CMOSTEK

AN113

CMT2150A/2250(1)A One-Way RF Link Development Kits User's Guide

Introduction

The purpose of this document is to provide the guidelines for the users to use the CMT2150A/2250(1)A One-Way RF Link Development Kits (Development Kits) in different application schemes. The related part numbers covered by this document is shown in table below.

Table 1. Part Numbers Covered in this Document

Part Number	Description
CMT2150A	True single-chip, highly flexible, high performance, OOK RF transmitter with embedded data encoder ideal for 240 to 480 MHz wireless applications
CMT2250A	True single-chip, ultra low power and high performance device that consists of an OOK RF receiver, a data decoder and 4 data output pins for various 300 to 480 MHz wireless applications
CMT2251A	True single-chip, ultra low power and high performance device that consists of an OOK RF receiver, a data decoder and 1 PWM output pin for various 300 to 480 MHz wireless applications.

The Development Kits are a set of the hardware and software tools designed to help the users to easily evaluate the performance and demonstrate the features of products CMT2150A, CMT2250A and CMT2251A. These devices are part of the CMOSTEK Microelectronics Co., Ltd. (CMOSTEK) NextGenRF™ family, which include a complete line of transmitters, receivers and transceivers. They are optimized for the low system cost, low power consumption, battery-powered one-way RF link application with their highly integrated and low power design.

The package of the Development Kits is shown in Figure 1.

Figure 1. CMT2150A/2250(1)A One-Way RF Link Development Kits

Table of Contents

Abbreviations

Abbreviations used in this document are described below.

AN	Application Notes	**PC**	Personal Computer
API	Application Programming Interface	**PCB**	Printed Circuit Board
BOM	Bill of Materials	**PER**	Packet Error Rate
CDROM	Compact Disk Read Only Memory	**PWM**	Pulse Width Modulation
EM	Evaluation Module(s)	**RF**	Radio Frequency
Err	Error	**RFPDK**	RF Products Development Kit
ID	Identification	**Rx**	Receiving, Receiver
ksps	Kilo Symbols Per Second	**Tx**	Transmission, Transmitter
LED	Light Emitting Diode	**SR**	Symbol Rate
OOK	On-Off Keying	**USB**	Universal Serial Bus
PA	Power Amplifier		

1. Development Kits Contents

The Development Kits contain the following components:

- 1 x **CMT2150A-EM** V1.0 Tx module
- 1 x **CMT2250A-EM** V1.0 Rx on-off control module
- 1 x **CMT2251A-EM** V1.0 Rx PWM control module
- 1 x **USB Programmer** V1
- 1 x **CDROM** with RFPDK installer and documents
- 1 x **USB Cable**
- 6 x **AA Batteries**
- 3 x **Antennas**

Please note that the CMT2150A-EM is by default configured to work in pair with CMT2250A-EM. Using the RFPDK, the user can easily program the PWM function into the CMT2150A, so that it can work in pair with CMT2251A-EM. Please refer to "Chapter 2 Application Schemes" for the detail of the configuration.

Figure 2. Development Kits Contents

CMT2150A-EM

The CMT2150A-EM is the Tx evaluation module, it can be used to work in pair with CMT2250A-EM to demonstrate the On-Off control feature, and work in pair with CMT2251-EM to demonstrate the PWM control feature.
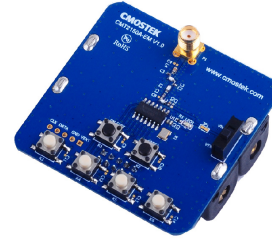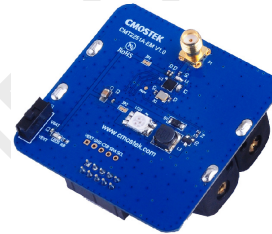
CMT2250A-EM

The CMT2250A-EM is the On-Off control Rx evaluation module. The user can use it to evaluate the CMT2250A On-Off control feature.

CMT2251A-EM

The CMT2251A-EM is the PWM control Rx evaluation module. The user can use it to evaluate the CMT2251A PWM control feature.

RFPDK

CMOSTEK provides the PC application that allows the users to configure all the product features to CMOSTEK NextGenRF^{TM} products in the most intuitional way. The installation pack can be found on the CDROM of the CMT2150A/2250(1)A One-Way RF Link Development Kits.
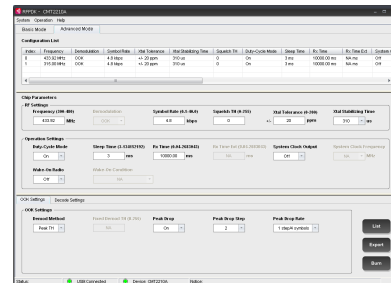
USB Programmer

It transmits data between the EM and the PC via two interfaces: USB to PC and serial port to EM. The protocols of the serial port differ for different parts (chips). The USB programmer automatically identifies the part on the EM once it is connected, and then uses the desired protocol to communicate to the part.

2. Application Schemes

In order to help to user to start using the Development Kits easily, CMOSTEK has defined a few configurations with different application schemes on the RFPDK. The user only needs to follow the guidelines in the subsections of this chapter, program the configuration to the corresponding evaluation modules and start the evaluation. The application schemes are listed in the tables below with the different modules required.

Table 2. Application Schemes for CMT2150A-EM in Pair with CMT2250A-EM

Application Schemes	CMT2150A		CMT2250A		Description
	Basic/Advanced	Index	Basic/Advanced	Index	
LED On/Off	Basic	1	Basic	1	To control the LEDs on CMT2250A-EM in On/Off manner
Pulse	Basic	2	Basic	2	To control the LEDs on CMT2250A-EM in Short Pulse manner
Periodic Tx	Advanced	1	Advanced	1	Periodic transmission from CMT2150A-EM to CMT2250A-EM

Table 3. Application Scheme for CMT2150A-EM in Pair with CMT2251A-EM

Application Schemes	CMT2150A		CMT2251A		Description
	Basic/Advanced	Index	Basic/Advanced	Index	
PWM	Advanced	2	Advanced	1	To control the LED on the CMT2251A-EM with PWM signal generated by the CMT2251A

The configurations of each application scheme are by default provided on the RFPDK. The Index number is shown in the 1st (left) column of the configuration list, while the name of the application list (also called "List Type") is shown in the last (right) column. An example of the CMT2150A configuration lists in Basic / Advanced modes are shown in the figures below.
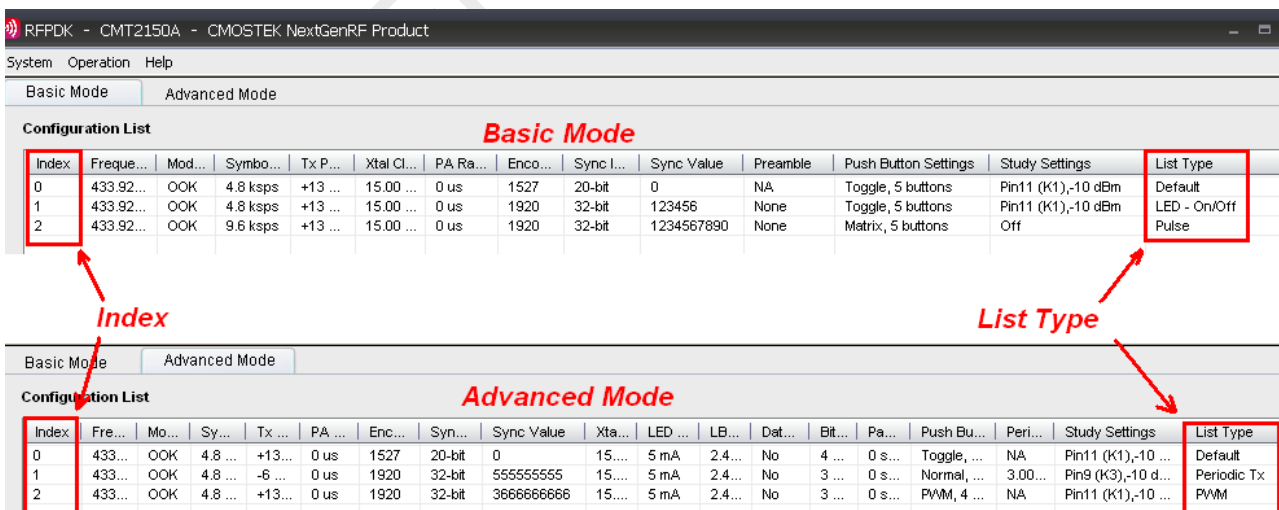

Figure 3. Configuration Lists of the CMT2150A

After selecting and programming the application scheme into the devices, the corresponding functions can be immediately demonstrated. Those functions are introduced in the below sub-sections.

2.1 LED On/Off

In the LED On/Off scheme, the user can experience to push buttons on the transmitter module to turn on and off the LEDs on the receiver module. Push buttons on the CMT2150A-EM and the 4 LEDs on CMT2250A-EM are shown and described as below.
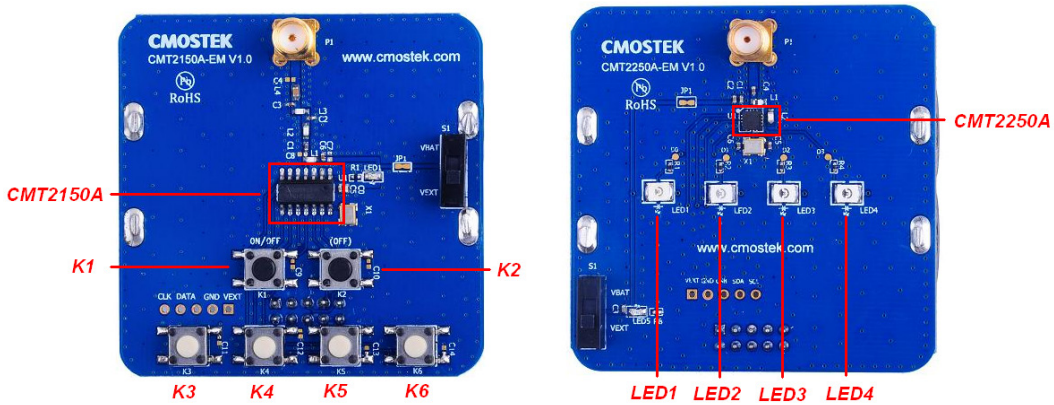

Figure 4. EMs Used to Experience LED On/Off Scheme

Table 4. Push Buttons Functions Definition of LED On/Off Scheme

Push Button	Function Description
K1	Global On/Off control button, turns on or off the 4 LEDs on CMT2250A-EM. Press K1 more than for 5 seconds will send out the study packet.
K2	Not used. It could be used as Off button if the On/Off button(s) is set as "Separated" on the RFPDK.
K3, K4, K5, K6	Turn on and off the LED1, LED2, LED3 and LED4 on CMT2250A-EM respectively.

