24G Millimeter Wave Radar Module

R24DVD1

Human Presence Radar

User manual（Ver.1.7）

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Contents

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1. Product introduction

This document mainly describes the use of radar, the problems that may be encountered at different stages, to minimize the design costs and increase the stability of the product, and to improve the efficiency of the project.

Hardware circuit reference design, radar antenna and housing layout requirements, how to distinguish between interference and multi-functional UART protocol output.

The radar is a self-contained space sensing sensor, which is composed of RF antenna, radar chip and high speed main frequency MCU. It relies on stable and flexible algorithm architecture core to provide solution for scene detections. It's equipped with upper computer or host computer to output detection status and data, and meet several groups of GPIO for user customization and development.

The radar antenna transmits electromagnetic wave signals, and synchronically receives reflected echo signals. Then, the radar analyzes the waveform parameter of the echo signals, and gives feedback on distance, orientation, speed and other information of the target, making it possible to detect the status and trajectory of moving objects.

2. Theory of operation

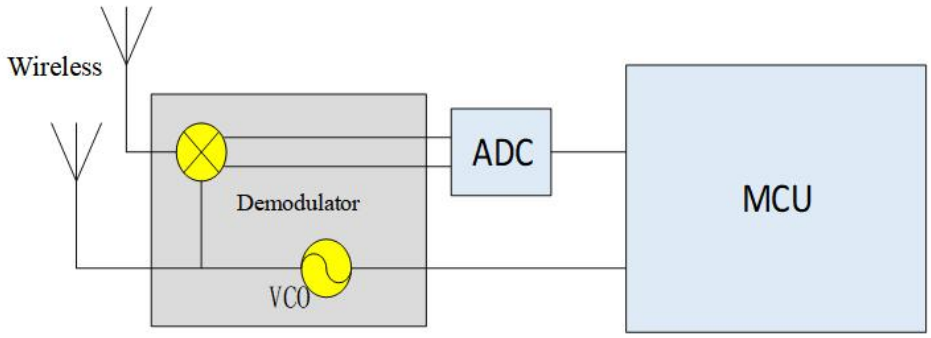

Figure 1

The radar transmits 24G band millimeter wave signal, the measured target reflects the electromagnetic wave signal, and demodulates the transmitted signal, which is then amplified, filtered, and processed by ADC to obtain the echo demodulated signal data. Information about the amplitude, frequency, and phase of the echo signal is calculated in the MCU unit, thereby

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completing target parameter (breath, motion, and micro-motion) measurement and scene evaluation.

3. Communication wiring instructions

The rated supply voltage of this radar shall be 4.9 - 6V (default to be 5V), and in normal circumstances, the rated current shall be at least 200mA. Power supply design, power supply ripple shall be ≤ 100mv.

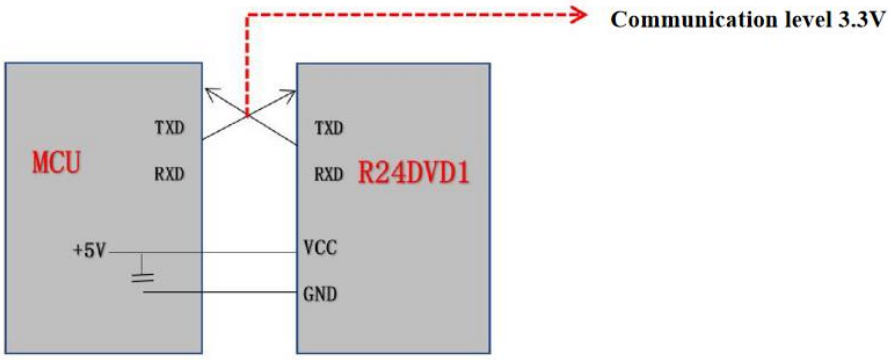

Figure 2. Schematic diagram for connection between radar module and peripherals

4. Requirements for antenna and housing layout

PCBA: Mounting height for radar shall be ≥ 1mm compared with other components

Housing structure: Radar antenna surface and housing surface shall be kept at a distance of 2 - 5mm

Housing detection surface: Non-metallic shell shall be flat, otherwise it may affect the performance of the entire scanning surface

