

SMART Modular Technologies

LoRa[®] AT Command Manual

Revision History

Date	Description
August 21, 2019	Initial release.
May 27, 2020	Added Factory reset command, network join mode, and reboot for the update in region

Contents

1.	FEATURES	1
2.	APPLICATIONMODEL.....	2
3.	SERIAL PORT SETUP	2
4.	COMMANDFORMAT	2
4.1.	FORMATTING RULES FOR CHARACTER STRING COMMAND	2
4.2.	STATUS STRINGS FOLLOWING COMMAND EXECUTION	3
4.3.	COMMANDATTRIBUTES	3
5.	AT COMMAND USAGE SCENARIO	4
5.1.	INITIAL JOIN REQUEST TO NETWORK SERVER OVER THE AIR ACTIVATION(OTAA)	4
5.2.	DATA TRANSFER DURING SERVER CONNECTION (UPLOAD, DOWNLOAD)	5
5.3.	ENTERING SLEEP MODE AND WAKING UP FROM SLEEP MODE	7
5.4.	P2PCOMMUNICATION	8
6.	ACTIVATIONCOMMAND.....	10
6.1.	COMMAND TABLE	10
6.2.	COMMAND DETAIL	10
6.2.1.	AT+DEVEUI	10
6.2.2.	AT+APPEUI	11
6.2.3.	AT+APPKEY	11
6.2.4.	AT+PNM	12
6.2.5.	AT+NJM	12
6.2.6.	AT+CLASS	14
6.2.7.	AT+JOIN	15
6.2.8.	AT+NJS	15
6.2.9.	AT+AJOIN	15
6.2.10.	AT+NWKSKEY	16
6.2.11.	AT+APPSKEY	16
6.2.12.	AT+DADDR	17
6.2.13.	AT+NWKID	17
6.2.14.	AT+AINF	18
7.	UP/DOWN LINK COMMAND	19

7.1.	COMMANDTABLE	19
7.2.	COMMANDDETAIL	19
7.2.1.	AT+SEND	19
7.2.2.	AT+SENDB	20
7.2.3.	AT+RECV.....	20
7.2.4.	AT+RECVB	21
7.2.5.	AT+RSSI	21
7.2.6.	AT+SNR	22
8.	LORAMACCONFIGURECOMMAND	23
8.1.	COMMANDTABLE	23
8.2.	COMMANDDETAIL	23
8.2.1.	AT+REGION	23
8.2.2.	AT+ADR	24
8.2.3.	AT+DR	25
8.2.4.	AT+RX2FQ	26
8.2.5.	AT+RX2DR	26
8.2.6.	AT+RX1DL.....	27
8.2.7.	AT+RX2DL.....	27
8.2.8.	AT+JN1DL	28
8.2.9.	AT+JN2DL	28
8.2.10.	AT+MUFR	29
8.2.11.	AT+MCFR.....	29
8.2.12.	AT+TXP	30
8.2.13.	AT+FCU.....	31
8.2.14.	AT+FCD.....	31
8.2.15.	AT+BAT.....	32
8.2.16.	AT+LCHK.....	32
8.2.17.	AT+CRYPTO	33
8.2.18.	AT+CH	33
9.	SYSTEMCOMMAND.....	35
9.1.	COMMANDTABLE	35
9.2.	COMMANDDETAIL	35

9.2.1.	AT+RESET	35
9.2.2.	AT+SINF	36
9.2.3.	AT+VER.....	36
9.2.4.	AT+SAG	37
9.2.5.	AT+CFM.....	37
9.2.6.	AT+SLEEP	38
9.2.7.	AT+ALARM	38
9.2.8.	AT+TIME.....	39
9.2.9.	AT+DATE	40
9.2.10.	AT+ECHO	40
9.2.11.	AT+FRESET	41
10.	DEBUGCOMMAND.....	42
10.1.	COMMAND TABLE	42
10.2.	COMMANDDETAIL	42
10.2.1.	AT+DBG	42
10.2.2.	AT+TXCW	43
10.2.3.	AT+RXTT	43
10.2.4.	AT+TXTT	44
10.2.5.	AT+TSTP	44
10.2.6.	AT+GPIO.....	45
11.	P2PCOMMAND.....	46
11.1.	COMMAND TABLE	46
11.2.	COMMANDDETAIL	46
11.2.1.	AT+P2PCH	46
11.2.2.	AT+P2PDA	47
11.2.3.	AT+P2PSW.....	47

1. FEATURES

- Powered by MS500, the Ultra-Low Power Advanced Security MCU
 - Cortex M0
 - Hardware Security system.
- SEMTECH SX1276 radio transceiver supporting LoRa.
 - Receiver Sensitivity up to -136 dBm
 - Frequency Range: 920 – 923 MHz (Korea), 923 (Japan/Asia), 863 – 870 MHz (EU), 902 – 928 MHz (North America), 865 – 867 MHz (India)
 - Up to 14 dBm Output Power
 - LoRa Alliance Certified
- UART Communication Interface
 - AT+Command set support for LoRaWAN
- LoRaWAN Certified
 - KR920-923 (Korea), AS923 (Japan/Asia), EU863-870 (Europe), US902-928 (US,Canada)

2. APPLICATION MODEL

- SMW-SX1276M0

3. SERIAL PORT SETUP

Port Setup Information	
Baud Rate	115200
Data	8 bit
Parity	None
Stop	1 bit
Flow Control	None

4. COMMAND FORMAT

4.1. FORMATTING RULES FOR CHARACTER STRING COMMAND

- 1) Command Line terminates either in <CR> or <LF>.
- 2) Command Parameter is defined by a Blank Character.
- 3) Command Parameter is separated by the symbol <,> as described below.

→ CR + LR + '<' + "OK or an error string" + '>' + CR + LR

4.2. STATUS STRINGS FOLLOWING COMMAND EXECUTION

- All commands return with one of the following four status strings after execution as shown below.

Syntax	Command
<OK>	Command executed successfully
<Failed>	Command failed to execute
<Failed : "Error Character String">	"Error Character String" Command failed to execute
<Command Not Found>	Command is Not Found.

4.3. COMMAND ATTRIBUTES

- All Commands have one or more of the following attributes.

Syntax	Command
R	Command to read out data and/or to monitor system status
W	Command to Write and/or to control system status
F	Command to store configuration in Flash memory
+	Reset the module after system control command is executed
E	Asynchronous Event (for example when data is received)

5. AT COMMAND USAGE SCENARIO

5.1. INITIAL JOIN REQUEST TO NETWORK SERVER OVER THE AIR ACTIVATION (OTAA)

- To be connect to a LoRa network server, the device EUI information of the node device (module) must be sent to the server company, and in return, the server company must provide Application EUI (AppEUI) and Application KEY (AppKEY) to each node.

