HOPERF

AN191

CMT2380F64-EB Evaluation Board User Guide

Overview

This document mainly introduces the operation of two factory defaulted evaluation board, that is CMT2380F64-QFN40-Eb and CMT2380F64-QFN48-EB (hereinafter referred to as CMT2380F64-EB). The evaluation platform is designed specifically for users to evaluate the performance of CMT2380F64. As the controller kernel of CMT2380F64 is a CM0 level single chip. This evaluation board can be regarded as its development board for various functions of CMT2380F64 such as debugging, verification and testing.

The product models covered in this document are shown in the table below.

Table 1. Product Models Covered in This Document

Product Model	Frequency Range	Modulation Method	Chip Function	Configuration Method	Package
CMT2380F64-EQR	127 – 1020 MHz	(G)FSK	Integrated high-performance RF transceiver sigle chip	SoC	QFN40
CMT2380F64-EQR	127 – 1020 MHz	(G)FSK	Integrated high-performance RF transceiver sigle chip	SoC	QFN48

Remark:

1. Users are recommended to read the relavant document of CMT2300A in advance for the RF kernel of CMT2380F64 is adopted from CMT2300A.

Table of Contents

1 Hardware Platform

CMT2380F64 comes in two packages, QFN40 and QFN48, which respecttively correspond to two evaluation board: CMT2380F64-EB and CMT2380F64-QFN48-EB. As CMT2380F64 is an integrated transceiver, so the two evaluation board itself owns the character of development board. The following shows introduction to the two evaluation boards.

1.1 CMT2380F64-EB Introduction

Top view and introduction of the CMT2380F64-EB is shown in the following figure.

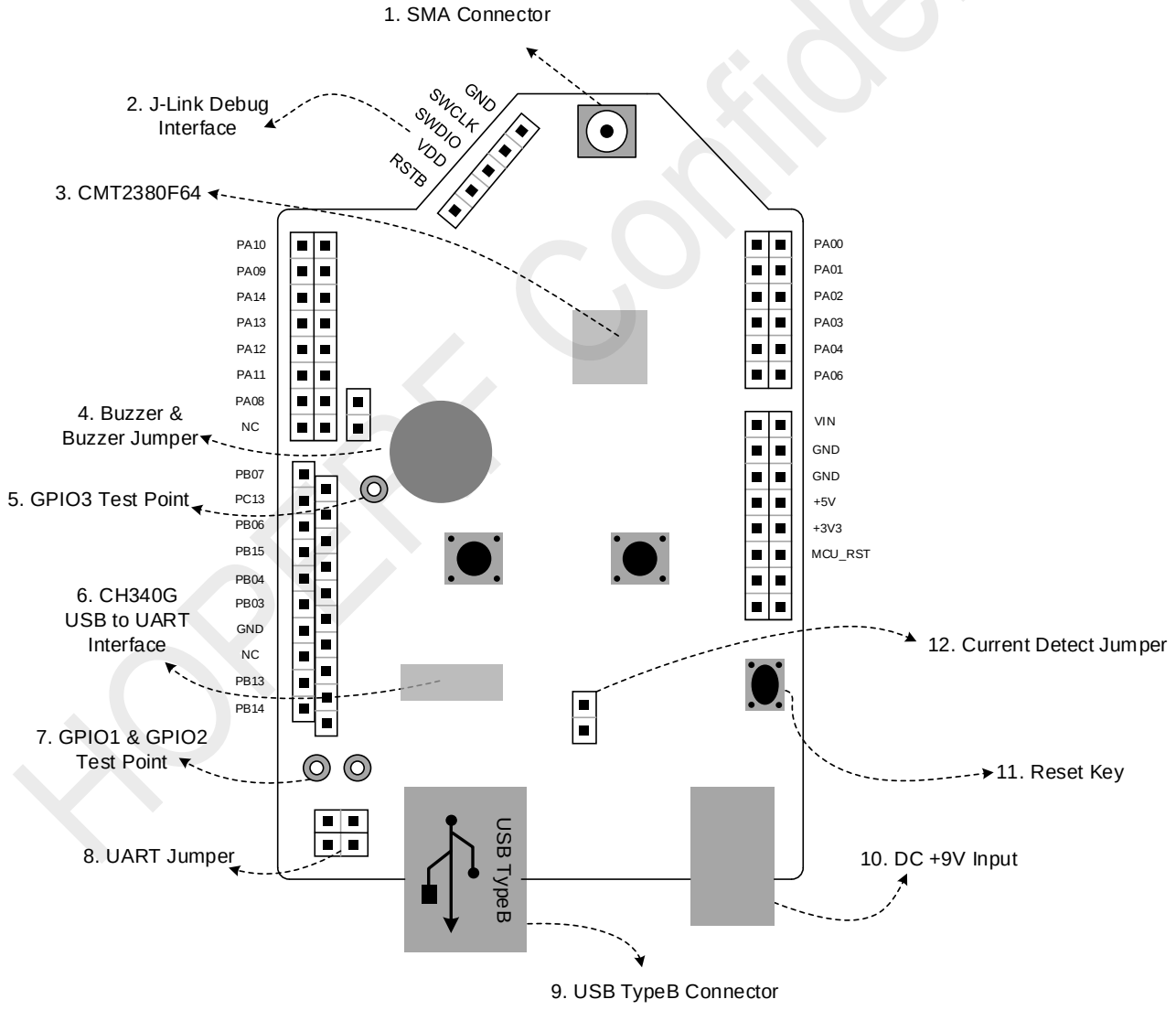

Figure 1-1. CMT2380F64-EB Top View

Table 1-1. CMT2380F64-EB Description

Number	Function	Description
1	SMA Connector	CMT2380F64 connects to the antenna or test machine through the SMA interface after matching complete.
2	J-link Debug Interface	J-link debug interface（SWD）
3	CMT2380F64	CMT2380F64-EQR chip
4	Buzzer & Buzzer Jumper	Board buzzer and the control port jumper
5	GPIO3 Test Point	Test point of CMT2380F64 RF part，GPIO3 on board is connected to PC13.
6	CH340G USB to UART Interface	CH340G USB to the chip interface of UART
7	GPIO1 & GPIO2 Test Point	Test point of CMT2380F64 RF part，GPIO1 is connected to PB14 and GPIO2 is connected to PB13.
8	UART Jumper	CH340G chip jumper that connects to the MCU serial port（PA09、PA10）.
9	USB TypeB Connector	USB interface，TypeB
10	DC +9V Input	Input interface of 9V direct current
11	Reset Key	Reset key of evaluation board
12	Current Detect Jumper	The power consumption of each working state of CMT2380F64 can be carried out by the current test jumper.

Note: For more detail information, please refer to the CMT2380F64-EB schematic diagram.

Table 1-2. CMT2380F64-EB Pin Function

Pin Name	CMT2380F64-EB	LCD Shiled[1]	Pin Name	CMT2380F64-EB	LCD Shiled
PA10	UART_RxD		PA00	PA00	LCD_SDIO
PA09	UART_TxD		PA01	PA01	LCD_RS
PA14	SWD_SLCK	LCD_LED	PA02	PA02	LCD_CS
PA13	SWD_SDIO		PA03	PA03	LCD_SCK
PA12	KEY2	KEY2	PA04	PA04	LCD_ROM_CS
PA11	KEY1	KEY1	PA06	PA06	LCD_ROM_SDIO
PA08	BUZZER		VIN		
NC	--		GND		
PB07	RF_FCSB		GND		
PC13	RF_GPIO3		+5V		
PB06	RF_CSB		+3V3		
PB15	RF_SDIO[2]		MCU_RESET		
PB04	RF_SDIO		NC		
PB03	RF_SCK		NC		
GND			PC14	32768Hz crystal	
NC	--	LCD_RESET	PC15	32768Hz crystal	
PB13	RF_GPIO2	KEY3			
PB14	RF_GPIO1	KEY4			

Note：

[1]. LCD Shiled is a lattice screen shiled with size of 128x64 that can be plugged into the CMT2380F64-EB；It is a screen with 4 buttons and it can be used as function of human-computer interaction input and display. For the LCD_RESET pin of the shield board is corresponded to the NC pin of CMT2380F64-EB, the LCD_RESET pin of the LCD shield cannot be controlled. In order to effectively reset LCD screen after the LCD shield is powered on, a 100nF capacitor is needed to be connected to the LCD_RESET pin of the LCD shield.

[2].The RF core is from CMT2300A, and its control bus is 3-wire SPI. In general, the analog 3-wire SPI timing sequence is adopted and the SPI speed is not fast enough. To increase the SPI speed, 4-wire SPI delivered with the controller can be connected to the RF 3-wire SPI. In this case, both of MOSI and MISO of the controller need to be connected to the RF_SDIO together. Considering the conflict between the two ports, a 1K resistance is connected in series between PB15 and PB04/RF_SDIO on board.

1.2 CMT2380F64-QFN48-EB Introduction

Below shows top view and introduction of CMT2380F64-QFN48-EB.

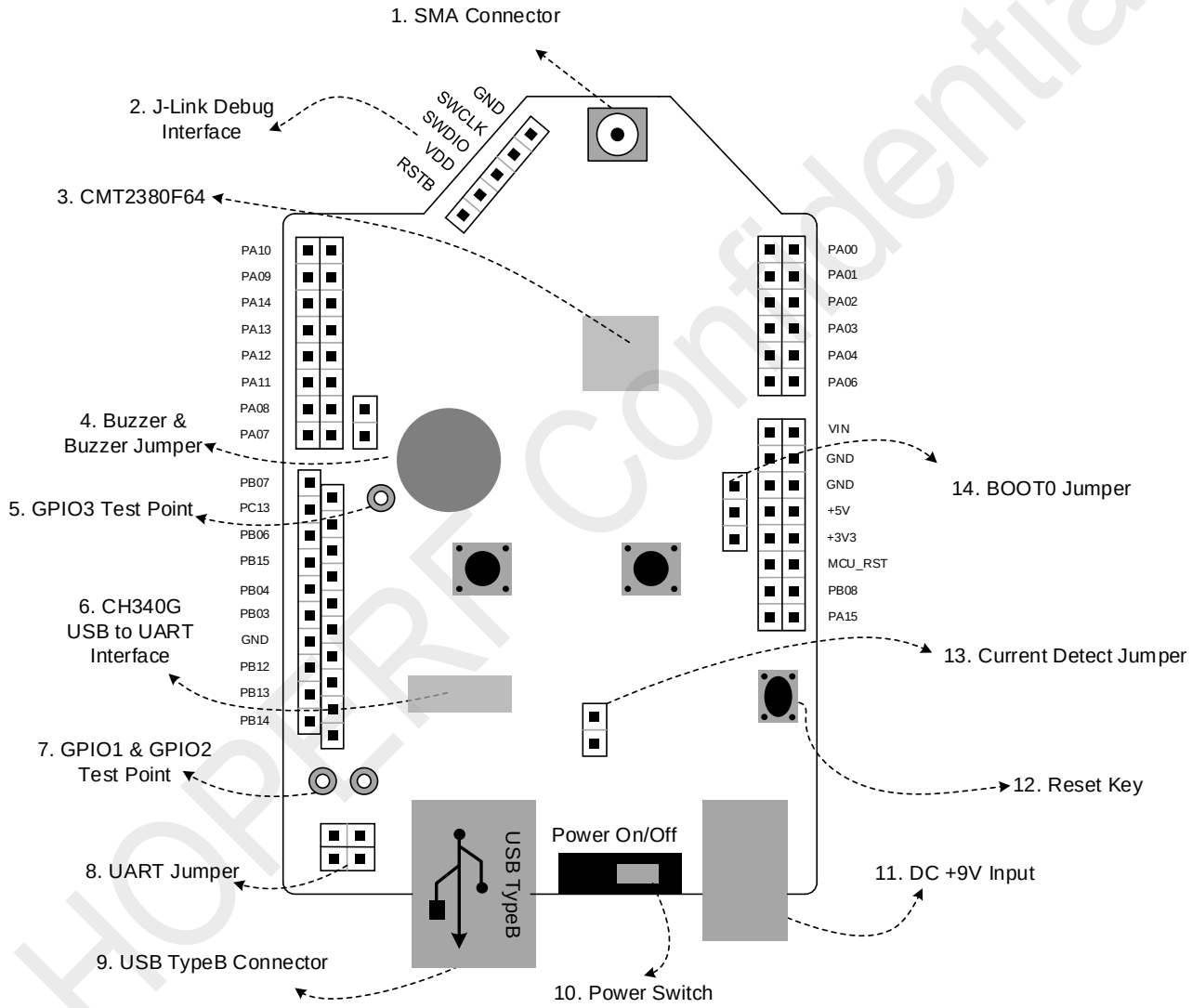

Figure 1-2. CMT2380F64-QFN48-EB Top View

Note: For more information, please refer to the schematic diagram of CMT2380F64-QFN48-EB.

Table 1-3. CMT2380F64-QFN48-EB Description

Number	Function	Description
1	SMA Connector	CMT2380F64 connects to the antenna or test machine through the SMA interface after matching complete.
2	J-link Debug Interface	J-link debug interface（SWD）
3	CMT2380F64	CMT2380F64-EQR chip
4	Buzzer & Buzzer Jumper	Board buzzer and the control port jumper
5	GPIO3 Test Point	Test point of CMT2380F64 RF part，GPIO3 on board is connected to PC13.
6	CH340G USB to UART Interface	CH340G USB to the chip interface of UART
7	GPIO1 & GPIO2 Test Point	Test point of CMT2380F64 RF part，GPIO1 is connected to PB14 and GPIO2 is connected to PB13.
8	UART Jumper	CH340G chip jumper that connects to the MCU serial port（PA09、PA10）.
9	USB TypeB Connector	USB interface，TypeB
10	Power Switch	Power switch（switch the power supply or direct current supply）
11	DC +9V Input	Input interface of 9V direct current
12	Reset Key	Reset key of evaluation board
13	Current Detect Jumper	The power consumption of each working state of CMT2380F64 can be carried out by the current test jumper.
14	BOOT0 Jumper	Controller BOOT0 jumper selection

Table 1-4. CMT2380F64-QFN48-EB Controller Pin Function

Pin Name	QFN48-EB	LCD Shiled[1]	Pin Name	QFN48-EB	LCD Shiled
PA10	UART_RxD		PA00	PA00	LCD_SDIO
PA09	UART_TxD		PA01	PA01	LCD_RS
PA14	SWD_SLCK	LCD_LED	PA02	PA02	LCD_CS
PA13	SWD_SDIO		PA03	PA03	LCD_SCK
PA12	KEY2	KEY2	PA04	PA04	LCD_ROM_CS
PA11	KEY1	KEY1	PA06	PA06	LCD_ROM_SDIO
PA08	BUZZER		VIN		
PA07	PA07		GND		
PB07	RF_FCSB		GND		
PC13	RF_GPIO3		+5V		
PB06	RF_CSB		+3V3		
PB15	RF_SDIO[2]		MCU_RESET		
PB04	RF_SDIO		PB08	PB08	
PB03	RF_SCK		PA15	PA15	
GND			PC14	32768Hz crystal	
PB12	PB12	LCD_RESET	PC15	32768Hz crystal	
PB13	RF_GPIO2	KEY3	PF00	12MHz crystal	
PB14	RF_GPIO1	KEY4	PF01	12MHz crystal	

Note：

[1]. LCD Shiled is a lattice screen shiled with size of 128x64 that can be plugged into the CMT2380F64-EB；It is a screen with 4 buttons and it can be used as function of human-computer interaction input and display. For the LCD_RESET pin of the shield board is corresponded to the PB12 pin of CMT2380F64-QFN48-EB, the LCD screen can be effectively reset by PB12.

