

Transmitter Module PTM 33x / 33xC

May 4, 2010



Observe precautions! Electrostatic sensitive devices!

Patent protected:

WO98/36395, DE 100 25 561, DE 101 50 128,
WO 2004/051591, DE 103 01 678 A1, DE 10309334,
WO 04/109236, WO 05/096482, WO 02/095707,
US 6,747,573, US 7,019,241

REVISION HISTORY

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

No	Major Changes

**Published by EnOcean GmbH, Kolpingring 18a, 82041 Oberhaching, Germany
www.enocean.com, info@enocean.com, phone ++49 (89) 6734 6890**

© EnOcean GmbH
All Rights Reserved

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.

TABLE OF CONTENT

1 GENERAL DESCRIPTION 4

 1.1 Basic Functionality 4

 1.2 Technical Data 4

 1.3 Physical Dimensions 5

 1.4 Environmental Conditions 6

 1.5 Ordering Information 6

2 FUNCTIONAL DESCRIPTION 6

 2.1 Block diagram 6

 2.2 Pin out 7

 2.3 Pin Description and operational characteristics 7

 2.4 Configuration Interface 8

 2.5 Absolute maximum ratings (non operating) 9

 2.6 Maximum Ratings (operating) 9

 2.7 Radio telegram 10

 2.7.1 Normal operation 10

 2.7.2 User defined operation 11

 2.8 Transmit timing 11

3 APPLICATIONS INFORMATION 12

 3.1 How to connect an energy harvester 12

 3.2 How to generate an equivalent energy pulse 12

 3.3 Antenna 13

 3.4 Layout recommendations 14

 3.5 Soldering information PTM 332/332C 15

 3.6 Transmission range 16

4 AGENCY CERTIFICATIONS (in preparation) 17

 4.1 CE approval 17

 4.2 FCC (United States) Certification 18

 4.3 IC (Industry Canada) Certification 20

PRELIMINARY

1 GENERAL DESCRIPTION

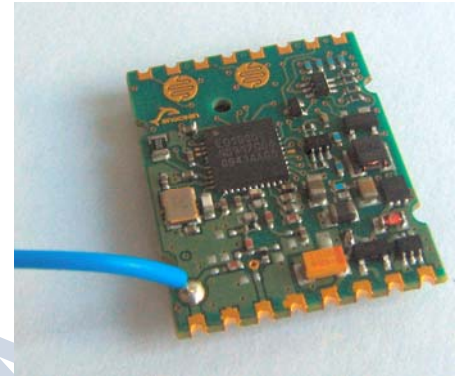
1.1 Basic Functionality

The radio transmitter module PTM 330 from EnOcean enables the implementation of wireless sensors and switches without batteries.

Key applications are handheld remote controls or industrial switches.

Functional Principle

When an energy pulse is supplied (e.g. by ECO 200 from EnOcean) an RF telegram is transmitted including a unique 32-bit module ID, the polarity of the energy pulse, and the operating status of 4 digital inputs. The RPS telegram content can be configured if other content is needed.



PTM 330 can be connected to ECO 200 via a contact spring. There are two meander structures on the PCB which allow usage of a rubber pad to set the level of two digital inputs. Alternatively PTM 330 can be mounted as an SMD component onto a host PCB. In this case energy supply pins and digital input pins are accessible via contact pads.

Product variants

- PTM 330: 868MHz variant, pre-installed whip antenna, delivery in card board box
- PTM 332: 868MHz variant, no pre-installed antenna, delivery as tape & reel
- PTM 330C: 315MHz variant, pre-installed whip antenna, delivery in card board box
- PTM 332C: 315MHz variant, no pre-installed antenna, delivery as tape & reel

