PTM 216B Bluetooth® Pushbutton Transmitter Module

21 July 2023

Observe precautions! Electrostatic sensitive devices!

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WO 2004/051591, DE 103 01 678 A1, DE 10309334,
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REVISION HISTORY

The following major modifications and improvements have been made to this document:

Version	Author	Reviewer	Date	Major Changes
1.0	MKA	MKA	25 May 2023	Initial Customer Release
1.1	MKA	MKA	21 July 2023	Added ACMA (Australia) approval

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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.

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1. General description

1.1 Basic functionality

PTM 216B enables the realization of energy harvesting wireless switches for lighting, building or industrial automation control systems using Bluetooth® low energy technology. PTM 216B is the successor of PTM 215B product providing higher transmission power while maintaining functional backwards compatibility.

PTM 216B is uses the standard EnOcean PTM 210 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 216B 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 radio telegram according to the Bluetooth® low energy standard is transmitted. This radio telegram transmits the status of all four contact nipples when the energy bow was pushed down or released. PTM 216B radio telegrams are protected with AES-128 security based on a device-unique private key.

PTM 216B is available in the following variants:

- PTM 216B
  Stand-alone module without additional components for OEM integration
- EWSSB / EWSDB
  PTM 216B integrated into European-style single / double rocker wall switch housing
- ESRPB / EDRPB
  PTM 216B integrated into US-style single or double rocker pad housing

The term “PTM 216B” as used in this document applies to all product variants unless otherwise mentioned. Figure 1 below shows from left to right the PTM 216B module, the EWSSB / EWSDB European wall switches and the ESRPB / EDRPB US-style rocker pads.

Figure 1 – PTM 216B, EWSSB/EWSDB and ESRPB/EDRPB

1.2 Technical data

Antenna	Integrated PCB antenna
Transmission power (typical)	+4 dBm
Communication Range (guidance only)	75 m outdoor / 15 m indoor environment
Communication Standard	Bluetooth Low Energy (BLE)
Radio Frequency (min / max)	2402 MHz / 2480 MHz
Radio Channels (default)	CH 37 / 38 / 39 (2402 MHz / 2426 MHz / 2480 MHz)
Data Rate and Modulation	1 Mbit/s GFSK (default) / 2 Mbit GFSK (NFC option)
Configuration Interface	NFC Forum Type 2 Tag (ISO/IEC 14443 Part 2 and 3)
Device Identification	Unique 48 Bit Device ID (factory programmed)
Security	AES128 (CBC Mode) with Sequence Code
Power Supply	Integrated Kinetic Energy Harvester
Button Inputs	Up to four buttons or two rockers
Dimensions	40.0 x 40.0 x 11.2 mm
Weight	20 g +/- 1g

1.3 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.

1.4 Packaging information

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

1.5 Ordering information

Type	Ordering Code	Description
PTM 216B	S3221-A216	Module only
EWSSB	E8221-A270:DB	Wall Switch (Single Rocker, see separate documentation)
EWSDB	E8221-A280:DB	Wall Switch (Double Rocker, see separate documentation)
ESRPB	ESRPB-W-EnOcean:DB	Rocker Pad (Single Rocker, see separate documentation)
EDRPB	EDRPB-W-EnOcean:DB	Rocker Pad (Double Rocker, see separate documentation)

2. Functional information

2.1 Product overview

The pushbutton transmitter module PTM 216B from EnOcean enables the implementation of wireless remote controls without batteries. It transmits Bluetooth Low Energy (BLE) data telegrams where the required energy is provided by a built-in electro-dynamic energy generator.

The PTM 216B product outline with key functional components is shown in Figure 2 below.

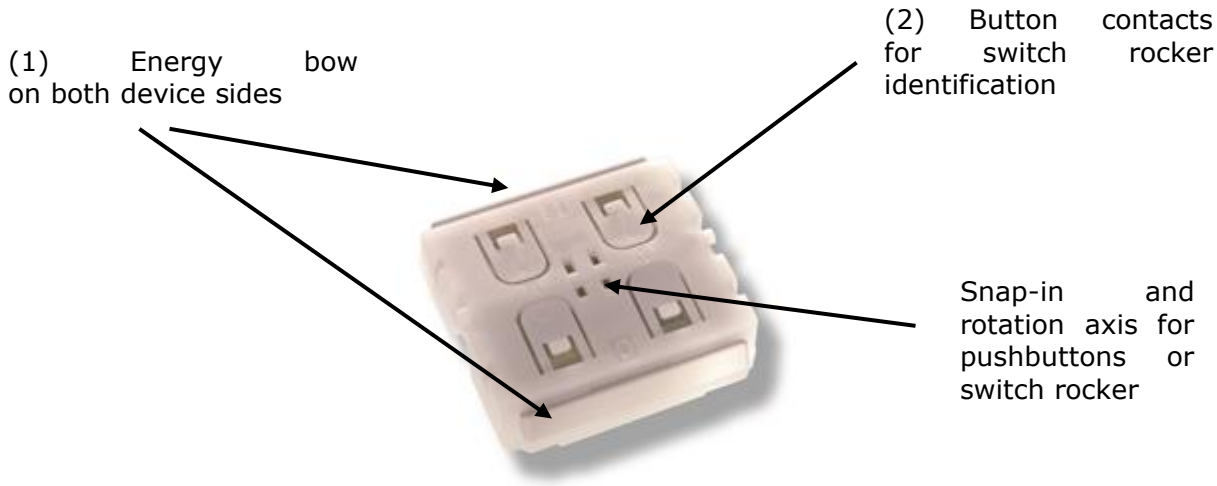


Figure 2 – PTM 216B Product Outline

2.2 Basic functionality

PTM 216B devices contain an electro-dynamic energy converter 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 BLE radio telegram is transmitted which identifies the action (pressed or not pressed) and the status 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 telegrams 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 Functional block diagram

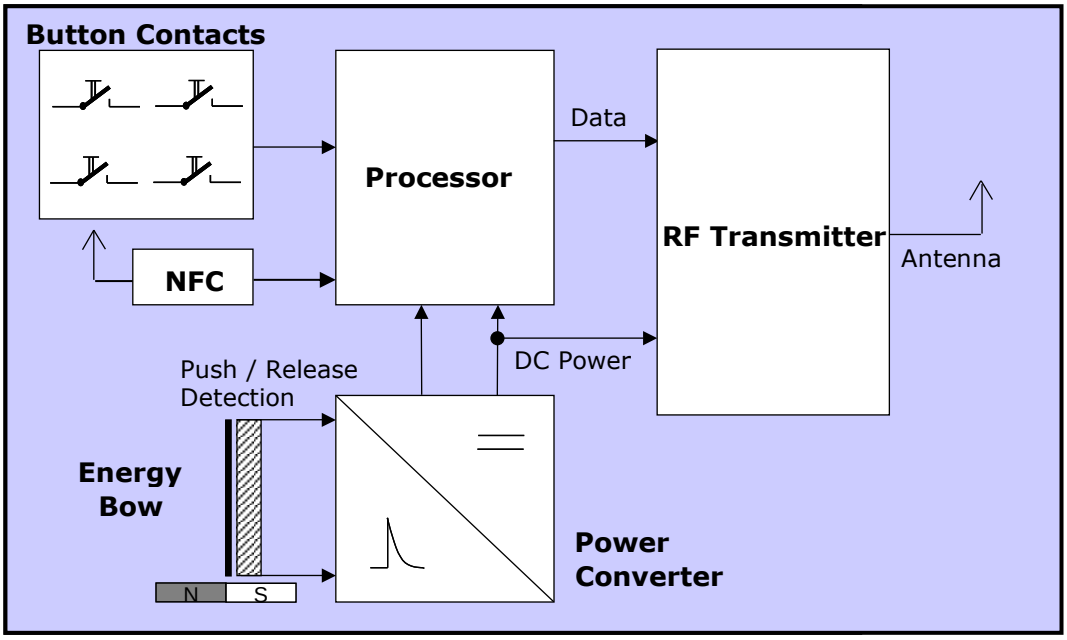


Figure 3 – Functional block diagram of PTM 216B

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

RF transmitter
Transmits the data in the form of a series of short 2.4 GHz Bluetooth Low Energy radio telegrams using the integrated antenna

NFC interface
Allows reading and writing certain product parameters using an NFC compliant reader / writer supporting NFC Forum Type 2 tags (as specified by ISO/IEC 14443 Part 2 and 3).

2.4 **User Interface**

PTM 216B 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 (48 Bit device ID) whenever the energy bow is pushed or released.

Figure 4 below shows the arrangement of the four button contacts and their designation:

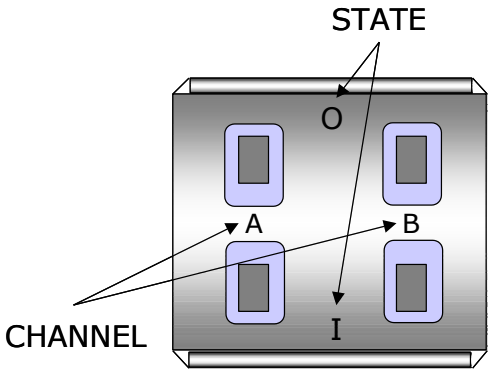


Figure 4 – Button contact designation

3. Telegram transmission

3.1 Radio channel parameters

PTM 216B transmits Bluetooth Low Energy (BLE) advertising telegrams within the 2.4 GHz radio frequency band (2402MHz … 2480MHz).

By default, PTM 216B will use the three BLE advertising channels (BLE Channel 37, 38 and 39) defined for transmission. The transmission of a radio telegram on these three advertising channels is called an Advertising Event.

Use of different radio channels within the frequency band from 2402 MHz to 2480 MHz is possible via NFC configuration as described in chapter 6.

