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**Annex 5 to Test Report # EMCC-110010WB, 2016-09-22**

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**DETAILED INFORMATION ABOUT DUTY CYCLE PROVIDED BY CUSTOMER**

**EQUIPMENT UNDER TEST:**

Device:	PTM 215B
Serial Number:	none
Application:	Wireless Remote Control
Manufacturer:	EnOcean GmbH
FCC ID:	SVZ-PTM215B
IC ID:	5713A-PTM215B
Address:	Kolpingring 18 a 82041 Oberhaching Germany
Phone:	+49 89 6734689-627
Fax:	+49 89 6734689-56

**RELEVANT STANDARD(S):**

47 CFR § 15.249  
RSS-210 Issue 9, Annex B.10

**MEASUREMENT PROCEDURE:**

ANSI C63.10-2013       RSS-Gen Issue 4       Other

## PTM 215B duty cycle



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### General

PTM 215B is device which transmits limited amount of telegrams when triggered to send.

Device transmits radio signal in 3 different channels.

The standard radio channels are fixed:

CH 37: 2402 MHz  
CH 38: 2426 MHz  
CH 39: 2480 MHz

There is an option for the customer to choose any other 3 frequency within the spectrum from 2402 MHz to 2480 MHz.

PTM 215B can operate in two modes:

- Data mode is used to transmit data telegrams reporting the status of PTM 215B button inputs
- Radio-based commissioning mode  
Radio-based commissioning mode is used to commission (teach-in) PTM 215B into a specific receiver or network by means of a specific commissioning telegram.  
This is an alternative for scenarios where NFC commissioning cannot be used.

### Data Mode

Telegram sending is triggered when pulse from energy harvesting generator is detected.

### PTM 215B duty cycle



EnOcean ECO 200 generates pulse on press and on release of the rockers. This means that by one press and then release of the switch max. number of events sent is 6 in one channel as shown on figure 1.



P.No.	Time (µs)	Channel	Access Address	Adv PDU Type	Adv PDU Header	AdvA	AdvData	CRC	PS1 (dBm)	FCS
					Type TxAdd RxAdd PDU-Length					
1	+0	0x27	0x8E99ED4	ADV_PDU	2 1 0 19	0x215B00A0002	0C FF FF FF 92 00 00 00 01 7E EC AA DA	0x2DF98C	-37	OK
2	+19113	0x27	0x8E99ED4	ADV_PDU	2 1 0 19	0x215B00A0002	0C FF FF FF 92 00 00 00 01 7E EC AA DA	0x2DF98C	-37	OK
3	+19237	0x27	0x8E99ED4	ADV_PDU	2 1 0 19	0x215B00A0002	0C FF FF FF 92 00 00 00 01 7E EC AA DA	0x2DF98C	-36	OK
4	+59352	0x27	0x8E99ED4	ADV_PDU	2 1 0 19	0x215B00A0002	0C FF FF FF 92 00 00 00 01 7E EC AA DA	0x2DF98C	-34	OK
5	+172244	0x27	0x8E99ED4	ADV_PDU	2 1 0 19	0x215B00A0002	0C FF FF FF 92 00 00 00 01 7E EC AA DA	0x2DF98C	-36	OK
6	+19103	0x27	0x8E99ED4	ADV_PDU	2 1 0 19	0x215B00A0002	0C FF FF FF 92 00 00 00 01 7E EC AA DA	0x2DF98C	-36	OK

Figure 1. Press and release of the switch

Figure 1 shows data telegrams captured during one press and release in channel 37. The executed Radio transmission sequence does the same in another 2 channels CH 38 and CH 39 respectively.

