

# TEST SOLUTION for LoRaWAN®

RedwoodComm is a leading company for development of wireless communication test solutions. RedwoodComm develops and provides measurement system for R&D, mass-production of broadcast system and wireless communications such as DAB, DRM, RDS, NFC and LoRa technologies. We will keep making every effort to be the world best company of test & measurement system based on technical know-how and experience of test & measurement system for wireless communications.



Wide Area Network for IoT



## RWC5020B

### Tester for LoRaWAN



RWC5020B is a compact all-in-one tester, providing a perfect solution for test and measurement of LoRa and LoRaWAN technology, which is fully suitable for R&D, QC, and manufacturers. It provides various test functions that can be performed in signaling mode, e.g. including activation procedures, as well as non-signaling mode. Automated PC software will help users test and debug their devices by performing pre-certification tests, as specified by the LoRa Alliance

## LoRaWAN® Compliance

Confirming that the end device meets the functional requirements of the LoRaWAN® protocol specification

RWC5020B pre-certification test is recommended for the purpose of pre-qualification. Some of the test items could be limited or not fully covered due to the limitation of maximum number of channels supported simultaneously.

### Supported Pre-certification Test Option

- LoRa Alliance® European EU 863-870MHz Region End Device Certification Requirements
- LoRa Alliance® US + Canada US902-928MHz Region End Device Certification Requirements
- LoRa Alliance® Asia AS 923MHz Region End Device Certification Requirements
- LoRa Alliance® South Korea 920-923MHz Region End Device Certification Requirements
- LoRa Alliance® India 865-867MHz Region End Device Certification Requirements

### Supported LoRaWAN® Region

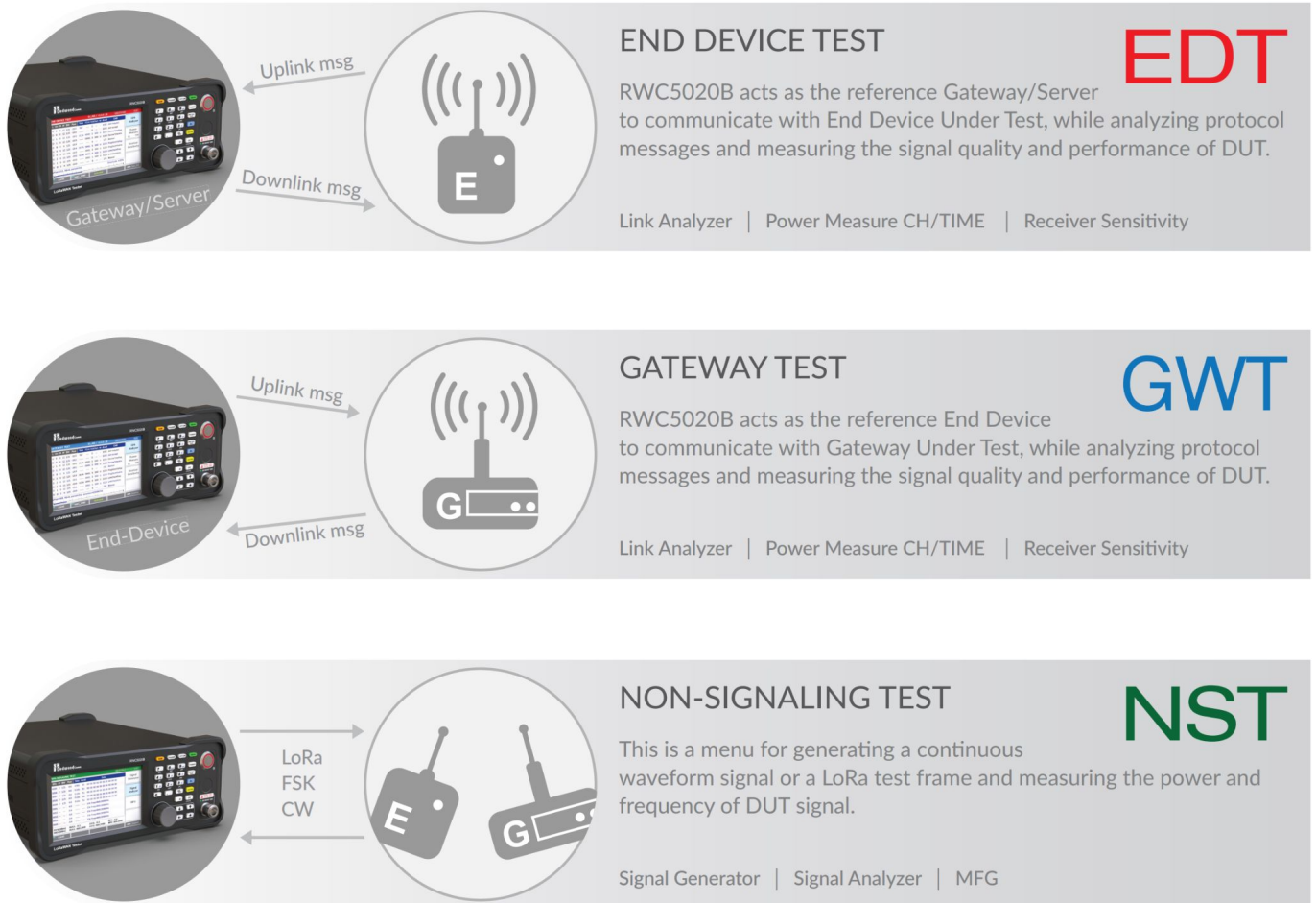
- Compatible with LoRaWAN® version of V1.0.2, 1.0.3, 1.0.4 and V1.1.0
- Class A/B/C