The initialization value for data whitening is set as follows:

- For BLE channels is set according to specification (value = radio channel)
- For the custom radio channels the initialization value is equal to the offset from 2400 MHz (e.g. value = 3 for 2403 MHz)

Table 1 below summarizes radio channels supported by PTM 216B.

Radio Channel	Frequency	Channel Type
BLE Radio Channels		
37	2402 MHz	BLE Advertising Channel
0	2404 MHz	BLE Data Channel
1	2406 MHz	BLE Data Channel
…		
10	2424 MHz	BLE Data Channel
38	2426 MHz	BLE Advertising Channel
11	2428 MHz	BLE Data Channel
12	2430 MHz	BLE Data Channel
…		
36	2478 MHz	BLE Data Channel
39	2480 MHz	BLE Advertising Channel
Custom Radio Channels		
40	2403 MHz	Custom Radio Channel
41	2405 MHz	Custom Radio Channel
…		
77	2477 MHz	Custom Radio Channel
78	2479 MHz	Custom Radio Channel

Table 1 – PTM 216B supported radio channels

3.2 Default radio transmission sequence

PTM 216B transmits telegrams in its standard configuration by using so-called Advertising Events.

An advertising event is defined as the transmission of the same radio telegram on all selected radio channels (by default this would be on BLE Channel 37, 38 and 39) one after another with minimum delay in between.

For reliability reasons, PTM 216B will send several (minimum two, maximum three) advertising events for each button input. The resulting transmission sequence is shown in Figure 5 below.

The default interval between the advertising events is 20 ms. Starting with product version DC-06 it is possible to reduce this interval to 10 ms via NFC configuration as described in chapter 6.

Figure 5 – Default radio transmission sequence

3.3 User-defined radio transmission sequences

In certain situations, it might be desirable to transmit radio telegrams on channels other than the three advertising channels.

PTM 216B therefore allows to select the radio channels to be used for the transmission of data telegrams and commissioning telegrams. The following transmission modes are supported:

- Both commissioning telegrams and data telegrams are transmitted on the advertising channels as three advertising events. This is the default configuration and described in chapter 3.2 above.
- Commissioning telegrams are transmitted on the advertising channels as three advertising events while data telegrams are transmitted in a user-defined sequence as described below.
- Both commissioning and data telegrams are transmitted in a user-defined sequence as described below.

The selection of the transmission mode is via NFC configuration as described in chapter 6.

3.3.1 Supported radio transmission sequences

PTM 216B supports the following user-defined sequences:

- Three channel sequence
  This sequence is similar to the default Advertising Event with the difference that the user can select the radio channels to be used. The three-channel sequence is described in chapter 3.3.2 below.

- Two channel sequence
  In this sequence the radio telegram is transmitted using four transmissions on two radio channels. It is described in chapter 3.3.3 below.

- One channel sequence
  In this sequence the radio telegram is transmitted using six transmissions on one radio channel. It is described in chapter 3.3.4 below.

The selection of user-defined radio transmission sequences is made via NFC configuration as described in chapter 6.

3.3.2 Three-channel radio transmission sequence

The three-channel radio transmission sequence is similar to the default transmission sequence. The difference is that the radio channels (BLE Channel 37, 38 and 39 in the default transmission sequence) can be selected using the registers `TX_CHANNEL1`, `TX_CHANNEL2` and `TX_CHANNEL3`.

The PTM 216B telegram will in this mode be transmitted on the radio channel selected by `TX_CHANNEL1` first, immediately followed by a transmission on the radio channel selected by `TX_CHANNEL2` and a transmission on the radio channel selected by `TX_CHANNEL3`.

This transmission sequence will be sent three times in total as shown in Figure 6 below.

The default interval between the advertising events is 20 ms; it is possible to reduce this interval to 10 ms via NFC configuration as described in chapter 6.

Figure 6 – Three channel radio transmission sequence

3.3.3 Two-channel radio transmission sequence

The two-channel radio transmission sequence removes transmission on the third radio channel (selected by TX_CHANNEL3) and instead repeats the transmission once more (four times in total).

The PTM 216B telegram will in this mode be transmitted on the radio channel selected by TX_CHANNEL1 first, immediately followed by a transmission on the radio channel selected by TX_CHANNEL2.

This two-channel transmission sequence will be sent four times in total as shown in Figure 7 below.

The default interval between the advertising events is 20 ms; it is possible to reduce this interval to 10 ms via NFC configuration as described in chapter 6.

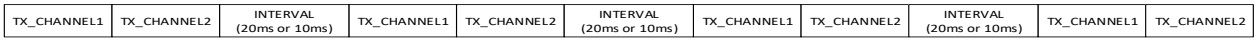


Figure 7 – Two channel radio transmission sequence

3.3.4 Single-channel radio transmission sequence

The single-channel radio transmission sequence removes transmission on the second and third radio channel (selected by TX_CHANNEL2 and TX_CHANNEL3 respectively), i.e. all transmissions will be on the radio channel selected by TX_CHANNEL1.

The PTM 216B telegram will be sent six times on this radio channel as shown in Figure 8 below.

The default interval between the advertising events is 20 ms; it is possible to reduce this interval to 10 ms via NFC configuration as described in chapter 6.

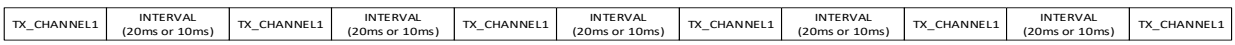


Figure 8 – Single channel radio transmission sequence

4. Telegram format

PTM 216B transmits Bluetooth Low Energy (BLE) radio telegrams in the 2.4 GHz band. For detailed information about the Bluetooth Low Energy standard, please refer to the applicable specifications.

Figure 9 below summarizes the BLE frame structure.

Preamble 0xAA	Access Address 0x8E89BED6	Header (2 Byte)	Source Address (6 Byte)	Payload (0 ... 31 Byte)	Check Sum (3 Byte)

Figure 9 – BLE frame structure

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

4.1 Preamble

The BLE Preamble is 1 byte long and identifies the start of the BLE frame. The value of the BLE Preamble is always set to `0xAA`.

4.2 Access Address

The 4 byte BLE Access Address identifies the radio telegram type. For advertising frames, the value of the Access Address is always set to `0x8E89BED6`.

4.3 Header

The BLE Header identifies certain radio telegram parameters. Figure 10 below shows the structure of the BLE header.

Bit 15 (MSb) Bit 0 (LSb)

UNUSED (2 Bit)	LENGTH (6 Bit)	RX ADDR (1 Bit)	TX ADDR (1 Bit)	UNUSED (2 Bit)	TYPE (4 Bit)
00	Length of Address + Payload	0: Not used	1: Random	00	0010: TX-only Advertising (ADV_NONCONN_IND)

Figure 10 – BLE header structure

4.4 Source address

The 6 byte BLE Source Address (MAC address) uniquely identifies each PTM 216B product.

PTM 216B supports two source address modes:

- Static Source Address mode (default)
  In this mode, the source address is constant (but its lower 32 bit can be configured via NFC interface)

- Resolvable Private Address mode (NFC configurable option)
  In this mode, the source address changes for each transmission

By default, PTM 216B uses Static Source Address mode. Private Resolvable Address mode can be selected via NFC configuration as described in chapter 6. These two address modes are described in the following chapters.

4.4.1 Static source address mode

By default, PTM 216B uses static source addresses meaning that the source address is constant during normal operation. The static source address can be read and configured (written) via NFC as described in chapter 6.

The structure of PTM 216B static addresses is as follows:

- The upper 2 bytes of the source address are used to identify the device type and set to `0xE215` for all PTM 216B devices (to designate EnOcean PTM 215 device type). These two bytes cannot be changed.

- The lower 4 bytes are uniquely assigned to each device.

Figure 11 below illustrates the static address structure used by PTM 216B.

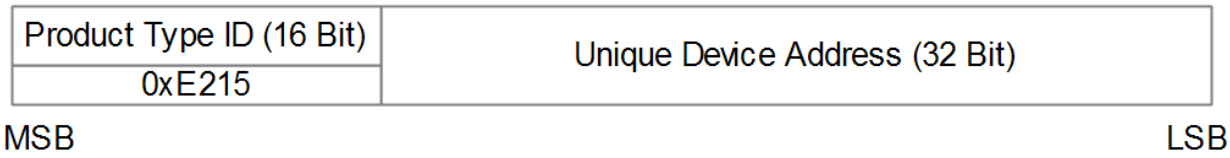


Figure 11 – BLE static source address structure

4.4.2 Resolvable private address mode

For some applications it is desirable to obfuscate the origins of PTM 216B data telegrams in order to prevent tracking of its radio transmissions. This can be achieved by using resolvable private addresses (RPA) as defined in the Bluetooth Core Specification.

PTM 216B can be configured to use resolvable private addresses via NFC configuration as described in chapter 6.

When using resolvable private addresses, the address used by PTM 216B is modified (rotated) according to a defined scheme which on one hand precludes determining the device identity by unauthorized receivers while allowing authorized receivers (sharing a specific security key with PTM 216B) to do so.

The shared security key – which has to be known by both PTM 216B and the authorized receiver – is called the Identity Resolution Key (IRK). PTM 216B uses its device-unique random key as identity resolution key. This key can be modified if needed via via NFC configuration as described in chapter 6.

For each data telegram transmitted by PTM 216B (i.e. for every button push or release), a new resolvable private address is generated. The 48 bit address field of such resolvable private address is split into two sub-fields:

- `prand`
  This field contains a random number which always starts (two most significant bits) with 0b10. The `prand` value is changed for each telegram that is transmitted. Individual advertising events used to transmit the same telegram (as described in chapter 3) use the same `prand` value.

- `hash`
  This field contains a verification value (hash) generated from `prand` using the IRK

The structure of a resolvable private address is shown in Figure 12 below.

