EnOcean

PTM 215ZE - 2.4 GHz Zigbee Pushbutton Switch Transmitter Module

PTM 215ZE

2.4 GHz Zigbee® Pushbutton Switch Transmitter Module

14 March 2024

Observe precautions! Electrostatic sensitive devices!

Patent protected:
WO98/36395, DE 100 25 561, DE 101 50 128, WO 2004/051591, DE 103 01 678 AI, 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 this document:

Version	Author	Date	Major Changes
2.0	MKA	08 Mar 2022	Initial Release
2.1	MKA	11 Apr 2022	Added FCC and ISED grant
2.2	MKA	25 May 2023	Addition of NFC interface in revision DB
2.3	MKA	28 Jul 2023	Addition of ARIB grant
2.4	MKA	14 Dec 2023	Updated the order code
2.5	MKA	14 Mar 2024	Updated drawings with position indicator

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 indi-rectly, 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

PTM 215ZE - 2.4 GHz Zigbee Pushbutton Switch Transmitter Module

1 General description

1.1 Basic functionality

PTM 215ZE enables the realization of energy harvesting wireless switches for systems communicating based on the ON / OFF Switch model of the 2.4 GHz Zigbee® Green Power standard [1].

PTM 215ZE product revision DB integrates an NFC interface which can be used to configure device parameters. Product revision DA does not provide this functionality.

PTM 215ZE is mechanically compatible with the established PTM 21x form factor enabling quick integration into a wide range of designs. Key applications are wall-mounted or portable switches either with up to two rockers or up to four push buttons.

PTM 215ZE pushbutton transmitters are self-powered (no batteries) and fully maintenance-free. They can therefore be used in all environments including locations that are difficult to reach or within hermetically sealed housings. The required energy is generated by an electro-dynamic energy transducer actuated by an energy bow located on the left and right of the module. This energy bow which can be pushed from outside the module by an appropriate pushbutton or switch rocker.

When the energy bow is pushed down or released, electrical energy is created and a 2.4GHz radio telegram according to the Zigbee Green Power standard [1] is transmitted. This radio telegram transmits the operating status of all four contact nipples when the energy bow was pushed down or released. PTM 215ZE telegrams are protected with an AES-128 signature based on a device-unique private key.

Figure 1 below shows PTM 215ZE.

Figure 1 – PTM 215ZE Product Outline

1.2   Technical data

Antenna	Integrated antenna
Radio Transmission Power (typ)	+4 dBm
Communication Protocol	Zigbee Green Power (ON / OFF Switch Model)
Radio Band	2.4 GHz (2402 MHz … 2480 MHz)
Supported Radio Channels	Zigbee: Channel 11 … 26 (Default: Channel 11)
Radio Channel Selection	User-selectable (Commissioning)
Device Identification	Individual 32-bit Device ID (factory programmed)
Telegram Authentication	AES128 (CBC Mode) with Sequence Code
Power Supply	Integrated Kinetic Energy Harvester
Button Inputs	Up to four buttons or two rockers
Configuration Interface	NFC ISO 14443 (only in production revision DB)

1.3   Physical dimensions

Module Dimensions	40.0 x 40.0 x 11.2 mm
Module Weight	20 g

1.4   Environmental conditions

Operating Temperature	-25°C … 65°C
Storage Temperature	-25°C … 65°C
Humidity	0% to 95% r.h. (non-condensing)

⚠️ Operation at very low (below 0°C) or very high temperatures (above 40°C) might affect the mechanical behaviour of rocker switches due to mechanical expansion or contraction of the rockers. Correct operation at such temperatures should be verified as part of the mechanical design by customers.

1.5   Packaging information

Packaging Unit	100 units
Packaging Method	Tray / Box (10 units per tray, 10 trays per box)

1.6   Ordering information

Type	Ordering Code	Frequency
PTM 215ZE:DB	S3271-A215:DB	2.4 GHz Zigbee

2 Functional information

2.1 PTM 215ZE device overview

The pushbutton transmitter module PTM 215ZE from EnOcean enables the implementation of wireless remote controls without batteries. Power is provided by a built-in electro-dynamic power generator.

The outer appearance of PTM 215ZE is shown in Figure 2 below.

(1) Energy bow on both device sides

(2) Button contacts for switch rocker identification

Rotation axis for pushbuttons or switch rocker
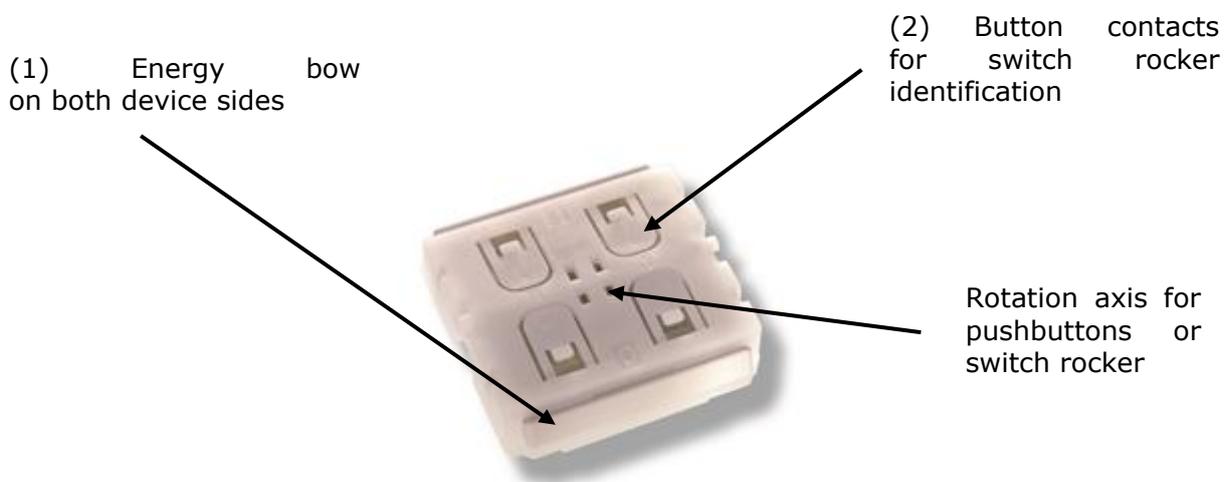
Figure 2 – Electro-dynamic powered pushbutton transmitter module PTM 215ZE

2.2 Basic functionality

PTM 215ZE devices contain an electro-dynamic energy transducer which is actuated by an energy bow (1). This bow is pushed by an appropriate push button, switch rocker or a similar construction mounted onto the device. An internal spring will release the energy bow as soon as it is not pushed down anymore.

When the energy bow is pushed down, electrical energy is created and a Zigbee Green Power radio telegram is transmitted which identifies the status (pressed or not pressed) of the four button contacts (2). Releasing the energy bow similarly generates energy which is used to transmit a different radio telegram.

It is therefore possible to distinguish between radio telegrams sent when the energy bar was pushed and radio telegrams sent when the energy bar was released.

By identifying these different telegram types and measuring the time between pushing and releasing of the energy bar, it is possible to distinguish between "Long" and "Short" button contact presses. This enables simple implementation of applications such as dimming control or blinds control including slat action.
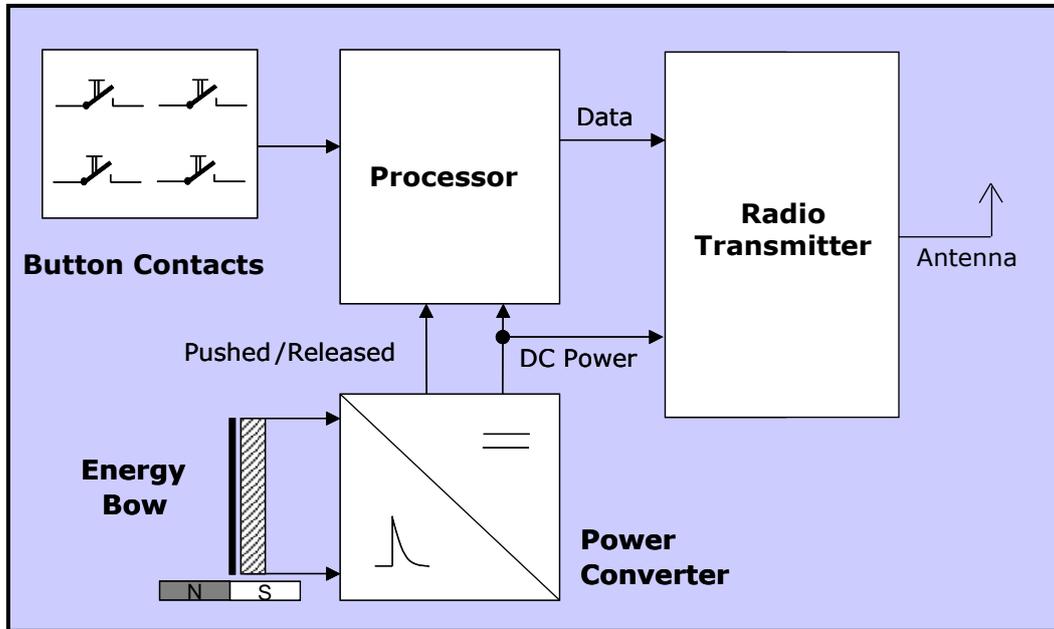
2.3   Block diagram

Figure 3 – Block diagram of PTM 215ZE

Energy Bow / Power Generator
Converts the motion of the energy bow into electrical energy

Power Converter
Converts the energy of the power generator into a stable DC supply voltage for the device electronics

Processor
Determines the status of the button contacts and the energy bow, encodes this status into a data word, generates the proper radio telegram structure and sends it to the radio transmitter

Radio transmitter
Transmits the data in the form of a series of short Zigbee Green Power radio telegrams using the integrated antenna

In addition, PTM 215ZE product revision DB provides an integrated NFC interface according to ISO 14443 that can be used to configure device parameters.

2.4 User interface

PTM 215ZE devices provide four button contacts. They are grouped into two channels (Channel A and Channel B) each containing two button contacts (State O and State I).

The state of all four button contacts (pressed or not pressed) is transmitted together with a unique device identification (32-bit Zigbee Green Power Device ID) whenever the energy bow is pushed or released.

Figure 4 below shows the arrangement of the four button contacts and their designation.
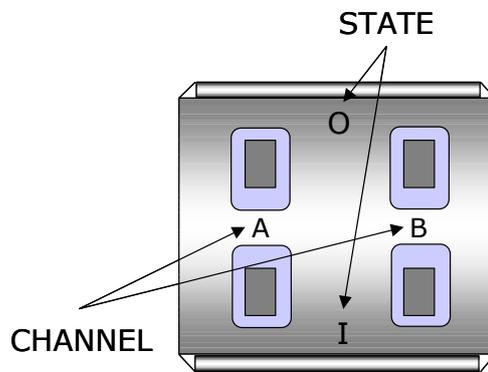
Figure 4 – Button contact designation

3   Radio communication

PTM 215ZE transmits radio telegrams according to the ON /OFF Switch model of the Zigbee Green Power standard [1]. Other models can be selected as described in chapter 3.3.1.

