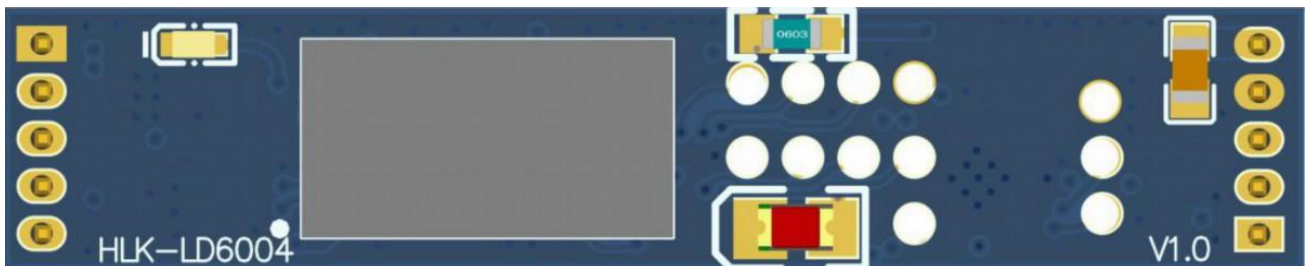


Shengui Technology Co.,Ltd

LD6004

3D Presence Radar Module Communication Protocol



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April 2026

目录

1. Purpose	1
2. Scope	1
3. Data communication link agreement	1
3.1. Introduction to communication link	1
3.2. Example of communication information	1
4. Explanation of agreement provisions	3
4.1. Protocol structure diagram	3
4.2. Introduction to protocol structure	3
4.3. TF Frame parsing process	4
4.4. Detailed explanation of TF example frame parsing	5
5. General message types	8
5.1. Message type: Query firmware status (TYPE: 0xFFFF)	8
5.2. Message type: Return firmware status (TYPE: 0xFFFF)	9
5.3. Message type: Enter OTA upgrade (TYPE:0x3000)	9
5.4. Message type: OTA upgrade (TYPE: 0x3000)	10
6. Presence Perception 2D/3D Project	10
6.1. Message type: Set control command 0x0201	11
6.2. Message type: Set the coordinate positions of interference area, detection area, and dwell area 0x0202	12
6.3. Message type: Set hold delay time 0x0203	13
6.4. Message type: Set Z-axis range 0x0204	14
6.5. Message type: Set sleep time for low-power mode when unattended 0x0205	14
6.6. Message type: Set parking area target lifecycle 0x0206	15
6.7. Message type: Set serial port output interval 0x0207	15
6.8. Message type: Report personnel location 0x0A04 / 0x0A08	16
6.9. Message type: Report whether there is someone in the area 0x0A0A	16
6.10. Message type: Reporting the locations of interference areas, detection areas, and dwell areas 0x0A0B / 0x0A0C/0x0A16	17
6.11. Message type: Report Hold Delay Time 0x0A0D	18
6.12. Message type: Report detection sensitivity status 0x0A0E	18
6.13. Message type: reporting trigger speed status 0x0A0F	19
6.14. Message type: report Z-axis range 0x0A10	19
6.15. Message type: Reporting installation method 0x0A11	20
6.16. Message type: Reporting working mode 0x0A12	20
6.17. Message type: report sleep time in low-power mode when unattended 0x0A13	20
6.18. Message type: Reporting unmanned low-power mode working status 0x0A14	21
6.19. Message type: Report GPIO state switch 0x0A15	21
6.20. Message type: report parking area target lifecycle 0x0A17	22
6.21. Message type: report serial port output interval 0x0A18	22
6.22. Message type: Set Bluetooth serial port baud rate 0x0F0F	23
7. Programming interface	23
7.1. Encoding TF messages	23
7.2. Decoding TF messages	24
7.3. Example code	25
8. Maintenance and Support of Products:	25
8.1 Precautions and Maintenance of Products	25
8.1.1 Precautions	25
8.1.2 Maintenance	26
8.2 Technical Support	26

1. Purpose

This document defines the communication protocol for radar modules.

2. Scope

This document is applicable to project developers, maintainers, testers, and customers.

3. Data communication link agreement

3.1. Introduction to communication link

Server refers to the module side, while client refers to the host computer side

Communication methods on the server side: active upload and passive upload

Communication mode of the client: Active issuance

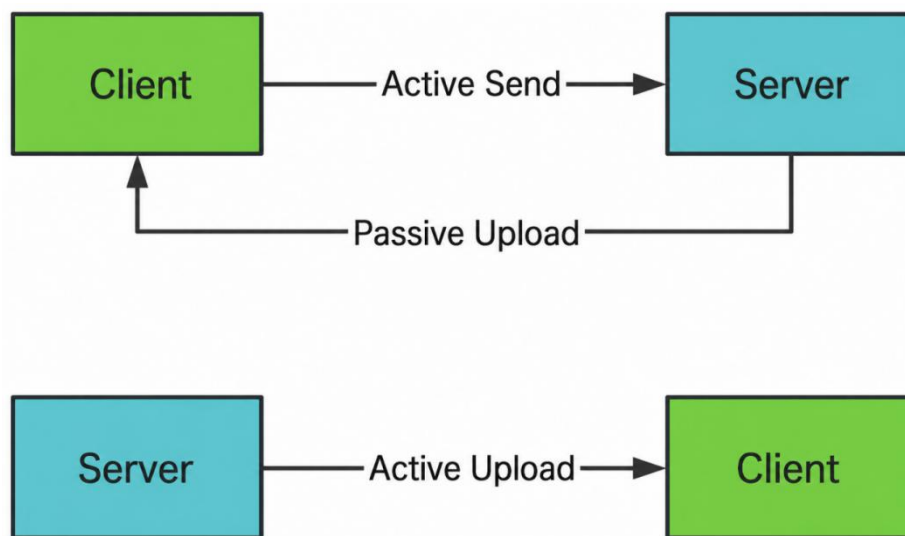


Figure 1: Communication Methods

3.2. Example of communication information

Message type: Query firmware status (TYPE: 0xFFFF)

Communication Mode:	Active Send		
Format	Bytes	Basic Type	Frame Structure
SOF	1 byte	uint8	Start Frame
ID	2 byte	uint16	Frame ID
LEN	2 byte	uint16	Data Frame Length
TYPE	2 byte	uint16	Frame Type
HEAD_CKSUM	1 byte	uint8	Header Checksum

Example TF frame: 01 00 01 00 00 FF FF FF

Message type: Upload target information (TYPE: 0x0A08)

Communication Mode:		Passive Upload	
Format	Bytes	Basic Type	Frame Structure
SOF	1 byte	uint8	Start Frame
ID	2 byte	uint16	Frame ID
LEN	2 byte	uint16	Data Frame Length
TYPE	2 byte	uint16	Frame Type
HEAD_CKSUM	1 byte	uint8	Header Checksum
DATA (see below)			
DATA_CKSUM	1 byte	uint8	Data Checksum

The following are the meanings corresponding to the DATA bits:

DATA			
Number of Bytes	Basic Type	Frame Structure	Frame Meaning
1 byte	uint8	[project_name]	Indicates the project running on the radar 0: Presence Detection Project. 1: Respiration Detection Project. 2: Gesture Detection Project. 3: Ranging Project. 4: People Counting Project. 5: 3D Point Cloud Detection Project.
1 byte	uint8	[major_version]	Indicates radar major version number
1 byte	uint8	[sub_version]	Indicates radar minor version number
1 byte	uint8	[modified_version]	Indicates radar revision version number

Example TF frame: 01 04 AF 00 04 FF FF 51 06 03 0A 00 F0

Message type: Upload target information (TYPE: 0x0A08)

Communication Mode:		Active Upload	
Format	Bytes	Basic Type	Frame Structure
SOF	1 byte	uint8	Start Frame
ID	2 byte	uint16	Frame ID
LEN	2 byte	uint16	Data Frame Length
TYPE	2 byte	uint16	Frame Type
HEAD_CKSUM	1 byte	uint8	Header Checksum
DATA (see below)			
DATA_CKSUM	1 byte	uint8	Data Checksum

The following are the meanings corresponding to the DATA bits:

DATA			
Bytes	Basic Type	Frame Structure	Frame Meaning
4 byte	int32	[target_num]	Number of targets
4 byte	float	[x]	x coordinate, data type float, unit: m
4 byte	float	[y]	y coordinate, data type float, unit: m
4 byte	float	[z]	z coordinate, data type float, unit: m
4 byte	int32	[dop_idx]	Data type int32, velocity dop idx
4 byte	int32	[cluster_id]	Data type int32, clustered target ID
...
Note: When there are N targets, x, y, z, dop_idx, and cluster_id also have N entries.			

