CMOSTEK

AN197

CMT2300A/CMT2119B/CMT2219B fast manual frequency hopping

summary

This article introduces the fast manual frequency hopping mechanism of the three products CMT2300A / CMT2119B / CMT2219B to help users more conveniently Design and application.

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

Table **1.** Product models covered by this document

Product number	Working frequency modulation mode Main function configuration mode CMT2300A 126.33 -				encapsulation
1020MHz (G)FSK/OOK transceiver register CMT2119B 126.33 - 1020MHz (G)FSK/OOK transmitter register CMT2219B 126.33 -					QFN16
1020MHz (G)FSK/OOK receiver register					QFN16
					QFN16

Before reading this document, it is recommended to read "AN142-CMT2300A Quick Start Guide", "AN184-CMT2119B Quick Start Guide", and "AN161-CMT2219B Quick Start Guide" to understand the basic usage of the three products.

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1. Fast manual frequency hopping mechanism

This article introduces the manual frequency hopping mechanism of 3 products. Some of the operations are for RX mode. For those who only use CMT2119B or For users of CMT2300A TX frequency hopping, you can ignore the relevant description.

Manual frequency hopping means that based on the basic frequency point configured using RRPDK, such as 433.92MHz, during the application process, use MCU By simply setting 1 or 2 registers, you can quickly switch to another frequency point. Below are the relevant configuration registers.

Table **2.** Quick manual frequency hopping

Register name	Number of **digitsR/W**	Bit name	Function Description
CUS_FREQ_CHNL (0x63)	7:0 RW	FH_CHANNEL<7:0>	Set the number of channels for quick manual frequency hopping, total 255 channels.
CUS_FREQ_OFS (0x64)	7:0 RW	FH_OFFSET<7:0>	Set the channel width for quick manual frequency hopping. every bits increased by approximately 2.5kHz, the largest channel The width is 2.5x255 = 637.5 kHz.

The effective working frequency bands of the three products are:

Table **3.** Effective frequency band table

Target band		FREQ_DIVX_CODE <2:0> DIVIDER	
FREQ_VCO_BANK<2:0> = 110	FREQ_VCO_BANK<2:0> = 001		
758 – 840 MHz	840 – 1020 MHz	000	2
379 – 420 MHz	420 – 510 MHz	001	4
189.5 – 210 MHz	210 – 255 MHz	010	8
126.33 – 140 MHz	140 – 170 MHz	011	12
252.67 – 280 MHz	280 – 340 MHz	101	6

In the above table, we believe that frequencies using the same DIVIDER value are in the same frequency band, for example, 758 – 1020 MHz is the same frequency band.

The calculation formula for the target frequency point of manual frequency hopping is:

FREQ = basic frequency **+ 2.5 kHz x FH_OFFSET<7:0> x FH_CHANNEL<7:0>**

Although the basic frequencies of RX and TX are independent, there is only one frequency hopping mechanism, but the chip will automatically switch, that is, it will jump when entering TX. The frequency mechanism is performed on the basic frequency point of TX, and when entering RX, it is performed on the basic frequency point of RX. The basic frequency band refers to the configuration on RFPDK A good frequency point determines the current frequency band. In subsequent frequency hopping operations, this frequency band cannot be exceeded.

Generally speaking, users can first set FH_OFFSET<7:0> during the power-on initialization configuration stage, and then continue to use it in the application. Just change FH_CHANNEL<7:0> to switch channels.

2. **AFC** parameter setting for **RX** frequency hopping

The contents of this chapter can be ignored for users who only use CMT2119B or CMT2300A TX frequency hopping.

When using manual frequency hopping of RX, the frequency hopping operation will affect the setting of AFC_OVF_TH<7:0>, an important parameter of AFC (automatic frequency control). If the setting is incorrect, reception may not be possible at the current frequency. Normally, this parameter is automatically calculated by RFPDK through the frequency points input by the user, and the user does not need to configure it specifically. However, when the user uses fast frequency hopping or manually configures the frequency point, the frequency point setting is separated from RFPDK, so RFPDK cannot help the user configure this parameter. CMOSTEK provides another tool to automatically calculate this parameter for customers, which is the "CMT2300A-CMT2219B Frequency Hopping Calculation Table". The usage method is as follows:

1. The user fills in 4 parameters respectively

Xtal Frequency (MHz) - Crystal frequency, the default is 26MHz, if necessary, modify it according to the actual frequency

RX Xtal Tolerance (ppm) - Maximum error of the crystal used in the receiver

TX Xtal Tolerance (ppm) - Maximum error of the crystal used in the transmitter

RX Frequency Range (MHz) - The frequency band range in which the receiver hops

Note that the crystal errors of TX and RX refer to the crystal errors used by both communication parties. For TRX products, it can be assumed that a certain One side is RX and the other side is TX.