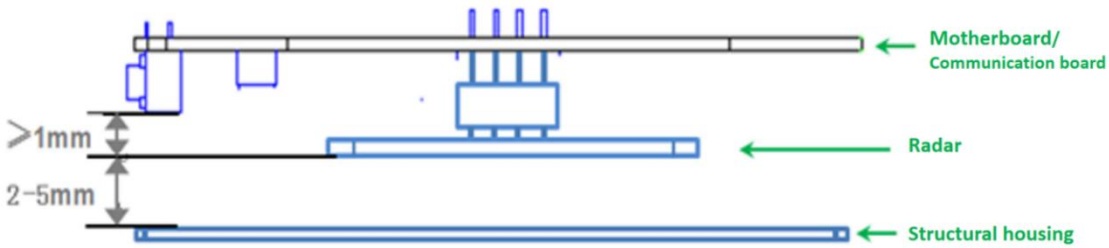

Figure 3

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5. Electrostatic protection

Radar products contain electrostatic sensitive circuits, and shall be protected from static electricity during transportation, storage, working and picking up. Do not touch the radar module antenna surface and connector pins. Hold the components by their edge.

When handling the radar sensor, please wear anti-static gloves.

6. Functional interference factors

6.1 Abnormal non-presence output under presence state

Under normal conditions, the radar will accurately judge the sitting still and sleeping state of human, and output corresponding vital signs and other information

A. The radar scanning area is large, and the motion near the door and the wooden wall is detected

Adjustment: Reduce radar sensitivity, set scenarios within the coverage of the radar

B. The radar directly faces the running air conditioner and fan

Adjustment: Adjust the radar position, and do not directly face the air conditioner or fan

C. Object shaking caused by the air conditioning wind

Adjustment: Cotton and non-metallic objects will not cause false alarms, and metals need to be fixed

D. The radar is not fixed and vibrates, causing false alarms

Avoid shaking and vibration of the radar support

E. Moving objects such as pets and birds

Due to the high sensitivity of radar measurement for subtle motion, the interference cannot be eliminated

F. Power interference, resulting in occasional misjudgment

Try to maintain stable power supply current and reduce ripple

6.2 Abnormal non-presence output under presence state

Radar transmits and receives the electromagnetic waves to detect the human presence. The closer the distance to the radar, the higher the accuracy.

A. Human is outside the radar range

Radar scanning range, adjust the installation angle. For the radar measurement range, the scanning area varies slightly due to differences in the reflection area of electromagnetic wave under different conditions.

B. Metal obstruction causing incorrect output

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Overstuffed office desks and chairs and metal seats will block the penetration of electromagnetic waves, causing misjudgment.

C. Scanning angle difference

The radar did not scan the body, causing misjudgment.

D. Very low radar sensitivity

The radar provides parameter adjustment capability, so sensitivity can be increased for improvement.

7. Function description

7.1 Description of standard function point

Function point for radar setting	State change time/function explanation
DP1: Presence/Non-presence	Report within 0.5s from non-presence to presence Output non-presence state in 30s from presence to non-presence
DP2: Active/static/non-presence	Report within 0.5s from static to active Report within 2s from active to static Report non-presence state when no one is present
DP3: Scenario mode (living room, bedroom, area detection, toilet)	Adapt to different scenario modes depending on the size of the dynamic detection area, and it is set to setting [Living Room Mode] by default
DP4: Sensitivity (1-3)	Adapt to different levels of sensitivity depending on the size of the static detection area, and it is set to setting [Sensitivity 3] by default

7.2 Description of open function point

Function point for radar setting	State change time/function explanation
DP1: Report presence energy value	Static information includes: Presence energy value/static distance Presence energy value: Real-time environmental background noise for subtle motion, report in a real-time manner [Range: 0-250] Static distance: The module detects the linear distance of human breath; [Range: 0-10m]

