USER MANUAL V1.3

Scavenger Transmitter Module
STM 320 / STM 329 / STM 320C / STM 320U

March 3, 2015

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

EnOcean GmbH
Kolpingring 18a
82041 Oberhaching
Germany

Phone +49.89.67 34 689-0
Fax +49.89.67 34 689-50
info@enocean.com
www.enocean.com

Subject to modifications
STM 320 / STM 329 / STM 320C / STM 320U
User Manual V1.3
March 3, 2015

REVISION HISTORY

The following major modifications and improvements have been made to the first version of this document:

No	Major Changes
0.5	Initial version
0.90	New drawings added; new energy consumption data added; application note for connecting an external battery added; Agency certifications added; new charging circuitry added; editorial changes
0.95	Editorial changes
0.99	Pin for connection of backup battery changed; section 3.4 inserted; drawings updated
1.00	Drawing updated
1.02	Remark added in 3.4; additional remarks in 2.4; label information modified in chapter 5; Shelf life added in 1.4; Conducted output power replaced by radiated output power in 1.2; other editorial changes
1.03	Duration of a sub-telegram corrected to 0.9ms in 2.3;
1.04	Specification of shelf life improved. Chapter Related Documents added
1.1	STM 320U added
1.2	STM 329 added
1.3	Added advanced security information of firmware STM 320 / STM 331

Published by EnOcean GmbH, Kolpingring 18a, 82041 Oberhaching, Germany
www.enocean.com, info@enocean.com, phone ++49 (89) 6734 6890

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.

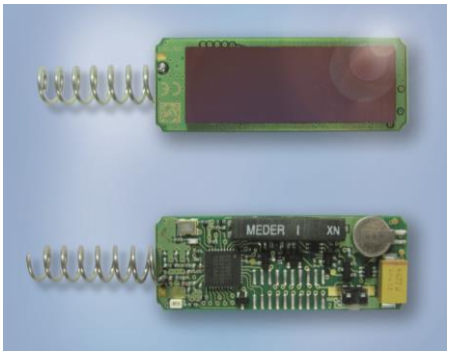
TABLE OF CONTENT

1 RELATED DOCUMENTS

For mechanical integration please refer to our 3D drawings found at
http://www.enocean.com/en/enocean_modules/stm-320/

2 GENERAL DESCRIPTION

2.1 Basic functionality



The radio transmitter module STM 32x from EnOcean enables the implementation of a wireless magnet contact sensor. Powered by a solar cell, it works absolutely maintenance-free. An integrated energy store allows operation for several days even in total darkness.
Key applications are window and door sensors.
The STM 32x supervises an integrated reed contact and reports every status change immediately (open <> closed). In addition a sign of life signal is transmitted every 20-30 minutes.
A LRN button is pre-installed on the PCB. When this button is pressed a special teach-in signal is sent.
There are three frequency variants – STM 320, STM 329 in 868 MHz, STM 320C in 315 MHz, and STM 320U in 902MHz.
Additionally the STM 320 and STM 329 in 868 MHz include the enhanced secure mode. In enhanced secure mode the communication is protected by enhanced security features e.g. encryption. The modules can be switched from standard mode (without enhanced security) to enhanced mode and back by long press of LRN button also in field operation.

Features with built-in firmware

- Pre-installed solar cell
- On-board energy storage and charging circuit
- On-board LRN button
- On-board TX indicator LED
- On-board reed contact
- Communication protected by enhanced security features – STM 320 / STM 329

2.2 Technical data

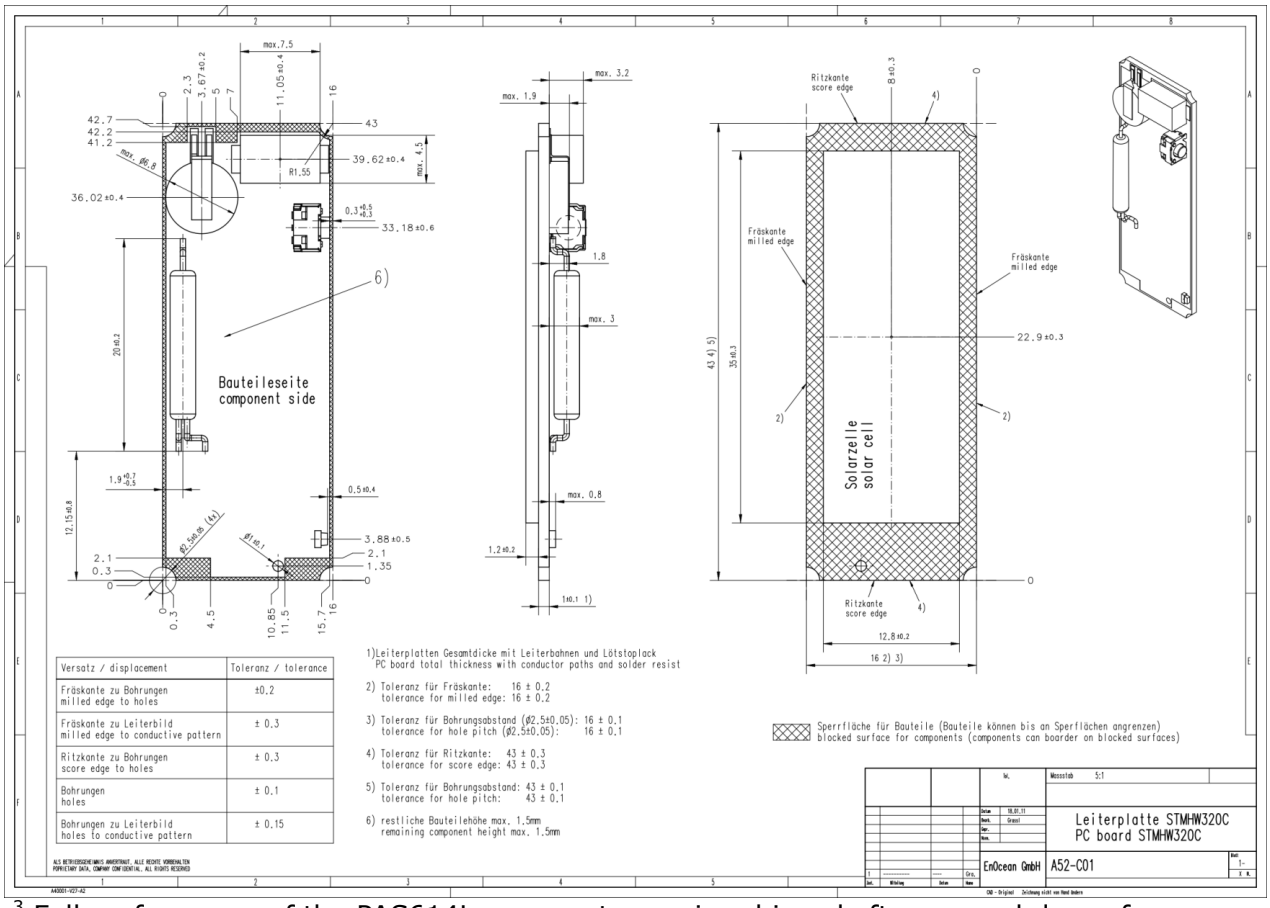
Antenna	Pre-installed helical antenna installed
Frequency	315.0 MHz (STM 320C) 868.3 MHz (STM 32X) 902.875MHz (STM 320U)
Radio Standard	EnOcean 902MHz/868 MHz/315 MHz
Data rate/Modulation type	125 kbps/ASK(868MHz, 315MHz) FSK(902MHz)
Radiated Output Power	STM 32X: +5 dBm[1] (EIRP) ± 2.5 dB[2] STM 320C: +92 dBµV/m**1** ± 2 dB**2** STM 320U: +99 dBµV/m**1** ± 2 dB**2**
Power Supply	Pre-installed solar cell

