

USB 300 / USB 400J / USB 500U  
USB Gateway for EnOcean Radio

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Observe precautions! Electrostatic sensitive devices!

Patent protected:

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

**REVISION HISTORY**

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

Version	Author	Reviewer	Date	Major Changes
1.7	MK	MKA, CB	01.06.2017	RED and Layout change
1.8	MK		17.04.2019	USB 300 chip -> PCB antenna, USB 400J USB plug shifted 1 mm for more housing clearance and USB 500U introduced

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**Important!**

This information describes the type of component and shall not be considered as assured characteristics. No responsibility is assumed for possible omissions or inaccuracies. Circuitry and specifications are subject to change without notice. For the latest product specifications, refer to the EnOcean website: <http://www.enocean.com>.

As far as patents or other rights of third parties are concerned, liability is only assumed for modules, not for the described applications, processes and circuits.

EnOcean does not assume responsibility for use of modules described and limits its liability to the replacement of modules determined to be defective due to workmanship. Devices or systems containing RF components must meet the essential requirements of the local legal authorities.

The modules must not be used in any relation with equipment that supports, directly or indirectly, human health or life or with applications that can result in danger for people, animals or real value.

Components of the modules are considered and should be disposed of as hazardous waste. Local government regulations are to be observed.

Packing: Please use the recycling operators known to you.

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USB 300 / USB 400J / USB 500U  
USB Gateway for EnOcean Radio**1. INTRODUCTION**

USB 300/400J/500U is an EnOcean transceiver module with gateway controller software and USB interface. It can be directly connected to PC's or smart home servers. Example picture of USB 500U.



The USB stick provides bidirectional EnOcean radio protocol to devices with USB interface. Radio messages are sent and received through a virtual serial interface (FTDI Virtual COM Port). In addition the USB stick provides detailed telegram information like signal strength (RSSI).

Available frequencies:

- 868.300 MHz: USB 300 with RED approval (EU)
- 902.375 MHz: USB 500U with FCC and IC approval (US/CA)
- 928.350 MHz: USB 400J with ARIB approval (Japan)

USB 300/400J/500U includes a TCM radio module with EnOcean Gateway Controller software (not customer programmable). Further information about supported commands and features can be found within the TCM user manuals:

USB 300 (TCM 310): [http://www.enocean.com/en/enocean\\_modules/tcm-310](http://www.enocean.com/en/enocean_modules/tcm-310)

USB 400J (TCM 400J): <https://www.enocean.com/en/enocean-modules-928mhz/details/tcm-410j/>

USB 500U (TCM 500U): <https://www.enocean.com/en/enocean-modules-902mhz/details/tcm-515u/>

## 2. TECHNICAL DATA & ENVIRONMENTAL CONDITIONS

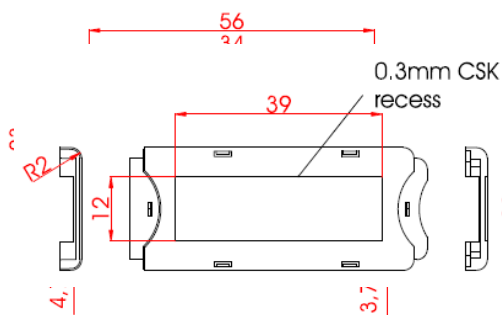
### Features overview

<b>Frequency/antenna</b>	USB 300: 868.300 MHz / PCB antenna USB 500U: 902.875 MHz / PCB antenna USB 400J: 928.350 MHz / PCB antenna
<b>Data rate</b>	125 kBit/s
<b>Modulation type</b>	USB 300: ASK 868 MHz <sup>1)</sup> USB 500U: FSK 902 MHz <sup>1)</sup> USB 400J: FSK 928 MHz <sup>1)</sup>
<b>Receiver Sensitivity</b> (at 25°C) <sup>2)</sup>	USB 300: typ. -96 dBm <sup>2)</sup> USB 500U: typ. -98 dBm <sup>2)</sup> USB 400J: typ. -95 dBm <sup>2)</sup>
<b>Receiver Category</b> (RED, EN 300 220)	2 (standard performance)
<b>Output Power</b>	USB 300: max. 6,7 dBm (radiated) USB 500U: typ. 1 dBm (conducted) USB 400J: typ. 0 dBm (conducted)
<b>Dimensions</b> (incl. cap)	70 x 23 x 9 mm
<b>OEM label size</b>	39 x 12 mm
<b>USB connector</b>	Typ A
<b>Operating temperature</b>	-20°C to +50°C (max. 90% r.h.)
<b>Radio Regulations</b>	USB 300: RED (EU) USB 300U: FCC (US) / ISED (CA) USB 400J: ARIB (Japan)

1) According to ISO/IEC 14543-3-1x

2) 0.1% telegram error rate (based on the combination of 3 received sub-telegrams).  
 USB extension cable is recommended for best performance.

### Housing:



OEM Label

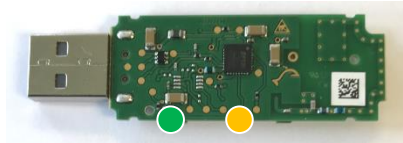
12 (+/- 0.5)



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**USB 300 (stepcode >=DC) and USB 400J:**



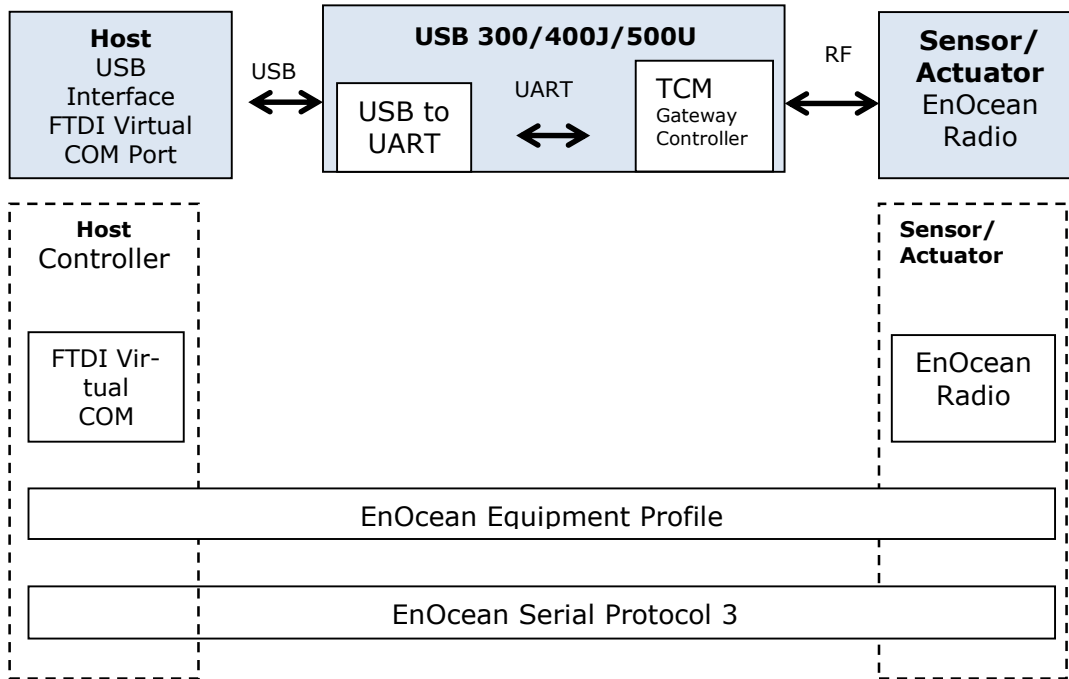
- USB Power LED
- USB transfer active

**USB 500U:**



- USB Power LED
- USB transfer active

### 3. BLOCK DIAGRAM AND PROTOCOL LAYERS



#### 4. DOCUMENTATION OF PROTOCOLS AND ENOCEAN PROFILES

- Plug'n play device drivers are available from USB chip manufacturer FTDI for the operating systems Microsoft Windows, Linux and Apple Mac OS:  
<http://www.ftdichip.com/FTDrivers.htm>
- If you want to develop for other host platforms, you can use or adapt available C-source code for Linux OS from FTDI Website:  
<http://www.ftdichip.com/Drivers/VCP.htm>
- USB stick uses EnOcean Serial Protocol 3 for control commands and data communication. A description of ESP 3 is available at:  
<http://www.enocean.com/en/knowledge-base/>
- The content of EnOcean radio telegrams is standardized by the EnOcean Alliance. You will find the latest definition of EnOcean Equipment Profiles (EEP) at:  
<http://www.enocean-alliance.org/>
- **Attention:**  
**The USB stick has been designed for gateway applications, some radio telegrams (e.g. Smart Acknowledge RORGs 0xC6/C7/A7/D0) will be internally processed and not sent to host. For the same reason measurement of sub telegram amount and timing is not supported. It is not customer programmable with DolphinSniffer software.**

**For detailed protocol tracing it is strongly recommended to use TCM 320 or STM 300 on adapter with DolphinSniffer from the EnOcean Developer Kit.**

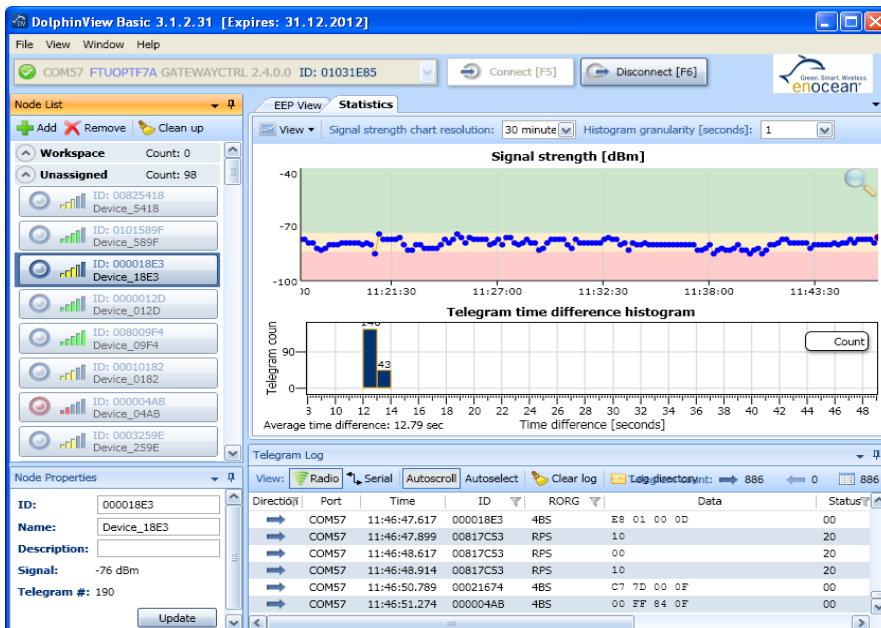


## 5. ADDITIONAL FEATURES OF USB 300/400J/500J

- The USB stick can be configured as repeater of EnOcean telegrams; this will expand the range of radio devices. In addition the USB stick can filter EnOcean telegrams; this can avoid heavy data load for the host system.
- For USB 300 the configuration has to be done at every startup. USB 400J and USB 500J will store repeater configurations in a flash memory. For details see ESP3 command description.
- The USB stick supports remote management of self-powered radio nodes. For details see ESP3 command description of REMOTE\_MAN command.
- The USB stick supports smart acknowledge of self-powered radio nodes internally. This feature enables bidirectional communication for self-powered radio nodes.
- Commands are defined within TCM Gateway Controller and ESP3 documentation, this is available at: <http://www.enocean.com/en/knowledge-base/>
- For advanced analysis and protocol debugging we recommend EnOcean Developer Kit EDK with DolphinView Advanced and DolphinSniffer.

## 6. FIRST STEPS WITH USB 300/400J/500U AND DOLPHINVIEW

1. Register download and install DolphinView:  
<http://www.enocean.com/en/download/>
2. Plug USBstick to an USB port of the PC.  
 (USB extension cable is recommended for best performance)
3. Start DolphinView and connect to COM port
4. Press self-powered switch or learn button of sensor,  
 DolphinView will display telegram



## 7. PRODUCT SAFETY AND ADDITIONAL HINTS

- USB stick should not be exposed to rapid temperature changes shortly before or during operation. Condensation of moisture might damage the device.
- USB stick is not intended to be used in rough environment with heavy vibrations or mechanical shocks.
- The USB stick front cap is used as handling protection during delivery.
- In order to optimize radio performance use an USB extension cable.
- Installation location of radio nodes should be carefully planned. Application note AN001 at <http://www.enocean.com/en/application-notes/> will explain basic rules.
- Any USB stick configurations done by ESP3 commands (e.g. repeater on, filter, maturity time) will be lost in case of power off. If you need these configurations permanent, make sure USB stick has continues power or re-send commands after power down.
- USB stick has been designed for usage with DolphinView. For advanced protocol analysis and debugging we recommend the usage of EnOcean Developer Kit with DolphinView Advanced and DolphinSniffer.
- USB stick has been optimized for cyclic sending/receiving status values and not for continuous data communication; therefore the radio interface is limited to receive approx. 90 telegrams per second. Higher traffic can lead to telegram loss.
- Microsoft Windows increases the COM port number for every installed USB stick (FTDI virtual COM port device). If the number reaches 255, you have to reset the device driver and follow the instructions from the company FTDI.

## 8. LEGAL ISSUES AND APPROVALS

USB 300 has been designed and tested to fulfil the requirements of CE/RED for the European Union, USB 500U fulfils FCC/ISED (US/CA) and USB 400J ARIB (Japan). Approvals and certifications are based on the delivered radio module hardware with internal antenna and the built-in firmware. According to RED it is not allowed to change hardware and/or firmware.

### Radio Equipment Directive (RED) for the European Union

USB 300 is delivered to OEM manufacturers for their use as final (branded) product. OEM manufacturers or distributors have to take care about legal issues of selling products to the European market. At least following topics have to be considered

- Product labeling or documentation containing full postal address of the manufacturer as well as radio frequency band and max. transmitting power
- User manual, safety information and a declaration of conformity for the final product in local language
- Provide product development and test documentation upon request
- Fulfillment of country specific registration and recycling regulations of electronic waste and packaging material (WEEE)

Duty cycle lock for 868.3 MHz variant:

According to the radio approval for the European Union, the transmission time for the 868.3 MHz frequency band is limited to a duty cycle of 1% (calculated per hour). For details see EN 300 220 and ERC recommendation 70-03.

In order to ensure the 1% duty cycle limit, a watcher function is implemented in firmware. This watcher limits the transmission of telegrams beyond the defined 1 % boundary. If the amount of transmitted bytes exceeds 1% (= 562.5 kByte gross transmitted bytes) in the observed hour, it will block transmission for max. 6 minutes.

The implementation works as follows. The 60 minute regulatory interval is divided into 10 rolling time slots of 6 minutes. For each of these time slots, the amount of transmitted bytes is recorded. New telegrams will only be transmitted, if the transmitted byte sum of the 10 observed time slots (this incl. the current slot) and the byte count of current telegram is below 1% limit, which means less than 562.5 kByte gross bytes transmitted.

Remarks:

In order to transmit telegrams with EnOcean Equipment Profile (EEP) content, additional information(e.g. preamble, checksum, ...) is need for the physical layer of the air interface (ISO/IEC 14543-3-10). By default most devices will send 3 redundant sub-telegrams with the same telegram content.

Following table provides some sub-telegram examples:

Telegram type	EEP length (byte)	Radio (byte)	Tx time (ms)	max sub-tel/h	max telegram/h
RPS/1BS	7	15	0.96	37,500	12,500

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4BS	10	19	1.216	29,605	9,868
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**FCC (US)**

USB 500U (902MHz) is based on the EnOcean TCM 515U radio module. This hardware has a limited modular approval according to FCC. The conformity has been proven and the according documentation has been deposited at EnOcean.

*Contains FCC ID: SZV-TCM515U*

*The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:*

- (i.) this device may not cause harmful interference and*
- (ii.) this device must accept any interference received, including interference that may cause undesired operation.*

**ISED (former Industry Canada)**

USB 500U (902MHz) is based on the EnOcean TCM 515U radio module. This hardware has a limited modular approval according to FCC. The conformity has been proven and the according documentation has been deposited at EnOcean.

*Contains IC: 5713A-TCM515U*

*The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:*

- (i.) this device may not cause harmful interference and*
- (ii.) this device must accept any interference received, including interference that may cause undesired operation.*

**ARIB (Japan)**

USB 400J (928MHz) is based on the EnOcean TCM 410J radio module. This hardware has an approval according to ARIB STD-T108. The conformity has been proven and the according documentation has been deposited at EnOcean.

When the product is placed on the Japanese market, it must carry the Specified Radio Equipment marking as shown below:

