Firmware Release Note

Equipment: RWC5020A/B LoRaWAN Tester

Revision History

Version	Date	Description
V1.300	17/August/2020	**[LoRaWAN] – <mark>adaptation to TS001-1.0.4 / RP002-1.0.1</mark>** 1. Add AS923_CH_CROUP and AS923_FREQ_OFFSET parameters to accommodate country specific sub-bands. 2. DR6 and DR7 are allowed for downlink of AS923. 3. DR7 is allowed for downlink of IN865. 4. Add UL_DWELL_TIME parameter for AU915. 5. CN470 Regional Parameter has been significantly changed and are not backward compatible with previous version. - Add CH_PLAN parameter to support channel plan 20M Type A, 20M Type B, 26M Type A, and 26M Type B - Most default RF frequency values are changed according to the new spec. 6. The version display was integrated into LoRaWAN1.0.x while reflecting the changes of LoRaWAN 1.0.4. 7. Fixed to maintain the current DR when receiving LinkAdrReq with DR15. **[Pre-Certification]** 8. After running the US915 Certi item 9.4, some DUTs that have the function to turn on all RF channels automatically, may cause a problem that the next test items do not proceed normally. To avoid this, it has been modified to send the LinkADRReq to set the proper channel mask at the end of the test item 9.4. 9. Updated IN865 Certification with Ver1.1 **[RF Performance]** 10. If the DUT does not respond properly to the sensitivity test, it will auto-stop after several attempts.

		[NST] 11. For long preamble testing, the maximum value of the preamble size of NST TX has been changed from 13 to 255. 12. The RX preamble size has been added to NST RX. **[Link Analyzer]** 13. Added MIC_ERROR, XOR_MHDR, XOR_FHDR parameters to generate abnormal MAC command for malfuction test. 14. Added time stamp function to log messages 15. Added DEV_EUI on contents of Join Request message **[ETC]** 16. Added remote command for Reboot and Factory Reset. 17. Added remote command for IP setting. 18. Added protection function to reset in case of save/recall memory error.
V1.220	18/May/2020	**[LoRaWAN]** 1. The default value of the channel mask for AS923 in GWT was incorrectly set to 0x07 indicating 3 channels. Changed to 0x03 to indicate only 2 channels. **[Pre-Certification]** 2. In the SKT TC01, the DUT reset timing was not appropriate; the RWC5020x sent the reset command to the DUT even after receiving a Join-request message from DUT, causing the activation to fail sometimes. Removed unnecessary reset commands. 3. In 10.1 of US/CA915 Certification, the RX1DROffset value for DL DR setting was not correct. Fixed it. **[RF Performance]** 4. Changing TX power while the link is running caused the link to be stopped automatically. Changed to keep the link status

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even though TX power is changed.

5. In the RX sensitivity test in GWT mode, the RWC5020x counted up the number of errors even when missing a packet from the DUT. Fixed not to include the tester's fault into the test result.

6. Improved comment messages in the RX sensitivity test in GWT mode.

7. One of the scenarios for TX power measurement in EDT mode, CERTI_UL was renamed to CERTI_DL_CNT.

8. In the RX sensitivity test, a big difference between the normal link power (defined in the RF configuration) and the initial power for the RX sensitivity test could cause a DUT not to receive packets due to sudden big change of the power. Improved with a way of changing the power gradually so that the DUT can adapt.

[NST]

9. There was a problem in receiving LoRa packets caused by incorrect setting of the RX polarity and the SF. Fixed it.

10. RX packet parameters were not allowed to modify while the Signal Analyzer (NST RX function) is running. Improved it possible.

11. Removed the DUT TYPE parameter from NST TX, NST RX and MFG to avoid complexity.

12. Removed the optional DR from the RX sensitivity test in GWT mode, because an End-device cannot initiate configuration of optional DR for the link.

