UM10011

EVBKS5 EVK User Manual

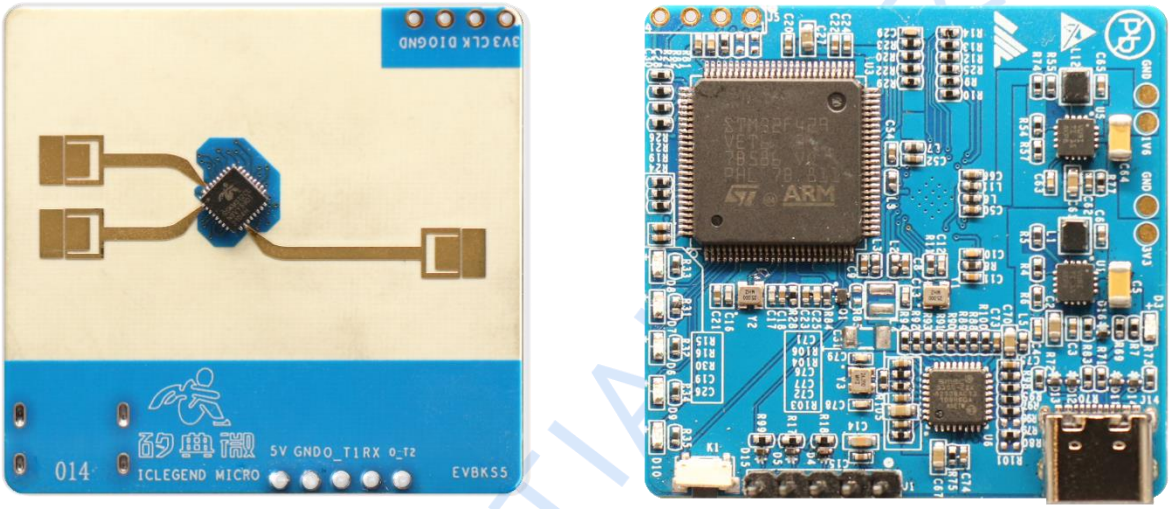
Rev. 1.0

User Manual

Introduction

EVBKS5 is an evaluation kit for 24GHz mmWave sensor IC S5KM312CL. This kit enables users to quickly evaluate the characteristics of S5KM312CL, by providing EVBKS5 evaluation board, firmware, Waveform Configuration and Demonstration GUI etc.

EVBKS5 evaluation kit provides an easy-to-use 1TX2RX mmWave sensor board. The board is equipped with three antennas, one 24GHz mmWave sensor chip S5KM312CL, and one STM32F4 series MCU. The outlooks of EVBKS5 evaluation board's top side and back side are shown in Figure 0-1.



EVBKS5 board top side

EVBKS5 board back side

Figure 0-1 Outlooks of EVBKS5 evaluation board

Contents

1 Hardware Description

S5KM312CL is a highly integrated Si-based mmWave radar chip, works at 24GHz ISM band. It provides high precision human presence detection solution with very low power consumption and minimalist size, and can be widely applied to AIoT consumer and industrial applications.

Figure 1-1 illustrates the block diagram of S5KM312CL. S5KM312CL incorporates 24GHz full transceiver (including one transmit channel, two receive channels, PLL, Mixer, etc.), baseband processing (including IF amplifier, ADC, and DSP hardware accelerator), power management, temperature sensor, and multiple communication interfaces (I2C / SPI / UART / GPIO).

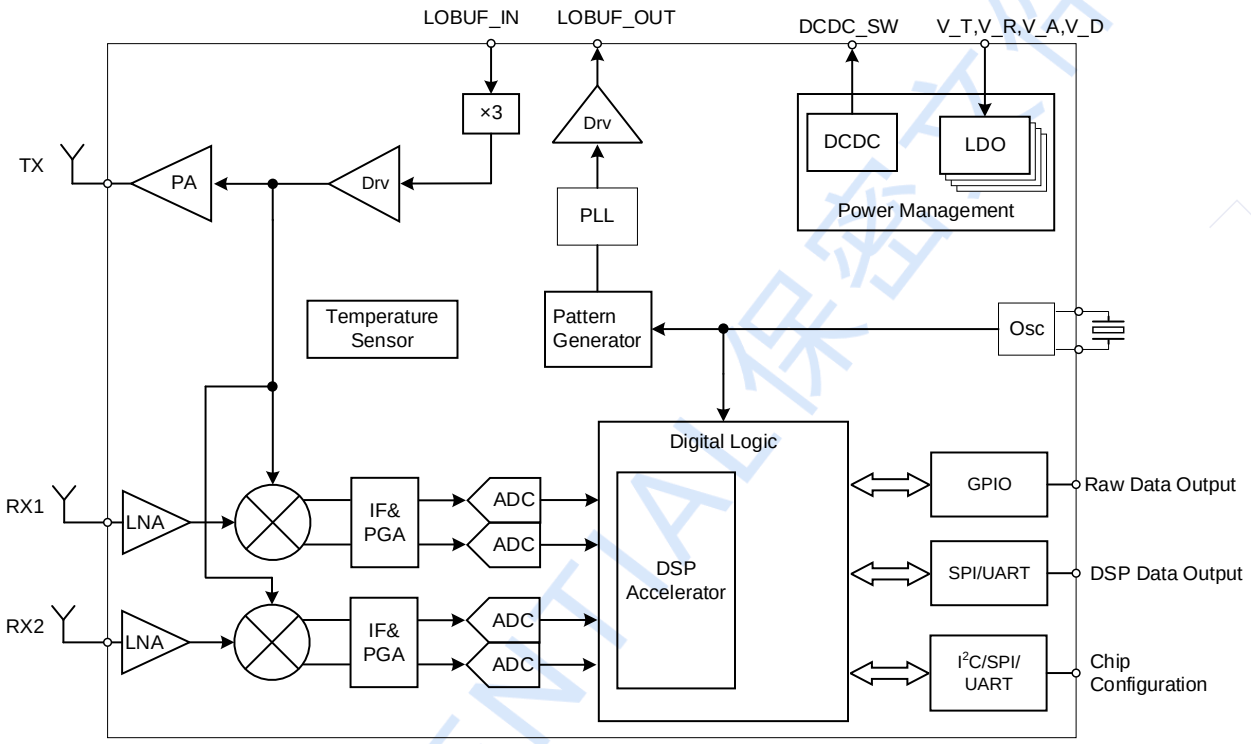


Figure 1-1 S5KM312CL schematics

EVBKS5 evaluation kit can detect both moving and motionless standing person, and it is fit for various AIoT scenarios. It allows users to install desired firmware via IAP. EVBKS5 evaluation kit is equipped with the following demonstration functions:

- Human Presence Detection
- Moving Target Detection

2 System Characteristics

2.1 System Diagram

The system diagram of EVBKS5 evaluation board is shown as Figure 2-1. It is composed of the following two main blocks.

RF: Consists of S5KM312CL chip and 24GHz PCB micro-strip antennas;

Digital Signal Process: Consists of S5KM312CL chip and STM32F429VET6 MCU, and can collect and process radar signal quickly.

Here is a brief introduction of how EVBKS5 evaluation board works. FMCW signal is firstly produced by the integrated waveform generator, then goes through the frequency multiplier and transmit channel before being transmitted to the air via TX antenna; target person or object reflects the mmWave signal, the reflected signal is collected by Rx antenna and conversed to analogue intermediate frequency (IF) baseband signal by S5KM312CL IC receiver path, ADC converse the analogue IF baseband signal to digital raw data, the digital raw data can be selected to output 1DFFT / 2DFFT DSP processed data or directly output raw data to external MCU through SPI communication interface. MCU will process the data with intelligent algorithms, detect the target in specified detection region, and report the detection result via USB Type-C or UART interface.