[1] Measured in test laboratory, measurement uncertainty 2.7 dB
[2] Tolerance of measurement in production at 50 Ω

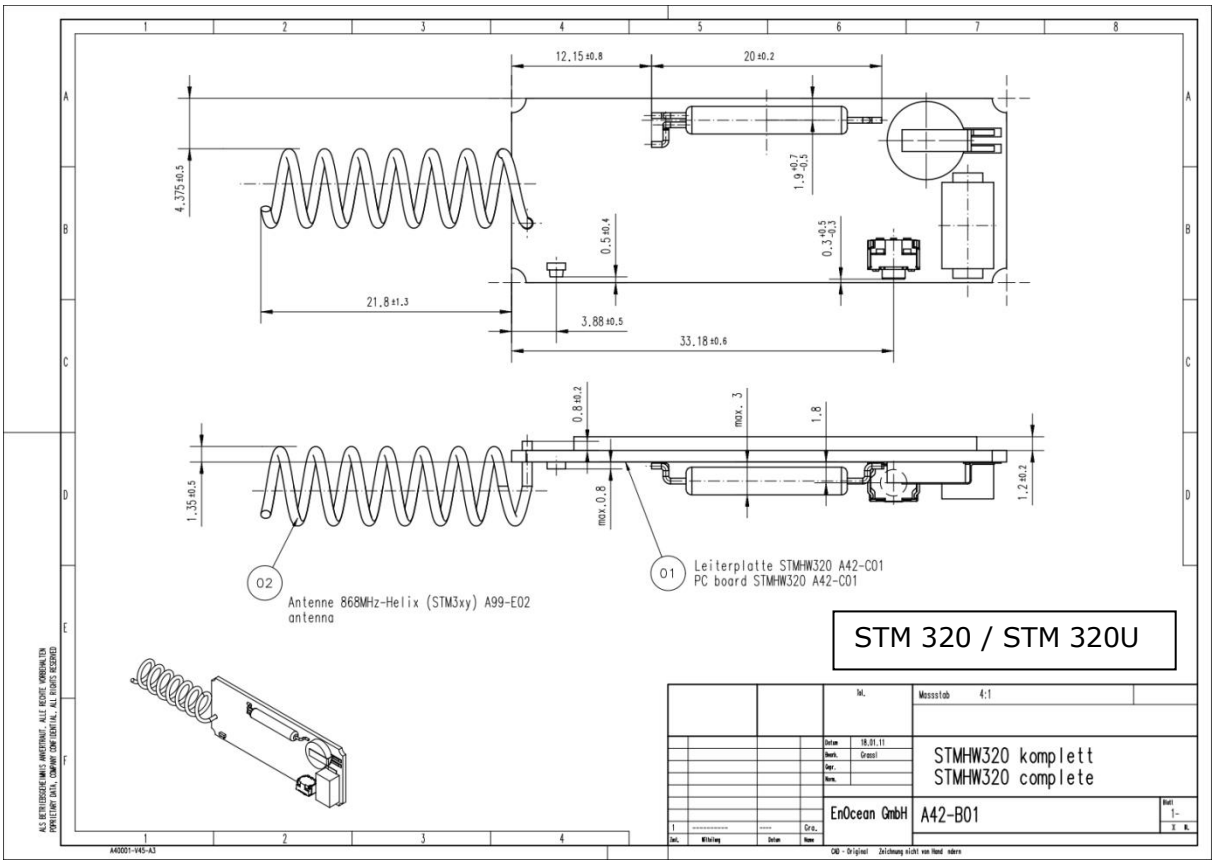
	Illumination 50-100000 lux
Initial operation time in darkness @ 25°C	typ. 6 days, min 90 hours if energy storage fully charged transmission of telegram every 25 min on average[3]
Operation start up time with empty energy store	typ. 2.5 min @ 400 lux / 25°C incandescent or fluorescent light
Reed contact	1x internal, Meder MK23-90-BV14496 or MK01-I
Radio Regulations	R&TTE EN 300 220 (STM 32X) FCC CFR-47 Part 15 (STM 320C, STM 320U)
Encryption Algorithms	VAES 128, CMAC – STM 320 / STM 329