[Link Analyzer]

13. Increased the maximum limit of the MAC_ANS_TO from 600 to 6,000 seconds, to cope with a DUT whose UL interval is very long.

14. There was a system halt issue due to an initialization failure of the LoRa modulation chipset when the frequency band is changed from high (862~960MHz) to Low (400~510MHz).

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		Fixed it.
		15. In EDT mode, RWC5020x responded with Join-accept even for Join-request over an invalid channel. Fixed it by preventing RWC5020x from responding, and just marking the received join-request as a channel error.
		16. Added Periodic Downlink option in Class A Mode – None, Confirmed, or Unconfirmed.
		17. FPort was displayed as 000 for a packet with no payload. Changed it to be shown as "---".
		18. Even after receiving a Join-accept with the MIC error in GWT mode, the RWC5020x acted as activated by sending uplink messages. Fixed it.
		[ETC]
		19. Improved the FW upgrade function with two-step method - the FW binary data is transferred to the main processor of the tester, and it is written into the flash memory for better reliability of upgrading.
		20. In GWT mode, the downlink slot parameter had to be selected manually to RX1, RX2, or RX1&RX2 according to the test purpose. Improved the receiver performance of the RWC5020x, so that the downlink slot is fixed to RX1&RX2. Removed the downlink slot parameter.
		21. Improved the calibration function of the touch screen.
V1.210	09/Jan/2020	**[LoRaWAN]** 1. In CN470, DR5 is decoded as DR0. Fix this bug. 2. In RU864, KZ865, the default value of Ping DR is changed as DR3. **[Pre-Certification]** 3. In SKT TC05, RWC5020x sent unconfirmed ExtDevMgmt message. Change the message type as confirmed. 4. Remove SKT TX Power test which uses index 7 because of specification is changed. 5. In SKT TC01, certification was not stopped properly. Fix the

		bug.
		6. In SKT certification, DUT control method is improved for better synchronization with certification procedure.
		7. In RWC5020x Ver1.20, the minimum power index of IN Certi 9.2 was mistakenly changed from 10 to 15. It is returned to 10.
		[RF Performance]
		8. In Normal UL sensitivity test, RWC5020x sent Activate Test mode command. It is fixed to do not send Activate Test mode command in this mode.
		9. Fix the AGC problem in CW Power & Frequency Test measurement.
		[NST]
		10. Network setting had problem. It did not applied to RF correctly.
		11. Some parameters have been shared between TX/RX/MFG modes. Separate all parameters for independent set.
		[Link Analyzer]
		12. IN865 ADR_CH_MASK range was limited to 0x07. The range of this value is changed as 0x7F.
		13. Change the Maximum value of UPDATE_FCNT from 0xFFFF to 0xFFFFFFFF
		14. Fix the bug of multiple LinkADRReq in GWT. RWC5020x only applied the last LinkADRReq command.
		15. Fix the bug with applying the channel masks in US915 and AU915. The changed channel mask value was not immediately applied.
V1.200	16/Sept/2019	1st Official Firmware Release for RWC5020B
		[LoRaWAN]
		1. Add KZ865 regional parameters.
		2. Fix the Bug. In EDT mode, the first of second group UL

| | | channel should be modifiable but it showed as unmodifiable.

3. Fix the Bug. After TX power measurement was executed, SET_TEST_MODE function did not work correctly.
4. Modify Class B test scenario to use default value of PING_PERIODICITY. This value becomes editable in EDT mode from this version
5. Increase Maximum number of UL channel from 7 to 8 for EU868 region in EDT mode
6. Increase Maximum number of UL channel from 6 to 7 for IN865 region in EDT mode
7. Add AS923CH_MODE parameter to select AS923 band(AS920-923, AS923-925)
8. Channel number was fixed for optional DR. From this version, the channel number for optional DR is editable.
9. Change Pop-up value list of ADR_DR for LINK_ADR MAC Command in EDT from [DR_0, DR_1, DR_2, DR_3, DR_4, DR_5, DR_6, DR_7] to [DR0_SF12BW125, DR1_SF11BW125, DR2_SF10BW125, DR3_SF9BW125, DR4_SF8BW125, DR5_SF7BW125, DR6_SF7BW250, DR7_FSK50].
10. Allow to transmit DL packet in beacon guard time in class B mode

