

RWC2020A Interference Generator

Operating Manual

Version 1.00 (ENG)
(RWC2020A FW Version 1.00)

June 2019



Contents

I. General Information	2
1.1 Warranty	3
1.2 Safety Considerations	4
1.2.1 Injury Precautions	4
1.2.2 Product Damage Precautions	4
1.2.3 Safety Symbols and Terms.....	5
1.3 Contact Information	6
1.4 Key Features	7
1.5 Specifications.....	9
1.6 Initial Inspection	10
1.7 SMPS Adaptor	11
1.8 Operating Environment.....	12
II. Operation.....	13
2.1 Front Panel View	14
2.2 Rear Panel View.....	15
2.3 Main Screen.....	16
2.3.1 Mode Switch	16
2.3.2 LBT Channel Mode.....	16
2.3.3 LBT Burst Mode	18
2.3.4 Single-tone Mode	19
2.3.4 Dual-tone Mode	20
2.4 Information Screen.....	23
2.5 Ethernet IP Setup	24
2.6 Firmware Upgrade	25
2.7 Remote Control Interface	28
III. Revision History.....	29

I. General Information

This chapter covers specifications, key features, warranty, and safety consideration of the Instrument.

- 1.1 Warranty
- 1.2 Safety Considerations
- 1.3 Contact Information
- 1.4 Key Features
- 1.5 Specifications
- 1.6 Initial Inspection
- 1.7 Power Requirement
- 1.8 Operating Environment

1.1 Warranty

RedwoodComm Warrants that this product will be free from defects in materials and workmanship for a period of two(2) years from the date of shipment. During the warranty period, RedwoodComm will, at its option, either repair or replace products that prove to be defective.

For warranty service or repair, Customer must notify RedwoodComm of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by RedwoodComm. Customer shall prepay shipping charge to RedwoodComm designated service center and RedwoodComm shall pay shipping charge to return the product to customer. Customer is responsible for all shipping charges including freight, taxes, and any other charge if the product is returned for service to RedwoodComm, if customer is located outside of Korea.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate malignance by buyer, buyer-supplied software or interfacing, unauthorized modification or misuse, accident or abnormal conditions of operation.

RedwoodComm responsibility to repair or replace deductive products is the sole and exclusive remedy provided to the customer for breach of this warranty. RedwoodComm will not be liable for any indirect, special, incidental, or consequential damages irrespective of whether RedwoodComm has advance notice of the possibility of such damages

1.2 Safety Considerations

Review the following safety precautions to avoid injury and prevent damage to this product or any product connected to it.

1.2.1 Injury Precautions

Use Proper Power Cord

To avoid fire hazard, use only the power cord specified for this product.

Avoid Electric Overload

To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is specified beyond the range.

Ground the Product

This product is grounded through the grounding conductor of the power cord. In case no ground is available at the power outlet, it is recommended to provide a separate grounding path to the instrument by connecting wire between the instrument ground terminal and an earth ground to avoid electric shock or instrument damage. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Do Not Operate Without Covers

To avoid electric shock or product damage, do not operate this product with protective covers removed.

Do Not Operate in Wet/Damp Conditions

To avoid injury or fire hazard, do not operate this product in wet or damp conditions.

Do not use in a manner not specified by the manufacturer

1.2.2 Product Damage Precautions

Use Proper Power Source

Do not operate this product from a power source that applies more than the voltage specified. Main supply voltage fluctuations do not to exceed $\pm 10\%$ of the nominal voltage.

Provided Proper Ventilation

To prevent product overheating, provide proper ventilation.

Do Not Operate With Suspected Failures

If you there is damage to this product, have it inspected by qualified service personnel.

Environmental Conditions

Refrain from using this equipment in a place subject to much vibration, direct sunlight, outdoor and where the flat is not level. Also, do not use it where the ambient temperature is outside 5 °C to 40 °C, and altitude is more than 2000m. The maximum relative humidity is 80% for temperatures up to 31 °C decreasing linearity to 50% relative humidity at 40 °C. Over voltage Installation Category II for mains supply. Pollution Degree 2.