3.1   PTM 215ZE radio channel parameters

PTM 215ZE supports all sixteen IEEE 802.15.4 / Zigbee Green Power radio channels in the 2.4 GHz band (channels 11 … 26 according to IEEE 802.15.4 notation).

Table 1 below shows the correspondence between channel number and channel frequency (in MHz).

Channel ID	Lower Frequency	Centre Frequency	Upper Frequency
11	2404	2405	2406
12	2409	2410	2411
13	2414	2415	2416
14	2419	2420	2421
15	2424	2425	2426
16	2429	2430	2431
17	2434	2435	2436
18	2439	2440	2441
19	2444	2445	2446
20	2449	2450	2451
21	2454	2455	2456
22	2459	2460	2461
23	2464	2465	2466
24	2469	2470	2471
25	2474	2475	2476
26	2479	2480	2481

Table 1 - IEEE 802.15.4 Radio Channels and Frequencies (in MHz)

3.2 Telegram structure

PTM 215ZE transmits radio telegrams in the 2.4 GHz band as defined by the Zigbee Green Power standard [1] which uses an IEEE 802.15.4 frame structure [1].

⚠️ Note that the byte order used by Zigbee Green Power and IEEE 802.15.4 is little endian. This means that if there are multi-byte structures (such as 2-byte, 4-byte or 8-byte fields), then the least significant byte (LSB) is transmitted first.

The frame structure used by PTM 215ZE consists of the following main parts:

- **PHY Header**
  The PHY header indicates to the receiver the start of a transmission and provides information about the length of the transmission.
  It contains the following fields:

- **Preamble**
  Pre-defined sequence (4 byte, value 0x00000000) used to adjust the receiver to the transmission of the sender

- **Start of frame**
  Pre-defined symbol (1 byte, value 0xA7) identifying the start of the actual data frame

- **Length of frame**
  1 byte indicating the combined length of all following fields

- **MAC Header**
  The MAC header provides detailed information about the frame.
  It contains the following fields:

  - **Frame control field**
    2 bytes (always 0x0801) identifying frame type, protocol version, addressing and security mode

  - **Sequence number**
    1 byte sequential number identifying the order of transmitted frames

  - **Address**
    PAN ID and address of source (if present) and destination of the telegram
    PTM 215ZE does not use source address and source PAN ID

- **MAC Payload**
  The MAC payload is based on the Zigbee Green Power standard. It contains telegram control, device ID, telegram data and telegram security fields.

- **MAC Trailer**
  The MAC Trailer contains the Frame Check Sum (FCS) field used to verify the integrity of the telegram data.

PTM 215ZE - 2.4 GHz Zigbee Pushbutton Switch Transmitter Module

Figure 5 below summarizes the IEEE 802.15.4 frame structure.

802.15.4 PHY Header			802.15.4 MAC Header			802.15.4 Payload	802.15.4 MAC Trailer
Preamble	Start of Frame	Length of Frame	Frame Control	Sequence Number	DstAddress PAN | Addr	ZigBee Green Power Payload	Frame Check Sum (FCS)
4 Byte 0x00:00:00:00	1 Byte 0xA7	1 Byte 0x19 (DATA) 0x2E (COM) 0x18 (DECOM)	2 Byte 0x01 0x08	1 Byte	4 Byte 0xFFFF | 0xFFFF	16 Byte (DATA) 37 Byte (COM) 15 Byte (DECOM)	2 Byte

Figure 5 – IEEE 802.15.4 Frame Structure

The content of these fields is described in more detail below.

3.2.1 IEEE 802.15.4 PHY Header

The IEEE 802.15.4 PHY header consists of the following fields:

- Preamble

- Start of Frame

- Length of Frame fields

The content of the *Preamble* and *Start of Frame* fields is fixed for all telegram types supported by PTM 215ZE as follows:

- Preamble = 0x00000000

- Start of Frame = 0xA7

The content of the *Length of Frame* field differs depending on the telegram type as follows:

- Data telegram
  Length = 25 bytes (0x19)

- Commissioning telegram
  Length= 46 bytes (0x2E)

- Decommissioning telegram
  Length = 24 bytes (0x18)

3.2.2 IEEE 802.15.4 MAC Header

The IEEE 802.15.4 MAC Header contains the following fields:

- Frame Control Field (2 byte)
  The *Frame Control Field* is set to `0x0801` in all PTM 215ZE telegrams in order to identify them as data telegrams with short addresses based on version IEEE 802.15.4-2003

- Sequence Number (1 byte)
  The *Sequence Number* is an incremental number used to identify the order of telegrams

- Address Field (4 byte in PTM 215ZE implementation)
  The *Address Field* is set to `0xFFFFFFFF` to identify PTM 215ZE telegrams as broadcast telegrams using short Destination Address (16 Bit) together with the Destination PAN ID (16 Bit). Source address and Source PAN ID are not present in PTM 215ZE MAC Header.

3.2.3 IEEE 802.15.4 MAC Trailer

The MAC Trailer only contains the Frame Check Sum (FCS) field.

Its length is 2 byte and it is calculated as Cyclic Redundancy Check (CRC16) over the entire MAC payload including the *Length of Frame* field of the PHY Header using the following polynomial: $x^{16} + x^{12} + x^5 + 1$

EnOcean

PTM 215ZE - 2.4 GHz Zigbee Pushbutton Switch Transmitter Module

3.3   IEEE 802.15.4 payload (ZGP telegram data)

The 802.15.4 payload contains the Zigbee Green Power (ZGP) telegram data for the follow-ing telegram types:

- ZGP data telegram

- ZGP commissioning telegram

- ZGP decommissioning telegram

Each telegram type is described in more detail in the subsequent chapters.

3.3.1   Data telegram

Zigbee Green Power data telegrams are used by PTM 215ZE to transmit button events. The structure of the data telegram depends on the Zigbee Green Power device model as de-scribed in the next chapters.

3.3.1.1   Zigbee Green Power device models

PTM 215ZE supports a wide range of Zigbee Green Power device models allowing the use of PTM 215ZE in a wide variety of applications.

Table 2 below lists the Device Models supported by PTM 215ZE.

ZGP Device ID (Device Model)	ZGP Device Role	Model Type
0x00	ZGP Simple Generic 1-state Switch	Command-based
0x01	ZGP Simple Generic 2-state Switch	Command-based
0x02 (Default)	**ZGP ON/OFF Switch**	**Command-based**
0x03	ZGP Level Control Switch	Command-based
0x05	ZGP Advanced Generic 1-state Switch	Command-based
0x06	ZGP Advanced Generic 2-state Switch	Command-based
0x07	ZGP Generic 8-contact Switch	Generic
0x10	ZGP Color Dimmer Switch	Command-based

Table 2 – ZGP Device Models supported by PTM 215ZE

By default, PTM 215ZE uses the ON / OFF Button device model identified by Zigbee Green Power Device ID 0x02. It is possible to select a different (command-based or generic) device model via the NFC PC configuration tool as described in chapter 4.2.

PTM 215ZE - 2.4 GHz Zigbee Pushbutton Switch Transmitter Module

3.3.1.1 Command-based device models

Command-based device models transmit defined Zigbee Green Power commands such as "ON" or "OFF" instead of generic information such as "Button A1 was pressed" which is used by the Generic Switch model.

PTM 215ZE uses by default the command-based device model "ON / OFF Switch" identified by Device ID 0x02. PTM 215ZE can be configured via NFC to use one of the other command-based device models or the Generic Switch device model via the NFC PC configuration tool as described in chapter 4.2.

If a command-based device model is selected (which is the case by default), then the correspondence between button action and transmitted command is configurable via via the NFC PC configuration tool as described in chapter 4.2.

Figure 6 below shows the Zigbee Green Power payload structure for data telegrams using a command-bases model.

Zigbee Green Power Payload for Command-based Device Models (15 byte)					
Frame Control	Ext Control	Source Address	Sequence Counter	ZGP Command	Authentication Signature
1 byte	1 byte	4 byte	4 byte	1 byte	4 byte
0x8C	0x30	0x015x:xxxx	Variable	Variable	Variable

Figure 6 – Payload structure for data telegrams a command-based model

The default mapping between button action and transmitted command is shown in Table 3 below. Note that 0xFF means that no telegram will be sent for that specific button action.

B1	B0	A1	A0	Default Command
Not Pressed	Not Pressed	Not Pressed	Not Pressed	0x10
				0x11
Not Pressed	Not Pressed	Not Pressed	Pressed	0x22
				0x23
Not Pressed	Not Pressed	Pressed	Not Pressed	0x18
				0x19
Not Pressed	Not Pressed	Pressed	Pressed	0x64
				0x65
Not Pressed	Pressed	Not Pressed	Not Pressed	0x14
				0x15
Not Pressed	Pressed	Not Pressed	Pressed	0x62
				0x63
Not Pressed	Pressed	Pressed	Not Pressed	0x1C
				0x1D
Not Pressed	Pressed	Pressed	Pressed	0xFF (No Telegram)
				0xFF (No Telegram)
Pressed	Not Pressed	Not Pressed	Not Pressed	0x12
				0x13
Pressed	Not Pressed	Not Pressed	Pressed	0x1E
				0x1F
Pressed	Not Pressed	Pressed	Not Pressed	0x1A
				0x1B
Pressed	Not Pressed	Pressed	Pressed	0xFF (No Telegram)
				0xFF (No Telegram)
Pressed	Pressed	Not Pressed	Not Pressed	0x16
				0x17
Pressed	Pressed	Not Pressed	Pressed	0xFF (No Telegram)
				0xFF (No Telegram)
Pressed	Pressed	Pressed	Not Pressed	0xFF (No Telegram)
				0xFF (No Telegram)
Pressed	Pressed	Pressed	Pressed	0xFF (No Telegram)
				0xFF (No Telegram)

Table 3 – Default command table for command-based device models

3.3.1.2   Generic Switch device model

PTM 215ZE can be configured via NFC to use the Generic Switch model defined by the Zigbee Green Power standard [1] to encode the button status.

In this model, button press events are transmitted using Command ID 0x69 followed by 1 byte button status. Likewise, release events are transmitted using Command ID 0x6A followed by 1 byte button status.

Figure 7 below shows the Zigbee Green Power payload structure for data telegrams when using the Generic Switch model.