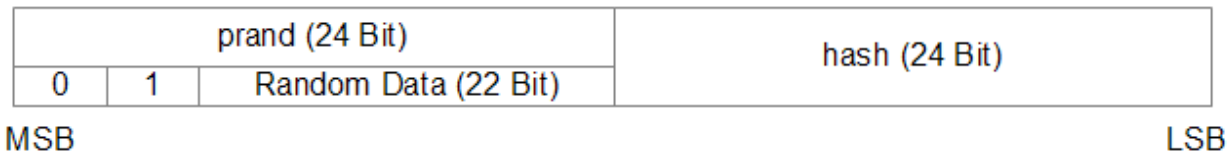


Figure 12 – BLE resolvable private address structure

The `prand` value is encrypted using the IRK. The lowest 24 bit of the result (encrypted value) are then used as `hash`. The concatenation of 24 bit `prand` and 24 bit `hash` will be transmitted as 48 bit private resolvable source address.

The receiver maintains a list of IRK for all transmitters that have been commissioned to work with it.

Whenever the receiver receives a data telegram with a resolvable private address (identified by the most significant bits of the address field being set to `0b10`), it will itself generate a 24 bit `hash` from the 24 bit `prand` sequentially using each IRK known to it (i.e. the IRK of each device that has been learned into it).

If an IRK matches (i.e. when `prand` is encoded with the IRK then the result matches `hash`), then the receiver has established the IRK used by the transmitter and thereby the identity of the transmitter.

So conceptually the IRK takes the role of the device address of the transmitter while `prand` and `hash` provide a mechanism for the receiver to select the correct IRK among the set of IRK known to it.

This mechanism is illustrated in Figure 13 below.

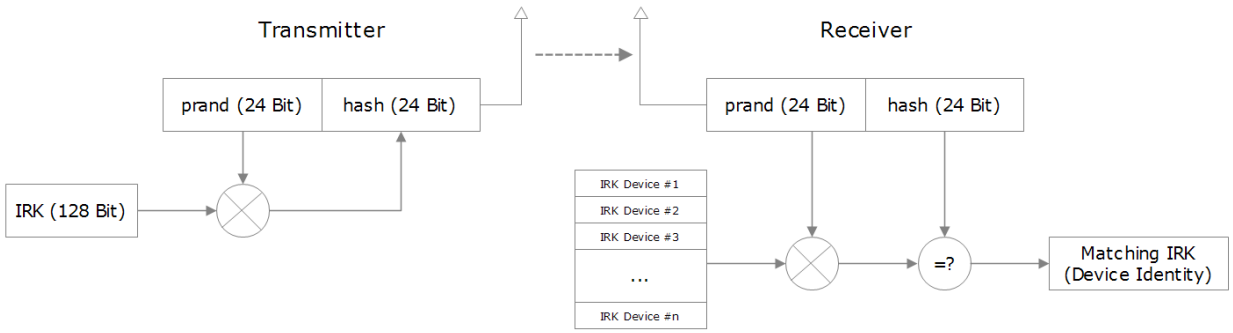


Figure 13 – Resolving private addresses

Note that commissioning telegrams (as described in chapter 5.3.2) always use static source addresses (as described in chapter 4.4.1) since they establish the device identity and contain the IRK in the payload.

4.5 Check Sum

The 3 byte BLE Check Sum is used to verify data integrity of received BLE radio telegrams. It is calculated as CRC (cyclic redundancy check) of the BLE Header, Source Address and Payload fields.

4.6 Telegram payload

PTM 216B can transmit two types of telegrams:

- Data telegrams
  The payload of data telegrams contains the switch status together with optional data (if applicable), the current sequence counter value and the resulting authentication signature

- Commissioning telegrams
  The payload of commissioning telegrams contains the private security key as well as the current value of the sequence counter and the device address

The payload structure of both telegram types is described in the following chapters.

4.6.1 Data telegram payload

The payload of data telegrams is 13 … 17 bytes long (depending on the size of the Optional Data field) and consists of the following fields:

- Length (1 byte)
  The Length field specifies the combined length of the following fields. The content of the field depends on the size of the Optional Data field (which can be 0 / 1 / 2 or 4 byte). The resulting Length setting would be 12 / 13 / 14 or 16 byte (`0x0C` / `0x0D` / `0x0E` / `0x10`) respectively

- Type (1 byte)
  The Type field identifies the data type used for this telegram. For PTM 216B data telegrams, this field is always set to `0xFF` to designate manufacturer-specific data field

- Manufacturer ID (2 byte)
  The Manufacturer ID field is used to identify the manufacturer of BLE devices based on assigned numbers. EnOcean has been assigned `0x03DA` as manufacturer ID code.

- Sequence Counter (4 byte)
  The Sequence Counter is a continuously incrementing counter used for security processing. It is initialized to `0` at the time of production and incremented for each telegram (data telegram or commissioning telegram) sent.

- Switch Status (1 byte)
  The Switch Status field reports the button action. The encoding of this field is described in chapter 4.6.2.

- Optional Data (0 / 1 / 2 or 4 byte)
  PTM 216B provides the option to transmit additional user-defined data within each data telegram via NFC configuration as described in chapter 6.

- Security Signature (4 byte)
  The Security Signature is used to authenticate PTM 216B radio telegrams as described in chapter 4.6.3

Figure 14 below illustrates the data telegram payload.

0x0C … 0x10	0xFF	Manufacturer ID 0x03DA	Sequence Counter (4 Byte)	Switch Status	Optional Data (0/1/2/4 Byte)	Security Signature (4 Byte)
LEN	TYPE					

Figure 14 – Data telegram payload structure

4.6.2 Button action encoding

The `Switch Status` field within the data telegram payload identifies the PTM 216B button action (button push or release). PTM 216B uses the following sequence to identify and transmit button contact status:

1. Determine direction of the energy bar movement (Push Action or Release Action)
2. Read input status of all button contacts
3. Calculate data payload
4. Calculate security signature

In PTM 216B, the type of action (Press Action or Release Action) is indicated by Bit 0 (Energy Bar). If a button contact has been actuated during Press Action or Release Action, then this is indicated by the according status bit set to '1'.

Note that all contacts that were pressed during Press Action will be released during Release Action. The case of continuing to hold one (or several) button contacts during Release Action is mechanically not possible.

The default button action encoding used by PTM 216B is shown Figure 15 in below. It is possible to modify this encoding using the NFC interface.

Switch Status							
Reserved			B1	B0	A1	A0	ACTION TYPE
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Shall be 0b000			0 = No Action 1 = Action	0 = No Action 1 = Action	0 = No Action 1 = Action	0 = No Action 1 = Action	0 = Release Action 1 = Press Action

Figure 15 - PTM 216B button action encoding

4.6.3 Commissioning telegram payload

The payload of commissioning telegrams is 30 bytes long and consists of the following fields:

- Length (1 byte)
  The Length field specifies the combined length of the following fields. For PTM 216B commissioning telegrams, this field is set to `0x1D` to indicate 29 byte of manufacturer-specific data.
  Note: In product versions prior to DC-06 this field was incorrectly set to `0x1E`.

- Type (1 byte)
  The Type field identifies the data type used for this telegram. This field is set to `0xFF` to indicate a "Manufacturer-specific Data" field

- Manufacturer ID (2 byte)
  The Manufacturer ID field is used to identify the manufacturer of BLE devices based on assigned numbers. This field is set to `0x03DA` (EnOcean GmbH).

- Sequence Counter (4 byte)
  The Sequence Counter is a continuously incrementing counter used for security processing. It is initialized to 0 at the time of production and incremented for each telegram (data telegram or commissioning telegram) sent.

- Security Key (16 byte)
  Each PTM 216B device contains its own 16 byte device-unique random security key which is generated and programmed during manufacturing. It is transmitted during commissioning to enable the receiver to authenticate PTM 216B data telegrams and used as IRK for the case of resolvable private address mode

- Static Source Address (6 byte)
  The Static Source Address is used to uniquely identify each BLE device. It is transmitted as part of the BLE frame as described in chapter 4.4.1.
  Some devices (most notable all iOS-based products) however do not expose this address to their applications. This makes it impossible to use such applications to commission PTM 216B. The Static Source Address is therefore again transmitted as part of the payload.

Figure 16 below illustrates the commissioning telegram payload.

LEN	TYP	Manufacturer ID	Manufacturer-specific Data		
0x1D	0xFF	0x03DA	Sequence Counter (4 Byte)	Security Key (16 Byte)	Static Source Address (6 Byte)

Figure 16 – Commissioning telegram payload structure

4.7 PTM 216B data telegram authentication

PTM 216B implements telegram authentication for transmitted data telegrams to ensure that only telegrams from transmitters using a previously exchanged security key will be accepted by the receiver. Authentication relies on a 32 bit telegram signature which is calculated as shown in Figure 17 below and exchanged as part of the radio telegram.

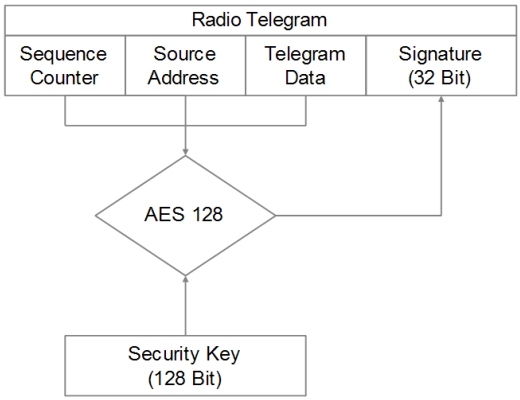


Figure 17 – Telegram authentication flow

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 216B 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 the following statements are true:

- Transmitter (PTM 216B) and receiver use the same security key
- The message content (address, sequence counter, data) has not been modified

At this point, the receiver has validated that the message originates from a trusted transmitter (as identified by its security key) and that its content is valid.

