

Energy Harvesting Temperature Sensor Transmitter Module  
STM 330 / STM 331 / STM 331U / STM 332U / STM 333U  
(Stepcode DE and later)

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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 the first version of this document:

No	Major Changes
0.55	Initial version
0.90	New drawings added; Agency certifications added; Charging circuitry modified; editorial changes
0.91	Drawings updated
0.95	Parameters of A/D converter corrected and specified in more detail; Charging circuitry modified.
0.99	Pin for connection of backup battery changed; ICHAR modified, drawings updated
1.00	Block diagram and pin description modified.
1.01	Table in 2.11 modified
1.02	Remark added in 3.5; additional remarks in 2.11; label information modified in chapter 5; Shelf life added in 1.4; supply voltage for programming added in 2.2; Conducted output power replaced by radiated output power in 1.2; programming interface added in 2.3.2; other editorial changes
1.03	Support for HSM 100 humidity sensor module added
1.04	Specification of shelf life improved; figure added in 3.3.1; Chapter Related Documents added.
1.05	STM 331 with helix antenna added (naming + helix antenna description), hints to update module via STMSEN
1.10	Product variants STM 332U and STM 333U added
1.15	Included PCB Drawings of STM 332U / STM 333U
1.20	Added information on connector type
1.30	Added advanced security information of firmware STM 330 / STM 331. Default manufacturer ID code is EnOcean.
1.31	Improved ext. button circuit example to avoid keybounce of digital inputs, deleted STM 300C, R&TTE -> R&TTE / RED, deleted EOP 300
1.4	New Dolphin layout, STM 330C deleted, Added STM 331U, R&TTE -> RED
2.0	Update with long term energy storage replacement, additional transport mode for shelf storage & air cargo, optimized secure mode, additional information on market approval for secondary battery, new drawings, new QR code and deleted 315 MHz antenna description, brand changed

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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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## 1 RELATED DOCUMENTS

STM 33x modules are available in several frequency, antenna and button position variants:

- STM 330 (868.3 MHz, whip antenna, vertical/backside oriented LRN button)
- STM 331 (868.3 MHz, helical antenna, vertical/backside oriented LRN button)
- STM 331U (902.875 MHz, helical antenna, vertical/backside oriented LRN button)
- STM 332U (902.875 MHz, whip antenna, side oriented LRN button)
- STM 333U (902.875 MHz, helical antenna, side oriented LRN button)

This document describes operation of STM 330, STM 331U, 331C, STM 332U, STM 333U modules with their built-in firmware.

If you want to write own firmware running on the integrated micro controller or need more detailed information on the Dolphin core please also refer to Dolphin Core Description and Dolphin API Documentation at: <http://www.enocean.com/en/knowledge-base/>

If you want to connect other generic sensors to STM 33x (former STM 310 applications), you can download STEMSEN Software from following link:  
<http://www.enocean.com/en/download/>

Module can be configured and/or programmed via EDK 350 / EOP 350 programmer board.

For mechanical integration please refer to our 3D drawings found at  
[http://www.enocean.com/en/enocean\\_modules/stm-330/](http://www.enocean.com/en/enocean_modules/stm-330/)

If you want to add a humidity sensor please refer to the HSM 100 data sheet at  
[http://www.enocean.com/en/enocean\\_modules/stm-330/](http://www.enocean.com/en/enocean_modules/stm-330/)

In addition we recommend following our [application notes](#), in particular AN102: Antenna Basics – Basic Antenna Design Considerations for EnOcean based Products

## 2 GENERAL DESCRIPTION

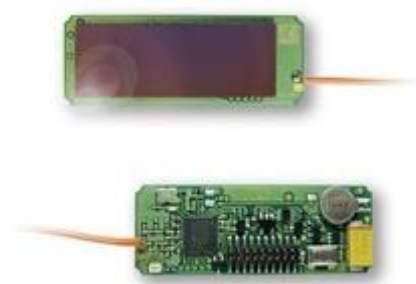
**This user manual specifies STM 33x modules with stepcode DE or later:**

- See chapter "6.1 Product Label" to find out the module stepcode
- User manual for older modules can be downloaded from the product website
- For a detailed description of product changes see Product Change Notification (PCN).

### 2.1 Basic functionality

The extremely power saving RF transmitter module family STM 33x of EnOcean is optimized for realization of wireless and maintenance free temperature sensors, or room operating panels including set point dial and occupancy button. It requires only a minimum number of external components and provides an integrated and calibrated temperature sensor.

Power supply is provided by a small pre-installed solar cell, an external energy harvester, or an external 3 V backup battery.



Exemplary image

An energy storage element is installed in order to bridge periods with no supply from the energy harvester. The module provides a user configurable cyclic wake up.

After wake up, the internal microcontroller reads the status of the temperature sensor and optional set point dial. A radio telegram will be transmitted in case of a significant change of measured temperature or set point values or if the external occupancy button is pressed. In case of no relevant input change, a redundant retransmission signal is sent after a user configurable number of wake-ups to announce all current values.

In addition to the cyclic wake-up, a wake up can be triggered externally using the input for the occupancy button or the internal LRN button.

All variants include the enhanced secure mode. In enhanced secure mode the communication is protected by enhanced security features e.g. encryption and authentication. The modules can be switched from transport mode to standard or secure mode. The firmware can be configured to use different EEPs according to the availability set point dial and occupancy button.

#### Features with built-in firmware

- Pre-installed solar cell with energy storage and charging circuit
- On-board LRN button
- On-board Tx indicator LED
- Calibrated internal temperature sensor
- On board connector for external occupancy button and set point dial input
- Configurable wake-up and transmission cycle
- Wake-up via Wake pins or LRN button

- Support for humidity sensor module HSM 100
- Communication protected by enhanced security features  
(to enable this feature, the receiver or gateway has to support EnOcean security)

### **Features accessible via API**

Using the Dolphin API library it is possible to write custom firmware for the module, the API provides:

- Integrated 16 MHz 8051 CPU with 32 kB FLASH and 2 kB SRAM
- Integrated temperature sensor
- Various power down and sleep modes down to typ. 0.2 µA current consumption
- Up to 13 configurable I/Os
- 10 bit ADC, 8 bit DAC

## 2.2 Technical data

<b>Available variants</b>	STM 330: 868.3 MHz, whip, back button frequency, antenna, learn button STM 331: 868.3 MHz, helical, back button STM 331U: 902.875 MHz, helical, back button STM 332U: 902.875 MHz, whip, side button STM 333U: 902.875 MHz, helical, side button
<b>Radio standard</b>	EnOcean 902 MHz / 868 MHz
<b>Data rate/Modulation type</b>	125 kbps / ASK (868 MHz), FSK (902 MHz)
<b>Radiated output power</b>	STM 330: +8 dBm <sup>1</sup> (EIRP) ± 2.5 dB <sup>2</sup> STM 331: +5 dBm <sup>1</sup> (EIRP) ± 2.5 dB <sup>2</sup> STM 331U: +99 dBµV/m <sup>1</sup> ± 2 dB <sup>2</sup> STM 332U: +101 dBµV/m <sup>1</sup> ± 2 dB <sup>2</sup> STM 333U: +99 dBµV/m <sup>1</sup> ± 2 dB <sup>2</sup>
<b>Power supply @ VDD</b>	Pre-installed solar cell Illumination 50-100000 lux 2.1 V–5.0 V, 2.6 V needed for start-up
<b>Operation time in darkness @ 25°C</b>	min. 10 days, if energy storage fully charged <sup>3</sup>
<b>Operation start up time with empty energy store</b>	typ. <2.5 min @ 400 lux / 25 °C incandescent or fluorescent light
<b>Input channels</b>	Internal: temperature sensor, LRN button External: occupancy button, set point dial, HSM 100
<b>Temperature sensor</b>	Measurement range 0-40 °C, resolution 0.16 K Accuracy typ. ±0.5 K between 17 °C and 27 °C typ. ±1 K between 0 °C and 40 °C
<b>EnOcean Equipment Profiles</b>	configurable EEPs: A5-02-05 (default), A5-02-30, A5-10-05, A5-10-03 and with HSM 100: A5-04-01, A5-10-10, A5-10-12 SIGNAL 0x0E (Entering Transport Mode)
<b>Connector</b>	20 pins, grid 1.27 mm, □ 0.4 mm
<b>Radio regulations</b>	RED (EU): STM 330 / STM331 FCC (US) / ISCED (CA): STM 331U / STM 332U / 333U
<b>Encryption algorithms</b>	VAES 128 / CMAC

<sup>1</sup> Measured in test laboratory, measurement uncertainty 2.7 dB

<sup>2</sup> Tolerance of measurement in production at 50 Ω

<sup>3</sup> At default configuration (wake-up cycle 100 s, transmission cycle 1000 s).

Energy storage performance degrades over life time, especially if energy storage is long time exposed to very high temperatures. High temperatures will accelerate aging. Very low temperature will temporary reduce capacity of energy store and this leads to considerable shorter dark time operation.