1.2 Technical Data

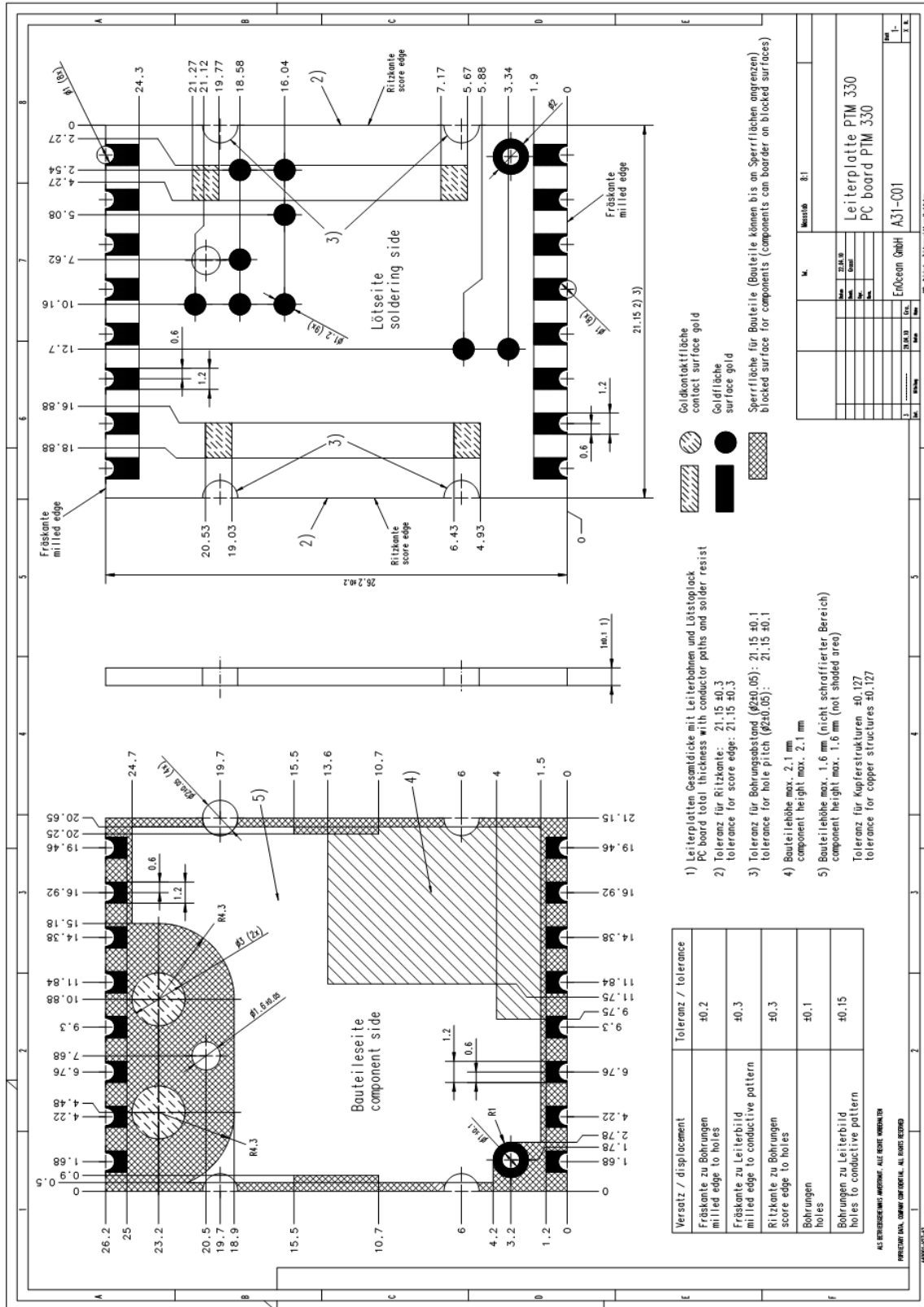
Power supply	ECO 200 or equivalent energy pulse
Antenna	pre-installed whip antenna PTM 330/330C external 50 Ohm or whip antenna PTM 332/332C
Frequency	868.3 MHz (PTM 33x) / 315.0 MHz (PTM 33xC)
Transmission power	typ. 2 dBm at antenna base
Data rate / Modulation type	125 kbps / ASK
Telegram type	RPS of type 2 (allows interpretation of operating two buttons simultaneously)
Digital inputs	4
Transmission range	up to 200 m free field, up to 30 m indoor

PTM 33X / 33XC

1.3 Physical Dimensions

PCB dimensions

26.2 x 21.15 x 3.5 mm



1.4 Environmental Conditions

Operating temperature	-25 °C ... +85 °C
Storage temperature	-40 °C ... +85 °C
Storage temperature in Tape&Reel	-20 °C ... +50 °C
Humidity	0% ... 93% r.h., non-condensing

