Weightless Starter Kit

AT Command Reference Guide

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Models: Weightless Starter Kit 868/915MHz

Part Number:

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Revision History

Revision Code	Date	Description	Comments
1.0.0	Aug 16, 2017	Initial Draft	
1.0.5	Sep 7, 2017	For Firmware Version 1.0.5	
1.0.7	Nov 1, 2017	For Firmware Version 1.0.7	
1.0.8	Jan 18, 2018	For Firmware Version 1.0.8 Add AT+RXQ Add AT+RXQMAX Add AT+RXQFLOW Add AT+TX64 Add AT+RXBASE64 Update to AT+E Add +RX64 Add AT+RETX, Add AT+RATIMEOUT Add AT+RSSI Add AT+PAGAIN	

Contents

Syntax

User-originated AT commands are strings of characters transmitted over UART:
Baud rate: 115,200
Data bits: 8
Stop bits: 2
Parity: None
Flow control: None

User-originated AT commands

The command ends with a character code S3 (default is ASCII 13, '\r').
A valid AT command begins with either "AT" or "at", optionally followed by a plus sign and a command name:
AT+ *atCmd*

There are 4 types of user-originated AT commands:

- QUERY
  - **“AT+ *atCmd?”:*** checks for availability of AT command ***atCmd***. Responds OK if it exists, ERROR otherwise
- GET
  - **“AT+ *atCmd =?”:*** performs a GET operation on the AT command ***atCmd***
- SET
  - **“AT+ *atCmd =param1,param2, …”:*** performs a SET operation on the AT command ***atCmd.*** Number of mandatory and optional parameters is command-specific.
- EXECUTE
  - **“AT+ *atCmd”:*** executes the AT command ***atCmd.*** This does not accept any parameter.

Unsolicited AT commands

Unsolicited AT commands are generated by Weightless communication module and sent to the host. They start with a plus “+” sign.

List of user-originated AT commands

AT: No operation

Command type:
EXECUTE
Response:
OK

AT+S3: Get or set S3, the end-of-command character code

Command type:
GET / SET

Parameter(s) for SET:
[M] S3 character ASCII code, decimal (default is 13 for '\r')
Response:
[SET] OK
[GET] S3 as decimal ASCII code

AT+S4: Get or set S4, the end-of-line character

Command type:
GET / SET
Description:
Get or set S4, the end-of-line character
Parameter(s) for SET:
[M] S4 character ASCII code, decimal
Response:
[SET] OK
[GET] S4 as decimal ASCII code

AT+E: Get or set E flag to enable/disable AT command echoing

Command type:
GET / SET
Parameter(s) for SET:
[M] E flag value (1/0, default is 0)
Response:
[SET] OK
[GET] E flag value (1 or 0)

AT+WARFCN: Get or set the current WARFCNs

Command type:
GET / SET
Parameter(s) for SET:
[M] start WARFCN (decimal, default is 8631)
[O] Number of WARFCNs to search (default is 1)
[O] Spacing between each searched WARFCN (default is 0)

Response:
[SET] OK
[GET] +WARFCN:*startWARFCN,numWARFCN,spacing*

To configure the ED such that it scans 915MHz, 915.5MHz and 916MHz, use AT+WARFCN=9150,3,5.

AT+STATS: Displays statistics on memory usage and task CPU usage

Command type:
EXECUTE
Response:
Silent

AT+MEM: Displays list of currently allocated memory blocks

Command type:
EXECUTE
Response:
Silent

AT+CREG: Request registration to or deregistration from the Base Station

Command type:
GET / SET / EXECUTE
Parameter(s) for SET:
[O] Registration request (1: register 0: deregister)
[O] Mode (for deregistration
Response:
[SET / EXECUTE] OK
[GET] +CREG:*cregStatus* Current registration status

AT+CREGTO: Get or set registration timeouts

Command type:
GET / SET

Parameter(s) for SET:
[M] Complete registration procedure timeout in seconds (default is 90, 0 is infinite)
[O] Network Search timeout per WARFCN in seconds. Negative value would trigger immediate registration upon the first valid Base Station found (default is -13, 0 is infinite)
[O] Base Station camp timeout in seconds (default is 13, 0 is infinite)
Response:
[SET] OK
[GET] +CREGTO:*cregTimeout,searchTimeout,campTimeout*