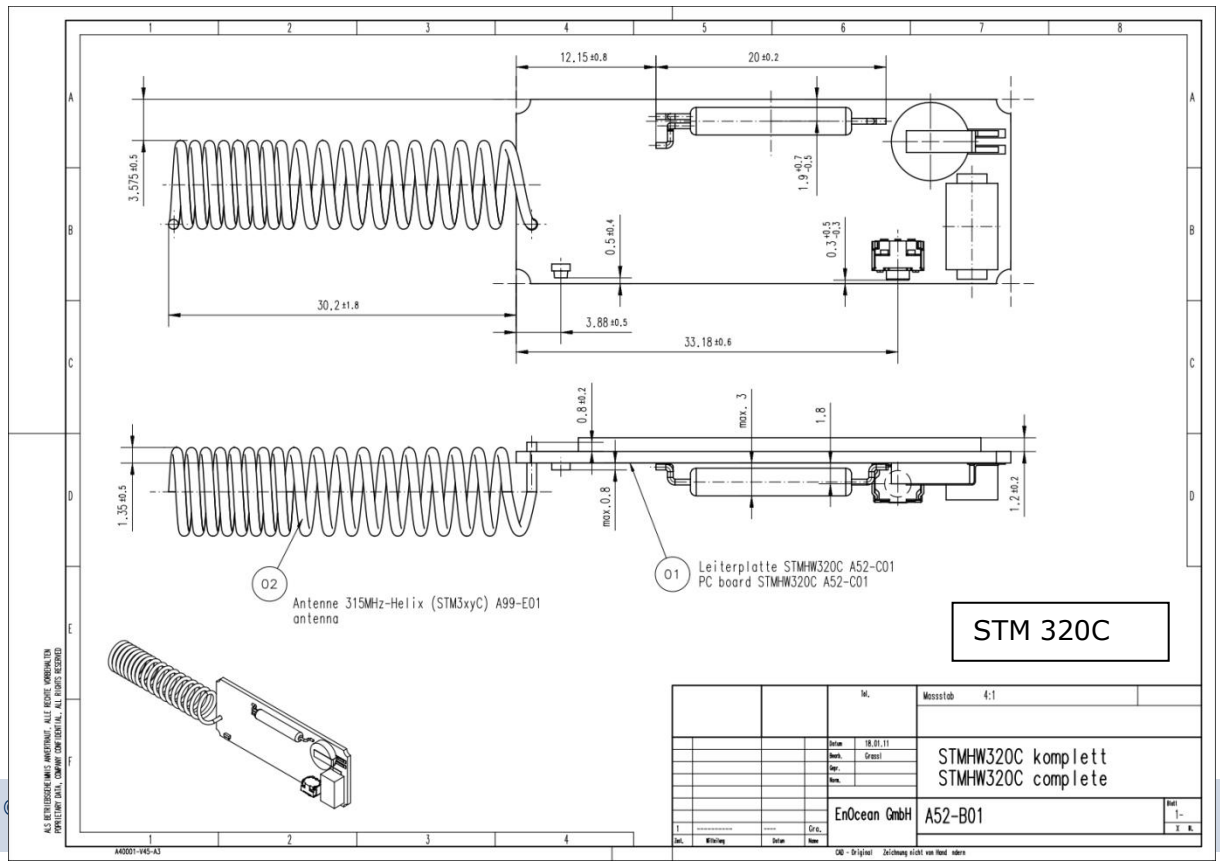
2.3 Physical dimensions

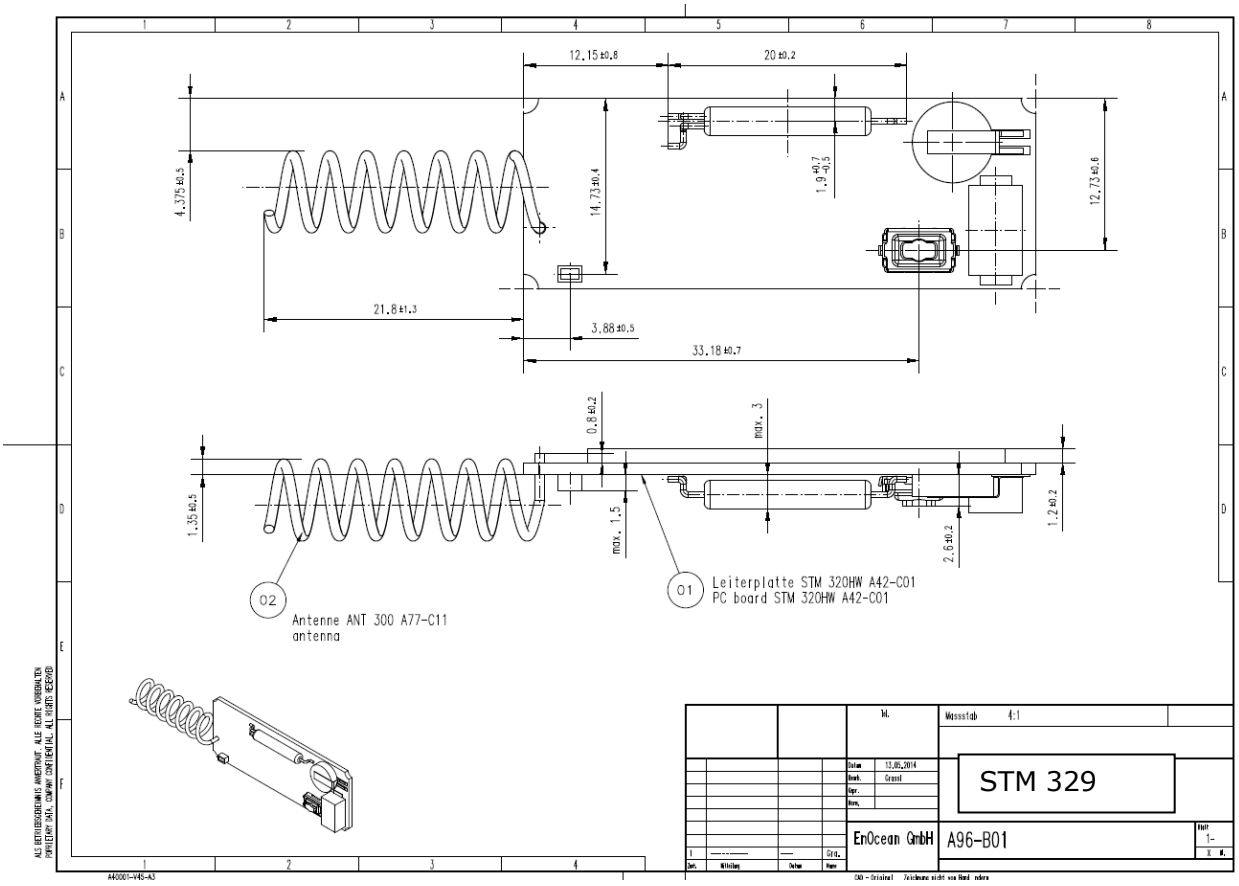
PCB dimensions	43±0.2 x 16±0.3 x 1±0.1 mm
Module height	6 mm
Weight	5.2 g (STM 32X), 6.5 g (STM 320C), 5.2 g (STM 320U)



