PRELIMINARY
USER MANUAL

Transmitter Module
PTM 430J

June 26, 2013

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,
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EnOcean GmbH
Kolpingring 18a
82041 Oberhaching
Germany

Phone +49.89.67 34 689-0
Fax +49.89.67 34 689-50
info@enocean.com
www.enocean.com

REVISION HISTORY

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

No	Major Changes
0.9	Initial release

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

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.

TABLE OF CONTENT

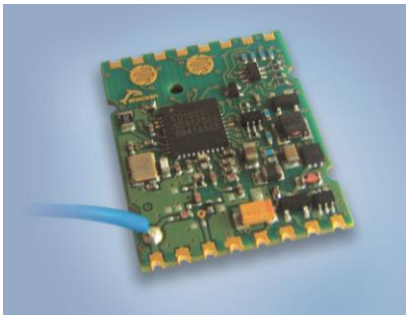
1 RELATED DOCUMENTS

In addition to this document additional information is available on our web site:

- Proposal for mechanical integration with ECO 200 in 2D and 3D format
- Footprint with positions of pads available in Protel and Gerber format
- AN102: Antenna Basics – Basic antenna design considerations for EnOcean based products

2 GENERAL DESCRIPTION

2.1 Basic Functionality



The radio transmitter module PTM 430J from EnOcean enables the implementation of wireless sensors and switches without batteries.

Key applications are handheld remote controls or industrial switches.

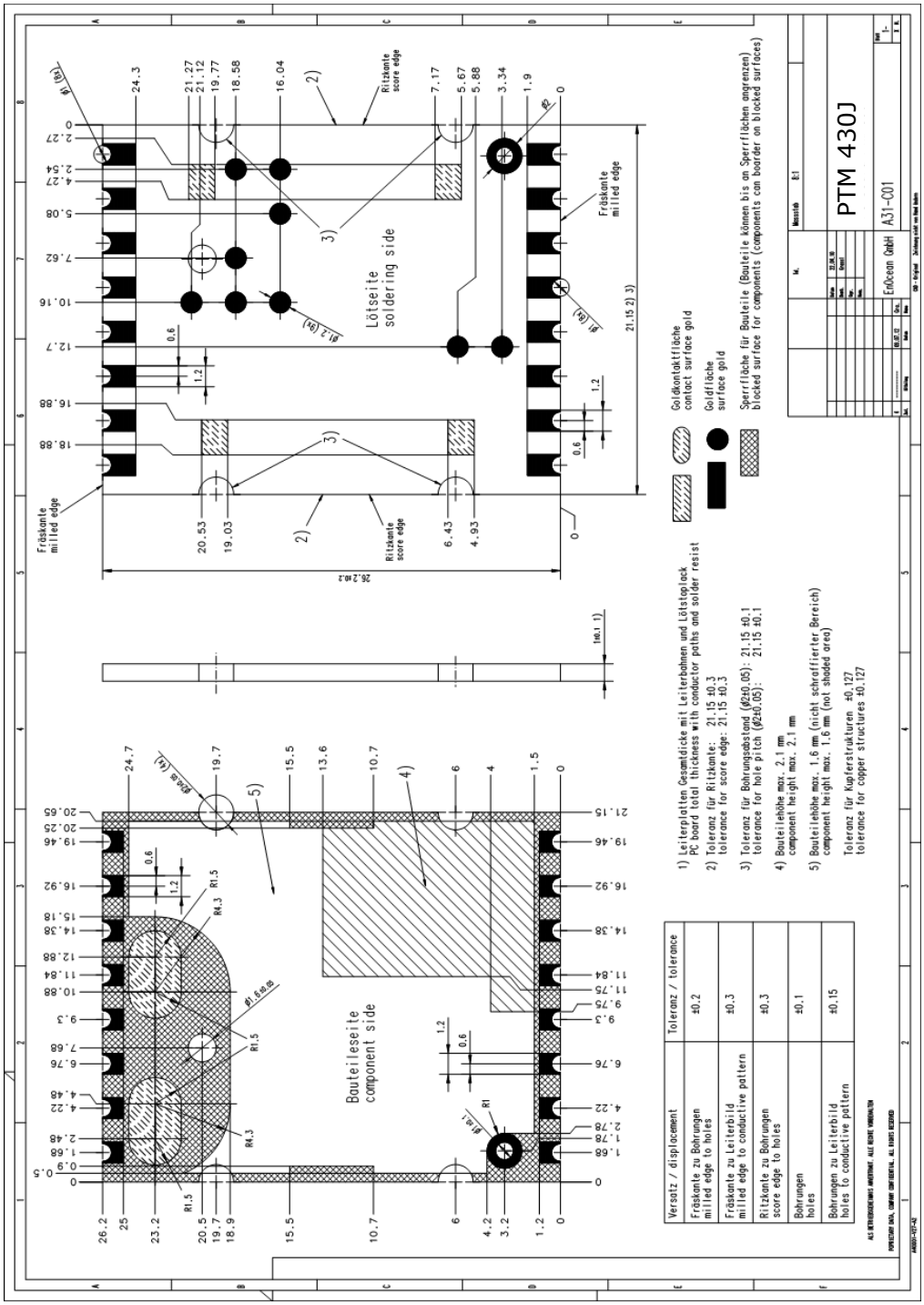
Functional Principle
When an energy pulse is supplied (e.g. by ECO 200 from EnOcean) an RF telegram is transmitted including a unique 32-bit module ID, the polarity of the energy pulse, and the operating status of 4 digital inputs. The RPS telegram (EnOcean Radio Protocol 2) can be configured if other content is needed.