In order 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 216B and only accepts messages with higher sequence counter values (i.e. not accepts equal or lower sequence counter values for subsequent telegrams).

4.7.1 Authentication implementation

PTM 216B implements data telegram authentication based on AES128 in CCM (Counter with CBC-MAC) mode as described in IETF RFC3610. At the time of writing, the RFC3610 standard could be found here: https://www.ietf.org/rfc/rfc3610.txt

The 13 Byte Nonce (number used once – unique) initialization value is constructed as concatenation of 6-byte Source Address, 4-byte Sequence Counter and 3 bytes of value 0x00 (for padding).

Note that both Source Address and Sequence Counter use little endian format (least significant byte first). Figure 18 below shows the structure of the Nonce.

AES128 Nonce (13 Byte)												
Source Address						Sequence Counter				Padding		
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 0	Byte 1	Byte 2	Byte 3	0x00	0x00	0x00

Figure 18 –Nonce structure

The Nonce and the 128-bit device-unique security key are then used to calculate a 32-bit signature of the authenticated telegram payload shown in Figure 19 below.

Authenticated Payload								
LEN	TYPE	MANUFACTURER	Sequence Counter				STATE	Optional Data
Byte 0	0xFF	0x03DA	Byte 0	Byte 1	Byte 2	Byte 3	Byte 0	0 / 1 / 2 / 4 byte

Figure 19 – Authenticated payload

The calculated 32-bit signature is then appended to the data telegram payload as shown in Figure 14 in chapter 4.6.

5. Commissioning

Commissioning is the process by which PTM 216B is learned into a receiver (actuator, controller, gateway, etc.).

The following two tasks are required in this process:

- Device identification
  The receiver needs to know how to uniquely identify this specific PTM 216B device. This is achieved by using a unique 48 Bit ID (Source Address) for each PTM 216B device as described in chapter 4.4. In addition, up to 4 byte of Optional Data can be configured via NFC configuration as described in chapter 6.

- Security parameter exchange
  The receiver needs to be able to authenticate radio telegrams from PTM 216B in order to ensure that they originate from this specific device and have not been modified as described in chapter 4.6.3. This is achieved by exchanging a 128 Bit random security key used by PTM 216B to authenticate its radio telegrams.

PTM 216B provides the following options for these tasks:

- NFC-based commissioning
  The PTM 216B parameters are read by a suitable commissioning tool (e.g. NFC smartphone with suitable software) which is already part of the network into which PTM 216B will be commissioned. The commissioning tool then communicates these parameters to the intended receiver of PTM 216B radio telegrams. NFC-based commissioning is described in chapter 6

- Camera-based commissioning
  Each PTM 216B module contains an optically readable QR Code which identifies its ID and its security key. This QR code can be read by a by a suitable commissioning tool (e.g. smartphone) which is already part of the network into which PTM 216B will be commissioned. The commissioning tool then communicates these parameters to the intended receiver of PTM 216B radio telegrams.
  The QR code structure is described in chapter 7.2.

- Radio-based commissioning
  PTM 216B can communicate its parameters via special radio telegrams (commissioning telegrams) to the intended receiver. To do so, PTM 216B can be temporarily placed into radio-based commissioning mode as described in chapter 5.3

5.1 NFC-based commissioning

All required PTM 216B parameters can be read via a suitable NFC reader and writer supporting the ISO/IEC 14443 Part 2 and 3 standards. The actual NFC implementation in PTM 216B uses a Mifare Ultralight tag.

Commissioning via NFC should follow these steps:

1. Unlock PTM 216B using the default NFC PIN code `0x0000E215`

2. Read the PTM 216B Source Address, Security Key and Sequence Counter and configure the receiver accordingly

3. **Important**: The pre-programmed random security key used by PTM 216B can be obtained both from the product DMC code as described in chapter 5.2, from received commissioning telegrams as described in chapter 5.3 and via the NFC interface. For security-critical applications where unauthorized users could have physical access to the switch it is therefore strongly recommended to change the security key to a new security key as part of the NFC-based commissioning process.

4. **Important**: It is strongly recommended to disable radio-based commissioning after programming a new security key via NFC configuration as described in chapter 6. This ensures that the new security key cannot be read out by triggering a commissioning telegram as described in chapter 5.3.

5. **Important**: You should always change the NFC PIN code from its default setting to a new NFC PIN code and lock the NFC configuration interface. This step is mandatory to avoid access to the PTM 216B configuration using the default PIN code. Should you lose the new NFC PIN code then PTM 216B can be reset to factory mode (with the default NFC PIN code) by means of a factory reset as described in chapter 5.4. For security reasons, this factory reset will always reset the security key to its pre-programmed value.

5.2 Camera-based commissioning

Each PTM 216B module contains an optically readable Commissioning Code implemented either as Data Matrix Code or as QR Code depending on the device revision.

This Commissioning Code on the device label can be scanned by a suitable commissioning tool (e.g. smartphone or PC with DMC / QR code reader) to read the static source address and the security key of the device.

The commissioning tool can the use this information to configure the intended receiver of PTM 216B radio telegrams.

See chapter 7 for details of the commissioning code structure.

5.3 Radio-based commissioning

For cases where both NFC and camera-based commissioning are not feasible it is possible to set PTM 216B into a specific mode where it transmits commissioning telegrams.

This functionality can be disabled via NFC configuration as described in chapter 6 or by means of a specific button press (long press of A0 + A1 + B1), see chapter 5.3.4.

5.3.1 Commissioning mode entry

Commissioning mode is entered using a special button contact sequence. This is illustrated in Figure 20 below.

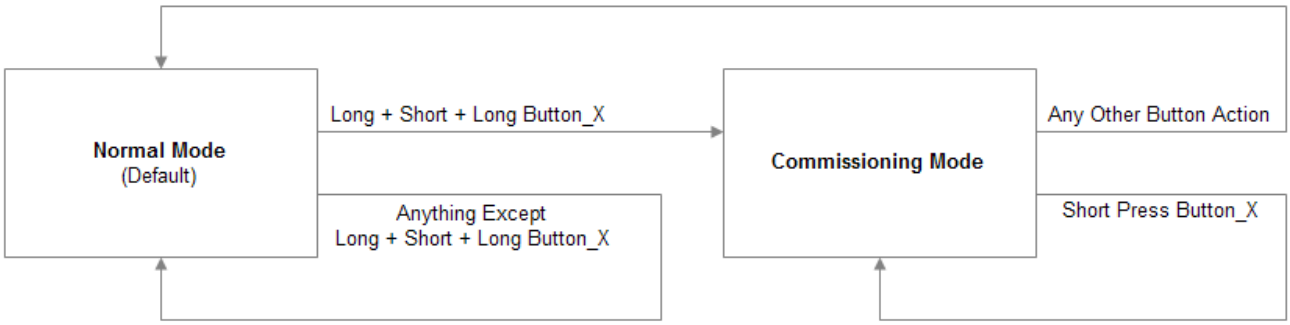


Figure 20 – Button sequence to enter radio-based commissioning mode

To enter commissioning mode, start by selecting one button contact of PTM 216B. Any button of PTM 216B (A0, A1, B0, B1) can be used. This button is referred to as `Button_X` in Figure 20 above.

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

1. Press and hold the selected button together with the energy bar for more than 7 seconds before releasing it

2. Press the selected button together with the energy bar quickly (hold for less than 2 seconds)

3. Press and hold the selected button together with the energy bar again for more than 7 seconds before releasing it

Upon detection of this sequence, PTM 216B will enter commissioning mode unless this has been disabled via NFC configuration as described in chapter 6.
Otherwise, PTM 216B will not enter commissioning mode and transmit normal data telegrams according to the button status.

5.3.2 Commissioning telegram transmission

PTM 216B will transmit a commissioning telegram (on the radio channels selected as described in chapter 3.1) upon entering commissioning mode. The structure of the commissioning telegram is described in chapter 4.6.3.

PTM 216B will continue to transmit commissioning telegrams whenever the button used for entry into commissioning mode (`Button_X`) is pressed or released again.

5.3.3 Exit from commissioning mode

Pressing any key except the button used for entry into commissioning mode (`Button_X`) will cause PTM 216B to stop transmitting commissioning telegrams and return to normal data telegram transmission.

5.3.4 Disable commissioning mode

Starting with product version DC-06 it will be possible to disable commissioning mode in addition to using the NFC interface also by means of a specific button input.

To do so, press buttons A0, A1 and B1 together with the energy bar and hold them for at least 10 seconds before releasing them.

Commissioning mode can be re-enabled by means of a factory reset as described below.

5.4 **Factory reset**

PTM 216B can be reset to its default settings by means of a factory reset.

This ensures that PTM 216B can be reset to a known configuration in case the PIN for the NFC access has been lost or NFC access is not possible for other reasons

In order to execute such factory reset, the rocker(s) and the switch housing have to be removed from the PTM 216B module. Then, all four button contacts (A0, A1, B0 and B1) have to be pressed at the same time while the energy bow is pressed down.

The energy bow must then be held at the down position for at least 10 seconds before being released. The button contacts A0, A1, B0 and B1 can be released at any time after pressing the energy bow down, i.e. it is no requirement to hold them as well for at least 10 seconds.

Upon detecting this input, PTM 216B will reset changes made via button input or via the NFC configuration as described in chapter 6.

6. NFC interface

PTM 216B implements an NFC interface to provide read and write access to the PTM 216B configuration memory which allows configuration of the device as described in the following chapters.

6.1 NFC interface parameters

The NFC interface of PTM 216B uses 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.

6.2 NFC access protection

Protected data access is only possible after unlocking the configuration memory with the correct 32-bit PIN code. By default, the protected area is locked and the default pin code for unlocking access is `0x0000E215`.