[3] Full performance of the PAS614L energy storage is achieved after several days of operation (up to two weeks) at good illumination level. Performance degrades over life time, especially if energy storage is exposed to higher temperatures. Each 10 K drop in temperature doubles the expected life span.


12,15 ±0,8
20 ±0,2
4,375 ±0,5
1,9 +0,7 -0,5
0,5 ±0,4
0,3 +0,5 -0,3
21,8 ±1,3
3,88 ±0,5
33,18 ±0,6
0,8 ±0,2
max. 3
1,8
1,35 ±0,5
max. 0,8
1,2 ±0,2
02
Antenne 868MHz-Helix (STM3xy) A99-E02
antenna
01
Leiterplatte STMHW320 A42-C01
PC board STMHW320 A42-C01
STM 320 / STM 320U
Massstab 4:1
STMHW320 komplett
STMHW320 complete
EnOcean GmbH
A42-B01


12,15 ±0,8
20 ±0,2
3,575 ±0,5
1,9 +0,7 -0,5
0,5 ±0,4
0,3 +0,5 -0,3
30,2 ±1,8
3,88 ±0,5
33,18 ±0,6
0,8 ±0,2
max. 3
1,8
1,35 ±0,5
max. 0,8
1,2 ±0,2
02
Antenne 315MHz-Helix (STM3xyC) A99-E01
antenna
01
Leiterplatte STMHW320C A52-C01
PC board STMHW320C A52-C01
STM 320C
Massstab 4:1
STMHW320C komplett
STMHW320C complete
EnOcean GmbH
A52-B01



2.4 Environmental conditions

Operating temperature	-20 °C … +60 °C
Storage temperature	-20 °C … +60 °C, recommended[4]: +10 °C…+30 °C, <60%r.h.
Shelf life (in absolute darkness)	36 months after delivery[5]
Humidity	0% … 93% r.h., non-condensing

The module shall not be placed on conductive materials, to prevent discharge of the internal energy storages5. Even materials such as conductive foam (ESD protection) may have negative impact.

[4] Recommended for maximum life of energy storage capacitor

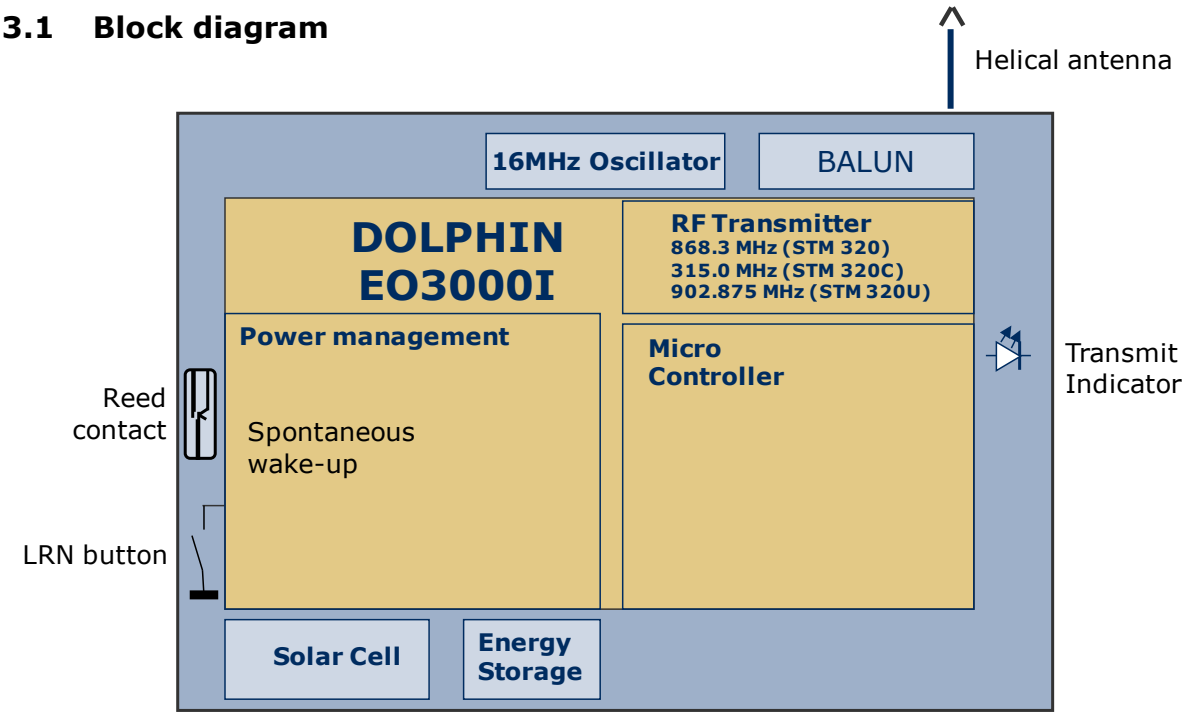
[5] Deep discharge of the PAS614L energy storage leads to degradation of performance. Therefore products have to be taken into operation after 36 months. At least the PAS614L needs to be recharged to 2.1 V.

