S

u-locateEmbed

Short range standalone modules

AT commands manual

Abstract

u-blox AT commands reference manual for the short-range stand-alone modules running the u-LocateEmbed software for Bluetooth® direction finding using Angle of Arrival.

UBX-22025586 - R03
C1-Public

Document information

Title	**u-locateEmbed**	
Subtitle	Short range standalone modules	
Document type	AT commands manual	
Document number	UBX-22025586	
Revision and date	R03	2-Feb-2024
Disclosure restriction	C1-Public	

This document applies to the following products:

Product name
ANT-B10
ANT-B11
C211

☞ u-connectLocate is now renamed to u-locateEmbed.

Contents

1 AT command settings

u-blox short range modules running u-locateEmbed provide at least one physical interface for configuration and data transport. Currently the UART interface is supported.

1.1 Definitions

In this document, the following naming conventions are used:

- DCE (Data Communications Equipment): u-blox short range module
- DTE (Data Terminal Equipment) or TE (Terminal Equipment): The terminal that issues the command to the module.

The terms DCE and DTE are used in the serial interface context.

1.1.1 Command description

The AT commands configure and enable the short-range module functionality according to 3GPP normative and u-blox specifications. The AT commands are issued to the module via a serial connection through a command line and are described in the following sections. A general description of each command is provided, including the functionalities, the correct syntax to be provided by the TE/DTE, and the allowed responses.

The command description defines each named parameter with its type, range (valid / acceptable values), default value (when available), and factory default setting (when applicable).

☞ In this document, <CR><LF> are intentionally omitted in the command syntax.

1.1.2 Command line

The AT commands are typically issued to the short-range modules using a command line with the following generic syntax:

"AT"<command_name><string><CR>

Where:

- "AT": The prefix to be set at the beginning of each command line.
- <command_name>: The command name string; it can have a "+" character as prefix.
- <string>: The string consisting of the value parameters following the syntax provided in this manual.
- The following rules are used when describing the command syntax:
  - <...>: The name in angle brackets is a parameter. The brackets themselves do not appear in the command line.
  - [...]: The square brackets represent the optional parameters of a command or an optional part of the DCE information text response. Brackets themselves do not appear in the command line. When a parameter is not given, the value will be set to the default value provided in the command description.

☞ The command line is not case sensitive.

The serial interface driver generally does not allow a new command until the previous one has been terminated by "OK" or an error message.

1.1.3 Default values

If the command has optional parameters and default values are not specified, the default values are assumed as follows:

- For parameters of type Number, the default value is 0.
- For parameters of type String, the default value is an empty string.

1.1.4 Information text responses and result codes

The response format is as follows:

- Information text response(s): `<CR><NL><text><CR><NL>`
- Result codes: `<CR><NL><verbose code><CR><NL>`

2 General operation

2.1 AT command types

2.1.1 Set command

A set command configures preferred settings for the specified command. The set command is the only way to set the preferred settings in the DCE. Parameters set with a set command are used immediately and the parameters can be stored to the startup database using `&W`.

☞ Some Set commands require a reboot before using. Store with `&W` and reset with `+CPWROFF`.

2.1.2 Read command

A read command provides current setting of the command parameters. It is used to find out the current command configuration.

2.1.3 Status command

A status command provides the current operating status of the module.

2.1.4 Action command

An action command forces the DCE to print information text or execute a specific action for the command.

2.1.5 Configuration action command

Some configuration commands require that the configuration is reset, stored, activated, or deactivated using a corresponding configuration action command.

2.1.6 Unsolicited result code (URC)

An unsolicited result code is a string message (provided by the DCE) that is not triggered as an information text response to a previous AT command. When enabled, the message can be output at any time to inform the DTE of a specific event or status change. The URC can have the same name as the command that enables it or can be enabled by another command.

