

## Transceiver Module TCM 410J

16 December 2014



**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

## TCM 410J

## REVISION HISTORY

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

No	Major Changes
1.00	Initial version
1.10	Added certification information and PCB Design
1.2	Changed power support information
1.3	Updated Energy consumption. Added example circuits for reset and prog_en pins. Extended PIN description. Added IOVDD and PINs circuits when using dee psleep.

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

© EnOcean GmbH  
 All Rights Reserved

### 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.



TCM 410J

**TABLE OF CONTENT**

- 1 MODULE VARIANTS AND RELATED DOCUMENTS ..... 4
- 2 GENERAL DESCRIPTION ..... 4
  - 2.1 Basic functionality ..... 4
  - 2.2 Technical data ..... 5
  - 2.3 Physical dimensions ..... 5
  - 2.4 Environmental conditions ..... 6
  - 2.5 Ordering information ..... 6
- 3 FUNCTIONAL DESCRIPTION ..... 6
  - 3.1 Pin out ..... 6
  - 3.2 Pin description and operational characteristics ..... 8
    - 3.2.1 GPIO supply voltage - IOVDD ..... 9
  - 3.3 Absolute maximum ratings (non operating) ..... 10
  - 3.4 Maximum ratings (operating) ..... 10
  - 3.5 System environment ..... 11
  - 3.6 Serial Interface ..... 12
  - 3.7 Built-in Repeater ..... 13
  - 3.8 Smart Acknowledge ..... 13
  - 3.9 Remote Management ..... 13
  - 3.10 Serial communication with TYPE 01 or TYPE 10 ..... 13
  - 3.11 Module configuration ..... 14
- 4 APPLICATIONS INFORMATION ..... 14
  - 4.1 Transmission range ..... 14
  - 4.2 Antenna options ..... 15
    - 4.2.1 Overview ..... 15
    - 4.2.2 Whip antenna ..... 15
    - 4.2.3 Helical antenna ..... 15
    - 4.2.4 Top loaded PCB spiral antenna ..... 16
  - 4.3 Recommendations for laying a whip antenna ..... 19
  - 4.4 Power supply requirements ..... 20
  - 4.5 Layout recommendations ..... 20
    - 4.5.1 Recommended foot pattern ..... 21
  - 4.6 Soldering information ..... 24
  - 4.7 Tape & Reel specification ..... 25
- 5 AGENCY CERTIFICATIONS ..... 26
  - 5.1 Japanese Type Approval ..... 26

## TCM 410J

## 1 MODULE VARIANTS AND RELATED DOCUMENTS

This document describes operation of TCM 410J module with the frequency 928.35 MHz. Subject of description is the:

- build in software Gateway Controller.
- used hardware TCM 410J

In the Document we refer to the Hardware and Software characteristic by the module name TCM 410J.

In addition we recommend following our [application notes](#), in particular

- AN101: Power Supply Layout – Layout considerations for Line-Power
- AN102: Antenna Basics – Basic Antenna Design Considerations for EnOcean based Products

The specification of the serial protocol ESP3 can be found here:

<http://www.enocean.com/esp>

## 2 GENERAL DESCRIPTION

### 2.1 Basic functionality

TCM 410J is a SMD mountable radio transmitter module enabling the realization of gateways for EnOcean 928.35 MHz radio systems. It provides a bi-directional radio interface and a bi-directional serial interface. Radio messages are sent transparently through the serial interface in both directions from and to an externally connected host processor or host PC. In addition control commands can be sent from the host, e.g. to configure the repeater functionality or to manage Smart Ack functions. TCM 410J can act as postmaster for up to 15 bi-directional sensors using Smart Ack technology.



### Features

- Smart Ack controller functionality
- Transparent radio channel
- Programmable repeater functionality (1 Level)
- ESP3 support (EnOcean Serial Protocol V3)
- API programmable!

