

## Transmitter Module 315MHz PTM 240C

September 26, 2008



Patent protected:  
WO98/36395  
DE 100 25 561  
DE 10309334

## REVISION HISTORY

The following major modifications and improvements have been made to the first version of this document:

No	Major Changes
0.97	Documentation of energy pulse requirements extended
0.98	Energy pulse requirements corrected. Polarity is important!
1.00	Product released to serial production
1.01	Timing requirement for SW1, SW2 modified in section 2.2

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### Important!

This information describes the type of component and shall not be considered as assured characteristics. No responsibility is assumed for possible omissions or inaccuracies. Circuitry and specifications are subject to change without notice. For the latest product specifications, refer to the EnOcean website: <http://www.enocean.com>.

As far as patents or other rights of third parties are concerned, liability is only assumed for modules, not for the described applications, processes and circuits.

EnOcean does not assume responsibility for use of modules described and limits its liability to the replacement of modules determined to be defective due to workmanship. Devices or systems containing RF components must meet the essential requirements of the local legal authorities.

The modules must not be used in any relation with equipment that supports, directly or indirectly, human health or life or with applications that can result in danger for people, animals or real value.

Components of the modules are considered and should be disposed of as hazardous waste. Local government regulations are to be observed.

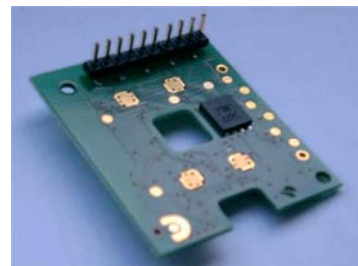
Packing: Please use the recycling operators known to you. By agreement we will take packing material back if it is sorted. You must bear the costs of transport. For packing material that is returned to us unsorted or that we are not obliged to accept, we shall have to invoice you for any costs incurred.

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## 1 GENERAL DESCRIPTION

The radio transmitter module PTM 240C from EnOcean enables the implementation of batteryless occupancy sensors for applications in building technology. Power is provided by an external short energy pulse.



The PTM 240C module serves the 315 MHz air interface protocol of EnOcean. Together with the transceiver module TCM2xyC, this module can be easily integrated in operation and control units for the implementation of different application specific system solutions.

### 1.1 Functional Principle

When a short energy pulse is supplied to the PTM 240C module an RF telegram is transmitted including a 32-bit module ID. In addition the information of 2 inputs is transmitted. These inputs shall be used in the application circuitry to connect a learn button and the evaluation unit of a passive infrared sensor (PIR).

### 1.2 Features Overview

<b>Power supply</b>	external voltage pulse
<b>Frequency / Transmission power</b>	315.0 MHz / typ. 3 dBm conducted
<b>Data rate / Modulation type</b>	125 kbps / ASK
<b>Minimal switching interval</b>	50 ms
<b>Antenna</b>	15 cm whip antenna mounted
<b>Transmission range</b>	up to 200 m free field, up to 30m indoor range strongly dependent on surrounding material and position relative to energy harvester or metal surfaces
<b>Serial Telegram type</b>	4BS (provided at TCM2xyC serial output)
<b>Module identifier</b>	individual 32-bit ID (factory programmed)
<b>Radio standards</b>	FCC part 15 (for use in USA and Mexico) RSS210 Issue 6 (for use in Canada)



**Observe precautions! Electrostatic sensitive devices!**

### 1.3 Mechanical Interface

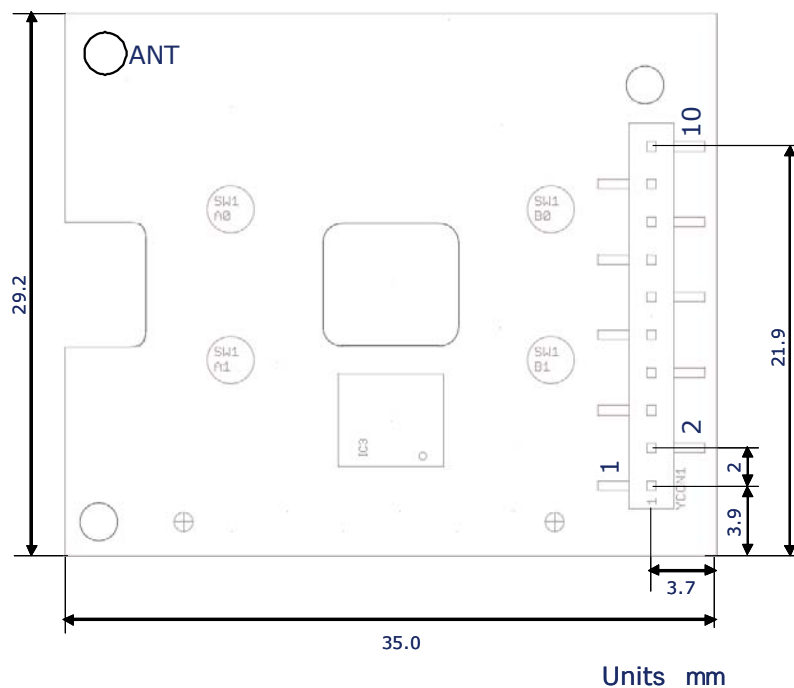


Figure: PCB Dimensions in mm



Do not connect with wrong orientation. The module may be destroyed!