2.2 Data types

The definition of each command specifies the data types used for values associated with the command. The different data types are:

- String
- Integer
- Enumerator
- Byte_Array
- MAC_Addr
- Bd_Addr
- List

2.2.1 String

A string must consist of a sequence of displayable characters in the ISO 8859-1 character set – except for backslash (\), double quote ("), and other characters below 32 (space). A string constant must be delimited by two double quote characters ("…"), for example, "Donald Duck". If the double quote characters (") are to be used within a string, for example, "My friend "Bono" is a singer", they must be represented as "\22". If the back-slash character (\) is to be used within a string constant, it must be represented as "\5C". An empty string is represented by two adjacent delimiters ("").

2.2.2 Integer

An integer value consists of a sequence of characters, all in the range {0..9} plus a possible minus sign (-) for negative values. Numeric constants are expressed in decimal format only.

2.2.3 Enumerator

An enumerator value is an integer, where all its possible values are specified in each case. Only the defined values are accepted for the command in question.

2.2.4 Byte_Array

A Byte_Array consists of a sequence of characters expressed in two-digit hexadecimal in the ranges {0..9}, {a..f} and {A..F}. The hexadecimal values are grouped together without delimiters; an example of Byte_Array (three values) is "800000" (Bit 23 is set) – excluding the double quote characters.

2.2.5 MAC_Addr

A MAC_Addr is a Byte_Array of fixed length (6 values). An example MAC_Addr is "01A0F7101C08" – excluding the double quote characters.

2.2.6 Bd_Addr

A Bd_Addr is a MAC_Addr followed by an optional address type, "r" for random address and "p" for public address.

If the address type is omitted, it defaults to public. An example Bd_Addr is "01A0F7101C08p" – excluding the double quote characters.

2.2.7 List

A List is a comma (,) separated list of items, where items can be any of the other data types. For example, channel list is a list of integers, "1,6,11" – excluding the double quote characters.

3 General

3.1 Attention AT

AT				
Modules	NINA-B41X-40B			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	No	No	-

3.1.1 Description

Attention command that determines the presence of a Data Communication Equipment (DCE).

3.1.2 Syntax

AT command	Description
`AT`	Attention command

Response	Description
`OK`	Successful response
`ERROR`	Error Response

3.2 Manufacturer identification +GMI

+GMI				
Modules	NINA-B41X-40B			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	No	No	-

3.2.1 Description

Read a text string that identifies the manufacturer.

3.2.2 Syntax

AT command	Description
`AT+GMI`	Read manufacturer

Response	Description
`<manufacturer>` `OK`	Successful read response

3.2.3 Defined values

Parameter	Type	Description
manufacturer	String	u-blox

3.3 Model identification +GMM

+GMM				
Modules	NINA-B41X-40B			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	No	No	-

3.3.1 Description

Read a text string that identifies the model.

3.3.2 Syntax

AT command	Description
AT+GMM	Read model identification

Response	Description
<model> OK	Successful read response

3.3.3 Defined values

Parameter	Type
model	String

3.4 Echo On/Off E

E				
Modules	NINA-B41X-40B from u-locateEmbed 3.0.			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	Profile	No	-

3.4.1 Description

Configure whether the unit echoes characters received from the host.

3.4.2 Syntax

AT command	Description
ATE<echo_on>	Set echo on or off
ATE?	Reads current echo setting

Response	Description
<echo_on> OK	Successful read response
OK	Successful response
ERROR	Error response

3.4.3 Defined values

Parameter	Type	Description
echo_on	Integer	Turn echo on/off: 0: Unit does not echo the characters in command mode. 1: (factory default): Unit echoes the characters in command mode.

3.5 Software identification I

I				
Modules	NINA-B41X-40B			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	No	No	-

3.5.1 Description

Read identification information.

3.5.2 Syntax

AT command	Description
`ATI<value>`	Read identification information

Parameter value	Response	Description
9	<ApplicationVersion>, <UniqueIdentifier> OK	Successful read response

3.5.3 Defined values

Parameter	Type	Description
value	Enumerator	9: Complete software version information

3.5.4 Parameter values

Parameter	Type
ApplicationVersion	String
UniqueIdentifier	String

3.6 Software version identification +GMR

+GMR				
Modules	NINA-B41X-40B			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	No	No	-

3.6.1 Description

Read a text string that identifies the software version of the module.