The user can follow below instructions to experience the LED On/Off scheme.

1. Install the latest RFPDK on the PC (refer to "Section 7.1 Installation Steps") and connect the USB programmer to the PC with a USB cable, then start the RFPDK on the PC.

2. Connect the CMT2150A-EM to the USB Programmer with EM-Connector, select CMT2150A on the RFPDK, stay in Basic Mode, select the LED On/Off scheme on the configuration list, as shown in figure below, and burn the configuration to the CMT2150A-EM.
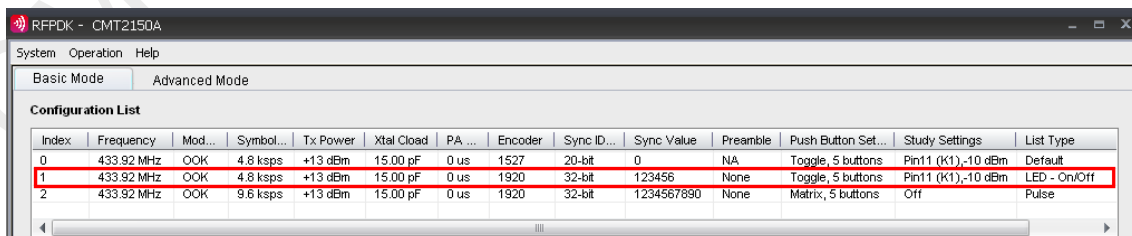

Figure 5. Selecting the LED On/Off Configuration of CMT2150A

3. Repeat step 2 to burn the LED On/Off configuration to the CMT2250A-EM on the RFPDK

Figure 6. Selecting the LED On/Off Configuration of CMT2250A

4. After both of the modules are programmed done successfully, the user can start evaluate the LED On/Off control scheme.

A few key parameters settings in this application scheme are:

- Frequency   = 433.92 MHz
- Symbol Rate   = 4.8 ksps
- Encoder   = 1920
- Push Button Setting = Toggle, 5 buttons
- Study Function   = on
- Study Button   = Pin11 (K1)

Notes:

1. Please refer to the "AN112 CMT2150A Configuration Guideline" for the introduction of Toggle mode of the push button setting and the 1920 encoding format.

2. The study function is enabled in this scheme, while the Sync ID on both of the Tx and Rx side are set to the same by default. In order to experience the study function, the user should set the Sync ID to the different values before burning the configurations to the Tx and Rx devices. Pin11 (K1) is assigned as the study button in Periodic Tx scheme.

2.2   Pulse

In the Pulse scheme, the user can experience to push buttons on the transmitter module to turn on and off the LEDs on the receiver module. Each time an instruction is issued by pressing the button(s), the corresponding LEDs will only be turned on for 2 seconds and then automatically switched off. The push buttons are shown and described in the figure/table below:
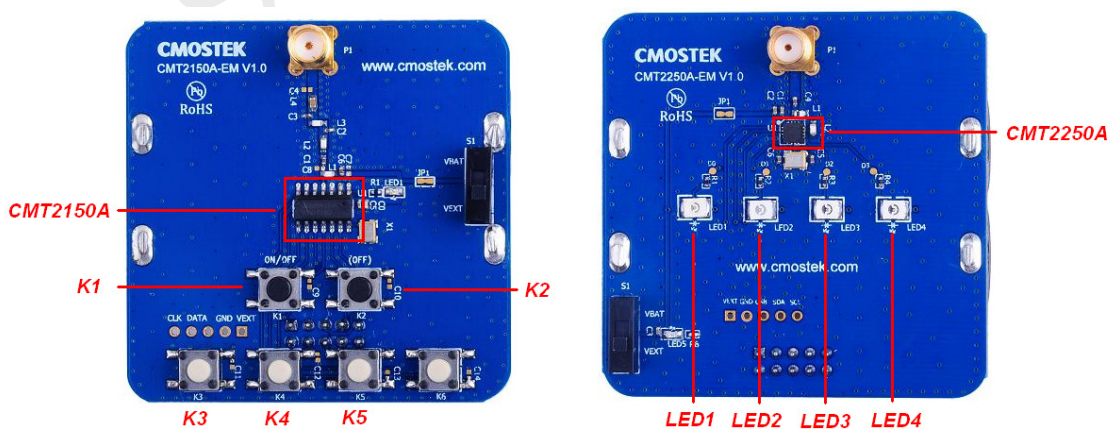

Figure 7. EMs Used to Experience Pulse Scheme

**Table 5. Push Buttons Functions Definition of Pulse Scheme**

Push Button	Function Description
K1, K2,K3, K4, K5	Turn on the LED(s) on the CMT2250A-EM for 2 seconds in the manner shown in Table 6, and then the LED(s) will be switched off automatically.
K6	Not used in this scheme

The user can follow below instructions to experience the Pulse scheme.

1. Install the latest RFPDK on the PC (refer to "Section 7.1 Installation Steps") and connect the USB programmer to the PC with a USB cable, then start the RFPDK on the PC.

2. Connect the CMT2150A-EM to the USB Programmer with EM-Connector, select CMT2150A on the RFPDK, stay in Basic Mode, select the Pulse configuration on the configuration list, as shown in figure below, and burn the configuration to the CMT2150A-EM.
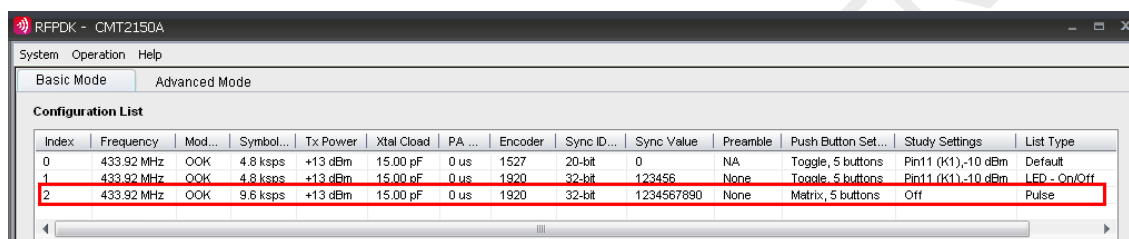
Figure 8. Selecting the Pulse Configuration of CMT2150A

3. Repeat step 2 to burn the Pulse configuration to the CMT2250A-EM on the RFPDK
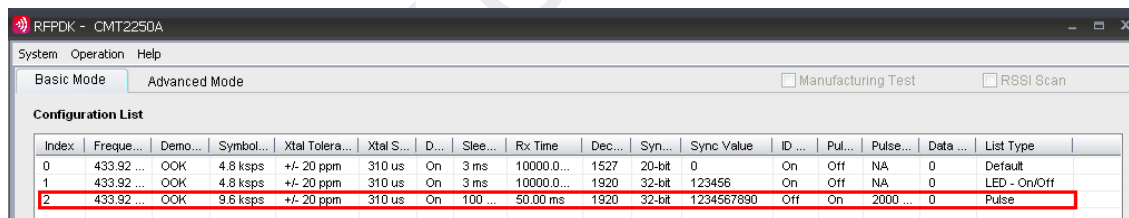
Figure 9. Selecting the Pulse Configuration of CMT2250A

4. After the programming is done, the user can start to use the evaluation modules in Pulse scheme.

In this scheme, push button K1-K5 are used to control the LED1-4 with the mapping rule shown in the table below, K6 is unused in this scheme.

Table 6. Mapping from K1-K5 to LED1-LED4 in Matrix Button Mode

Push Buttons on CMT2150A-EM[1]					LED CMT2250A-EM[2]			
K1	K2	K3	K4	K5	LED1	LED2	LED3	LED4
1	0	0	0	0	**Pulse**	0	0	0
0	**1**	0	0	0	0	**Pulse**	0	0
0	0	**1**	0	0	**Pulse**	**Pulse**	0	0
0	0	0	**1**	0	0	0	**Pulse**	0
0	0	0	0	**1**	**Pulse**	0	**Pulse**	0
1	**1**	0	0	0	0	**Pulse**	**Pulse**	0
1	0	**1**	0	0	**Pulse**	**Pulse**	**Pulse**	0
1	0	0	**1**	0	0	0	0	**Pulse**
1	0	0	0	**1**	**Pulse**	0	0	**Pulse**
0	**1**	**1**	0	0	0	**Pulse**	0	**Pulse**
0	**1**	0	**1**	0	**Pulse**	**Pulse**	0	**Pulse**
0	**1**	0	0	**1**	0	0	**Pulse**	**Pulse**
0	0	**1**	**1**	0	**Pulse**	0	**Pulse**	**Pulse**
0	0	**1**	0	**1**	0	**Pulse**	**Pulse**	**Pulse**
0	0	0	**1**	**1**	**Pulse**	**Pulse**	**Pulse**	**Pulse**

Note:

[1]. In the push buttons part, "1" represents press action while "0" represents un-pressed, the largest number of buttons can be pressed at the same time is 2.

[2]. In the LED part, "Pulse" represents that the LED is turned on for 2 seconds and then turned back to off, while "0" represents that the LED remains the off status.