1.2.3 Safety Symbols and Terms

These terms may appear in this manual

WARNING: Warning statements identify conditions or practices that could result in injury or loss of life.

CAUTION: Caution statements identify conditions or practices that could result in damage to this product or other property.

1.3 Contact Information

The contact information of RedwoodComm is as follows:

Headquarters in Korea: +82-70-7727-7011

Branch office in Canada: +1-604-720-2688

Technical Support: support@redwoodcomm.com

Homepage: <http://www.redwoodcomm.com>

1.4 Key Features

General Descriptions

RWC2020A is an interference generator being capable to be used for the purpose of a wide range of tests or measurements, e.g. the Listen Before Talk (LBT) test, the Gateway Non-regression tests, the Intermodulation Immunity test and so on. RWC2020A shall be connected to RWC5020A via RS-232C for a remote control and setup of the full automation tests.

Key Features

Operating Modes

- *LBT Channel mode*
 - Generating up to 8 tones with different power levels.
- *LBT Burst mode*
 - Generating 8 tones with one power level, called *Normal*, and switching to the other power level, called *Burst*, with a time interval.
- *Single-tone mode*
 - Generating a single tone with high-performance phase noise.
- *Dual-tone mode*
 - Generating dual tones of up to 20MHz spacing.

Test Capabilities in collaboration with RWC5020A

- *LBT Test*
 - RWC5020A will emulate a gateway including a network server and measure how an end-device under test will use RF channels, while RWC2020A generates interference signals, which can be set up for the LBT channel test or for the LBT burst test.
- *Gateway Non-regression Test*
 - Some of Gateway Non-regression tests, defined by Semtech™ and implemented by RedwoodComm, require an interference signal for the tests, which must have high-performance phase noise that can be accomplished in Single-tone mode.
- *Intermodulation Immunity Test*
 - Two continuous-wave signals can be generated with configurable frequency space to emulate interference signals caused by intermodulation.

PC Software

- Control of RWC2020A is only provided via RWC5020A PC Application Software. Please refer to RWC5020A PC Application Software to see how the tests are performed using RWC2020A.

1.5 Specifications

Frequency

- Range : 400MHz ~ 1000MHz
- Resolution : 100Hz
- Accuracy : ± 2 ppm/year @ operating temperature

Output Level

- Range: -10dBm ~ -100dBm
- Resolution : 0.1dB
- Accuracy : ± 1 dB

RF Characteristics

- Phase Noise (Single-tone mode) :
-103dBc@1kHz / -110dBc@10kHz / -110dBc@100kHz / -138dBc@1MHz
- VSWR : Better than 1:1.5
- Impedance : 50 Ω

Remote Interface

- RS-232C

Miscellaneous

- Operating temperature : 5 ~ 40°C
- Input : DC 12V, 3A
- Dimension : 166(w) x 50(h) x 194(d) mm
- Display : 2.81 inch OLED
- Weight : 950g

1.6 Initial Inspection

After the delivery of the product, damage to its exterior that may occur during the shipping process should be inspected, then it should be carefully checked that all accessories are included as listed in the following table:

NO.	Item Code	Item	Specifications	Q'ty
1	C2020A-00	RWC2020A Interference Generator		1
2	2020A00-8001	Manual		1
3	6016-0001-001	MF405, SMA(M) to SMA(M) Cable	L:0.5m	2
4	6211-0002-001	SMA(F) to N(M) Adaptor		1
5	6210-0003-001	SMA(F) to RP-SMA(M) Adaptor		1
6	6112-0001-001	RJ45 Cross LAN Cable	2m	1
7	6115-0001-001	RS-232C, Data Cable	1.8m	1
8	6114-00XX-001	Power Cord		1
9	4150-0001-001	SMPS Adaptor		1

WARNING: If any damage to interior or exterior of the product is found, please stop using immediately for safety and contact to the technical support.