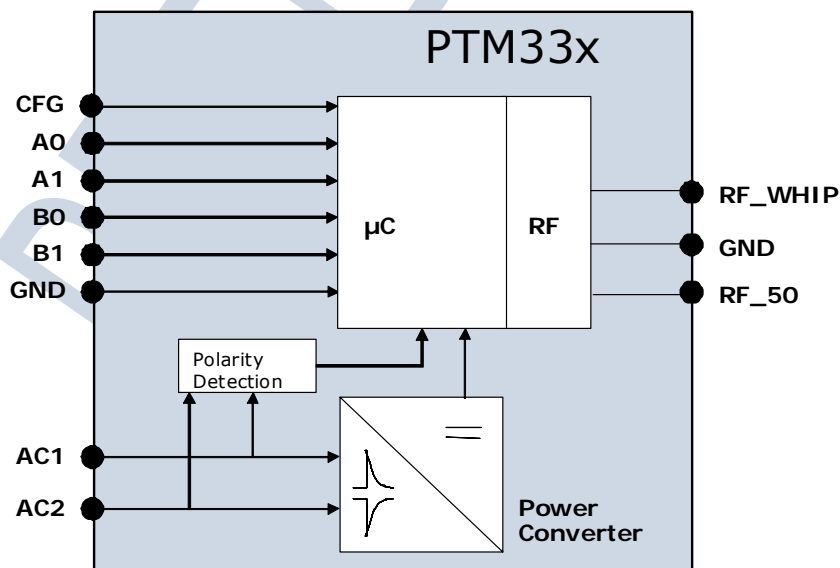
1.5 Ordering Information

Type	Ordering Code	Frequency	Note
PTM 330	S3001-A330	868.3 MHz	Whip antenna mounted Card board box
PTM 332	S3001-A332	868.3 MHz	No antenna mounted Tape & Reel
PTM 330C	S3031-A330	315.0 MHz	Whip antenna mounted Card board box
PTM 332C	S3031-A332	315.0 MHz	No antenna mounted Tape & Reel

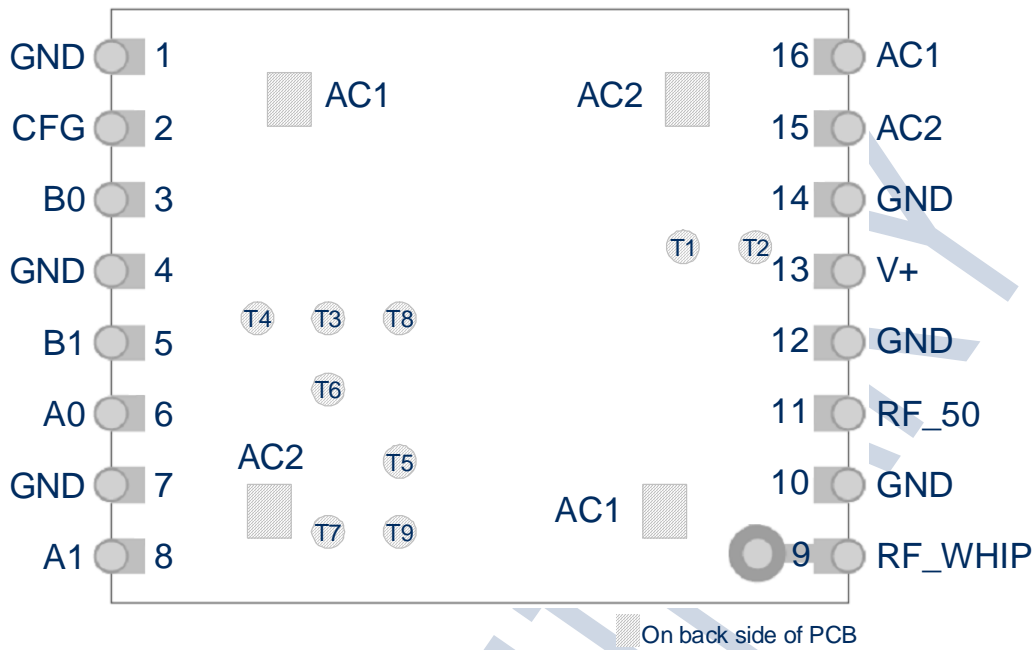
2 FUNCTIONAL DESCRIPTION

2.1 Block diagram

At power-up by an energy pulse at AC1, AC2 a DC voltage is provided to the internal micro controller. The microcontroller reads the polarity of the supply voltage pulse and the status of the digital inputs A0, A1, B0, B1. After that 3 identical radio telegrams calculated from the status of these inputs are transmitted.



