

Application Note:

RxDutyCycle

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1. Introduction

This document explains what the RxDutyCycle mode is and how it works on our SX126x family parts.

2. Principle of Operation

RxDutyCycle is a special RX mode that allows decreasing power consumption by putting periodically the radio in reception, while keeping the microcontroller in sleep mode. When a packet is received by the SX1261/2 it triggers an interrupt for the microcontroller in order to wake it up.

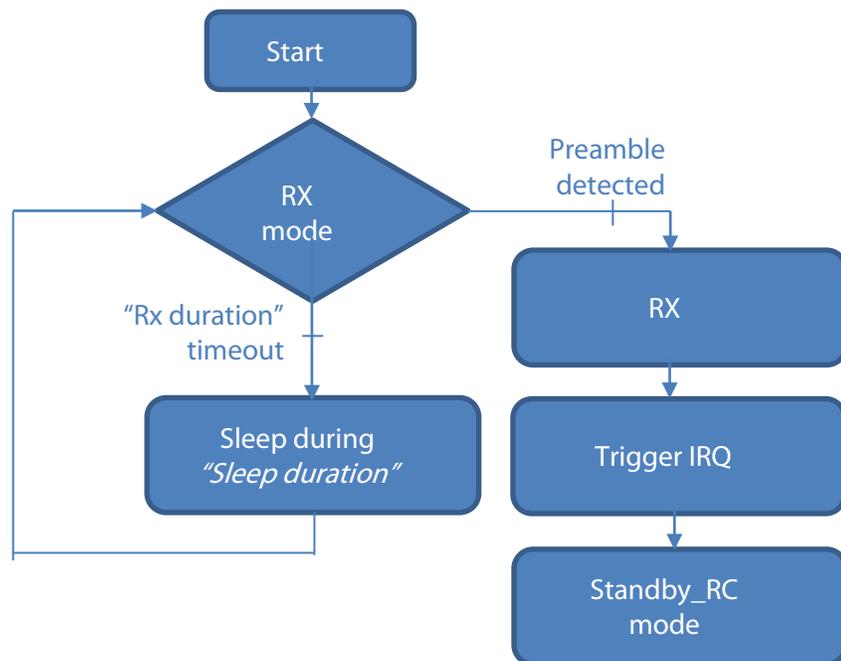


Figure 1: RxDutyCycle Flow Chart

For more details on the implementation, see the SX1261/2 Data Sheet on www.semtech.com, chapter "SetRxDutyCycle".

3. StopTimerOnPreamble Command

This command has an impact on the power consumption of the SX1261/2 chip in case of a false preamble (FSK) or a header (LoRa®). If this option is enabled, the RX timeout is stopped and the chip will remain in RX mode until the next reception.

Example 1:

The SX1261 is set on RxDutyCycle with *StopTimerOnPreamble* enabled.

