CMOSTEK

AN102

CMT2110/17A Configuration Guideline

Introduction

The CMT2110/17A is an ultra low-cost, highly flexible, high performance, single-chip OOK transmitter for various 240 to 960 MHz wireless applications. The devices are part of the NextGenRF™ family, which includes a complete line of transmitters, receivers and transceivers.

Table 1. Part Number Covered in this Document

Product	Frequency	Modulation	Max Output Power	Tx Current Consumption	Embedded EEPROM
CMT2110A	240-480 MHz	OOK	+13 dBm	13.4 mA (+10 dBm @ 433.92 MHz)	✓
CMT2117A	240-960 MHz	OOK	+13 dBm	15.5 mA (+10 dBm @ 868.35 MHz)	✓

The RFPDK (Radio Frequency 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 CMT2110A and the CMT2117A on the RFPDK.

To help the user develop their application with CMT2110/17A and CMT2210/17A easily, CMOSTEK provides **CMT2110A/2210A One-Way RF Link Development Kits** and **CMT2117A/2217A One-Way RF Link Development Kits** which enable the user to quickly evaluate the performance, demonstrate the features and develop the application. The Development Kits includes:

- RFPDK
- USB Programmer
- RF-EB (evaluation board for NextGenRF™ products)
- CMT2110A-EM or CMT2117A-EM (Tx evaluation module)
- CMT2210A-EM or CMT2217A-EM (Rx evaluation module)

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1. Getting Started

Install the RFPDK on the PC. The details 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 Figure 1 before configuring the CMT2110/17A. The application with CMT2110/17A can be CMT2110/17A-EM provided by CMOSTEK, PCB designed by the user with CMT2110/17A.

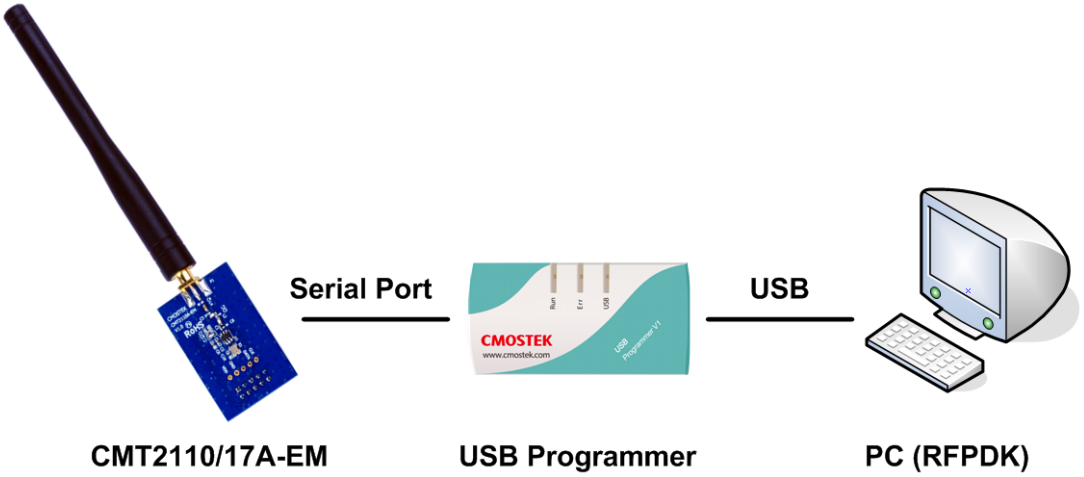

Figure 1. CMT2110/17A Configuration Setup

Start the RFPDK from the computer’s desktop and select CMT2110A or CMT2117A in the Device Selection Panel shown in Figure 2. Once a device is selected, the Device Control Panel appears as shown in Figure 3. Because the Advanced Mode covers all the configurable features / parameters while the Basic Mode only contains a subset, the Advanced Mode is described in this document.