2.2 Pin out

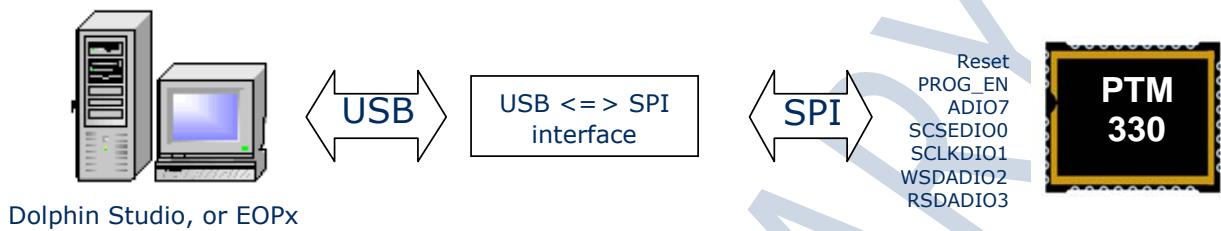


2.3 Pin Description and operational characteristics

Symbol	Function	Characteristics
GND	Ground connection	Must be connected to GND
V+	For test purposes only	Do not connect
B0	O-Button Rocker B	Digital input, leave open or connect to GND Internal pull-up
B1	I-Button Rocker B	Digital input, leave open or connect to GND Internal pull-up
A0	O-Button Rocker A	Digital input, leave open or connect to GND Internal pull-up
A1	I-Button Rocker A	Digital input, leave open or connect to GND Internal pull-up
CFG	Activate VOFF comparator when connected to GND	Must be connected to GND when used with equivalent energy pulse instead of ECO 200 Internal pull-up
AC1	Input for ECO 200	ECO 200 or equivalent energy pulse
AC2	Input for ECO 200	ECO 200 or equivalent energy pulse
RF_WHIP	RF output	Output for whip antenna
RF_50	RF output	50 Ohm output for external antenna
T1-9	Configuration Interface	See 2.4

2.4 Configuration Interface

Via the programming interface the telegram content can be modified. The interface is shown in the figure below:



EnOcean provides EOPx (EnOcean Programmer, a command line program) and Dolphin Studio (Windows application for chip configuration, programming, and testing) and the USB/SPI programmer device as part of the EDK 300 developer's kit.

Pin	Symbol	Function	Characteristics
T1	VDD	Supply voltage	Interface to programmer
T2	GND	Ground connection	Interface to programmer
T3	SCSEDIO0	SPI chip select	Interface to programmer
T4	SCLKDIO1	SPI serial clock	Interface to programmer
T5	WSDADIO2	SPI input	Interface to programmer
T6	RSDADIO3	SPI output	Interface to programmer
T7	RESET	Reset	Interface to programmer, internal pull down
T8	ADIO7	Sync output	
T9	PROG_EN	Enable programming mode	Interface to programmer HIGH: programming mode active LOW: operating mode Internal pull-down

2.5 Absolute maximum ratings (non operating)

Symbol	Parameter	Min	Max	Units
AC1 AC2	Supply voltage	0	6.4	V
GND	Ground connection	0	0	V
A0 A1 B0 B1	Voltage digital input pins	0	0	V

2.6 Maximum Ratings (operating)

Symbol	Parameter	Min	Max	Units
AC1 AC2	Supply voltage	0	6.0	V
GND	Ground connection	0	0	V
A0 A1 B0 B1	Voltage digital input pins	0	0	V

2.7 Radio telegram

2.7.1 Normal operation

In default configuration PTM 33x transmits the same telegrams as a PTM 200 radio switch:

- Telegram type RPS: There are two message types depending on how many buttons (A0, A1, B0, B1) have been pressed (connected to GND)
 - N-message: Only one or two buttons have been pressed.
 - U-message: No pushbutton was pressed when activating the energy generator, or more than two pushbuttons have been pressed.
- Unique factory programmed 32 bit ID
- DATA_BYTE2, DATA_BYTE1, DATA_BYTE0=0
- DATA_BYTE3 and STATUS as follows:

N-message:

DATA_BYTE3:

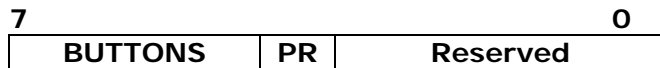
7						0
RID	UD	PR	SRID	SUD	SA	
RID	(2 bit)				Rocker ID, A=0, B=1	
UD	(1 bit)				UD=1 → O-button, UD=0 → I-button	
PO	(1 bit)				Polarity, see table below	
SRID	(2 bit)				Second Rocker ID	
SUD	(1 bit)				(Second) SUD=1 → O-button, SUD=0 → I-button	
SA	(1 bit)				SA=1 → Second action (2 buttons pressed simultaneously), SA=0 → No second action	

STATUS:

7				0
Reserved	T21	NU	RP_COUNTER	
Reserved	(2 bit)		For future use	
T21	(1 bit)		1	
NU	(1 bit)		NU=1 → N-message.	
RP_COUNTER	(4 bit)		Repeater level: 0 is original message (not repeated)	