A few key parameters settings in this application scheme are:

- Frequency = 433.92 MHz
- Symbol Rate = 9.6 ksps
- Encoder = 1920
- Push Button Setting = Matrix, 5 buttons
- Pulse Time = 2 seconds
- Study Function = Off

Notes:

1. Please refer to the "AN112 CMT2150A Configuration Guideline" for the introduction of Matrix mode of the push button setting and the 1920 encoding format.

2.3 Periodic Tx

In the Periodic Tx scheme, the CMT2150A-EM will send out packets to the CMT2250A-EM automatically in every 3 seconds. The LED1-3 on the CMT2250A-EM will be turned on for 500 ms on each transmission. The push buttons are shown and described in the figure/table below:
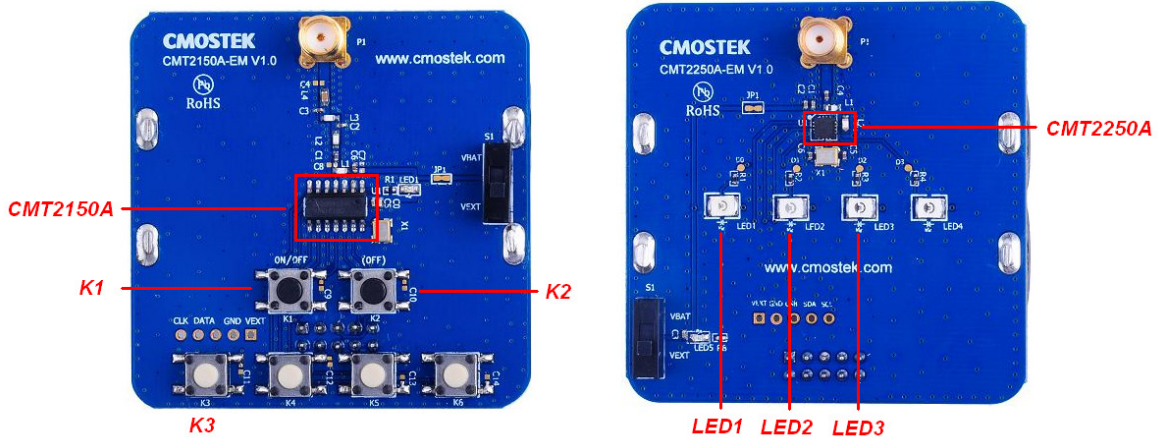
Figure 10. EMs Used to Experience Periodic Tx Scheme

Table 7. Push Buttons Functions Definition of Periodic Tx Scheme

Push Button	Function Description
K1, K2	Manually turn the LED1-LED3 on for 500 ms and turn them back to off.
K3	Manually turn the LED1-LED3 on for 500 ms and turn them back to off. Press K3 more than for 5 seconds will send out the study packet.
K4, K5, K6	Not used in this scheme

The user can follow the below instruction to experience the modules in Periodic Tx scheme.

1. Install the latest RFPDK on the PC (refer to "Section 7.1 Installation Steps") and connect the USB programmer to the PC with a USB cable, then start the RFPDK on the PC.

2. Connect the CMT2150A-EM to the USB Programmer with EM-Connector, select CMT2150A on the RFPDK, select the Advanced Mode, select the Periodic configuration on the configuration list, as shown in figure below, and burn the configuration to the CMT2150A-EM.
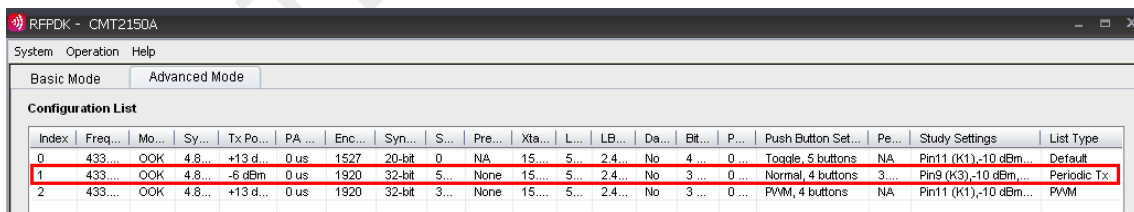

Figure 11. Selecting the Periodic Tx Configuration of CMT2150A

3. Repeat step 2 to burn the Periodic Tx configuration to the CMT2250A-EM on the RFPDK
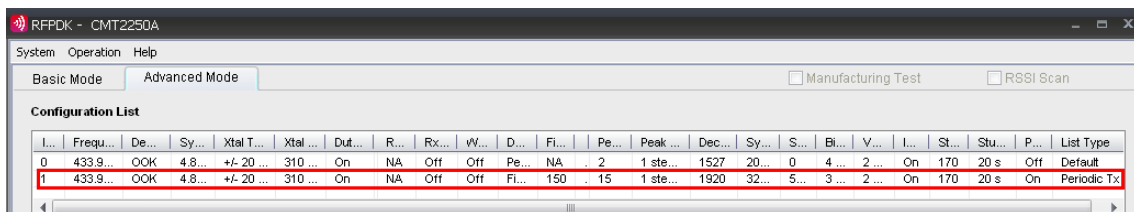

Figure 12. Selecting the Periodic Tx Configuration of CMT2250A

4. After the programming is done, the user can start to use the evaluation modules in Periodic Tx scheme.

In this scheme, the Tx module repeat transmission in every 3 seconds, and in each transmission, 6 predefined packets are sent out. After CMT2250A-EM received the packets successfully, LED1-3 will be turned on at the same time for 500ms and turned back to off. LED4 is unused in this scheme.

Beside the periodic transmission which is done automatically, the user can press the K1-K3 to send out the packets manually, and the CMT2250A-EM responses to the transmission as usual. K4-K6 is unused in this scheme.

A few key parameters settings in this application scheme are:

- Frequency = 433.92 MHz
- Symbol Rate = 4.8 ksps
- Encoder = 1920
- Push Button Setting = Normal, 5 buttons
- Periodic Time = 3 seconds
- Study Function = on
- Study Button = Pin9 (K3)

Notes:
1. Please refer to the "AN112 CMT2150A Configuration Guideline" for the introduction of Normal mode of the push button setting and the 1920 encoding format.
2. The study function is enabled in this scheme, while the Sync ID on both of the Tx and Rx side are set to be the same by default. In order to experience the study function, the user should set the Sync ID to the different values before burning the configurations to the Tx and Rx devices. Pin9 (K3) is assigned as the study button in Periodic Tx scheme.

2.4 PWM

In the PWM scheme, the user can use the push buttons on the CMT2150A-EM to perform dimming control on the LED on the CMT2251A-EM by the PWM signals generated by CMT2251A. The brightness of the LED changes with the duty cycle of the PWM signal. The push buttons are shown and described in the figure/table below:
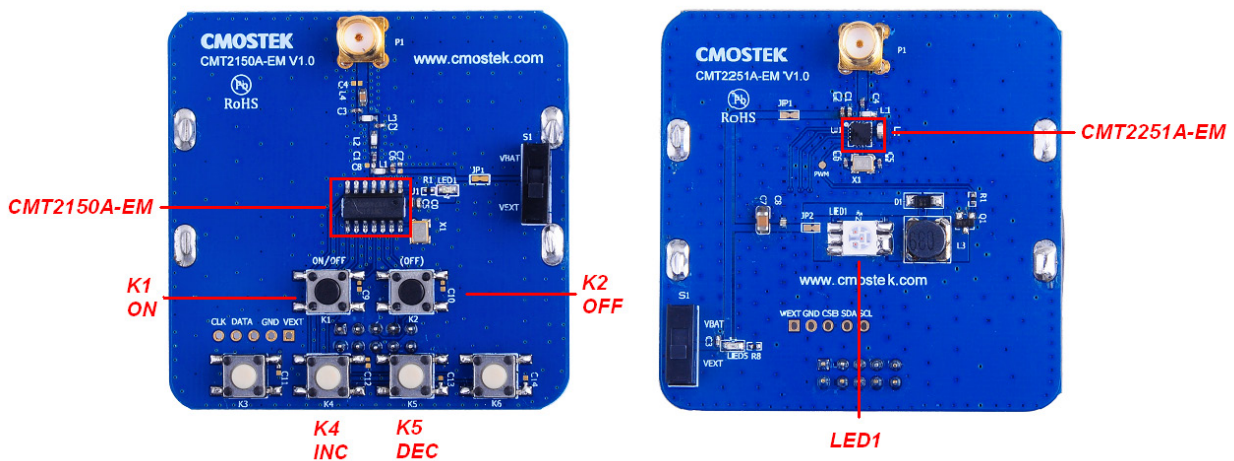

Figure 13. EMs Used to Experience PWM Scheme

Table 8. Push Buttons Functions Definition of PWM Scheme

Push Button	Function Description
K1	Turn the LED1 on the CMT2251A-EM to 100% on. Press K1 more than for 5 seconds will send out the study packet.
K2	Turn the LED1 off
K4	Increase the brightness of the LED1 in 1.5% step size till 100% on.
K5	Decrease the brightness of the LED1 in 1.5% step size till off.
K3, K6	Not used in this scheme.

The user can follow the below instruction to experience the modules in PWM scheme.

1. Install the latest RFPDK on the PC (refer to "Section 7.1 Installation Steps") and connect the USB programmer to the PC with a USB cable, then start the RFPDK on the PC.