- Device EUI of the Node can be obtained by using AT+Command (see below), or from module label.

```
AT+DEVEUI
0000000000000001
<OK>
```

- Received AppEUI and AppKey are stored in the Node device (Module) by using the following AT+Command.

```
AT+APPEUI 70b3d57ed0010e4f
<OK>
AT+APPKEY de52ddd16146079649c89a0c1bd9eae5
<OK>
```

- Execute AT+JOIN command to join the server. The connection status can be checked in the resulting Log file. It can also be confirmed by running AT+NJS command.

```
AT+JOIN
Send JOIN_REQ Port 0 Size 0 Adr 1 AdrAckReq 0 Ack 0 Cnt 0
00:00:19.925 TxConfig ch922500000 pwr 14 bw 0 sf7

<OK>
00:00:20.001 TxDone
00:00:24.974 RxConfig ch 922500000 bw 0 sf7
00:00:26.037 RxConfig ch 921900000 bw 0 sf12
00:00:27.072 TxConfig ch 922100000 pwr 14 bw 0 sf7
00:00:27.148 TxDone
00:04:42.642 RxConfig ch922100000 bw 0 sf7
Rx1 JOIN_ACCEPT size 33 rssi -88 snr 24 Rx1DrOffset 0 RxDelay1 1000 Rx2Dr 0

[EVENT] JOINED <- An Event Message is generated when the server connection is completed.
AT+NJS <- To monitor the Join status to the server
1 <- (0: not connected, 1: connected)
<OK>
```

- 4) AT+command, as shown below, is used to setup mode automatically during the boot mode of the module.

```
AT+AJOIN 1 <- set "1"
<OK>
AT+RESET <- Reset (Reboot) the Module
*
Boot by CPU
OTAA KR920
Boot completed <- Message indicating the Booting is completed
* an Attempt to auto Join as shown below.

Send JOIN_REQ Port 0 Size 0 Adr 1 AdrAckReq 0 Ack 0 Cnt 0
00:07:34.585 TxConfig ch 922500000 pwr 14 bw 0 sf7
00:07:34.660 TxDone
AT+A00:07:39.644 RxConfig ch 922500000 bw 0 sf7
Rx1 JOIN_ACCEPT size 33 rssi -88 snr 26 Rx1DrOffset 0 RxDelay1 1000 Rx2Dr 0
[EVENT] JOINED <- Join is completed
```

5.2. DATA TRANSFER DURING SERVER CONNECTION (UPLOAD, DOWNLOAD)

- 1) Uplink : Send Data from the Node to Network server

```
AT+SENDB 2:1100ff <- Send the 3 Byte Hexadecimal [ 11, 00, ff ] data to Port #2
Send UNCONFIRMED_UP Port 2 Size 3 Adr 1 AdrAckReq 0 Ack 0 Cnt 0
00:16:37.677 TxConfig ch 922100000 pwr 14 bw 0 sf12

<OK>
00:16:39.009 TxDone
00:16:40.035 RxConfig ch 922100000 bw 0 sf12
00:16:41.046 RxConfig ch 921900000 bw 0 sf12
```

2) Downlink : Confirming the data sent from a network server to a Node

Under the default Class A, Uplink data must be sent to Server in order to receive data at a Node,

```
AT+SEND 2:hello -> Send Text Data "hello" to Port #2
Send UNCONFIRMED_UP Port 2 Size 5 Adr 1 AdrAckReq 0 Ack 0 Cnt 1
00:18:36.373 TxConfig ch 923100000 pwr 14 bw 0 sf12

<OK>
00:18:37.705 TxDone
00:18:38.720 RxConfig ch 923100000 bw 0 sf12
00:18:39.732 RxConfig ch 921900000 bw 0 sf12

Rx2 UNCONFIRMED_DOWN size 16 rssi -91 snr 29 Adr 0 AdrAckReq 0 Ack 0 Cnt 0

[EVENT] RECVB 1:aabbff <- Received the 3 Byte Hexadecimal data [ aa,bb,ff] from server to Port #1
AT+RECVB <- To confirm the received downlink data
1:aabbff

<OK>
AT+RECVB <- Once confirmed, the received data is removed. Thus, no output.
1:

<OK>
```

5.3. ENTERING SLEEP MODE AND WAKING UP FROM SLEEP MODE

- When there is no activity after connecting to the network server, set the device in Sleep mode to save battery power

1) Wake up the module by RESET signal after entering sleep mode

```
AT+SLEEP <- Command to Enter Sleep Mode
[EVENT] SLEEP <- Message indicating Entering Sleep Mode is completed

*
Wakeup by RESETN <- Message indicating the Wake up by RESET
OTAA
KR920
Wakeup completed <- Message indicating Wake up is completed
```

2) Wake up by setting the RTC Alarm

```
AT+ALARM 5 <- Set to Wake up, 5 second after entering Sleep Mode

<OK>

AT+SLEEP <- Command to Enter Sleep Mode
[EVENT] SLEEP <- Entering Sleep Mode is completed

*
Wakeup by RTC <- Message indicating Wake Up by RTC
OTAA
KR920
Wakeup completed <- Message indicating Wake Up is completed
```

5.4. P2P COMMUNICATION

The P2P communication stands for “Point to Point” communication where two End Nodes can establish a communication channel without the involvement of a gateway or a server.

In terms of configuring the node devices to P2P mode, the “join mode” of the two nodes (i.e. node A and node B) should be set to 2 (i.e. P2P). Next, the device address value of one node should be used to set the P2P device address value of the other node, and vice versa. For example, the node A’s P2P device address (P2PDA) should be set with the device address value of the node B (DADDR), and likewise, the node B’s P2P device address should be set with the device address value of the node. In order to start the P2P communication, the session keys (Network Session Key and Application Session Key) must be set with the same value at both nodes. The data communication starts after the node devices are rebooted..

- Configuration of Node A)

AT+NJM 2 ← Configure the Node A to P2P Join Mode

[EVENT] JOINED

<OK>

AT+DADDR 00000001 ← Configure Node A’s own address (value =00000001)

<OK>

AT+P2PDA 00000002 ← Configure the P2P device address with Node B’s address (value =00000002)

<OK>

AT+NWKSKY 00000000000000000000000000000000c ← Set NwkSkey (Use the same key value as Node B)

<OK>

AT+APPSKEY 00000000000000000000000000000000b ← Set AppSkey (Use the same key value as Node B)

<OK>

AT+RESET

*

Boot by CPU

P2P ← Boot at P2P Mode

KR920

06:57:38.248 RxConfig ch 922100000 bw 0 sf 12

Boot completed

AT+SEND 5:helloB ← Data is Transfer to Node B

Send UNCONFIRMED_DOWN Port 5 Size 6 Adr 0 AdrAckReq 0 Ack 0 Cnt 1

07:21:33.437 TxConfig ch 922100000 bw 0 sf 12 pwr 14

<OK>

-Node B)

```
AT+NJM 2 ← Configure the Node B to P2P Join Mode

[EVENT] JOINED

<OK>

AT+DADDR 00000002 ← Configure Node B's own address (value =00000002)

<OK>

AT+P2PDA 00000001 ← Configure the P2P device address with Node A's address (value =00000001)

<OK>

AT+NWKSKEY 00000000000000000000000000000000c ← Set NwkSkey (Use the same key value as Node A)

<OK>

AT+APPSKEY 00000000000000000000000000000000b ← Set AppSkey (Use the same key value as Node A)

<OK>

AT+RESET

*

Boot by CPU

P2P ← Boot at P2P Mode

KR920

06:57:38.248 RxConfig ch 922100000 bw 0 sf 12

Boot completed

Rx1 UNCONFIRMED_DOWN size 19 rssi -83 snr 24 Adr 0 AdrAckReq 0 Ack 0 Cnt 1 Len 6

[EVENT] RECVB 5:68656c6c6f42 ← Data is received

07:28:47.695 RxConfig ch 922100000 bw 0 sf 12

AT+RECV

5:helloB ← "helloB" is confirmed received

<OK>
```