3.6.2 Syntax

AT command	Description
AT+GMR	Read software version

Response	Description
<version> OK	Successful read response

3.6.3 Defined values

Parameter	Type
version	String

4 System

4.1 Local address +UMLA

+UMLA				
Modules	NINA-B41X-40B			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	Profile	No	-

4.1.1 Description

Read the local address of the interface id.

4.1.2 Syntax

AT command	Description
`AT+UMLA=<interface_id>`	Read the local address of the interface id

Response	Description
`+UMLA:<address>` `OK`	Successful read response
`ERROR`	Error response

4.1.3 Defined values

Parameter	Type	Description
interface_id	integer	1: Bluetooth
address	MAC_Addr	MAC address of the interface id

4.2 Store current configuration &W

&W				
Modules	NINA-B41X-40B			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	No	No	-

4.2.1 Description

Store the current configuration. Note that a restart is needed to write to permanent storage.

4.2.2 Syntax

AT command	Description
`AT&W[<profile>]`	Commit all the settings to be stored in start-up database. The parameters are written to non-volatile memory when +CPWROFF is issued.

Response	Description
`OK`	Successful response
`ERROR`	Error response if <profile> is invalid

4.2.3 Defined values

Parameter	Type	Description
Profile	Enumerator	0: Only valid value

4.3 Module switch off +CPWROFF

+CPWROFF				
Modules	NINA-B41X-40B			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	Yes	No	-

4.3.1 Description

Reboot the DCE. During shutdown, the settings marked for storing to start up the database by &W are written in the non-volatile memory of the module.

4.3.2 Syntax

AT command	Description
AT+CPWROFF	Reboot the DCE

Response	Description
OK	Successful read response

4.4 Set to factory defined configuration +UFACTORY

+UFACTORY				
Modules	NINA-B41X-40B			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	No	No	-

4.4.1 Description

Reset to factory defined defaults. A reboot is required before using the new settings.

4.4.2 Syntax

AT command	Description
AT+UFACTORY	Reset to factory defaults

Response	Description
OK	Successful response

4.5 Enter FW update mode AT+UFWUPD

+UFWUPD				
Modules	NINA-B41X-40B			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Partial	No	No	-

4.5.1 Description

Force start the boot loader.

The boot loader starts at the defined baud rate. Optional parameters are available for secure boot and are supported by NINA-B41.

4.5.2 Syntax

AT command	Description
AT+UFWUPD=<mode>,<baud_rate>	Force start the boot loader

Response	Description
OK	Successful write response

4.5.3 Defined values

Parameter	Type	Description
Mode	Enumerator	Download mode: 0: u-connect software update using serial port
Baud_rate	Enumerator	Baud rate in bits per second: 19200 28800 31250 38400 56000 57600 76800 115200 (default) 230400 250000 460800 921600 1000000

4.6 RS232 setting +UMRS

+UUDF				
Modules	NINA-B41X-40B			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	Yes	No	-

4.6.1 Description

Read and set the RS232 settings.

4.6.2 Syntax

AT command	Description
AT+UMRS?	Read the current RS232 settings from the module
AT+UMRS=<baud_rate>[,<flow_control>]	Apply new RS232 settings

4.6.3 Defined values

Parameter	Type	Description
baud_rate	Integer	Factory default value 115200 Valid baud rates: 19200, 28800, 31250, 38400, 56000, 57600, 76800, 115200, 230400, 250000, 460800, 921600, 100000
flow_control	Integer	0: CTS/RTS not used. 1 (factory default): CTS/RTS used for flow control

4.6.4 Notes

This command requires a store (AT&W) and restart (AT+CPWROFF) to take effect.

