

ST50

Commands Set Reference

for RF test

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Nov, 23, 2020	Initial version.	JC	V0.7.2
Aug, 31, 2021	Release version for Firmware v1.1.1	Yunlin	V1.1.1
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Release Note

FW Version	Revised Contents
V1.1.1	Initial version.
V1.1.2	<p>Normal</p> <p>1.Modify verbosity level 0 to LoRa Rx message only</p> <p>EU868 :</p> <p>1.When add channel to channel list, band will fill in after calculation automatically.</p> <p>AU915 :</p> <p>1.Enable region AU915.</p> <p>2.Add add/remove channel function.</p> <p>3.Add set/get Rx1 downlink channel command.</p> <p>US915 :</p> <p>1.Add set/get Rx1 downlink channel command.</p> <p>AS923 、CN779 、EU433 、EU868 、IN865 、KR920 、RU864 :</p> <p>1.When applied CFList channel list will not be cleared.</p>
V1.1.3	<p>Normal</p> <p>1.Print downlink mac command from server(gateway).</p> <p>2.Check EEPROM at boot, if is empty write default value, else read to buffer.</p> <p>3.Print string "Please disable the ADR function first.\r\n" in command AT+DR.</p> <p>4.Remove command "AT+READ".</p>
V1.1.4	<p>AU915 :</p> <p>1.Change Channel mask storage format in eeprom to fix the channel list display issue.</p> <p>US915 :</p> <p>1.Change Channel mask storage format in eeprom to fix the channel list display issue.</p> <p>2. Add dwell time switch command(AT+UPDWELL 、 AT+DWDWELL).</p> <p>Normal :</p> <p>1.Fix an issue where command AT+BR could not be used.</p> <p>2. Store baud rate in eeprom by using AT+SAVE.</p>

FW Version	Revised Contents
V1.2.0	<p>This version is base on STM official SDK V1.2.0 modified to apply to AcSip ST50 series.</p> <p>EU868 :</p> <ol style="list-style-type: none"> 1. Fix Band duty cycle store format in eeprom. <p>US915 :</p> <ol style="list-style-type: none"> 1. Don't check the number of active channels in mask set function. <p>Normal :</p> <ol style="list-style-type: none"> 1. Update the AT commands help string. 2. Disable region : CN779 、EU433 、KR920 、IN865 、RU864. 3. Modify erase page 124~127 to 125~127 in command AT+FATRS.
V1.2.1	<p>Normal :</p> <ol style="list-style-type: none"> 1. Enable region : KR920 、IN865.
V1.2.2	<p>Normal :</p> <ol style="list-style-type: none"> 1. Fix command "AT+TCONF" issue. 2. Fix command "AT+TXRETRY" not work issue. 3. Leave STOP2 mode during the command "AT+MCO". 4. Command "AT+MCO" add MSI and HSI output source. 5. Add command "AT+CLKTRIM" to modify MSI and HSI calibration trimming. 6. Add command "AT+TIMER" to piggy back a mac command "DeviceTimeReq" to next uplink. 7. Command "AT+LTIME" modify time zone from UTC+2 to UTC. 8. Fix command "AT+TTH" tx channel not hopping issue.
V1.2.4	<p>Normal :</p> <ol style="list-style-type: none"> 1. Modify command "AT+CERTIF" to support LoRaWAN v1.0.4 End Device Certification <p>AS923 、US915 、AU915 、CN779 、EU868 、KR920 、IN865 、RU864 :</p> <ol style="list-style-type: none"> 1. If rejoin the channel list will setup to default. 2. Disable modify the band default channel
V1.2.6	<p>Normal :</p> <ol style="list-style-type: none"> 1. Enable region RU864
V1.2.7	<p>Normal :</p> <ol style="list-style-type: none"> 1. Remove RTC wakeup interrupt in command "AT+PWR=STOP2"

1. Configuration

1.1 Software Configuration

The default baud rate of ST50 LPUART is set at **9600**. And the rest of LPUART setting, please follow these below settings:

Baud rate: **9600**

Data bits: **8**

Stop bits: **1**

Parity: **none**

Flow Control: **none**

Forward: **none**

To quickly start using ST50, the 1st step is using USB cable to connect EVB to PC/NB via micro USB port. The next step is checking whether the UART-To-USB bridge IC driver can be properly installed on PC/NB. By using win7/win10, the UART-To-USB bridge IC driver could be installed automatically and shows a USB serial com port after connecting well between EVB and PC/NB via USB cable.

After successful installation of USB driver, you can use any terminal program (suggesting free terminal software: [termite](#)) to connect to EVB. The commands set can be used through the terminal program.

By using [termite](#) or other terminal software, be aware of not being appended nothing in the end of a UART string (Figure 1.1).

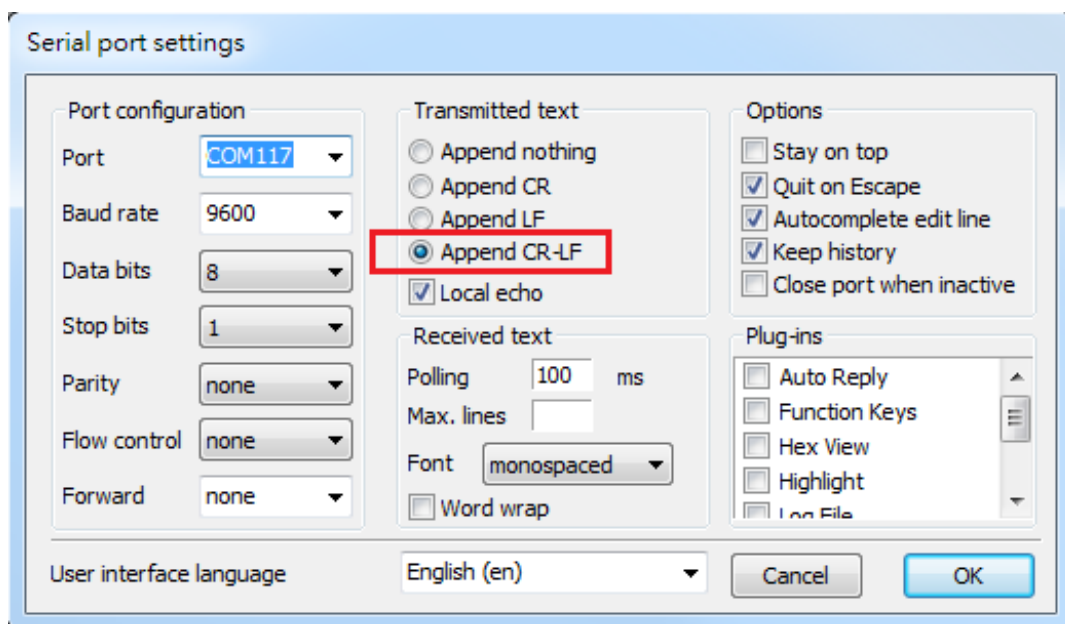


Figure 1.1

The AT commands have the standard format “AT+XXX”, with XXX denoting the command.

There are four available command behaviors:

- AT+XXX? provides a short help of the given command, for example AT+DEUI?
- AT+XXX is used to run a command, such as AT+JOIN
- AT+XXX=? is used to get the value of a given command, for example AT+CFS=?
- AT+XXX=<value> is used to provide a value to a command, for example
AT+SEND=2:Hello

The output of the commands is provided on the UART. The output format is as below:

<value><CR><LF>

<CR><LF><Status><CR><LF>

<CR> stands for “carriage return” and <LF> stands for “line feed”

The <value><CR><LF> output is returned whenever the “help AT+XXX?” or the “get AT+XXX=?” commands are run.

When no value is returned, the <value><CR><LF> output is not returned at all.

Every command (except for ATZ used for MCU reset) returns a status string, which is preceded and followed by <CR><LF> in a “<CR><LF><Status><CR><LF>” format. The possible status are:

- OK: command run correctly without error.
- AT_ERROR: generic error.
- AT_PARAM_ERROR: a parameter of the command is wrong.
- AT_BUSY_ERROR: the LoRa® network is busy, so the command has not been completed.
- AT_TEST_PARAM_OVERFLOW: the parameter is too long.
- AT_NO_CLASSB_ENABLE: End-node has not yet switched in Class B.
- AT_NO_NETWORK_JOINED: the LoRa® network has not been joined yet.
- AT_RX_ERROR: error detection during the reception of the command.

More details on each command description and examples are given in the remainder of this section. Note that each command preceded by # is provided by the host to the module. Then the return of the module is printed.

2.Commands Set Reference

2.1 General commands

2.1.1 AT

Purpose: This command is used to check that the link is working properly.

Response: OK.

Command	Input parameter	Return value	Return code	Command behavior
AT	-	-	OK	Run the command.

Example:

```
AT
OK
```

2.1.2 AT?

Purpose: This command provides short help for all the supported commands

Response: OK.

Command	Input parameter	Return value	Return code	Command behavior
AT?	-	All Command Help	OK	Provide help.