AT+RLT: Get or set the Radio Link Timeout

Command type:
GET / SET
Parameter(s) for SET:
[M] Radio Link Timeout value
Response:
[SET] OK
[GET] +RLT:*RadioLinkTimeout*

The Radio Link Timeout is a countdown. It has an initial value of 16 and a maximum value of 16. It is incremented by 4 whenever a Resource Allocation or System Information Block is received, incremented by 1 when a normal packet is received, and decremented by 1 every frame. The ED triggers a timeout and returns to Network Search state upon RLT reaching 0. It can be overridden by setting its value (but it would still be capped to 16).

AT+TX: Send data to the Network (uplink)

Command type:
SET
Parameter(s) for SET:
[M] Payload as hexadecimal string
[O] ACK mode (1:acknowledged 0:unacknowledged, default is 0)
Response:
[SET] BUSY / ERROR / +TX-SEQ[*sequenceNumber*]:*dataSize,lchName*

If the data can be successfully enqueued, it will be assigned a *sequenceNumber*, and there will be an associated +TX-ACK message for that *sequenceNumber*.

AT+TX64: Send data to the Network (uplink, Base64 encoded)

Command type:
SET
Parameter(s) for SET:
[M] Payload as Base64 (url-safe, '+' replaced by '-' and '/' by '_')
[O] ACK mode (1:acknowledged 0:unacknowledged, default is 0)
Response:
[SET] BUSY / ERROR / +TX-SEQ[*sequenceNumber*]:*dataSize,lchName*

If the data can be successfully enqueued, it will be assigned a *sequenceNumber*, and there will be an associated +TX-ACK message for that *sequenceNumber*.

AT+TXQMAX: Set uplink queue maximum depth

Command type:
GET / SET
Parameter(s) for SET:
[M] LCH (0 for unacknowledged, 1 for acknowledged)
[M] maximum queue depth (0 is unlimited, default is 2)
Response:
[SET] OK / PARAM_ERROR
[GET} +TXQMAX:*qMaxUUD,qMaxUAD* (*qMaxUUD* is maximum depth of unacknowledged queue, *qMaxUAD* for acknowledged). Attempt to transmit when the queue is already full would be rejected with BUSY)

AT+TXQ: Query depth and size of uplink queues

Command type:
GET
Response:
+TXQ[0]:*qUUDDepth*,*qUUDSize*

+TXQ[1]:*qUADDepth*,*qUADSize*

qUxDDepth and *qUxDSize* are the depth (in number of elements) and size (in bytes) of the uplink queue for **U**nacknowledged and **A**cknowledged queues)

AT+RXQMAX: Set downlink queue maximum depth

Command type:
GET / SET
Parameter(s) for SET:
[M] LCH (0 for unacknowledged, 1 for acknowledged)
[M] maximum queue depth (0 is unlimited, default is 2)
Response:
[SET] OK / PARAM_ERROR
[GET} +RXQMAX:*qMaxUUD,qMaxUAD* (*qMaxUUD* is maximum depth of unacknowledged queue, *qMaxUAD* for acknowledged). The queues are only used when RXQ Flow Control is SUSPENDED.

AT+RXQ: Query depth and size of downlink queues

Command type:
GET
Response:
+RXQ[0]:*qUUDDepth*,*qUUDSize*
+RXQ[1]:*qUADDepth*,*qUADSize*

qUxDDepth and *qUxDSize* are the depth (in number of elements) and size (in bytes) of the downlink queue for **U**nacknowledged and **A**cknowledged queues)

AT+RXQFLOW: Get or set downlink flow state

Command type:
GET / SET
Parameter(s) for SET:
[M] FXQ Flow state (0: OFF, 1: ON)
Response:
[SET] OK
[GET] +RXQFLOW:*state* Current RXQ Flow state (decimal)

When RXQ Flow is ON, downlink messages are sent via the +RX unsolicited command. If RXQ Flow is OFF, downlink messages are queued (up to RXQMAX limits) and no +RX is generated. The queues will be automatically flushed whenever the RXQ Flow is set to ON again. This can be used if the Host is powered down for extended periods of time and will not be able to receive +RX. Downlink messages will be automatically buffered.

