CMOSTEK

AN108

CMT2210/17A Configuration Guideline

Introduction

The CMT2210/17A devices are ultra low power, high performance, low-cost OOK stand-alone RF receiver for various 300 to 960 MHz wireless applications. The chip is part of the CMOSTEK NextGenRF^{TM} family, which includes a complete line of transmitters, receivers and transceivers.

Table 1. Part Number Covered in this Document

Product	Modulation/ Frequency	Sensitivity	Rx Current	Embedded EEPROM	Standalone Operation
CMT2210A	OOK/ 300-480 MHz	-113 dBm (433.92 MHz, 1 ksps, 0.1% BER)	3.8 mA (433.92 MHz)	√	√
CMT2217A	OOK/ 300-960 MHz	-110 dBm (868.35 MHz, 1 ksps, 0.1% BER)	5.2 mA (868.35 MHz)	√	√

The RFPDK (RF Products Development Kit) is a PC application developed by CMOSTEK for the NextGenRF^{TM} 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^{TM} 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 CMT2210/17A with the RFPDK.

To help the user develop their application with CMT2110A and CMT2217A easily, CMOSTEK provides **CMT2110A/2210A One-Way RF Link Development Kits** and **CMT2117A/2217A One-Way RF Link Development Kit** that enables 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^{TM} products)
- CMT2210A-EM or CMT2217A-EM (Rx evaluation module)
- CMT2110A-EM or CMT2117A-EM (Tx evaluation module)

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 CMT2210/17A. The Application with CMT2210/17A can be CMT2210/17A-EM provided by CMOSTEK, or the PCB designed by the user with CMT2210/17A.

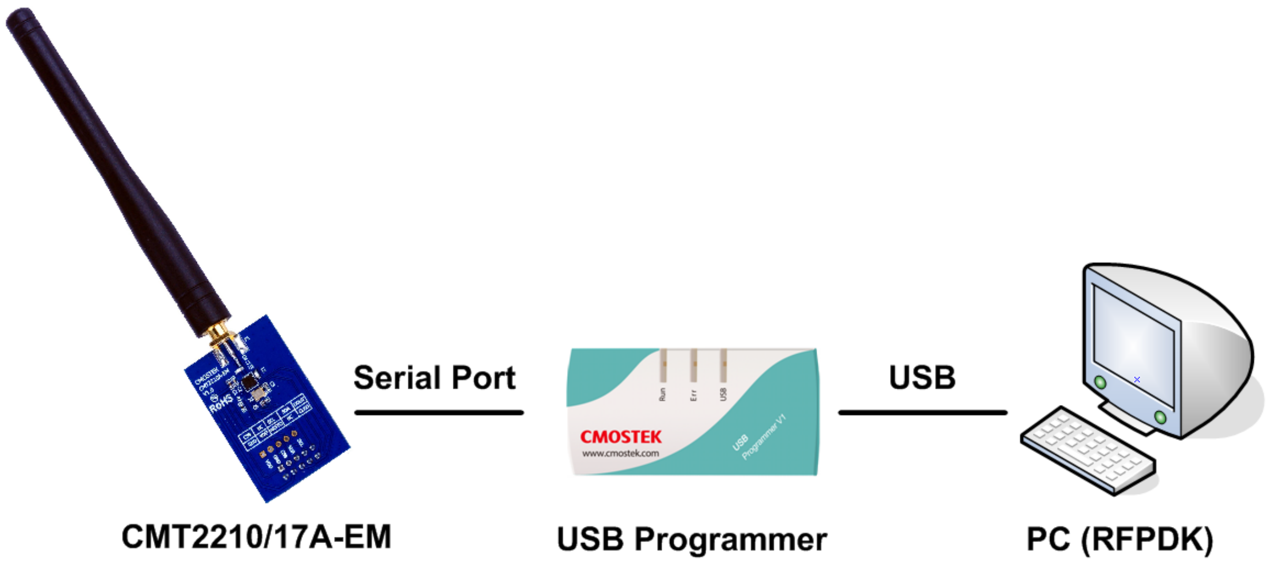

Figure 1. CMT2210/17A Configuration Setup

Start the RFPDK from the computer’s desktop and select CMT2210/17A 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. 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.

