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Scope

This document provides a detailed description of the RF self-polling mode that can be configured in the Melexis RF transceiver ICs MLX73290-M and MLX73290-A (both called MLX73290 in this document).

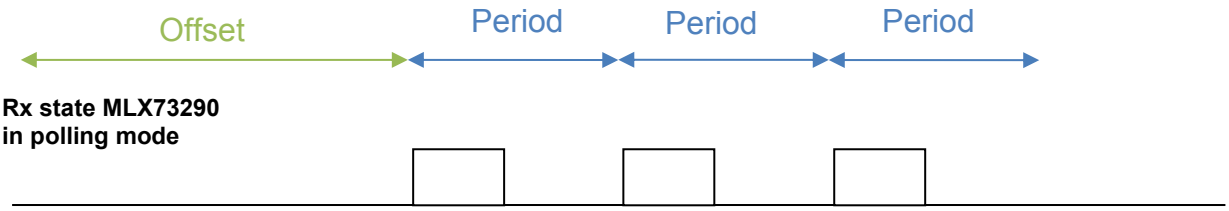
Self-polling is realized by an integrated timer with very low power consumption. The polling mode wakes up the RF receiver or transmitter after a programmable time and scans one or more frequency channels for valid data. It can also be used to transmit the same data periodically.

1) RF Receiver Self Polling

The MLX73290 can be configured in automatic polling mode, using a programmable interval based on a 16-bit timer clocked with the internal calibrated RC oscillator (typ. at 15.6kHz), pre-scaled by a binary power of 215 giving a maximum interval of 38 hours. Polling mode must be activated by the two registers POLL_RFRX and EN_POLL (POLL_RFRX enables the RF RX polling and EN_POLL enables the RF polling timer).

a) Polling periods

Polling grid



It is possible to define an offset to decide when to start polling. The offset and polling period are configured with the registers POLL_EXP[3:0], POLL_OFFSET[15:0] and POLL_PERIOD[15:0] according to the following formulas:

$$Offset = \frac{2^{(11+POLL_{EXP})}.(1+POLL_{OFFSET})}{f_{XTAL}}[sec]$$

$$Period = \frac{2^{(11+POLL_{EXP})}.(1+POLL_{PERIOD})}{f_{XTAL}}[sec]$$

At the end of the waiting period, the timer restarts and sets the corresponding IRQ flag TMR_FLAG, the MLX73290 is set in receiver mode looking for a valid synchronization word (SYNC_WORD[31:0]), during a certain time.

b) Termination timer

The termination timer is programmable between 64 µs and 34 s (RXTERM_MANT[3:0] and RXTERM_EXP[3:0]).

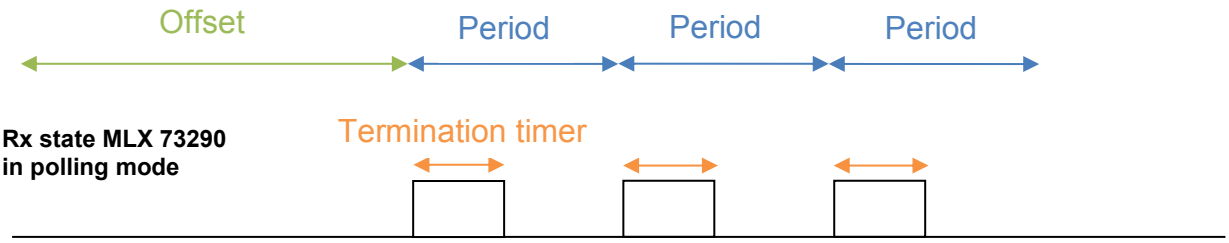
- When RXTERM_EXP = 0

$$termination\ timer = \frac{2^{11}.(1 + RXTERM_{MAN})}{f_{XTAL}}$$

- When RXTERM_EXP is between 1 and 15

$$termination\ timer = \frac{2^{11}.(RXTERM_{MAN} + 17).2^{(RXTERM_{EXP}-1)}}{f_{XTAL}}$$

Polling grid



When the timer expires, termination may be postponed while RSSI is above the threshold, or while payload is being received, depending on the setting of the bit RXTERM_COND. Then the state machine will take the action selected by RXTERM_ACT: it will stop or recalibrate and resume reception.