[Pre-Certification]
11. Add option for US915 certification 2.1 and 2.2 to skip checking alternatively using BW125 and BW500 BW for Join request.
12. In India Certi 10.1 for RX Parameter setup testing, RX2 frequency value is changed from 867550000Hz to 866750000Hz.
13. In India Certi 15.2 for oversized payload testing, DLcounter value is ignored to check Pass/Fail verify.
14. In US Certi 3.1 for Channel Plan and usage, RWC5020A/B waited up to 40 packets to check channel usage. But Certi spec requires wait just 2 times of channel number then number of waiting packets is reduced to 16. It becomes |

		tighter.
		15. In US Certi 12.2 for Uplink-oversized payloads via Echo, RWC5020A/B checked Downlink Counter value for verdict. From this version, RWC5020A/B does not use Downlink Counter value for verdict because the Certi spec is not clear.
		16. In US Certi 9.2 TxPower, user can select power index range from this version. Old spec uses from 0 to 10 index range, but new spec uses from 0 to 14 index range.
		17. In US Certi 9.2 TxPower, RWC5020A/B did not measure TX power to check power difference between max index and min index. It was the bug and fixed in this version.
		[RF Performance]
		18. Target Channel Mask parameter in GWT is removed.
		[NST]
		19. Reduce the minimum time interval (50ms → 10ms) between packets in NST TX and MFG to improve test speed.
		20. Add Remote command for NST and MFG test function
		[Link Analyzer]
		21. Multiple MAC command function in GWT mode becomes available.
V1.170	17/June/2019	**[LoRaWAN]**
		[Pre-Certification]
		1. Improve EU10.2 certification procedure to verify behavior of confirmed uplink retransmission with NAK reply and without any response.
		2. Fixed the bug by adding NewChannelReq procedure in IN13.1 certification for FSK PER testing.
		[RF Performance]
		3. In TX Power measurement, added the parameter to set the

		minimum number of packets per channel [3~100].
		4. In Scenario of sensitivity, DL_CNT mode is added. In this mode RWC5020A uses DLcounter packets to test PER.
		5. DL channel frequency parameters are added to modify downlink frequency in sensitivity of EDT.
		6. Target channel mask parameter is added in sensitivity test of GWT.
		7. Change Pop-up value list of UPLINK_DR, RX2_DR, PING_DR, BEACON_DR, REJOIN_DR parameters from [DR_0, DR_1, DR_2, DR_3, DR_4, DR_5, DR_6, DR_7] to [DR0_SF12BW125, DR1_SF11BW125, DR2_SF10BW125, DR3_SF9BW125, DR4_SF8BW125, DR5_SF7BW125, DR6_SF7BW250, DR7_FSK50].
		8. Combine Power channel and Power time screen into Power measure screen. In this single screen, user can select one of power channel and power time mode.
		9. Added TX Power measure scenario to measure TX power of DUT in specific scenarios.
		[NST]
		[Link Analyzer]
		10. Add CONF:LINK:ABNORMAL remote command for abnormal behavior testing like NO_RSP, MIC_ERR, etc....
		11. Modify PING_FREQ, PING_DR, BC_FREQ, CW_TIMEOUT, CW_FREQ, CW_POWER, ECHO_LEN parameters as array type for multi mac command function with different setting value.
		12. Delete CONF:LINK:BEACON:DR, READ:LINK:BEACON:DR? remote command
		13. Add READ:RF:PING_FREQ?, READ:RF:PING_DR?, READ:RF:BC_FREQ?, READ:RF:BC_DR?
		14. Add CONF:LINK:RX2_FREQ, READ:LINK:RX2_FREQ?, CONF:LINK:RX2_DR, READ:LINK:RX2_DR?, CONF:LINK:RECEIVE_DELAY, READ:LINK:RECEIVE_DELAY?
V1.160	12/APR/2019	**[LoRaWAN]**
		1. Chang the default DEV_ADDR value from 0 to 1.
		[Pre-Certification]
		2. Warning message was not appropriate when DUT cannot