Example TF frame: 01 00 06 00 04 0A 08 FE 00 00 00 00 FF

4. Explanation of agreement provisions

4.1. Protocol structure diagram

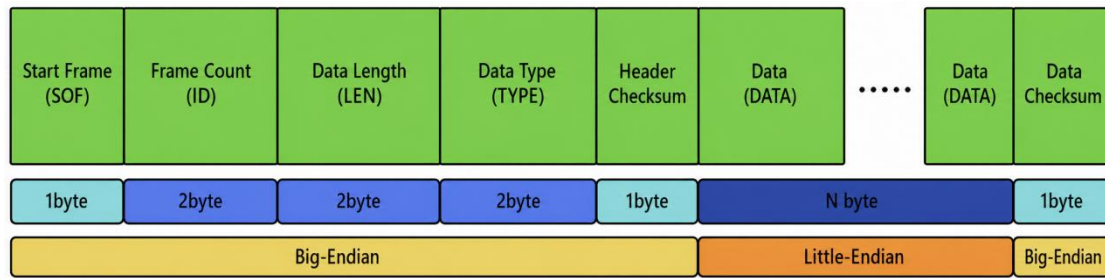


Figure 2: Protocol Structure

4.2. Introduction to protocol structure

format	byte count	storage method	Format meaning
SOF	1	Big-endian	It represents the starting bit of a frame of TF data, which is usually fixed 0x01.
ID	2	Big-endian	It represents the sequence of packets sent, which can be used to detect the client and server. Is the data frame continuous.
LEN	2	Big-endian	The default setting in the program is that the total data frame length should not exceed 1024 Byte.
TYPE	2	Big-endian	"Representing the message types of the entire data frame, with different message types" The functions represented are different.
HEAD_CKSUM	1	Big-endian	Represent the header frame check sum, starting from the SOF bit to the TYPE bit, all in full."Perform an XOR operation on the bits, and then

			negate the result
DATA	N	Little-endian order	Represents the payload of data, with the DATAbit indicating the data length and..."The LEN bit is related. For example, if the LEN bitvalue is 2, then the DATA bit is determined byConsists of two bytes of data.
DATA_CKSUM	1	Big-endian	"Representing the last frame check sum, all DATA bits are first processed together." Exclusive-OR operation, then negation.

Note: The reason for using big-endian ordering for the SOF bit to HEAD_CKSUM bit and DATA_CKSUM is to facilitate viewing the TYPE type of the instruction and the data length. The DATA bit adopts little-endian ordering, which is consistent with the storage order of the calculator and facilitates parsing of DATA data (data type can be forcibly converted)