## 2.3 Physical dimensions

### PCB dimensions

43±0.2 x 16±0.3 x 1±0.1 mm

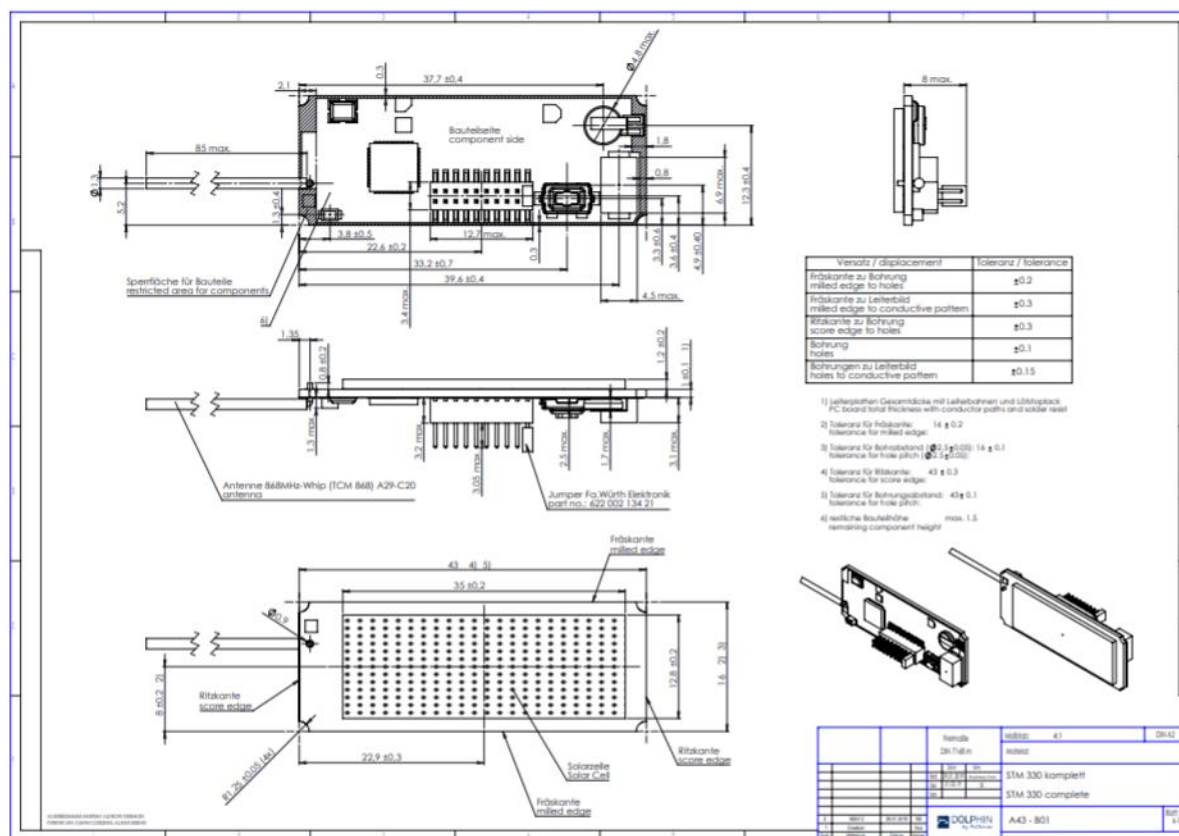
### Module height

8 mm

### Weight

4.5 g

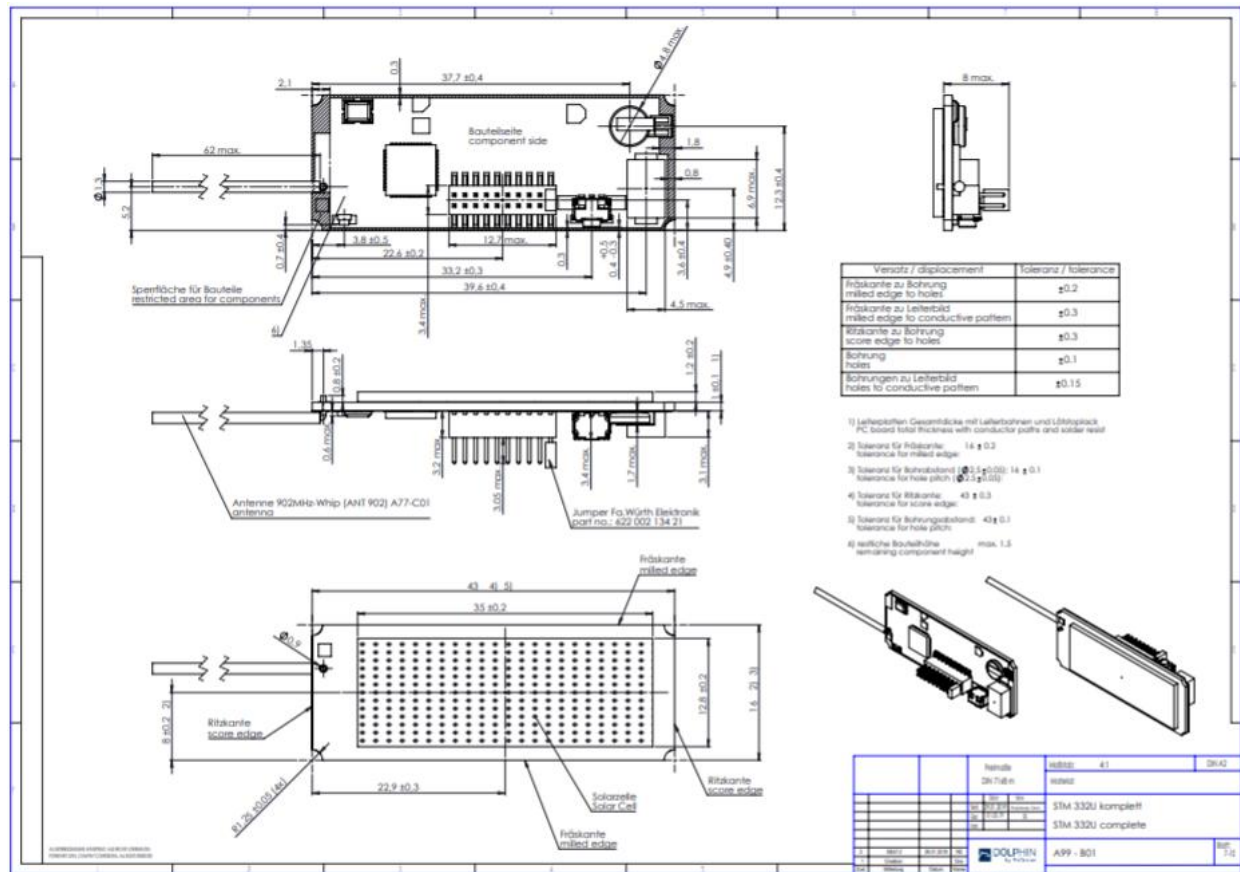
### 2.3.1 Mechanical outline of STM 330







### 2.3.4 Mechanical outline of STM 332U





## 2.4 Environmental conditions

<b>Operating temperature</b>	-20 °C ... +60 °C
<b>Storage temperature</b>	-20 °C ... +60 °C, recommended <sup>4</sup> : +10 °C...+30 °C, <60%r.h.
<b>Shelf life (in absolute darkness)</b>	36 months after delivery
<b>Humidity</b>	0% ... 93% r.h., non-condensing



**Deep discharge of the energy storage leads to degradation of performance. Radio modules will be delivered in transport mode to avoid this. If there is a storage time after configuration or commissioning, the radio module has to be switched back to transport mode to reduce power consumption to a minimum.**



If a storage time of more than 36 months is required, the energy storage (MS414FE) has to be recharged (e.g. 2 days @ 1.000 lux) or with external 3.1 V.



The module shall not be placed on conductive materials, to prevent discharge of the internal energy storages. Even materials such as conductive foam (ESD protection) may have negative impact.

## 2.5 Ordering Information

Type	Ordering Code	Frequency	Note
<b>STM 330</b>	<b>S3001-D330</b>	<b>868.3 MHz</b>	whip antenna, back oriented LRN button
<b>STM 331</b>	<b>S3001-D331</b>	<b>868.3 MHz</b>	helical antenna, back oriented LRN button
<b>STM 331U</b>	<b>S3051-D331</b>	<b>902.875 MHz</b>	helical antenna, back oriented LRN
<b>STM 332U</b>	<b>S3051-D332</b>	<b>902.875 MHz</b>	whip antenna, side oriented LRN button
<b>STM 333U</b>	<b>S3051-D333</b>	<b>902.875 MHz</b>	helical antenna, side oriented LRN button

### 3 FUNCTIONAL DESCRIPTION

#### 3.1 Commissioning and mode change

The module will be shipped in transport mode to switch off the energy store for long term shelf storage and air cargo. The mode can be changed by pressing the learn button. The procedure for enter the standard mode has not been changed to keep compatible with modules before stepcode DE.

Make sure that the solar cell will get enough light for mode change and/or learn telegram.

##### ■ Change from transport to standard mode

After pressing the learn button 1x short (1s) the radio module will enter Standard Mode (Mode 1). The LED will flash 1x and a standard learn telegram will be sent.

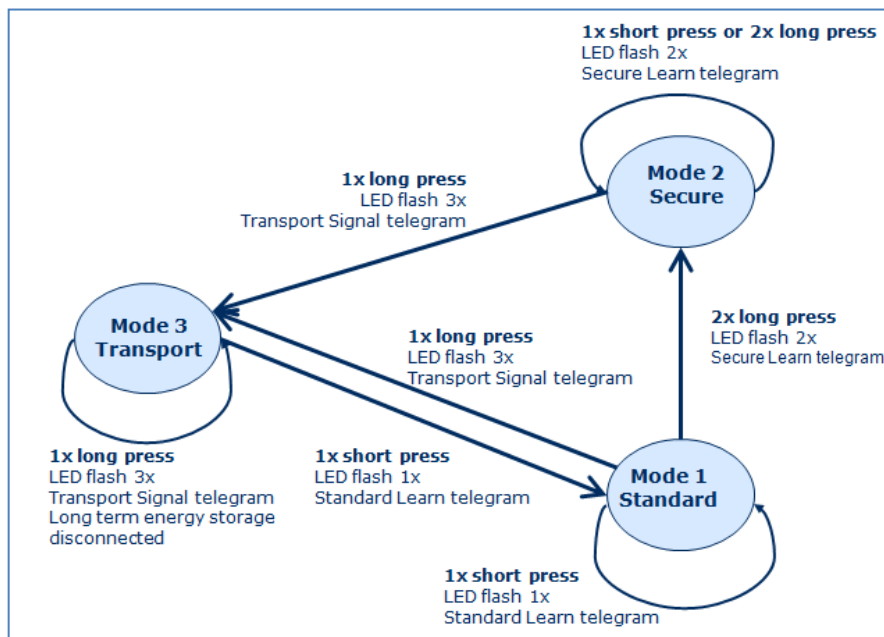
##### ■ Change from standard to secure mode

After pressing the learn button 2x long (2x 5s, pause <1s) the radio module will enter Secure Mode (Mode 2). A secure learn telegram will be sent and the LED will flash 2x.

##### ■ Change from secure or standard mode to transport mode

After pressing the learn button 1x long (5s) the radio module will enter Transport Mode (Mode 3). A signal telegram will be sent and the LED will flash 3x.

The following diagram illustrates all implemented mode transitions.



Short press: **1 s** (firmware 0.1 – 3.0 s)

Long press: **5 s** (firmware 3 – 7 s)

2x long press with very short pause of max. 1 s between



Customers can adapt the mode change options via module configuration:

- \* Transport/Standard/Secure Mode change on (default see diagram above) or
- \* limited to Transport & Secure Mode (details [support@enocean.com](mailto:support@enocean.com)) or
- \* limited Transport & Standard Mode (details [support@enocean.com](mailto:support@enocean.com))

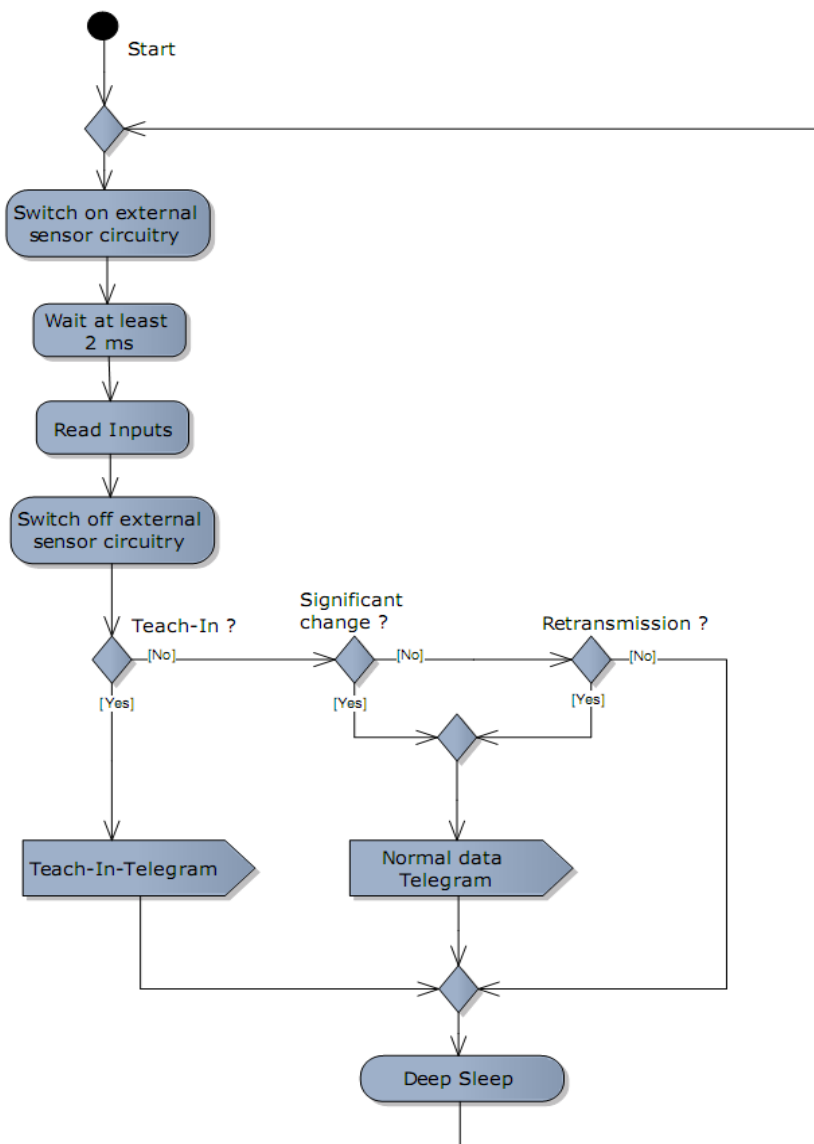


Before changing the operating mode please make sure to clear the device from all receivers which have been taught to work with this device before. Otherwise the receiver will ignore the telegrams and the application will not work.