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DP2: Moving energy value report	Moving information includes: Moving energy value/moving distance/moving speed Moving energy value: Real-time environmental background noise for motion, report in a real-time manner [Range: 0-250] Moving distance: The module detects the linear distance of human motion; [Range: 0-10m], Moving speed: The module detects the real-time speed of human motion [Range: ±5m/s];
DP3: Presence judgment threshold setting	Please refer to the default values for EMW threshold setting in the environment where someone/no one is present. If there are moving interfering objects, set it after collection of the presence energy value. [Range: 0-250]
DP4: Motion triggering amplitude threshold setting	Radar trigger settings: The motion amplitude for someone entering into the environment is set to limit external false alarms. The default value is preferred [Range: 0-250]
DP5: Presence judgment boundary setting	The radar breathing detection distance is set to reduce the radar's false alarm rate. Reduce interference outside the detection range [Range: 0.5-10m]
DP6: Motion triggering boundary setting	The human motion detection distance is set to reduce the radar's false alarm rate. Reduce interference from walking near the doors and glass doors beyond the detection range. [Range: 0.5-10m]
DP7: Motion triggering time setting	Time accumulation for motion triggering, multiple judgment triggering to reduce false alarm rate. Performance limit can be set in combination with the motion amplitude triggering threshold and motion triggering boundary [Range: 0-1000ms, 150ms by default]
DP8: Moving-to-static time setting	This parameter is set to adjust the duration of reporting the current human motion status. Its combination with static and motion triggering threshold setting conditions enables the approximate state of human motion amplitude in the environment [Range: 1-60s, 3s by default]
DP9: Switching to non-presence state time setting	If the radar fails to detect breath and subtle motion for a period of time, it will automatically switch to non-presence state. This parameter is manually set to quickly switch to set the time for switching to non-presence state. [≥ 30s]

8. Protocol description

This protocol is applied to the communication between the 24G millimeter wave human presence detection radar and the host computer.

This protocol outlines the radar workflow, gives a brief introduction to the interface protocol composition architecture, and explains the control commands and data required for radar operation. The serial communication is defined as follows:

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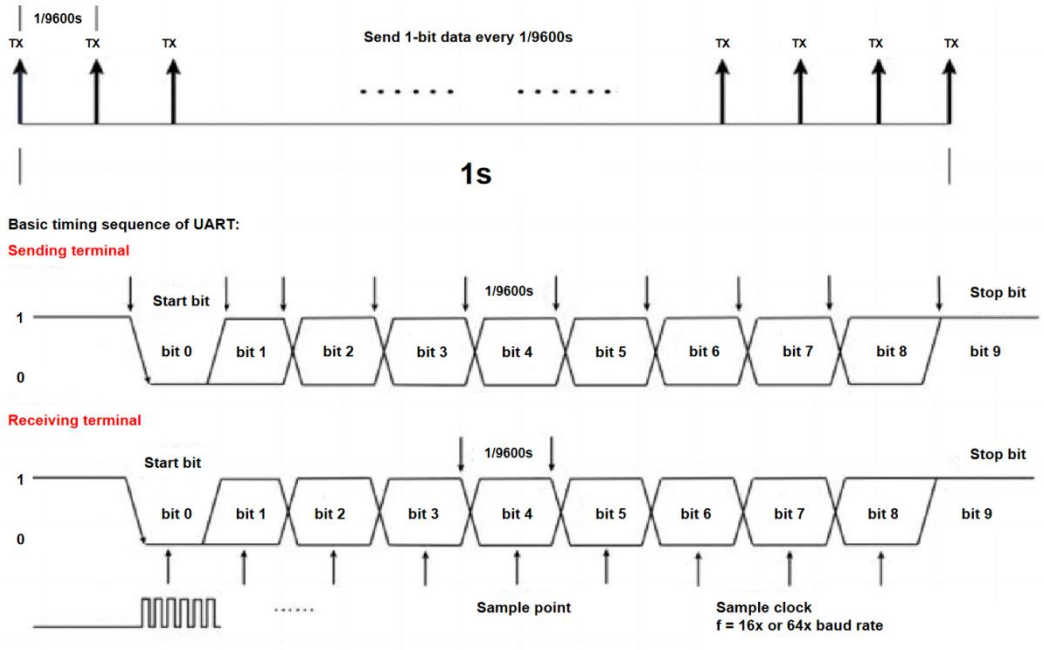
- Interface level: TTL
- Baud rate: 115200bps
- Stop bit: 1
- Data bit: 8
- Parity check: N/A