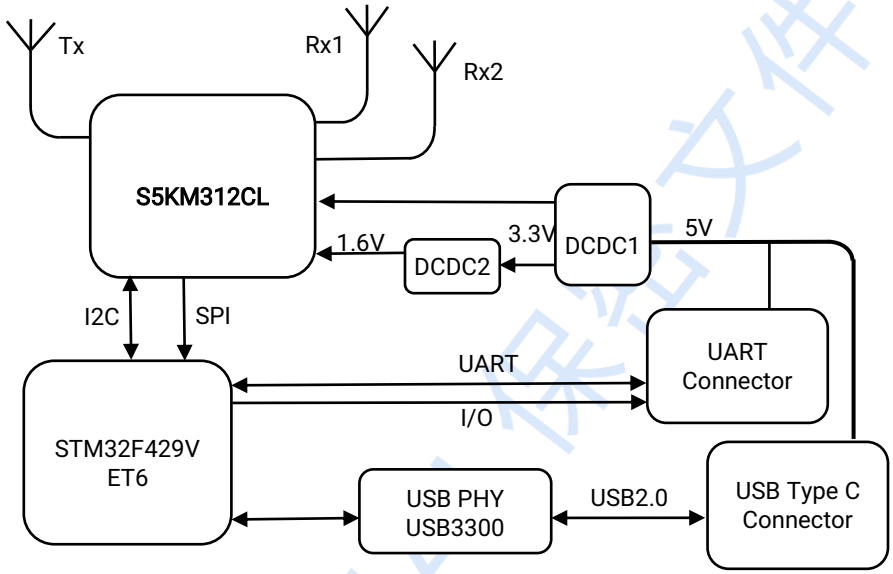


Figure 2-1 EVBKS5 evaluation board system diagram

2.2 System Characteristics

EVBKS5 evaluation board has the following characteristics:

- Incorporate 24GHz 1TX2RX micro-strip antennas;
- Chirp bandwidth up to 4GHz;
- Equipped with Type-C interface and USB PHY chip, support USB 2.0 High Speed mode for data transfer, data rate up to 34Mbps;
- Support mutual data communication via UART or USB Type-C interface;
- Support programming and debugging the board via hardware SWD interface, or via GUI IAP function;
- Support both external and internal DCDC for S5KM312CL 1.6V power supply;
- Support 2 external power supply methods: (1) USB Type-C; (2) other external power supply interface.

The basic parameters of EVBKS5 evaluation board are listed in Table 2-1.

Table 2-1 EVBKS5 basic parameter description

Parameter	Description	Min.	Typ.	Max.	Unit
Frequency Range		23.5		27.5	GHz
Chirp Bandwidth			0.25	4	GHz
EIRP				16.8	dBm
Power Supply		3.3	5	5.5	V
Size			43.2 × 41.5		mm × mm
Operating Ambient Temperature	T_{case}	-40		85	°C

2.3 Antennas and Characteristics

EVBKS5 evaluation board incorporates 24GHz 1TX2RX mmWave micro-strip antennas. The simulated antenna gain is about10dBi @ normal direction, 6dB back-off FOV is around 72° × 85°（H plane × E plane）, detecting angle is ±40°@ H-plane, ±45° @ E-plane. Photo of EVBKS5 evaluation board antennas is shown in Figure 2-2, and EVBKS5 evaluation board's antenna radiation patterns @ H-plane and E-plane are shown in Figure 2-4 and Figure 2-5.

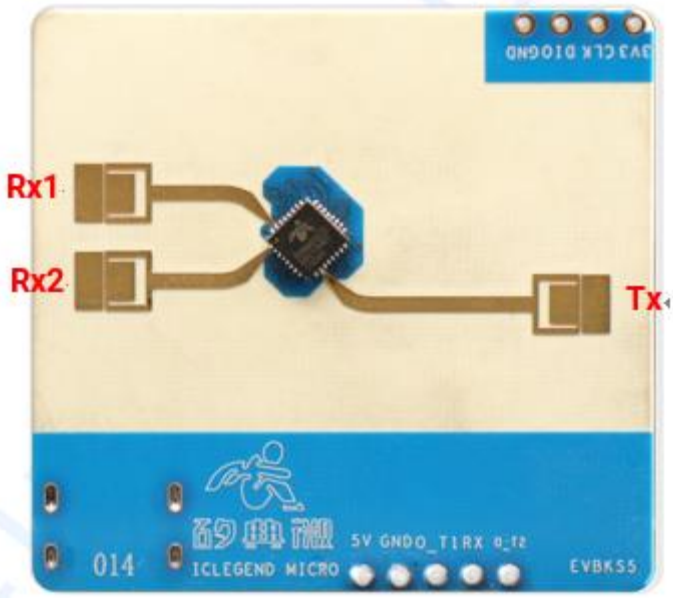


Figure 2-2 Antennas on EVBKS5 evaluation board

Note: take Figure 2-2 as a reference plane, the horizontal direction is X axis(as shown in Figure 2-3), vertical is Y axis, O is the crossing point of X axis and Y axis, Z axis is the direction that is vertical to plane XOY; so E-plane denotes plane XOZ, and H-plane YOZ.