2.5 Ordering Information

Type	Ordering Code	Frequency	Note
STM 320	**S3001-D320**	**868.3 MHz**	**Supports Enhanced security.**
STM 329	**S3001-D329**	**868.3 MHz**	**Supports Enhanced security.**
STM 320C	**S3031-D320**	**315.0 MHz**	
STM 320U	**S3051-D320**	**902.875 MHz**	

3 FUNCTIONAL DESCRIPTION

3.1 Block diagram



A change of the reed contact status or pushing the LRN button will wake the transmitter unit to send a radio telegram immediately (reed contact position, LRN push button status, unique 32-bit sensor ID, checksum). In addition a redundant retransmission signal is sent to announce the contact status even in case of no input signal changes. This signal transmitted every 20-30 min, affected at random. The transmit indicator LED flashes briefly at every radio transmission.

Between the wake-up phases, the device is in sleep mode for minimum power consumption.

3.2 Radio telegram

STM 32x transmits a radio telegram according to EnOcean Equipment Profile EEP D5-00-01 as defined in the EnOcean Equipment Profiles specification. (http://www.enocean-alliance.org/eep/)

By pressing the LRN button in standard mode an 1BS Teach-in telegram is transmitted.

3.2.1 Enhances security telegram – STM 320 / STM 329

The STM 320 / STM 329 can be operated in:

- Standard mode – no enhanced security is used. This is the common operation mode, originally available. This is also the default factory mode.
- Security mode – communication is protected by enhanced security features. This mode was added later in module evolution.

In secure mode of STM 320 / STM 329 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 the highest possible level:

- 24-bit RLC,
- No RLC TX
- 4-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 3.2. EEP D5-00-01.

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

3.2.2 Switching between modes - STM 320 / STM 329

STM 320 / STM 329 can be switched from normal mode to secure mode and vice versa by long press of the LRN Button.

The behaviour of the LRN button is following:

1. Button is pressed – LED flashes briefly Teach-in is performed according to the actual mode.
2. Button is hold
    a. If released in period < 10 seconds then actual mode is kept. No further action.
    b. If hold for at least 10 seconds then the actual mode is changed (standard -> secure or secure -> standard). LED flashes briefly. Teach-in is performed according to the actual (new) mode.
3. Button is released – no action.

Upon entry into secure mode, a secure teach-in telegram is sent by STM 320 / STM 329. Please see Chapter 3.2.3 for details.

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. Therefore mode change is limited to 50 times. In normal application scenario only very few are required.

The factory delivery mode of the STM 320 / STM 329 is Standard – not encrypted. This mode is common mode originally available. Secure mode was added in later product upgrades.

3.2.3 Security Teach-In – STM 320 / STM 329

To process security communication on a receiver the STM 320 / STM 329 has to send a security teach-in telegram to the receiver and so inform him about the used security profile,

AES key and initial RLC counter. The security teach-in has to take place before any other communication can be executed (profile teach-in included). To trigger the transmission of the teach-in telegram press the LRN button. The security teach-in and then the profile teach-in are transmitted. The profile teach-in telegram is already protected by advanced security features.

The process of sending security teach-in telegram and profile teach-in telegram is triggered by pressing the LRN button in secure mode.

The behaviour of the LRN button is following:

1. Button is pressed
2. Security 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 http://www.enocean.com/en/security-specification/.

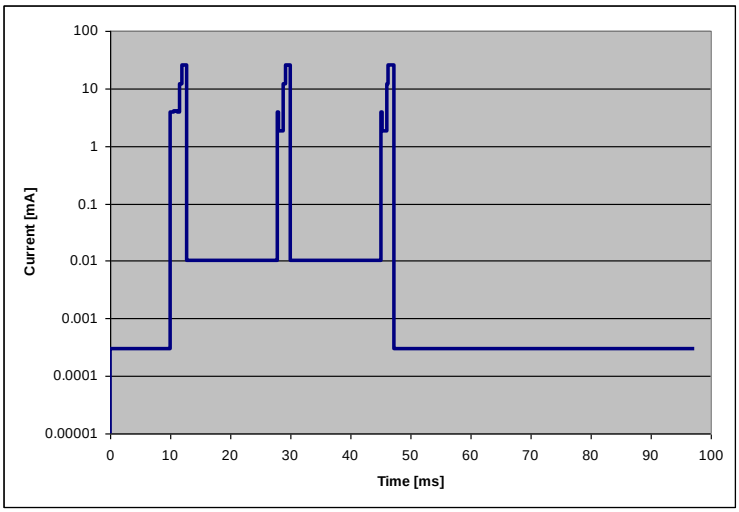
3.3 Transmit timing

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 transmission cycle, 3 identical subtelegrams are transmitted within 40 ms. The transmission of a subtelegram lasts approximately 0.9 ms. The delay between the three transmission bursts is affected at random.

3.3.1 Secure transmission timing

In secure mode of STM 320 and STM 329 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 subtelegram lasts approximately 1.2 ms.

3.4 Energy consumption



Charge needed for one measurement and transmit cycle: ~80 µC
Charge needed for one measurement cycle without transmit: ~10 µC

Calculations are performed on the basis of electric charges because of the internal linear voltage regulator of the module. Energy consumption varies with voltage of the energy storage while consumption of electric charge is constant.

From these values the following typical performance parameters at room temperature have been calculated:

Wake and transmit cycle [s]	Operation Time in darkness [h] when storage fully charged	Required reload time [h] at 200 lux within 24 h for continuous operation
1500	175	1.8

Assumptions:

- Internal storage PAS614L-VL3 (after several days of operation at good illumination level) with 0.25 F, Umax=3.2 V, Umin=2.3 V, T=25 °C
- Consumption: Transmit cycle 80 µC, measurement cycle 10 µC
- Pre-installed solar cell ECS 300, operating values 3 V and 5 µA @ 200 lux fluorescent light
- Current proportional to illumination level (not true at very low levels!)

These values are calculated, the accuracy is about +/-20%! The performance varies over temperature and may be strongly reduced at extreme temperatures.

3.4.1 Consumption in enhanced security mode STM 320 / STM 329

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. With this measure the operation in dark time is even little bit increased.

There it is to assume the operation in dark time is not reduced by using enhanced security.

3.5 Storing the Rolling code counter – STM 320 / STM 329

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.

