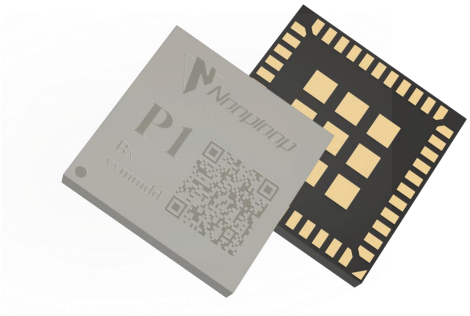
uBeacon Tag UART Protocol

Standard precision UWB module

Version: V1.5



1 Frame

In UART communication, the interaction between the host and the device is governed by a protocol. Data in the protocol is stored in little-endian mode. Additionally, to represent more data using fewer bytes, integers are used to represent floating-point numbers. Therefore, when packaging and unpacking, some data needs to be processed in conjunction with corresponding multipliers.

1.1 Frame Format

A data frame consists of a Frame Header, Payload Size, Payload, and Checksum. The payload contains UID, Frame ID and messages, and frames carrying different messages can achieve different functionalities.

Frame includes Uplink-Frame and Downlink-Frame.

The Uplink-Frame represents data sent by the device.

The Downlink-Frame represents data sent by the host to the tag.

The frame format and composition are as shown in Table 1 to Table 4.

Table 1. Uplink-Frame Format

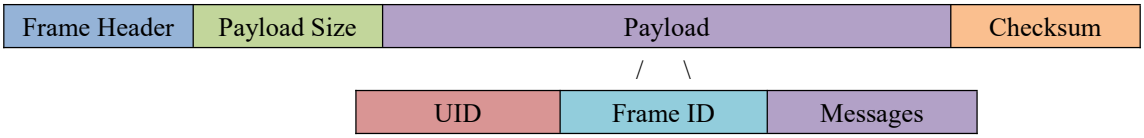


Table 2. Downlink-Frame Format

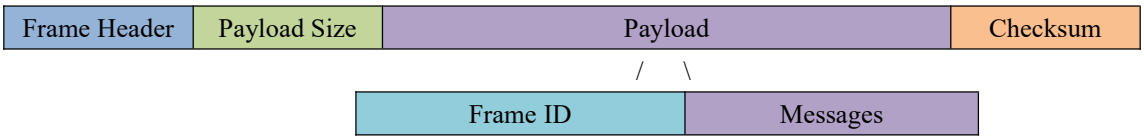


Table 3. Frame Composition

Data		Type	Length (Bytes)	Description
Frame Header		Uint8	1	Header of frame, value=0xAA.
Payload Size		Uint16	2	Size of payload，max 1020.
Payload	UID	Uint8	6	Universally Unique Identifier. Use in Uplink-Frame.
	Frame ID	Uint8	1	Frame ID,See Table 4.
	Message	Uint8	Payload Size-7	Frame payload data, composed of messages.
Checksum		Uint8	1	The Checksum is equal to all previous bytes added.

Table 4. Frame ID List

Frame ID	Value	Description
Serial_Frame_Down	2	Common Downlink-Frame ID.
Serial_Frame_Tag_Up	5	Tag Data Uplink-Frame ID.

1.1.1 Frame Example

The following examples will demonstrate the composition of a data frame.

Delay 10s to Reset:

Host send data: AA 04 00 02 02 01 0A BD.

Table 5. Delay 10s to Reset Frame Example

Data		Hex	Result
Header		AA	Header 0xAA
Payload Size		04 00	4 Bytes
Payload	Frame ID	02	Serial_Frame_Down
	Message	02 01 0A	MSG_RESET
Checksum		BD	0xBD

Location Result:

Device send data: AA 29 00 01 04 02 13 08 C0 05 44 20 56 5A 5C 03 00 00 00 00 2D C1 FB 3F 33 75 92 3F FD 78 99 3F FF FF FC FF 00 00 0B 0E 08 0C 0D 07 55.

Table 6. Location Result Frame Example

Data		Hex	Result
Header		AA	Header 0xAA
Payload Size		29 00	45 Bytes
Payload	UID	01 04 02 13 08 C0	
	Frame ID	05	Serial_Frame_Tag_Up
	Message	44 20...0D 07	MSG_LOCATION_RESULT
Checksum		55	0x55

1.2 Massage Format

A message consists of a Message ID, Need Confirm, Payload Size, and Payload.