4.3. TF Frame parsing process

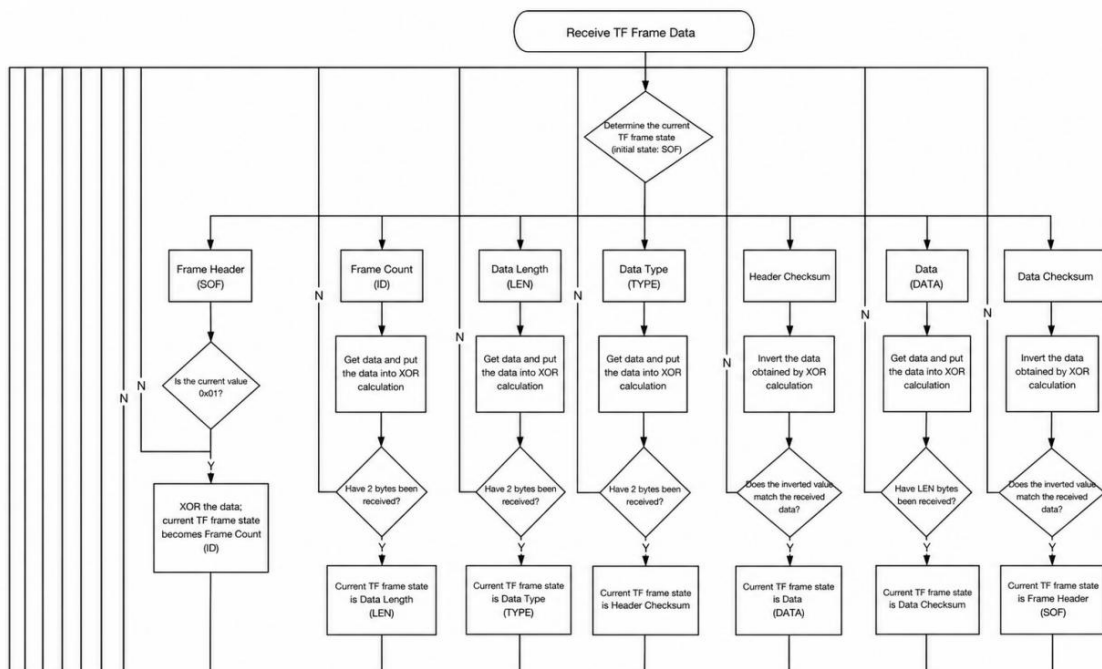
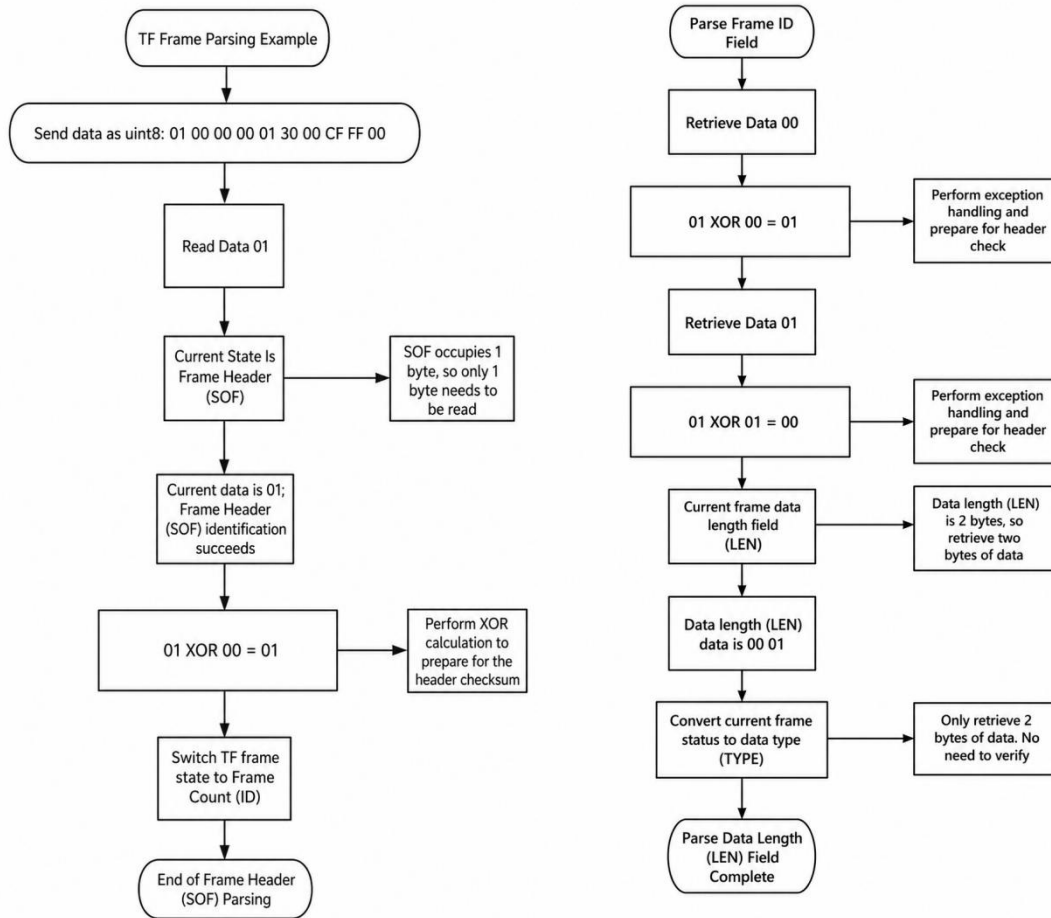
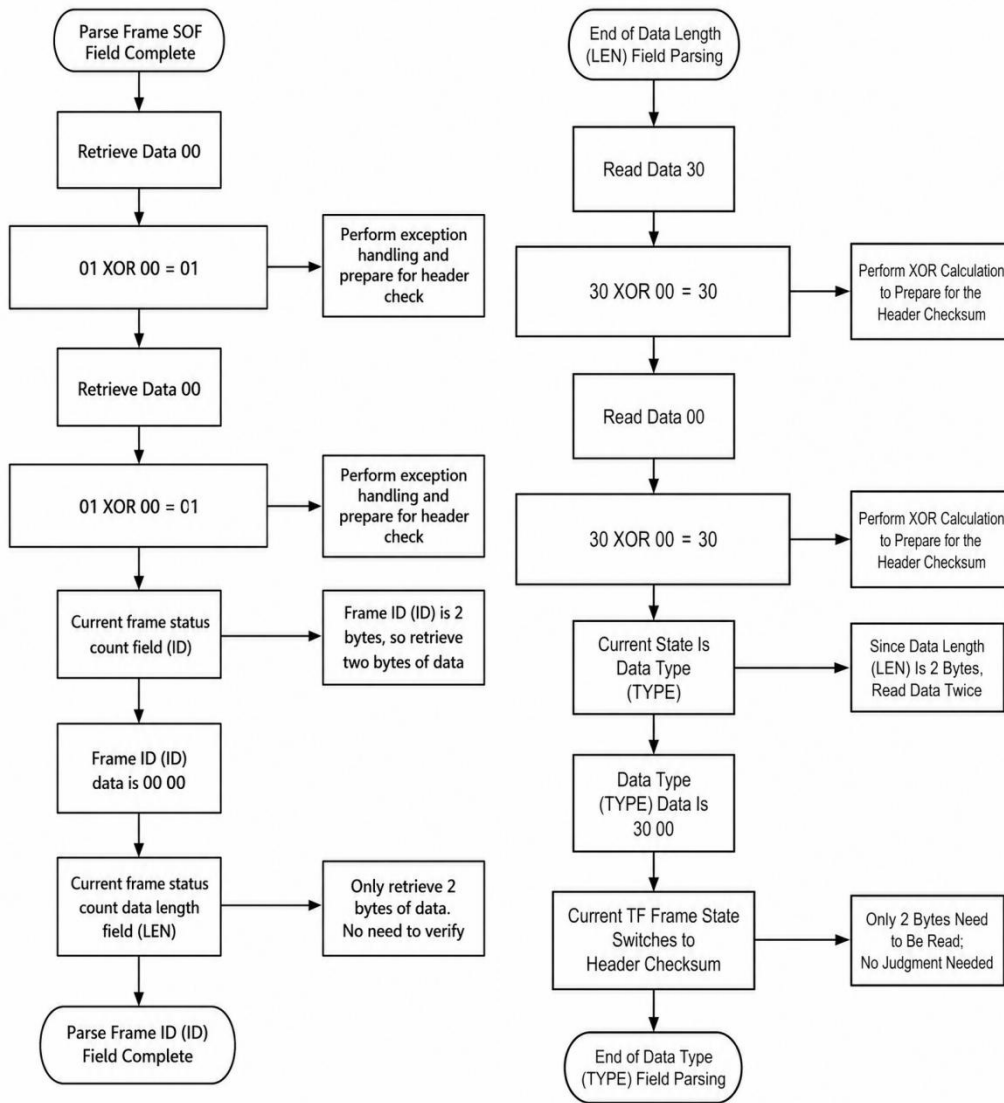
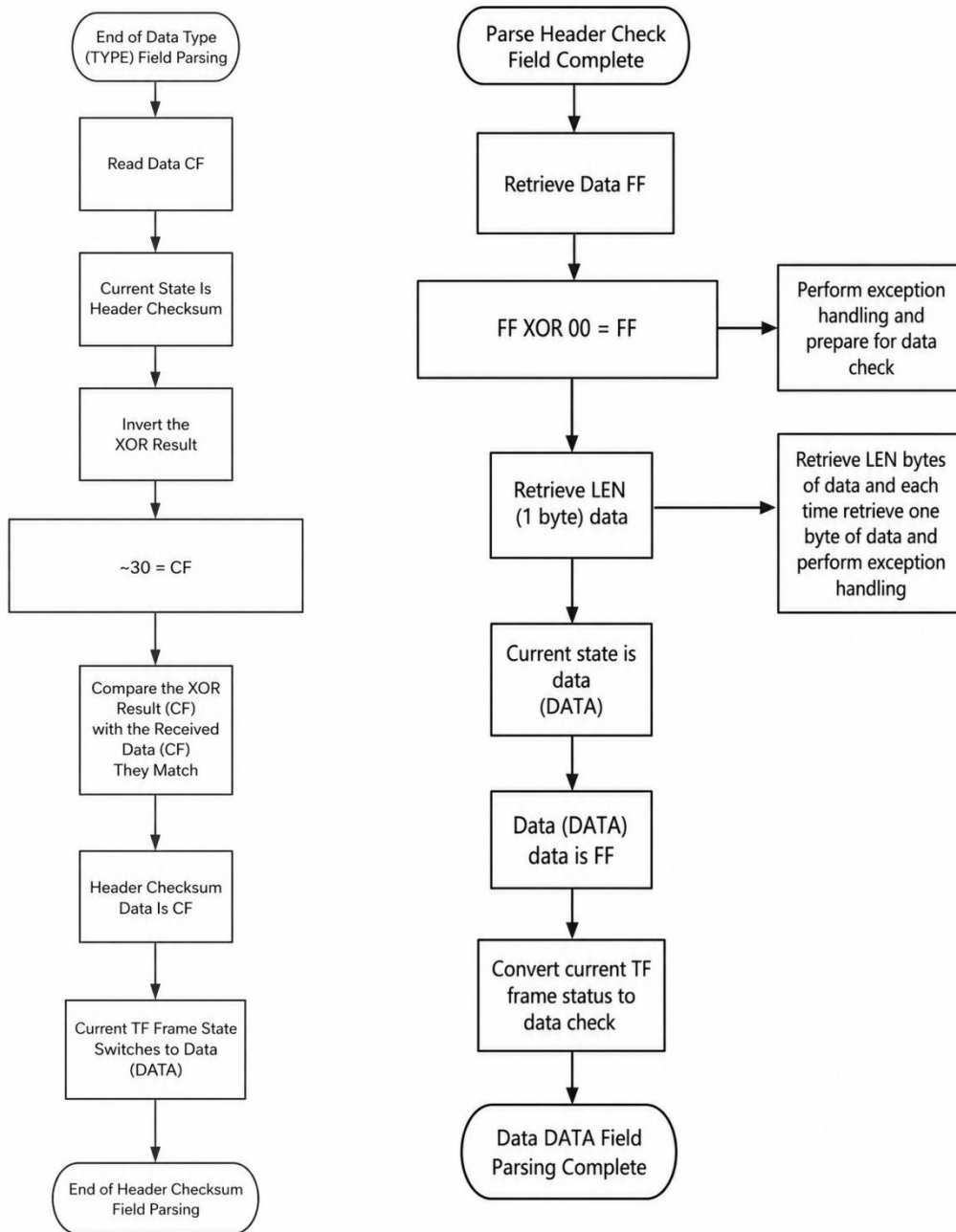