1.7 SMPS Adaptor

Items	Specifications
Input	AC 100-240V, 50/60Hz, 1.0A
Output	DC 12V, 3A

CAUTION: If AC power is beyond the range of operation, the adaptor may malfunction or could be permanently damaged. Main supply voltage fluctuations should be not to exceed $\pm 10\%$ of the nominal voltage.

1.8 Operating Environment

Refrain from using this equipment in a place subject to much vibration, direct sunlight, outdoor and where the flat is not level. Also, do not use it where the ambient temperature is outside 5 °C to 40 °C, and altitude is more than 2000m.

The maximum relative humidity is 80% for temperatures up to 31 °C decreasing linearity to 50% relative humidity at 40 °C. Over voltage Installation Category II for main supply. Pollution Degree 2.

The storage temperature range for this equipment is –20 °C to 70 °C. When this equipment is not used for a long period of time, store it in a dry place away from direct sunlight, covered with vinyl or placed in a cardboard box.

II. Operation

This section describes the basic concepts and details of operating RWC2020A Interference Generator. Understanding the basic concept of your RWC2020A may help you use it effectively.

- 2.1 Front Panel View
- 2.2 Rear Panel View
- 2.3 Main Screen
- 2.4 Information Screen
- 2.5 Ethernet IP Setup
- 2.6 Firmware Upgrade
- 2.7 Remote Control Interface

2.1 Front Panel View

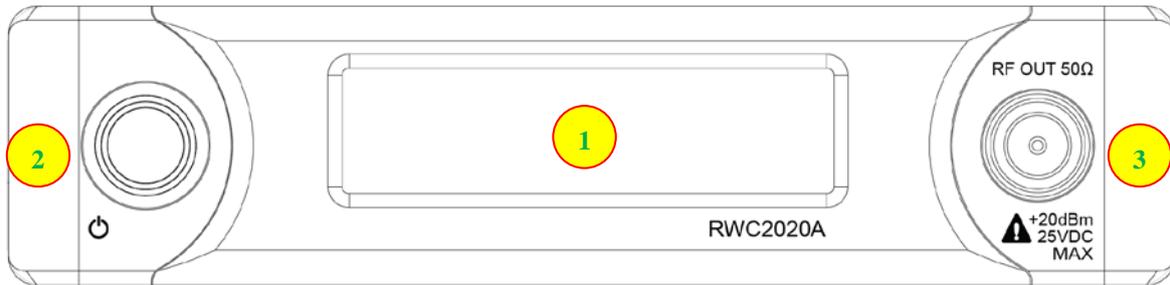


Fig 2.1 RWC2020A Front Panel View

NO	Items	Names and Descriptions
1		2.81 inch OLED Display
2		Power Switch
3		RF OUT Connector

2.2 Rear Panel View

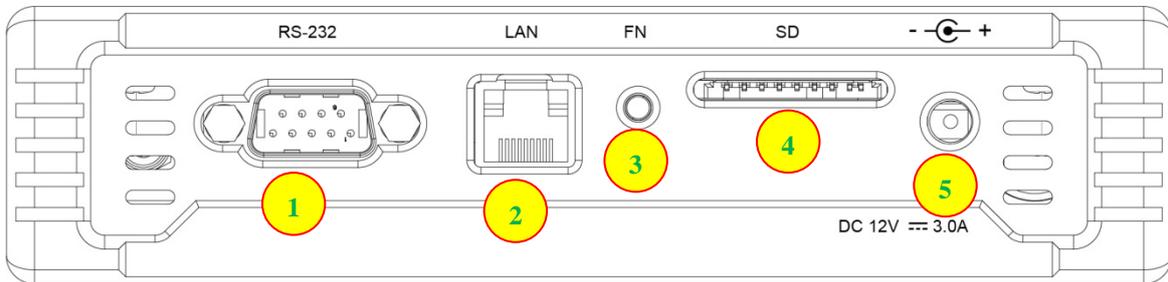
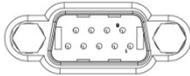
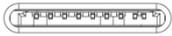