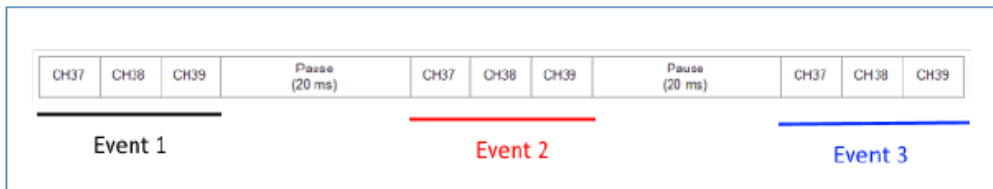


Figure 2. Radio transmission sequence

Within 100 ms is not possible physically to have more than one press and release.

On one press three events are created and each event consists of three telegrams (figure 2.).

#### Total transmission time

Total number of bytes we transmit in the air per telegram is 29 bytes.

There is an option to transmit extra 4 bytes on customer request.

Each telegram, if we transmit standard 29 bytes is 281 µs long and pause between each is 102 µs (Figure 3).

Duration per one byte is then 9.7 µs. In case we transmit 4 extra bytes (total 33 bytes) each telegram will be 320 µs long.

After 3 telegrams (1 event) there is pause of around 20 ms (Figure 4).

PTM 215B duty cycle

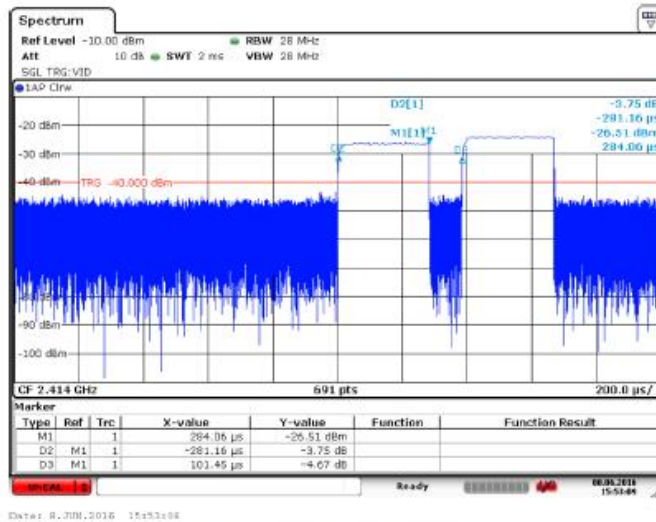


Figure 3. Length of data telegrams

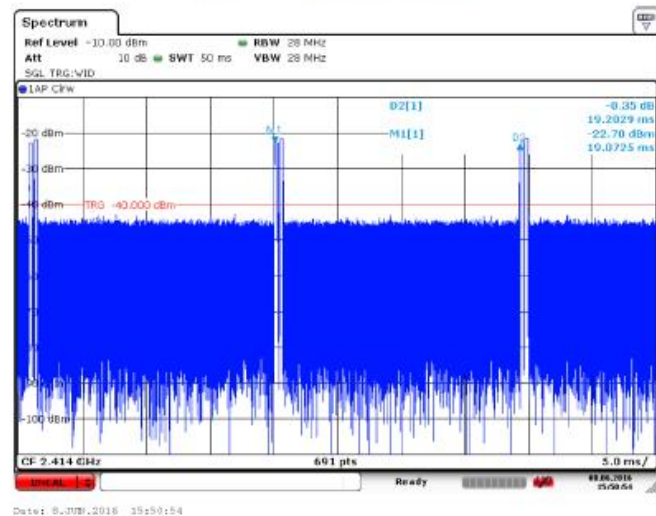


Figure 4. Transmission of data events on press of the rocker  
(3rd telegram is missing due to the limited bandwidth of the measuring device)

Duty cycle calculation for data telegrams in case of one press and release

If we observe 100 ms period, max. number of events transmitted is 3 events on press of the rocker and 3 events on release of the rocker. Physically we cannot press and release rockers more than 1 time in 100 ms.

This result in total 18 telegrams being transmitted in 100 ms period.

