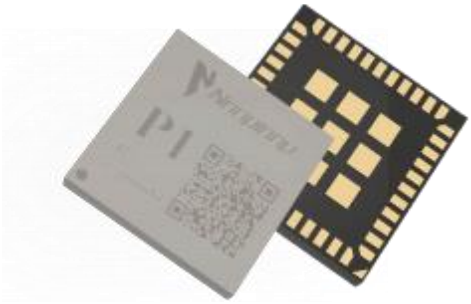
uBeacon Tag IIC Protocol

Standard precision UWB module

Version: V1.2



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1 IIC Serial Interface

The Tag IIC is a bus slave. The IIC is employed to write the data to the registers, whose content can also be read back.

The relevant IIC terminology is provided in the table below.

Table 1. IIC Terminology

Term	Description
Transmitter	The device which sends data to the bus
Receiver	The device which receives data from the bus
Master	The device which initiates a transfer, generates clock signals and terminates a transfer
Slave	The device addressed by the master

There are two signals associated with the IIC bus: the Serial Clock Line (SCL) and the Serial data Line (SDA). The latter is a bidirectional line used for sending and receiving the data to/from the interface. Both the lines must be connected to VCC through external pull-up resistors. When the bus is free, both the lines are high.

The IIC interface is implemented with fast mode (400 kHz) IIC standards.

The Slave Address (SAD) associated to the Tag is 0x08.

Table 2. SAD+Read/Write Patterns

Command	R/W	SAD+R/W
Read	1	0x11
Write	0	0x10

Transfer timing reference Table 3 and Table 4.

Table 3. Transfer when master is receiving (reading) multiple bytes of data from slave

Master	Start	SAD+W		SUB		Start	SAD+R			ACK		NACK	STOP
Slave			ACK		ACK			ACK	Data		Data		

Table 4. Transfer when master is writing multiple bytes to slave

Master	Start	SAD+W		SUB		Data		Data		STOP
Slave			ACK		ACK		ACK		ACK	

2 Register Mapping

The register map overview is given inTable 5. This lists the registers in address order. Section3 gives a detailed description of each register.

Table 5. Register Mapping

SUB	Register File Name	Length(Bytes)	Data	Read/Write Type
0x02	Restart	2	delay	WO
			only_restart_when_need	
0x03	Find devices	1	duration	WO
0x3D	Location Parameter	15	reserved[4]	RW
			expect_z	
			z_noise	
			smooth_window	
			max_acceleration[3]	
			output	
			sniff_duty_cycle	
0x3F	Interface Parameter	1	UART	RW
			IIC	
			UWB	
0x44	Location Result	34	location_time	RO
			pos[3]	
			vel[3]	
			pos_noise[3]	
			vel_noise[3]	
			map_id	
			error_code	
			area_id	
0x60	Anchor Signal	variable length	location_time	RO
			count	
			area_id	
			reserved	
			addr	
			reserved	
			reserved	
			reserved	
			rx_rssi	
			fp_rssi	
			uwb_clock_offset_ppm	
			mcu_clock_offset_ppm	
			rx_rate	
0x61	Anchor Ddoa	16	location_time	RO
			addr0	
			addr1	
			ddoa	
			ddoa_std	
0x65	Run Time	1	sniff_duty_cycle	RW

3 Detailed Sub-Register Description

3.1 0x02-Restart

3.1.1 Composition

Table 6. Restart Composition

Data	Type	Multiplier	Length (Bytes)	Description
delay	uint8	1	1	Delay time to restart module, unit s.
only_restart_when_need	uint8:1	1	1bits	Just restart when needed

only_restart_when_need = true means that the hardware will check if there are any parameter changes that need to be restarted to take effect after receiving this command. If there are, it will restart. If not, this command will ignore it and will not restart

3.1.2 Example

Data: 0A 01

Table 7. Restart Parsing Example

Data	Hex	Result
delay	0A	10s
only_restart_when_need	01	Need restart

3.2 0x03-Find Devices

3.2.1 Composition

Table 8. Find Devices Composition

Data	Type	Multiplier	Length (Bytes)	Description
duration	uint8	1	1	The duration of continuous external prompts (such as vibration, flashing lights) received by the device