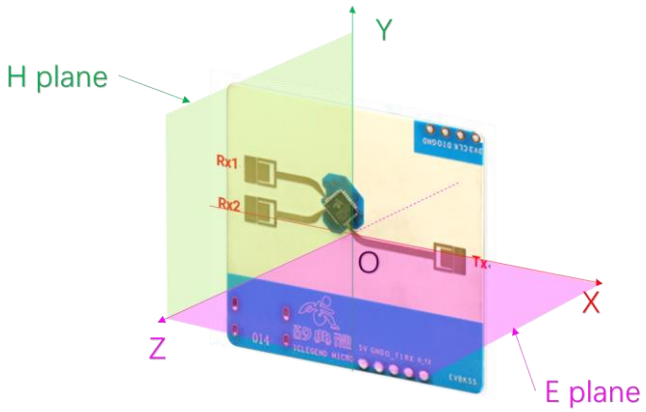


Figure 2-3 Illustration of H-plane and E-plane

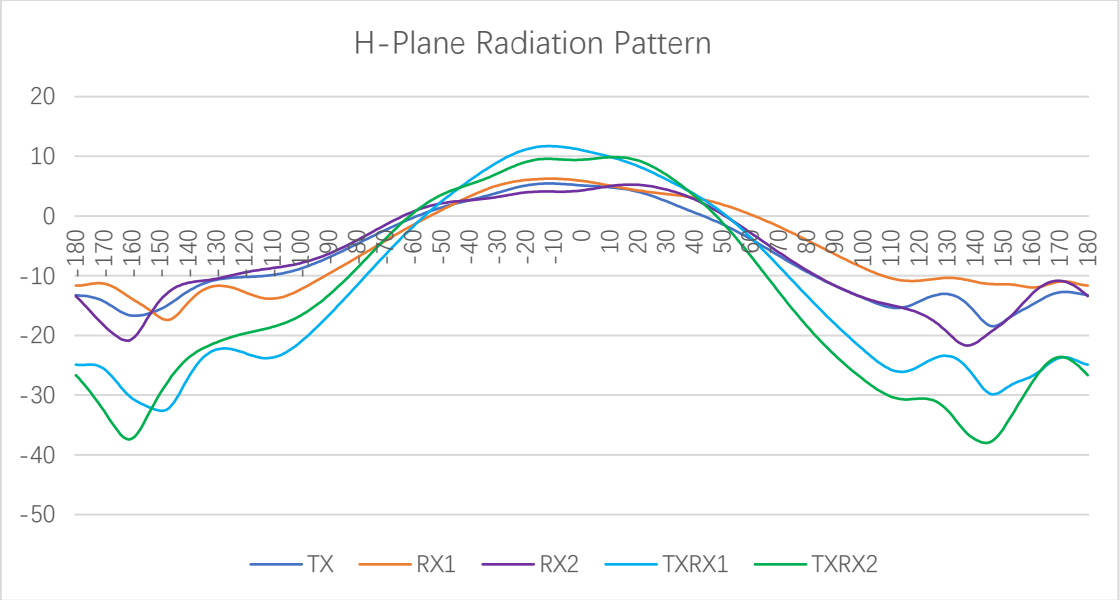


Figure 2-4 EVBKS5 H-plane antenna radiation pattern

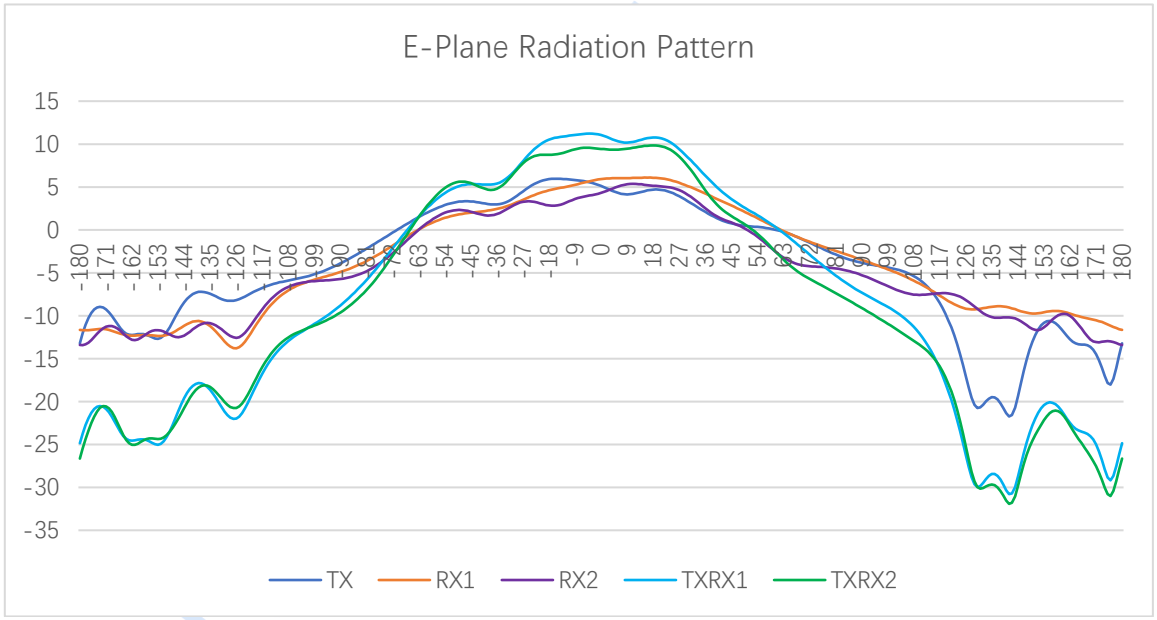


Figure 2-5 EVBKS5 E-plane antenna radiation pattern

Please be aware that the value of 72° × 85° is applied to -6dB half-power beam width. However, this does not mean that the radar sensor is not capable of detecting targets outside this angle range. Therefore, to confirm the radar sensor's effective detecting area, the target's distance from the radar as well as its RCS must be taken into consideration.

2.4 Tips on PCB Storage and Transportation

To protect the printed board from taint, physical injury, humidity, and solderability degradation, it is suggested that these PCBs should be stored in places under room temperature and low humidity. It is recommended to store them in dry oven, if necessary.

Attention should be paid on ESD in case the components are damaged when operating PCB. The best way to prevent ESD damage is to make sure that the components and its surrounding environment are equipotential,

and are connected to the earth ground. Detailed requirements are as follows:

- Components operating zone should be constructed with static dissipative materials and connected to earth ground;
- Components operating zone should not have electrical insulation material; if does, then ionizers should be equipped to neutralize accumulated electrostatic charges;
- Person directly touching components should wear antistatic clothing, wrist strap or anti-static shoes;
- The transmission, transport, or storage of components should be conducted through anti-static turnover box or similar anti-static carriers. The packaging material in direct contact with the components should be electrostatic dissipative.

3 System Connection Guide

3.1 Power Supply

EVBKS5 evaluation kit supports power supply between 3.3V and 5.5V. After normal power up, D3 (power indicator LED) shows green and keeps on, and D8 (normal operating indicator LED) shows green and blinks.

EVBKS5 evaluate kit supports two power supply methods, and the power connection interface is shown in Figure 3-1:

- Power supply via J14 USB interface:

  The default method to provide power for EVBKS5 is via J14 USB Type-C interface.

- Exterior power supply via J1 interface:

  When J14 USB power supply is not used, users can provide power via Pin 1 and Pin 2 of J1 interface.

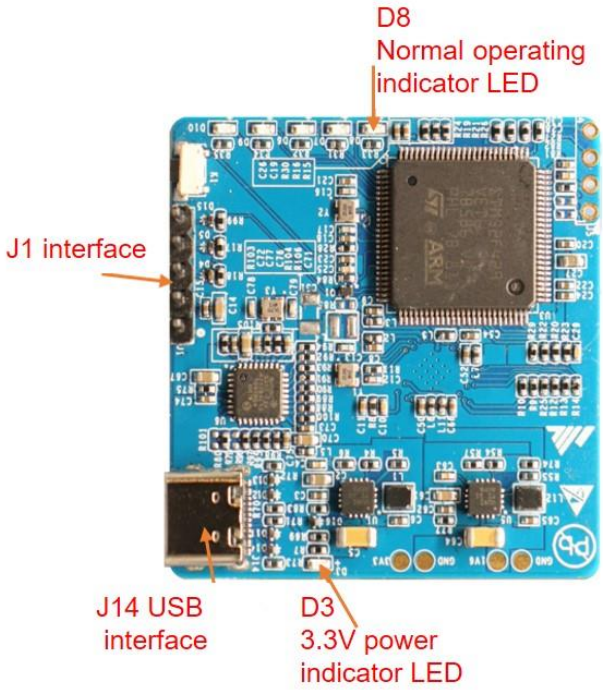


Figure 3-1 EVBKS5 power connection interface

3.2 Switch and LED

All the switches and indicator LEDs on EVBKS5 evaluation board are presented in Figure 3-2.

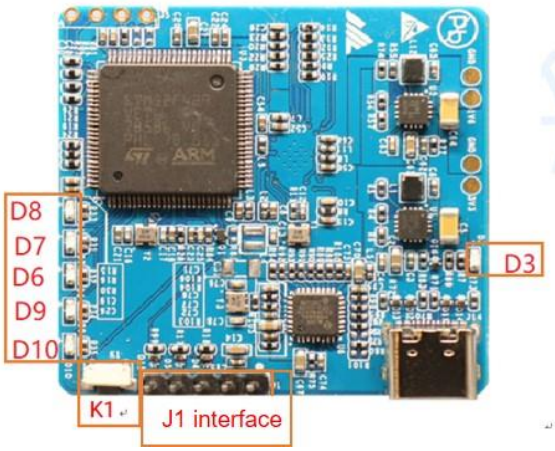


Figure 3-2 Switches and indicator LEDs on EVBKS5 evaluation board

The tag number and description of the switches and indicator LEDs on EVBKS5 board are presented in Table 3-1.