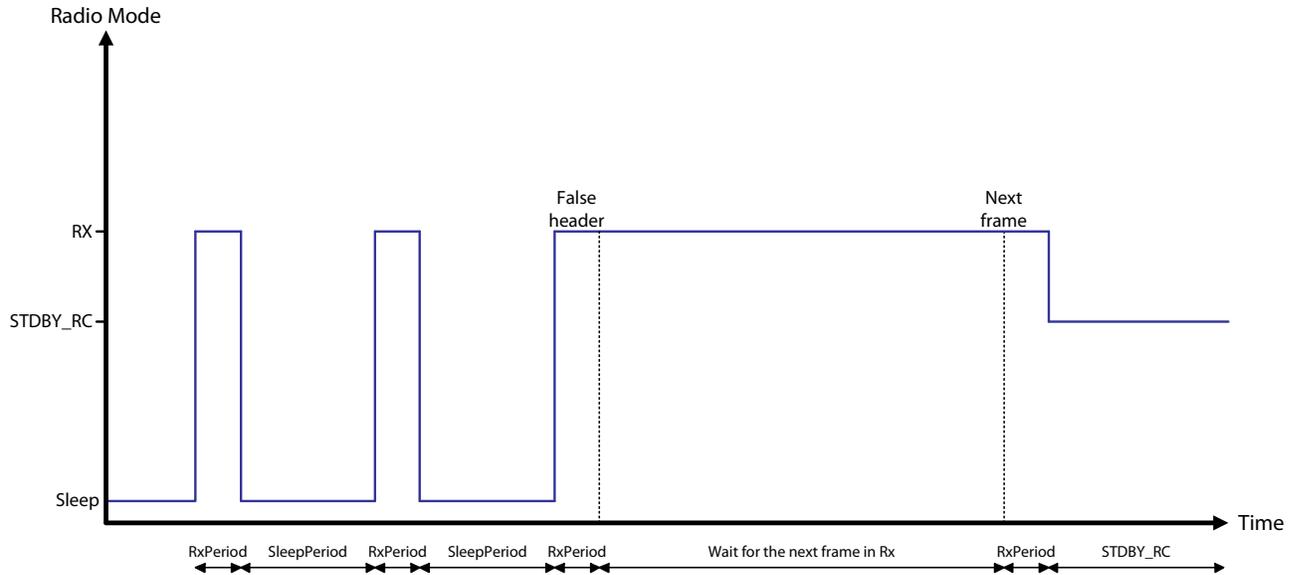


Figure 2: RxDutyCycle with *StopTimerOnPreamble* Enabled

When the false header happens, the chip stays in RX mode until the next received frame, and then switches back to the STDBY_RC mode.

Example 2:

The SX1261 is set on RxDutyCycle with *StopTimerOnPreamble* disabled.