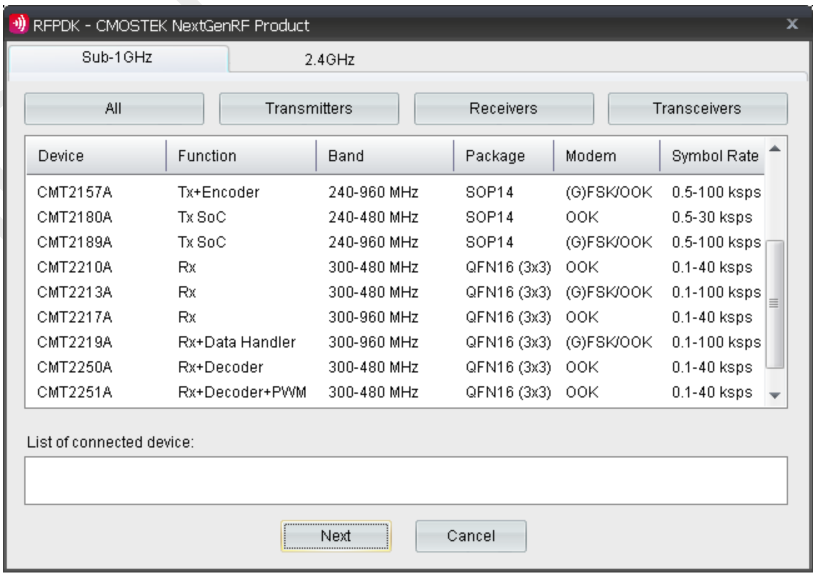

Figure 2. Device Selecting Panel

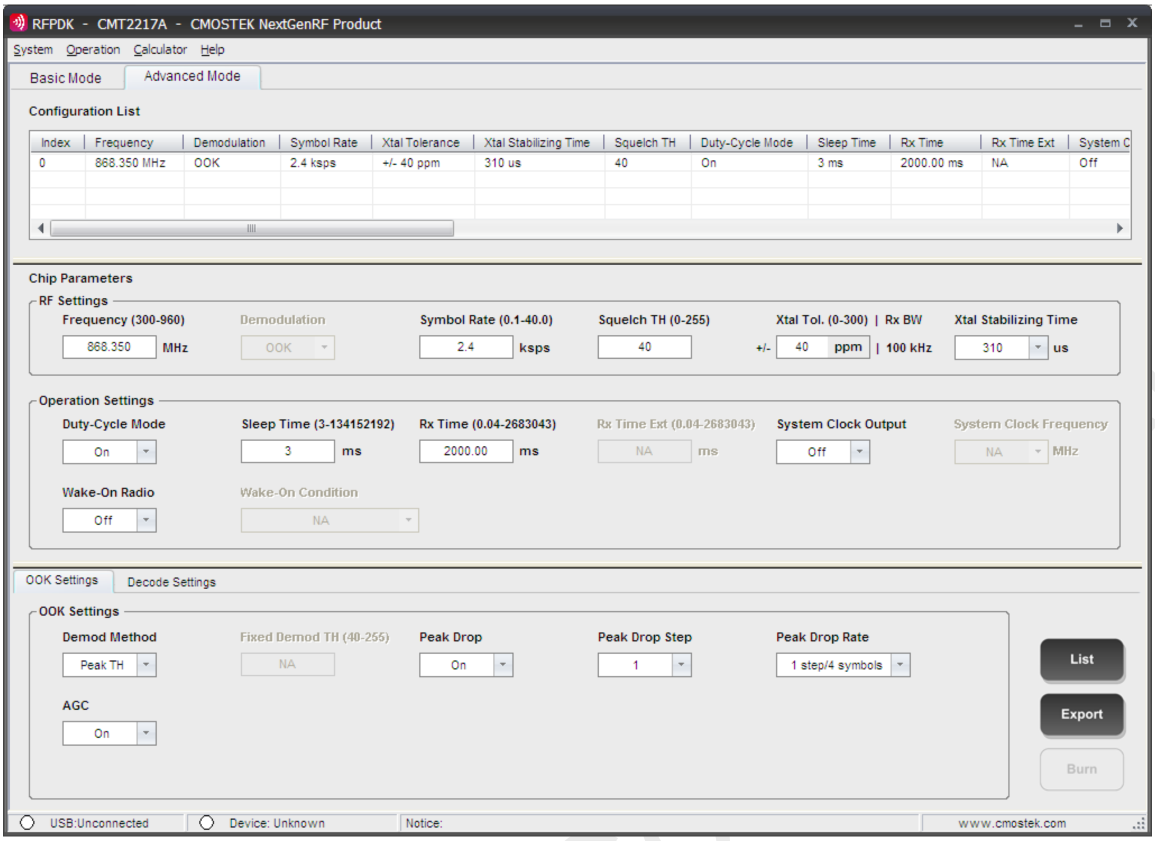

Figure 3. Advanced Mode of Device Control Panel

2. RF Settings

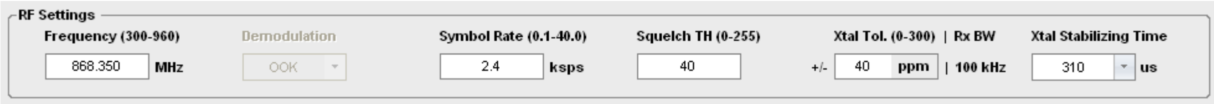

Figure 4. RF Settings

Table 2. RF Settings Parameters

Parameters	Descriptions	Default	Mode
Frequency (CMT2210A)	The receive radio frequency, the range is from 300 to 480 MHz, with resolution of 0.001 MHz.	433.920 MHz	Basic Advanced
Frequency (CMT2217A)	The receive radio frequency, the range is from 300 to 960 MHz, with resolution of 0.001 MHz.	868.350 MHz	Basic Advanced
Demodulation	The demodulation type, only OOK demodulation is supported in this product.	OOK	Basic Advanced
Symbol Rate	The receiver symbol rate, the range is from 0.1 to 40.0 ksps, with resolution of 0.1 ksps.	2.4 ksps	Basic Advanced
Squelch TH (CMT2210A/CMT2217A)	The threshold of the squelch circuit to suppress the noise, the range is from 0 to 255.	54 / 40	Basic Advanced
Xtal Tol. | Rx BW (CMT2210A/CMT2217A)	The sum of the crystal frequency tolerance of the Tx and the Rx, the range is from 0 to ±300 ppm. And the calculated BW is configured and displayed.	±150 ppm | 200 kHz / ±40 ppm | 100 kHz	Basic Advanced
Xtal Stabilizing Time	Time for the device to wait for the crystal to get settled after power up. The options are: 78, 155, 310, 620, 1240 or 2480 us.	310 us	Basic Advanced

2.1 Frequency

CMT2210A covers a wide range of the receive radio frequency from 300 to 480 MHz while CMT2217A covers the frequency ranges from 300 to 960 MHz. The frequency is accurate to three decimal places on the RFPDK.

2.2 Demodulation

CMT2210/17A only supports OOK demodulation.

2.3 Symbol Rate

With OOK demodulation, CMT2210/17A supports 0.1 – 40.0 ksps symbol rate. Normally, the symbol rate tolerance of the device is from -80% to +100% of the "Symbol Rate" configured on the RFPDK. For example, the user set the symbol rate to 9.6 ksps on the RFPDK, the covered symbol rate of the transmitted data is from 1.92 to 19.2 ksps. If the user set it to 40 ksps, the covered range is from 8 to 40 ksps. Any symbol rate outside the range of 0.1 – 40 ksps is not supported. The less symbol rate offset exists between the transmitter and the receiver, the less sensitivity is lost. The following data can be used as a reference.

It should be noticed that, if the Wake-on Radio (see Chapter 3.3 Wake-On Radio, Wake-On Condition) function is turned on, the symbol rate tolerance changes to -25% to +25%.

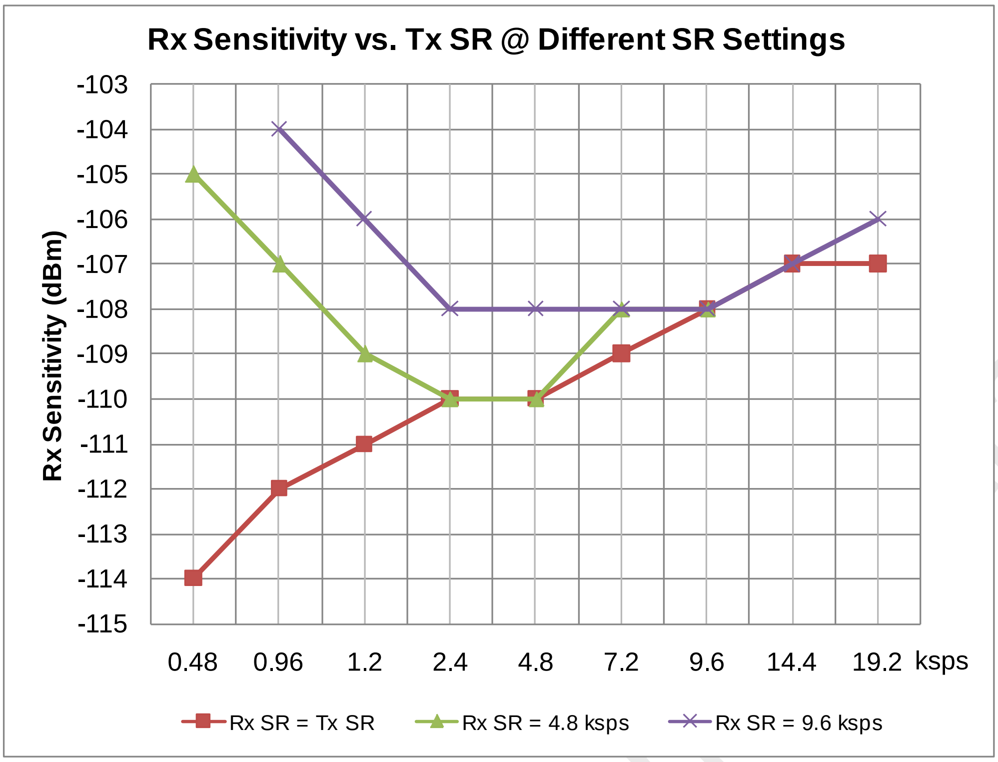

Figure 5. Symbol Rate VS Sensitivity

The above figure shows the relationship between the symbol rate and sensitivity. Three sets of data measured at 433.92 MHz are given, which are:

- On RFPDK, Symbol Rate is set to exactly the same to the Tx symbol rate
- On RFPDK, Symbol Rate is set to 4.8 ksps, the covered range is from 0.96 to 9.6 ksps
- On RFPDK, Symbol Rate is set to 9.6 ksps, the covered range is from 1.92 to 19.2 ksps

The figure reveals that while there is no symbol rate offset between the Tx and the Rx (Rx SR = Tx SR), the highest sensitivity can be reached. When the receiver symbol rate is set to 1.2 ksps, the device is able to receive the data transmitted at the symbol rate of 1.2 ksps, with the sensitivity of -111 dBm. When the receiver symbol rate is set to 4.8 ksps, the device is able to receive the data transmitted at the symbol rate of 1.2 ksps, with the sensitivity of -109 dBm. When the receiver symbol rate is set to 9.6 ksps, the device is able to receive the data transmitted at the symbol rate of 1.2 ksps, with the sensitivity of -106 dBm. Besides, when no symbol rate offset exist, the lower the symbol rate is used, the higher sensitivity the device can reach.