### 1.4 Environmental Conditions

Operating temperature	-25 up to +65 °C
Storage temperature	-40 up to +85 °C
Humidity	0 % to 93 % r.h., non-condensing, no IP-class

### 1.5 Ordering Information

Type	Ordering Code
PTM 240C	S3031-A240

## 2 FUNCTIONAL DESCRIPTION

### 2.1 Block Diagram

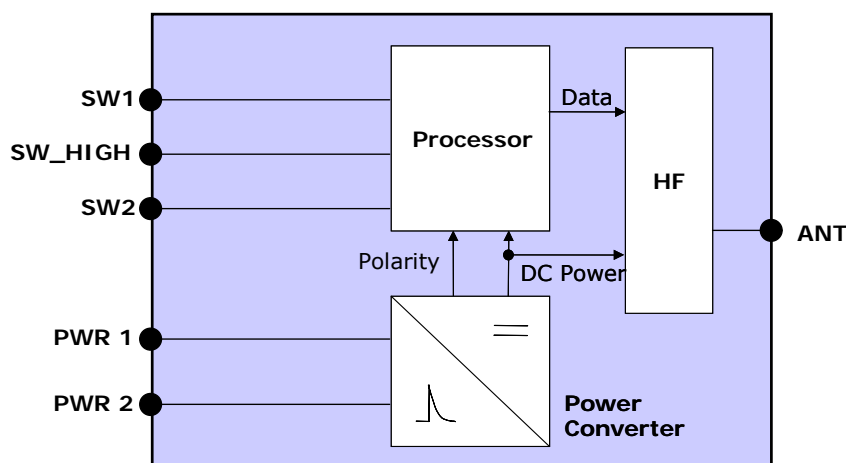


Figure: Block diagram of PTM 240C

### 2.2 Pin Description and operational characteristics

Pin	Symbol	Function	Operational Characteristics
3	PWR1	Negative input for energy pulse	Maximum wire length: 5cm each
1	PWR2	Positive input for energy pulse	See section 2.4 for requirements on the energy pulse.
7 9	SW1 SW2	Digital inputs. Connect SW2 to SW_HIGH for transmission of a teach-in telegram. Leave SW2 open to transmit a data telegram. The status of SW1 will then determine if "PIR ON" or "PIR OFF" will be signaled.	No capacitive load! Maximum wire length to SW_HIGH: 3cm each.  The signal at SW1 and SW2 must be stable $\geq 0\mu s$ before and $> 10ms$ after energy is supplied to the module. Please consider contact bouncing!
2	SW_HIGH	Supply for SW1 and SW2	Maximum wire length to SW1, SW2: 3cm
4, 5, 6, 8, 10	RES	Reserved	Leave open!
	ANT	Pad for antenna mounting	15cm whip antenna as defined in 3.1

## 2.3 PTM 240C Radio Telegram

### 2.3.1 Transmission timing

The transmission timing of the radio module PTM 240C has been developed to avoid possible collisions with data packages of other EnOcean transmitters as well as disturbances from the environment.

With each transmission cycle, up to 3 identical subtelegrams are transmitted. The transmission of a subtelegram lasts approximately 1.2 ms. To optimize data security, each telegram is repeated several times within about 40 ms, whereas the delay between the second and the third transmission burst is effected at random.

### 2.3.2 Telegram Data

The PTM 240C transmits an EnOcean radio telegram according to profile 0b000111 – Occupancy Sensor - type 0b0000001 as defined in "Standardization EnOcean Communication Profiles V1.03".

For detailed information on the serial protocol please refer to the user manual of TCM2xyC and the above standardization document.

A teach-in telegram is transmitted, if SW2 is connected to SW\_HIGH. This telegram contains the above mentioned profile and type information as well as a manufacturer ID which is 0b1111111111 (multiuser ID) in this case.

In case SW2 is left open the module transmits a data telegram with the information about the status of the PIR sensor which has to be coded using SW1.

