 R<exec:nst:tx:run SLEEP 15000</exec:nst:tx:run </read:nst:tx:repeat_num? </comf:nst:tx:repeat_num></read:nst:tx:payload? | SLEEP 500 | | |
| SLEEP 500 R <conf:nst:tx:repeat_num 100<br="">R<read:nst:tx:repeat_num? SLEEP 500 R<exec:nst:tx:run SLEEP 15000</exec:nst:tx:run </read:nst:tx:repeat_num? </conf:nst:tx:repeat_num> | | 789ABCDEF123456789ABCDEF | |
| R <conf:nst:tx:repeat_num 100<br="">R<read:nst:tx:repeat_num? SLEEP 500 R<rexec:nst:tx:run SLEEP 15000</rexec:nst:tx:run </read:nst:tx:repeat_num? </conf:nst:tx:repeat_num> | R <read:nst:tx:payload?< td=""><td></td><td></td></read:nst:tx:payload?<> | | |
| R <read:nst:tx:repeat_num? SLEEP 500 R<exec:nst:tx:run SLEEP 15000</exec:nst:tx:run </read:nst:tx:repeat_num? | SLEEP 500 | | |
| SLEEP 500 R <exec:nst:tx:run SLEEP 1500</exec:nst:tx:run | R <conf:nst:tx:repeat_num 100<="" td=""><td></td><td></td></conf:nst:tx:repeat_num> | | |
| R <exec:nst:tx:run SLEEP 15000</exec:nst:tx:run | | | |
| SLEEP 15000 | | | |
| | R <exec:nst:tx:run< td=""><td></td><td></td></exec:nst:tx:run<> | | |
| R <exec:nst:tx:stop< td=""><td></td><td></td><td></td></exec:nst:tx:stop<> | | | |
| | R <exec:nst:tx:stop< td=""><td></td><td></td></exec:nst:tx:stop<> | | |

Fig 3.57 Sending commands of RWC5020x Control window

3.5.2.3 Sending commands

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

3.5.3 Screen Capture

| UTILITY | ABOUT | | | | |
|------------------|---------|--|--|--|--|
| DUT | Control | | | | |
| RWC5020x Control | | | | | |
| Screen Capture | | | | | |

Fig 3.58 Screen capture menu

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

| | | | | | | | | | SCI | REI | EN CA | PTURE | | 2 |
|-----|-----|-----|------|-------|-------------------|--------|-------|-----|-------|------|---------|-----------------|-------------------|----------|
| K | 0) | | GET | SCR | EEN | | | | | | | Capture | RWC2020 | |
| FIL | E N | AM | E | .\DEN | /IO\lora | _demo | _v121 | 0\d | emo\ | der | no_20 | 20-03-10_18_46_ | 47.bmp | |
| GΑ | TE\ | NA | 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 | | Power |
| U | 2 | - | | | -30.0 | REF | | 0 | | | | Join-request | Power | Time |
| U | 1 | 0 | 12 | 125 | -30.0 | REF | | 0 | | • | 1482 | Join-request | Measure | |
| υ | 0 | 0 | 12 | 125 | -30.0 | REF | | 0 | | · | 1482 | Join-request | <u>CH</u> TIME | Power |
| U | 1 | | | 125 | | REF | | 0 | •••• | • | | Join-request | | Chann |
| U | 2 | 0 | 12 | 125 | -30.0 | REF | | 0 | | · | | Join-request | Receiver | |
| U | 0 | 0 | 12 | 125 | -30.0 | REF | | 0 | | • | 1482 | Join-request | Sensitivity | Meas |
| U | 2 | 0 | 12 | 125 | -30.0 | REF | | 0 | | · | 1482 | Join-request | | Sens |
| U | 1 | 0 | 12 | 125 | -30.0 | REF | | 0 | | - | 1482 | Join-request | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| Fn1 | C | LEA | R | | ^{fn2} MA | C_SEND | | 1 | Activ | atin | 2 | | LINK: Running | |
| _ | _ | - | _ | | _ | _ | _ | _ | _ | - | | | | |
| CA | PTU | REI | D IN | IAGE | LIST | 24 fil | es | | | | | | | |
| dem | 0 2 | 020 | 9-0 | 1-31 | 13 31 | 42.b | np | | | | | | | |
| | _ | | | | 13_31 | _ | | | | | | | | |
| | | | | | _13_32 | | | | | | | | | |
| | | | | | _13_33 13_29 | | | | | | | | | |
| | | | | | 13 31 | | | | | | | | | |
| dem | o_2 | 02(| 9-0 | 2-07 | 13_31 | _21.b | mp | | | | | | | |
| | | | | | 13_31 | | | | | | | | | |
| | _ | | | | _13_32 14 05 | - | | | | | | | | |
| | _ | | | | 14_05 | _ | | | | | | | | |
| dem | o_2 | 02(| 9-0 | 3-10 | 09_50 | _40.br | mp | | | | | | | |
| - | 0 2 | 020 | a_0 | 3-10 | 18_46 | 47 h | nn | | | | | | | |