To conclude, on the RFPDK, the user is able to fill in a proper centre value of symbol rate to cover a wide range of symbol rates of the transmitter. On the other hand, the user is also able to fill in a value that is as close to the Tx symbol rate as possible to reach the highest receiving sensitivity.

2.4 Squelch TH

The Squelch Threshold is used to mute the audio output of the receiver in the absence of the desired radio signal. Since the RSSI is digitized to an 8-bit binary value that has the range from 0 to 255, the squelch threshold is designed to be an 8-bit binary value that is comparable to the digitized RSSI.

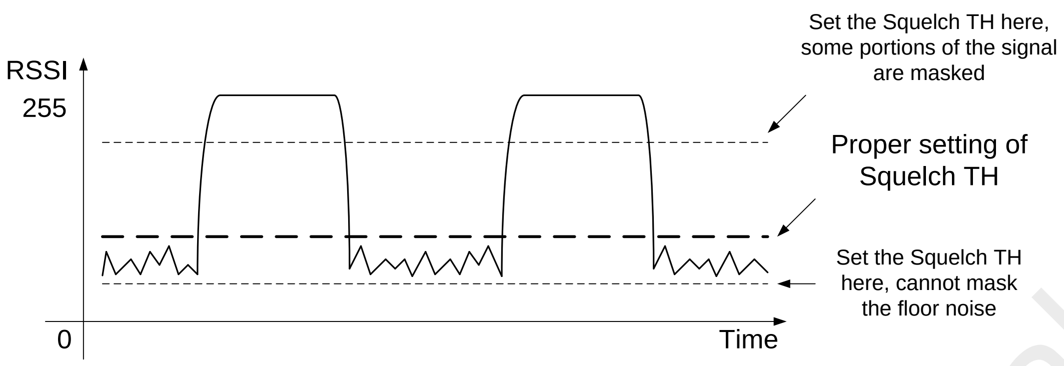

Figure 6. Squelch Threshold

When the received signal strength falls below this threshold the output of the receiver is muted. The user shall set the squelch threshold just above the background radio noise level. Setting a larger threshold requires higher received signal strength to un-mute the receiver, which also means the receiving sensitivity becomes lower. When the radio muting is not required, the squelch threshold can be set to 0 to avoid any potential lost in the sensitivity.

The best way to find the proper value of the Squelch TH is to observe the demodulation output on DOUT. Without any effective signal being transmitted in the channel, the DOUT stays logic 0 while the threshold is set over the noise floor, and outputs random sequence of 0 and 1 while the threshold is set below the noise floor. The user is able to find a value that is just over the noise floor by try and error.

The Squelch Threshold only takes effect when the OOK demodulation method is set to “Peak TH”. See “Chapter 4.1 Demod Method” for more details of the OOK demodulation.

2.5 Xtal Tol. | Rx BW

This is the sum of the crystal frequency tolerance of the transmitter and receiver. The input range is from 0 to ±300 ppm. The wide range of crystal tolerance allows very low cost crystal to be used in the applications.

Assuming the crystal tolerance of the transmitter is ±10 ppm, and the crystal tolerance of the receiver is ±20 ppm, the user shall enter the total tolerance of ±30 ppm on the RFPDK. The RFPDK takes this into account to calculate the receiving bandwidth, which is displayed on the right hand side of the input Xtal tolerance. When the crystal tolerance increases, the bandwidth is increased and the sensitivity is reduced.

It is also recommended for the user to perform on-field testing of the sensitivity with the desired setting of the Xtal Tolerance.

2.6 Xtal Stabilizing Time

This defines the time for the device to wait for the crystal to get stable after it is powered up. The user shall select one of the six options provided on the RFPDK that is most suitable for the crystal used in the applications.

3. Operation Settings

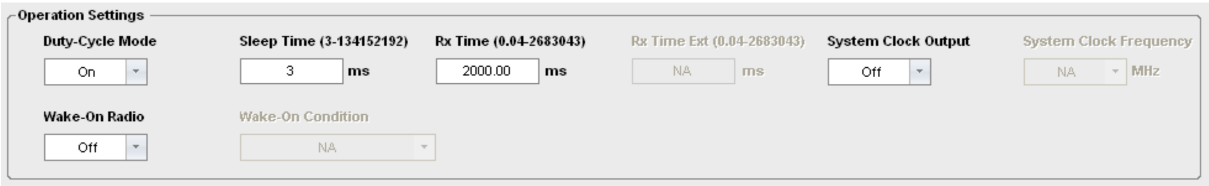

Figure 7. Operation Settings

The available operating options for the radio control are:

Table 3. Operation Settings Parameters

Parameters	Descriptions	Default	Mode
Duty-Cycle Mode	Turn on/off the duty-cycle mode, the options are: on or off.	On	Basic Advanced
Sleep Time	The sleep time in duty-cycle mode, the range is from 3 to 134,152,192 ms.	3 ms	Basic Advanced
Rx Time	The receive time in duty-cycle receive mode, the range is from 0.04 to 2,683,043.00 ms.	2,000 ms	Basic Advanced
Rx Time Ext	The extended receive time in duty-cycle mode, the range is from 0.04 to 2,683,043.00 ms. It is only available when WOR is on.	200.00 ms	Advanced
Wake-On Radio	Turn on/off the wake-on radio function, the options are: on or off.	Off	Advanced
Wake-On Condition	The condition to wake on the radio, the options are: Extended by Preamble, or Extended by RSSI. It is only available when WOR is on.	Extended by Preamble	Advanced
System Clock Output	Turn on/off the system clock output on CLKO, the options are: on or off.	Off	Advanced
System Clock Frequency	The system clock output frequency, the options are: 13.000, 6.500, 4.333, 3.250, 2.600, 2.167, 1.857, 1.625, 1.444, 1.300, 1.182, 1.083, 1.000, 0.929, 0.867, 0.813, 0.765, 0.722, 0.684, 0.650, 0.619, 0.591, 0.565, 0.542, 0.520, 0.500, 0.481, 0.464, 0.448, 0.433, 0.419 or 0.406 MHz.	6.5 MHz	Advanced

3.1 Duty-Cycle Mode

This allows the user to determine how the radio is controlled, as shown in the figure below.