9. Definition of communication command and parameter - standard function point/open underlying function point

9.1 Definition and description of frame structure

Definition of frame structure

Frame header	Control word	Command word	Length identification		Data	Check digit	Frame tail
0X53 0X59	Control	Command	Lenth_H	Lenth_H	Data	Sum	0X54 0X43
2 Byte	1 Byte	1 Byte	1 Byte	1 Byte	n Byte	1 Byte	2 Byte



Description of frame structure

- Frame header: 2Byte, fixed to 0X53,0X59
- Control word: 1 Byte

(0x01-heartbeat packet identification, 0x02-product information, 0x03-OTA upgrade,

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0x05-working status, 0x80-human presence)

- Command word: 1 Byte (identification of current data)
- Length identification: 2 Byte, equal to the specific byte length of data
- Data: n Byte, defined according to the actual function
- Check digit: 1 Byte

(check digit calculation: (frame header + control word + command word + length identifier + data) take the lowest eight bits after summation)

- Frame end: 2 Byte, fixed to 0X54, 0X43

9.2 Description of address assignment and data information

9.2.1 Description of standard function point

Category	Function description	Transmission direction	Frame header	Control word	Command word	Length identification	Data	Verification field	Frame tail	Remarks
System functions	Heartbeat package query	Issue	5359	01	01	0001	0F	sum	5443	
		Reply	5359	01	01	0001	0F	sum	5443	
	Module reset	Issue	5359	01	02	0001	0F	sum	5443	
		Report	5359	01	02	0001	0F	sum	5443	
Product Info	**Information query**									
	Product model query	Issue	5359	02	A1	0001	0F	sum	5443	
		Reply	5359	02	A1	len	len B product information	sum	5443	
	Product id query	Issue	5359	02	A2	0001	0F	sum	5443	
		Reply	5359	02	A2	len	len B product id	sum	5443	
	Hardware model query	Issue	5359	02	A3	0001	0F	sum	5443	
		Reply	5359	02	A3	len	len B hardware model	sum	5443	
	Firmware version query	Issue	5359	02	A4	0001	0F	sum	5443	
		Reply	5359	02	A4	len	len B firmware version query	sum	5443	
	Protocol type query	Issue	5359	02	A5	0001	0F	sum	5443	
		Reply	5359	02	A5	0001	01: General protocol 03: Tuya WIFI protocol	sum	5443	
Working status	Message of initialization complete	Report	5359	05	01	0001	0f	sum	5443	
	Scenario settings	Issue	5359	05	07	0001	01-04	sum	5443	1: Living room; 2. Bedroom; 3. Bathroom; 4. Area detection

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	Reply	5359	05	07	0001	01-04	sum	5443	Detection coverage of each scenario mode: Living room: 4m Bedroom: 3.5m Bathroom: 2.5m Area detection: 3m
Sensitivity settings	Issue	5359	05	08	0001	01-03	sum	5443	1: Sensitivity 1 2: Sensitivity 2 3: Sensitivity 3
	Reply	5359	05	08	0001	01-03	sum	5443	Detection coverage of each sensitivity level Sensitivity 1: 2m Sensitivity 2: 3m Sensitivity 3: 4m
Information query									
Initialization progress query	Issue	5359	05	81	0001	0F	sum	5443	
	Reply	5359	05	81	0001	01: Completed 02: Not completed	sum	5443	
Scenario setting query	Issue	5359	05	87	0001	0F	sum	5443	
	Reply	5359	05	87	0001	0X00-0X04	sum	5443	0: Currently in custom mode 1: Living room 2. Bedroom 3. Bathroom 4. Area detection
Sensitivity query	Issue	5359	05	88	0001	0F	sum	5443	
	Reply	5359	05	88	0001	0X00-0X03	sum	5443	0: Currently in custom mode 1: Sensitivity 1 2: Sensitivity 2 3: Sensitivity 3
Human presence report									
Human presence information report	Report	5359	80	01	0001	00: Non-presence 01: Presence	sum	5443	Report method: Report on status changes
Movement information report	Report	5359	80	02	0001	00: No 01: Static 02: Active	sum	5443	Report method: Report on status changes
Body movement parameter report	Report	5359	80	03	0001	1B body movement parameters	sum	5443	Report method: Report every 1s Body movement parameter: Human motion amplitude. When no one is present in the space, the body movement parameter is 0; When someone is present and stationary, the body movement parameter is 1; When the human body is moving, the body movement parameter is 2-100 (the larger the motion amplitude, the closer the distance, the greater the body movement parameter); value range: 0-100
Non-presence time settings	Issue	5359	80	0a	0001	none: 0X00 10s: 0X01 30s: 0X02	sum	5443	30s by default

