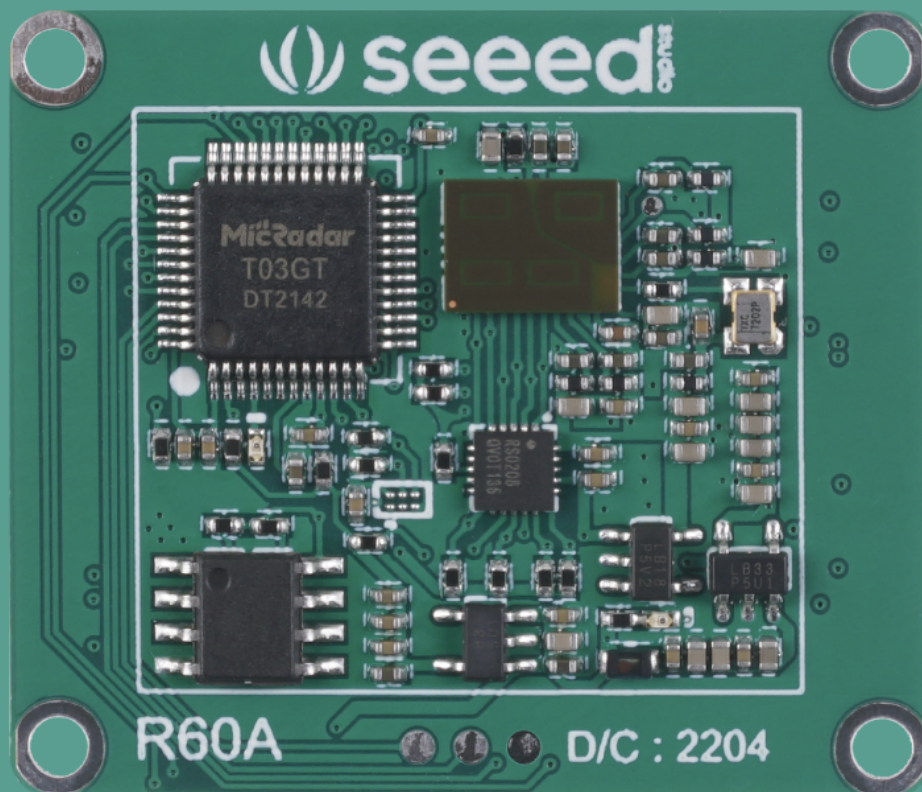


MR60BHA1

60G Breathing Heartbeat Radar
– Radar Interface Protocol (V1.01)



1. Description of the protocol

This protocol is applied to the communication between the company's radar and the host computer.

This protocol includes the definition of a number of operational commands for the control, testing, upgrading and information query of the radar equipment, as well as a clear definition of the data format and command definitions for the transmission between the radar and the host computer. The protocol outlines the radar workflow, provides a brief introduction to the interface protocol component architecture, and gives the control commands and data required for the relevant radar operation.

1.1. Scope of application of the protocol

This protocol is applicable to the 24G, 60G and 77G series of radar equipment developed by the company.

1.2. Explanation of relevant terms

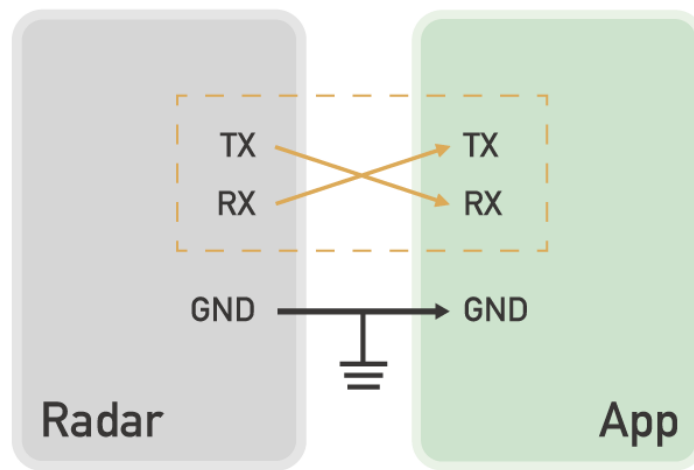
1. Uplink transmission: transmission of data and commands from the radar to the host computer.
2. Downlink transmission: transmission of commands or other content from the upper computer to the radar.
3. Uplink: the communication target corresponding to the radar terminal for radar data reception, radar control and other operations, the uplink may be in the form of a computer, embedded device or web server etc.
4. Heartbeat packet: a command word that the radar device sends to the application terminal to notify the other party of its status at regular intervals, the default time interval is 1 minute.