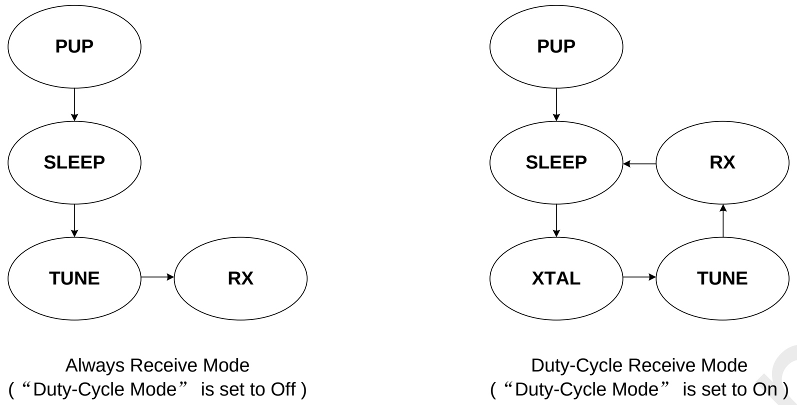

Figure 8. Radio Operation with Duty-Cycle Mode On and Off

3.1.1 Always Receive Mode

If the duty-cycle mode is turned off, the device will go through the Power Up (PUP) sequence, stay in the SLEEP state for about 3 ms, tune the receive frequency, and finally stay in the RX state until the device is powered down. The power up sequence, which takes about 4 ms to finish, includes the task of turning on the crystal and calibrating the internal blocks. The device will continuously receive the incoming RF signals during the RX state and send out the demodulated data on the DOUT pin. The configurable system clock is also output from the CLKO pin if it is enabled in the Advanced Mode on the RFPDK (see Chapter 3.4 System Clock for more details). The figure below shows the timing characteristics and current consumption of the device from the PUP to RX.

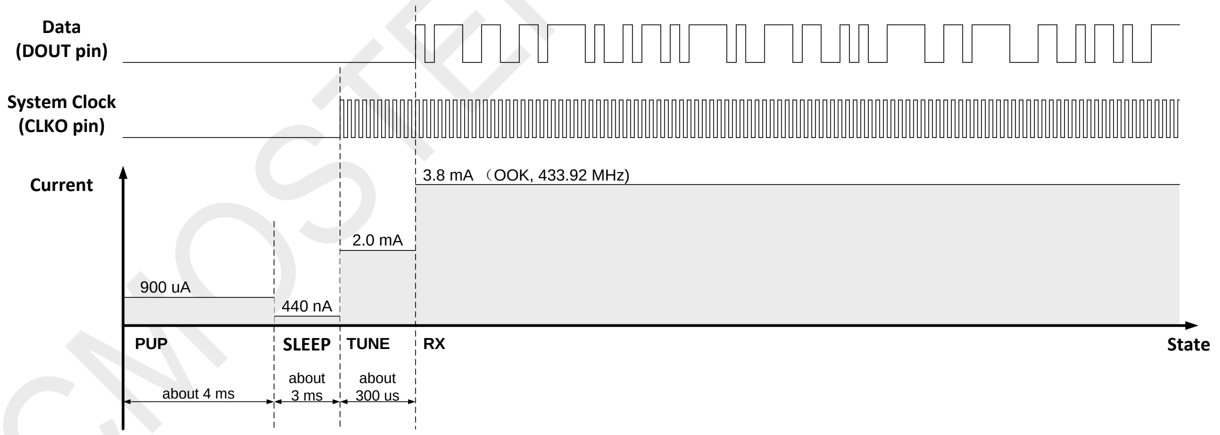

Figure 9. Timing and Current Consumption for Always Receive Mode

3.1.2 Duty-Cycle Receive Mode

If the duty-cycle mode is turned on, after the PUP the device will automatically repeat the sequence of SLEEP, XTAL, TUNE and RX until the device is powered down. This allows the device to re-tune the synthesizer regularly to adept to the changeable environment and therefore remain its highest performance. The device will continuously receive any incoming signals during the RX state and send out the demodulated data on the DOUT pin. The configurable system clock output is output from the CLKO pin during the TUNE and RX state. The PUP sequence consumes about 9.5 ms which is longer than the 4 ms in the Always Receive Mode. This is because the LPOSC, which drives the sleep timer, must be calibrated during the PUP.

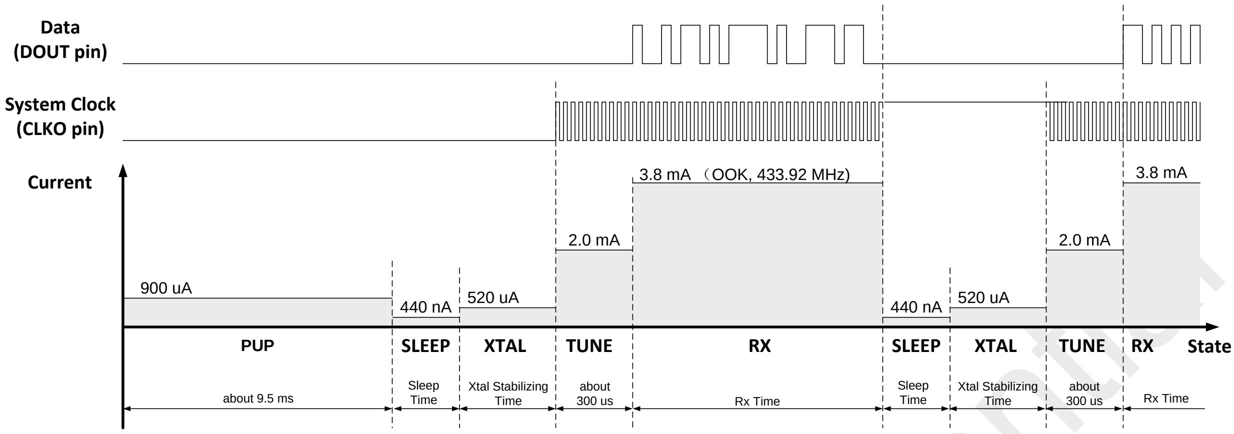

Figure 10. Timing and Current Consumption for Duty-Cycle Receive Mode

It is strongly recommended for the user to turn on the duty-cycle mode option. The advantages are:

- Maintaining the highest performance of the device by regular frequency re-tune.
- Increasing the system stability by regular sleep (resetting most of the blocks).
- Saving power consumptions of both of the Tx and Rx device.

As long as the Sleep Time and Rx Time are properly configured, the transmitted data can always be captured by the device.

3.2 Sleep Time, Rx Time

When the Duty-Cycle Mode is turned on, the Sleep Time and Rx Time is opened to the user to configure. Proper setting of these two values is important for the device to work in an expected scenario.

3.2.1 Easy Configuration

When the user wants to take the advantage of maintaining the highest system stability and performance, and the power consumption is not the first concern in the system, the Easy Configuration can be used to let the device to work in the duty-cycle mode without complex calculations, the following is a good example:

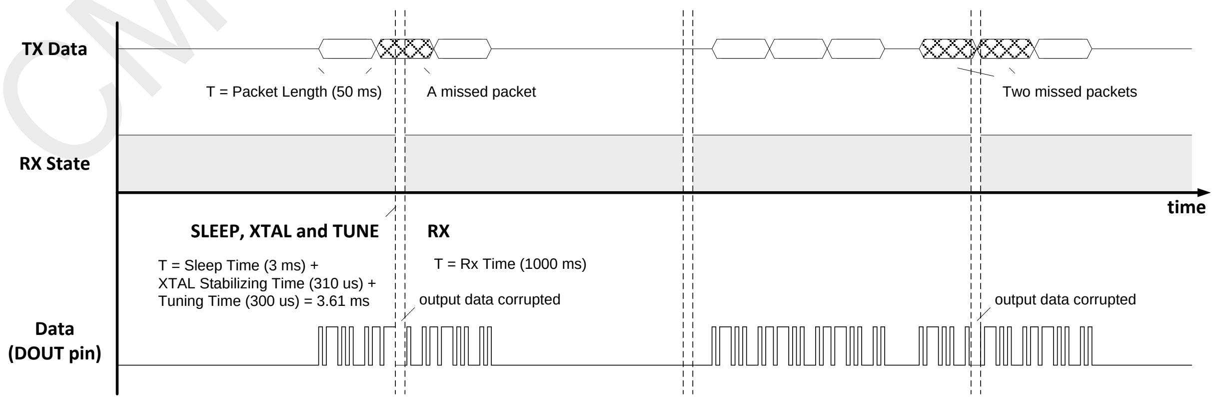

Figure 11. Tx and Rx relationship of Easy Configuration

In this example, the Tx device transmits the data at 1.2 ksps and there are 60 symbols in one data packet. Thus, the packet length is 50 ms. The user can do the following:

- Set the Sleep Time to the minimum value of 3 ms.
- Set the Rx Time to 1 second which is much longer than the packet length.
- Let the Tx device to send out 3 continuous data packets in each transmission.