Table 3-1 Description of switches and indicator LEDs on EVBKS5 evaluation board

Tag No.	Name	Description
K1	Switch	Reset switch
D3	Green indicator LED	3.3V power supply indicator
D6	Green indicator LED	Radar data reception overflow indicator
D7	Green indicator LED	Radar data index error indicator
D8	Green indicator LED	Normal operating indicator
D9	Green indicator LED	Radar data transmission overflow indicator
D10	Green indicator LED	MCU indicator which indicates command reception overflow from host computer

3.3 Functional Interfaces

All functional interfaces on EVBKS5 evaluation board are presented in Table 3-3.

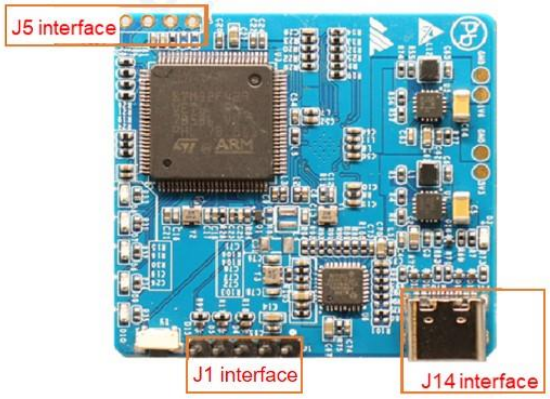


Figure 3-3 Functional interfaces on EVBKS5 evaluation board

3.3.1 USB Type-C Interface

USB interface J14 is a Type-C interface which is the default configuration and communication interface of EVBKS5 evaluation board. In default mode, this interface is used for both power supply and communicating with the host PC. Description of USB Type-C interface Pins is presented in Table 3-2.

Table 3-2 USB Type-C interface

PIN	Name	PIN	Name
A1	GND	B12	GND
A4	VBUS	B9	VBUS
A5	CC1	B8	SBU2
A6	DP1	B7	DN2
A7	DN1	B6	DP2
A8	SBU1	B5	CC2
A9	VBUS	B4	VBUS
A12	GND	B1	GND

3.3.2 J1 Interface

Users can also use J1 interface to supply power for the board instead of using USB interface. It can also be used as a UART debug interface when debugging customized firmware developed by users. Description of J1 interface Pins is presented in Table 3-3.

Table 3-3 J1 Pin description

PIN	Name	Function	Description
1	5V	Power supply input	Vcc: 3.3V~5.5V, Typ.: 5V
2	GND	Connect to ground	
3	O_T1	Can be configured as UART_TX or IO, cannot be configured as UART_TX at the same time with Pin O_T2. Default set as UART_TX	IO voltage: 0~3.3V
4	RX	UART_RX	IO voltage: 0~3.3V
5	O_T2	Can be configured as UART_TX or IO, cannot be configured as UART_TX at the same time with O_T1. Default set as IO	IO voltage: 0~3.3V

3.3.3 SWD Interface

J5 is a SWD debugging and programming interface for MCU. J5 pin description is presented in Table 3-4.

Table 3-4 J5 Pin description

PIN	Name	Function	Description
1	GND	Connect to ground	
2	DIO	Data input/output	IO voltage: 0~3.3V
3	CLK	Reference clock signal input	IO voltage: 0~3.3V
4	3V3	Reference power supply output	Reference voltage: 1.8~3.6V, Typ.: 3.3V

4 Quick Start

4.1 Hardware Configuration

Connect host PC USB port with EVBKS5 evaluation board's USB Type-C interface with a USB Type-C cable, the host PC starts providing 5V power supply.

4.2 PC Connection and Driver Installation

1. Log in STMCU website [1], download STM32 *Virtual COM Port Driver of STSW_STM32102*, install *VCP_V1.5.0_Setup_W7_x64_64bits.exe* by default settings.

2. Connect EVBKS5 evaluation board's USB Type-C interface J14 to the host PC's USB port with USB cable, then a new COM port device can be found in host PC's device manager, as shown in Figure 4-1.

[1] https://www.st.com/en/development-tools/stsw-stm32102.html

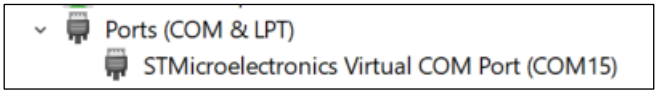


Figure 4-1 Windows device manager

When *STMicroelectronics Virtual COM Port* is found, it means the host PC has successfully connected with EVBKS5 evaluation board. If the device is not found in the list, or a new device shows up in the list but with a question mark, users should check whether the driver is installed correctly or the board is correctly powered up.

4.3 Demonstration Firmware

EVBKS5 provides two sets of demonstration firmware: *EVBKS5_BodySensing* and *EVBKS5_MotionDetect*. Both demonstration programs require no extra configuration as long as users programmed corresponding firmware into the evaluation board.

There are two ways to program the firmware into the board, through GUI IAP function, or hardware SWD interface:

- GUI IAP function: details please refer to 6 IAP Function;
- SWD interface: users should erase previous firmware in MCU before programming desired firmware into the board.

4.4 Software Configuration

Start "*EVBKS5 Waveform Configuration and Demonstration GUI.exe*", click *Demo* in *Main Menu Bar*, then two options, *Human Presence Detection* and *Moving Target Detection*, will show up in the drop box. Choose the proper option based on the firmware programmed into the MCU.