5. OTA: shorthand for remote upgrade.
6. Data frames: The transmission between the radar and the host computer takes place in data frame mode.

2. Overview

2.1 Radar system organisation

A block diagram of the interface between the radar and the application equipment is shown in the diagram below.



The radar interface is a serial communication (UART) with a TTL (3.3V) interface level. The interface is converted via an external RS485 interface circuit if required by the user, but the format of the transmitted data remains unchanged.

2.2. interface protocol

The interface between the radar module and the application side includes a data interface and a control interface with the following interface parameters.

	Function	Control interfaces	Notes
1	Interface level	TTL	
2	Baud rate	9600bps	
3	Data bits	8	
4	Stop bits	1	
5	Parity Check	None	

3. Definition of transmission

3.1 Radar data transmission classification

The data transfer between the radar and the host computer includes commands for radar detection, radar testing, parameter queries, OTA upgrades, etc. The categories in turn include two-way interactive communication between the host computer and the radar, respectively. The main data transmission between the radar and the host computer is shown in the diagram below.

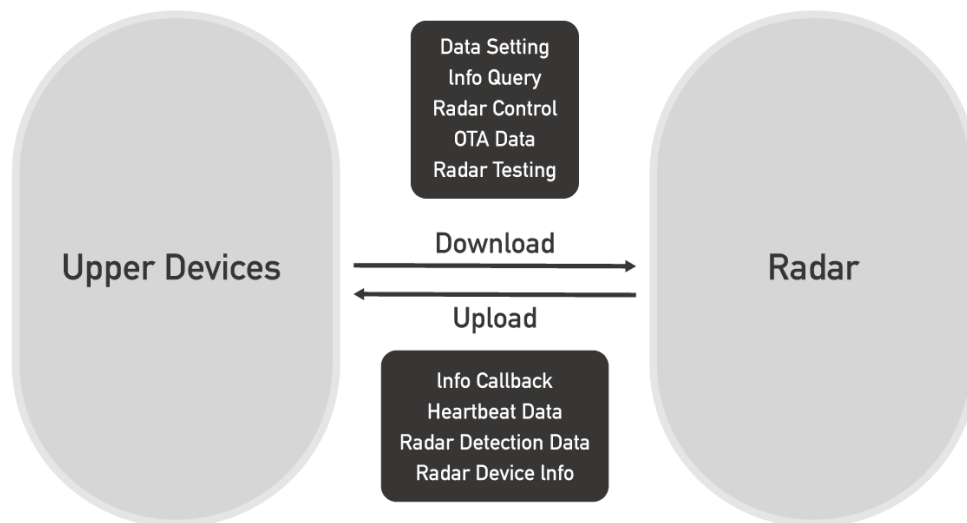


Fig. 1 Radar information transmission architecture

3.2. frame format definition

The frame format is defined as shown below.

FH	CD	OD	L1	DA	CH	FT
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Of which:

Serial No.	Fields	Marking	Length(B)	Description
1	Frame headers	FH	2	Fixed to "0x53 0x59" //"S Y"
2	Control characters	CD	1	0x01 – heartbeat pack identification; 0x02 – product information; 0x03 – OTA upgrade; 0x04 – radar test; 0x05 – operating status; 0x06 – radar location information; 0x80 – human presence; 0x81 – respiratory heartbeat.
3	Command words	OD	1	Identification of the current data content, to be defined
4	Length marking	L1	2	Equal to DA data length
5	Data	DA	–	0~2048Byte
6	Checksum fields	CH	1	Checksum
7	End of frame	FT	2	Fixed to "0x54 0x43" //"T C"

Note: In the above table, the OD content may be defined differently in different radar applications.