4.7 System Configurations +USYSCFG

+ USYSCFG				
Modules	NINA-B41X-40B from u-locateEmbed 3.0			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	No	No	-

4.7.1 Description

System configuration such as controlling RGB LEDs.

4.7.2 Syntax

AT command	Description
AT+ USYSCFG ?	Read config options
AT+ USYSCFG=<param_tag>,<param_value>	Write config

Response	Description
OK	Successful write response
ERROR	Error Response

4.7.3 Defined values

Param. tag	Min value/ length	Max value/ length	Default value	Type	Description
1	0	1	1	Integer	0: Disable RGB LEDs. 1: Enable RGB LEDs. ☞ Applicable only for boards with RGB LEDs.

4.8 UART sleep +UPWRSAVE

+ UPWRSAVE				
Modules	NINA-B41X-40B from u-locateEmbed 3.0			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	No	No	-

4.8.1 Description

In sleep mode, the UART receive on anchor side is disabled and power consumption in the UART is reduced by ~400uA. The host continues to receive events from the u-locateEmbed software, such as `+UUDF` events, but is unable to send AT commands.

To put the UART in sleep mode, use the `AT+UPWRSAVE=<wakeup_mode>` command, where the `<wakeup_mode>` parameter defines how the UART can wake up from sleep mode .

4.8.2 Syntax

AT command	Description
AT+ UPWRSAVE=<wakeup_mode>	Write config

Response	Description
OK	Successful write response
ERROR	Error Response

4.8.3 Defined values

Parameter	Type	Description
wakeup_mode	Integer	1: By sending any character to the UART, the host wakes up the UART. After sending a character the host must wait ~50ms before sending an AT command. To return to sleep mode and save additional power, send the `AT+UPWRSAVE=1` command again. 2: The host pulls GPIO1 low to wake up the UART.

☞ Sending a character to wake up the UART can create garbage, which then causes the host to receive an `ERROR` after the first AT command is sent to enable the UART. To make sure that the u-locateEmbed software is in sync with host, always enter "`AT`" after wake up.

4.9 Startup event +STARTUP

4.9.1 Description

Factory default greeting text.

When the module start-up mode is command mode. The greeting text is shown at boot once.

5 Direction Finding

5.1 Configure direction finding +UDFCFG

+UDFCFG				
Modules	NINA-B41X-40B			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	Yes	No	-

5.1.1 Description

Configure the direction-finding algorithm and the anchor output.

5.1.2 Syntax

AT command	Description
AT+UDFCFG=<param_tag>,<param_value>	Write configuration
AT+UDFCFG?	Read all configuration options
AT+UDFCFG=<param_tag>	Read individual configuration

Response	Description
+UDFCFG:<param_tag>,<param_value> … OK	Read response
OK	Successful write response
ERROR	Error Response

5.1.3 Defined values

Param. tag	Min value/ length	Max value/ length	Default value	Type	Description
1	0	10000	1	Integer	Minimum interval between +UUDF events for each tag in milliseconds. +UUDF events can arrive at a higher frequency if multiple tags are tracked. This setting is used if the host cannot handle the rate of +UUDF events generated or when debugging to get less outputs. In a real scenario, it is better to just throw away the +UUDF events on host if they cannot be processed.
2	0	30	""	String	User defined string that can be set to any value. For example, this string can be useful to set the GPS position (longitude/latitude) of an anchor for use in a positioning engine. Leave blank if not needed.
3	0	1	1	Integer	Angle calculations enabled at startup. This setting enables +UUDF events at startup – without the need to call +UDFENABLE.
4	0	30	MAC address	String	Anchor ID. This sets the Anchor ID field in the +UUDF event. It can be used to identify the sending anchor when the host forwards the +UUDF events to a server.