Fig 2.2 RWC2020A Rear Panel View

NO	Items	Names and Descriptions
1	<p>RS-232</p> 	RS-232C Interface
2	<p>LAN</p> 	Ethernet Interface
3	<p>FN</p> 	Function Key
4	<p>SD</p> 	SD Card Slot
5	<p>--G-- +</p> 	DC 12V/3A Power Input

2.3 Main Screen

2.3.1 Mode Switch

RWC2020A Interference Generator has four operating modes: LBT channel mode, LBT burst mode, single-tone mode, and dual-tone mode. It can be switched from one to another by changing OP_MODE in parameter setup of RWC5020A, which shall be connected with an RS-232C cable. An example screen of RWC5020A for controlling RWC2020A is shown in Fig 2.3.

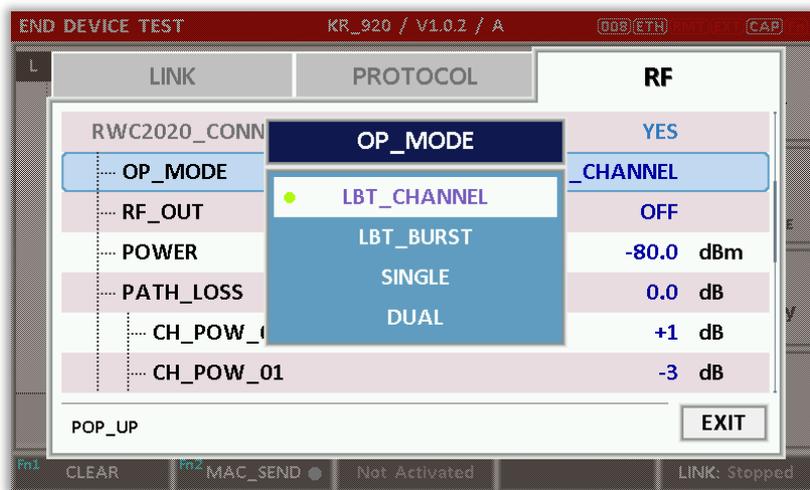


Fig 2.3 RWC5020A Screen for Controlling RWC2020A

2.3.2 LBT Channel Mode

In LBT channel mode, different power offsets can be applied to each RF channel. According to the local regulations, users can define their own test scenario by configuring power offsets and monitor the use of the channels during the specified time.

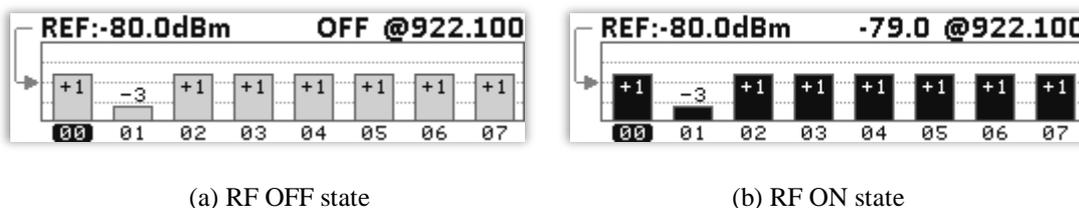


Fig 2.4 LBT Channel Mode



(a) Configuration 1 of 2



(b) Configuration 2 of 2

Fig 2.5 LBT Channel Mode Control in RWC5020A

RF_OUT

This parameter controls the status of RF TX output.

PATH_LOSS

The path loss can be measured between the RF port of RWC2020A and the RF port of DUT via an RF splitter. RWC2020A's real output power will be increased by this value to compensate the path loss.

POWER

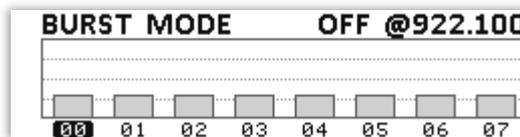
This parameter defines the reference power level to configure relative power levels with offsets.