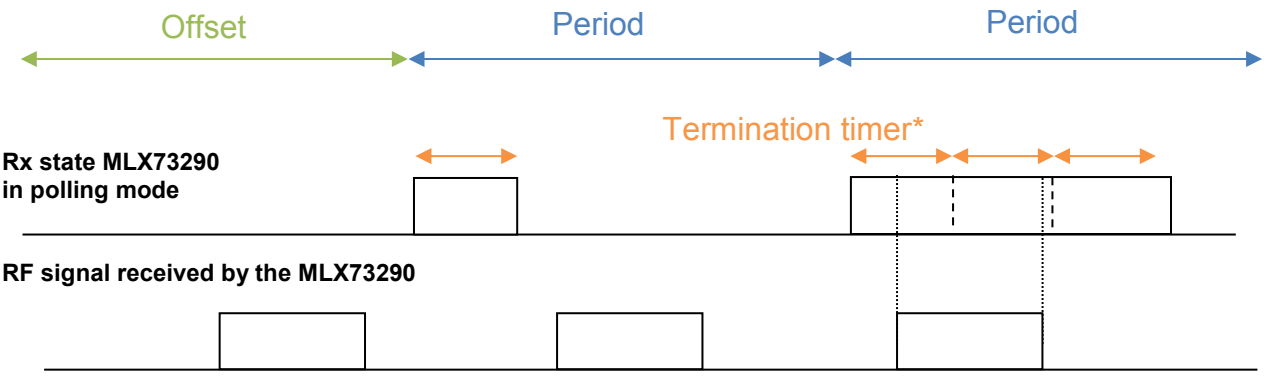
- After timeout has expired, postpone termination if RXTERM_COND is equal to:
  - 0 = always (i.e. never terminate)
  - 1 = never (i.e. terminate unconditionally)
  - 2 = as long as RSSI is above threshold, or payload is being received (after detection of a valid sync word)
  - 3 = as long as a payload is being received

Furthermore, there is the option to set a threshold RX_RSSI_TH on the RSSI.

- Action to take for RX termination timeout is selected by RXTERM_ACT:
  - 0 = go to error state
  - 1 = flush RF RX FIFO, recalibrate RX, then RX

The example below with RXTERM_COND = 3 and RXTERM_ACT = 0 shows when a packet received is longer than the termination timer:

Polling grid



*The termination timer is postponed as long as a payload is being received.

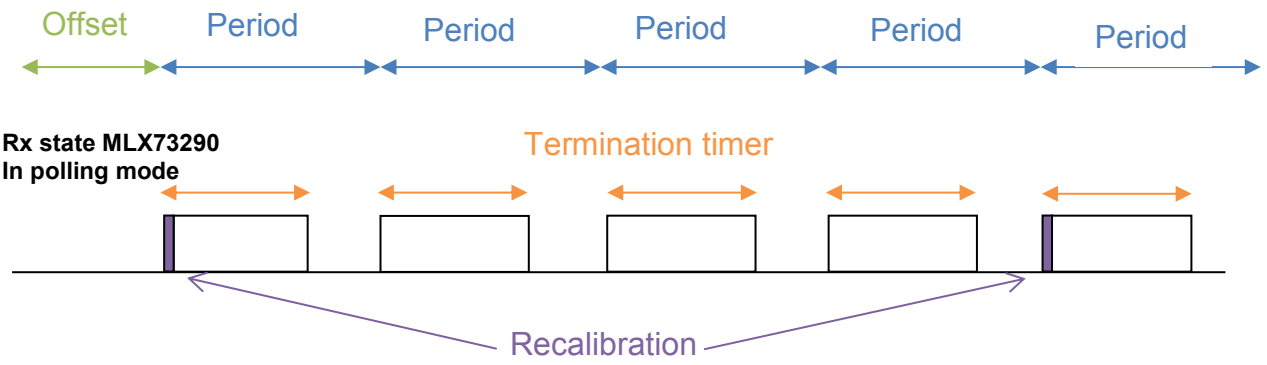
c) *Recalibration*

The RX period might be preceded by periodic recalibration as configured by CALIB_MODE[0:2].