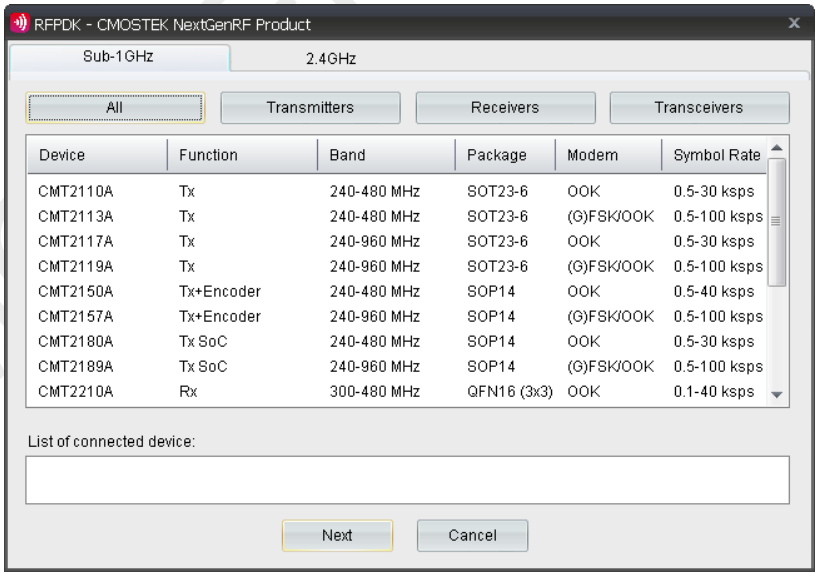

Figure 2. Device Selection Panel

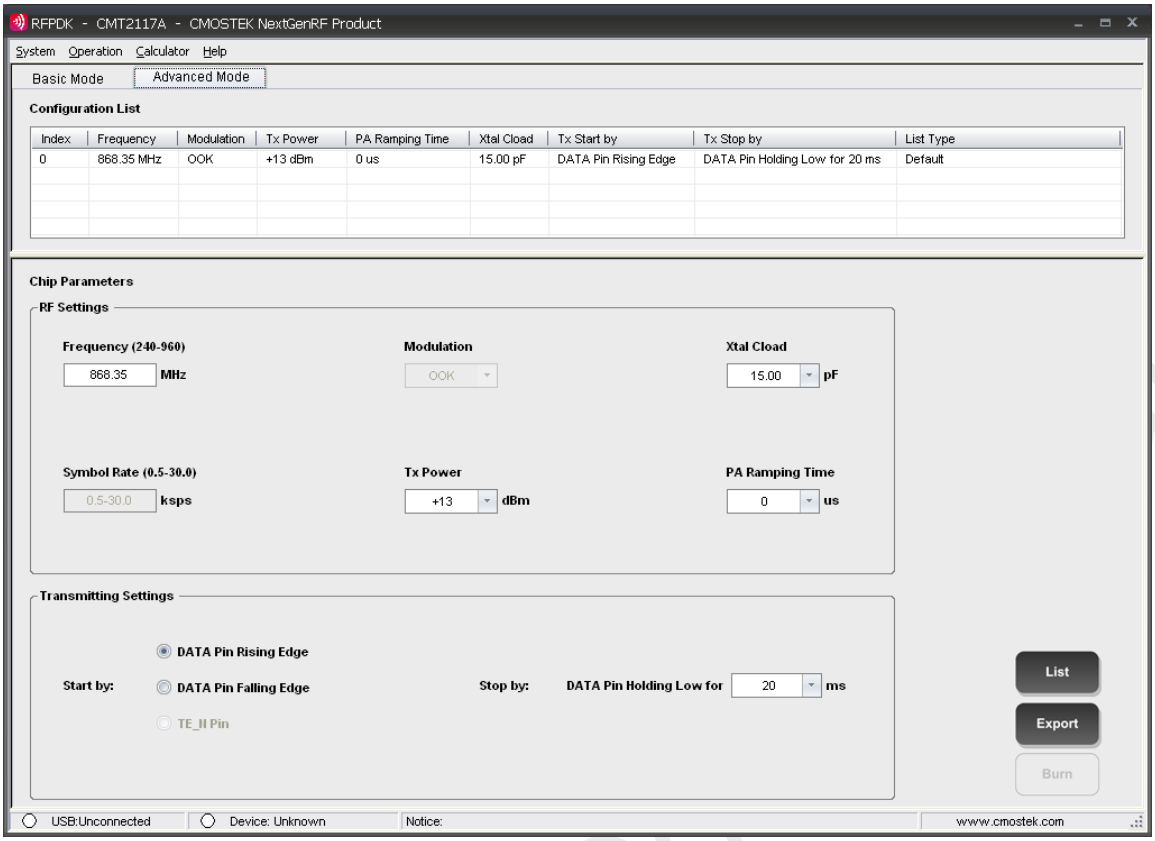

Figure 3. Advanced Mode of Device Control Panel

Table 2. All Configurable Parameters

Category	Parameters	Descriptions	Default	Mode
RF Settings	Frequency (CMT2110A)	To input a desired transmitting radio frequency in the range from 240 to 480 MHz. The step size is 0.001 MHz.	433.92 MHz	Basic Advanced
	Frequency (CMT2117A)	To input a desired transmitting radio frequency in the range from 240 to 960 MHz. The step size is 0.001 MHz.	868.35 MHz	Basic Advanced
	Tx Power	To select a proper transmitting output power from -10 dBm to +14 dBm, 1 dBm margin is given above +13 dBm.	+13 dBm	Basic Advanced
	Xtal Cload	On-chip XOSC load capacitance options: from 10 to 22 pF.	15 pF	Basic Advanced
	PA Ramping	To control PA output power ramp up/down time, options are 0 and 2^n us (n from 0 to 10).	0 us	Advanced