Zigbee Green Power Payload for Generic Switch Device Model (16 byte)						
Frame Control	Ext Control	Source Address	Sequence Counter	Command	Button Status	Authentication Signature
1 byte	1 byte	4 byte	4 byte	1 byte	1 byte	4 byte
0x8C	0x30	0x015x:xxxx	Variable	0x69 or 0x6A	Variable	Variable

Figure 7 – Payload structure for data telegrams using the Generic Switch model

The button(s) that were pushed are encoded in the 1-byte Button Status field using the structure shown in Figure 8 below.
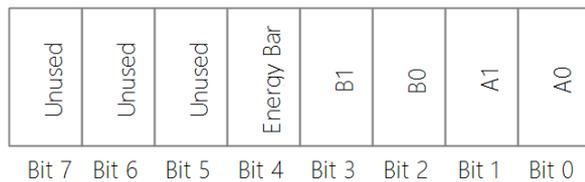
Figure 8 – Button status encoding for Generic Switch model

3.3.2 Commissioning telegram

Zigbee Green Power Commissioning telegrams are used to commission PTM 215ZE into Zigbee Green Power networks. Commissioning telegrams are identified by the Command ID 0xE0 and contain the required information about the properties of PTM 215ZE.

Commissioning telegrams contain the security key used by the device to authenticate its data telegrams. The security key is encrypted using either TCLK or IC as discussed in chapter 3.5.1. The correct decryption of the security key can be verified using the Security Key Hash field.

The format for some fields of the commissioning telegram depends on the device model as described in the next chapters.

3.3.2.1 Format for command-based models without Application Info

By default, PTM 215ZE does not transmit the Application Information fields to provide backwards-compatibility with previous revisions of PTM 215ZE. If Application Information is not present, then the Commissioning telegram contains the following fields:

- Device ID   0x00, 0x01, 0x02, 0x03, 0x05, 0x06 or 0x10

- Options   0x81 (Application Information not present)

- Extended Options   0xF2

- Security Key   16 byte device-unique security key (encrypted)

- Security Key Hash   4 byte hash of the encrypted security key

- Outgoing Security Counter   4 byte value of security counter

PTM 215ZE - 2.4 GHz Zigbee Pushbutton Switch Transmitter Module

3.3.2.2 Format for command-based models with Application Info

PTM 215ZE can be configured via NFC as described in chapter 4.2. to provide Application Information as part of the Commissioning Telegram to provide compatibility with newer implementations.

If this feature is enabled, then a variable length commissioning telegram payload is used where the length of the payload depends on the number of commands that are used.

The following fields are present in this case:

- Device ID   0x00, 0x01, 0x02, 0x03, 0x05, 0x06 or 0x10

- Options   0x85

- Extended Options   0xF2

- Security Key   16 byte device-unique security key (encrypted)

- Security Key Hash   4 byte hash of the encrypted security key

- Outgoing Security Counter   4 byte value of security counter

- Application Information   0x04 (Command List present)

- Application Information Size   Variable (Number of enabled commands)

- Command List   List of all enabled commands (1 … 32 byte)

3.3.2.3 Format for Generic Switch model

If the Generic Switch model is used, then the following are present to identify the properties of PTM 215ZE:

- Device ID   0x07 (Generic Button model)

- Options   0x85

- Extended Options: 0xF2

- Security Key   16 byte device-unique security key (encrypted)

- Security Key Hash   4 byte hash of the encrypted security key

- Outgoing Security Counter   4 byte value of security counter

- Application Information   0x10 (Generic Button Configuration present)

- Application Information Size   0x02 = 2 byte of Application Information follow

- Button Configuration   0x05 = 5 buttons (configurable via NFC)

- Current Button Contact   Button that was pressed (as defined in Figure 8)

The Button Configuration field encodes the number of supported buttons. By default, this is set to 5 representing the 4 buttons contacts and the energy bar (actuated without button press). This parameter can be changed via the NFC PC configuration tool as described in chapter 4.2.to match the actual product.

PTM 215ZE - 2.4 GHz Zigbee Pushbutton Switch Transmitter Module

3.3.3 Decommissioning telegram

Zigbee Green Power Decommissioning telegrams are used to inform the network of devices to which PTM 215ZE had been commissioned that PTM 215ZE will leave the network due to a change of radio channel.

Decommissioning telegrams are therefore sent each time PTM 215ZE changes radio channel during commissioning as described in chapter 3.5.

The structure of decommissioning telegrams used by PTM 215ZE is shown in Figure 9 below.

ZGP Payload: Decommissioning Telegram (15 Byte)					
Frame Control	Extended Frame Control	Source Address	Security Frame Counter	Command ID	Security Signature (MIC)
1 Byte 0x8C	1 Byte 0x30	4 Byte Device Address	4 Byte Current Value	1 Byte 0xE1	4 Byte MIC

Figure 9 – ZGP payload structure for decommissioning telegrams

3.4 Telegram authentication

PTM 215ZE implements telegram authentication for data telegrams and decommissioning telegrams to ensure that only telegrams from senders using a previously exchanged security key will be accepted.

3.4.1 Authentication implementation

Authentication relies on a 32-bit telegram signature which is calculated as shown in Figure 10 below using either SECURITY_KEY1 or SECURITY_KEY2 as security key and exchanged as part of the radio telegram. The security key can be selected via the NFC PC configuration tool as described in chapter 4.2; by default, SECURITY_KEY1 is used.
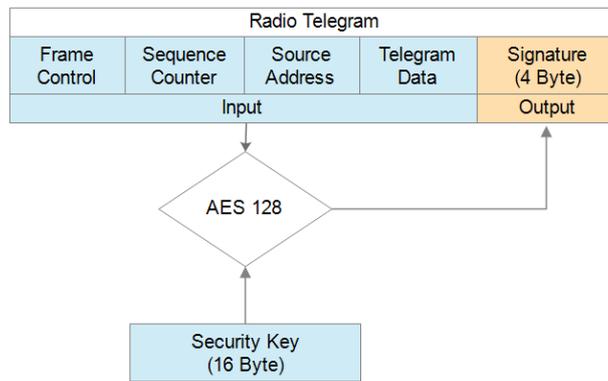
Figure 10 – Telegram authentication flow

Sequence counter, source address and the remaining telegram data together form the input data for the signature algorithm. This algorithm uses AES128 encryption based on the device-unique random security key to generate a 32-bit signature which will be transmitted as part of the radio telegram.

The signature is therefore dependent both on the current value of the sequence counter, the device source address and the telegram payload. Changing any of these three parameters will therefore result in a different signature.

The receiver performs the same signature calculation based on sequence counter, source address and the remaining telegram data of the received telegram using the security key it received from PTM 215ZE during commissioning.

The receiver then compares the signature reported as part of the telegram with the signature it has calculated. If these two signatures match, then sender (PTM 215ZE) and receiver use the same security key and the message content (address, sequence counter, data) has not been modified.

To avoid message replay (capture and retransmission of a valid message), it is required that the receiver tracks the value of the sequence counter used by PTM 215ZE and only accepts messages with higher sequence counter values (meaning that the receiver does not accept telegrams having an equal or lower sequence counter value as the last received telegram).

3.4.2   Algorithm parameters

PTM 215ZE implements telegram authentication according to the Zigbee Green Power standard [1]. It uses AES128 in CCM (Counter with CBC-MAC) mode as described in IETF RFC3610 [3].

The 13 Byte CCM Nonce (number used once – unique) initialization value is constructed as concatenation of 4-byte Device ID, 4-byte Device ID again, 4-byte Sequence Counter and 1 STATUS byte of value 0x05.

Note that both Device ID and Sequence Counter use little endian format (least significant byte first). Figure 11 below shows the structure of the AES128 Nonce.

AES128 Nonce (13 Byte)												
Device ID				Device ID				Sequence Counter				STATUS
Byte 0	Byte 1	Byte 2	Byte 3	Byte 0	Byte 1	Byte 2	Byte 3	Byte 0	Byte 1	Byte 2	Byte 3	0x05

Figure 11 – AES128 Nonce structure

The AES128 Nonce and the 128-bit device-unique security key are then used to calculate a 32-bit signature of the authenticated telegram payload for data and decommissioning telegrams.

The authenticated data for data telegrams is shown in Figure 12 below.

Authenticated Data For Data Telegrams (12 Byte)											
Frame Control		Source ID				Sequence Counter				Command	Optional Data
0x8C	0x30	Byte 0	Byte 1	Byte 2	Byte 3	Byte 0	Byte 1	Byte 2	Byte 3	0x69 / 0x6A	Button Status

Figure 12 – Authenticated payload for data telegrams

The authenticated data for decommissioning telegrams is shown in Figure 13 below.

Authenticated Data For Decommissioning Telegrams (11 Byte)										
Frame Control		Source ID				Sequence Counter				Command
0x8C	0x30	Byte 0	Byte 1	Byte 2	Byte 3	Byte 0	Byte 1	Byte 2	Byte 3	0xE1

Figure 13 – Authenticated payload for decommissioning telegrams

The calculated 32-bit signature is then appended to the data telegram payload as shown in chapter 3.3.

The security key required for the telegram authentication can be obtained from the product DMC code as shown in chapter 5.3.1. For Zigbee Green Power receivers, it is also provided as part of the Commissioning telegram as described in chapter 3.3.2.

PTM 215ZE - 2.4 GHz Zigbee Pushbutton Switch Transmitter Module

3.5 Security Keys

PTM 215ZE supports two different security keys for the authentication of data telegrams:

- SECURITY_KEY1
  This security key is readable via NFC and provided by the Installation QR code of the device label described in chapter 5.3.1.
  This security key is used by default.

- SECURITY_KEY2
  This security key is intended for application requiring a very high level of security.
  This key must be written by the user to NFC via the NFC PC configuration tool as described in chapter 4.2.
  Once written, this key is not readable via NFC and is not provided by the Installation QR code of the device label described in chapter 5.3.1.
  Use of SECURITY_KEY2 for the authentication of data telegrams can be selected via the NFC PC configuration tool as described in chapter 4.2.

To further increase security, it is possible to encrypt the transmission of the security key in the Commissioning telegram using the user-defined SECURITY_KEY3 as Installation Code (IC) as described below.

3.5.1 User-defined Installation Code (IC)

The Zigbee Green Power standard [1] defines mechanisms to protect the transmission of the security key in the Commissioning telegram. The following mechanisms are possible:

- Protection with Trust Center Link Key (TCLK)
  The transmission of the security key is protected by a shared key (TCLK).

- Protection with user-defined Installation Code (IC)
  The transmission of the security key is protected by a user-defined key (IC). This is an optional operation mode of PTM 215ZE that can be selected via the NFC PC configuration tool as described in chapter 4.2.

The default operation mode of PTM 215ZE is to use TCLK. If protection with an Installation Code (IC) is selected, then SECURITY_KEY3 will be used as Installation Code.

SECURITY_KEY3 is provided by the Installation QR code and is readable or writable via the NFC PC configuration tool as described in chapter 4.2.