Since each telegram is 281 µs long, total on time in 100 ms period when we sum all channels is:  
 $281\mu\text{s} \times 18 = 4215\mu\text{s} = \underline{5.1\text{ ms}}$

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### PTM 215B duty cycle



Total on time per single channel is  $281 \mu\text{s} \times 6 = \underline{1.7 \text{ ms}}$ .

*Duty cycle is then:*

If we observe total on time in all channels:

- Total on time = 5.1 ms
- Interval = 100 ms
- Duty cycle = 5.1 %

If we observe total on time per channel:

- Total on time = 1.7 ms
- Interval = 100 ms
- Duty cycle = 1.7 %

#### Worst case duty cycle

Worst case we have when we transmit data telegrams with extra 4 bytes which result in telegram length of  $320 \mu\text{s}$  (33 bytes).

*Duty cycle is then:*

Total on time:  $320 \mu\text{s} \times 3 \text{ Events} \times 3 \text{ Telegrams/Event} \times 2 = \underline{5.8 \text{ ms}}$

- Total on time = 5.8 ms
- Interval = 100 ms
- Duty cycle = 5.8 %

Total on time per channel:  $320 \mu\text{s} \times 3 \text{ Events} \times 1 \text{ Telegram/Event} \times 2 = \underline{1.9 \text{ ms}}$

- Total on time per channel = 1.9 ms
- Interval = 100 ms
- Duty cycle = 1.9 %

#### **Duty cycle calculation in data mode with one press of the rocker**

If we observe 100 ms period, max. number of events transmitted is 3 events on press of the rocker.

Physically we cannot press rockers more than 1 time in 100 ms.

This result in total 9 telegrams being transmitted in 100 ms period.

Since each telegram is  $281 \mu\text{s}$  long, total on time in 100 ms period when we sum all channels is:  
 $281 \mu\text{s} \times 9 = 2529 \mu\text{s} = \underline{2.53 \text{ ms}}$

Total on time per single channel is  $281 \mu\text{s} \times 3 = \underline{0.84 \text{ ms}}$ .

*Duty cycle is then:*

If we observe total on time in all channels:

- Total on time = 2.53 ms

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### PTM 215B duty cycle



- Interval = 100 ms
- Duty cycle = 2.53 %

If we observe total on time per channel:

- Total on time = 0.84 ms
- Interval = 100 ms
- Duty cycle = 0.84 %

#### Worst case duty cycle

Worst case we have when user chooses to transmit data telegrams with extra 4 bytes which result in telegram length of 320 μs (33 bytes).

*Duty cycle is then:*

Total on time:  $320 \mu\text{s} \times 3 \text{ Events} \times 3 \text{ Telegrams/Event} = \underline{2.88 \text{ ms}}$

- Total on time = 2.88 ms
- Interval = 100 ms
- Duty cycle = 2.88 %

Total on time per channel:  $320 \mu\text{s} \times 3 \text{ Events} \times 1 \text{ Telegram/Event} = \underline{0.96 \text{ ms}}$