- Periodic (re)calibration mode:
  - 0 = always recalibrate
  - 1 = 1:4
  - 2 = 1:8
  - 3 = 1:16
  - 4 = 1:32
  - 5 = 1:64
  - 6 = 1:128
  - 7 = never recalibrate

Example below with CALIB_MODE = 1:

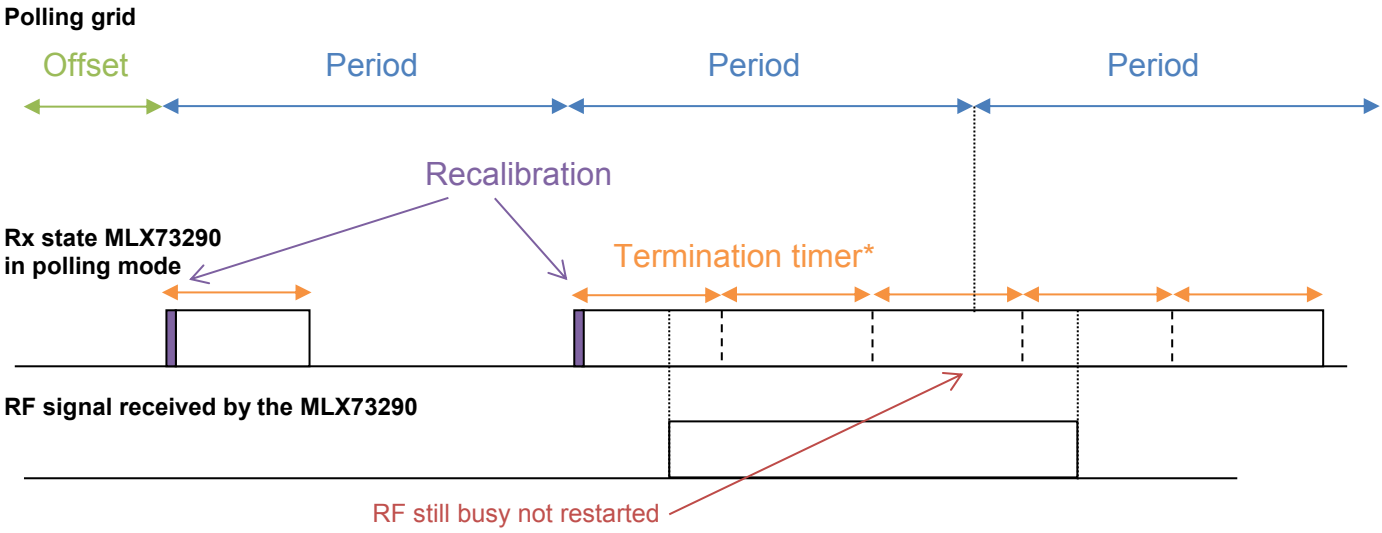
Polling grid



d) Example

The RF state machine will eventually return to its stopped (idle) state after completion of the task (e.g. packet received) or when an error occurs (e.g. RX termination timer expires, PLL out of lock, FIFO overrun etc.). In the meantime, the polling timer continues to run, so the polling grid is in no way affected by how long it takes the RF transceiver to return to its idle state. This is important for RF protocols with beacons or timeslots at fixed intervals.

The following picture shows the basic functionality of the RF polling feature when a packet is longer than the polling period.



*The termination timer is postponed as long as a payload is being received.

Settings:

- CALIB_MODE = 0
- RXTERM_COND = 3
- RXTERM_ACT = 0

2) Continuous Current Consumption in Receive Mode

Parameter	Symbol	Test conditions	Typical	Units
Sleep mode current	I_{SLEEP}	RCO timer on	0.6	µA
RF Receive mode current	$I_{RX,315MHz}$	100kbps, FSK, NRZ	14	mA
	$I_{RX,433MHz}$		15	
	$I_{RX,868MHz}$		16	
	$I_{RX,915MHz}$		17	

3) Timer Settings

Period	Min	Max	Step
Termination timer	64 µs	**33.55 sec**	64 µs
Sleep timer		**38.17 hours**	
Offset timer			

4) Polling Grid Examples

To reach an average current consumption of for example 2mA, the polling grid could have the following structure:

Termination period in s	Sleep period in s
1	8.3
2	15.7
4	29
8	60
16	116
33.55	230

With the longest termination period of 33.55 seconds, the average current consumption can be decreased further using the following sleep period:

Average current in mA	Sleep period in s
15	2.2
10	20
5	75
2	230 (3.8 min)
1	500 (8.3 min)
0.5	1,000 (16.6 min)
0.2	2,700 (45 min)
0.1	5,400 (90 min)
0.05	11,000 (3 h)
0.02	29,000 (8 h)
0.01	61,000 (17 h)
0.006	112,000 (31 h)

The average current consumption as a function of sleep period and termination period can be illustrated as follows: