

RWC5020A Application Program

Operating Manual

Version 1.13
(RWC5020A SW Version 1.13)

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I. Getting Started

This chapter explains how to download and start RWC5020A application program.

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

1.1 Download and Installation

RWC5020A application program is provided by email or download link and the downloaded file can be unzipped into users' directory. The following figures show an example.

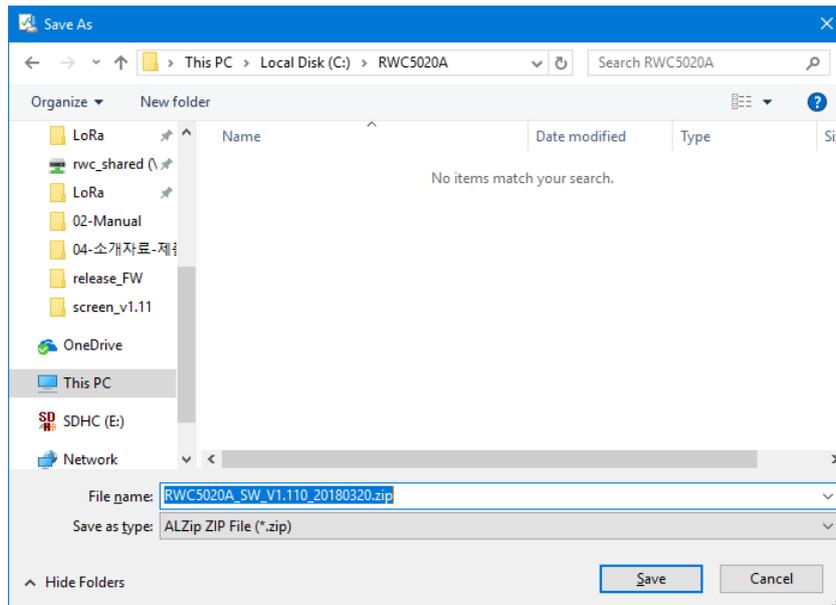


Fig 1.1 Downloading Zip file

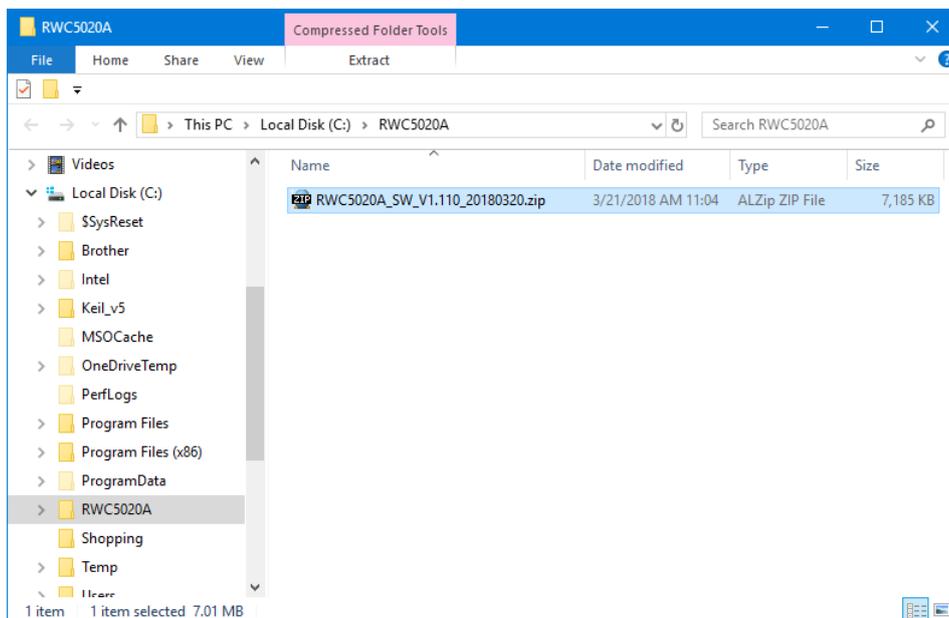


Fig 1.2 Downloaded into User's Directory

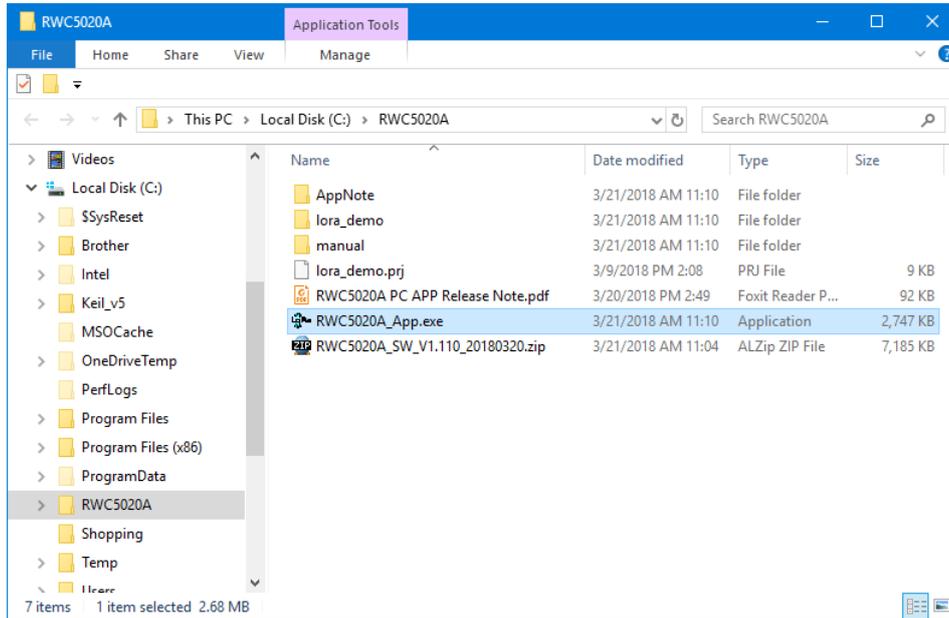


Fig 1.3 Unzipped Files

After unzipped, the following files or directories are shown:

- the executable file 'RWC5020A_App.exe',
- the Release Note for the current version release,
- the example project 'lora_demo.prj',
- the directory including manual documents,
- and the directory including application notes.

Note: Operating system for User's PC is recommended to be used Windows 7 or later.

1.2 Start the Application

Execute the application 'RWC5020A_App.exe'. Most likely the following popup window will be shown at the first execution if Ethernet configuration between the Tester and user's PC is not done correctly. If Ethernet configuration done, it will not happen any longer.

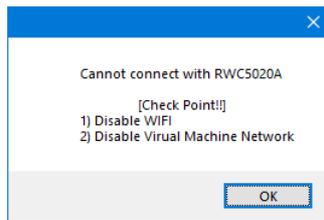


Fig 1.4 Popup Message for Connection Alert

After clicking OK, the application will be opened as the following figure.

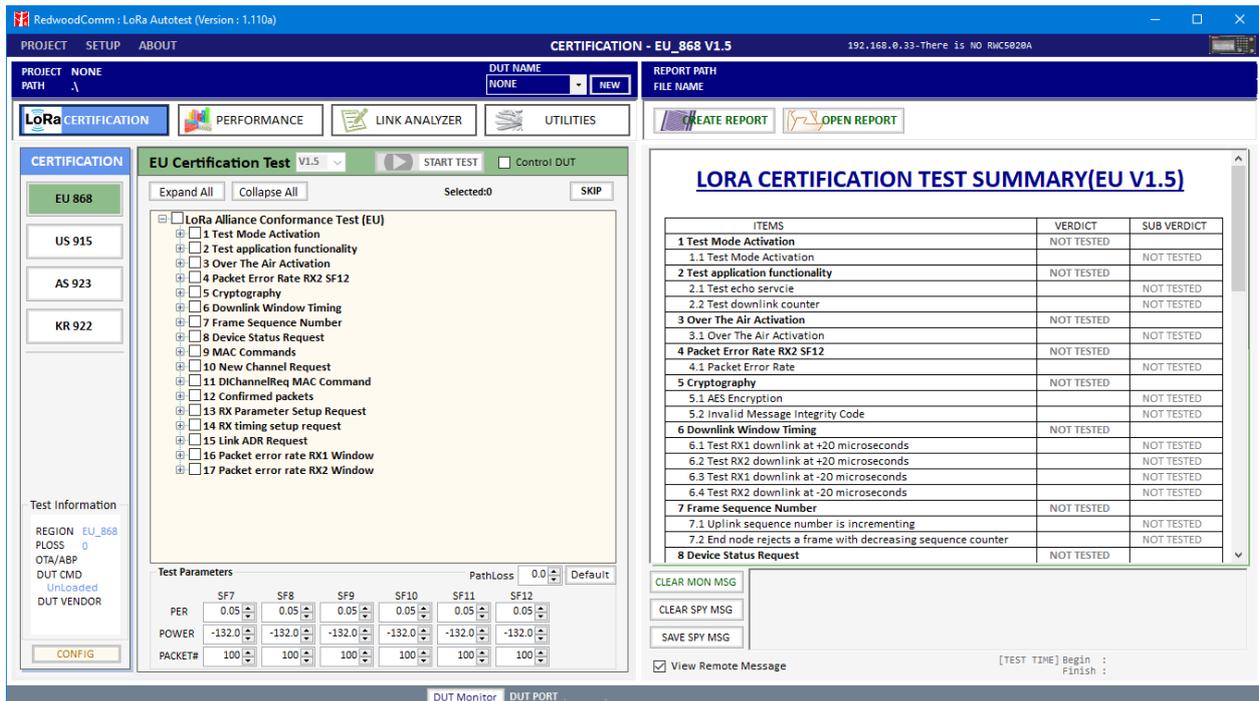


Fig 1.5 Initial Screen of the Application

1.3 GUI Structure

RWC5020A application program consists of three categories: Project Menus, Test Functions, and Report Functions. The next chapters will include the detail explanation about each category respectively. In the following figure, blue color boxed functions are project menu functions, and red color boxed functions are test related ones, and green color boxed functions are report related ones.