6. ACTIVATION COMMAND

6.1. COMMAND TABLE

Table 1 Activation Command Table

AT Command	Description	Reference
AT+DEVEUI	End-device identifier	6.2.1
AT+APPEUI	AppEUI is a global application ID	6.2.2
AT+APPKEY	Application key	6.2.3
AT+PNM	Public Network Mode Status	6.2.4
AT+NJM	Network Join Mode	6.2.5
AT+CLASS	LoRa Mac Class	6.2.6
AT+JOIN	Execute JOIN request for LoRa Network Server	6.2.7
AT+NJS	Join (Network Server Connection) Status	6.2.8
AT+AJOIN	Execute auto JOIN after the booting	6.2.9
AT+NWKSKY	Network Session Key	6.2.10
AT+APPSKEY	Application Session Key	6.2.11
AT+DADDR	Device Address(4byte)	6.2.12
AT+NWKID	Returns Network ID (4 Byte)	6.2.13
AT+AINF	Returns Activation setting value	6.2.14

6.2. COMMAND DETAIL

6.2.1. AT+DEVEUI

- End-device identifier in IEEE EUI64 address space (Provided by the Module Manufacturer)
- 16 Hex Digit (8byte)

Table 2 AT+DEVEUI

Syntax	Operation	Remark
AT+DEVEUI	R	Readout the current value of DevEUI
		[Example] AT+DEVEUI 0000000000000001 <OK>
	WF	Update DevEUI with the specified value and store it in secure storage (in Flash memory)
		[Format] : AT+DEVEUI <devEUI> <ENTER> [Example] AT+ DEVEUI 0000000000000001 <OK>

6.2.2. AT+APPEUI

- The AppEUI is a global application ID in IEEE EUI64 address space (Provided by the Lora Network Supplier)
- 16 Hex digit (8 Byte) input and output.

Table 3 AT+APPEUI

Syntax	Operation	Remark
AT+APPEUI	R	Readout the current value of AppEUI
		[Example] AT+APPEUI 70b3d57ed0010e4f <OK>
	WF	Update AppEUI with the specified value and store it in secure storage (in Flash memory)
		[Format] : AT+APPEUI <AppEUI> <ENTER> [Example] AT+ APPEUI 70b3d57ed0010e4f <OK>

6.2.3. AT+APPKEY

- To read out the Application key (AppKey). The AppKey is an AES-128 root key specific to the end-device (Provided by the Lora Network Supplier).
- 32 hex digit (16 Byte) input and output.

Table 4 AT+APPKEY

Syntax	Operation	Remark
AT+APPKEY	R	[Example] AT+APPKEY de52ddd16146079649c89a0c1bd9eae5 <OK>
	WF	Update Application Key (16 Byte) with the specified value (ABP only) and store it in secure storage (in Flash memory).
		[Format] : AT+APPKEY <AppKey> <ENTER> [Example] AT+APPKEY de52ddd16146079649c89a0c1bd9eae5 <OK>

➤ **Note)** AppKey : 32 hex digit (16Byte)

6.2.4. AT+PNM

- Public Network Mode Status
 - % Under the Lora Network (Server) Policy.

Table 5 AT+PNM

Syntax	Operation	Remark
AT+PNM	R	Readout the current setting value of Public Network Mode
		[Example] AT+PNM 1 <OK>
	WF	Update the setting value of Public Network Mode with the specified value
		[Format] : AT+PNM <0 1> <ENTER> [Example] AT+PNM 0 <OK>

- **Note)** 0 : Public Network OFF
 1 : Public Network ON (Default)

6.2.5. AT+NJM

- Command for Network Join Mode Setting, Reboot after the setting is updated and stored.

Table 6 AT+NJM

Syntax	Operation	Remark
AT+NJM	R	Return with current setting value of Network Join Mode
		[Example] AT+NJM 1 <OK>
	WF	Update Network Join Mode Setting with the specified value
		[Format] : AT+NJM <0 1> <ENTER> [Example] AT+NJM 1 * Boot by CPU OTAA KR920 Boot completed F/W VERSION : 0.15 DEVICE EUI : 50f8a50000010099

- **Note)** 0: ABP
1: OTAA (Default
2:P2P

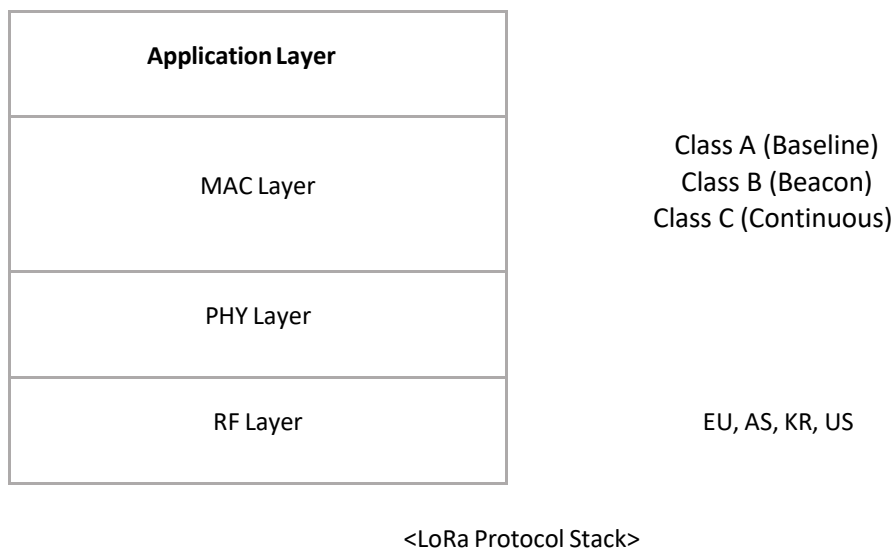
6.2.6. AT+CLASS

- The Command for setting the LoRa MAC Class

Table 7 AT+CLASS

Syntax	Operation	Remark
AT+CLASS	R	Return with current setting value of LoRa MAC Class
		[Example] AT+CLASS A <OK>
	WF	Update the LoRa MAC CLASS with the specified value
		[Format] : AT+CLASS <LoRa MAC Class> <ENTER> [Example] AT+CLASS C <OK>

- Note)** LoRa MAC Class : A(Default), B, or C



6.2.7. AT+JOIN

- Command to Join LoRa Network Server

Table 8 AT+JOIN

Syntax	Operation	Remark
AT+JOIN	W	Join Request command to LoRa Network Server
		[Format] : <u>AT+JOIN <ENTER></u>
		[Example] AT+JOIN <OK>
	E	When JOIN Request is successful, the EVENT Message returns [Example] <timestamp><space>"[EVENT]"<space>"JOINED"<CR><LF> 03:00:02.556 [EVENT] JOINED

6.2.8. AT+NJS

- Command to check Join Status

Table 9 AT+NJS

Syntax	Operation	Remark
AT+NJS	R	[Format] : <u>AT+NJS <ENTER></u>
		[Example] AT+NJS 1 <OK>

- Note)** 0 : Network not joined
1 : Network joined

6.2.9. AT+AJOIN

- Command to set Automatic Join Request when device is booted.