Figure 3: TF Frame Analysis Process

4.4. Detailed explanation of TF example frame parsing







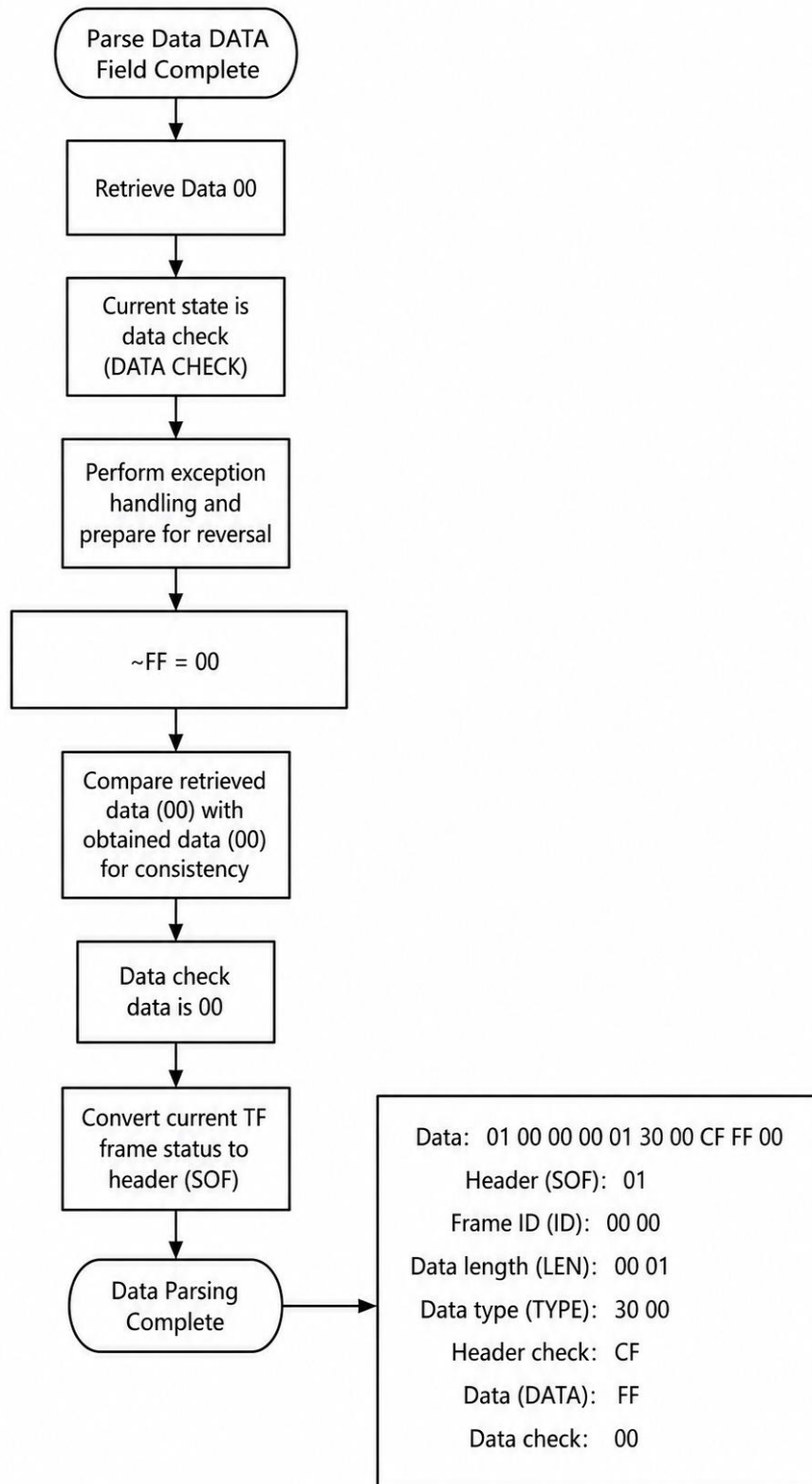


Figure 4: Detailed Explanation of TF Sample Frame Analysis

5. General message types

5.1. Message type: Query firmware status (TYPE: 0xFFFF)

Communication Mode:	Active Send		
Format	Bytes	Basic Type	Frame Structure
SOF	1 byte	uint8	Start Frame
ID	2 byte	uint16	Frame ID
LEN	2 byte	uint16	Data Frame Length
TYPE	2 byte	uint16	Frame Type
HEAD_CKSUM	1 byte	uint8	Header Checksum

Example TF frame: 01 00 01 00 00 FF FF FF

5.2. Message type: Return firmware status (TYPE: 0xFFFF)

Communication Mode:	Passive Upload		
Format	Bytes	Basic Type	Frame Structure
SOF	1 byte	uint8	Start Frame
ID	2 byte	uint16	Frame ID
LEN	2 byte	uint16	Data Frame Length
TYPE	2 byte	uint16	Frame Type
HEAD_CKSUM	1 byte	uint8	Header Checksum
DATA (see below)			
DATA_CKSUM	1 byte	uint8	Data Checksum

The following are the meanings corresponding to the DATA bits:

DATA			
Bytes	Basic Type	Frame Structure	Frame Meaning
1 byte	uint8	[project_name]	Indicates the project running on the radar 0: Presence Detection project 1: Respiration Detection project. 2: Gesture Detection project. 3: Ranging project. 4: People Counting project. 5: 3D Point Cloud Detection project.
1 byte	uint8	[major_version]	Indicates the radar major version number
1 byte	uint8	[sub_version]	Indicates the radar sub-version number
1 byte	uint8	[modified_version]	Indicates the radar revision version number

Example TF frame: 01 04 AF 00 04 FF FF 51 06 03 0A 00 F0

5.3. Message type: Enter OTA upgrade (TYPE:0x3000)

Communication Mode:	Active Send		
Format	Bytes	Basic Type	Frame Structure
SOF	1 byte	uint8	Start Frame
ID	2 byte	uint16	Frame ID
LEN	2 byte	uint16	Data Frame Length
TYPE	2 byte	uint16	Frame Type
HEAD_CKSUM	1 byte	uint8	Header Checksum

Example TF frame: 01 00 01 00 00 30 00 CF

5.4. Message type: OTA upgrade (TYPE: 0x3000)

Communication Mode:	Passive Upload		
Format	Bytes	Basic Type	Frame Structure
SOF	1 byte	uint8	Start Frame
ID	2 byte	uint16	Frame ID
LEN	2 byte	uint16	Data Frame Length
TYPE	2 byte	uint16	Frame Type
HEAD_CKSUM	1 byte	uint8	Header Checksum
DATA (see below)			
DATA_CKSUM	1 byte	uint8	Data Checksum