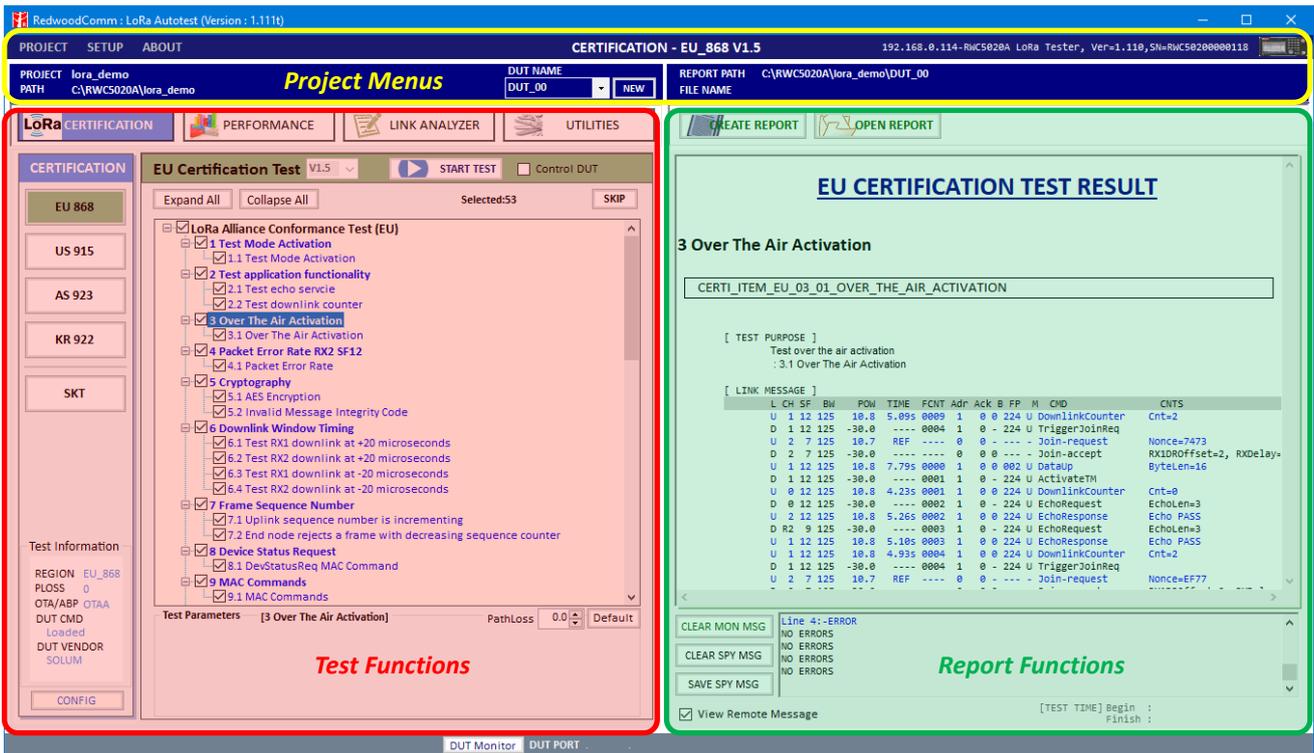


Fig 1.6 3 Categories of the Application

II. Project Menus

This chapter explains how to handle a project, DUT, test condition and test environment. With Top Menus, user can create or open a project file, or delete currently opened project, and manage DUT environment file. User can also access to User Manual file and optional information.

- 2.1 Project Menu
- 2.2 Setup Menu
- 2.3 About Menu

2.1 Project Menu

The application has three top menu; [PROJECT], [SETUP], and [ABOUT]. This section shows how to use and configure them before tests.

2.1.1 Project

Before starting use of the application, at least two basic works should be done; one is creating project and the other is creating a DUT. When a new project is created, a 'project_name.ini' file will be generated. When a new DUT is created in the project, a 'DUT_name.ini' file will be generated.

2.1.1.1 New Project

[New Project] creates a new project file. Before test, a project file and a DUT file must be created or opened. Project may have many DUTs

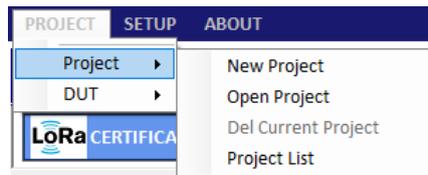


Fig 2.1 Project Menu



Fig 2.2 Example of a new project (DUT empty)

2.1.1.2 Open Project

[Open project] opens an existing project file which the user selects. [Open project] also opens the last tested DUT file automatically when the application starts, if 'Load last project at start' is checked in [SETUP] -> [Utility Environment].

2.1.1.3 Del Current Project

[Del Current Project] deletes currently opened project including all DUT files in project folder. The deleted project cannot be recovered. Be careful to delete a project.

2.1.1.4 Project List

[Project List] shows the list of projects in current directory.

2.1.2 DUT

In this application, DUT means device name to be tested. DUT is a member of a project. You can create many DUTs. If a new DUT is created, a 'DUT_name.ini' file will be generated. It includes information of DUT's test environment. If you want to test a new DUT, you'd better create a new DUT file and test.

2.1.2.1 New DUT

When [New DUT] of DUT Menu or NEW button of  clicked, the 'NEW DUT CREATION' window which helps you create a new DUT will be shown.

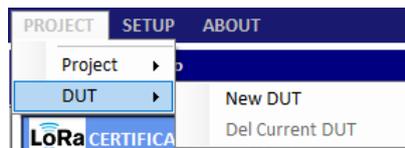


Fig 2.3 DUT Menu

Type a DUT name and click [CREATE] button.

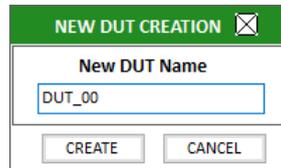


Fig 2.4 Creation of a new DUT

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

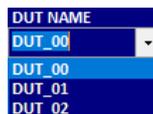


Fig 2.5 List of DUT names

2.1.2.2 DEL Current DUT

[DEL Current DUT] deletes currently opened DUT file. The deleted DUT file cannot be recovered.

2.2 Setup Menu

2.2.1 Connect RWC5020A

RWC5020A Application works under Ethernet connection between user's PC and RWC5020A.

2.2.1.1 Open RWC5020A CONTROL PORT window

Clicking [Connect RWC5020A] of SETUP Menu or clicking  icon shows the 'RWC5020A CONTROL PORT' window which helps you setup RWC5020A's IP.

2.2.1.2 Setup IP

Setup the IP address same as the RWC5020A's connected to the PC and click [CONNECT] button. If PC recognizes a RWC5020A, the [CONNECT] will be changed to [CONNECTED].

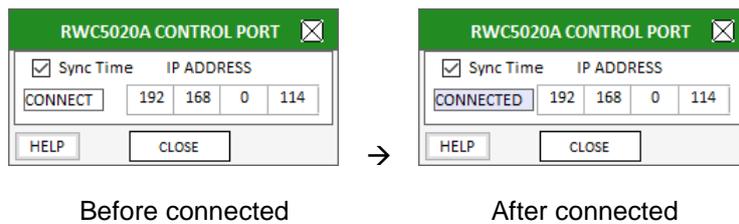


Fig 2.6 IP Setup for connection

2.2.2 Control DUT

Control DUT menu consists of five sub menus : Open Port, Load User Cmds, Show User Cmds, Show DUT Monitor, and Make Cmds Template.

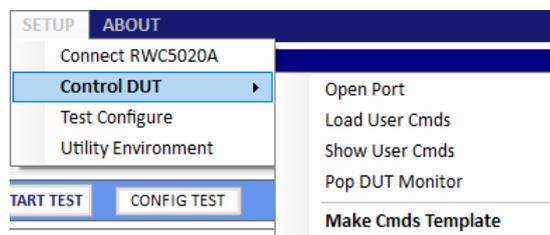


Fig 2.7 Control DUT Menu

2.2.2.1 Open PORT

[Open PORT] shows a 'DUT CONTROL PORT' window to setup and open UART port for DUT control. After configuring its port number and baud rate, click [OPEN PORT] button.

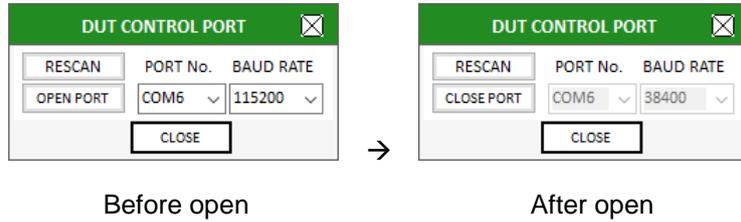


Fig 2.8 DUT Control Port Setup

2.2.2.2 Load User Cmds

[Load User Cmds] pops up a '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.