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							1min: 0X03 2min: 0X04 5min: 0X05 10min: 0X06 30min: 0X07 1hour: 0X08			
		Reply	5359	80	0a	0001	none: 0X00 10s: 0X01 30s: 0X02 1min: 0X03 2min: 0X04 5min: 0X05 10min: 0X06 30min: 0X07 1hour: 0X08			
	Body movement report	Report	5359	80	0b	0001	none: 0X00 close_to: 0X01 far_away: 0X02	sum	5443	00: Non-presence/presence, static/disordered motion 01: Continuously approaching the radar for 3s 02: Continuously leaving away from the radar for 3s
Information query										
	Presence information query	Issue	5359	80	81	0001	0F	sum	5443	
		Reply	5359	80	81	0001	00: Non-presence 01: Presence	sum	5443	
	Movement information query	Issue	5359	80	82	0001	0F	sum	5443	
		Reply	5359	80	82	0001	00: No 01: Static 02: Active	sum	5443	
	Body movement parameter query	Issue	5359	80	83	0001	0F	sum	5443	
		Reply	5359	80	83	0001	1B body movement parameters	sum	5443	Value range: 0-100
	Non-presence time query	Issue	5359	80	8a	0001	0F	sum	5443	
		Reply	5359	80	8a	0001	none: 0X00 10s: 0X01 30s: 0X02 1min: 0X03 2min: 0X04 5min: 0X05 10min: 0X06 30min: 0X07 1hour: 0X08	sum	5443	30s by default
	Body	Issue	5359	80	8b	0001	0F	sum	5443	

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	movement report query	Reply	5359	80	8b	0001	none: 0X00 close_to: 0X01 far_away: 0X02	sum	5443	00: Non-presence/presence, static/disordered motion 01: Continuously approaching the radar for 3s 02: Continuously leaving away from the radar for 3s
OTA	Start OTA upgrade	Issue	5359	03	01	0004	4B upgrade packet size	sum	5443	
		Reply	5359	03	01	0004	4B firmware size per frame	sum	5443	
	Upgrade package transmission	Issue	5359	03	02	0404	4Byte packet offset address + 1024Byte upgrade packet	sum	5443	
		Reply	5359	03	02	0001	01: Received 02: Failed to receive	sum	5443	
	Stop OTA upgrade	Issue	5359	03	03	0X0001	0X01: Upgrade package sending completed; 0X02: Upgrade package sending not completed	sum	5443	
		Reply	5359	03	03	0X0001	0X01: Received 0X02: Failed to receive	sum	5443	

9.2.2 Description of open underlying function point information

A.Open parameter output switch

Function description	Transmission direction	Frame header	Control word	Command word	Length identification	Data	Verification field	Frame tail	Remarks
Open underlying information output switch									
Radar output information switch settings	Issue	5359	08	00	0001	0X00: Disable 0X01: Enable	sum	5443	A switch that controls the output of open parameters. Report if switched on, not report if switched off
	Reply	5359	08	00	0001	0X00: Disable 0X01: Enable	sum	5443	Off by default
Open underlying information output switch query									
Radar output information switch query (disabled by default)	Issue	5359	08	80	0001	0f	sum	5443	
	Reply	5359	08	80	0001	0X00: Disable 0X01: Enable	sum	5443	Off by default