AT+RXBASE64: Get or set Base64 mode for downlink

Command type:
GET / SET
Parameter(s) for SET:
[M] RXBASE64 mode (0: OFF, 1: ON, default is OFF)
Response:
[SET] OK
[GET] +RXBASE64 :*mode*

AT+RESET: Reset the device

Command type:
EXECUTE
Response:
Silent

AT+VERSION: Displays the firmware version

Command type:
EXECUTE
Response:
Firmware version

AT+UUEID: Get the UUEID of the device

Command type:
GET

Response:
+UUEID:*uueid* (*uueid* as a string of 16 hexadecimal digits)

AT+MCS: Get or set the default Modulation and Coding Scheme (MCS)

Command type:
GET / SET
Parameter(s) for SET:
[M] MCS for Network Search (decimal 0-11)
Response:
[SET] OK
[GET] +MCS:*mcs* Current MCS (decimal)

AT+TXPWR: Get or set the current transmit power

Command type:
GET / SET
Parameter(s) for SET:
[M] Transmit power (dBm, default is 15)
[O] Maximum transmit power (dBm, default is 15)
[O] Power Amplifier Gain (if any) (dB, default is 0)
Response:
[SET] OK
[GET] +TXPWR: *txPowerdBm,maxPwrdBm*

AT+PAGAIN: Get or set the Power Amplifier gain

Command type:
GET / SET
Parameter(s) for SET:
[M] Power Amplifier Gain (if any) (dB, default is 0)
Response:
[SET] OK
[GET] +PAGAIN: *paGaindBm*

AT+RETX: Get or set Acknowledge Mode retransmission settings

Command type:
GET / SET
Parameter(s) for SET:
[M] Number of Retries (default 4)
[M] Time Out in number of Frames (default 4)
Response:
[SET] OK
[GET] +RETX:*numRetries,retxTimeOut*

AT+RATIMEOUT: Get or set Resource Allocation timeout

Command type:
GET / SET
Parameter(s) for SET:
[M] Resource Allocation timeout (default 256)
Response:
[SET] OK
[GET] +RATIMEOUT:*raTimeOut*

When the End Device has Uplink data pending, it will monitor the Uplink Resource Allocation. If it is not scheduled by the Base Station after *raTimeOut* consecutive Uplink Resource Allocation, it will consider the link lost and return to Unregistered state.

AT+AS: Get or set auto-start mode

Command type:
GET / SET
Parameter(s) for SET:
[M] Auto-start mode (0: disable 1:enable).
When enabled, the device will start searching for a Network when powered up or reset.
Response:
[SET] OK
[GET] +AS:*autoStartMode* (1 or 0)

AT+RSSI: Get Downlink RSSI average

Command type:
GET
Response:
+RSSI:*rssiIndBm,numSamples*
Returns the average Downlink RSSI since the last call. The number of averaged samples is *numSamples*. RSSI will be -32768 if *numSamples* is 0.

AT+RSSI_MIN: Get or set RSSi threshold for quick registration

Command type:
GET / SET
Parameter(s) for SET:
[M] Minimum RSSI in dBm above which ED would directly try to register (default is -70)
Response:
[SET] OK
[GET] +RSSI_MIN:*rssiMindBm*
The normal procedure is for the End Device to search all frequencies specified by AT+WARFCN before deciding which Base Station to register to (based on highest RSSI). However, if the RSSI is above *rssiMindBm* it will go to registration straight away.

AT+LNA: Get or set LNA gain

Command type:
GET / SET
Parameter(s) for SET:
[M] LNA gain in dB (default 0)
Response:
[SET] OK
[GET] +LNA:*lnaGaindB*

AT+SLEEP: Get or set sleep mode

Command type:
GET / SET

Parameter(s) for SET:
[M] sleepmode (0: sleep 1: deep sleep)
Response:
[SET] OK
[GET] +SLEEP:*sleepMode*

The End Device automatically sleeps most of the time when there is no software activity. The sleep mode used can be forced to Deep Sleep to ensure sub-10uA current consumption. The side-effect could be a less responsive UART, which may require to send a dummy AT command when using higher baudrate than 115,200 with 2 sotp bits. Specifically, in Deep Sleep mode the UART is inactive and the End Device wakes up on a falling edge of the UART Rx. The wake-up time is short enough not to lose any data bits with 115,200bps 2 stop bits. NOTE: the sleep mode resets itself to 0 after every AT command. When the Host is doneconfiguring the End Device, it is recommended to issue AT+SLEEP=1 again.