3.2.2 Example

Data: 0A

Table 9. Find Devices Parsing Example

Data	Hex	Result
duration	0A	10s

3.3 0x3D-Location Parameter

3.3.1 Composition

Table 10. Location Parameter Composition

Data	Type	Multiplier	Length (Bytes)	Description
reserved[4]	uint8	1	4	Reserved
expect_z	float	1	4	Expected height of label, unit: m.
z _noise	uint8	100	1	Standard deviation of expected height for labels, 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/s2.
output.tag_pos	uint8	1	1bits	Output label positioning result
output.anchor_packet			1bits	Forwarding beacon packets sent to the backend
output.anchor_pos			1bits	Output the beacon coordinate information received by the tag
output.anchor_link_data			1bits	Output link information between beacons
output.anchor_signal			1bits	Output beacon positioning signal data received by the tag
output.anchor_ddoa			1bits	Output distance difference information between tags and beacons
output.tag_pos_even_error			1bits	Output even if the positioning result is invalid
output.anchor_link_status			1bits	Output the synchronization status of inter beacon links
sniff_duty_cycle	uint8	1	1	Sniffing periodic

3.3.2 Example

Data: 00 00 80 3F 00 00 C0 3F 14 02 0A 0A 01 01 14.

Table 11. Location Parameter Parsing Example

Data		Hex	Result
reserved		00 00 80 3F	Reserved
expect_z		00 00 C0 3F	1.5m
z _noise		14	0.2m
smooth_window		02	2
max_acceleration[3]	x	0A	0.2 m/s2.
	y	0A	0.2 m/s2
	z	01	0.02 m/s2
output		01	output.tag_pos:1
sniff_duty_cycle		14	20

3.4 0x3F-Interface Parameter

3.4.1 Composition

Table 12. Interface Parameter Composition

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

3.4.2 Example

Data: 02.

Table 13. Interface Parameter Parsing Example

Data	Hex	Result
UART	02	0
IIC		1
UWB		0

3.5 0x44-Location Result

3.5.1 Composition

Table 14. 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.
map_id	uint8	1	1	The ID of the current map
error_code	uint8	1	4bits	TBD
area_id			4bits	The ID of the area

3.5.2 Example

Data: 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 02 00

Table 15. Location Result Parsing Example

Data		Hex	Result
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
map_id		02	2
error_code		00	0
area_id			0

3.6 0x60-Anchor Signal

Please note that if you need to read data from this register address, you need to enable debug mode on the ubeacon tool and turn on the corresponding data switch in the parameter configuration

3.6.1 Composition

Table 16. Anchor Signal Composition

Data		Type	Multiplier	Length(Bytes)	Description
location_time		uint64	1	8	Time on module location time.
count		uint8	1	4bits	Received beacons num
area_id				4bits	Area id
reserved		uint8	1	1	Reserved
datas[9]	addr	uint16	1	2	Ubeacon addr
	reserved	int16	10	2	Reserved
	reserved	int8	1	1	Reserved
	reserved	uint8	100	1	Reserved
	rx_rssi	uint8	-2	1	Received signal strength
	fp_rssi	uint8	-2	1	First path signal strength
	uwb_clock_offset_ppm	int16	100	2	UWB frequency offset
	mcu_clock_offset_ppm	int16	100	2	RTC frequency offset
	rx_rate	uint8	255	1	Recent packet reception rate of this beacon signal

3.7 0x61-Anchor Ddoa

Please note that if you need to read data from this register address, you need to enable debug mode on the ubeacon tool and turn on the corresponding data switch in the parameter configuration

3.7.1 Composition

Table 17. Anchor Ddoa Composition

Data	Type	Multiplier	Length(Bytes)	Description
location_time	uint64	1	8	Time on module location time.
addr0	uint16	1	2	Device communication address
addr1	uint16	1	2	Device communication address
ddoa	int16	100	2	Distance between beacons
ddoa_std	uint16	100	2	Standard deviation of distance between beacons

3.7.2 Example

Data: B5 23 0B 02 00 00 00 00 69 11 89 A9 00 00 23 00

Table 18. Anchor Ddoa Example

Data	Hex	Result
location_time	B5 23 0b 02 00 00 00 00	34284469 ms
addr0	69 11	
addr1	89 A9	
ddoa	00 00	0
ddoa_std	23 00	0.35

3.8 0x65-Run Time

3.8.1 Composition

Table 19. Run Time Composition

Data	Type	Multiplier	Length(Bytes)	Description
sniff_duty_cycle	uint8	1	1	Sniffing periodic

3.8.2 Example

Data: 14

Table 20. Run Time Example

Data	Hex	Result
sniff_duty_cycle	14	20

4 Abbreviation and Acronyms

Table 21. Abbreviation and Acronyms

Abbreviation	Full Title
UWB	Ultra Wideband
GNSS	Global Navigation Satellite System
IMU	Inertial Measurement Unit
RSSI	Received Signal Strength Indication

5 Document Version

Table 22. Update Log

Version	Date	Description
1.0	20240927	● Initial release.
1.1	20241028	● Fixing some mistake
1.2	20250506	● Update protocol

6 Contact

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