### Supported LoRaWAN® Protocol

EU 868 // EU 433 // US 915 // AU 915 // CN 470 // KR 920 // AS 923 // IN 865 // RU 864

## Key Features

### 3 main operational modes



### Protocol & Functional Test

- Support of LoRaWAN® Pre-Certification Tests for all regions
- Scenarios for transmission of MAC commands and user application data
- FUOTA Test with user firmware binaries

### RF Test Solutions

- RF Performance Tests for End-device – TX Power and RX Sensitivity (downlink: RX1, RX2, RXC or Ping-slot)
- RF Performance Tests for Gateway – TX Power and RX Sensitivity (uplink)
- Semtech’s Non-regression Tests for Gateway – integrated with RWC2020A Interference Generator
- LBT Test Solution for end-devices and gateways – integrated with RWC2020A Interference Generator

### Manufacturing Test Solutions

- Signal Generator and Signal Analyzer
- Frequency Measurement Function
- Separate TX/RX Tests with DUT controls – power, frequency and sensitivity
- Simultaneous TX/RX Tests (MFG) without wired DUT controls

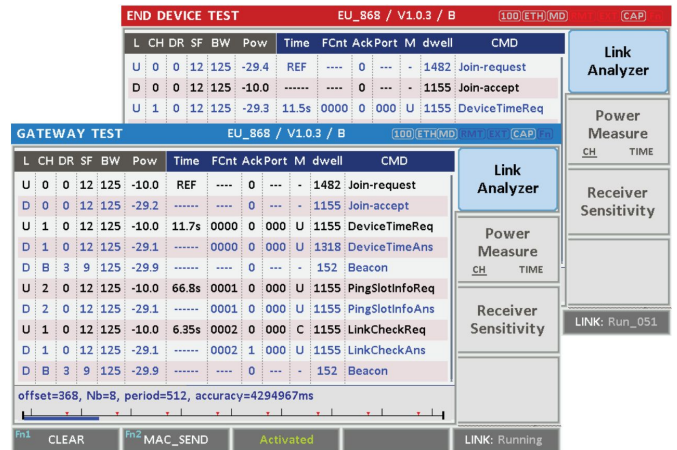
## Link Analyzer

### Analyzing frames for MAC/PHY analysis

RWC5020B provides a function of Link Analyzer for EDT and GWT. Link Analyzer in EDT (or GWT) helps to create a link between RWC5020B and an End Device (or Gateway/Server) Under Test and to analyze the protocol messages.

### MAC command Test

- Multiple MAC commands in a single frame
- All MAC commands defined in LoRaWAN with user-configurable parameters
- Field selection: frame payload or frame options
- Message type selection: confirmed or unconfirmed
- User defined message: editable payload data and port field



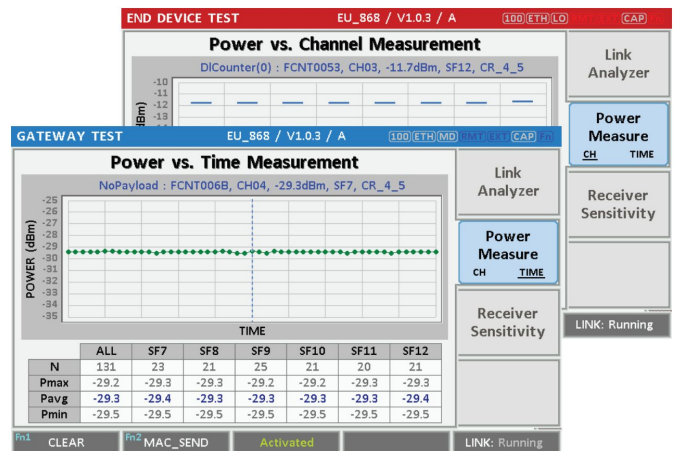
Link Analyzer for EDT/GWT

## Power Measure CH/TIME

### Continuously monitoring TX power of DUT with respect to channels and data rates(SF)

RWC5020B provides a function of Power vs. Channel/Time measurement for EDT and GWT. It helps to create a link between RWC5020B and an End Device (or Gateway/Server) Under Test and to measure the received power with RF channels or respect to data rates.

- Continuous monitoring of DUT's TX Power w.r.t. Channel
- Calculating the maximum/average/minimum values



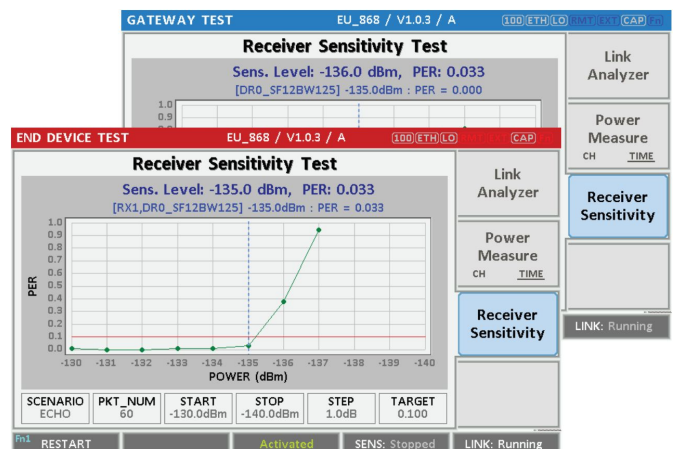
Power Measure CH/TIME for EDT/GWT

## Receiver Sensitivity

### Finding the minimum power level at which DUT can receive frames from the Tester

Receiver Sensitivity is a function of testing the receiver performance of DUT. RWC5020B sweeps its power level from the start value to the stop value with the step value and checks whether DUT functions properly, and stops immediately after DUT does not function properly to find the minimum sensitivity level.