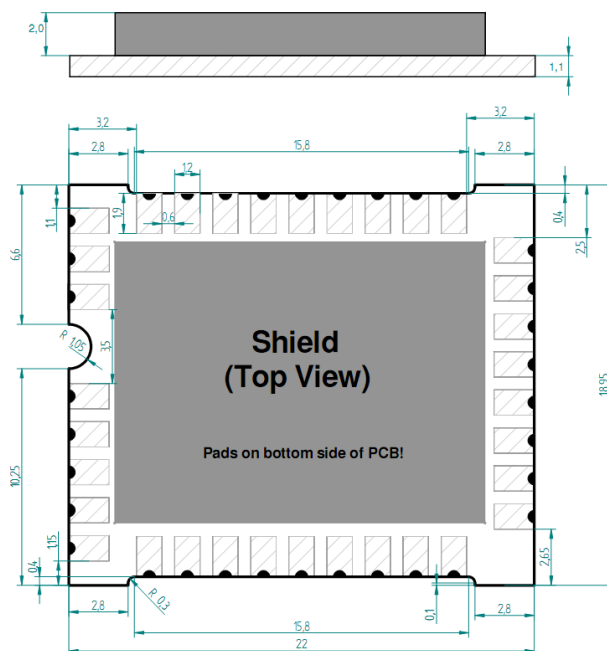
TCM 410J

## 2.2 Technical data

### Features overview

<b>Antenna</b>	External whip or 50Ω antenna mountable
<b>Frequency</b>	928.35 MHz (FSK)
<b>Radio Standard</b>	EnOcean Radio Protocol 2 (FSK)
<b>Data rate/Modulation type</b>	125 kbps FSK
<b>Receiver Sensitivity (at 25°C)</b>	typ. -95 dBm
<b>Conducted Output Power</b>	typ. 0dBm
<b>Power Supply</b>	2.6...5V
<b>Serial Interface</b>	UART - EnOcean Serial Protocol 3
<b>Current Consumption</b>	Receive mode (incl. CPU current): 27 mA Transmit mode (incl. CPU current): 22 mA
<b>Dimensions of PCB</b>	22x19x3.1 mm
<b>Operating temperature</b>	-25 to +85°C
<b>Radio Regulations</b>	ARIB STD-T108

## 2.3 Physical dimensions



Unless otherwise specified dimensions are in mm.

Tolerances:

PCB outline dimensions ±0.2 mm

All other tolerances ±0.1 mm

### TCM 410J (pads on bottom side of PCB!)

<b>PCB Dimension</b>	22 x 19 x 3.1 mm
<b>Weight</b>	1.9 g

TCM 410J

### 2.4 Environmental conditions

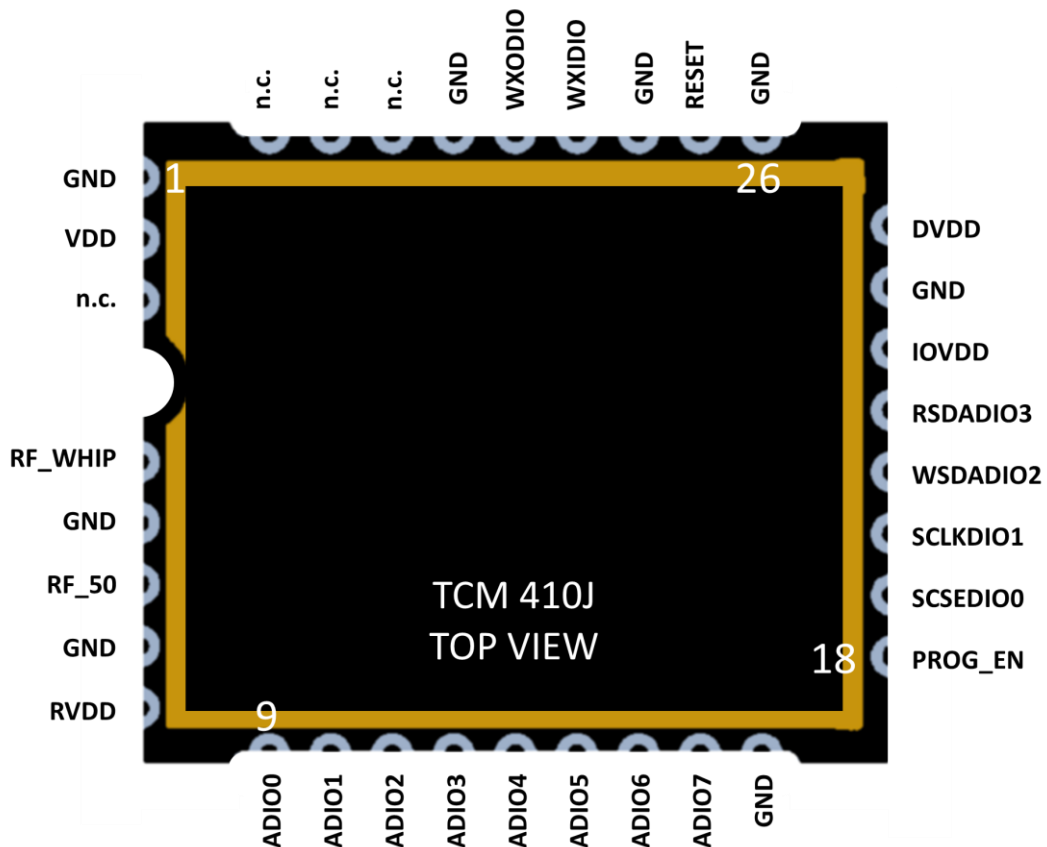
Operating temperature	-25 °C ... +85 °C
Storage temperature	-40 °C ... +85 °C
Storage temperature in tape & reel package	-20 °C ... +50 °C
Humidity	0% ... 93% r.H., non-condensing