U-message:

DATA_BYTE3:

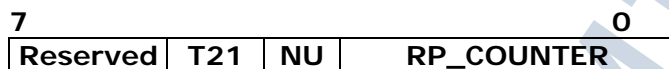


BUTTONS (3 bit) Number of simultaneously pressed buttons, as following:

- 0 = 0 Button
- 1 = not possible
- 2 = not possible
- 3 = 3 or 4 buttons
- 4 = not possible
- 5 = not possible
- 6 = not possible
- 7 = not possible

PO (1 bit) Polarity, see table below
Reserved (4 bit)

STATUS:



Reserved (2 bit) For future use
T21 (1 bit) 1
NU (1 bit) NU=0 → U-message.
RP_COUNTER (4 bit) Repeater level: 0 is original message (not repeated)

The polarity PO is defined as follows:

AC1	AC2	PO
-	+	1
+	-	0

2.7.2 User defined operation

Via the configuration interface it is possible to define different content of DATA_BYTE3 and define if a N-message or U-message shall be sent. This allows for example to transmit other ORG=5 telegrams, e.g. "Mechanical handle", as described in the EnOcean Equipment Profiles defined by EnOcean Alliance.

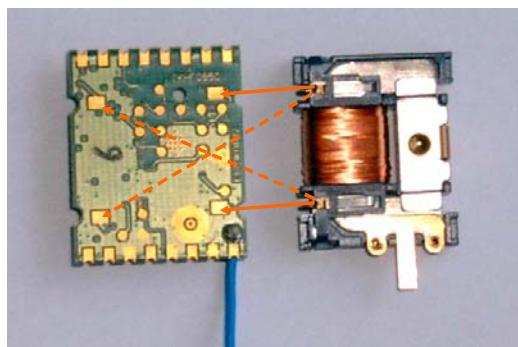
2.8 Transmit timing

The setup of the transmission timing allows avoiding possible collisions with data packages of other EnOcean transmitters as well as disturbances from the environment. With each transmission cycle, 3 identical subtelegrams are transmitted within 40 ms. The transmission of a subtelegram lasts approximately 0.7 ms. The delay between the three transmission bursts is affected at random.

3 APPLICATIONS INFORMATION

3.1 How to connect an energy harvester

PTM 330 can be connected to ECO 200 without soldering. ECO 200 provides contact springs which can directly be connected to contact pads of PTM 330. The contact pads on the bottom of the PCB are shown below (left). A second orientation where PTM 330 is rotated 180° with respect to ECO 200 is also possible as shown with dashed lines.



3.2 How to generate an equivalent energy pulse

3.3 Antenna

315 MHz

Option 1: 150 mm wire, connect to RF_WHIP

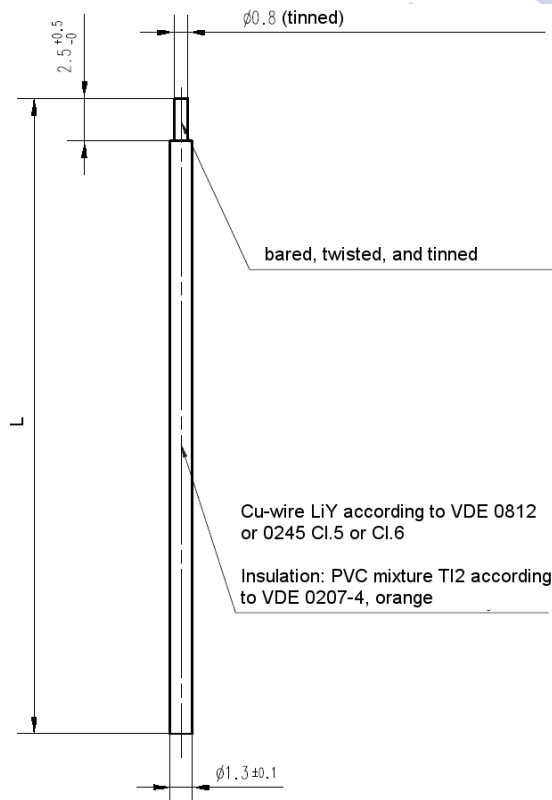
Option 2: A 50Ω antenna can be connected to RF_50.

In this case the limited modular FCC/IC approval is not valid!
An FCC/IC approval is then needed for the end device!