- Determine power range and step for testing
- The result value is the minimum power level at which DUT can receive the Tester's frame



Receiver Sensitivity Test for EDT/GWT

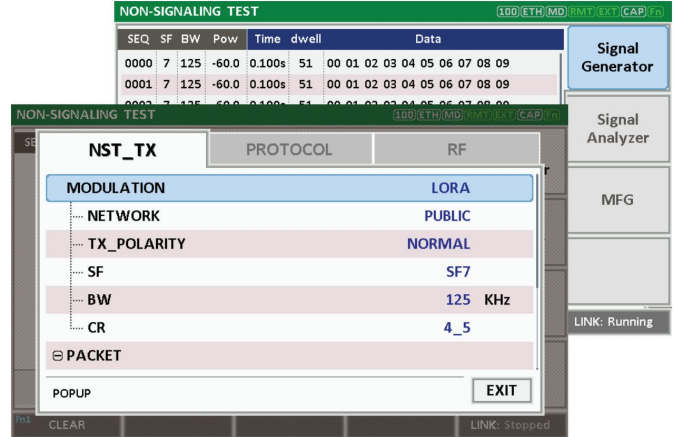
# Signal Generator

## Transmitting LoRa test frames/CW

Signal Generator is a function of transmitting the defined test waveform to DUT repeatedly. Three different modes are provided; LoRa, FSK and CW. Especially in case of LoRa and FSK modes, various parameters are configurable to compose a LoRa test frame.

### DUT's RX Performance Test

- Set the DUT to always listen the pre-defined packet
- Tester transmits pre-defined number of packets
- DUT needs to calculate PER by itself



RX Test for NST

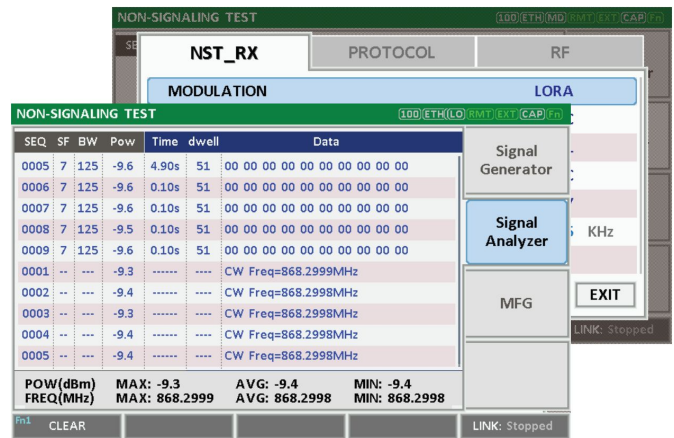
# Signal Analyzer

## Receiving LoRa frames and measuring the power

Signal Analyzer is a function of analyzing LoRa frames received from DUT repeatedly. Various parameters are configurable to receive a specific LoRa or FSK frame. Additionally TX power and frequency of DUT is measured in LoRa or CW mode.

### DUT's TX Performance Test

- Set the DUT to always transmit the pre-defined packet
- Tester measures TX power and CW frequency

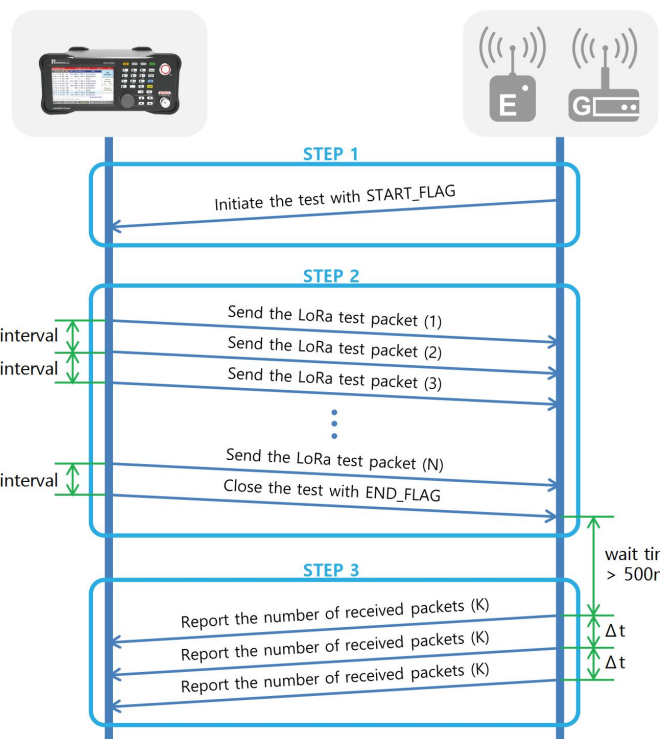
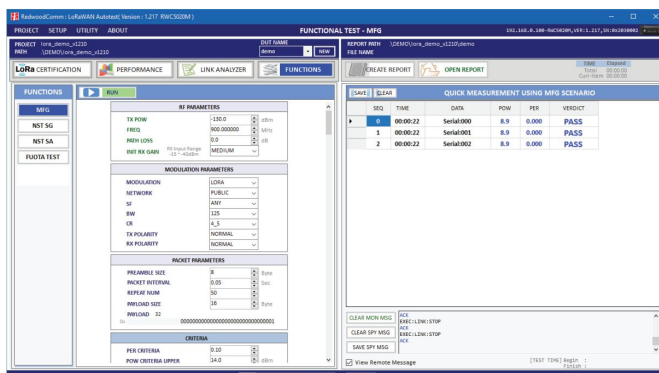