4.4.1 Human Presence Detection Demonstration

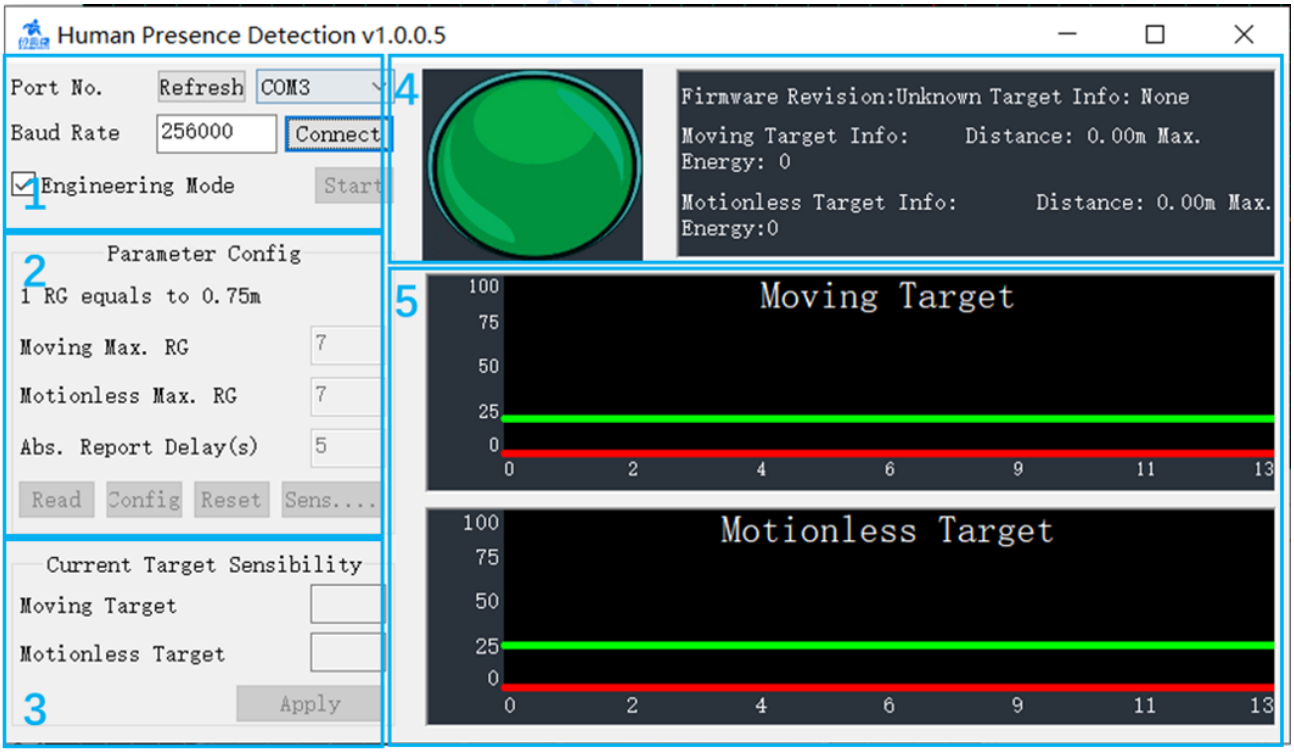


Figure 4-2 Human Presence Detection demonstration GUI

As shown in Figure 4-2, Human Presence Detection GUI can be partitioned into 5 zones. They are Port and Data Format (Zone1), Parameter Config. (Zone2), Sensibility Statistics (Zone3), Target and Revision Info. (Zone4), and Engineering Mode Display (Zone5). Functions of each zone are explained in Table 4-1.

Table 4-1 Human Presence Detection Demo GUI Description

Zone	Function
Port and Data Format	Obtain and display the radar's port number, configure baud rate and data type
Parameter Config.	Configure and display radar parameters, including the maximum range gate (moving & stationary), absence report delay, sensibility of each range gate (moving & stationary) etc.
Sensibility Statistics	Display the maximum energy of all range gates in each radar data frame and update them in real time
Target and Revision Info.	Display the firmware revision number and the basic information of the target, including its state, direct distance to the radar and maximum energy level (moving & stationary)
Engineering Mode Display	When *Engineering Mode* is ticked, this zone displays the energy value of each radar range gate in curves. The red curves display energy values of the target and are refreshed in real time, while green curves display the sensibility levels and will not be updated until the latest radar parameters are received

Users can configure Range Gate Number, Absence Report Delay, and Sensibility. To configure Sensibility for each range gate, click *Sensibility* button on the GUI in Zone2, and a new window named *Sensibility Configuration* will pop up, as shown in Figure 4-3. It allows users to configure the sensibility of each range gate in multiple ways. Click *Set* and *Confirm* after typing in the new sensibility values in the table, and new parameter values will be sent to the radar; click *Restore* and *Confirm* button in turn, all the values will be reset to default values.

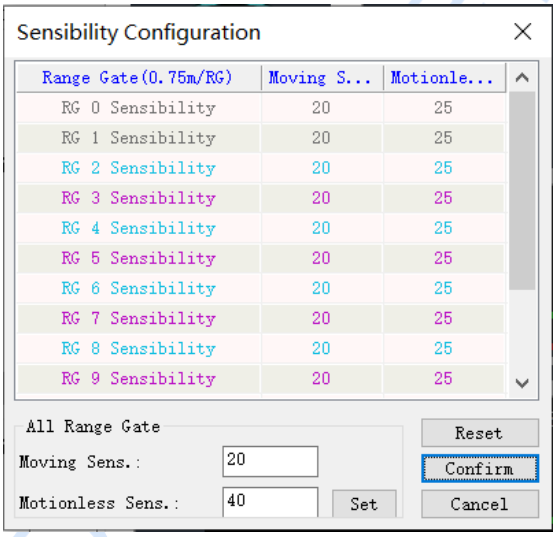


Figure 4-3 Sensibility configuration interface

4.4.2 Moving Target Detection Demonstration

Currently, no configuration is needed for running moving target detection demonstration. The visual interface of Moving Target Detection program is shown in Figure 4-4.

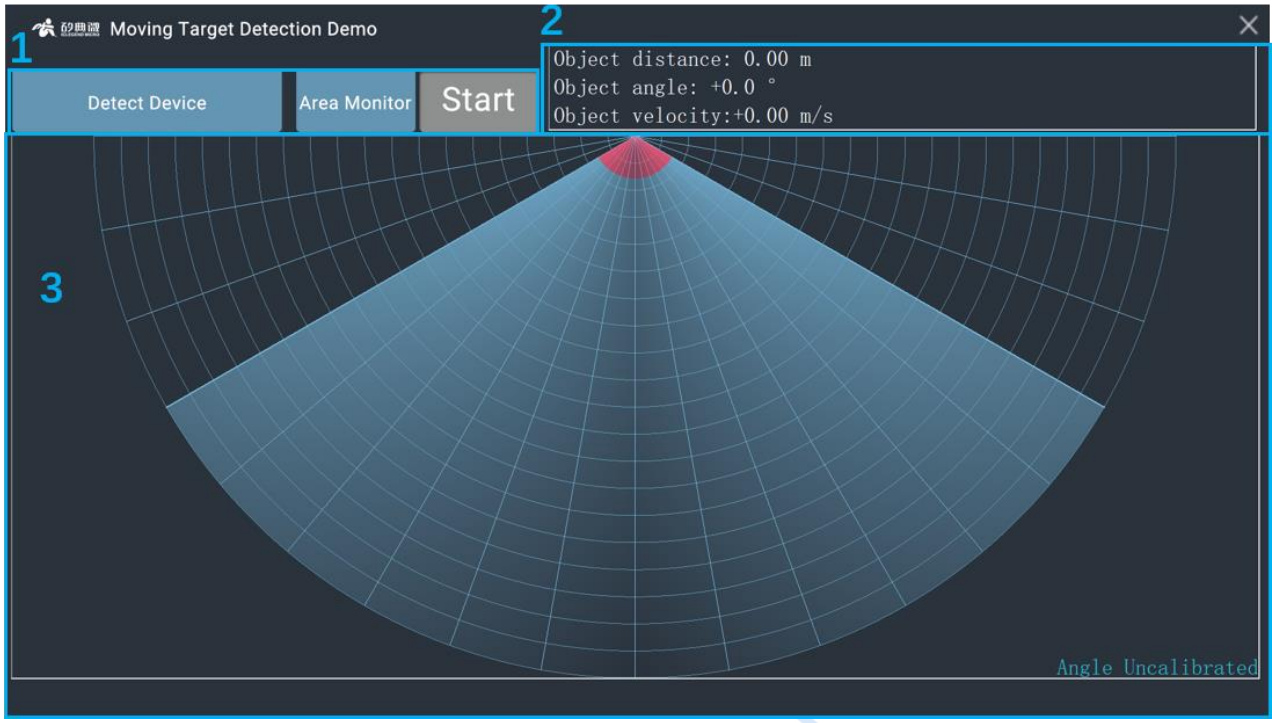


Figure 4-4 Moving Target Detection demonstration GUI

As shown in Figure 4-4, Moving Target Detection GUI can be partitioned into 3 zones, they are Operation Zone (1), Results Display Zone (2) and Position Display Zone (3). Functions of each zone are explained in Table 4-2.

Table 4-2 Moving Target Detection GUI Description

Zone	Function
Operation Zone	Detect Device, Area Monitor, Start or Stop detecting
Results Display Zone	Display range and angle values
Position Display Zone	Display moving target's position in detection range

Functions of the buttons in Operation Zone are explained in detail as follows:

Detect Device: click this button to detect whether EVBKS5 is connected to host PC; if the connection is failed, a notice window writing *No device detected!* will pop out;

Area Monitor: for setting up a monitor area, and when a target enters this area the color of this area on the GUI will change;

Start(/Stop): click this button to start (or stop) receiving data from the radar and display the target's position in detection range in real time.