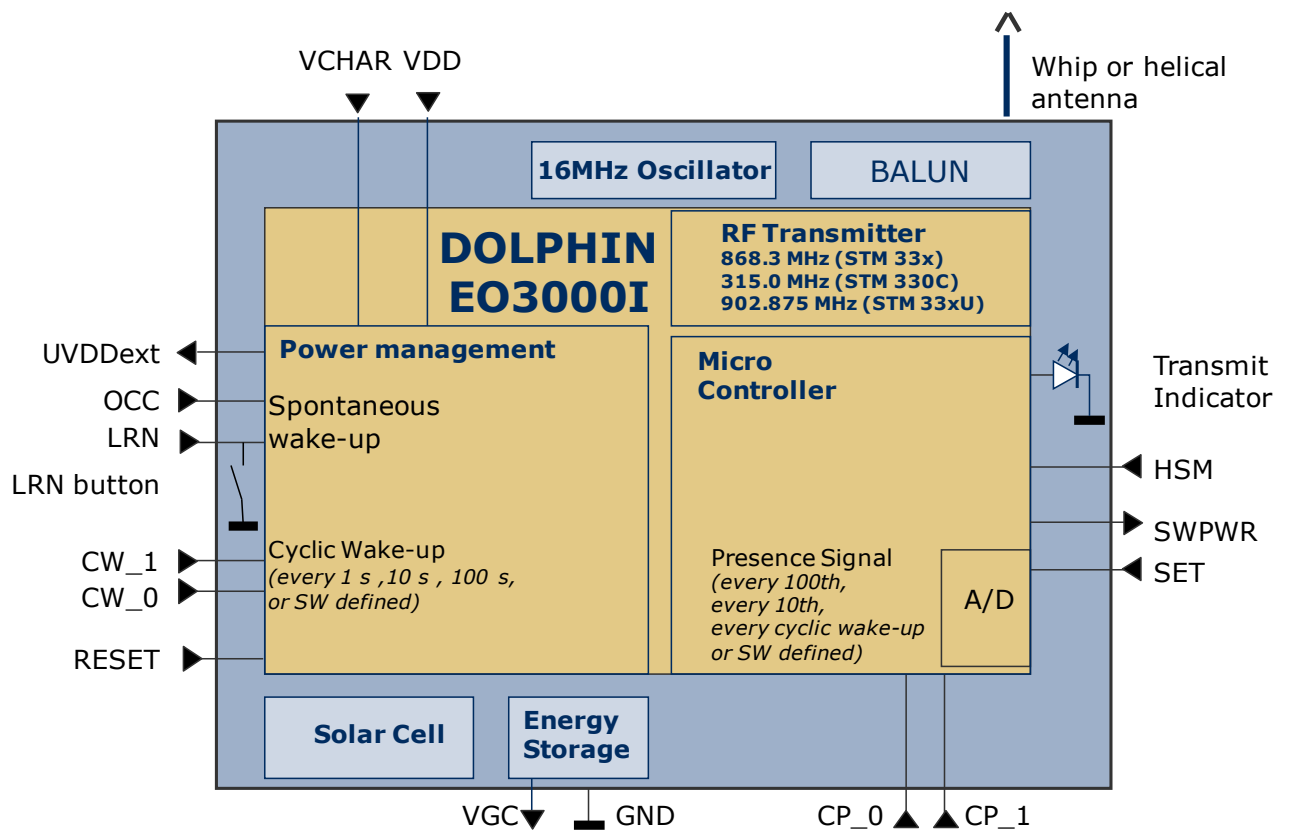
The flag for actual mode itself is stored in non-volatile memory. After power down reset the previous selected mode is active. The mode change is limited to 50 times. In normal application scenario only very few are required.

### 3.2 Simplified firmware flow chart for standard /secure mode



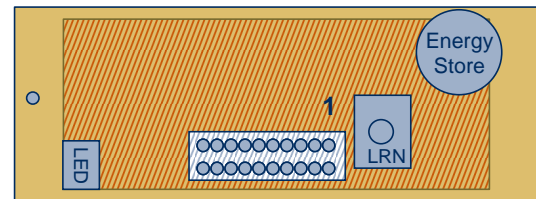


### 3.3 Simplified device block diagram



### 3.4 Pin out

UVDDext	1	○	○	2	WAKE0
WAKE1	3	○	○	4	VGC
GND	5	○	○	6	VCHAR
PROG_EN	7	○	○	8	SWPWR
ADIO0	9	○	○	10	ADIO3
ADIO1	11	○	○	12	ADIO4
ADIO2	13	○	○	14	ADIO6
RESET	15	○	○	16	ADIO7
RSDADIO3	17	○	○	18	SCLKDIO1
WSDADIO2	19	○	○	20	SCSEDIO0



The figure above shows the pin out and location of the extension connector provided by STM 33x modules. The connector pins are named according to the naming of the EO3000I chip to simplify usage of the DOLPHIN API.

The connector type is Samtec FTSH-110-01-L-DV-P-TR or a functional equivalent. Please refer to Samtec for detailed drawings and recommendation about suitable mating connectors as needed.

The table in section 3.4 shows the translation of hardware pins to a naming that fits the functionality of the built-in firmware.

### 3.5 Pin description and operational characteristics

STM 33x Hardware Symbol	STM 33x Firmware Symbol	Function	Characteristics
GND	GND	Ground connection	
VDD	VDD	Supply voltage	2.1 V – 5.0 V; Start-up voltage: 2.6 V Maximum ripple: see 3.8 Not available at pin header.
		Supply for programming I/F	Recommended supply voltage for programming 3V
VCHAR	VCHAR	Charging input	Input for an external energy harvester or a battery. See 0.
		Supply for programming I/F if VDD cannot be used. <sup>5</sup>	Recommended supply voltage for programming 3.3V – 3.6 V
VGC	VGC	Voltage Gold Cap	Connection of additional external energy storage possible. See 0.
SWPWR (= switched DVDD of EO3000I)	SWPWR	DVDD supply voltage regulator output switched via transistor controlled by EO3000I ADIO5 pin.	1.8 V. Output current: max. 5 mA. Supply for external circuitry, available while not in deep sleep mode. SWPWR is switched on 0.25 ms before sampling of inputs and is switched off afterwards.
UVDDext (=UVDD of EO3000I with 1.8MΩ in series)	UVDDext	Ultra low power supply voltage regulator output	Not for supply of external circuitry! For use with WAKE pins only, see section 4.1. Limited to max. 1 μA output current by internal 1.8 MΩ resistor!
IOVDD (not available at pin connector)	IOVDD	GPIO supply voltage	Internal connection to EO3000I DVDD (typ. 1.8 V) See 3.5.1
RESET	RESET	Reset input Programming I/F	Active high reset (1.8 V) Fixed internal 10 kΩ pull-down.
PROG_EN	PROG_EN	Programming I/F	HIGH: programming mode active LOW: operating mode Digital input, fixed internal 10 kΩ pull-down.
ADIO0	SET	Analog input	For connection of an external set point dial. See 4.3
ADIO1		Not used	Internal pull-up; do not connect
ADIO2		Not used	Internal pull-up; do not connect

<sup>5</sup> E.g. if module shall be programmed or configured via pin connector.

If a bed of nails fixture for programming is available VDD should be used instead of VCHAR.

ADIO3	HSM	Input for HSM 100	Internal pull-up; leave open or connect HSM 100
ADIO4		Not used	Internal pull-up; do not connect
ADIO6		Not used	Internal pull-up; do not connect
ADIO7		Programming I/F	Leave open
SCSEDIO0	CW_1	Encoding input for wake-up cycle	Configuration interface. Leave open or connect to GND. See 3.9.1. Internal pull-up
		Programming I/F	
SCLKDIO1	CW_0	Encoding input for wake-up cycle	Configuration interface. Leave open or connect to GND. See 3.9.1. Internal pull-up
		Programming I/F	
WSDADIO2	CP_1	Encoding input for retransmission	Configuration interface. Leave open or connect to GND. See 3.9.1. Internal pull-up
		Programming I/F	
RSDADIO3	CP_0	Encoding input for retransmission	Configuration interface. Leave open or connect to GND. See 3.9.1. Internal pull-up
		Programming I/F	
WAKE0	OCC	Wake input	Input for external occupancy button. Change of logic state leads to wake-up and transmission of a telegram if correct EEP selected. See 3.9.2. Must be connected to UVDDext or GND! At time of delivery WAKE0 is connected to UVDDext via a jumper at the connector. See also 4.1.
WAKE1	LRN	LRN input	Press (HIGH to LOW) transmission of teach-in telegram. Long press (typ. 10 sek in LOW) leads to mode change. – STM 330 / STM 331. Internal pull-up to UVDD. See also 3.10 and 4.1.

### 3.5.1 GPIO supply voltage

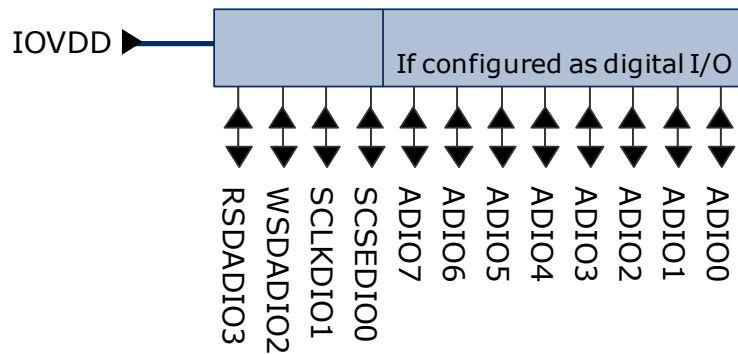
The IOVDD pin of EO3000I is internally connected to DVDD. For digital communication with other circuitry therefore a voltage of 1.8 V has to be used. While the module is in deep sleep mode the microcontroller with all its peripherals is switched off and DVDD, IOVDD, and SWPWR are not supplied.



If DVDD=0 V and IOVDD is not supplied (e.g. while in sleep mode), do not apply voltage to ADIO0 to ADIO7 and the pins of the serial interface (SCSEDIO0, SCLKDIO1, WSDADIO2, RSDADIO3). This may lead to unpredictable malfunction of the device.



For I/O pins configured as analog pins the IOVDD voltage level is not relevant! See also 3.5.2.