The following are the meanings corresponding to the DATA bits:

DATA			
Bytes	Basic Type	Frame Structure	Frame Meaning
1 byte	uint8	[tmpCodeInfo]	FF: Pending Upgrade

Example TF frame: 01 00 03 00 01 30 00 CC FF 00

6. Presence Perception 2D/3D Project

Special Note:

- 1. In this project, all TF frames sent to the lower-level device will first reply with a message of the same TYPE type without the DATA bit after receiving the message, informing the upper-level device that the data has been received. If there is no reply, please resend the configuration message.**
- 2. Enable the low-power consumption mode when unattended, and the subordinate device will enter sleep mode. Before sending the configuration message, the RX0 pin of UART0 needs to be pulled low for wake-up. Alternatively, the subordinate device can be woken up by sending a configuration message, and read back to confirm whether the message has been successfully configured. If there is no reply, resend the configuration message.**
- 3. After the host computer sends data, or when the slave computer is woken up,**

the slave computer will operate in normal mode and will not enter the unattended low-power consumption mode within 10 seconds. If there is no activity after 10 seconds, it will enter the unattended low-power consumption mode again.

6.1. Message type: Set control command 0x0201

The message type is 0x0201, and it only supports a one-way data transmission mode.

Host Computer Sends Data to Radar: MSG_CFG_HUMAN_DETECTION_3D					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Used to configure some radar states.
ID	2 byte	uint16	Frame ID	00 00	
LEN	2 byte	uint16	Data Frame Length	00 04	
TYPE	2 byte	uint16	Frame Type	02 01	
HEAD_CKSUM	1 byte	uint8	Header Checksum	F3	
DATA	4 byte	int32	[command]	01 00 00 00	
DATA_CKSUM	1 byte	uint8	Data Checksum	FE	

The following are the effects of different values for command:

- 0x1: Automatically generate interference zones.
- 0x2: Obtain the interference area and detection area.
- 0x3: Clear the interference area.
- 0x4: Reset detection area.
- 0x5: Obtain the hold delay time.
- 0x6: Turn on point cloud display.
- 0x7: Disable point cloud display.
- 0x8: Turn on target display.
- 0x9: Disable target display.
- 0xA: Set detection sensitivity to low.
- 0xB: Set detection sensitivity to medium.
- 0xC: Set detection sensitivity: High.
- 0xD: Get detection sensitivity status.
- 0xE: Set trigger speed: slow.
- 0xF: Set trigger speed: Medium.
- 0x10: Set trigger speed: fast.
- 0x11: Get trigger speed status.
- 0x12: Get Z-axis range. Note: This protocol is only applicable to 3D.
- 0x13: Set installation method: top-mounted. Note: This protocol is only applicable to 3D.
- 0x14: Set installation method: side installation. Note: This protocol is only

applicable to 3D.

- 0x15: Get the installation method.
- 0x16: Set working mode: low power consumption mode when unattended.
- 0x17: Set working mode: Normal detection mode.
- 0x18: Get working mode.
- 0x19: Obtain the sleep time in low-power mode when unattended.
- 0x1A: Reset to unmanned state.
- 0x1B: Set working mode: turn off radar mode, P20 outputs high voltage level.
- 0x1C: Set working mode: turn off radar mode, P20 outputs low level.
- 0x1D: Set P20 output: When there is someone present, P20 outputs high voltage; when there is no one present, P20
- outputs low voltage.
- 0x1E: Set P20 output: When someone is present, P20 outputs a low voltage level; when no one is present, P20
- outputs a high voltage level.
- 0x1F: Output the status of whether there is someone in P20.
- 0x20: Set P20 output: P20 has no action, continuously outputting low level.
- 0x21: Set P20 output: P20 has no action, continuously outputting high level.
- 0x22: Set P20 output: P20 jog, switch output between presence and absence states, maintaining a low level for
- 500ms.
- 0x23: Set P20 output: P20 jog, toggle output between presence and absence states with a 500ms high level.
- 0x24: Set working mode: Strong reflection scene mode.
- 0x25: Clear the dwell area.
- 0x26: Obtain the target lifecycle of the parking area.
- 0x27: Get serial port output interval.

6.2. Message type: Set the coordinate positions of interference area, detection area, and dwell area 0x0202

The message type is 0x0202, and it only supports one-way data transmission mod

Host Computer Sends Data to Radar: MSG_CFG_HUMAN_DETECTION_3D_AREA					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Used to set the interference area, detection area, and stay area.
ID	2 byte	uint16	Frame ID	00 00	
LEN	2 byte	uint16	Data Frame Length	00 1C	
TYPE	2 byte	uint16	Frame Type	02 02	
HEAD_CKSUM	1 byte	uint8	Header Checksum	/	
DATA	4 byte	int32	[area_id]	/	
DATA	4 byte	float	[x_min]	/	
DATA	4 byte	float	[x_max]	/	
DATA	4 byte	float	[y_min]	/	
DATA	4 byte	float	[y_max]	/	
DATA	4 byte	float	[z_min]	/	
DATA	4 byte	float	[z_max]	/	
DATA_CKSUM	1 byte	uint8	Data Checksum	/	

The following are the effects of different values for DATA:

- [area_id]: Set the ID of the area. The data type is int32. Values from 0 to 3 represent interference areas, 4 to 7 represent detection areas, and 8 to 11 represent dwell areas.
- [x_min]: Sets the minimum value of the x-coordinate in the region. The data type is float, and the unit is meter (m).
- [x_max]: Sets the maximum value of the x-coordinate in the region. The data type is float, and the unit is meter (m).
- [y_min]: Sets the minimum value of the y-coordinate in the region. The data type is float, and the unit is meter (m).
- [y_max]: Sets the maximum value of the y-coordinate in the region. The data type is float, and the unit is meters (m).
- [z_min]: Sets the minimum value of the z-coordinate in the region. The data type is float, and the unit is meter (m).
- [z_max]: Sets the maximum value of the z-coordinate in the region. The data type is float, and the unit is meter (m).
- **Note: There are a total of 4 interference zones, 4 detection zones, and 4 dwell zones. Zones ID0 to ID3 are interference zones, zones ID4 to ID7 are detection zones, and zones ID8 to ID11 are dwell zones. Only one zone can be set at a time.**
- **Note: When this protocol is used for 2D, please set z_min to -6m and z_max to 6m.**

6.3. Message type: Set hold delay time 0x0203

The message type is 0x0203, and it only supports one-way data transmission mode

Host Computer Sends Data to Radar: MSG_CFG_HUMAN_DETECTION_3D_PWM_DELAY					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Used to set the hold delay time.
ID	2 byte	uint16	Frame ID	00 00	
LEN	2 byte	uint16	Data Frame Length	00 04	
TYPE	2 byte	uint16	Frame Type	02 03	
HEAD_CKSUM	1 byte	uint8	Header Checksum	/	
DATA	4 byte	uint32	[pwm_delay]	1E	
DATA_CKSUM	1 byte	uint8	Data Checksum	FE	

The following are the effects of different values for DATA:

- [pwm_delay]: Sets the hold delay time. Data type: uint32. Unit: second (s).
- **Note: The default is 30 seconds.**

6.4. Message type: Set Z-axis range 0x0204

The message type is 0x0204, and it only supports a one-way data transmission mode.