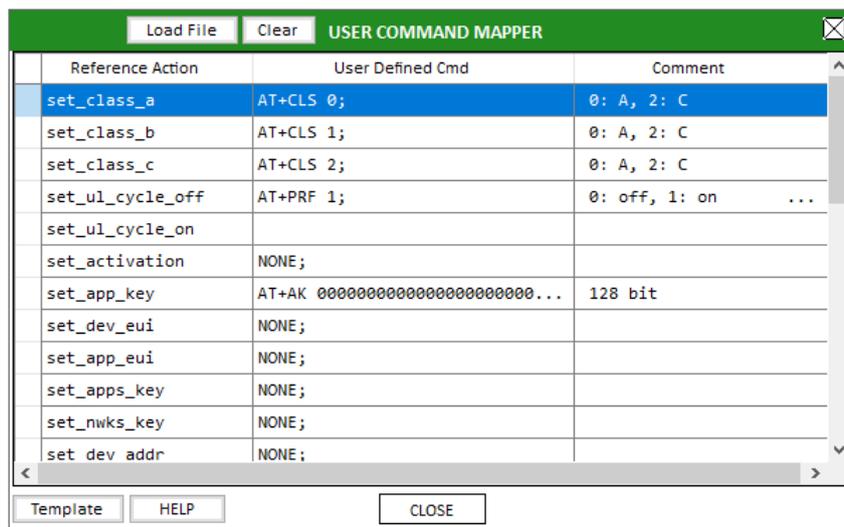
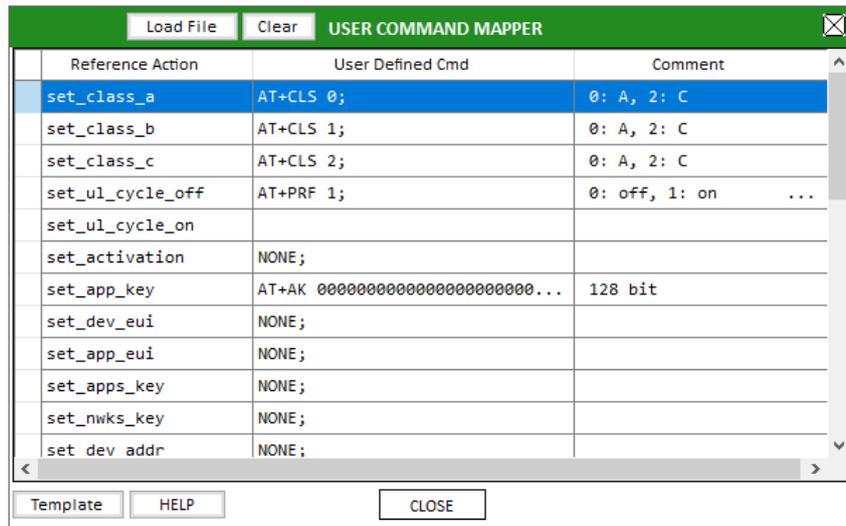


Fig 2.8 Example of Load User Cmds

2.2.2.3 Show User Cmds

[Show User Cmds] pops up the 'COMMAND LIST for DUT CONTROL' window and shows user-defined commands which are loaded currently. To see user's own commands with this window, user has to load a ready-made DUT control file(.txt).



Reference Action	User Defined Cmd	Comment
set_class_a	AT+CLS 0;	0: A, 2: C
set_class_b	AT+CLS 1;	0: A, 2: C
set_class_c	AT+CLS 2;	0: A, 2: C
set_ul_cycle_off	AT+PRF 1;	0: off, 1: on ...
set_ul_cycle_on		
set_activation	NONE;	
set_app_key	AT+AK 000000000000000000000000...	128 bit
set_dev_eui	NONE;	
set_app_eui	NONE;	
set_apps_key	NONE;	
set_nwks_key	NONE;	
set dev addr	NONE;	

Fig 2.9 Example of Show User Cmds

2.2.2.4 Show DUT Monitor

[Show DUT Monitor] shows a popup window which shows the DUT's response. User may send control commands using the popup window.

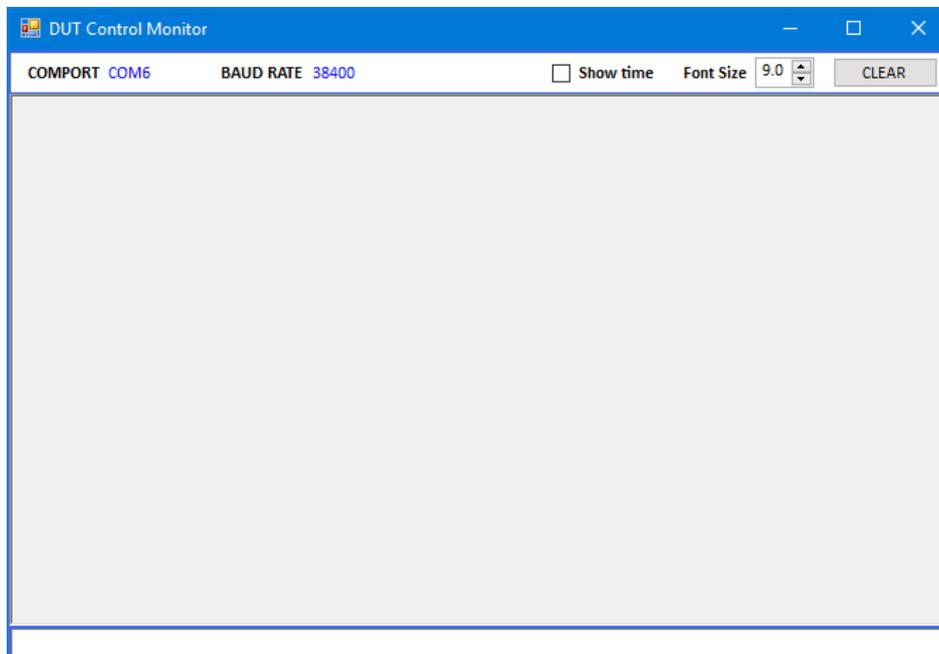


Fig 2.10 DUT Monitor screen

2.2.2.5 Make Cmds Template

[Make Cmds Template] creates a template file function which can help user create user's own control file by showing a template file. User can fill it up and save it as a text file (.txt).



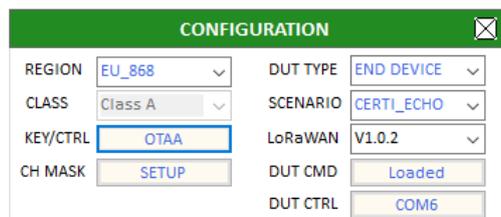
```

[CONFIG]
VENDOR=NONAME
NUM_CMDS=33
BAUDRATE=115200
EOL=rn
SEQ_CMD_INTV=1.5
[CMDS]
set_class_a=NONE;           //insert your command and parameter
set_class_b=NONE;
set_class_c=NONE;
set_ul_cycle_off=NONE;
set_ul_cycle_on=NONE;
set_activation=NONE;
set_app_key=NONE;
set_dev_eui=NONE;
set_app_eui=NONE;
set_apps_key=NONE;
set_nwks_key=NONE;
set_dev_addr=NONE;
reset_device=NONE;
do_pseudo_join=NONE;
set_addr_en=NONE;
set_addr_dis=NONE;
set_dr0=NONE;
set_dr1=NONE;
set_dr2=NONE;
set_dr3=NONE;
set_dr4=NONE;
set_dr5=NONE;
set_rtr_num=NONE;
send_data_cfm=NONE;
send_data_uncfm=NONE;
send_link_check_req=NONE;
send_dev_time_req=NONE;
send_data_cfm_max=NONE;
send_data_uncfm_max=NONE;
start_ns_tx=NONE;
start_ns_rx=NONE;
get_num_pkts_rx=NONE;
reset_num_pkts_rx=NONE;
    
```

Fig 2.11 Template of User Control Commands

2.2.3 Test Configuration

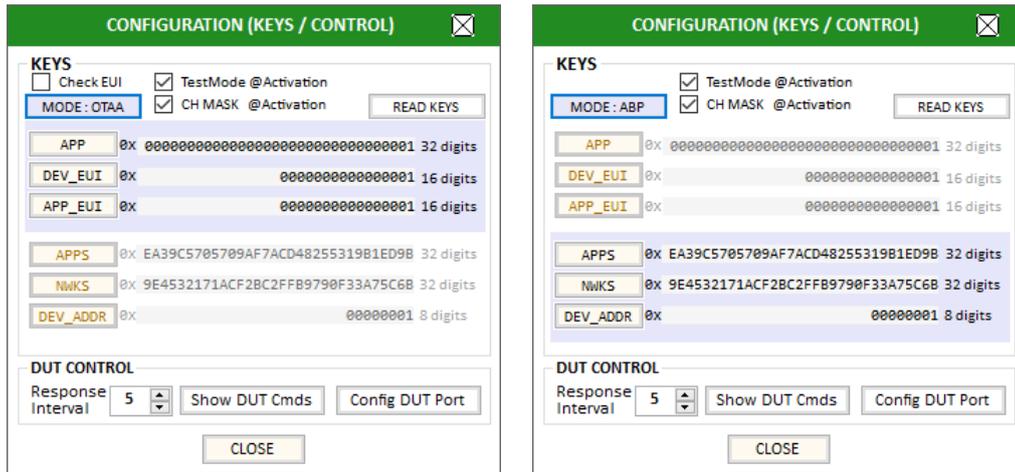
[Test Configure] or **CONFIG TEST** shows a window in which user can setup the basic properties of DUT. This configuration is applied to all test functions of the application.



CONFIGURATION			
REGION	EU_868	DUT TYPE	END DEVICE
CLASS	Class A	SCENARIO	CERTI_ECHO
KEY/CTRL	OTAA	LoRaWAN	V1.0.2
CH MASK	SETUP	DUT CMD	Loaded
		DUT CTRL	COM6

Fig 2.12 Test Configuration window

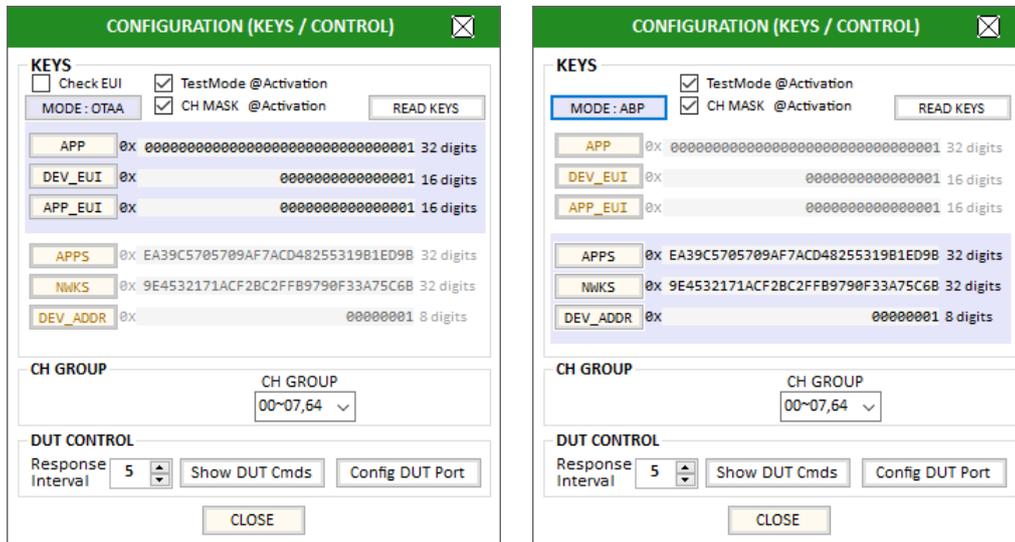
Clicking the value of 'KEY/CTRL' shows a popup window for protocol key values configuration in which user can setup keys and switch DUT between OTAA and ABP mode. In case of regions that the number of channels is greater than 8, the window also shows the selection of channel group. This configuration is applied to all test functions of the application.



