



NRC7292 Evaluation Kit

User Guide

(AT Command)

Ultra-low power & Long-range Wi-Fi

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NEWRACOM, Inc.

NRC7292 Evaluation Kit User Guide (AT Command) Ultra-low power & Long-range Wi-Fi

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1 Overview

This document introduces the NRC7292 AT-command. The NRC7292 AT-command allows users to apply fine controls over the NRC7292 modules such as: checking the modem status, scanning, connecting to an AP, opening sockets, and exchanging data.

2 Basic Setup

2.1 Hardware

The AT-command communication is achieved via the UART or SPI interface between the NRC7292 and an external host. The NRM7292 evaluation board (EVB) use the Raspberry Pi 3 B/B+ as a host.

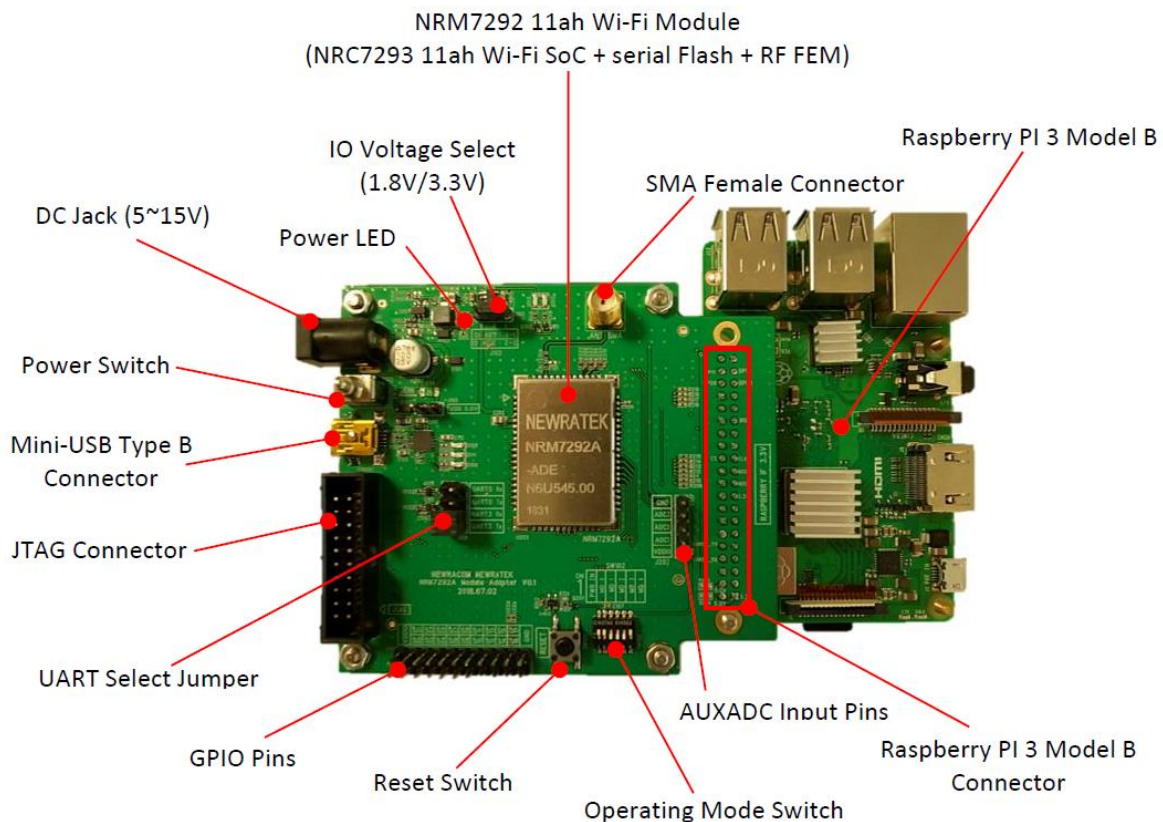


Figure 2.1 NRC7292 evaluation board v0.2

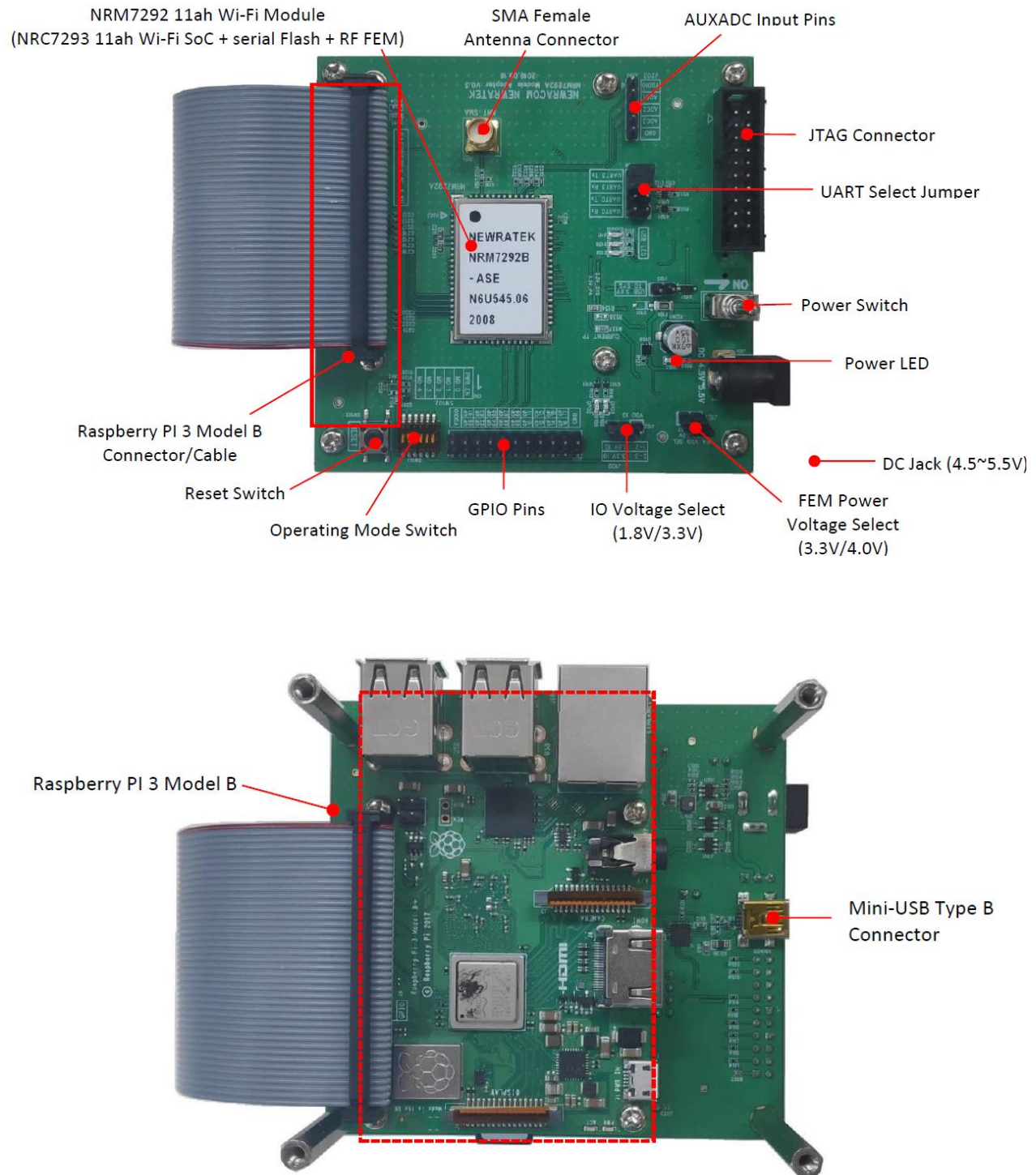


Figure 2.2 NRC7292 evaluation board v0.5

The Raspberry Pi board is connected to the NRM7292 EVB through a 40-pin header. The 40-pin header has signals for UART and SPI.



Figure 2.3 Pin map of 40-pin header for Raspberry Pi 3 B/B+

The NRM7292 EVB and Raspberry Pi board is connected as shown in the Figure 2.4.

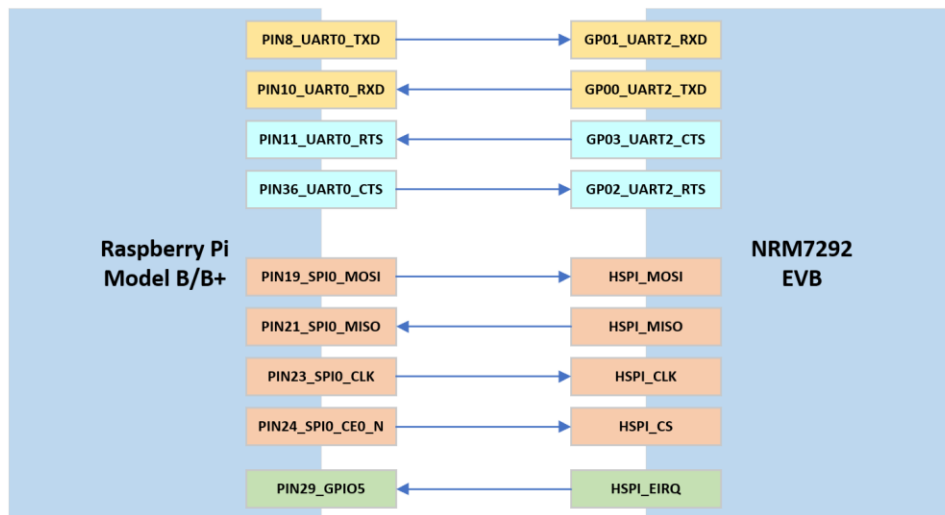
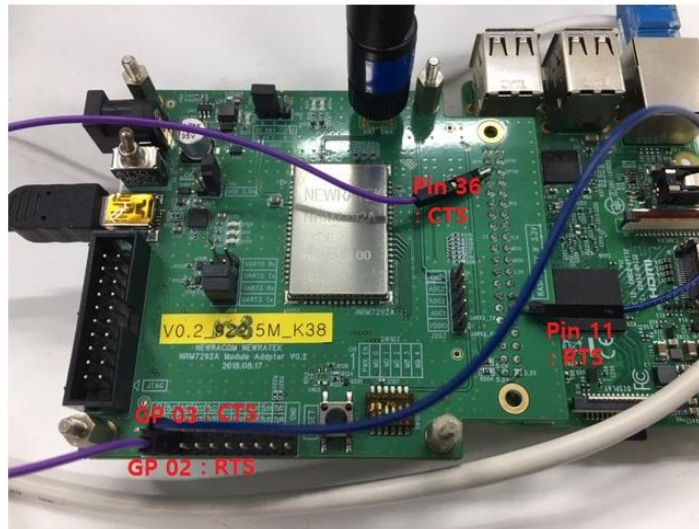


Figure 2.4 Connection between NRM7292 EVB and Raspberry Pi

Both PIN11_UART0_RTS and PIN36_UART0_CTS used for hardware flow control on the UART needs to be directly connected to a 20-pin header in the NRM7292 EVB v0.2 by a jumper wire.



The NRM7292 EVB v0.5 can use the hardware flow control on the UART without a jumper wire.



NOTE:

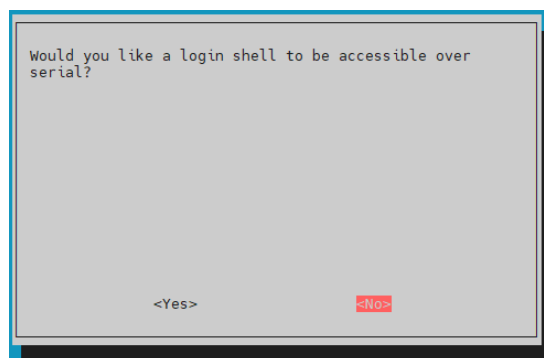
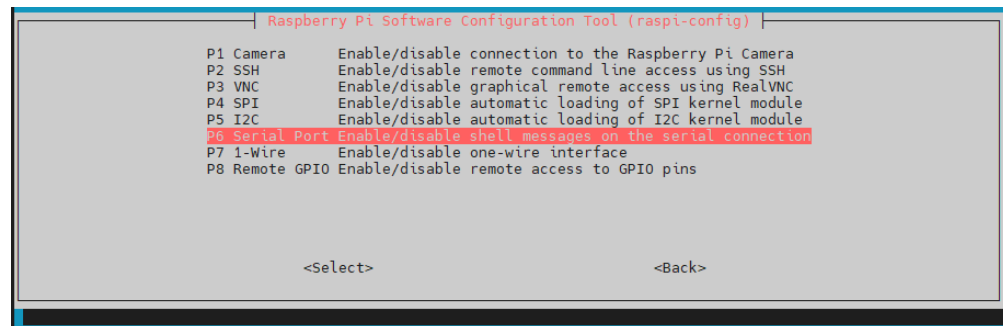
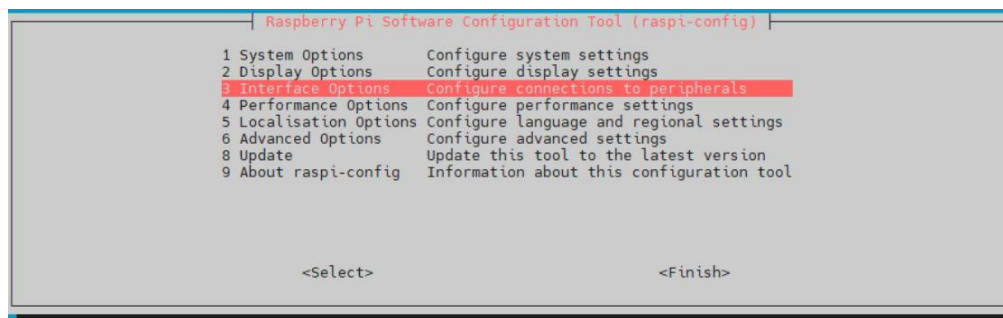
If the host is connected with a 20-pin header, detach the Raspberry Pi board from the EVB first before proceeding. The EVB must be used as a standalone for stable AT communication.

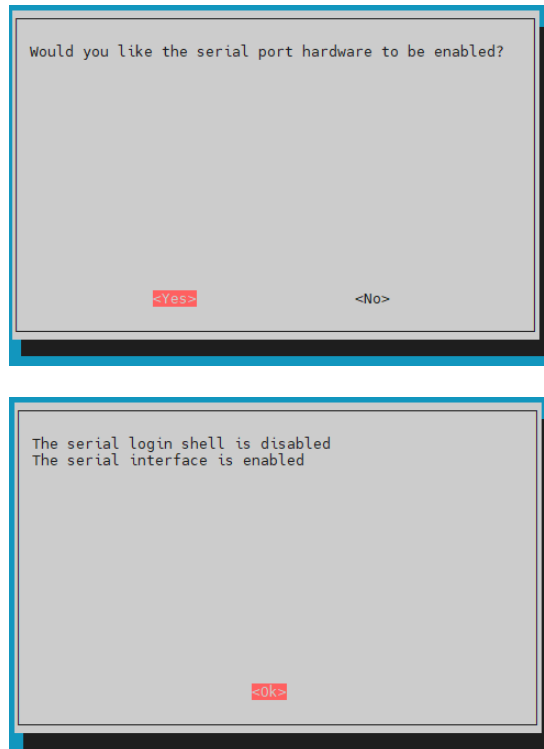
2.1.1 UART

The NRC7292 AT command firmware uses UART channel 2. RTS/CTS is optional and is required to use baudrate greater than 115,200 bps.

To perform AT command communication through UART on Raspberry Pi, Serial Port must be enabled in the Raspberry Pi configuration tool.

```
# sudo raspi-config
```





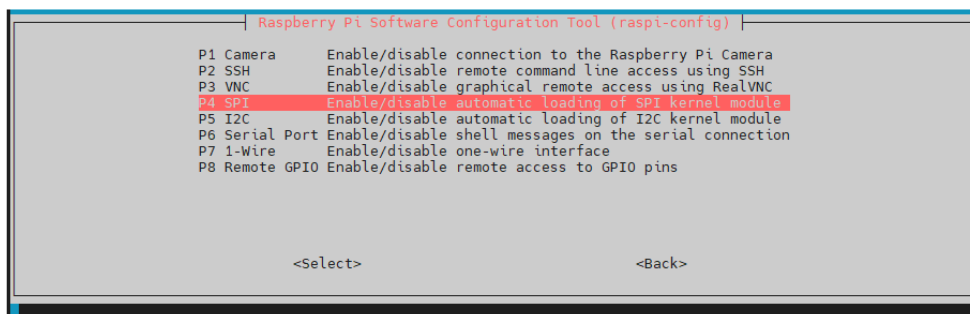
2.1.2 HSPI

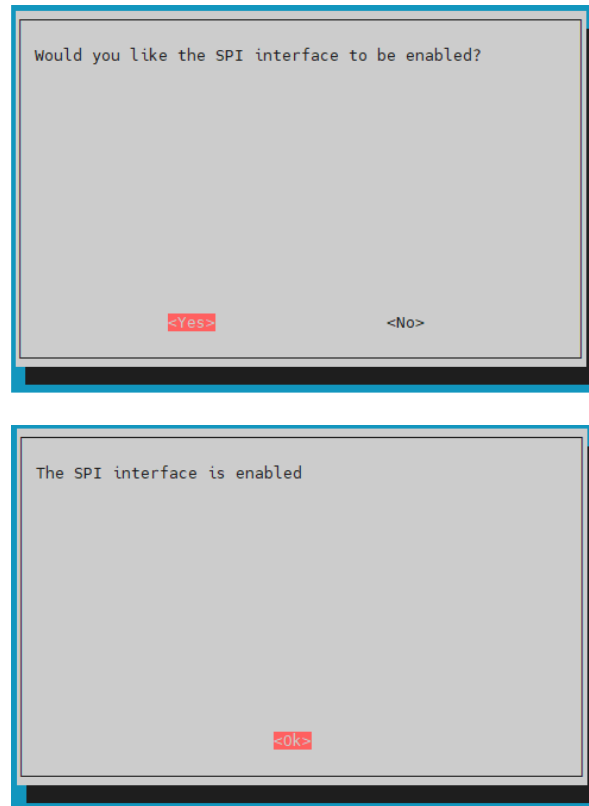
The NRC7292 has a dedicated SPI slave controller for high speed. HSPI_EIRQ is optional.

To perform AT command communication through SPI on Raspberry Pi, spidev (User mode SPI device driver) must be enabled.

First, SPI interface must be enabled in the Raspberry Pi configuration tool.

sudo raspi-config





If `spidev0.0` and `spidev0.1` are not created under `/dev` directory, open and check the `/boot/config.txt`.

```
# Uncomment some or all of these to enable the optional hardware interfaces
#dtparam=i2c_arm=on
#dtparam=i2c=on
dtparam=spi=on

# Uncomment this to enable the lirc-rpi module
#dtoverlay=lirc-rpi

# Additional overlays and parameters are documented /boot/overlays/README

# Enable audio (loads snd_bcm2835)
dtparam=audio=on
enable_uart=1
dtoverlay=pi3-disable-bt
dtoverlay=pi3-disable-wifi
dtoverlay=pi3-disable-spidev
```

After rebooting the Raspberry Pi, `spidev0.0` and `spidev0.1` could be accessible from the userspace.


```

pi@raspberrypi:~$ ls /dev
autofs      gpiochip2  loop7      ram0      random    tty11     tty26     tty40     tty55     uhid      vcsa2
block       gpiomem   loop-control ram1      raw       tty12     tty27     tty41     tty56     uinput    vcsa3
btrfs-control hidraw0   mapper     ram10     rfkill    tty13     tty28     tty42     tty57     urandom   vcsa4
bus         hidraw1   mem        ram11     serial0   tty14     tty29     tty43     tty58     vchiq     vcsa5
cachefiles  hwrng    memory_bandwidth ram12     serial1   tty15     tty3      tty44     tty59     vcio      vcsa6
char        initctl   mmcblk0    ram13     shm       tty16     tty30     tty45     tty6      vc-mem    vcsa7
console     input    mmcblk0p1  ram14     sd        tty17     tty31     tty46     tty60     vcs       vcs8
cpu_dma_latency kmsg     mmcblk0p2  ram15     spidev0.0 tty18     tty32     tty47     tty61     vcs1      vchi
cuse        log       mqqueue    ram16     spidev0.1 tty19     tty33     tty48     tty62     vcs2      watchdog
disk        loop0     net        ram17     stderr    tty2      tty34     tty49     tty63     vcs3      watchdog0
fb0         loop1     network_latency ram18     stdin     tty20     tty35     tty5      tty7      vcs4      zero
fd          loop2     network_throughput ram19     stdout    tty21     tty36     tty50     tty8      vcs5
full        loop3     null       ram20     tty       tty22     tty37     tty51     tty9      vcs6
fuse        loop4     ppp        ram21     tty0      tty23     tty38     tty52     ttyAMA0   vcs7
gpiochip0   loop5     ptmx       ram22     tty1      tty24     tty39     tty53     ttyprintk vcsa
gpiochip1   loop6     pts        ram23     tty10     tty25     tty4      tty54     ttyS0     vcsa1

```

2.2 Software

Users need to download the firmware binary onto the flash on the NRC7292 module to enable AT-command communication via UART or SPI.

Refer to the user guide **UG-7292-004-Standalone SDK.pdf** for instructions on how to download the firmware binary. (3 How to download compiled binaries)

3 AT Command Type

There are four types of AT-commands: HELP, GET, SET and RUN.

Type	Format	Description
HELP	AT+<CMD>=?	List the input argument format and description.
SET or RUN	AT+<CMD>	Run with no argument.
	OR AT+<CMD>=<X1,X2,...>	OR Set or run with the given arguments.
GET	AT+<CMD>?	Query the current values with no argument.
	OR AT+<CMD>?=<X1,X2,...>	OR Query the current values with the given arguments.