- Total on time per channel = 0.96 ms
- Interval = 100 ms
- Duty cycle = 0.96 %

### PTM 215B duty cycle

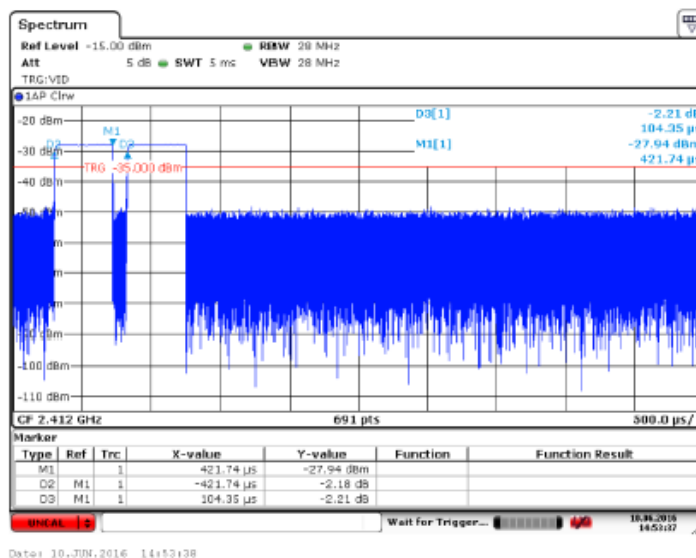


#### Commissioning mode

Device can also transmit in commissioning mode. In this case we transmit 47 bytes per telegram. In commissioning mode we transmit only 2 events on press of the rockers and 2 events on release of the rockers which result in total 12 transmitted telegrams (figure 6). This is max. what we can transmit in 100 ms period.

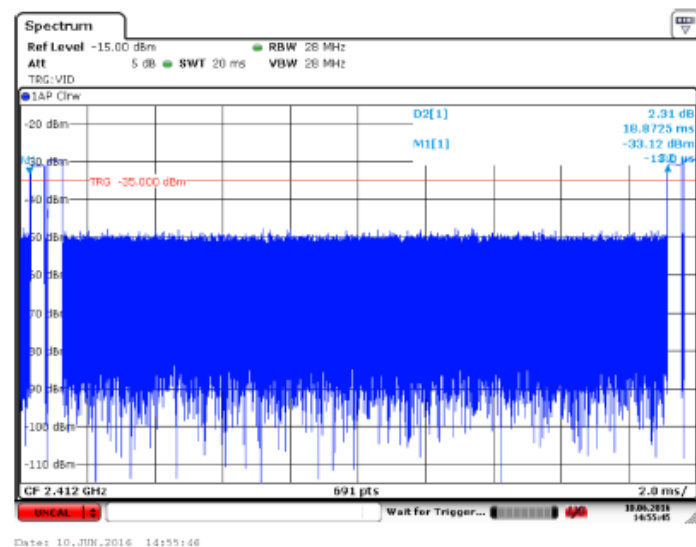
Total on time in 100 ms period when we sum all channels is  $422 \mu\text{s} \times 12 = 5.1 \text{ ms}$ .

Total on time per channel is  $422 \mu\text{s} \times 4 = 1.7 \text{ ms}$ .



Date: 10. JUN. 2016 14:53:38

Figure 5. Length of Commissioning telegram



Date: 10. JUN. 2016 14:55:48

Figure 6. Transmission of commissioning events on press of the rocker  
(3rd telegram is missing due to the limited bandwidth of the measuring device)

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### PTM 215B duty cycle



#### **Duty cycle calculation for commissioning telegrams**

If we observe 100 ms period, max. number of events transmitted in this mode is 2 events on press of the rocker and 2 events on release of the rocker. Physically we cannot press and release rockers more than 1 time in 100 ms.

This result in total 12 telegrams being transmitted in 100 ms period.

Since each telegram is 422  $\mu$ s long, total on time in 100 ms period when we sum all channels is:  
 $422 \mu\text{s} \times 12 = \underline{5.1 \text{ ms}}$

Total on time per single channel is  $422 \mu\text{s} \times 4 = \underline{1.7 \text{ ms}}$ .

#### ***Duty cycle is then:***

If we observe total on time in all channels:

- Total on time = 5.1 ms
- Interval = 100 ms
- Duty cycle = 5.1 %

If we observe total on time per channel:

- Total on time = 1.7 ms
- Interval = 100 ms
- Duty cycle = 1.7 %



PTM 215B duty cycle**Conclusion**

PTM 215 B observed in 100 ms transmission period does not have duty cycle bigger than 6%.

The maximums show that in operation mode worst case duty cycle is 5.8% when extra 4 bytes bytes are transmitted over all 3 radio channels.

Standard operation mode transmissions (29 bytes) or commissioning mode transmissions duty cycle have the same value of 5.1 % over all 3 radio channels.