868 MHz

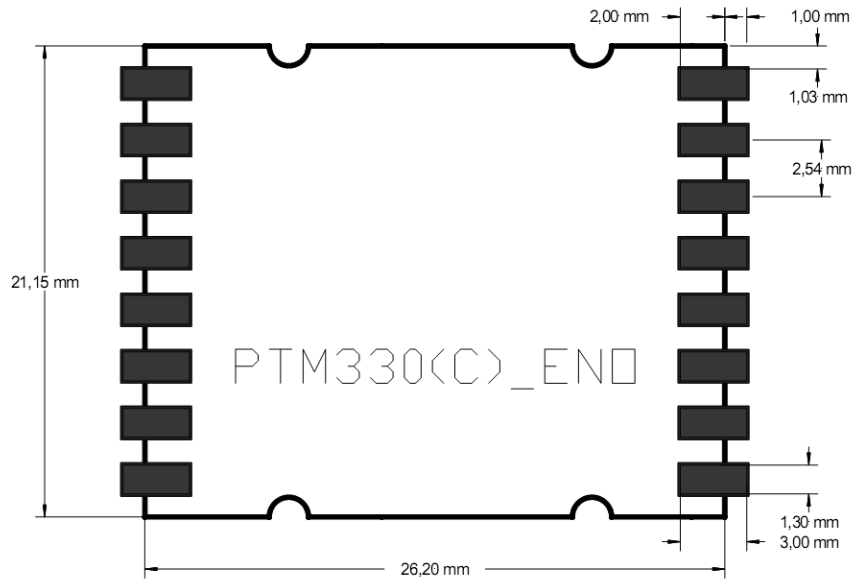
Option 1: 87 mm wire, connect to RF_WHIP

Option 2: A 50 Ω antenna can be connected to RF_50

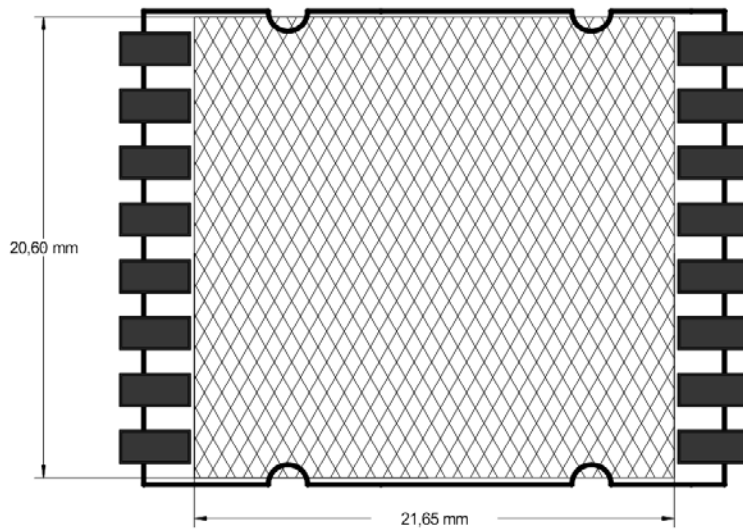


Specification of the whip antenna; L=150 mm @ 315 MHz, L=87 mm @ 868 MHz

3.4 Layout recommendations



Proposal for foot print on host PCB



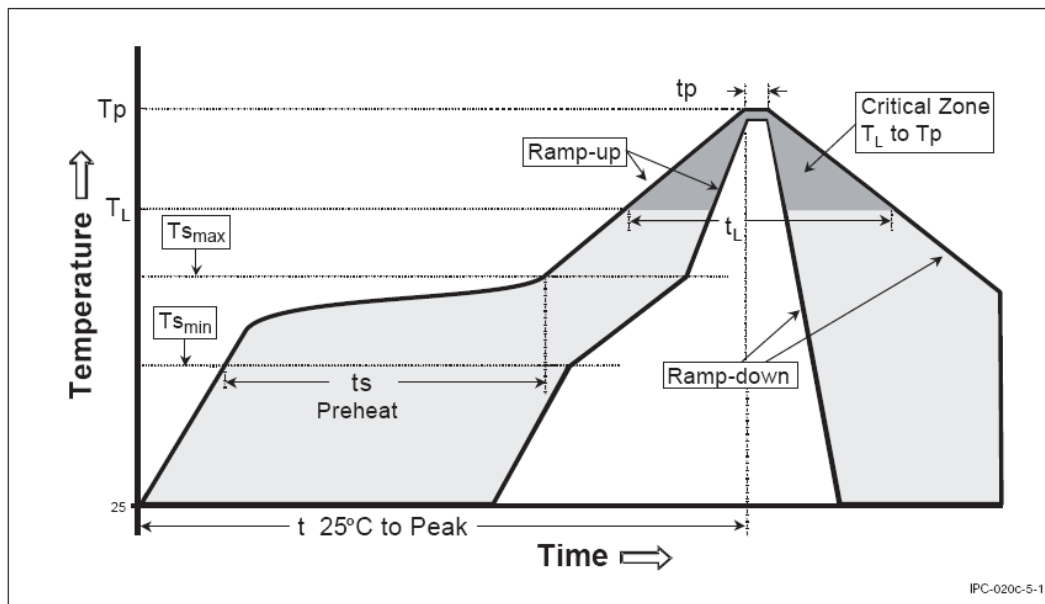
Keep out area on host PCB. No copper surface area allowed!