The default pin code shall be changed to a user-defined value as part of the installation process. This can be done by unlocking the NFC interface with the old PIN code and then writing the new PIN code to page `0x4B`.

6.3 Using the NFC interface

Using the NFC interface requires the following:

- NFC reader
  This can be either a USB NFC reader connected to a PC or a suitable smartphone with NFC functionality

- NFC SW with read, write, PIN lock, PIN unlock and PIN change functionality
  This can be either a PC application or an Android / iOS app

These options are described in more detail below.

6.3.1 PC with dedicated NFC reader

For PC-based applications, EnOcean provides a dedicated PC application called EnOcean NFC configurator which works in conjunction with the TWN4 Multitech 2 HF NFC Reader.

EnOcean NFC Configurator can be obtained available from the EnOcean homepage:
https://www.enocean.com/en/product/enocean-nfc-configurator/

The TWN4 Multitech 2 HF NFC Reader is available from Elatec RFID Systems (sales-rfid@elatec.com) using order code T4BT-FB2BEL2-SIMPL. It is shown in Figure 21 below.

Figure 21 – Elatec TWN4 MultiTech Desktop NFC Reader

6.3.2 Android or iOS smartphone with NFC

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

7. PTM 216B device label

Each PTM 216B module contains a device label.

Note that the finished switches (EWSSB, EWSDB, ESRPB and EDRPB) use a different product label as described in their user manuals and the information given in the subsequent chapters applies only to the PTM 216B module itself.

7.1 PTM 216B device label structure

Figure 22 below shows the structure of the PTM 216B device label. It identifies key parameters such as the source address (in this case E215:0150:0100) and the manufacturing date (in this case week 20, 2023) in writing.

Additionally, the device label contains a QR code for device identification and camera-based commissioning as discussed in chapter 5.2.

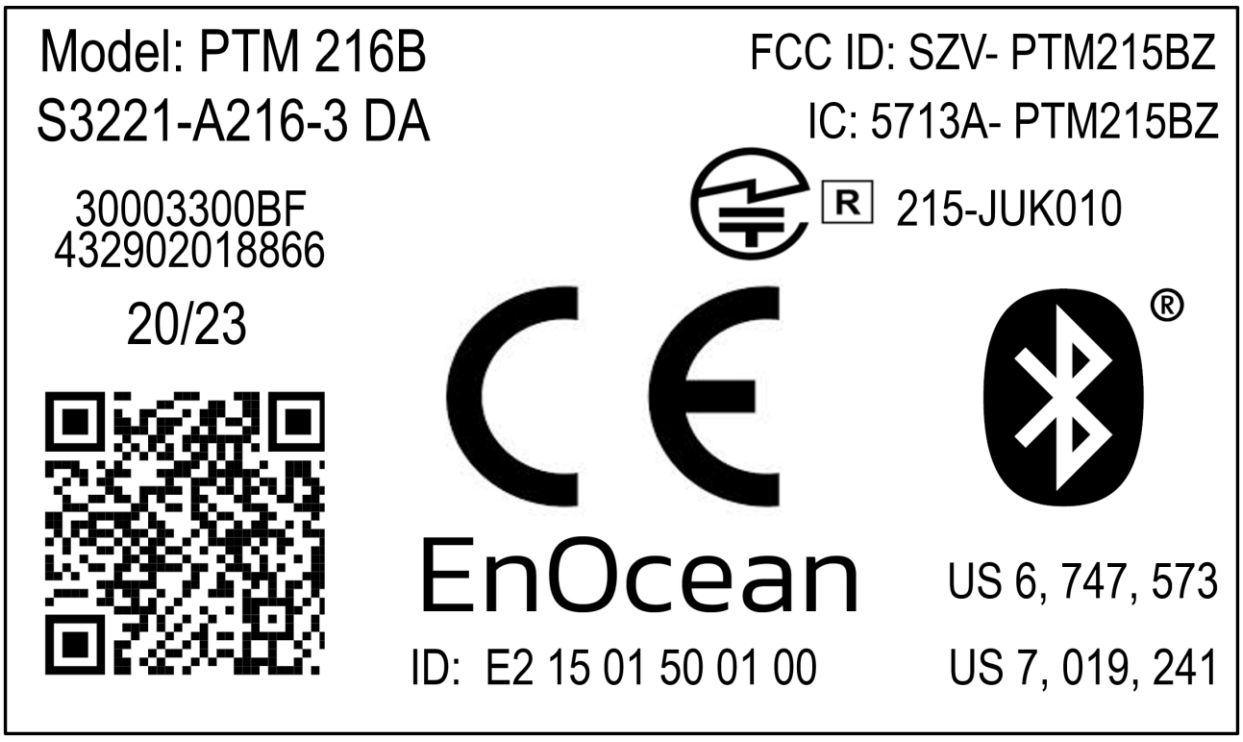


Figure 22 – PTM 216B device label structure

7.2 QR code format

The QR code used in the PTM 216B product label encodes key product parameter according to the ANSI/MH10.8.2-2013 industry standard. The QR code shown in Figure 22 above encodes the following string:

```
30SE21501500100+Z0123456789ABCDEF0123456789ABCDEF+30PS3221-A216+2PDA03+31Z0000E215
+S01234567890123
```

Table 2 below describes the ANSI/MH10.8.2 data identifiers used by the PTM 216B device label and shows the interpretation of the data therein.

Identifier	Length	Content	Value in this example
30S	12 char	Static Source Address	E21501500100
Z	32 char	Security Key	0123456789ABCDEF0123456789ABCDEF
30P	10 char	Ordering Code	S3221-A216
2P	4 char	Step Code - Revision	DA03
31Z	8 char	NFC PIN Code	0000E215
S	14 char	Serial Number	01234567890123

Table 2 – QR code format

8. Device integration

PTM 216B 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.

8.1 Mechanical interface characteristics

Energy bow travel / operating force	1.8 mm / typ. 9 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)

8.2 Mechanical interface drawings

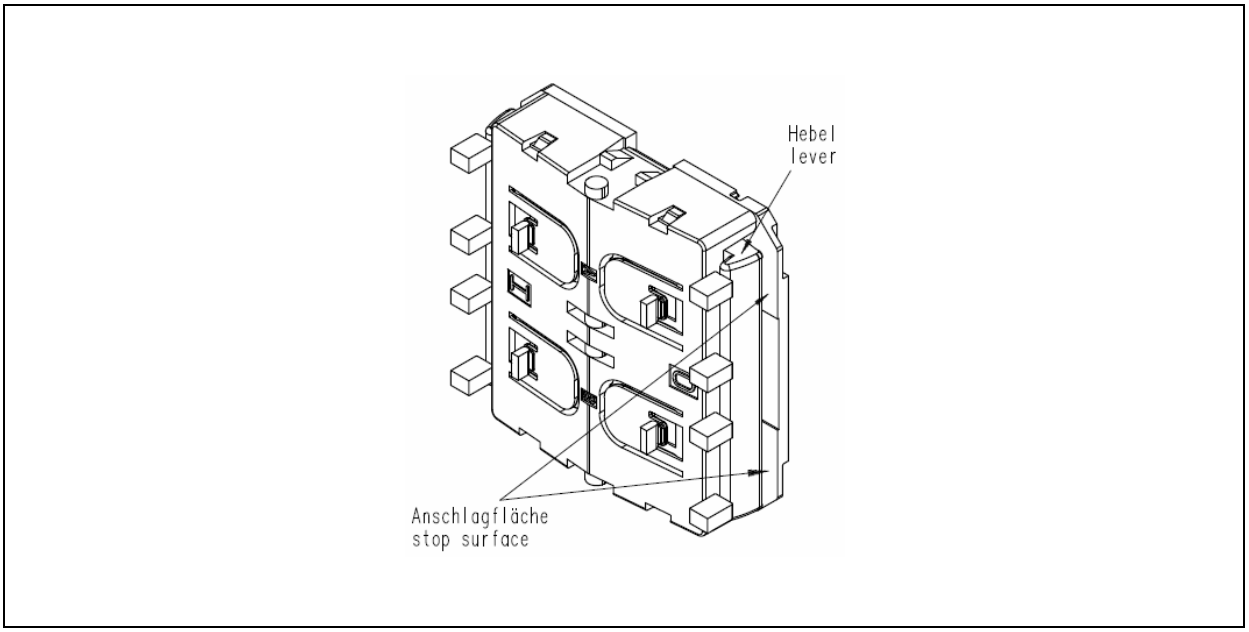
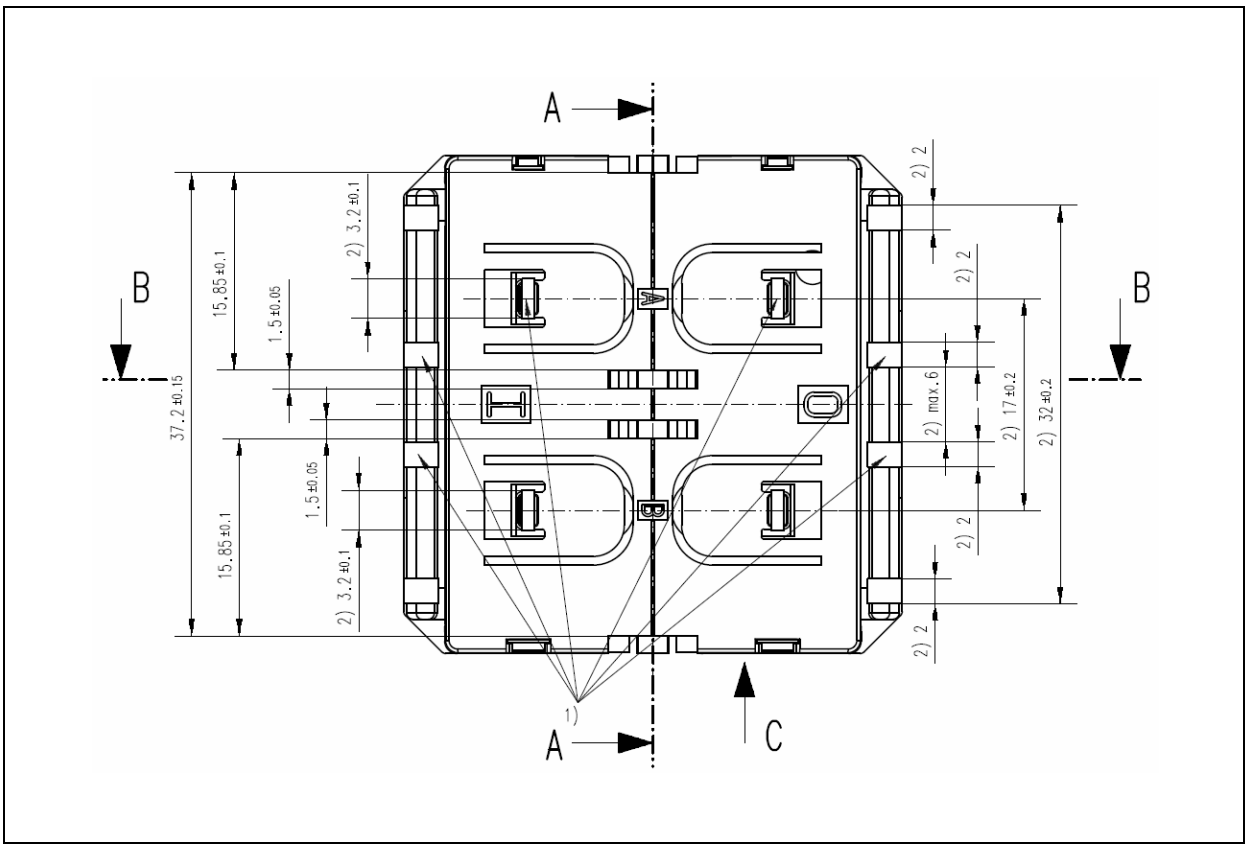