4.5 Start and Run

4.5.1 Human Presence Detection Demonstration

Steps for running Human Presence Detection Demonstration are as follows:

1. Connect EVBKS5 evaluation board to a host PC with USB Type-C cable;

2. Program *EVBKS5_BodySensing* firmware into EVBKS5 evaluation board using corresponding programming tool;

3. Double click "*EVBKS5 Waveform Configuration and Demonstration GUI.exe*" to start the program, click *Demo* in *Main Menu Bar*, choose "*Human Presence Detection*" in the drop box, and Human Presence Detection demonstration GUI will pop up;

4. Click "*Refresh*" button to obtain the COM port number of EVBKS5 evaluation board;

5. Click "*Start*" button, the host PC will display the detected target's detailed information, as well as the energy value of each range gate (moving or motionless). Till now, the demonstration program is all set for normal working.

As shown in Figure 4-5, when EVBKS5 detects a human target, GUI zone4 will display detailed target information, including range and energy; meanwhile, zone5 will display the threshold value (green curve) and energy value (red curve) at each range gate. When energy value exceeds the threshold, it means a human body is found at this range gate.

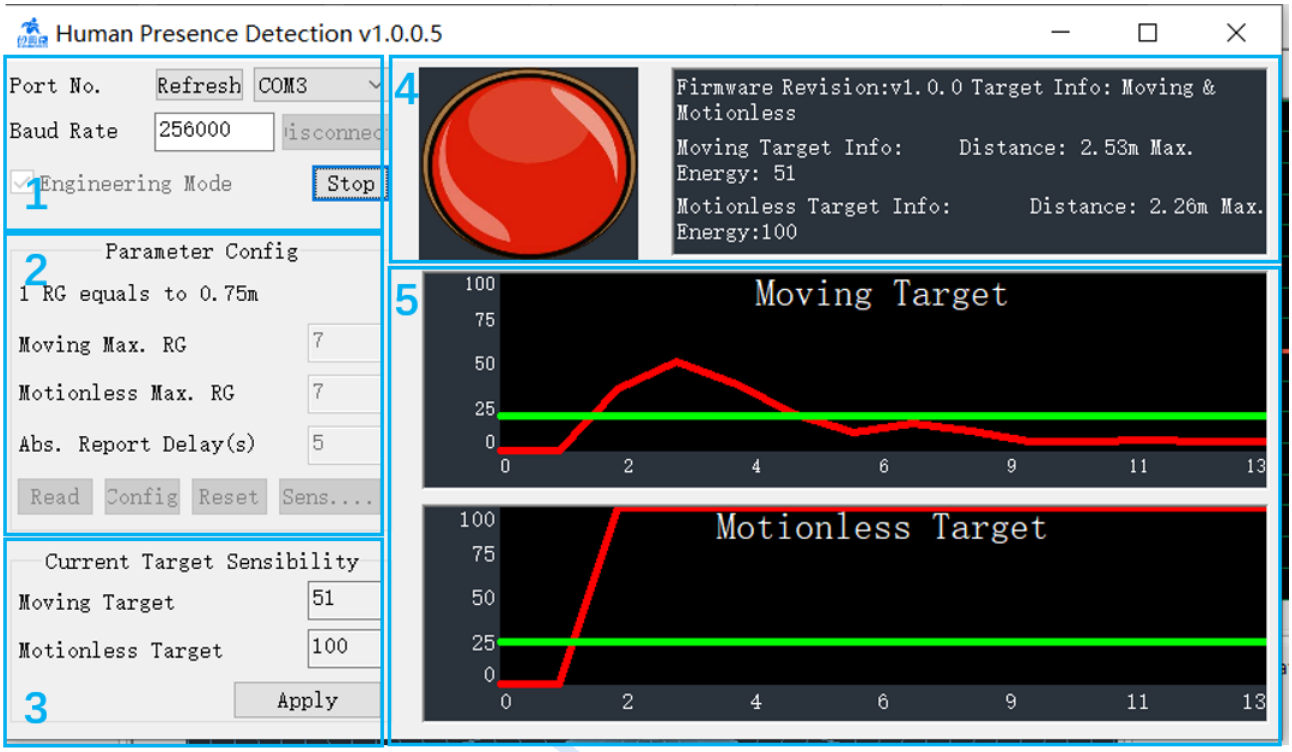


Figure 4-5 Human Presence Detection demonstration GUI when running

4.5.2 Moving Target Detection Demonstration

Steps for running Moving Target Detection Demonstration are as follows:

1. Connect EVBKS5 evaluation board to a host PC with USB Type-C cable;

2. Program *EVBKS5_MotionDetect* firmware into EVBKS5 evaluation board using corresponding programming tool;

3. Double click "*EVBKS5 Waveform Configuration and Demonstration GUI.exe*" to start the program; Click Detect Device button, the host PC will connect to EVBKS5 board via USB port;

4. Click *"Start"* button, the host PC starts receiving distance and angle information from EVBKS5 board, and presents target as a dot (as shown in Figure 4-6) in the fan-shaped area in demonstration GUI; meanwhile, the "*Start"* button turns to "*Stop"*;

5. Click *"Stop"* button, the host PC stops receiving data from EVBKS5 evaluation board.

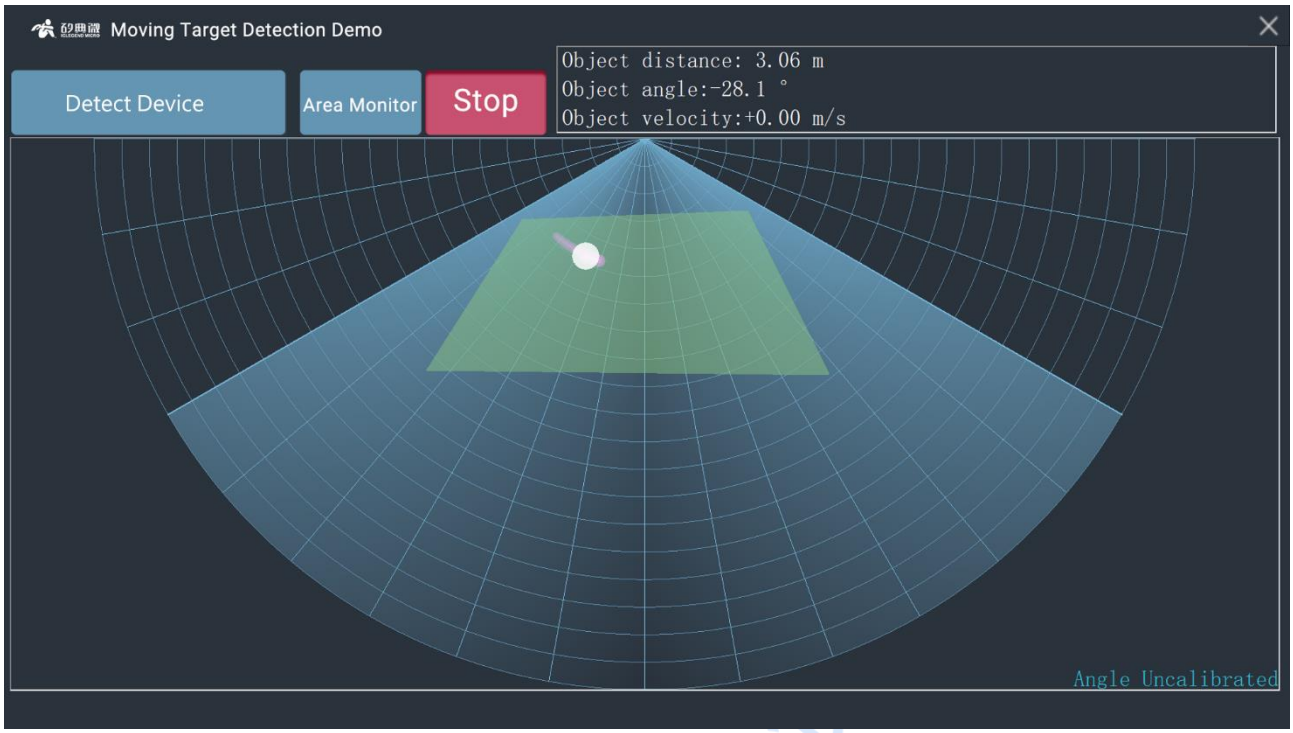


Figure 4-6 Moving Target Detection demonstration GUI when running

5 Customized Firmware and Algorithm Development Guide

EVBKS5 evaluation board provides a data transmission firmware: *EVBKS5_USBHS_datatransfer*. This firmware can help users to configure their self-defined transmit waveform and transfer radar sensor data to the host PC. Users can easily develop customized algorithms based on this platform.