Host Computer Sends Data to Radar: MSG_CFG_HUMAN_DETECTION_3D_Z					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Used to set the Z-axis range.
ID	2 byte	uint16	Frame ID	00 00	
LEN	2 byte	uint16	Data Frame Length	00 08	
TYPE	2 byte	uint16	Frame Type	02 04	
HEAD_CKSUM	1 byte	uint8	Header Checksum	/	
DATA	4 byte	float	[z_min]	/	
DATA	4 byte	float	[z_max]	/	
DATA_CKSUM	1 byte	uint8	Data Checksum	FE	

The following are the effects of different values for DATA:

- [z_min]: Sets the minimum value of the z-coordinate in the region. The data type is float, and the unit is meter (m).
- [z_max]: Sets the maximum value of the z-coordinate in the region. The data type is float, and the unit is meter (m).
- **Note: This agreement is only applicable to 3D.**

6.5. Message type: Set sleep time for low-power mode when unattended 0x0205

The message type is 0x0205, and it only supports one-way data transmission mode

Host Computer Sends Data to Radar: MSG_CFG_HUMAN_DETECTION_3D_LOW_POWER_MODE_TIME					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Used to set the hold delay time.
ID	2 byte	uint16	Frame ID	00 00	
LEN	2 byte	uint16	Data Frame Length	00 04	
TYPE	2 byte	uint16	Frame Type	02 05	
HEAD_CKSUM	1 byte	uint8	Header Checksum	/	
DATA	4 byte	uint32	[waitingPeriod]	01 F4	
DATA_CKSUM	1 byte	uint8	Data Checksum	FE	

The following are the effects of different values for DATA:

- [waitingPeriod]: Sets the sleep time for low-power mode when unattended. Data type: uint32. Unit: milliseconds (ms).
- **Note: The default is 500ms**

6.6. Message type: Set parking area target lifecycle 0x0206

The message type is 0x0206, which only supports a one-way data transmission mode.

Host Computer Sends Data to Radar: MSG_CFG_HUMAN_DETECTION_3D_STAY_LIFE					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Used to set the target lifetime in the stay area.
ID	2 byte	uint16	Frame ID	00 00	
LEN	2 byte	uint16	Data Frame Length	00 04	
TYPE	2 byte	uint16	Frame Type	02 06	
HEAD_CKSUM	1 byte	uint8	Header Checksum	/	
DATA	4 byte	uint32	[stayLife]	20	
DATA_CKSUM	1 byte	uint8	Data Checksum	/	

The following are the effects of different values for DATA:

- [stay_life]: Sets the target lifecycle of the dwell zone. Data type: uint32. Decreases by 20 per second (s).
- **Note: The default value is 300, decreasing by 20 per second (s).**

6.7. Message type: Set serial port output interval 0x0207

The message type is 0x0207, and it only supports one-way data transmission mode.

Host Computer Sends Data to Radar: MSG_CFG_HUMAN_DETECTION_3D_OUTPUT_INTERVAL					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Used to set the serial port output interval.
ID	2 byte	uint16	Frame ID	00 00	
LEN	2 byte	uint16	Data Frame Length	00 04	
TYPE	2 byte	uint16	Frame Type	02 07	
HEAD_CKSUM	1 byte	uint8	Header Checksum	/	
DATA	4 byte	uint32	[outputInterval]	1	
DATA_CKSUM	1 byte	uint8	Data Checksum	/	

The following are the effects of different values for DATA:

- [outputInterval]: Sets the serial port output interval, with data type being uint32.
- **Note: The default is 1, which means outputting every frame. For example, if set to 10, it will output once every 10 frames.**

6.8. Message type: Report personnel location 0x0A04 / 0x0A08

The message type is 0x0A04, which only supports a one-way data transmission mode. 0x0A04 represents the target data, while 0x0A08 represents the point cloud data.

Radar Sends Data to Host Computer: MSG_IND_HUMAN_DETECTION_3D_TGT_RES					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Used to report human positions.
ID	2 byte	uint16	Frame ID	00 00	
LEN	2 byte	uint16	Data Frame Length	/	
TYPE	2 byte	uint16	Frame Type	0A 04	
HEAD_CKSUM	1 byte	uint8	Header Checksum	/	
DATA	4 byte	int32	[target_num]	/	
DATA	4 byte	float	[x]	/	
DATA	4 byte	float	[y]	/	
DATA	4 byte	float	[z]	/	
DATA	4 byte	int32	[dop_idx]	/	
DATA	4 byte	int32	[cluster_id]	/	
...	
DATA_CKSUM	1 byte	uint8	Data Checksum	/	

The following is the meaning corresponding to each DATA bit:

- [target_num]: The number of targets.
- [x]: x-coordinate, data type float, unit: meter (m).
- [y]: y-coordinate, data type float, unit: meter (m).
- [z]: z-coordinate, data type float, unit: meter (m).
- [dop_idx]: data type int32, speed dop_idx.
- [cluster_id]: Data type int32, representing the ID of the clustering target.

Note: When there are N targets, there are also N x, y, z, dop_idx, and cluster_id.

- **Note: In 2D mode, the Z-axis output for this protocol is 0.**

6.9. Message type: Report whether there is someone in the area 0x0A0A

The message type is 0x0A0A, and only supports one-way data transmission mode.

Radar Sends Data to Host Computer: MSG_IND_HUMAN_DETECTION_3D_RES					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Reports whether someone is present in each area.
ID	2 byte	uint16	Frame ID	00 00	
LEN	2 byte	uint16	Data Frame Length	00 10	
TYPE	2 byte	uint16	Frame Type	0A 0A	
HEAD_CKSUM	1 byte	uint8	Header Checksum	F3	
DATA	4 byte	uint32	[detection_state_area0]	01	
DATA	4 byte	uint32	[detection_state_area1]	01	
DATA	4 byte	uint32	[detection_state_area2]	00	
DATA	4 byte	uint32	[detection_state_area3]	01	
DATA_CKSUM	1 byte	uint8	Data Checksum	FE	

The following is the meaning corresponding to each DATA bit:

- Report whether there is someone in the 4 detection areas, with 1 indicating presence and 0 indicating absence.

6.10. Message type: Reporting the locations of interference areas, detection areas, and dwell areas 0x0A0B / 0x0A0C/0x0A16

The message type 0x0A0B represents messages for the interference area, 0x0A0C for the detection area, and 0x0A16 for the dwell area. Only one-way data transmission mode is supported.

Radar Sends Data to Host Computer: MSG_IND_HUMAN_(NOISE)DETECTION_3D_NOISE_AREA_RES					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	When the host computer sends a command with data type 0x0201 and data 0x02, the device sends three TF frame messages: 0x0A0B, 0x0A0C, and 0x0A16. Among them, 0x0A0B is the message for the interference area, 0x0A0C for the detection area, and 0x0A16 for the stay area.
ID	2 byte	uint16	Frame ID	00 00	
LEN	2 byte	uint16	Data Frame Length	/	
TYPE	2 byte	uint16	Frame Type	0A 0B/0A 0C	
HEAD_CKSUM	1 byte	uint8	Header Checksum	/	
DATA	4 byte	int32	[x_min]	/	
DATA	4 byte	float	[x_max]	/	
DATA	4 byte	float	[y_min]	/	
DATA	4 byte	float	[y_max]	/	
DATA	4 byte	float	[z_min]	/	
DATA	4 byte	float	[z_max]	/	
...	
DATA_CKSUM	1 byte	uint8	Data Checksum	FE	

The following is the meaning corresponding to each DATA bit:

- [x_min]: Sets the minimum value of the x-coordinate in the region. The data type is float, and the unit is meter (m).
- [x_max]: Sets the maximum value of the x-coordinate in the region. Data type: float. Unit: meter (m).
- [y_min]: Set the minimum value of the y-coordinate in the region. Data type: float.

Unit: meter (m).