		receive Join accept message in US Cert 2.1
		3. In US Cert 4.3, RWC5020A checked ACK flag only in DLcounter packet. If DUT transmitted ACK flag using other packets, RWC5020A ignored. It is fixed to check any kind of packets.
		4. Chang the Max DR value from 7 to 5 in AS Cert 10.2 & 10.4
		[RF Performance]
		5. The TX power measurement function had an error that only worked when the EU Certi option was present.
		[NST]
		[Link Analyzer]
		6. Added function to modify foption field for customer MAC command.
		7. For Class B testing in GWT mode, several scenarios are required to create Class B connection. In previous version, RWC5020A sent User MAC command with Class B flag. The RWC5020A now uses LinkCheckReq MAC command for Class B switching.
V1.150	15/DEC/2018	**[LoRaWAN]**
		1. Changed to display all of KEY and EUI values regardless of activation mode.
		2. Fixed a bug of NETWORK parameter setting. Sometimes, NETWORK parameter was not applied to RF signal.
		3. Added NTT operator to AS923 and LIANSHU operator to CN470.
		[Pre-Certification]
		4. Some DUT transmit confirmed DLcounter packets after enabling test mode. EU Cert 15.12 Redundancy test item must be tested with unconfirmed DLcounter packets. So it is improved to transmit Unconfirmed frame command at the beginning stage of this Certification test.
		5. Fixed a bug of Echo response decoder. When DUT re-transmit Echo response, RWC5020A displayed it as another type of command instead of Echo response.
		[RF Performance]
		6. Added receiver sensitivity test mode for Class B. If the class is

		set as B, RWC5020A uses ping slot for PER testing. 7. Fixed a bug in RX sensitivity test by checking ACK flag too when DUT sends Confirmed UL message periodically. In previous version, only FCnt value was checked for error counting. 8. Extended the range of TIME_OFFSET value to +/- 10ms. 9. Added TX power measurement with Normal UL mode. 10. Improved to display comment messages while RX sensitivity test is running. **[NST]** 11. Fixed a bug of SF in MFG. If SF set as ANY, RWC5020A should have received any type of SF from DUT. **[Link Analyzer]** 12. Added Remote commands (READ:LINK:MAC_SEND_STATUS?, READ:LINK:MAC_SEND_RESULT?) to read MAC command transmission status and result.
V1.140	10/OCT/2018	**[LoRaWAN]** 1. Improved Class B operation by compatibility test with real Class B products. In Link Analyzer, graphical display was added for understanding of Class B operation. In End Device Test, downlink packets can be transmitted periodically via ping slots. 2. Added a special downlink channel other than RX1 and RX2 in Class C, named as RX_C. 3. Renamed channel plan of regional parameters as common name defined in LoRaWAN Regional Parameters v1.0.3. 4. Fixed a bug of decryption in case MAC command is contained in FOption field. 5. Updated definition of UL DR in AU915 by adding SF12 and SF11. 6. Applied Effective_RX1DROffset (RX1DROffeset is 6 or 7) for AS and IN regions. **[Pre-Certification]** 7. Added test cases for optional DR (SF7BW250, FSK50)