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B.Custom mode

Function description	Transmission direction	Frame header	Control word	Command word	Length identification	Data	Verification field	Frame tail	Remarks
Custom mode settings									
Custom mode settings	Issue	5359	05	09	0X0001	0X01-0X04	sum	5443	0X01: Custom mode 1 0X02: Custom mode 2 0X03: Custom mode 3 0X04: Custom mode 4
	Reply	5359	05	09	0X0001	0X01-0X04	sum	5443	
Custom mode setting ended	Issue	5359	05	0a	0X0001	0X0f	sum	5443	Save custom parameters
	Reply	5359	05	0a	0X0001	0X0f	sum	5443	
Custom mode query									
Custom mode query	Issue	5359	05	89	0X0001	0F	sum	5443	
	Reply	5359	05	89	0X0001	0X00-0X04	Sum	5443	0X00: Currently in standard scenario mode 0X01: Custom mode 1 0X02: Custom mode 2 0X03: Custom mode 3 0X04: Custom mode 4

C.Real-time underlying radar parameter report/query

Open underlying radar function information report									
Radar information report	Report	5359	08	01	0005	byte1: Presence energy value range: 0-250 byte2: Static distance range: 0X00-0X14 byte3: Moving energy value range: 0-250 byte4: Moving distance range: 0X00-0X14 byte5: Speed information range: 0X01-0X14	sum	5443	**Presence energy value:** There are electromagnetic waves in the environment, and the frequency of electromagnetic waves changes at a low rate when no one is present. When someone is breathing(subtle chest motion with breath) in the space, the reflection of electromagnetic wave in the space will fluctuate slightly. **Static distance:** The module detects the linear distance of human breath, which generally does not exceed 3m **Moving energy value:** Motion amplitude. Different motion amplitudes result in different EMW frequency changes. **Moving distance:** Moving target distance detection **Moving speed:** Real time judgment of the target moving speed. The speed is positive

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									when the target is approaching the radar (0X01-0X09), and negative when the target is leaving away from the radar (0X0b-0X14). When there is no moving speed, the value is 0a (0m/s), within an increment of 0.5m/s in the speed level, for example 0X0b represents +0.5m/s; 0X09 represents -0.5m/s.
Information query of open underlying radar function									
Presence energy value query	Issue	5359	08	81	0001	0f	sum	5443	
	Reply	5359	08	81	0001	Range: 0-250	sum	5443	
Moving energy value query	Issue	5359	08	82	0001	0f	sum	5443	
	Reply	5359	08	82	0001	Range: 0-250	sum	5443	
Static distance query	Issue	5359	08	83	0001	0f	sum	5443	
	Reply	5359	08	83	0001	0X00: Non-presence 0X01: 0.5m 0X02: 1m 0X03: 1.5m 0X04: 2.0m 0X05: 2.5m 0X06: 3m 0X07: 3.5m 0X08: 4m 0X09: 4.5m 0X0a: 5m 0X0b: 5.5m 0X0c: 6m 0X0d: 6.5m 0X0e: 7m 0X0f: 7.5m 0X10: 8m 0X11: 8.5m 0X12: 9m 0X13: 9.5m 0X14: 10m	sum	5443	
Moving distance query	Issue	5359	08	84	0001	0f	sum	5443	
	Reply	5359	08	84	0001	0X00: No moving target 0X01: 0.5m 0X02: 1m 0X03: 1.5m 0X04: 2.0m 0X05: 2.5m 0X06: 3m 0X07: 3.5m 0X08: 4m 0X09: 4.5m 0X0a: 5m 0X0b: 5.5m	sum	5443	

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						0X0c: 6m 0X0d: 6.5m 0X0e: 7m 0X0f: 7.5m 0X10: 8m 0X11: 8.5m 0X12: 9m 0X13: 9.5m 0X14: 10m			
Target moving speed query	Issue	5359	08	85	0001	0f	sum	5443	
	Reply	5359	08	85	0001	0X00: No moving target 0X01-0X14	sum	5443	
Approaching/leaving away query	Issue	5359	08	86	0001	0f	sum	5443	
	Reply	5359	08	86	0001	0X00: Non-presence 0X01: Approaching 0X02: Leaving away	sum	5443	00: Non-presence/presence, static/disordered motion 01: Continuously approaching the radar for 3s 02: Continuously leaving away from the radar for 3s
Body movement parameter query	Issue	5359	08	87	0001	0f	sum	5443	
	Reply	5359	08	87	0001	Range: 0-100	sum	5443	