Figure 23 – PTM 216B, tilted view (including rocker catwalks)



1) these catwalks are not needed when using one single rocker only 2) dimensions of rocker part

Figure 24 – PTM 216B, top view (note cut A, B and C marking)

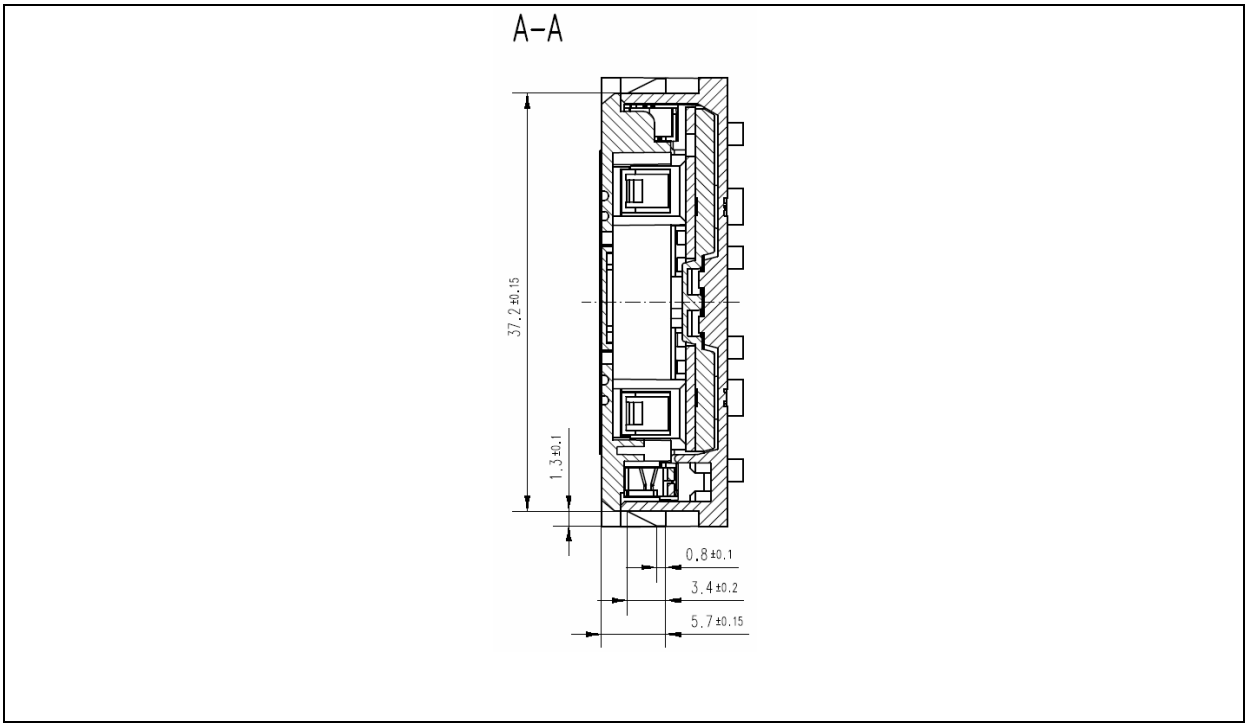
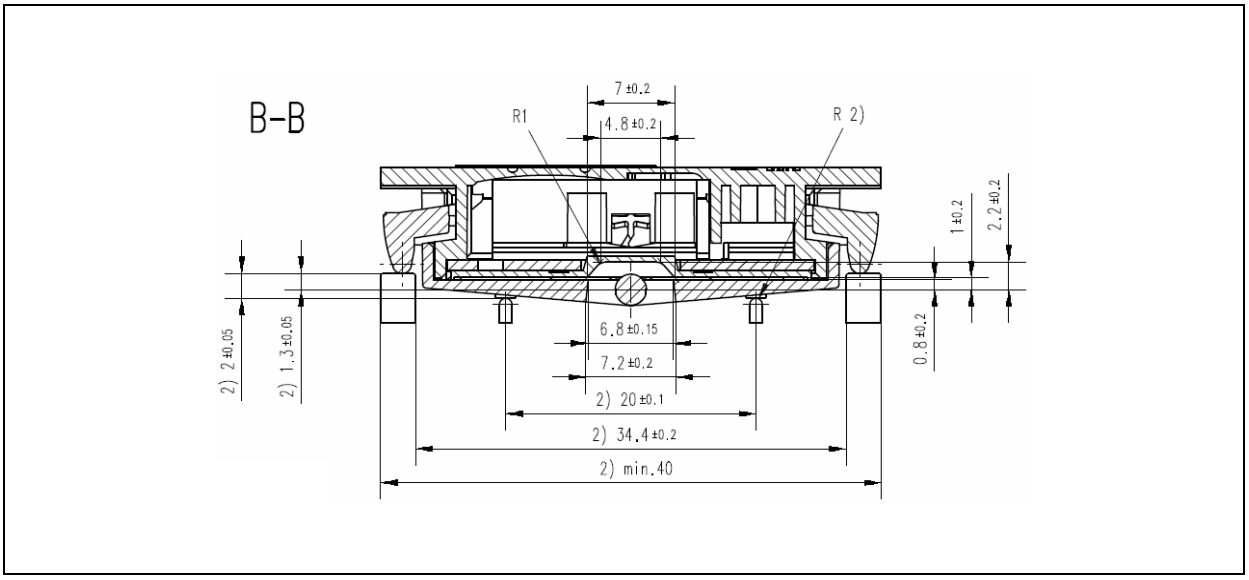
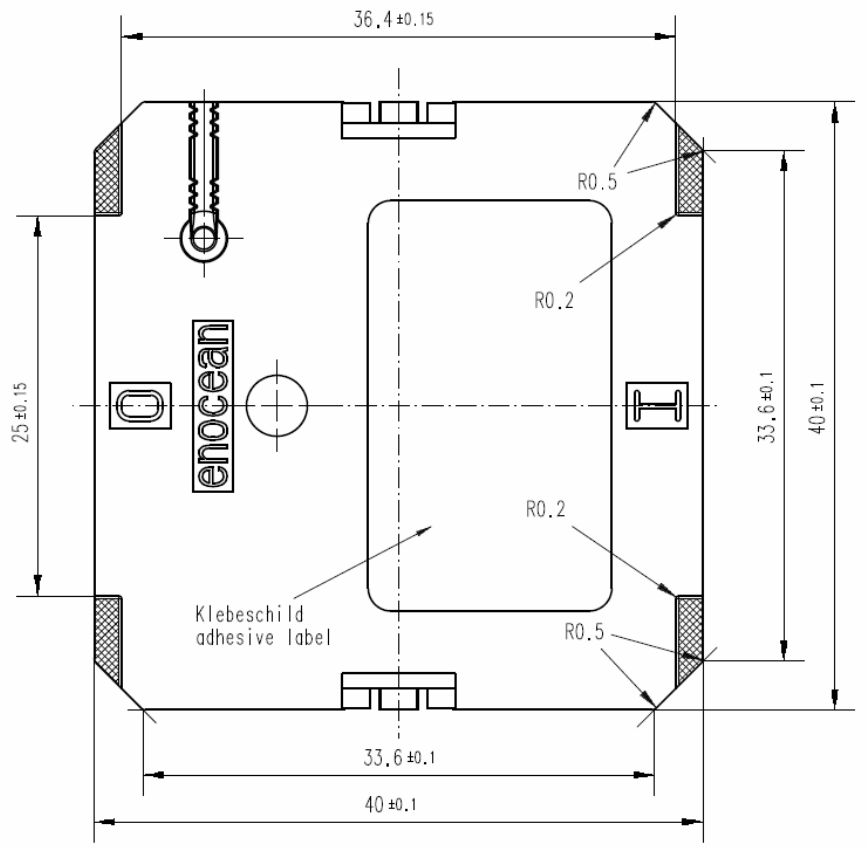