Because the Sleep Time is very short, the non-receive time is only about 3.61 ms (the sum of the Sleep Time, XTAL stabilizing time and the tuning time), which is much shorter than the packet length of 50 ms. Therefore, this non-receive time period will only have a change to corrupt no more than 2 packets receiving. During the non-receive time period, the DOUT pin will output logic 0.

Because the Rx Time is very long, and 3 continuous data packets are sent in each transmission, there is at least 1 packet that can be completely received by the device and sent out via the DOUT pin with no corruption. The external MCU will only need to observe the DOUT pin status to perform data capturing and further data processing.

3.2.2 Precise Configuration

If the system power consumption is a sensitive and important factor in the application, the Precise Configuration can be used.

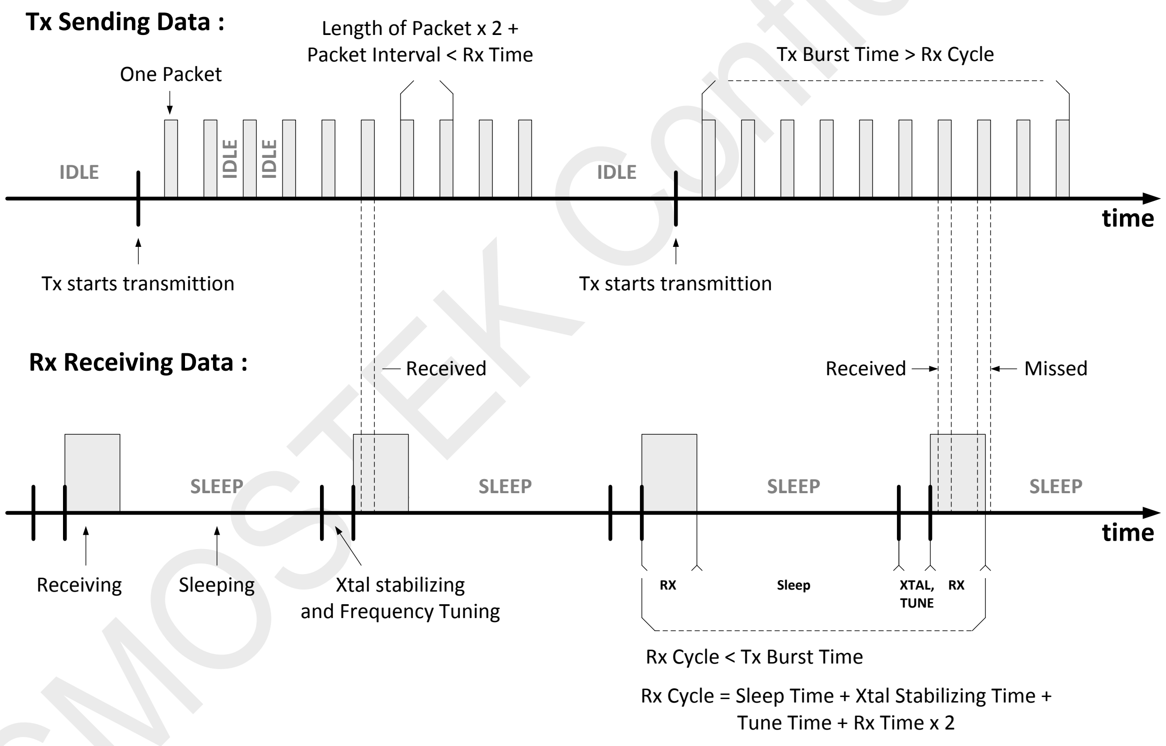

Figure 12. Tx and Rx Relationship of Precise Configuration

The above figure is a conceptual diagram to explain the timing relationships between the Tx and the Rx device. The user will have to make some trade-off amount the packet length, packet interval, Tx burst time, Rx receive time and Rx sleep time, to optimize the power consumption of the Rx device. Two requirements must be fulfilled:

- Length of Packet x 2 + Packet Interval < Rx Time
- Tx Burst Time > Rx Cycle, where Rx Cycle = Xtal Stabilizing Time + Tune Time + Rx Time x 2 + Sleep Time

The Rx Time must always be longer than the packet length plus the packet interval which is determined by the Tx setting (symbol rate, number of symbol per packet, etc). This ensures that the receiver always has a chance to capture at least 1 packet within a

Tx Burst. Normally, it is recommended for the user to set the Rx Time to be longer than 2 or more packets plus the intervals, especially when the application environment is noisy and interferential. The user must also ensure the Rx Cycle, which is the sum of Tune, Rx and Sleep Time, is shorter than the Tx Burst Time. In another words, it must be ensured that at least 1 RX state happens during 1 Tx Burst.

3.3 Wake-On Radio, Wake-On Condition

The wake-on radio function is an effective power consumption saving technique that minimizes the receive time while it guarantees that the device can successfully capture the transmitted data. The following application examples are provided for good understanding.

Please note that the sleep timer which is driven by the LPOSC has ±1% frequency tolerance. The receive timer is driven by the crystal oscillator therefore the timer accuracy is crystal-dependent.

3.3.1 Application Example 1: Fixed Duty

Table 4. Fixed Duty Configurations

Options	Value
Sleep Time	5,000 ms
Rx Time	400 ms
Rx Time Ext	NA
Wake-On Radio	Off
Wake-On Condition	NA
Preamble Size	NA

The sleep and receive time is fixed to 5,000 ms and 400 ms, respectively.
The Xtal Stabilizing Time is set to 310 us.

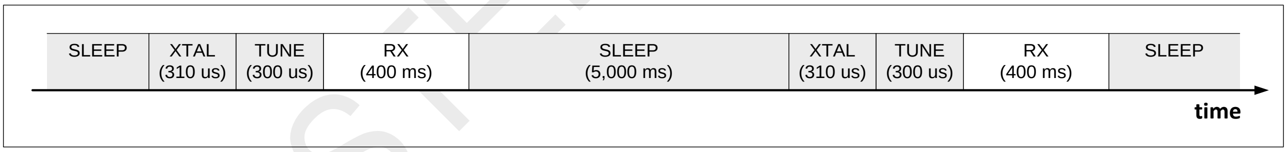

Figure 13. Fixed Duty Operation

After a successful power up, the device enters the SLEEP state. When it reaches the sleep timeout of 5,000 ms, it switches to XTAL state to wait for the crystal to get stable. Subsequently it takes about 300 us to tune the frequency synthesizer to the desired frequency. Once the frequency synthesizer is locked, the device starts receiving. When the Rx timer is timeout at 400 ms, the device switches back to the SLEEP state and repeat the same cycle continuously until it is powered down.