2. Connect the CMT2150A-EM to the USB Programmer with EM-Connector, select CMT2150A on the RFPDK, select the Advanced Mode, select the PWM configuration on the configuration list, as shown in figure below, and burn the configuration to the CMT2150A-EM.
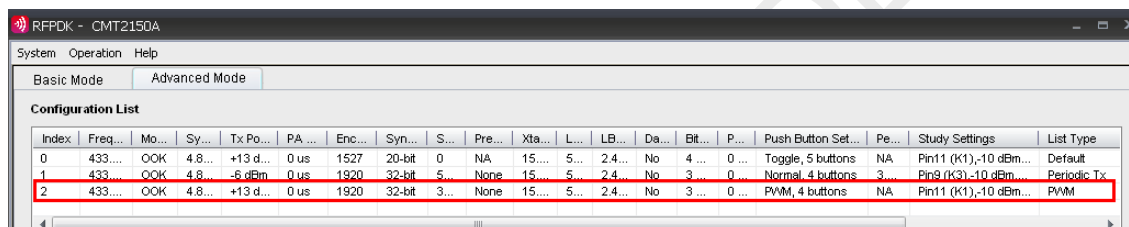

Figure 14. Selecting the PWM Configuration of CMT2150A

3. Repeat step 2 to burn the PWM configuration to the CMT2251A-EM on the RFPDK
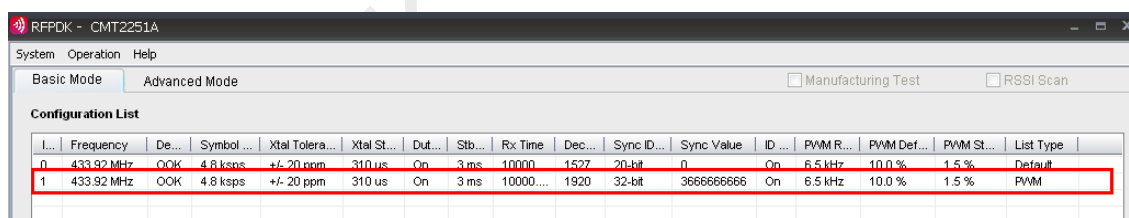

Figure 15. Selecting the PWM Configuration of CMT2251A

4. After the programming is done, the user can start to use the evaluation modules in PWM scheme.

A few key parameters settings in this application scheme are:

- Frequency   = 433.92 MHz
- Symbol Rate   = 4.8 ksps
- Encoder   = 1920
- Push Button Setting = PWM, 4 buttons
- PWM Default Ratio   =10%
- PWM Step Size   =1.5%
- PWM Rate   =6.5 kHz
- Study Function   = on
- Study Button   = Pin11 (K1)

Notes:

1. Install the latest RFPDK on the PC (refer to "Section 7.1 Installation Steps") and connect the USB programmer to the PC with a USB cable, then start the RFPDK on the PC.

2. The study function is enabled in this scheme, while the Sync ID on both of the Tx and Rx side are set to be the same by default. In order to experience the study function, the user should set the Sync ID to the different values before burning the configurations to the Tx and Rx devices. Pin11 (K1) is assigned as the study button in Periodic Tx scheme.

2.5   Normal

The user can experience the normal scheme, by setting the Button Mode on the RFPDK to Normal. In this scheme, each LED on the CMT2250A-EM is controlled by one push button on the CMT2150A-EM respectively. The push buttons are shown and described in the figure/table below:
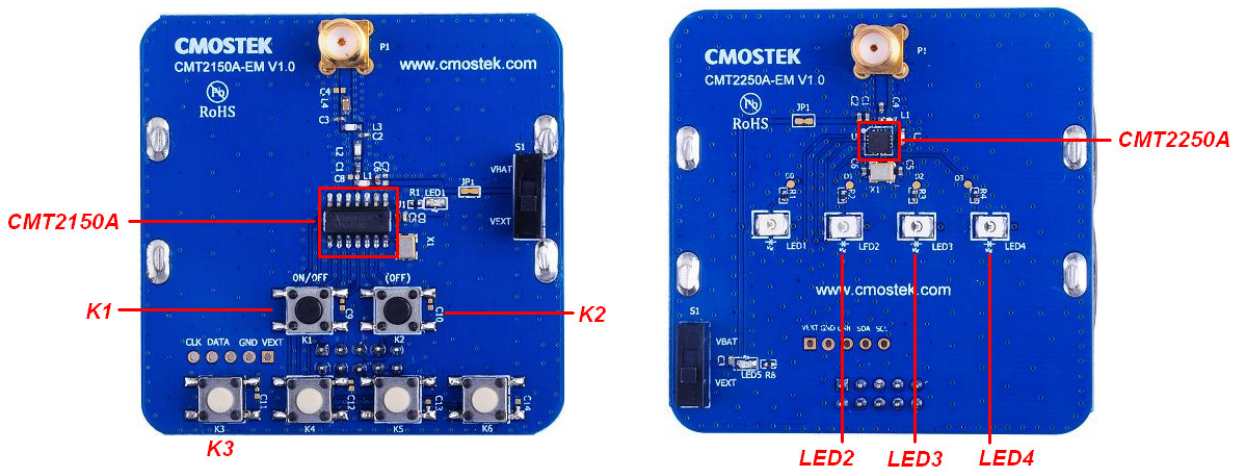

Figure 16. EMs Used to Experience Normal Scheme

Table 9. Push Buttons Functions Definition of Normal Scheme

Push Button	Function Description
K1	Turn LED2 on, turn LED3 and LED4 off.
K2	Turn LED3 on, turn LED1 and LED4 off.
K3	Turn LED4 on, turn LED2 and LED3 off.
K4, K5, K6	Not used in this scheme, as there are only 4 LEDs on the CMT2250A-EM

Please note that the configuration for the Normal scheme is not provided by the RFPDK by default. If the user want to evaluate the Normal mode, the user can follow the below steps to configure the Normal scheme, as shown in figure below
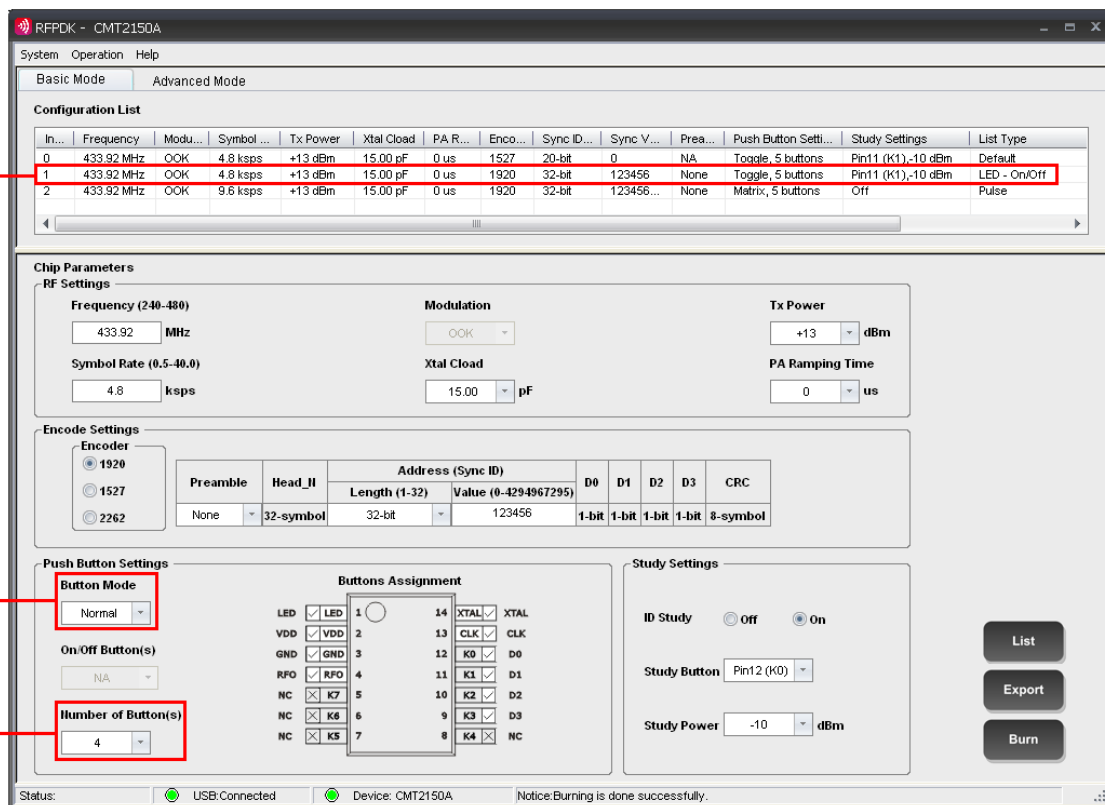
Figure 17. Configuring the Normal Scheme Based on LED On/Off Scheme

1. Start from CMT2150A – Basic Mode – LED On/Off Configuration
2. Change the Button Mode from Toggle to Normal, please note that by changing this, the Study Button is changed to Pin12(K0) by default.
3. Change the Number of Button(s) from 5 to 4
4. Burn the configuration to the CMT2150A-EM
5. Burn the CMT2250A – Basic Mode – LED On/Off Configuration to the CMT2250A-EM

After the programming is done, the CMT2150A-EM and CMT2250A-EM can be used in normal scheme with the following items to be noticed.

1. Since the push button, which should be connected to Pin12(K0), is not designed on the CMT2150A-EM V1.0, with the configuration steps introduced above, the LED1 on the CMT2250A-EM cannot be controlled. Only K1, K2 and K3 are available to control the LED2, LED3 and LED4 (with the Data Pin Reset Code set to 0000), see Table 7 for the description of the push buttons.