### 2.5 Ordering information

Type	Ordering Code	Frequency
TCM 410J	S3063-K410	928.35 MHz

## 3 FUNCTIONAL DESCRIPTION

### 3.1 Pin out



The figure above shows the pin out of the TCM 410J hardware. The pins are named according to the naming of the Dolphin chip to simplify usage of the DOLPHIN API 2.

## TCM 410J

The table in section 0 shows the translation of hardware pins to a naming that fits the functionality of the built-in firmware..

## TCM 410J

### 3.2 Pin description and operational characteristics

HW Symbol	Pin #	Function	Characteristics
GND	1, 5, 7, 17, 24, 26, 28, 31	Ground connection	Must be connected to GND; see 4.4
VDD	2	Supply voltage	2.6 V ... 5 V
RVDD	8	RF supply voltage regulator output	Leave open
DVDD	25	Digital supply voltage regulator output	1.8 V Output current: max. 5 mA
IOVDD	23	GPIO supply voltage	Must be connected to desired interface supply voltage (see 3.4) See also 3.2.1.
RESET	27	Reset input Programming I/F	Active high reset. External 10 kΩ pull-down parallel to 10nF capacitor recommended. See 3.5.
PROG_EN	18	Digital input, Programming I/F	HIGH (at start up): programming mode active LOW: operating mode External 10 kΩ pull-down parallel to 10nF capacitor recommended. See 3.5.
ADIO0	9	Not used by standard FW.	Configured as Digital In with Pull Up
ADIO1	10	Not used by standard FW.	Configured as Digital In with Pull Up
ADIO2	11	Not used by standard FW.	Configured as Digital In with Pull Up
ADIO3	12	Not used by standard FW.	Configured as Digital In with Pull Up
ADIO4	13	Not used by standard FW.	Configured as Digital In with Pull Up
ADIO5	14	Not used by standard FW.	Configured as Digital In with Pull Up
ADIO6	15	UART input – RX	See 3.7
ADIO7	16	UART output - TX Programming I/F	See 3.7
SCSEDIO0	19	Not used by standard FW. Programming I/F	Configured as Digital In with Pull Up
SCLKDIO1	20	Not used by standard FW. Programming I/F	Configured as Digital In with Pull Up
WSDADIO2	21	Not used by standard FW. Programming I/F	Configured as Digital In with Pull Up
RSDADIO3	22	Not used by standard FW. Programming I/F	Configured as Digital In with Pull Up
WXIDIO	29	Not used by standard FW.	Configured as Digital In with Pull Up
WXODIO	30	Not used by standard FW.	Configured as Digital In with Pull Up
RF_WHIP	4	RF output	Output for whip antenna
RF_50	6	RF output	50 Ohm output for external antenna
n.c.	3, 32,33, 34	Not connected	Do not connect!



## TCM 410J

### 3.2.1 GPIO supply voltage - IOVDD

For digital communication with other circuitry (peripherals) the digital I/O configured pins of the mixed signal sensor interface (ADIO0 to ADIO7) and the pins of the serial interface (SCSEDIO0, SCLKDIO1, WSDADIO2, RSDADIO3) may be operated from supply voltages different from DVDD. Therefore an interface voltage supply pin IOVDD is available which must be connected either to DVDD or to an external supply within the tolerated voltage range of IOVDD.