Param. tag	Min value/ length	Max value/ length	Default value	Type	Description
5	0	1	1	Integer	Configure if the anchor is to calculate two angles. • 0: Only the direct angle is calculated and output in +UUDF event, elevation angle is fixed to output 0°. • 1: Two angles are calculated and output in +UUDF event. Depending on the configuration of tag 13 , the two angles are calculated as an azimuth/direct angle and an elevation angle. Configuring an anchor to calculate only one angle can speed up the calculation time to make the anchor more efficient. When an anchor is configured to output a single angle, the output is given as a direct angle. This is due to that the calculation for an azimuth angle requires an elevation angle.
6	0	1	0	Integer	Antenna board used: • 0: C211 • 1: CoreHW Core Patch antenna • 2: ANT-B10 • 3: ANT-B11 Valid for u-locateEmbed version 1.2 and later. On ANT-B10 and ANT-B11 boards, the correct default value is programmed in production.
7	0	1	0	Integer	Use CoreHW output format instead of +UUDF u-blox format.
8	0	1	1	Integer	Activate post processing of the angle. It is advisable to keep this enabled. • 0: Disabled • 1: Enabled
9	0	60000	1000	Integer	Minimum time between +UUDFP events in milliseconds. 0 means output all received advertising events. Valid from u-locateEmbed 2.0.
10	1	100	20	Integer	Accepted lag for an angle. This parameter is a factor and setting it lower means that less smoothing is applied to the received angle values, which results in lower lag but more unstable reported angle values. The amount of smoothing depends on the tag packet rate. If a tag changes advertising interval, the rate adjusts dynamically to keep the lag constant. Valid from u-locateEmbed 2.0.
11	0	100	0	Integer	Fixed smoothing factor. This overrides tag 10 and skips dynamic adjustment of how much smoothing/post processing is done. Setting this parameter to a lower value means more postprocessing is applied to the reported angles. This results in a smoother range of reported angles but with provides less direct feedback on the movement of tracked tags. Valid from u-locateEmbed 2.0.
12	0	1	0	Integer	Stop scanning when all tags in user defined tag filter are synced. • 0: running background scanning. • 1: stop background scanning.

Param. tag	Min value/ length	Max value/ length	Default value	Type	Description
					A tag filter (+UDFFILT) based on instanceID needs to be defined for this option to work. This option can be used to save power. Valid from u-locateEmbed 3.0.
13	0	1	1	Integer	Angle types: • 0: Direct angle • 1: Azimuth angle For angle definitions, see also the ANT-B10 SIM. Valid from u-locateEmbed 3.0. This tag is only supported for antenna boards with the feature capabilities to report two angles.

☞ For the direction-finding configuration to be activated, use the commands `&W` and `+CPWROFF` to store the configuration to the startup database.

☞ When all tags in the filter are synced, you can stop u-locateEmbed from background scanning using the command `AT+UDFCFG=12,1`. This halts scanning for other tags and reduces power consumption.

5.2 Direction finding enable +UDFENABLE

+UDFENABLE				
Modules	NINA-B41X-40B			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	No	No	-

5.2.1 Description

Enable or disable angle calculation.

5.2.2 Syntax

AT command	Description
AT+UDFENABLE=<enabled>	Start or stop angle calculations during runtime

Response	Description
OK	Successful write response
ERROR	Error Response

5.2.3 Defined values

Parameter	Type	Description
Enabled	Integer	0: Disabled 1: Enabled

5.3 Configure direction finding scanning +UDFSCANCFG

+UDFSCANCFG				
Modules	NINA-B41X-40B from u-locateEmbed 3.0			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	Yes	No	-

5.3.1 Description

Configure the tag scanning behavior.

☞ u-locateEmbed software (2.0 and higher) supports continuous tracking of up to 25 individual tags. A round robin scheme is used to track 25+ tags, which introduces some delay in angle reporting for individual tags. Use the `+UDFSCANCFG` command to adjust the behavior of this algorithm.