TX Test for NST

# MFG

## Speeding up the test in production lines

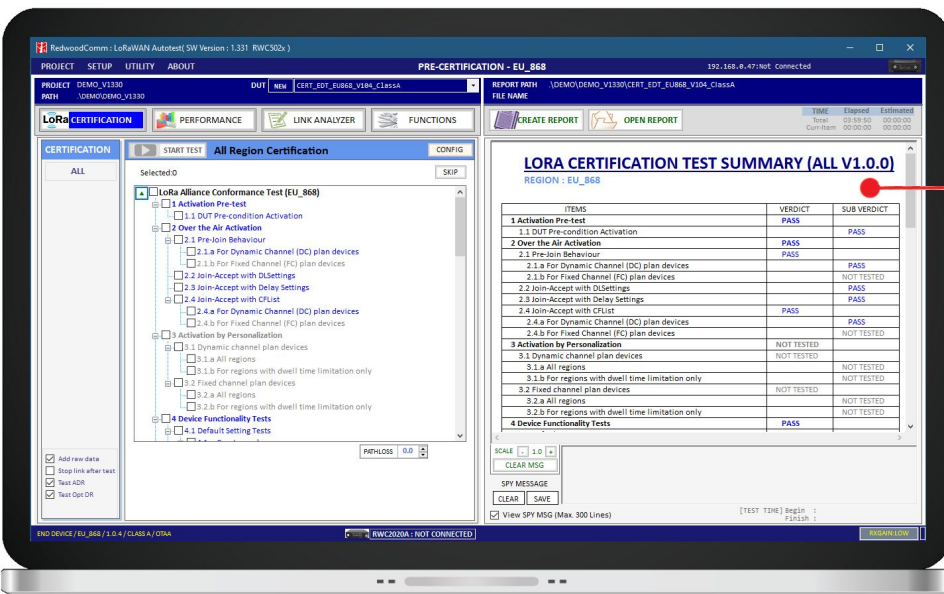
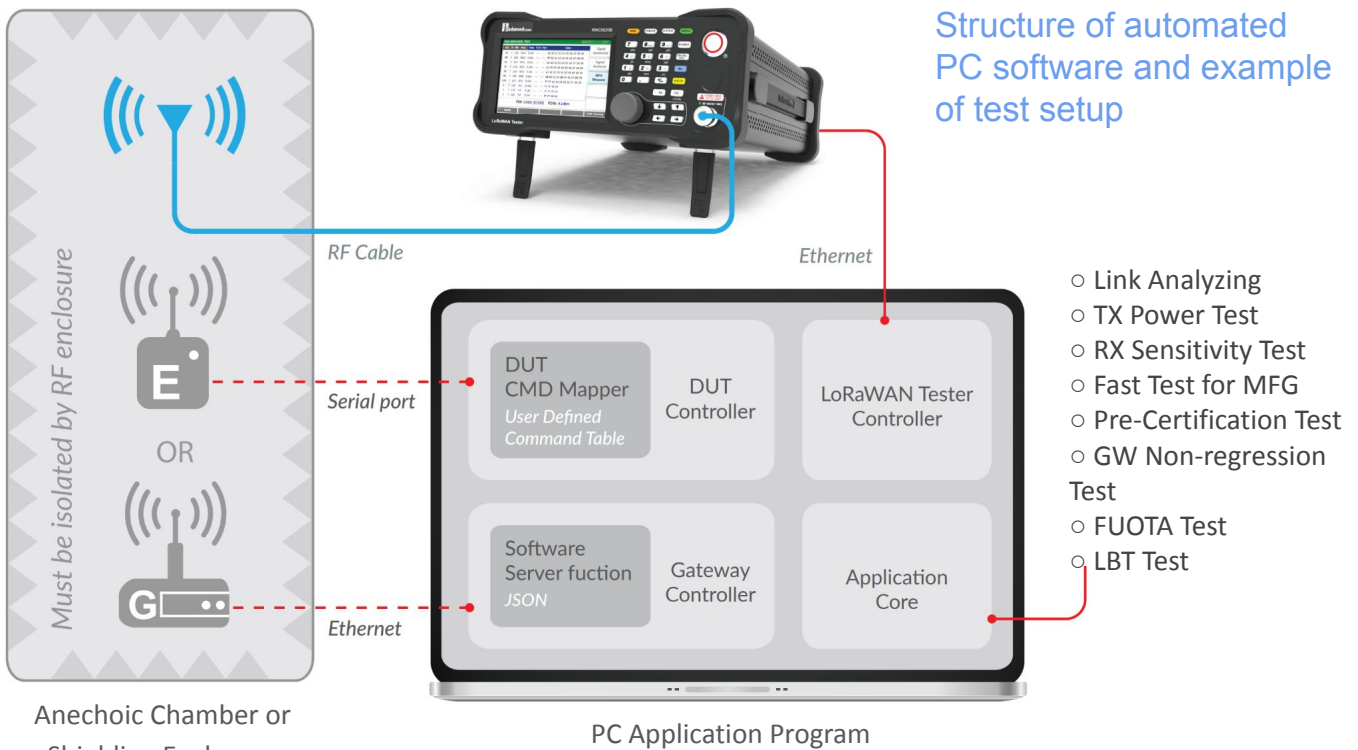
MFG is a function of manufacturing tests to measure the TX and RX performances of DUT simultaneously; power measurement for TX and sensitivity measurement for RX respectively. Basically manufacturing test of LoRa products should be performed in non-signaling mode because of two reasons; test time and a type of DUT.