Table 3.1 AT-command type

- String input parameter values must be enclosed between double quotation marks (“”).
- Parameters enclosed between a pair of square brackets ‘[]’ indicate optional parameters.
- Optional parameters may be nested.
- All AT commands must be in upper-case letters and terminated by CR-LF.
- Default optional values in the parameter descriptions are indicated by the asterisk ‘*’ characters.

4 Return for Command

Return Message	Description
OK	The operation for command completes successfully.
ERROR	The command is not supported.
+<CMD>:1 ERROR	The parameter for command is not valid.
+<CMD>:2 ERROR	The previous operation for command is in progress.
+<CMD>:3 ERROR	The operation for command failed with some error.
+<CMD>:4 ERROR	The operation for command is still in progress after the specified time.

5 Basic AT Commands

Commands	Description
AT	Check the AT serial interface status.
ATE	Enable or disable echo.
ATZ	Reset the hardware and restart the firmware.
AT+VER	Fetch the AT firmware version and software package version.
AT+BOOT	Fetch the cause of the most recent system boot.
AT+UART	Configure the serial UART parameters.
AT+GPIOCONF	Configure the GPIO pin mode, direction and pull-up option.
AT+GPIOVAL	Read or write the output GPIO pin level.
AT+FWUPDATE	Set the information required for firmware update.
AT+FWBINDL	Download the firmware binary data to RAM and write it to FLASH.
AT+SFUSER	Read, write and erase the user data area of Flash memory.
AT+SFSYSUSER	Read the user factory area of Flash memory.
+BEVENT	Asynchronously raised event messages.

5.1AT

Command	AT
Response	OK
Description	Check the AT serial interface status.
Example	AT OK

5.2ATE

Command	ATE0 or ATE1
Response	OK
Description	Enable (ATE1) or disable (ATE0) echo. (default: disable) NOTE: Echo should typically be enabled for manual communication via a terminal.
Example	ATE1 OK ATE0 OK

5.3ATZ

Command	ATZ
Response	
Description	Reset the hardware and restart the firmware.
Example	ATZ

5.4AT+VER

Command	<u>GET</u> AT+VER?
Response	<u>GET</u> +VER: <SDK>,<ATCMD>

	OK
Parameters	<SDK> SDK version <ATCMD> AT Command Set version
Description	Fetch the version information of current firmware.
Example	AT+VER? +VER:"1.4.0","1.23.5" OK

5.5 AT+BOOT

Command	<u>GET</u> AT+BOOT?	
Response	<u>GET</u> +BOOT: <reason> OK	
Parameters	<reason> The cause of the system boot. <ul style="list-style-type: none">● “POR” : Power On Reset● “WDT” : Watchdog Timer● “PMC” : Power Management Controller● “HSPI” : HSPI controller	
Description	Fetch the cause of the most recent system boot.	
	Boot Cause	Description
	POR	This indicates a Power-On Reset (POR), which can occur due to one of the following: <ul style="list-style-type: none">- Powering on the system.- Triggering the reset pin manually.- A software command that writes to the reset register.
	WDT	The system was reset due to a Watchdog Timer (WDT) event. This typically happens when the system fails to respond or hang for a prolonged period, causing the watchdog timer to reset the system to prevent it from freezing.

	PMC	This indicates a reset caused by the Power Management Controller (PMC), which is responsible for managing power-related functions in the system.
	HSPI	This indicates a reset caused by the HSPI controller. A host application can request a firmware reset by writing a software reset register in the HSPI controller.
	<p>NOTE:</p> <p>After booting, the AT Command firmware writes the message "+BOOT:<reason>" to the host interface (UART or HSPI).</p>	
Example	<pre>+BOOT:"POR" : : AT+BOOT? +BOOT:"POR" OK</pre>	

5.6 AT+UART

Command	<p><u>SET</u> AT+UART=<baud_rate>,<HFC></p> <p><u>GET</u> AT+UART?</p>
Response	<p><u>SET</u> OK</p> <p><u>GET</u> +UART:<baud_rate>,<data_bits>,<stop_bits>,<parity>,<HFC> OK</p>
Parameters	<p><baud rate> 9600, 19200, 38400, 57600, 115200*, 230400, 460800, 500000, 576000, 921600, 1000000, 1152000, 1500000, 2000000</p> <p><data bits> Always 8 (8-bit)*</p>

	<p><stop bits> Always 1 (1-bit)*</p> <p><parity> Always 0 (None)*</p> <p><HFC> 0 : disable RTS/CTS* 1 : enable RTS/CTS</p>
Description	<p>Configure the baud rate and hardware flow control for the UART.</p> <p>NOTE :</p> <p>For higher baud rates, it is recommended to enable hardware flow control.</p> <p>When hardware flow control is disabled, the AT+SSEND command can only set synchronous send mode.</p>
Example	<p>AT+UART=115200,1 OK</p> <p>AT+UART? +UART:115200,8,1,0,1 OK</p>

5.7 AT+GPIOCONF

Command	<p><u>SET</u> AT+GPIOCONF=<number>,<direction>,<pull-up></p> <p><u>GET</u> AT+GPIOCONF? AT+GPIOCONF?=<number></p>
Response	<p><u>SET</u> OK</p> <p><u>GET</u> +GPIOCONF=<number>,<direction>,<pull-up> : OK</p>
Parameters	<number>

	<p>GPIO pin number. (8, 9, 10, 11, 12, 13, 14, 15, 16, 17)</p> <p><direction> 0 : input 1 : output</p> <p><pull-up> (input pin only) 0 : pull-down 1 : pull-up</p>
Description	Configure the GPIO pin direction and pull-up option.
Example	<p>AT+GPIOCONF? +GPIOCONF:8,1,0 +GPIOCONF:9,1,0 +GPIOCONF:10,1,0 +GPIOCONF:11,1,0 +GPIOCONF:12,1,0 +GPIOCONF:13,1,0 +GPIOCONF:14,1,0 +GPIOCONF:15,1,0 +GPIOCONF:16,1,0 +GPIOCONF:17,1,0 OK</p> <p>AT+GPIOCONF=10,0,1 OK</p> <p>AT+GPIOCONF?=10 +GPIOCONF:10,0,1 OK</p>

5.8AT+GPIOVAL

Command	<p><u>SET</u> AT+GPIOVAL=<number>,<level></p> <p><u>GET</u> AT+GPIOVAL?</p>
---------	---

	AT+GPIOVAL?=<number>
Response	<u>SET</u> OK <u>GET</u> +GPIOVAL:<number>,<level> OK
Parameters	<number> GPIO pin number. (8, 9, 10, 11, 12, 13, 14, 15, 16, 17) <level> 0 : low 1 : high
Description	Read or write the output GPIO pin level.
Example	AT+GPIOVAL? +GPIOVAL:8,1 +GPIOVAL:9,1 +GPIOVAL:10,1 +GPIOVAL:11,1 +GPIOVAL:12,1 +GPIOVAL:13,1 +GPIOVAL:14,1 +GPIOVAL:15,1 +GPIOVAL:16,1 +GPIOVAL:17,1 OK AT+GPIOVAL=9,0 OK AT+GPIOVAL?=9 +GPIOVAL:9,0 OK

5.9AT+FWUPDATE

Command	<u>RUN</u>
---------	------------

	<p>AT+FWUPDATE</p> <p><u>SET</u></p> <p>AT+FWUPDATE=<length>,<crc32>[,<verify>]</p> <p><u>GET</u></p> <p>AT+FWUPDATE?</p>
Response	<p><u>RUN</u></p> <p>OK</p> <p><u>SET</u></p> <p>OK</p> <p><u>GET</u></p> <p>+FWUPDATE:<length>,<crc32>,<verify></p> <p>OK</p>
Parameters	<p><length></p> <p>Total length of firmware binary data.</p> <p><crc32></p> <p>A 32-bit hexadecimal value, prefixed with '0x' and calculated using the CRC-32 algorithm to detect data corruption.</p> <p>To determine the CRC value of the 'newFW.bin' file, you can use the 'crc.py' script located in the 'package\standalone\atcmd\host\python-http-server\python' directory. Simply run the command 'python crc.py newFW.bin' and add the '0x' prefix to the result.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <pre>(ex) python crc.py newFW.bin 97cb8611</pre> </div> <p><verify></p> <p>Enable or disable to check for data error. (*0 : disable, 1 : enable)</p> <p>If the "<verify>" option is set to 1, the written binary data is read to check for data error. And if a data error occurs, the binary data is written back to the erased flash memory.</p>
Description	<p>Set the information required for firmware update.</p> <p>The SET command sets the data length and CRC value before downloading the firmware binary data with the AT+FWBINDL command. The AT+FWUPDATE=0 command resets previous settings to 0.</p>

	<p>The RUN command is required after completing the download with the AT+FWBINDL command and before resetting the system. A system reset can be performed with the ATZ command.</p> <p>Replacing the old firmware with a new one is performed by the bootloader after a system reset.</p>
Example	<p>AT+FWUPDATE=0 OK</p> <p>AT+FWUPDATE=915320,0xDAE06D27 OK</p> <p>AT+FWUPDATE? +FWUPDATE: 915320,0xDAE06D27 OK</p> <p>!!! Download the firmware binary data with the AT+FWBINDL SET command !!!</p> <p>AT+FWUPDATE OK</p> <p>ATZ</p>

5.10 AT+FWBINDL

Command	<p><u>SET</u> AT+FWBINDL=<offset>,<length></p> <p><u>GET</u> AT+FWBINDL?</p>
Response	<p><u>SET</u> OK</p> <p><u>GET</u> +FWBINDL:<total_length>,<done_length> OK</p>
Parameters	<p><offset> Zero-based offset of the data to download.</p> <p><length> Length of data to download.</p>

	<p><total_length> Total length of firmware binary data.</p> <p><done_length> The data length written to flash memory after downloading.</p>
Description	<p>Download the firmware binary data to RAM and write it to FLASH.</p> <p>Firmware binary data can be downloaded with multiple SET commands. After receiving the OK message for the SET command, data can be downloaded up to 4KB at a time.</p> <p>If no data is downloaded for 1 second, the FWBINDL_IDLE event is raised. At this time, the download can be canceled with the "AT\r\n" command without downloading the remaining data.</p> <p>+BEVENT:"FWBINDL_IDLE",<offset>,<length>,<count></p> <p>When a download is cancelled, the FWBINDL_DROP event is raised. However, the data downloaded with the previous SET command remains, so canceled data can be downloaded again.</p> <p>+BEVENT:"FWBINDL_DROP", <offset>,<length></p> <p>If the downloaded data cannot be written to FLASH or if the data written to FLASH does not match the downloaded data, the FWBINDL_FAIL event is raised.</p> <p>+BEVENT:"FWBINDL_FAIL", <offset>,<length></p> <p>If data is downloaded without cancellation and error, the FWBINDL_DONE event is raised. After the FWBINDL_DONE event, the next data can continue to be downloaded with the SET command.</p> <p>+BEVENT:"FWBINDL_DONE", <offset>,<length></p>
Example	<pre>AT+FWUPDATE=915320,0xDAE06D27 OK AT+FWBINDL? +FWBINDL:915320,0 OK AT+FWBINDL=0,4096 OK</pre>

	<div>< data > +BEVENT:"FWBINDL_DONE",0,4096 AT+FWBINDL=4096,4096 OK < data > +BEVENT:"FWBINDL_DONE",4096,4096 AT+FWBINDL=8192,4096 OK < data > +BEVENT:"FWBINDL_DONE",8192,4096 : : AT+FWBINDL=909312,4096 OK < data > +BEVENT:"FWBINDL_DONE",909312,4096 AT+FWBINDL=913408,1912 OK < data > +BEVENT:"FWBINDL_DONE",913408,1912 AT+FWBINDL? +FWBINDL:915320,915320 OK</div>
--	---

5.11 AT+SFUSER

Command	<div><u>SET</u> AT+SFUSER=<mode>[,<offset>,<length>] <u>GET</u> AT+SFUSER?</div>
Response	<div><u>SET</u> OK <u>GET</u> +SFUSER:<address>,<size> OK</div>
Parameters	<div><mode></div>

	<p>0 : Read 1 : Write 2 : Erase</p> <p><offset> Offset from the start address of the user data area.</p> <p><length> Amount of data in bytes to read, write, or erase.</p> <p><address> Start address of the user data area.</p> <p><size> Total size of the user data area in kilobytes.</p>
Description	<p>Read, write and erase the user data area of Flash memory.</p> <ol style="list-style-type: none"> Read <ul style="list-style-type: none"> Read data from the specified Flash memory offset. The read data is appended after the +RXD_SFUSER message. +RXD_SFUSER:<offset>,<length>\r\n<data> Write <ul style="list-style-type: none"> Write data to the specified Flash memory offset. During the write operation, several events may occur. These events indicate the status of the write process: <ol style="list-style-type: none"> +BEVENT:"SFUSER_IDLE", <offset>,<length>,<count> <ul style="list-style-type: none"> No data is received from the host interface (UART or SPI) for more than 1 second. <count> indicates the amount of data received before the event. +BEVENT:"SFUSER_DROP", <offset>,<length> <ul style="list-style-type: none"> An operation is canceled with the "AT\r\n" command after a "SFUSER_IDLE" event. +BEVENT:"SFUSER_FAIL", <offset>,<length> <ul style="list-style-type: none"> Flash write operation failed. +BEVENT:f"SFUSER_DONE", <offset>,<length>

	<div>- Write operation completed successfully.</div> <div>3. Erase<ul style="list-style-type: none">● Erase the specified section of Flash memory.● If no offset or length is specified, the entire user data area is erased.</div> <div>NOTE: The user data area may or may not be supported depending on the Flash memory map profile. The total size of the available user data area can be checked with the GET command. The total size of the user data area is 100KB or 8KB.</div>
Example	<div>AT+SFUSER? +SFUSER:0x1E6000,100 OK</div> <div>AT+SFUSER=0,0,128 OK +RXD_SFUSER:0,128 <data></div> <div>AT+SFUSER=1,0,128 OK <data> +BEVENT:"SFUSER_DONE",0,128</div> <div>AT+SFUSER=0,0,128 OK +RXD_SFUSER:0,128 <data></div> <div>AT+SFUSER=2,0,128 OK</div> <div>AT+SFUSER=2 OK</div>

5.12 AT+SFSYSUSER

Command	<u>SET</u>
---------	------------

	AT+SFSYSUSER=<offset>[,<length>] <u>GET</u> AT+SFSYSUSER?
Response	<u>SET</u> OK <u>GET</u> +SFSYSUSER:<address>,<size> OK
Parameters	<p><offset> Offset from the start address of the user factory area</p> <p><length> Amount of data in bytes to read, write, or erase.</p> <p><address> Start address of the user factory area.</p> <p><size> Total size of the user factory area in bytes.</p>
Description	<p>Read the user factory data in the 4KB SYSCONFIG area of Flash memory.</p> <p>The read data is appended after the +RXD_SFSYSUSER message. +RXD_SFSYSUSER:<offset>,<length>\r\n<data></p> <p>NOTE: The total size of the available user factory area can be checked with the GET command.</p>
Example	AT+SFSYSUSER? +SFSYSUSER:0x1FC100,512 OK AT+SFSYSUSER=0 OK +RXD_SFSYSUSER:0,512 <data> AT+SFSYSUSER=128

	OK +RXD_SFSYSUSER:128,384 <data> AT+SFSYSUSER=256,128 OK +RXD_SFSYSUSER:256,128 <data>
--	--

5.13 +BEVENT

Message	+BEVENT:<event>[,<parameter 1>,...,<parameter N>]
Parameters	<event> "FWBINDL_IDLE",<offset>,<length>,<count> "FWBINDL_DROP", <offset>,<length> "FWBINDL_FAIL", <offset>,<length> "FWBINDL_DONE", <offset>,<length> "SFUSER_IDLE",<offset>,<length>,<count> "SFUSER_DROP", <offset>,<length> "SFUSER_FAIL", <offset>,<length> "SFUSER_DONE", <offset>,<length>
Description	Asynchronously raised event messages.
Example	+BEVENT:"FWBINDL_IDLE",102400,4096,1024 +BEVENT:"FWBINDL_DROP",102400,4096 +BEVENT:"FWBINDL_FAIL",102400,4096 +BEVENT:"FWBINDL_DONE",909312,4096 +BEVENT:"SFUSER_IDLE",128,1024,512 +BEVENT:"SFUSER_DROP",128,1024 +BEVENT:"SFUSER_FAIL",128,1024 +BEVENT:"SFUSER_DONE",128,1024

6 Wi-Fi AT Commands

Commands	Description
AT+WMACADDR	Read the MAC address.
AT+WOUNTRY	Configure the Wi-Fi country code
AT+WTXPOWER	Configure the TX power level.
AT+WRXSIG	Fetch or monitor the RSSI (dBm) and SNR (dB) values.
AT+WRATECTRL	Toggle the MCS rate control option.
AT+WMCS	Set the MCS index.
AT+WDUTYCYCLE	Configure duty cycle operation.
AT+WCCATHRESHOLD	Set CCA threshold.
AT+WTXTIME	Set carrier sense time and pause time.
AT+WTSF	Read the elapsed TSF timer duration.
AT+WBI	Get the beacon interval of the connected AP in STA mode.
AT+WLI	Set the listen interval in STA mode.
AT+WSCAN	Perform Wi-Fi scanning.
AT+WSCANSSID	Perform Wi-Fi scanning with probe request frames that specify full SSID.
AT+WBGSCAN	Performs periodic background scans based on signal strength.
AT+WSAEPWE	Set the SAE PWE derivation method
AT+WCONN	Connect to a new AP.
AT+WDISCONN	Disconnect from the AP or abort an on-going connection process.
AT+WSOFTAP	Run as the AP mode.
AT+WSOFTAPSSID	Set how to specify the SSID in the beacon frame.
AT+WBSSMAXIDLE	Configure the BSS Max idle service for SoftAP.
AT+WSTAINFO	Get information of associated STAs on AP mode.
AT+WMAXSTA	Set the maximum number of STAs allowed in AP mode.
AT+WIPADDR	Configure the IPv4 address.

AT+WDNS	Configure the IP address for the DNS server.
AT+WDHCP	Request dynamic IP allocation from the DHCP server.
AT+WDHCPS	Run the DHCP sever in SoftAP mode.
AT+WPING	Send ICMP ECHO_REQUEST to network hosts with IPv4 address.
AT+WDEEPSLEEP	Configure deep-sleep mode to save power.
AT+WFOTA	Enable or disable Firmware Over-the-Air (FOTA).
AT+WCTX	Send dummy data frames for continuous TX without connecting to AP.
AT+WRELAY	Run as the RELAY mode.
AT+WWPS	Enable WPS PBC mode and start WPS negotiation.
AT+WTIMEOUT	Configure the response timeout for the specified command.
+WEVENT	Asynchronously raised Wi-Fi event messages.