Transmitting Settings	Start by	Start condition of a transmitting cycle, by Data Pin Rising/Falling Edge.	Data Pin Rising Edge	Advanced
	Stop by	Stop condition of a transmitting cycle, by Data Pin Holding Low for 20 to 90 ms.	Data Pin Holding Low for 20 ms	Advanced

2. RF Settings

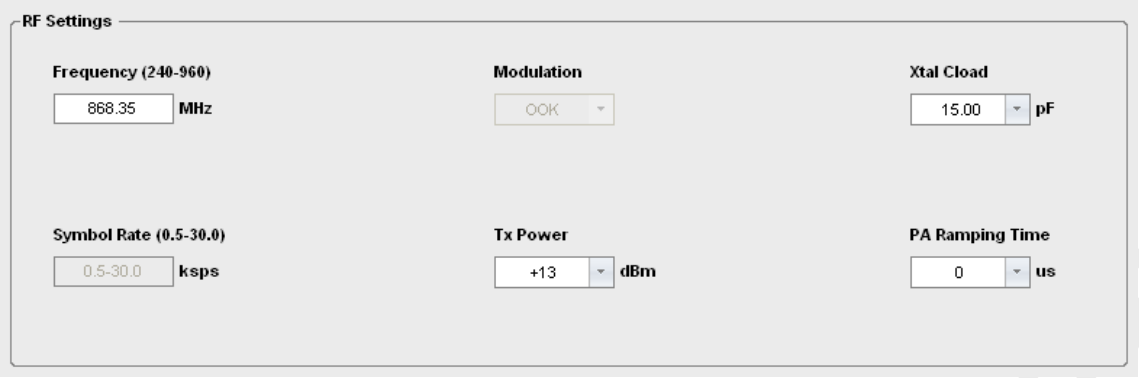

Figure 4. RF Settings

Four parameters can be configured for CMT2110/17A, as shown in figure above. And the configuration range is shown in the table below. Please note that

Table 3. CMT2110/17A RF Settings

Parameters	Symbol	Min	Max	Step Size	Unit
Frequency(CMT2110A)[1]	F_{RF}	240	480	0.001	MHz
Frequency(CMT2117A)[1]	F_{RF}	240	960	0.001	MHz
Tx Power[2]	P_{OUT}	-10	+14	1	dBm
PA Ramping Time	t_{RAMP}	0	1024	2^n	us
Xtal Load[3]	C_{LOAD}	10	22	0.33	pF

Notes:

[1]. CMT2110/17A RF frequency resolution is better than 198 Hz.

[2]. Proper PA matching network is required, see “AN101 CMT211xA Schematic and PCB Layout Design Guideline” for details of recommended matching network.