5.3.2 Syntax

AT command	Description
AT+UDFSCANCFG=<param_tag>,<param_value>	Write configuration
AT+UDFSCANCFG?	Read all configuration options
AT+UDFSCANCFG=<param_tag>	Read individual configuration

Response	Description
+UDFSCANCFG:<param_tag>,<param_value> ... OK	Read response
OK	Successful write response
ERROR	Error Response

5.3.3 Defined values

Param. tag	Min value/ length	Max value/ length	Default value	Type	Description
1	1000	-	5000	Integer (ms)	With 25+ tags: Define how long a tag is tracked before it is dropped and scanning for other tags is resumed.
2	1	-	9	Integer	With 25+ tags: Define how many +UUDF events are sent to the host before a tag is dropped. The tag is dropped earlier if the param tag 1 timeout is reached before the specified number of angle events.
3	1000	-	30000	Integer (ms)	Define the length of time before u-locateEmbed “forgets” a tag when no packets are received from it, for example if the tag moves out of range. u-locateEmbed attempts to sync the tag for the specified time.
4	1	-	2	Integer	Define how many times u-locateEmbed attempts to sync to a tag before attempting to sync to the next visible tag.
5	1000	-	10000	Integer (ms)	Define how long each sync attempt to a tag lasts. Use Tag 4 to define the number of sync attempts.
6	1	25	25	Integer	Define how many tags u-locateEmbed can track simultaneously before moving to the round robin scheme.
7	1	50	50	Integer	Define how many tags u-locateEmbed can try to sync to at the same time. Recommended to keep as default.
8	4	16384	16 (10ms)	Integer	Scan interval. Define the radio scan interval for new tags. The entered value must be greater or equal to that configured in param tag 9. Each unit value represents 0.625 ms. The default value is 16 x 0.625 ms = 10 ms.

Param. tag	Min value/ length	Max value/ length	Default value	Type	Description
9	4	16384	16 (10ms)	Integer	Scan window. Define how long the radio scan for tags during each interval. The entered value must be greater or equal to that configured in param tag 8. Each unit value represents 0.625 ms. The default value is 16 x 0.625 ms = 10 ms.
10	-105	0	-105	Integer (dBm)	Tags with an RSSI that is less that the specified value are not tracked. Tags that are already tracked but then later show a diminished strength that is less than the specified RSSI threshold are removed.

5.3.4 Notes

By default, u-locateEmbed uses a100% radio duty cycle to scan for new tags to track. This minimizes the time it takes to find new tags entering the area. The drawback with this approach is that the current consumption is high.

Controlling the radio duty cycle when scanning tags is intended for anchors that are powered by battery. To run an anchor on battery the radio duty cycle needs to be decreased.

To configure the duty cycle, use the `AT+UDFSCANCFG=<parameter tag>[,<param>]` command to adjust the default value (16x0.625=10 ms) of parameter tags 8 and 9.

Use that same command to adjust the default value of tag 10 to filter out tags with low RSSI value. This can help with reducing power consumption and speed up the handing of tags in vicinity.

5.4 Direction finding tag block list +UDFTAGBLOCK

+UDFTAGBLOCK				
Modules	NINA-B41X-40B from u-locateEmbed 3.0			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	No	No	-

5.4.1 Description

Cancel tracking of a tag, add a tag to a block list, or remove a tag a block list.

The tag blacklist resides in RAM and is emptied during a board reset. The list can't be saved. This functionality can change in future releases of the software.

5.4.2 Syntax

AT command	Description
`AT+UDFTAGBLOCK=<instance_id>,<action>`	Cancel sync and possibly block a tag
`AT+UDFTAGBLOCK?`	List all blocked tags.

Response	Description
`+UDFTAGBLOCK:<instance_id>` `OK`	Read response
`OK`	Successful write response
`ERROR`	Error response

5.4.3 Defined values

Parameter	Type	Description
action	Enumerator	Possible actions: • 1: Cancel sync with this tag • 2: Cancel sync and add tag to block list • 3: Remove tag from block list
instance_id	String (12 HEX characters)	Eddystone instance id

5.5 Direction finding list tracked tags +UDFTAGS

+UDFTAGS				
Modules	NINA-B41X-40B from u-locateEmbed 3.0			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	No	No	-

5.5.1 Description

Lists all currently tracked/synced tags.