3.6 Commissioning

Commissioning mode is used to commission (teach-in, learn in) PTM 215ZE into a specific (target) receiver or network. To do so, PTM 215ZE provides two key functions:

- Radio channel selection
  This allows to set the radio channel of PTM 215ZE such that it matches the radio channel used by the network

- Transmission of a commissioning telegram
  The commissioning telegram is used to learn-in PTM 215ZE into the network by communicating device type, device address and security parameters

3.6.1 Commissioning modes

PTM 215ZE supports the following commissioning modes:

- Direct commissioning by button press
  If the intended receiver or network operates on one of the primary radio channels (channel 11, 15, 20 or 25) and PTM 215ZE is integrated into a double rocker or four button switch, then PTM 215ZE can be commissioned directly using a simplified button sequence.
  This feature is disabled by default to provide backwards compatibility with previous PTM 215ZE implementations.

- Sequential commissioning by button press
  If the intended receiver or network does not operate on one of the primary radio channels (channel 11, 15, 20 or 25) or the radio channel is unknown or PTM 215ZE is integrated into a single rocker design then PTM 215ZE can sequentially request to be commissioned on each of the 16 radio channels one after the other until a response from the intended receiver or network is received.

- Commissioning via NFC
  The NFC interface can be used to quickly and easily commission PTM 215ZE.

Direct commissioning by button press and sequential commissioning by button press are described in more detail below. Commissioning via NFC is described in chapter 4.

3.6.2   Direct commissioning by button press

Direct commissioning is a simplified procedure by which PTM 215ZE may be commissioned onto one of the primary radio channels (channel 11, 15, 20 or 25). It is disabled by default and can be enabled via the NFC interface as discussed in chapter 3.6.2.4.

Direct commissioning consists of two steps:

- Commissioning request
  In this step, PTM 215ZE sends a commissioning telegram on the selected radio channel to the intended receiver or network

- Radio channel confirmation
  If the commissioning request was accepted by the intended receiver or network then the selected radio channel has to be confirmed so that it will be used for subsequent telegram transmissions.

3.6.2.1   Commissioning request

The commissioning request is triggered by long-pressing (for 7 seconds or more) one of the four buttons of PTM 215ZE. Upon detection of such long button press, PTM 215ZE will transmit a commissioning request on the corresponding radio channel.

The correspondence between PTM 215ZE button and the radio channel used for the transmission of the commissioning telegram is shown in Table 4 below.

Button	Radio Channel
A0	CH 15
B0	CH 11
AI	CH 20
BI	CH 25
Energy Bar	CH 11

Table 4 – Correspondence between button and direct commissioning channel

The commissioning request can be repeated (by repeatedly long-pressing the required button) until a confirmation from the intended receiver or network about acceptance of the commissioning request has been received. This confirmation could be for instance a notification on a user interface (for instance a connected smartphone) or an action by the receiver (for instance by blinking a light).

3.6.2.2 Radio channel confirmation

Once confirmation about successful commissioning has been received, the radio channel of the PTM 215ZE module that was used for transmission of the commissioning telegram has to be confirmed so that it will be used for subsequent transmissions of data telegrams as well.

To confirm the radio channel, buttons AI and B0 have to be pressed together as next action after the transmission of the commissioning telegram.

Note that this step requires that both AI and B0 buttons can be operated together. This is only mechanically possible if PTM 215ZE is integrated into a double rocker or a four-button switch design. Otherwise (for instance for the case of a single rocker switch design), PTM 215ZE would have to be removed from the housing design first.

Upon press of AI and B0, PTM 215ZE will permanently adjust the radio channel to the one selected by the long-pressed button as defined in Table 4 and send a data telegram on this channel.

If the new radio channel is different from the previously used radio channel, then PTM 215ZE will send a decommissioning command (0xE1) on the previously used radio channel upon release of AI and B0. If the radio channel remains unchanged, then PTM 215ZE will send a data telegram upon release of AI and B0.

3.6.2.3 Example of direct commissioning

Consider the case where PTM 215ZE should be commissioned into a network or receiver operating on radio channel 15.

To do so, follow these steps:

1. Long press (for more than 7 seconds) button A0

2. Verify that the receiver or network received and accepted the commissioning telegram. Otherwise step #1 can be repeated as needed.

3. Confirm the selected radio channel (channel 15 in this case) for subsequent use by pressing AI and B0 together.

3.6.2.4 Enabling direct commissioning

Direct commissioning is by default disabled to provide backwards compatibility with previous PTM 215ZE implementations. It can be enabled via the NFC PC configuration tool as described in chapter 4.2.

Direct commissioning will be disabled by means of a factory reset as described in chapter 3.7.

3.6.3 Sequential commissioning by button press

Sequential commissioning is intended for the case where the intended receiver or network does not operate on one of the primary radio channels or where direct commissioning is not practical due to the mechanical constraints of the switch design (for instance for single rocker switches).

Sequential commissioning allows selecting the radio channel either from the primary radio channels (channel 11, 15, 20 or 25) only or from all 16 radio channels (channel 11 … 26). The selection between these two options can be made via the NFC PC configuration tool as described in chapter 4.2. The default setting is that selection from all 16 radio channels is possible.

Sequential commissioning can be executed even on single rocker switches. It is however more complex than direct commissioning and therefore recommended mainly for cases where direct commissioning cannot be used.

3.6.3.1 Commissioning request

Commissioning requests are triggered using a special button contact sequence. This is illustrated in Figure 14 below for the case where selection from all channels is enabled.
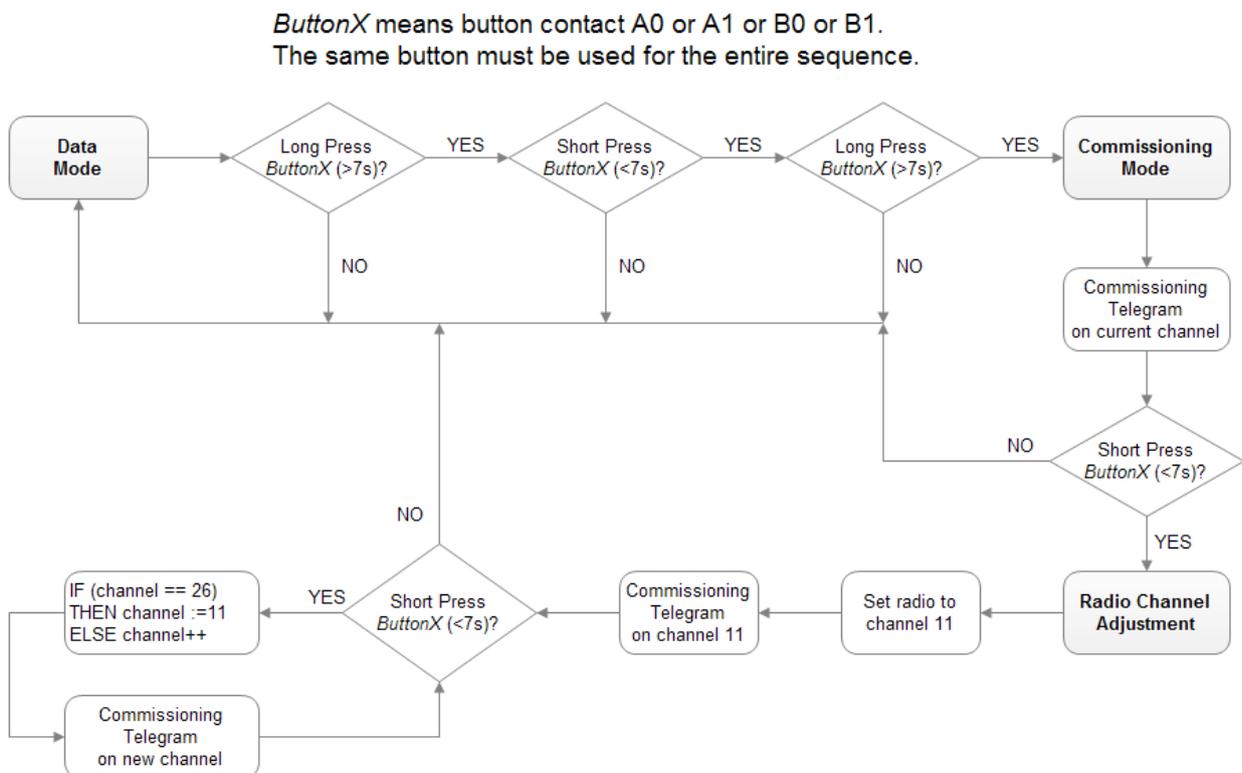
Figure 14 – Button sequence for sequential commissioning

To send a commissioning request, start by selecting one button contact of PTM 215ZE. Any contact of PTM 215ZE (A0, AI, B0, BI) can be used (therefore sequential commissioning will work even for single rocker designs). This contact is referred to as *ButtonX* in Figure 14 above.

Next, execute the following long-short-long sequence:

1. Long press the selected button contact together with the energy bar (e.g. by pressing one side of the selected rocker for more than 7 seconds)

2. Short press the selected button contact together with the energy bar (e.g. by pressing the same side of the selected rocker for less than 2 seconds)

3. Long press the selected button contact together with the energy bar (e.g. by pressing one side of the selected rocker for more than 7 seconds)

Upon detection of this sequence, PTM 215ZE will transmit a commissioning telegram on the currently selected radio channel.

The radio channel can be changed by pressing the selected button contact shortly (< 7s). PTM 215ZE will then sequentially (one cycle per button press) cycle through the supported radio channels starting with channel 11 and transmit a commissioning telegram every time a new channel is selected.

Sometimes the user might be unsure if PTM 215ZE if part of the entry sequence into commissioning mode has already been executed. For such cases, PTM 215ZE can always be set into a defined state (normal operation mode) by shortly (< 7s) pressing two different buttons one after another. After that, PTM 215ZE will operate in normal mode and the full sequence for commissioning (long-short-long) must be executed again.

3.6.3.2   Example of sequential commissioning

Consider the case where PTM 215ZE should be commissioned into a network or receiver operating on radio channel 17.

To do so, follow these steps:

1. Select a button of the switch and execute the long – short – long sequence. This will cause PTM 215ZE to transmit a commissioning telegram on its currently used radio channel

2. Press the same button shortly 7 times to select channel 17.
   PTM 215ZE will follow the channel sequence 11 -> 12 -> 13 -> 14 ->15 -> 16 -> 17

3. Confirm selection of radio channel 17 by pressing a button different from the one used during the previous two steps.

3.6.3.3 Disabling sequential commissioning

Sequential commissioning can be disabled by pressing B0 and BI together for more than 7 seconds. Note that for rocker switches this is only possible after removing the rocker and manually operating the button contacts and the energy bar.

Direct commissioning can be re-enabled by means of a factory reset as described in chapter 3.7 or via the NFC PC configuration tool as described in chapter 4.2.

3.6.4 Sequential versus direct commissioning

Sequential commissioning takes priority over direct commissioning if both variants are enabled.

This means that the long press at the end of the long – short – long sequence will cause transmission of a commissioning telegram on the currently used radio channel which might be different from the radio channel corresponding to this button in direct commissioning mode.