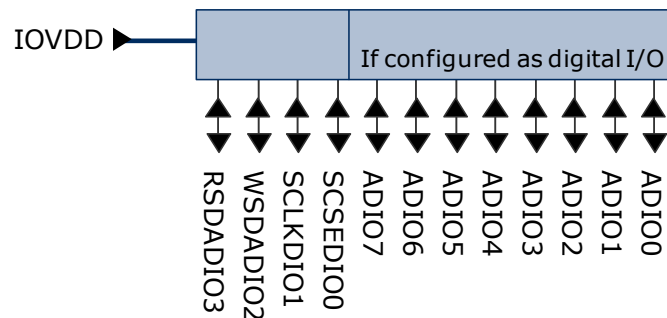


If DVDD=0 V (e.g. in any sleep mode or if  $VDD < V_{OFF}$ ) and IOVDD is supplied, there may be unpredictable and varying current from IOVDD caused by internal floating nodes. It must be taken care that the current into IOVDD does not exceed 10 mA while DVDD=0 V.

If DVDD=0 V and IOVDD is not supplied, do not apply voltage to any above mentioned pin. This may lead to unpredictable malfunction of the device.



For I/O pins configured as analogue pins the IOVDD voltage level is not relevant! However it is important to connect IOVDD to a supply voltage as specified in 3.4.



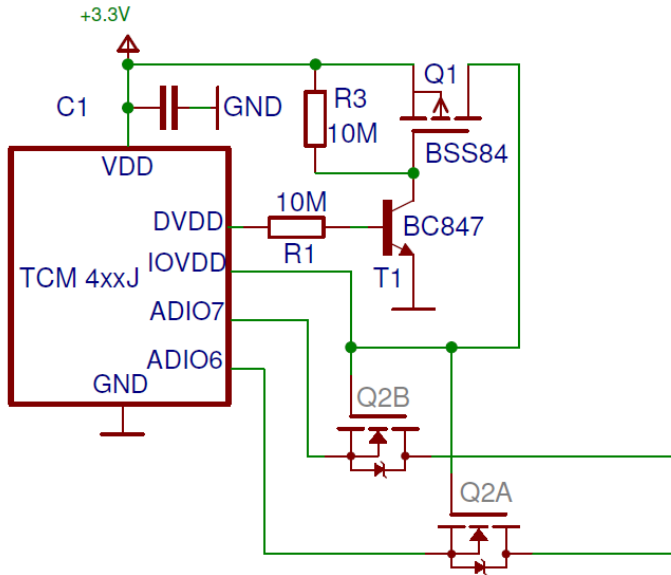
### 3.2.2 Handling IOVDD and PINs with sleep mode

TCM 410J is aimed for line powered applications to communicate over UART. But sometimes it is desirable to put the device into sleep mode. As stated in chapter 3.2.1. it is not recommended to supply IOVDD or connect voltage to IOs if DVDD = 0 V (e.g. in any sleep mode or if  $VDD < V_{OFF}$ ).

If the module is put into deep sleep mode (i.e. with the serial command CO\_WR\_SLEEP, see chapter 3.7) it is important to respect above statement and cut IOVDD supply and do not apply voltage on IOs. The IOs concern mostly the UART interface

The following example applies to cut the IOVDD from supply and IO by the DVDD as controlling signal.

TCM 410J



**3.3 Absolute maximum ratings (non operating)**

Symbol	Parameter	Min	Max	Units
VDD	Supply voltage at VDD	-0.5	5.5	V
IOVDD	GPIO supply voltage	-0.5	3.6	V
GND	Ground connection	0	0	V
VINA	Voltage at every analog input pin	-0.5	2	V
VIND1	Voltage at RESET, and every digital input pin except WXIDIO/WXODIO	-0.5	3.6	V
VIND2	Voltage at WXIDIO / WXODIO input pin	-0.5	2	V

**3.4 Maximum ratings (operating)**

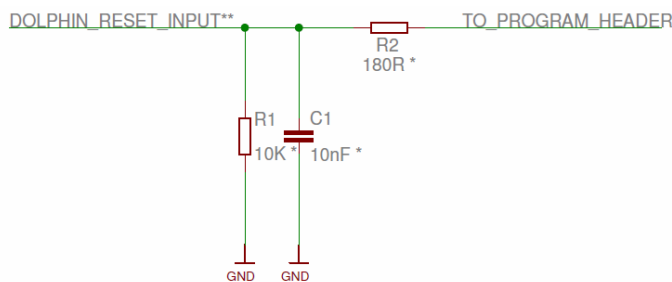
Symbol	Parameter	Min	Max	Units
VDD	Supply voltage at VDD	2.6	5	V
IOVDD	GPIO supply voltage (see also 3.2.1)	1.7	3.6	V
GND	Ground connection	0	0	V
VINA	Voltage at every analog input pin	0	2.0	V
VIND1	Voltage at RESET, and every digital input pin except WXIDIO / WXODIO	0	3.6	V
VIND2	Voltage at WXIDIO / WXODIO input pin	0	2.0	V
VDDR	Max. ripple at VDD		50	mVpp

TCM 410J

### 3.5 Suggested RESET and PROG\_EN circuitry

In order to ensure reliable operation it is recommended to connect both the RESET and the PROG\_EN with a 10 kΩ resistor in parallel with a 10 nF capacitor to ground. This avoids spurious signal detection in very noisy environments and in situations where an external programming header is provided.