6.1 AT+WMACADDR

Command	<u>GET</u> AT+WMACADDR?
Response	<u>GET</u> +WMACADDR:"<mac_address_0>","<mac_address_1>" OK
Parameters	<mac_address_0> , <mac_address_1> The MAC address 'HH:HH:HH:HH:HH:HH' where H is a hexadecimal character. mac_address_0 indicates the STA MAC address in STA mode, and the AP MAC address in AP and RELAY modes. mac_address_1 indicates the STA MAC address in RELAY mode.
Description	Read the MAC address
Example	AT+ WMACADDR? +WMACADDR:"2F:33:4F:65:11:20", "2F:33:4F:65:11:21" OK

6.2 AT+WCCOUNTRY

Command	<u>SET</u> AT+WCCOUNTRY="<country code>" <u>GET</u> AT+WCCOUNTRY?
Response	<u>SET</u> OK <u>GET</u> +WCCOUNTRY="<country code>" OK
Parameters	<country_code> <ul style="list-style-type: none"> - AU : Australia - CN : China - EU : Europe - JP : Japan - NZ : New Zealand - US : United States - K1 : Korea USN1

	<ul style="list-style-type: none"> - K2 : Korea USN5 - S8 : Singapore 860MHz band - S9 : Singapore 920MHz band - T8 : Taiwan 840MHz band - T9 : Taiwan 920MHz band
Description	<p>Configure the Wi-Fi country code. Supported country codes can be retrieved with the “AT+WCCOUNTRY=?” command.</p> <p>NOTE:</p> <p>If the nrc7394 module has RF calibration data, the country code is set during boot as shown in the firmware log below.</p> <pre>[ATCMD] RF_CAL_INFO: cal_use=1 country=US id=1 Target RF calibration data country code = US, ID = 1 # 32KHz external XTAL is working [630] Target RF calibration data country code = US, ID = 1 [ATCMD] wifi_init: US 45 1M_BW: 9025 9035 9045 9055 9065 9075 9085 9095 9105 9115 1M_BW: 9125 9135 9145 9155 9165 9175 9185 9195 9205 9215 1M_BW: 9225 9235 9245 9255 9265 9275 2M_BW: 9030 9050 9070 9090 9110 9130 9150 9170 9190 9210 2M_BW: 9230 9250 9270 4M_BW: 9060 9100 9140 9180 9220 9260</pre> <p>If not, the country code may need to be set with the SET command after boot.</p>
Example	<pre>AT+WCCOUNTRY=? +AT+WCCOUNTRY="{US JP K1 T8 EU CN NZ AU K2 S8 S9 T9}" OK AT+ WCCOUNTRY ="US" OK AT+WCCOUNTRY? +WCCOUNTRY:"US" OK</pre>

6.3 AT+WTXPOWER

Command	<p>SET AT+WTXPOWER=<power>[, "<mode>"]</p> <p>GET AT+WTXPOWER?</p>
Response	<p>SET OK</p>

	GET +WTXPOWER:<power_0>,<power_1>,"<mode>"[,<limit_power>] OK											
Parameters	<mode> TX power mode <table><tr><th>Mode</th><th>Description</th></tr><tr><td>"auto"</td><td>TX power is automatically adjusted based on signal quality. (default)</td></tr><tr><td>"fixed"</td><td>TX power remains fixed at the specified <power> level.</td></tr><tr><td>"limit"</td><td>TX power is adjusted within the specified <power>.</td></tr></table>	Mode	Description	"auto"	TX power is automatically adjusted based on signal quality. (default)	"fixed"	TX power remains fixed at the specified <power> level.	"limit"	TX power is adjusted within the specified <power>.			
	Mode	Description										
	"auto"	TX power is automatically adjusted based on signal quality. (default)										
	"fixed"	TX power remains fixed at the specified <power> level.										
	"limit"	TX power is adjusted within the specified <power>.										
<power> TX power level (1dBm to 30dBm)												
<power_0>, <power_1> TX power level at last transmission <table><tr><th>Device Type</th><th>power_0 (wlan0)</th><th>power_1 (wlan1)</th></tr><tr><td>AP</td><td>AP TX Power</td><td>Always 0</td></tr><tr><td>STA</td><td>STA TX Power</td><td>Always 0</td></tr><tr><td>RELAY</td><td>Relay AP TX Power</td><td>Relay STA TX Power</td></tr></table>	Device Type	power_0 (wlan0)	power_1 (wlan1)	AP	AP TX Power	Always 0	STA	STA TX Power	Always 0	RELAY	Relay AP TX Power	Relay STA TX Power
Device Type	power_0 (wlan0)	power_1 (wlan1)										
AP	AP TX Power	Always 0										
STA	STA TX Power	Always 0										
RELAY	Relay AP TX Power	Relay STA TX Power										
<limit_power> Maximum allowable TX power level when TX power mode is set to "limit."												
Description	Configure the TX power level.											
Example	AT+WTXPOWER? +WTXPOWER:0,0,"auto",30 <--- no transmission OK AT+WPING="192.168.200.1" : OK AT+WTXPOWER? +WTXPOWER:20,0,"auto",30 OK											
	< FIXED mode > AT+WTXPOWER=10 OK											

	<div>AT+WPING="192.168.200.1"</div> <div>:</div> <div>OK</div> <div>AT+WTXPOWER?</div> <div>+WTXPOWER:10,0,"fixed",10</div> <div>OK</div> <div>< LIMIT mode ></div> <div>AT+WTXPOWER=15,"limit"</div> <div>OK</div> <div>AT+WPING="192.168.200.1"</div> <div>:</div> <div>OK</div> <div>AT+WTXPOWER?</div> <div>+WTXPOWER:15,0,"limit",15</div> <div>OK</div> <div>< AUTO mode ></div> <div>AT+WTXPOWER=0</div> <div>OK</div> <div>AT+WPING="192.168.200.1"</div> <div>:</div> <div>OK</div> <div>AT+WTXPOWER?</div> <div>+WTXPOWER:20,0,"auto",30</div> <div>OK</div>
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6.4AT+WRXSIG

Command	<div><u>SET</u></div> <div>AT+WRXSIG =<time></div> <div><u>GET</u></div> <div>AT+WRXSIG?</div>
Response	<div><u>SET</u></div> <div>+WRXSIG:<rssi>,<snr></div> <div>...</div> <div>+WRXSIG:<rssi>,<snr></div>

	OK <u>GET</u> +WRXSIG:<rss>,<snr> OK
Parameters	<time> Monitoring time in seconds. <rss> Received Signal Strength Indication <snr> Signal to Noise Ratio
Description	Fetch or monitor the RSSI (dBm) and SNR (dB) values in STA mode.
Example	AT+WRXSIG? +WRXSIG:-68,31 OK AT+WRXSIG=10 +WRXSIG:-68,31 +WRXSIG:-68,30 +WRXSIG:-68,32 +WRXSIG:-68,32 +WRXSIG:-68,32 +WRXSIG:-68,32 +WRXSIG:-68,30 +WRXSIG:-68,31 +WRXSIG:-68,32 +WRXSIG:-68,32 OK

6.5 AT+WRATECTRL

Command	<u>SET</u> AT+WRATECTRL=<mode> <u>GET</u> AT+WRATECTRL?
Response	<u>SET</u>

	OK GET +WRATECTRL=<mode> OK
Parameters	<mode> 0 : disable 1 : enable*
Description	Toggle the MCS rate control option.
Example	AT+WRATECTRL? +WRATECTRL:1 OK AT+WRATECTRL=0 OK AT+WRATECTRL? +WRATECTRL:0 OK

6.6 AT+WMCS

Command	<u>SET</u> AT+WMCS=<index> <u>GET</u> AT+WMCS?					
Response	<u>SET</u> OK <u>GET</u> +WMCS=<tx_index_0>,<tx_index_1>,<rx_index_0>,<rx_index_1> OK					
Parameters	<index> Modulation Coding Scheme index (0, 1, 2, 3, 4, 5, 6, 7 and 10) <tx_index_0> , <tx_index_1> , <rx_index_0> , <rx_index_1> MCS index at last transmission/reception <table><tr><td>device type</td><td>tx_index_0, rx_index_0 (wlan0)</td><td>tx_index_1, rx_index_1 (wlan1)</td></tr></table>			device type	tx_index_0, rx_index_0 (wlan0)	tx_index_1, rx_index_1 (wlan1)
device type	tx_index_0, rx_index_0 (wlan0)	tx_index_1, rx_index_1 (wlan1)				

	AP	AP MCS index	Always 0
	STA	STA MCS index	Always 0
	RELAY	Relay AP MCS index	Relay STA MCS index
Description	Set the MCS index. NOTE: The MCS index can only be set when rate control is disabled.		
Example	<pre>AT+WRATECTRL? +WRATECTRL:1 OK AT+WMCS? +WMCS:7,0,7,0 OK AT+WMCS=0 ERROR AT+WRATECTRL=0 OK AT+WRATECTRL? +WRATECTRL:0 OK AT+WMCS? +WMCS:4,0,7,0 OK AT+WMCS=10 OK AT+WMCS? +WMCS:10,0,7,0 OK</pre>		

6.7AT+WDUTYCYCLE

Command	<p>SET AT+WDUTYCYCLE=<window>[,<duration>[,<margin>]]</p>
---------	--

	<u>GET</u> AT+WDUTYCYCLE?
Response	<u>SET</u> OK <u>GET</u> +WDUTYCYCLE=<window>,<duration>,<margin> OK
Parameters	<window> Duty cycle window in microseconds <duration> TX duration in microseconds allowed within duty cycle window <margin> Duty margin in microseconds
Description	Configure duty cycle operation.
Example	AT+WDUTYCYCLE? +WDUTYCYCLE:0,0,0 OK AT+WDUTYCYCLE=1000000,100000 AT+WDUTYCYCLE? +WDUTYCYCLE:1000000,100000,0 OK AT+WDUTYCYCLE=0 OK AT+WDUTYCYCLE? +WDUTYCYCLE:0,0,0 OK

6.8 AT+WCCATHRESHOLD

Command	<u>SET</u>
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	AT+WCCATHRESHOLD=<threshold> <u>GET</u> AT+WCCATHRESHOLD?
Response	<u>SET</u> OK <u>GET</u> +WCCATHRESHOLD=<threshold> OK
Parameters	<threshold> CCA threshold.(unit: dBm) (-100 ~ -35)
Description	Set CCA threshold.
Example	AT+WCCATHRESHOLD? +WCCATHRESHOLD:-75 OK AT+WCCATHRESHOLD=-80 OK AT+WCCATHRESHOLD? +WCCATHRESHOLD:-80 OK

6.9 AT+WTXTIME

Command	<u>SET</u> AT+WTXTIME=<cs_time>,<pause_time> <u>GET</u> AT+WTXTIME?
Response	<u>SET</u> OK <u>GET</u> +WTXTIME:<cs_time>,<pause_time> OK
Parameters	<cs_time> Carrier sensing time in microseconds (0 ~ 13260)

	<pause_time> Tx pause time in microseconds
Description	Set carrier sense time and pause time for Listen Before Talk.
Example	AT+WTXTIME? +WTXTIME:0,0 OK AT+WTXTIME=128,2000 OK AT+WTXTIME? +WTXTIME:128,2000 OK

6.10 AT+WTSF

Command	<u>GET</u> AT+WTSF?
Response	<u>GET</u> +WTSF:<time_0>[,<time_1>] OK
Parameters	<time_0> , <time_1> Elapsed TSF timer duration in microseconds. time_0 indicates the STA time in STA mode, and the AP time in AP and RELAY modes. time_1 indicates the STA time index in RELAY mode and is excluded in AP and STA modes.
Description	Read the elapsed TSF timer duration.
Example	AT+WTSF? +WTSF:44142384 OK

6.11 AT+WBI

Command	<u>GET</u> AT+WBI?
----------------	-----------------------

Response	<u>GET</u> +WBI:<beacon_interval> OK
Parameters	<u><beacon_interval></u> Beacon interval expressed in Time Unit (TU) *1TU = 1024us
Description	<p>Get the beacon interval of the connected AP in STA mode.</p> <p>The beacon Interval indicates the time between beacon frames transmitted by an AP. Since it is expressed in TU, the beacon interval time is calculated as follows.</p> $\text{Beacon Interval Time (us)} = \text{<beacon_interval>} \times 1024$ <p>NOTE: If there is no connected AP, an ERROR message is returned.</p>
Example	AT+WBI? ERROR AT+WCONN="halow_atcmd_open" OK AT+WBI? +WBI:100 OK

6.12 AT+WLI

Command	<u>SET</u> AT+WLI=<listen_interval> <u>GET</u> AT+WLI?
Response	<u>SET</u> OK <u>GET</u> +WLI:<listen_interval> OK

Parameters	<listen_interval> Listen interval expressed in Beacon Interval (BI)
Description	<p>Set the listen interval in STA mode.</p> <p>The listen interval indicates how often the STA will wake to hear a beacon that includes a Traffic Indication Map (TIM) information element. Since it is expressed in BI, the listen interval time is calculated as follows.</p> $\begin{aligned}\text{Listen Interval Time (us)} &= \text{<listen_interval>} \times \text{Beacon Interval Time} \\ &= \text{<listen_interval>} \times \text{<beacon_interval>} \times 1024\end{aligned}$ <p>If BSS MAX IDLE service is enabled in AP, the listen interval time should be less than BSS MAX IDLE time to avoid association-reject.</p> <p>NOTE: The listen interval can only be set before the AT+WCONN command. While connected to the AP, the SET command returns an ERROR message.</p>
Example	<pre>AT+WLI? +WLI:0 OK AT+WLI=1000 OK AT+WLI? +WLI:1000 OK AT+WCONN="halow_atcmd_open" OK AT+WLI? +WLI:1000 OK AT+WLI=100</pre>

ERROR

6.13 AT+WSCAN

Command	<u>RUN</u> AT+WSCAN <u>SET</u> AT+WSCAN=[{+ -}]<freq>[@<bandwidth>][,<freq>[@<bandwidth>] ...] <u>GET</u> AT+WSCAN?
Response	<u>RUN</u> +WSCAN:<bssid>,<freq>@<bandwidth>,<sig_level>,<flags>,<ssid> : OK <u>SET</u> OK <u>GET</u> +WSCAN:<bandwidth>,<freq>[,<freq> ...] : OK
Parameters	<bssid> The BSSID of the AP. <freq> The center frequency of the channel. (MHz) <bandwidth> The bandwidth of the channel. (1/2/4 MHz) <sig_level> The RSSI (Received Signal Strength Indicator) in dBm. <flags> Service set flags. <ssid> The SSID of the AP.
Description	<u>RUN</u>

	<p>Perform Wi-Fi scanning.</p> <p><u>SET/GET</u></p> <p>Set the frequencies of the channel to scan or get a list of them.</p> <p>In the SET command, if the first frequency value has a '+' or '-' prefix, a new frequency is added or a specific frequency is excluded.</p> <p>"AT+WSCAN=0" command resets the scan frequency list to scan all supported channels.</p> <p>NOTE:</p> <p>The SET command cannot be used while connected to the AP and responds with ERROR.</p> <p>After "AT+WCCOUNTRY" and "AT+WDISCONN" commands, the scan frequency list is reset to scan all supported channels.</p>
Example	<p>AT+WCCOUNTRY="US"</p> <p>OK</p> <p>AT+WSCAN?</p> <p>+WSCAN:1,902.5,903.5,904.5,905.5,906.5,907.5,908.5,909.5,910.5,911.5</p> <p>+WSCAN:1,912.5,913.5,914.5,915.5,916.5,917.5,918.5,919.5,920.5,921.5</p> <p>+WSCAN:1,922.5,923.5,924.5,925.5,926.5,927.5</p> <p>+WSCAN:2,903.0,905.0,907.0,909.0,911.0,913.0,915.0,917.0,919.0,921.0</p> <p>+WSCAN:2,923.0,925.0,927.0</p> <p>+WSCAN:4,906.0,910.0,914.0,918.0,922.0,926.0</p> <p>OK</p> <p>AT+WSCAN</p> <p>+WSCAN:"02:00:eb:13:d3:4a",922.5@1,-39,"[ESS]","halow_open"</p> <p>+WSCAN:"68:27:eb:0e:07:27",922.5@1,-30,"[WPA2-PSK-CCMP][ESS]","halow_wpa2"</p> <p>+WSCAN:"8c:0f:fa:00:28:1f",906.0@4,-54,"[WPA3-SAE-CCMP][ESS]","halow_sae"</p> <p>+WSCAN:"8c:0f:fa:00:29:46",921.0@2,-75,"[WPA3-SAE-CCMP][ESS]","halow_sae2"</p> <p>OK</p> <p>AT+WSCAN=922.5</p>


```
OK
AT+WSCAN?
+WSCAN:1,922.5
OK
AT+WSCAN
+WSCAN:"02:00:eb:13:d3:4a",922.5@1,-39,"[ESS]","halow_open"
+WSCAN:"68:27:eb:0e:07:27",922.5@1,-30,"[WPA2-PSK-CCMP][ESS]","halow_wpa2"
OK

AT+WSCAN=+906,921
OK
AT+WSCAN?
+WSCAN:1,922.5
+WSCAN:2,921.0
+WSCAN:4,906.0
OK
AT+WSCAN
+WSCAN:"02:00:eb:13:d3:4a",922.5@1,-39,"[ESS]","halow_open"
+WSCAN:"68:27:eb:0e:07:27",922.5@1,-30,"[WPA2-PSK-CCMP][ESS]","halow_wpa2"
+WSCAN:"8c:0f:fa:00:28:1f",906.0@4,-54,"[WPA3-SAE-CCMP][ESS]","halow_sae"
+WSCAN:"8c:0f:fa:00:29:46",921.0@2,-75,"[WPA3-SAE-CCMP][ESS]","halow_sae2"
OK

AT+WSCAN=-921,922.5
OK
AT+WSCAN?
+WSCAN:4,906.0
OK
AT+WSCAN
+WSCAN:"8c:0f:fa:00:28:1f",906.0@4,-54,"[WPA3-SAE-CCMP][ESS]","halow_sae"
OK

AT+WSCAN=0
OK
AT+WSCAN?
```

```
+WSCAN:1,902.5,903.5,904.5,905.5,906.5,907.5,908.5,909.5,910.5,911.5
+WSCAN:1,912.5,913.5,914.5,915.5,916.5,917.5,918.5,919.5,920.5,921.5
+WSCAN:1,922.5,923.5,924.5,925.5,926.5,927.5
+WSCAN:2,903.0,905.0,907.0,909.0,911.0,913.0,915.0,917.0,919.0,921.0
+WSCAN:2,923.0,925.0,927.0
+WSCAN:4,906.0,910.0,914.0,918.0,922.0,926.0
OK

AT+WSCAN=922.5
OK
AT+WSCAN
+WSCAN:"02:00:eb:13:d3:4a",922.5@1,-39,"[ESS]","halow_open"
+WSCAN:"68:27:eb:0e:07:27",922.5@1,-30,"[WPA2-PSK-CCMP][ESS]","halow_wpa2"
OK
AT+WCONN="halow_open"
OK
AT+WSCAN?
+WSCAN=1,922.5
OK
AT+WSCAN=+906,921
ERROR

AT+WDISCONN
OK
AT+WSCAN?
+WSCAN:1,902.5,903.5,904.5,905.5,906.5,907.5,908.5,909.5,910.5,911.5
+WSCAN:1,912.5,913.5,914.5,915.5,916.5,917.5,918.5,919.5,920.5,921.5
+WSCAN:1,922.5,923.5,924.5,925.5,926.5,927.5
+WSCAN:2,903.0,905.0,907.0,909.0,911.0,913.0,915.0,917.0,919.0,921.0
+WSCAN:2,923.0,925.0,927.0
+WSCAN:4,906.0,910.0,914.0,918.0,922.0,926.0
OK

-----

AT+WCCOUNTRY="JP"
```

```
OK
AT+WSCAN?
+WSCAN:1,921.0,923.0,924.0,925.0,926.0,927.0
+WSCAN:2,923.5,924.5,925.5,926.5
+WSCAN:4,924.5,925.5
OK

AT+WSCAN=926,923,923.5,925.5
OK
AT+WSCAN?
+WSCAN:1,923.0,926.0
+WSCAN:2,923.5,925.5
OK

AT+WSCAN=926,923,926.5,925.5@2,925.5@4,924.5@2
OK
AT+WSCAN?
+WSCAN:1,923.0,926.0
+WSCAN:2,924.5,925.5,926.5
+WSCAN:4,925.5
OK

AT+WSCAN=-926.5,925.5@2
OK
AT+WSCAN?
+WSCAN:1,923.0,926.0
+WSCAN:2,924.5
+WSCAN:4,925.5
OK

AT+WSCAN=+924.5@4,925
OK
AT+WSCAN?
+WSCAN:1,923.0,925.0,926.0
+WSCAN:2,924.5
+WSCAN:4,924.5,925.5
OK
```

6.14 AT+WSCANSSID

Command	<u>SET</u> AT+WSCANSSID=" <ssid> "
Response	<u>SET</u> +WSCANSSID:" <bssid> ", <freq> , <sig_level> ," <flags> "," <ssid> " OK
Parameters	<ssid> The SSID of the AP
Description	Perform Wi-Fi scanning with probe request frame that specify full SSID.
Example	AT+WSCANSSID="halow_atcmd_open" +WSCANSSID:"8c:0f:fa:00:28:16",902.5,-74,"[ESS]","halow_atcmd_open" OK AT+WSCANSSID="halow_atcmd_sae" +WSCANSSID:"8c:0f:fa:00:28:16",906.0,-71,"[WPA3-SAE-CCMP][ESS]","halow_atcmd_sae" OK

6.15 AT+WBGSCAN

Command	<u>SET</u> AT+WBGSCAN= <short_interval> , <long_interval> , <signal_threshold> <u>GET</u> AT+WBGSCAN?
Response	<u>SET</u> OK <u>GET</u> +WBGSCAN= <scanning> , <short_interval> , <long_interval> , <signal_threshold> OK
Parameters	<short_interval> Short scan interval in seconds <long_interval> Long scan interval in seconds

	<signal_threshold> Minimum RSSI needed for connection
Description	Performs periodic background scans based on signal strength. Background scans can be performed for roaming purposes within an ESS, a single network where all APs use the same SSID. NOTE: Parameters for background scans must be set with the AT+WBGSCAN SET command before the AT+WCONN RUN/SET command.
Example	AT+WDHCP=1 OK AT+WBGSCAN=30,300,-50 OK AT+WBGSCAN? +WBGSCAN:1,30,300,-50 OK AT+WCONN="halow_atcmd_open" OK

6.16 AT+WSAEPWE

Command	<u>SET</u> AT+WSAEPWE=<sae_pwe> <u>GET</u> AT+WSAEPWE?
Response	<u>SET</u> OK <u>GET</u> +WSAEPWE=<sae_pwe> OK
Parameters	<sae_pwe> SAE PWE derivation method (default : 2) <ul style="list-style-type: none"> ● 0 : Hunting-and-pecking loop only ● 1 : Hash-to-element only ● 2 : Both hunting-and-pecking loop and hash-to-element enabled

	This mode provides the broadest compatibility.
Description	<p>Set the SAE (Simultaneous Authentication of Equals) PWE (Password Element) derivation method, which is how the password element is derived during the WPA3-SAE process.</p> <p>The SAE PWE derivation method can be set with the SET command before the AT+WCONN command.</p>
Example	<pre>AT+WSAEPWE? +WSAEPWE:2 OK AT+WSAEPWE=1 OK AT+WSAEPWE? +WSAEPWE:1 OK [Run STA in WPA3-SAE mode] AT+WCONN="halow_atcmd_sae","sae","12345678" OK</pre>

6.17 AT+WCONN

Command	<p>SET AT+WCONN="<ssid> <bssid>"[, "<security>"[, "<password>"]]</p> <p>GET AT+WCONN?</p>
Response	<p>SET OK</p> <p>GET +WCONN="<ssid>", "<bssid>", "<security>", "<password>", "<state>" OK</p>
Parameters	<p><ssid> The SSID of the AP.</p> <p><bssid> The BSSID of the AP.</p> <p><security> open*, wpa2-psk (or psk), wpa3-owe (or owe), wpa3-sae (or sae)</p>