OTAA mode

ABP mode

Fig 2.13 Protocol Keys Configuration window



OTAA mode

ABP mode

Fig 2.14 Protocol Keys Configuration window for US/CA Region

Clicking 'SETUP' for CH MASK in Test Configuration window shows a popup window for modification of

one of channel frequencies.

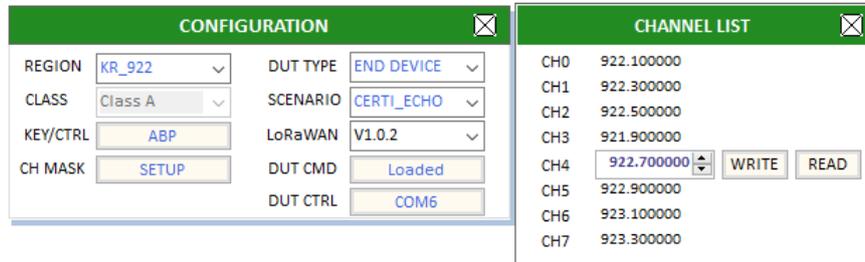


Fig 2.15 Modification of Channel Frequency

III. Test Functions

This chapter explains how to use pre-certification tests, RF performance tests, Link Analyzer, and other utilities. With test functions, user can select test mode of test items, handle test operation, and setup test environment.

- 3.1 Certification Test
- 3.2 Performance Test
- 3.3 Link Analyzer
- 3.4 Utilities

3.1 Certification Test

3.1.1 LoRaWAN Certification

There are four LoRaWAN Certification functions like EU, US/CA, AS, and KR. Other regional certification functions will be added as soon as they are published. If you select one of the certification functions, regional parameters will be configured automatically according to the certification.



Fig 3.1 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.



Fig 3.2 Selection of Region for Operator Certification Test

3.1.3 Certification Test Items

3.1.3.1 Meaning of Text Colors

Each color has the meaning of verdict; the blue-colored is PASSED, the red-colored is FAILED, the black colored is NOT_TESTED.

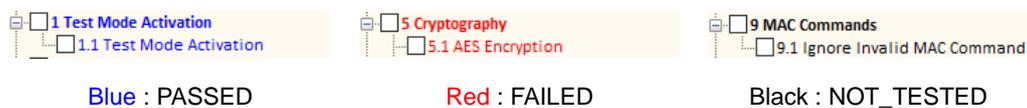


Fig 3.3 Meaning of Text Color

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.

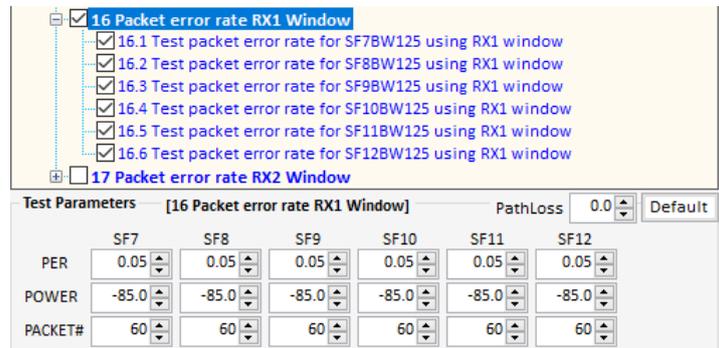


Fig 3.4 Configuration of Test Parameters

3.1.3.3 Start Test

Just click  button and all selected items will be tested sequentially. Keep in mind RWC5020A 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 always keeps the recent test results.

3.1.3.4 Control DUT

If you want to control DUT while test, check the **Control DUT** check box, then PC 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  button and a large DUT control monitor will be pop up.

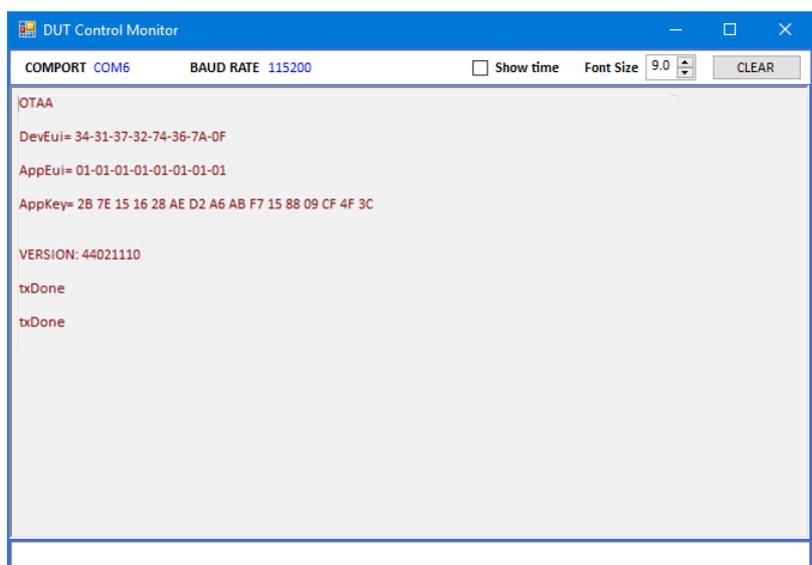


Fig 3.5 DUT Control Monitor

COMPORT and BAUDRATE information of the current control port will be displayed as follows.

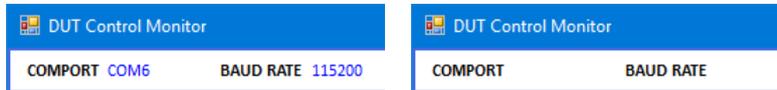


Fig 3.6 COMPORT and BAUDRATE

3.1.3.5 Test Result – Summary Table

When click the certification title, the test summary table will be shown on result window.

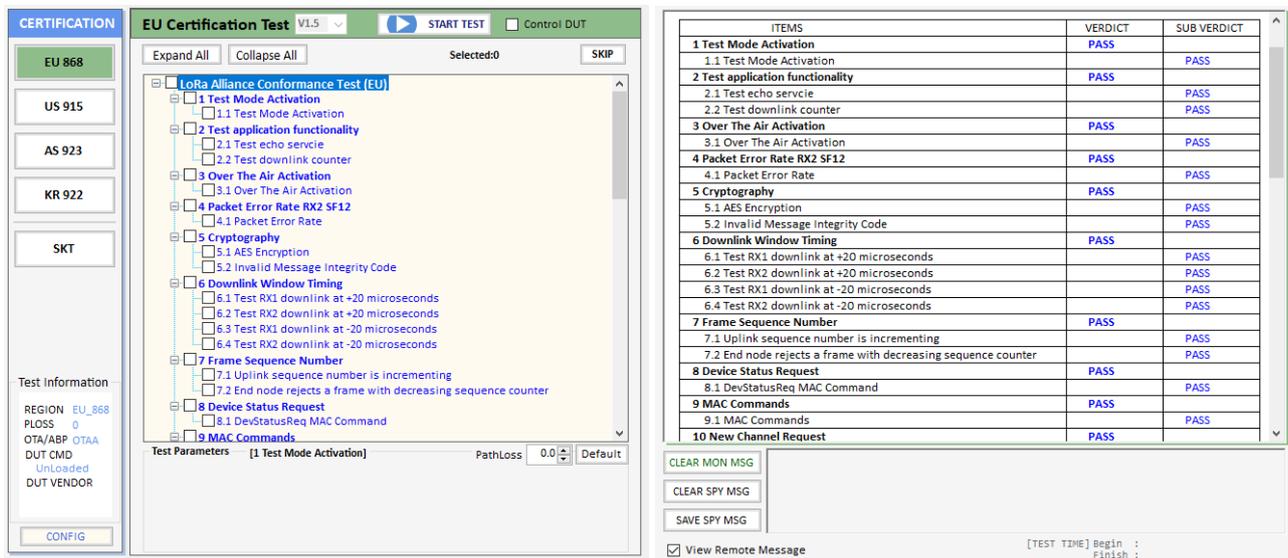
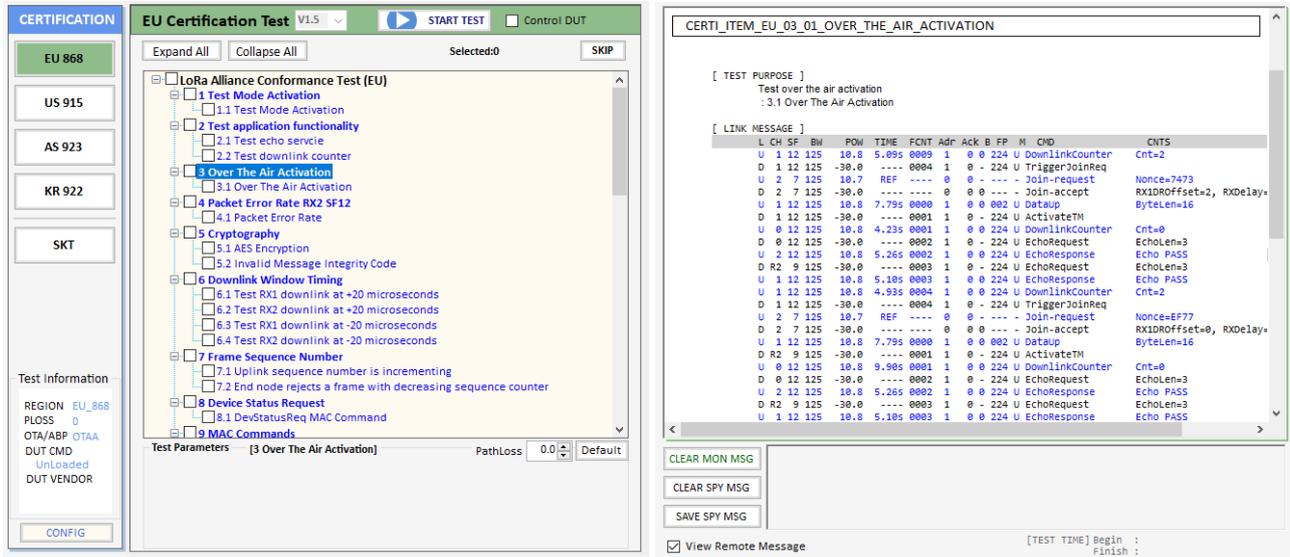


Fig 3.7 Test Result – Summary Table

3.1.3.6 Test Result – Detail Report

Clicking the sub title, detail test result will be shown on result window



The screenshot displays the LoRa Alliance Certification Test software interface. On the left, a sidebar lists certification regions: EU 868 (selected), US 915, AS 923, KR 922, and SKT. Below this, test information is shown for REGION EU_868, PLOSS 0, OTA/ABP OTAA, and DUT GMD (Unloaded). The main window shows the 'EU Certification Test V1.5' configuration for '3 Over The Air Activation'. A tree view on the left lists various test categories, with '3 Over The Air Activation' expanded. The 'Test Parameters' section shows 'PathLoss' set to 0.0. On the right, a detailed report for 'CERT_ITEM_EU_03_01_OVER_THE_AIR_ACTIVATION' is displayed, including a test purpose and a table of link messages.