AT+TCXO: Get or set TCXO mode

Command type:
GET / SET
Parameter(s) for SET:
[M] TCXO mode (0:auto 1: always on, default 1)
Response:
[SET] OK
[GET] +TCXO:*tcxoMode*

The TCXO used for RF is automatically controlled during Rx and Tx. However, it can be set as always-on for the best frequency stability.

AT+SNIFF: RSSI scan

Command type:
SET
Parameter(s) for SET:
[M] Start frequency channel (WARFCN)
[O] Stop frequency (default is Start frequency)
[O] RSSI scan duration per frequency in milliseconds (default is 0, use LBT setting)
Response:

[SET]
+RSSI:*frequency,rssiAveragedBm,rssiMaxdBm,rssiStdDeviationdB,rssiMeasureCount*

AT+LBT: Listen Before Talk settings

Command type:
GET / SET
Parameter(s) for SET:
[M] LBT enable (0: off, 1: on default off)
[O] LBT threshold in dBm (default -80)
[O] LBT duration in milliseconds (default 3000)
[O] LBT sniff period in microseconds (default 1000)
Response:
[SET] OK
[GET] +LBT:*lbtEnable*,*lbtThresholddBm*,*lbtDurationMS*,*sniffPeriodUS*

AT+UART: Configure UART settings

Command type:
GET / SET
Parameter(s) for SET:
[M] baudrate (19200, 38400, 57600, 115200 default, 230400, 460800, 921600)
[M] stopbits (1 or 2, default 2)
[M] parity (0: no parity, 1: odd, 2: even, default 0)
Response:
[SET] OK
[GET] +UART:*baudrate,stopbits,parity*

AT+GPIODIR: Set GPIO Direction

Command type:
GET
Parameter(s) for SET:
[M] port is PA0-5, PF6, PC6 or PC7 (others will return error)
[M] direction is in or out
[O] pull is optional, applies only for in, and can be up, down or none
Response:

[SET] OK

AT+GPO: Set GPIO Value

Command type:
GET
Parameter(s) for SET:
[M] port is PA0-5, PF6, PC6 or PC7 (others will return error)
[M] val is 0 or 1
Response:
[SET] OK

AT+GPI: Get GPIO Value

Command type:
GET
Parameter(s) for SET:
[M] port is PA0-5, PF6, PC6 or PC7 (others will return error)
Response:
[GET] +GPI:*port,value* (value is 0 or 1)

AT+ADC: Read analog input

Command type:
GET
Parameter(s) for GET:
[M] port is PA0 to PA5
Response:
[GET] +ADC:*port,value* (in millivolts)

Perform an ADC sampling of the specified port in single-ended mode. ADC Full-Scale is 5V but input cannot exceed supply voltage.

AT+VBAT: Get battery voltage

Command type:

GET
Parameter(s) for GET:
None
Response:
[GET] +VBAT:*vbatValue* (in millivolts)

AT+TEMP: Get temperature

Command type:
GET
Parameter(s) for GET:
None
Response:
[GET] +TEMP:*temperature* (in hundredth of °C, like 2750 for 27.50°C)

Perform an ADC sampling of the specified port in single-ended mode. ADC Full-Scale is 5V but input cannot exceed supply voltage.

AT+RNG: True random-number generator

Command type:
GET
Parameter(s) for GET:
None
Response:
[GET] +RNG:*randomNumber*

This is a non-deterministic hardware-based entropy generator.