[2].The RF core is from CMT2300A, and its control bus is 3-wire SPI. In general, the analog 3-wire SPI timing

sequence is adopted and the SPI speed is not fast enough. To increase the SPI speed, 4-wire SPI delivered with the controller can be connected to the RF 3-wire SPI. In this case, both of MOSI and MISO of the controller need to be connected to the RF_SDIO together. Considering the conflict between the two ports, a 1K resistance is connected in series between PB15 and PB04/RF_SDIO on board.

1.3 LCD Shiled Introduction

Below shows top view and introduction of LCD Shiled.

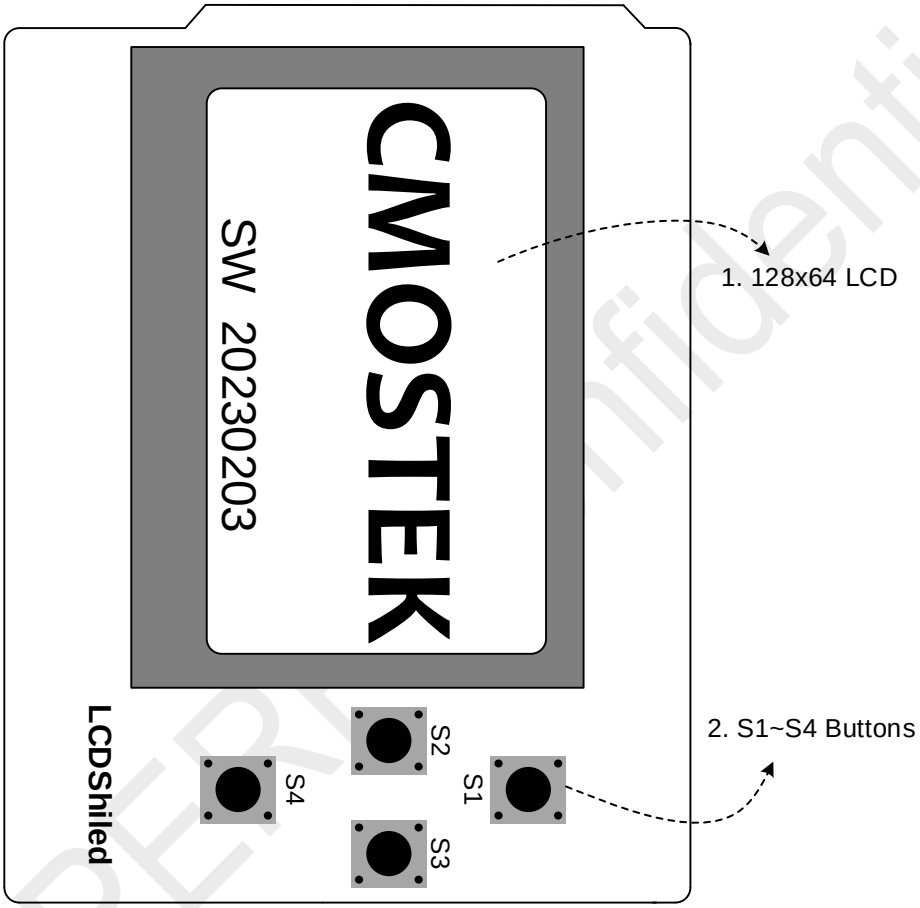

Figure 1-3. LCD Shiled Top View

Table 1-4. LCD Shiled Description

No.	Function	Remark
1	128x64 LCD screen	
2	S1~S4 Button	

2 Introduction for Parameter Setting

A firmware will be pre-burned around the chip before delivery for multiple functional test and evaluation (it needs to be used together with LCD shield display) for CMT2380F64-EB or CMT2380F64-QFN48-EB. This firmware will be updated from time to time as functional changes, it can be downloaded from the official website of HOPE and it will be updated through J-Flash software from J-link debugger (the updated firmware is described in detail in Chapter 4 of this article). In this chapter, parameter setting menu of the factory firmware will be introduced in detail.

2.1 Startup Interface

- The startup interface is show in Fig. 2-1.

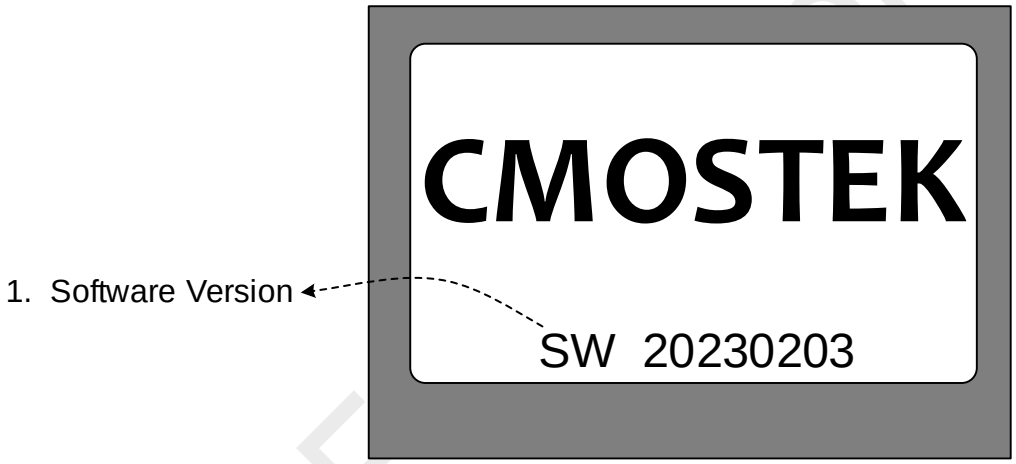

Figure 2-1. Startup Interface

No.	Function	Description
1	Software Version	Factory firmware（CMT2380F64 burning software）version information, as shown in the above figure, it indicates that the current operation version is: 20230203

- The startup interface of RF indentified failed is shown as Fig 2-2 (chip abnormal)

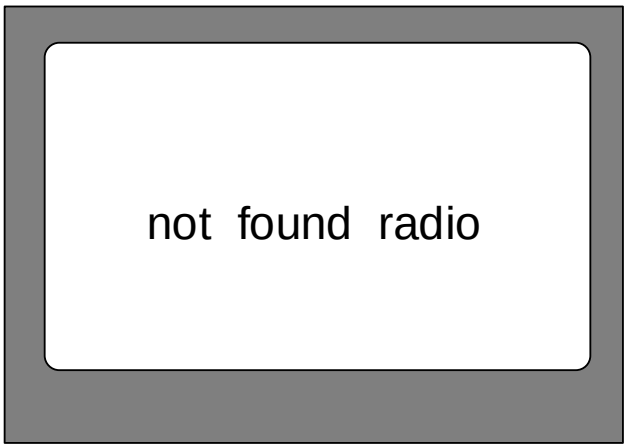

Figure 2-2. Startup Interface as RF Identification Failed

2.2 Main Menu Interface

The main menu interface will pop up 1 second after the startup interface, as shown in Figure 2-3.

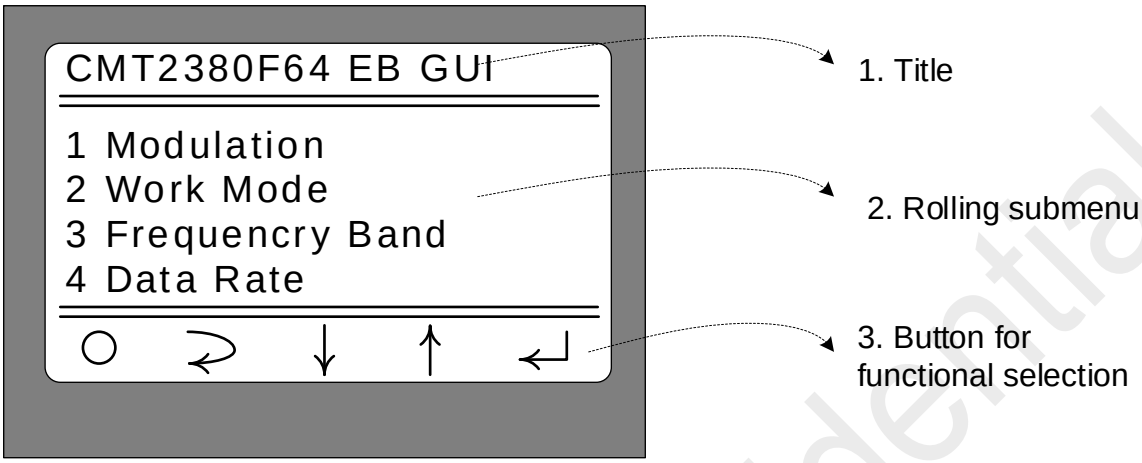

Figure 2-3. Main Menu Interface

No.	Function	Description
1	Title	CMT2380F64 EB GUI
2	Rolling submenu	15 submenu selections are shown in the area： 1. Modulation（Modulation and demodulation mode selection） 2. Work Mode（Working mode selection） 3. Frequencry Band（Frequency band selection） 4. Data Rate（Rate/frequency offset parameter selection） 5. Tx Output Power（Transmission power selection） 6. Preamble Length（Preamble length selection） 7. Packet Length（Packet length selection） 8. Coding Format（Coding format selection） 9. CRC Select（CRC verification mode selection） 10. Freq Space（Frequency offset interval setting） 11. Freq Channel（Frequency channel signal setting） 12. Gaussian Select（Gaussian mode selection） 13. Test Counter（Test counter for packet TX） 14. Payload Content（Method for payload content） 15. AFC Select（Switch Selection for AFC）
3	Button for functional selection	The positions of S1 - S4 are corresponding to 5 signals. ○：It is corresponding to S2（left button），indicating that the firmware will enter into working state as parameters/modes set by the above menus with short press； ➲：with no option； ↓：It is corresponding to S4（down button），indicating that the firmware will enter the next selection with short press； ↑：It is corresponding to S1（up button），indicating that the firmware will enter the above selection with short press； ↵：It is corresponding to S3（right button），indicating that the firmware will enter the current selection with short press；

Operation of the main menu interface：

1. Select the required modified submenu by short press the S4（↓）and S1（↑）, the selected submenu will flash accordingly.
2. Select the submenu respectively to set the corrsponding parameters by short press S3（↵）.
3. Enter into the corresponding working mode according to the setting by short press S2（○）.

2.3 Modulation Submenu

Select submenu“1 Modulation”and press S3 button will enter into the interface shown as followed.

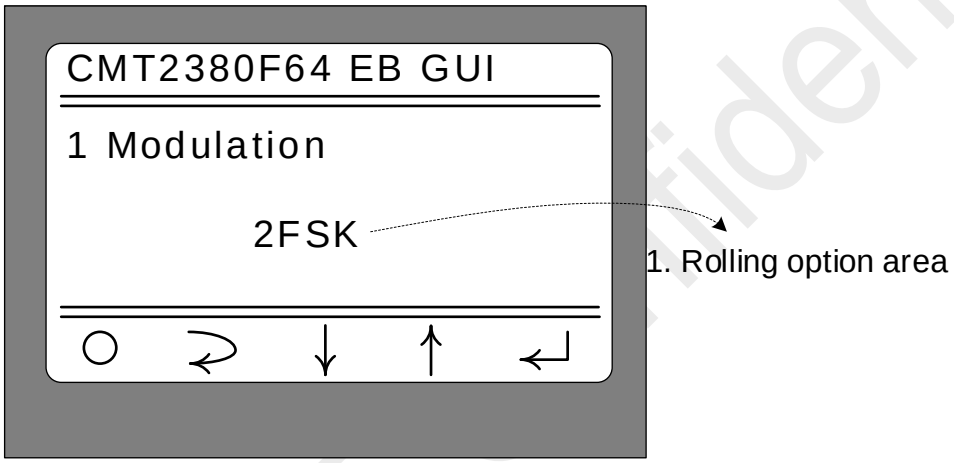

Figure 2-4. Modulation Submenu Interface

No.	Function	Description
1	Rolling option area	3 modulation and demodulation modes can be selected by short pressing S1 or S4. • OOK • 2FSK After selecting the corresponding modulation and demodulation modes, press S2 or S3 to confirm the selection and return to the upper menu (i.e. the main menu).

2.4 Work Mode Submenu

Select submenu “2 Work Mode”and press S3 button will enter into the interface shown as followed.

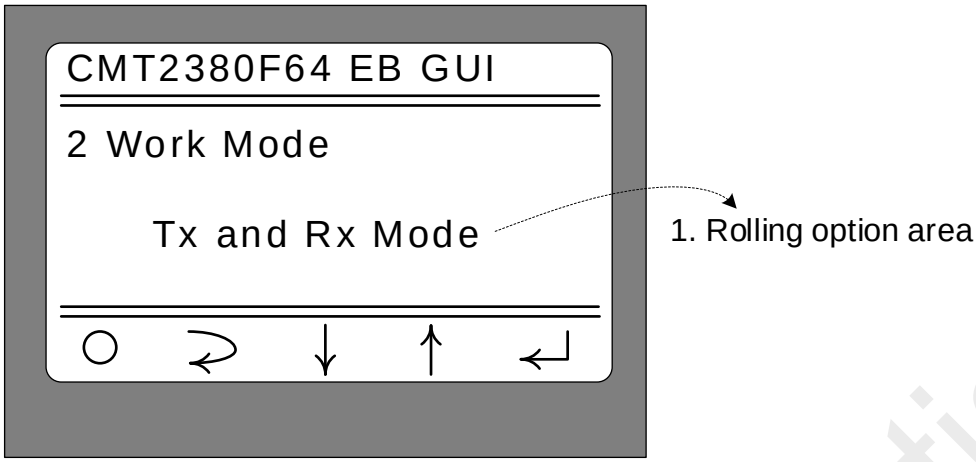

Figure 2-5. Work Mode Submenu Interface

No.	Function	Description
1	Rolling option area	6 working modes can be selected by short pressing S1 or S4 ; • Sleep（only the RF part enters into sleep mode and the controller still at working mode, supporting interface operation） • CW Tx（enter into CW Tx mode） • Direct Rx（enter into direct Rx mode） • Only Tx Mode（enter into only Tx mode, unidirectional mode） • Only Rx Mode（enter into only Rx mode, unidirectional mode） • Tx and Rx Mode（enter into Tx and Rx mode – bidirectional mode） After selecting the corresponding modulation mode,short press S2 or S5 to confirm the selection and return to the upper menu (i.e. the main menu).