TEST PURPOSE
Test over the air activation
: 3.1 Over The Air Activation

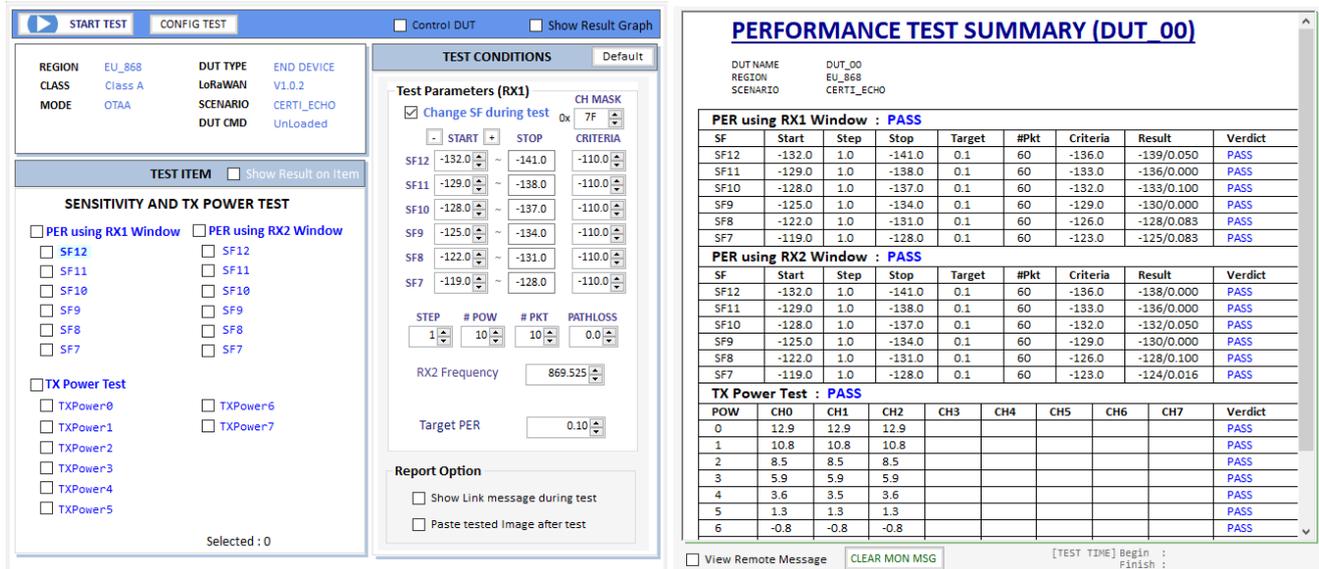
LINK MESSAGE

L	CH	SF	BW	POW	TIME	FCNT	Adr	Ack	B	FP	M	OID	CNTS
U	1	12	125	-30.0	5.09%	0009	1	0	0	224	U	DownlinkCounter	Cnt=2
D	1	12	125	-30.0	----	0004	1	0	0	224	U	TriggerJoinReq	
U	2	7	125	-30.0	REF	----	0	0	0	----	U	Join-request	Nonce=7473
D	2	7	125	-30.0	----	----	0	0	0	----	U	Join-accept	RXIDROffset=2, RXDelay=
U	1	12	125	-30.0	7.79%	0000	1	0	0	002	U	Dataup	ByteLen=16
D	1	12	125	-30.0	----	0001	1	0	0	224	U	ActivateTM	
U	0	12	125	-30.0	4.23%	0001	1	0	0	224	U	DownlinkCounter	Cnt=0
D	0	12	125	-30.0	----	0002	1	0	0	224	U	EchoRequest	EchoLen=3
U	2	12	125	-30.0	5.26%	0002	1	0	0	224	U	EchoResponse	Echo PASS
D	R2	9	125	-30.0	----	0003	1	0	0	224	U	EchoRequest	EchoLen=3
U	1	12	125	-30.0	5.10%	0003	1	0	0	224	U	EchoResponse	Echo PASS
U	1	12	125	-30.0	4.93%	0004	1	0	0	224	U	DownlinkCounter	Cnt=2
D	1	12	125	-30.0	----	0004	1	0	0	224	U	TriggerJoinReq	
U	2	7	125	-30.0	REF	----	0	0	0	----	U	Join-request	Nonce=EF77
D	2	7	125	-30.0	----	----	0	0	0	----	U	Join-accept	RXIDROffset=0, RXDelay=
U	1	12	125	-30.0	7.79%	0000	1	0	0	002	U	Dataup	ByteLen=16
D	R2	9	125	-30.0	----	0001	1	0	0	224	U	ActivateTM	
U	0	12	125	-30.0	9.90%	0001	1	0	0	224	U	DownlinkCounter	Cnt=0
D	0	12	125	-30.0	----	0002	1	0	0	224	U	EchoRequest	EchoLen=3
U	2	12	125	-30.0	5.26%	0002	1	0	0	224	U	EchoResponse	Echo PASS
D	R2	9	125	-30.0	----	0003	1	0	0	224	U	EchoRequest	EchoLen=3
U	1	12	125	-30.0	5.10%	0003	1	0	0	224	U	EchoResponse	Echo PASS

Fig 3.8 Test Result – Detail Report

3.2 Performance Test

Performance test function makes RWC5020A search the sensitivity level by measuring the PER (Packet Error Rate) and measure TX power of DUT according to the test configuration and conditions.



TEST CONDITIONS Default

Change SF during test

CH MASK: 0x 7F

	START	STOP	CRITERIA
SF12	-132.0	-141.0	-110.0
SF11	-129.0	-138.0	-110.0
SF10	-128.0	-137.0	-110.0
SF9	-125.0	-134.0	-110.0
SF8	-122.0	-131.0	-110.0
SF7	-119.0	-128.0	-110.0

STEP: 1, # POW: 10, # PKT: 10, PATHLOSS: 0.0

RX2 Frequency: 869.525

Target PER: 0.10

Report Option

Show Link message during test

Paste tested Image after test

PERFORMANCE TEST SUMMARY (DUT_00)

DUT NAME: DUT_00
REGION: EU_868
SCENARIO: CERTI_ECHO

PER using RX1 Window : PASS

SF	Start	Step	Stop	Target	#Pkt	Criteria	Result	Verdict
SF12	-132.0	1.0	-141.0	0.1	60	-136.0	-139/0.050	PASS
SF11	-129.0	1.0	-138.0	0.1	60	-133.0	-136/0.000	PASS
SF10	-128.0	1.0	-137.0	0.1	60	-132.0	-133/0.100	PASS
SF9	-125.0	1.0	-134.0	0.1	60	-129.0	-130/0.000	PASS
SF8	-122.0	1.0	-131.0	0.1	60	-126.0	-128/0.083	PASS
SF7	-119.0	1.0	-128.0	0.1	60	-123.0	-125/0.083	PASS

PER using RX2 Window : PASS

SF	Start	Step	Stop	Target	#Pkt	Criteria	Result	Verdict
SF12	-132.0	1.0	-141.0	0.1	60	-136.0	-138/0.000	PASS
SF11	-129.0	1.0	-138.0	0.1	60	-133.0	-136/0.000	PASS
SF10	-128.0	1.0	-137.0	0.1	60	-132.0	-132/0.050	PASS
SF9	-125.0	1.0	-134.0	0.1	60	-129.0	-130/0.000	PASS
SF8	-122.0	1.0	-131.0	0.1	60	-126.0	-128/0.100	PASS
SF7	-119.0	1.0	-128.0	0.1	60	-123.0	-124/0.016	PASS

TX Power Test : PASS

POW	CH0	CH1	CH2	CH3	CH4	CH5	CH6	CH7	Verdict
0	12.9	12.9	12.9						PASS
1	10.8	10.8	10.8						PASS
2	8.5	8.5	8.5						PASS
3	5.9	5.9	5.9						PASS
4	3.6	3.5	3.6						PASS
5	1.3	1.3	1.3						PASS
6	-0.8	-0.8	-0.8						PASS

Fig 3.9 Performance Test

3.2.1 How to Use

3.2.1.1 Test Configuration

Click **CONFIG TEST** to set up the test configuration: Region, DUT Type, Class, test scenario, channels, and so on. There are three types of DUT; END DEVICE, GATEWAY, and NON-SIGNAL. Available test items may be different according to the selection of Region and DUT Type parameters. There are two types of test scenario to measure PER; NORMAL_UL and CERTI_ECHO. The CERTI_ECHO requires DUT to support Certification test mode and applicable only to END DEVICE test. The NORMAL_UL uses confirmed signaling to check packet loss.

3.2.1.2 Selection and Test Condition 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 conditions will be shown at the right side of test items.