Consider the case where PTM 215ZE operates on channel 15 and the user executed a long – short - long sequence on button B0. In this case, upon the first long button press of the sequence, a commissioning telegram will be transmitted on channel 11 which corresponds to button B0 in direct commissioning mode (see Table 4).

Upon the second long button press of button B0 (which marks completion of the long – short – long sequence using button B0) however, PTM 215ZE will transmit a commissioning telegram on the current radio channel which is channel 15.

3.6.5 Disabling commissioning by button press

Sequential and direct commissioning (if enabled) can both be disabled at the same time by pressing buttons A0, AI and BI at the same time for at least 7 seconds (long press). In addition to that, sequential and direct commissioning can both be enabled or disabled via the NFC PC configuration tool as described in chapter 4.2.

If sequential or direct commissioning is disabled, then button input for sequential or direct commissioning will be ignored and a normal data telegram corresponding to the button input will be sent.

Sequential commissioning can be re-enabled by means of a factory reset as described in chapter 3.7.

3.6.6 Disabling channel change by button press

Change of the radio channel by means of direct or sequential commissioning can be disabled by pressing buttons AI, B0 and BI at the same time for at least 7 seconds (long press) or via via the NFC PC configuration tool as described in chapter 4.2.

After that, it is not possible anymore to change the radio channel by button press. Any commissioning action by button press (if enabled) will result in commissioning telegrams being transmitted at the currently selected radio channel.

Radio channel change by button press can be re-enabled by means of a factory reset as described in chapter 3.7 or via the NFC PC configuration tool as described in chapter 4.2.

3.7 Factory reset

PTM 215ZE can be reset to factory state by pressing buttons A0, AI, B0 and BI at the same time for at least 7 seconds (long press) or via the NFC PC configuration tool as described in chapter 4.2.

Executing a factory reset will reset all configuration registers to their default values. It will also reset the NFC PIN code to the default value (as provided by the Installation QR code, see chapter 5.3.1).

PTM 215ZE will send a decommissioning telegram (command 0xE1) on the currently used radio channel. After that, PTM 215ZE will transmit data telegrams on channel 11, sequential commissioning by button press will be enabled and direct commissioning by button press will be disabled.

PTM 215ZE - 2.4 GHz Zigbee Pushbutton Switch Transmitter Module

4 NFC interface

PTM 215ZE implements NFC Forum Type 2 Tag functionality as specified in the ISO/IEC 14443 Part 2 and 3 standards. For a detailed description about the NFC functionality, please refer to the ISO/IEC 14443 standard.

The NFC functionality in PTM 215ZE can be used to access (read and write) the PTM 215ZE configuration memory and thereby configure the device as described in the following chapters.

4.1 NFC access protection

Configuration of PTM 215ZE via the NFC interface is only after unlocking the configuration memory with the correct 32-bit NFC PIN code.

Each PTM 215ZE device has an own default NFC PIN code which is randomly generated as part of the manufacturing process. The NFC PIN code is provided by the Installation QR code of the device label as described in chapter 5.3.1. The default NFC PIN code can be changed to a user-defined value as part of the installation process.

It is possible to reset the PIN code to its factory-defined value (provided by the Installation QR code) by executing a factory reset. Note that any changes made in the device configuration will be lost after such factory reset.

Configuring the device via the NFC interface always requires providing the NFC PIN code. Make sure that you note down the NFC PIN code as part of the installation process because it is not possible to configure the device unless you know the NFC PIN code.

For security reasons, it is not possible to reset the NFC PIN code to a specific value other than the random, factory-default value. This value is only provided by the Installation QR code and no record is maintained about it.

PTM 215ZE - 2.4 GHz Zigbee Pushbutton Switch Transmitter Module

4.2 Using the NFC interface

Using the NFC interface requires the following:

- NFC reader (either PC USB accessory or suitable smartphone / tablet)

- NFC SW with read, write, PIN lock, PIN unlock and PIN change functionality

NFC communication distance is for security reasons set to require close contact between reader and PTM 215ZE.

4.2.1 PC-based configuration

For PC-based configuration, EnOcean recommends TWN4 (order code T4BT-FB2BEL2-SIMPL) from Elatec RFID Systems (https://www.elatec-rfid.com/en/) as USB NFC reader.
This reader is shown in Figure 15 below.

Figure 15 – Elatec TWN4 MultiTech Desktop NFC Reader

EnOcean provides a PC application called EnOcean NFC configurator which can be used to configure PTM 215ZE devices. This tool is available here:
 https://www.enocean.com/en/product/enocean-nfc-configurator/

4.2.2 Mobile app configuration

NFC functionality is available in certain Android (e.g. Samsung Galaxy S7 or newer) and iOS (iPhone7 or newer, firmware version 13 or newer) smartphones.

EnOcean provides the configuration app "EnOcean Tool" for these devices which can be downloaded directly from the respective app store.

At the time of writing, the tool was available from the Google Play Store using this link:
 https://play.google.com/store/apps/details?id=de.enocean.easytool&hl=en

Likewise, the tool was available from the Apple Store using this link:
 https://apps.apple.com/de/app/enocean-tool/id1497283202

5 Device integration

PTM 215ZE is designed for integration into button or rocker-based switches. It implements the established PTM 2xx mechanical form factor and can therefore be used with a wide variety of existing designs.

5.1 Mechanical interface characteristics

Energy bow travel / operating force	1.8 mm / typ. 10 N At room temperature Only one of the two energy bows may be actuated at the same time!
Restoring force at energy bow	typ. 0.7 N Minimum restoring force of 0.5 N is required for correct operation
Number of operations at 25°C	typ. 100.000 actuations tested according to VDE 0632 / EN 60669
Cover material	Hostaform (POM)
Energy bow material	PBT (50% GV)

5.2 Mechanical interface drawings
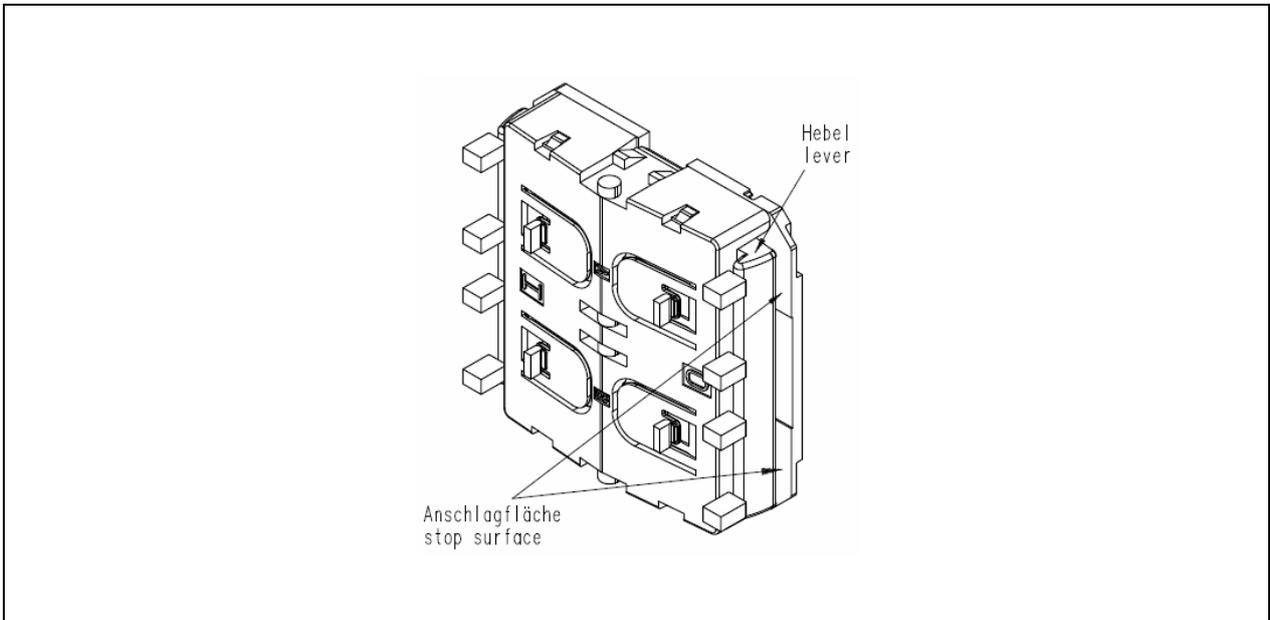
Figure 16 – PTM 215ZE, tilted view (including rocker catwalks)
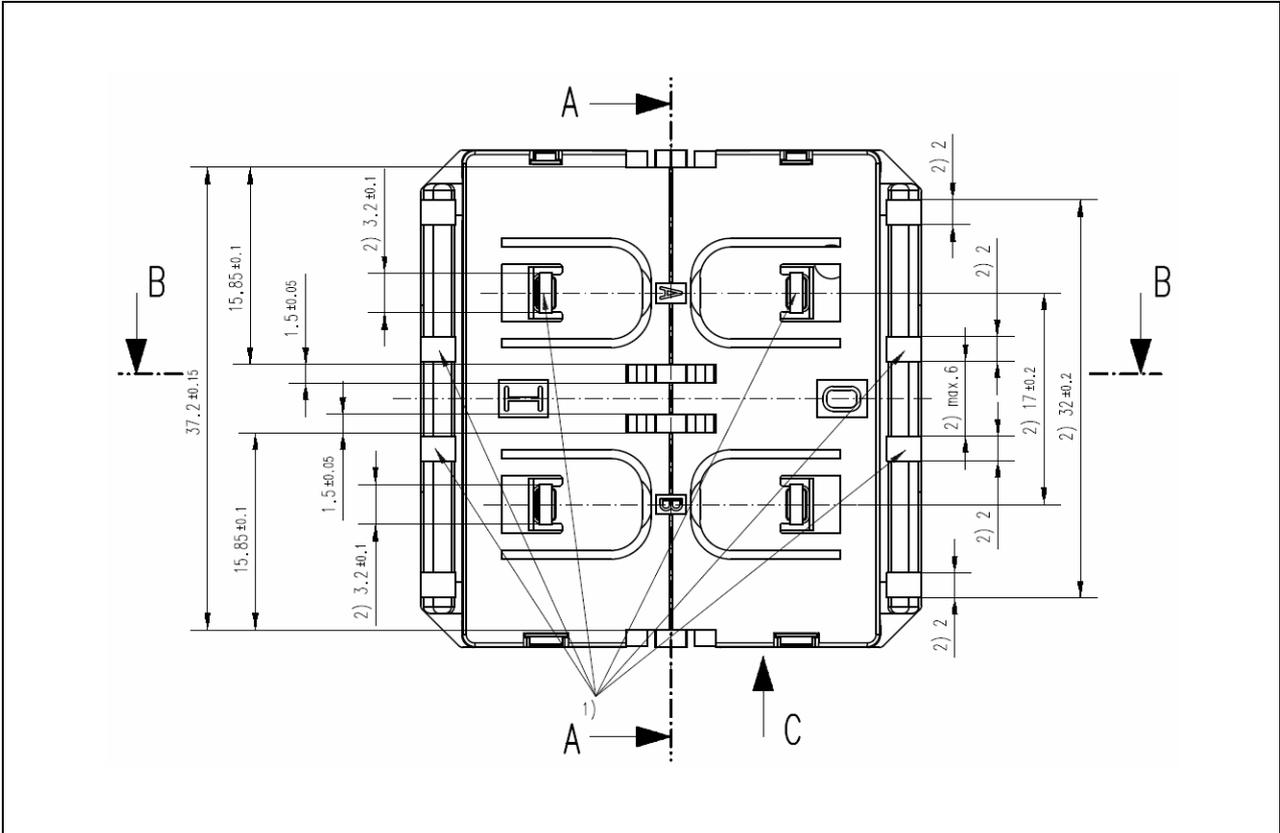
1) these catwalks are not needed when using one single rocker only   2) dimensions of rocker part