Note: In main menu state, the working mode is entered by short pressing S2 (○) in accordance with the selected modes in sub-menu.

2.5 Frequencry Band Submenu

Select submenu “3 Frequencry Band” and press S3 button will enter into the interface shown as followed.

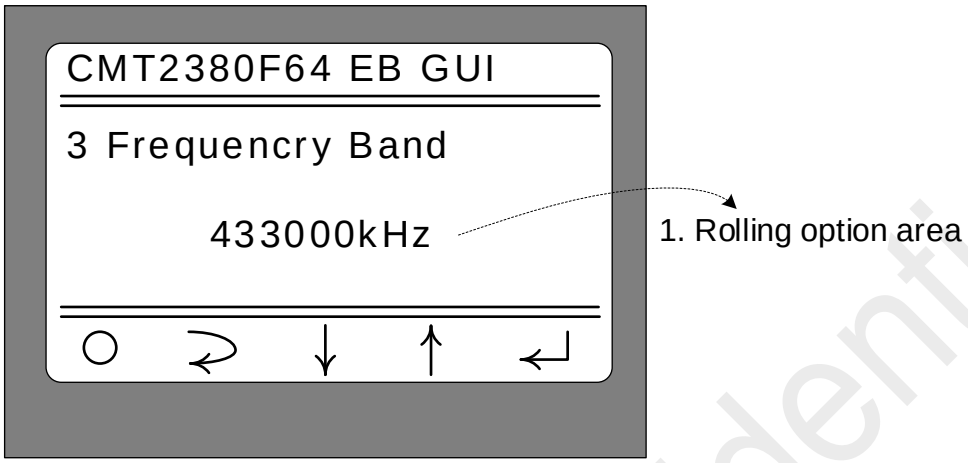

Figure 2-6. Frequencry Band Submenu Interface

No.	Function	Description
1	Rolling option area	The following 6 freqency band can be selected by short pressing S1 or S4: • 169000kHz（i.e. the start frequency is 169MHz） • 230000kHz （i.e. the start frequency is 230MHz） • 314000kHz （i.e. the start frequency is 314MHz） • 433000kHz （i.e. the start frequency is 433MHz） • 470000kHz （i.e. the start frequency is 470MHz） • 779000kHz （i.e. the start frequency is 779MHz） • 863000kHz （i.e. the start frequency is 863MHz） • 902000kHz （i.e. the start frequency is 902MHz） After selecting the corresponding modulation mode, press S2 or S3 to confirm the selection and return to the upper menu (i.e. the main menu).

Note: ThE submenu is selected as the start frequency, because frequency offset can be achieved through ferq. Space and freq. Channel. For more information, please see at the Freq.Space and Freq. Channel submenu section.

2.6 Data Rate Submenu

Select the *4 Data Rate* and press *S3* to enter the submenu, as shown in Figure 2-7.

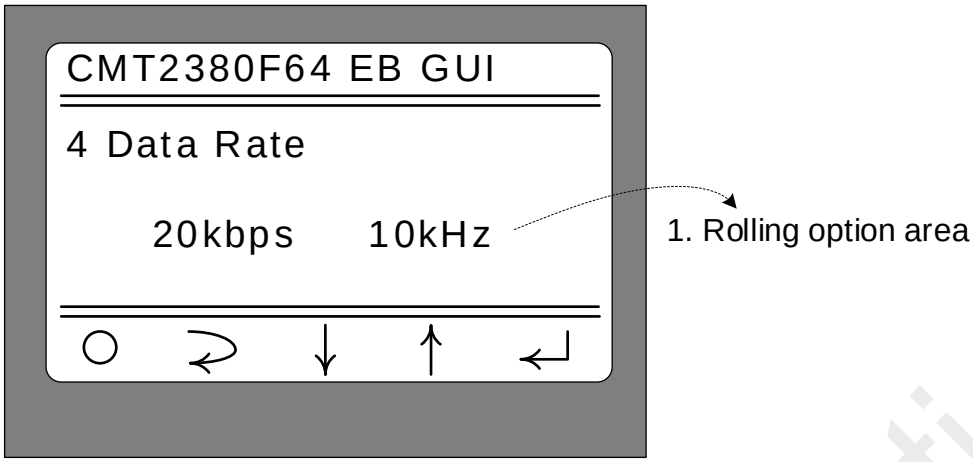

Figure 2-7. Data Rate Submenu Interface

No.	Function	Description
1	Rolling option area	Different data rate and frequency offset can combine differently according to different modulation modes by short pressing S1 or S4. ● OOK mode： – 2kbps – 5kbps – 10kbps – 20kbps – 40kbps ● 2FSK mode： – 2kbps, 10kHz（i.e. data rate is 2kbps，offset is +/-10kHz） – 10kbps, 10kHz – 20kbps, 20kHz – 50kbps, 25kHz – 100kbps, 50kHz – 200kbps, 100kHz – 300kbps, 100kHz After selecting the corresponding modulation mode, short press S2 or S3 to confirm the selection and return to the upper menu (i.e. the main menu).

Note：

1. The combined parameters of rate/frequency offset provided in each modulation and demodulation mode are basically corresponding to the test parameters in the CMT2380F64 data manual for the convenience of retest and confirm by users.

2. For the rate/frequency offset combination parameters provided in each modulation and demodulation mode, all the configuration parameters are derived from RFPDK, and the crystal deviation is set at 10ppm.

2.7 Tx Output Power Submenu

Select the *5 Tx Output Power* and press *S3* to enter the submenu, as shown in Figure 2-8.

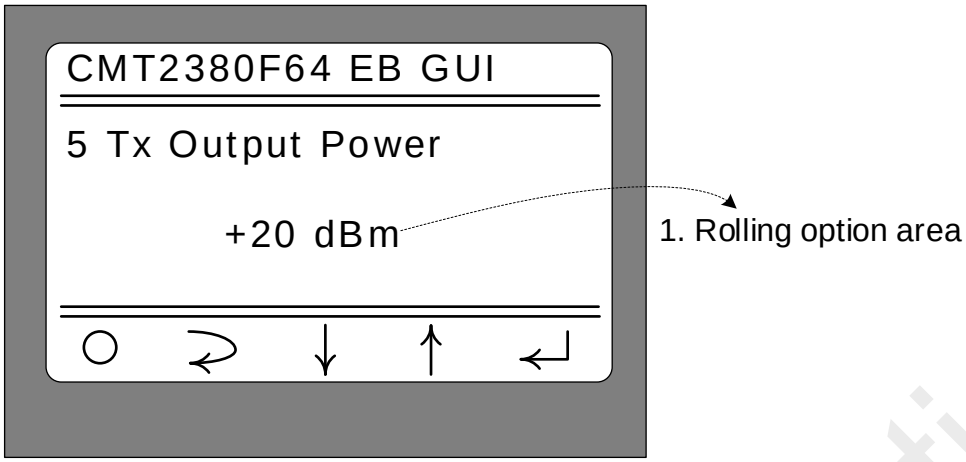

Figure 2-8. Tx Output Power Submenu Interface

No.	Function	Description
1	Rolling option area	In this area, different Tx power can be selected by short pressing K3 or K4： • -10dBm • -7dBm • -3dBm • 0dBm • +3dBm • +7dBm • +10dBm • +13dBm • +17dBm • +20dBm After selecting the corresponding modulation mode, short press S2 or S3 to confirm the selection and return to the upper menu (i.e. the main menu).

Note：

1. The matching parameters of CMT2380F64-EB and CMT2380F64-QFN48-EB are different according to the frequency. For example, CMT2380F64-EB -434MHz indicates that its optimal matching parameter patch component is at 434MHz frequency band; CMT2380F64-EB-868MHz indicates that its optimal matching parameter patch component is at 868MHz frequency band. Thus the accurate transmission power effect can be tested by selecting optimal working frequency band in accordance with the EM.

2. The transmit power adjustment is applicable to the operating frequency band of 314MHz, 433MHz, 863MHz and 902MHz (click Frequencry Band on the menu). If the Tx power of 169MHz and 230MHz, 470MHz donnot optimized, the presentation effect will be offset.

2.8 Preamble Length Submenu

Select the *6 Preamble Length* and press *S3* to enter the submenu, as shown in Figure 2-9.

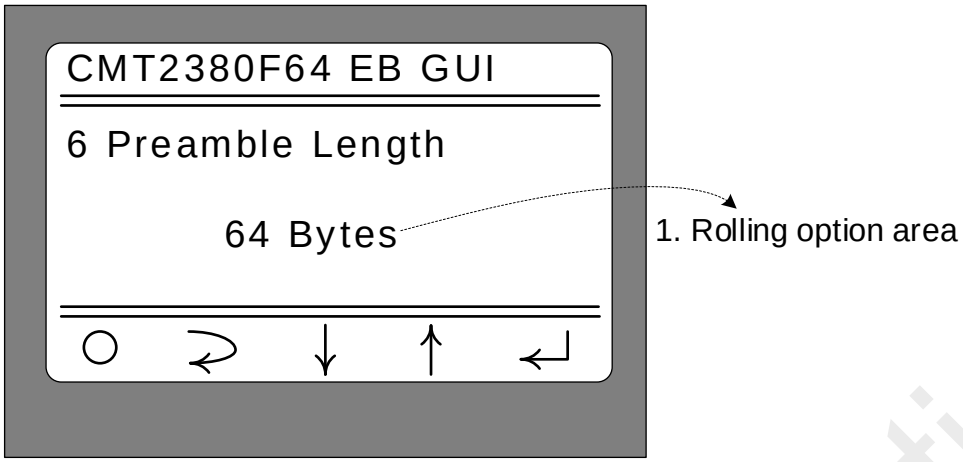

Figure 2-9. Preamble Length Submenu Interface

No.	Function	Description
1	Rolling option area	In this area different preamble length can be selected by short pressing S1 or S4： • 8 Bytes • 16 Bytes • 32 Bytes • 64 Bytes • 128 Bytes • 256 Bytes • 512 Bytes • 1024 Bytes After selecting the corresponding modulation mode, press S2 or S3 to confirm the selection and return to the upper menu (i.e. the main menu).

2.9 Packet Length Submenu

Select the *7 Packet Length* and press *S3* to enter the submenu, as shown in Figure 2-10.

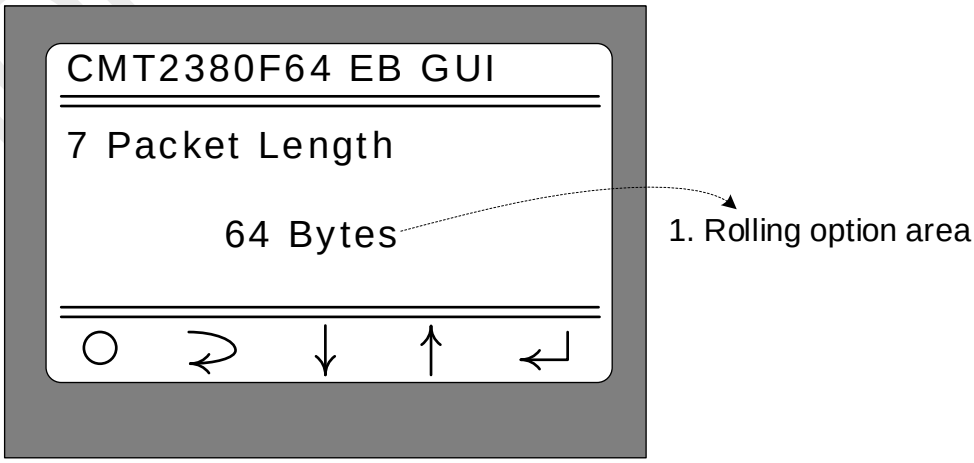

Figure 2-10. Packet Length Submenu Interface

No.	Function	Description
1	Rolling option area	In this area different Payload Length can be selected by short pressing S1 or S4： • 8 Bytes • 16 Bytes • 32 Bytes • 64 Bytes • 128 Bytes • 256 Bytes • 512 Bytes • 1024 Bytes After selecting the corresponding modulation mode, press S2 or S3 to confirm the selection and return to the upper menu (i.e. the main menu).

2.10 Coding Format Submenu

Select the *8 Coding Format* and press *S3* to enter the submenu, as shown in Figure 2-11.

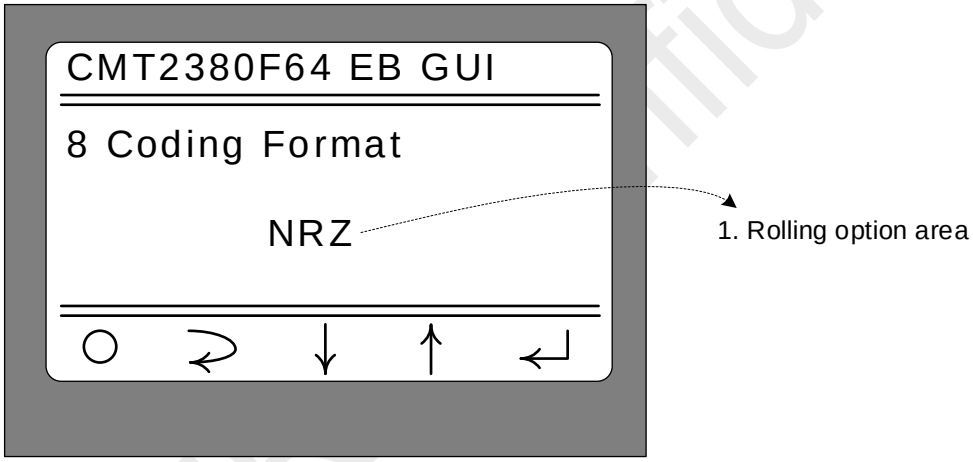

Figure 2-11. Coding Format Submenu Interface

No.	Function	Description
1	Rolling option area	In this area, different coding format can be selected by short pressing S1 or S4： • NRZ（Non-Return-Zero encoding） • Whitening（Whitening encoding） • Manchester（Manchester encoding） • FEC TypeA • FEC TypeB After selecting the corresponding modulation mode, press S2 or S3 to confirm the selection and return to the upper menu (i.e. the main menu).