Table 10 AT+AJOIN

Syntax	Operation	Remark
AT+AJOIN	R	Return with current setting value of Automatic Join Request when the device is booted.
		[Example] AT+AJOIN 0 <OK>
	WF	Update the setting value of Automatic Join Request when the device is booted with the specified value [Format] : <u>AT+AJOIN <0 1> <ENTER></u>

Syntax	Operation	Remark
	WF	[Example] AT+AJOIN 1 <OK>

- **Note)** 0 : OFF (Automatic Join Request is off)
 1 : ON (Automatic Join Request is set)

6.2.10. AT+NWKSKEY

- Network Session Key (16 Byte)
% Automatic from OTAA Join Mode
- Returns 32 hex digit (16 Byte)

Table 11 AT+NWKSKEY

Syntax	Operation	Remark
AT+NWKSKEY	R	Readout the current setting value of Network Session Key
		[Example] AT+NWKSKEY 74b3ee804428aaca16f319ab5d615f0b <OK>
	WF	Update Network Session Key (16 Byte) with the specified value (ABP only)
		[Format] : AT+NWKSKEY <Network Session Key> <ENTER> [Example] AT+NWKSKEY 74b3ee804428aaca16f319ab5d615f0b <OK>

6.2.11. AT+APPSKEY

- Application Session Key(16byte)
- Returns 32 hex digit (16 Byte)

Table 12 AT+APPSKEY

Syntax	Operation	Remark
AT+APPSKEY	R	Readout the current setting value of Application Session Key
		[Example] AT+APPSKEY 5e337a1a75a4f87911cb718631a162ff <OK>
	WF	Update Application Session Key (16byte) with the specified value (ABP only)
		[Format] : AT+NWKSKEY <APPSKEY> <ENTER> [Example] AT+APPSKEY 5e337a1a75a4f87911cb718631a162ff <OK>

6.2.12. AT+DADDR

- Device Address (4 Byte)
- Return with 8 hex digits (4 Byte)

Table 13 AT+DADDR

Syntax	Operation	Remark
AT+DADDR	R	Readout current value of device address (4 Byte)
		[Example] (e.g. MSB 0x26, 0x05, 0x21, 0xe9) AT+DADDR 260521e9 <OK>
	WF	Update Application Session Key with the specified value (16 Byte) (ABP only)
		[Format] : AT+DADDR <Device Address> <ENTER> [Example] (e.g. MSB 0x26, 0x05, 0x21, 0xe9) AT+DADDR 260521e9 <OK>

6.2.13. AT+NWKID

- Network ID (4byte) display value
-> 8 hex digit (4byte) display (e.g. MSB 0x00, 0x12, 0x34, 0x56)
- WF Mode 6 hex digit (3Byte) input (e.g. MSB 0x12, 0x34, 0x56)

Table 14 AT+DADDR

Syntax	Operation	Remark
AT+NWKID	R	Readout current value of Network ID (4 Byte)
		[Example] (e.g. MSB 0x00, 0x12, 0x34, 0x56) AT+NWKID 00123456 <OK>
	WF	Update Network ID with the specified value (3 Byte) (ABP Only)
		[Format] : AT+DADDR <Device Address> <ENTER> [Example] (e.g. MSB 0x12, 0x34, 0x56) AT+DADDR 123456 <OK>

6.2.14. AT+AINF

- Returns Activation Setting Configuration
- Return Format: "AT Command Name" + ":" + setting value

Table 15 AT+AINF

Syntax	Operation	Remark
AT+AINF	R	[Format] : AT+AINF <ENTER>
		[Example] AT+AINF DEVEUI:0000000000000002 APPEUI:70b3d57ed0010e4f APPKEY:de52ddd16146079649c89a0c1bd9eae5 PNM:Public NJM:OTAA CLASS:A NJS:Joined0 NetID:00123456 DADDR:260521e9 NWKSKEY:74b3ee804428aaca16f319ab5d615f0b APPSKEY:5e337a1a75a4f87911cb718631a162ff AJoin:Auto <OK>

7. UP/DOWN LINK COMMAND

7.1. COMMAND TABLE

Table 16 UP/Down Link Command Table

AT Command	Description	Reference
AT+SEND	LoRa Data Uplink (data type in text)	7.2.1
AT+SENDB	LoRa Data Uplink (data type in hexadecimal)	7.2.2
AT+RECV	Confirm Received Downlink Data (data type in text)	7.2.3
AT+RECVB	Confirm Received Downlink Data (data type in hexadecimal)	7.2.4
AT+RSSI	Returns RSSI value of the last received data	7.2.5
AT+SNR	Returns SNR value from the last received data	7.2.6

7.2. COMMAND DETAIL

7.2.1. AT+SEND

- LoRa Data Uplink Command
- Send Data Type : text data

Table 17 AT+SEND

Syntax	Operation	Remark
AT+SEND	W	Uplink command of LoRa Data Data transfer type: text
		[Format] : AT+SEND <application port>:<data> <ENTER>
		[Example] Send text data string "12345" (5 Byte) to port #2 AT+SEND 2:12345 <OK>

- **Note)** When the data is sent successfully, <OK> message returns
If Failed to send, <AT_ERROR> message returns

7.2.2. AT+SENDB

- LoRa Data Uplink Command
- Send Data type : hexadecimal data

Table 18 AT+SENDB

Syntax	Operation	Remark
AT+SENDB	W	Uplink command of LoRa Data
		Data transfer type: hexadecimal
		[Format] : AT+SENDB <application port>:<data> <ENTER>
		[Example] Send 5 Byte hexadecimal 0x0a 0x0b 0x0c 0x0d 0x0e to Port #2 AT+SENDB 2:0a0b0c0d0e <OK>

- **Note)** When the data is sent successfully, <OK> message returns.
If failed, <AT_ERROR> message returns.

7.2.3. AT+RECV

- Readout Received Downlink Data
- Received Data Type : text data

Table 19 AT+RECV

Syntax	Operation	Remark
AT+RECV	R	Readout received downlink data
		Data type: text
		[Format] : AT+RECV <application port>:<data> <ENTER>
		[Example 1] No Data Received AT+RECV 0: <OK> [Example 2] Received Data is 12345 through port #2 AT+RECV 2:12345 <OK>

7.2.4. AT+RECVB

- Readout Received Downlink Data
- Received Data Type: hexadecimal data

Table 20 AT+RECVB

Syntax	Operation	Remark
AT+RECVB	R	Readout received downlink data Data type: hexadecimal
		[Format] : AT+RECVB=<application port>:<data> <ENTER>
		[Example] - Received Data is 0x0a 0x0b 0x0c 0x0d 0x0e through port #2 AT+RECVB 2:0a0b0c0d0e <OK>
		- Once received data is read out, the data is removed. Thus, the following subsequent readout command returns no data as shown below. AT+RECV 2: <OK>
	E	An EVENT Message is printed out when Payload data is received
		[Example] "[EVENT]"<space>"RECVB"<space><port number><colon> "Hex data"<CR><LF> [EVENT] RECVB 99:000102030405060708090a0b0c0d0e0f

➤ **Note)** Execute the AT+RECVB command to confirm that the received data type is hexadecimal.