The suggested circuit is shown below.



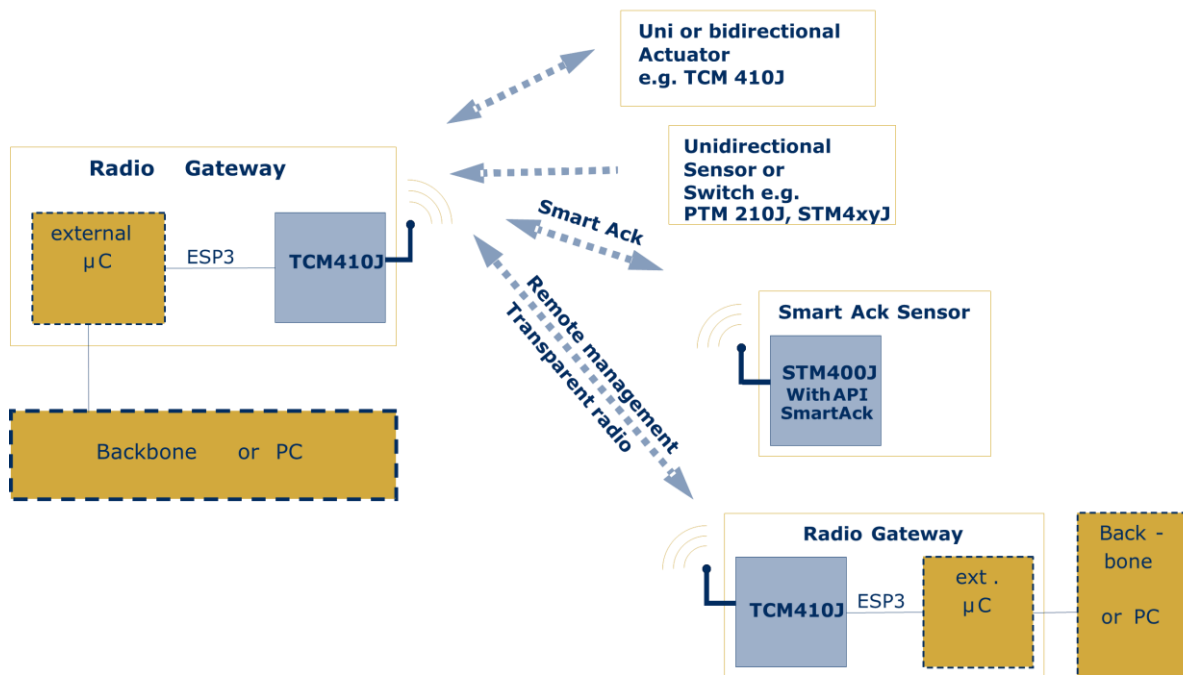
\* values may be different depending on the application

\*\* same circuit recommended for PROG\_EN Input

If the programming interfaces / reset line is not used then the TO\_PROGRAM\_HEADER line should be put to GND.

### 3.6 System environment

In the figure below, TCM 410J is shown in a typical system environment.



## TCM 410J

### 3.7 Serial Interface

TCM 410J provides a bi-directional serial interface which conforms to the EnOcean ESP3 specification. For details regarding ESP3 please refer to the ESP3 specification<sup>1</sup>. The data rate on the serial interface is 56.8 kbit/s which is usually interoperable with systems running at 57.6 kbit/s.