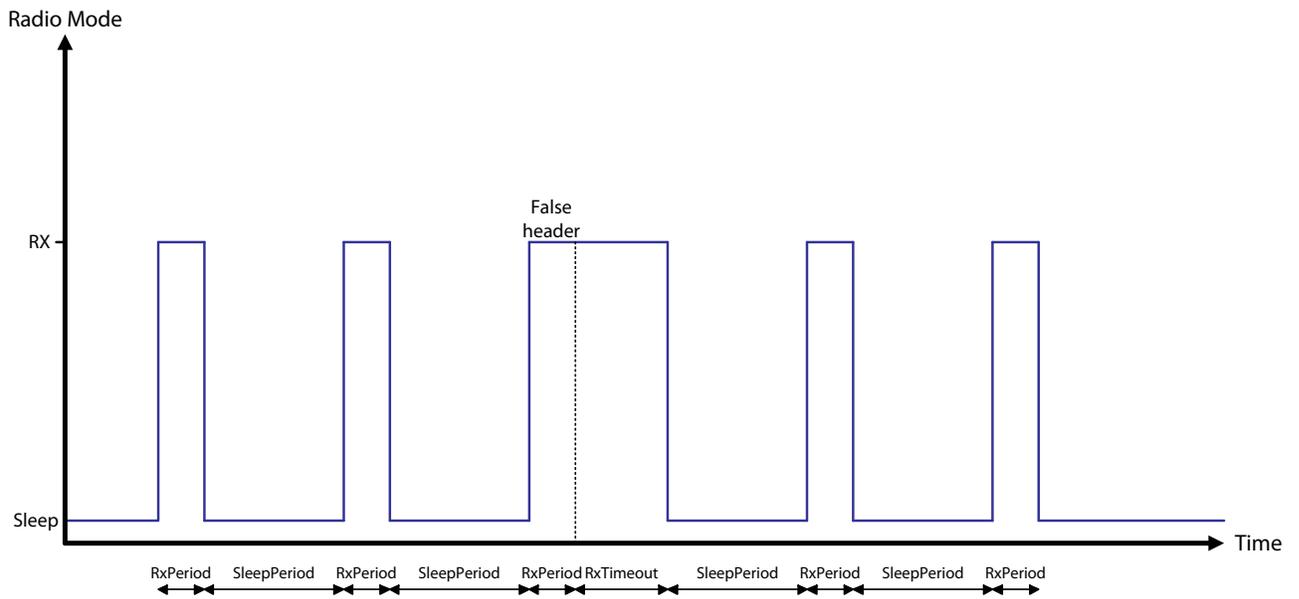


Figure 3: RxDutyCycle with *StopTimerOnPreamble* Disabled

4. Timing Recommendations

The SX1261/2 in RxDutyCycle mode will spend most of its time asleep. To ensure the detection of an incoming message it is required to have a preamble emission time long enough to cover sleepPeriod + preamble/header detection.

Use Case: Preamble length < sleepPeriod

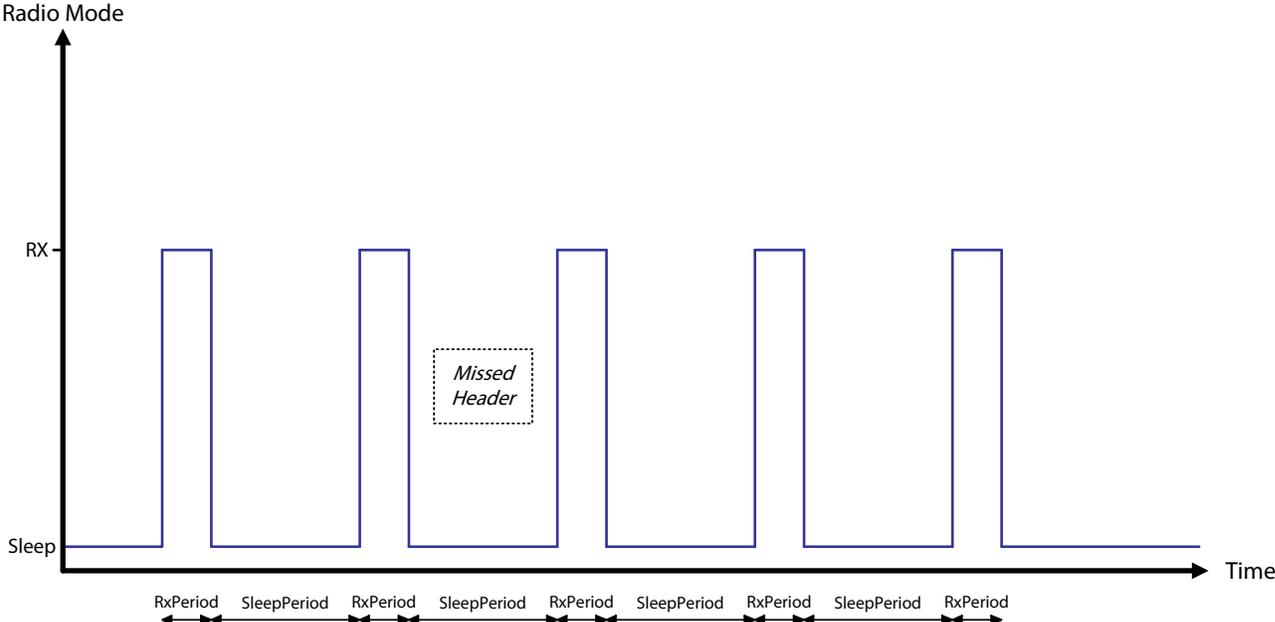


Figure 4: Missed Frame

The frame can be missed if the transmission happens during sleepPeriod.

Worst case preamble length:

The worst case is when the preamble starts just after the beginning of a sleepPeriod.

As a consequence the preamble should have a minimum value consisting of

- sleepPeriod + 2 bytes in FSK
- sleepPeriod + 8 symbols in LoRa®

Note:

2 bytes in FSK and 8 symbols in LoRa® make up the time required to ensure that the SX1261/2 detects a valid incoming packet.