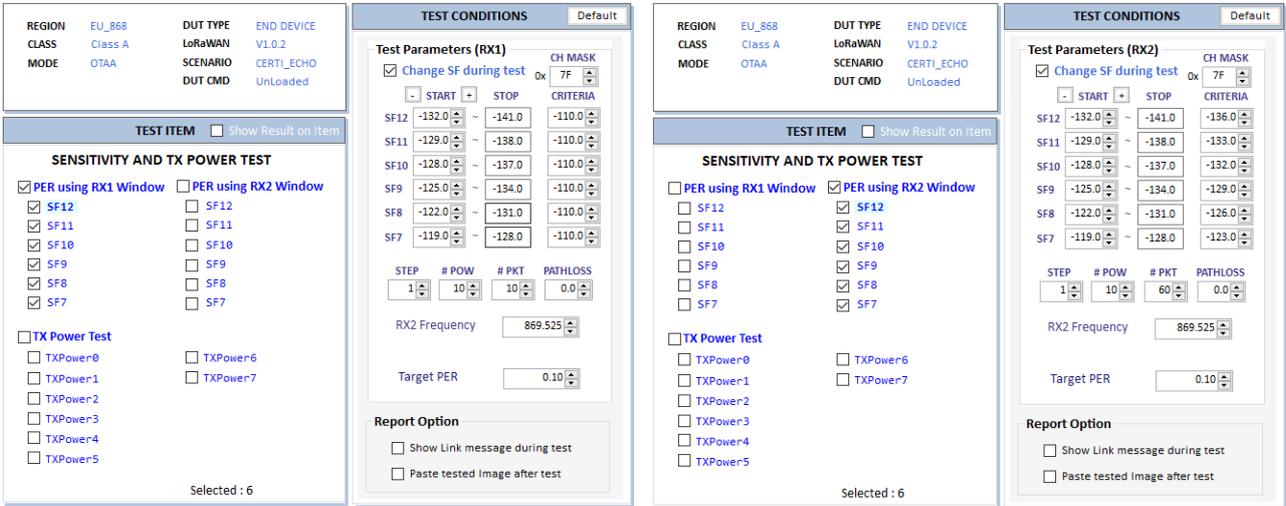


Fig 3.10 Test Conditions for PER using RX1 and RX2 Window

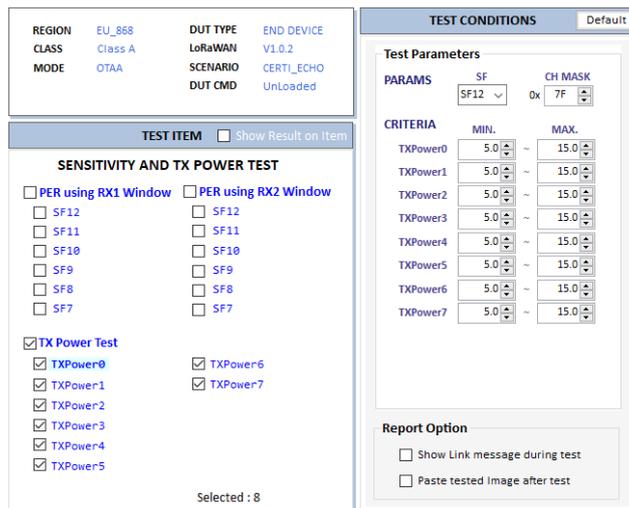


Fig 3.11 Test Conditions for TX Power Test

3.2.1.2 Start Test

If button is clicked, the selected test items will be tested sequentially.

3.2.1.3 Test Result – Summary Table

When the tile “SENSITIVITY AND TX POWER TEST” is clicked, the test result summary table will be shown on the result window

PERFORMANCE TEST SUMMARY (DUT_00)									
DUT NAME	DUT_00								
REGION	EU_868								
SCENARIO	CERTI_ECHO								
PER using RX1 Window : PASS									
SF	Start	Step	Stop	Target	#Pkt	Criteria	Result	Verdict	
SF12	-132.0	1.0	-141.0	0.1	60	-136.0	-139/0.050	PASS	
SF11	-129.0	1.0	-138.0	0.1	60	-133.0	-136/0.000	PASS	
SF10	-128.0	1.0	-137.0	0.1	60	-132.0	-133/0.100	PASS	
SF9	-125.0	1.0	-134.0	0.1	60	-129.0	-130/0.000	PASS	
SF8	-122.0	1.0	-131.0	0.1	60	-126.0	-128/0.083	PASS	
SF7	-119.0	1.0	-128.0	0.1	60	-123.0	-125/0.083	PASS	
PER using RX2 Window : PASS									
SF	Start	Step	Stop	Target	#Pkt	Criteria	Result	Verdict	
SF12	-132.0	1.0	-141.0	0.1	60	-136.0	-138/0.000	PASS	
SF11	-129.0	1.0	-138.0	0.1	60	-133.0	-136/0.000	PASS	
SF10	-128.0	1.0	-137.0	0.1	60	-132.0	-132/0.050	PASS	
SF9	-125.0	1.0	-134.0	0.1	60	-129.0	-130/0.000	PASS	
SF8	-122.0	1.0	-131.0	0.1	60	-126.0	-128/0.100	PASS	
SF7	-119.0	1.0	-128.0	0.1	60	-123.0	-124/0.016	PASS	
TX Power Test : PASS									
POW	CH0	CH1	CH2	CH3	CH4	CH5	CH6	CH7	Verdict
0	12.9	12.9	12.9						PASS
1	10.8	10.8	10.8						PASS

Fig 3.12 Test Result – Summary Table

3.2.1.4 Test Result – Detail Report

When the subtitle “PER using RX1 Window” is clicked, all tested results will be shown on the result window from SF12 to SF7 at the same time. When the test item title is clicked, the selected item’s test result will be shown on the result window.

PERFORMANCE TEST RESULT	
PER using RX1 Window : SF12	
[TEST CONDITION]	
[TEST CONFIGURATION]	
Region	: EU_868
Dut Type	: END DEVICE
Class	: Class A
Scenario	: CERTI_ECHO
[SENSITIVITY]	
Start Power	: -132.0 dBm
Step Power	: 1.0 dB
Number of Power	: 10
Stop Power	: -141.0 dBm
Path Loss	: 1.0
RX Window	: RX1
RX SpreadingFactor	: SF12
Number of Packet	: 60
Target PER	: 0.1
Sensitivity Criteria	: -136 dBm
[TEST RESULT]	
[SENSITIVITY RESULT]	
Measured PER	: 0.1
Measured Sensitivity	: -139.0 dBm
[VERDICT]	
PASS	

Fig 3.13 Test Result – Detail Report

3.2.1.5 Report Option

There are two options for reporting the test results as the following figure.



Fig 3.14 Report Option

If “Show Link Message during test” is checked, Link messages during test will be attached in the test report.

[LINK MESSAGE]

L	CH	SF	BW	POW	TIME	FCNT	Adr	Ack	B	FP	M	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	BytLen=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	-	000	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 3.15 Link Messages attached in Test Report

If “Paste tested Image after test” is checked, the result figure will be attached in the test report.

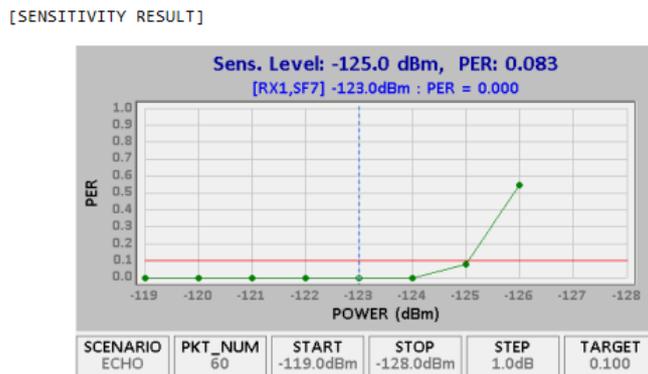


Fig 3.16 Result Figure attached in Test Report

3.2.2 Test options

3.2.2.1 Change SF during test

If “Change SF during test” is checked, it makes RWC5020A send commands to make DUT change spreading factor according to the test item.

3.2.2.2 Show Result Graph

If “Show Result Graph” is checked, it shows PER curve or TX power graph while or after test as the following figure.

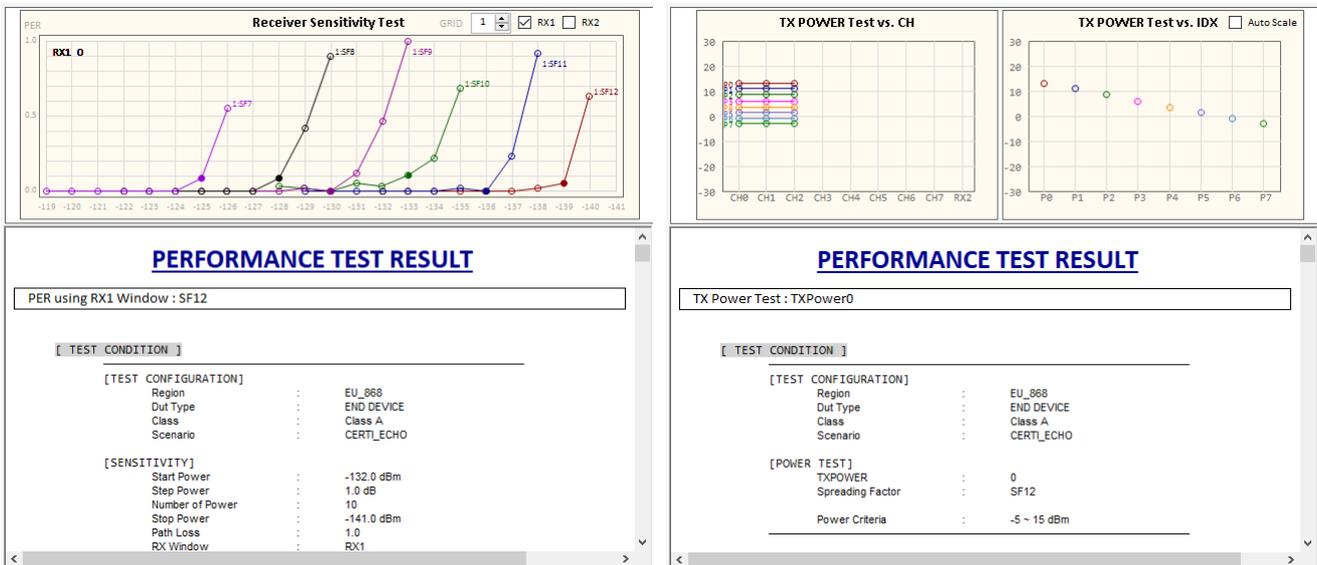


Fig 3.17 Show Result Graph

3.2.2.3 View Remote Message

If “View Remote Message” is checked, it shows remote control commands and responses between the application and RWC5020A.