In this example, the non-receive time is 5,000 + 0.31 + 0.3 = 5,000.61 ms. The receive time is 400 ms. Therefore, according to the principle introduced in the “Precise Configuration”, the Tx burst time must be longer than 5,400.61 ms, and 2 data packets must appear during the RX state for safety.

3.3.2 Application Example 2: Wake on Preamble

Table 5. Wake on Preamble Configurations

Options	Value
Sleep Time	800 ms
Rx Time	20 ms
Rx Time Ext	200 ms
Wake-On Radio	On
Wake-On Condition	Extended by Preamble
Preamble Size	2-byte

The wake-on radio function provides a powerful scheme to save the power. In this example, the receive time is set to 20 ms which is much shorter than the packet length. The sleep time is 800 ms.

When there is no effective signal received, the radio acts like the one introduced in the Application Example 1. Because the Rx time is much shorter, more power is saved.

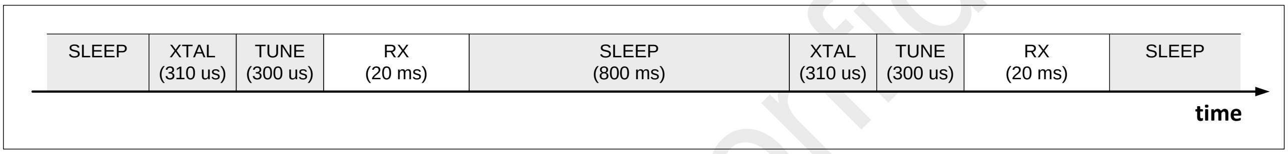

Figure 14. Preamble Wake-On Operation without Preamble Detected

If a valid preamble is received, the RX state is extended to RX EXT which is long enough for more than 2 data packets reception. A valid preamble means the preamble of the size (2-byte in this example) defined on the RFPDK. Please note that the preamble size defined for the Rx device is not necessarily the entire preamble length that is transmitted by the Tx device.

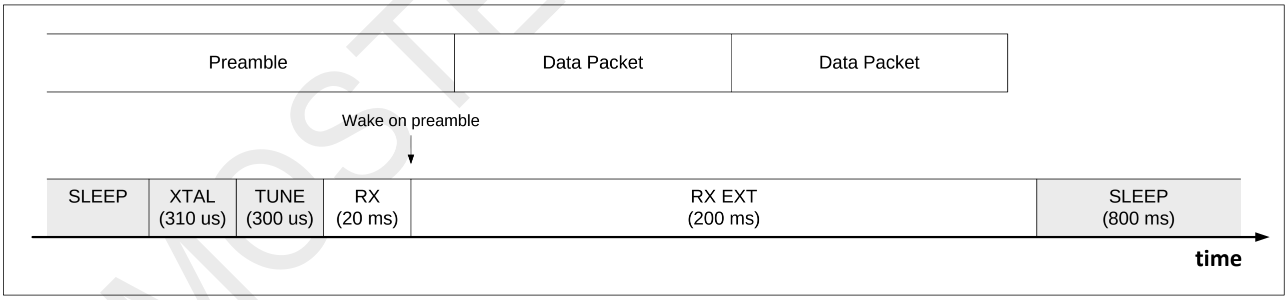

Figure 15. Preamble Wake-On Operation with Preamble Detected

In order to ensure that the preamble can be captured by the Rx, the RX EXT must be longer than the valid preamble size which is 2-byte.

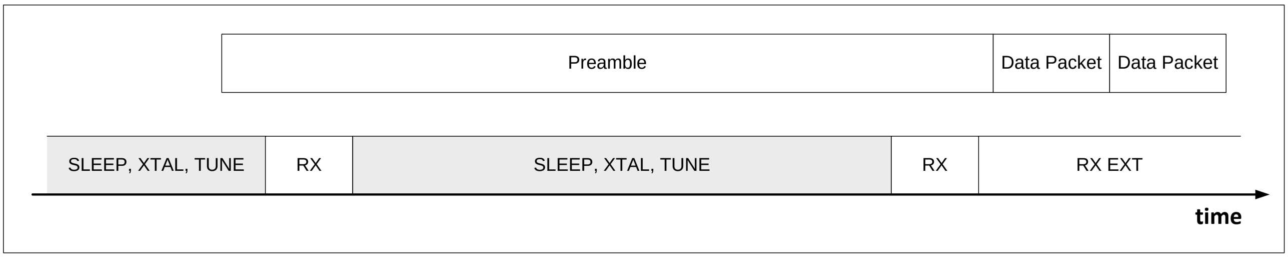

Figure 16. The Transmitted Preamble Length

Also, as shown in the above figure, for the Tx device, the transmitted preamble length must be long enough to ensure the Rx reception:

Preamble Length > RX + SLEEP + XTAL + TUNE + RX

The longer the transmitted preamble length is, the more power the Tx device consumes in each transmission. Therefore, this example is suitable for the application where the Tx device does not send out data very often, and the Rx device is very sensitive about the current consumption.

Last but not the least, to allow the detection of preamble, the symbol rate offset between the Tx and the Rx must be less than ± 25%.

3.3.3 Application Example 3: Wake on RSSI

Table 6. Wake on RSSI Configurations

Options	Value
Sleep Time	800 ms
Rx Time	20 ms
Rx Time Ext	200 ms
Wake-On Radio	On
Wake-On Condition	Extended by RSSI
Preamble Size	NA

This is similar to the Application Example 2, but the wake-on condition is changed to a valid RSSI. Once a valid RSSI is detected, the RX state is extended to RX EXT which is long enough for more than 2 data packets reception.

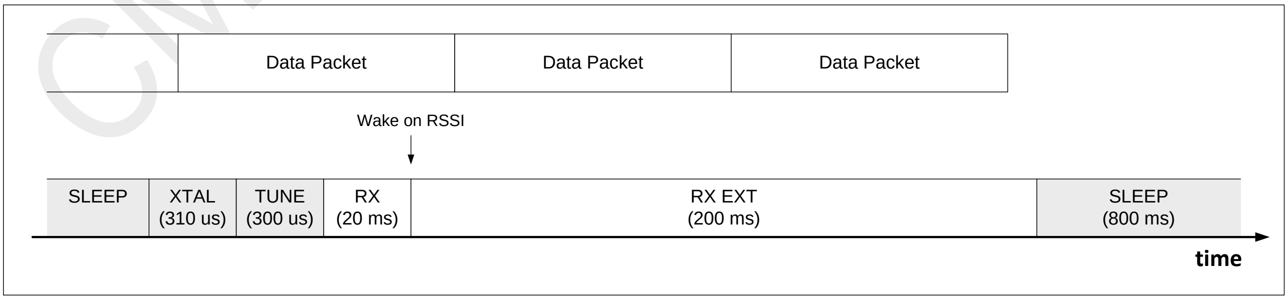

Figure 17. RSSI Wake-On Operation with RSSI Detected

The timing requirement obeys the rules introduced in the "Precise Configuration".

This example is only suitable for the application where the noise level is known and the squelch threshold is properly set to mask the noise. This is because any incoming noise higher than the squelch threshold leads to a valid RSSI produced that can wake on the radio. As a result, the goal of saving the power consumption cannot be reached.

3.4 System Clock Output, System Clock Frequency

If the system clock output is enabled on the RFPDK, a continuous clock signal divided down from the 26 MHz crystal clock is output via the CLKO pin to drive the external MCU or other devices. The selectable clock frequency has a wide range from 0.406 to 13 MHz. As introduce in the Chapter 3.1 and 3.2, this clock is only available when the device is not in the SLEEP and XTAL state.