### 3.5.2 Analog and digital inputs

Parameter	Conditions / Notes	Min	Typ	Max	Units
<b>Analog Input Mode</b>					
Measurement range	Single ended	0.07		RVDD-0.07	V
	Internal reference RVDD/2 Interpreted as <sup>6</sup>	0x00		0xFF	
Input coupling			DC		
Input impedance	Single ended against GND @ 1 kHz	10			MΩ
Input capacitance	Single ended against GND @ 1 kHz			10	pF

Parameter	Conditions / Notes	Min	Typ	Max	Units
<b>Digital Input Mode</b>					
Input HIGH voltage		2/3 IOVDD			V
Input LOW voltage				1/3 IOVDD	V
Pull up resistor	@IOVDD=1.7 ... 1.9 V	90	132	200	kΩ

### 3.5.3 Temperature sensor

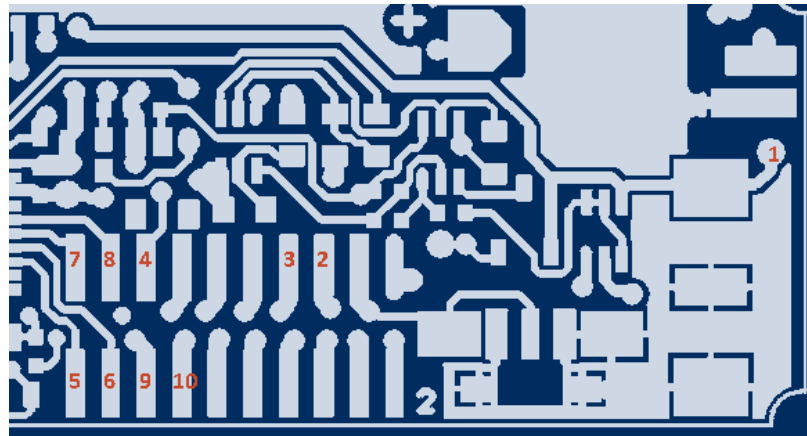
Parameter	Conditions / Notes	Min	Typ	Max	Units
Measurement range		0		40	°C
Accuracy	17 - 27 °C		0.5		K
	0 - 40		1		K

<sup>6</sup> For measurement of set point with external set point dial

### 3.5.4 Programming Interface

The positions of the pads needed for programming are shown in the layout below. Data are available from EnOcean as Gerber files (STM3XY(C)\_05.GTL and STM3XY(C)\_05.GK0).

Number	Symbol
1	VDD
2	GND
3	PROG_EN
4	RESET
5	SCSEDIO0
6	SCLKDIO1
7	WSDADIO2
8	RSDADIO3
9	ADIO7
10	ADIO6 Only if in addition to programming I/F a serial inter- face is needed



Top layer

If VDD is not accessible, e.g. because the module shall be programmed via the pin connector, please use VCHAR instead of VDD (see 0).

### 3.6 Absolute maximum ratings (non operating)

Symbol	Parameter	Min	Max	Units
VDD	Supply voltage at VDD	-0.5	5.5	V
VGC	Voltage long term storage	2.0	3.3	V
VCHAR	Supply voltage from external energy harvester	0	6	V
ICHAR	Supply current from external energy harvester		45	mA
GND	Ground connection	0	0	V
VINA	Voltage at every analog input pin	-0.5	2	V
VIND	Voltage at RESET, WAKE0/1, and every digital input	-0.5	3.6	V

### 3.7 Maximum ratings (operating)

Symbol	Parameter	Min	Max	Units
VDD	Supply voltage at VDD and VDDLIM	2.1	5.0	V
VGC	Voltage long term storage	2.0	3.3	V
VCHAR	Supply voltage from external energy harvester	0	6	V
ICHAR	Supply current from external energy harvester VCHAR < 4 V 4 V < VCHAR < 6 V		Limited internally 45	mA
GND	Ground connection	0	0	V
VINA	Voltage at every analog input pin	0	2.0	V
VIND	Voltage at RESET, WAKE0/1, and every digital input	0	3.6	V

### 3.8 Power management and voltage regulators

Symbol	Parameter	Conditions / Notes	Min	Typ	Max	Units
<b>Voltage Regulators</b>						
VDDR	Ripple on VDD, where Min(VDD) > VON				50	mV <sub>pp</sub>
UVDD	Ultra Low Power supply			1.8		V
RVDD	RF supply	Internal signal only	1.7	1.8	1.9	V
DVDD	Digital supply	Internal signal only	1.7	1.8	1.9	V
<b>Threshold Detector</b>						
VON	Turn on threshold		2.3	2.45	2.6	V
VOFF	Turn off threshold	Automatic shutdown if VDD drops below VOFF	1.85	1.9	2.1	V

#### Threshold detector

STM 33x provides an internal ultra low power ON/OFF threshold detector.

If  $VDD > VON$ , it turns on the ultra low power regulator (UVDD), the watchdog timer and the WAKE# pins circuitry. If  $VDD \leq VOFF$ , it initiates the automatic shut down of STM 33x.

For details of this mechanism please refer to the Dolphin Core Description documentation.

### 3.9 Configuration

#### 3.9.1 Configuration via pins

The encoding input pins have to be left open or connected to GND in correspondence with the following connection schemes. These settings are checked at every wake-up.

##### Wake-up cycle time

CW_0	CW_1	Wake-up cycle time
NC	GND	1 s $\pm 20\%$
GND	NC	10 s $\pm 20\%$
NC	NC	100 s $\pm 20\%$
GND	GND	No cyclic wake-up

##### Redundant retransmission

Via CP\_0 and CP\_1 an internal counter is set which is decreased at every wake-up signal. Once the counter reaches zero the redundant retransmission signal is sent.

CP_0	CP_1	Number of wake-ups that trigger a redundant retransmission
GND	NC	Every timer wake-up signal
NC	NC	Every 7 <sup>th</sup> - 14 <sup>th</sup> timer wake-up signal, affected at random
NC	GND	Every 70 <sup>th</sup> - 140 <sup>th</sup> timer wake-up signal, affected at random
GND	GND	No redundant retransmission



A radio telegram is always transmitted after wake-up via WAKE pins (unless the WAKE1 (learn button) press-release sequence is not valid).

After transmission the counter is reset to a random value within the specified interval.



According to FCC 15.231a) a redundant retransmission at every timer wake-up to determine the system integrity is only allowed in safety and security applications! In this case the total transmission time must not exceed two seconds per hour, which means that a combination with a 1 s wake-up cycle time is not allowed!

If applied in other (non-safety, non-security) applications a minimum of 10 s between periodic transmissions is required. In addition the device has to comply with the lower field strength limits of 15.231e). The limited modular approval of STM 33xU is not valid in this case.

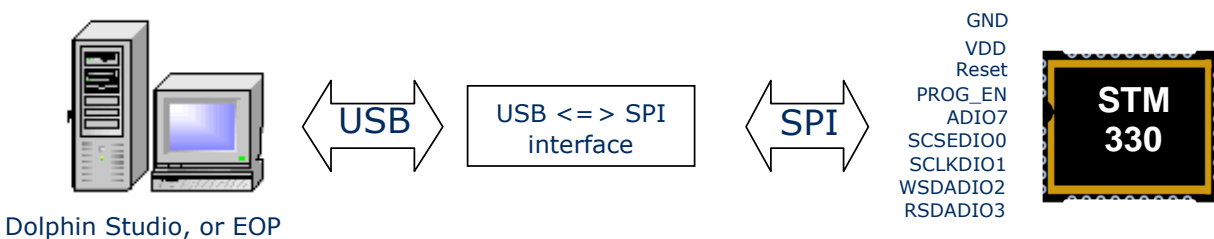


### 3.9.2 Configuration via serial interface

Via the programming interface the configuration area can be modified. This provides a lot more configuration options. Values set via serial interface override hardware settings! These settings are read after RESET or power-on reset only and not at every wake-up of the module!

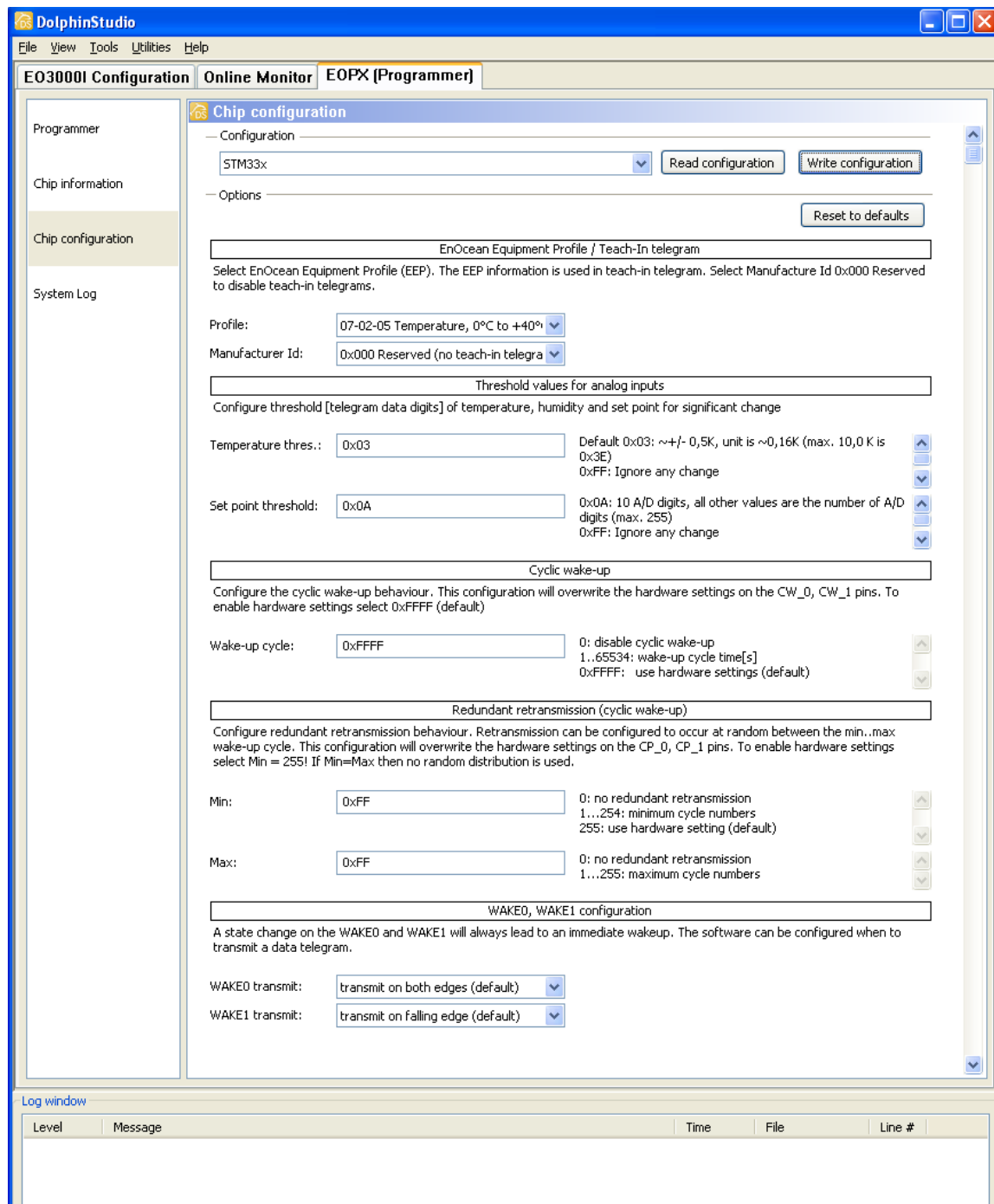
Parameter	Configuration via pins	Configuration via serial interface
Wake up cycle	See section 3.9.1	Value can be set from 1 s to 65534 s
Redundant Retransmission cycle	See section 3.9.1	Min...Max values for random interval If Min=Max -> random switched off
Threshold values for inputs (transmission of telegram if threshold value exceeded)	No	The default values are: Temperature measurement: $\pm 0.5$ K Set point measurement: $\pm 10$ digits
Edge of wake pin change causing a telegram transmission	No	Every change of a wake pin triggers a wake-up. For both wake pins it can be configured individually if a telegram shall be sent on rising, falling or both edges. On STM 330 / STM 331 only the wake1 pin can be configured. The wake0 behaviour is fixed due to mode switch between secure and enhanced mode.
Manufacturer ID and EEPROM (EnOcean Equipment Profile)	No	Information about manufacturer and type of device. This feature is needed for "automatic" interoperability of sensors and actuators or bus systems. Unique manufacturer IDs are distributed by the EnOcean Alliance.