2. Proper configuration of the Data Pin Reset Code for the CMT2250A-EM is required if the user wants to turn off all the LEDs at the same time. For example, if the Data Pin Reset Code is set to D0:D3 = 0100, K1 on the CMT2150A-EM becomes the Off button to turn off all the LEDs on the CMT2250A-EM.
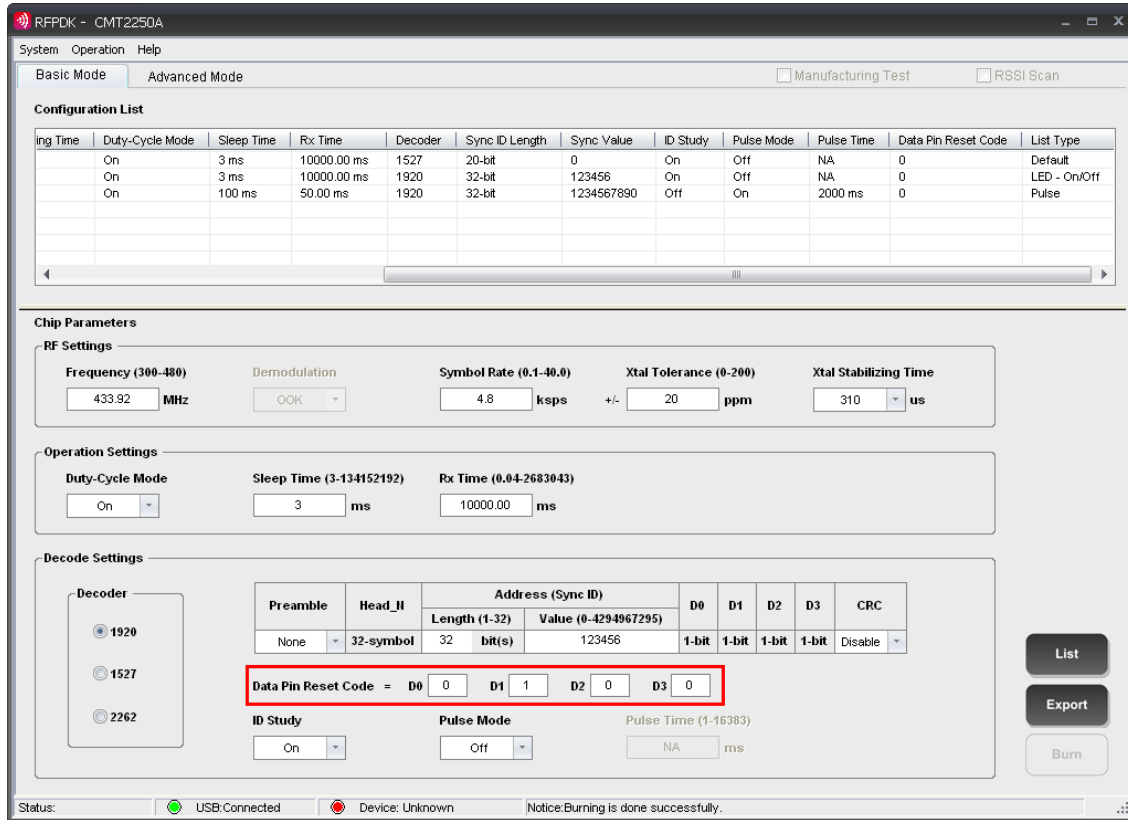
Figure 18. Configuring Data Pin Reset Code of the CMT2250A

The user can refer to "AN112 CMT2150A Configuration Guideline" for more information about the Normal button mode.

3. CMT2150A-EM

The CMT2150A-EM is the Tx module with a CMT2150A device, 6 push buttons, battery case and a couple of necessary external components. The EM-Connector on the back side of the module allows the connection to the USB Programmer. The main components are listed below:
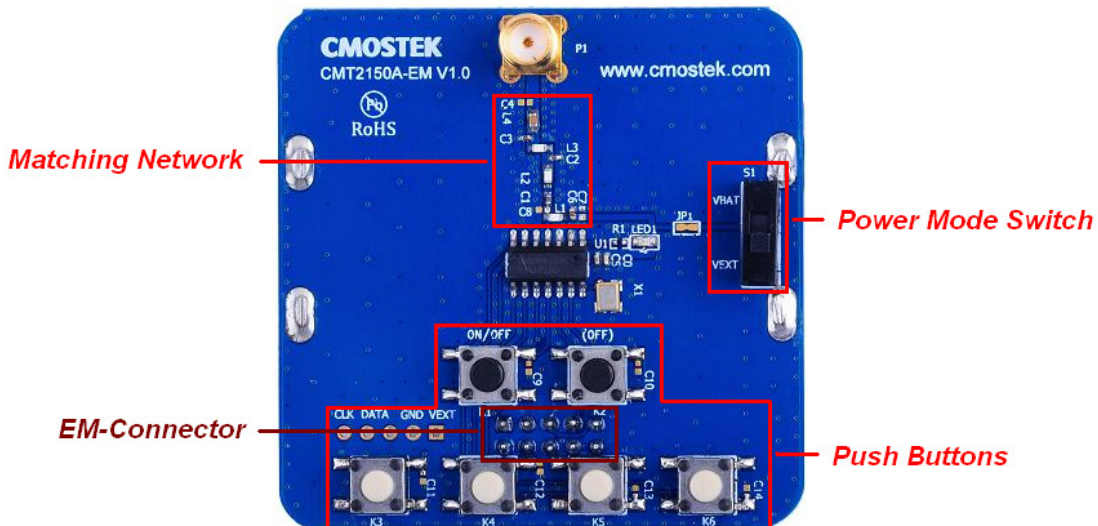

Figure 19. Top View of CMT2150A-EM

1. **EM-Connector** –The EM-Connector is 10-pin, 2.54 mm male connector used to connect to the USB Programmer.
2. **Power Mode Switch** –The power mode Switch (S1) is used to select the power supply source of the module. The module can be supplied by the battery (S1 switched to the VBAT side) or the EM-Connector (S1 switched to the VEXT side). It is recommended to put the switch to the VEXT side when programming the CMT2150A-EM with the USB Programmer.
3. **Push Buttons** – 6 push buttons are connected to K[6:1] pins of the device. With different configurations, the push buttons with have different behavior.
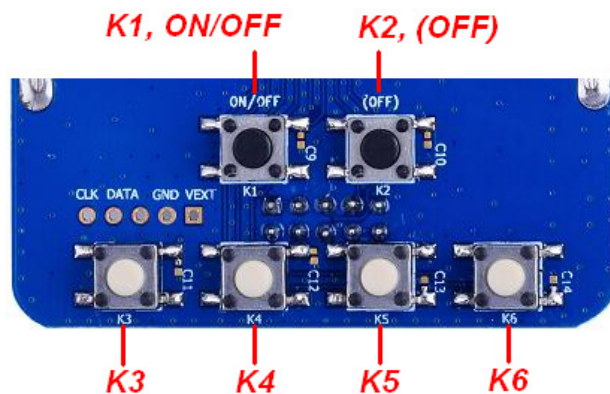

Figure 20. Push Buttons on the CMT2150A-EM

Table 10. Push Button Function in Different Button Modes

Push Button	Button Modes			
	Normal[1]	Matrix[2]	Toggle[3][5]	PWM[4][5]
K1, ON/OFF	D1	K1	ON/OFF	ON/OFF
K2, (OFF)	D2	K2	(OFF)	(OFF)
K3	D3	K3	D0	-
K4	D4	K4	D1	Increase
K5	D5	K5	D2	Decrease
K6	D6	-	D3	-

Notes

[1]. In Normal mode, the functions of 8 pins are not printed, because they are flexibly configurable by the user using the RFPDK. See Chapter 2.5 to learn how to evaluate the Normal Button Mode.

[2]. In Matrix mode, the selected pins are fixed from K1 to K5. The maximum number of buttons allowed to press at the same time is two.

[3]. In Toggle mode, K1 and K2 are assigned as on/off buttons. K3-K6 are assigned to control the 4 data bits of the transmitted packet.

[4]. In PWM mode, K1 and K2 are assigned as on/off buttons. K4 and K5 are assigned as increase and decrease buttons.

[5]. In Toggle and PWM modes, if **On/Off Button(s)** on the RFPDK are set to Single, only K1 is used as on and off button, if **On/Off Button(s)** is set to Separated. K1 is used as on button and K2 is used as off button.

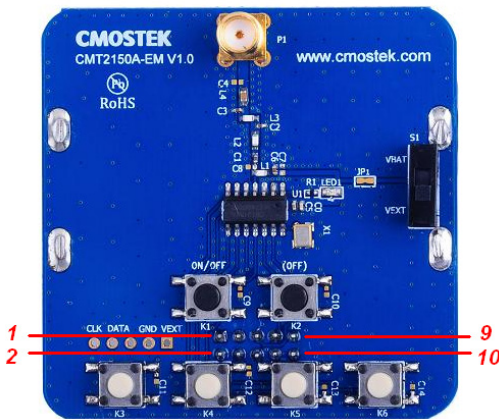The definition of the EM-connector on the CMT2150A-EM is given below:

Figure 21. EM-Connector on the CMT2150A-EM

Pin	Signal Name
1	NC
2	GND
3	NC
4	VDD
5	CLK
6	NC
7	DATA
8	NC
9	NC
10	NC

Table 11. CMT2150A-EM EM-Connector Pin Definition

The module can be used in the following schemes

1. Work with the CMT2250A-EM to demonstrate the Normal, Toggle and Matrix button modes and periodic transmission.
2. Work with the CMT2251A-EM to demonstrate the PWM button mode.

The evaluation module contained in this Development Kits is designed with the matching network at 433.92 MHz. For application with different frequencies, the matching network might need to be changed.

See "Chapter 10 Appendix: CMT2150A-EM and CMT2250(1)A-EM Schematics" for the CMT2150A-EM Schematic.