Example:

```

AT?
AT+<CMD>?      : Help on <CMD>
AT+<CMD>        : Run <CMD>
AT+<CMD>=<value> : Set the value
AT+<CMD>=?      : Get the value
ATZ.           : Trg a MCU reset.
AT+VL=<Level><CR>. Set the Verbose Level=[0:OFF/RF_RX .. 3:High].
AT+LTIME.       : Get the local time in UTC format.
AT+BR=<Baud_Rate><CR>. Get or Set the baud rate of LPUART, default 9600, Baud_Rate=[1200, 2400, 4800, 9600].
AT+FAIRS.       : All LoRaWAN and radio configuration parameters will be set to default value and trig a MCU reset.
AT+APPEUI=<XX:XX:XX:XX:XX:XX:XX:XX><CR>. Get or Set the App Eui.
AT+APPKEY=<XX:XX:XX:XX:XX:XX:XX:XX:XX:XX:XX:XX:XX:XX:XX:XX><CR>. Get or Set the Application Key.
AT+NWKSKEY=<XX:XX:XX:XX:XX:XX:XX:XX:XX:XX:XX:XX:XX:XX:XX:XX><CR>. Get or Set the Network Session Key.
AT+APPSKEY=<XX:XX:XX:XX:XX:XX:XX:XX:XX:XX:XX:XX:XX:XX:XX:XX><CR>. Get or Set the Application Session Key.
AT+DADDR=<XX:XX:XX:XX><CR>. Get or Set the Device address.
AT+DEUI=<XX:XX:XX:XX:XX:XX:XX:XX><CR>. Get or Set the Device EUI.
AT+NWKID=<NwkID><CR>. Get or Set the Network ID=[0..127].
AT+JOIN=<Mode><CR>. Join network with Mode=[0:ABP, 1:OTAA].
AT+TIMER.       : Piggyback a Device Time Request to the next uplink.
AT+LINKC.       : Piggyback a Link Check Request to the next uplink.
AT+SEND=<Port>:<Ack>:<Payload><CR>. Send binary data with the application Port=[1..199] and Ack=[0:unconfirmed, 1:confirm]
AT+ULCNT.       : Get or Set the Uplink Counter.
AT+DLCNT.       : Get the Downlink Counter.
AT+PUBNWK.      : Get or Set the Public Network setting(0: private network, 1: public network).
AT+UPDWELL.     : Get or Set the Uplink Dwell(0: OFF, 1: ON).
AT+DWDWELL.     : Get or Set the Downlink Dwell(0: OFF, 1: ON).
AT+DCBAND=<Band>:<DutyCycle><CR>. Get or Set the duty cycle of specified band.
AT+VER.         : Get the FW version.
AT+ADR=<ADR><CR>. Get or Set the Adaptive Data Rate setting ADR=[0:off, 1:on].
AT+DR=<DataRate><CR>. Get or Set the Tx DataRate=[0..7].
AT+BAND=<BandID><CR>. Get or Set the Active Region BandID=[0:AS923, 1:AU915, 5:EU868, 6:KR920, 7:IN865, 8:US915, 9:RU864]
AT+CLASS=<Class><CR>. Get or Set the Device Class=[A, B, C].
AT+DCS=<DutyCycle><CR>. Get or Set the ETSI DutyCycle=[0:disable, 1:enable] - Only for testing.
AT+JN1DL=<Delay><CR>. Get or Set the Join Accept Delay between the end of the Tx and the Join Rx Window 1 in ms.
AT+JN2DL=<Delay><CR>. Get or Set the Join Accept Delay between the end of the Tx and the Join Rx Window 2 in ms.
AT+RX1DL=<Delay><CR>. Get or Set the delay between the end of the Tx and the Rx Window 1 in ms.
AT+RX2DL=<Delay><CR>. Get or Set the delay between the end of the Tx and the Rx Window 2 in ms.
AT+RX2DR=<DataRate><CR>. Get or Set the Rx2 window DataRate=[0..7].
AT+RX2FQ=<Freq><CR>. Get or Set the Rx2 window Freq in Hz.
AT+TXP=<Power><CR>. Get or Set the Transmit Power=[0..15](valid range according to region).
AT+PGSLOT=<Period><CR>. Set or Get the unicast ping slot Period=[0:1s .. 7:128s](=2*Period).
AT+TONE.        : Starts RF Tone test.
AT+TTLRA=<PacketNb><Interval><Payload><CR>. Sent payload with RF Tx test, PacketNb=[0-100000(0:Unlimit)], Interval=[0-300]
AT+TRLRA=<Payload><CR>. Received payload with RF Rx test, Payload=[size:1-254(optional)].
AT+TRSSI.       : Starts RF RSSI tone test.
AT+TCONF.       : Config RF test parameters.
AT+CERTEIF=<Mode><CR>. Set the module in LoRaWAN Certification with Join Mode=[0:ABP, 1:OTAA, 2:Leave certification mode].
AT+SAVE.        : Save the LoRa and LoRaWAN parameters.
AT+GPIOM.       : Set the GPIO mode.
AT+GPIOS.       : Set the GPIO output status or Get the input status.
AT+UID.         : Get the unique device ID(96-bit).
AT+IEUID.       : Get the IEEE 64-bit unique device ID.
AT+PWR.         : Let the ST50H enter low power mode (STOP2).
AT+RFMODE=<Mode>. Get or Set the RF into standby or sleep mode, Mode=[SLEEP, STDBY_RC, STDBY_XOSC].
AT+RFRLO=<Mode>. Get or Set the RF regulator, Mode=[DCDC, LDO].
AT+RTICOUT=<Switch><CR>. Set the GPIO pin PC13(RTC_OUT1) output the 4Hz signal, Switch=[4Hz, DISABLE].
AT+MCO=<Switch><CR>. Set the GPIO pin PA8(MCO) output the LSE or SYSCLK signal, Switch=[LSE, MSI, HSI, SYSCLK, DISABLE].
AT+CLKTRIM=<ClockType><TrimmingValue><CR>. Set or Get the MSI/HSI calibration trimming value to/from RCC_ICSCR_MSITRIM/RO
AT+CHRE.        : Remove the channel by Channel ID.

AT+SUPCH.       : Show the all uplink channels.
AT+CHADD.       : Add or set up the channel.
AT+RPSEND.      : Repeat send the data for RF Certification(ex. CE, FCC, etc.).
AT+TTH=<Fstart>:<Fstop>:<Fdelta>:<PacketNb>:<Data><CR>. Starts RF Tx hopping test from Fsta
AT+TOFF.        : Stops on-going RF test.
AT+RX1FQ=<Freq><Step><Count><CR>. Get or Set the Rx1 first channel Freq in Hz, Rx1 stepwidth
AT+BAT          : Get the battery Level in mV.

```

OK

2.1.3 ATZ

Purpose: This command resets the module and start FW over again.

Response: The beginning information since FW starts.

Command	Input parameter	Return value	Return code	Command behavior
ATZ?	-	ATZ. Trig a MCU reset	OK	Provide a short help.
ATZ	-	No return value and return code. The MCU is reset.	-	Run the command.

Example:

ATZ

```

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                                                                                                             Tech Co., LTD
                                                                                                             LoRaWAN v1.0.4 Ready
                                                                                                             (Class A, B & C)
>> ST50H - V1.2.7 - AS923 - Nov 22 2024 - 09:53:51

```

2.1.4 AT+VER

Purpose: Get current firmware version.

Response: A string representing firmware version.

Command	Input parameter	Return value	Return code	Command behavior
AT+VER?	-	AT+VER. Get the FW version	OK	Provide a short help.
AT+VER=?	-	V.x.y.z	OK	Get the value.

Example:

```

AT+VER=?
AcSip_FW_VERSION:    V1.2.7
MW_LORAWAN_VERSION:  V2.4.0
MW_RADIO_VERSION:    V1.2.0
L2_SPEC_VERSION:     V1.0.4
RP_SPEC_VERSION:     V2-1.0.1
OK

```

2.1.5 AT+FATRS


Purpose: This command resets all ST50, LoRaWAN and radio configuration to factory.

Response: The beginning information since FW starts.

Command	Input parameter	Return value	Return code	Command behavior
AT+FATRS?	-	AT+FATRS. All LoRaWAN and radio configuration parameters will be set to default value and trig a MCU reset	OK	Provide a short help.
AT+FATRS	-	No return value and return code. The MCU is reset.	-	Run the command.

Example:

AT+FATRS


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2.1.6 AT+VL=<LEVEL>

Purpose: Sets/gets the verbose level of the application.

<LEVEL> : 0, 1, 2, or 3.

- 0: VLEVEL_OFF (Only show LoRa RX related message **block other message include command response**)
- 1: VLEVEL_L
- 2: VLEVEL_M
- 3: VLEVEL_H

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+VL?	-	AT+VL=<Level><CR>. Set the Verbose Level=[0:Off .. 3:High]	OK	Provide a short help.
AT+VL=?	-	0, 1, 2 or 3	OK	Get the value.
AT+VL=<LEVEL>	0, 1, 2 or 3	-	OK AT_PARAM_ERROR	Set the value.

Example:

```
AT+VL=?
2
```

```
OK
AT+VL=2
```

```
OK
```

2.1.7 AT+BAT

Purpose: Get the battery Level.

Response: A integer representing the battery level.

Command	Input parameter	Return value	Return code	Command behavior
AT+BAT?	-	AT+BAT. Get the battery Level=[0..254]	OK	Provide a short help.
AT+BAT=?	-	<void>	OK	Get the value.

Example:

- Get the battery Level.

AT+BAT=?

3295

OK

2.1.8 AT+BR=<Baud Rate>

Purpose: Get or Set the baud rate of LPUART.

Note: Change baud rate will see unrecognizable message is normal, because baud rate is change.


Response: A integer representing the baud rate of LPUART.

Command	Input parameter	Return value	Return code	Command behavior
AT+BR?	-	AT+BR. Get or Set the baud rate of LPUART, default 9600, baud rate=[1200, 2400, 4800, 9600]	OK	Provide a short help.
AT+BR=?	-	<void>	OK	Get the value.
AT+BR=<Param>	1200, 2400, 4800, 9600	<void>	OK	Set the value.

Example:

- Get the baud rate of LPUART.

ATZ



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AT+BR=?
9600

OK
AT+BR=4800
??????

AT+SAVE

OK
ATZ


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$$AT + BR = ?$$

$$4800$$

OK

2.1.1.9 AT+CLKTRIM=<ClockType><TrimmingValue>

Purpose: Set or Get the MSI/HSI calibration trimming value to/from register

Note : Use AT+CLKTRIM=DEFAULT reset to default value.

<ClockType> 0=MSI, 1=HSI

<TrimmingValue> 0~255

Response: MSI and HSI trimming/calibration value.

Command	Input parameter	Return value	Return code	Comm and behavior
AT+CLKTRIM?	-	AT+CLKTRIM=<ClockType><TrimmingValue><CR>. Set or Get the MSI/HSI calibration trimming value to/from RCC_ICSCR_MSITRIM/RCC_ICSCR_HSI TRIM register, ClockType=[0=MSI, 1=HSI],TrimmingValue=[0~255], DEFAULT=Set default value.	OK	Provide a short help.
AT+CLKTRIM=?	-	MSI Trimming Value : 0xXX MSI Calibration Value : 0xXX HSI Trimming Value : 0xXX HSI Calibration Value : 0xXX	OK	Get the value
AT+CLKTRIM=<ClockType><TrimmingValue>	<0 or 1><0~255>		OK AT_PARAM_ERROR	Set the value

Example:

```
AT+CLKTRIM=?
MSI Trimming Value : 0x00
MSI Calibration Value : 0x78
HSI Trimming Value : 0x40
HSI Calibration Value : 0x8a
```

```
OK
AT+CLKTRIM=0:21
```

```
OK
AT+CLKTRIM=?
MSI Trimming Value : 0x15
MSI Calibration Value : 0x8d
HSI Trimming Value : 0x40
HSI Calibration Value : 0x8a
```


```
OK
```

2.2.1 AT+SAVE

Response: **Ok**, if input arguments are valid.