Note：

1. The Whitening code is in the PN9-CCITT mode (according to the default option of RFPDK), and the Whitening Seed value is set to 0x01FF；

2. The Manchester encoding uses logic_1=2’b01，logic_0=2’b10, and SyncWord enables the Manchester code；

3. The FEC configuration is referred to the related AN of CMT2300A or RFPDK.

2.11 CRC Select Submenu

Select the *9 CRC Select* and press *S3* to enter the submenu, as shown in Figure 2-12.

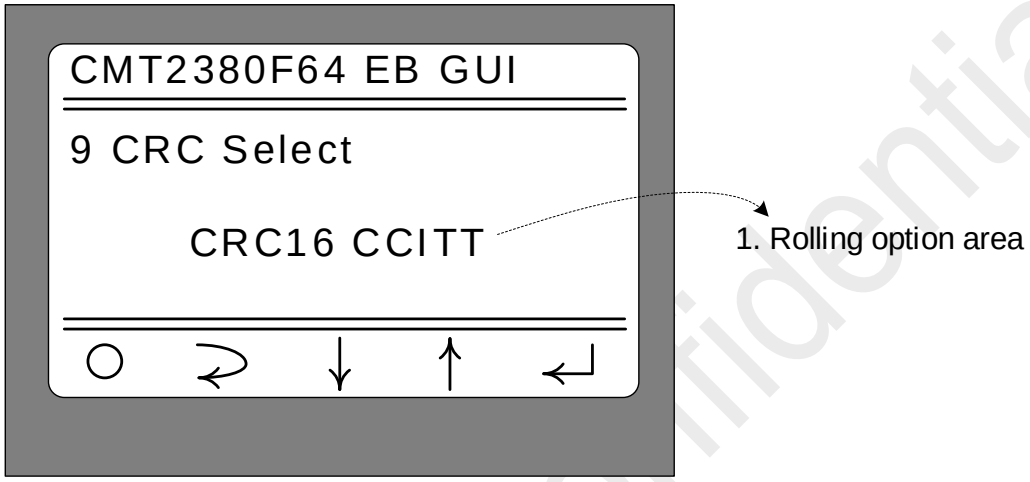

Figure 2-12. CRC Select Submenu Interface

No.	Function	Description
1	Rolling option area	In this area, different CRC verification format can be selected by short pressing S1 or S4： • CRC16-CCITT • CRC16-IBM After selecting the corresponding modulation mode, press S2 or S3 to confirm the selection and return to the upper menu (i.e. the main menu).

Note：

1. No matter which kind of CRC verification mode is selected, the Seed value of CRC is 0.；

2. If the Packet Length is relatively long, the CRC32 mode is recommended；

2.12 Packet Structure

Chapters from 2.8 to 2.11 are related to the packet structure. Therefore, this section is mainly for describing the packet structure mode of the firmware, as shown in Figure 2-13.

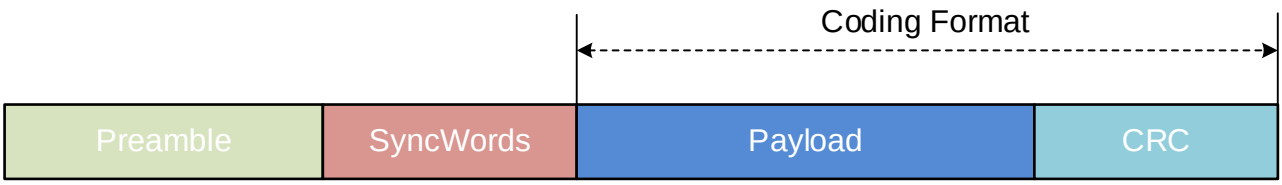

Figure 2-13. Packet Structure

1. The test Packet adopts fixed-length packet mode. The Payload Length is configured by the 7 Packet Length submenu；
2. The Preamble transmission Length of packet is set from the 6 Preamble Length submenu with unit of 8 bits. The Preamble values are configured as followed：

Modulation/Demodulation Mode	Preamble Value
OOK	0xAA
2FSK	0xAA

3. The SyncWords value of the test packet is set to 6 bytes and the value is 0x2DD42DD42DD4；
4. CRC mode is set by the "9 CRC Select" submenu；
5. The Payload content is set from the Payload Content menu, it can be set as random number or increasing data;
6. The Coding Format (content set by the 6 Coding Format submenu) affects the packet range, as shown in the figure above, which mainly applies to the Payload and CRC. Noted that when the encoding mode of the packet in this firmware uses Manchester encoding, the SyncWords also uses Manchester encoding.

2.13 Frequencry Space and Frequencry Channel Submenu

The 10 Freq Space and 11 Freq Channel submenus are associated with each other and they aims to the RF Channel Settings. The 10 Freq Space sub-menu sets Frequencry Space, i.e. the channel interval value, with setting range from 0 to 255 in kHz unit. The 11 Freq Channel submenu sets the Frequencry Channel, i.e. the Channel signal, with setting range from 0 to 255. The transceiver frequency offset can be calculated through the formula showned as followed：

$$\text{Frequencry Offset} = \text{Frequencry\_}Space \times 2.5\text{kHz} \times Frequencry\_Channel\ (\text{kHz})$$

This Frequency Offset take the initial frequency set in the "3 Frequencry Band". Since the maximum value of these two settings is 255, therefore the maximum Frequencry Offset can achieve in range from 0MHz to 162MHz with unit of 2.5kHz. For example, if the target frequency is 433.92MHz, then you can set the starting frequency to 433000kHz in the "3 Frequencry Band", and Frequencry Space value to 184, Frequencry Channel to 2.

Select the 10 Freq Space or 11 Freq Channel and press S3 to enter the submenu, as shown in Figure 2-14 or Figure 2-15.

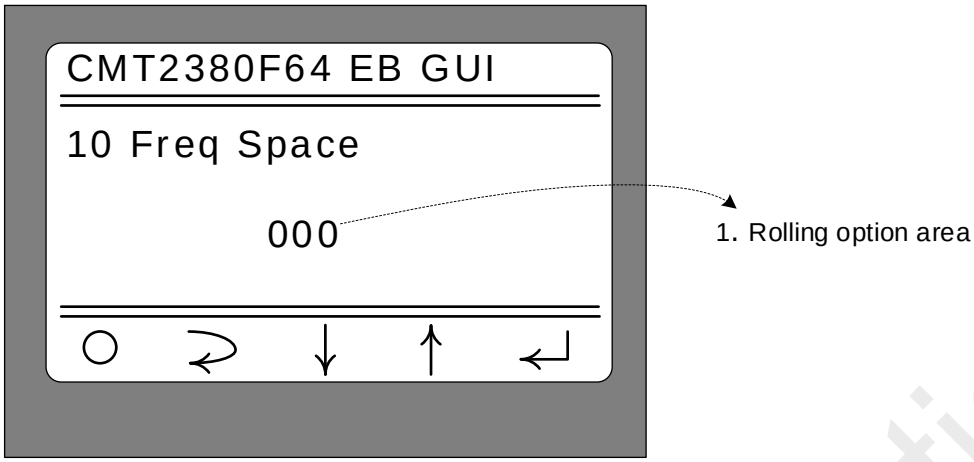

Figure 2-14. Freq Space Submenu Interface

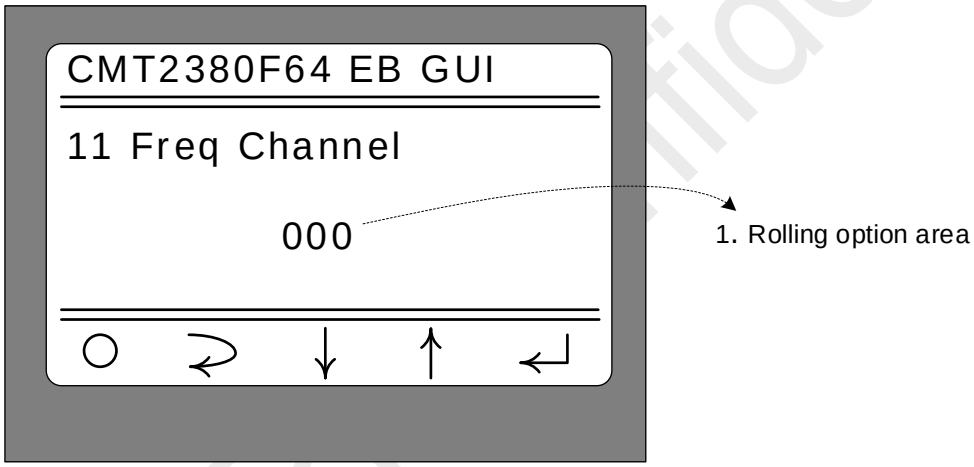

Figure 2-15. Freq Channel Submenu Interface

No.	Function	Description
1	Rolling option area	In this area, Frequencry Space or Frequencry Channel can be configured by pressing S4（↓）and S1（↑）： • Short press S4（↓）, the value will decreased by 1 unit; (2 equals to 5 kHz); If the value reaches to 0, it will overflow 637.5 , which means 637.5kHz. • Short press S1（↑）, the value will increased by 1; If the value reaches to “637 5”, increase by 1 unit will generates “000 0”, which means 0 kHz. • Long press S4（↓）(hold on for 1~2 seconds), the value will automatically decrease by 1 until the frequency overflow to 637.5kHz, it will becomes 0 and then it will decrease by 1 unit once again for cycles until loosing the S4 button. • Long press S1（↑）(hold on for 1~2 seconds), the value will automatically increase by 1 until the frequency reaches 637.5kHz, it will becomes 0 and then it will increase by 1 unit once again for cycles until loosing the S1 button.

No.	Function	Description
		• After modifing, press S2 or S3 to confirm the current value and return to the upper menu (that is, the main menu).

2.14 Gaussian Select Submenu

Select 12 Gaussian Select and press S3 to enter the submenu, as shown in figure 2-17.

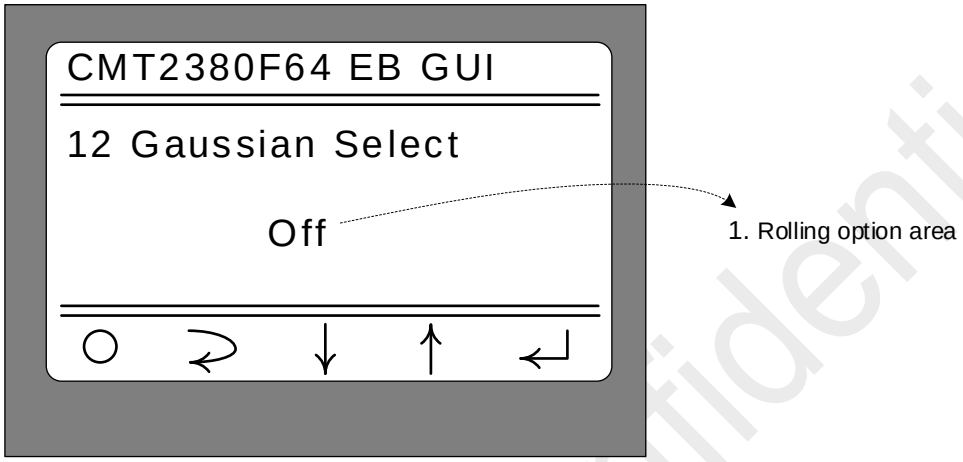

Figure 2-17. Gaussian Select Submenu Interface

No.	Function	Description
1	Rolling option area	The options can be switched by short pressing S1 or S4： • Off，disable the Gaussian filter transmission； • BT03，enable the Gaussian filter transmission with BT coefficient as 0.3; • BT05，enable the Gaussian filter transmission with BT coefficient as 0.5; • BT08，enable the Gaussian filter transmission with BT coefficient as 0.8; • BT10，enable the Gaussian filter transmission with BT coefficient as 1.0; After selecting the corresponding modulation and demodulation mode, selection can be confirmed by short pressing S2 or S3, and return to the upper menu (that is, the main menu).

Note：After Gaussian transmission is enabled, 2FSK equals to 2GFSK modulation mode.

2.15 Test Counter Submenu

Select the 13 Test Counter and press S3 to enter the submenu, as shown in Figure 2-18.

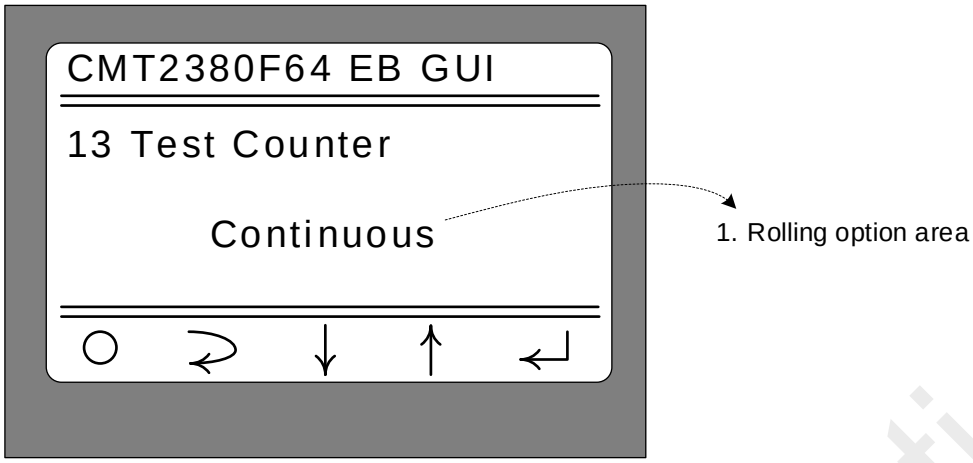

Figure 2-18. Test Counter Submenu Interface

No.	Function	Description
1	Rolling option area	The options can be switched by short pressing S1 or S4： • Continuous, no limit number of the active packet sending test； • 100, active packet sending test, limit of 100 times; • 200, active packet sending test, limit of 200 times; • 500, active packet sending test, limit of 500 times; • 1000, active packet sending test, limit of 1000 times; • 2000, active packet sending test, limit of 2000 times; • 5000, active packet sending test, limit of 5000 times; • 10000, active packet sending test, limit of 5000 times; After selecting the corresponding modulation and demodulation mode, selection can be confirmed by short pressing S2 or S3, and return to the upper menu (that is, the main menu).

2.16 Payload Content Submenu

Select the 14 Payload Content and press S3 to enter the submenu, as shown in Figure 2-19.