4. CMT2250A-EM

The CMT2250A-EM is the Rx on/off control module with a CMT2250A device, 4 LEDs, battery case and a couple of necessary external components. The EM-Connector on the back side of the module allows the connection to the USB Programmer. The main components are listed below:
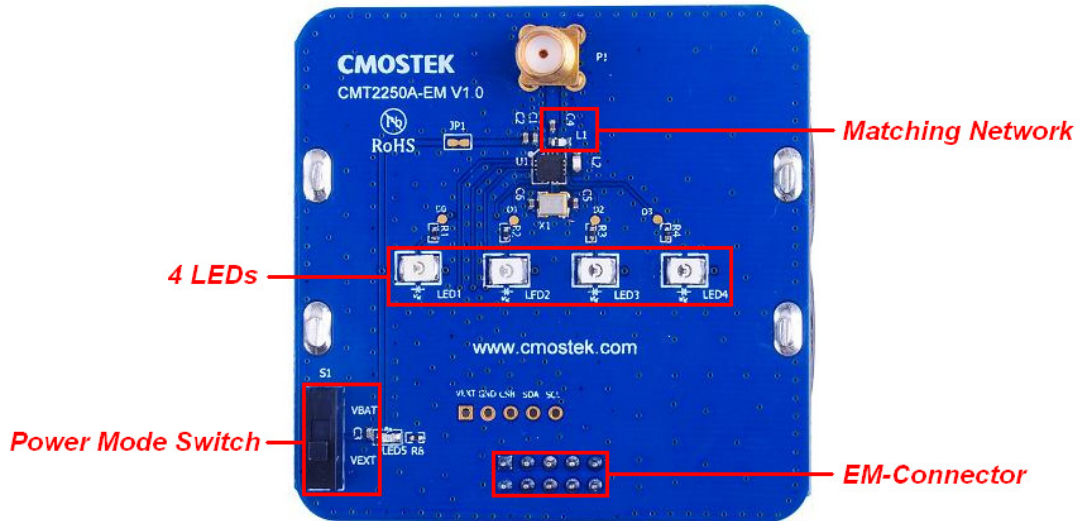

Figure 22. Top View of CMT2250A-EM

1. **EM-Connector** –The EM-Connector is 10-pin, 2.54 mm male connector used to connect to the USB Programmer.
2. **Power Mode Switch** –The power mode Switch (S1) is used to select the power supply source of the module. The module can be supplied by the battery (S1 switched the VBAT side) or the EM-Connector (S1 switched to the VEXT side). It is recommended to put the switch to the VEXT side when programming the CMT2250A-EM with the USB Programmer.
3. **LED** – 4 orange LEDs are available on the PCB connecting the pins DATA0 – DATA3. The LEDs are lighted up according to different button modes selected at the Tx side to demonstrate the functions of the CMT2150A and CMT2250A.

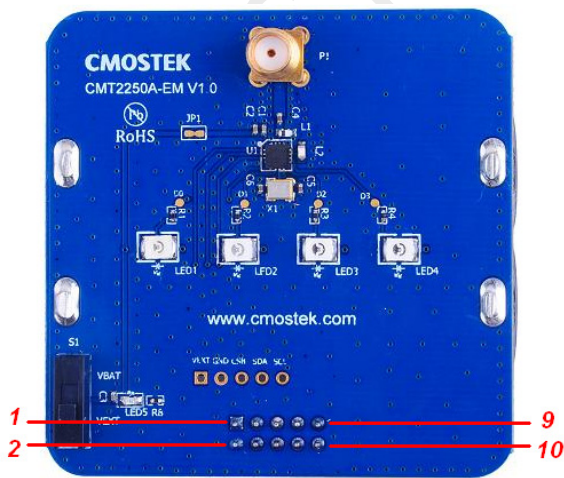The definition of the EM-connector on the CMT2250A-EM is given below:

Pin	Signal Name
1	CSB
2	GND
3	NC
4	VDD
5	SCL
6	NC
7	SDA
8	NC
9	NC
10	NC

Figure 23. EM-Connector on the CMT2250A-EM

Table 12. CMT2250A-EM EM-Connector Pin Definition

The module can work with CMT2150A-EM to demonstrate the Normal, Toggle and Matrix button modes and periodic transmission.

The evaluation module contained in this Development Kits is designed with the matching network at 433.92 MHz. For application with different frequencies, the matching network might need to be changed.

See "Chapter 10 Appendix: CMT2150A-EM and CMT2250(1)A-EM Schematics" for the CMT2250A-EM Schematic.

5. CMT2251A-EM

The CMT2251A-EM is the Rx PWM control module with a CMT2251A device, a PWM controlled LED, battery case and a couple of necessary external components. The EM-Connector on the back side of the module allows the connection to the USB Programmer. The main components are listed below:
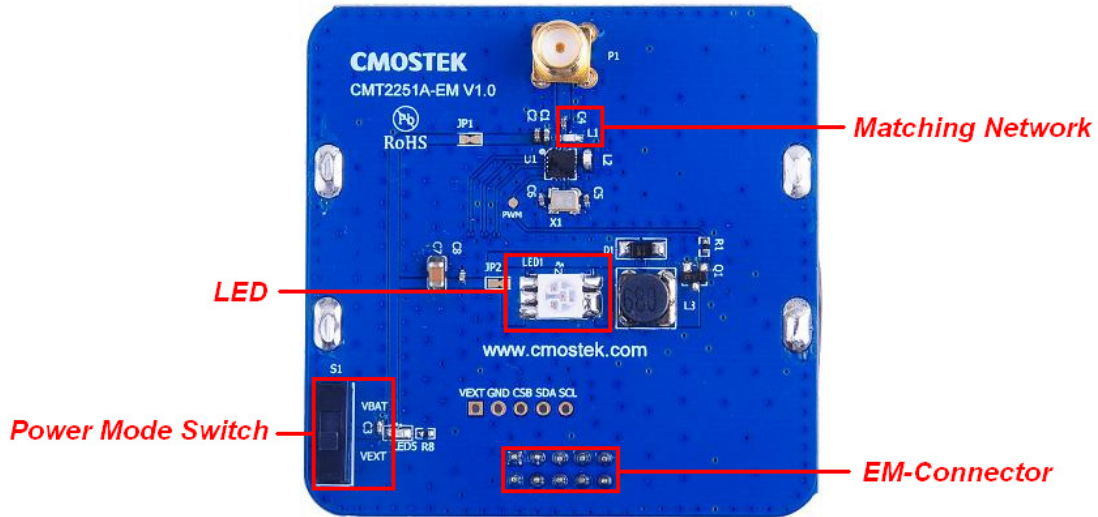

Figure 24. Top View of CMT2251A-EM

1. **EM-Connector** – The EM-Connector is a 10-pin, 2.54 mm male connector used to connect to the USB Programmer.
2. **Power Mode Switch** –The power mode Switch (S1) is used to select the power supply source of the module. The module can be supplied by the battery (S1 switched to the VBAT side) or the EM-Connector (S1 switched to the VEXT side). It is recommended to put the switch to the VEXT side when programming the CMT2251A-EM with the USB Programmer.
3. **LED** – A red LED is available on the PCB connecting the PWM pin of the CMT2251A. An NPN transistor is used to turn on the LED when there is PWM signal coming out from the CMT2251A to adjust the brightness of the LED.

The definition of the EM-connector on the CMT2251A-EM is given below:

Figure 25. EM-Connector on the CMT2251A-EM

Pin	Signal Name
1	CSB
2	GND
3	NC
4	VDD
5	SCL
6	NC
7	SDA
8	NC
9	NC
10	NC

Table 13. CMT2251A-EM EM-Connector Pin Definition

The module can work with CMT2150A-EM to demonstrate the Normal, Toggle and Matrix button modes and periodic transmission.

The evaluation module contained in this Development Kits is designed with the matching network at 433.92 MHz. For application with different frequencies, the matching network might need to be changed.

See "Chapter 10 Appendix: CMT2150A-EM and CMT2250(1)A-EM Schematics" for the CMT2251A-EM Schematic.

6. USB Programmer

The USB Programmer is the programming tool for the user to program the configuration into the CMOSTEK NextGenRF™ products with the RFPDK. The evaluation modules should be connected to the PC through the USB Programmer. There are 3 LEDs on the USB Programmer to indicate its working status.

6.1 EM-Connector

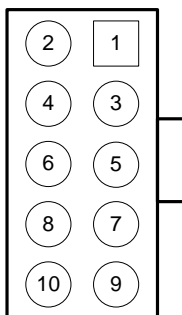The EM-Connector on the USB Programmer is 10-pin, 2.54 mm female connector as shown below.

Figure 26. EM-Connector

Table 14. Pin Descriptions of EM-Connector

Pin Number	Pin Functions	
	CMT2150A	**CMT2250(1)A**
1	Reserved	CSB
2	GND	GND
3	Reserved	Reserved
4	VDD	VDD
5	CLK	SCL
6	Reserved	Reserved
7	DATA	SDA
8	Reserved	Reserved
9	Reserved	Reserved
10	Reserved	Reserved

6.2 LED Indicators

The USB Programmer has 3 LED indicators to indicate 3 working status of the programmer, which are shown in Figure 26. See Table 10 for the descriptions of the LEDs.

Figure 27. LED Indicators on the USB Programmer

Table 15. LED Indicators on the USB Programmer

Name	Descriptions	Color
Run	Flashes when there are valid connections between the PC and USB Programmer. Turned on when the evaluation modules is being programmed.	Green
Err	Turned on for 5 seconds when the programming has failed.	Red
USB	Turned on when the USB is correctly connected to the PC.	Green

6.3   USB Socket

The USB Programmer contains a type-B USB socket. A type-A to type-B USB cable is provided in the Development Kits for the user to connect the USB Programmer to the PC. The USB socket has two functions:

■   Obtain power from the PC to supply the USB Programmer.
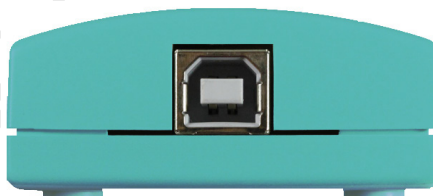■   Communicate to the RFPDK installed on the PC.

Figure 28. USB Socket

7. RFPDK

RFPDK (RF Products Development Kit) is a member of the CMT2150A/2250(1)A One-Way RF Link Development Kits supporting the development and manufacturing with CMOSTEK NextGenRF™ products. It is a PC application runs on Windows 2000, XP, 7 and 8. It works with the USB Programmer to configure the CMOSTEK NextGenRF™ products.

7.1 Installation Steps

Important Note: Before installing this software, local administration rights must be obtained from your network administrator.

Double click the RFPDK setup icon in the CDROM to install the RFPDK onto the computer.