	<p><password> (wpa2/wpa3-sae security option only) The password when wpa2/wpa3-sae security option is used. (length : 8 ~ 64)</p> <p><state> State indicator: "connecting", "connected", "disconnecting" or "disconnected"</p> <p>NOTE: For security reasons from AT Command Set v1.26.7, we decided to hide the password in the response message to the GET command. However, for compatibility with previous versions, the password field is displayed as "" or "*". "*" indicates that the AP information is recovered after waking up from deep sleep with the AT+WDEEPSLEEP command. And in this case, the AP information is initialized after disconnection.</p>						
Description	<p>Connect to a new AP or retrieves information about the current AP.</p> <p>If an ERROR is returned with the error number 2 (in progress) or 4 (timeout), the followings are required before a connection is attempted again with the AT+WCONN command.</p> <table border="1"> <thead> <tr> <th>Error number</th><th>Required operation</th></tr> </thead> <tbody> <tr> <td>2 (in progress)</td><td>STA should be disconnected from the AP with the AT+WDISCONN command.</td></tr> <tr> <td>4 (timeout)</td><td>Amount of timeout should be increased with the AT+WTIMOEUT command.</td></tr> </tbody> </table>	Error number	Required operation	2 (in progress)	STA should be disconnected from the AP with the AT+WDISCONN command.	4 (timeout)	Amount of timeout should be increased with the AT+WTIMOEUT command.
Error number	Required operation						
2 (in progress)	STA should be disconnected from the AP with the AT+WDISCONN command.						
4 (timeout)	Amount of timeout should be increased with the AT+WTIMOEUT command.						
Example	<p>OPEN : AT+WSCAN +WSCAN:"8c:0f:fa:00:2b:a1",922.0,-13,"[ESS]","halow_ap" OK AT+WCONN="halow_ap" OK AT+WCONN? +WCONN:"halow_ap","8C:0F:FA:00:2B:A1","open","", "connected" OK</p> <p>WPA2-PSK : AT+WSCAN +WSCAN:"8c:0f:fa:00:2b:a1",922.0,-14,"[WPA2-PSK-CCMP][ESS]","halow_ap"</p>						

	<div>OK</div> <div>AT+WCONN="halow_ap","wpa2-psk","12345678"</div> <div>OK</div> <div>AT+WCONN?</div> <div>+WCONN:"halow_ap","8C:0F:FA:00:2B:A1","wpa2-psk","","connected"</div> <div>OK</div> <div>WPA3-OWE :</div> <div>AT+WSCAN</div> <div>+WSCAN:"8c:0f:fa:00:2b:a1",922.0,-13,"[WPA2-OWE-CCMP][ESS]","halow_ap"</div> <div>OK</div> <div>AT+WCONN="halow_ap","wpa3-owe"</div> <div>OK</div> <div>AT+WCONN?</div> <div>+WCONN:"halow_ap","8C:0F:FA:00:2B:A1","wpa3-owe","","connected"</div> <div>OK</div> <div>WPA3-SAE :</div> <div>AT+WSCAN</div> <div>+WSCAN:"8c:0f:fa:00:2b:a1",922.0,-14,"[WPA2-SAE-CCMP][ESS]","halow_ap"</div> <div>OK</div> <div>AT+WCONN="halow_ap","wpa3-sae","12345678"</div> <div>OK</div> <div>AT+WCONN?</div> <div>+WCONN:"halow_ap","8C:0F:FA:00:2B:A1","wpa3-sae","","connected"</div> <div>OK</div>
--	---

6.18 AT+WDISCONN

Command	<div><u>RUN</u></div> <div>AT+WDISCONN</div>
Response	<div><u>RUN</u></div> <div>OK</div>
Description	Disconnect from the AP or abort an on-going connection process.
Example	<div>AT+WDISCONN</div> <div>OK</div>

6.19 AT+WSOFTAP

Command	<u>SET</u> AT+WSOFTAP=<frequency>[@<bandwidth>], "<ssid>" [, "<security>" [, "<password>"]] <u>GET</u> AT+WSOFTAP?
Response	<u>SET</u> OK <u>GET</u> +WSOFTAP=<bandwidth>,<frequency>,"<ssid>","<security>","<password>" [, "<dhcp>"] OK
Parameters	<p><bandwidth> S1G channel bandwidth (1/2/4 MHz)</p> <p><frequency> S1G channel frequency (MHz)</p> <p><ssid> The SSID of the AP.</p> <p><security> open*, wpa2-psk (or psk)</p> <p><password> (wpa2 security option only) The password when wpa2 security option is used. (length : 8 ~ 63)</p> <p><dhcp> Only included when the DHCP server is running.</p> <p>NOTE: For security reasons from AT Command Set v1.26.7, we decided to hide the password in the response message to the GET command. However, for compatibility with previous versions, the password field is displayed as "".</p>
Description	Run as the AP mode or retrieves information about the current settings. NOTE: The system should be reset to exit the AP mode. Software Reset is possible with the ATZ command.
Example	AT+WCCOUNTRY="JP"

	OK AT+WSCAN? +WSCAN:923.5,924.5,925.5,926.5,921.0,923.0,924.0,925.0,926.0,927.0 +WSCAN:924.5,925.5 OK AT+WSOFTAP=925.5@4,"halow_softap_psk","psk","12345678" OK AT+WSOFTAP? +WSOFTAP:4,925.5,"halow_softap_psk","wpa2-psk","" OK AT+WDHCPS +WDHCPS:192.168.200.27,255.255.255.0,192.168.200.1 OK AT+WSOFTAP? +WSOFTAP:4,925.5,"halow_softap_psk","wpa2-psk","","dhcp" OK
--	---

6.20 AT+WSOFTAPSSID

Command	<u>SET</u> AT+WSOFTAPSSID=<type> <u>GET</u> AT+WSOFTAPSSID?
Response	<u>SET</u> OK <u>GET</u> +WSOFTAPSSID:<type> OK
Parameters	<type> 0 : Full SSID* 1 : Empty SSID (length=0) 2 : Clear SSID
Description	Set how to specify the SSID in the beacon frame.

	<p>Empty SSID or Clear SSID is used to hide the SSID on the network.</p> <p>NOTE:</p> <p>Set the SSID type before starting the AP with the AT+WSOFTAP command.</p>
Example	<pre> AT+WSOFTAPSSID? +WSOFTAPSSID:0 OK AT+WSOFTAPSSID=1 OK AT+WSOFTAPSSID? +WSOFTAPSSID:1 OK AT+WSOFTAP=925,"halow_atcmd_open" OK AT+WSOFTAPSSID? +WSOFTAPSSID:1 OK AT+WSOFTAPSSID=2 ERROR </pre>

6.21 AT+WBSSMAXIDLE

Command	<p><u>SET</u></p> <p>AT+WBSSMAXIDLE=<period>[,<retry>]</p> <p><u>GET</u></p> <p>AT+WBSSMAXIDLE?</p>
Response	<p><u>SET</u></p> <p>OK</p> <p><u>GET</u></p> <p>+WBSSMAXIDLE:<period>,<retry></p> <p>OK</p>
Parameters	<p><period></p> <p>BSS MAX IDLE period in 1000TU (1 ~ 65535, default: 0)</p> <p>*TU : Time Unit (1024 us)</p>

	<p><retry> retry count for receiving keep alive packet from STA (3 ~ 100, default: 3)</p>
Description	<p>Configure the BSS MAX IDLE service for SoftAP.</p> <p>SoftAP disconnects STA that is inactive for BSS MAX IDLE time. If the AP does not receive a keep alive packet from the STA for BSS MAX IDLE time, it is determined that the STA is in an inactive state. The listen interval time should be less than BSS MAX IDLE time to avoid association-reject.</p> <p>Example:</p> <ul style="list-style-type: none"> - period = 1800 TU, retry count = 5 - BSS MAX IDLE time = 1800 x (1000 x 1024) = 1843.2 secs - Total BSS MAX IDLE time = 5 x 1843.2 = 9216 secs <p>If the period is set 0, the service is disabled.</p>
Example	<pre> AT+WBSSMAXIDLE? +WBSSMAXIDLE:0,3 OK AT+WBSSMAXIDLE=1800 OK AT+WBSSMAXIDLE? +WBSSMAXIDLE:1800,3 OK AT+WSOFTAP=918.5,"halow_softap_wpa2","wpa2-psk","12345678" OK AT+WDHCPS +WDHCPS:"192.168.50.1","255.255.255.0","192.168.50.1" OK AT+WBSSMAXIDLE=1800,5 OK AT+WBSSMAXIDLE? +WBSSMAXIDLE:1800,5 </pre>

	OK
	AT+WBSSMAXIDLE=0
	OK
	AT+WBSSMAXIDLE?
	+WBSSMAXIDLE:0,3
	OK

6.22 AT+WSTAINFO

Command	<u>SET</u> AT+WSTAINFO=<aid>[,<time>] <u>GET</u> AT+WSTAINFO?
Response	+WSTAINFO=<aid>,"<mac_address>",<rssi>,<snr>,<tx_mcs>,<rx_mcs> OK
Parameters	<p><aid> Association ID</p> <p><time> Monitoring duration in seconds.</p> <p><mac_address> Hardware address of associated station</p> <p><rssi> Received Signal Strength indication</p> <p><snr> Signal to Noise Ratio</p> <p><tx_mcs> , <rx_mcs> Modulation Coding Scheme index</p>
Description	Get information of associated STAs in SoftAP mode.
Example	AT+WSOFTAP=918.5,"halow_softap","wpa2-psk","12345678" OK AT+WIPADDR="192.168.1.1","255.255.255.0","192.168.1.1"

```
OK
AT+WDHCPS
+WDHCPS:"192.168.1.1","255.255.255.0","192.168.1.1"
OK

Wait for one or more stations to be associated ...

AT+WSTAINFO?
+WSTAINFO:1,"8c:0f:fa:00:2b:a1",-34,31,7,7
+WSTAINFO:2,"8c:0f:fa:00:2b:a2",-45,34,7,7
+WSTAINFO:3,"8c:0f:fa:00:2b:a3",-16,21,7,7
OK

AT+WSTAINFO=1
+WSTAINFO:1,"8c:0f:fa:00:2b:a1",-33,34,7,7
OK

AT+WSTAINFO=3,5
+WSTAINFO:3,"8c:0f:fa:00:2b:a3",-16,22,7,7
+WSTAINFO:3,"8c:0f:fa:00:2b:a3",-18,21,7,7
+WSTAINFO:3,"8c:0f:fa:00:2b:a3",-16,21,7,7
+WSTAINFO:3,"8c:0f:fa:00:2b:a3",-16,22,7,7
+WSTAINFO:3,"8c:0f:fa:00:2b:a3",-17,21,7,7
OK
```

6.23 AT+WMAXSTA

Command	<u>SET</u> AT+WMAXSTA=<max_num_sta> <u>GET</u> AT+WMAXSTA?
Response	<u>SET</u> OK <u>GET</u> +WMAXSTA=<max_num_sta> OK
Parameters	<max_num_sta> maximum number of STAs
Description	Set the maximum number of STAs allowed in AP mode.

	<p>NOTE:</p> <p>The maximum number of STAs must be set before starting AP mode with the AT+WSOFTAP SET command.</p>
Example	<pre>AT+WMAXSTA? +WMAXSTA:10 OK AT+WMAXSTA=1 OK AT+WSOFTAP=925,"halow_softap_psk","psk","12345678" OK AT+WMAXSTA? +WMAXSTA:1 OK</pre>

6.24 AT+WIPADDR

Command	<p><u>SET</u></p> <p>AT+WIPADDR="<u><address></u>","<netmask>","<gateway>"</p> <p><u>GET</u></p> <p>AT+WIPADDR?</p>
Response	<p><u>SET</u></p> <p>OK</p> <p><u>GET</u></p> <p>+WIPADDR="<u><address></u>","<netmask>","<gateway>"</p> <p>OK</p>
Parameters	<p><u><address></u>,<netmask>,<gateway></p> <p>IPv4 address</p>
Description	Configure the IPv4 address.
Example	<pre>AT+WIPADDR="192.168.200.20","255.255.255.0","192.168.200.1" OK AT+WIPADDR? +WIPADDR="192.168.200.20","255.255.255.0","192.168.200.1" OK</pre>

6.25 AT+WDNS

Command	<u>SET</u> AT+WDNS="<DNS1>"[, "<DNS2>"] <u>GET</u> AT+WDNS?
Response	<u>SET</u> OK <u>GET</u> +WDNS="<DNS1>"[, "<DNS2>"] OK
Parameters	<DNS1>,<DNS2> IPv4 address
Description	Configure the IP address of the DNS server.
Example	AT+WDNS? +WDNS="192.168.200.1","0.0.0.0" OK AT+WDNS="8.8.8.8" OK AT+WDNS? +WDNS="8.8.8.8","0.0.0.0" OK AT+WDNS="8.8.8.8","8.8.4.4" OK AT+WDNS? +WDNS="8.8.8.8","8.8.4.4" OK

6.26 AT+WDHCP

Command	<u>RUN</u> AT+WDHCP <u>SET</u> AT+WDHCP=<mode>
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	<u>GET</u> AT+WDHCP?
Response	<u>RUN</u> +WDHCP:"<address>","<netmask>","<gateway>",<lease_time> OK <u>SET</u> OK <u>GET</u> +WDHCP:{0 1} OK
Parameters	<mode> 0 : manually start the DHCP client after connection 1 : automatically start the DHCP client after connection or reconnection <address>, <netmask> and <gateway> IPv4 Address <lease_time> Duration of time in seconds that a DHCP server grants a device to use an IP address.
Description	Request dynamic IP allocation from the DHCP server. When the DHCP client is automatically started with the AT+WDHCP=1 command, the following events are sent to the terminal or host. +WEVENT:"DHCP_START" +WEVENT:"DHCP_STOP" +WEVENT:"DHCP_BUSY" +WEVENT:"DHCP_FAIL" +WEVENT:"DHCP_SUCCESS","<address>","<netmask>","<gateway>",<lease_time> +WEVENT:"DHCP_TIMEOUT",<time> If the DHCP server allows renewal before the lease expires, the firmware sends a DHCP_RENEW event to the terminal or host. +WEVENT:"DHCP_RENEW","<address>","<netmask>","<gateway>",<lease_time> If the IP address settings of the DHCP server change and a new IP address is assigned, the firmware may send a DHCP_RELEASE event before the DHCP_RENEW event.

	+WEVENT:"DHCP_RELEASE" NOTE: Wi-Fi connection must be established before the RUN command.
Example	AT+WCONN="halow_ap","wpa3-sae","12345678" OK AT+WDHCP +WDHCP:"192.168.200.20","255.255.255.0","192.168.200.1",86400 OK AT+WDISCONN OK AT+WDHCP? +WDHCP:0 OK AT+WDHCP=1 OK AT+WCONN="halow_ap","wpa3-sae","12345678" OK +WEVENT:"DHCP_START" +WEVENT:"DHCP_SUCCESS","192.168.200.18","255.255.255.0","192.168.200.1" +WEVENT:"DISCONNECT","","halow_ap","wpa3-sae" +WEVENT:"CONNECT_SUCCESS","","halow_ap","wpa3-sae" +WEVENT:"DHCP_START" +WEVENT:"DHCP_SUCCESS","192.168.200.18","255.255.255.0","192.168.200.1",86400 +WEVENT:"DHCP_RENEW","192.168.200.18","255.255.255.0","192.168.200.1",86400 +WEVENT:"DHCP_RENEW","192.168.200.18","255.255.255.0","192.168.200.1",43200 +WEVENT:"DHCP_RENEW","192.168.200.18","255.255.255.0","192.168.200.1",43200 +WEVENT:"DHCP_RELEASE" +WEVENT:"DHCP_RENEW","192.168.200.121","255.255.255.0","192.168.200.1",43200 +WEVENT:"DHCP_RENEW","192.168.200.121","255.255.255.0","192.168.200.1",43200

6.27 AT+WDHCPS

Command	<u>RUN</u> AT+WDHCPS
Response	<u>RUN</u> +WDHCPS:"<IP>","netmask","<gateway>" OK
Parameters	<IP> , <netmask> and <gateway> 'A.B.C.D' where A, B, C and D are between 0 and 255, inclusive.
Description	Run the DHCP sever in SoftAP mode. NOTE: SoftAP must be established before using this command. Refer to chapter 6.15. (AT+WSOFTAP)
Example	AT+WDHCPS +WDHCPS:"192.168.50.1","255.255.255.0","192.168.50.1" OK

6.28 AT+WPING

Command	<u>SET</u> AT+WPING="<remote address>"[,<time>] <u>GET</u> AT+WPING?
Response	<u>SET</u> +WPING:<size>,"<remote address>",<sequence number>,<TTL>,<elapsed time> : +WPING:<size>,"<remote address>",<sequence number>,<TTL>,<elapsed time> OK <u>GET</u> +WPING:"<remote address>",<time>
Parameters	<remote address> The remote IPv4 address of the recipient. <time> Monitoring duration in seconds. (Default: 5)

	<p><sequence number> ICMP sequence number.</p> <p><TTL> Time to leave (TTL).</p> <p><elapsed time> Time since the start of the session in seconds.</p>
Description	<p>Send ICMP ECHO_REQUEST to network hosts with IPv4 address.</p> <ul style="list-style-type: none"> - Interval Time : 1 sec - Packet Size : 64-bytes
Example	<pre>AT+WPING ="192.168.200.1",10 +WPING:64,"192.168.200.1",1,64,4 +WPING:64,"192.168.200.1",2,64,4 : +WPING:64,"192.168.200.1",9,64,4 +WPING:64,"192.168.200.1",10,64,4 OK</pre>

6.29 AT+WDEEPSLEEP

Command	<p>SET AT+WDEEPSLEEP=<timeout>[,<gpio>]</p>
Response	<p>SET OK</p>
Parameters	<p><timeout> Time in milliseconds. 0 for TIM mode.</p> <p><gpio> GPIO number to use as external signal input. Available GPIO numbers are between 8 and 17.</p>
Description	<p>Configure deep-sleep mode to save power.</p> <p>Deep sleep mode powers off most peripherals to use minimal power. The RTC and retention RAM are always powered. The CPU is powered only in TIM mode to run</p>

	<p>the uCode stored in the retention RAM. And the GPIO may be powered for external signal input.</p> <p>In TIM mode, the NRC7394 wakes up when there are frames to receive. However, in Non-TIM mode, it cannot be woken up until a timeout.</p> <p>If there are frames to send, the NRC7394 can only be woken up via the GPIO input. The GPIO input level should be low in active mode. If it is high in deep sleep mode, the NRC7394 wakes up. After waking up, the CPU resets and the firmware reboots. When the firmware reboot is finished, the host application or terminal program will receive a "DEEPSLEEP_WAKEUP" event message. And the AP connection and IP address will also be recovered to the same as before entering deep sleep.</p>
Example	<p>< Deep Sleep, TIM mode ></p> <pre>AT+WCONN="halow_ap","wpa2-psk","12345678" OK AT+WDHCP +WDHCP:"192.168.200.18","255.255.255.0","192.168.200.1" OK AT+WDEEPSLEEP=0,11 OK +WEVENT:"DEEPSLEEP_WAKEUP"</pre> <p>AT+WCONN? +WCONN="halow_ap","wpa2-psk","*", "connected" OK AT+WIPADDR? +WIPADDR:"192.168.200.18","255.255.255.0","192.168.200.1" OK AT+WPING="192.168.200.1",2 +WEVENT:"PING",64,"192.168.200.1",1,64,5 +WEVENT:"PING",64,"192.168.200.1",2,64,4 OK <p>< Deep Sleep, Non-TIM mode ></p> <pre>AT+WCONN="halow_ap","wpa3-sae","12345678" OK</pre> </p>

	AT+WDHCP +WDHCP:"192.168.200.18","255.255.255.0","192.168.200.1" OK AT+WDEEPSLEEP=5000,11 OK +WEVENT:"DEEPSLEEP_WAKEUP" AT+WCONN? +WCONN="halow_ap","wpa3-sae","*", "connected" OK AT+WIPADDR? +WIPADDR:"192.168.200.18","255.255.255.0","192.168.200.1" OK AT+WPING="192.168.200.1",2 +WEVENT:"PING",64,"192.168.200.1",1,64,6 +WEVENT:"PING",64,"192.168.200.1",2,64,4 OK
--	--

6.30 AT+WFOTA

Command	<u>SET</u> AT+WFOTA=<check_time>[,\"<server_url>\"] AT+WFOTA=<check_time>[,\"<server_url>\",\"<bin_name>\",<bin_crc32>] <u>GET</u> AT+WFOTA? <u>RUN</u> AT+WFOTA
Response	<u>SET</u> OK <u>GET</u> +WFOTA:<check_time>,\"<server_url>\",\"<bin_name>\",<bin_crc32> OK <u>RUN</u> OK
Parameters	<u><check_time></u> Interval time in seconds to get new firmware information from the server.