3.5 Soldering information PTM 332/332C

PTM 332 has to be soldered according to IPC/JEDEC J-STD-020C standard.

Profile Feature	Pb-Free Assembly
Average Ramp-Up Rate (TS _{max} to Tp)	3° C/second max.
Preheat	
– Temperature Min (TS _{min})	150 °C
– Temperature Max (TS _{max})	200 °C
– Time (ts _{min} to ts _{max})	60-180 seconds
Time maintained above:	
– Temperature (TL)	217 °C
– Time (tL)	60-150 seconds
Peak/Classification Temperature (Tp)	260 °C
Time within 5 °C of actual Peak Temperature (tp)	20-40 seconds
Ramp-Down Rate	6 °C/second max.
Time 25 °C to Peak Temperature	8 minutes max.

Note 1: All temperatures refer to topside of the package, measured on the package body surface.



PTM 332 shall be handled according to Moisture Sensitivity Level MSL4 which means a floor time of 72 h. PTM 332 may be soldered only once, since one time is already consumed at production of the module itself.

Once the dry pack bag is opened, the desired quantity of units should be removed and the bag resealed within two hours. If the bag is left open longer than 30 minutes the desiccant should be replaced with dry desiccant. If devices have exceeded the specified floor life time of 72 h, they may be baked according IPC/JEDEC J-STD-033B.

Devices packaged in moisture-proof packaging should be stored in ambient conditions not exceeding temperatures of 40 °C or humidity levels of 90% r.h..

PTM 332 modules have to be soldered within 6 months after delivery!

3.6 Transmission range

The main factors that influence the system transmission range are type and location of the antennas of the receiver and the transmitter, type of terrain and degree of obstruction of the link path, sources of interference affecting the receiver, and "Dead" spots caused by signal reflections from nearby conductive objects. Since the expected transmission range strongly depends on this system conditions, range tests should categorically be performed before notification of a particular range that will be attainable by a certain application.

The following figures for expected transmission range are considered by using a PTM, a STM or a TCM radio transmitter device and the TCM radio receiver device with preinstalled whip antenna and may be used as a rough guide only:

- Line-of-sight connections: Typically 30 m range in corridors, up to 100 m in halls
- Plasterboard walls / dry wood: Typically 30 m range, through max. 5 walls
- Line-of-sight connections: Typically 30 m range in corridors, up to 100 m in halls
- Ferroconcrete walls / ceilings: Typically 10 m range, through max. 1 ceiling
- Fire-safety walls, elevator shafts, staircases and supply areas should be considered as screening.

The angle at which the transmitted signal hits the wall is very important. The effective wall thickness – and with it the signal attenuation – varies according to this angle. Signals should be transmitted as directly as possible through the wall. Wall niches should be avoided. Other factors restricting transmission range:

- Switch mounted on metal surfaces (up to 30% loss of transmission range)
- Hollow lightweight walls filled with insulating wool on metal foil
- False ceilings with panels of metal or carbon fiber
- Lead glass or glass with metal coating, steel furniture

The distance between EnOcean receivers and other transmitting devices such as computers, audio and video equipment that also emit high-frequency signals should be at least 0.5 m

A summarized application note to determine the transmission range within buildings is available as download from www.enocean.com.

4 AGENCY CERTIFICATIONS (in preparation)

The modules have been tested to fulfil the approval requirements for CE (PTM 33x) and FCC/IC (PTM 33xC) based on the built-in firmware.