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. OOK Settings

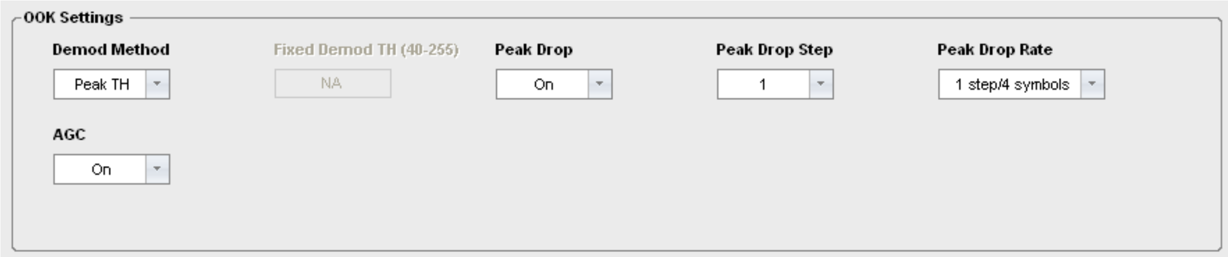

Figure 18. OOK Settings

The available operating options for the OOK settings are:

Table 7. OOK Settings

Parameters	Descriptions	Default	Mode
Demod Method	The OOK demodulation methods, the options are: Peak TH, or Fixed TH.	Peak TH	Advanced
Fixed Demod TH (CMT2210A/CMT2217A)	The threshold value when the Demod Method is "Fixed TH", the minimum input value is the value of Squelch Threshold set on the RFPDK, the maximum value is 255.	60 / 50	Advanced
Peak Drop	Turn on/off the RSSI peak drop function, the options are on, or off.	On	Advanced
Peak Drop Step	The RSSI peak drop step size, the options are: 1, 2, 3, 5, 5, 9, 12 or 15.	1	Advanced
Peak Drop Rate	The RSSI peak drop rate, the options are: 1 step/4 symbols, 1 step/2 symbols, 1 step/1 symbol, or 1 step/0.5 symbol.	1 step/4 symbols	Advanced
AGC	Automatic Gain Control, the options are: on or off.	On	Advanced

4.1 Demod Method

The OOK demodulation is done by comparing the RSSI to a demodulation threshold. The threshold is an 8-bit binary value that is comparable to the 8-bit digitized RSSI.

4.1.1 Fixed Threshold Method

When the "Demod Method" is set to Fixed TH, once the RSSI goes above the threshold, logic 1 is output as the demodulated signal, otherwise logic 0 is output.

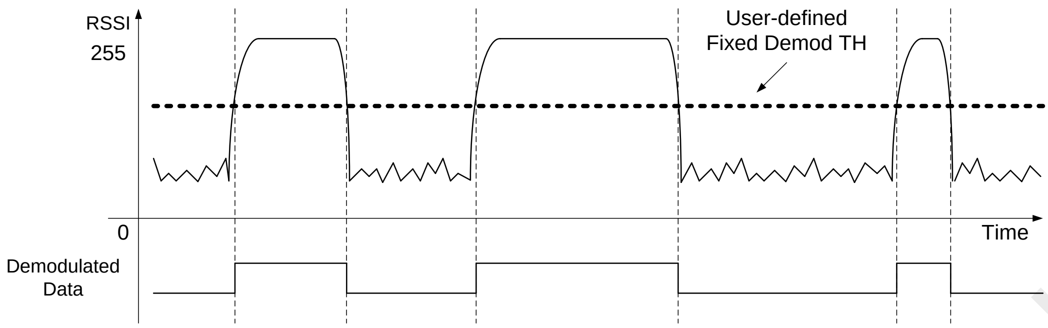

Figure 19. OOK Demodulation Using Fixed Threshold

The minimum value of the Fixed Demod TH is always higher than the Squelch Threshold, because anything lower than the squelch threshold is muted, and therefore setting the Fixed Demod TH lower than the squelch threshold is meaningless.

4.1.2 Peak Threshold Method

When the "Demod Method" is set to "Peak TH", the demodulator dynamically detects the peak value of the RSSI. The comparison threshold (Demod TH) is then obtained by reducing N dB from the peak. The magnitude of N is internally calculated according to the different bandwidths, symbol rates and filtering settings.

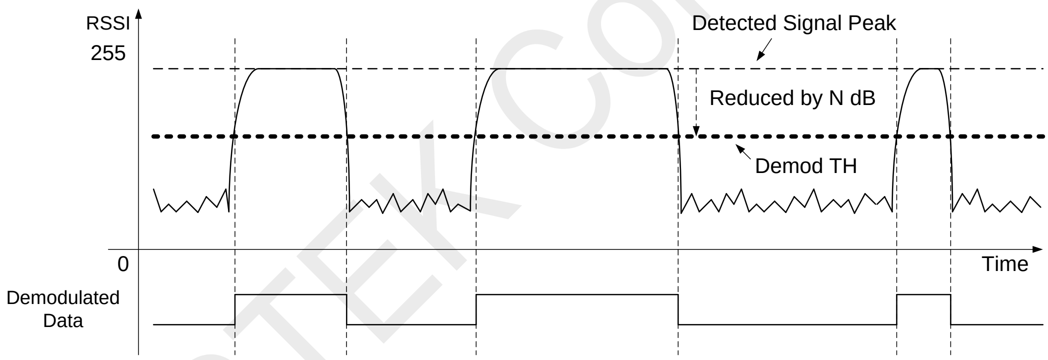

Figure 20. OOK Demodulation Using Peak - N Threshold

When the signal disappears, the peak is detected on the noise floor (see more descriptions in the next section). A proper setting of Squelch Threshold holds its functionality of muting the floor noise when there is no valid signal being received.

To compare the two different modes, the Peak TH mode is used by default on the RFPDK, due to its high adaptability to the different environments and it is carefree for the user. The Fixed TH mode allows the system to only receive the signals whose strength is above a preset value, which is helpful for the user to control the communication distance between the Tx and the Rx.

4.2 Fixed Demod TH

This parameter defines the value of the fixed threshold. The minimum value of this parameter can be set is the value of the Squelch Threshold. This is because anything below the Squelch Threshold is muted. Setting the demodulation threshold below the Squelch Threshold is insignificant. It is unused when the demodulation method is set to Peak TH.

4.3 Peak Drop Step, Peak Drop Rate

When using the Peak TH mode, the Peak Drop function is very useful to deal with the long string of logical "0" on the received data.

When the Peak Drop function is turned off, the dynamically detected peak remains 8 symbols. This means within a moving 8-symbol time window the peak value of the RSSI will be recorded to calculate the demodulation threshold. This might have problem when a string longer than 8 symbols of logical "0" appears, as shown in the below figure.