PTM 430J 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 430J 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. THT soldering of whip antenna has to be considered.

2.2 Technical Data

Power supply	ECO 200 or equivalent energy pulse
Antenna	pre-installed whip antenna
Frequency	928.350 MHz
Transmission power	typ. 0 dBm at antenna base
Data rate / Modulation type	125 kbps /FSK
Telegram type	RPS type 2 (EnOcean Radio Protocol 2)
Digital inputs	4
Transmission range	up to 200 m free field, up to 20 m indoor
PCB dimensions	26.2 x 21.15 x 3.5 mm

2.3 Physical Dimensions



2.4 Environmental Conditions

Operating temperature	-25 °C … +65 °C
Storage temperature	-40 °C … +85 °C
Humidity	0% … 93% r.h., non-condensing

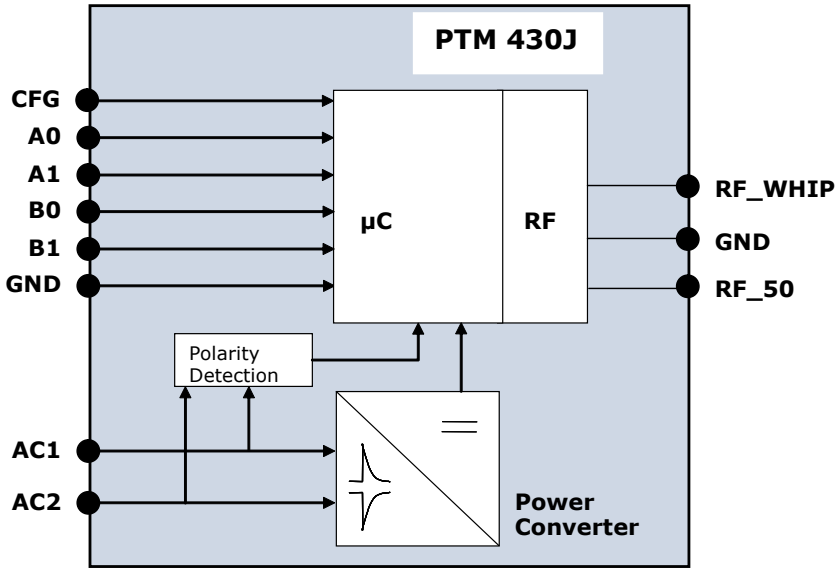
2.5 Ordering Information

Type	Ordering Code	Frequency	Note
PTM 430J	**S3061-A430**	**928.350 MHz**	**Whip antenna mounted, Trays in card board box**