[3]. Recommended Xtal load capacitance is 12 to 20 pF. 2 pF margin is given in both ends in order to ensure the recommended load capacitance can be covered.

2.1 Frequency and Tx Power

The Frequency can be continuously configured from 240 to 480 MHz for CMT2110A and to 960 MHz for CMT2117A, accurate to three decimal places. Tx Power can be configured from -10 dBm to +14 dBm in 1 dBm step size. The actual output power could be slightly different due to the user’s PCB layout and the components used for matching network differing from CMOSTEK’s recommendations. Therefore, the user should select the proper value from the Tx Power pull down menu to meet the system output power requirement according the actual measurement.

2.2 PA Ramping Time

The PA can be configured with different ramping time by setting the PA Ramping Time. The available options for the ramping (up and down) time are 0, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512 and 1024 us. When the option is set to 0, the PA output power will ramp up or down to its configured value in the shortest possible time. See Figure 5 for different PA ramping times.

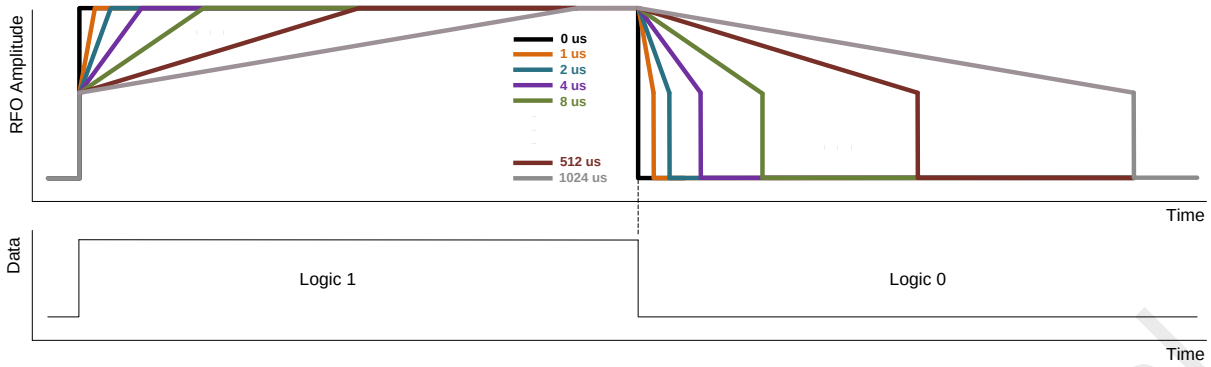

Figure 5. Different PA Ramping Time

2.3 Xtal Cload

The CMT2110/17A uses a 1-pin crystal oscillator circuit with the required crystal load capacitance integrated on the chip. The recommended specifications for the crystal are: 26 MHz with ±20 ppm frequency tolerance, ESR (Rm) < 60 Ω, load capacitance C_{LOAD} ranging from 12 to 20 pF. In order to cover the 12 to 20 pF load capacitance range, the parameter Xtal Cload pull down menu is intended to extend extra 2 pF margin in both ends. The recommended procedure to set the Xtal Cload is shown as the figure below.