CMOSTEK
RFPDK-V1.10.exe

Figure 29. RFPDK Setup Icon

7.2 Starting the RFPDK

The RFPDK can be started by double-clicking the RFPDK icon on the PC Desktop, as shown in Figure 29 below. For Windows 2000, XP and 7, the user can also start the RFPDK from the Microsoft Windows® Start button by clicking Start → All Programs → CMOSTEK → RFPDK → CMOSTEK RFPDK V1.01.

CMOSTEK
RFPDK V1.10

Figure 30. Starting RFPDK from PC Desktop

Once the program has started, the device selection panel of the RFPDK appears as shown in Figure 30. The user can use the two tabs at the top of the panel to choose the product family: either devices operating in the 2.4 GHz frequency band or the sub-1 GHz frequency band. Under each tab, all the products belong to the family are listed in the middle of the panel. The products can be filtered by the buttons of All, Transmitters, Receivers and Transceivers. The main features of the products, including Device, Function, Band, Package, Modem and Symbol Rate, are shown to assist the device selection.

If an evaluation module is connected to the PC through the USB Programmer, the device part number, USB Programmer hardware version and firmware revision will appear in the "List of connected device".

The rest part of this chapter takes configuring the CMT2150-EM with the RFPDK as an example unless otherwise noted.
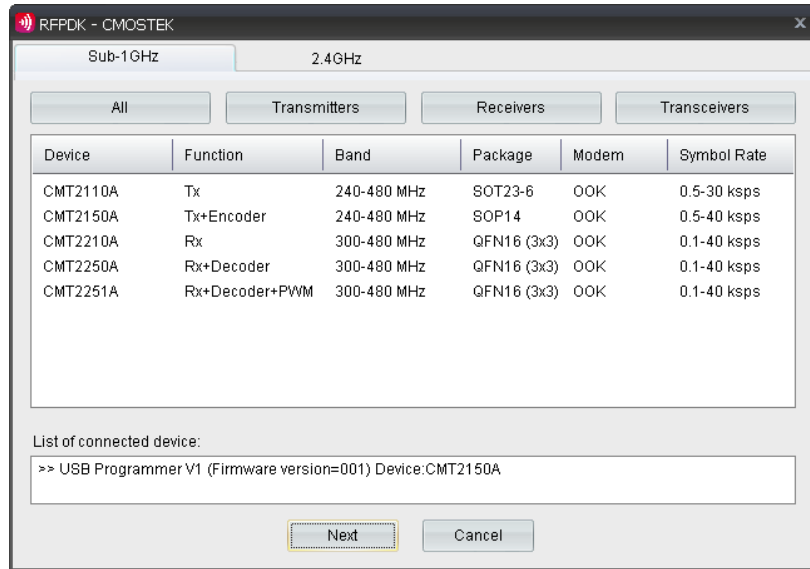
Figure 31. Device Selection Panel

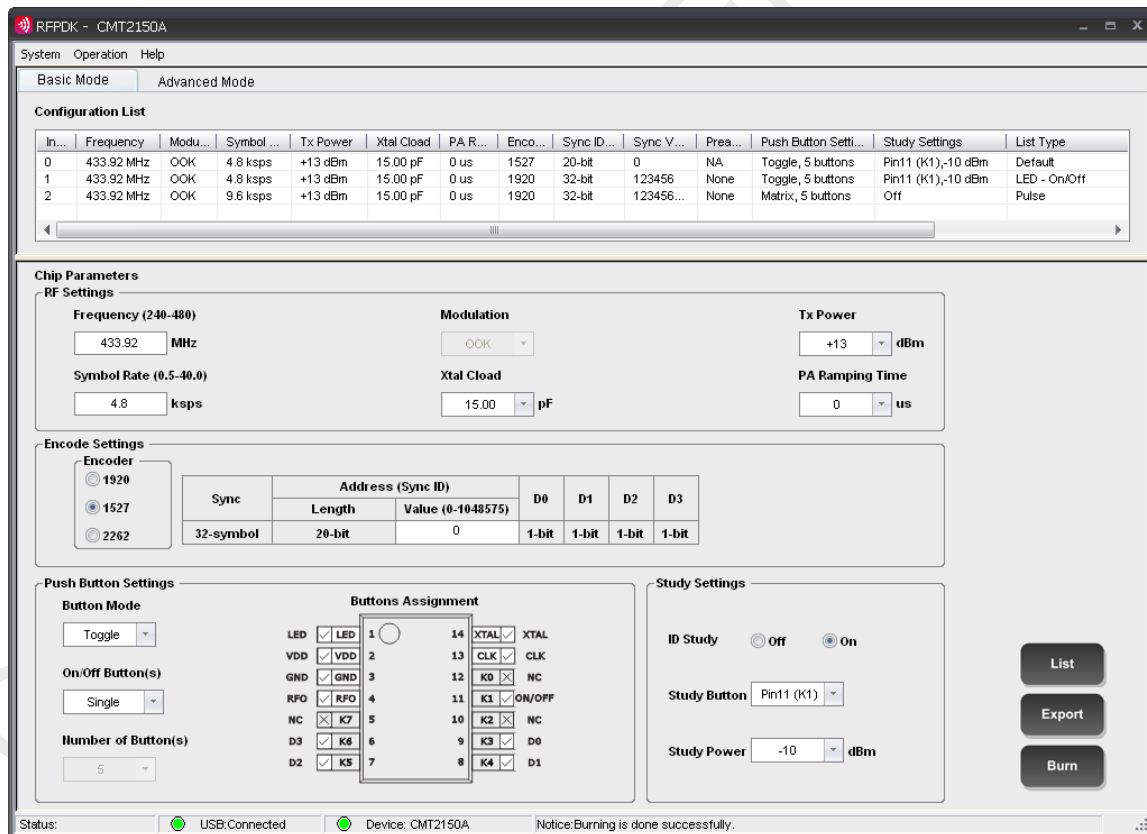Select the proper device, and then click "Next", the Device Control Panel appears as below.

Figure 32. Device Control Panel

7.3 Device Control Panel

7.3.1 Basic Mode and Advanced Mode

The RFPDK has two configuration modes: Basic Mode and Advanced Mode.

■ **Basic Mode**

A few fundamental settings of the selected device are available for the users to easily get started with their design.

■ **Advanced Mode**

All settings of the selected device are available for the users to configure the device more flexibly.

The details of each feature/setting are described in "AN112 CMT2150A Configuration Guideline", "AN118 CMT2250A Configuration Guideline" and "AN119 CMT2251A Configuration Guideline".

In both Basic and Advanced modes, default configurations can be loaded for direct use, or as a starting point to further customize the chip in the differentiating RF systems.

7.3.2 Configuration List and Chip Parameters

The control panel contains a Configuration List area and a Chip Parameters area.

■ **Configuration List**

It lets the users to select predefined chip configuration from the list, including the default configurations provided by CMOSTEK or the customized configurations save by the user. For the non-default configurations, the user can add notes to the "List Type" column by double-clicking the cell, as shown in the below figure.

Index	Frequency	Modulation	Tx Power	Xtal Cload	List Type
0	433.92 MHz	OOK	+10 dBm	15.00 pF	Default
1	315 MHz	OOK	+10 dBm	15.00 pF	Default
2	315 MHz	OOK	+12 dBm	15.00 pF	2014-05-16 16:08:40, the user can add note here
3	316 MHz	OOK	+12 dBm	15.00 pF	2014-05-16 16:08:46

Figure 33. Add Note to User-saved Configurations

■ **Chip Parameters**

This area contains the parameters to configure the device.

7.3.3 List, Export and Burn

Saving the configurations, generating the EEPROM image file for manufacturing and programming the configuration to the device can be done by pressing the List, Export and Burn buttons on the panel, respectively.

■ **List**

The users can click the List button to save a new configuration to the "Configuration List".

■ **Export**

The user can click the Export button to export the current configurations to an EEPROM image file suffixed by ".exp". The file can be loaded by the manufacturing programmer in mass production phase to program the CMOSTEK NextGenRF™ products.

■ **Burn**

Once all the parameters are properly set and all the hardware are correctly connected, the user can click the Burn button

to program the configuration to the chip. A message will pop out to confirm whether the programming is done successfully or not. If the programming is failed, the users should double check the setup and try again.

7.3.4 Status and Notice

Status information and Notice information is shown at the bottom of the Control Panel.

■ **Status**

It indicates whether the USB Programmer and the device are properly connected to the PC or not. Table 11 shows the details.

Table 16. Status Information in Control Panel

Status	Descriptions
🟢 USB: Connected	The USB Programmer is properly connected to the PC.
🔴 USB: Unconnected	The USB Programmer is unconnected or improperly connected to the PC.
🟢 Device: CMT2150A	The device is properly connected to the USB Programmer.
🔴 Device: Unknown	The device is unconnected or improperly connected to the USB Programmer, or the device is connected but the USB Programmer is in "Unconnected" status.
🔴 Device: CMT2150A	The device plugged in is different from that selected in the Device Selection Panel. The part number of the plugged device will be displayed. The Burn button is disabled in this case.

■ **Notice**

It indicates the process and the results of the Burn action, as shown in Table 12 below:

Table 17. Notice Information in Control Panel

Notice	Descriptions
Notice: Burning parameters to the device, please wait…	The RFPDK is executing the Burn action.
Notice: Burning is done successfully.	The Burn action is completed successfully.
Notice: Burning failed. Please check the setup and try again.	The Burn action is failed and stopped. The users should check the setup and try again.