	<p>Set to 0 to stop the getting or get manually. Set to -1 to disable FOTA operation.</p> <p><server_url> HTTP or HTTPS Server URL *AT command firmware for 2MB FLASH does not support HTTPS.</p> <p><bin_name> Firmware binary name with extension .bin.</p> <p><bin_crc32> A 32-bit hexadecimal value, prefixed with '0x' and calculated using the CRC-32 algorithm to detect data corruption. To determine the CRC value of the 'newFW.bin' file, you can use the 'crc.py' script located in the 'package\standalone\atcmd\host\python-http-server\python' directory. Simply run the command 'python crc.py newFW.bin' and add the '0x' prefix to the result.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <pre>(ex) python crc.py newFW.bin 97cb8611</pre> </div>
Description	<p>FOTA(Firmware Over-the-Air) is enabled with the SET command and disabled by AT+WFOTA=-1 command.</p> <p>When FOTA is enabled, the current firmware starts checking for new firmware on the server. The server check interval can be controlled through the <check_time> parameter.</p> <p>To check for new firmware, the current firmware downloads the fota.json file from the server. The server should have a fota.json file as well as firmware binary. The contents of the fota.json file are as follows.</p> <pre> 1 { 2 "AT_SDK_VER" : "10.10.10", 3 "AT_CMD_VER" : "10.10.10", 4 5 "AT_HSPI_BIN" : "nrc7292_standalone_xip_ATCMD_HSPI_2M.bin", 6 "AT_HSPI_CRC" : "d35c22d8", 7 8 "AT_UART_BIN" : "nrc7292_standalone_xip_ATCMD_UART_2M.bin", 9 "AT_UART_CRC" : "bfea0540", 10 11 "AT_UART_HFC_BIN" : "nrc7292_standalone_xip_ATCMD_UART_HFC_2M.bin", 12 "AT_UART_HFC_CRC" : "b6f9eb78" 13 }</pre> <p>After getting information about new firmware from the server, the current firmware sends a FOTA_VERSION event to the terminal or host.</p>

+WEVENT:"FOTA_VERSION", "<sdk_version>", "<atcmd_version>"

After receiving the FOTA_VERSION event, the terminal or host can use the RUN command to download new firmware from the server.

If there is no fota.json file on the server, the firmware information to be downloaded can be set with the bin_name and bin_crc32 parameters. And the terminal or host can use the RUN command without receiving the FOTA_VERSION event.

The terminal or host can check the download process through FOTA_BINARY and FOTA_DOWNLOAD events from the current firmware.

+WEVENT: "FOTA_BINARY", "<binary_name>"

+WEVENT: "FOTA_DOWNLOAD", <total_size>, <download_size>

When the download is complete and ready to update, the terminal or host will receive a FOTA_UPDATE event from the current firmware.

+WEVENT: "FOTA_UPDATE"

If an error occurs during the above process, the terminal or host will receive a FOTA_FAIL event from the current firmware.

+WEVENT: "FOTA_FAIL"

And FOTA will be automatically disabled.

If there are no errors, the current firmware will be replaced with the new firmware after a software reset. A software reset is possible with the ATZ command.

Firmware replacement will take about 10 seconds or more.

If an error occurs while accessing the flash memory for firmware replacement, the current firmware cannot be restored. If the error still occurs after a hardware reset, the firmware can only be restored through the download tool.

NOTE:

Whether or not the firmware in the server is the latest version can be determined by comparing the version confirmed by the AT+VER command and the FOTA_VERSION event.

EVENT:

Name	Description
FOTA_VERSION	The version of new firmware on the server. - User SDK version - AT Command Set version
FOTA_BINARY	The binary name of new firmware to download from the server.
FOTA_DOWNLOAD	The binary size of new firmware being downloaded from the server. - Total size - Downloaded size
FOTA_UPDATE	The current firmware is ready to be replaced with the new firmware.
FOTA_FAIL	An error occurred during the FOTA process.

TEST:

The AT+WFOTA command can be tested using the python-http-server in the SDK.

This package has the shell and python scripts to run HTTP/HTTPS server.

Path : atcmd/host/python-http-server

```

atcmd/host/python-http-server/
├── fota.json
├── nrc7292_standalone_xip_ATCMD_HSPI_2M.bin
├── nrc7292_standalone_xip_ATCMD_UART_2M.bin
├── nrc7292_standalone_xip_ATCMD_UART_HFC_2M.bin
├── python
│   ├── crc.py
│   ├── https-server.py
│   ├── Run-server.sh
│   ├── ssl-cert
│   │   ├── server.crt
│   │   ├── server.csr
│   │   ├── server.key
│   │   └── server.key.origin
│   └── Update-fota-info.sh

```

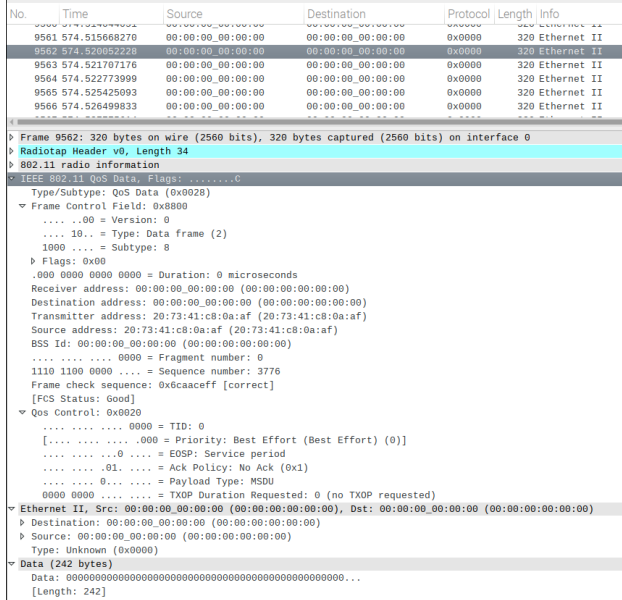
Shell Script	Description
Run-sever.sh	Run HTTP or HTTPS server. Usage: \$./Run-server.sh http \$./Run-server.sh https

	Update-fota-info.sh	<p>Calculate the CRC value of firmware binaries and update the fota.json file.</p> <p>Usage: \$./Update-fota-info.sh [{-h --help} {clean}]</p> <p>After running the script, select nrc7292 as the chip name. The version and binary name can be entered optionally.</p> <pre> 1) nrc7292 2) nrc7394 3) Quit Please select chip name : 1 (Optional) Please enter SDK version (10.10.10) : (Optional) Please enter ATCMD version (10.10.10) : (Optional) Please enter ATCMD_HSPI binary name (nrc7292_standalone_xip_ATCMD_HSPI_2M.bin) : (Optional) Please enter ATCMD_UART binary name (nrc7292_standalone_xip_ATCMD_UART_2M.bin) : (Optional) Please enter ATCMD_UART_HSPI binary name (nrc7292_standalone_xip_ATCMD_UART_HFC_2M.bin) : </pre> <p>If a binary is replaced with a new one, the fota.json should be updated by Update-fota-info.sh.</p>
Example	<p>AT+VER? +VER:"1.5.0","1.23.5" OK</p> <p>AT+WFOTA? +WFOTA:0,"","",0x0 OK</p> <p>< Get new firmware information from fota.json file ></p> <p>AT+WFOTA=10,"https://192.168.200.1:4443" AT+WFOTA=10,"https://192.168.200.1:4443" OK</p> <p>AT+WFOTA? +WFOTA:10,"https://192.168.200.1:4443","",0x0 OK</p> <p>+WEVENT:"FOTA_VERSION","10.10.10","10.10.10" +WEVENT:"FOTA_VERSION","10.10.10","10.10.10" +WEVENT:"FOTA_VERSION","10.10.10","10.10.10"</p> <p>*Stop the getting to switch manually.</p> <p>AT+WFOTA=0 OK</p> <p>AT+WFOTA=0 OK</p>	

	<pre>+WEVENT:"FOTA_VERSION","10.10.10","10.10.10" < Set new firmware information without fota.json file > AT+WFOTA=0,"https://192.168.200.1:4443","nrc7292_atcmd_hspi.bin",0x3e47cf92 OK AT+WFOTA? +WEVENT:0,"https://192.168.200.1:4443","nrc7292_atcmd_hspi.bin",0x3E47CF92 OK < Download the firmware binary > AT+WFOTA OK +WEVENT:"FOTA_BINARY","nrc7292_atcmd_hspi.bin" +WEVENT:"FOTA_DOWNLOAD",897632,90112 +WEVENT:"FOTA_DOWNLOAD",897632,180224 +WEVENT:"FOTA_DOWNLOAD",897632,270336 : +WEVENT:"FOTA_DOWNLOAD",897632,720896 +WEVENT:"FOTA_DOWNLOAD",897632,811008 +WEVENT:"FOTA_DOWNLOAD",897632,897632 +WEVENT:"FOTA_UPDATE" < Reset and update > ATZ</pre>
--	---

6.31 AT+WCTX

Command	<p><u>RUN</u> AT+WCTX</p> <p><u>SET</u> AT+WCTX=<frequency>,<bandwidth>,<mcs>,<txpower></p> <p><u>GET</u> AT+WCTX?</p>
Response	<p><u>RUN/SET</u> OK</p> <p><u>GET</u> +WCTX: <frequency>,<bandwidth>,<mcs>,<txpower></p>

	OK
Parameters	<p><frequency> Channel frequency in units of 100 KHz</p> <p><bandwidth> S1G channel bandwidth (1, 2 and 4 MHz)</p> <p><mcs> Modulation Coding Scheme index (0, 1, 2, 3, 4, 5, 6, 7 and 10)</p> <p><txpower> Transmission Power Level (1 ~ 30 dBm)</p>
Description	<p>Send dummy data frames for continuous TX without connecting to AP.</p> <p>Dummy data frame captured with Wireshark :</p>  <p>NOTE: This command is for testing purposes only.</p>
Example	<p>AT+WCCOUNTRY="US"</p> <p>OK</p> <p>< Set parameters for continuous TX ></p> <p>AT+WCTX=9180,4,7,17</p> <p>OK</p>

	AT+WCTX? +WCTX:9180,4,7,17 OK < Start continuous TX > AT+WCTX OK < Stop continuous TX > AT+WCTX=0 OK
--	--

6.32 AT+WWPS

Command	<u>RUN</u> AT+WWPS <u>SET</u> AT+WWPS="<bssid>"
Response	<u>RUN</u> OK <u>SET</u> OK
Parameters	<bssid> The BSSID of the AP.
Description	<p>Enable WPS-PBC mode and start WPS negotiation. WPS-PBC (Push Button Configuration) is a method within Wi-Fi Protected Setup (WPS).</p> <p>The result of the WPS Negotiation can be identified by one of the following events.</p> <pre>+WEVENT:"WPS_SUCCESS" +WEVENT:"WPS_TIMEOUT" +WEVENT:"WPS_FAIL"</pre> <p>NOTE:</p> <p>This command is not supported in RELAY mode. The SET command with the BSSID of the AP is supported only in STA mode. The AT+WWPS=0 command can be used to cancel a pending WPS operation.</p>

Example**[ATCMD SOFTAP]**

```
AT+WMACADDR?
+WMACADDR:"88:57:1d:f1:e1:ba","88:57:1d:f1:e1:bb"
OK
AT+WSOFTAP=918,"halow_atcmd_softap","wpa2-psk","12345678"
OK
AT+WSOFTAP?
+WSOFTAP:4,918.0,"halow_atcmd_softap","wpa2-psk",""
OK
AT+WIPADDR="192.168.100.1","255.255.255.0","192.168.100.1"
OK
AT+WDHCPS
+WDHCPS:192.168.100.1,255.255.255.0,192.168.100.1
OK
AT+WWPS
OK
```

```
+WEVENT:"STA_CONNECT","88:57:1D:F1:E1:70"
+WEVENT:"WPS_SUCCESS"
+WEVENT:"STA_DISCONNECT","88:57:1D:F1:E1:70"
+WEVENT:"STA_CONNECT","88:57:1D:F1:E1:70"
```

[ATCMD STA]

```
AT+WMACADDR?
+WMACADDR:"88:57:1d:f1:e1:70","88:57:1d:f1:e1:71"
OK
AT+WDHCP=1
OK
AT+WWPS
OK
```

```
+WEVENT:"WPS_SUCCESS"
+WEVENT:"CONNECT_SUCCESS","88:57:1d:f1:e1:ba","halow_atcmd_softap","wpa2-
psk"
+WEVENT:"DHCP_START"
```

	+WEVENT:"DHCP_SUCCESS","192.168.100.2","255.255.255.0","192.168.100.1"
--	--

6.33 AT+WTIMEOUT

Command	<u>SET</u> AT+WTIMEOUT="<command>",<timeout> <u>GET</u> AT+WTIMEOUT?
Response	<u>SET</u> OK <u>GET</u> +WTIMEOUT:"<command>",<timeout> ... OK
Parameters	<command> "WCONN", "WDISCONN", "WDHCP" <timeout> Timeout in seconds. (0: no timeout)
Description	Configure the response timeout for the specified command. Default timeout : <ul style="list-style-type: none"> - WCONN : 60 secs - WDISCONN : 60 secs - WDHCP : 60 secs
Example	AT+WTIMEOUT? +WTIMEOUT:"WCONN",60 +WTIMEOUT:"WDISCONN",60 +WTIMEOUT:"WDHCP",60 OK AT+WTIMEOUT="WCONN",120 OK AT+WTIMEOUT? +WTIMEOUT:"WCONN",120 +WTIMEOUT:"WDISCONN",60

```
+WTIMEOUT:"WDHCP",60
OK
```

6.34 +WEVENT

Response	+WEVENT:<event>[,<parameter 1>,...,<parameter N>]
Parameters	<p><event></p> <p>"CONNECT_SUCCESS", "<bssid>", "<ssid>", "<security>"</p> <p>"DISCONNECT", "<bssid>", "<ssid>", "<security>"</p> <p>"DHCP_START"</p> <p>"DHCP_STOP"</p> <p>"DHCP_BUSY"</p> <p>"DHCP_FAIL"</p> <p>"DHCP_SUCCESS", "<address>", "<netmask>", "<gateway>", "<lease_time>"</p> <p>"DHCP_TIMEOUT", "<time>"</p> <p>"DHCP_RELEASE"</p> <p>"DHCP_RENEW", "<address>", "<netmask>", "<gateway>", "<lease_time>"</p> <p>"STA_CONNECT", "<mac_addr>"</p> <p>"STA_DISCONNECT", "<mac_addr>"</p> <p>"FOTA_VERSION", "<sdk_version>", "<atcmd_version>"</p> <p>"FOTA_BINARY", "<binary_name>"</p> <p>"FOTA_DOWNLOAD", "<total_size>", "<download_size>"</p> <p>"FOTA_UPDATE"</p> <p>"FOTA_FAIL"</p> <p>"DEEPSLEEP_WAKEUP"</p> <p>"WPS_SUCCESS"</p> <p>"WPS_TIMEOUT"</p> <p>"WPS_FAIL"</p>
Description	Asynchronously raised Wi-Fi event messages.

Example

```
+WEVENT:"CONNECT_SUCCESS","8c:0f:fa:00:2b:a1","halow_sae","wpa3-sae"  
+WEVENT:"DISCONNECT","8c:0f:fa:00:2b:a1","halow_sae","wpa3-sae"  
  
+WEVENT:"DHCP_START"  
+WEVENT:"DHCP_STOP"  
+WEVENT:"DHCP_BUSY"  
+WEVENT:"DHCP_FAIL"  
+WEVENT:"DHCP_SUCCESS","192.168.200.18","255.255.255.0","192.168.200.1",86400  
+WEVENT:"DHCP_TIMEOUT",60  
+WEVENT:"DHCP_RENEW","192.168.200.18","255.255.255.0","192.168.200.1",86400  
+WEVENT:"DHCP_RELEASE"  
  
+WEVENT:"STA_CONNECT","8C:0F:FA:00:39:0D"  
+WEVENT:"STA_DISCONNECT","8C:0F:FA:00:39:0D"  
  
+WEVENT:"FOTA_VERSION","10.10.10","10.10.10"  
+WEVENT:"FOTA_BINARY","nrc7292_atcmd_hspi.bin"  
+WEVENT:"FOTA_DOWNLOAD",897632,90112  
+WEVENT:"FOTA_UPDATE"  
+WEVENT:"FOTA_FAIL"  
  
+WEVENT:"DEEPSLEEP_WAKEUP"  
  
+WEVENT:"WPS_SUCCESS"  
+WEVENT:"WPS_TIMEOUT"  
+WEVENT:"WPS_FAIL"
```

7 Socket AT Commands

Commands	Description
AT+SOPEN	Create a TCP/UDP socket for IPv4 domain.
AT+SCLOSE	Close an existing socket.
AT+SLIST	List all currently open sockets.
AT+SSEND	Send data through a socket.
AT+SRECV	Read buffered data from the network stack (lwip).
AT+SRECVMODE	Configures how data is read from the network stack (lwip).
AT+SRECVINFO	Configure the information level of “+RXD” message.
AT+SADDRINFO	Check the IP address from the domain name.
AT+STCPKEEPALIVE	Enable or disable TCP keepalive.
AT+STCPNODELAY	Enable or disable TCP Nagle’s algorithm.
AT+STIMEOUT	Configure the response timeout for the specified socket command.
+SEVENT	Asynchronously raised socket event messages.
+RXD	An event log for a received packet with payload.

7.1 AT+SOPEN

Command	<u>SET</u> AT+SOPEN="udp",<local_port>[,<reuse_addr>] AT+SOPEN="tcp",<local_port>[,<reuse_addr>] AT+SOPEN="tcp","<server address>",<server port>[,<reuse_addr>]
Response	<u>SET</u> +SOPEN=<socket ID> OK
Parameters	<local_port> (UDP) The outgoing local port. <local_port> (TCP Server) Local port to listen on. <server address>,<server port> (TCP Client) The IPv4 address and port number of the TCP server. <reuse_addr> SO_REUSEADDR option (0:disable, 1:enable) <socket ID> The ID allocated to the socket.
Description	Create a TCP/UDP socket for IPv4 domain. A socket for TCP server will listen on the given port in the background and asynchronously raise the event CONNECT to notify incoming connections.
Example	AT+SOPEN="UDP",60000 +SOPEN=0 OK AT+SOPEN="TCP",50000 +SOPEN=1 OK +SEVENT: "CONNECT",2 AT+SOPEN="TCP","192.168.200.100",5001 +SOPEN=3

	OK
--	----

7.2 AT+SCLOSE

Command	<u>SET</u> AT+SCLOSE=<socket ID> <u>RUN</u> AT+SCLOSE
Response	<u>SET</u> +SCLOSE:<socket ID> OK <u>RUN</u> +SCLOSE:<socket ID> : +SCLOSE:<socket ID> OK
Parameters	<socket ID> The ID allocated to the socket.
Description	Close an existing socket. To close all existing sockets, run a command without the parameter <socket ID>. If a server socket is closed, all client sockets connected to the server socket will close automatically.
Example	AT+SCLOSE=1 +SCLOSE:1 OK AT+SCLOSE +SCLOSE:0 +SCLOSE:2 +SCLOSE:3 OK

7.3 AT+SLIST

Command	<u>GET</u> AT+SLIST?
Response	<u>GET</u> +SLIST:<socket ID>,"<protocol>","<remote address>",<remote port>,<local port> :

	+SLIST:<socket ID>,"<protocol>","<remote address>",<remote port>,<local port> OK
Parameters	<p><socket ID> The ID allocated to the socket.</p> <p><protocol> TCP or UDP</p> <p><remote address>,<remote port>,<local port> The remote address, remote port and local port associated with the socket.</p>
Description	List all currently open sockets.
Example	AT+SLIST? +SLIST:0,"UDP","0.0.0.0",0,60000 +SLIST:1,"TCP","0.0.0.0",0,50000 +SLIST:2,"TCP","192.168.200.100",55354,0 +SLIST:3,"TCP","192.168.200.100",5001,52433 OK

7.4 AT+SSEND

Command	<p>SET</p> AT+SSEND =<ID>[,<length>[,<done_event>]] AT+SSEND =<ID>,"<remote host>",<remote port>[,<length>[,<done_event>]]
Response	<p>SET</p> OK
Parameters	<p><ID> The ID allocated to the socket.</p> <p><remote host> (UDP only) IPv4 address or domain name of the UDP server/client.</p> <p><remote port> (UDP only) Port number of the UDP server/client.</p> <p><length> Number of raw bytes to send.</p> <p><done_event></p>

	SEND_DONE event. (0:disable, 1:enable)
Description	<p>Send data through a socket.</p> <p>Data can be sent in one of the following modes when the return message is OK.</p> <ol style="list-style-type: none"> 1. Synchronous Send <p>Synchronous send mode is set when the length parameter has a positive number. The length parameter indicates the length of data sent with one AT+SSEND command. Data can be sent up to 4096 bytes at a time.</p> 2. (Buffered) Passthrough Send <p>Data can be continuously sent with one AT+SSEND command.</p> <p>Passthrough send mode is set when the length parameter is 0 or omitted. Data is copied to the TCP/IP stack by the socket send function without buffering, and the length of the copied data is variable.</p> <p>Buffered passthrough send mode is set when the length parameter has a negative number. The length parameter indicates the length of the buffer. The maximum length of the buffer is 4096 bytes. If the length parameter is -2048, data is buffered up to 2048 bytes. The maximum length of data copied to the TCP/IP stack by the socket send function is equal to the buffer length.</p> <p>To exit (buffered) passthrough send mode and send a new AT command, the following is required:</p> <ol style="list-style-type: none"> ① Wait at least 1 second after sending the last data. ② Send the EXIT command "AT\r\n" when SEND_IDLE event is raised. ③ Send a new AT command after SEND_EXIT event is raised. <p>If an error occurs before the data is copied to the TCP/IP stack, SEND_ERROR event is raised. If the done_event parameter is set to 1, SEND_DONE event is raised when data is successfully copied to the TCP/IP stack.</p> <p>NOTE:</p> <p>If the host interface is UART and hardware flow control is disabled, the (buffered) passthrough send mode is not available. Data can only be sent in synchronous</p>

	<div>send mode, and it is recommended to set the done_event parameter to 1 and send the next data after checking the SEND_DONE event.</div>
Example	<div><div>[Synchronous Send : done_event=0]</div><div>AT+SSEND=0,6 OK Hello!</div><div>[Synchronous Send : done_event=1]</div><div>AT+SSEND=0,6,1 OK Hello! +SEVENT:"SEND_DONE",6</div><div>[Passthrough Send : done_event=0]</div><div>AT+SSEND=0 OK Hello, World! Goodbye, World!</div><div><i>/* If no data is sent for more than 1 second, the SEND_IDLE event is raised. */</i></div><div>+SEVENT:"SEND_IDLE",0,28,0,0</div><div><i>/* Send the EXIT command "AT\r\n" to exit the passthrough send mode. */</i></div><div>AT OK +SEVENT:"SEND_EXIT",0,28,0</div><div>[Buffered Passthrough Send : done_event=1]</div><div>AT+SSEND=0,-8,1 OK TEST0001 +SEVENT:"SEND_DONE",8 TEST0002 +SEVENT:"SEND_DONE",8 TEST0003</div></div>