Figure 25 – PTM 216B, cut A



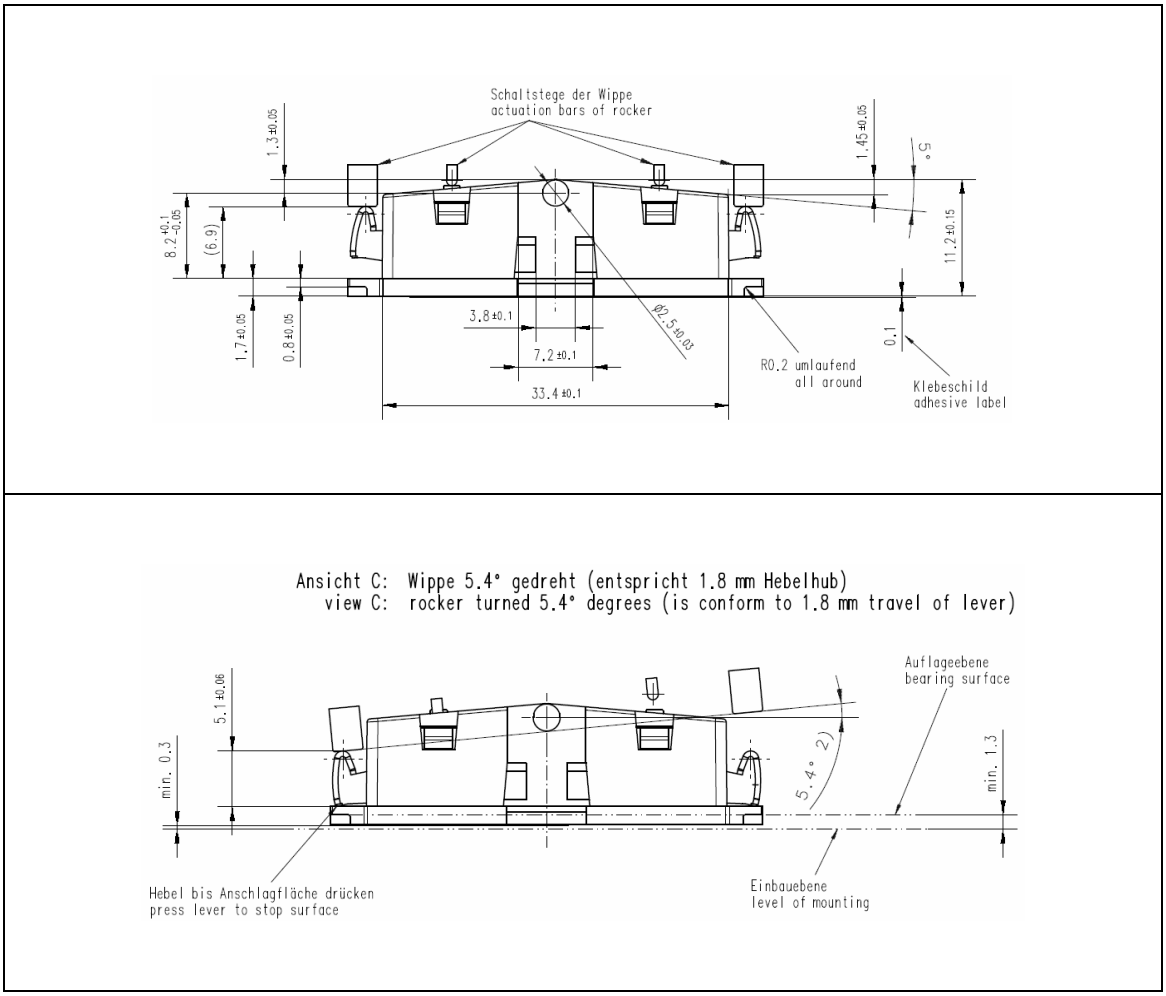
2) dimensions of rocker part

Figure 26 – PTM 216B, cut B and C



Hatched areas: support planes

Figure 27 – PTM 216B rear view



2) dimensions of rocker part

Figure 28 – PTM 216B, side view

If the rocker is not mounted on the rotation axis of PTM 216B several tolerances have to be considered! The measure from support plane to top of the energy bow is 7.70 mm +/- 0.3 mm!

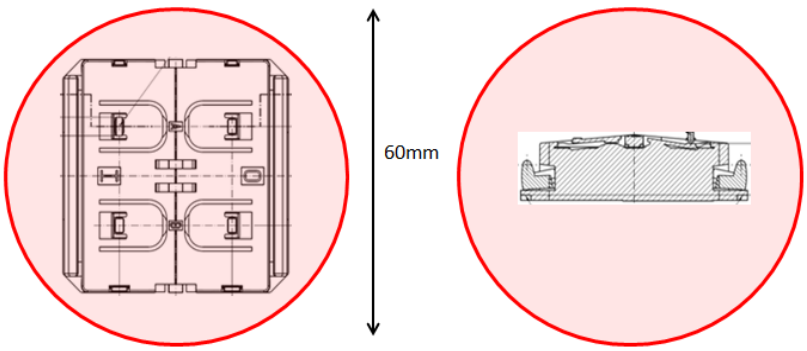
The movement of the energy bow must not be limited by mounted rockers!

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

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.

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 216B is powered by the electromagnetic generator ECO 200. For proper function magnets or ferromagnetic materials are not permitted within a keep-out zone of 60mm around the center of PTM 216B.



8.3 OEM product QR code

Customers integrating PTM 216B modules into their own OEM products should include the original PTM 216B QR code on their product label for the purpose of commissioning as described in chapter 5.2. This QR code can then be scanned by commissioning tools to automatically extract the required product parameters.

9. Application information

9.1 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 30 m in halls

- Plasterboard walls / dry wood
  Typically 10 m range, through max. 2 walls

- Fire-safety walls, massive ferro-concrete walls such including 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.

Note that interference from other radio equipment operating in the 2.4 GHz band (WiFi routers, smartphones, wireless audio and video systems, etc.) can have major impact on radio performance.

9.2 Receiver configuration

PTM 216B communicates user actions (rocker push / release) using a sequence of advertising telegrams as described in chapter 3.

In order to maximize the likelihood of reception of these telegrams, it is necessary that the receiver is either permanently in receive mode on one of the radio channels used by PTM 216B or – if this is not possible – periodically in receive mode for a sufficiently long duration.

Three key timing parameters have to be considered when configuring a receiver (scanner) for periodical reception of advertising events sent by a transmitter (advertiser). These three parameters are:

- Advertising interval
  Time between two advertising events sent by the transmitter
- Scan interval
  Time between the start of two consecutive scanning cycles of the receiver
- Scan window
  Duration for which the receiver will scan within each scanning cycle

Figure 29 below illustrates these three parameters.

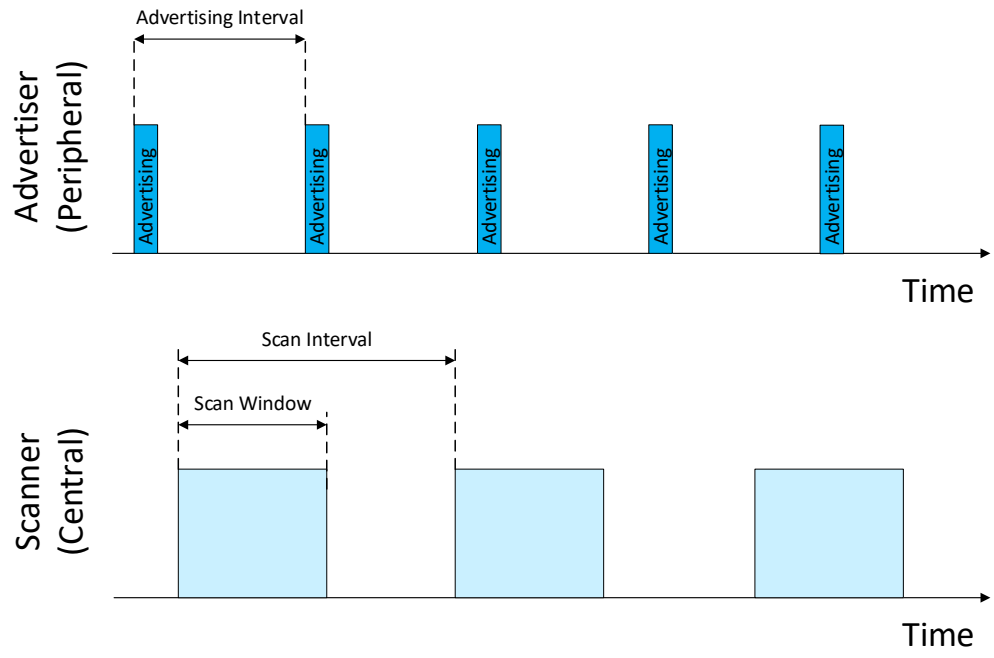


Figure 29 – Scanning parameters

9.2.1 Advertising interval

PTM 216B transmits advertising events with an advertising interval of either 20 ms (default setting) or 10 ms (NFC configurable setting).

The time required to transmit each advertising telegram within the advertising event is approximately 0.5 ms and the time required to transmit the entire advertising event (transmission of three advertising telegrams on three different radio channels including radio channel change) is approximately 2.5 ms.

9.2.2 Scan window

The scan window has to be selected such that the receiver will under all conditions receive at least one full advertising telegram.

To ensure this requirement, we consider the worst-case condition where the receiver starts scanning directly after the start of one transmission and therefore misses a part of it. Under these conditions, it is necessary that the receiver remains active until the next advertising telegram has been fully transmitted. This is illustrated in Figure 30 below.