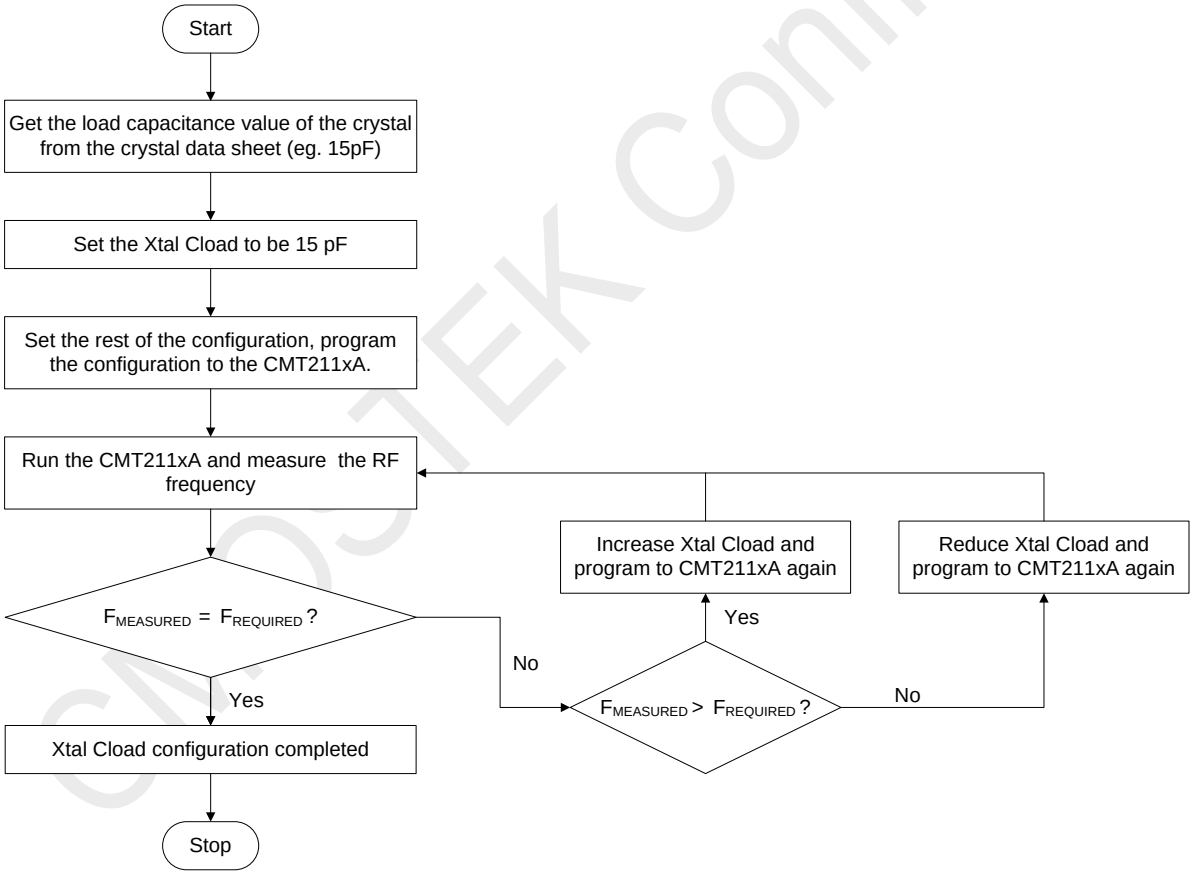

Figure 6. Procedure of Setting Xtal Cload

3. Transmitting Settings

Figure 7. Transmitting Settings

Start by and Stop by can be configured in the Transmitting Settings, as shown in the figure above.

Please note that the CMT211xA devices support Two-wire Interface (TWI) communication for more robust and power-saving transmissions. The timing requirement of the TWI commands (TWI_RST, TWI_OFF and SOFT_RST) are related to the Start by and Stop by conditions, which will introduce below. The user can refer to the CMT211xA datasheets for details.

3.1 Start by

The transmission of CMT2110/17A can be started by either “DATA Pin Rising Edge” or “DATA Pin Falling Edge”. See the two figures below for the 2 different Start by conditions and Table 4 for the timing requirements of the conditions.