- [y_max]: Sets the maximum value of the y-coordinate in the region. The data type is float, and the unit is meters
- (m).
- [z_min]: Sets the minimum value of the z-coordinate in the region. The data type is float, and the unit is meter (m).
- [z_max]: Sets the maximum value of the z-coordinate in the region. The data type is float, and the unit is meters
- (m).

Note: This message reports the locations of interference areas, detection areas, and dwell areas. There are a total of 4 interference areas, 4 detection areas, and 4 dwell areas. In the area, the coordinates of 4 jamming areas are reported in 0x0A0B, the coordinates of 4 detection areas are

reported in 0x0A0C, and the coordinates of 4 dwell areas are reported in 0x0A16.

- **Note: This protocol is only applicable to 2D scenarios, with z_min set to -6m and z_max set to 6m by default.**

6.11. Message type: Report Hold Delay Time 0x0A0D

The message type is 0x0A0D, and it only supports a one-way data transmission mode.

Radar Sends Data to Host Computer: MSG_IND_HUMAN_DETECTION_3D_PWM_DELAY					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Reports the hold delay time.
ID	2 byte	uint16	Frame ID	00 01	
LEN	2 byte	uint16	Data Frame Length	00 04	
TYPE	2 byte	uint16	Frame Type	0A 0D	
HEAD_CKSUM	1 byte	uint8	Header Checksum	FC	
DATA	4 byte	uint32	[pwmDelayTimer]	05	
DATA_CKSUM	1 byte	uint8	Data Checksum	FA	

The following is the meaning corresponding to each DATA bit:

- Maintain the delay time

6.12. Message type: Report detection sensitivity status 0x0A0E

The message type is 0x0A0E, and it only supports a one-way data transmission mode.

Radar Sends Data to Host Computer: MSG_IND_HUMAN_DETECTION_3D_DETECT_SENSITIVITY					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Reports the detection sensitivity status.
ID	2 byte	uint16	Frame ID	00 01	
LEN	2 byte	uint16	Data Frame Length	00 01	
TYPE	2 byte	uint16	Frame Type	0A 0E	
HEAD_CKSUM	1 byte	uint8	Header Checksum	FF	
DATA	1 byte	uint8	[detectSensitivity]	01	
DATA_CKSUM	1 byte	uint8	Data Checksum	FE	

The following is the meaning corresponding to each DATA bit:

- Report the detection sensitivity, where 0 indicates low, 1 indicates medium, and 2 indicates high.

6.13. Message type: reporting trigger speed status 0x0A0F

The message type is 0x0A0F, and it only supports one-way data transmission mode.

Radar Sends Data to Host Computer: MSG_IND_HUMAN_DETECTION_3D_DETECT_TRIGGER					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Reports the trigger speed status.
ID	2 byte	uint16	Frame ID	00 01	
LEN	2 byte	uint16	Data Frame Length	00 01	
TYPE	2 byte	uint16	Frame Type	0A 0F	
HEAD_CKSUM	1 byte	uint8	Header Checksum	FB	
DATA	1 byte	uint8	[detectTrigger]	02	
DATA_CKSUM	1 byte	uint8	Data Checksum	FD	

The following is the meaning corresponding to each DATA bit:

- Report triggering speed, 0: slow, 1: medium, 2: fast.

6.14. Message type: report Z-axis range 0x0A10

The message type is 0x0A10, and it only supports a one-way data transmission mode.

Radar Sends Data to Host Computer: MSG_IND_HUMAN_DETECTION_3D_DETECT_TRIGGER					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Gets the Z-axis setting range.
ID	2 byte	uint16	Frame ID	00 01	
LEN	2 byte	uint16	Data Frame Length	00 08	
TYPE	2 byte	uint16	Frame Type	0A 10	
HEAD_CKSUM	1 byte	uint8	Header Checksum	FB	
DATA	4 byte	float	[z_min]	/	
DATA	4 byte	float	[z_max]	/	
DATA_CKSUM	1 byte	uint8	Data Checksum	FD	

The following is the meaning corresponding to each DATA bit:

- [z_min]: Sets the minimum value of the z-coordinate in the region. The data type

is float, and the unit is meter (m).

- [z_max]: Sets the maximum value of the z-coordinate in the region. The data type is float, and the unit is meter (m).
- **Note: This agreement is only applicable to- 3D.**

6.15. Message type: Reporting installation method 0x0A11

The message type is 0x0A11, and it only supports a one-way data transmission mode.

Radar Sends Data to Host Computer: MSG_IND_HUMAN_DETECTION_3D_INSTALL_SITE					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Get installation method.
ID	2 byte	uint16	Frame ID	02 2E	
LEN	2 byte	uint16	Data Frame Length	00 01	
TYPE	2 byte	uint16	Frame Type	0A 11	
HEAD_CKSUM	1 byte	uint8	Header Checksum	C8	
DATA	1 byte	uint8	[installSite]	/	
DATA_CKSUM	1 byte	uint8	Data Checksum	FD	

The following is the meaning corresponding to each DATA bit:

- Report the installation method, 0: top installation, 1: side installation.

6.16. Message type: Reporting working mode 0x0A12

The message type is 0x0A12, and it only supports one-way data transmission mode.

Radar Sends Data to Host Computer: MSG_IND_HUMAN_DETECTION_3D_LOW_POWER_MODE					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Get the working mode.
ID	2 byte	uint16	Frame ID	02 2E	
LEN	2 byte	uint16	Data Frame Length	00 01	
TYPE	2 byte	uint16	Frame Type	0A 12	
HEAD_CKSUM	1 byte	uint8	Header Checksum	/	
DATA	1 byte	uint32	[lowPowerMode]	/	
DATA_CKSUM	1 byte	uint8	Data Checksum	FD	

The following is the meaning corresponding to each DATA bit:

- 0: Normal detection mode.
- 1: Low power consumption mode when unattended.
- 2: Disable radar mode, P20 outputs high voltage level.
- 3: Disable radar mode, P20 outputs low voltage level.
- 4: Strong reflection scene mode.

6.17. Message type: report sleep time in low-power mode when unattended 0x0A13

The message type is 0x0A12, which only supports a one-way data transmission mode

Radar Sends Data to Host Computer: MSG_IND_HUMAN_DETECTION_3D_LOW_POWER_TIME					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Gets the no-person low-power mode sleep time.
ID	2 byte	uint16	Frame ID	02 2E	
LEN	2 byte	uint16	Data Frame Length	00 01	
TYPE	2 byte	uint16	Frame Type	0A 13	
HEAD_CKSUM	1 byte	uint8	Header Checksum	/	
DATA	4 byte	uint32	[waitingPeriod]	/	
DATA_CKSUM	1 byte	uint8	Data Checksum	FD	

The following is the meaning corresponding to each DATA bit:

- Sleep time in low power consumption mode when unattended.

6.18. Message type: Reporting unmanned low-power mode working status 0x0A14

The message type is 0x0A14, which only supports a one-way data transmission mode.

Radar Sends Data to Host Computer: MSG_IND_HUMAN_DETECTION_3D_MODE					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Reports the no-person low-power mode operating status.
ID	2 byte	uint16	Frame ID	02 2E	
LEN	2 byte	uint16	Data Frame Length	00 01	
TYPE	2 byte	uint16	Frame Type	0A 14	
HEAD_CKSUM	1 byte	uint8	Header Checksum	/	
DATA	1 byte	uint8	[detectStateMessenger]	/	
DATA_CKSUM	1 byte	uint8	Data Checksum	FD	

The following is the meaning corresponding to each DATA bit:

- 0: The working state is in an unmanned low-power consumption state.
- 1: The working status is in normal mode.