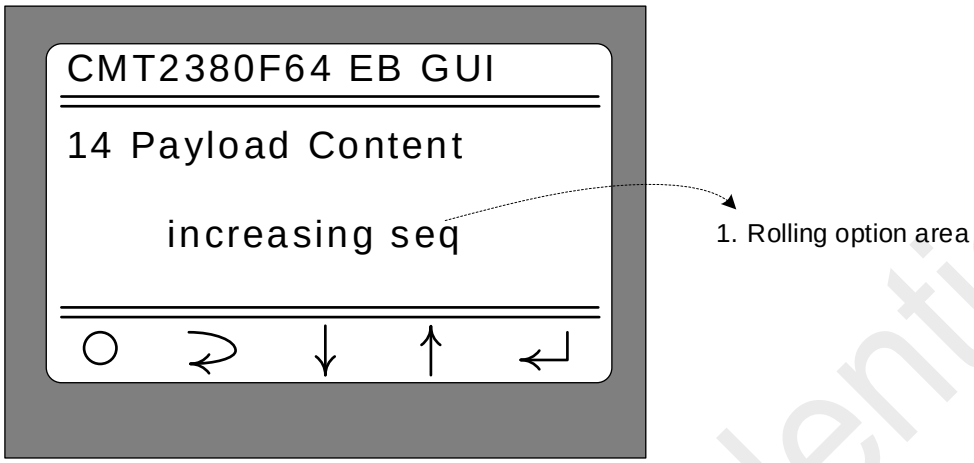

Figure 2-19. Payload Content Submenu Interface

No.	Function	Description
1	Rolling option area	The options can be switched by short pressing S1 or S4： • Increasing seq：the contents of active packets are filled in an order sequence and started from 0 with increasing of 1 each time and overflow until it reaches 255, and then starts from 0 again; • random sequence；active packets are filled with random sequences; After selecting the corresponding modulation and demodulation mode, selection can be confirmed by short pressing S2 or S3, and return to the upper menu (that is, the main menu).

2.17 AFC Select Submenu

Select the 15 AFC Select and press S3 to enter the submenu, as shown in Figure 2-20.

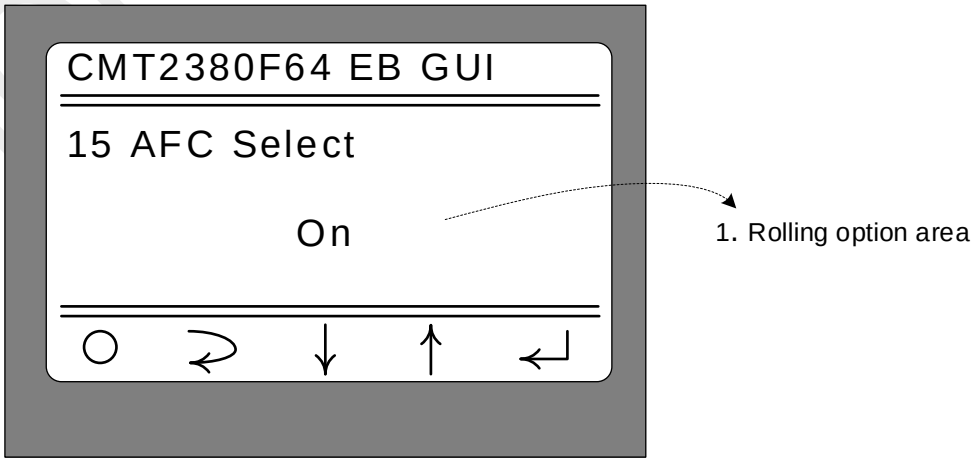

Figure 2-20. AFC Select Submenu Interface

No.	Function	Description
1	Rolling option area	The options can be switched by short pressing S1 or S4： • On：Enable AFC function； • Off；Disable AFC function； After selecting the corresponding modulation and demodulation mode, selection can be confirmed by short pressing S2 or S3, and return to the upper menu (that is, the main menu).

3 Working Mode Description

After setting the required parameters and mode according to the "Parameter Setting Menu" in Chapter 2, short press S2 “○” at the main menu interface and it will work according to "2 Work Mode" submenu. The following will describe the operation of each mode.

3.1 Sleep Mode

Selecting "Sleep" mode and short pressing S2 “○” in main menu interface to enter Sleep working mode, as shown in Figure 3-1 below.

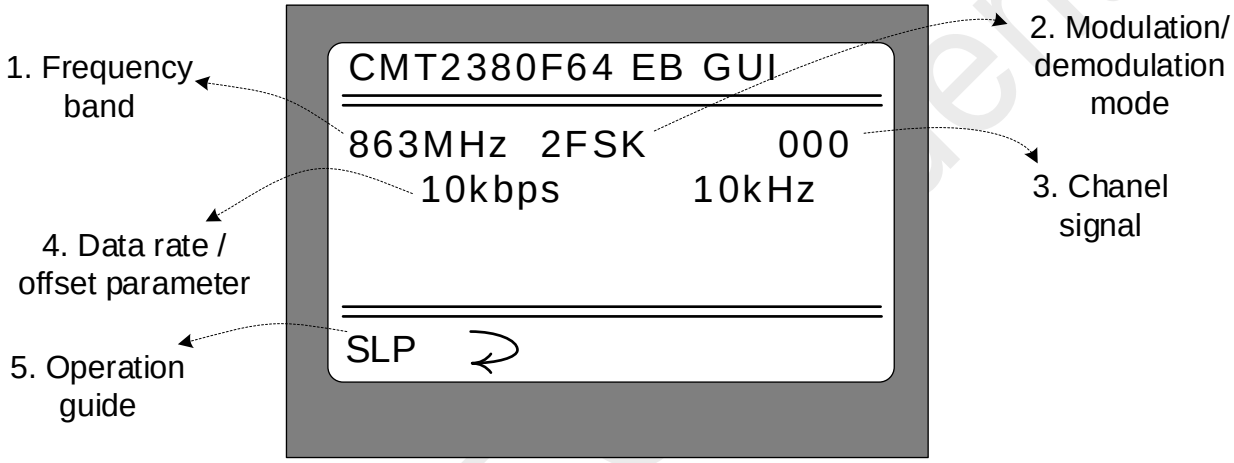

Figure 3-1. Sleep Mode Interface

No.	Function	Description
1	Frequency band	Display the selected frequency band as shown in the figure above. It indicates that the start frequency of the selected frequency band is 863000kHz.
2	Modulation/ demodulation mode	Display the selected modulation/demodulation mode, as shown in the figure above, indicating that the current modulation and demodulation mode is set to 2FSK.
3	Chanel signal	Display the channel signal (value of Frequencry Channel) as shown in the figure above, the channel signal is 0. Therefore, both of the operating frequency and starting frequency is 863MHz.
4	Data rate/frequency offset parameter	Display the data rate/frequency offset parameters currently set. As shown in the figure above, it indicates that the current setting rate is 10kbps and the frequency offset is +/ -10khz.
5	Operation guide	The corresponding S1~S4 operation guide is shown in the figure above： • Short press S2（SLP） to make the RF part of CMT2380F64 enter into Sleep mode； • Short press S3（ ） ，and return to the upper menu（that is，the main menu）

On the basis of the operation shown in the above figure, short press S2 to make the RF part of CMT2380F64 enters into Sleep mode and the display is updated as shown in Figure 3-2 below.

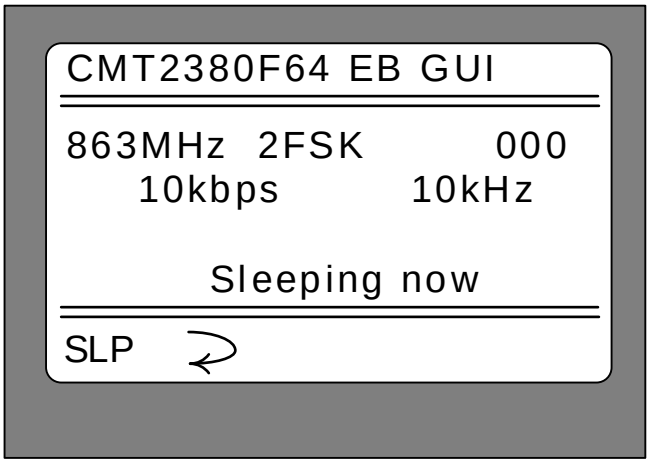

Figure 3-2. Sleep Mode Interface（RF part enters into Sleep mode）

Note：

1. In this interface, short pressing S2 again will not update the information while the firmware will send out Sleep command again；

2. In this interface,short pressing S3 to make RF part of CMT2380F64 exit Sleep mode and return to the upper menu (that is, the screen shown in Figure 3-1. To return to the main menu, short press S3 once again).

3.2 CW Tx Mode

After selecting "CW Tx" mode, short press S2 “○” in the main menu interface to enter the CW Tx working mode, as shown in Figure 3-3 below.

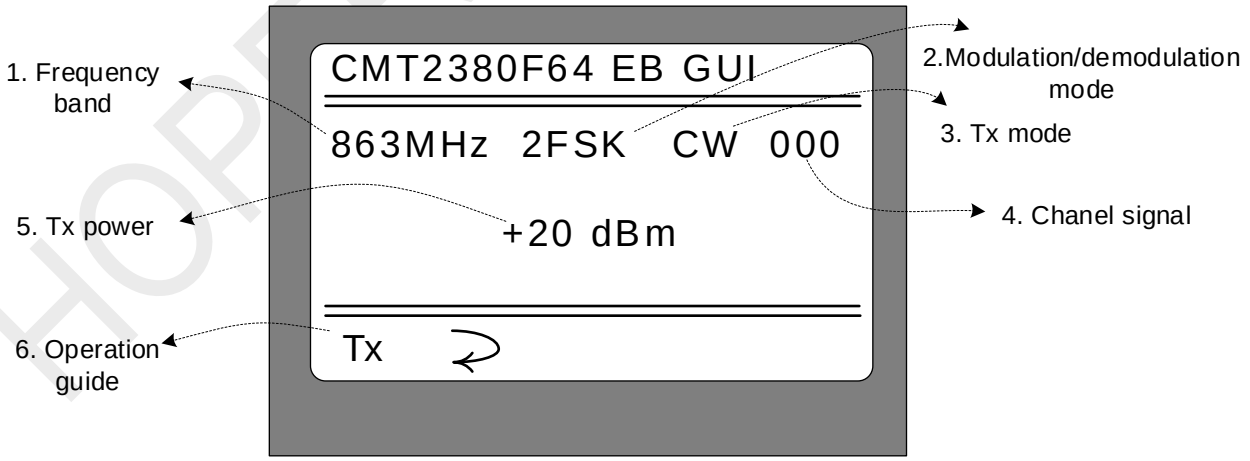

Figure 3-3. CW Tx Working Mode

No.	Function	Description
1	Frequency band	Display the selected frequency band as shown in the figure above. It indicates that the start frequency of the selected frequency band is 863000kHz.
2	Modulation/ demodulation mode	Display the selected modulation/demodulation mode, as shown in the figure above, indicating that the current modulation and demodulation mode is set to 2FSK.
3	Tx mode	Display the current transmit mode. CW indicates the transmit carrier mode
4	Chanel signal	Display the channel signal (value of Frequencry Channel) as shown in the figure above, the channel signal is 0. Therefore, both of the operating frequency and starting frequency is 863MHz.
5	Tx power	Display the currently set transmit power. As shown in the figure above, it indicates that the current set transmit power is +20dBm.
6	Operation guide	The corresponding S1~S4 operation guide is shown in the figure above: • Short press S2（Tx），CMT2380F64 enters into carrier transmit mode； • Short press S3（ ），and return to the upper menu（that is，the main menu）.

On the basis of the operation shown in the above figure, short press S2 to enter into Carrier Tx mode, and the display is updated as shown in Figure 3-4 below.

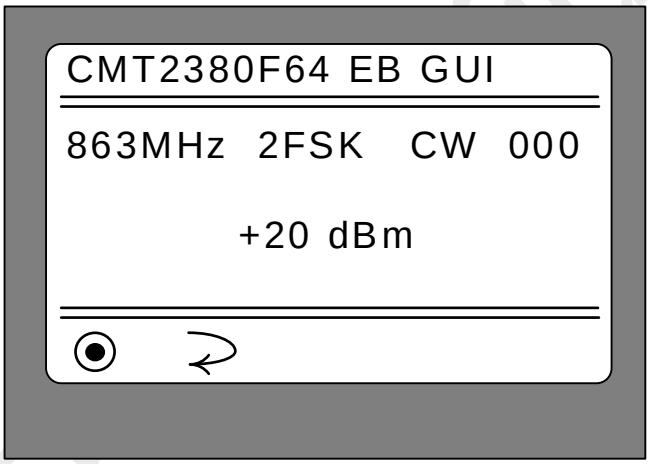

Figure 3-4. CW Tx mode interface（Carrier Wave is in Tx）

Note：

1. Under this interface, short press S3 again to stop the current carrier transmission mode and return to the upper menu (as shown in Figure 3-3). That is, the carrier transmission can be alternately enabled and stopped by short pressing S3.

2. Under this interface, short press S3 to exit CW Tx working mode and returns to the main menu.

3. The already set data rate/frequency offset combination parameter is not related to carrier wave transmission mode.

3.3 Direct Rx Mode

After selecting " Direct Rx " mode, press S2 “○” in the main interface to enter the Direct Rx working mode, as shown in Figure 3-5 below.