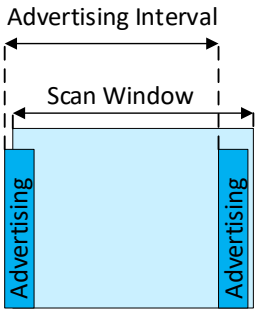


Figure 30 – Scan window setting

From Figure 30 above it can be seen that the minimum duration of the scan window is dependent on the advertising interval:

- If PTM 216B uses 20 ms advertising intervals, then the scan window has to be at least 20 ms (advertising interval) plus 0.5 ms (telegram duration) plus a timing margin to account for the random time offset at the transmitter.
  Using a scan window of at least 23 ms is recommended for this case.

- If PTM 216B uses 10 ms advertising intervals, then the scan window has to be at least 10 ms (advertising interval) plus 0.5 ms (telegram duration) plus a timing margin to account for the random time offset at the transmitter.
  Using a scan window of at least 13 ms is recommended for this case.

9.2.3 Scan interval

The scan interval has to be selected such that the receiver will not be inactive so long that it misses all three advertising events.

The longest period for which the receiver can be inactive is given by the time between the end of the first advertising events (assuming that the receiver exactly misses the last bit of it) and the beginning of the third advertising event (so that this will certainly be received). Figure 31 illustrates this.

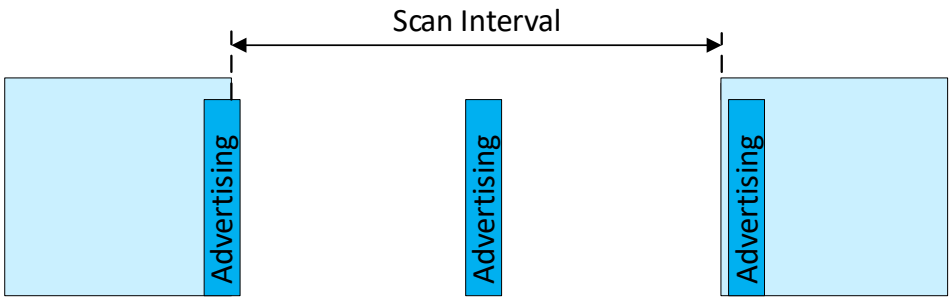


Figure 31 – Scan interval setting

From Figure 31 above it can be seen that the maximum duration of the scan interval is dependent on the advertising interval:

- If PTM 216B uses 20 ms advertising intervals, then the scan interval has to be less than the time between the end of the first advertising event and the begin of the third advertising event (2 * 20 ms = 40 ms) minus 0.5 ms (telegram duration) minus a timing margin to account for the random time offset at the transmitter. Using a scan interval of no more than 37 ms is recommended for this case.

- If PTM 216B uses 10 ms advertising intervals, then the scan interval has to be less than the time between the end of the first advertising event and the begin of the third advertising event (2 * 10 ms = 20 ms) minus 0.5 ms (telegram duration) minus a timing margin to account for the random time offset at the transmitter. Using a scan interval of no more than 17 ms is recommended for this case.

9.2.4 Summary

Table 3 below summarizes the recommended receiver scan settings.

PTM 216B Advertising Interval	Receiver Scan Window (Minimum)	Receiver Scan Interval (Maximum)
10 ms	23 ms	37 ms
20 ms	13 ms	17 ms

Table 3 – Recommended receiver scan settings

10. Regulatory information

PTM 216B has been certified according to FCC (US), ISED (CA), RED (EU), ARIB (Japan) and ACMA (Australia) regulations. Changes or modifications not expressly approved by EnOcean could void the user's authority to operate the equipment.

10.1 RED for European Market

The Radio Equipment Directive (2014/53/EU, typically referred to as RED) replaces R&TTE directive as regulatory framework for radio products in the European Union. All products sold final customers within the European Union 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

Dolphin 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.

10.2 FCC (United States)

10.2.1 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

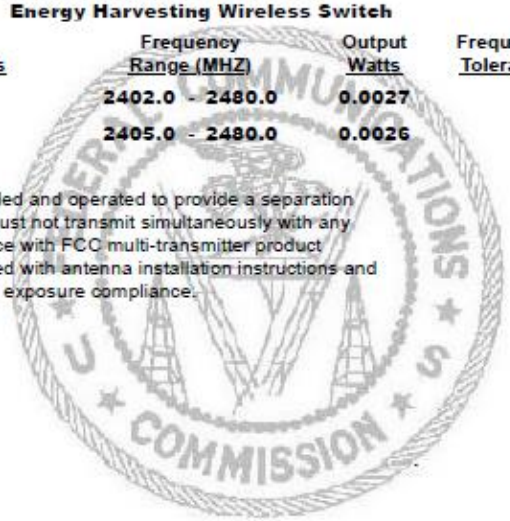
NOT TRANSFERABLE

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.



10.2.2 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.

10.3 ISED (former Industry Canada)

10.3.1 Certificate

TIMCO ENGINEERING, Inc. AN IIA COMPANY — A2LA ACCREDITED CERT # 0955.02 — INDUSTRIAL INSPECTION & ANALYSIS

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

10.3.2 Regulatory Statement

10.3.2.1 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 undesired operation of the device.

This equipment has been tested and found to comply with the limits for a Class B digital device, 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 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

10.3.2.2 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

10.4 **ARIB (Japan) Construction Type Conformity Certification**

CETECOM GmbH
RCB Identifier 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 216B
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-JUK010

Place, date of issue

Essen, 2022-03-10

CETECOM GmbH

Tero Lehtinen / RCB

10.5 ACMA (Australia) Declaration of Conformity

Supplier's declaration of conformity

Australian Government | acma Australian Communications and Media Authority

This is the Australian Communications and Media Authority (ACMA) approved form for a declaration of conformity under the following legislative instruments:

- Radiocommunications Equipment (General) Rules 2021
- Radiocommunications Labelling (Electromagnetic Compatibility) Notice 2017.

Instructions for completion

Do not return this form to the ACMA. This completed form must be retained by the supplier as part of the documentation required for the compliance records and must be made available for inspection by the ACMA when requested.

Supplier's details

Company name (or individual)	RCM Responsible Supplier number
Braco Compliance Pty Ltd	E304
Street Address (Australian)	OR
36 Roe St	ACN/ARBN
Coomera, QLD 4209	84156023504

Product details

Product description – brand name, type, current model, lot, batch or serial number (if available), software/firmware version (if applicable)

EnOcean

Bluetooth® Pushbutton Transmitter Module, Model **PTM 216B**.

Date of manufacture or importation of the original/modified item July 2023

Compliance – applicable standards and other supporting documents

Evidence of compliance with applicable standards may be demonstrated by test reports, endorsed/accredited test reports, certification/competent body statements.
Having had regard to these documents, I am satisfied the above mentioned product complies with the requirements of the relevant ACMA Standards made under the Radiocommunications Act 1992 and the Telecommunications Act 1997.
List these documents including details of the standard title, number and, if applicable, number and, if applicable, number of the test report/endorsed test report or certification/competent body statement

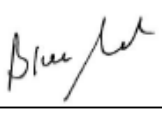
Radiocommunications (Electromagnetic Compatibility) Standard 2017 **EN 55032:2015 + A11:2020 Class B** Electromagnetic compatibility of multimedia equipment – Emission requirements Report No.: 21/11-0027, Dated: 9 March 2022, STC Germany GmbH
Essential Safety Criteria - AS/NZS 3820:2020 **EN62368-1:2014 + A11:2017** Report No.: 21/11-0027, Dated: 3 February 2022, STC Germany GmbH
Radiocommunications Equipment (General) Rules 2021 (Amended 2023) **Schedule 5 Part 15 – Short Range Equipment Standard** **AS/NZS 4268:2017 + A1:2021** **EN 300 330 V2.1.1** Report No.: 21/11-0027, Dated: 4 March 2022, STC Germany GmbH

Declaration

I hereby declare that:

1. I am authorised to make this declaration on behalf of the Company mentioned above,
2. the contents of this form are true and correct, and
3. the product mentioned above complies with the applicable above mentioned standards and all products supplied under this declaration will be identical to the product identified above.
4. I understand that giving false or misleading information is a serious offence.

Note: It is an offence to knowingly provide false or misleading information to a Commonwealth entity or a person who is exercising powers, performing functions under, or in connection with, a law of the Commonwealth. It is an offence to knowingly provide false or misleading information or documents in compliance or purported compliance with a law of the Commonwealth. (See sections 137.1 and 137.2 of the *Criminal Code Act 1995*.)
Penalty: 12 months imprisonment

	Bruce Maule
	Director
	11 July 2023

The *Privacy Act 1988* (Cth) (the Privacy Act) imposes obligations on the ACMA in relation to the collection, security, quality, access, use and disclosure of personal information. These obligations are detailed in the Australian Privacy Principles.
The ACMA may only collect personal information if it is reasonably necessary for, or directly related to, one or more of the ACMA's functions or activities.
The purpose of collecting the personal information in this form is to ensure the supplier is identified in the 'Declaration of conformity'. If this Declaration of Conformity is not completed and the requested information is not provided, a compliance label cannot be applied.
Further information on the Privacy Act and the ACMA's Privacy Policy is available at www.acma.gov.au/privacypolicy. The Privacy Policy contains details about how you may access personal information about you that is held by the ACMA, and seek the correction of such information. It also explains how you may complain about a breach of the Privacy Act and how we will deal with such a complaint.
Should you have any questions in this regard, please contact the ACMA's privacy contact officer on telephone on 1800 226 667 or by email at privacy@acma.gov.au

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11. Product history

Table 4 below lists the product history of PTM 216B.

Revision	Release date	Key changes versus previous revision
DA-04	May 2023	Initial release (upgrade from PTM 215B)

Table 4 – Product History