The interface is shown in the figure below:



EnOcean provides EOPx (EnOcean Programmer, a command line program) and Dolphin Studio (Windows application for chip configuration, programming, and testing) and the USB/SPI programmer device EOP 350 as part of the EDK 350 developer's kit.

The configuration page of DolphinStudio is shown in the figure below.



Please select STM 33x and press "Read configuration" button before modifying the entries!

Due to security features additional parameters apply for STM 330 / STM 331.

Parameter	Configuration via programming interface
Mode changes	By default the change between transport, standard and secure is enable. The configuration can be changed to transport/standard modes (enhance secure disable) or to transport/enhance secure modes (standard disable).
CMAC Length	CMAC length 3 bytes (default)
Private Key	AES 128 key which is used for data encryption.
Subkey 1	Subkey derivated from private key.
Subkey 2	Subkey derivated from private key.
Set initial RLC	Initial value of the RLC (0 by default).

Please refer to the EnOcean Security Specification for details  
<http://www.enocean.com/en/security-specification/>.

### 3.10 Radio telegram

#### 3.10.1 Default configuration and standard mode

In default configuration and standard mode STM 33x transmits a radio telegram according to EnOcean Equipment Profile A5-02-05 (Temperature sensor 0-40 °C) as defined in the EnOcean Equipment Profiles (EEP) specification.

In standard mode STM 33x can be configured to following EEPs:

STM 33x: A5-02-05, A5-02-30, A5-10-05, A5-10-03

STM 33x with HSM 100 extension: A5-04-01, A5-10-10, A5-10-12

By pressing the LRN button 1 s in standard mode a 4BS teach-in telegram is transmitted. After pressing the LRN button for 5 seconds a signal telegram (data: 0x0E) will be sent and the module enters the transport mode. For details see EnOcean Alliance EEP specification (Stepcode >=DE). In this mode the module does not send telegrams.

For details please refer to the EnOcean Equipment Profiles specification.  
[\(http://www.enocean-alliance.org/EEP/\)](http://www.enocean-alliance.org/EEP/)

### 3.10.2 Teach-in telegram

In case of a wake-up via WAKE1 pin (LRN button input) the module transmits a teach-in telegram.

- If the manufacturer code is not set, the module transmits a data telegram according to 3.10.1 with the difference that DI\_3=0. See EnOcean Alliance EEP specification appendix 3.3 variant 1.
- If a Manufacturer ID is set, this teach-in telegram contains special information as described below EEP specification appendix variant 2. By default EnOcean Manufacturer ID is set. Customer can configure their own ID.

With this teach-in telegram it is possible to identify the manufacturer of a device and the function and type of a device. The following EnOcean Equipment Profiles are supported by STM 33x. They have to be selected according to the availability of external occupancy button and set point control by the method described in 3.9.2. Profile can be set via programmer and DolphinStudio PC Software:

- A5-02-05 Temperature sensor 0-40 °C (default)
- A5-02-30 Temperature sensor -40 – 62,3 °C
- A5-10-03 Temperature sensor 0-40 °C, set point control
- A5-10-05 Temperature sensor 0-40 °C, set point, and occupancy control

If a HSM 100 module is plugged onto the connector in addition the following EEPs are supported:

- A5-04-01 Temperature and humidity sensor 0-40 °C and 0-100% r.h.
- A5-10-10 Temperature and humidity sensor 0-40 °C and 0-100% r.h., set point control, and occupancy control
- A5-10-12 Temperature and humidity sensor 0-40 °C and 0-100% r.h., set point control

For details please refer to the EnOcean Equipment Profiles specification.

(<http://www.enocean-alliance.org/eeep/>)

## 3.11 Secure radio telegram

The STM 3xy modules can operate in secure mode; this means the communication is protected by enhanced security features. Commissioning and mode change is described in chapter 3.1.

### 3.11.1 Enhances security telegram

In secure mode of STM 330 / STM 331 the payload content of the telegram is always protected with advanced security features. Normal operation telegram payload and also Teach-in telegram payload are protected in the same way.

The security features used are defined by the Security Level format - SLF. This parameter is set by default to following values (Stepcode >=DE):

- 24-bit RLC which starts from 0 at production
- RLC sent explicitly
- 3-byte CMAC

#### ■ VAES encryption

The security features are added to the communication by encapsulating the payload and Teach-in telegram payload into a secured telegram. The payload itself is not changed and corresponds to the standard mode payload like defined in chapter 3.10.1.

Please refer to the EnOcean Security Specification for details:  
<https://www.enocean.com/security-specification>

### 3.11.2 Secure Teach-In

To process secure communication with a receiver STM 3xy has to send a secure teach-in telegram to the receiver and so inform him about the used security profile, AES key and initial RLC counter. The secure teach-in has to take place before any other communication can be executed (profile teach-in included). Press the LRN button to trigger the transmission of the teach-in telegram. Take into account the information in chapter 3.1. The secure teach-in and then the profile teach-in are transmitted. The profile teach-in telegram is already protected by advanced security features. Profile teach-in telegram corresponds to the telegram defined in chapter 3.10.2.

The behaviour of the LRN button is the following:

1. Button is pressed
2. Secure teach-in is send.
3. Profile teach-in is send.

For more information on the structure of the teach-in telegram please refer to chapter 4.2 of .

## 3.12 Transmit timing

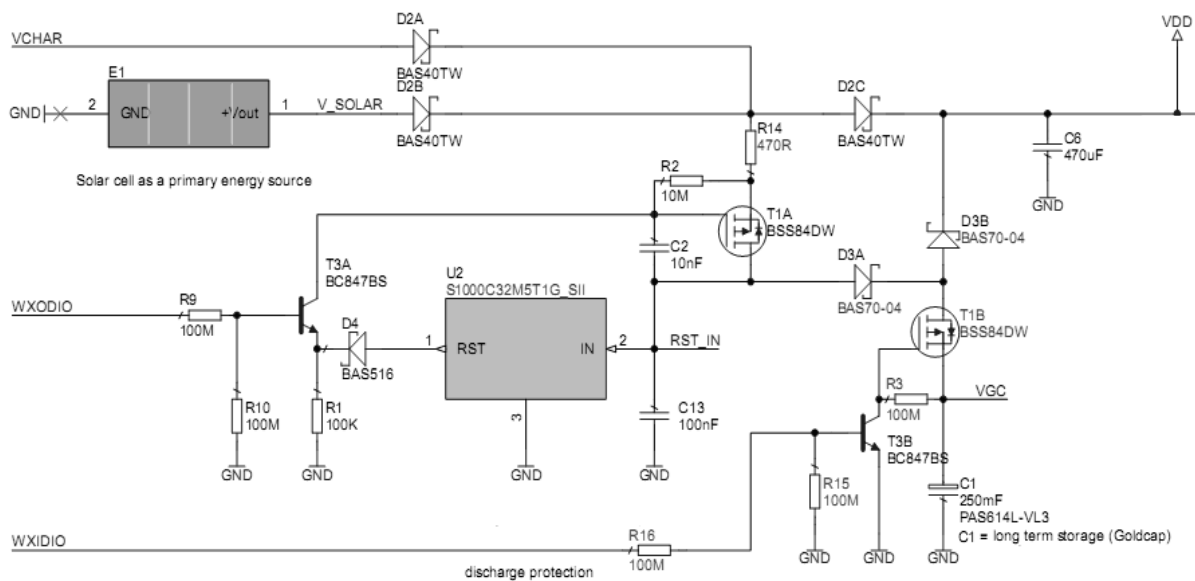
The setup of the transmission timing allows avoiding possible collisions with data packages of other EnOcean transmitters as well as disturbances from the environment. With each default transmission cycle, 3 identical sub-telegrams are transmitted within 40 ms. Transmission of a sub-telegram lasts approximately 1.2 ms. The delay between the three transmission bursts is affected at random.

### 3.12.1 Secure transmission timing

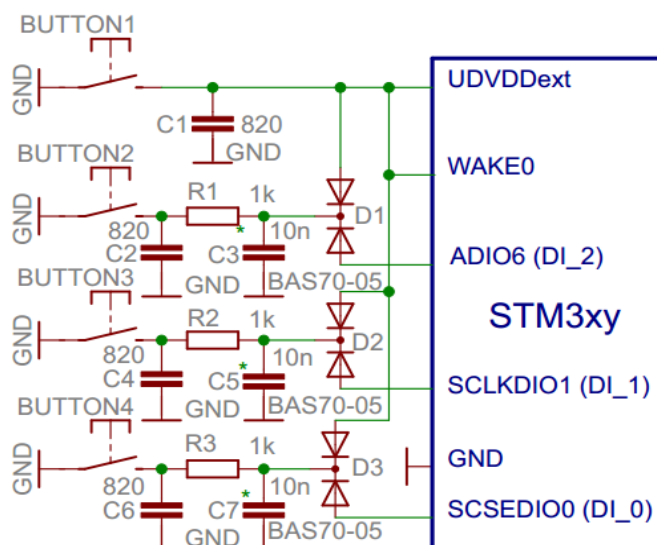
In secure mode the transmission cycle includes 2 identical subtelegrams are transmitted within 20 ms. This is required to compensate the additional energy requirement of enhanced security computing and additional payload. The transmission of a enhanced secure subtelegram lasts approximately 1.6 ms.

### 3.13 Charging circuitry

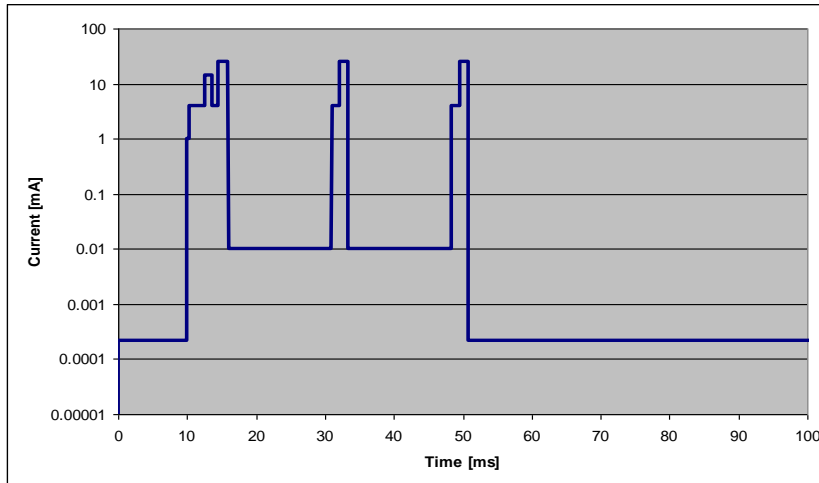
The figure below shows the internal charging circuit. It is controlled via the WXODIO pin of EO3000I which switches according to the status of the internal threshold detector. For details please refer to our Dolphin Core Description documentation. The WXIDIO pin is used to disconnect the long term energy storage at voltages below VOFF to avoid deep discharge.



An external 3 V backup battery can be connected at VCHAR. If STM 3xy is battery supplied, we strongly recommend to avoid keybouncing by adding a PI filter at wake inputs with buttons or keys (details see below).



### 3.14 Energy consumption



Current Consumption of STM 33x

#### For energy calculations following values are used:

- Internal energy storage MS412FE with usable capacity of about 0.7 mAh  
<https://www.sii.co.jp/en/me/datasheets/ms-rechargeable/ms412fe-5/>  
(usable voltage range 2.4 - 3 V at 25 °C)
- Solar cell ECS 200 delivers at 200 lux about 5 µA  
<https://www.enocean.com/de/enOcean-module/details/ecs-300/>
- Power consumption transmit cycle standard mode: 100 µAs
- Power consumption internal sensor measurement: cycle 30 µAs  
Current is proportional to illumination level (not true at very low levels!)
- Average leak current of STM 3xy at 25°C: 0.5 µA

#### Example calculation of the energy consumption with following parameters:

- Requirements for example calculation:
  - \* configuration: wake cycle 100 s and min. transmit every 10<sup>th</sup> wake up
  - \* 8 h light per day (24 h) light @ 200 lux and 25°C
- Current consumption (depending on amount of wake-ups due to temperature change):
  - \* Min. current consumption with no wake-up cycle due to temperature changes:  
 $30 \text{ uAs} / 100 \text{ s} + 100 \text{ uAs} / 1000 \text{ s} + 0.5 \text{ uA} = 0.9 \text{ uA}$
  - \* Maximum current consumption with max. wake-up cycles due to temperature changes :  
 $30 \text{ uAs} / 100 \text{ s} + 100 \text{ uAs} / 100 \text{ s} + 0.5 \text{ uA} = 1.8 \text{ uA}$
  - \* Average current consumption:  $(0.9 \text{ uA} + 1.8 \text{ uA}) / 2 = 1.35 \text{ uA}$
- Average solar power harvested:  $5 \text{ uA} / (8 \text{ h} / 24 \text{ h}) = 1.67 \text{ uA}$
- Time to fully charge energy storage (2.4 to 3.0 V) at stable temperature:  
 $0.7 \text{ mAh} / (1.67 \text{ uA} - 0.9 \text{ uA}) = 909 \text{ h} = 38 \text{ days}$
- Average operation time in darkness when fully charged (3.0 V to 2.4 V):  
 $0.7 \text{ mAh} / 1.35 \text{ uA} = 519 \text{ h} = 22 \text{ days}$

**Remarks:**

- Calculation examples and values have tolerances of about +/- 20%.
- Energy storage performance, power consumption and solar cell performance varies over temperature.
- Energy storage performance degrades over life time, especially if energy storage is long time exposed to very high temperatures. High temperatures will accelerate aging, each 10 K increase from 25°C will half expected life time. Very low temperature will temporary reduce capacity of energy store and this leads to considerable shorter dark time operation.
- Short wake-up cycles (e.g. 1 s) and transmit intervals (e.g. 1 s) significantly reduce energy storage performance, for this use case an external power supply is recommended

**3.14.1 Consumption in enhanced security mode**

Enhanced security mode requires more energy due to encryption algorithm computing time and extended telegram length because of CMAC. This added consumption is compensated by reducing the subtelegram count to 2.

**3.15 Storing the Rolling code counter in enhanced security operation**

For the enhanced security features a RLC Counter needs to be stored in non-volatile memory. For security reasons the RLC Counter is incremented by every transmitted telegram. Together with the CMAC the RLC ensures that messages cannot be reproduced or forged.

The RLC is stored in the Dolphin chip flash memory. To improve the endurance of the flash memory and also the energy budget not every increment is saved to the non-volatile flash memory. During deep sleep the RLC is stored in RAM0 memory. The RLC storing algorithm is described in the following text.

**Constraints**

- Writing a RLC (3 bytes) into flash is not energy consuming. It is fast (µSec) and requires almost no extra energy.
- Erasing a flash page is energy consuming operation. It takes 40 ms and requires extra energy.

For details on energy consumption for flash operation please see the Dolphin Chip Core specification: <https://www.enocean.com/dolphin-core-description/>



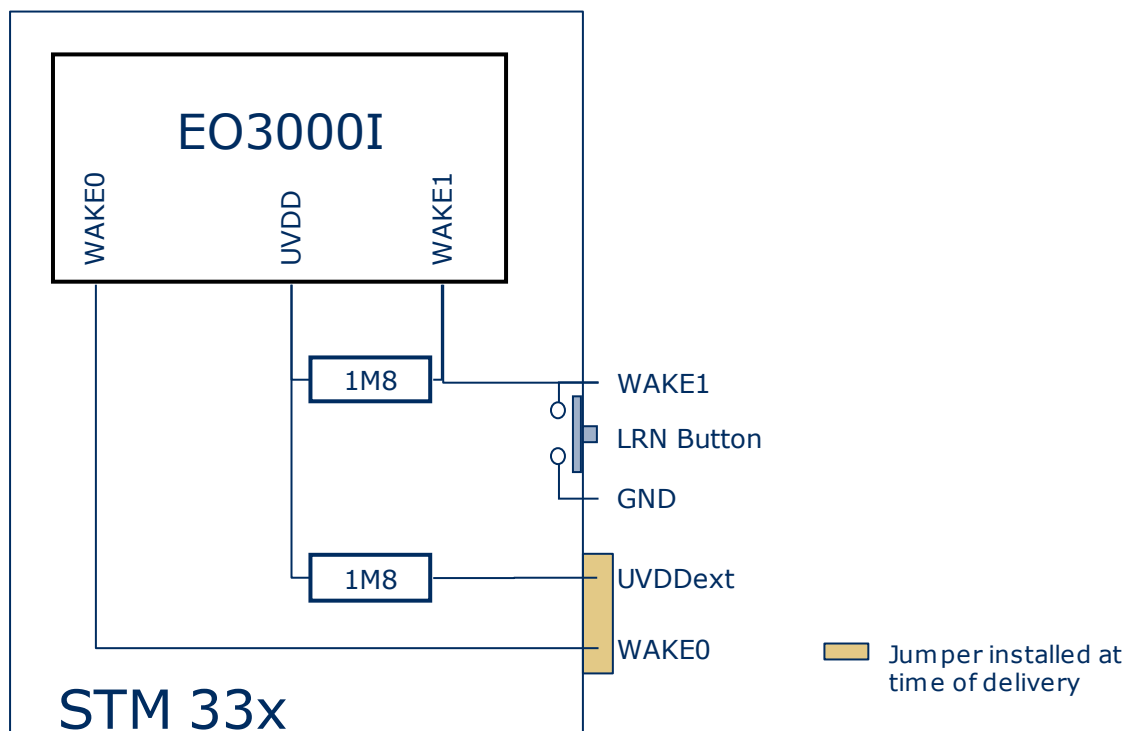
## 4 APPLICATIONS INFORMATION

### 4.1 Using the WAKE pins

The logic input circuits of the WAKE0 and WAKE1 pins are supplied by UVDD and therefore also usable in "Deep Sleep Mode". Due to current minimization there is no internal pull-up or pull-down at the WAKE pins. When STM 33x is in "Deep Sleep Mode" and the logic levels of WAKE0 and / or WAKE1 is changed, STM 33x starts up.



As there is no internal pull-up or pull-down at the WAKE0 pin, it has to be ensured by external circuitry, that the WAKE0 pin is at a defined logic level at any time. At time of delivery a jumper is connected between WAKE0 and UVDDext. WAKE1 provides an internal 1.8 MΩ pull-up. See figure below.



When the LRN button is pressed WAKE1 is pulled to GND and a teach-in telegram is transmitted or mode change is executed. As long as the button is pressed a small current of approximately 1 μA is flowing. It is possible to connect an additional external button in parallel between WAKE1 and GND if a different position of the button in the device is required.

WAKE0 is connected to UVDDext via a jumper at time of delivery. If the module is mounted onto a host PCB the jumper has to be removed. The circuitry on the host PCB then has to ensure that WAKE0 is always in a defined position.

There are two ways to use WAKE0:

- Connect WAKE0 to UVDDext and connect an external button between WAKE0 and GND. As long as the button is pressed a current of 1 μA will flow.
- Connect a 3 terminal switch and switch WAKE0 to either GND or UVDDext. In this case there is no continuous flow of current in either position of the switch.

## 4.2 Temperature sensor

STM 33x provides an internal temperature sensor. The sensor is part of the EO3000I IC and measures the chip temperature. Therefore it is important to provide a good thermal connection of the IC to the environment by ensuring sufficient ventilation of air inside the housing. Only then the measurement will represent the ambient temperature. Depending on the design of the housing a delay between ambient temperature changes and measured temperature value will be seen.

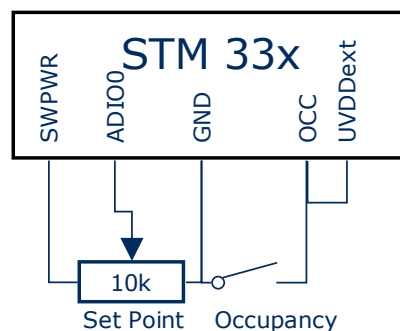


Heating of the chip due to its current consumption is negligible as the chip only consumes 200 nA while in sleep mode.

Temperature measurement every second is not recommended as in this case effects of heating of the chip might become visible and accuracy is reduced.

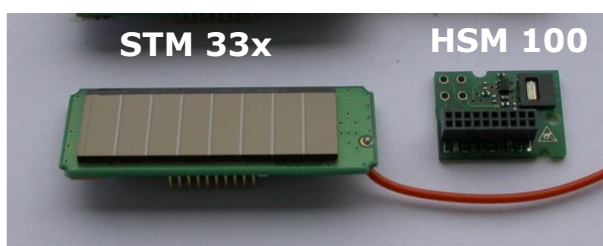
## 4.3 Set point control and occupancy button

In order to control the set point, an external potentiometer has to be connected as shown below. In addition this figure shows how to connect the occupancy button.



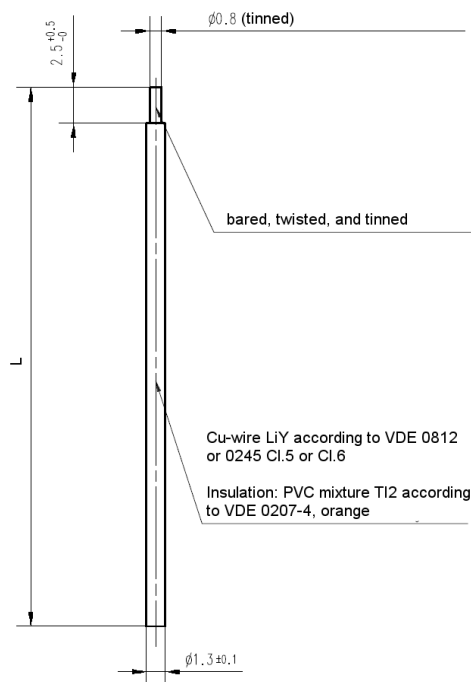
## 4.4 Combination with humidity sensor module HSM 100

The humidity sensor module HSM 100 extends the functionality of STM 33x temperature sensor modules. HSM 100 contains an internal calibrated humidity sensor. It can be plugged onto STM 33x modules via the 20 pin connector. For details please refer to the data sheet of HSM 100.