5.5.2 Syntax

AT command	Description
AT+UDFTAGS?	List all synced/tracked tags

Response	Description
+UDFTAGS:<instance_id> OK	Read response
OK	Successful write response
ERROR	Error response

5.5.3 Defined values

Parameter	Type	Description
instance_id	String (12 HEX characters)	Eddystone instance id.

5.5.4 Examples

The following command examples demonstrate how to use +UDFTAGBLOCK to cancel tracking of a tag, add a tag to block list, and remove a tag from block list. Use +UDFTAGS to list all currently tracked tags.

```
AT+UDFTAGS?          <- Lists synced tags
+UDFTAGS:F1EB938372AD      <- One tag is in sync
OK

AT+UDFTAGBLOCK="F1EB938372AD",1   <- Cancel sync on the tag but not added it to block list
OK

AT+UDFTAGS?          <- Lists synced tags
+UDFTAGS:F1EB938372AD      <- This tag is not in block list and got synced again
OK

AT+UDFTAGBLOCK="F1EB938372AD",2   <- Cancel sync on the tag and add it to block list
OK

AT+UDFTAGBLOCK?      <- List all blocked tags
+UDFTAGBLOCK:F1EB938372AD  <- One tag is in block list
OK

AT+UDFTAGS?          <- Lists synced tags
OK           <- The tag in the block list can not get synced

AT+UDFTAGBLOCK="F1EB938372AD",3   <- Remove the tag from block list
OK

AT+UDFTAGS?
+UDFTAGS:F1EB938372AD      <- The tag is synced again
OK
```

5.6 Direction finding filter +UDFFILT

+UDFFILT				
Modules	NINA-B41X-40B			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	Yes	No	-

5.6.1 Description

Configure a filter to track all devices with a specific namespace, or individual tags with a certain namespace and instance id. Currently, only filter types 1,2 (EDDYSTONE) are supported.

5.6.2 Syntax

AT command	Description
AT+UDFFILT=<filter_type>,<action>[,<option_val>]	Set the tag filter for tracked tags
AT+UDFFILT=<filter_type>	Read the current filter for the specified <filter_type>

Response	Description
+UDFFILT:<filter_type>,<option_val> OK	Read response
OK	Successful write response
Error	Error response

5.6.3 Defined values

Parameter	Type	Description
filter_type	Enumerator	Filter type, see description in table below
action	Enumerator	1: clear filter 2: append to filter
option_val		Filter values, see description in table below

Filter type	Description	Option values	Option Type	Optional
1	Eddystone namespace	option_val: Eddystone namespace id. Only one namespace can be set. Default value is “4E494E412D4234544147”.	String (10 HEX characters)	Yes
2	Eddystone instance ID	option_val: Eddystone instance id. Up to 100 instance ids can be set.	String (6 HEX characters)	Yes

5.6.4 Notes

This setting takes effect immediately. Use the command &W and +CPWROFF to store the configuration to startup database. Maximum filter length is 100.

☞ All hexadecimal data needs to be quoted. For example: AT+UDFFILT=2,2,”0011223344FF”.

5.7 Angle calculation event +UUDF

+UUDF				
Modules	NINA-B41X-40B			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	No	No	-

5.7.1 Description

Unsolicited response code for an angle calculation event.

5.7.2 Syntax

Response	Description
+UUDF:<ed_instance_id>,<rssi>,<azimuth_angle/direct_angle>,<elevation_angle>,<not_used>,<channel>,<anchor_id>,<user_defined_str>,<time stamp_ms>,<periodic_event_counter>	Angle calculation event

5.7.3 Defined values

Parameter	Type	Description
ed_instance_id	Byte_Array	6-byte Eddystone instance id
rssi	Integer	RSSI
azimuth_angle/direct_angle	Integer	For antenna boards with capability and configuration to report 2 angles, the SW can output either azimuth angle or direct angle, depending on the configuration for +UDFCFG param tag 13. The angle is in range -90° to 90 °. ☞ Software versions prior to u-locateEmbed 3.0 always report direct angle. ☞ Antenna boards that only report one angle always report the direct angle.