4.1 CE approval

The modules bear the EC conformity marking CE and conforms to the R&TTE EU-directive on radio equipment. The assembly conforms to the European and national requirements of electromagnetic compatibility. The conformity has been proven and the according documentation has been deposited at EnOcean. The modules can be operated without notification and free of charge in the area of the European Union, and in Switzerland. The following provisos apply:

- EnOcean RF modules must not be modified or used outside their specification limits.
- EnOcean RF modules may only be used to transfer digital or digitized data. Analog speech and/or music are not permitted.
- The final product incorporating EnOcean RF modules must itself meet the essential requirement of the R&TTE Directive and a CE marking must be affixed on the final product and on the sales packaging each. Operating instructions containing a Declaration of Conformity has to be attached.
- If the transmitter is used according to the regulations of the 868.3 MHz band, a so-called "Duty Cycle" of 1% per hour must not be exceeded. Permanent transmitters such as radio earphones are not allowed.
- The module must be used with only the following approved antenna(s).

Type	Parameter	Value
Wire/Monopole at RF_WHIP	Maximum gain	1.0 dBi
External antenna at RF_50	Antenna type	Passive
	Impedance	~50 Ohm
	Maximum gain	≤ 0 dBd

4.2 FCC (United States) Certification

PTM330C and PTM332C LIMITED MODULAR APPROVAL

This is an RF module approved for Limited Modular use operating as an intentional transmitting device with respect to 47 CFR 15.231(a-c) and is limited to OEM installation. The module is optimized to operate using small amounts of energy, and may be powered by a battery. The module transmits short radio packets comprised of control signals, (in some cases the control signal may be accompanied with data) such as those used with alarm systems, door openers, remote switches, and the like. The module does not support continuous streaming of voice, video, or any other forms of streaming data; it sends only short packets containing control signals and possibly data. The module is designed to comply with, has been tested according to 15.231(a-c), and has been found to comply with each requirement. Thus, a finished device containing the PTM330C/PTM332C radio module can be operated in the United States without additional Part 15 FCC approval (approval(s) for unintentional radiators may be required for the OEM's finished product), under EnOcean's FCC ID number. This greatly simplifies and shortens the design cycle and development costs for OEM integrators. The module can be triggered manually or automatically, which cases are described below.

Manual Activation

The radio module can be configured to transmit a short packetized control signal if triggered manually. The module can be triggered, by pressing a switch, for example. The packet contains one (or more) control signals that is(are) intended to control something at the receiving end. The packet may also contain data. Depending on how much energy is available from the energy source, subsequent manual triggers can initiate the transmission of additional control signals. This may be necessary if prior packet(s) was(were) lost to fading or interference. Subsequent triggers can also be initiated as a precaution if any doubt exists that the first packet didn't arrive at the receiver. Each packet that is transmitted, regardless of whether it was the first one or a subsequent one, will only be transmitted if enough energy is available from the energy source.

Automatic Activation

The radio module also can be configured to transmit a short packetized control signal if triggered automatically. Again, the packet contains a control signal that is intended to control something at the receiving end and may also contain data. As above, it is possible for the packet to get lost and never reach the receiver. However, if enough energy is available from the energy source, and the module has been configured to do so, then another packet or packets containing the control signal may be transmitted at a later time.

OEM Requirements

In order to use EnOcean's FCC ID number, the OEM must ensure that the following conditions are met:

- End users of products, which contain the module, must not have the ability to alter the firmware that governs the operation of the module. The agency grant is valid only when the module is incorporated into a final product by OEM integrators.
- The end-user must not be provided with instructions to remove, adjust or install the module.



PTM 33X / 33XC

- The Original Equipment Manufacturer (OEM) must ensure that FCC labeling requirements are met. This includes a clearly visible label on the outside of the final product. Attaching a label to a removable portion of the final product, such as a battery cover, is not permitted. The label must include the following text:

Contains FCC ID: SZV-PTM33XC

The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (i.) this device may not cause harmful interference and (ii.) this device must accept any interference received, including interference that may cause undesired operation.

The user manual for the end product must also contain the text given above.

- Changes or modifications not expressly approved by EnOcean could void the user's authority to operate the equipment.
- The module must be used with only the following approved antenna(s).

Part Number	Type	Gain
N.A.	Wire/Monopole	1.0 dBi

- The OEM must ensure that timing requirements according to 47 CFR 15.231(a-c) are met.
- The OEM must sign the OEM Limited Modular Approval Agreement with EnOcean

PRELIMINARY

4.3 IC (Industry Canada) Certification

In order to use EnOcean's IC number, the OEM must ensure that the following conditions are met:

- Labeling requirements for Industry Canada are similar to those required by the FCC. The Original Equipment Manufacturer (OEM) must ensure that IC labeling requirements are met. A clearly visible label on the outside of a non-removable part of the final product must include the following text:

Contains IC: 5713A-PTM33XC

- The OEM must sign the OEM Limited Modular Approval Agreement with EnOcean

PRELIMINARY