7.2.5. AT+RSSI

- Readout RSSI value of the last received data

Table 21 AT+RSSI

Syntax	Operation	Remark
AT+RSSI	R	Readout RSSI value of the last received data
		[Format] : AT+RSSI <ENTER>
		[Example] AT+RSSI -10 <OK>

7.2.6. AT+SNR

- Readout SNR (signal noise ratio) value of the last received data

Table 22 AT+SNR

Syntax	Operation	Remark
AT+SNR	R	Readout SNR value of the last received data
		[Format] : <u>AT+SNR <ENTER></u>
		[Example] AT+SNR 26 <OK>

8. LORAMAC CONFIGURE COMMAND

8.1. COMMAND TABLE

Table 23 LoRaMAC Configure Command

AT Command	Description	Reference
AT+REGION	LoRaMAC Region Configuration	8.2.1
AT+ADR	ADR Command	8.2.2
AT+DR	Data rate Command	8.2.3
AT+RX2FQ	Rx Window 2 frequency Command	8.2.4
AT+RX2DR	Rx Window 2 data rate (0-7 corresponding to DR_X)	8.2.5
AT+RX1DL	The Tx and the Rx Window 1 Delay	8.2.6
AT+RX2DL	The Tx and the Rx Window 2 Delay	8.2.7
AT+JN1DL	The Tx and the Rx Window 1 Join Accept Delay	8.2.8
AT+JN2DL	The Tx and the Rx Window 2 Join Accept Delay	8.2.9
AT+MUFR	Unconfirmed uplink Resend	8.2.10
AT+MCFR	Confirmed uplink resend	8.2.11
AT+TXP	Tx Power index	8.2.12
AT+FCU	Uplink Counter	8.2.13
AT+FCD	Downlink Counter	8.2.14
AT+BAT	Battery Level	8.2.15
AT+LCHK	Mac Command <i>LinkCheckReq</i>	8.2.16
AT+CRYPTO	Encryption Configuration (Standard)	8.2.17
AT+CH	Channel Configuration	8.2.18

8.2. COMMAND DETAIL

8.2.1. AT+REGION

- Returns LoRaMAC Region Configuration. Reboot after the configuration is updated.

Table 24 AT+REGION

Syntax	Operation	Remark
AT+REGION	R	Readout current LoRaMAC Region Configuration
		LORAMAC_REGION_AS923 = 0, LORAMAC_REGION_AU915 = 1, LORAMAC_REGION_CN470 = 2, LORAMAC_REGION_CN779 = 3, LORAMAC_REGION_EU433 = 4, LORAMAC_REGION_EU868 = 5, LORAMAC_REGION_KR920 = 6, (default) LORAMAC_REGION_IN865 = 7, LORAMAC_REGION_US915 = 8,

Syntax	Operation	Remark
		LORAMAC_REGION_US915_HYBRID = 9
		[Example] AT+REGION 6 <OK>
		Update the REGION set with the specified value
		[Format] : AT+REGION <0 - 9> <ENTER> <i>Warning) Once the parameter is set for Region, it becomes effective only after a device reset.</i> [Example] Update the Region set to KR920 AT+REGION 6 * Boot by CPU OTAA KR920 Boot completed F/W VERSION : 0.15 DEVICE EUI : 50f8a50000010099
	WF	

8.2.2. AT+ADR

- Auto Data Rate (ADR) Configuration

Table 25 AT+ADR

Syntax	Operation	Remark
AT+ADR	R	Readout current set value of ADR Configuration
		[Example] AT+ADR 1 <OK>
	WF	Set ADR Configuration
		[Format] : AT+ADR <0 1> <ENTER> [Example] set ADR configuration to 0 AT+ADR 0 <OK>

➤ **Note)** 0 : ADR off / 1 : ADR on

8.2.3. AT+DR

- Current Data Rate Configuration Status. The spreading factor (SF) may vary by region.

Table 26 AT+DR

Syntax	Operation	Remark
AT+DR	R	Returns with a current data rate
		[Example] AT+DR 0 <OK>
	WF	Update data rate with a specified number
		[Format] : AT+DR <data rate> <ENTER> [Example] AT+DR 5 <OK>

➤ **Note)** Data Rate Configuration

0: SF12 BW125 (KR920, AS923, EU868)

1: SF11 BW125 (KR920, AS923, EU868)

2: SF10 BW125 (KR920, AS923, EU868)

3: SF9 BW125 (KR920, AS923, EU868)

4: SF8 BW125 (KR920, AS923, EU868)

5: SF7 BW125 (KR920, AS923, EU868)

6: SF7 BW250 (AS923, EU868)

7: FSK (AS923, EU868)

8.2.4. AT+RX2FQ

- RX Window 2 Frequency Command

Table 27 AT+RX2FQ

Syntax	Operation	Remark
AT+RX2FQ	R	Readout the current frequency of RX Window 2
		[Example] AT+RX2FQ 921900000 <OK>
	W	Update the frequency of RX Window 2 with a specified number
		[Format] : AT+RX2FQ <Rx Window 2> <ENTER> [Example] AT+RX2FQ 921900000 <OK>

8.2.5. AT+RX2DR

- Rx Window 2 data rate (0-7 corresponding to DR_X) Command

Table 28 AT+RX2DR

Syntax	Operation	Remark
AT+RX2DR	R	Readout current value of Rx Window 2 data rate
		[Example] AT+RX2DR 0 <OK>
	W	Update Rx Window 2 data rate with a specified number
		[Format] : AT+RX2DR <0-7 corresponding to DR_X> <ENTER> [Example] AT+RX2DR 0 <OK>

8.2.6. AT+RX1DL

- Set the delay between the end of the TX and the Rx Window 1 in ms

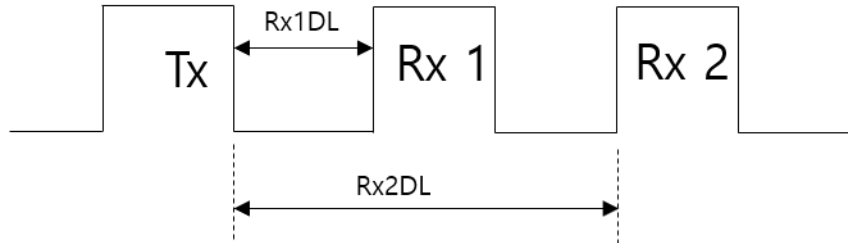


Table 29 AT+RX1DL

Syntax	Operation	Remark
AT+RX1DL	R	Readout the delay between the end of the TX and the RX Window 1 in ms
		[Example] AT+RX1DL 1000 <OK>
	WF	Set the delay between the end of the Tx and the Rx Window 1 in ms Reset using the default setting.
		[Format 1] AT+RX1DL <delay> <ENTER>
		[Example 1] AT+RX1DL 1000 <OK>
		[Format 2] AT+RX1DL reset <ENTER> [Example 2] AT+RX1DL reset <OK>

8.2.7. AT+RX2DL

- Set the delay between the end of the TX and the Rx Window 2 in ms

Table 30 AT+RX2DL

Syntax	Operation	Remark
AT+RX2DL	R	Readout the delay between the end of the TX and the RX Window2 in ms
		[Example] AT+RX2DL 2000 <OK>
	WF	Set the delay between the end of the Tx and the Rx Window 2 in ms Reset using the default setting.
		[Format 1] AT+RX2DL <delay> <ENTER>
		[Example 1] AT+RX2DL 2000

Syntax	Operation	Remark
		<OK>
		[Format 2] AT+RX2DL reset <ENTER>
		[Example 2] AT+RX2DL reset <OK>

8.2.8. AT+JN1DL

- This command allows the user to access the join delay on RX window 1 in ms.

Table 31 AT+JN1DL

Syntax	Operation	Remark
AT+JN1DL	R	Readout the Join Accept Delay between the end of the Tx and the Join Rx Window 1 in ms
		[Example] AT+JN1DL 5000 <OK>
	W	Set the Join Accept Delay between the end of the Tx and the Join Rx Window 1 in ms
		[Format] : AT+JN1DL <delay> <ENTER>
		[Example] AT+JN1DL 5000 <OK>

8.2.9. AT+JN2DL

- Set the Join Accept delay between the end of the TX and the Join Rx Window 2 in ms

Table 32 AT+JN2DL

Syntax	Operation	Remark
AT+JN2DL	R	Readout the Join Accept Delay between the end of the Tx and the Join Rx Window 2 in ms
		[Example] AT+JN2DL 6000 <OK>
	W	Set the Join Accept Delay between the end of the Tx and the Join Rx Window 2 in ms
		[Format] : AT+JN2DL <delay> <ENTER>
		[Example] AT+JN2DL 6000 <OK>

8.2.10. AT+MUFR

- Command to repeat the unconfirmed uplink without waiting for acknowledgement from the server. The default value is set to 1. The maximum number of repetitions is set to 15.