Fig 3.59 Capturing the screen image of RWC5020A/B



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

4.1.1 Creating Report

Clicking will open the save file window. You can change file name and save the result document. The result file will be saved as a word document. will be enabled on Certification and Performance tab.

| → · · ↑ _ « Local Disk (C:) | > RWC5020A > ~ ℃ | Search RWC5020A | م |
|-------------------------------------|-------------------------------|------------------------|------------|
| Organize 🔻 New folder | | :== :== | - ? |
| \$SysReset ^ Name | ^ | Date modified | Туре |
| Brother AppN | lote | 3/21/2018 AM 11:10 | File folde |
| Intel | lemo | 3/22/2018 AM 11:14 | File folde |
| Keil_v5 manu | ıal | 3/21/2018 AM 11:10 | File folde |
| MSOCache lora_o | lemo.prj | 3/22/2018 PM 2:06 | PRJ File |
| OneDriveTemp 🔤 per.b | mp | 3/22/2018 PM 4:25 | BMP File |
| PerfLogs | omp | 3/22/2018 PM 4:25 | BMP File |
| Program Files | 1 | 3/22/2018 PM 4:25 | BMP File |
| 🔬 rwc50 |)20.ini | 3/22/2018 PM 3:28 | Configura |
| IN INVO | 5020A PC APP Release Note.pdf | 3/20/2018 PM 2:49 | Foxit Rea |
| | 5020A_App.exe | 3/22/2018 AM 11:17 | Applicatio |
| RWC5020A ✓ < | | | > |
| File <u>n</u> ame: C:\RWC5020A\lora | _demo\DUT_00\DUT_00_ED_PERF | ORMANCE_TEST_RESULT.do | oc 🔹 |
| Save as type: | | | ` |

Fig 4.1 Creation of Test Report File

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

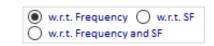
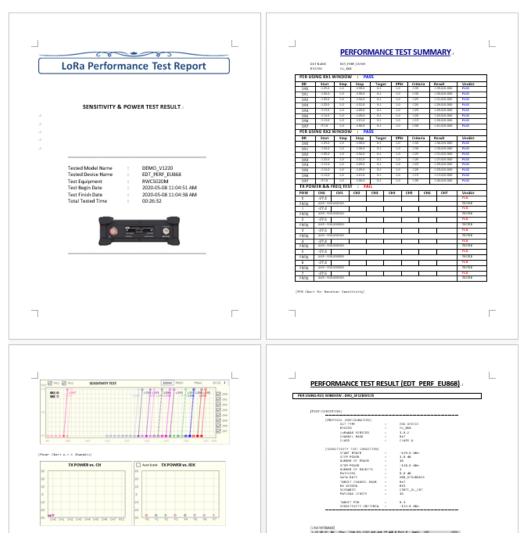


Fig 4.2 Report option menu for NON-REGRESS test

- 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
- 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



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.



Fig 4.4 The List of test report files



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