Follow-Me Protocol V1.0

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 CRC Checksum. The payload contains 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 device.

The frame format and composition are as shown in Table 1 to Table 2.

Table 1. Frame Format

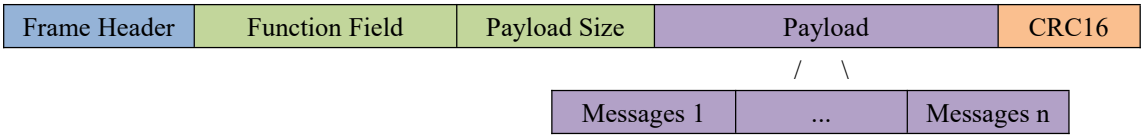

Table 2. Frame Composition

Data		Type	Length	Description
Frame Header		uint8	1 bytes	Header of frame, value=0xAA.
Function Field	System Type	uint8	4 bits	Fixed, value=0x06 (only used in Uplink-Frame)
	Role		4 bits	Anchor: 0,Tag: 1 (only used in Uplink-Frame)
	Frame CNT	uint8	1 byte	Range: 0-255.
	UID	uint8	6 bytes	Universally Unique Identifier. (only used in Uplink-Frame)
Payload Size		uint16	2 bytes	Size of payload, max 242 bytes.
Payload	Message 1	uint8	Payload Size	Frame payload data.
	...			
	Message n			
CRC-16		uint16	2 bytes	CRC-16/Modbus calculated over all bytes from Frame Header to the end of Payload, excluding the CRC field.

1.1.1 Uplink-Frame Example

The following section demonstrates an example of Downlink-frame parsing, specifically illustrating MSG_SPHERICAL_RESULT transmission from the Anchor.

Device send data: AA 06 04 83 E3 A1 65 44 9E 16 00 2A 14 15 CD 5B 07 00 00 00 0B CD CC

0C 40 33 33 53 40 CD CC 8C 40 35 DE.

Table 3. Uplink-Frame Parsing Example

Data		Hex	Result
Frame Header		AA	Header:0xAA
Function Field	System Type	06	System Type:0x06
	Role		Anchor
	Frame CNT	04	4
	UID	83 E3 A1 65 44 9E	
Payload Size		16 00	22 bytes
Payload	Message	2A 14 15 CD 5B 07 00 00 00 0B CD CC 0C 40 33 33 53 40 CD CC 8C 40	
CRC16		35 DE	0xDE35

1.1.2 Downlink-Frame Example

The following section demonstrates an example of Downlink-frame parsing, specifically illustrating MSG_DATA_USER_TO_USER transmission from the Tag.

Device send data: AA 04 06 00 24 04 03 01 02 03 03 8E.

Table 4. Downlink-Frame Parsing Example

Data		Hex	Result
Frame Header		AA	Header:0xAA
Function Field	Frame CNT	04	4
Payload Size		06 00	6 bytes
Payload	Message	24 04 03 01 02 03	
CRC16		03 8E	0x8E03

1.2 Message Format

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

Table 5. Message Format

Message ID	Payload Size	Payload

Table 6. Message Composition

Data	Type	Length	Description
Message ID	uint8	1 byte	Message ID.
Payload Size	uint8	1 byte	Size of message payload, max 240 bytes.
Payload	uint8	Payload Size	Message payload data.

1.2.1 Message Example

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

Frame Payload: 2A 14 15 CD 5B 07 00 00 00 0B CD CC 0C 40 33 33 53 40 CD CC 8C 40.

Table 7. Message Parsing Example

Data	Hex	Result
Message ID	2A	MSG_SPHERICAL_RESULT
Payload Size	14	20 bytes
Payload	15 CD 5B 07 00 00 00 0B CD CC 0C 40 33 33 53 40 CD CC 8C 40	

1.3 CRC-16

To ensure data integrity and reliability during transmission, this protocol utilizes the CRC-16/MODBUS algorithm for error checking. The 2-byte CRC checksum is appended immediately following the data frame payload.