List of application-specific AT commands

AT+PERIOD: Get or set the application reporting period in seconds

Command type:
GET / SET
Parameter(s) for SET:

[M] period (default is 10s)
Response:
[SET] OK
[GET] +PERIOD:*periodInSeconds*

AT+APPTYPE: Get/set the Application Type

Command type:
GET / SET
Parameter(s) for SET:
[M] Application Type (0; reports RSSI, 1: reports Temperature/RH, 2: send timestamped random uplink data)
Response:
[SET] OK
[GET] Current Application Type

AT+APPSTREAM: Get or set random uplink data parameters

Command type:
GET / SET
Parameter(s) for SET:
[M] Number of uplink data payloads to generate at once
[M] Payload size in bytes (Link layer handles fragmentation so Protocol limitation is 64kB, but the ED has limited RAM so practical maximum is 1-2kB)
[M] LCH (0: unacknowledged, 1: acknowledged)
Response:
[SET] OK
[GET] +APPSTREAM:*payloadNum,payloadSize,lch*

With APPTYPE=2, the ED will generate *payloadNum* data packets of *payloadSize* bytes. The period is still configurable with AT+PERIOD. The uplink payload would consists in random data, except for the first 7 bytes which would contain a human-readable date and time acquired from the base Station, when available. Data will be dropped if the uplink queues reach TXQMAX settings.

AT+TEMP_RH: Get I2C sensor's temperature and humidity

Command type:
GET
Parameter(s) for GET:
None
Response:
[GET] +TEMP_RH:*timestamp,temperature,relativeHumidity* (*timestamp* is the number of milliseconds since boot, *temperature* in hundredth of degree Celsius, *relativeHumidity* in percent)

List of unsolicited AT commands

+BOOT*:* Indicates boot of the firmware

+FATAL:*message:* Indicates an internal fatal error

Description:
message contains additional information about the error. A System Reset will occur shortly after the FATAL message has been notified 3 times.

+RX[*channel*]:*n,data:* Indicates a received payload

Description:

- ***channel*** is the logical channel (LCH_UUD for unacknowledged data, LCH_UAD for acknowledged data).
- ***n*** is the length in bytes,
- ***data*** is a hexadecimal string representing the data.

+RX64[*channel*]:*n,data:* Indicates a received payload

Description:

- ***channel*** is the logical channel (LCH_UUD for unacknowledged data, LCH_UAD for acknowledged data).
- ***n*** is the length in bytes,
- ***data*** is a base64 url-safe representation of the data

+TX-ACK[*sequenceNumber*]:*status:* reports uplink status

Description:

- ***sequenceNumber*** is the sequence number previosuly reported in the response to AT+TX or AT+TX64
- ***status*** is the uplink status for this transmission, in hexadecimal format. 00 indicates a successful transmission (for unacknowledged channel) or that the acknowledgment has been successfully received from the Base Station (for acknowledged channel). Values other than 00 indicate an error.

+CREG:*n:* Indicates a change of registration state

Description:

n is one of the following:
-4: Security Failure
-3: Registration rejected
-2: Network Search failed
-1: Radio Link Timeout / Registration Timeout
0: Unregistered
1: Registered
2: Cipher Verify state
3: Network Nonce received, proceeding to sending End Device Nonce
4: Network found, starting registration procedure
5: Searching for a network

After power up or reset registration state is 0. Once triggered with AT+CREG or AT+CREG=1 the End Device will start searching for a suitable Network. A successful registration will go through states 4 to 1.
Any negative value indicates the End Device returns to Unregistered state 0.

Successful registration:

```
AT+CREG=?
```

```
0
AT+CREG
OK
```
…immediately
```
+CREG:5
```
…waiting a few seconds
```
+CREG:4
```
…Network found, start security association
```
+CREG:3
```
…security association 1/2
```
+CREG:2
```
…security association 2/2
```
+CREG:1
```
…fully registered, can start sending data with AT+TX
```
AT+TX=123456789A
+TX-SEQ[1]:5,LCH_UUD
…
+TX-ACK[1]:00

+RX[LCH_UAD]:4,12345678
```
…trigger deregistration procedure
```
AT+CREG=0
OK
```
…wait a few seconds
```
+CREG:0
```

Failed registration:

```
AT+CREG=?
0
AT+CREG
OK
```
…waiting a few seconds
```
+CREG:-2
```
…failed to find a suitable network

Contact

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END