Test Procedure for MFG Test

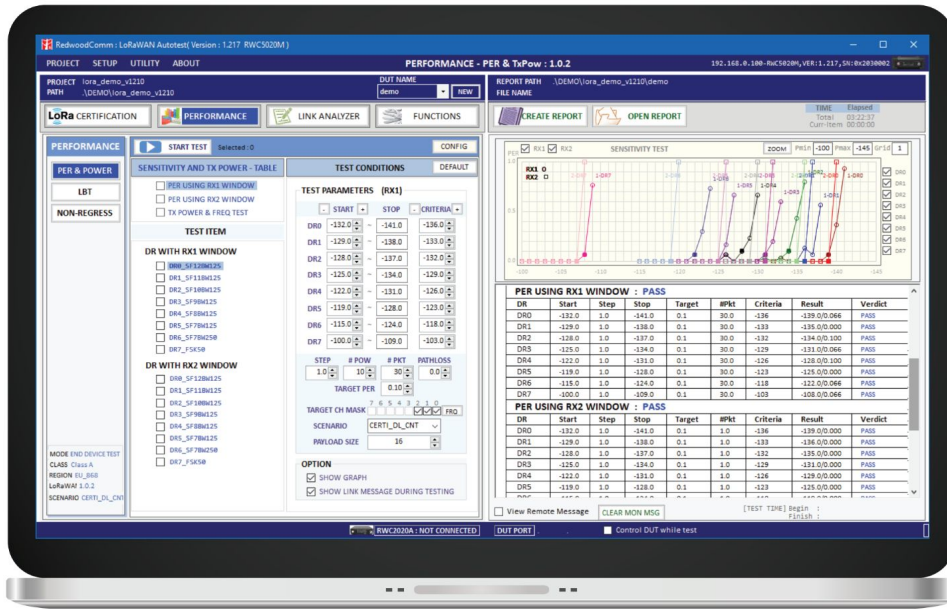
## PC Software

This PC application provides a variety of special measurement functions such as LoRaWAN pre-certification test, RF performance measurement, link message logging and DUT control. The RWC5020B automatically measures specified characteristics such as the PER of the DUT, obtains data such as link messages or measurement data according to the LoRa Alliance standard, and summarizes and creates the report in one click.



## TX/RX Performance Tests

It provides fully automated RF performance measurement functions such as TX Power, CW Frequency and RX sensitivity

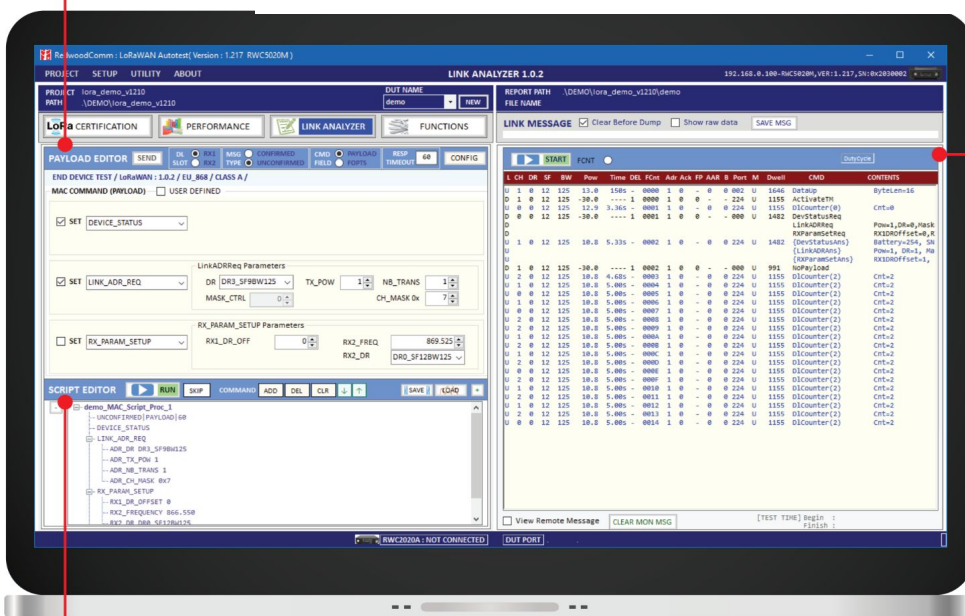


Ethernet



## Payload Editor

Any type of LoRa MAC commands defined in LoRa protocol can be transmitted



## Link Analyzer

All protocol messages with link analyzer function can be captured and saved.