5.1 Data Transmission Firmware

Directory structure of EVBKS5_USBHS_datatransfer firmware is presented in Figure 5-1.

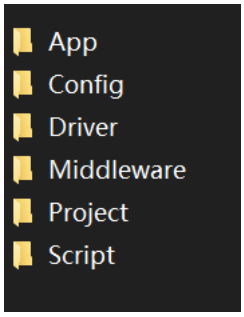


Figure 5-1 Directory structure of EVBKS5_USBHS_datatransfer firmware

App: application folder, execute application level functions, including receiving data, parsing data, implementing algorithms

Config: configuration folder for configuring S5KM312CL's function

Driver: official drivers' folder, for MCU platform and peripherals

Middleware: middleware folder, for conveniently expanding to different platforms

Project: project engineering directory

Script: script folder

5.2 Radar Waveform Configuration

Users should configure radar sensor signal and waveform before developing customized firmware and algorithms. For detailed configuration method please refer to UM < *UM10012N_EVBKS5 Wave Configuration and Demonstration GUI* >Section 2.3.1 *"Signal Configuration"* and 2.3.2 *"Waveform Configuration". UM10012N can be directly found under EVBKS5 GUI's "HELP" drop box.*

5.3 Radar Data Format Configuration

EVBKS5 evaluation kit supports multiple data types such as 1DFFT, and 2DFFT. For detailed configuration method please refer to UM < *UM10012N_EVBKS5 Wave Configuration and Demonstration GUI Rev.1.0.0.0* > Section 2.3.3 *"Data Output Configuration".* 1DFFT and 2DFFT Data frame formats are illustrated in Figure 5-2 and Figure 5-3.

Header [Dword 0]	'b 1010 1010	[23:22][2]	'b 11	FFT_chirp_index[19:11] [3]	'b 00	CFG_FFT_TX_MAX[8:0] [4]
Data [Dword 1]	FFT real data 0 [31:16]			FFT Imaginary data 0 [15:0]		
Data [Dword 2]	FFT real data 1 [31:16]			FFT Imaginary data 2 [15:0]		
Data [Dword ...]	FFT real data ... [31:16]			FFT Imaginary data ... [15:0]		
Data [Dword m]	FFT real data m-1 [31:16]			FFT Imaginary data m-1 [15:0]		
Tail [Dword (m+1)]	Check_sum [31:16] [5]			[15:14] [6]	'b 11	FFT_chirp_index[11:8] [7]	'b 0101 0101

Note:

[1] MOSI[x]: MOSI[0] and MOSI[1] share the same data format, x can be 0 or 1.

[2] [23:22]: value is 'b00 if MOSI[0], value is 'b01 if MOSI[1]

[3] FFT_chirp_index[8:0]: the chirp sequence number in one frame, start from "0" in each frame.

[4] CFG_FFT_TX_MAX[8:0]: the number of m (the total FFT transferred points) +1 in this chirp

[5] Check_sum[15:0]: sum of all data in this frame, and equals to the value of low 16bits sum result.

[6] [15:14]: value is 'b00 if MOSI[0], value is 'b01 if MOSI[1]

[7] FFT_chirp_index[3:0]: the chirp sequence number in one frame, it equals to FFT_chirp_index[8:0]'s low 4bits value.

Figure 5-2 1DFFT data frame format

Header [Dword 0]	'b 1010 1010	[23:22][2]	'b 11	'b 1111	DPL_frame_cnt [15:0] [3]
Data [Dword 1]	DFFT real data 0 [31:16]				DFFT imaginary data 0 [15:0]
Data [Dword 2]	DFFT real data 1 [31:16]				DFFT imaginary data 1 [15:0]
Data [Dword ...]	DFFT real data ... [31:16]				DFFT imaginary data ... [15:0]
Data [Dword 1024]	DFFT real data 1023 [31:16]				DFFT imaginary data 1023 [15:0]
Tail [Dword 1025]	Check_sum [31:16] [4]				'b 0101 0101 0101 0101

Note:

[1] MOSI[x]: MOSI[0] and MOSI[1] share the same data format, x can be 0 or 1.

[2] [23:22]: value is 'b10 if MOSI[0], value is 'b11 if MOSI[1]

[3] DPL_frame_cnt: Doppler frame sequence number, start from 0, cycling between 0 and 0xFFFF.

[4] Check_sum: sum of DFFT data in this frame, and equals to the value of low 16bits sum result.

Figure 5-3 2DFFT data frame format

5.4 Register Configuration

After setting up radar's waveform parameters, *EVBKS5 Waveform Configuration and Demonstration GUI* will generate register information for S5KM312CL. Users can access register information (as shown in the blue box in Figure 5-4) by clicking *File*, *Configuration Overview* in turn.

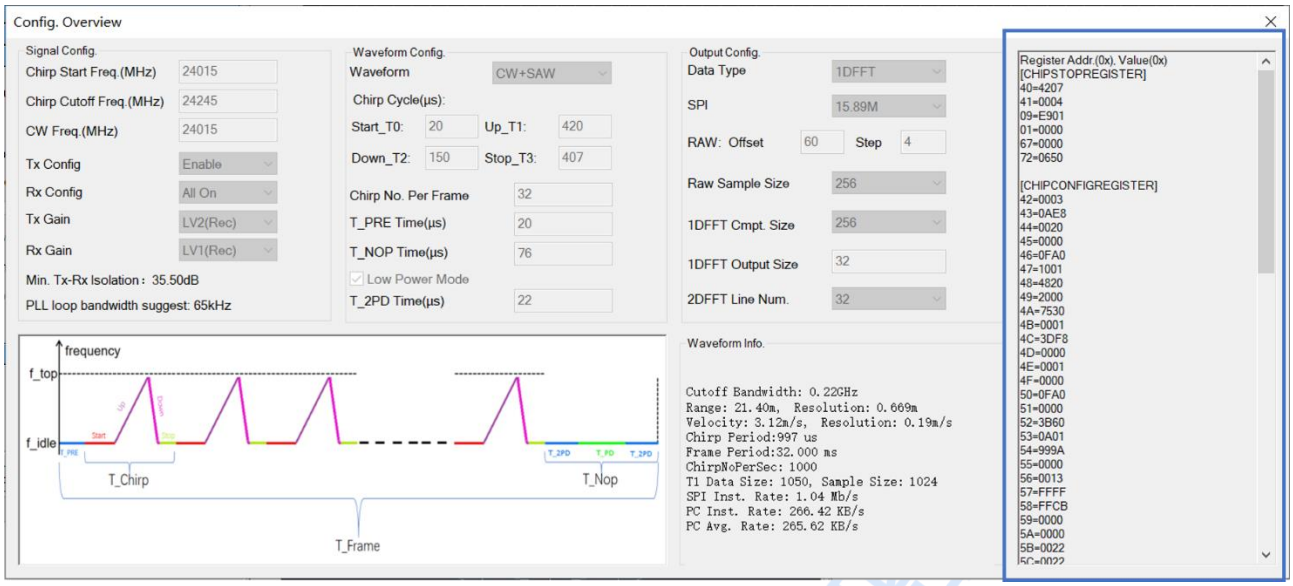


Figure 5-4 EVBKS5 Register Information

After the register information (such as 40=4207) is generated, users need to copy it to firmware file ..*Config**radarPara**EVBKS5.txt*, to replace original default settings. Please be aware that the data format must be the same as the original one.