Table 33 AT+MUFR

Syntax	Operation	Remark
AT+MUFR	R	Readout the set value of repetition for unconfirmed uplink
		[Example] AT+MUFR 15 <OK>
	W	Set the value of repetition for unconfirmed uplink with the specified value
		[Format] : AT+MUFR <number> <ENTER> AT+MUFR 15 <OK>

➤ **Note)** number: number of repetition (1-15), default=1, max = 15

8.2.11. AT+MCFR

- Resend command for confirmed uplink. The send command repeats until an acknowledgement from the server is arrived. The default number of repetitions is sets to 8.

Table 34 AT+MCFR

Syntax	Operation	Remark
AT+MCFR	R	Readout the current setting value of resending confirmed uplink
		[Example] AT+MCFR 8 <OK>
	W	Set the number of resending confirmed uplink
		[Format] : AT+MCFR <number> <ENTER> [Example] AT+MCFR 8 <OK>

➤ **Note)** number: number of resend (1-8), default=8

8.2.12. AT+TXP

- Tx Power Index Command

Table 35 AT+TXP

Syntax	Operation	Remark
AT+TXP	R	Readout the current setting of Transmit Power Index Value
		[Example] AT+TXP 0 <OK>
	W	Set the Tx power index value with the specified value
		[Format] : AT+TXP <index(0 ~ 7 in KR920)> <ENTER> [Example] AT+TXP 0 <OK>

➤ **Note)** Tx Power Index Value

➤ Tx Power Index Value Table

TxPower(dBM) Region	0	1	2	3	4	5	6	7	8	9	10
AS923	Max EIRP	Max EIRP -2	Max EIRP -4	Max EIRP -6	Max EIRP -8	Max EIRP -10	Max EIRP -12	Max EIRP -14	-	-	-
AU915	Max EIRP	Max EIRP -2	Max EIRP -4	Max EIRP -6	Max EIRP -8	Max EIRP -10	Max EIRP -14	Max EIRP -14	Max EIRP -16	Max EIRP -18	Max EIRP -20
CN470	Max EIRP	Max EIRP -2	Max EIRP -4	Max EIRP -6	Max EIRP -8	Max EIRP -10	Max EIRP -14	Max EIRP -14	-	-	-
CN779	Max EIRP	Max EIRP -2	Max EIRP -4	Max EIRP -6	Max EIRP -8	Max EIRP -10	-	-	-	-	-
EU433	Max EIRP	Max EIRP -2	Max EIRP -4	Max EIRP -6	Max EIRP -8	Max EIRP -10	-	-	-	-	-
EU868	Max EIRP	Max EIRP -2	Max EIRP -4	Max EIRP -6	Max EIRP -8	Max EIRP -10	Max EIRP -14	Max EIRP -14	-	-	-
IN865	Max EIRP	Max EIRP -2	Max EIRP -4	Max EIRP -6	Max EIRP -8	Max EIRP -10	Max EIRP -14	Max EIRP -14	Max EIRP -16	Max EIRP -18	Max EIRP -20
KR920	Max EIRP	Max EIRP -2	Max EIRP -4	Max EIRP -6	Max EIRP -8	Max EIRP -10	Max EIRP -14	Max EIRP -14	-	-	-
US915	Max ERP	Max ERP -2	Max ERP -4	Max ERP -6	Max ERP -8	Max ERP -10	Max ERP -16	Max ERP -16	Max ERP -16	Max ERP -16	Max ERP -10
US915_HYBRID	Max ERP	Max ERP -2	Max ERP -4	Max ERP -6	Max ERP -8	Max ERP -10	Max ERP -16	Max ERP -16	Max ERP -16	Max ERP -16	Max ERP -10

8.2.13. AT+FCU

- Uplink Counter Command

Table 36 AT+FCU

Syntax	Operation	Remark
AT+FCU	R	Readout current value of the uplink counter
		[Example] AT+FCU 65535 <OK>
	W	Set the Uplink Counter (For Testing Purpose)
		[Format] : AT+FCU <number> <ENTER> [Example] AT+FCU 65535 <OK>

➤ **Note)** number: uplink counter (0-65535)

8.2.14. AT+FCD

- Downlink Counter Command

Table 37 AT+FCD

Syntax	Operation	Remark
AT+FCD	R	Readout the current downlink counter value
		[Example] AT+FCD 65535 <OK>
	W	Set Downlink Counter with the specified value (For Testing Purpose)
		[Format] : AT+FCD <number> <ENTER> [Example] AT+FCD 65535 <OK>

➤ **Note)** number: downlink counter (0-65535)

8.2.15. AT+BAT

- This command allows the user to access the battery level of the end-device

Table 38 AT+BAT

Syntax	Operation	Remark
AT+BAT	R	Readout the current battery level
		[Example] AT+BAT 0 <OK>
	W	Set the battery level to the specified value
		[Format] : AT+BAT <Battery level> <ENTER> [Example] AT+BAT 254 <OK> - Updated battery level value is sent to server as part of <i>DevStatusAns</i>

- **Note)** Battery level
0: USB / 1: Min level ~ / 254: Fully charged / 255: Error

8.2.16. AT+LCHK

- Line Check Command. The command is used to check that the link is working properly.

Table 39 AT+LCHK

Syntax	Operation	Remark
AT+LCHK	W	The Mac command <i>LinkCheckReq</i> is sent to the server
		[Format] : AT+LCHK <ENTER>
		[Example] AT+LCHK <OK>
	E	Response from the server with EVENT message LinkCheckAns [Example] <timestamp><space>"[EVENT]"<space>"LinkCheckAns"<CR><LF> [EVENT] LinkCheckAns

8.2.17. AT+CRYPTO

- Readout Encryption Configuration (Standard)
 - ** AES encryption algorithm is used in LoRaWAN by default.

Table 40 AT+CRYPTO

Syntax	Operation	Remark
AT+CRYPTO	R	Readout the current Encryption Configuration
		[Example] AT+CRYPTO 0 <OK>
	WF	Set the encryption method to 1 (i.e. ARIA)
		[Format] : AT+CRYPTO <number> <ENTER> [Example] AT+CRYPTO 1 <OK>

- Note) [1] number : Encryption methods
0 : AES (*Default) / 1 : ARIA

[2] ARIA is a block cypher which gets selected as a standard cryptographic technique in Korea.

[3] Exception: ARIA is incompatible with LoRaWAN standard.

When JOIN gets requested in OTAA mode, the AES is used instead of ARIA.

- The ARIA gets used only used in Uplink/Downlink data encryption.