Note: In the unattended low-power consumption mode, it will enter low-power consumption mode when unattended and switch to normal mode when attended. This message will only be sent when the mode is set to unattended low-power consumption mode, and it will be sent when switching between unattended low-power consumption mode and normal mode.

6.19. Message type: Report GPIO state switch 0x0A15

The message type is 0x0A15, and it only supports one-way data transmission mode.

Radar Sends Data to Host Computer: MSG_IND_HUMAN_DETECTION_3D_GPIO_SWITCH					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Reports GPIO status switching.
ID	2 byte	uint16	Frame ID	02 2E	
LEN	2 byte	uint16	Data Frame Length	00 01	
TYPE	2 byte	uint16	Frame Type	0A 15	
HEAD_CKSUM	1 byte	uint8	Header Checksum	/	
DATA	1 byte	uint8	[gpioOutputSwitch]	/	
DATA_CKSUM	1 byte	uint8	Data Checksum	FD	

The following is the meaning corresponding to each DATA bit:

- 0: When someone is present, P20 outputs a high voltage level; when no one is present, P20 outputs a low voltage level.
- 1: When someone is present, P20 outputs a low voltage level; when no one is present, P20 outputs a high voltage level.
- 2: P20 has no action and continuously outputs a low voltage level.
- 3: P20 has no action and continuously outputs a high voltage level.
- 4: P20 jog, toggle output between presence and absence states with a 500ms low level.
- 5: P20 jogs, with a 500ms high-level output for switching between presence and absence statuses.

6.20. Message type: report parking area target lifecycle 0x0A17

The message type is 0x0A17, and it only supports a one-way data transmission mode.

Radar Sends Data to Host Computer: MSG_IND_HUMAN_DETECTION_3D_STAY_LIFE					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Get the target lifetime in the stay area.
ID	2 byte	uint16	Frame ID	00 01	
LEN	2 byte	uint16	Data Frame Length	00 04	
TYPE	2 byte	uint16	Frame Type	0A 17	
HEAD_CKSUM	1 byte	uint8	Header Checksum	/	
DATA	4 byte	uint32	[stayLife]	1	
DATA_CKSUM	1 byte	uint8	Data Checksum	/	

The following is the meaning corresponding to each DATA bit:

- Target lifecycle of the parking area.

6.21. Message type: report serial port output interval 0x0A18

The message type is 0x0A18, and it only supports a one-way data transmission mode.

Radar Sends Data to Host Computer: MSG_IND_HUMAN_DETECTION_3D_OUTPUT_INTERVAL					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Gets the serial port output interval.
ID	2 byte	uint16	Frame ID	00 01	
LEN	2 byte	uint16	Data Frame Length	00 04	
TYPE	2 byte	uint16	Frame Type	0A 18	
HEAD_CKSUM	1 byte	uint8	Header Checksum	/	
DATA	4 byte	uint32	[outputInterval]	1	
DATA_CKSUM	1 byte	uint8	Data Checksum	/	

The following is the meaning corresponding to each DATA bit:

- Serial port output interval.

6.22. Message type: Set Bluetooth serial port baud rate 0x0F0F

The message type is 0x0F0F, and it only supports one-way data transmission mode.

Host Computer Sends Data to Bluetooth: MSG_CFG_HUMAN_DETECTION_3D_BAUD					
Format	Bytes	Basic Type	Frame Structure	Example Frame	Frame Meaning
SOF	1 byte	uint8	Start Frame	01	Used to set the serial port baud rate.
ID	2 byte	uint16	Frame ID	00 00	
LEN	2 byte	uint16	Data Frame Length	00 01	
TYPE	2 byte	uint16	Frame Type	0F 0F	
HEAD_CKSUM	1 byte	uint8	Header Checksum	/	
DATA	1 byte	uint8	[baud index]	1	
DATA_CKSUM	1 byte	uint8	Data Checksum	/	

The following are the effects of different values for DATA:

- [baud index]: Set the serial port baud rate, data type uint8.
- **Note: The default value is 1, 115200.**

baud index	baud
0	9600
1	115200
2	128300
3	256000
4	460800
5	921600

● Example: 01 00 00 00 01 0f 0f xx 00 00

7. Programming interface

7.1. Encoding TF messages

```
void tinyFrameTx(TF_TYPE type, uint8 *data, TF_LEN len);
```

Where "type" denotes the type of data being sent, and is of type uint16. For instance, in the case of reporting person detection data results, the data type is 0x0A10. See Section 4.2.1.6 for details.

uint8* data is the address of the data to be sent.

len represents the length of the data to be sent, with a type of uint16.

7.2. Decoding TF messages

```
TinyFrameRx tinyFrameRx(void);
```

After successfully receiving the message, the received data is returned to a variable of type TinyFrameRx.

A. The following is the method for retrieving DATA bit data:

As follows: When receiving hexadecimal data through the serial port, int32 is converted to float. For example, if the [x_point] bits are 0x66, 0x66, 0xA2, and 0x41, they are first combined into a uint32 integer. Since the TF frame Data bits are in little-endian order, the value is 0x41A26666. Then, a type cast is performed to convert it to a float type. The final result is: 20.3.

```
1. int main(void)
2. {
3.     unsigned int param = 0x41A26666;
4.     float res = *(float *)&param;
5.
6.     printf("data: %f\n", res);
7.     return 0;
8. }
```

B. The following is an explanation of each CKSUM:

HEAD_CKSUM: TF frame header checksum [from the first byte to the byte preceding the HEAD_CKSUM bit]

DATA_CKSUM: TF data checksum [from the first byte of DATA to the byte preceding the DATA_CKSUM bit]

The method for calculating CKSUM is as follows in code:

```
1. unsigned char getCksum(unsigned char *data, unsigned char len)
2. {
3.     unsigned char ret = 0;
4.
5.     for (int i = 0; i < len; i++)
```

```
6.     ret = ret ^ data[i];
7.
8.     ret = ~ret;
9.
10.    return ret;
11. }
12.
```

7.3. Example code

If you want to analyze the demos of TF frame data (including C language demos and Python language demos in Linux environment and Keil μ Vision5 environment), you can directly communicate with the sales team to obtain them.

8. Maintenance and Support of Products:

8.1 Precautions and Maintenance of Products

8.1.1 Precautions

- ◆ Please do not remove or insert the modules while it is running!
- ◆ Please follow all warnings and guidance information marked on the product.
- ◆ Please keep this product dry.If it is splashed or soaked by any liquid accidentally, please power off immediately and dry thoroughly.
- ◆ Please pay attention to the ventilation and heat dissipation in the environment of running the product to avoid the damage of components by high temperature.
- ◆ Please do not use or store the product in dusty or dirty environment.
- ◆ Please do not use the product in alternating environment between hot and cold avoid condensation damage to the components of the product.
- ◆ Please do not handle the product roughly. Falling, knocking or violent shaking may damage the circuit and components.
- ◆ Please do not clean this product with organic solvents or corrosive liquids.

- ◆ Please do not repair or disassemble our products by yourself. If the products break down, please contact us for maintenance in time. Unauthorized repair may damage the product, so the resulting damage will not be covered by warranty.

8.1.2 Maintenance

Address: Room 9#-211, Building 9, Minhua Technology Information Incubation Base, D-10-2, Information Industry Park, Chaoyang Road, Qixing District, Guilin, Guangxi, China

Department: After-sales Repair Department, Guilin Shengrui Technology Co., Ltd.

Tel: +86-773-2608835

8.2 Technical Support

Support hours: 09:30-11:30 and 13:30-17:30 (GMT+8)

Tel: +86-773-2608835 Email: contact@seengreat.com

Thank you for choosing Shengrui Technology products. For more information, please visit **www.seengreat.com**.

If you have creative product ideas, feel free to email us: **contact@seengreat.com**