## Script Editor

Add, remove or edit MAC command scenarios as needed



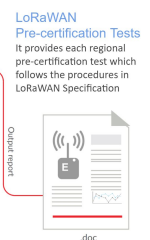
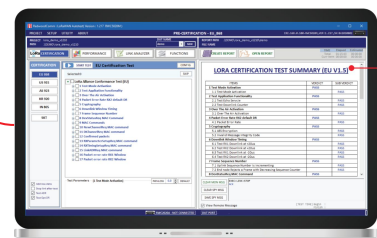




## RWC5020M Tester for LoRaWAN

The RWC5020M is a compact all-in-one LoRa/LoRaWAN tester, which offers most of the industry-leading features of RWC5020B at a very attractive price. It supports both engineering and manufacturing tests with a single tester: RF Performance, LoRaWAN Pre-certification, Firmware Update Over The Air (FUOTA), and more.

## RWC5021P Protocol Tester for LoRaWAN



**RWC5021P** is a compact dangle-type tester for LoRaWAN<sup>®</sup> protocol analysis for end devices, providing the pre-certification test function and link analyzer function that can be performed in signaling mode. In the case of the precertification function, it follows the standardized procedure of the LoRaWAN<sup>®</sup> specified by the LoRa Alliance<sup>®</sup>. In the case of the link analyzer, users can let RWC5021P communicate with user's DUT with MAC commands even with users' defined commands or mal-functioned MAC commands.

In order to use all dedicated functions, it must be connected with the RWC5020x PC software that will help users test and debug users' devices by performing the pre-certification tests, as specified by the LoRa Alliance<sup>®</sup>. It provides only End device test mode.

	RWC5020B	RWC5020M	RWC5021P
<b>Stand-alone Capability</b>	YES	NO	NO
<b>Exterior</b>			
Dimensions	250(w)x110(h)x348(d) mm	200(w)x70(h)x220(d) mm	100(w)x30(h)x140(d) mm
Weight	5 kg	2.2 kg	0.5 kg
Display	5", 800x480, 16M color, TFT LCD	2.8", 256x64, 16 gray, OLED	4 LED indicators
Front Keypad	YES	NO	NO
Power Input	100 to 240 VAC, 50/60Hz	12V/3A VDC (AC/DC adapter)	5V/0.5A (USB-C)
Control Interface	Ethernet, RS-232C	Ethernet, RS-232C	Ethernet, USB-C (VCOM)
<b>Frequency Bands</b>			
400MHz to 510MHz	Included	Selectable by Band option	Selectable by Region option
862MHz to 960MHz	Included	Selectable by Band option	Selectable by Region option
<b>RF Power Level</b>			
Output Power	0dBm to -150dBm	0dBm to -150dBm	0dBm to -30dBm
Input for Power Measurement	+30dBm to -80dBm	+30dBm to -80dBm	+30dBm to -80dBm
Input for Frequency Measurement	+30dBm to -50dBm	+30dBm to -50dBm	Not available
<b>Operational Modes</b>			
End-device Test	Selectable	Selectable	Included
Gateway Test	Selectable	Selectable	Not available
Non-signaling Test	Included	Selectable	Not available
<b>Protocol Compliance Tests (end-device only)</b>			
LoRaWAN Pre-Certification Tests	Optional	Optional	Optional
Operator Pre-Certification Tests	Optional	Optional	NO
<b>RF Performance Tests</b>			
Receiver Sensitivity Test	YES	YES	NO
Output Power Measurement	YES	YES	NO
Carrier Frequency Measurement	YES	YES	NO
LBT Test	YES (2020A required)	YES (2020A required)	NO
Gateway Non-regression Test	YES (2020A required partly)	YES (2020A required partly)	NO
<b>Link Analyzer</b>			
Message Logging and Analysis	YES	YES	YES
MAC Commands Transmission	YES	YES	YES
Application/User Data Transmission	YES	YES	YES
User Script Generation	YES	YES	YES
<b>Functionalities</b>			
FUOTA Test	YES	YES	NO
Manufacturing Test (MFG/NST)	YES	YES	NO
<b>Compatibility with 5020x PC Application Software</b>			
Pre-Certification Test	YES	YES	YES
RF Performance Test	YES	YES	NO
Link Analyzer	YES	YES	YES
Functions: NST, MFG, FUOTA	YES	YES	NO

## RWC2020A Interference Generator



RWC2020A is an interference generator being able to be used for the purpose of various tests or measurements, e.g. the Listen Before Talk (LBT) test, the Gateway Non-regression tests, the Intermodulation Immunity test and so on. It can generate up to eight multi-tone signals with different output levels per each tone for the LBT test and two tones of up to 20MHz distant for the Intermodulation Immunity test.

It also can generate a single tone with phase noise of high performance for the Gateway Non-regression tests. RWC2020A shall be connected to RWC5020x via RS-232C for control and setup of the full automation tests.

## LBT Test

Listen Before Talk (LBT) is a technique that device enters RX mode and senses the interference signal level before it starts a transmission. It is used to prevent interference or collision between devices that use common frequency bands. RWC2020A provides a perfect solution to verify LBT functionality of DUT, gateways or end-devices, as a supplementary equipment synchronized with RWC5020x. It generates up to eight interference signals to occupy frequency bands. The interference signal level, the number of channels, and channel frequencies are editable through RWC5020B LoRaWAN tester GUI or PC software.