		[RF Performance] 8. Changed PER test item from SF to DR and added optional DR. 9. Added 500kHz uplink channel for receiver sensitivity test for Gateway Test 10. Added ANY as a type of SF in MFG test, in order to make it possible to receive any type of SF which DUT sends. So the SF of test packets can be determined same as the one of START FLAG packet of DUT. Added FSK modulation. 11. Fixed a bug in TX power measurement by eliminating the first unexpected power measurement. **[NST]** 12. Added ANY as a type of SF in NST RX, the tester can receive any type of SF using 125kHz BW. 13. Added FSK modulation. **[Link Analyzer]** 14. When MAC command is selected as USER_DEFINED, CMD FIELD is restricted to PAYLOAD. 15. In case MAC command is contained in FOption field, { } is used in command name to distinguish. 16. Removed SET_CH_MASK parameter, which was applicable only to 64 channels of US915 and AU915 and became useless.
V1.130	19/JUL/2018	**[LoRaWAN]** 1. Certified by LoRa End Device Certification EU868 2. Certified by LoRa End Device Certification KR920 3. Support of LoRaWAN V1.0.3 4. Support of Russian regional parameters **[Pre-Certification]** 5. Implemented updated versions of LoRaWAN Certifications; US V1.3, KR V1.2, AS V1.1 and IN V1.0 (new) 6. Fixed a bug in case of PACKET_NUM less than 10 in US Pre-Certification 10.1 and 10.2 Receive Window Tests. 7. Fixed a bug of tester reset in case when the tester receives Join-request message again from DUT in OTAA test 8. Implemented additional test items for SKT 41 to 46

		[RF Performance] 9. Improved TX Power measurement of DUT in RF Performance Test by adding CW mode, which is the same way as used in LoRaWAN RF Performance Test 10. Added MFG function for fast receiver sensitivity tests in NST mode, applicable to manufacturing lines **[NST]** 11. Fixed bugs of running status in Signal Analyzer of NST 12. Disabled automatic running of Signal Analyzer in NST mode due to inconvenience **[Link Analyzer]** 13. Added a function of Periodic Downlink in Class C mode of EDT 14. Added the stop function of MAC command transmission 15. Added calculation of dwell time in Link Analyzer 16. Implemented reply retransmission of RxParamSetupAns, RxTimingSetupAns, and DlChannelAns in case of absence of a downlink message 17. Renamed a parameter SET_TM_AT_OTAA as SET_TEST_MODE and moved to sub-parameter of ACTIVATION 18. Renamed a parameter SET_CH_AT_OTAA as SET_CH_MASK and moved to sub-parameter of ACTIVATION, shown only in case of US915 region
V1.120	25/APR/2018	1. Added a standard test solution for manufacturing lines to test TX and RX of devices simultaneously 2. Verified and improved all test procedures of EU, US/CA, AS, and KR Certification Tests based on comparison of KR Certification with other test lab 3. Modified default channel frequencies of Europe to be matched with the local regulation 4. Changed the max number of channels supported in Europe and India to 7 due to limitation of hardware. 5. Added MAC commands related with certification test mode; COMFIRMED_TM, UNCONFIRMED_TM, ECHO_REQUEST_TM,

		TRIGGER_JOIN_REQ_TM, and ENABLE_CW_MODE_TM 6. Added a function of duty cycle measurement in EDT Link Analyzer 7. Added protocol parameters in Link Analyzer screen for users' convenience such as DR, RxDelay, ADRACKReq and FPending 8. Minor bug fixes and updates
V 1.110	20/MAR/2018	1. Improved Signal Generator and Signal Analyzer of NST; providing various configurable MAC parameters in order to send and receive LoRaWAN frames 2. Enabled modification of part of channel frequencies; the first frequency of the second channel group (4~7) can be modified 3. Added more commands in MAC command transmission: *ForceRejoinReq*, *RejoinParamSetupReq*, and *ADRParamSetupReq* for EDT; *ResetInd* for GWT. 4. Added display of Activation status at the bottom of the screen 5. Minor bug fixes and updates
V 1.100	22/DEC/2017	1. Support of LoRaWAN V1.1 2. Changed Class B operation to match with LoRaWAN V1.0.2classB-draft4 3. Improved control of minimum TX power level for DUT's RX sensitivity test - the minimum TX power is -150dBm 4. Added a flag to determine whether to force DUT to enter Test Mode by sending *Activate Test Mode* command actions after activation 5. Added a flag to determine whether to configure channel masks by sending multiple *LinkADRReq* commands actions after activation 6. Added a flag to determine whether to display erroneous frames in Link Analyzer screen
V 1.060	08/NOV/2017	1. Release of implementation of Certification Tests - Final version of implementation for US/CA V1.2