Command	Input parameter	Return value	Return code	Command behavior
AT+SAVE?	-	AT+SAVE. Save the LoRa and LoRaWAN parameters	OK	Provide a short help.
AT+SAVE	-	-	OK AT_BUSY_ERROR	Run the command.

- Save LoRa and LoRaWAN parameters.



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ATZ


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OK

2.2.2 AT+UID

Purpose: Each STM32 MCU device has its own unique ID, use this command to read it out.

Response: A string representing hardware STM32 MCU UID 96-bit value.

Command	Input parameter	Return value	Return code	Command behavior
AT+UID?	-	AT+UID: Get the unique device ID(96-bit)	OK	Provide a short help.
AT+UID=?	-	Unique device ID=xxxxxxxxxxxxxxxxxxxxxxxxxx	OK	Get the value.

Example:

```
AT+UID=?
Unique device ID=2036395835565011002a004f
OK
```

2.2.3 AT+IEUID

Purpose: Each STM32 MCU device has its own IEEE 64-bit unique device ID, use this command to read it out.

Response: A string representing hardware STM32 MCU IEEE 64-bit unique device ID value.

Command	Input parameter	Return value	Return code	Command behavior
AT+IEUID?	-	AT+IEUID: Get the IEEE 64-bit unique device ID	OK	Provide a short help.
AT+IEUID=?	-	IEEE 64-bit unique device ID=xxxxxxxxxxxxxxxxxx	OK	Get the value.

Example:

```
AT+IEUID=?
IEEE 64-bit unique device ID=0080e1150006bfee
OK
```

2.2.4 AT+DEUI=<DEUI>

Purpose: Allows the user to access the global end-device EUI.

<DEUI> an 8-byte hexadecimal string representing Device EUI used for LoRaWAN, 8 hexa separated by ":".

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+DEUI?	-	AT+DEUI: Get or Set the Device EUI.	OK	Provide a short help.
AT+DEUI=?	-	<8 hexa separated by:>	OK	Get the value.
AT+DEUI=<Param>	<8 hexa separated by:>	-	OK AT_PARAM_ERROR	Set the value.

Example:

- Get the Device EUI. The Device EUI is 0750363256375020.

```
AT+DEUI=?
00:80:e1:15:00:06:bf:ee
OK
```

- Set the Device EUI is 1122334455667788.

```
AT+DEUI=?
00:80:e1:15:00:06:bf:ee

OK
AT+DEUI=11:22:33:44:55:66:77:88

OK
AT+DEUI=?
11:22:33:44:55:66:77:88

OK
```

2.2.5 AT+APPEUI=<AEUI>

Purpose: Allows the user to access the global application identifier EUI.

<AEUI> an 8-byte hexadecimal string representing application identifier EUI used for LoRaWAN, 8 hexa separated by “:”.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+APPEUI?	-	AT+APPEUI: Get or Set the App EUI.	OK	Provide a short help.
AT+APPEUI=?	-	<8 hexa separated by:>	OK	Get the value.
AT+APPEUI=<Param>	<8 hexa separated by:>	-	OK AT_PARAM_ERROR	Set the value.

Example:

- Get the application identifier EUI. The application identifier EUI is 0101010101010101.

```
AT+APPEUI=?
01:01:01:01:01:01:01:01
OK
```

- Set the application identifier EUI is 1122334455667788.

```
AT+APPEUI=?
01:01:01:01:01:01:01:01
OK
AT+APPEUI=11:22:33:44:55:66:77:88
OK
AT+APPEUI=?
11:22:33:44:55:66:77:88
OK
```

2.2.6 AT+DADDR=<ADDR>

Purpose: Allows the user to access the device address.

<ADDR> a 4-byte hexadecimal string representing device address used for LoRaWAN, 4 hexa separated by “:”.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+DADDR?	-	AT+DADDR: Get or Set the Device address.	OK	Provide a short help.
AT+DADDR=?	-	<4 hexa separated by:>	OK	Get the value.
AT+DADDR=<Param>	<4 hexa separated by:>	-	OK AT_PARAM_ERROR	Set the value.

Example:

- Get the device address. The device address is 0100000a.

```
AT+DADDR=?
00:06:bf:ee
OK
```

- Set the device address is 11223344.

```
AT+DADDR=?
00:06:bf:ee

OK
AT+DADDR=11:22:33:44

OK
AT+DADDR=?
11:22:33:44

OK
```

2.2.7 AT+APPKEY=<KEY>

Purpose: Allows the user to access the application key.

<KEY> a 16-byte hexadecimal string representing application key used for LoRaWAN, 16 hexa separated by “:”.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+APPKEY?	-	AT+APPKEY: Get or Set the Application Key.	OK	Provide a short help.
AT+APPKEY=?	-	<16 hexa separated by:>	OK	Get the value.
AT+APPKEY=<Param>	<16 hexa separated by:>	-	OK AT_PARAM_ERROR	Set the value.

Example:

- Get the application key. The application key is 2b7e151628aed2a6abf7158809cf4f3c.

```
AT+APPKEY=?
2b:7e:15:16:28:ae:d2:a6:ab:f7:15:88:09:cf:4f:3c
OK
```

- Set the application key is 112233445566778899AABBCCDDEEFF11.

```
AT+APPKEY=?
2b:7e:15:16:28:ae:d2:a6:ab:f7:15:88:09:cf:4f:3c
OK
AT+APPKEY=11:22:33:44:55:66:77:88:99:AA:BB:CC:DD:EE:FF:11
OK
AT+APPKEY=?
11:22:33:44:55:66:77:88:99:aa:bb:cc:dd:ee:ff:11
OK
```

2.2.8 AT+APPSKEY=<KEY>

Purpose: Allows the user to set the application session key.

<KEY> a 16-byte hexadecimal string representing application session key used for LoRaWAN, 16 hexa separated by “:”.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+APPSKEY?	-	AT+APPSKEY: Set the Application Session Key.	OK	Provide a short help.
AT+APPSKEY=?	-	<16 hexa separated by:>	OK	Get the value.
AT+APPSKEY=<Param>	<16 hexa separated by:>	-	OK AT_PARAM_ERROR	Set the value.

Example:

- Get the application session key. The application key is 2b7e151628aed2a6abf7158809cf4f3c.

```
AT+APPSKEY=?
2b:7e:15:16:28:ae:d2:a6:ab:f7:15:88:09:cf:4f:3c
OK
```

- Set the application session key is 112233445566778899AABBCCDDEEFF11.

```
AT+APPSKEY=?
2b:7e:15:16:28:ae:d2:a6:ab:f7:15:88:09:cf:4f:3c
OK
AT+APPSKEY=11:22:33:44:55:66:77:88:99:AA:BB:CC:DD:EE:FF:11
OK
AT+APPSKEY=?
11:22:33:44:55:66:77:88:99:aa:bb:cc:dd:ee:ff:11
OK
```


2.2.9 AT+NWKSKEY=<KEY>

Purpose: Allows the user to set the network session key.

<KEY> a 16-byte hexadecimal string representing network session key used for LoRaWAN, 16 hexa separated by “:”.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+NWKSKEY?	-	AT+NWKSKEY: Set the Network Session Key.	OK	Provide a short help.
AT+ NWKSKEY=?	-	<16 hexa separated by:>	OK	Get the value.
AT+NWKSKEY=<Param>	<16 hexa separated by:>	-	OK AT_PARAM_ERROR	Set the value.

Example:

- Get the network session key. The application key is 2b7e151628aed2a6abf7158809cf4f3c.

AT+NWKSKEY=?

2b:7e:15:16:28:ae:d2:a6:ab:f7:15:88:09:cf:4f:3c

OK

- Set the network session key is 112233445566778899AABBCCDDEEFF11.

AT+NWKSKEY=?

2b:7e:15:16:28:ae:d2:a6:ab:f7:15:88:09:cf:4f:3c

OK

AT+NWKSKEY=11:22:33:44:55:66:77:88:99:AA:BB:CC:DD:EE:FF:11

OK

AT+NWKSKEY=?

11:22:33:44:55:66:77:88:99:aa:bb:cc:dd:ee:ff:11

OK

2.2.10 AT+JOIN=<MODE>

Purpose: This command does a join request to the network.

<MODE> : A decimal string representing join mode of LoRaWAN, can be 1 (otaa, over-the-air activation) or 0 (abp, activation by personalization).

Response: **Ok**, if input arguments are valid.

AT_BUSY_ERROR, the LoRa® network is busy, so the command has not been completed.

Command	Input parameter	Return value	Return code	Command behavior
AT+JOIN?	-	AT+JOIN: join network.	OK	Provide a short help.
AT+JOIN=<MODE>	0 or 1	-	OK AT_BUSY_ERROR	Set the value.

Example:

- Join LoRaWAN by OTAA.

```
AT+JOIN=1
TX on freq 923200000 Hz at DR 2, power 14 dBm

OK
MAC txDone
RX_1 on freq 923200000 Hz at DR 2
IRQ_RX_TX_TIMEOUT
MAC rxTimeOut
RX_2 on freq 923200000 Hz at DR 2
IRQ_RX_TX_TIMEOUT
MAC rxTimeOut
+EVT:JOIN FAILED
```

- Join LoRaWAN by ABP.

```
AT+JOIN=0
+EVT:JOINED

OK
```

2.2.11 AT+CLASS=<CLASS>

Purpose: Allow the user to access the LoRaWAN class.

Note: **AT+CLASS** must after **JOIN(2.2.10)** the network.