CH_POW_01 ~ 07

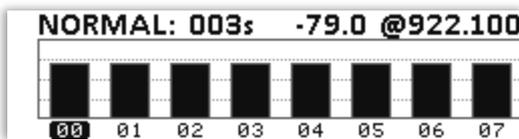
These parameters define the offset values for RF channels with respect to the reference power level.

2.3.3 LBT Burst Mode

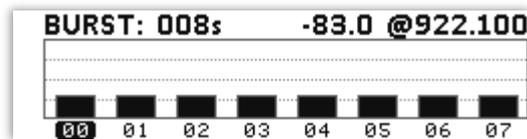
In LBT burst mode, two different power levels can be applied to all RF channels with different time intervals. One is called 'Normal' and the other 'Burst'. The existence of burst signals can be simulated with configurable power levels and time intervals.



(a) RF OFF state



(b) RF ON state – Normal



(c) RF ON state – Burst

Fig 2.6 LBT Burst Mode



Fig 2.7 LBT Burst Mode Control in RWC5020A

RF_OUT

This parameter controls the status of RF TX output.

PATH_LOSS

The path loss can be measured between the RF port of RWC2020A and the RF port of DUT via an RF splitter. RWC2020A's real output power will be increased by this value to compensate the path loss

NORMAL_POWER

This parameter defines the power level of normal state which will be applied to all channels.

NORMAL_TIME

This parameter defines the time interval of normal state to maintain the normal power level.

BURST_POWER

This parameter defines the power level of burst state which will be applied to all channels.

BURST_TIME

This parameter defines the time interval of burst state to maintain the burst power level.

2.3.4 Single-tone Mode

In single-tone mode, a continuous-wave signal can be generated which has phase noise of high performance. This mode is applicable to a variety of interference immunity tests which requires an interference signal of very low noise for sensitivity tests.



(a) RF OFF state

(b) RF ON state

Fig 2.8 Single-tone Mode



Fig 2.9 Single-tone Mode Control in RWC5020A

RF_OUT

This parameter controls the status of RF TX output.

PATH_LOSS

The path loss can be measured between the RF port of RWC2020A and the RF port of DUT via an RF splitter. RWC2020A's real output power will be increased by this value to compensate the path loss.

POWER

This parameter defines the power level of the signal.

FREQUENCY

This parameter defines the frequency of the signal.

2.3.4 Dual-tone Mode

In dual-tone mode, two continuous-wave signals can be generated. This mode is applicable to an inter-modulation immunity test which requires two interference signals to be configured for sensitivity tests.



Fig 2.10 Dual-tone Mode



Fig 2.11 Dual-tone Mode Control in RWC5020A

RF_OUT

This parameter controls the status of RF TX output.

PATH_LOSS

The path loss can be measured between the RF port of RWC2020A and the RF port of DUT via an RF splitter. RWC2020A's real output power will be increased by this value to compensate the path loss.

POWER

This parameter defines the power level of the signals.

FREQ1

This parameter defines the frequency of the first signal.

FREQ2_OFFSET

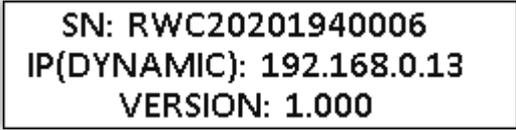
This parameter defines the frequency offset of the second signal relative to the FREQ1.

FREQ2

This parameter indicates the frequency of the second signal (display only).

2.4 Information Screen

RWC2020A provides an additional information screen for users' conveniences, which will be displayed by pressing the FN key on the rear panel. It shows its serial number, the IP address, and the firmware version. Moreover, the IP address is configurable remotely by RWC5020A.



```
SN: RWC20201940006
IP(DYNAMIC): 192.168.0.13
VERSION: 1.000
```

Fig 2.12 RWC2020A Information Screen

2.5 Ethernet IP Setup

Upgrading of RWC2020A firmware is only available through Ethernet interface, so IP configuration must be done before upgrading. IP configuration of RWC2020A is shown in RF parameter screen of RWC5020A as “IP_TYPE” and “IP_ADDR”.