Figure 17 – PTM 215ZE, top view (note cut A, B and C marking)

PTM 215ZE - 2.4 GHz Zigbee Pushbutton Switch Transmitter Module
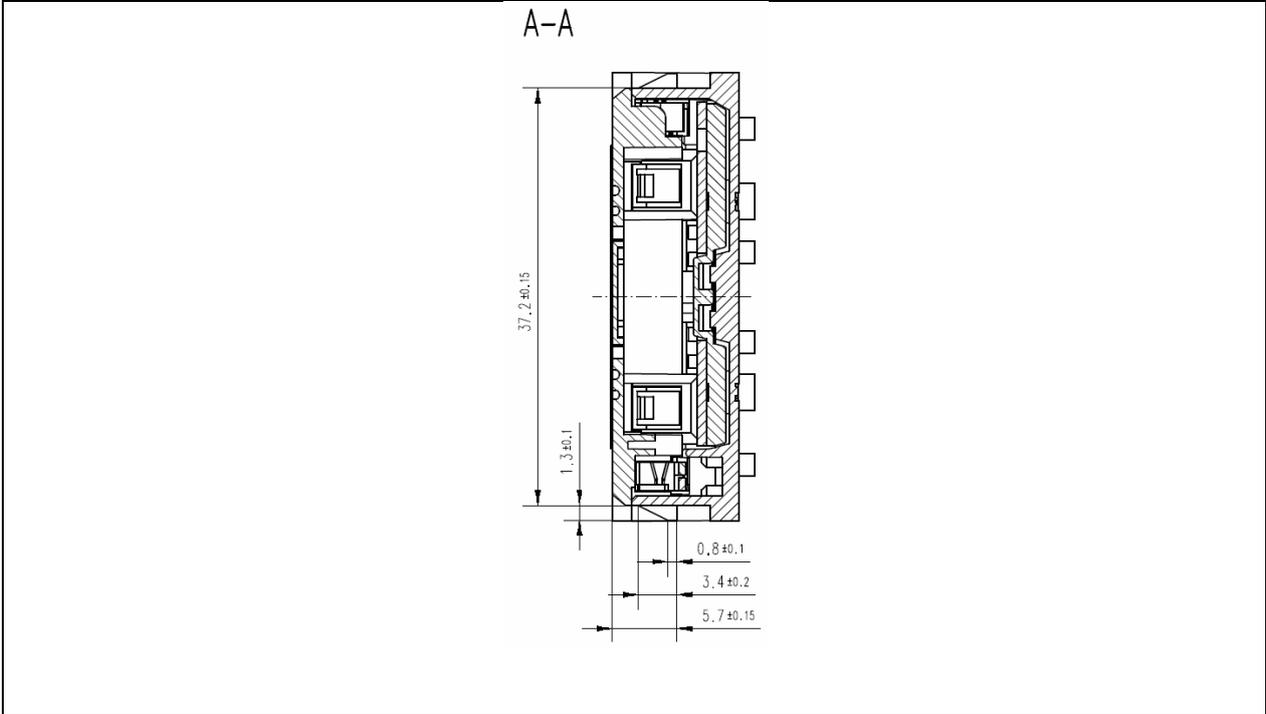
Figure 18 – PTM 215ZE, cut A
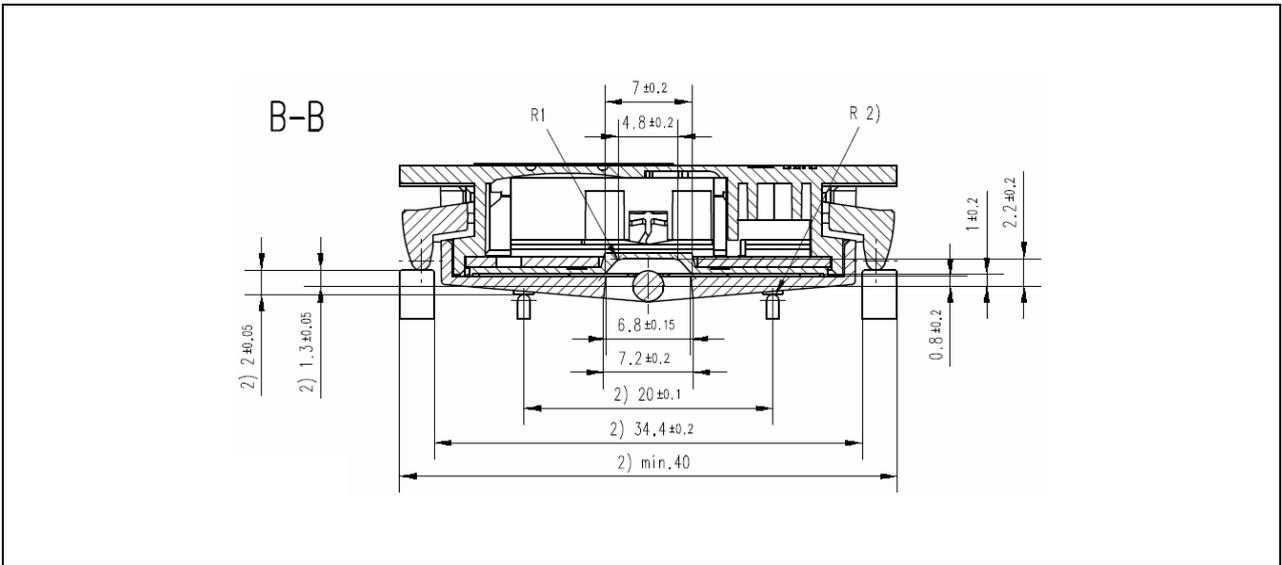
2) dimensions of rocker part

Figure 19 – PTM 215ZE, cut B and C

PTM 215ZE - 2.4 GHz Zigbee Pushbutton Switch Transmitter Module

Hatched areas: Support planes

(*) Position indicator: Identifies the A0 position on the PTM 215ZE module
Present on PTM 215ZE devices manufactured after week 07, 2024
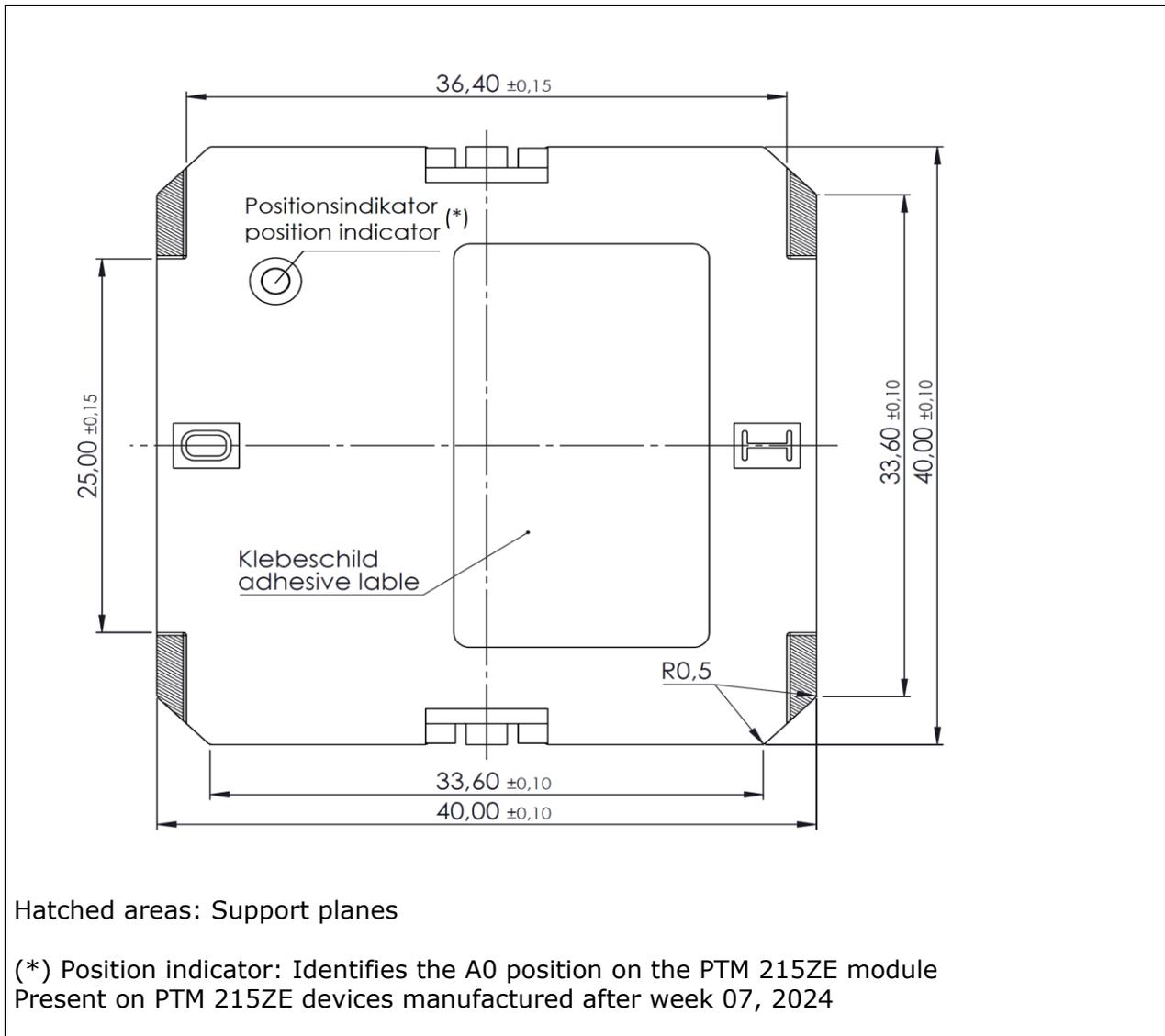
Figure 20 – PTM 215ZE rear view
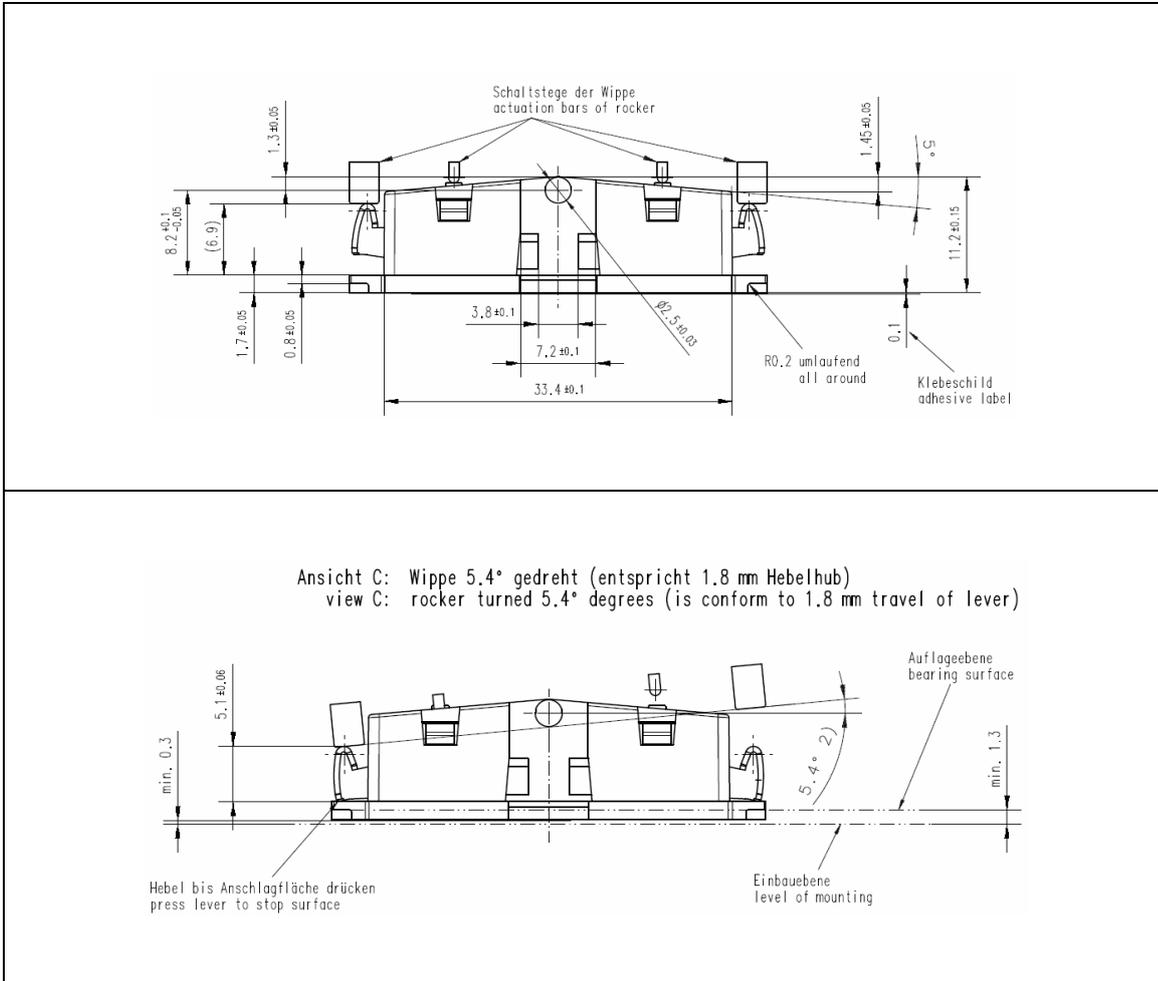
2) dimensions of rocker part