4. Detailed agreement definitions

4.1 Parameter classification and address correspondence table

Serial No.	Product categories	Function descriptions	Direction of transmission	Frame headers	Control characters	Command words	Length marking	Data	Check –sum	End of frame	Notes
1	Heartbeat package parameters	Heartbeat Packet Enquiry	Issuing 0x53 0x59 Response 0x53 0x59	0x53 0x59 0x53 0x59	0x01 0x01	0x01 0x01	0x0001 0x0001	0x0f 0x0f	sum	0x54 0x43 0x54 0x43	
2	Product Information	Product Model Lookup	Issuing 0x53 0x59 Response 0x53 0x59	0x53 0x59 0x53 0x59	0x02 0x02	0x01 0x01	0x0001 len	0x0f Product information	sum	0x54 0x43 0x54 0x43	
3		Product Model Setting	Issuing 0x53 0x59 Response 0x53 0x59	0x53 0x59 0x53 0x59	0x02 0x02	0x02 0x02	len len	Product information Product information	Sum	0x54 0x43 0x54 0x43	
4		Product ID lookup	Issuing 0x53 0x59 Response 0x53 0x59	0x53 0x59 0x53 0x59	0x02 0x02	0x03 0x03	0x0001 len	0x0f Product ID	Sum	0x54 0x43 0x54 0x43	
5		Product ID settings	Issuing 0x53 0x59 Response 0x53 0x59	0x53 0x59 0x53 0x59	0x02 0x02	0x04 0x04	len len	Product ID Product ID	Sum	0x54 0x43 0x54 0x43	
6		Hardware Model Lookup	Issuing 0x53 0x59 Response 0x53 0x59	0x53 0x59 0x53 0x59	0x02 0x02	0x05 0x05	0x0001 len	0x0f Hardware model	sum	0x54 0x43 0x54 0x43	
7		Hardware Model Setting	Issuing 0x53 0x59 Response 0x53 0x59	0x53 0x59 0x53 0x59	0x02 0x02	0x06 0x06	len len	Hardware model Hardware model	Sum	0x54 0x43 0x54 0x43	

8		Firmware Lookup	Issuing 0x53 0x59 Response 0x53 0x59	0x53 0x59 0x53 0x59	0x02 0x02	0x07 0x07	0x0001 len	0x0f Firmware model	Sum	0x54 0x43 0x54 0x43	
9		Firmware model setting	Issuing 0x53 0x59 Response 0x53 0x59	0x53 0x59 0x53 0x59	0x02 0x02	0x08 0x08	len len	Firmware model Firmware model	Sum	0x54 0x43 0x54 0x43	
10		Protocol Information Lookup	Issuing 0x53 0x59 Response 0x53 0x59	0x53 0x59 0x53 0x59	0x02 0x02	0x09 0x09	0x0001 len	0x0f Protocol information	Sum	0x54 0x43 0x54 0x43	
11		Protocol information setting	Issuing 0x53 0x59 Response 0x53 0x59	0x53 0x59 0x53 0x59	0x02 0x02	0x0a 0x0a	len len	Protocol information Protocol information	sum	0x54 0x43 0x54 0x43	
12	OTA parameters	Starting OTA upgrade	Issuing 0x53 0x59 Response 0x53 0x59	0x53 0x59 0x53 0x59	0x03 0x03	0x01 0x01	0x0013 0x0001	4Byte firmware package size + 15Byte firmware version number 0x01:Consent to upgrade 0x02:Refuse to upgrade	Sum	0x54 0x43 0x54 0x43	
13		Upgrade package transmissio n	Issuing 0x53 0x59 Response 0x53 0x59	0x53 0x59 0x53 0x59	0x03 0x03	0x02 0x02	0x0404 0x0001	4Byte packet offset address + 1024Byte data packet 0x01:Received successfully 0x02:Reception failure	sum	0x54 0x43 0x54 0x43	
14		Ending OTA upgrades	Issuing 0x53 0x59 Response 0x53 0x59	0x53 0x59 0x53 0x59	0x03 0x03	0x03 0x03	0x0001 0x0001	0x01:Firmware packet delivery completed 0x02:Firmware packet delivery	Sum	0x54 0x43 0x54 0x43	