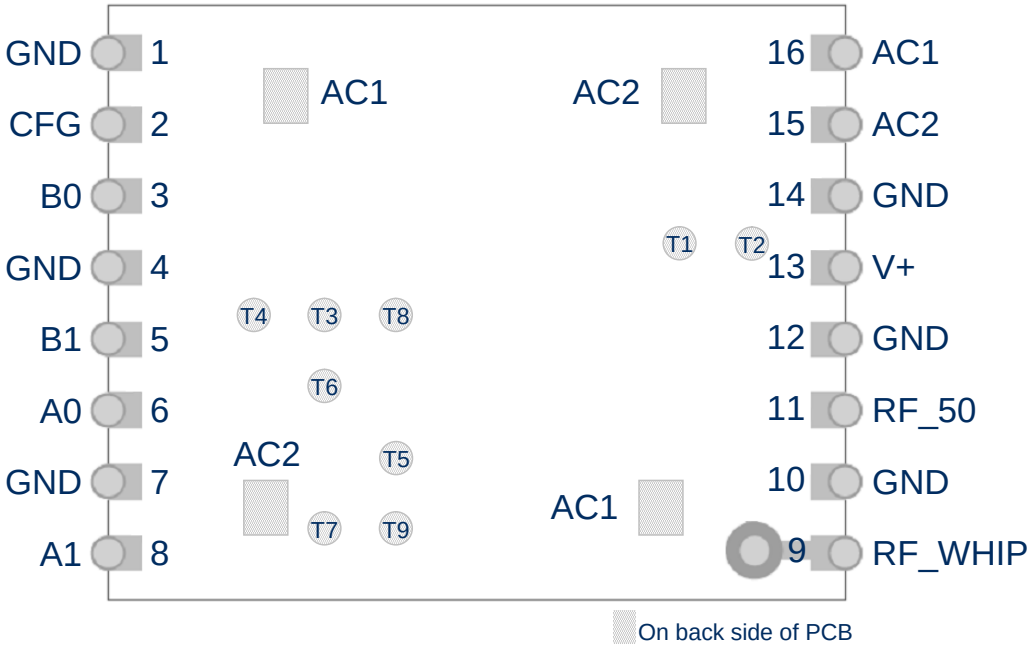
3 FUNCTIONAL DESCRIPTION

3.1 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.



3.2 Pin out



3.3 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	For test purposes only	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, not available for PTM 430J
T1-9	Configuration Interface	See 3.4

3.4 Configuration Interface

Via the SPI programming interface the telegram content can be modified:

1. PTM 430J needs to be connected by needle bed adapter with the SPI programming pins: Reset, PROG_EN, ADIO7, SCSEDIO0, SCLKDIO1, WSDADIO2 and RSDADIO3.

2. Use programmer board EOP 350 (part of EDK 350 / EDK 400J) as interface between needle bed adapter and PC.

3. DolphinModuleConfigurator as part of DolphinSuite can be used as graphical user interface to change PTM 430J parameters

Pad	Symbol	Function	Characteristics
T1	VDD	Supply voltage	Interface to programmer; Max. 3.3 V
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

3.5 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

3.6 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

3.7 Radio telegram

3.7.1 Normal operation

In default configuration PTM 430J transmits the same telegrams as a PTM 210J radio switch (EnOcean radio protocol 2):

R-ORG : F6
FUNC : 02
TYPE : 01, 02, 03

Reserved is required to be 0.

Telegram definitions:

Offset	Size	Bit-range	Data	Short-cut	Description	Valid Range	Scale	Unit
0	1	DB0.7	Energy bow	EBO	State of the energy bow.	Enumeration: 1: pressed 0: released		
1	1	DB0.6	Button cod-ing	EBO	Signalize but-ton coding..	Enumeration: 0: button		
2	2	DB0.5-DB0.4	Reserved					
0	1	DB0.3	BI	RBI	State I of the rocker B.	Enumeration: 1: pressed 0: not pressed		
0	1	DB0.2	B0	RB0	State 0 of the rocker B.	Enumeration: 1: pressed 0: not pressed		
0	1	DB0.1	AI	RAI	State I of the rocker A.	Enumeration: 1: pressed 0: not pressed		
0	1	DB0.0	A0	RA0	State 0 of the rocker A.	Enumeration: 1: pressed 0: not pressed		

R-ORG : F6
FUNC : 04
TYPE : 01

Reserved is required to be 0.