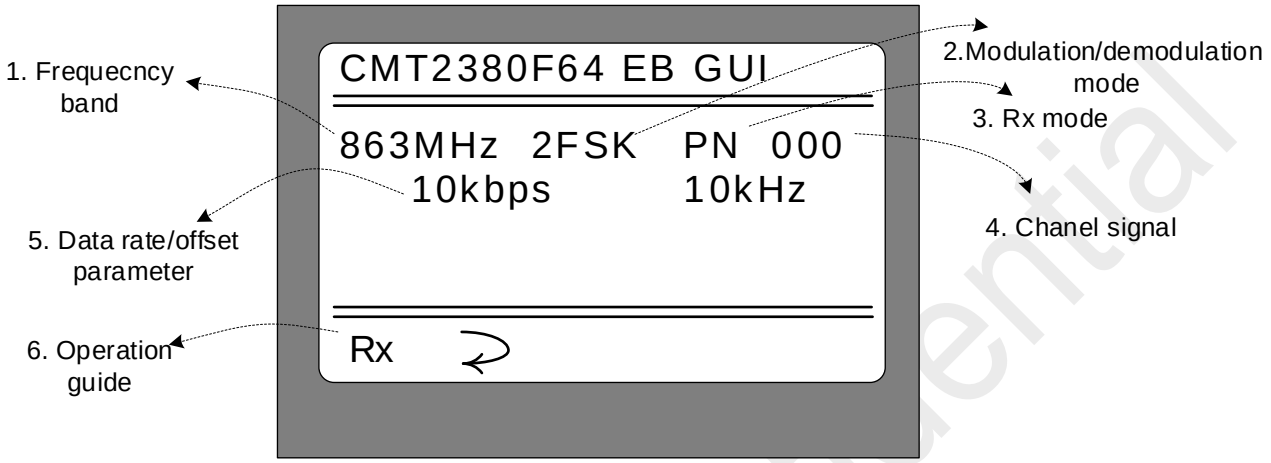

Figure 3-5. Direct Rx Working Mode

No.	Function	Description
1	Frequency band	Display the selected frequency band as shown in the figure above. It indicates that the start frequency of the selected frequency band is 863000kHz.
2	Modulation/ demodulation mode	Display the selected modulation/demodulation mode, as shown in the figure above, indicating that the current modulation and demodulation mode is set to 2FSK.
3	Rx mode	Display the current receiving mode. PN indicates the Direct Rx mode (can be used as sensitivity test for PN9 series)
4	Chanel signal	Display the channel signal (value of Frequencry Channel) as shown in the figure above, the channel signal is 0. Therefore, both of the operating frequency and starting frequency is 863MHz
5	Data rate/offset parameter	Display the currently set data rate/frequency offset parameters. As shown in the figure above, it indicates that the current setting rate is 10kbps and the frequency offset is +/ -10khz.
6	Operation guide	The corresponding S1~S4 operation guide is shown in the figure above： • Short press S2（Rx）, CMT2380F64 enters into direct receiving mode； • Short press S3（ ）, return to the upper menu（that is, the main menu）

On the basis of the operation shown in the above figure, short press K1 and CMT2380F64 enters into Direct Rx mode, the interface is updated as shown in Figure 3-6 below.

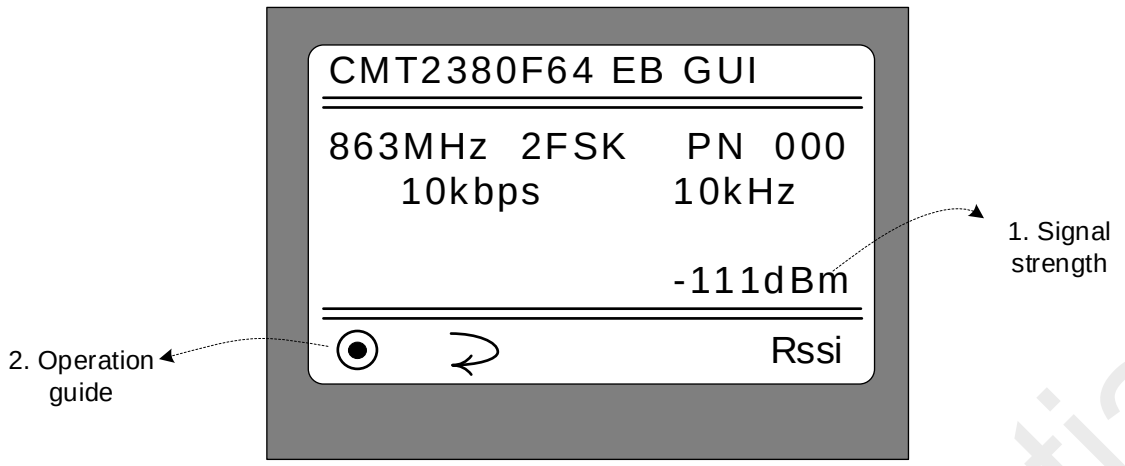

Figure 3-6. Direct Rx mode（In Receiving Mode）

No.	Function	Description
1	Signal strength	Displays the real-time signal strength in the current receiving state, in dBm
2	Operation guide	The corresponding S1~S4 operation guide is shown in the figure above： • Short press S2（Rx / ⦿）, CMT2380F64 enters into or / suspend Direct Rx mode； • Short press S3（ ⤼ ）, and return to the upper menu（that is, the main menu）

Note:

In this receiving mode, it can be used to dock the signal generator and evaluate the bit error rate (BER) of CMT2380F64 by the PN9 sequence, which is used to evaluate the sensitivity of CMT2380F64. The sensitivity test is related to the rate/frequency offset parameter, so it needs to be set according to the rate and frequency offset required by the target. GPIO3 is used as the output demodulation data stream.

3.4 Only Tx Mode

After selecting the "Only Tx Mode", short press S2 "○" in the main menu to enter the only Tx Mode, as shown in Figure 3-7 below.

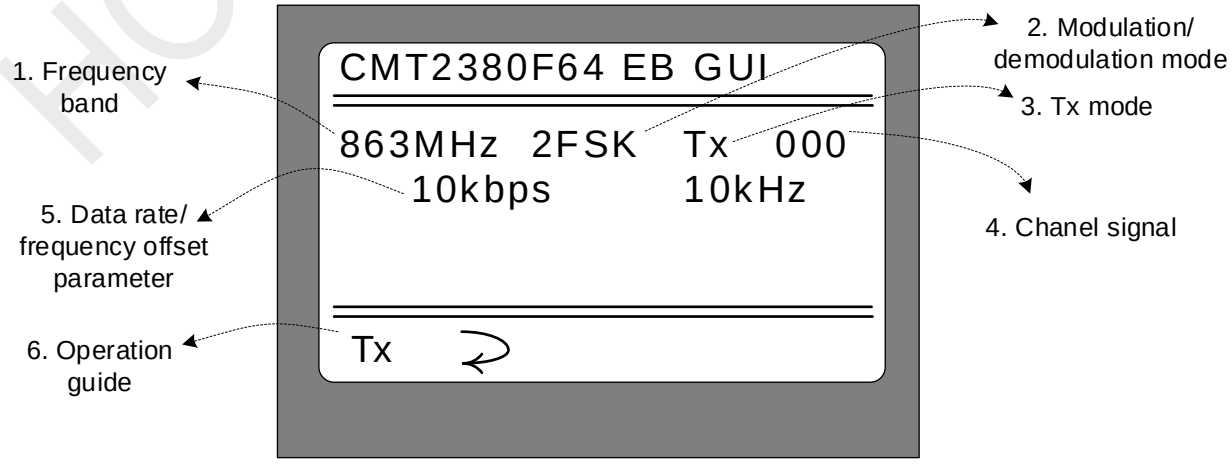

Figure 3-7. Only Tx Working Mode

No.	Function	Description
1	Frequency band	Display the selected frequency band as shown in the figure above. It indicates that the start frequency of the selected frequency band is 863000kHz.
2	Modulation/ demodulation mode	Display the selected modulation/demodulation mode, as shown in the figure above, indicating that the current modulation and demodulation mode is set to 2FSK.
3	Tx mode	Display the current transmit mode, Tx indicates the only Tx mode.
4	Chanel signal	Display the channel signal (value of Frequencry Channel) as shown in the figure above, the channel signal is 0. Therefore, both of the operating frequency and starting frequency is 863 MHz.
5	Data rate/offset parameter	Display the currently set data rate/frequency offset parameters. As shown in the figure above, it indicates that the current setting rate is 10kbps and the frequency offset is +/ -10khz.
6	Operation guide	The corresponding S1~S4 operation guide is shown in the figure above： • Short press S2（Rx），CMT2380F64 enters into only Tx mode • Short press S3（ ），return to the upper menu（that is, the main menu）

On the basis of the operation shown in the above figure, short press S2 and CMT2380F64 enters into only Tx mode, the interface is updated as shown in Figure 3-8 below.

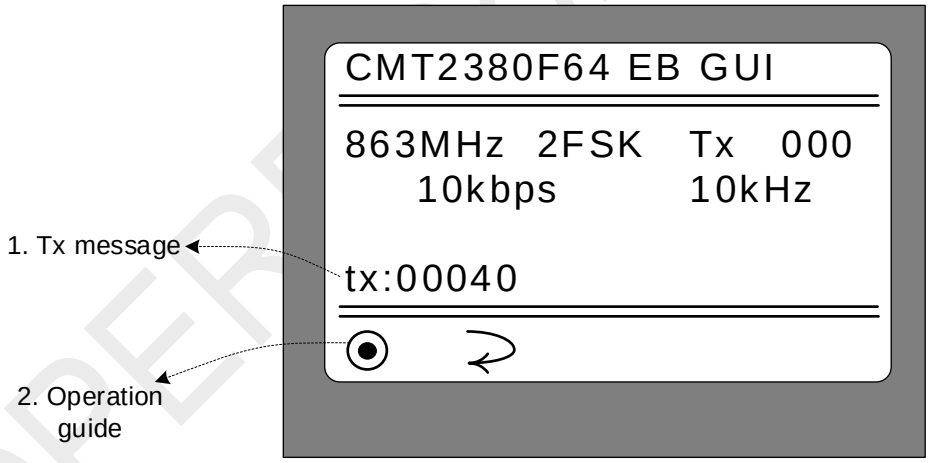

Figure 3-8. Only Tx Mode Working Mode（In transmitting mode）

No.	Function	Description
1	Tx Packet information	Display the current packets numbers. For each packet sent, the number is increased by 1. The test stops automatically after it ends in sending the packet. The maximum packet number is 1000.
2	Operation guide	The corresponding S1~S4 operation guide is shown in the figure above： • Short press S2（Tx / ），enter into / suspend the packet sending process. Suspending will not reset the Tx packet counter； • Short press S3（ ），and return to the upper menu, reset the packet counter（that is, clearing）

3.5 Only Rx Mode

After selecting the "Only Rx Mode", press S2 "○" in the main menu to enter the only Rx Mode, as shown in Figure 3-9 below.

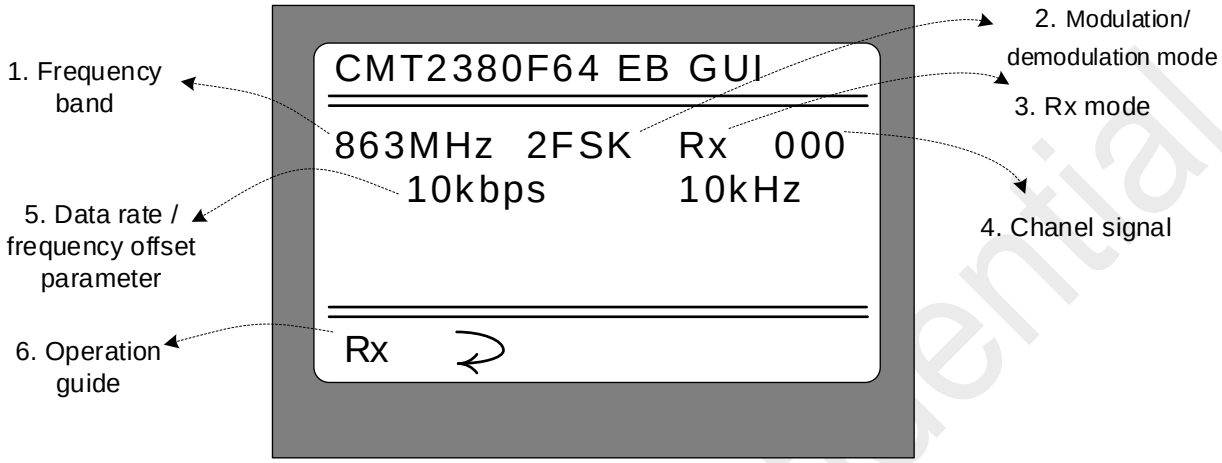

Figure 3-9. Only Rx Mode Interface

No.	Function	Description
1	Frequency band	Display the selected frequency band as shown in the figure above. It indicates that the start frequency of the selected frequency band is 863000kHz.
2	Modulation/ demodulation mode	Display the selected modulation/demodulation mode, as shown in the figure above, indicating that the current modulation and demodulation mode is set to 2FSK.
3	Rx mode	Display the current receiving mode. Rx indicates the only receiving mode.
4	Chanel signal	Display the channel signal (value of Frequencry Channel) as shown in the figure above, the channel signal is 0. Therefore, both of the operating frequency and starting frequency is 863MHz.
5	Data rate/offset parameter	Display the currently set data rate/frequency offset parameters. As shown in the figure above, it indicates that the currently setting rate is 10kbps and the frequency offset is +/ -10khz.
6	Operation guide	The corrresponding S1~S4 operation guide is shown in the figure above: • Short press S2（Rx），CMT2380F64 enter into only Rx mode; • Short press S3（ ），and return to the upper menu（that is, the main menu）

On the basis of the interface in the figure above, short press S2 and CMT2380F64 enters into only Rx mode, the display is updated as shown in Figure 3-10 below

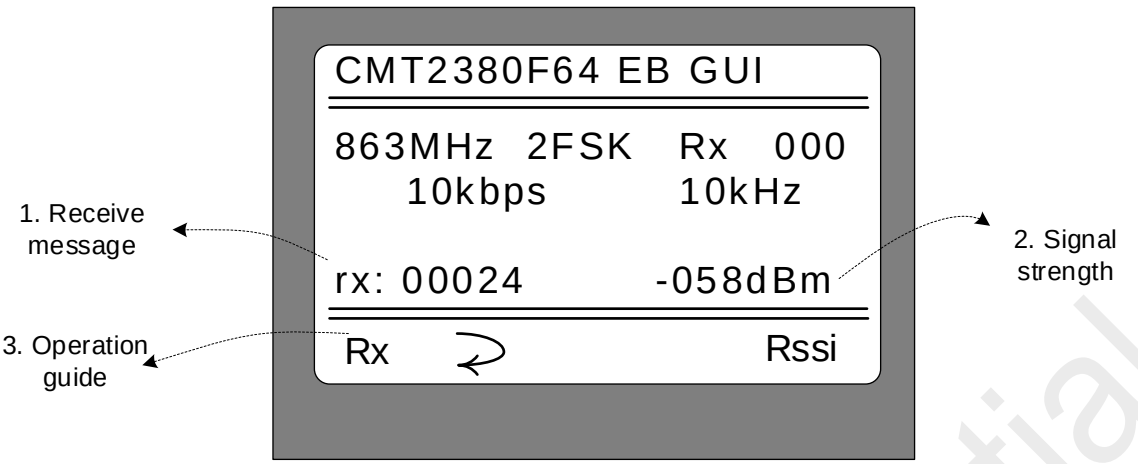

Figure 3-10. Only Rx Mode（In reveiving）

No.	Function	Description
1	Receive message	Display the current receiving packet numbers. For each packet received, the count is increased by 1.
2	Signal strength	Display the signal strength value of the current received packet, in dBm.
3	Operation guide	The corresponding S1~S4 operation guide is shown in the figure above： • Short press S2（Rx / ⦿），enter into / suspend the packet Rx process. Suspending will not reset the Rx packet counter； • Short press S3（⇄），and return to the upper menu, reset the packet counter（that is, clearing）.