Table 7. Message Format

Message ID	Need Confirm	Payload Size	Payload

Table 8. Message Composition

Data	Type	Length	Description
Message ID	Uint8	1 Byte	Message ID.
Payload Size	Uint8	7 Bits	Size of payload, max 107.
Need Confirm		1 Bit	Need confirm, 1: True, 0: False.
Payload	Uint8	Payload Size	Message payload data.

1.3 Communication Process

1.3.1 Active Output

Frames actively output by the device. e.g. MSG_LOCATION_RESULT

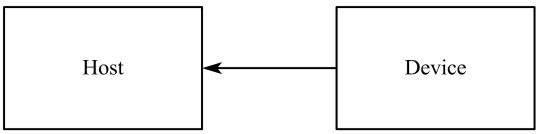


Figure 1. Active Output

1.3.2 Read Communication

The host sends a frame containing a READ_MSG, and the device responds with a frame containing a RESP_MSG.

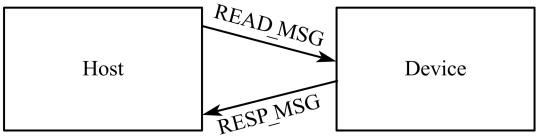


Figure 2. Read Communication

1.3.3 Write Communication

The host sends a frame containing a WRITE_MSG, and the device responds with a frame containing a RESP_MSG.

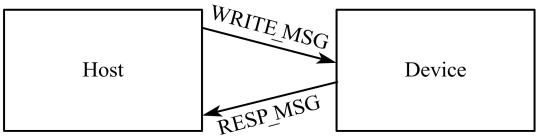


Figure 3. Write Communication

2 Message

Different messages serve different functions, distinguished by their message IDs.

2.1 Message ID

Table 9. Message ID List

Message Group	Message ID	Value	Type
MSG_RESET	MSG_Reset	0x02	WO
MSG_LOCATION_PARAM	MSG_Read_Location_Param	0x3C	WO
	MSG_Write_Location_Param	0x3D	WO
	MSG_Response_Location_Param	0x3D	RO
MSG_INTERFACE_PARAM	MSG_Read_Interface_Param	0x3E	WO
	MSG_Write_Interface_Param	0x3F	WO
	MSG_Response_Interface_Param	0x3F	RO
MSG_LOCATION_RESULT	MSG_Location_Result	0x44	RO
MSG_HEARTBEAT	MSG_Heartbeat	0x4E	RO

2.2 MSG_RESET

Restart current device, usually used to apply changes in parameters.

2.2.1 Composition

Table 10. MEG_RESET Composition

Data	Type	Multiplier	Length (Bytes)	Description
delay	uint8	1	1	Delay time to reset module, unit s.

2.2.2 Example

Delay 10s to reset:

Host send Message Data: 02 01 0A.

Table 11. MSG_RESET Parsing Example

Data		Hex	Result
Message ID		02	Value=2 MSG_Reset
Payload Size		01	1
Need Confirm		0	No
Payload	Delay	0A	10s

2.3 MSG_LOCATION_PARAM

Used for user-defined location parameters.

2.3.1 Composition

Table 12. MSG_LOCATION_PARAM Composition

Data	Type	Multiplier	Length (Bytes)	Description

expect_location_freq	float	1	4	Expect location frequency, unit: Hz.
expect_z	float	1	4	User sets the Z-axis value, unit: m.
z_noise	uint8	100	1	User sets the Z-axis noise, unit: m.
smooth_window	uint8:4	1	4bits	Smooth window,0~5
max_acceleration[3]	uint8	50	3	3 axis max acceleration{x,y,z},unit:m/s^2.

2.3.2 Example

Read location parameters

Host send message data: 3C 00.

Table 13. MSG_LOCATION_PARAM Read Parsing Example

Data	Hex	Result
Message ID	3C	Value=60 MSG_Read_Location_Param
Payload Size	00	0
Need Confirm	0	No

Devise response message data: 3D 0D 00 00 80 3F 9A 99 99 3F 0A 02 0A 0A 01.