## 4.5 Antenna layout

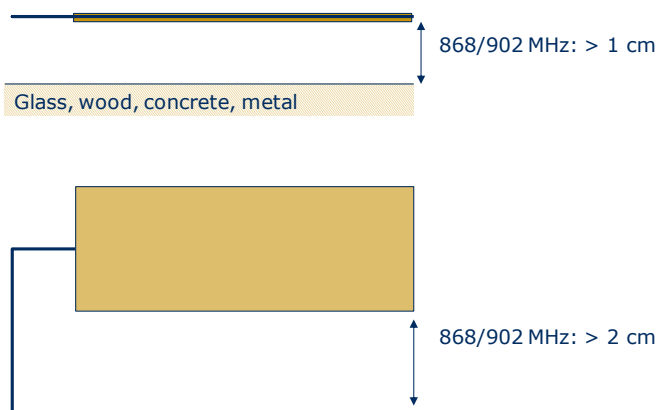
### 4.5.1 Whip antenna (STM 330 / STM 332U)



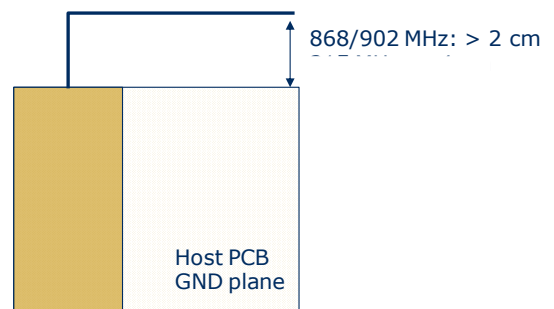
**Specification of the whip antenna; L=86 mm @ 868 MHz, L=64mm @ 902.875MHz**

Antenna layout recommendation:

STM 330 without host PCB

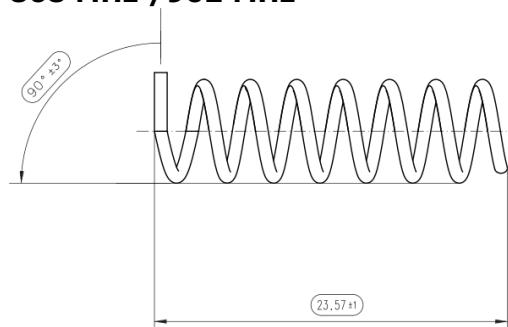


STM 330 with host PCB



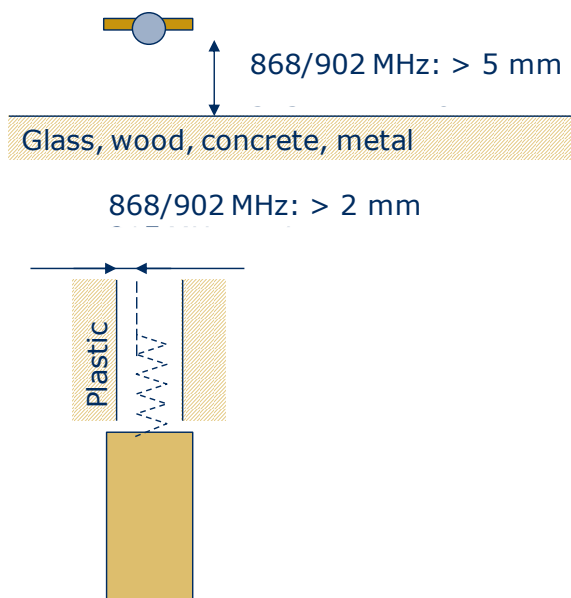
#### 4.5.2 Helical antenna (STM 331 / STM 331U/ STM 333U)

##### 868 MHz /902 MHz

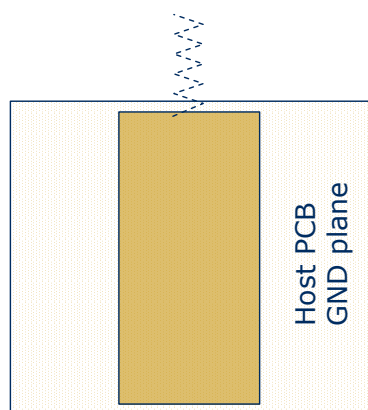


Antenna recommendation:

STM 33x without host PCB

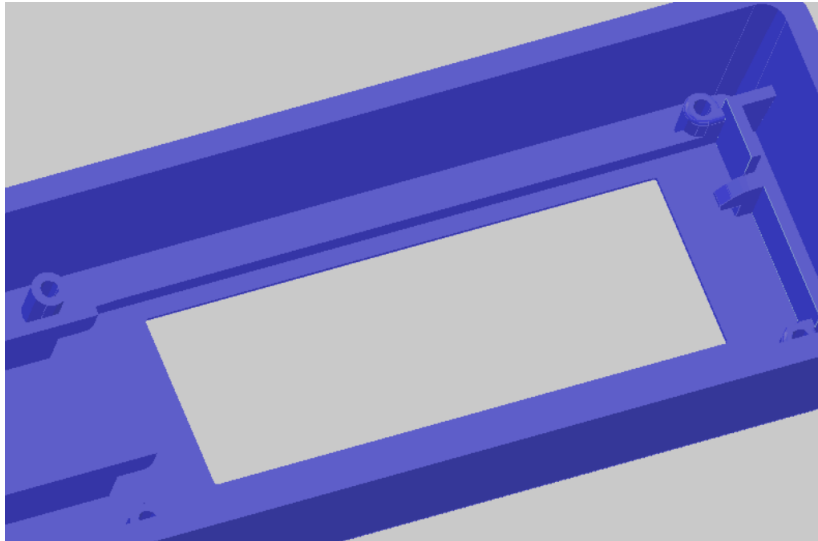


STM 33x with host PCB



## 4.6 Mounting STM 33x into a housing

The figure below shows an example of a housing in which the module can be mounted (with antenna pointing to the left). Design data of the housing and the modules is available in .igs format.



In order to prevent damage to the solar cell and the module itself, please make sure not to exert shear force (side force within the plane of the solar cell) onto the solar cell! The maximum vertical force onto the solar cell must not exceed 4 N and should be homogeneously distributed! Bending of the PCB must be avoided!



Please make sure that the housing covers 0.5 mm at the solar cell edges. Within 0.5 mm off the edge flaking is possible due to the cutting process.

## 4.7 Transmission range

The main factors that influence the system transmission range are type and location of the antennas of the receiver and the transmitter, type of terrain and degree of obstruction of the link path, sources of interference affecting the receiver, and "Dead" spots caused by signal reflections from nearby conductive objects. Since the expected transmission range strongly depends on this system conditions, range tests should categorically be performed before notification of a particular range that will be attainable by a certain application.

The following figures for expected transmission range may be used as a rough guide only:

- Line-of-sight connections: Typically 30 m range in corridors, up to 100 m in halls
- Plasterboard walls / dry wood: Typically 30 m range, through max. 5 walls
- Ferroconcrete walls / ceilings: Typically 10 m range, through max. 1 ceiling
- Fire-safety walls, elevator shafts, staircases and supply areas should be considered as screening.

The angle at which the transmitted signal hits the wall is very important. The effective wall thickness – and with it the signal attenuation – varies according to this angle. Signals should be transmitted as directly as possible through the wall. Wall niches should be avoided. Other factors restricting transmission range:

- Switch mounted on metal surfaces (up to 30% loss of transmission range)
- Hollow lightweight walls filled with insulating wool on metal foil
- False ceilings with panels of metal or carbon fiber
- Lead glass or glass with metal coating, steel furniture

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

A summarized application note to determine the transmission range within buildings is available as download from [www.enocean.com](http://www.enocean.com).

## 5 RADIO CERTIFICATIONS

The modules have been tested to fulfil the approval requirements for RED (STM 330 / STM 331) and FCC/ISED (STM 331U / STM 332U / STM 333U) based on the built-in firmware.



**When developing customer specific firmware based on the API for this module, special care must be taken not to exceed the specified regulatory limits, e.g. implement receiver function, change HF settings or exceed the duty cycle limitations!**

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

The Radio Equipment Directive (2014/53/EU, typically referred to as RED) replaces the old R&TTE directive from 1999 as regulatory framework for radio products in the European Union. All products sold to final customers after 12th of June, 2017 have to be compliant to RED. At the time of writing, the text of the RED legislation was available from this link: <http://eur-lex.europa.eu/eli/dir/2014/53/oj>

Dolphin radio modules such as STM 330 or STM 331 are components which are delivered to OEM manufacturers for their use in final or combined products.

It is the responsibility of the OEM manufacturer to demonstrate compliance to all applicable EU directives and standards. The attestation of conformity for STM 330 or STM 331 serves 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 clearly identifying company name or brand and product name as well as type, charge or serial number for market surveillance
- Include documentation containing full postal address of the manufacturer as well as radio frequency band and max. transmitting power
- Include 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.

RED conformity has been proven and the according documentation has been deposited at EnOcean. The modules can be operated without notification and free of charge in the area of the European Union and in Switzerland.



- EnOcean RF modules must not be modified or used outside their specification limits.
- RED approval is only valid for delivered standard hardware and software
- EnOcean RF modules must not be used with gain antennas, since this may result in allowed ERP or spurious emission levels being exceeded.
- The final product incorporating EnOcean RF modules must itself meet the essential requirement of the EU directives and a CE marking must be affixed on the final product and on the sales packaging each. Operating instructions containing a Declaration of Conformity has to be attached.
- If the STM 33x transmitter is used according to the regulations of the 868.3 MHz band, a so-called "Duty Cycle" of 1% per hour must not be exceeded. Permanent transmitters such as radio earphones are not allowed.
- The module must be used with only the following approved antenna(s).

Model	Type
STM 330	Pre-installed whip antenna
STM 331	Pre-installed helix antenna



## 5.2 FCC (United States) certification

### 5.2.1 331U / 332U / 333U LIMITED MODULAR APPROVAL

This is an RF module approved for Limited Modular use operating as an intentional transmitting device with respect to 47 CFR 15.231(a-c) and is limited to OEM installation. The module is optimized to operate using small amounts of harvested energy, such as can be collected by a small solar cell exposed to ambient light.

The module transmits short radio packets comprised of control signals, (in some cases the control signal may be accompanied with data) such as those used with alarm systems, door openers, remote switches, and the like.

The module does not support continuous streaming of voice, video, or any other forms of streaming data; it sends only short packets containing control signals and possibly data and is typically powered by a solar cell in ambient light. The module is designed to comply with, has been tested according to 15.231(a-c), and has been found to comply with each requirement.

Thus, a finished device containing the STM 331U / 332U / 333U radio module can be operated in the United States without additional Part 15 FCC approval (approval(s) for unintentional radiators may be required for the OEM's finished product), under EnOcean's FCC ID number. This greatly simplifies and shortens the design cycle and development costs for OEM integrators.

The module can be triggered manually or automatically, which cases are described below.

#### Manual Activation

The radio module can be configured to transmit a short packetized control signal if triggered manually. The module can be triggered, by pressing a switch, for example. The packet contains one (or more) control signals that is(are) intended to control something at the receiving end. The packet may also contain data. Depending on how much energy is available from the energy source, subsequent manual triggers can initiate the transmission of additional control signals. This may be necessary if prior packet(s) was (were) lost to fading or interference. Subsequent triggers can also be initiated as a precaution if any doubt exists that the first packet didn't arrive at the receiver. Each packet that is transmitted, regardless of whether it was the first one or a subsequent one, will only be transmitted if enough energy is available from the energy source.

#### Automatic Activation

The radio module also can be configured to transmit a short packetized control signal if triggered automatically, by a relevant change of its inputs, for example. Again, the packet contains a control signal that is intended to control something at the receiving end and may also contain data. As above, it is possible for the packet to get lost and never reach the receiver. However, if enough energy is available from the energy source, and the module has been configured to do so, then another packet or packets containing the control signal may be transmitted at a later, unpredictable time.

## OEM Requirements

In order to use EnOcean's FCC ID number, the OEM must ensure that the following conditions are met.