	<pre>+SEVENT:"SEND_DONE",8 /* Wait for the SEND_IDLE event without sending any data to exit the buffered passthrough send mode. */ +SEVENT:"SEND_IDLE",0,24,0,0 AT OK +SEVENT:"SEND_EXIT",0,24,0</pre>
--	--

7.5 AT+SRECV

Command	<p><u>SET</u> AT+SRECV=<socket ID>[,<length>]</p> <p><u>GET</u> AT+SRECV? AT+SRECV?=<socket ID></p>
Response	<p><u>SET</u> OK</p> <p><u>GET</u> +SRECV:<socket_ID>,<bufferd_length> ... OK</p>
Parameters	<p><socket ID> The ID allocated to the socket.</p> <p><length> The maximum number of raw bytes to read *If omitted, it is set to the maximum value supported by the firmware.</p> <p><bufferd_length> The number of raw bytes currently buffered</p>
Description	<p>Read buffered data from the network stack (lwip).</p> <p>If the <length> parameter is omitted and no data is received, the firmware will enter blocking mode until data is received. The timeout for blocking mode can be set in seconds using the following command:</p> <p style="text-align: center;">AT+STIMEOUT="SRECV",<timeout></p>

	<p>NOTE:</p> <p>1) AT+SRECV command can be used only when passive mode is set with AT+SRECVMODE command.</p> <p>2) If it is UDP data, it will be lost when the buffer is full.</p>
Example	<pre>AT+SLIST? +SLIST:0,"TCP","192.168.200.1",50000,0 +SLIST:1,"UDP","0.0.0.0",0,60001 OK +SEVENT:"RCV_READY",0,1024 +SEVENT:"RCV_READY",1,1024 AT+SRECV? +SRECV:0,7168 +SRECV:1,7168 OK AT+SRECV=0 +RXD:0,4096,"192.168.200.1",50000 OK AT+SRECV=1 +RXD:1,1024,"192.168.200.1",60000 OK +SEVENT:"RCV_READY",0,3072 +SEVENT:"RCV_READY",1,6144 AT+SRECV?=0 +SRECV:0,3072 OK AT+SRECV?=1 +SRECV:1,6144 OK</pre>

7.6AT+SRECVMODE

Command	<p><u>SET</u></p> <p>AT+SRECVMODE=<mode>[,<event>]</p> <p><u>GET</u></p>
---------	--

	AT+SRECVMODE?
Response	<u>SET</u> OK <u>GET</u> +SRECVMODE:<mode>,<event> OK
Parameters	<mode> 0 : active* 1 : passive <event> 0 : ready event disable 1 : ready event enable*
Description	<p>Configures how data is read from the network stack (lwip).</p> <p>If the event parameter is set to 1 in passive mode, a RECV_READY event occurs when there is buffered data.</p> <p>The event does not occur again until the buffered data is read with the AT+SRECV command.</p>
Example	AT+SRECVMODE=1 OK AT+SRECVMODE? +SRECVMODE:1,0 OK AT+SRECVMODE=1,1 OK AT+SRECVMODE? +SRECVMODE:1,1 OK AT+SRECVMODE=0 OK AT+SRECVMODE? +SRECVMODE:0,0 OK

7.7 AT+SRECVINFO

Command	<u>SET</u> AT+SRECVINFO=<mode> <u>GET</u> AT+SRECVINFO?
Response	<u>SET</u> OK <u>GET</u> +SRECVINFO:<mode> OK
Parameters	<mode> 0 : terse* 1 : verbose
Description	Configure the information level of “+RXD” message. NOTE: The AT+SRECVINFO command is the same as the previous AT+SRXLOGLEVEL command. Only the command name is different.
Example	AT+SRECVINFO =1 OK AT+SRECVINFO? + SRECVINFO:1 OK

7.8 AT+SADDRINFO

Command	<u>SET</u> AT+SADDRINFO="<domain_name>"
Response	<u>SET</u> +SADDRINFO:"<address>" OK
Parameters	<domain_name>

	Domain name <address> IPv4 address
Description	Check the IP address from the domain name.
Example	AT+SADDRINFO =" www.google.com " +SADDRINFO:"142.250.199.100" OK

7.9 AT+STCPKEEPALIVE

Command	<u>SET</u> AT+STCPKEEPALIVE=<socket ID>,<keepalive>[,<keepidle>,<keepcnt>,<keepintvl>] <u>GET</u> AT+STCPKEEPALIVE? AT+STCPKEEPALIVE?=<socket ID>
Response	<u>SET</u> OK <u>GET</u> +STCPKEEPALIVE:<socket_ID>,<keepalive>,<keepidle>,<keepcnt>,<keepintvl> : OK
Parameters	<socket ID> The ID allocated to the socket for TCP client. <keepalive> 0 : disable 1 : enable <keepidle> The time to wait before sending out the first probe in seconds. (default : 7200) <keepcnt> The number of probes that are sent and unacknowledged. (default : 9) <keepintvl> The interval between subsequent keepalive probes in seconds. (default : 75)
Description	Enable or disable TCP keepalive.
Example	< TCP Server > AT+SOPEN="TCP",50000 +SOPEN=0

OK
+SEVENT:"CONNECT",1
AT+SLIST?
+SLIST:0,"TCP","0.0.0.0",0,50000
+SLIST:1,"TCP","192.168.200.2",52432,0
OK
AT+STCPKEEPALIVE?
+STCPKEEPALIVE:1,0,7200,9,75
OK

AT+STCPKEEPALIVE=1,0,60,5,30
OK
AT+STCPKEEPALIVE?
+STCPKEEPALIVE:1,0,60,5,30
OK

AT+STCPKEEPALIVE=1,1
OK
AT+STCPKEEPALIVE?
+STCPKEEPALIVE:1,1,60,5,30
OK

< TCP Client >
AT+SOPEN="TCP","192.168.200.1",50000
+SOPEN:0
OK
AT+SLIST?
+SLIST:0,"TCP","192.168.200.1",50000,0
OK
AT+STCPKEEPALIVE?
+STCPKEEPALIVE:0,0,7200,9,75
OK

AT+STCPKEEPALIVE=0,1,60,5,30
OK
AT+STCPKEEPALIVE?=0
+STCPKEEPALIVE:0,1,60,5,30
OK

7.10 AT+STCPNODELAY

Command	<u>SET</u>
---------	------------

	AT+STCPNODELAY=<socket ID>,{0 1} <u>GET</u> AT+STCPNODELAY?
Response	<u>SET</u> OK <u>GET</u> +STCPNODELAY:<socket_ID>,<status> OK
Parameters	<socket ID> The ID allocated to the socket. <status> 0 : disable 1 : enable
Description	Enable or disable TCP Nagle's algorithm.
Example	< TCP Server > AT+SOPEN="TCP",50000 +SOPEN=0 OK +SEVENT:"CONNECT",1 AT+SLIST? +SLIST:0,"TCP","0.0.0.0",0,50000 +SLIST:1,"TCP","192.168.200.2",52432,0 OK AT+STCPNODELAY? +STCPNODELAY:1,0 OK AT+STCPNODELAY=1,1 OK AT+STCPNODELAY? +STCPNODELAY:1,1 OK < TCP Client > AT+SOPEN="TCP","192.168.200.1",50000 +SOPEN:0 OK AT+SLIST? +SLIST:0,"TCP","192.168.200.1",50000,0

	OK AT+STCPNODELAY? +STCPNODELAY:0,0 OK AT+STCPNODELAY=0,1 OK AT+STCPNODELAY? +STCPNODELAY:0,1 OK
--	--

7.11 AT+STIMEOUT

Command	<u>SET</u> AT+STIMEOUT="<command>",<timeout> <u>GET</u> AT+STIMEOUT?
Response	<u>SET</u> OK <u>GET</u> +STIMEOUT:"<command>",<timeout> ... OK
Parameters	<command> "SOPEN", "SSEND" <timeout> Timeout in seconds. (0 : no timeout)
Description	Configure the response timeout in seconds for the specified socket command. Default timeout : <ul style="list-style-type: none"> - SOPEN : 30 - SSEND : 0 (blocking mode)
Example	AT+STIMEOUT? +STIMEOUT:"SOPEN",30 +STIMEOUT:"SSEND",0 OK AT+STIMEOUT="SOPEN",60

	OK AT+STIMEOUT="SEND",3 OK AT+STIMEOUT? +STIMEOUT:"SOPEN",60 +STIMEOUT:"SEND",3 OK
--	--

7.12 +SEVENT

Response	+SEVENT:<event>,<socket ID>[,<parameter 1>,...,<parameter N>]
Parameters	<p><event> "CONNECT",<socket ID> "CLOSE",<socket ID>,<error>,"<description>" "SEND_DONE",<socket ID>,<done> "SEND_DROP",<socket ID>,<drop> "SEND_IDLE",<socket ID>,<done>,<drop>,<wait> "SEND_EXIT",<socket ID>,<done>,<drop> "SEND_ERROR",<socket ID>,<error>,"<description>" "RECV_READY",<socket ID>,<length> "RECV_ERROR",<socket ID>,<error>,"<description>"</p> <p><socket ID> Socket ID</p> <p><done> The length of the sent payload.</p> <p><drop> The length of the dropped payload.</p> <p><wait> The length of the buffered payload.</p> <p><length></p>

	<p>The length of the receivable payload.</p> <p><error> error code</p> <p><description> string describing the error code</p> <p>NOTE:</p> <p>The error code may not match the POSIX error code.</p> <p>The error code defined in the errno.h file included in the ARM Toolchain is different from the POSIX error code.</p>
Description	Asynchronously raised socket event messages.
Example	<pre>+SEVENT:"CONNECT",1 +SEVENT:"CLOSE",1,128,"Socket is not connected" +SEVENT:"SEND_DONE",1,152 +SEVENT:"SEND_DROP",1,152 +SEVENT:"SEND_IDLE",1,1500,152,200 +SEVENT:"SEND_EXIT",1,1700,152 +SEVENT:"SEND_ERROR",1,104,"Connection reset by peer" +SEVENT:"RECV_READY",1,1488 +SEVENT:"RECV_ERROR",1,128,"Socket is not connected"</pre>

7.13 +RXD

Response	<p><u>RX Log Level (Terse)</u> +RXD:<socket ID>,<actual read length> <raw bytes></p> <p><u>RX Log Level (Verbose)</u> +RXD:<socket ID>,<actual read length>,"<remote IP>",<remote port> <raw bytes></p>
Parameters	<p><socket ID> The ID allocated to the socket.</p>

	<p><max read length> The maximum number of bytes to read. (Max: 2048)</p> <p><actual read length> Actual number of bytes read.</p> <p><remote IP>,<remote port> The remote IP and port.</p> <p><raw bytes> The received raw bytes (0x00~0xFF) payload.</p>
Description	<p>An event log for a received packet with payload.</p> <p>Upon receiving packets, +RXD event logs will automatically appear on the terminal output.</p> <p>Note that there will be no 'OK' message following the event log.</p>
Example	<p><u>RX Log Level (Terse)</u> +RXD=0,15 ABCDE12345,.?="+</p> <p><u>RX Log Level (Verbose)</u> +RXD=0,12,"192.168.200.1",5025 HELLO,WORLD!</p>

8 Test Application

8.1 Command Line Interface (raspi-atcmd-cli)

CLI application is a Linux program running on Raspberry Pi for AT-command communication via UART or SPI. In the CLI application, as in terminal program via UART, the user can enter the AT command and check the response to the command.

8.1.1 Source files

File	Description
common.h	Common header file
main.c	CLI related functions.
Makefile	Make file for building.
nrc-atcmd.c nrc-atcmd.h	AT command handler
nrc-hspi.c nrc-hspi.h	Protocol driver for HSPI. *Refer to this file to communicate with the ATCMD firmware via HSPI.
nrc-iperf.c nrc-iperf.h	Iperf server/client
raspi-hif.c raspi-hif.h	Wrapper for user mode driver.
raspi-eirq.c	User mode driver for GPIO EIRQ.
raspi-spi.c	User mode driver for SPI.
raspi-uart.c	User mode driver for UART.
scripts/	Script files

Table 8.1 raspi-atcmd-cli source files

8.1.2 Build

Copy the “atcmd/host/raspi-atcmd-cli” directory to the Raspberry Pi’s home directory. And build the CLI application with the make command.

```
$ cd $HOME
```

```
$ cd raspi-atcmd-cli
```

\$ make clean

```
removed 'raspi-atcmd-cli'
```

\$ make

```
cc -g -o raspi-atcmd-cli raspi-spi.c raspi-uart.c raspi-eirq.c raspi-hif.c nrc-hspi.c nrc-atcmd.c nrc-iperf.c main.c
-lpthread -Wall -lpthread
```

8.1.3 Run

● Help

\$./raspi-atcmd-cli [-h|--help]

```
raspi-atcmd-cli version 1.3.3
Copyright (c) 2019-2023 <NEWRACOM LTD>

Usage:
$ ./raspi-atcmd-cli -S [-D <device>] [-E <trigger>] [-c <clock>] [-s <script> [-n]]
$ ./raspi-atcmd-cli -U [-D <device>] [-b <baudrate>] [-s <script> [-n]]
$ ./raspi-atcmd-cli -U -f [-D <device>] [-b <baudrate>] [-s <script> [-n]]

UART/SPI:
-D, --device #       Specify the device. (default: /dev/spidev0.0, /dev/ttyAMA0)
-s, --script #       Specify the script file.
-n, --noexit #       Do not exit the script when the AT command responds with an error.

SPI:
-S --spi             Use the SPI to communicate with the target.
-E, --eirq #         Use EIRQ mode for the SPI. (0:low, 1:high, 2:falling, 3:rising)
-c, --clock #        Specify the clock frequency for the SPI. (default: 20000000 Hz)

UART:
-U --uart            Use the UART to communicate with the target.
-f --flowctrl        Enable RTS/CTS signals for the hardware flow control on the UART. (default: off)
-b, --baudrate #     Specify the baudrate for the UART. (default: 115200 bps)

Miscellaneous:
-v, --version        Print version information and quit.
-h, --help           Print this message and quit.
```

● SPI

The maximum clock frequency is 20MHz.

\$ sudo ./raspi-atcmd-cli -S [-D <device>] [-E <trigger>] [-c <clock>] [-s <script> [-n]]

```
$ sudo ./raspi-atcmd-cli -S -c 20000000 -E 2
```

```
[ SPI ]  
- device: /dev/spidev0.0  
- clock: 20000000 Hz  
- irq: falling
```

```
#
```

● UART

The supported baud rates are described in chapter “5.6 AT+UART”.

```
$ sudo ./raspi-atcmd-cli -U [-D <device>] [-b <baudrate>] [-s <script> [-n]]
```

```
$ sudo ./raspi-atcmd-cli -U -b 115200
```

```
[ UART ]  
- device: /dev/ttyAMA0  
- baudrate : 115200
```

```
#
```

● UART_HFC

Hardware flow control using RTS/CTS can be enabled with the -f option to the UART.

```
$ sudo ./raspi-atcmd-cli -U -f [-D <device>] [-b <baudrate>] [-s <script> [-n]]
```

```
$ sudo ./raspi-atcmd-cli -U -f -b 2000000
```

```
[ UART_HFC ]  
- device: /dev/ttyAMA0  
- baudrate : 2000000
```

```
#
```

● Examples

Getting the informations.

```
# AT  
SEND: AT  
RCV: OK
```

```
# AT+VER?
SEND: AT+VER?
RECV: +VER:"1.5.0","1.23.5"
RECV: OK

# AT+WMACADDR?
SEND: AT+WMACADDR?
RECV: +WMACADDR:"8c:0f:fa:00:29:43"
RECV: OK

# AT+WOUNTRY?
SEND: AT+WOUNTRY?
RECV: +WOUNTRY:"US"
RECV: OK

# AT+WTXPOWER?
SEND: AT+WTXPOWER?
RECV: +WTXPOWER:17
RECV: OK

# AT+WRATECTRL?
SEND: AT+WRATECTRL?
RECV: +WRATECTRL:1
RECV: OK

# AT+WIPADDR?
SEND: AT+WIPADDR?
RECV: +WIPADDR:"0.0.0.0","0.0.0.0","0.0.0.0"
RECV: OK
```

Connecting to an AP.

```
# AT+WCONN?
SEND: AT+WCONN?
RECV: +WCONN:"halow","00:00:00:00:00:00","open","", "disconnected"
RECV: OK

# AT+WSCAN
SEND: AT+WSCAN
RECV: +WSCAN:"8c:0f:fa:00:28:1f",906.0,-39,"[WPA3-SAE-CCMP][ESS]","halow_atcmd_sae"
RECV: +WSCAN:"8c:0f:fa:00:28:11",925.0,-68,"[WPA3-OWE-CCMP][ESS]","halow_fota"
RECV: +WSCAN:"8c:0f:fa:00:28:1e",903.5,-93,"[ESS]","halow_s1g_demo_open"
RECV: OK

# AT+WCONN="halow_atcmd_sae","sae","12345678"
SEND: AT+WCONN="halow_atcmd_sae","sae","12345678"
RECV: OK

# AT+WCONN?
```

```
SEND: AT+WCONN?
RECV: +WCONN:"halow_atcmd_sae","8c:0f:fa:00:28:1f","wpa3-sae","", "connected"
RECV: OK

# AT+WDHCP
SEND: AT+WDHCP
RECV: +WDHCP:"192.168.200.18","255.255.255.0","192.168.200.1"
RECV: OK

# AT+WIPADDR?
SEND: AT+WIPADDR?
RECV: +WIPADDR:"192.168.200.18","255.255.255.0","192.168.200.1"
RECV: OK

# AT+WPING="192.168.200.1"
SEND: AT+WPING="192.168.200.1"
RECV: +WPING:64,"192.168.200.1",1,64,5
RECV: +WPING:64,"192.168.200.1",2,64,5
RECV: +WPING:64,"192.168.200.1",3,64,149
RECV: +WPING:64,"192.168.200.1",4,64,4
RECV: +WPING:64,"192.168.200.1",5,64,5
RECV: OK
```

Sending and receiving the data with a socket for TCP client.

```
# AT+SOPEN="TCP","192.168.200.1",50000
SEND: AT+SOPEN="TCP","192.168.200.1",50000
RECV: +SOPEN:0
RECV: OK

# AT+SLIST?
SEND: AT+SLIST?
RECV: +SLIST:0,"TCP","192.168.200.1",50000,52432
RECV: OK

# AT+SSEND=0,10
SEND: AT+SSEND=0,10
RECV: OK

# ABCDEFGHIJKLMNOPQRSTUVWXYZ
SEND: DATA 10

# RECV: +RXD:0,10

# AT+SSEND=0
SEND: AT+SSEND=0
RECV: OK

# DAJFKDAJFKDAJFKDAJFAKFJDK
```

```
SEND: DATA 25

#  RECV: +RXD:0,25
RECV: +SEVENT:"SEND_IDLE",0,25,0,0

# DKAJFKDAJFEKJAFKDJFADKJFAKDJFAKEJFKADJFAKEJFKAJDFKDJAFDKJFADK
SEND: DATA 61

#  RECV: +RXD:0,61
RECV: +SEVENT:"SEND_IDLE",0,86,0,0

# AT
SEND: AT
RECV: OK

#  RECV: +SEVENT:"SEND_EXIT",0,86,0
```

Closing all sockets.

```
# AT+SLIST?
SEND: AT+SLIST?
RECV: +SLIST:0,"TCP","192.168.200.1",50000,52432
RECV: OK

# AT+SCLOSE
SEND: AT+SCLOSE
RECV: +SCLOSE:0
RECV: OK

# EXIT
```

8.1.4 Run with a script

CLI application provides the option to run the script file. (-s/--script)

UART/SPI:	
-s, --script #	Specify the script file.
-n, --noexit #	Do not exit the script when the AT command responds with an error.

The script file can be created using the AT command and script command.

