CMOSTEK AN151

CMT2210B/LA Configuration Guideline

Introduction

The CMT2210B/LA are ultra-low power, high performance, and low-cost OOK stand-alone RF receivers for various 300 to 480 MHz wireless applications. The devices part of the CMOSTEK NextGenRF™ family, which includes a complete line of transmitters, receivers and transceivers.

Table 1. Part Numbers Covered in this Document

Product	Modulation/ Frequency	Sensitivity	Rx Current	Embedded EEPROM	Package
CMT2210B	OOK/ 300-480 MHz	-113 dBm (433.92 MHz, 1 kbps, 0.1% BER)	3.8 mA (433.92 MHz)	√	QFN16
CMT2210LA	OOK/ 300-480 MHz	-113 dBm (433.92 MHz, 1 kbps, 0.1% BER)	3.8 mA (433.92 MHz)	√	SOP8

The RFPDK (RF Products Development Kit) is a PC application developed by CMOSTEK for the NextGenRF™ product line. Differing from traditional RF chip configuration methods, which usually require complex software programming and register-based controlling, the RFPKD revolutionarily simplifies the NextGenRF™ product configurations. The user can easily complete the product configuration by just clicking and inputting a few parameters. After that, the product can be directly used in the RF system without performing any further configurations.

This document describes the details of how to configure the features/parameters of the CMT2210B/LA with the RFPDK.

Table of Contents

1. Getting Started

Install RFPDK on the computer. The detail of the installation can be found in “AN103 CMT211xA/221xA One-Way RF Link Development Kits User’s Guide”.

Setup the development kits as shown in the figure below before configuring the CMT2210B/LA. The Application with CMT2210B/LA can be CMT2210B/LA-EM provided by CMOSTEK, or the PCB designed by the user with CMT2210B/LA.

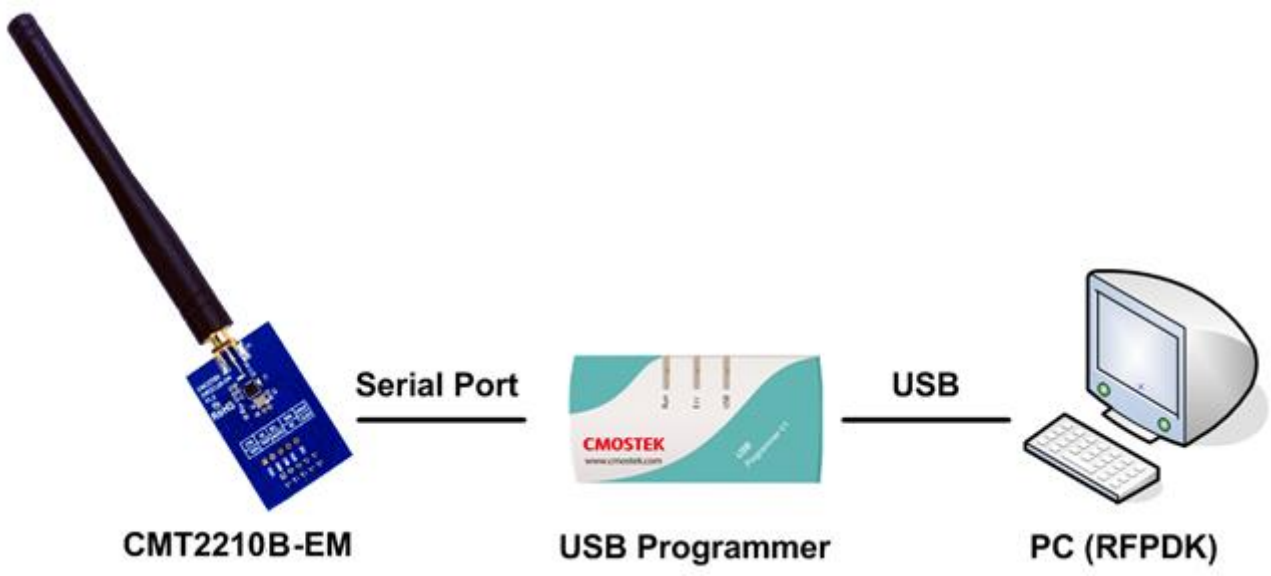

Figure 1. CMT2210B Configuration Setup

Start the RFPDK from the computer’s desktop and select CMT2210B/LA in the Device Selection Panel shown in the figure below. Once a device is selected, the Device Control Panel appears as shown in Figure 3.

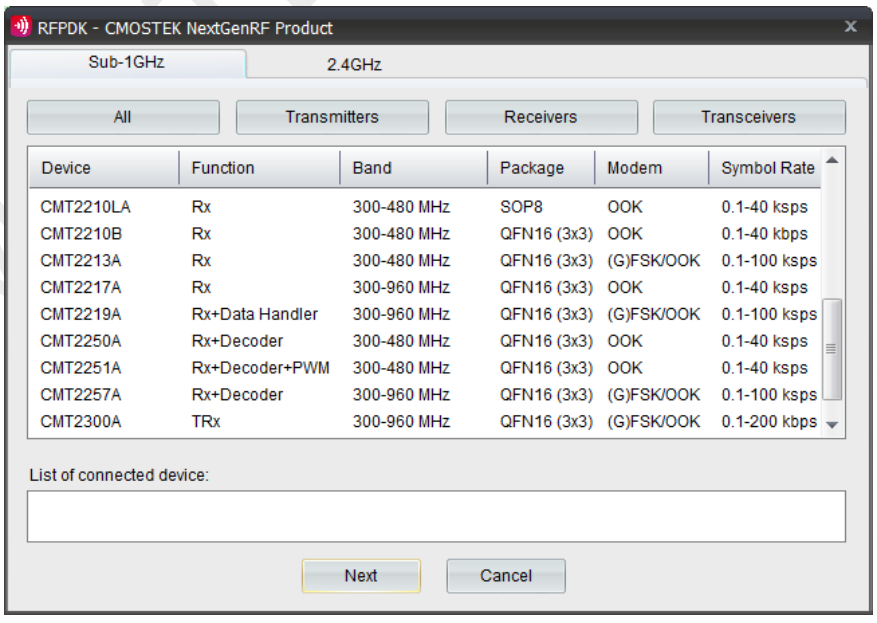

Figure 2. Device Selecting Panel

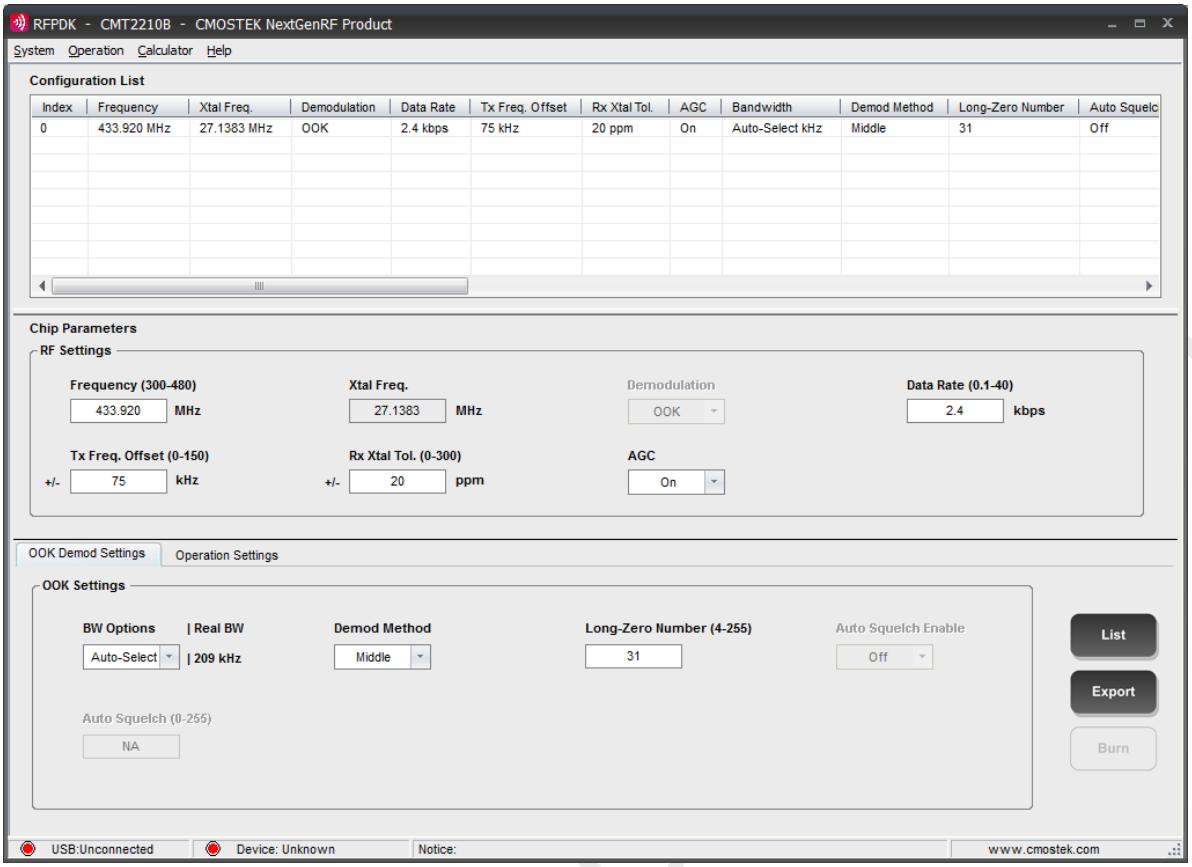

Figure 3. Device Control Panel

2. RF Settings

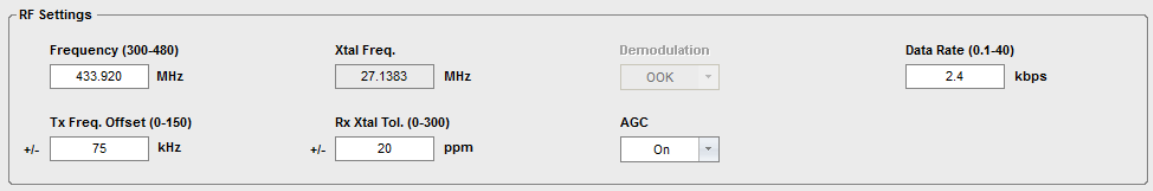

Figure 4. RF Settings

Table 2. RF Settings Parameters

Parameters	Descriptions	Default
Frequency	The receive radio frequency, the range is from 300 to 480 MHz, with resolution of 0.001 MHz, this determines the Xtal Freq should be used.	433.920 MHz
Xtal Freq.	When Frequency is specified, the Xtal Freq. is automatically calculated and displayed	27.1383 MHz
Demodulation	The demodulation type, only OOK demodulation is supported in this product.	OOK
Data Rate	The receiver data rate, the range is from 0.1 to 40.0 kbps, with resolution of 0.1 kbps.	2.4kbps
Tx Freq. Offset	Tx frequency offset need to cover. Specifying this parameter helps to determine the appropriate Rx bandwidth.	±75 kHz
Rx Xtal Tol.	The sum of the crystal frequency tolerance of the Rx, the range is from 0 to ±300 ppm. Specifying this parameter helps to determine the appropriate Rx bandwidth.	±20 ppm
AGC	Automatic Gain Control, the options are: on or off.	On

2.1 Frequency

CMT2210B/LA covers a wide range of the receive radio frequency from 300 to 480 MHz. The frequency is accurate to three decimal places on the RFPDK. This determines the Xtal Freq should be used

2.2 Xtal Freq.