The information transmitted is:

- Unique factory programmed 32bit ID
- ORG, Data3, Data2, Data1, Data0 and Status as follows:

SW1	SW2	ORG	Data3	Data2	Data1	Data0	Status	Description
open	open	0x07	0xFF	0xFF	0x00	0xFF	0x0R	PIR OFF
SW_HIGH	open	0x07	0xFF	0xFF	0xFF	0xFF	0x0R	PIR ON
open	SW_HIGH	0x07	0x1C	0x0F	0xFF	0x80	0x0R	Teach-in
SW_HIGH	SW_HIGH	0x07	0x1C	0x0F	0xFF	0x80	0x0R	Teach-in

R=repeater counter

## 2.4 Energy Pulse Requirements

The energy pulse has to fulfill the following requirements:

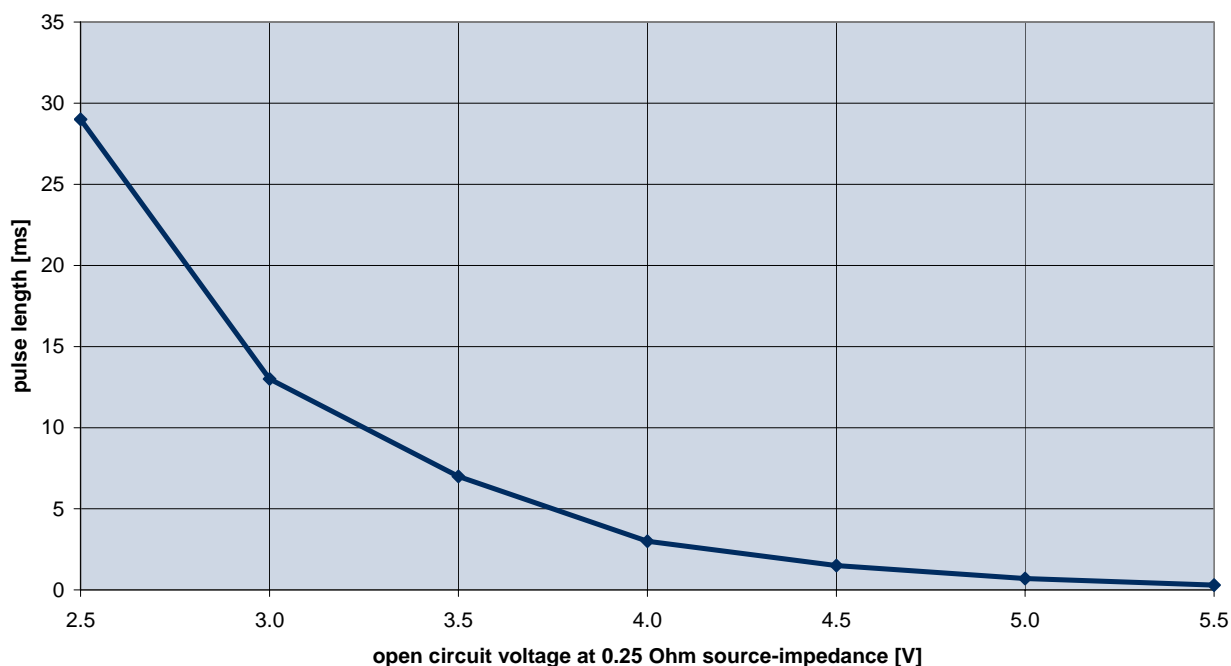
- $E_{\text{Pulse}} > 0.25\text{mWs}$
- $U_{\text{min}} = 0\text{V}$
- $2.5\text{V} \leq U_{\text{max,Pulse}} \leq 5.5\text{V}$
- $0.3\text{ms} \leq T_{\text{Pulse}} \leq 25\text{ms}$



Please make sure to use right polarity as specified in section 2.2!  
Otherwise the module may transmit only 2 subtelegrams.

The required pulse width depends on voltage, pulse shape and source impedance.

The figure below shows how the required pulse length changes for a rectangular pulse as a function of the open circuit voltage. The measurement has been performed with a source impedance of 0.25 Ohm.





### 3 APPLICATIONS INFORMATION

#### 3.1 Antenna Mounting

Positioning and choice of receiver and transmitter antennas are the most important factors in determining system transmission range. The PTM 240C modules are supplied with antenna. For standard applications the use of a whip antenna is recommended ( $L=15\text{cm}$ ). This antenna enables a very compact unit with good radio characteristics. For mounting the antenna, the following notes should be considered to optimize the system performance:

##### Mounting a 1/4-wave whip antenna:

For good transmit performance, great care must be taken about the space immediately around the antenna since this has a strong influence on screening and detuning the antenna. The antenna should be drawn out straight as far as possible and must never be cut off. Primarily, the far end of the wire should be mounted as far away as possible from all metal parts, PCB strip lines and fast logic components (e.g. microprocessors).