								not completed 0x0f			
15	Operating status parameters	Working mode settings	Issuing 0x53 0x59 Response 0x53 0x59	0x53 0x59 0x53 0x59	0x05 0x05	0x01 0x01	0x0001 0x0001	1Byte operating mode 1Byte operating mode	sum	0x54 0x43 0x54 0x43	
16		Working mode enquiry	Issuing 0x53 0x59 Response 0x53 0x59	0x53 0x59 0x53 0x59	0x05 0x05	0x02 0x02	0x0001 0x0001	0x0f 1Byte operating mode	Sum	0x54 0x43 0x54 0x43	
17		Hours of Work Enquiry	Issuing 0x53 0x59 Response 0x53 0x59 Response 0x53 0x59	0x53 0x59 0x53 0x59 0x53 0x59	0x05 0x05 0x06	0x03 0x03 0x09	0x0001 0x0004 0x0002	0x0f Working hours 2Byte FOV angle	Sum	0x54 0x43 0x54 0x43 0x54 0x43	
18	Human presence radar	Existence information	Issuing 0x53 0x59	0x53 0x59	0x80	0x01	0x0001	0x00:Nobody 0x01:occupied	sum	0x54 0x43	Report on status changes
19		Campaign information	Issuing 0x53 0x59	0x53 0x59	0x80	0x02	0x0001	0x00:None 0x01:Close 0x02:away 0x03:Disorderly motion	sum	0x54 0x43	Report on status changes
20		Body motion parameters	Issuing 0x53 0x59	0x53 0x59	0x80	0x03	0x0001	1Byte body motion parameter	sum	0x54 0x43	Periodical reporting
21		Number of people in the current environment	Issuing 0x53 0x59	0x53 0x59	0x80	0x04	0x0001	1Byte Number of people information	Sum	0x54 0x43	Report when numbers change
22	Respiratory Heartbeat Radar	Heart rate information	Issuing 0x53 0x59	0x53 0x59	0x81	0x01	0x0006	1Byte heart rate information + 1Byte heart rate value + 4Byte	sum	0x54 0x43	Heart rate information 0x01:Normal 0x02:Heart rate too high

								heart rate waveform			0x03:Heart rate too low
23		Respiratory information	Issuing 0x53 0x59	0x53 0x59	0x81	0x02	0x0006	1Byte respiratory information + 1Byte respiratory values + 4Byte respiratory waveforms	sum	0x54 0x43	Breathing information 0x01:Normal 0x02: Hyperventilation 0x03: Hypopnea
24		Respiratory information	Issuing 0x53 0x59	0x53 0x59	0x81	0x03	0x0005	1Byte position warning + 2Byte standstill distance + 2Byte standstill angle	sum	0x54 0x43	Warning when a target is detected out of detection range
25		Respiratory information	Issuing 0x53 0x59	0x53 0x59	0x81	0x04	0x0001	1 Byte Respiratory information	sum	0x01:N ormal 0x02: Hyperventilation 0x03: Hyperventilation 0x04:D etection in progress	
26		Respiratory values	Issuing 0x53 0x59	0x53 0x59	0x81	0x05	0x0001	1 Byte Respiratory values	sum		
27		Respiratory waveforms	Issuing 0x53 0x59	0x53 0x59	0x81	0x06	0x0001	1 Byte	Sum	0x54 0x43	

28		Location detection anomalies	Issuing 0x53 0x59	0x53 0x59	0x81	0x07	0x0001	1 Byte	Sum	0x54 0x43	
29		Resting distance	Issuing 0x53 0x59	0x53 0x59	0x81	0x08	0x0002	1 Byte	Sum	0x54 0x43	
30		Stationary angle	Issuing 0x53 0x59	0x53 0x59	0x81	0x09	0x0002	1 Byte	sum	0x54 0x43	

Note: The Breathing Heartbeat Radar protocol has only been completed for Human Presence Radar and Breathing Heartbeat Radar (29–36), with subsequent functionality to be improved

4.2. Data description

4.2.1. Heartbeat data

The total length of the data is 4Byte, temporarily reserved.

4.2.2. Feedback on product models

Equipment complete information query, feedback information including equipment hardware information, firmware information, protocol information, etc., respectively, according to the hardware information feedback, firmware information feedback, protocol information feedback in order to report. Product model query, feedback the product model, the length is 10Byte.

4.2.3. Product ID feedback

Product ID query to feed back the product ID, 12bit in length.

4.2.4. Hardware information feedback

The length of the hardware feedback is 12Byte and the message specification is given in the Device Coding Specification.

4.2.5. firmware information feedback

The firmware information is 15Byte in length and the information specification is described in the Device Coding Specification.

4.2.6. protocol information feedback

The protocol message length is 8Byte and the message specification is given in the Device Coding Specification.

4.2.7. OTA content transmission

The first 4Byte is the firmware package offset address, followed by 1024Byte of firmware content.