This parameter is the Xtal frequency or external reference clock frequency required for the CMT2210B/LA works correctly. The XTAL frequency can be obtained when the desired F_{RF} is input on the RFPDK, with the calculation shown below.

$$F_{XTAL} = \frac{F_{RF}}{11.98923}, \quad 300\ \text{MHz} \leqslant F_{RF} < 360\ \text{MHz}$$

$$F_{XTAL} = \frac{F_{RF}}{15.98923}, \quad 360\ \text{MHz} \leqslant F_{RF} \leqslant 480\ \text{MHz}$$

For examples:

1. When F_{RF} = 315 MHz, we get F_{XTAL} = 26.27358 MHz;
2. When F_{RF} = 433.92 MHz, we get F_{XTAL} = 27.13827 MHz.

2.3 Demodulation

CMT2210B/LA only supports OOK demodulation.

2.4 Data Rate

With OOK demodulation, CMT2210B/LA supports 0.1 – 40.0 kbps data rate. With the Sync Clock turned off (Preamble/Ext-Code related Wake-On Condition is not selected), the receiver is able to tolerate a wide range of data rate error. The less data rate error exists between the Tx and Rx, the higher performance the device can achieve.

It should be noticed that, if the Wake-on Radio function is turned on, and the Wake-On Condition is set to preamble or Ext-Code related item, the sync clock technique is chosen, the data rate tolerance is determined by the number of consecutive zeros/ones in the data packet. The computation can be done by:

$$Data\ Rate\ Tolerance = \frac{\pm 50\%}{Number\ of\ Consecutive\ Zeros\ or\ Ones}$$

For example, if the largest number of consecutive zeros/ones in the packet is 4, then the data rate tolerance is ±12.5%. The more number of long zeros or ones exist, the less error the receiver can tolerate.