In STM 320 / STM 329 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.

Constrains

- Writing a RLC (4bytes) 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 40ms 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/

Strategy

- We implement a ring buffer which consist of multiple (16) pages
- The RLCs are written sequentially to the current page
- When the page is full we move to the next page
- When almost all pages are full, we erase the oldest page

Diagram

Legend

Free page

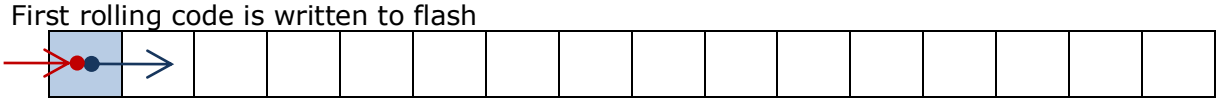
Partially written page

Full page

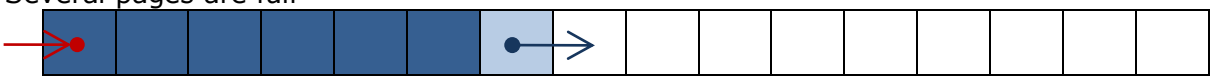
Pointer to the current page and direction how the rolling codes are written

Pointer to the last/oldest page and direction how the flash pages are erased

First rolling code is written to flash

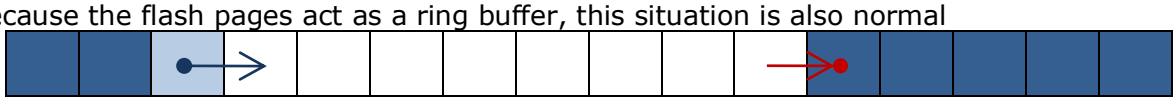


Several pages are full



Almost all flash were full, we deleted the first page

Because the flash pages act as a ring buffer, this situation is also normal



Definitions

- RLC - 32-bit counter value used for encryption and authentication. After a data telegram is send it is incremented by 1.
- RLC_{ram0} - RLC value saved in RAM0. It contains the actual RLC value
- RLC_{flash} - RLC value saved in flash. This value is older or the same as RLC_{ram0}
- $\Delta RLC = RLC_{ram0} - RLC_{flash}$. The difference between the RLC_{flash} value saved in flash, and the current RLC_{ram0} saved in RAM0.
- $RLC_{SAVE-WINDOW}$ is fixed to 30.
- V_{cc} - actual supply voltage [V]
- V_{on} - voltage required to switch the chip ON after it was in OFF state.
- V_{off} - under this voltage the chip is switched off, RAM and RAM0 data are lost.

Constrains

- We assume that the voltage will not drop from about Von to under Voff
- It has to be assured by HW and SW that any operation e.g. sending a telegram or erasing a flash page will not cause to drop the voltage from Von to under Voff

Rules

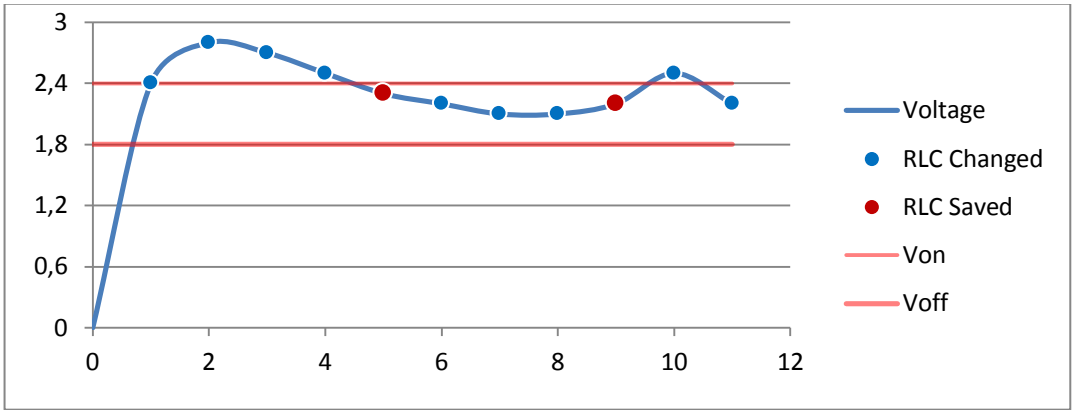
- If $V_{cc} > V_{on}$ then
  increment the RLC_{ram0} after the data telegram has been sent
  saving to flash is not needed

- If $V_{cc} < V_{on}$ and $\Delta RLC > RLC_{SAVE-WINDOW}$ then
  the RLC_{ram0} has to be saved to flash and $RLC_{flash} = RLC_{ram0}$
  send data telegram and increment RLC_{ram0}

- If $V_{cc} > 2.8V$ and *flash memory is almost full* then
  erase a flash page and go to deepsleep
  don't send any telegram - this would required even more energy, and the chip would probably switch off

- After the chip starts from power down
  read RLC_{flash} from flash and set $RLC_{ram0} = RLC_{flash} + RLC_{SAVE-WINDOW}$