8.2.18. AT+CH

- Readout the current Configuration then update the Channel

Table 41 AT+CH

Syntax	Operation	Remark
AT+CH	R	Readout the current Channel Configuration
		[Format] : AT+CH [freq? / drrange? / status? / <ch> ?] <ENTER>
		[Example] Display Configuration for all Channel AT+CH
		0 freq 922100000 drrange 0 to 5 status 1 1 freq 922300000 drrange 0 to 5 status 1 2 freq 922500000 drrange 0 to 5 status 1 3 freq 922700000 drrange 0 to 5 status 0 4 freq 922900000 drrange 0 to 5 status 0 5 freq 923100000 drrange 0 to 5 status 0 6 freq 923300000 drrange 0 to 5 status 0

Syntax	Operation	Remark
		7 freq 0 drrange 0 to 0 status 0 8 freq 0 drrange 0 to 0 status 0 9 freq 0 drrange 0 to 0 status 0 10 freq 0 drrange 0 to 0 status 0 11 freq 0 drrange 0 to 0 status 0 12 freq 0 drrange 0 to 0 status 0 13 freq 0 drrange 0 to 0 status 0 14 freq 0 drrange 0 to 0 status 0 15 freq 0 drrange 0 to 0 status 0 <OK> [Example] Readout CH1 Configuration AT+CH 1? freq 922300000 drrange 0 to 5 status 1 <OK> [Example] Readout CH1 Frequency AT+CH 1 freq? 922300000 <OK> [Example] Readout CH1 DR Range AT+CH 1 drrange? 0 to 5 <OK> [Example] Readout CH1 Status (Availability) 1:used 0:unused AT+CH 1 status? 1 <OK>
	WF	Change Channel Properties and store at Memory [Example] Change CH7 Frequency AT+CH 7 freq=922300000 <OK> [Example] Change DR Range Min and Max of CH1 AT+CH 7 drrange=1 4 <OK> [Example] Configure to activate CH7 AT+CH 7 status=1 <OK> [Example] Readout CH7 Configuration AT+CH 7? freq 922300000 drrange 1 to 4 status 1 <OK>

9. SYSTEM COMMAND

9.1. COMMAND TABLE

Table 42 SYSTEM Command

AT Command	Description	Reference
AT+RESET	System Reboot	9.2.1
AT+SINF	System Information	9.2.2
AT+VER	Firmware Version	9.2.3
AT+SAG	Antenna Gain	9.2.4
AT+CFM	Uplink Packet Type	9.2.5
AT+SLEEP	Enters Low Power Mode	9.2.6
AT+ALARM	RTC Wakeup time	9.2.7
AT+TIME	RTC time	9.2.8
AT+DATE	RTC Date	9.2.9
AT+ECHO	AT Command Responding Message ECHO	9.2.10
AT+FRESET	Command to reset the configuration	9.2.11

9.2. COMMAND DETAIL

9.2.1. AT+RESET

- System Reset command

Table 43 AT+RESET

Syntax	Operation	Remark
AT+RESET	W+	System Reset Command
		[Format] AT+RESET <ENTER>
		[Example] After Reset Booting Message prints out. AT+RESET * Boot by CPU OTAA KR920 Boot completed
		AT+RESET channels <ENTER> [Example] Delete Channels' Configuration from the Memory then Reset the Module AT+RESET channels * Boot by CPU ABP AU915 Boot completed Boot completed

9.2.2. AT+SINF

- Command to readout system information
- Output format: "AT Command Name" + ":" + configured value

Table 44 AT+SINF

Syntax	Operation	Remark
AT+SINF	R	[Example] AT+SINF VER:0.01 REGION:KR920 DATE:2000:01:01 TIME:05:49:54.275 ECHO:On SAG:0.000000 dBi ADR:Enabled DR:0-SF12-BW125 MCFR:8 (Confirmed Uplink retry count) MUFR:1 (Unconfirmed Uplink retry count) CFM:Unconfirmed(Uplink Message Type) ALARM:0 seconds <OK>

9.2.3. AT+VER

- Firmware Version Information

Table 45 AT+SAG

Syntax	Operation	Remark
AT+VER	R	Readout firmware version
		[Example] AT+VER 0.01 <OK>

9.2.4. AT+SAG

- The Command to readout Antenna Gain

Table 46 AT+SAG

Syntax	Operation	Remark
AT+SAG	R	Readout Antenna Gain Configuration
		[Example] AT+SAG 0.000000 <OK>
	WF	Set the antenna gain. When the Tx power is configured to transmit a packet, set it to as small as Antenna Gain
		[Format] AT+SAG <gain> <ENTER> [Example] AT+SAG -1 -1.000000 <OK>

- Note)** default Value : 0 dBm
[gain] : Integer Input Value between -4 and 6 (dBm) is allowed

9.2.5. AT+CFM

- Readout and set command for Uplink Packet Type

Table 47 AT+CFM

Syntax	Operation	Remark
AT+CFM	R	Readout uplink packet type
		[Example] AT+CFM 1 <OK>
	WF	Set the Uplink Packet Type
		[Format] AT+CFM <type> <ENTER> [Example] AT+CFM 0 <OK>

- Note) Type
1 : Confirmed Packet
0 : Unconfirmed Packet

9.2.6. AT+SLEEP

- Enter Low Power Mode (Use RST to Wakeup)
- This command is useful for measuring the current consumption

Table 48 AT+SLEEP

Syntax	Operation	Remark
AT+SLEEP	W	[Format] <code>AT+SLEEP <ENTER></code>
		[Example] <code>AT+SLEEP</code> <code><OK></code>
	E	Enter Sleep
		[Example] <code><timestamp><space>"[EVENT]"<space>"SLEEP"<CR><LF></code> <code>[EVENT] SLEEP</code>

9.2.7. AT+ALARM

- RTC Wakeup time (Default is set to 0 sec)

Table 49 AT+WAKEUPTIME

Syntax	Operation	Remark
AT+ALARM	R	Readout the current set value of RTC wakeup time
		[Example] <code>AT+ALARM</code> <code>5</code> <code><OK></code>
	W	Set the RTC wakeup time with a specified number
		[Format] <code>AT+ALARM <ver> <ENTER></code>
		[Example 1] <code>AT+ALARM 5</code> <code><OK></code>
		[Example 2] Wake up by alarm after entering the Sleep Mode <code>AT+SLEEP</code> <code>[EVENT] SLEEP</code> <code>*</code> <code>Wakeup by RTC</code> <code>OTAA</code> <code>KR920</code> <code>Wakeup completed</code>

- > **Note)** [1] Default 0 sec
[2] Return value is a positive number in seconds
[3] When wakeup time gets set to a positive number, the device wakes up at the set time since the device entered Sleep mode.

9.2.8. AT+TIME

- RTC Time Command

Table 50 AT+TIME

Syntax	Operation	Remark
AT+TIME	R	Displays the RTC time
		[Example] AT+TIME 15:43:09.630 <OK>
	W	Set the RTC time
		[Format] <u>Hour(2 digit):Min(2 digit):Sec(2 digit):ms(3 digit)</u> [Example] AT+TIME 15:42:30 <OK>

- **Note)** Use the same input format, as shown in the displayed output time.

9.2.9. AT+DATE

- RTC Date Command

Table 51 AT+DATE

Syntax	Operation	Remark
AT+DATE	R	Displays the RTC date
		[Example] AT+DATE 2018:03:15 <OK>
	W	Set the RTC date
		year(4 digit):month(2 digit):date(2 digit) [Example] AT+DATE 2018:3:15 <OK>

- > **Note)** Use the same input format, as shown in the displayed output date.

