LoRaWAN TEST SOLUTION

RedwoodComm is a professional developing company for wireless communication test solution. 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.
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 LoRa Alliance.

LoRaWAN Compliance

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

RWC5020B certification test is recommended for purpose of pre-qualification. Some of certification 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 V1.5
- LoRa Alliance US + Canada US902-928MHz Region End Device Certification Requirements V1.3
- LoRa Alliance Asia AS 923MHz Region End Device Certification Requirements V1.1
- LoRa Alliance South Korea 920-923MHz Region End Device Certification Requirements V1.2
- LoRa Alliance India 865-867MHz Region End Device Certification Requirements V1.1

Supported LoRaWAN® Region
IN 865 // RU 864 // KZ 865

Supported LoRaWAN® Protocol
- Compatible with LoRaWAN version of V1.0.2, V1.0.3 and V1.1
- Support of Class A, Class B and Class C
LoRa/LoRaWAN Test Solutions

Protocol Test Solutions
- Support of LoRaWAN Pre-Certification Tests – EU V1.5, US/CA V1.3, AS V1.1, KR V1.2 and IN V1.1
- Scriptable scenario for transmission of MAC commands and user data (or 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 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
- Separate T/RX Tests with DUT controls – power, frequency, and sensitivity
- Simultaneous T/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

Power vs. Time

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

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

Continuously monitoring TX power of DUT with respect to channels

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

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

Receiver Sensitivity

Finding the minimum power level 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.

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

Transmitting LoRa test frames/CW

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

**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 frame. Additionally TX power of DUT is measured in LoRa or CW mode.

**DUT's RX Performance Test**

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

**DUT's TX Performance Test**

- Set the DUT to always transmit the pre-defined packet
- Tester measures CW frequency
MFG

Speeding up the test time 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. Testing in signaling mode requires much longer test time caused by the limitation of LoRa communication technology. Testing in non-signaling mode does not concern about a type of DUT, in other words, either an End-device or a Gateway can be tested under the same test concept.

Test Procedure for MFG Test

State Transition Diagram during MFG Test
PC Software

This PC application provides a variety of special measurement functions such as LoRa pre-certification test, 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.

LoRa Pre-certification Tests
It provides each regional pre-certification test which follows the procedures in LoRaWAN Specification.

TX/RX Performance Tests
It provides fully automated RF performance measurement functions such as TX Power and RX sensitivity.
PC Software

Payload Editor
You can transmit any type of LoRa MAC commands defined in LoRa protocol.

Link Analyzer
You can gather and save all protocol messages with link analyzer function.

Script Editor
You can add, remove or edit MAC command even multi-commands as you wish.

Manufacturing Tests
It provides Non-signaling functions such as TX/RX/MFG Test for fast manufacturing Tests.
User can measure TX power and RX sensitivity simultaneously using MFG function on the production line.

Ethernet
Structure of automated PC software and example of test setup

Anechoic Chamber or Shield Box
Must be isolated by RF enclosure
Specifications

**Frequency**
- Range: 400MHz ~ 510MHz, 862MHz ~ 960MHz
- Resolution: 100Hz
- Stability vs. +25°C: ±0.5ppm standard
- Stability vs. Aging: ±1ppm/1st year

**Output Level**
- Range: 0dBm ~ -150dBm
- Resolution: 0.1dB
- Accuracy: ±1dB
- Impedance: 50Ω

**Input Level**
- +30dBm ~ -80dBm for Power Measurement
- +30dBm ~ -50dBm for Frequency Measurement

**Measurement Accuracy**
- ±1dB for Power
- ±1KHz for Frequency (Single Tone)

**VSWR**
- Better than 1:1.5

**External Frequency Reference**
- Frequency: 10MHz
- Power Range: 0dBm ~ +20dBm

**Remote Programming Ports**
- RJ45 (Ethernet)
- RS-232C

**Miscellaneous**
- Operating temperature: 5 ~ 40°C
- Line Voltage: 100 to 240 VAC, 50/60Hz
- Dimension: 250(w) x 110(h) x 348(d) mm
- Weight: 5kg

Order code (for RWC5020B LoRaWAN Tester)

- C5020B-00  EDT+GWT+NST
- C5020B-01  EDT+GWT
- C5020B-02  NST
- C5020B-03  EDT
- C5020B-04  GWT
- C5020B-05  EDT+NST
- C5020B-06  GWT+NST
- O5020B-01  LoRaWAN Pre-Certification Test EU Option
- O5020B-03  LoRaWAN Pre-Certification Test US/CA Option
- O5020B-04  LoRaWAN Pre-Certification Test AS Option
- O5020B-05  LoRaWAN Pre-Certification Test KR Option
- O5020B-06  LoRaWAN Pre-Certification Test IN Option
- O5020B-95  Extra Hardware Warranty Option
- O5020B-99  Maintenance option for software and firmware upgrade

*Each option can be purchased later as an upgrade method.*
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 RWC5020B 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 RWC5020A. 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.
**CW Interferer Immunity Test**

The CW Interferer Immunity Test and Intermodulation Immunity Test which are ones of the Gateway Non-regression tests require CW interference signals with high performance phase noise. RWC2020A generates a single-tone or dual-tone interference signal for those tests.

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**Specifications**

| Frequency | Range : 400MHz ~ 1000MHz  
| Resolution : 100Hz  
| Accuracy : ±2ppm/year@operating temperature |
| Output Level | Range : -10dBm ~ -100dBm  
| Resolution : 0.1dB  
| Accuracy : ±1dB |
| RF Characteristics | Phase Noise (Single tone mode) : -103dBc@1kHz / -110dBc@10kHz / -110dBc@100kHz / -138dBc@1MHz  
| VSWR : Better than 1:1.5  
| Impedance : 50Ω |
| Remote Interface | RS-232C |
| Miscellaneous | Operating temperature : 5 ~ 40°C  
| Input : DC 12V, 3A  
| Dimension : 166(w) x 50(h) x 194(d) mm  
| Weight : 950g |