Table 14. MSG_LOCATION_PARAM Response Parsing Example

Data			Hex	Result
Message ID			3D	Value=61 MSG_Response_Location_Param
Payload Size			0D	14 Bytes
Need Confirm			0	No
Payload	expect_location_freq		00 00 80 3F	1Hz
	expect_z		9A 99 99 3F	1.2m
	z_noise		0A	0.1m
	smooth_window		02	2
	max_acceleration[3]	x	0A	0.2m/s^2
		y	0A	0.2m/s^2
		z	01	0.02m/s^2

2.4 MSG_INTERFACE_PARAM

2.4.1 Composition

Table 15. MSG_INTERFACE_PARAM Composition

Data	Type	Multiplier	Length (Bytes)	Description
UART	uint8:1	1	1bit	UART interface switch
IIC	uint8:1	1	1bit	IIC interface switch
UWB	uint8:1	1	1bit	UWB interface switch

2.4.2 Example

Read location parameters

Host send message data: 3E 00.

Table 16. MSG_INTERFACE_PARAM Read Parsing Example

Data	Hex	Result
Message ID	3E	Value=62 MSG_Read_Interface_Param
Payload Size	00	00
Need Confirm	0	No

Devise response message data: 3F 01 05.

Table 17. MSG_INTERFACE_PARAM Response Parsing Example

Data		Hex	Result
Message ID		3F	Value=63 MSG_Response_Interface_Param
Payload Size		01	1 Byte
Need Confirm		0	No
Payload	UART	05	1
	IIC		0
	UWB		1

2.5 MSG_LOCATION_RESULT

2.5.1 Composition

Table 18. MSG_LOCATION_RESULT Composition

Data	Type	Multiplier	Length(Bytes)	Description
location_time	uint64	1	8	Time on module location time.
pos [3]	float	1	12	3 axis position{x,y,z},unit:m.
vel [3]	int16	100	6	3 axis velocity{x,y,z},unit:m/s.
pos_noise [3]	uint8	100	3	3 axis position noise{x,y,z},unit:m.
vel_noise [3]	uint8	100	3	3 axis velocity noise{x,y,z},unit:m/s.

2.5.2 Example

Device Active Output Location Result:

Device send message data: 44 20 B5 23 0B 02 00 00 00 00 DD 51 b1 41 EB 58 57 41 AA E7 9A 3F FA FF 04 00 00 00 07 07 04 08 08 04.

Table 19. MSG_LOCATION_PARAM Response Parsing Example

Data			Hex	Result
Message ID			44	Value=68 MSG_Response_Location_Param
Payload Size			20	32 Bytes
Need Confirm			0	No
Payload	location_time		B5 23 0b 02 00 00 00 00	34284469 ms
	pos[3]	x	DD 51 b1 41	22.164972 m

		y	EB 58 57 41	13.459208 m
		z	AA E7 9A 3F	1.210195 m
	vel[3]	x	FA FF	-0.06 m/s
		y	04 00	0.04 m/s
		z	00 00	0 m/s
	pos_noise [3]	x	07	0.07 m
		y	07	0.07 m
		z	04	0.04 m
	vel_noise [3]	x	08	0.08 m/s
		y	08	0.08 m/s
		z	04	0.04 m/s

2.6 MSG_HEARTBEAT

2.6.1 Composition

Table 20. MSG_HEARTBEAT Composition

Data	Type	Multiplier	Length(Bytes)	Description
Battery_percent	uint8	1	1	Battery percent , %
Reserved	uint8	1	2	Reserved
Firmware_series	uint8	1	1	Firmware Series
Firmware_version	uint8	1	4	Firmware Version
UID	uint8	1	10	UID

2.6.2 Example

Device Active Output Location Result:

Device send message data: 4E 0E 00 00 00 22 02 00 01 00 01 04 02 13 08 c0

Table 21. MSG_HEARTBEAT Response Parsing Example

Data	Hex	Result
Message ID	4E	MSG_HeartBeat
Payload Size	0E	14 Bytes
Need Confirm	0	No
Battery_percent	00	0%
Reserved	00 00	Reserved
Firmware_series	22	
Firmware_version	02 00 01 00	V2.0.1.0
UID	01 04 02 13 08 C0	UID

3 Document Version

Table 22: Update Log

Version	Date	Description
0.1	20240224	● Initial release.
0.2	20240321	● Fixing some phrasing issues.
1.0	20240506	● Change the document information . ● Official version release.
1.1	20240529	● Update Frame Protocol ,Increase UID and Frame ID.
1.2	20240710	● Change file name to “uBeacon Tag Protocol”
1.3	20240806	● Add MSG_HEARTBEAT
1.4	202408015	● Fixing some mistake
1.5	20040927	● Add MSG_INTERFANCE_PARAM ● Change the UID length to 6 bytes ● Fixing some mistake

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