9.2.10. AT+ECHO

- Echo command

Table 52 AT+ECHO

Syntax	Operation	Remark
AT+ECHO	R	Readout the configured value of the Echo Command. The default is 0 (i.e. OFF)
		[Example] AT+ECHO 0 <OK>
	WF	- Set the Echo command with the specified value
		[Format] AT+ECHO < 0 1 > <ENTER> [Example] AT+ECHO 1 <OK>

- > **Note)** 1 : ON
0 : OFF (Default)

9.2.11. AT+FRESET

- Except for Device EUI reset the configuration

Table 53 AT+FRESET

Syntax	Operation	Remark
AT+FRESET	W	Execute Reset Command
		[Example] AT+FRESET Factory reset! * Boot by CPU OTAA KR920 Boot completed

10. DEBUG COMMAND

10.1.COMMAND TABLE

Table 54 Debug Command

AT Command	Description	Reference
AT+DBG	Event and Debug Message Configuration	10.2.1
AT+TXCW	FSK Tx Continuous Wave mode (Tx Signal Strength Test))	10.2.2
AT+RXTT	LoRa Rx Signal Strength Test	10.2.3
AT+TXTT	LoRa Tx Signal Strength Test	10.2.4
AT+TSTP	Stop RF Test	10.2.5
AT+GPIO	MS500 GPIO Pin Information	10.2.6

10.2.COMMAND DETAIL

10.2.1. AT+DBG

- Readout the Debug Message Type

Table 55 AT+DBG

Syntax	Operation	Remark
AT+DBG	R	Readout the current Debug Message configuration. AT+DBG 0 <OK>
	W	Set the Debug Message with the specified value AT+DBG 1 <OK>

- > **Note)** 0 : Debug message Off / 1 : Debug message On

10.2.2. AT+TXCW

- FSK Tx Continuous Wave Mode (Tx Strength Test)

Table 56 AT+TXCW

Syntax	Operation	Remark
AT+TXCW	W	[Format] AT+TXCW <frequency> <Power in dBm> <Timeout (Sec)> <ENTER>
		[Example] AT+TXCW 920000000 14 100000 <OK>
	E	Tx Timeout (Tx End)
		<timestamp><space>"[EVENT]"<space>"TXCW TIMEOUT"<CR><LF> 03:00:02.556 [EVENT] TXCW timeout

10.2.3. AT+RXTT

- LoRa Rx (RF Strength Test)

Table 57 AT+RXTT

Syntax	Operation	Remark
AT+RXTT	W	[Format] AT+RXST <Spreading Factor (Data rate)> <ENTER>
		[Example] Frequency = 922500000, SF=7 for Rx mode until the data is received. AT+RXTT 922500000 7 0 <OK>
	E	1. Rx Receive Data Print format: <timestamp><space>"[EVENT]"<space>"RXST"<space>"Data Size"<space>"RSSI value"<space>"SNR value"<CR><LF> [EVENT] RxDone size 23 rssi -6 snr 26
		2. Rx Error <timestamp><space>"[EVENT]"<space>"RXST error"<CR><LF> [EVENT] RError

- > Note) * Bandwidth 0 : 125 kHz
1 : 250 kHz
2 : 500 kHz

10.2.4. AT+TXTT

- LoRa Tx RF Test
- % LoRaMac can be used after the device reboot.

Table 58 AT+TXTT

Syntax	Operation	Remark
AT+TXTT	W	[Format] AT+TXST <Power(dBm)> <Spreading Factor(Data rate)> BW<0,1,2> <transmission frequency (sec)> <ENTER>
		[Example] - Frequency (922500000), 14dBm, SF7, Bandwidth 125kHz, 100Byte Data is transmitted in 5 sec period. AT+TXTT 922500000 14 7 0 100 5 <OK>
	E	57. Tx transmission is successful Print format: <timestamp><space>[EVENT]<space>TXST transmitted <CR><LF>
		[EVENT] TxDone 2. Tx Transmission Timeout (Transmission failure) Print format: <timestamp><space>[EVENT]<space>TXST timeout <CR><LF> [EVENT] TxTimeout

10.2.5. AT+TSTP

- RF Test Stop

Table 59 AT+TSTP

Syntax	Operation	Remark
AT+TSTP	W	[Format] AT+TXST
		<OK>

10.2.6. AT+GPIO

- Returns with the MS500 GPIO Pin Configuration

Table 60 AT+GPIO

Syntax	Operation	Remark
AT+GPIO	R	<p>[Example]</p> <p>Returns with information on PC6 Pin Configuration (* Pin Name is case-insensitive)</p> <p>AT+GPIO PC6</p> <p>Pull-Down GPIO(Out) 1</p> <p><OK></p>
	W	<p>[Format] AT+GPIO < Pin > <Input/Output> <ENTER></p> <p>[Example 1]</p> <p>- PC6 Pin Input Configuration (Use either 'I' or 'i')</p> <p>AT+GPIO PC6 i</p> <p><OK></p> <p>[Example 2]</p> <p>- Confirm the configuration value of PC6 pin</p> <p>AT+GPIO PC6</p> <p>Pull-Down GPIO(In) 0</p> <p><OK></p> <p>[Example 3]</p> <p>- Set the PC6 Pin Output Configuration (Use either 'O' or 'o')</p> <p>AT+GPIO PC6 o 1</p> <p><OK></p> <p>[Example 4]</p> <p>- Confirm the configuration value of PC6 pin</p> <p>AT+GPIO PC6</p> <p>Pull-Down GPIO(Out) 1</p> <p><OK></p>

11. P2PCOMMAND

11.1.COMMAND TABLE

Table 61. P2P Command

AT Command	Description	Reference
AT+P2PCH	Readout List of Channels and Configure a Channel	11.2.1
AT+P2PDA	Set P2PDA with Peer Device Address	11.2.2
AT+P2PSW	Set Radio Sync Word	11.2.3

11.2.COMMAND DETAIL

11.2.1. AT+P2PCH

- Readout List of Channels to be used and to select a channel for P2P communication

Table 62 AT+P2PCH

Syntax	Operation	Remark
AT+P2PCH	R	Readout list of Regional Channel List and selected channel number.
		<p>*</p> <p>Boot by CPU</p> <p>OTAA</p> <p>KR920 ← Configured as Korean Region</p> <p>Boot completed</p> <p>AT+P2PCH</p> <p>0 ← Set to Channel #0</p> <p>0 922100000</p> <p>1 922300000</p> <p>2 922500000</p> <p>3 922700000</p> <p>4 922900000</p> <p>5 923100000</p> <p>6 923300000</p> <p>7 0</p> <p>8 0</p> <p>9 0</p> <p>10 0</p> <p>11 0</p> <p>12 0</p> <p>13 0</p> <p>14 0</p> <p>15 0</p> <p><OK></p>

Syntax	Operation	Remark
	W	Set the Channel number to be used AT+P2PCH 1 <OK>

> **Note)** Default : 0

11.2.2. AT+P2PDA

- Set P2P Device Address (4 Bytes) for target node

Table 63 AT+P2PDA

Syntax	Operation	Remark
AT+P2PDA	R	[Example] AT+P2PDA 260521e9 <OK>
		Update the Peer Device Address (Only P2P mode only)
	WF	[Format] : AT+P2PDA <Device Address> <ENTER>
		[Example] AT+P2PDA 260521e8 <OK>

11.2.3. AT+P2PSW

- Configuration of Radio Sync Word

Table 64 AT+P2PSW

Syntax	Operation	Remark
AT+P2PSW	R	[Example] Readout setting value AT+P2PSW 18 <OK>
	WF	[Example] AT+P2PSW 19 <OK>

> **Note)** *The range of value is between 1 and 255 where the default value is set to 18 (0x12).