Direction	Nominal serial data rate	Tolerance
TX (sent by module)	56888 bit/s (=57600 bit/s - 1.23%)	< 50 ppm
RX (received by module)	56888 bit/s	< 5%

The following ESP3 commands are supported:

- Type 1 Radio command for transparent mode (compatible mode)
- Type 10 Radio command for transparent mode (native mode)
- Type 2 Responses
- Type 4 Event
  - SA\_CONFIRM\_LEARN to confirm/discard learn in/out
  - CO\_READY to indicate wake up from deep sleep initiated by CO\_WR\_SLEEP
- Type 5 Common commands
  - CO\_WR\_SLEEP to enter energy saving mode (deep sleep mode)
  - CO\_WR\_RESET to reset the device
  - CO\_RD\_VERSION to read SW/HW versions, chip ID etc.
  - CO\_WR\_BIST to perform flash BIST operation
  - CO\_WR\_IDBASE to write ID range base number
  - CO\_RD\_IDBASE to read ID range base number
  - CO\_WR\_REPEATER to configure repeater functionality
  - CO\_RD\_REPEATER to read repeater state
  - CO\_WR\_FILTER\_ADD to add filter to filter list (up to 10 filters are supported)
  - CO\_WR\_FILTER\_DEL to delete filter from filter list
  - CO\_WR\_FILTER\_DEL\_ALL to delete all filter
  - CO\_WR\_FILTER\_ENABLE to enable/disable supplied filters
  - CO\_RD\_FILTER to read supplied filters
  - CO\_WR\_WAIT\_MATURITY to wait maturity time before returning radio telegrams
  - CO\_WR\_MODE - Sets the gateway transceiver mode, either packet type 01 or packet type 10
- Type 6 Smart Acknowledge commands
  - SA\_WR\_LEARNMODE to set/reset Smart Acknowledge learn mode
  - SA\_RD\_LEARNMODE to get learn mode
  - SA\_WR\_LEARNCONFIRM to add or delete a mailbox of a client
  - SA\_WR\_RESET to send a reset command to a client
  - SA\_RD\_LEARNEDCLIENTS to get learned mailboxes/clients
  - SA\_WR\_POSTMASTER to activate/deactivate post master functionality
- Type 7 Remote Management messages up to 256 Bytes



All configuration values set via ESP3 commands are held in RAM and will therefore be lost after RESET or after a deep sleep phase. Only Smart Ack mailboxes are stored in FLASH and are available also after RESET or a deep sleep phase.

<sup>1</sup> [http://www.enocean.com/en/enocean\\_modules/tcm-310/](http://www.enocean.com/en/enocean_modules/tcm-310/)

## TCM 410J



After sending a CO\_WR\_RESET command, the following CO\_READY event indicates wake up reason 06 meaning "A memory request from the CPU core does not correspond to any valid memory location." This is caused by the real reset cause used when CO\_WR\_RESET will be performed. It is not a SW/HW malfunction.

### 3.8 Built-in Repeater

TCM 410J provides the option to activate a one level repeater for EnOcean radio telegrams. 1 Level Repeater, If a received telegram is a valid and original (not yet repeated), the telegram is repeated after a random delay.



The repeated telegram is marked as "repeated" by an increased repeater counter.

Configuration of the repeater is done via serial interface commands.

For detailed recommendations regarding the usage of repeaters please refer to our application note [EnOcean Wireless Systems - Installation Notes \(PDF\), 09/2010](#).

### 3.9 Smart Acknowledge

TCM 410J provides a post master function with 15 mailboxes for sensors using Smart Ack technology. For more information on smart acknowledge please refer to <http://www.enocean.com/en/knowledge-base/>.



When teaching-in a device using Smart Acknowledge please take care to switch off all TCM 4xyJ devices which are not continuously powered. Otherwise these TCM 4xyJ modules could be declared postmaster. As soon as the power supply is switched off, a postmaster would be missing and Smart Acknowledge would not work any longer!

### 3.10 Remote Management

TCM 410J provides a transparent radio channel also for remote management messages with a message length of up to 256 bytes. This enables an external micro controller connected to TCM 410J to handle remote management request from external devices or to control other devices via remote management. For more information on remote management please refer to <http://www.enocean.com/en/knowledge-base/>.

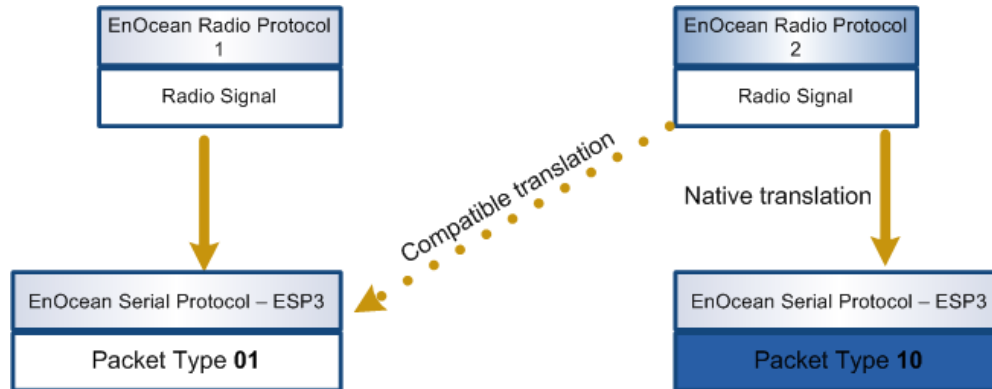
### 3.11 Serial communication with TYPE 01 or TYPE 10

TCM 410J operates as transparent gateway so the received radio telegrams are forwarded on as serial packets to external controller with type 01 or type 10. The mode can be switched by the serial command CO\_WR\_MODE.