Example Diagram

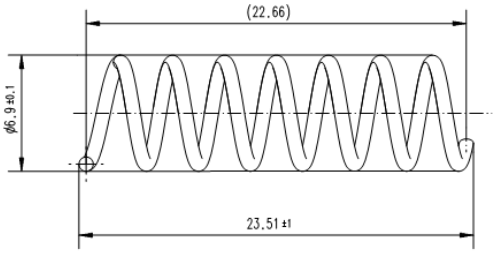


For the illustration we set $RLC_{SAVE\text{-}WINDOW}$ equal to 4

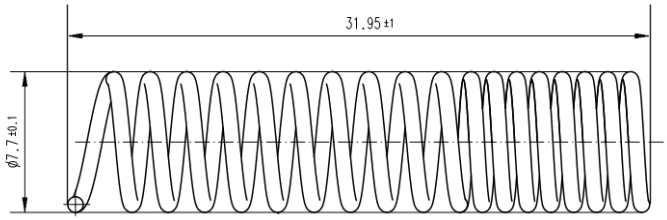
4 APPLICATIONS INFORMATION

4.1 Helical antenna

868 MHz / 902 MHz

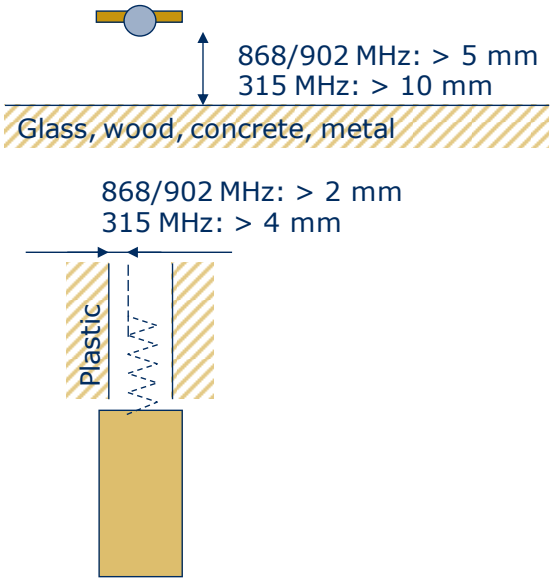


315 MHz

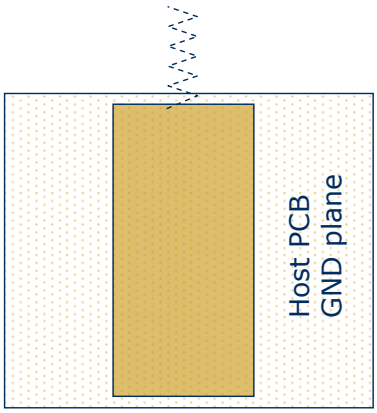


Antenna recommendation:

STM 320 without host PCB



STM 320 with host PCB



4.2 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 are considered by using a PTM, a STM or a TCM radio transmitter device and the TCM radio receiver device with preinstalled whip antenna and 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:

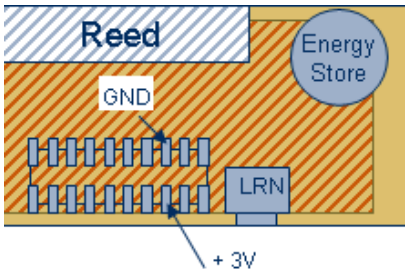
- Switch mounted on metal surfaces (up to 30% loss of transmission range)
- Hollow lightweight walls filled with insulating wool on metal foil
- False ceilings with panels of metal or carbon fiber
- Lead glass or glass with metal coating, steel furniture

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.

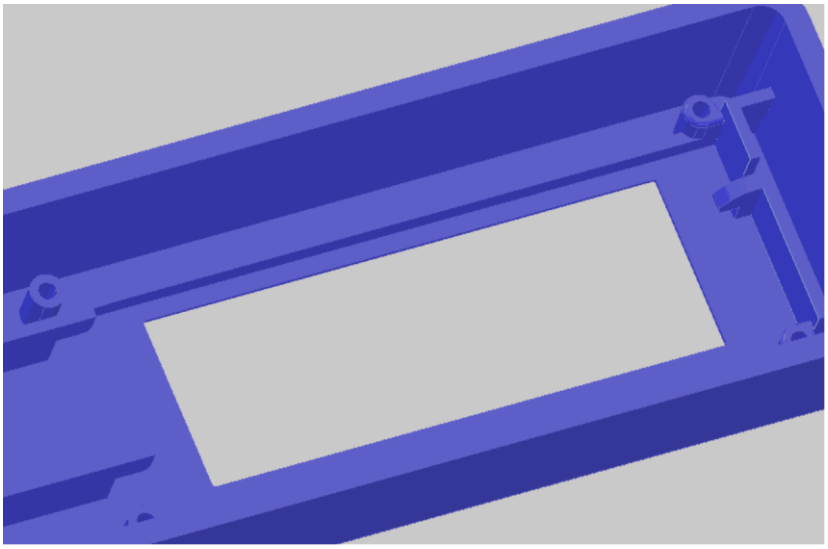
4.3 Connecting an external backup battery

In case there is not sufficient light available for operation with solar cell an external 3 V Lithium backup battery can be connected to the module at the soldering pads shown below:



4.4 Mounting STM 32x 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.

5 AGENCY CERTIFICATIONS

The modules have been tested to fulfil the approval requirements for CE (STM 320) and FCC/IC (STM 320C / STM 320U) 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. the duty cycle limitations!

5.1 CE Approval

The STM 320 module bears the EC conformity marking CE and conforms to the R&TTE EU-directive on radio equipment. The assembly conforms to the European and national requirements of electromagnetic compatibility. The 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.
- EnOcean RF modules may only be used to transfer digital or digitized data. Analog speech and/or music are not permitted.
- 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 R&TTE Directive 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 320 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 320	Pre-installed helical antenna
STM 329	Pre-installed helical antenna

5.2 FCC (United States) certification

5.2.1 STM 320C FCC 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 from 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 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 320C 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 button, 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 320C

  Contains FCC ID: SZV-STM311C
  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 320C	Pre-installed helical antenna	-9 dBi

5.2.2 STM 320C FCC Grant

TCB

GRANT OF EQUIPMENT AUTHORIZATION

TCB

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

PHOENIX TESTLAB GmbH
Koenigswinkel 10
D-32825 Blomberg,
Germany

Date of Grant: 09/28/2010

Application Dated: 09/27/2010

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-STM311C
Name of Grantee: EnOcean GmbH
Equipment Class: Part 15 Security/Remote Control Transmitter
Notes: Transmitter Module
Modular Type: Limited Single Modular

Grant Notes	FCC Rule Parts	Frequency Range (MHZ)	Output Watts	Frequency Tolerance	Emission Designator
	15.231	315.0 - 315.0			

5.2.4 STM 320U FCC APPROVAL

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.

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

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 320U

Contains FCC ID: SZV-STM320U
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.

5.2.5 STM 320U 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: 06/20/2013

Application Dated: 06/20/2013

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-STM320U
Name of Grantee: EnOcean GmbH
Equipment Class: Part 15 Security/Remote Control Transmitter
Notes: 902.875 MHz transmitter

Grant Notes	FCC Rule Parts	Frequency Range (MHZ)	Output Watts	Frequency Tolerance	Emission Designator
	15.231	902.875 - 902.875			

5.2.6 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.