Command	Description	Example
---------	-------------	---------

CALL <script_file>	Read and run the specified script file.	CALL wifi_connect CALL wifi/connect
LOOP <line> <count>	Repeat next lines. <line>: number of lines to repeat <count>: number of repetitions.	LOOP 2 5 AT+SSEND=0,1024 DATA 1024
DATA <length>	Send payload with random value.	DATA 1024
WAIT <time>{s m u}	Wait for the specified time. s: sec m: msec u: usec	WAIT 1s WAIT 1000m WAIT 100u
ECHO "<message>"	Print a message.	ECHO "AT Command"
TIME	Print current time.	TIME
HOLD	Pause until there is keyboard input.	ECHO "Run an AP in open mode" HOLD
EXIT	Exit script.	EXIT

Users can refer to the script files under the "raspi-atcmd-cli/scripts" directory.

```

raspi-atcmd-cli/scripts/
├── socket-tcp-client-send
├── socket-tcp-client-send-passthrough
├── socket-tcp-client-send-passthrough-buffered
├── socket-tcp-server
├── socket-tcp-server-send
├── socket-tcp-server-send-passthrough
├── socket-tcp-server-send-passthrough-buffered
├── socket-udp-client-send
├── socket-udp-client-send-passthrough
├── socket-udp-client-send-passthrough-buffered
├── socket-udp-server
├── socket-udp-server-send
├── socket-udp-server-send-passthrough
├── socket-udp-server-send-passthrough-buffered
├── softap-tcp-client-send-normal
└── softap-tcp-client-send-passthrough

```

|—— softap-tcp-server
|—— softap-udp-client-send-normal
|—— softap-udp-client-send-passthrough
|—— softap-udp-server
|—— sta-tcp-client-send-normal
|—— sta-tcp-client-send-passthrough
|—— sta-tcp-server
|—— sta-udp-client-send-normal
|—— sta-udp-client-send-passthrough
|—— sta-udp-server
|—— wifi-connect-open-dhcp-auto-kr-mic
|—— wifi-connect-open-dhcp-auto-us
|—— wifi-connect-open-dhcp-kr-mic
|—— wifi-connect-open-dhcp-kr-usn
|—— wifi-connect-open-dhcp-us
|—— wifi-connect-wpa2-psk-dhcp-auto-kr-mic
|—— wifi-connect-wpa2-psk-dhcp-auto-us
|—— wifi-connect-wpa2-psk-dhcp-kr-mic
|—— wifi-connect-wpa2-psk-dhcp-us
|—— wifi-connect-wpa3-owe-dhcp-auto-kr-mic
|—— wifi-connect-wpa3-owe-dhcp-auto-us
|—— wifi-connect-wpa3-owe-dhcp-kr-mic
|—— wifi-connect-wpa3-owe-dhcp-us
|—— wifi-connect-wpa3-sae-dhcp-auto-kr-mic
|—— wifi-connect-wpa3-sae-dhcp-auto-us
|—— wifi-connect-wpa3-sae-dhcp-kr-mic
|—— wifi-connect-wpa3-sae-dhcp-us
|—— wifi-softap-open-dhcps-kr-mic
|—— wifi-softap-open-dhcps-kr-usn
|—— wifi-softap-open-dhcps-us
|—— wifi-softap-wpa2-psk-dhcps-kr-mic
|—— wifi-softap-wpa2-psk-dhcps-us

8.1.5 Iperf

The CLI application supports the iperf2 command used for network performance measurement. However, the available options are limited as shown below.

iperf {-h|--help}

Usage: iperf {-s}|{-c <host>} [options]

Client/Server:

-i, --interval # seconds between periodic bandwidth reports (default: 1 sec)
-p, --port # server port to listen on/connect to (default: 5001)
-u, --udp use UDP rather than TCP

Server specific:

-s, --server run in server mode

Client specific:

-c, --client <host> run in client mode, connecting to <host>
-t, --time # time in seconds to transmit for (default: 10 sec)
-P, --passthrough transmit in passthrough mode
-N, --negative use negative length for buffered passthrough mode (always negative in UDP)
-D, --done_event enable SEND_DONE event

Miscellaneous:

-h, --help print this message and quit

The iperf command can be run after completing the Wi-Fi connection and IP setup.

Wi-Fi connection and IP setup can be done in one of two ways:

- Enter AT command in the CLI application.

```
# AT+WSCAN
SEND: AT+WSCAN
RECV: +WSCAN:"8c:0f:fa:00:28:1f",914.0,-38,"[WPA3-SAE-CCMP][ESS]","halow_atcmd_sae"
RECV: OK

# AT+WCONN="halow_atcmd_sae","sae","12345678"
SEND: AT+WCONN="halow_atcmd_sae","sae","12345678"
RECV: OK

# AT+WDHCP
SEND: AT+WDHCP
RECV: +WDHCP:"192.168.200.18","255.255.255.0","192.168.200.1"
RECV: OK
```

- Specify a script file containing AT command with the -s option when running the CLI application.

```
$ sudo ./raspi-atcmd-cli -S -s scripts/example/wifi-connect-wpa3-sae-dhcp
```

```
CALL: scripts/examples/wifi-connect-wpa3-sae-dhcp
```

```
SEND: AT
```

```
RECV: OK
```

```
SEND: AT+WDISCONN
```

```
RECV: OK
```

```
ECHO: Run an AP in WPA3-SAE.
```

```
ECHO: - SSID : halow_atcmd_sae
```

```
ECHO: - Password : 12345678
```

```
ECHO: - IP : 192.168.200.1
```

```
ECHO: - DHCP Server
```

```
HOLD: Press ENTER to continue.
```

```
SEND: AT+WSCAN
```

```
RECV: +WSCAN:"8c:0f:fa:00:28:1f",906.0,-39,"[WPA3-SAE-CCMP][ESS]","halow_atcmd_sae"
```

```
RECV: OK
```

```
SEND: AT+WDISCONN
```

```
RECV: OK
```

```
SEND: AT+WCONN="halow_atcmd_sae","wpa3-sae","12345678"
```

```
RECV: OK
```

```
SEND: AT+WCONN?
```

```
RECV: +WCONN:"halow_atcmd_sae","8c:0f:fa:00:28:1f","wpa3-sae","", "connected"
```

```
RECV: OK
```

```
SEND: AT+WDHCP
```

```
RECV: +WDHCP:"192.168.200.18","255.255.255.0","192.168.200.1"
```

```
RECV: OK
```

```
DONE: scripts/examples/wifi-connect-wpa3-sae-dhcp
```

- **Iperf TCP Client/Server**

```
# iperf -c 192.168.200.1
```

```
[ IPERF OPTION ]
```

```
- role: client
```

```
- protocol: tcp
```

```
- server_port: 5001
```

```
- server_ip: 192.168.200.1
```

```
- send_length: 1440
```

```
- send_time: 10
```

```
- send_passthrough: off
```

```
- send_done_event: 0
- report_interval: 1
```

[IPERF TCP Client]

Sending 1440 byte datagram ...

Interval	Transfer	Bandwidth
0.0 ~ 1.0 sec	187.03 KBytes	1.53 Mb/s
1.0 ~ 2.0 sec	192.66 KBytes	1.57 Mb/s
2.0 ~ 3.0 sec	191.25 KBytes	1.56 Mb/s
3.0 ~ 4.0 sec	194.06 KBytes	1.59 Mb/s
4.0 ~ 5.0 sec	191.25 KBytes	1.56 Mb/s
5.0 ~ 6.0 sec	194.06 KBytes	1.58 Mb/s
6.0 ~ 7.0 sec	195.47 KBytes	1.59 Mb/s
7.0 ~ 8.0 sec	192.66 KBytes	1.57 Mb/s
8.0 ~ 9.0 sec	191.25 KBytes	1.56 Mb/s
9.0 ~ 10.0 sec	187.03 KBytes	1.58 Mb/s
0.0 ~ 10.0 sec	1.87 MBytes	1.57 Mb/s

Sent 1363 datagrams

Done

iperf -c 192.168.200.1 -P

[IPERF OPTION]

```
- role: client
- protocol: tcp
- server_port: 5001
- server_ip: 192.168.200.1
- send_length: 1440
- send_time: 10
- send_passthrough: on
- send_done_event: 0
- report_interval: 1
```

[IPERF TCP Client]

Sending 1440 byte datagram ...

Interval	Transfer	Bandwidth
0.0 ~ 1.0 sec	426.09 KBytes	3.47 Mb/s
1.0 ~ 2.0 sec	407.81 KBytes	3.34 Mb/s
2.0 ~ 3.0 sec	406.41 KBytes	3.32 Mb/s
3.0 ~ 4.0 sec	412.03 KBytes	3.37 Mb/s
4.0 ~ 5.0 sec	403.59 KBytes	3.30 Mb/s
5.0 ~ 6.0 sec	414.84 KBytes	3.40 Mb/s
6.0 ~ 7.0 sec	403.59 KBytes	3.29 Mb/s
7.0 ~ 8.0 sec	405.00 KBytes	3.31 Mb/s
8.0 ~ 9.0 sec	405.00 KBytes	3.31 Mb/s
9.0 ~ 10.0 sec	409.22 KBytes	3.39 Mb/s
0.0 ~ 10.0 sec	4.00 MBytes	3.35 Mb/s

Sent 2911 datagrams

Done

iperf -c 192.168.200.1 -P -N

[IPERF OPTION]

- **role: client**
 - **protocol: tcp**
 - server_port: 5001
 - server_ip: 192.168.200.1
 - send_length: 1440
 - send_time: 10
 - **send_passthrough: on (-)**
 - send_done_event: 0
 - report_interval: 1

[IPERF TCP Client]

Sending 1440 byte datagram ...

Interval	Transfer	Bandwidth
0.0 ~ 1.0 sec	348.75 KBytes	2.85 Mbits/sec
1.0 ~ 2.0 sec	343.12 KBytes	2.79 Mbits/sec
2.0 ~ 3.0 sec	340.31 KBytes	2.77 Mbits/sec
3.0 ~ 4.0 sec	334.69 KBytes	2.74 Mbits/sec
4.0 ~ 5.0 sec	337.50 KBytes	2.76 Mbits/sec
5.0 ~ 6.0 sec	336.09 KBytes	2.75 Mbits/sec
6.0 ~ 7.0 sec	330.47 KBytes	2.70 Mbits/sec
7.0 ~ 8.0 sec	337.50 KBytes	2.76 Mbits/sec
8.0 ~ 9.0 sec	341.72 KBytes	2.79 Mbits/sec
9.0 ~ 10.0 sec	330.47 KBytes	2.77 Mbits/sec
0.0 ~ 10.0 sec	3.30 MBytes	2.77 Mbits/sec

Sent 2404 datagrams

Done

iperf -s

[IPERF OPTION]

- **role: server**
 - **protocol: tcp**
 - server_port: 5001
 - report_interval: 1

[IPERF TCP Server]

Connected with client: 192.168.200.1 port 52174

Interval	Transfer	Bandwidth
0.0 ~ 1.0 sec	415.77 KBytes	3.41 Mbits/sec
1.0 ~ 2.0 sec	424.22 KBytes	3.47 Mbits/sec
2.0 ~ 3.0 sec	428.46 KBytes	3.51 Mbits/sec
3.0 ~ 4.0 sec	435.53 KBytes	3.57 Mbits/sec

```

4.0 ~ 5.0 sec  425.39 KBytes  3.48 Mb/s/sec
5.0 ~ 6.0 sec  424.46 KBytes  3.48 Mb/s/sec
6.0 ~ 7.0 sec  439.77 KBytes  3.60 Mb/s/sec
7.0 ~ 8.0 sec  418.56 KBytes  3.43 Mb/s/sec
8.0 ~ 9.0 sec  425.63 KBytes  3.49 Mb/s/sec
9.0 ~ 10.0 sec 416.91 KBytes  3.42 Mb/s/sec
0.0 ~ 10.0 sec  4.15 MBytes  3.49 Mb/s/sec

```

Done

Press ENTER to continue or type "quit" : quit

#

Remote Iperf TCP Server/Client

\$ iperf -s -i 1

Server listening on TCP port 5001

TCP window size: 85.3 KByte (default)

```

-----
[ 4] local 192.168.200.1 port 5001 connected with 192.168.200.43 port 52432
[ ID] Interval      Transfer      Bandwidth
[ 4]  0.0- 1.0 sec   187 KBytes   1.53 Mb/s/sec
[ 4]  1.0- 2.0 sec   193 KBytes   1.58 Mb/s/sec
[ 4]  2.0- 3.0 sec   190 KBytes   1.56 Mb/s/sec
[ 4]  3.0- 4.0 sec   194 KBytes   1.59 Mb/s/sec
[ 4]  4.0- 5.0 sec   191 KBytes   1.57 Mb/s/sec
[ 4]  5.0- 6.0 sec   193 KBytes   1.58 Mb/s/sec
[ 4]  6.0- 7.0 sec   194 KBytes   1.59 Mb/s/sec
[ 4]  7.0- 8.0 sec   191 KBytes   1.57 Mb/s/sec
[ 4]  8.0- 9.0 sec   191 KBytes   1.57 Mb/s/sec
[ 4]  9.0-10.0 sec   193 KBytes   1.58 Mb/s/sec
[ 4]  0.0-10.0 sec   1.87 MBytes  1.57 Mb/s/sec
[ 5] local 192.168.200.1 port 5001 connected with 192.168.200.43 port 52433
[ 5]  0.0- 1.0 sec   408 KBytes   3.34 Mb/s/sec
[ 5]  1.0- 2.0 sec   405 KBytes   3.32 Mb/s/sec
[ 5]  2.0- 3.0 sec   408 KBytes   3.34 Mb/s/sec
[ 5]  3.0- 4.0 sec   412 KBytes   3.37 Mb/s/sec
[ 5]  4.0- 5.0 sec   400 KBytes   3.28 Mb/s/sec
[ 5]  5.0- 6.0 sec   418 KBytes   3.42 Mb/s/sec
[ 5]  6.0- 7.0 sec   402 KBytes   3.30 Mb/s/sec
[ 5]  7.0- 8.0 sec   403 KBytes   3.30 Mb/s/sec
[ 5]  8.0- 9.0 sec   406 KBytes   3.32 Mb/s/sec
[ 5]  9.0-10.0 sec   413 KBytes   3.39 Mb/s/sec
[ 5] 10.0-11.0 sec   18.2 KBytes   149 Kbits/sec
[ 5]  0.0-11.3 sec   4.00 MBytes  2.98 Mb/s/sec
[ 4] local 192.168.200.1 port 5001 connected with 192.168.200.43 port 52434
[ 4]  0.0- 1.0 sec   336 KBytes   2.75 Mb/s/sec

```

```
[ 4] 1.0- 2.0 sec 340 KBytes 2.78 Mb/s/sec
[ 4] 2.0- 3.0 sec 339 KBytes 2.78 Mb/s/sec
[ 4] 3.0- 4.0 sec 333 KBytes 2.73 Mb/s/sec
[ 4] 4.0- 5.0 sec 338 KBytes 2.77 Mb/s/sec
[ 4] 5.0- 6.0 sec 333 KBytes 2.72 Mb/s/sec
[ 4] 6.0- 7.0 sec 334 KBytes 2.73 Mb/s/sec
[ 4] 7.0- 8.0 sec 337 KBytes 2.76 Mb/s/sec
[ 4] 8.0- 9.0 sec 339 KBytes 2.78 Mb/s/sec
[ 4] 9.0-10.0 sec 338 KBytes 2.77 Mb/s/sec
[ 4] 10.0-11.0 sec 15.2 KBytes 124 Kbits/sec
[ 4] 0.0-11.3 sec 3.30 MBytes 2.46 Mb/s/sec
```

```
$ iperf -c 192.168.200.43 -i 1
```

```
-----
Client connecting to 192.168.200.43, TCP port 5001
TCP window size: 43.8 KByte (default)
-----
```

```
[ 3] local 192.168.200.1 port 52174 connected with 192.168.200.43 port 5001
[ ID] Interval      Transfer      Bandwidth
[ 3] 0.0- 1.0 sec    512 KBytes    4.19 Mb/s/sec
[ 3] 1.0- 2.0 sec    384 KBytes    3.15 Mb/s/sec
[ 3] 2.0- 3.0 sec    512 KBytes    4.19 Mb/s/sec
[ 3] 3.0- 4.0 sec    384 KBytes    3.15 Mb/s/sec
[ 3] 4.0- 5.0 sec    384 KBytes    3.15 Mb/s/sec
[ 3] 5.0- 6.0 sec    512 KBytes    4.19 Mb/s/sec
[ 3] 6.0- 7.0 sec    384 KBytes    3.15 Mb/s/sec
[ 3] 7.0- 8.0 sec    384 KBytes    3.15 Mb/s/sec
[ 3] 8.0- 9.0 sec    512 KBytes    4.19 Mb/s/sec
[ 3] 9.0-10.0 sec    384 KBytes    3.15 Mb/s/sec
[ 3] 0.0-10.2 sec    4.25 MBytes    3.51 Mb/s/sec
```

NOTE:

When sending data in passthrough mode with the -P option, the socket can only be closed after receiving the SEND_IDLE event. It takes more than 1 second after sending the last data. So, the remote iperf tcp server stops after 1 second.

● Iperf UDP Client/Server

```
# iperf -c 192.168.200.1 -u
```

```
[ IPERF OPTION ]
```

```
- role: client
- protocol: udp
- server_port: 5001
- server_ip: 192.168.200.1
- send_length: 1470
```



```
- send_time: 10
- send_passthrough: off
- send_done_event: 0
- report_interval: 1
```

[IPERF UDP Client]

Sending 1470 byte datagrams ...

Interval	Transfer	Bandwidth
0.0 ~ 1.0 sec	215.33 KBytes	1.76 Mbits/sec
1.0 ~ 2.0 sec	216.77 KBytes	1.77 Mbits/sec
2.0 ~ 3.0 sec	222.51 KBytes	1.82 Mbits/sec
3.0 ~ 4.0 sec	219.64 KBytes	1.79 Mbits/sec
4.0 ~ 5.0 sec	222.51 KBytes	1.81 Mbits/sec
5.0 ~ 6.0 sec	222.51 KBytes	1.82 Mbits/sec
6.0 ~ 7.0 sec	216.77 KBytes	1.77 Mbits/sec
7.0 ~ 8.0 sec	213.90 KBytes	1.75 Mbits/sec
8.0 ~ 9.0 sec	215.33 KBytes	1.76 Mbits/sec
9.0 ~ 10.0 sec	206.72 KBytes	1.74 Mbits/sec
0.0 ~ 10.0 sec	2.12 MBytes	1.78 Mbits/sec

Sent 1513 datagrams

Done

iperf -c 192.168.200.1 -u -P

[IPERF OPTION]

```
- role: client
- protocol: udp
- server_port: 5001
- server_ip: 192.168.200.1
- send_length: 1470
- send_time: 10
- send_passthrough: on (-)
- send_done_event: 0
- report_interval: 1
```

[IPERF UDP Client]

Sending 1470 byte datagrams ...

Interval	Transfer	Bandwidth
0.0 ~ 1.0 sec	480.91 KBytes	3.94 Mbits/sec
1.0 ~ 2.0 sec	467.99 KBytes	3.83 Mbits/sec
2.0 ~ 3.0 sec	469.42 KBytes	3.84 Mbits/sec
3.0 ~ 4.0 sec	467.99 KBytes	3.83 Mbits/sec
4.0 ~ 5.0 sec	469.42 KBytes	3.83 Mbits/sec
5.0 ~ 6.0 sec	470.86 KBytes	3.83 Mbits/sec
6.0 ~ 7.0 sec	467.99 KBytes	3.83 Mbits/sec
7.0 ~ 8.0 sec	467.99 KBytes	3.83 Mbits/sec
8.0 ~ 9.0 sec	466.55 KBytes	3.82 Mbits/sec
9.0 ~ 10.0 sec	462.25 KBytes	3.84 Mbits/sec

```

0.0 ~ 10.0 sec   4.58 MBytes   3.84 Mbits/sec
Sent 3268 datagrams
Done

```

```
# iperf -c 192.168.200.1 -u -P -N
```

```
[ IPERF OPTION ]
```

```

- role: client
- protocol: udp
- server_port: 5001
- server_ip: 192.168.200.1
- send_length: 1470
- send_time: 10
- send_passthrough: on (-)
- send_done_event: 0
- report_interval: 1

```

```
[ IPERF UDP Client ]
```

```
Sending 1470 byte datagrams ...
```

Interval	Transfer	Bandwidth
0.0 ~ 1.0 sec	483.78 KBytes	3.96 Mbits/sec
1.0 ~ 2.0 sec	467.99 KBytes	3.82 Mbits/sec
2.0 ~ 3.0 sec	470.86 KBytes	3.84 Mbits/sec
3.0 ~ 4.0 sec	467.99 KBytes	3.83 Mbits/sec
4.0 ~ 5.0 sec	469.42 KBytes	3.83 Mbits/sec
5.0 ~ 6.0 sec	470.86 KBytes	3.84 Mbits/sec
6.0 ~ 7.0 sec	470.86 KBytes	3.83 Mbits/sec
7.0 ~ 8.0 sec	467.99 KBytes	3.83 Mbits/sec
8.0 ~ 9.0 sec	470.86 KBytes	3.85 Mbits/sec
9.0 ~ 10.0 sec	455.07 KBytes	3.84 Mbits/sec
0.0 ~ 10.0 sec	4.59 MBytes	3.85 Mbits/sec

```
Sent 3271 datagrams
```

```
Done
```

```
# iperf -s -u
```

```
[ IPERF OPTION ]
```

```

- role: server
- protocol: udp
- server_port: 5001
- report_interval: 1

```

```
[ IPERF UDP Server ]
```

```
Connected with client: 192.168.200.1 port 56129
```

Interval	Transfer	Bandwidth	Jitter	Lost/Total Datagrams
0.0 ~ 1.0 sec	482.34 KBytes	3.95 Mbits/sec	0.964 ms	0/ 336 (0%)
1.0 ~ 2.0 sec	490.96 KBytes	4.02 Mbits/sec	0.393 ms	0/ 342 (0%)

2.0 ~ 3.0 sec	490.96 KBytes	4.02 Mb/s	0.276 ms	0/ 342 (0%)
3.0 ~ 4.0 sec	489.52 KBytes	4.01 Mb/s	0.509 ms	0/ 341 (0%)
4.0 ~ 5.0 sec	486.65 KBytes	3.98 Mb/s	0.280 ms	0/ 339 (0%)
5.0 ~ 6.0 sec	486.65 KBytes	3.99 Mb/s	0.544 ms	0/ 339 (0%)
6.0 ~ 7.0 sec	490.96 KBytes	4.02 Mb/s	0.454 ms	0/ 342 (0%)
7.0 ~ 8.0 sec	489.52 KBytes	4.01 Mb/s	0.301 ms	0/ 341 (0%)
8.0 ~ 9.0 sec	488.09 KBytes	3.99 Mb/s	0.607 ms	0/ 340 (0%)
9.0 ~ 10.0 sec	489.52 KBytes	4.01 Mb/s	0.807 ms	0/ 341 (0%)
0.0 ~ 10.0 sec	4.77 MBytes	4.00 Mb/s	0.807 ms	0/ 3403 (0%)