D.Threshold parameter setting/query

State judgment threshold setting									
Presence judgment threshold setting	Issue	5359	08	08	0001	Range: 0-250	sum	5443	Please refer to the default values for EMW threshold setting in the environment where someone/no one is present. If there are moving interfering objects, set it after collection of the static energy value.
	Reply	5359	08	08	0001	Range: 0-250	sum	5443	5 by default
Motion amplitude triggering threshold setting	Issue	5359	08	09	0001	Range: 0-250	sum	5443	Radar trigger settings: The motion amplitude for someone entering into the environment is set to limit external false alarms. The default value is preferred
	Reply	5359	08	09	0001	Range: 0-250	sum	5443	3m by default
Presence sensing boundary setting	Issue	5359	08	0a	0001	0x01:0.5m 0x02:1m 0x03:1.5m 0x04:2.0m 0x05:2.5m 0x06:3m 0x07:3.5m 0x08:4m 0x09:4.5m 0x0a:5m 0x0b: 5.5m 0x0c: 6m 0x0d: 6.5m 0x0e: 7m	sum	5443	The radar breathing detection distance is set to reduce the radar's false alarm rate. Reduce interference outside the detection range

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						0x0f: 7.5m 0x10: 8m 0x11: 8.5m 0x12: 9m 0x13: 9.5m 0x14: 10m			
	Reply	5359	08	0a	0001	0x01: 0.5m 0x02: 1m 0x03: 1.5m 0x04: 2.0m 0x05: 2.5m 0x06: 3m 0x07: 3.5m 0x08: 4m 0x09: 4.5m 0x0a: 5m 0x0b: 5.5m 0x0c: 6m 0x0d: 6.5m 0x0e: 7m 0x0f: 7.5m 0x10: 8m 0x11: 8.5m 0x12: 9m 0x13: 9.5m 0x14: 10m	sum	5443	5m by default
Motion triggering boundary setting	Issue	5359	08	0b	0001	0x01: 0.5m 0x02: 1m 0x03: 1.5m 0x04: 2.0m 0x05: 2.5m 0x06: 3m 0x07: 3.5m 0x08: 4m 0x09: 4.5m 0x0a: 5m 0x0b: 5.5m 0x0c: 6m 0x0d: 6.5m 0x0e: 7m 0x0f: 7.5m 0x10: 8m 0x11: 8.5m 0x12: 9m 0x13: 9.5m 0x14: 10m	sum	5443	The human motion detection distance is set to reduce the radar's false alarm rate. Reduce interference from walking near the doors and glass doors beyond the detection range
	Reply	5359	08	0b	0001	0x01: 0.5m 0x02: 1m 0x03: 1.5m 0x04: 2.0m 0x05: 2.5m 0x06: 3m 0x07: 3.5m 0x08: 4m 0x09: 4.5m 0x0a: 5m 0x0b: 5.5m	sum	5443	5m by default

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						0x0c: 6m 0x0d: 6.5m 0x0e: 7m 0x0f: 7.5m 0x10: 8m 0x11: 8.5m 0x12: 9m 0x13: 9.5m 0x14: 10m			
State judgment threshold query									
Presence judgment threshold setting query	Issue	5359	08	88	0001	0f	sum	5443	
	Reply	5359	08	88	0001	Range: 0-250	sum	5443	
Motion amplitude triggering threshold setting query	Issue	5359	08	89	0001	0f	sum	5443	
	Reply	5359	08	89	0001	Range: 0-250	sum	5443	
Presence sensing boundary setting query	Issue	5359	08	8a	0001	0f	sum	5443	
	Reply	5359	08	8a	0001	0x01: 0.5m 0x02: 1m 0x03: 1.5m 0x04: 2.0m 0x05: 2.5m 0x06: 3m 0x07: 3.5m 0x08: 4m 0x09: 4.5m 0x0a: 5m 0x0b: 5.5m 0x0c: 6m 0x0d: 6.5m 0x0e: 7m 0x0f: 7.5m 0x10: 8m 0x11: 8.5m 0x12: 9m 0x13: 9.5m 0x14: 10m	sum	5443	
Motion triggering boundary setting query	Issue	5359	08	8b	0001	0f	sum	5443	
	Reply	5359	08	8b	0001	0x01: 0.5m 0x02: 1m 0x03: 1.5m 0x04: 2.0m 0x05: 2.5m 0x06: 3m 0x07: 3.5m 0x08: 4m 0x09: 4.5m 0x0a: 5m 0x0b: 5.5m 0x0c: 6m 0x0d: 6.5m 0x0e: 7m 0x0f: 7.5m 0x10: 8m	sum	5443	