5.5 Algorithm Interface

"EVBKS5_USBHS_datatransfer" firmware reserves a specified API for users to develop and verify their own algorithms.

Development process:

- Comment OFF the macro sentence in file <*global_conf.h*>: *SUPPORT_DATA_PASSTHROUGH*
- Users can program customized algorithm in function interface *"StartAlgorithm"* in file <*dataprocess.c*>. The customized algorithm interface parameter setting should be in accordance with those of function interface "*StartAlgorithm"*.

```
void StartAlgorithm(uint8_t* dataBuf, uint16_t dataLen, uint8_t channel, uint16_t index)
{
    /*do algo here*/
}
```

Figure 5-5 Algorithm function interface

Parameter definition:

dataBuf: pointer of radar sensor data buffer

dataLen: length of radar sensor data

channel: channel of received radar sensor data

index: Chirp index of radar sensor chirp

5.6 Execution and Result Output

Users need to define data output type in compiling software. After successfully compiling, users can program it into MCU and run the software.

EVBKS5 evaluation kit reserves three types of output interface for reporting results, they are UART, USB, and GPIO. Users can add or modify codes for data output to determine which interface is preferred for reporting results.

6 IAP Function

EVBKS5 enables users to update firmware through IAP function.

6.1 Flash Allocation

EVBKS5 applies STM32F429VET6 MCU whose flash size is 512KB. Details of flash address allocation for IAP function are shown in Table 6-1.

Table 6-1 EVBKS5 flash address allocation

Start Address	End Address	Size	Function
0x0800 0000	0x0800 BFFF	48K Bytes	Bootloader program
0x0800 C000	0x0800 FFFF	16K Bytes	Store application partition and update information etc.
0x0801 0000	0x0801 FFFF	64K Bytes	Store application's configuration
0x0802 0000	0x0803 FFFF	128K Bytes	Application 0
0x0804 0000	0x0805 FFFF	128K Bytes	Application 1
0x0806 0000	0x0807 FFFF	128K Bytes	Store application's configuration

6.2 Bootloader Firmware and APP Firmware

To use EVBKS5 IAP function, users should first program bootloader firmware into the board. Then users can update APP firmware through bootloader.

EVBKS5 provides one set of bootloader firmware and three sets of APP firmware, they are listed below.

Bootloader firmware: EVBKS5_IAP.

APP firmware: EVBKS5_BodySensing，EVBKS5_MotionDetect，EVBKS5_USBHS_datatransfe

Any one of the APP firmware, after compiling, will generate two image files that are defined to run at different flash address. Take *EVBKS5_BodySensing* as an example, when opening its project directory in the embedded compiling tool users can find two projects that called APP0 and APP1. These two projects are identical, the only difference between them is that they are supposed to run at different flash address. When building the project, users MUST CHOOSE "*Rebuild all target files*"so that both APP projects can be compiled and their bin files can be found under firmware's Objects directory, as shown in Figure 6-1. These two bin files are two image files that are used for updating EVBKS5 board.

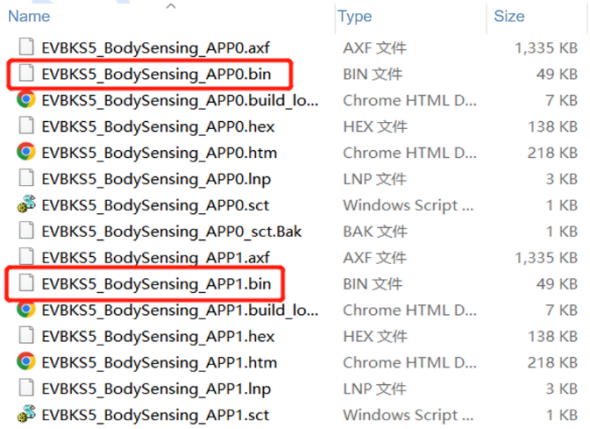


Figure 6-1 Example of image bin files

6.3 Download bin File on Host PC

First of all, make sure that EVBKS5 has programmed the bootloader program. Then connect the board to a host PC. Start *EVBKS5 Wave Configuration and Demonstration GUI*, click *Device*, choose *Update Firmware* option, and *Update Firmware* interface will pop up.

Click *Refresh Device* to obtain COM port number, and choose the correct port number in the drop box, as shown in Figure 6-2.

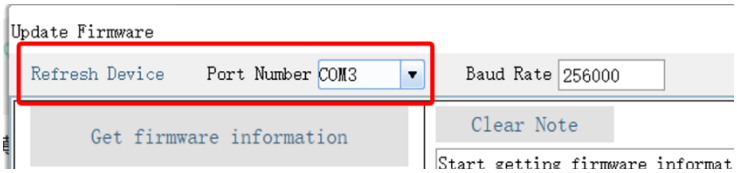


Figure 6-2 Obtain port number on Update Firmware interface

Click *Get firmware information* button, then GUI will display the firmware that is running in MCU and the device ID, as shown in Figure 6-3.

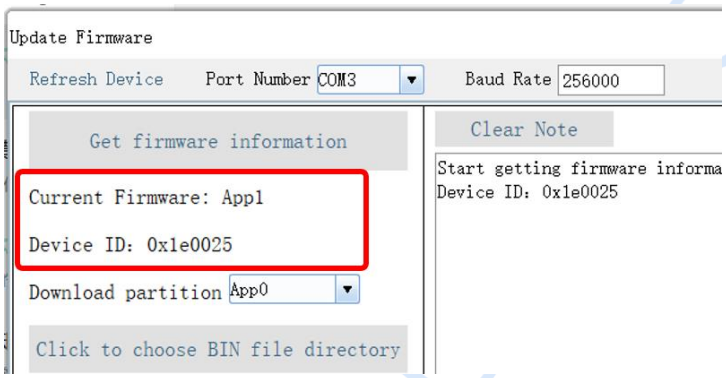


Figure 6-3 Obtain firmware information

If the running firmware is bootloader, then users can download either APP0 or APP1 on this interface.

If the running firmware is an APP, then users can only be allowed to download the APP that is running in another flash partition.

The rules for firmware downloading on *Update Firmware* interface are listed in Table 6-2.

Table 6-2 Rules for updating firmware for EVBKS5 via IAP

Running firmware	Updatable firmware
Boot Loader	APP0/APP1
APP0	APP1
APP1	APP0

For updating firmware, first choose the download partition, then click *Click to choose BIN file directory* button to load the bin file, and click *Download* button to start downloading. When downloading is finished, the updated firmware will replace the original one and start running.

7 Abbreviation

ADC —— Analogue to Digital Conversion

DSP —— Digital Signal Processing

EIRP —— Equivalent Isotropic Radiated Power

FOV —— Field of View

ESD —— Electro Static Discharge

8 Reference

1. S5KM312C Datasheet V1.03——Datasheet[2]

9 Revision History

Revision	Date	Modification
0.9	2022/3/21	Initial release.
1.0	2022/7/25	Update chip schematics; Add IAP function description.

[2] Please contact ICLM sales department to get this document.

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