The specific configuration parameters for the CRC-16 algorithm used in this protocol are defined in the table below:

Table 8.CRC-16/MODBUS Parameter

Parameter	Value	Description
Name	CRC-16/MODBUS	
Width	16	Generates a 16-bit checksum (2 bytes)
Polynomial	0x8005	Represented as $X^{16}+X^{15}+X^{2}+1$
Initial Value	0xFFFF	The register is initialized to all 1s
Reflect In	True	Input bytes are processed least-significant bit (LSB) first
Reflect Out	True	The final checksum is bit-reversed before the XOR stage
XOR Out	0x0000	No final XOR inversion is applied to the result

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	Device	Type
MSG_RESULT	MSG_RESULT	0x1D	A	RO
	MSG_PREV_RESULT	0x1E	T	RO
MSG_SPHERICAL_RESULT	MSG_SPHERICAL_RESULT	0x2A	A	RO
	MSG_PREV_SPHERICAL_RESULT	0x2B	T	RO
MSG_DATA_USER_TO_USER	MSG_DATA_USER_TO_USER	0x24	A/T	RW
MSG_DIS	MSG_DIS	0x2E	T	RO

A: Anchor Message, T: Tag Message.

2.2 MSG_RESULT

The anchor reports the tag's location information, which includes the position, velocity, position noise, and velocity noise in the X, Y, and Z directions.

2.2.1 Composition

Table 10. MSG_RESULT Composition

Data		Type	Multiplier	Length (bytes)	Description
Message ID		uint8		1 byte	
Payload Size		uint8		1 byte	
Payload	local_time	uint64		56 bits	unit:us
	cnt			8 bits	
	pos[3]	float		12 bytes	unit:m
	vel[3]	int16	100	6 bytes	unit:m/s
	pos_noise[3]	uint16	100	6 bytes	unit:m
	vel_poise[3]	uint16	100	6 bytes	unit:m/s

2.2.2 Example

Message data: 1D 26 15 CD 5B 07 00 00 00 0B 0B AF 35 3F D9 06 B7 BE BD 26 58 3E FB FF E4 FF F9 FF 04 00 02 00 02 00 31 00 23 00 09 00.

Table 11. MSG_RESULT Parsing Example

Data			Hex	Result
Message ID			1D	MSG_ID = 0x1D
Payload Size			26	38 bytes
Payload	local_time		15 CD 5B 07 00 00 00 0B	123456789 us
	cnt			11
	pos[3]	x	0B AF 35 3F	0.709702 m
		y	D9 06 B7 BE	-0.357474 m
		z	BD 26 58 3E	0.211085 m
	vel[3]	x	FB FF	-0.05 m/s
		y	E4 FF	-0.28 m/s
		z	F9 FF	-0.07 m/s
	pos_noise[3]	x	04 00	0.04 m
		y	02 00	0.02 m
		z	02 00	0.02 m
	vel_poise[3]	x	31 00	0.49 m/s
		y	23 00	0.35 m/s
		z	09 00	0.09 m/s

2.3 MSG_PREV_RESULT

The tag reports the location information, which includes the position in the X, Y, and Z directions.

2.3.1 Composition

Table 12. MSG_PREV_RESULT Composition

Data	Type	Multiplier	Length	Description
Message ID	uint8		1 byte	

Payload Size		uint8		1 byte	
Payload	cnt	uint8		1 byte	
	pos[3]	float		12 bytes	unit:m

2.3.2 Example

Message data: 1E 0D 0B 0B AF 35 3F D9 06 B7 BE BD 26 58 3E.

Table 13. MSG_PREV_RESULT Parsing Example

Data			Hex	Result
Message ID			1E	MSG_ID = 0x1E
Payload Size			0D	13 bytes
Payload	cnt		0B	11
	pos	x	0B AF 35 3F	0.709702 m
		y	D9 06 B7 BE	-0.357474 m
		z	BD 26 58 3E	0.211085 m

2.4 MSG_SPHERICAL_RESULT

The anchor reports the spherical coordinate results, which include the distance, azimuth, and elevation angle of the tag relative to the anchor.