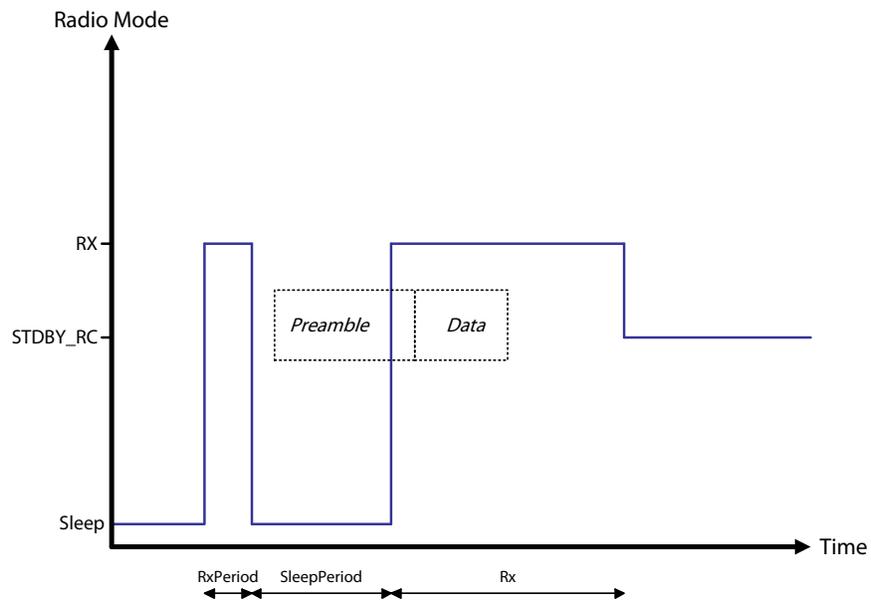


Figure 5: Correct Frame

5. Usage

A minimal code example base on C++ drivers is given below:

```
// Put radio in standby mode
Radio.SetStandby( STDBY_RC );
// Configure Radio
Radio.SetPacketType( PacketType );
Radio.SetModulationParams( &ModulationParams );
Radio.SetPacketParams( &PacketParams );
Radio.SetRfFrequency( Frequency );
Radio.SetBufferBaseAddresses( 0x00, 0x00 );
// Configure IRQ
Radio.ClearIrqStatus( IRQ_RADIO_ALL );
Radio.SetDioIrqParams( IRQ_RX_DONE | IRQ_CRC_ERROR,
                      IRQ_RX_DONE | IRQ_CRC_ERROR,
                      IRQ_RADIO_NONE, IRQ_RADIO_NONE
                      );
// Start RxDutyCycle mode
// rxDuration (µs) = rxTime * 15.625
// sleepDuration (µs) = sleepTime * 15.625
Radio.SetRxDutyCycle( rxTime, sleepTime );
```

6. Impact on Power Consumption Savings

The RxDutyCycle mode decreases power savings, depending on the length of *Sleep duration* and *RX duration*. A calculator is available on the www.semtech.com to estimate the figures.

Inputs		
* Sleep duration	200 000	µs
* RX duration	1 000	µs
Results for DC-DC mode	FSK 4.8 kps	Boosted FSK 4.8 kps
	Consumption µA/hour	Consumption µA/hour
RxDutyCycle	24.69	27.91
Continuous Rx	4 400.00	5 000.00

Figure 6: LoRa® Power Consumption Calculator

The fields in **Green** can be modified by the user and the results are displayed in the table.

Note:

The figures takes into account an average time from sleep to RX, which may vary depending on the time needed for the XTAL to start, the PLL to lock, etc. It might not be accurate for high duty cycle.

Contact your Semtech representative if more accuracy is needed.

7. Glossary

FSK	Frequency Shift Keying
LoRa®	LOng RANge modulation technique
RF	Radio-Frequency
RX	Receiver
TX	Transmitter



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