Do not roll up or twist the whip antenna!



To avoid possible damage to the module the end of the antenna should be insulated.

Note that 315 MHz whip antennas do not show any directional effects under free-field radio-wave propagation conditions (spot-wise radiator).

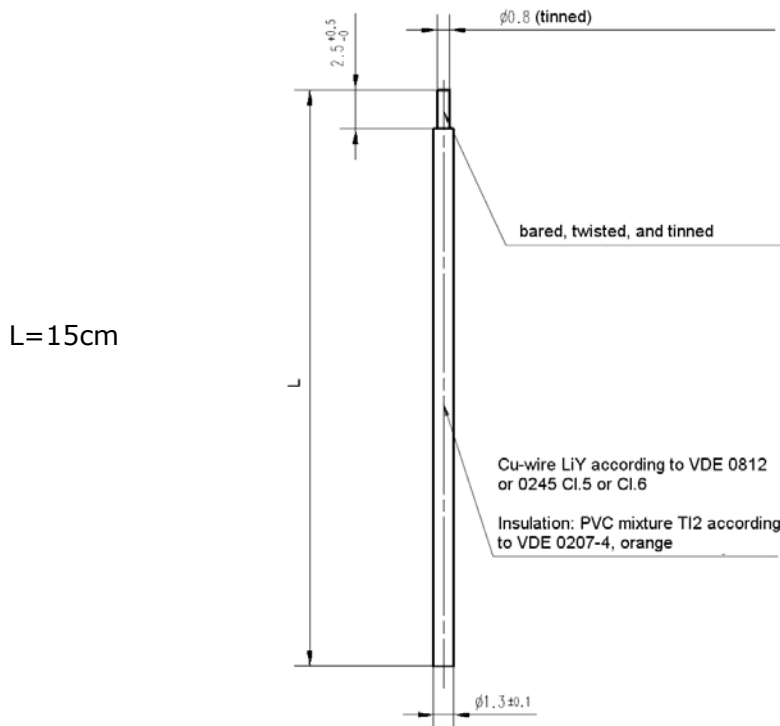


Figure: Specification of whip antenna

### 3.2 Transmission Range

The main factors that influence the system transmission range are:

- Type and location of the antennas of receiver and transmitter
- Type of terrain and degree of obstruction of the link path
- Sources of interference affecting the receiver
- "Dead" spots caused by signal reflections from nearby conductive objects

Since the expected transmission range strongly depends on these system conditions, range tests should categorically be performed in early project phases!

The following figures for expected transmission range are considered by using the PTM 240C radio transmitter module and the TCM2xyC radio transceiver module with mounted whip antenna and may be used as a rough guide only:

- **10 m** in industrial applications with metal in the vicinity
- **30 m** for obstructed environment (e.g., through two brick walls inside a building)
- **200 m** for unobstructed environment ("free field")

Further notes to determine the transmission range within buildings are available as download from [www.enocean.com](http://www.enocean.com).

### 3.3 FCC/IC Approval Requirements

Because of the very low radiated field strength on average, the EnOcean radio technology can be approved in the USA and in Canada. If the PTM240C is operated in compliance with the following requirements, a finished sensor unit containing this radio will comply with Part 15 of the FCC Rules and with RSS-210 of Industry Canada.

The finished radio sensor unit has to be approved by a notified body for operating free of charge in the area of the United States of America ("FCC approval") and in Canada ("IC approval").

#### **FCC/IC operational and timing requirements:**

Because of the very low average to peak factor, the (corrected) field strengths of EnOcean transmitters meet the FCC 15.231 conditions for manually operated transmitters and the lower field strength limit values for intentional radiators operated at a periodic rate. In addition to the field strength limits, the following timing conditions have to be met with respect to FCC 15.231:

- **Intentional radiators operated at a periodic rate:**

Periodic transmissions of EnOcean modules at regular predetermined intervals are allowed with respect to FCC 15.231e, if the silent period between transmissions is in no case less than 10 seconds.

- **Manually operated transmitters:**

- If transmissions are not periodic approval according to FCC 15.231a is possible. In this case the total duration of transmissions must not exceed more than two seconds per hour for each transmitter.
- Under this regulation it must be ensured that the PTM240C radio sensor module does not transmit data more than 1058 times per hour. For this timing calculation the PTM240C packet length of 1.2 ms, a tolerance of 5% in packet length, a 50% on average packet Ton/Toff ratio and all 3 redundant packets are considered.

For details please refer to the FCC part 15 regulation, which is available for download at <http://www.fcc.gov/oet/info/rules/>.