- End users of products, which contain the module, must not have the ability to alter the firmware that governs the operation of the module. The agency grant is valid only when the module is incorporated into a final product by OEM integrators.
- The end-user must not be provided with instructions to remove, adjust or install the module.
- The Original Equipment Manufacturer (OEM) must ensure that FCC labeling requirements are met. This includes a clearly visible label on the outside of the final product. Attaching a label to a removable portion of the final product, such as a battery cover, is not permitted. The label must include the following text:

STM 331U / STM 332U / STM 333U:

*Contains FCC ID: SZV-STM332U*

*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.*

When the device is so small or for such use that it is not practicable to place the statement above on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed. However, the FCC identifier or the unique identifier, as appropriate, must be displayed on the device.

The user manual for the end product must also contain the text given above.

- Changes or modifications not expressly approved by EnOcean could void the user's authority to operate the equipment.
- The OEM must ensure that timing requirements according to 47 CFR 15.231(a-c) are met.
- The OEM must sign the OEM Limited Modular Approval Agreement with EnOcean
- The module must be used with only the following approved antenna(s).

Model	Type	Gain
STM 331U	Pre-installed Helical Antenna	-1.0 dBi
STM 332U	Pre-installed Wire/Monopole	1.0 dBi
STM 333U	Pre-installed Helical Antenna	-1.0 dBi

## 5.2.2 STM 331U / STM 332U / STM 333U FCC Grant

**TCB**

### GRANT OF EQUIPMENT AUTHORIZATION

**TCB**

Certification  
Issued Under the Authority of the  
Federal Communications Commission  
By:

EMCCert Dr. Rasek GmbH  
Stoernhofer Berg 15  
D-91364 Unterleinleiter,  
Germany

Date of Grant: 06/21/2013

Application Dated: 06/21/2013

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-STM332U  
Name of Grantee: EnOcean GmbH  
Equipment Class: Part 15 Security/Remote Control Transmitter  
Notes: 902.875MHz transmitter  
Modular Type: Limited Single Modular

### Grant Notes

FCC Rule Parts  
15.231

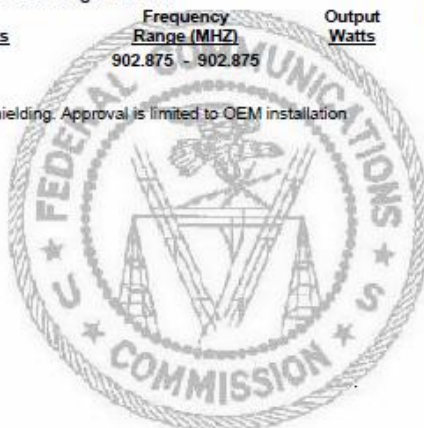
Frequency  
Range (MHz)  
902.875 - 902.875

Output  
Watts

Frequency  
Tolerance

Emission  
Designator

Limited modular approval due to lack of module shielding. Approval is limited to OEM installation  
only in host platforms as described in this filing.



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### 5.2.3 FCC Regulatory Statements

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. Any changes or modifications not expressly approved by manufacturer could void the user's authority to operate the equipment.

**IMPORTANT!** Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

**NOTE:** 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 or more 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

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### 5.3 ISED (former Industry Canada) certification

In order to use EnOcean's IC number, the OEM must ensure that the following conditions are met:

- Labeling requirements for Industry Canada are similar to those required by the FCC. The Original Equipment Manufacturer (OEM) must ensure that IC labeling requirements are met. A clearly visible label on the outside of a non-removable part of the final product must include the following text:

STM 331U / STM 332U / STM 333U:

*Contains IC: 5713A-STM332U*

- The OEM must sign the OEM Limited Modular Approval Agreement with EnOcean

Pour utiliser le numéro IC EnOcean, le OEM doit s'assurer que les conditions suivantes sont remplies:

- Les exigences d'étiquetage pour Industrie Canada sont similaires à ceux exigés par la FCC. Le fabricant d'équipement d'origine (OEM) doit s'assurer que les exigences en matière d'étiquetage IC sont réunies. Une étiquette clairement visible à l'extérieur d'une partie non amovible du produit final doit contenir le texte suivant:

STM 331U / STM 332U / STM 333U:

*Contient le module d'émission IC: 5713A-STM332U*

- L'OEM doit signer l'accord OEM limitée Approbation modulaire avec EnOcean

### 5.3.1 STM 332U / STM 333U IC Technical Approval Certificate



FCB under the Canada-EC MRA  
TCB under the USA-EC MRA  
RFCAB under the Japan-EC MRA  
Notified Body R&TTE Directive 99/5/EC  
Notified Body EMC Directive 2004/108/EC

No. ► CA001349D

#### TECHNICAL ACCEPTANCE CERTIFICATE CANADA

#### CERTIFICAT D'ACCEPTABILITÉ TECHNIQUE CANADA

CERTIFICATION No. ► 5713A-STM332U  
No. DE CERTIFICATION  
ISSUED TO ► EnOcean GmbH  
DÉLIVRÉ À

Street Address ► Kolpingring 18 a  
Numéro et rue  
Province or State ► Germany  
Province ou État

City ► Oberhaching  
Ville  
Postal Code ► 82041  
Code postal

TYPE OF EQUIPMENT ► Remote Control Device  
GENRE DE MATÉRIEL ► Limited Modular Approval  
ANTENNA ► Integrated  
ANTENNE ► Incorporé

TRADE NAME & MODEL ► Transmitter Modules STM 330U,  
MARQUE ET MODÈLE ► STM 331U, STM 332U, STM 333U  
ANTENNA GAIN ►  
GAIN D'ANTENNE ►

FREQUENCY RANGE BANDE DE FRÉQUENCES	EMISSION TYPE GENRE D'ÉMISSION	R.F. POWER PUISSANCE H.F.	SPECIFICATION/ ISSUE/ DATE SPÉCIFICATION/ ÉDITION/ DATE
902.88 - 902.88 MHz	323K7F1DAN	70.18 dBuV/m @ 3m	RSS-210 8 11 Dec 2010
902.88 - 902.88 MHz	322K1F1DAN	66.58 dBuV/m @ 3m	RSS-210 8 11 Dec 2010

TEST LABORATORY ► EMCCons DR. RAŠEK GmbH & Co. KG  
LABORATOIRE D'ESSAI

Street Address ► Moggast, Boelwiese 8  
Numéro et rue  
Province or State ► Germany  
Province ou État  
Name ► Karlheinz Kraft  
Nom  
E-mail ► k.kraft@emcc.de

CN 3464C OATS 3464C-1  
City ► Ebermannstadt  
Ville  
Postal Code ► 91320  
Code postal  
Tel 0049 9194 9016  
Fax 0049 9194 8125

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 Industry Canada 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 Industry Canada. 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 Industry Canada.

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

La certification du matériel signifie seulement que le matériel a satisfait aux exigences de la norme indiquée ci-dessus. Les demandes de licences nécessaires pour l'utilisation du matériel certifié sont traitées en conséquence par le bureau de délivrance d'Industrie Canada et dépendent des conditions radio ambiantes, du service et de l'emplacement d'exploitation. Le présent certificat est délivré à la condition que le titulaire satisfasse et continue de satisfaire aux exigences et aux procédures d'Industrie Canada. Le matériel à l'égard duquel le présent certificat est délivré ne doit pas être fabriqué, importé, distribué, loué, mis en vente ou vendu à moins d'être conforme aux procédures et aux spécifications techniques applicables publiées par Industrie Canada.

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

DATE 21 June 2013

  
Certification Officer

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### **5.3.2 ISED (former Industry Canada) Regulatory Statements**

This device complies with Industry Canada licence-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.

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.

**IMPORTANT!** Tous les changements ou modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner cet équipement.

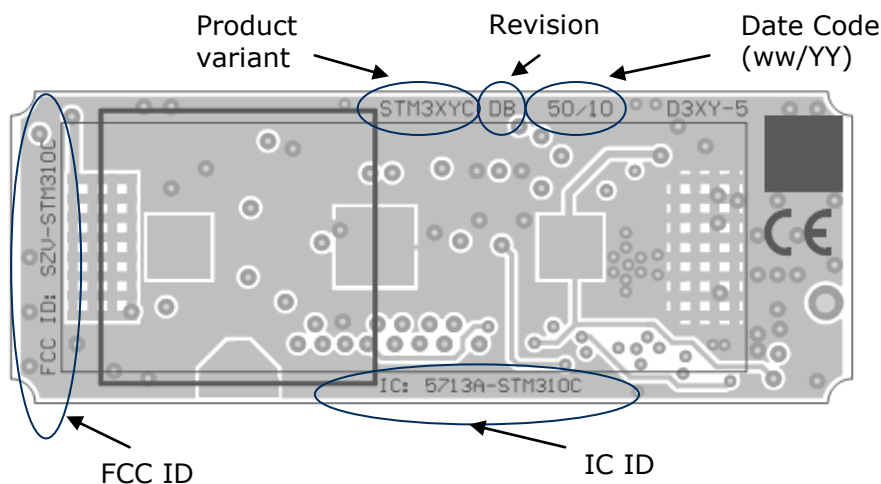
This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada

## 6 Additional information

### 6.1 Product label

#### 6.1.1 Laser markings



#### 6.1.2 QR Code

In order to improve STM 3xy logistic and commissioning a QR code label is fixed on top of the radio controller. The QR code is implemented according to the EnOcean Alliance system specification: "Product ID and Standardized Labeling Specification". For details see:

<https://www.enocean-alliance.org/productid/>



#### **Format (STM 330) :**

[30S00000502CB78+ 13ZBA2054A875E77768C7740157BDF9CF68+30PS3001-D330+2PDE15+S01123456123456]

30S00000502CB78	15 CHARS	30S	<6 Byte Chip-ID>
+	1 CHAR		
13ZBA2054A.....68	35 CHARS	13Z	<32 Digit Key>
+	1 CHAR		
30PS3001-D330	13 CHARS	30P	<Order code>
+	1 CHAR		
2PDE15	6 CHARS	2P	<2 Stepcode><2 Status>
+	1 CHAR		
Sxxxxxxxxxxxxxx	15 CHARS	S	<2 Manufacturer><12 DMC>



## 6.2 Rechargeable accumulator

- In order to conserve the energy level of the rechargeable accumulator, OEMs should put the final product with housing to transport mode
- In specific markets e.g. EU a rechargeable accumulator (secondary battery) requires additional markings at product label & documentation. A registration according to battery law could be required.
- According to the manufacturer of the rechargeable battery following warnings apply:
  1. Do not charge by high current or high voltage. Doing so may generate gas inside the battery, resulting swelling, catching fire, and heat generation or bursting.
  2. Do not heat, disassemble nor dispose of in fire Doing so damages the insulation materials and may cause catching fire, heat generation, leakage or bursting.
  3. Do not solder directly to the battery If soldering is performed directly to the battery, the battery is heated up, consequently cause leakage, explosion or fire due to overheating from internal short-circuiting.
  4. Do not short. If the (+) and (-) come into contact with metal materials, short-circuiting occurs. As a result, catching fire, heat generation, leakage or bursting.
  5. Keep batteries/module out of children's reach. If leaked liquid is ingested or a battery is swallowed, consult a physician immediately.
  6. Do not reverse placement of (+) and (-) If the (+) and (-) side of the battery is reverse inserted; it may cause a short-circuiting or over discharge of the battery on some equipment and it may induce overheating, explosion or fire.
  7. Do not discharge by force If the battery is discharged by direct connection to an external power supply etc., voltage of the battery will decline lower than 0 volts (electrical reversal) and will cause the battery case to expand, overheat, leak, explode or burn.
  8. In case of leakage or a strange-smell; keep away from fire to prevent ignition of any leaked electrolyte.
  9. In case of disposal, insulate between (+) and (-) of battery by an insulating Jumbling batteries or with other metal materials cause short-circuiting. As a result, catching fire, heat generation, leakage or bursting.