<CLASS> : A, B or C.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+CLASS?	-	AT+CLASS: get or set the device class.	OK	Provide a short help.
AT+CLASS=?	-	A, B or C	OK	Get the value.
AT+CLASS=<CLASS>	A, B or C	-	OK AT_PARAM_ERROR AT_NO_CLASS_B_ENABLE AT_NO_NET_JOINED	Set the value.

Example:

- Get the LoRaWAN class.

```
AT+CLASS=?
A
OK
```

- Set the LoRaWAN class.

```
AT+CLASS=C
647s268:RX_C on freq 923200000 Hz at DR 2
Switch to Class C done
OK
```

2.2.12 AT+BAND=<BAND>

Purpose: Allows the user to access the Active Region.

Note: Enabled region:

ST50H/HE: AS923 、 AU915 、 EU868 、 KR920 、 IN865 、 US915 、 RU864

ST50L: CN470

<BAND> : A decimal string representing the band used for LoRaWAN.

- 0 : Asia band on 923MHz(AS923)
- 1 : Australia band on 915MHz(AU915)
- 2 : China band on 470MHz(CN470)
- 5 : European band on 868MHz(EU868)
- 6 : South Korean band on 920MHz(KR920)
- 7 : India band on 865MHz(IN865)
- 8 : North American band on 915MHz(US915)
- 9 : Russia band on 864MHz(RU864)

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

AT_BUSY_ERROR, the LoRa® network is busy, so the command has not been completed.

Command	Input parameter	Return value	Return code	Command behavior
AT+BAND?	-	AT+BAND: Get or Set the Active Region.	OK	Provide a short help.
AT+BAND=?	-	<integer>	OK AT_BUSY_ERROR	Get the value.
AT+BAND=<BAND>	<integer>	-	OK AT_PARAM_ERROR AT_BUSY_ERROR	Set the value.

Example:

- Get the active region.

AT+BAND=?

0:AS923

OK

2.2.13 AT+UPDWELL=<OFF/ON >

Purpose: Get or Set the Uplink Dwell.

Note: Only for AS923 、US915 and AU915.

<OFF/ON> 0 for OFF, 1 for ON.

Response: **Ok**, if input arguments are valid.

AT_ERROR, generic error.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+ UPDWELL?	-	AT+UPDWELL. Get or Set the Uplink DWell. (0: OFF, 1: ON)	OK	Provide a short help.
AT+ UPDWELL=?	-	ON or OFF	OK	Get the value.
AT+ UPDWELL=<Param>	0 or 1	-	OK AT_ERROR AT_PARAM,_ERROR	Set the value.

Example:

- Set the Uplink Dwell.

```
AT+UPDWELL=1
```

```
OK
```

- Get the Uplink Dwell.

```
AT+UPDWELL=?
```

```
OFF
```

```
OK
```

2.2.14 AT+DWDWELL=<OFF/ON >

Purpose: Get or Set the Downlink DWell.

Note: Only for AS923 、US915 and AU915.

<OFF/ON> 0 for OFF, 1 for ON.

Response: **Ok**, if input arguments are valid.

AT_ERROR, generic error.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+ DWDWELL?	-	AT+DWDWELL. Get or Set the Downlink DWell. (0: OFF, 1: ON)	OK	Provide a short help.
AT+ DWDWELL=?	-	ON or OFF	OK	Get the value.
AT+ DWDWELL=<Param>	0 or 1	-	OK AT_ERROR AT_PARAM,_ERROR	Set the value.

Example:

- Set the Downlink Dwell.

AT+DWDWELL=1

OK

- Get the Downlink Dwell.

AT+DWDWELL=?

ON

OK

2.2.15 AT+TXP=<POWER>

Purpose: Allows the user to access the transmit power.

<POWER> : A decimal string representing transmitting power in level.

Note : Value will vary depending on the region, please see 2.4.1 for detail.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+TXP?	-	AT+TXP: get or set the transmit power (0-5).	OK	Provide a short help.
AT+TXP=?	-	Value	OK	Get the value.
AT+TXP=<POWER>	2.4.1	-	OK AT_PARAM_ERROR	Set the value.

Example:

- Get the transmit power.

```
AT+TXP=?
```

```
0
```

```
OK
```

- Set the transmit power.

```
AT+TXP=5
```

```
OK
```

2.2.16 AT+SEND=<PORT>:<ACK>:<PAYLOAD>

Purpose: Allows the user to send binary data with the application port and confirmation mode.

<PORT> : A decimal string representing port number used for transmission, it can be from 1 to 223.

<ACK> : A decimal string representing type of transmitting message, can be 1 (confirmed) or 0 (unconfirmed).

<PAYLOAD> : A hexadecimal string representing data to be transmitted.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

AT_BUSY_ERROR, the LoRa® network is busy, so the command has not been completed.

AT_NO_NETWORK_JOINED, the LoRa® network has not been joined yet

Command	Input parameter	Return value	Return code	Command behavior
AT+SEND?	-	AT+SEND: Send binary data with the application port and confirmation mode.	OK	Provide a short help.
AT+SEND=<INPUT>	<PORT>:<ACK>: <PAYLOAD>	-	OK AT_PARAM_ERROR AT_BUSY_ERROR AT_NO_NET_JOINED AT_DUTYCYCLE_RESTRICTED AT_CRYPTO_ERROR AT_ERROR	Set the value.

Example:

- Send the data with app port 20 and confirmation mode.

```
AT+SEND=20:1:8a9ala2a3a
88s779:TX on freq 867300000 Hz at DR 2, power 14 dBm

OK
89s111:MAC txDone
91s107:RX_1 on freq 867300000 Hz at DR 2
91s407:MAC rxDone
+EVT:SEND_CONFIRMED
+EVT:RX_1, PORT 0, DR 2, RSSI -92, SNR 9
```

- Send the data with app port 20 and un-confirmation mode.

```
AT+SEND=20:0:8a9ala2a3a
128s512:TX on freq 868300000 Hz at DR 2, power 14 dBm

OK
128s844:MAC txDone
130s840:RX_1 on freq 868300000 Hz at DR 2
130s908:IRQ_RX_TX_TIMEOUT
130s908:MAC rxTimeOut
131s840:RX_2 on freq 869525000 Hz at DR 2
131s908:IRQ_RX_TX_TIMEOUT
131s908:MAC rxTimeOut
```

2.2.17 AT+RPSEND=<Port>:<Ack>:<Payload>

Purpose: Repeat send the data for RF Certification(ex. CE, FCC, etc.).

<PORT> : A decimal string representing port number used for transmission, it can be from 1 to 223.

<ACK> : A decimal string representing type of transmitting message, can be 1 (confirmed) or 0 (unconfirmed).

<PAYLOAD> : A hexadecimal string representing data to be transmitted.

Response: **Ok**, if input arguments are valid.

AT_ERROR, generic error.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+RPSEND?	-	AT+RPSEND. Repeat send the data for RF Certification(ex. CE, FCC, etc.)	OK	Provide a short help.
AT+RPSEND =<Param>	<Param> or OFF	-	OK AT_ERROR AT_PARAM,_ERROR	Set the value.

Example:

- Send the data with app port 20 and confirmation mode.

```

AT+RPSEND=20:1:8a9a1a2a3a
The data payload is 5 bytes
188s832:TX on freq 867900000 Hz at DR 2, power 14 dBm

OK
189s163:MAC txDone
191s160:RX_1 on freq 867900000 Hz at DR 2
191s458:MAC rxDone
+EVT:SEND_CONFIRMED
+EVT:RX_1, PORT 0, DR 2, RSSI -98, SNR 8
191s474:TX on freq 867500000 Hz at DR 2, power 14 dBm
191s806:MAC txDone
193s802:RX_1 on freq 867500000 Hz at DR 2
194s101:MAC rxDone
+EVT:SEND_CONFIRMED
+EVT:RX_1, PORT 0, DR 2, RSSI -98, SNR 7

```

- Stop send the data

```

AT+RPSEND=OFF

OK

```

2.2.18 AT+ADR=<ON/OFF>

Purpose: Allows the user to access the adaptive data rate.

<ON/OFF> : A decimal string representing whether ADR is enable(1) or disable(0).

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+ADR?	-	AT+ADR: get or set the adaptive data rate setting (0 = off, 1 = on).	OK	Provide a short help.
AT+ADR=?	-	0 or 1	OK	Get the value.
AT+ADR=<ON/OFF>	0 or 1	-	OK AT_PARAM_ERROR	Set the value.

Example:

- Get the adaptive data rate setting.

```

AT+ADR=?
1
OK

```

- Set the (turn off) adaptive data rate.

```

AT+ADR=?
1
OK
AT+ADR=0
OK
AT+ADR=?
0
OK

```

2.2.19 AT+DR=<DR>

Purpose: Allow the user to access the data rate.

<DR> : A decimal string representing data rate used for LoRaWAN, it can be from 0 to 7.

Note : Value will vary depending on the region, please see 2.4.1 for detail.

If ADR status is ON then AT+DR Command is not allow to use.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+DR?	-	AT+DR: Get or Set the Data Rate. (0-7 corresponding to DR_X).	OK	Provide a short help.
AT+DR=?	-	value	OK	Get the value.
AT+DR=<DR>	2.4.1	-	OK AT_PARAM_ERROR	Set the value.

Example:

- Get the data rate.

```

AT+DR=?
2
OK

```

- Set the data rate.

```

AT+DR=2
OK

```

2.2.20 AT+DCS=<ON/OFF>

Purpose: Allows the user to access the duty cycle parameter.

<ON/OFF> : A decimal string representing whether duty cycle is enable(1) or disable(0).

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+DCS?	-	AT+DCS: get or set the ETSI duty cycle setting: 0 = disable 1 = enable	OK	Provide a short help.
AT+DCS=?	-	0 or 1	OK	Get the value.
AT+DCS=<ON/OFF>	0 or 1	-	OK AT_PARAM_ERROR	Set the value.

Example:

- Get the duty cycle setting.

```

AT+DCS=?
0
OK

```

- Set the (turn on) duty cycle.

```

AT+DCS=?
0
OK
AT+DCS=1
OK
AT+DCS=?
1
OK

```

2.2.21 AT+RX1FQ=<Freq>:<Step>:<Count>

Purpose: Set Rx Frequency.

Note: Only enable for US915 and AU915.

<Freq> : Get or Set the Rx1 first channel Freq in Hz.

<Step> : Rx1 step width.

<Count> : Rx1 Frequency count.

$\text{RX Frequency} = \text{Freq} + (\text{channel mod Count}) \times \text{Step}$

Note: Channel is chosen by system it refer to AT+SUPCH list number.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+RX1FQ?	-	AT+RX1FQ=<Freq><Step><Count><CR>. Get or Set the Rx1 first channel Freq in Hz, Rx1 stepwidth and Rx1 Freq count.	OK	Provide a short help.
AT+RX1FQ=?	-	-	OK	Get the value.
AT+RX1FQ=<Input>		<Freq><Step><Count>-	OK AT_PARAM_ERROR	Set the value.

Example:

- Set Rx Frequency

```
AT+RX1FQ=923300000:600000:8
```

```
OK
```

2.2.22 AT+RX1DL=<TIME>

Purpose: Allows the user to access the delay of the received window 1.

<TIME> : A decimal string representing delay interval in milliseconds used for receive window 1.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

AT_BUSY_ERROR, the LoRa® network is busy, so the command has not been completed.

Command	Input parameter	Return value	Return code	Command behavior
AT+RX1DL?	-	AT+RX1DL: get or set the delay between the end of the Tx and the Rx window 1 in ms.	OK	Provide a short help.
AT+RX1DL=?	-	<integer>	OK AT_BUSY_ERROR	Get the value.
AT+RX1DL=<TIME>	<integer>	-	OK AT_BUSY_ERROR AT_PARAM_ERROR	Set the value.

Example:

- Get the delay of the received window 1.

```
AT+RX1DL=?
1000
```

OK

- Set the delay of the received window 1.

```
AT+RX1DL=1500
```

OK

2.2.23 AT+RX2DL=<TIME>

Purpose: Allows the user to access the delay of the received window 2.

<TIME> : A decimal string representing delay interval in milliseconds used for receive window 2.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

AT_BUSY_ERROR, the LoRa® network is busy, so the command has not been completed.

Command	Input parameter	Return value	Return code	Command behavior
AT+RX2DL?	-	AT+RX2DL: get or set the delay between the end of the Tx and the Rx window 2 in ms.	OK	Provide a short help.
AT+RX2DL=?	-	<integer>	OK AT_BUSY_ERROR	Get the value.
AT+RX2DL=<TIME>	<integer>	-	OK AT_BUSY_ERROR AT_PARAM_ERROR	Set the value.

Example:

- Get the delay of the received window 2.

```

AT+RX2DL=?
2000
OK

```

- Set the delay of the received window 2.

```

AT+RX2DL=3000
OK

```


2.2.24 AT+RX2FQ=<FREQ>

Purpose: Allows the user to access the frequency of the received window 2.

<FREQ>: A decimal string representing operation frequency of specified channel in Hz.

Note : Value will vary depending on the region, please see 2.4.1 for detail.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

AT_BUSY_ERROR, the LoRa® network is busy, so the command has not been completed.

Command	Input parameter	Return value	Return code	Command behavior
AT+RX2FQ?	-	AT+RX2FQ: get or set the Rx2 window frequency.	OK	Provide a short help.
AT+RX2FQ=?	-	<Frequency in Hz>	OK AT_BUSY_ERROR	Get the value.
AT+RX2FQ=<FREQ>	2.4.1	-	OK AT_BUSY_ERROR AT_PARAM_ERROR	Set the value.

Example:

- Get the frequency of the received window 2.

```
AT+RX2FQ=?
923200000
```

OK

- Set the frequency of the received window 2.

```
AT+RX2FQ=?
923000000

OK
AT+RX2FQ=922000000
```

```
OK
AT+RX2FQ=?
922000000
```

OK

2.2.25 AT+RX2DR=<DR>

Purpose: Allows the user to access the data rate of received window 2.

<DR> : A decimal string representing data rate used for LoRaWAN, it can be from 0 to 7.

Note : Value will vary depending on the region, please see 2.4.1 for detail.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

AT_BUSY_ERROR, the LoRa® network is busy, so the command has not been completed.

Command	Input parameter	Return value	Return code	Command behavior
AT+RX2DR?	-	AT+RX2DR: get or set the Rx2 window data rate (0-7) corresponding to DR_X.	OK	Provide a short help.
AT+RX2DR=?	-	value	OK AT_BUSY_ERROR	Get the value.
AT+RX2DR=<DR>	2.4.1	-	OK AT_PARAM_ERROR AT_BUSY_ERROR	Set the value.

Example:

- Get the data rate of received window 2.

```
AT+RX2DR=?
2
```

OK

- Set the data rate of received window 2.

```
AT+RX2DR=?
2
```

OK

```
AT+RX2DR=3
```

OK

```
AT+RX2DR=?
3
```

OK

2.2.26 AT+JN1DL=<TIME>

Purpose: Allows the user to access the join delay on RX window 1.

<TIME> : A decimal string representing join delay interval in milliseconds used for receive window 1.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

AT_BUSY_ERROR, the LoRa® network is busy, so the command has not been completed.

Command	Input parameter	Return value	Return code	Command behavior
AT+JN1DL?	-	AT+JN1DL: get or set the joint accept delay between the end of the Tx and the join Rx window 1 in ms.	OK	Provide a short help.
AT+JN1DL=?	-	<integer>	OK AT_BUSY_ERROR	Get the value.
AT+JN1DL=<TIME>	<integer>	-	OK AT_PARAM_ERROR AT_BUSY_ERROR	Set the value.

Example:

- Get the delay of the join received window 1.

```
AT+JN1DL=?
5000
```

OK

- Set the delay of the join received window 1.

```
AT+JN1DL=?
5000
OK
AT+JN1DL=7500
```

```
OK
AT+JN1DL=?
7500
```

OK

2.2.27 AT+JN2DL=<TIME>

Purpose: Allows the user to access the join delay on RX window 2.

<TIME> : A decimal string representing join delay interval in milliseconds used for receive window 2.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

AT_BUSY_ERROR, the LoRa® network is busy, so the command has not been completed.

Command	Input parameter	Return value	Return code	Command behavior
AT+JN2DL?	-	AT+JN2DL: get or set the joint accept delay between the end of the Tx and the join Rx window 2 in ms.	OK	Provide a short help.
AT+JN2DL=?	-	<integer>	OK AT_BUSY_ERROR	Get the value.
AT+JN2DL=<TIME>	<integer>	-	OK AT_PARAM_ERROR AT_BUSY_ERROR	Set the value.

Example:

- Get the delay of the join received window 2.

```
AT+JN2DL=?
```

```
6000
```

```
OK
```

- Set the delay of the join received window 2.

```
AT+JN2DL=?
```

```
6000
```

```
OK
```

```
AT+JN2DL=8500
```

```
OK
```

```
AT+JN2DL=?
```

```
8500
```

```
OK
```

2.2.28 AT+NWKID=<ID>

Purpose: Allows the user to access the Network ID.

<ID> : [0..127].

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+NWKID?	-	AT+NWKID: Get or Set the Network ID.	OK	Provide a short help.
AT+NWKID=?	-	[0..127]	OK	Get the value.
AT+NWKID=<ID>	[0..127]	-	OK AT_PARAM_ERROR	Set the value.

Example:

- Get the Network ID. The Network ID is 0.

```
AT+NWKID=?
```

```
0
```

```
OK
```

- Set the Network ID is 11223344.

```
AT+NWKID=?
```

```
0
```

```
OK
```

```
AT+NWKID=100
```

```
OK
```

```
AT+NWKID=?
```

```
100
```

```
OK
```

2.2.29 AT+PGSLOT=<PERIOD>

Purpose: Allows the user to access the unicast ping slot periodicity.

<PERIOD> : A decimal string representing the unicast ping slot used for LoRaWAN Class B.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

AT_BUSY_ERROR, the LoRa® network is busy, so the command has not been completed.

AT_NO_CLASS_B_ENABLE, End-node has not yet switched in Class B.

Command	Input parameter	Return value	Return code	Command behavior
AT+PGSLOT?	-	AT+PGSLOT: Set or Get the unicast ping slot periodicity.	OK	Provide a short help.
AT+PGSLOT=?	-	0 ~ 7	OK AT_BUSY_ERROR AT_NO_CLASS_B_ENABLE	Get the value.
AT+PGSLOT=<PERIOD>	0 ~ 7	-	OK AT_PARAM_ERROR AT_BUSY_ERROR AT_NO_CLASS_B_ENABLE	Set the value.

Example:

- Get the unicast ping slot used for LoRaWAN Class B.

```
AT+PGSLOT=?
```

```
4
```

```
OK
```

- Set the unicast ping slot used for LoRaWAN Class B.

```
AT+PGSLOT=?
```

```
4
```

```
OK
```

```
AT+PGSLOT=3
```

```
OK
```

```
AT+PGSLOT=?
```

```
3
```

```
OK
```

2.2.30 AT+LINKC

Purpose: Piggyback a Link Check Request to the next uplink.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+LINKC?	-	AT+LINKC. Piggyback a Link Check Request to the next uplink	OK	Provide a short help.
AT+LINKC	-	-	OK	Run the command.

Example:

```

AT+JOIN=0
+EVT:JOINED

OK
AT+LINKC

OK

```

2.2.31 AT+TIMER

Purpose: Piggyback a Device Time Request to the next uplink.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+TIMER?	-	AT+TIMER. Piggyback a Device Time Request to the next uplink.	OK	Provide a short help.
AT+TIMER	-	-	OK	Run the command.

Example:

```

AT+JOIN=0

OK
+EVT:JOINED
AT+TIMER

OK

```

2.2.32 AT+LTIME

Purpose: Allows the user to get the local time in a UTC format.

Response: A string representing the local time in a UTC format.

Command	Input parameter	Return value	Return code	Command behavior
AT+LTIME?	-	AT+LTIME: Get the local time in UTC format.	OK	Provide a short help.
AT+LTIME=?	-	LTIME:xxhxxmxxs on DD/MM/YYYY	OK	Get the value.

Example:

```
AT+LTIME=?
LTIME:02h07m48s on 01/01/1970
OK
```

2.2.33 AT+ULCNT=<Counter>

Purpose: Get or Set the Uplink Counter

<Counter> A decimal string representing counter.

Response: **Ok**, if input arguments are valid.

AT_ERROR, generic error.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+ ULCNT?	-	AT+ULCNT. Get or Set the Uplink Counter	OK	Provide a short help.
AT+ULCNT=?	-	Unjoin or Counter	OK AT_ERROR	Get the value.
AT+ULCNT=<Param>	-	-	OK AT_ERROR AT_PARAM,_ERROR	Set the value.

Example:

- Get the Uplink Counter

AT+ULCNT=?

0

OK

- Set the Uplink Counter.

AT+ULCNT=2

OK

AT+ULCNT=?

2

OK

2.2.34 AT+DLCNT

Purpose: Get the Downlink Counter

Response: **Ok**, if input arguments are valid.

AT_ERROR, generic error.

Command	Input parameter	Return value	Return code	Command behavior
AT+ DLCNT?	-	AT+DLCNT. Get the Downlink Counter	OK	Provide a short help.
AT+ DLCNT=?	-	Unjoin or counter	OK AT_ERROR	Get the value.

Example:

- Get the Downlink Data.

AT+DLCNT=?

Not any received Downlink data from joined until now.

OK

2.2.35 AT+ PUBNWK=<Private/ Public>

Purpose: Get or Set the Public Network setting.

<ON/OFF> 0 for Private, 1 for Public.

Response: **Ok**, if input arguments are valid.

AT_ERROR, generic error.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+ PUBNWK?	-	AT+PUBNWK. Get or Set the Public Network setting. (0: private network, 1: public network)	OK	Provide a short help.
AT+ PUBNWK=?	-	-	OK	Get the value.
AT+ PUBNWK=<Param>	0 or 1	-	OK AT_ERROR AT_PARAM,_ERROR	Set the value.

Example:

- Set the Public Network setting.
AT+PUBNWK=0
OK
- Get the Public Network setting.
AT+PUBNWK=?
Disable:Private Network
OK

2.2.36 AT+TXRETRY=<times>

Purpose: Get or Set the TX re-tries to get an acknowledge.

<times> A decimal string representing retry times. Maximum number is 8

Note : LoRaWAN v1.0.3 supported only.

Response: **Ok**, if input arguments are valid.

AT_ERROR, generic error.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+TXRETRY?	-	AT+TXRETRY. Get or Set the TX re-tries to get an acknowledge, Maximum number is 8	OK	Provide a short help.
AT+TXRETRY=?	-	-	OK	Get the value.
AT+TXRETRY=<Param>	0 to 8	-	OK AT_ERROR AT_PARAM,_ERROR	Set the value.

Example:

- Set the TX re-try times.

```
AT+TXRETRY=6
```

```
OK
```

- Get the TX re-try times.

```
AT+TXRETRY=?
```

```
6
```

```
OK
```

2.2.37 AT+DCBAND=<Band>:<Cycle>

Purpose: Get or Set the duty cycle of specified band.

<BAND> : A decimal string representing the band used for LoRaWAN.

- 0 : Asia band on 923MHz(AS923)
- 1 : Australia band on 915MHz(AU915)
- 2 : China band on 470MHz(CN470)
- 5 : European band on 868MHz(EU868)
- 6 : South Korean band on 920MHz(KR920)
- 7 : India band on 865MHz(IN865)
- 8 : North American band on 915MHz(US915)
- 9 : Russia band on 864MHz(RU864)

<Cycle> A decimal string representing Cycle from 1 to 65534.

Response: **Ok**, if input arguments are valid.

AT_ERROR, generic error.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+DCBAND?	-	AT+DCBAND. Get or Set the duty cycle of specified band.	OK	Provide a short help.
AT+DCBAND =?	-	void	OK AT_ERROR	Get the value.
AT+DCBAND =<Param>	-	-	OK AT_ERROR AT_PARAM,_ERROR	Set the value.

Example:

- Set the duty cycle of specified.

```
AT+DCBAND=0:200
```

```
OK
```

- Get the duty cycle of specified.

```
AT+DCBAND=?
```

```
Band(0):Duty Cycle(1/200)
```

```
OK
```

2.3 RF commands

2.3.1 AT+RFMDE=<MODE>

Purpose: Allow the user to access the RF running mode.

<MODE> RF running mode, it can be strings **SLEEP**, **STDBY_RC**, **STDBY_XOSC**.

Note: Let the RF part enter sleep mode with warm start by keyword **SLEEP**. Let the RF part enter standby mode and the mode where only RC13M is used is called **STDBY_RC** and the one with XOSC ON is called **STDBY_XOSC**.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+RFMDE?	-	AT+RFMDE: Get or Set the RF into standby or sleep mode.	OK	Provide a short help.
AT+RFMDE=?	-	<Void>	OK	Get the mode.
AT+RFMDE=<MODE>	SLEEP, STDBY_RC or STDBY_XOSC	-	OK AT_PARAM_ERROR	Set the mode.

Example:

- Set the RF part enter sleep mode.

```
AT+RFMDE=STDBY_XOSC
```

```
OK
```

- Get the RF part running mode.

```
AT+RFMDE=?
```

```
RF in STDBY_XOSC mode
```

```
OK
```

2.3.2 AT+RFRLO=<REGULATOR>

Purpose: Allow the user to access the RF part regulator setting.

<REGULATOR> RF part regulator setting, it can be strings **DCDC**, **LDO**.

Note: DC-DC buck converter by string **DCDC** or linear LDO regulator by string **LDO**.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+RFRLO?	-	AT+RFRLO: Get or Set the RF regulator.	OK	Provide a short help.
AT+RFRLO=?	-	<Void>	OK	Get the setting.
AT+RFRLO=<MODE>	DCDC or LDO	-	OK AT_PARAM_ERROR	Set the setting.

Example:

- Set the RF part regulator setting in DCDC(DC-DC buck converter).

```
AT+RFRLO=DCDC
```

```
OK
```

- Get the RF part regulator setting.

```
AT+RFRLO=?
```

```
RF Regulator in DCDC mode
```

```
OK
```

2.3.3 AT+RTCOUT=<OUT>

Purpose: Allow the user to output the RTC_OUT1 (4Hz square wave) signal on GPIO pin PC13.

<OUT> Output the RTC_OUT1 (4Hz square wave) signal on GPIO pin PC13, it can be strings **4Hz**, or disable the output by string **DISABLE**.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+RTCOUT?	-	AT+RTCOUT: Set the GPIO pin PC13(RTC_OUT1) output the 4Hz signal. (4Hz or DISABLE).	OK	Provide a short help.
AT+RTCOUT=<OUT>	4Hz or DISABLE	-	OK AT_PARAM_ERROR	Set the setting.

Example:

- Output the RTC_OUT1 (4Hz square wave) signal on GPIO pin PC13.

```
AT+RTCOUT=4Hz
```

```
OK
```

- Disable the RTC_OUT1 output..

```
AT+RTCOUT=DISABLE
```

```
OK
```

2.3.4 AT+MCO=<OUT>

Purpose: Allow the user to output the LSE or SYSClk signals on GPIO pin PA8.

<OUT> Output the LSE (32768Hz), MSI, HSI or SYSClk signals on GPIO pin PA8, it can be strings **LSE**, **SYSClk**, **MSI**, **HSI** or disable the output by string **DISABLE**.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+MCO?	-	AT+MCO: Set the GPIO pin PA8(MCO) output the LSE, MSI, HSI or SYSClk signal. (LSE, MSI, HSI, SYSClk or DISABLE).	OK	Provide a short help.
AT+MCO=<OUT>	LSE, MSI, HSI, SYSClk or DISABLE	-	OK AT_PARAM_ERROR	Set the setting.

Example:

- Output the LSE (32768Hz) signal on GPIO pin PA8.

AT+MCO=LSE

OK

- Disable the GPIO pin PA8 output.

AT+MCO=DISABLE

OK

2.3.5 AT+GPIOM=<Gpio_Group>:<Gpio_Pin_Number>:<Gpio_Mode>:<Gpio_Pull>

Purpose: Assign STM32 GPIO pin mode as input or output.

<Gpio_Group> A string representing STM32 GPIO pin groups, it can be these characters **PA**, **PB**, **PC** and **PH**.

<Gpio_Pin_Number> A decimal string representing STM32 GPIO pin number, it can be set from **0** to **15**.

Note: PA4, PA5, PA6, PA7, PA8, PA9, PA10, PA11, PA12, PA13, PA14, PA15, PB1, PB2, PB3, PB4, PB5, PB6, PB7, PB8, PB9, PB10, PB11, PB12, PB13, PB14, PB15, PC0, PC1, PC2, PC3, PC4, PC5, PC6, PC13, PH3, as mentioned above, all can used.

<Gpio_Mode> A decimal string representing STM32 GPIO pin mode, it can be assigned as **INPUT**, **OUTPUT_PP** or **OUTPUT_OD**.

Note: **INPUT** meaning input mode, **OUTPUT_PP** meaning output push-pull mode, **OUTPUT_OD** meaning output open-drain mode.

<Gpio_Pull> A decimal string representing STM32 GPIO pin pull activation, it can be assigned as **NOPULL**, **PULLUP** or **PULLDOWN**.

Note: **NOPULL** meaning GPIO no pull activation, **PULLUP** meaning GPIO pull-up activation, **PULLDOWN** meaning GPIO pull-down activation.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+GPIOM?	-	AT+GPIOM: Set the GPIO mode	OK	Provide a short help.
AT+GPIOM=<Param>	Void	Void	OK AT_PARAM_ERROR	Set the value.

Example:

- Set PA0 as output push-pull mode with pull-up activation.

```
AT+GPIOM=PA:0:OUTPUT_PP:PULLUP
OK
```

2.3.6 AT+GPIO=<Gpio_Group>:<Gpio_Pin_Number>:<Gpio_Value>

Purpose: Assign STM32 GPIO pin output state as high or low, or get the GPIO pin input state.

<Gpio_Group> A string representing STM32 GPIO pin groups, it can be these characters **PA**, **PB**, **PC** and **PH**.

<Gpio_Pin_Number> A decimal string representing STM32 GPIO pin number, it can be set from **0** to **15**.

Note: PA4, PA5, PA6, PA7, PA8, PA9, PA10, PA11, PA12, PA13, PA14, PA15, PB1, PB2, PB3, PB4, PB5, PB6, PB7, PB8, PB9, PB10, PB11, PB12, PB13, PB14, PB15, PC0, PC1, PC2, PC3, PC4, PC5, PC6, PC13, PH3, as mentioned above, all can used.

<Gpio_Value > A decimal string representing STM32 GPIO pin value, it can be assigned as high or low, set **1** would let pin be high state and **0** let it as low state. If assigned as **?**, meaning to get the GPIO pin input state.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+GPIO?	-	AT+GPIO: Set the GPIO output status or Get the input status	OK	Provide a short help.
AT+GPIO=<Param>	Void	Void (when set) PX=y (when get)	OK AT_PARAM_ERROR	Set or Get the value.

Example:

- Set PA0 as output high state.

```
AT+GPIO=PA:0:1
OK
```

- Get PH3 input state.

```
AT+GPIO=PH:3:?
PH3=0
OK
```

2.3.7 AT+TOFF

Purpose: Stop ongoing radio frequency test.

Response: **Ok**, if input arguments are valid.

Command	Input parameter	Return value	Return code	Command behavior
AT+TOFF?	-	AT+TOFF: Stops on-going RF test	OK	Provide a short help.
AT+TOFF	-	Test Stop.	OK	Run the command.

Example:

Stop RF test.

```
AT+TOFF
Test Stop
OK
```

2.3.8 AT+TCONF=<Freq>:<Power>:<Bandwidth>:<SF_Datarate>:<crNum>:<CodingRate>:<LNA>:<PaBoost>:<Modulation>:<fskDeviation>:<lowDrOpt>:<BTproduct>:<Preamble>:<CRC>:<IQ Inversion>

Purpose: Allows the user to access the LoRa® configuration test.

<Freq> a decimal string representing communication frequency in Hz, it can be values from **150000000** to **960000000**.

<Power> a decimal string representing transmitting power in dBm, it can be from **-9** to **22**.

<Bandwidth> a decimal string representing signal bandwidth in kHz, if for LoRa it can be: **125, 250, 500**. If for FSK it can be **4800 to 467000**.

<SF_Datarate> a decimal string representing spreading factor used for communication, if for LoRa modulation it can be: **5, 6, 7, 8, 9, 10, 11 and 12**. If for FSK modulation it can be **600 to 300000**.

<crNum> a decimal string representing CR number, always be number **4**.

<CodingRate> a decimal string representing coding rate, can be: **5, 6, 7, 8**.

<LNA> a decimal string representing Low Noise Amplifier, can be **0(off)** or **1(on)**.

<PaBoost> a decimal string representing Power Amplifier, can be **0(off)** or **1(on)**. **(Not use)**

<Modulation> a decimal string representing modulation, can be **0(FSK)**, **1(LoRa)**.

<fskDeviation> a decimal string representing Frequency deviation(Fdev), can be **600 to 200000**. **FSK only**.

<lowDrOpt> a decimal string representing Low Data Rate Optimization, can be **0**(off), **1**(on), **2**(Auto). This parameter is usually set when the LoRa® symbol time is equal or above 16.38 ms (typically for SF11 with BW125 and SF12 with BW125 and BW250). **LoRa only.**

<BTproduct> a decimal string representing Bandwidth-Time bit period product, can be **0**(no Gaussian Filter Applied), **1**(Gaussian BT=0.3), **2**(Gaussian BT=0.5), **3**(Gaussian BT=0.7), **4**(Gaussian BT=1). **FSK only.**

<Preamble> a decimal string representing preamble length, it can be from **8** to **65535**.

<CRC> a decimal string representing the CRC header is **1**(on) or **0**(off).

<IQ Inversion> a decimal string representing the Invert IQ functionality is **1**(on) or **0**(off).

Response: **Ok**, if input arguments are valid.

AT_ERROR, generic error.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+TCONF?	-	AT+TCONF: Config RF parameters.	OK	Provide a short help.
AT+TCONF=?	Void	Void	OK AT_ERROR	Get the value.
AT+TCONF=<Param>	Void	Void	OK AT_PARAM_ERROR	Set the value.

Example:

- Get the RF parameters.

```
AT+TCONF=?
1: Freq= 868000000 Hz
2: Power= 14 dBm
3: Bandwidth= 125000 Hz
4: SF= 12
5: CR= 4/5
6: LNA State= 0
7: PA Boost State= 0
8: modulation LORA
9: Frequency deviation not applicable
10: LowDrOpt[0 to 2]= 2
11: BT product not applicable
12: Preamble= 12 bits
13: CRC State= 1
14: IQ_Inversion State= 0
can be copy/paste in set cmd: AT+TCONF=868000000:14:125000:12:4/5:0:0:1:25000:2:3:12:1:0
OK
```

- Set the RF parameters.
 - 1: Freq= 923000000 Hz
 - 2: Power= 14 dBm
 - 3: Bandwidth= 125000 Hz
 - 4: SF= 12
 - 5: CR= 4/5
 - 6: LNA State= 0
 - 7: PA Boost State= 0
 - 8: modulation LORA
 - 9: Frequency deviation not applicable
 - 10: LowDRopt[0 to 2]= 2
 - 11: BT product not applicable
 - 12: Preamble= 12 bits
 - 13: CRC State= 1
 - 14: IQ_Inversion State= 0

```
AT+TCONF=923:14:125:12:4/5:0:0:1:25000:2:3:13:1:0
```

```
OK
```

```
AT+TCONF=?
```

```
1: Freq= 923000000 Hz
```

```
2: Power= 14 dBm
```

```
3: Bandwidth= 125000 Hz
```

```
4: SF= 12
```

```
5: CR= 4/5
```

```
6: LNA State= 0
```

```
7: PA Boost State= 0
```

```
8: modulation LORA
```

```
9: Frequency deviation not applicable
```

```
10: LowDRopt[0 to 2]= 2
```

```
11: BT product not applicable
```

```
12: Preamble= 13 bits
```

```
13: CRC State= 1
```

```
14: IQ_Inversion State= 0
```

```
can be copy/paste in set cmd: AT+TCONF=923000000:14:125000:12:4/5:0:0:1:25000:2:3:13:1:0
```

```
OK
```

2.3.9 AT+PWR=<MODE>

Purpose: Let ST50H enter low power (STOP2) mode.

<MODE> Low power mode, it can be string **STOP2**.

Note1: Just supported the "STOP2" low power mode. Wake up by any key input from AT cmd.

Note2: MCU enter "STOP2" low power mode, and RF part enter sleep mode with warm start.

Response: **Ok**, if input arguments are valid, and wake up after.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+PWR?	-	AT+PWR: Let the ST50H enter low power mode	OK	Provide a short help.
AT+PWR=<MODE>	STOP2	-	OK AT_PARAM_ERROR	Enter low power mode.

Example:

- ST50H enter "STOP2" low power mode.

AT+PWR=STOP2

OK

2.3.10 AT+TTONE

Purpose: Allows the user to start TX the RF tone test.

Response: **Ok**, if input arguments are valid.

AT_BUSY_ERROR: the LoRa® network is busy, so the command has not been completed.

Command	Input parameter	Return value	Return code	Command behavior
AT+TTONE?	-	AT+TTONE: Starts RF Tone test	OK	Provide a short help.
AT+TTONE	-	Tx TONE Test.	OK	Run the command.

Example:

- Start TX tone test.

```
AT+TTONE
Tx TONE Test
OK
```

- Stop TX tone test.

```
AT+TTONE
Tx TONE Test

OK
AT+TOFF
Test Stop
OK
```

2.3.11 AT+TTLRA=<Times>:<Interval>:<Data>

Purpose: Allows the user to start the RF Tx LoRa® test and to choose as input the number of packets to be sent.

<Times> a decimal string representing how many time of TX counts, it can be values from **0** to **100000**, "0" means TX would not stop until "AT+TOFF" send.

<Interval> a decimal string representing LoRa® TX interval in **ms**, it can be values from **0** to **300000**.

<Data> a hexadecimal string representing data to be transmitted. The maximum transfer length: **254** bytes

Response: **Ok**, if input arguments are valid.

AT_BUSY_ERROR: the LoRa® network is busy, so the command has not been completed.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+TTLRA?	-	AT+TTLRA: Set Nb of packets sent with RF Tx test.	OK	Provide a short help.
AT+TTLRA=<Param>	Void	Void	OK AT_BUSY_ERROR AT_PARAM_ERROR	Set the value and run the TX test.

Example:

- TX times is 100, TX interval is 200ms, TX data is 0xaa, 0xaa, 0x55, 0x55 that is 4 bytes.

```
AT+TTLRA=100:200:aaaa5555
```

```
>> AT+TTLRA(1)
```

```
OK
```

```
OnTxDone
```

```
OnTxDone
```

```
OnTxDone
```

```
OnTxDone
```

Note: (AT+TTLRA(n)) would be only shown when n is 1, 10, 20, 30, ...)

- Stop TX test.

```

AT+TTLRA=100:200:aaaa5555
>> AT+TTLRA(1)

OK
OnTxDone

OnTxDone

OnTxDone

OnTxDone

OnTxDone

AT+TOFF
>> AT+TTLRA(5)
Test Stop

OK

```

Note: When stop, AT+TTLRA(n) would be shown the n meaning the TX total times.

2.3.12 AT+TRLRA=<Data>

Purpose: Allows the user to start the RF Rx LoRa® test and to choose as input the data of packets to be received.

<Data> a hexadecimal string representing that demands to be matched. Max length limitation is **254** bytes.

Response: **Ok**, if input arguments are valid.

AT_BUSY_ERROR: the LoRa® network is busy, so the command has not been completed.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+TRLRA?	-	AT+TRLRA: Set Nb of packets to be received with RF Rx test.	OK	Provide a short help.
AT+TRLRA	-	Void	OK AT_BUSY_ERROR	Run the RX test. RX the any packet.
AT+TRLRA=<Data>	Data string	Void	OK AT_BUSY_ERROR AT_PARAM_ERROR	Set the value and run the RX test. RX the input packet.

Example:

- Start the RX test with input packet data aaaa5555.

```
AT+TRLRA=aaaa5555
Freq=923000000, SForDataRate=12, Bandwidth=4, CodingRate=1
PREAMBLE_LENGTH=13, SYMBOL_TIMEOUT=0(Symbols), CRC=1
OK
```

Note: (AT+TRLRA(n) would be only shown when n is 1, 10, 20, 30, ...)

- Start the RX test with any packet.

```
AT+TRLRA
Freq=923000000, SForDataRate=12, Bandwidth=4, CodingRate=1
PREAMBLE_LENGTH=13, SYMBOL_TIMEOUT=0(Symbols), CRC=1
OK
```

- Stop the RX test.

```
AT+TRLRA=aaaa5555
Freq=923000000, SForDataRate=12, Bandwidth=4, CodingRate=1
PREAMBLE_LENGTH=13, SYMBOL_TIMEOUT=0(Symbols), CRC=1
OK
AT+TOFF
>> AT+TRLRA(0)
Test Stop
OK
```

Note: When stop, AT+TRLRA(n) would be shown the n meaning the RX total times.

2.3.13 AT+SUPCH

Purpose: Show the all uplink channels.

Response: **Ok**, if input arguments are valid.

Command	Input parameter	Return value	Return code	Command behavior
AT+SUPCH?	-	AT+SUPCH. Show the all uplink channels	OK	Provide a short help.
AT+SUPCH=?	-	viod	OK	Get the value..

Example:

- Show the all uplink channels.

AT+SUPCH=?

Channel(0):Freq(923200000), Rx1Freq(0), DRmax(5), DRmin(0), Band(0)

Channel(1):Freq(923400000), Rx1Freq(0), DRmax(5), DRmin(0), Band(0)

OK

2.3.14 AT+CHADD=<ID>:<TX_Freq>:<RX_Freq>:<DX_Max>:<DR_Min>:<Band>

Purpose: Add or set up the channel.

Note : Only enable for AS923, EU868, KR920, IN865, RU864.

<ID> a decimal string representing Channel ID.

<TX_Freq> a decimal string representing communication frequency in Hz, it can be values from **150000000** to **960000000**.

<RX_Freq> a decimal string representing communication frequency in Hz, it can be values below **960000000**.

<DX_Max> a decimal string representing DX Max, it can be values below **16**.

<DR_Min> a decimal string representing DR Min, it can be values below **16**.

<BAND> : A decimal string representing the band used for LoRaWAN.

Note : Value will vary depending on the region, please see 2.4.1 for detail.

Response: **Ok**, if input arguments are valid.

AT_ERROR, generic error.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+CHADD?	-	AT+CHADD. Add or set up the channel	OK	Provide a short help.
AT+CHADD=<Param>	-	-	OK AT_ERROR AT_PARAM_ERROR	Set the value.

Example:

AT+SUPCH=?

Channel(0):Freq(923200000), Rx1Freq(0), DRmax(5), DRmin(0), Band(0)

Channel(1):Freq(923400000), Rx1Freq(0), DRmax(5), DRmin(0), Band(0)

OK

AT+CHADD=2:923500000:0:5:0:0

OK

AT+SUPCH=?

Channel(0):Freq(923200000), Rx1Freq(0), DRmax(5), DRmin(0), Band(0)

Channel(1):Freq(923400000), Rx1Freq(0), DRmax(5), DRmin(0), Band(0)

Channel(2):Freq(923500000), Rx1Freq(0), DRmax(5), DRmin(0), Band(0)

OK

2.3.15 AT+CHRE=<ID> or AT+CHRE=<ID_Head>:<ID_Tail>

Purpose: Remove the channel by Channel ID.

Note : Only enable for AS923, EU868, KR920, IN865, RU864, and cannot remove default channel.

<ID>,<ID_Head>,<ID_Tail> Channel ID and Tail cant smaller than Head.

Response: **Ok**, if input arguments are valid.

AT_ERROR, generic error.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+CHRE?	-	AT+CHRE. Remove the channel by Channel ID	OK	Provide a short help.
AT+CHRE=<Param>	-	viod	OK AT_ERROR AT_PARAM_ERROR	Set the value.

Example:

- Remove the channel by Channel ID.

AT+SUPCH=?

Channel(0):Freq(923200000), Rx1Freq(0), DRmax(5), DRmin(0), Band(0)

Channel(1):Freq(923400000), Rx1Freq(0), DRmax(5), DRmin(0), Band(0)

Channel(2):Freq(923600000), Rx1Freq(0), DRmax(5), DRmin(0), Band(0)

OK

AT+CHRE=2

OK

AT+SUPCH=?

Channel(0):Freq(923200000), Rx1Freq(0), DRmax(5), DRmin(0), Band(0)

Channel(1):Freq(923400000), Rx1Freq(0), DRmax(5), DRmin(0), Band(0)

OK

2.3.16 AT+TRSSI

Purpose: Starts RF RSSI tone test.

Response: **Ok**, if input arguments are valid.

AT_ERROR, generic error.

Command	Input parameter	Return value	Return code	Command behavior
AT+TRSSI?	-	AT+TRSSI. Starts RF RSSI tone test	OK	Provide a short help.
AT+TRSS	-	-	OK AT_ERROR	Run the command.

Example:

```
AT+TRSSI
628s547:Px FSK Test
628s585:>>> RSSI Value= -125 dBm

OK
```

2.3.17 AT+TTH=<Fstart>:<Fstop>:<Fdelta>:<PacketNb>:<Data>

Purpose: Starts RF Tx hopping test from Fstart to Fstop in Hz or MHz, Fdelta in Hz.

<Fstart> a decimal string representing communication frequency Start in MHz, it can be values below 1000.

<Fstop> a decimal string representing communication frequency End in MHz, it can be values below 1000.

<Fdelta> a decimal string representing communication hop frequency in Hz.

<PacketNb> a decimal string representing packet number.

<Data> a hexadecimal string representing Data, Maximum is 255.

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

Command	Input parameter	Return value	Return code	Command behavior
AT+ TTH?	-	AT+TTH=<Fstart>:<Fstop>:<Fdelta>:<PacketNb>:<Data><CR>. Starts RF Tx hopping test from Fstart to Fstop in Hz or MHz, Fdelta in Hz	OK	Provide a short help.
AT+ TTH=<Param>	-	Void	OK AT_PARAM_ERROR	Set the value.

Example:

- Start RF Tx hopping test.

```

AT+TTH=823:824:100000:4:11
3796s736:Tx Hop at 823000000Hz. 1 of 4
OnTxDone

3797s706:Tx Hop at 823100000Hz. 2 of 4
OnTxDone

3798s674:Tx Hop at 823200000Hz. 3 of 4
OnTxDone

3799s643:Tx Hop at 823300000Hz. 4 of 4
OnTxDone

OK

```

2.3.18 AT+CERTIF=<MODE>

Purpose: Set the module in LoRaWAN End Device Certification mode.

<MODE> : A decimal string representing join mode of LoRaWAN, can be 1 (OTAA, Over-The-Air Activation), 0 (ABP, Activation By Personalization) and 2 (stop).

Response: **Ok**, if input arguments are valid.

AT_PARAM_ERROR, if input argument are not valid or out of range.

AT_BUSY_ERROR, the LoRa® network is busy, so the command has not been completed.

Command	Input parameter	Return value	Return code	Command behavior
AT+CERTIF?	-	AT+CERTIF: Set the module in LoraWan Certification with join Mode (0: ABP, 1: OTAA, 2: stop).	OK	Provide a short help.
AT+CERTIF=<MODE>	0, 1 or 2	-	OK AT_BUSY_ERROR AT_PARAM_ERROR	Set the value and run.

Example:

- Set the module in LoRaWAN End Device Certification with ABP join Mode

```

AT+CERTIF=0

OK
+EVT:JOINED
TX on freq 923200000 Hz at DR 2, power 14 dBm
MAC txDone
RX_1 on freq 923200000 Hz at DR 2
IRQ_RX_TX TIMEOUT
MAC rxTimeOut
RX_2 on freq 923200000 Hz at DR 2
IRQ_RX_TX TIMEOUT
MAC rxTimeOut
TX on freq 923400000 Hz at DR 2, power 14 dBm
MAC txDone
RX_1 on freq 923400000 Hz at DR 2
IRQ_RX_TX TIMEOUT
MAC rxTimeOut
RX_2 on freq 923200000 Hz at DR 2
IRQ_RX_TX TIMEOUT
MAC rxTimeOut

```


2.4 Appendix

2.4.1 Region parameters

0: Asia band on 923MHz(AS923)

	MIN	MAX
Frequency(MHz)	915	928
PHY TX DR	0	7
PHY TX DR(UPDWELL)	2	7
RX DR	0	7
RX DR(UPDWELL)	2	7
TX POWER	7	0

1: Australia band on 915MHz(AU915)

	MIN	MAX
Frequency(MHz)	915.2	927.8
PHY TX DR	0	6
PHY TX DR(UPDWELL)	2	6
RX DR	8	13
RX DR(UPDWELL)	2	13
TX POWER	0	14

2: China band on 470MHz(CN470)

	MIN	MAX
Frequency(MHz)	470.3	509.7
PHY TX DR	1	5
RX DR	1	5
TX POWER	0	14

5: European band on 868MHz(EU868)

	MIN	MAX
Frequency(MHz)		
Band 0	865	868
Band 1	868	868.6
Band 2	863	865
Band 3	869.4	869.65
Band 4	869.7	870
Band 5	868.7	869.2
PHY TX DR	0	7
RX DR	0	7
TX POWER	7	0

6: South Korean band on 920MHz(KR920)

	MIN	MAX
Frequency(MHz)	920.9	923.3
PHY TX DR	0	7
RX DR	0	7
TX POWER	7	0

7: India band on 865MHz(IN865)

	MIN	MAX
Frequency(MHz)	865	867
PHY TX DR(except 6)	0	7
RX DR(except 6)	0	7
TX POWER	10	0

8: North American band on 915MHz(US915)

	MIN	MAX
Frequency(MHz)must be multiple of 600000	902.3	927.5
PHY TX DR	0	4
RX DR	8	13
TX POWER	14	0

9: Russia band on 864MHz(RU864)

	MIN	MAX
Frequency(MHz)must be multiple of 600000	864	870
PHY TX DR	0	7
RX DR	0	7
TX POWER	7	0