Fig 3.18 Remote Message

3.3 Link Analyzer

Link Analyzer helps to dump all link messages from RWC5020A while communicating with DUT. In addition, users can configure a single or multiple MAC commands in a single LoRa frame and send it anytime by clicking SEND button.

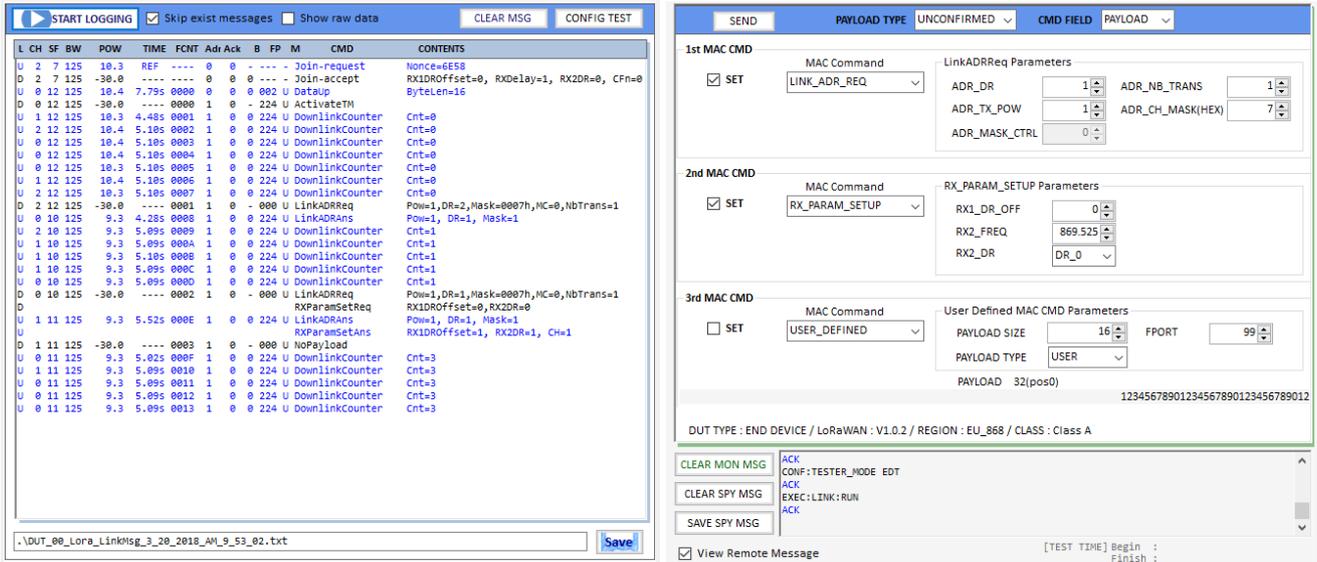


Fig 3.19 Link Analyzer

3.3.1 Dumping link message

Clicking START LOGGING makes RWC5020A start dumping link messages between RWC5020A and DUT line by line. Clicking STOP LOGGING button makes RWC5020A stop dumping.

3.3.2 MAC commands editor

With or without dumping, you can edit MAC commands and make RWC5020A send MAC command(s). User can send multiple MAC commands in single frame. The maximum number of multiple MAC commands in a frame is three with RWC5020A.

Define the PAYLOAD TYPE as UNCONFIRMED or CONFIRMED and define the CMD FIELD as PAYLOAD or FOPTION. If you want to select multiple MAC commands in a single frame, click 'SET' check box for each MAC CMD.

Clicking SEND makes RWC5020A send MAC command to DUT at the next TX slot of RWC5020A. After clicking SEND, the button's color and text will be changed like STOP. After RWC5020A transmits MAC command, they will be returned like SEND.

3.4 Utilities

It consists of 3 functions: DUT Control, Tester(RWC5020A) Control, and Screen capture.

3.4.1 DUT Control

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

3.4.1.1 How to Use

Just typing user own remote control commands and clicking  transmits commands to RWC5020A sequentially. User can use a special command SLEEP which just lets PC wait transmitting for described time. The parameter of SLEEP is time in millisecond unit, e.g., SLEEP 1000 makes PC wait for 1000ms.

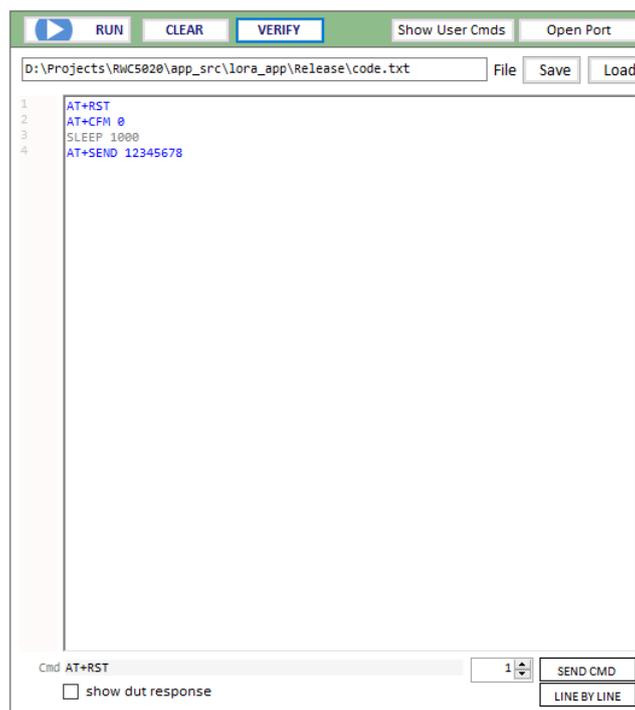
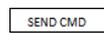
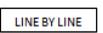


Fig 3.20 DUT Control

3.4.1.2 Verify Commands

Clicking  verifies 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.

3.4.1.3 Transmit Methods

Clicking  starts transmitting commands. Transmitting commands will be stopped if you click  or all commands are transmitted. Clicking  transmits the selected command. Clicking  transmits listed commands line by line.

3.4.2 Tester (RWC5020A) Control

This function is a simple terminal tool. It helps user control RWC5020A through LAN using string command. User can transmit RWC5020A remote commands all by one click or line-by-line.

3.4.2.1 How to Use

Clicking  starts transmitting commands on command window sequentially. User can use a special command SLEEP. It makes PC wait for transmitting the next command. The parameter of SLEEP is time in millisecond unit, e.g., SLEEP 1000 makes PC wait for 1000ms.

3.4.2.2 Template

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

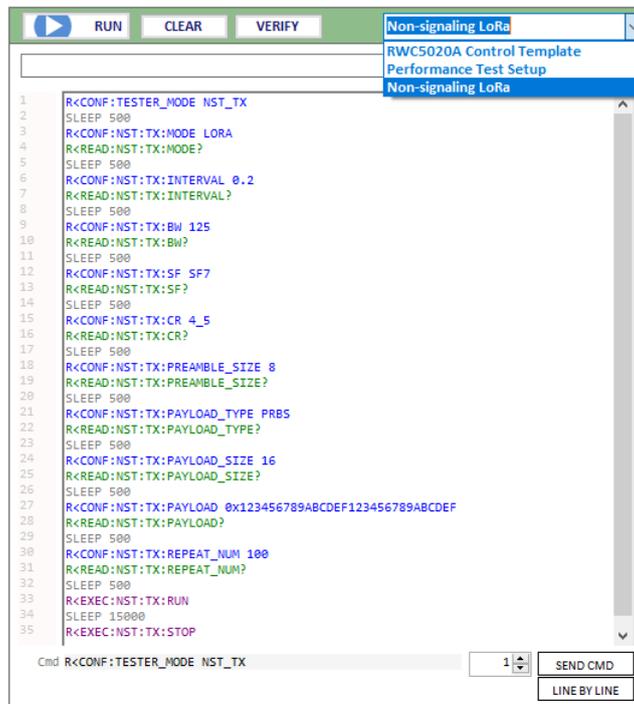


Fig 3.21 Tester Control

3.4.2.3 Transmit Methods

Clicking  starts transmitting commands. Transmitting commands will be stopped if you click  or all commands are transmitted. Clicking  transmits the selected command. Clicking  transmits listed commands line by line increasing the command number.

3.4.3 Screen Capture

Clicking  captures and shows the current screen of the connected RWC5020A and save it as a bmp file. If you click one of listed up file on list window, the selected bmp file will be shown on image window.

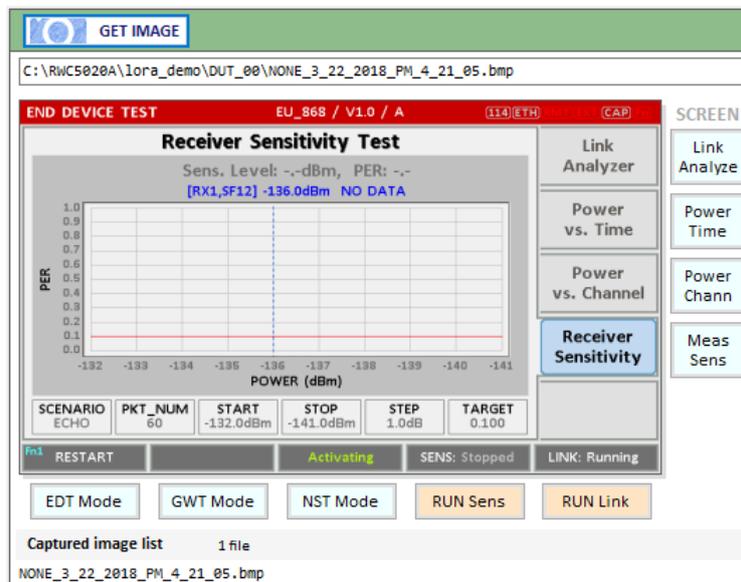


Fig 3.22 Screen Capture

3.4.4 Function for Manufacturing

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

For this function, a special function has to be prepared in DUT.