Parameter	Type	Description
elevation_angle	Integer	The elevation angle is in range -90° to 90 °. Antenna boards that only calculate and output direct angle, always show an elevation angle of 0°.
<not used>	Integer	Reserved for future use
channel	Integer	Channel from which the packet angle is calculated
anchor_id	String	Value set by +UDFCFG param_tag 4
user_defined_str	String	Value set by +UDFCFG param_tag 2
timestamp_ms	Integer	Time since boot in milliseconds
periodic_event_counter	Integer	Periodic event counter showing the value of the periodic advertising packet sent from a tag. This parameter is used to synchronize between several anchors in a multi-anchor setup. Valid from u-locateEmbed 2.0.

☞ Note that the RSSI values reported in angle calculation events only give a very rough indication of the distance between an anchor and tag. As RSSI values are prone to many error sources, like reflections of radio signals, these values alone should not be used to estimate position.

For angle definitions, see the ANT-B10 system integration manual [3].

5.8 Periodic advertising data event +UUDFP

+UUDFP				
Modules	NINA-B41X-40B u-locateEmbed 2.0 onwards			
Attributes	**Syntax**	**Settings saved**	**Can be aborted**	**Response time**
	Full	No	No	-

5.8.1 Description

Unsolicited response code carrying advertising data sent by the tag.

5.8.2 Syntax

Response	Description
+UUDFP:<ed_instance_id>,<hex_string_payload>	Advertising data event

5.8.3 Defined values

Parameter	Type	Description
ed_instance_id	Byte_Array	6-byte Eddystone instance id
hex_string_payload	Byte_Array	Advertising data from tag. Minimum 2 HEX characters, max 255 * 2 (510) HEX characters

☞ Maximum periodic advertising data length of a tag is 255 bytes. Longer data lengths are ignored by the u-locateEmbed software.

Appendix

A Glossary

Abbreviation	Definition
AoA	Angle of Arrival
AoD	Angle of Departure
ASCII	American Standard Code for Information Interchange
CTE	Constant Tone Extension
RSSI	Received Signal Strength Indication

Table 1: Explanation of the abbreviations and terms used

Related documentation

[1] u-connectXpress AT commands manual, UBX-14044127
[2] u-locateEmbed product page, https://www.u-blox.com/en/product/u-locateEmbed
[3] ANT-B10 system integration manual, UBX-22025788

☞ For product change notifications and regular updates of u-blox documentation, register on our website, www.u-blox.com.

Revision history

Revision	Date	Name	Comments
R01	23-Dec-2022	mape	Initial release. Information derived from related product user guides and updated for u-LocateEmbed 2.0.
R02	15-Nov-2023	lliu	Added list of u-LocateEmbed and common u-connectXpress AT commands in u-LocateEmbed AT commands chapter. Changed azimuth and elevation angles to angle1 and angle2 in Configure direction finding +UDFCFG and Angle calculation event +UUDF.
R03	02-Feb-2024	lliu	Restructured document content. Added new AT commands: Configure direction finding scanning +UDFSCANCFG Direction finding tag block list +UDFTAGBLOCK Direction finding list tracked tags +UDFTAGS System Configurations +USYSCFG Put UART to sleep +UPWRSAVE Added new tags in Configure direction finding +UDFCFG. Renamed u-connectLocate to u-locateEmbed. Renamed and redefined utput angles in Angle calculation event +UUDF.

Contact

u-blox AG

Address: Zürcherstrasse 68
8800 Thalwil
Switzerland

For further support and contact information, visit us at www.u-blox.com/support.