Done: 3403/3403

Press ENTER to continue or type "quit" :

[IPERF UDP Server]

Connected with client: 192.168.200.1 port 51030

Interval	Transfer	Bandwidth	Jitter	Lost/Total Datagrams
0.0 ~ 1.0 sec	496.70 KBytes	4.07 Mb/s	0.477 ms	0/ 346 (0%)
1.0 ~ 2.0 sec	501.01 KBytes	4.10 Mb/s	0.454 ms	0/ 349 (0%)
2.0 ~ 3.0 sec	499.57 KBytes	4.09 Mb/s	0.550 ms	0/ 348 (0%)
3.0 ~ 4.0 sec	499.57 KBytes	4.09 Mb/s	0.747 ms	0/ 348 (0%)
4.0 ~ 5.0 sec	501.01 KBytes	4.10 Mb/s	0.507 ms	0/ 349 (0%)
5.0 ~ 6.0 sec	501.01 KBytes	4.10 Mb/s	0.694 ms	0/ 349 (0%)
6.0 ~ 7.0 sec	502.44 KBytes	4.12 Mb/s	0.448 ms	0/ 350 (0%)
7.0 ~ 8.0 sec	499.57 KBytes	4.09 Mb/s	0.428 ms	0/ 348 (0%)
8.0 ~ 9.0 sec	501.01 KBytes	4.10 Mb/s	0.588 ms	0/ 349 (0%)
9.0 ~ 10.0 sec	505.31 KBytes	4.12 Mb/s	1.007 ms	0/ 352 (0%)
0.0 ~ 10.0 sec	4.89 MBytes	4.10 Mb/s	1.007 ms	0/ 3488 (0%)

Done: 3488/3488

Press ENTER to continue or type "quit" :

[IPERF UDP Server]

Connected with client: 192.168.200.1 port 39813

Interval	Transfer	Bandwidth	Jitter	Lost/Total Datagrams
0.0 ~ 1.0 sec	492.39 KBytes	4.03 Mb/s	0.633 ms	3/ 346 (0.87%)
1.0 ~ 2.0 sec	502.44 KBytes	4.11 Mb/s	0.402 ms	8/ 358 (2.2%)
2.0 ~ 3.0 sec	503.88 KBytes	4.12 Mb/s	0.486 ms	7/ 358 (2%)
3.0 ~ 4.0 sec	501.01 KBytes	4.10 Mb/s	0.627 ms	8/ 357 (2.2%)
4.0 ~ 5.0 sec	501.01 KBytes	4.10 Mb/s	0.773 ms	7/ 356 (2%)
5.0 ~ 6.0 sec	503.88 KBytes	4.13 Mb/s	0.404 ms	8/ 359 (2.2%)
6.0 ~ 7.0 sec	502.44 KBytes	4.11 Mb/s	0.383 ms	7/ 357 (2%)
7.0 ~ 8.0 sec	501.01 KBytes	4.10 Mb/s	0.487 ms	8/ 357 (2.2%)
8.0 ~ 9.0 sec	499.57 KBytes	4.09 Mb/s	0.550 ms	8/ 356 (2.2%)
9.0 ~ 10.0 sec	515.36 KBytes	4.16 Mb/s	1.931 ms	7/ 367 (1.9%)
0.0 ~ 10.0 sec	4.91 MBytes	4.11 Mb/s	1.931 ms	72/ 3573 (2%)

Done: 3500/3573

Press ENTER to continue or type "quit" : quit

#

Remote Iperf UDP Server/Client

```
$ iperf -s -u -i 1
```

```
-----
```

```
Server listening on UDP port 5001
```

```
Receiving 1470 byte datagrams
```

```
UDP buffer size: 160 KByte (default)
```

```
-----
```

```
[ 3] local 192.168.200.1 port 5001 connected with 192.168.200.43 port 50000
```

[ID]	Interval	Transfer	Bandwidth	Jitter	Lost/Total Datagrams
[3]	0.0- 1.0 sec	218 KBytes	1.79 Mbits/sec	0.499 ms	0/ 152 (0%)
[3]	1.0- 2.0 sec	215 KBytes	1.76 Mbits/sec	0.465 ms	0/ 150 (0%)
[3]	2.0- 3.0 sec	223 KBytes	1.82 Mbits/sec	0.659 ms	0/ 155 (0%)
[3]	3.0- 4.0 sec	218 KBytes	1.79 Mbits/sec	0.726 ms	0/ 152 (0%)
[3]	4.0- 5.0 sec	221 KBytes	1.81 Mbits/sec	0.606 ms	0/ 154 (0%)
[3]	5.0- 6.0 sec	223 KBytes	1.82 Mbits/sec	0.658 ms	0/ 155 (0%)
[3]	6.0- 7.0 sec	217 KBytes	1.78 Mbits/sec	0.901 ms	0/ 151 (0%)
[3]	7.0- 8.0 sec	214 KBytes	1.75 Mbits/sec	0.799 ms	0/ 149 (0%)
[3]	8.0- 9.0 sec	214 KBytes	1.75 Mbits/sec	0.712 ms	0/ 149 (0%)
[3]	0.0-10.0 sec	2.12 MBytes	1.78 Mbits/sec	0.756 ms	0/ 1513 (0%)

```
[ 4] local 192.168.200.1 port 5001 connected with 192.168.200.43 port 50000
```

[ID]	Interval	Transfer	Bandwidth	Jitter	Lost/Total Datagrams
[4]	0.0- 1.0 sec	468 KBytes	3.83 Mbits/sec	2.071 ms	0/ 326 (0%)
[4]	1.0- 2.0 sec	467 KBytes	3.82 Mbits/sec	2.216 ms	0/ 325 (0%)
[4]	2.0- 3.0 sec	469 KBytes	3.85 Mbits/sec	2.175 ms	0/ 327 (0%)
[4]	3.0- 4.0 sec	468 KBytes	3.83 Mbits/sec	2.077 ms	0/ 326 (0%)
[4]	4.0- 5.0 sec	468 KBytes	3.83 Mbits/sec	2.053 ms	0/ 326 (0%)
[4]	5.0- 6.0 sec	468 KBytes	3.83 Mbits/sec	2.109 ms	0/ 326 (0%)
[4]	6.0- 7.0 sec	467 KBytes	3.82 Mbits/sec	2.329 ms	0/ 325 (0%)
[4]	7.0- 8.0 sec	467 KBytes	3.82 Mbits/sec	2.159 ms	0/ 325 (0%)
[4]	8.0- 9.0 sec	468 KBytes	3.83 Mbits/sec	2.121 ms	0/ 326 (0%)
[4]	9.0-10.0 sec	469 KBytes	3.85 Mbits/sec	2.180 ms	0/ 327 (0%)
[4]	0.0-10.0 sec	4.58 MBytes	3.83 Mbits/sec	2.072 ms	0/ 3268 (0%)

```
[ 3] local 192.168.200.1 port 5001 connected with 192.168.200.43 port 50000
```

[ID]	Interval	Transfer	Bandwidth	Jitter	Lost/Total Datagrams
[3]	0.0- 1.0 sec	469 KBytes	3.85 Mbits/sec	2.106 ms	0/ 327 (0%)
[3]	1.0- 2.0 sec	468 KBytes	3.83 Mbits/sec	2.252 ms	0/ 326 (0%)
[3]	2.0- 3.0 sec	467 KBytes	3.82 Mbits/sec	2.483 ms	0/ 325 (0%)
[3]	3.0- 4.0 sec	469 KBytes	3.85 Mbits/sec	2.064 ms	0/ 327 (0%)
[3]	4.0- 5.0 sec	467 KBytes	3.82 Mbits/sec	2.311 ms	0/ 325 (0%)
[3]	5.0- 6.0 sec	469 KBytes	3.85 Mbits/sec	2.323 ms	0/ 327 (0%)
[3]	6.0- 7.0 sec	468 KBytes	3.83 Mbits/sec	2.198 ms	0/ 326 (0%)
[3]	7.0- 8.0 sec	468 KBytes	3.83 Mbits/sec	2.018 ms	0/ 326 (0%)
[3]	8.0- 9.0 sec	468 KBytes	3.83 Mbits/sec	2.115 ms	0/ 326 (0%)
[3]	9.0-10.0 sec	468 KBytes	3.83 Mbits/sec	2.247 ms	0/ 326 (0%)
[3]	0.0-10.0 sec	4.59 MBytes	3.83 Mbits/sec	2.124 ms	0/ 3271 (0%)

```
$ iperf -c 192.168.200.43 -u -b 4M -i 1
```

```
-----
```

```
Client connecting to 192.168.200.43, UDP port 5001
```

```
Sending 1470 byte datagrams, IPG target: 2940.00 us (kalman adjust)
```

UDP buffer size: 160 KByte (default)

[3] local 192.168.200.1 port 56129 connected with 192.168.200.43 port 5001

[ID]	Interval	Transfer	Bandwidth
-------	----------	----------	-----------

[3]	0.0- 1.0 sec	491 KBytes	4.02 Mb/s/sec
------	--------------	------------	---------------

[3]	1.0- 2.0 sec	488 KBytes	4.00 Mb/s/sec
------	--------------	------------	---------------

[3]	2.0- 3.0 sec	488 KBytes	4.00 Mb/s/sec
------	--------------	------------	---------------

[3]	3.0- 4.0 sec	488 KBytes	4.00 Mb/s/sec
------	--------------	------------	---------------

[3]	4.0- 5.0 sec	488 KBytes	4.00 Mb/s/sec
------	--------------	------------	---------------

[3]	5.0- 6.0 sec	488 KBytes	4.00 Mb/s/sec
------	--------------	------------	---------------

[3]	6.0- 7.0 sec	488 KBytes	4.00 Mb/s/sec
------	--------------	------------	---------------

[3]	7.0- 8.0 sec	490 KBytes	4.01 Mb/s/sec
------	--------------	------------	---------------

[3]	8.0- 9.0 sec	488 KBytes	4.00 Mb/s/sec
------	--------------	------------	---------------

[3]	9.0-10.0 sec	488 KBytes	4.00 Mb/s/sec
------	--------------	------------	---------------

[3]	0.0-10.0 sec	4.77 MBytes	4.00 Mb/s/sec
------	--------------	-------------	---------------

[3] Sent 3403 datagrams

[3] Server Report:

[3]	0.0-10.0 sec	4.77 MBytes	4.00 Mb/s/sec	0.807 ms	0/ 3403 (0%)
------	--------------	-------------	---------------	----------	--------------

\$ iperf -c 192.168.200.43 -u -b 4.1M -i 1

Client connecting to 192.168.200.43, UDP port 5001

Sending 1470 byte datagrams, IPG target: 2868.29 us (kalman adjust)

UDP buffer size: 160 KByte (default)

[3] local 192.168.200.1 port 51030 connected with 192.168.200.43 port 5001

[ID]	Interval	Transfer	Bandwidth
-------	----------	----------	-----------

[3]	0.0- 1.0 sec	502 KBytes	4.12 Mb/s/sec
------	--------------	------------	---------------

[3]	1.0- 2.0 sec	501 KBytes	4.10 Mb/s/sec
------	--------------	------------	---------------

[3]	2.0- 3.0 sec	500 KBytes	4.09 Mb/s/sec
------	--------------	------------	---------------

[3]	3.0- 4.0 sec	501 KBytes	4.10 Mb/s/sec
------	--------------	------------	---------------

[3]	4.0- 5.0 sec	501 KBytes	4.10 Mb/s/sec
------	--------------	------------	---------------

[3]	5.0- 6.0 sec	500 KBytes	4.09 Mb/s/sec
------	--------------	------------	---------------

[3]	6.0- 7.0 sec	501 KBytes	4.10 Mb/s/sec
------	--------------	------------	---------------

[3]	7.0- 8.0 sec	501 KBytes	4.10 Mb/s/sec
------	--------------	------------	---------------

[3]	8.0- 9.0 sec	500 KBytes	4.09 Mb/s/sec
------	--------------	------------	---------------

[3]	9.0-10.0 sec	501 KBytes	4.10 Mb/s/sec
------	--------------	------------	---------------

[3]	0.0-10.0 sec	4.89 MBytes	4.10 Mb/s/sec
------	--------------	-------------	---------------

[3] Sent 3488 datagrams

[3] Server Report:

[3]	0.0-10.0 sec	4.89 MBytes	4.10 Mb/s/sec	1.006 ms	0/ 3488 (0%)
------	--------------	-------------	---------------	----------	--------------

\$ iperf -c 192.168.200.43 -u -b 4.2M -i 1

Client connecting to 192.168.200.43, UDP port 5001

Sending 1470 byte datagrams, IPG target: 2800.00 us (kalman adjust)

UDP buffer size: 160 KByte (default)

[3] local 192.168.200.1 port 39813 connected with 192.168.200.43 port 5001

[ID]	Interval	Transfer	Bandwidth
-------	----------	----------	-----------

[3]	0.0- 1.0 sec	515 KBytes	4.22 Mb/s/sec
------	--------------	------------	---------------

```
[ 3] 1.0- 2.0 sec  512 KBytes  4.20 Mbits/sec
[ 3] 2.0- 3.0 sec  512 KBytes  4.20 Mbits/sec
[ 3] 3.0- 4.0 sec  512 KBytes  4.20 Mbits/sec
[ 3] 4.0- 5.0 sec  512 KBytes  4.20 Mbits/sec
[ 3] 5.0- 6.0 sec  512 KBytes  4.20 Mbits/sec
[ 3] 6.0- 7.0 sec  512 KBytes  4.20 Mbits/sec
[ 3] 7.0- 8.0 sec  514 KBytes  4.21 Mbits/sec
[ 3] 8.0- 9.0 sec  512 KBytes  4.20 Mbits/sec
[ 3] 9.0-10.0 sec  512 KBytes  4.20 Mbits/sec
[ 3] 0.0-10.0 sec  5.01 MBytes  4.20 Mbits/sec
[ 3] Sent 3573 datagrams
[ 3] Server Report:
[ 3] 0.0-10.0 sec  4.91 MBytes  4.11 Mbits/sec  1.930 ms  72/ 3573 (2%)
```

8.2 Remote Server/Client (raspi-atcmd-remote)

A remote server/client application run one server or client. This application is a Linux application and can be executed on Raspberry Pi.

8.2.1 Source files

File	Description
main.c	UDP/TCP server/client related functions
Makefile	Make file for building

Table 8.2 raspi-atcmd-remote source files

8.2.2 Build

Copy the “atcmd/host/raspi-atcmd-remote” directory to the Raspberry Pi's home directory. And build the remote application with the make command.

```
$ cd $HOME
$ cd raspi-atcmd-remote
$ make clean
```

```
removed 'raspi-atcmd-remote'
```

\$ make

```
cc -g -o raspi-atcmd-remote main.c -Wall -Wno-unused-function -DCONFIG_VERBOSE
```

8.2.3 Run

\$./raspi-atcmd-remote [-h|--help]

```
raspi-atcmd-remote version 1.2.0
Copyright (c) 2019-2023  <NEWRACOM LTD>

Usage:
$ ./raspi-atcmd-remote -s [-p <listen_port>] [-u] [-e]
$ ./raspi-atcmd-remote -c <server_ip> [-p <server_port>] [-u] [-e]

Options:
-s, --server          run in server mode
-c, --client #        run in client mode
-p, --port #          set server port to listen on or connect to (default: 50000)
-u, --udp             use UDP
-e, --echo            enable echo for received packets (default: off)
-v, --version         print version information and quit
-h, --help           print this message and quit
```

Examples:

Mode	Protocol	Command
Server	TCP	\$./raspi-atcmd-remote -s -p 50000 [-e]
	UDP	\$./raspi-atcmd-remote -s -u -p 60000 [-e]
Client	TCP	\$./raspi-atcmd-remote -c 192.168.200.1 -p 50000 [-e]
	UDP	\$./raspi-atcmd-remote -c 192.168.200.1 -u -p 60000 [-e]

9 Revision History

Revision No	Date	Comments
1.0	03/28/2019	Initial version for customer release created
1.1	07/02/2019	Sample Applications updated
1.2	08/01/2019	HW Flow Control added
1.3	09/17/2019	Additional AT-commands added
1.4	11/18/2019	Download binary update & remove description wpa security
1.5	02/14/2020	Improved command descriptions
1.6	03/25/2020	SPI connection and CLI application added
1.7	03/31/2020	AT+STXMODE, AT+SRXMODE, AT+SRXAVAIL and AT+SRECV commands removed
1.8	04/07/2020	Socket related events removed and added CLI application updated
1.9	05/15/2020	Ping size parameter removed Test Application added
1.10	05/22/2020	AT+WDHCPS, AT+WSOFTAP commands added
1.11	06/03/2020	AT+SLEEP command added
1.12	07/15/2020	“Chapter 2.2 Building the firmware” added
1.13	08/04/2020	UART default baudrate changed (38400 -> 115200) “4) Run with script file” in chapter 8.1 added
1.14	08/13/2020	BSSID in AT+WCONN command added
1.15	08/24/2020	AT+WROAM command added ROAMING event added
1.16	09/02/2020	AT+WFOTA command added FOTA event added
1.17	10/08/2020	In raspi-atcmd-cli application, lperf command supported
1.18	11/24/2020	FOTA updated <ul style="list-style-type: none"> - New events added - Get-bin-crc.sh removed - Update-fota-info.sh added
1.19	06/15/2021	AT+WSTAINFO command added
1.20	06/25/2021	WPA3-OWE/SAE security added
1.21	07/12/2021	AT+WMCS command removed
1.21.1	07/29/2021	Some examples fixed
1.22.0	10/21/2021	AT+SLEEP command removed AT+WSLEEP command added DEEPSLEEP_WAKEUP event added
1.22.1	11/12/2021	Country code added (AU, NZ)
1.22.2	12/16/2021	AT+WFOTA command updated <ul style="list-style-type: none"> - fota.json file in JSON format that describes new firmware

		<ul style="list-style-type: none"> - bin_name and bin_crc32 parameters to set new firmware - description and example
1.22.3	02/03/2022	Added setting form enable serial port Change event name from TCP CONNECT to CONNECT
1.22.4	02/25/2022	SCAN_DONE event removed ROAMING event removed CONNECT_SUCCESS event changed CONNECT_FAIL event changed DISCONNECT event changed
1.22.5	03/08/2022	SEND_IDLE event changed SEND_DROP event changed SEND_EXIT event changed SEND_ERROR event changed
1.22.6	03/16/2022	AT+WMCS command added AT+WXTIME command added AT+WDUTYCYCLE command added AT+WCCATHRESHOLD command added AT+WBSSMAXIDLE command added
1.22.7	03/28/2022	AT+WSCAN SET/GET command added
1.22.8	04/22/2022	AT+WCONN command updated AT+WTIMEOUT command updated AT+SSEND command updated
1.22.9	08/08/2022	AT+WDNS command added AT+SOPEN command updated AT+SSEND command updated AT+SRECV command added AT+SRECVMODE command added AT+SRXLOGLEVEL command removed AT+SRECVINFO command added AT+SADDRINFO command added RECV_READY event added
1.23.0	01/13/2023	AT+WDHCP SET/GET command added DHCP related events added Country code “K1” and “K2” added Test Application updated
1.23.1	03/10/2023	AT+STCPNODELAY command added
1.23.2	03/31/2023	AT+WROAM command removed CONNECT_FAIL event removed STA_CONNECT/STA_DISCONNECT events added
1.23.3	05/04/2023	AT+WCCATHRESHOLD command updated - CCA threshold range changed
1.23.4	06/30/2023	Country code “K0” added

		AT+WTXPOWER command updated AT+WSOFTAP command updated AT+WSLEEP command removed AT+WDEEPSLEEP command added AT+SOPEN command updated AT+SSEND command updated SEND_ERROR/RECV_ERROR events updated SEND_DONE event added
1.24	08/31/2023	AT+UART command updated AT+ADC command removed AT+WTXPOWER command updated AT+WMCS command updated AT+WSCAN command updated AT+WFOTA command updated AT+WBI command added AT+WLI command added AT+WMAXSTA command added AT+WCTX command added AT+STCPKEEPALIVE command added +SEVENT:"CLOSE" event updated +SEVENT:"SEND_ERROR" event updated +SEVENT:"RECV_ERROR" event updated
1.25	10/20/2023	AT+FWUPDATE command added AT+FWBINDL command added AT+WBSSMAXIDLE command updated AT+SSEND command updated AT+WSCANSSID command added AT+WSOFTAPSSID command added AT+SRECV command updated
1.26	02/05/2025	Added commands: AT+BOOT AT+SFUSER AT+WBGSCAN AT+WWPS Updated commands: AT+WMACADDR AT+WRXSIG AT+WTSF AT+WSTAINFO AT+FWUPDATE AT+STIMEOUT AT+SFSYSUSER AT+WTXPOWER

		<div>AT+WMCS</div> <div>AT+WOUNTRY</div> <div>AT+WDEEPSLEEP</div> <div>AT+WSCAN</div> <div>AT+WCONN</div> <div>AT+WSOFTAP</div> <div>AT+WSAEPWE</div> <div>AT+WDHCP</div> <div>AT+WFOTA</div> <div>AT+SRECV</div> <div>Added events:</div> <div>+BOOT</div> <div>+BEVENT:"FWBINDL_FAIL"</div> <div>+BEVENT:"SFUSER_IDLE"</div> <div>+BEVENT:"SFUSER_DROP"</div> <div>+BEVENT:"SFUSER_FAIL"</div> <div>+BEVENT:"SFUSER_DONE"</div> <div>+WEVENT:"DHCP_RELEASE"</div> <div>+WEVENT:"DHCP_RENEW"</div>
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