Figure 21 – PTM 215ZE, side view

⚠️ If the rocker is not mounted on the rotation axis of PTM 215ZE several tolerances have to be considered! The measure from support plane to top of the energy bow is 7.70 mm +/- 0.3 mm!

⚠️ The movement of the energy bow must not be limited by mounted rockers!

⚠️ Catwalks of the switch rocker must not exert continuous forces on the button contacts!

PTM 215ZE - 2.4 GHz Zigbee Pushbutton Switch Transmitter Module

⚠️ It is required to use non-conductive material (no metal or plastic with metal or graphite elements) for the rockers, the frame and the base plate to ensure best transmission range.

⚠️ PTM 215ZE is powered by the electromagnetic generator ECO 200 / ECO 260. For proper function of this generator, there must be a keep out zone of 60mm for magnets or ferromagnetic materials around the center of PTM 215ZE.

EnOcean
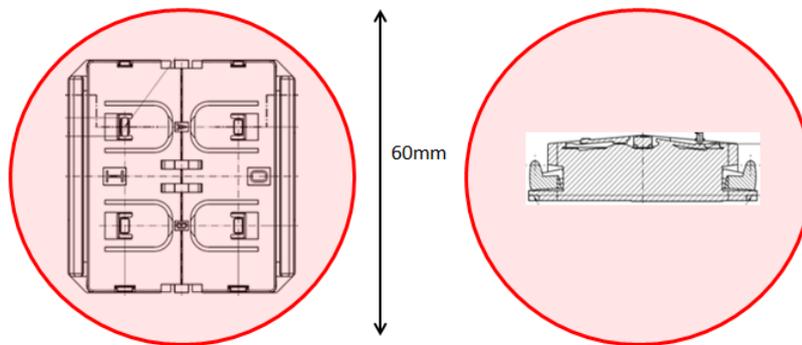
PTM 215ZE - 2.4 GHz Zigbee Pushbutton Switch Transmitter Module

---

5.3 Device label

Each PTM 215ZE module contains a device label as shown in Figure 22 below.
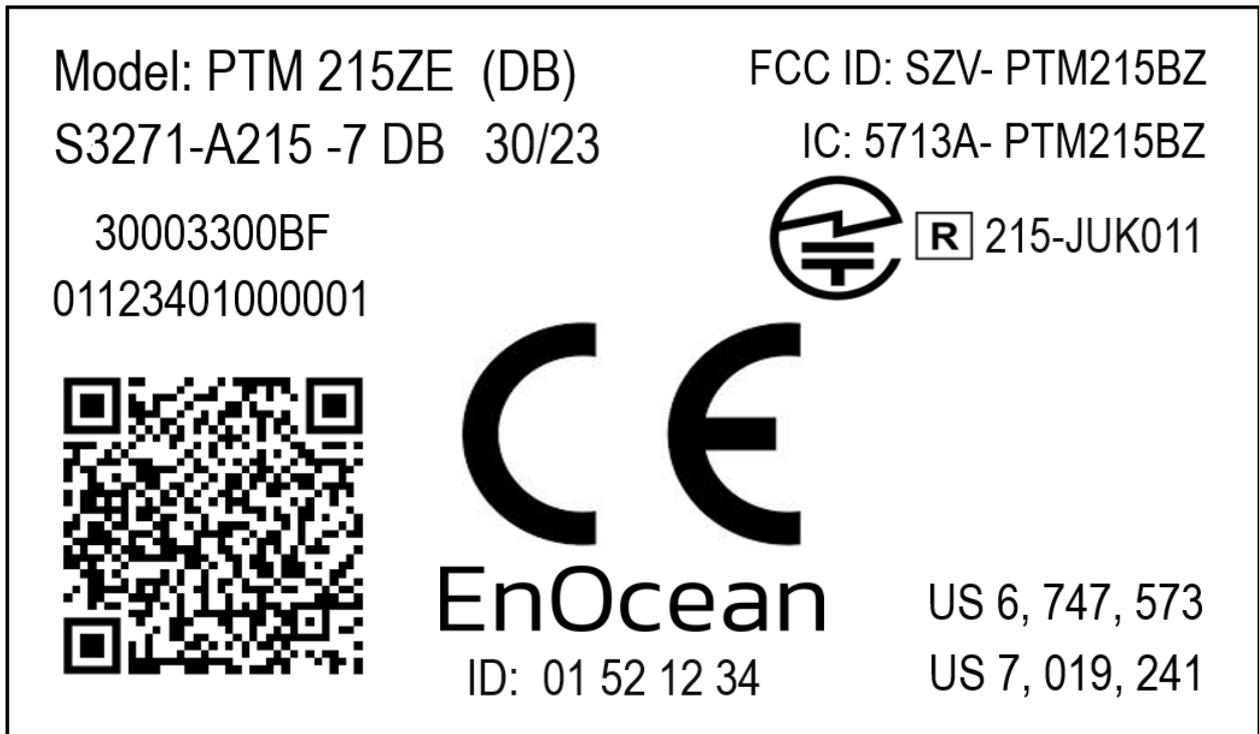
Figure 22 – PTM 215ZE device label

This device label identifies the following parameters in writing:

- Model name (PTM 215ZE)

- Order number (S3271-A215) and product revision (here DB-07)

- Manufacturing date (here week 30, 2023)

- Zigbee Green Power Device ID (here 01 52 12 34)

In addition, it contains an installation QR code providing information about this module in an electronically readable format. The structure of this installation QR code is described in the next chapter.

EnOcean

PTM 215ZE - 2.4 GHz Zigbee Pushbutton Switch Transmitter Module

5.3.1 Installation QR code

The installation QR code used in the new product label encodes the product parameter according to the ANSI/MH10.8.2-2013 industry standard. The installation QR code shown in Figure 22 above encodes the following string:

```
30PS3271-A215+2PDB07+30S01521234+Z6ED1E82DBA5971B4CA29EE1BD0C6B4D
+3Z175A172AECF5452BB5F6A26558CB9E96+31Z12345678+S01123401000001
```

Table 5 below describes the ANSI/MH10.8.2 data identifiers used by the PTM 215ZE device label and shows the interpretation of the data therein.

Identifier	Length of data (excl. identifier)	Content
30P	10 characters	Product Order Code (S3271-A215)
2P	4 characters	Product Revision (DB-07)
30S	8 characters	ZGP Source Address (4 byte, hexadecimal format)
Z	32 characters	Security Key 1 (16 byte, hexadecimal format)
3Z	32 characters	Security Key 3 (16 byte, hexadecimal format)
31Z	8 characters	NFC Pin Code (4 byte, hexadecimal format)
S	14 characters	Product Serial Number (14 digits, decimal format)

Table 5 – QR code format

6 Application information

6.1 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 this system conditions, range tests should always be performed to determine the reliably achievable range under the given conditions.

The following figures should be treated as a rough guide only:

- Line-of-sight connections
  Typically 15 m range in corridors, up to 50 m in halls

- Plasterboard walls / dry wood
  Typically 15 m range, through max. 2 walls

- Ferro concrete walls / ceilings
  Maximum 1 wall or ceiling, depending on thickness and material

- Fire-safety walls, elevator shafts, staircases and similar areas should be considered as shielded

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 include:
- Switch mounting 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 fibre
- Lead glass or glass with metal coating, steel furniture

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

7   Regulatory information

PTM 215ZE has been certified according to RED (EU), UKCA (UK), FCC (US), ISED (CA) and ARIB (Japan) regulations. Changes or modifications not expressly approved by EnOcean could void the user's authority to operate the equipment.