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						0x11: 8.5m 0x12: 9m 0x13: 9.5m 0x14: 10m			

E.Time logic parameter setting/query

Time parameter settings									
Motion triggering time setting	Issue	5359	08	0c	0004	Time information (4 bytes), unit: ms, 150ms by default	sum	5443	Time accumulation for motion triggering, multiple judgment triggering to reduce false alarm rate. Performance limit can be set in combination with the motion amplitude triggering threshold and motion triggering boundary
	Reply	5359	08	0c	0004	Time information (4 bytes)	sum	5443	Unit: ms, 150ms by default
Moving-to-static time setting	Issue	5359	08	0d	0004	Time information (4 bytes), unit: ms, 3s by default	sum	5443	This parameter is set to adjust the duration of reporting the current human motion status. Its combination with static and motion triggering threshold setting conditions enables the approximate state of human motion amplitude in the environment
	Reply	5359	08	0d	0004	Time information (4 bytes)	sum	5443	Unit: ms, 3ms by default
Switching to non-presence state time setting	Issue	5359	08	0e	0004	Time information (4 bytes), unit: ms, 30s by default	sum	5443	If the radar fails to detect breath and subtle motion for a period of time, it will automatically switch to non-presence state. This parameter is manually set to quickly switch to set the time for switching to non-presence state.
	Reply	5359	08	0e	0004	Time information (4 bytes)	sum	5443	Unit: ms, 30s by default
Time parameter query									
Triggering time for motion	Issue	5359	08	8c	0001	0f	sum	5443	
Setting query	Reply	5359	08	8c	0004	Time information (4 bytes)	sum	5443	
Moving-to-static time	Issue	5359	08	8d	0001	0f	sum	5443	
Setting query	Reply	5359	08	8d	0004	Time information (4 bytes)	sum	5443	
Switching to non-presence state	Issue	5359	08	8e	0001	0f	sum	5443	
Time setting query	Reply	5359	08	8e	0004	Time information (4 bytes)	sum	5443	

Appendix 1: Example of data instruction generation

Example: Presence information query

The data structure for confirming the presence information query according to the protocol form above:

- Frame header: 0X53 0X59
- Control word: 0X80
- Command word: 0X81

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- Length identification: 0X00 0X01
- Data: 0X0F
- Check digit: 1Byte (SUM)
- Frame end: 0X54 0X43
- Combined to a complete command as:53 598081 0001 0Fsum5443
- Check digit sum:（0X53+0X59+0X80+0X81+0X00+0X01+0X0F） = 0X01BD
- Take the lower byte to get sum = 0XBD
- So the complete presence information query command is: 53 59 80 81 00 01 0F BD 54 43

10. Contact

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11. Revision History

Revision	Release Date	Summary	Author
V1.0	2022/8/19	First draft	Mrak, OF_Frank
V1.1	2022/9/16	Modified some content relating to protocol, and added the custom mode protocol.	Ocean
V1.2	2022/9/19	Modified some terms, for example, changing static value to spatial static value.	Ocean
V1.3	2023/1/31	a. Added explanations for speed information value and modified explanations for static distance in the "Radar information report" section; b.Modified some parameters in the "Function description" section; c.Redefined the title of the scenario modes	Ocean
V1.4	2023/2/28	Deleted detection range restriction information settings and query protocol instructions	Ocean
v1.5	2023/3/3	Added explanations of some protocols	Ocean
V1.6	2023/5/9	Deleted the protocol instructions related to body movement and approaching/leaving	Ocean

		away in custom parameters; added moving and static boundary setting parameters; added moving and static distance parameters	
V1.7	2023/7/27	Modified reply instructions for scenario mode, sensitivity and custom mode queries	Ocean

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