In the special mode of DUT, transmitting MEAS_START_FLAG, counting packets, recognizing MEAS_STOP_FLAG, and transmitting 3 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

3.4.4.1 Test concept

MEAS_START_FLAG packet transmitted from DUT makes RWC5020A start transmitting packets to DUT at the power specified by user. After transmitting the MEAS_START_FLAG, DUT must switch to RX mode to receive packets from RWC5020A and count the number of the packets received.

After transmitting all packets, RWC5020A transmits MEAS_END_FLAG packet that makes DUT stop counting and report the number of received packets.

After receiving the MESA_END_FLAG from RWC5020A, DUT must transmit report frame including the number of received frames 3 times within TIMEOUT time.

RWC5020A calculated PER with the reported information. Whenever DUT transmits any frame

RWC5020A measures the TX power of DUT and show the averaged value after receiving report packets.

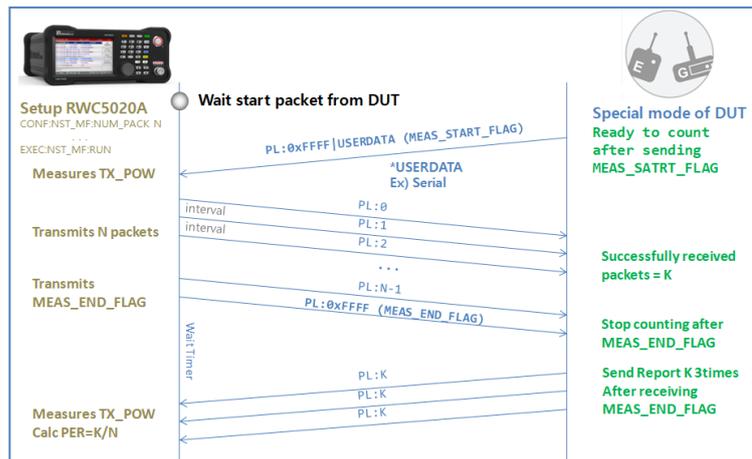


Fig 3.23 Test scenario for manufacturing

3.4.4.2 Test configuration

Click to set up the MFG configuration

MFG CONFIGURATION			
MFG MODE	LORA	NETWORK	PUBLIC
Transmit Power	-130.0 dBm	PER Criteria	0.10
Frequency	900.00000 MHz	Power Criteria(Up)	14.0 dBm
Pathloss	0.0 dB	Power Criteria(Low)	-30.0 dBm
DUT Type	END_DEVICE	Report Timeout	5 sec
Bandwidth	125	Number of Packets	50
Spread Factor	SF7	Frame Interval	0.05 sec
Payload Type	0000_0000	Payload Size	16 Byte
Use MAC format	OFF	Preamble Size	8 Byte

Fig 3.24 Configuration window for MFG

3.4.4.2 Operation example

Clicking makes RWC5020A wait the MEAS_START_FLAG MFG from DUT.



Fig 3.25 The screen of MFGA of RWC5020A and PC App. waiting for MEAS_START_FLAG from DUT



Fig 3.26 The screen of MFG of RWC5020A and PC App. while transmitting packets



Fig 3.27 The screen of MFG of RWC5020A and PC App. waiting for report frames from DUT

3.4.4.3 Getting the result

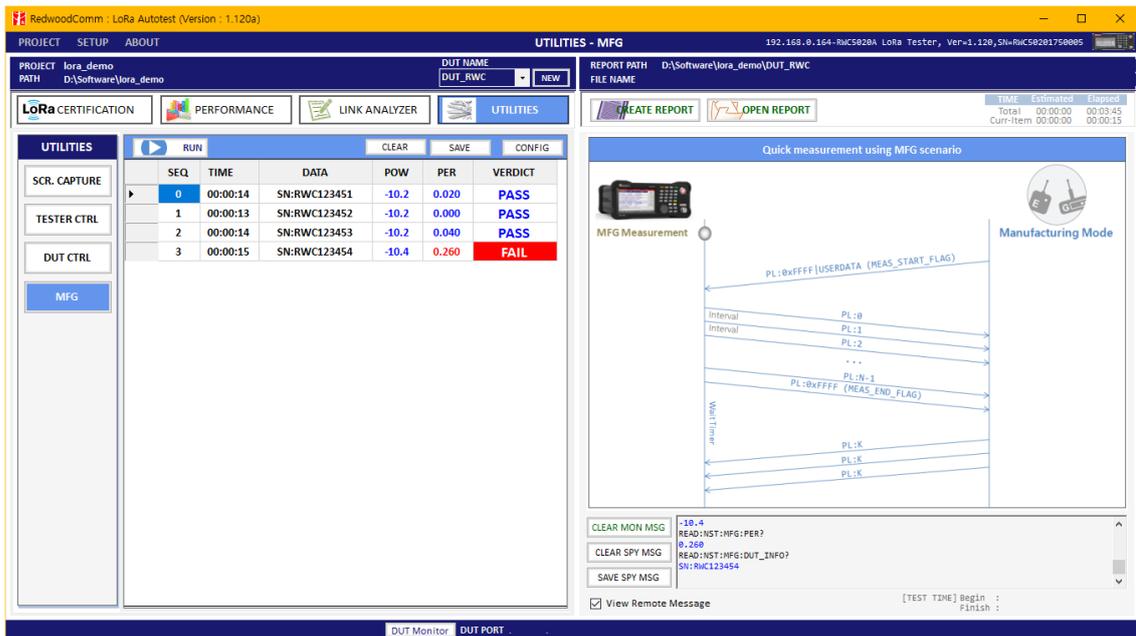
User can take measured result PER and TX Power of DUT using remote commands.

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?`



The screenshot shows the RedwoodComm LoRa Autotest (Version: 1.120a) interface. The main window is titled 'UTILITIES - MFG'. On the left, there is a 'UTILITIES' panel with a table showing test results for 4 DUTs. The table has columns for SEQ, TIME, DATA, POW, PER, and VERDICT. The results are as follows:

SEQ	TIME	DATA	POW	PER	VERDICT
0	00:00:14	SN:RWC123451	-10.2	0.020	PASS
1	00:00:13	SN:RWC123452	-10.2	0.000	PASS
2	00:00:14	SN:RWC123453	-10.2	0.040	PASS
3	00:00:15	SN:RWC123454	-10.4	0.260	FAIL

On the right side of the interface, there is a 'Quick measurement using MFG scenario' diagram. It shows a sequence of frames between 'MFG Measurement' and 'Manufacturing Mode'. The frames include:

- PL:0xFFFF (USERDATA (MEAS_START_FLAG))
- Interval
- PL:0
- Interval
- PL:1
- Interval
- PL:2
- ...
- Interval
- PL:N-1
- Interval
- PL:0xFFFF (MEAS_END_FLAG)
- Wait Time
- Interval
- PL:K
- Interval
- PL:K
- Interval
- PL:K

At the bottom of the interface, there is a 'View Remote Message' section showing the following data:

```

-10.4
READ:NST:MFG:PER?
0.260
READ:NST:MFG:DUT_INFO?
SN:RWC123454
    
```

Fig 3.28 Example test using 4 DUTs(N=50, Target PER=0.1)

IV. Report Functions

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

4.1 Report File Manager

4.1 Report File Manager

4.1.1 Create Report

Clicking  pops up 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.

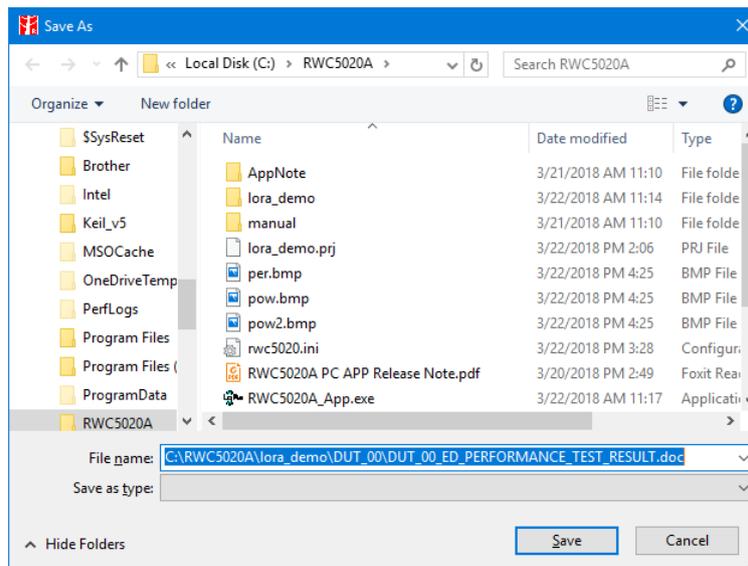
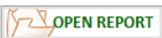


Fig 4.1 Creation of Test Report File

4.1.2 How to Open the Saved Report File

Clicking  pops up a REPORT LIST window. Double clicking on a file name opens the selected file. The reading tool is Microsoft Word installed on your PC.

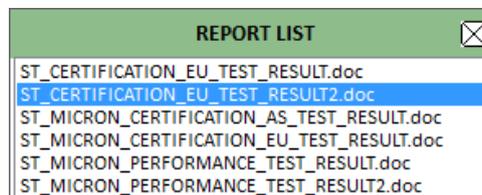


Fig 4.2 List of Test Report File

V. Revision History

Version	Date	Description
V1.11	2018.03.22	- Created for Firmware version: V1.11
V1.12	2018.04.25	- Modified for Firmware version: V1.12
V1.13	2018.07.19	- Modified for Firmware version: V1.13