2.5 Tx Freq. Offset and Rx Xtal Tol.

These two parameters specify the frequency offset of the RF link, including the Tx frequency offset, and Rx Xtal tolerance. The bandwidth of the device should be able to cover the frequency offset. If the Auto-select is used when configuring the BW Options, the device will calculate the best bandwidth option automatically based on the frequency offset, and the data rate configurations.

2.6 AGC

The Automatic Gain Control option is available for the device to have better blocking immunity performance for OOK demodulation. It is recommended to turn on the AGC during the normal operation.

3. OOK Settings

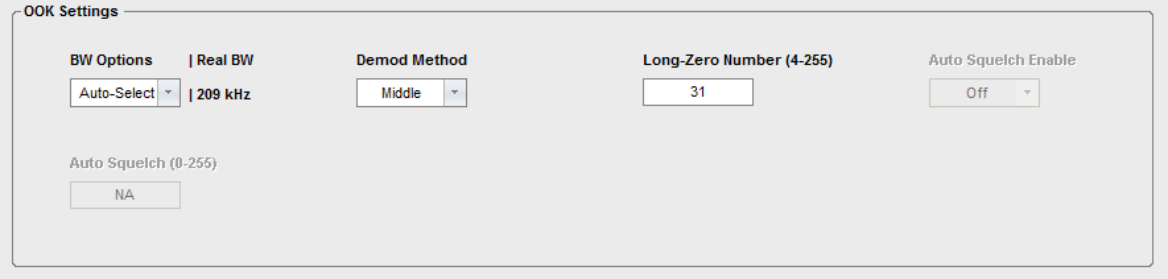

Figure 5. OOK Settings

The available operating options for the OOK settings are:

Table 3.OOK Settings

Parameters	Descriptions	Default
BW Options | Real BW	The bandwidth option of the receiver, the options are: 1: Auto-select; 2: 50 kHz; 3: 100 kHz; 4: 200 kHz; 5: 330 kHz. The real bandwidth will be slightly different according to the Xtal frequency used.	Auto-select
Demod Method	The demodulation method option of the receiver, the options are: Middle, Average.	Middle
Long-Zero Number	The maximum number of continuous zero allowed to be demodulated, ranging from 4 to 255.	31
Auto Squelch Enable	Turning on or off the Auto Squelch function	Off
Auto Squelch	The auto squelch threshold when the function is turned on.	40

3.1 BW Options | Real BW

The OOK bandwidth determines the sensitivity of OOK demodulation. The smaller the bandwidth is, the better sensitivity the device has. It is recommended to choose the Auto-Select option which means the RFPDK automatically calculates the bandwidth based on the Data Rate and Xtal Tolerance settings, unless it can't meet the user's application.

3.2 Demod Method, Long-Zero Number

The Middle demodulation method is continuously scanning the peak and bottom of the RSSI signal in one time window, and generates the $(peak + bottom)/2$ as the demodulation threshold. Once it is all zeros in one time window, the peak will go down slowly. The rate of peak ramp-down is related to Long-Zero Number. This method provides faster response to the received signal, but more sensitive to it, thus is suitable for the DC supplied application.

The Average demodulation method is using the average low-pass filter to process the RSSI signal and calculate its demodulation threshold. This method takes time to settle the threshold, thus not as sensitive to the fluctuation of the received signal as the Middle method does, suitable for the AC supplied application. However, the user should note that using this method could normally miss the first received packet.

3.3 Auto Squelch Enable, Auto Squelch

In OOK demodulation, if the Auto Squelch function is enabled, the device is able to mask the noise floor so that the DOUT is quiet

while no effective signal is received. The idea is that the device will detect the average level of the noise floor and add up the value of “Auto Squelch” to create a demodulation threshold. Everything below this self-generated threshold is masked out, therefore logical 0 is output to DOUT pin.