Note：

1. In the case of entering the receive mode while no packets received, the receive counter will not update or display, nor will the signal strength. The information is updated and displayed only when a packet is received.

2. As it is in the Only Rx Mode, the sending content is not known in advance (the Tx mode content is randomly with different content each packet according to the Only Tx mode of the Demo). Therefore, the receiving counter will be increased by 1 and the display will be updated only when the CRC is correct.

3.6 Tx and Rx Mode

The "Only Tx Mode" and "Only Rx Mode" mentioned in the previous two sections are for the evaluation of unidirectional communication links. In the evaluation of two targets of bidirectional links (or upstream and downstream links), the two tested points need to perform the evaluation in ping-pong Mode. In this case, select the "Tx and Rx Mode", and short press S2 "○" in the main menu to enter the Tx and Rx mode, as shown in Figure 3-11 below.

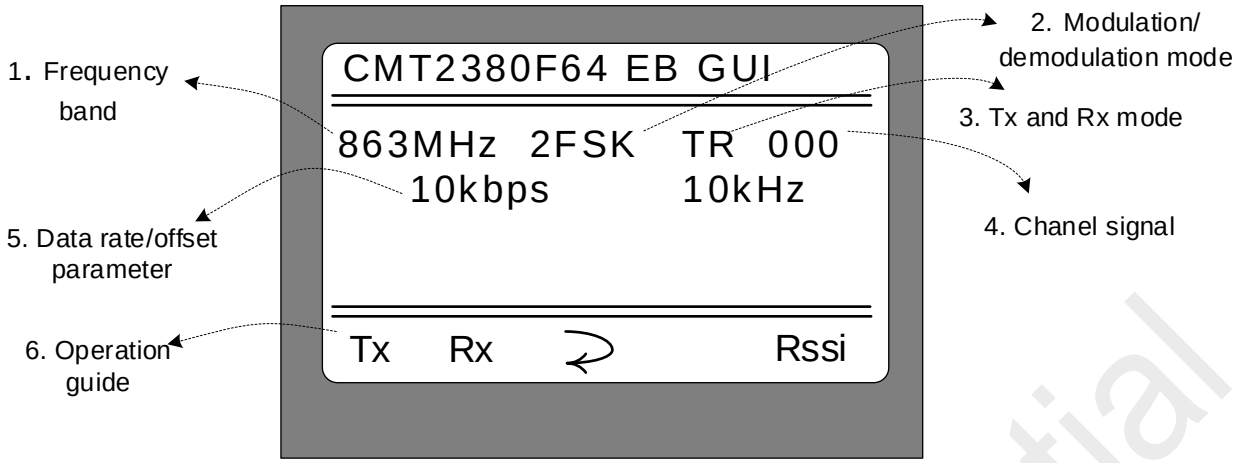

Figure 3-11. Tx and Rx Mode Interface

No.	Function	Description
1	Frequency band	Display the selected frequency band as shown in the figure above. It indicates that the start frequency of the selected frequency band is 863000kHz.
2	Modulation/ demodulation mode	Display the selected modulation/demodulation mode, as shown in the figure above, indicating that the current modulation and demodulation mode is set to 2FSK.
3	Tx and Rx mode	Display the current Rx and Tx mode, TR indicates alternative transmitting and receiving mode.
4	Chanel signal	Display the channel signal (value of Frequencry Channel) as shown in the figure above, the channel signal is 0. Therefore, both of the operating frequency and starting frequency is 863MHz.
5	Data rate/offset parameter	Display the currently set data rate/frequency offset parameters. As shown in the figure above, it indicates that the current setting rate is 10kbps and the frequency offset is +/ -10khz.
6	Frequency band	The corrresponding S1~S4 operation guide is shown in the figure above： • Short press S2（Tx），enters into active Tx mode； • Short press S3（Rx），enters into passive Rx mode； • Short press S4（ ），returns to the upper menu（that is, the main menu）

There are two sub-working modes in the alternative Rx and Tx mode: active Tx mode and passive Rx mode:

1. **Active Tx mode**: send out a message first with transmitting counter increased by 1, update the display and then automatically switch to Rx mode to receive the returned message as the preset receiving window. After receiving the returned message, compare it to the previous content. If the content is consistent, it is successful. The receiving counter is increased by 1 and the display is updated. If no return mode is received (or the receiving is incorrect, for example, the content is error, or the packet itself does not pass the CRC), the receiving counter remains the same.

2. **Passive Rx mode**: always in receiving mode. When receiving a correct packet (which is subject to CRC), the receiving counter will be increased by 1 as display updated and received packet content unchanged.

Therefore, two evaluation kits are needed for the Rx and Tx mode, one set to the active Tx mode and the other set to the passive Rx mode. After the two sets are started, a bidirectional ping-pong interaction

communication mode can be formed between the two points, so as to evaluate the bidirectional link communication quality.

Based on the interface shown in Figure 3-11, short press S2 (Tx) and CMT2380F64 enters into active transmission mode, and the display is updated as shown in Figure 3-12 below.

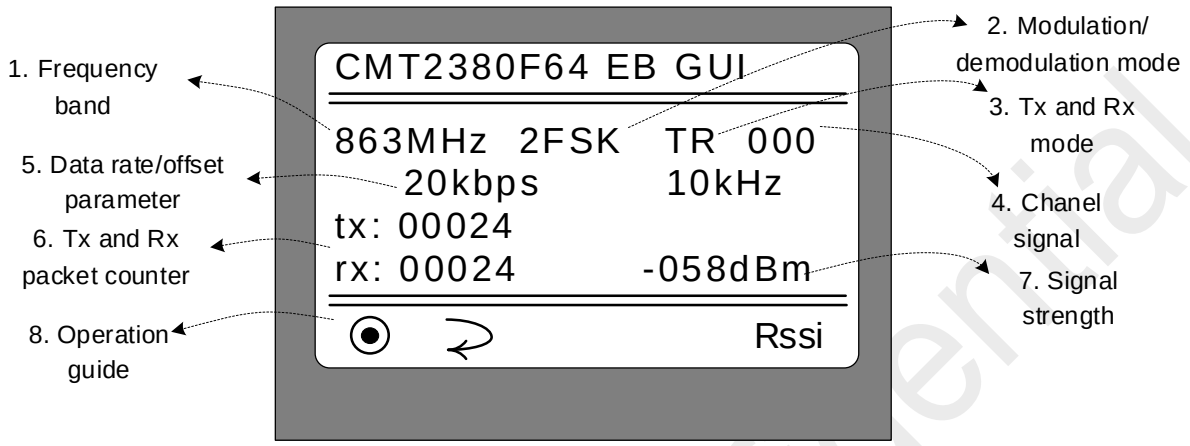

Figure 3-12. Active Tx and Rx Mode Interface

No.	Function	Description
1	Frequency band	Display the selected frequency band as shown in the figure above. It indicates that the start frequency of the selected frequency band is 863000kHz.
2	Modulation/ demodulation mode	Display the selected modulation/demodulation mode, as shown in the figure above, indicating that the current modulation and demodulation mode is set to 2FSK.
3	Tx and Rx mode	Display the current Rx and Tx mode, TR indicates alternative transmitting and receiving mode.
4	Chanel signal	Display the channel signal (value of Frequencry Channel) as shown in the figure above, the channel signal is 0. Therefore, both of the operating frequency and starting frequency is 863MHz.
5	Data rate/offset parameter	Display the currently set data rate/frequency offset parameters. As shown in the figure above, it indicates that the current setting rate is 10kbps and the frequency offset is +/ -10khz.
6	Tx and Rx packet counter	“tx : xxxx” dislay the active Tx packet numbers (the maximum packet number is 1000); “rx : xxxx” display the returned packet numbers (the returned packet has to be consistent with the Tx packet)；
7	Signal strength	Display the returned signal strength in dBm.
8	Operation guide	The corrresponding S1~S4 operation guide is shown in the figure above： • Short press S2（⦿），enters into/ suspend active Tx mode； • Short press S3（⮌），returns to the upper menu

On the basis of the interface shown in Figure 3-11, short press S2 (Rx) and CMT2380F64 enters into passive transmission mode, and the display is updated as shown in Figure 3-13 below.

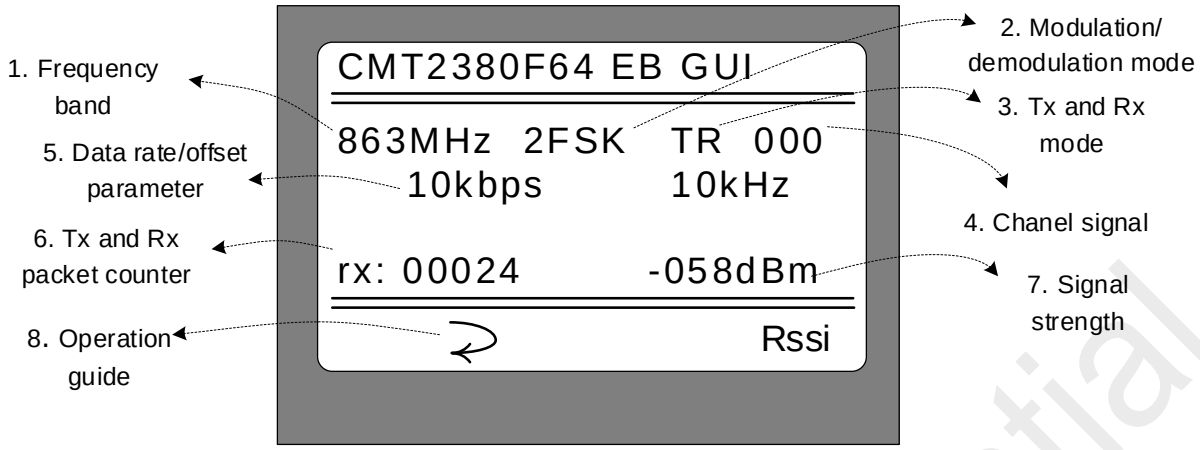

Figure 3-13. Passive Rx Mode Interface

No.	Function	Description
1	Frequency band	Display the selected frequency band as shown in the figure above. It indicates that the start frequency of the selected frequency band is 863000kHz.
2	Modulation/ demodulation mode	Display the selected modulation/demodulation mode, as shown in the figure above, indicating that the current modulation and demodulation mode is set to 2FSK.
3	Tx and Rx mode	Display the current Rx and Tx mode, TR indicates alternative transmitting and receiving mode.
4	Chanel signal	Display the channel signal (value of Frequencry Channel) as shown in the figure above, the channel signal is 0. Therefore, both of the operating frequency and starting frequency is 865MHz.
5	Data rate/offset parameter	Display the currently set data rate/frequency offset parameters. As shown in the figure above, it indicates that the current setting rate is 10kbps and the frequency offset is +/ -10khz.
6	Tx and Rx packet counter	“rx : xxxxx” indicates the receive packet numbers（passed by CRC）;
7	Signal strength	Display the returned signal strength in dBm.
8	Operation guide	The corrresponding S1~S4 operation guide is shown in the figure above: • Short press S2（ ）, returns to the upper menu.

Note:

1. In passive receiving mode, packets are not compared and must be sent back if it passes CRC. That is, the receiving counter equals to the sending counter and only the receiving counter will be displayed.

2. Combined with active transmitting mode, there will be three count value after completing two different tests, which are respectively the active transmitting count, passive receiving count and the returned packet count (that is, the returned count which is derived from the active transmitting terminal). These three values can be used to analyze whether the bidirectional communication is in balance. In the symmetric case, the packet loss probability is similar regardless of upstream or downstream. In the case of asymmetry (for example, if there is interference at one end of the attachment), a high probability of one side packet loss will occur.

4 Supplymentary

4.1 Firmware Update Burning Operation

Both of CMT2380F64-EB or CMT2380F64-QFN48-EB can be updated via J-Flash. The following will describe how to upgrade the firmware：

1. Start the J-flash software. Take J-Flash V6.30d as an example, as shown in Figure 4-1. Click on "File" in the main menu bar and select "New Project".

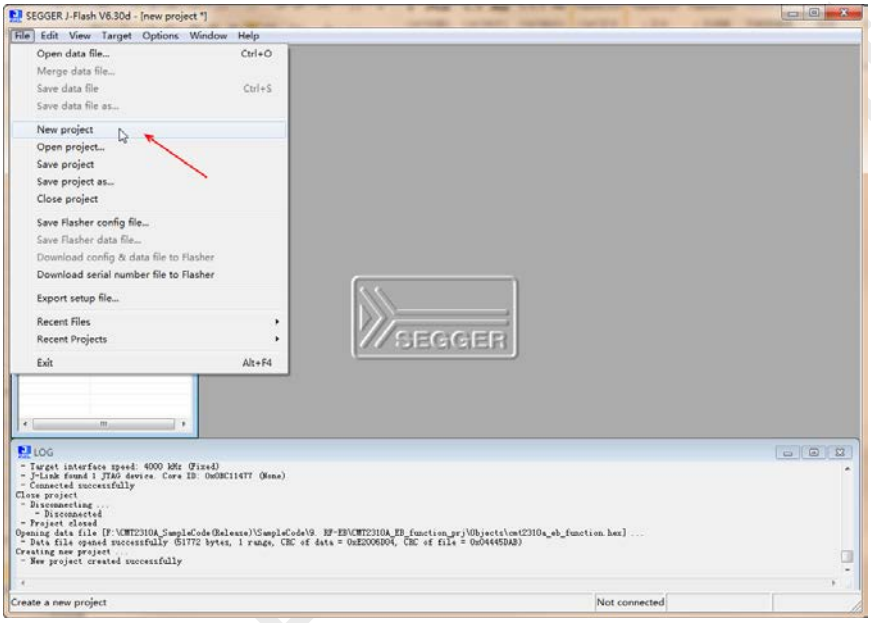

Figure 4-1. J-Flash Software Interface

2. The new project window popped up, as shown in Figure 4-2. Click "... "in this window, the Target Device selection list window is displayed as shown in Figure 4-3. Select N32G031C8 in the Select Device window and then click "OK".