Telegram Definition:

Offset	Size	Bit-range	Data	Short-cut	Description	Valid Range	Scale	Unit
0	1	DB0.7	Energy bow	EBO	State of the energy bow.	Enumeration: 1: card inserted 0: taken out		
1	1	DB0.6	Button coding	EBO	Signalize button cod-ing..	Enumeration: 0: button		
2	3	DB0.5 - DB0.3	Reserved					
5	1	DB0.2	State of card	SOC	State of the card.	Enumeration: 1: card inserted 0: taken out		
6	2	DB0.1 - DB0.0	Reserved					

When card is inserted field EBO and SOC are both having value 1. When take out, both are having value 0. This coding is required to have a context-less translation of RPS profiles between ERP 1 and ERP 2.

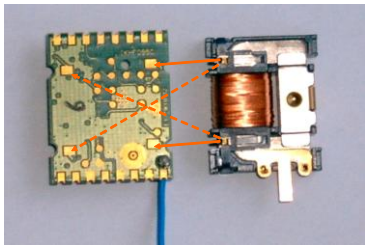
3.8 Transmit timing

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, 2 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.

4 APPLICATIONS INFORMATION

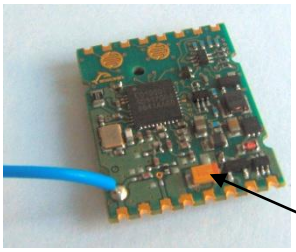
4.1 How to connect an energy harvester

PTM 430J can be connected to ECO 200 without soldering. ECO 200 provides contact springs which can directly be connected to contact pads of PTM 430J. The contact pads on the bottom of the PCB are shown below (left). A second orientation where PTM 430J is rotated 180° with respect to ECO 200 is also possible as shown with dashed lines.



4.2 How to generate an equivalent energy pulse

PTM 430J can also be operated from an external equivalent energy pulse. As the source impedance is not known a procedure is defined how to find the needed duration of the pulse. The pulse must provide a voltage between 5 V and 6 V for maximum 10 ms time.



storage capacitor

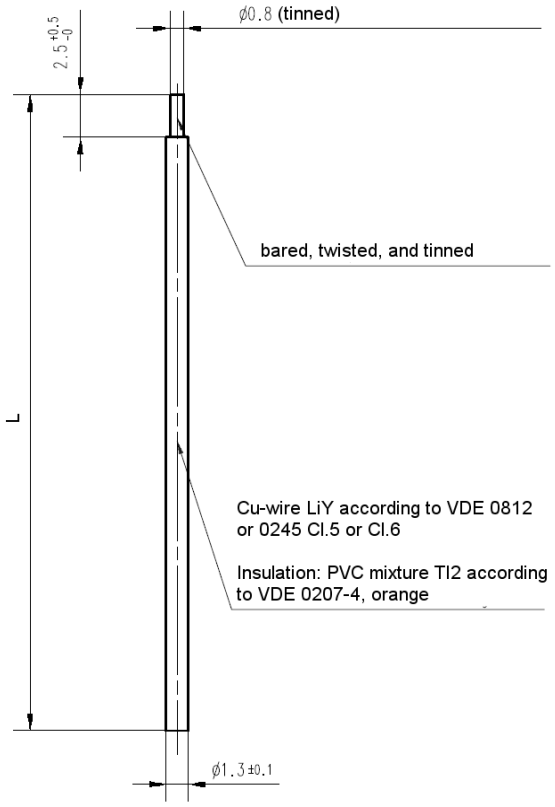
The length of this supply pulse needs to be defined by measuring the remaining voltage on the storage capacitor after the 2rd subtelegram, according to the following procedure:

1) Discharge the storage capacitor (see photo) completely
2) Apply a short pulse, voltage between 5 V to 6 V which charges the capacitor
3) Measure the voltage drop at the storage capacitor to ground (between pin 13 and pin 12) while the sub-telegrams are being transmitted with an oscilloscope
4) The remaining voltage shortly after the 2nd sub-telegram should be 2.5 to 3.0 V

4.3 Antenna

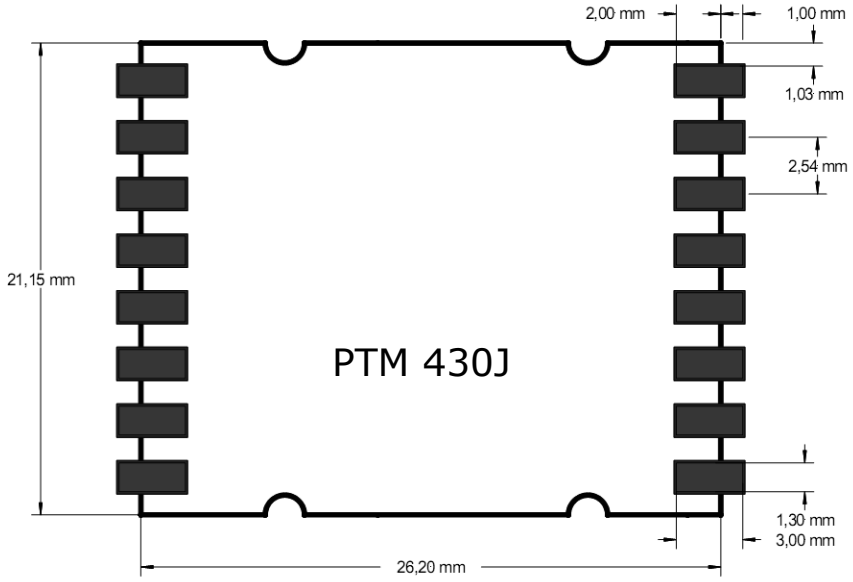
928.350 MHz

64 mm wire, connect to RF_WHIP

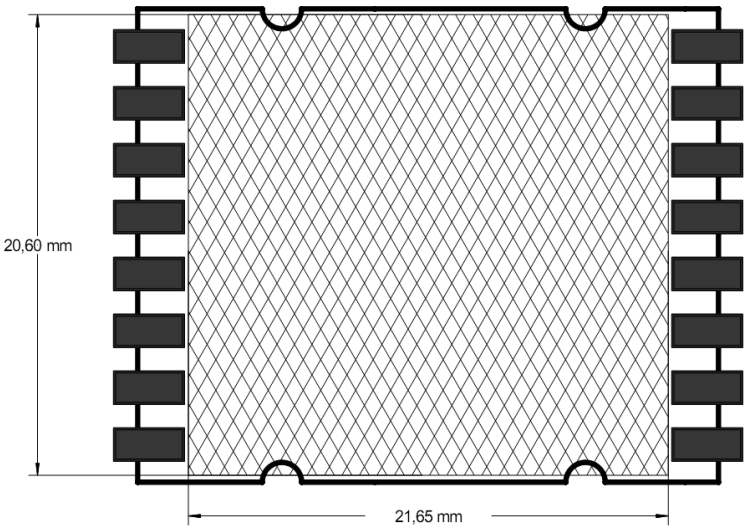


Specification of the whip antenna: L=64 mm @ 928.350 MHz

4.4 Layout recommendations



Proposal for foot print on host PCB



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

4.5 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 20 m range in corridors, up to 70 m in halls
- Plasterboard walls / dry wood: Typically 20 m range, through max. 4 walls
- Line-of-sight connections: Typically 20 m range in corridors, up to 70 m in halls
- Ferroconcrete walls / ceilings: Typically 7 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.

5 Radio Certification for the Japanese Market

PTM 430J has been prepared to be certified for the Japanese market according to ARIB STD-T108 V1.0 (2012-02). Customer needs to provide housing for the final approval.