		2. Support of Class B in LoRaWAN V1.0.2
		
		3. Included V1.051 patch
		   - fixed bugs in implementation of Certification EU V1.5 in Firmware version of V1.05
		
		4. Added display items in Link Analyzer
		   - Measured power, ADR flag, and Class B flag
		
		5. Changed position of contents in Link Analyzer
		   - from right column to bottom
		
		6. Enhanced functionality and stability of RF performance test (receiver sensitivity and TX power)
		
		7. Added or modified remote control commands (refer to the version history in User Manual)
		
		8. Minor bug fixes and updates

V 1.050	13/SEP/2017	1. Release of implementation of Certification Tests
		   - Final version of implementation for EU V1.5, AS V1.0 and KR V1.1
		   - draft version of implementation for US/CA V1.2
		
		2. In GWT, RF channels are fully are supported up to 64+8 channels for US/CA 915 and AU 921, and up to 96 channels for CN 490.
		
		3. Improved a function of MAC commands transmission
		   - Support for multiple MAC commands in a single frame
		   - Added commands: DL_CHANNEL, ACTIVATE_TM, DEACTIVATE_TM
		
		4. Added or modified remote control commands (refer to the version history in User Manual)
		
		5. Improved RF Performance Test function
		   - Test Scenario: Normal Uplink or CERTI_ECHO
		   - Gateway testing available
		   - TX Power measurement according to TXPower index
		   - More reliable by using ACK flag instead of FCntUp
		
		6. Added parameters to control timing offset in us and frequency offset in ppm.
		
		7. Modified the concept of Channel Group from one group with

		8 channels to two groups with 4 channels respectively, named as CH_GROUP_A and CH_GROUP_B, in cases of US/CA 915, AU 921 and CN 490.

V 1.040	01/AUG/2017	1. Class C support
		2. Fixed bugs in implementation of LoRaWAN Certification EU V1.2
		3. Improved Sensitivity Test function
		   - adding Test mode method using Echo Request
		   - selecting RX window and DR
		4. Fixed a bug in measuring power of unconfirmed frames
		5. Improved the minimum of TX power level down to -143dBm
		6. Renamed remote commands for transmission of MAC commands according to hierarchy structure
		7. Minor fixes and updates

V 1.030	04/JUL/2017	1. Fixed bugs in execution of EU Certification Tests 2. Added channel group function 3. Fixed a bug of mis-handling RX1DELAY value 4. Added 'M' field to indicate MTYPE in Link Analyzer and renamed MAC commands to follow the definition of LoRaWAN Spec. 5. Updated a remote command for reading of link messages 6. Added 'PREAMBLE_TYPE' parameter in NST mode 7. Added selection of downlink messages in EDT Sensitivity Test; ACK or user-defined data 8. Added and improved 'pre_alc_calibration' function in normal mode to guarantee the stability of TX power level
V 1.010	07/JUN/2017	1. Added an optional function of SKT Certification Profile (partly verified) 2. Modified the unit for input of path loss and TX power 3. Changed pictures of Main Menu 4. Re-arranged Signal Generator function in NST 5. Defined remote commands fully

		6. Verified Save/Recall functions 7. Updated User Manual
V 1.00	31/MAY/2017	1st Official Firmware Release