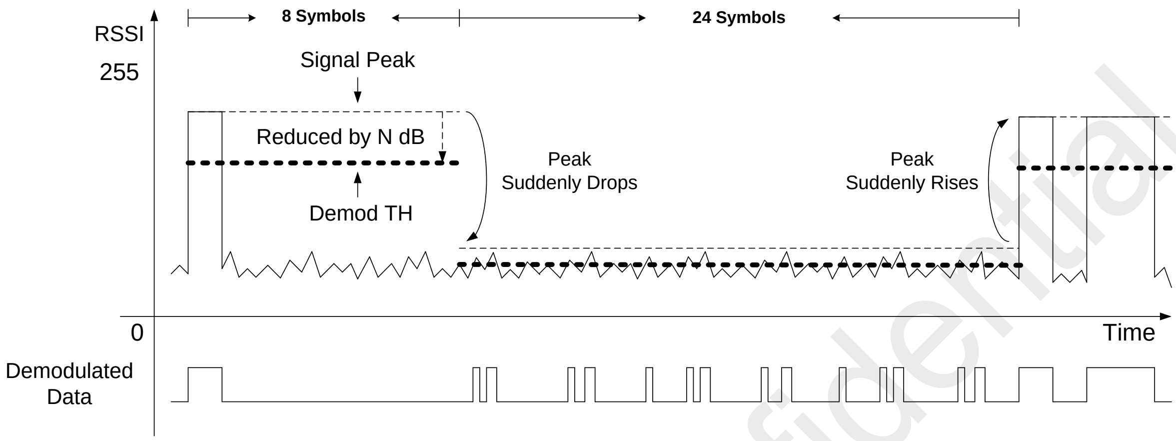

Figure 21. OOK Demodulation Using Peak - N Threshold, with Peak Drop Off

As shown in the above figure, the transmitter sends out a "1" symbol followed by thirty-one "0" symbols. After the signal peak stands for 8 symbols, it suddenly drops to just above the floor noise. From that point the detected peak is actually the floor noise peak and the demodulated data is unpredictable. The last 24 symbols of "0" are then lost or partially lost. Practically, the similar situation does exist and this will lead to failure of demodulation.

The problem can be resolved by turning on the Peak Drop function. It allows the detected peak to drop slowly in order to recognize more symbols of "0". The following figure gives an example. In this example, the Peak Drop Step parameter is set to 12 (RSSI code) on the RFPDK, with the Peak Drop Rate set to 1 step per 2 symbols.

The value of the Peak Drop Step defines how many RSSI codes the signal peak drops each time. The value of Peak Drop Rate defines how fast the peak drop is performed.

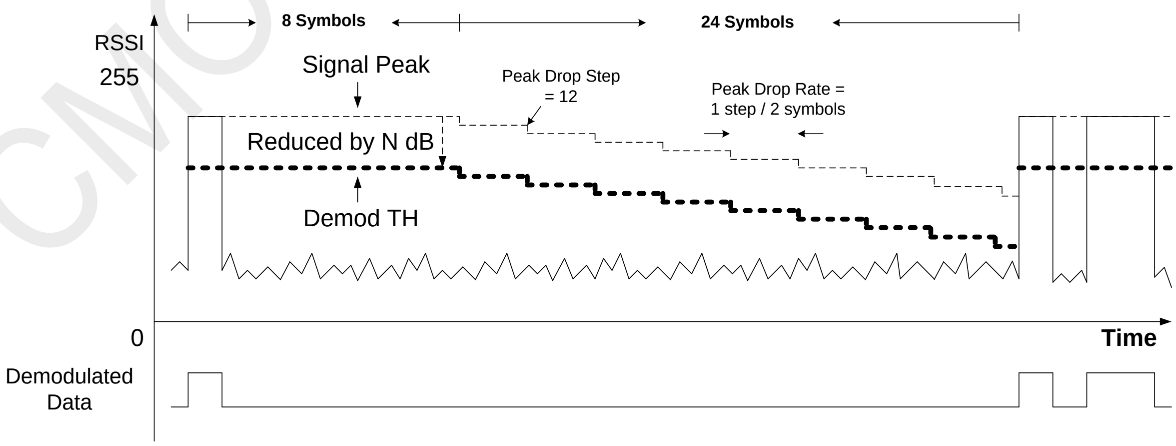

Figure 22. OOK Demodulation Using Peak - N Threshold, with Peak Drop On

As shown in the above figure, after remaining 8 symbols, the peak drops step by step until the next ‘1’ symbol comes. The demodulation threshold drops accordingly to the peak and stays above the noise floor during the long ‘0’ sequence, and therefore allows the device to produce the correct demodulation result. The longer it takes for the peak to drop to the noise floor, the more “0” the system can demodulate. In practice, the bottom of the dropping is either the Squelch Threshold defined on the RFPDK when all the noise are muted by the threshold, or the noise floor which varies depending on the different environments. Below is an example to calculate the total drop time:

Assuming the signal peak is 240, to drop from 239 to 0, the total drop time is computed by:

Drop Time = 240 / Peak Drop Step / Peak Drop Rate, units in Rx symbols

Since the maximum step size is 15 (in terms of RSSI code) and the highest rate is 1 step per 0.5 symbol, the fastest peak drop from 239 to 0 is: 240 / 15 / (1/0.5) = 8-symbol time. Since the minimum step is 1 and the lowest rate is 1 step per 4 symbols, the slowest peak drop from 239 to 0 is: 240 / 1 / (1/4) = 960-symbol time.

It should be noticed that, in the above computations the “time” is measured in “numbers of the Rx symbol” according to the symbol rate configured on the RFPDK. The user should take the symbol rate offset into account during the calculations. For instance, if the Rx symbol rate is set to 4.8 ksps while the Tx actually transmits the data at 2.4 ksps, the signal peak only stands for 4 symbols (at 2.4 ksps) instead of 8 symbols before starting the dropping. Also, the peak drop rate doubles.

CMOSTEK recommends turning on the peak drop function on the RFPDK. By default, the step is set to 2 and the rate is set to 1 step per 4 symbols, and thus it takes 480 symbols to drop from 239 to 0. This default setting fulfills the requirements in most of the wireless applications using OOK. The user does not have to change them unless particular situation are found, such as, the transmitted signals are very small, symbol rate offset is too large, or the string of ‘0’ is too long.

4.4 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.

5. Decode Settings

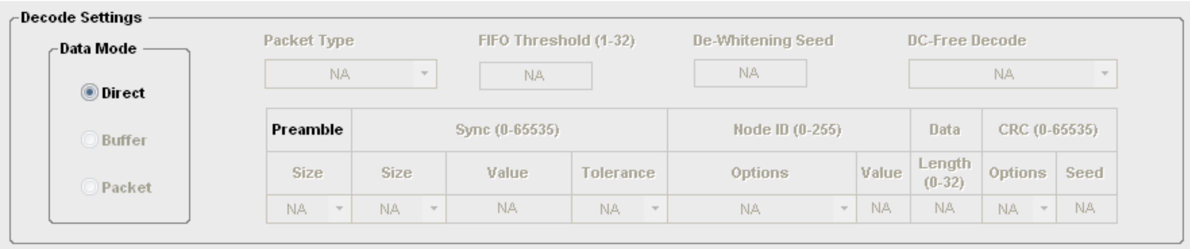

Figure 23. Decode Settings

Direct data mode, which is required in this product, means that the demodulated data is output via the DOUT pin. The available options of data decoding in the direct mode are:

Table 8. Decode Settings Parameter

Parameter	Descriptions	Default	Mode
Preamble	The size of the valid preamble, the options are: 1-byte, 2-byte, 3-byte, or 4-byte. It is only available when WOR is on.	2-byte	Advanced

5.1 Preamble

The preamble detection is only used when the wake-on radio is turned on and the wake-on condition is set to “Extended by Preamble”. Once the preamble detection is used, the symbol rate offset between the Tx and the Rx must be less than ±25%.

6. Document Change List

Table 9. Document Change List

Rev. No	Chapter	Description of Changes	Date
0.9	All	Initial released version	2014-06-14
1.0	3	Update Section 3.1.1 and Figure 9	2014-06-30
1.1	All	Adding Product CMT2217A to this document	2015-03-18

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