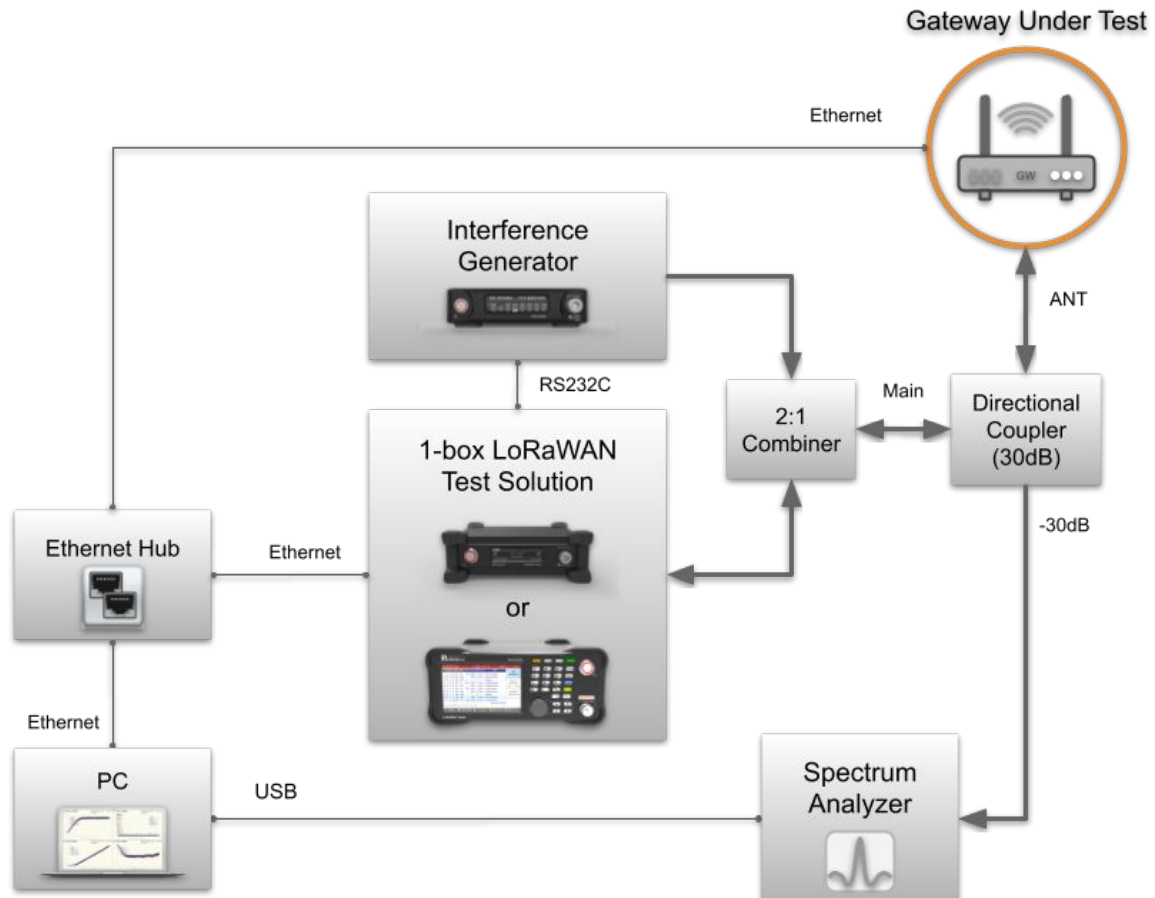


## Gateway Test & Measurement Guidelines

The LoRa Alliance introduces the new guidelines for LoRaWAN gateways provide recommendations for what and how to measure RF performance to standardize and accelerate deployments. As shown below, the RWC5020M/B with RWC2020A forms the heart of a full recommended test set up. We can supply the individual testers stand alone or as part of a full turn-key test solution. For the detailed information, please visit the LoRa Alliance at <https://lora-alliance.org/>.

The list of test items include:

- Tx & Rx Operation and Survival with Open/Short Load
- Measured and Reported RF Transmit Power Relative to Transmit Power Setting
- Tx Conducted Emissions Out-of-Band
- Tx Intermodulation
- Tx Frequency Error
- Rx Sensitivity
- Rx Dynamic Range
- Rx In-Band Blocking/Selectivity
- Rx Out-of-Band Blocking/Selectivity
- Rx Intermodulation
- Cold Start
- Time Accuracy