“IP_TYPE” parameter can be set to DYNAMIC or STATIC; DYNAMIC means that IP address may be obtained from the DHCP server automatically, and this configuration is recommended for RJ45 connection to a network hub. STATIC means that IP address should be configured manually by users, and this configuration is recommended for direct connection between RWC5020A and a remote PC using a crossover cable.

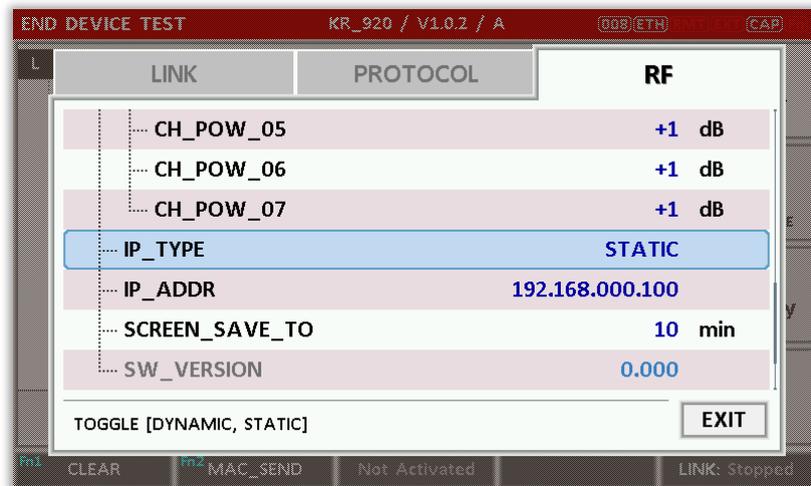


Fig 2.13 Example of STATIC IP

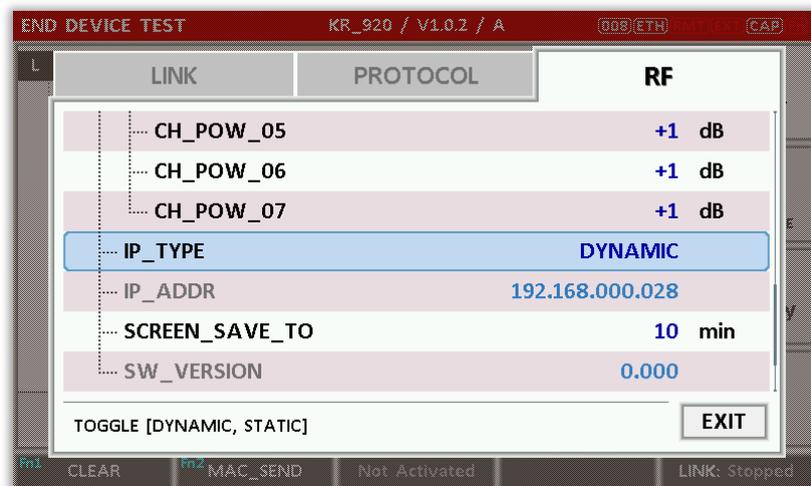


Fig 2.14 Example of DYNAMIC IP

2.6 Firmware Upgrade

As RWC2020A adapted Flash Memory, it is available to upgrade easily by using a remote PC without changing the hardware. For upgrading, 'RWC_Updater' program shall be used, which is provided together when the product is purchased or available to download the upgrade package including itself and the upgrade binary files from RedwoodComm website (<http://www.redwoodcomm.com>). The information for upgrading shall be kept being provided to the users via email or website.

Normal Firmware Upgrade Procedure

- 1) Set up Ethernet connection between RWC2020A and a remote PC, using an RJ45 cable for normal connection to a network hub or using a crossover cable for direct connection between them.
- 2) In case of direct connection using a crossover cable, IP configuration of a remote PC should be done manually as the following figure. The IP address of a remote PC shall be put with same as that of RWC2020A except the last number.