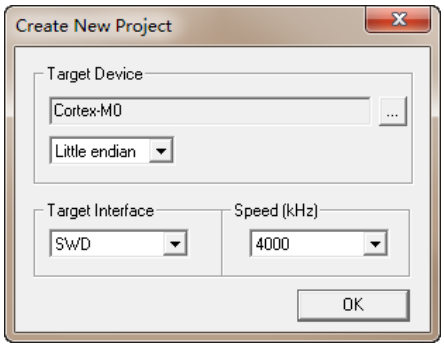

Figure 4-2. Create New Project Window

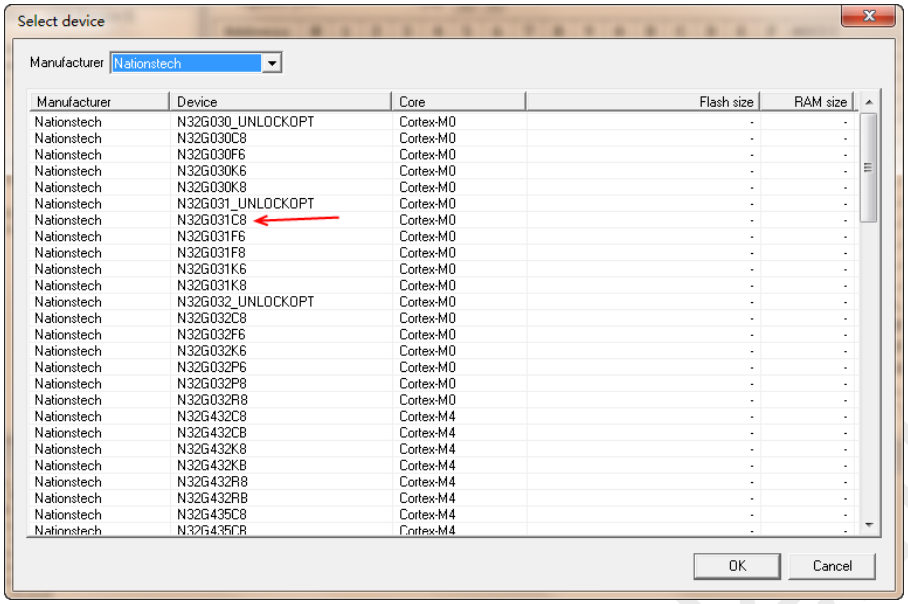

Figure 4-3. Select Device Window

3. Return to the J-Flash window, click "Target" in the main menu bar, select "Connect" and connect the target board (CMT2380F64-EB or CMT2380F64-QFN48-EB) through the J-link debugger. Before this, ensure that the J-link debugger is properly connected to the CMT2380F64-EB or CMT2380F64-QFN48-EB.

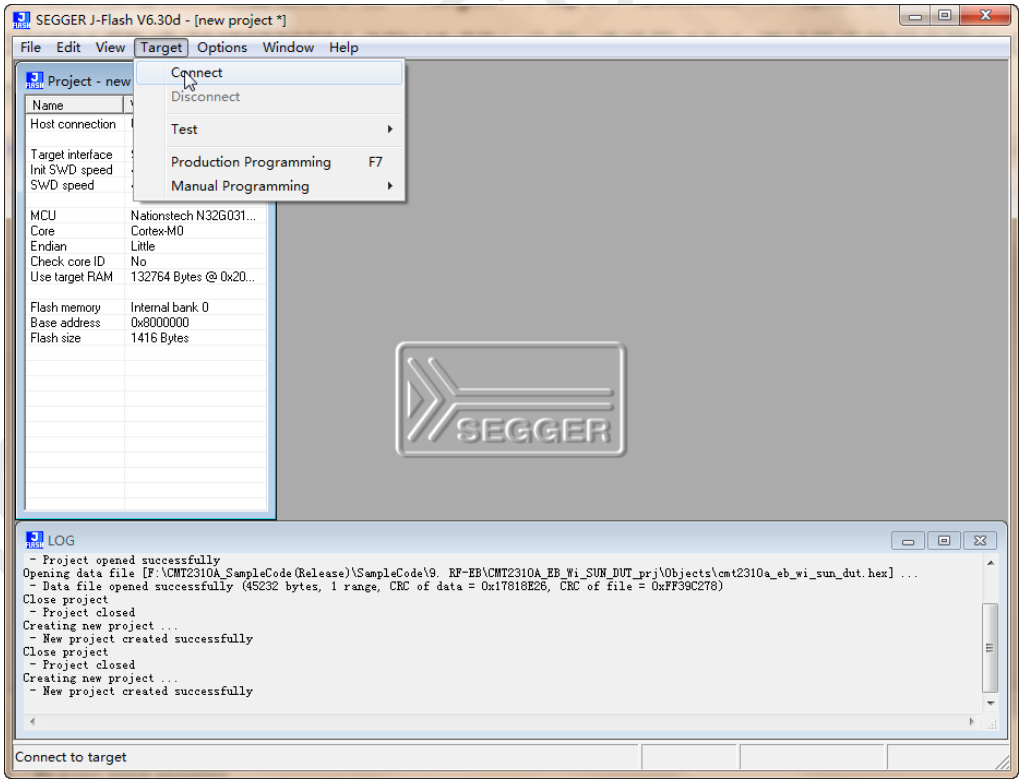

Figure 4-4. J-link Connecting Board

4. Click "File" on the main menu bar and select "Open Data File..." to load the burning target file, namely

CMT2380F64-EB or CMT2380F64-QFN48-EB.

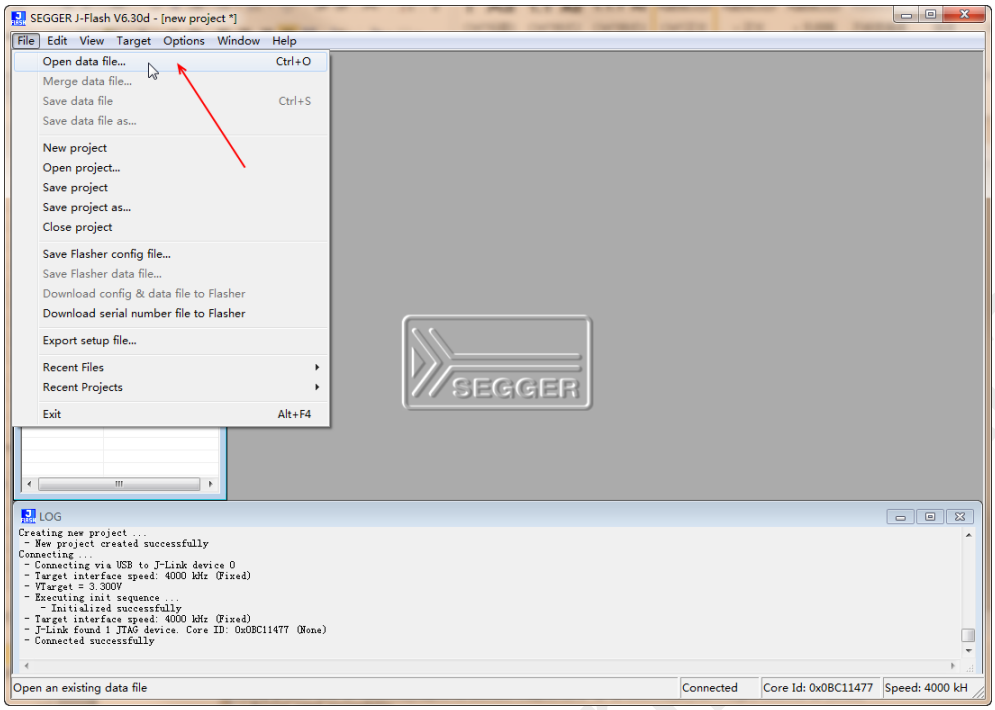

Figure 4-5. Upload the Target Burning File

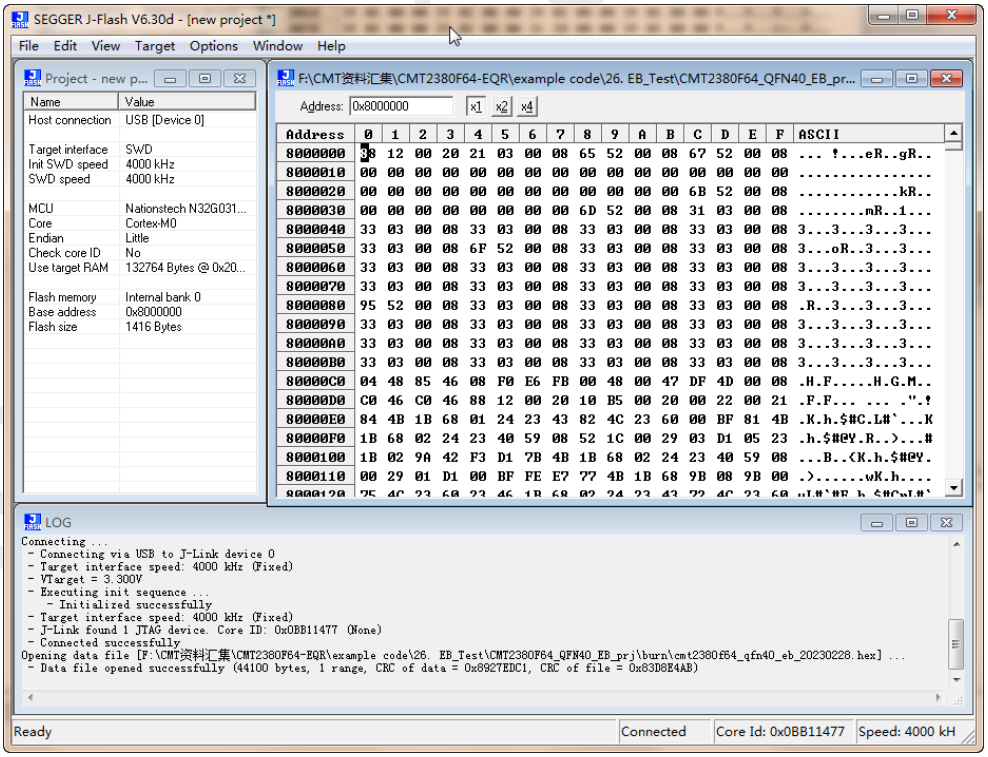

Figure 4-6. Open the Target Burning File

5. Click "Target" on the main menu bar, select "Manual Programming", and then select "Program", (it is recommended to erase the chip before operation) the J-Flash will burn the target file for CMT2380F64-EB or CMT2380F64-QFN48-EB.

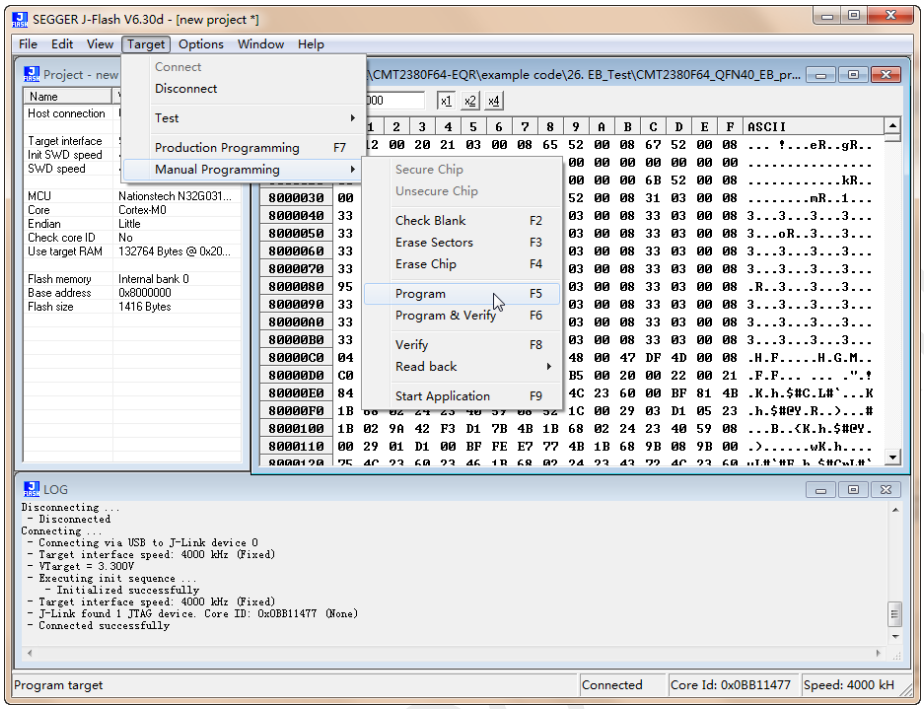

Figure 4-7. Manually Burning Operation

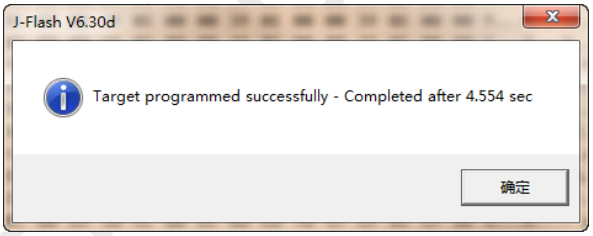

Figure 4-8. Successful Burning Prompt

6. Click CMT2380F64-EB/ CMT2380F64-QFN48-EB reset button to reset the main controller, then complete the firmware burning update.

4.2 Corresponding Mode for Each Function/Indicator

- Spectrum analysis test

The target frequency and target power can be tested for index of the spectrum when enter into CW Tx mode.

- Sensitivity test

The PN9 sequence error number rate can be tested by parameters of the target requency, target rate/frequency offset when enters into Direct Rx mode. GPIO3 can be used as demodulation output data stream and returns to the signal source instrument.

- Unidirectional distance test

Two sets, one is set for "Only Tx Mode", the other is set for "Only Rx Mode", when other parameters/configuration are consistent, one-way communication distance evaluation can be performed.

- Bidirectional distance test

Both sets are set to "Tx and Rx Mode". One sets the active Tx Mode and the other sets the passive Rx Mode. When other parameters/configurations are consistent, the bidirectional communication distance can be evaluated

- Reasonable RSSI evaluation

In the received state, the RSSI display is extracted. For example, in Direct Rx mode, the RSSI is monitored in real time and the display is updated, which can be used as an environmental noise assessment in the current test situation (based on conditions of the evaluation kit). Therefore, the communication link margin can be obtained by the comparision of the packet RSSI and environmental noise when the RSSI of the received packet is displayed no matter in unidirectional or bidirectional distant test.

5 Revise History

Table 5-1. Revise Record

Version	Chapter	Revise content	Date
0.1	All	Initial	2023-04-21

6 Contacts

Shenzhen Hope Microelectronics Co., Ltd.

Address: 30th floor of 8th Building, C Zone, Vanke Cloud City, Xili Sub-district, Nanshan, Shenzhen, GD, P.R. China

Tel: +86-755-82973805 / 4001-189-180
Post Code: 518052
Sales: sales@hoperf.com
Website: www.hoperf.com