2. Then, in the Index column, fill in each frequency hopping frequency point that needs to be used in order, up to 100. If the user does not use that many frequency points, just leave the backdoor blank.

3. After filling in all frequency hopping frequency points, the table will calculate the value (decimal) of AFC_OVF_TH<7:0> corresponding to each frequency point, and also display the value of Initial AFC_OVF_TH<7:0> on the left. in the table.

- If all AFC_OVF_TH<7:0> values are equal to Initial AFC_OVF_TH<7:0>, it means that there is no frequency point that requires special processing. Then the user only needs to change the Initial AFC_OVF_TH<7:0> value during the chip initialization process. The value can be written to the 0x27 CUS_FSK4 register once and does not need to be changed in the future.

- If in a certain frequency point, the values of AFC_OVF_TH<7:0> and Initial AFC_OVF_TH<7:0> are different, then the value will be marked in red. The user needs to configure the value of Initial AFC_OVF_TH<7:0> in the initialization process, and then update the corresponding value of AFC_OVF_TH<7:0> to the 0x27 CUS_FSK4 register before jumping to the frequency point (in STBY state) middle. Before jumping to the next frequency point, if the two values are the same, the register content needs to be restored to the value of Initial AFC_OVF_TH<7:0>.

In short, the user needs to ensure that before jumping to each frequency point, the value of the 0x27 CUS_FSK register must be the same as the corresponding AFC_OVF_TH<7:0> value in the table.

Regarding the initialization process, please participate in the quick start guide of the corresponding product.

3. The overall process of quick manual frequency hopping

The following summarizes the overall process of fast manual frequency hopping:

1. Use "CMT2300A-CMT2219B Frequency Hopping Calculation Table" to obtain Initial AFC_OVF_TH <7:0>, and set this value in the chip initialization Write to the 0x27 CUS_FSK4 register during the transformation process. If you only use TX frequency hopping, you can ignore this step.

2. Send go_stby to return the chip to STBY state.

3. Set FH_CHANNEL<7:0>. If you need to reset FH_OFFSET<7:0>, also process it in this step. Refer to the working frequency band division in Table 3 to limit the frequency hopping range. Remember that the chip does not support cross-band frequency hopping operations, that is, the value of the FREQ_DIVX_CODE<2:0> register cannot be changed. Since the basic frequency point is determined by RFPDK, the parameter table generated by RFPDK by default contains the value of the FREQ_DIVX_CODE<2:0> register corresponding to the frequency band. It is configured during initialization, and the user does not need to jump frequency every time. configuration. However, it should be noted that FREQ_VCO_BANK<2:0> will change in the same frequency band. When the user sets the frequency hopping frequency point in this step, it corresponds to the range marked in Table 3. If necessary, the value of FREQ_VCO_BANK<2:0> must be updated. .

4. If you are performing an RX frequency hopping operation, follow the method introduced in Chapter 2 and use the EXCEL tool sheet provided by CMOSTEK to ensure that the value of the 0x27 CUS_FSK4 register is equal to AFC_OVF_TH<7:0 corresponding to the frequency point you are currently jumping to. > value. If it is a TX frequency hopping operation, you can ignore this step.

5. Send go_tx into TX for transmission, or go_rx into RX for reception.

If the user performs TX frequency hopping operation and then switches to RX state for reception, FH_CHANNEL<7:0> must be set back to 0 before receiving in order to return to the RX basic frequency set by RFPDK. On the contrary, after performing the RX frequency hopping operation, FH_CHANNEL<7:0> must be set back to 0 before the TX basic frequency set by RFPDK can be used for transmission.

The advantage of manual frequency hopping is that the frequency can be changed by setting only 1 to 2 registers. If there is no such mechanism, you need to write Only the contents of the frequency area can be used to change the frequency. The contents of the registers to be written are greatly increased, and the time is also longer, which may not meet the application requirements.

4. Document change record

Table 4. Document change record table

version number	chapter	Change description	date
0.8	All initial releases		2017-11-07

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