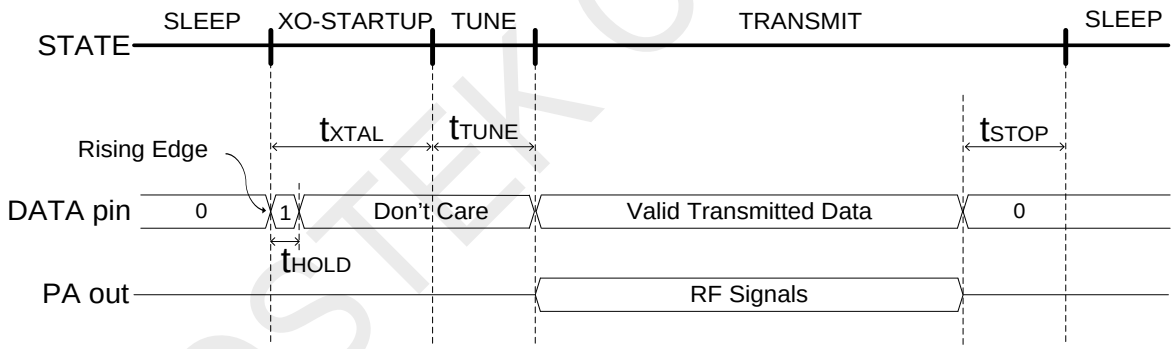

Figure 8. Transmission Enabled by DATA Pin Rising Edge

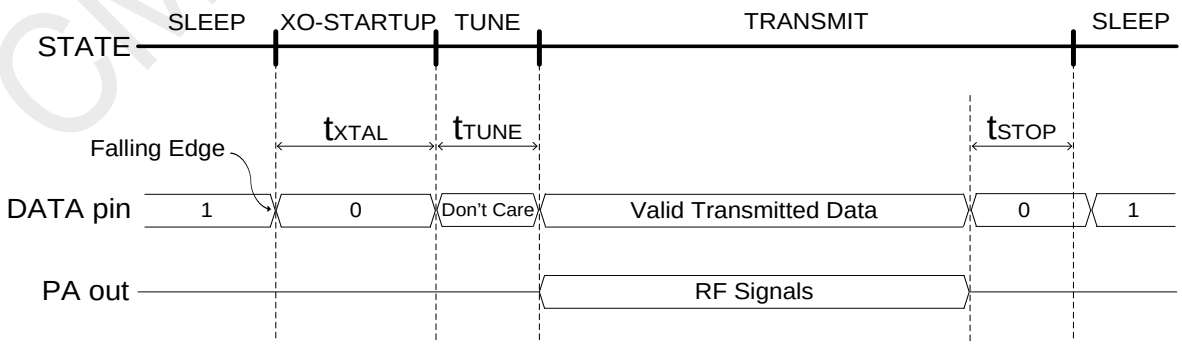

Figure 9. Transmission Enabled by DATA Pin Falling Edge

Table 4.Timing in Different Working States

Parameter	Symbol	Min	Typ	Max	Unit
XTAL Startup Time [1]	t_{XTAL}		400		us
Time to Tune to Desired Frequency	t_{TUNE}		370		us
Hold Time after Rising Edge	t_{HOLD}	10			ns
Time to Stop The Transmission[2]	t_{STOP}	20		90	ms

Notes:
[1]. This parameter is to a large degree crystal dependent.
[2]. Configurable from 20 to 90 ms in 10 ms step size.

3.2 Stop by

When the CMT2110/17A DATA pin is driven to low (logical zero) for the time t_{STOP} (can be selected from 20 to 90 ms in 10 ms step size), the transmission is ended and the CMT2110/17A goes back to the SLEEP state, waiting for the next transmit cycle. Please note that the selected stop time and the actual symbol rate limits the number of consecutive zeros that can be transmitted. If the number of zeros transmitted is larger than N, which is calculated as below, the transmission is ended.

$$N = \text{Integer}[\frac{t_{STOP}}{1/SR}]$$

Note:

1. SR represents the actual symbol rate of the transmitted data.
2. The unit for t_{STOP} is ms, and for SR is kbps.
3. The function **Integer [ ]** is rounding down to the nearest integer. E.g. Integer [1.4] = 1; Integer [10.6] = 10.

Example 1

If the t_{STOP} is 20 ms and the actual SR is 0.5 kbps, the maximum number of consecutive zeros that can be transmitted is Integer [20 * 0.5] = 10.

Example 2

If the t_{STOP} is 20 ms and the actual SR is 1.03 kbps, the maximum number of consecutive zeros can be transmitted is Integer [20 * 1.03] = 20.

4. Document Change List

Table 5. Document Change List

Rev. No.	Chapter	Description of Changes	Date
0.9	All	Initial released version	2014-06-14
1.0	-	-	2014-06-30
1.1	All	Adding product CMT2117A to this document	2015-3-18

5. Contact Information

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