	<b>RWC5020B</b>	<b>RWC5020M</b>
Frequency	<ul style="list-style-type: none"> <li>• Range : 400MHz to 510MHz, 862MHz to 960MHz</li> <li>• Resolution : 100Hz</li> <li>• Stability vs. +25°C : ±0.5ppm standard</li> <li>• Stability vs. Aging : ±1ppm/1st year</li> </ul>	
Output Level	<ul style="list-style-type: none"> <li>• Range : 0dBm to -150dBm</li> <li>• Resolution : 0.1dB</li> <li>• Accuracy : ±1dB</li> <li>• Impedance : 50Ω</li> </ul>	
Input Level	<ul style="list-style-type: none"> <li>• +30dBm to -80dBm for Power Measurement</li> <li>• +30dBm to -50dBm for Frequency Measurement</li> </ul>	
Measurement Accuracy	<ul style="list-style-type: none"> <li>• ±1dB for Power</li> <li>• ±1KHz for Frequency (Single Tone)</li> </ul>	
VSWR	<ul style="list-style-type: none"> <li>• Better than 1:1.5</li> </ul>	
External Reference Frequency Input	<ul style="list-style-type: none"> <li>• Frequency : 10MHz</li> <li>• Power Range : 0dBm to +20dBm</li> </ul>	
Remote Programming Ports	<ul style="list-style-type: none"> <li>• RJ45(Ethernet)</li> <li>• RS-232C</li> </ul>	
Miscellaneous	<ul style="list-style-type: none"> <li>• Operating temperature : 5 to 40°C</li> <li>• Line Voltage : 100 to 240 VAC, 50/60Hz</li> <li>• Dimension : 250(w) x 110(h) x 348(d) mm</li> <li>• Weight : 5kg</li> </ul>	<ul style="list-style-type: none"> <li>• Operating temperature : 5 to 40°C</li> <li>• Input : 12V/3A VDC</li> <li>• Dimension : 200(w) x 70(h) x 220(d) mm</li> <li>• Weight : 2.2kg</li> </ul>
	<b>RWC5021P</b>	<b>RWC2020A</b>
Frequency	<ul style="list-style-type: none"> <li>• Range : 400MHz to 510MHz, 862MHz to 960MHz</li> <li>• Resolution : 100Hz</li> <li>• Stability vs. +25°C : ±5 ppm</li> <li>• Stability vs. Aging : ±2.5ppm/year</li> </ul>	<ul style="list-style-type: none"> <li>• Range : 400MHz to 1000MHz</li> <li>• Resolution : 100Hz</li> <li>• Accuracy : ±2ppm/year@operating temperature</li> </ul>
Output Level	<ul style="list-style-type: none"> <li>• Range : 0dBm to -30dBm</li> <li>• Resolution : 0.1dB</li> <li>• Accuracy : ±2dB</li> <li>• Impedance : 50Ω</li> </ul>	<ul style="list-style-type: none"> <li>• Range : -10dBm to -100dBm</li> <li>• Resolution : 0.1dB</li> <li>• Accuracy : ±1dB</li> <li>• Impedance : 50Ω</li> </ul>
Input Level	<ul style="list-style-type: none"> <li>• +30dBm to -80dBm for Power Measurement</li> </ul>	N/A
Measurement Accuracy	<ul style="list-style-type: none"> <li>• ±3dB for Power</li> </ul>	N/A
VSWR	<ul style="list-style-type: none"> <li>• Better than 1:1.5</li> </ul>	<ul style="list-style-type: none"> <li>• Better than 1:1.5</li> </ul>
Phase Noise (Single tone mode)	N/A	<ul style="list-style-type: none"> <li>• -103dBc @ 1kHz</li> <li>• -110dBc @ 10kHz</li> <li>• -110dBc @ 100kHz</li> <li>• -138dBc @ 1MHz</li> </ul>
Remote Programming Ports	<ul style="list-style-type: none"> <li>• RJ45 (Ethernet)</li> <li>• USB-C (VCOM)</li> </ul>	<ul style="list-style-type: none"> <li>• RJ45 (Ethernet)</li> <li>• RS-232C</li> </ul>
Miscellaneous	<ul style="list-style-type: none"> <li>• Operating temperature : 5 to 40°C</li> <li>• Input : 5V/0.5A (USB-C)</li> <li>• Dimension : 100(w) x 30(h) x 140(d) mm</li> <li>• Weight : 0.5kg</li> </ul>	<ul style="list-style-type: none"> <li>• Operating temperature : 5 to 40°C</li> <li>• Input : 12V/3A VDC</li> <li>• Dimension : 166(w) x 50(h) x 194(d) mm</li> <li>• Weight : 0.95kg</li> </ul>

## RWC7100A

### RF Shielding Enclosure



A triple contact shielding structure guarantees more than 100 dB isolation. Such an excellent shielding effectiveness in wide band up to 6.5GHz is very suitable for measuring the following products which have quite good sensitivity performance.

## Features

- Triple contact shielding structure : stable shielding characteristics in wide frequency range up to 6.4GHz
- Internal Absorber : It provides more stable internal RF test condition
- Easy maintenance : Users can easily replace shielding gaskets manually
- Various IO modules provided : Users can easily replace any IO modules manually
- Antenna can be mounted on the lid : It provides users with more stable test environment

## Application

- LTE, NB-IoT devices (700 MHz, 2-6 GHz)
- LoRa, Sigfox devices (400 MHz, 900 MHz, 2.4 GHz)
- WiFi devices (2.4 GHz, 5.8-6.2 GHz)
- Bluetooth devices (2.4 GHz)
- GNSS devices (1.2-1.6 GHz)

## Specification

### Shielding Effectiveness

more than 100 dB from 400 MHz to 6.5 GHz

### Miscellaneous

Dimension W x D x H mm (inches)

Exterior : 355 x 270 x 180 (14" x 10.6" x 7")

Interior : 260 x 190 x 100 (10.2" x 7.5" x 3.9")

Packing : 450 x 350 x 270 (17.7" x 13.8" x 10.6")

Weight

Product : approx. 6 kg

Packaging : approx. 7 kg



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