7.4 Burn Log

After each burning, the log information of the burning is recorded automatically by the RFPDK into the Burn Log. The maximum number of recorded lines is limited to 1000. The old information is over-written by the new ones. The user can open the Burn Log by selecting Operation → Open Log. A Burn Log example is shown below:
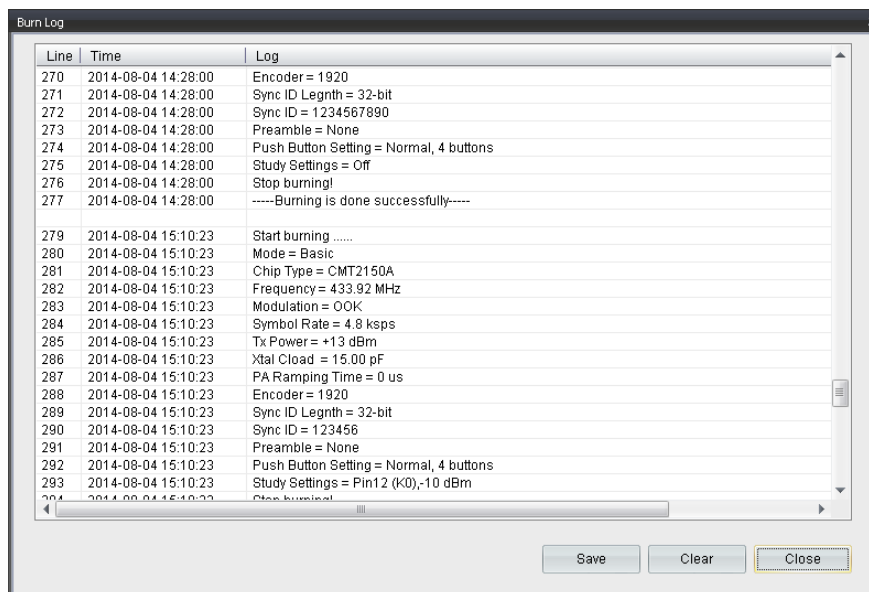
Figure 34. Burn Log

The user can save the Burn Log to a text file by pressing the Save button. This text file is one of the necessary materials to send back to CMOSTEK when the user asks for any technical support.

7.5 Read Device

When the device, the USB Programmer and the PC (RFPDK) are properly connected, the Read Device function can be used to read out and upload the EEPROM contents from the device to the PC. The user can use this function by selecting Operation → Read Device. After that, a Save-as window pops out so that the user can save the read-out contents into a text file suffixed by ".exp".

8. Frequently Asked Questions

Q1. Why do I not see any response from the PC when I plug the USB cable of the USB Programmer to the PC?
A1. Please try the following steps to resolve the problem:

1. Make sure the USB port is functioning well.
2. Make sure the USB connection is solid by checking if the "USB" LED on the USB Programmer is on.
3. Try another USB port on the PC.

If the problem still exists, please contact CMOSTEK for further support.

Q2. I plugged out the USB cable while the USB Programmer is running. After that, why can I not use any USB device on the PC anymore?
A2. It is commonly seen that such unexpected error might happen to the USB system if the user plugs out the USB device during any data communication. CMOSTEK recommends the user to close the RFPDK before plugging out the USB Programmer, and then reboot the PC to resolve this problem.

Q3. Can I install the RFPDK on a PC on which I don't have administration right?
A3. CMOSTEK recommends the user to obtain the administration right before installing the RFPDK.

Q4. Can the RFDPK and the USB Programmer support all CMOSTEK RF products?
A4. The current version of RFPDK and USB Programmer supports the existing RF products. In the future, CMOSTEK will update the RFPDK and USB Programmer firmware to support the new products. The user can visit www.cmostek.com for the latest version of the RFPDK and contact CMOSTEK to upgrade your USB Programmer.

Q5. Why can I not install the USB Programmer driver on the PC?
A5. Please try the following steps to resolve this problem:

1) Make sure the USB port is functioning well.
2) Plug out the USB cable, close the RFPDK application, and try to plug in the USB cable again.

If the problem still exists, please contact CMOSTEK for further support.

9. Document Change List

Table 18. Document Change List

Rev. No	Chapter	Description of Changes	Date
1.0		Initial version	2014-08-13

10. Appendix: CMT2150A-EM and CMT2250(1)A-EM Schematics
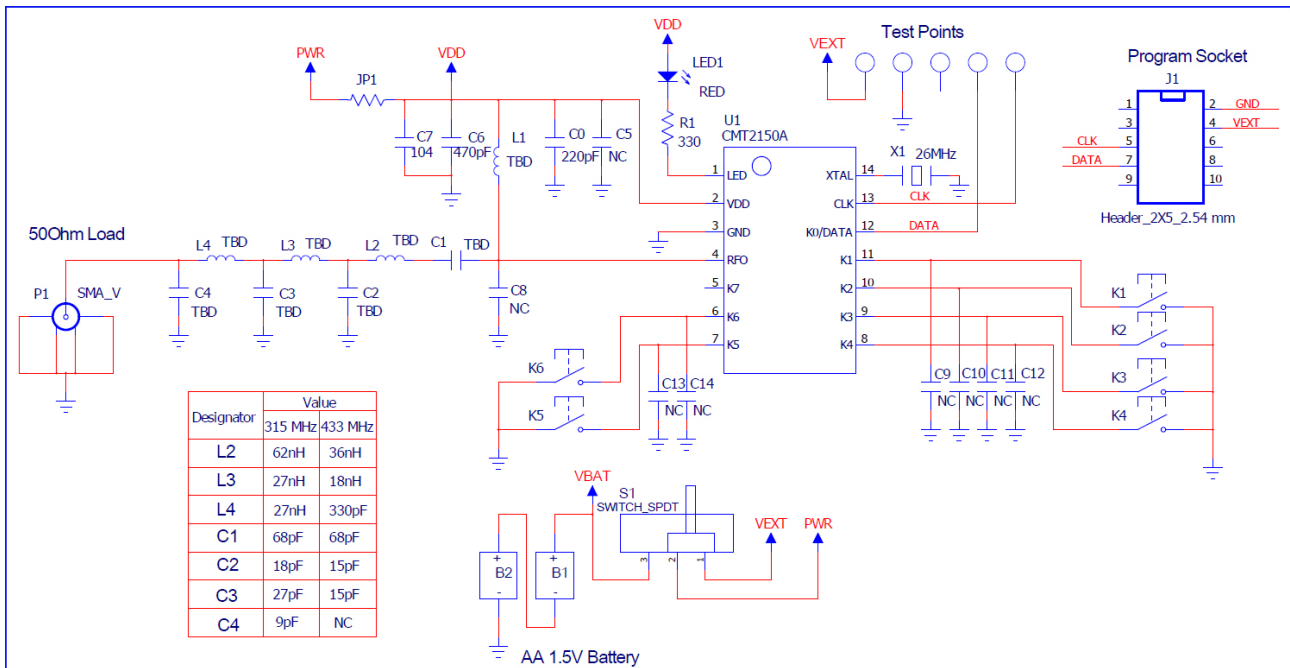

Figure 35. CMT2150A-EM Schematic

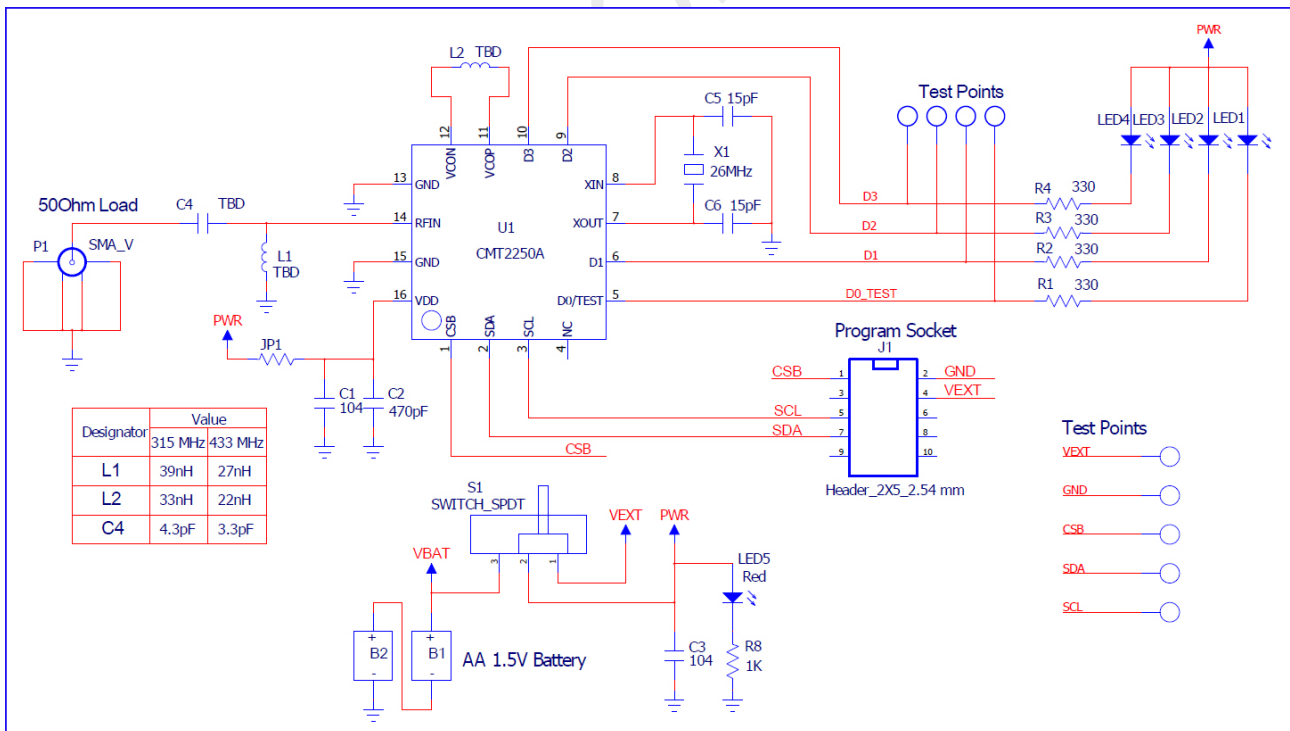**Figure 36. CMT2250A-EM Schematic**

Figure 37. CMT2251A-EM Schematic

11. Contact Information

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