5.3 IC (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 320C:
  Contains IC: 5713A-STM311C

  STM 320U:
  Contains IC: 5713A-STM320U

- 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 320C:
  Contains IC: 5713A-STM311C
  Contient le module d'émission IC: 5713A-STM311C

  STM 320U:
  Contains IC: 5713A-STM320U
  Contient le module d'émission IC: 5713A-STM320U

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

5.3.1 STM 320C Industry Canada Technical Approval Certificate

PHOENIX TESTLAB

TECHNICAL APPROVAL CERTIFICATE
based on the Agreement on Mutual Recognition between the European Community and Canada

CERTIFICAT D'APPROBATION TECHNIQUE
en se basant l'accord de reconnaissance mutuelle entre la Communauté Européenne et le Canada

CERTIFICATE NUMBER *NUMÉRO DE CERTIFICAT*	**10-112818a**
CERTIFICATION NUMBER *NUMÉRO DE CERTIFICATION*	**IC: 5713A-STM311C**
TYPE OF SERVICE *TYPE DE SERVICE*	**New Family Certification / Limited Modular Approval**
CERTIFICATE HOLDER *TITULAIRE DU CERTIFICAT*	**EnOcean GmbH Kolpingring 18a 82041 Oberhaching Germany**
TYPE OF EQUIPMENT *GENRE DE MATÉRIEL*	**Transmitter Module**
TRADE NAME AND MODEL NUMBER *MARQUE ET NUMÉRO DE MODELE*	**EnOcean** **STM311C / STM320C / STM321C**
FREQUENCY RANGE *BANDE DE FRÉQUENCES*	**315MHz**
EMISSION DESIGNATION (TRC-43) *DÉSIGNATION D'ÉMISSION (CRT-43)*	**398KA1D**
R.F. POWER RATING (WATT) *PUISSANCE NOMINALE H.F (WATT)*	**/**
ANTENNA INFORMATION *INFORMATION D'ANTENNE*	**Helical Antenna (3cm)**
CONTACT INFORMATION OF TESTING LABORATORY *COORDONNÉES DU LABORATOIRE D'ESSAI*	**Center of Quality Engineering SGS Germany GmbH Hofmannstraße 50 81379 München**
CERTIFIED TO / SPECIFICATION / ISSUE *CERTIFIÉ SELON LE / CAHIER DES CHARGES / ÉDITION*	**RSS-210 Issue 7, RSS-GEN Issue 2 RSS-102 Issue 4**

Certification of equipment means only that the equipment has met the requirements of the above noted specification. License applications, where applicable to use certified equipment, are acted on accordingly by the 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 of the radio standards specifications and procedures issued by the Department.

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 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 aux procédures d' Industry Canada.

Labelling of Certified Radio Equipment: Equipment that has received certification but is not labelled with the applicant's name, model number and the certification number as outlined above is not considered certified.

***Étiquetage du matériel radio homologué:* Le matériel pour lequel une certification a été obtenue mais qui n'est pas étiqueté conformément aux exigences ci-dessus (nom du requérant, numéro de modèle et numéro de certification) n'est pas considéré comme certifié.**

Certification Body Code: DE0003 recognised by Bundesnetzagentur

Signed by / *Signataire* Uwe Dollitz

Blomberg, 29 September 2010 Foreign Certification Body (FCB)

BNetzA-CAB-04/22-53

PHOENIX TESTLAB GmbH ▪ Königswinkel 10 D-32825 Blomberg, Germany ▪ Phone: +49 (0)5235-9500-0 ▪ Fax: +49 (0) 5235-9500-10
http://www.phoenix-testlab.de

5.3.2 STM 320U Industry Canada Technical Approval Certificate

EMCC DR. RAŠEK ™

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. ► CA001350D

TECHNICAL ACCEPTANCE CERTIFICATE CANADA

CERTIFICAT D'ACCEPTABILITÉ TECHNIQUE CANADA

CERTIFICATION No. / No. DE CERTIFICATION	►	**5713A-STM320U**			
ISSUED TO / DÉLIVRÉ A	►	**EnOcean GmbH**			
Street Address / Numéro et rue		Kolpingring 18 a	City / Ville		Oberhaching
Province or State / Province ou État		Germany	Postal Code / Code postal		82041
TYPE OF EQUIPMENT / GENRE DE MATÉRIEL	►	Remote Control Device	TRADE NAME & MODEL / MARQUE ET MODELE	►	Transmitter Module STM 320U
FREQUENCY RANGE / BANDE DE FRÉQUENCES	►	902.88 - 902.88 MHz	EMISSION TYPE / GENRE D'ÉMISSION	►	322K1F1DAN
R.F. POWER / PUISSANCE H.F.	►	66.58 dBµV/m @ 3m	ANTENNA / ANTENNE	►	Integrated / Incorporé
SPECIFICATION / SPÉCEFICATION	►	RSS-210	ISSUE / ÉDITION 8		11 December 2010
TEST LABORATORY / LABORATOIRE D'ESSAI	►	EMCCons DR. RAŠEK GmbH & Co. KG	CN 3464C	OATS	3461C-1
Street Address / Numéro et rue		Moggast, Boelwiese 8	City / Ville		Ebermannstadt
Province or State / Province ou État		Germany	Postal Code / Code postal		91320
Name / Nom		Karlheinz Kraft	Tel		0049 9194 9016
E-mail		k.kraft@emcc.de	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 exigencies 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 deliverance 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 procedures 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 laspécification ci-dessus.

DATE 21 June 2013

Certification Officer

EMCCert DR. RAŠEK GmbH • Stoernhofer Berg 15, 91364 Unterleinleiter, Germany
Tel.: +49 9194 72279-01 • Fax: +49 9194 72279-06 • E-mail: emc.cert@emcc.de • Web: www.emcc.de

5.3.3 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, meme si le brouillage est susceptible d'en compromet-tre 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 actioner cet équipment.

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 Label Information