- Usage of Type 01 is for compatibility reasons (compatibility mode)
- Usage of Type 10 is native for the Radio Protocol of TCM 410J.

The scenario is depicted on the figure below.

## TCM 410J



For transmission requests from external controller to the TCM 410J both types can be used at any time of the operation.

### 3.12 Module configuration

Configuration parameters will be stored in a non-volatile memory on the TCM 410J module. The parameters will be changeable with the Dolphin Suite configuration. The following parameters will be adjustable:

- default mode selection – if serial message are forwarded with serial type 01 or serial type 10
- sniffer mode selection – puts module into sniffer mode, which is suiting for network observation and evaluation
- baud rate selection

## 4 APPLICATIONS INFORMATION

### 4.1 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
- Ferro concrete 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

## TCM 410J

should be transmitted as directly as possible through the wall. Wall niches should be avoided. Other factors restricting transmission range:

- Devices mounted on metal surfaces (shielding and detuning of antenna may cause heavy loss of transmission range)
- Hollow lightweight walls filled with insulating wool on metal foil
- Suspended ceilings with panels of metal or carbon fibre
- 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).

## 4.2 Antenna options

### 4.2.1 Overview

Several antenna types have been investigated by EnOcean. Please refer to our application notes AN102, and AN105 which give an overview on our recommendations.

### 4.2.2 Whip antenna

#### 928.35 MHz

Antenna: 64 mm wire, connect to RF\_WHIP  
Minimum GND plane: 50 mm x 50 mm  
Minimum distance space: 10 mm

Positioning and choice of receiver and transmitter antennas are the most important factors in determining system transmission range.

For good receiver performance, great care must be taken about the space immediately around the antenna since this has a strong influence on screening and detuning the antenna. The antenna should be drawn out as far as possible and must never be cut off. Mainly the far end of the wire should be mounted as far away as possible (at least 15 mm) from all metal parts, ground planes, PCB strip lines and fast logic components (e.g. microprocessors).

Do not roll up or twist the whip antenna!

Radio frequency hash from the motherboard desensitizes the receiver. Therefore:

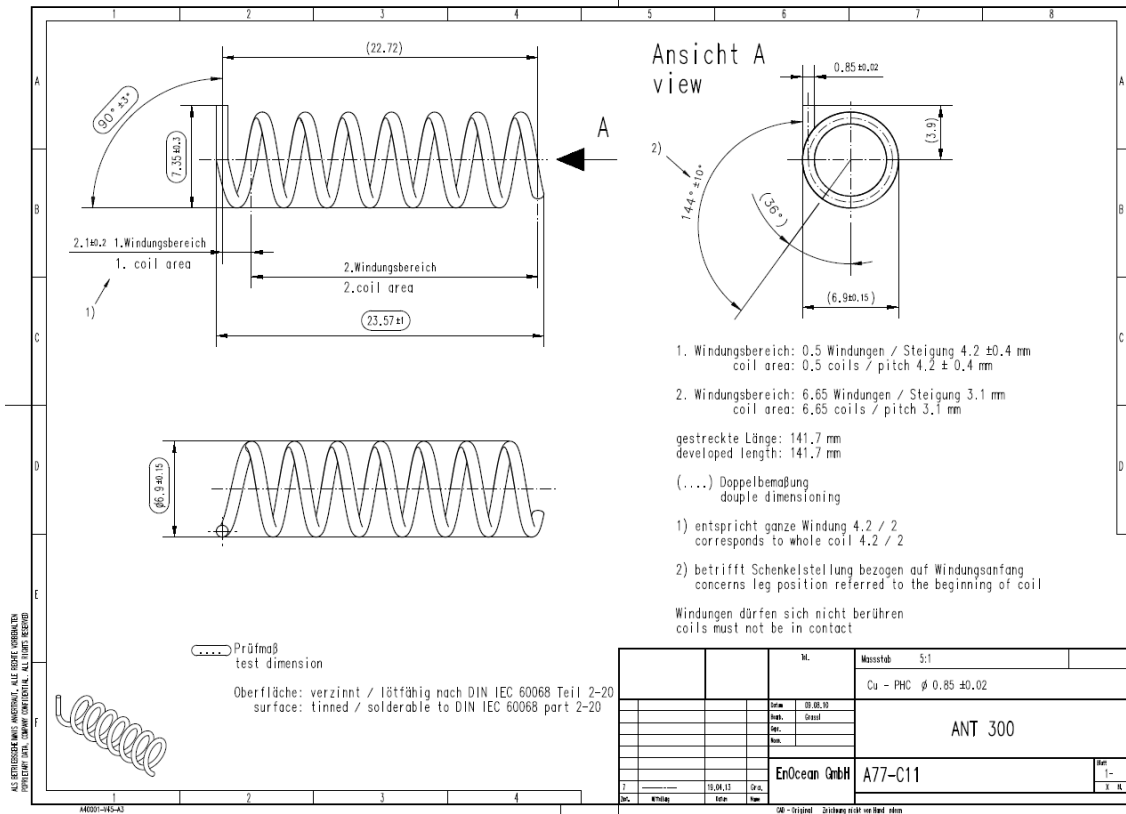
- PCB strip lines on the user board should be designed as short as possible
- A PCB ground plane layer with sufficient ground vias is strongly recommended