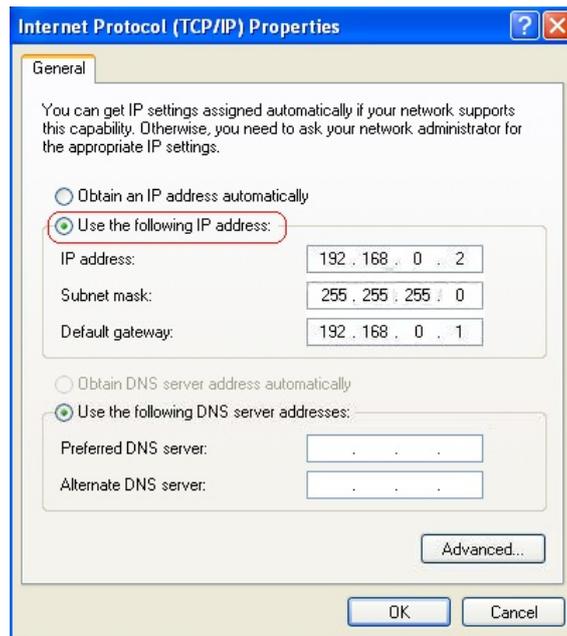


Fig 2.15 IP configuration of a remote PC

CAUTION: For reliable upgrade, it is recommended to disable all other networks (e.g. WiFi, Virtual Machine) than Ethernet network in ‘Change Adapter Settings’ of a remote PC.

- 3) After downloading upgrade files from RedwoodComm website, execute an application program for upgrading.
- 4) Set up IP address in the application program, and follow the instructions of the program.
- 5) During upgrading, RWC2020A may show the progressing information on its screen as the following figure.

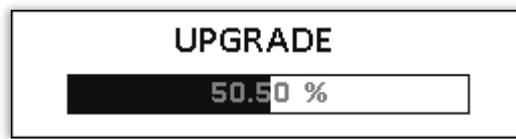


Fig 2.16 Firmware Upgrade Screen

- 6) After upgrading completed, reboot RWC2020A and check the firmware version in the information screen.

CAUTION: If upgrading fails, turn on RWC2020A in Emergency Upgrade Mode and upgrade firmware again. Refer to “Emergency Firmware Upgrade Procedure”.

Emergency Firmware Upgrade Procedure

- 1) If Normal Firmware Upgrade Procedure fails during upgrading, the internal memory may be damaged. In this case, RWC2020A may not boot correctly. Then RWC2020A must be upgraded in Emergency Upgrade Mode.
- 2) Turn off RWC2020A. While keeping FN key on the rear panel pressed, turn on RWC2020A. Then

RWC2020A will boot in Emergency Upgrade Mode as the following figure.

- 3) Make direct connection between a remote PC and RWC5020A using a crossover cable and wait until IP address of RWC2020A will be displayed on the screen.
- 4) Follow the steps 3) to 6) of Normal Firmware Upgrade Procedure.

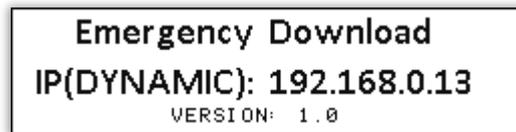


Fig 2.17 RWC2020A Boot Screen of Emergency Upgrade Mode

2.7 Remote Control Interface

RWC2020A can be controlled by RWC5020A through an RS-232C interface, so that all the necessary remote commands of RWC2020A are provided as ones of RWC5020A. Please refer to the user manual of RWC5020A to learn how to control RWC2020A remotely.

Immediately after RWC2020A is connected to RWC5020A using RS-232C cable, RWC5020A will detect RWC2020A automatically, and RWC5020A screen will show the parameters of RWC2020A.

III. Revision History

Version	Date	Description
V1.0	June 6 2019	Firmware version: V1.00 - First released