2.4.1 Composition

Table 14. MSG_SPHERICAL_RESULT Composition

Data		Type	Multiplier	Length	Description
Message ID		uint8		1 byte	
Payload Size		uint8		1 byte	Range:0~64
Payload	local_time	uint64		56 bits	unit:us
	cnt			8 bits	
	dis	float		4 bytes	unit:m
	azimuth	float		4 bytes	unit:deg
	elevation	float		4 bytes	unit:deg

2.4.2 Example

Message data: 2A 14 15 CD 5B 07 00 00 00 0B CD CC 0C 40 33 33 53 40 CD CC 8C 40.

Table 15. MSG_SPHERICAL_RESULT Parsing Example

Data		Hex	Value
Message ID		2A	MSG_ID = 0x2A
Payload Size		14	20 bytes
Payload	local_time	15 CD 5B 07 00 00 00 0B	123456789 us
	cnt		11
	dis	CD CC 0C 40	2.2m
	azimuth	33 33 53 40	3.3°
	elevation	CD CC 8C 40	4.4°

2.5 MSG_PREV_SPHERICAL_RESULT

The tag reports the spherical coordinate results, which include the distance, azimuth, and elevation angle of the tag relative to the anchor.

2.5.1 Composition

Table 16. MSG_PREV_SPHERICAL_RESULT Composition

Data		Type	Multiplier	Length	Description
Message ID		uint8		1 byte	
Payload Size		uint8		1 byte	Range:0~64
Payload	cnt	uint8		1 byte	
	dis	float		4 bytes	unit:m
	azimuth	float		4 bytes	unit:deg
	elevation	float		4 bytes	unit:deg

2.5.2 Example

Message data: 2B 0D 0B CD CC 0C 40 33 33 53 40 CD CC 8C 40.

Table 17. MSG_PREV_SPHERICAL_RESULT Parsing Example

Data		Hex	Value
Message ID		2B	MSG_ID = 0x2B
Payload Size		0D	13 bytes
Payload	cnt	0B	11
	dis	CD CC 0C 40	2.2m
	azimuth	33 33 53 40	3.3°
	elevation	CD CC 8C 40	4.4°

2.6 MSG_DIS

The independent range message output by the anchor includes information such as the distance and packet reception rate (PRR).

2.6.1 Composition

Table 18. MSG_DIS Composition

Data		Type	Multiplier	Length	Description
Message ID		uint8		1 byte	
Payload Size		uint8		1 byte	Range:0~64
Payload	local_time	uint64		56 bits	unit:us
	cnt			8 bits	
	dis	float		4 bytes	unit:m
	PRR	uint8		1 byte	Packet Reception Rate

2.6.2 Example

Message data: 2E 0D 15 CD 5B 07 00 00 00 7B A4 70 9D 3F 63.

Table 19.MSG_DIS Parsing Example

Data		Hex	Value
Message ID		2E	MSG_ID = 0x2E
Payload Size		0D	13 bytes
Payload	local_time	15 CD 5B 07 00 00 00 7B	123456789 us
	cnt		123
	dis	A4 70 9D 3F	1.23 m
	rx_rate	63	99%

2.7 MSG_DATA_USER_TO_USER

Two-way data transmission passed through the UWB link.

Table 4 provides an example of the entire data packet assembled by the tag to send user data to the base station. Users can refer to Table 21 to understand how data transmission is utilized.

2.7.1 Composition

Table 20. MSG_DATA_USER_TO_USER Composition

Data		Type	Length	Description
Message ID		uint8	1 byte	
Payload Size		uint8	1 byte	
Payload	UserData_payload_size	uint8	1 byte	Range:0~64
	UserData_payload	uint8	UserData_payload_size	

2.7.2 Example

Message data: 24 04 03 01 02 03

Table 21. MSG_DATA_USER_TO_USER Parsing Example

Data		Hex	Value
Message ID		24	MSG_ID = 0x24
Payload Size		04	4 bytes
Payload	UserData_payload_size	03	3 bytes
	UserData_payload	01 02 03	User Data 01 02 03

3 Document Version

Table 22: Update Log

Version	Date	Description
1.0	20260530	● Initial release.

4 Contact

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