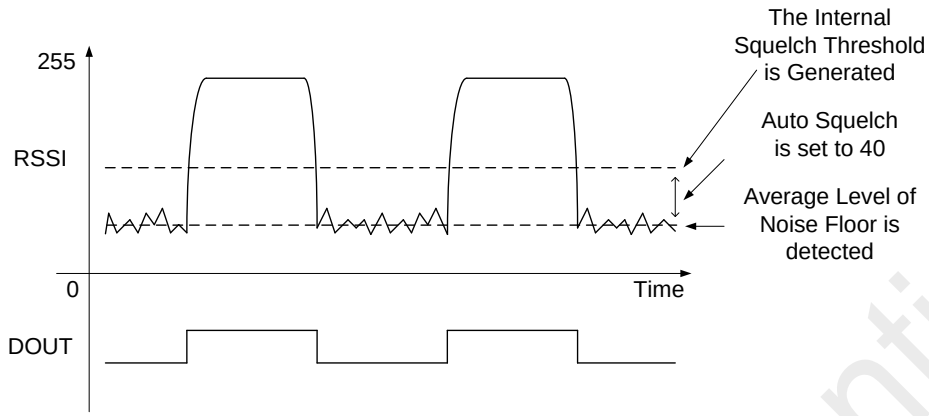

Figure 6. Auto Squelch

It is found that, normally, setting the Auto Squelch to about 30 – 40 will mask more than 95% of the noise. The user should be aware of that, using the Auto Squelch will lead to a few dB lost of sensitivity. The larger value the Auto Squelch is set to, the more sensitivity is lost, because the threshold also masks out a portion of useful signal. Please note that if the Auto Squelch Enable is set Off when the function is turned off, the value of the Auto Squelch is used as the absolute Squelch threshold, regardless of the actual noise floor level.

This function is also very useful cooperating with the RSSI related WOR. When the Auto Squelch is properly set, for example, noise is fully masked out, the Rx time switching or extension will not happen. Only when the effective signal (RSSI) is received, the Rx time switching or extension will happen.

4. Operation Settings

Figure 7. Operation Settings

The available operating options for the radio control are:

Table 4. Operation Settings Parameters

Parameters	Descriptions	Default
System Clock Output (CMT2210B only)	Turn on/off the system clock output on CLKO, the options are: on or off.	Off
System Clock Frequency (CMT2210B only)	The system clock output frequency, the options are: the F_{XTAL} divided by 2 to by 64. It is only available when System Clock Output is on.	6.785 MHz
GPO Config (CMT2210B only)	To select the function of the GPO pin, the options are: Rx Active, System Clock, Data Clock or LBD	Rx Active
GPO Invert (CMT2210B only)	The option to invert the state of the GPO pin	Off

4.1 GPO Config, GPO Invert

The GPO pin is available in the CMT2210B device. The GPO can be configured as Rx Active, Data Clock, System Clock and LBD by the GPO Config. The GPO Invert can be used to flip the default state of the GPO output

4.1.1 Rx Active

The Rx Active is used to indicate the TUNE and Rx state. With the GPO Invert set off, the GPO output high level starting from TUNE till the end of RX state, and output low level during the sleep state, as shown in the figure below.

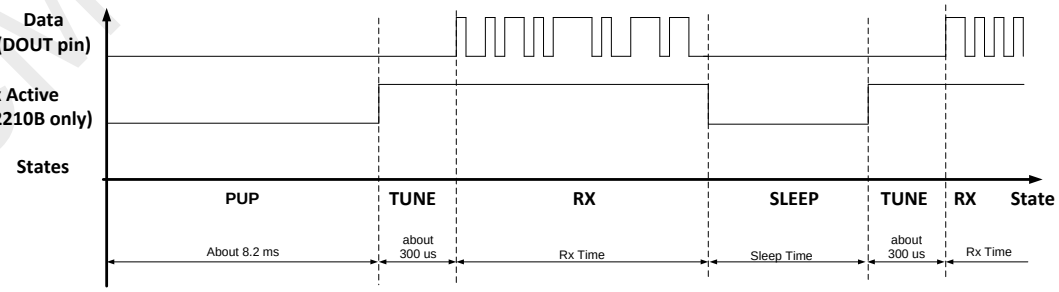

Figure 8. Rx Active, GPO Invert Off

4.1.2 System Clock

If the system clock output is selected in the GPO Config, a continuous clock signal divided down from the crystal clock is output via the GPO pin to drive the external MCU or other devices. The selectable clock frequency has a wide range from Xtal Freq. divided by 2 to that divided by 64. This clock is available when the device is in the TUNE and RX states.

The user can either use this clock to drive the external MCU, or as an indication of the device working status. In some circumstances, the MCU can treat this clock as an interrupt to synchronize the working status to that of the device.

4.1.3 Data Clock

When Preamble and Ext-Code related Wake-On Condition is selected, the synchronization clock is enabled, and it is available to the user with GPO Config is set to Data Clock.The user must be aware that if sync clock is used, the smaller data rate offset exists between the Tx and Rx, the larger number of consecutive zeros/ones in the packet can exist.

5. Document Change List

Table 5. Document Change List

Rev. No.	Chapter	Description of Changes	Date
0.6	All	Initial released version	2016-10-27

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