7.1   RED (European Union)

The Radio Equipment Directive (2014/53/EU, typically referred to as RED) replaces R&TTE directive from 1999 as regulatory framework for radio products in the European Union. All products sold to final customers after 12th of June, 2017 have to be compliant to RED.

At the time of writing, the text of the RED legislation was available from this link:
http://eur-lex.europa.eu/eli/dir/2014/53/oj

EnOcean radio modules are components which are delivered to OEM manufacturers for their use/integration in final or combined products. It is the responsibility of the OEM manufacturer to demonstrate compliance to all applicable EU directives and standards. The EnOcean attestation of conformity can be used as input to the declaration of conformity for the full product.

At the time of writing, guidance on the implementation of EU product rules – the so called "Blue Guide" – was available from this link:
http://ec.europa.eu/DocsRoom/documents/18027/

Specifically within the new RED framework, all OEM manufacturers have for instance to fulfill the following additional requirements:

- Provide product branding (on the product) clearly identifying company name or brand and product name as well as type, charge or serial number for market surveillance

- Include (with the product) documentation containing full postal address of the manufacturer as well as radio frequency band and max. transmitting power

- Include (with the product) user manual, safety information and a declaration of conformity for the final product in local language

- Provide product development and test documentation upon request

Please contact an accredited test house for detailed guidance.

7.2 UKCA (United Kingdom)

During a transition period, the United Kingdom will continue to accept products using the EU (RED) market approval as described above. Test reports are available on request.

Final products based on PTM 215ZE must meet the necessary application specific require-ments for UKCA conformity (e.g., building automation application, UK WEEE registration and packaging).

The OEM customer integrating PTM 215ZE into the final product is responsible for the final product documentation and must register at UK specific recycling organizations.

7.3 FCC (United States)

7.3.1 Certificate

TCB

GRANT OF EQUIPMENT AUTHORIZATION

Certification

Issued Under the Authority of the

Federal Communications Commission

By:

TCB

Timco Engineering, Inc.
849 NW State Road 45
Newberry, FL 32669

Date of Grant: 04/07/2022

Application Dated: 04/07/2022

EnOcean GmbH

Kolpingring 18a

Oberhaching, 82041

Germany

Attention: Armin Anders , Director Product Marketing

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: SZV-PTM215BZ
Name of Grantee: EnOcean GmbH
Equipment Class: Digital Transmission System
Notes: Energy Harvesting Wireless Switch

Grant Notes	FCC Rule Parts	Frequency Range (MHZ)	Output Watts	Frequency Tolerance	Emission Designator
	15C	2402.0 - 2480.0	0.0027		
	15C	2405.0 - 2480.0	0.0026		

Power listed is conducted. Device must be installed and operated to provide a separation distance of at least 20cm from all persons and must not transmit simultaneously with any other antenna or transmitter, except in accordance with FCC multi-transmitter product procedures. Users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.
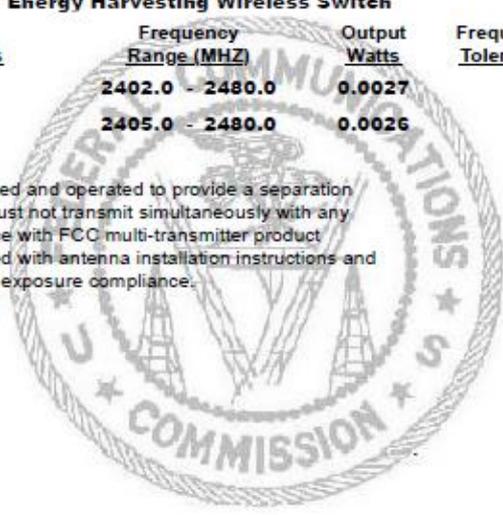
7.3.2 Regulatory Statement

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and

2. This device must accept any interference received, including interference that may cause undesired operation.

To comply with FCC/IC RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter

Warning
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Interference
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

PTM 215ZE - 2.4 GHz Zigbee Pushbutton Switch Transmitter Module

7.4 ISED (former Industry Canada)

7.4.1 Certificate

CANADIAN CERTIFICATION
TECHNICAL ACCEPTANCE CERTIFICATE

Certification No.	➢ **IC:** 5713A-PTM215BZ
Issued To ➢ EnOcean GmbH Kolpingring 18A Oberhaching 82041 Germany	**Tested By** ➢ VPI Laboratories, Inc. Company No.: 2041B 313 W. 12800 S. Suite 311 Draper, UT 84020 United States 801-260-4050; jasons@vpitech.com
Type of Equipment	➢ Other
Type of Service	➢ New Family Certification
Hardware Version Id Number (HVIN)	➢ PTM 215Z FOH (DB) ➢ PTM 215ZE (DB) ➢ PTM 216B ➢ PTM 216Z (DB)
Firmware Version Id Number (FVIN)	➢ N/A
Product Marketing Name: (PMN)	➢ PTM 215Z FOH (DB), PTM 215ZE (DB), PTM 216B, PTM 216Z (DB)
Host Marketing (HMN)	➢ N/A

FREQUENCY RANGE	EMISSION DESIGNATIONS NECESSARY BANDWIDTH & EMISSION CLASSIFICATION	R.F. POWER	ANTENNA INFO	SPECIFICATION/ ISSUE & DATE
2402 – 2480 MHz	1M07F1D	0.0037 – 0.0039 W	Trace, 1.5dBi	RSS-247 Issue 2; Feb. 2017
2402 – 2480 MHz	2M08F1D	0.0036 – 0.0037 W	Trace, 1.5dBi	RSS-247 Issue 2; Feb. 2017
2405 – 2480 MHz	2M30F1D	0.0036 – 0.0037 W	Trace, 1.5dBi	RSS-247 Issue 2; Feb. 2017

Note 1: This equipment also complies with RSS-102, Issue 5 (March 2015) and RSS-Gen, Issue 5 (April 2018).

Certification of equipment means only that the equipment has met the requirements of the above-noted specification. Licence applications, where applicable to use certified equipment, are acted on accordingly by the ISED issuing office and will depend on the existing radio environment, service and location of operation. This certificate is issued on condition that the holder complies and will continue to comply with the requirements and procedures issued by ISED. The equipment for which this certificate is issued shall not be manufactured, imported, distributed, leased, offered for sale or sold unless the equipment complies with the applicable technical specifications and procedures issued by ISED.

I hereby attest that the subject equipment was tested and found in compliance with the above-noted specifications.

La certification de l'équipement signifie uniquement que l'équipement a satisfait aux exigences de la spécification susmentionnée. Les demandes de licence, le cas échéant pour utiliser un équipement certifié, sont traitées en conséquence par le bureau émetteur d'ISED et dépendront de l'environnement radio, du service et du lieu d'exploitation existants. Ce certificat est délivré à condition que le titulaire se conforme et continuera de se conformer aux exigences et procédures émises par ISED. L'équipement pour lequel ce certificat est délivré ne doit pas être fabriqué, importé, distribué, loué, mis en vente ou vendu à moins que l'équipement ne soit conforme aux spécifications et procédures techniques applicables émises par ISED.

J'atteste par la présente que le matériel a fait l'objet d'essai et jugé conforme à la spécification ci-dessus.

ISSUED UNDER THE AUTHORITY OF MINISTER OF INDUSTRY
DÉLIVRÉ AVEC L'AUTORISATION DU MINISTRE DES INDUSTRIES

7.4.2 Regulatory Statement

7.4.2.1 English version

WARNING: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause interference, and

2. This device must accept any interference, including interference that may cause un-desired operation of the device.

This equipment has been tested and found to comply with the limits for a Class B digital de-vice, pursuant to ICES-003. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio com-munications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the re-ceiver is connected.

- Consult the dealer or an experienced radio/TV technician for help

7.4.2.2 French version

PRUDENCE: Changements ou modifications pourraient annuler le droit de l'utilisateur à utiliser l'équipement non autorisées.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. L'appareil ne doit pas produire de brouillage, et

2. L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Cet équipement a été testé et déclaré conforme aux limites d'un appareil numérique de classe B, conformément à la norme ICES-003. Ces limites sont conçues pour fournir une protection raisonnable contre les interférences nuisibles dans une installation résidentielle.

Cet équipement génère, utilise et peut émettre une énergie de radiofréquence et, s'il n'est pas installé et utilisé conformément a ux instructions, il peut causer des interférences nuisibles aux communications radio. Cependant, il n'existe aucune garantie que des interférences no se produiront pas dans une installation particulière.

Si cet équipement provoque des interférences nuisibles à la réception radio ou télévision, ce qui peut être déterminé en mettant l'équipement hors et sous tension, l'utilisateur est encouragé à essayer de corriger l'interférence par une ou plusieurs des mesures suivantes:

■ Réorienter ou déplacer l'antenne de réception.

■ Augmentez la distance entre l'équipement et le récepteur.

■ Connecter l'équipement à une sortie sur un circuit différent de celui sur lequel le récepteur est branché.

■ Consulter le revendeur ou un technicien radio / télévision expérimenté pour de l'aide

7.5 ARIB (Japan) Construction Type Conformity Certification

CETECOM

CETECOM GmbH
RCB Identifer 215

Bundesnetzagentur

authorized by the German Federal
Regulatory body BNetzA to act as a
CAB(Conformity Assessment Body) in
accordance with the MRA EU-Japan

BNetzA -CAB -18/25 -54

CONSTRUCTION TYPE CERTIFICATE

Certificate Holder	Matthias Kassner Kolpingring 18a 82041, Oberhaching Deutschland
CETECOM Registration No.	21-1-0155301T03
Model Name	PTM 215Z FOH, PTM 215ZE
Product Description	Wireless switch
Name of Manufacturer	Katek GmbH Körtingstraße 1 83224, Grassau Germany

This is to certify that the above-mentioned certification by type has been granted in accordance with the provisions of Article 38-24, Paragraph 1 of the Japan Radio Law.

This device must be labelled appropriately physically or electronically

⊜ [R] 215-JUK011

Place, date of issue

Essen, 2022-03-10

CETECOM GmbH

Tero Lehtinen
....
Tero Lehtinen / RCB

PTM 215ZE - 2.4 GHz Zigbee Pushbutton Switch Transmitter Module

8   Product history

Table 6 below lists the product history of PTM 215ZE.

Revision	Release date	Key changes versus previous revision
DA-01	Mar 2017	Initial release
DA-04	Nov 2019	Improved debouncing for very quick button action
DB-06	May 2023	Addition of NFC interface for device configuration

Table 6 – Product History

9   References

Consult the references listed below for additional information about PTM 215ZE functionality.

[1]   Zigbee Green Power Specification

[2]   IEEE 802.15.4 Specification

[3]   RFC3610 Specification