### 4.2.3 Helical antenna

#### 928.35 MHz

according to drawing below, connect to RF\_WHIP  
Minimum GND plane: 35 mm x 30 mm  
Minimum distance space: 10 mm

TCM 410J

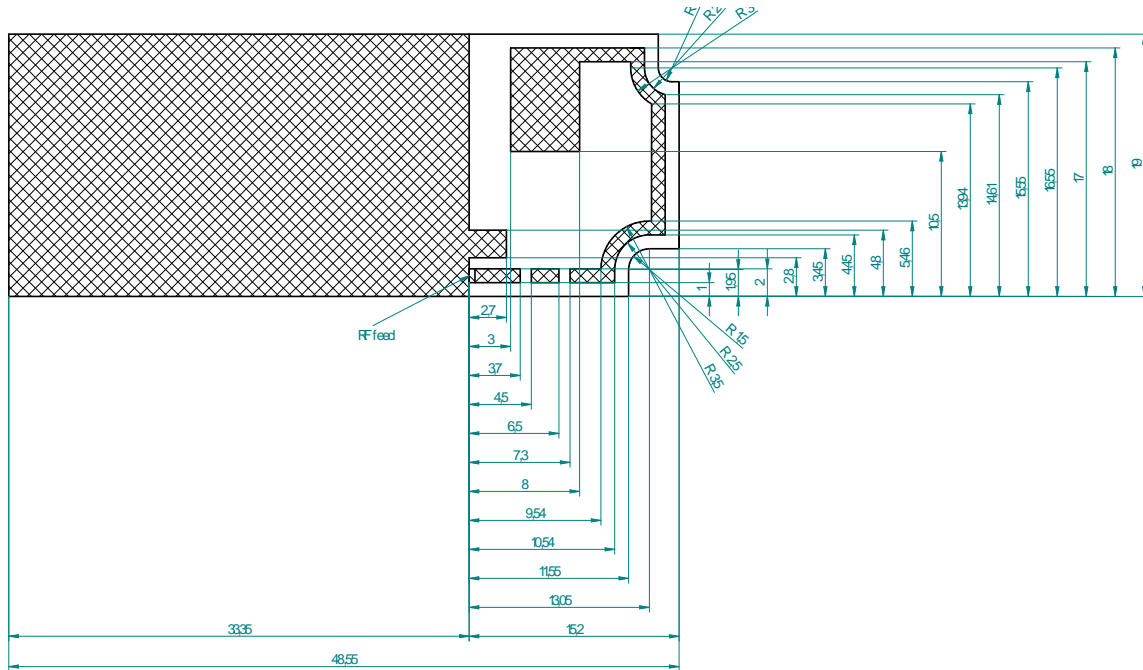


#### 4.2.4 Top loaded PCB spiral antenna

The design of the antenna made on a 1mm thick, two layer FR4 PCB. The dimensions are given in figure below. The hatched areas are double sided in layout. The large area to the left is a ground area. Components can be placed here as long as the area is not split by this nor has long cuts in it which can act as radiators its self.



TCM 410J



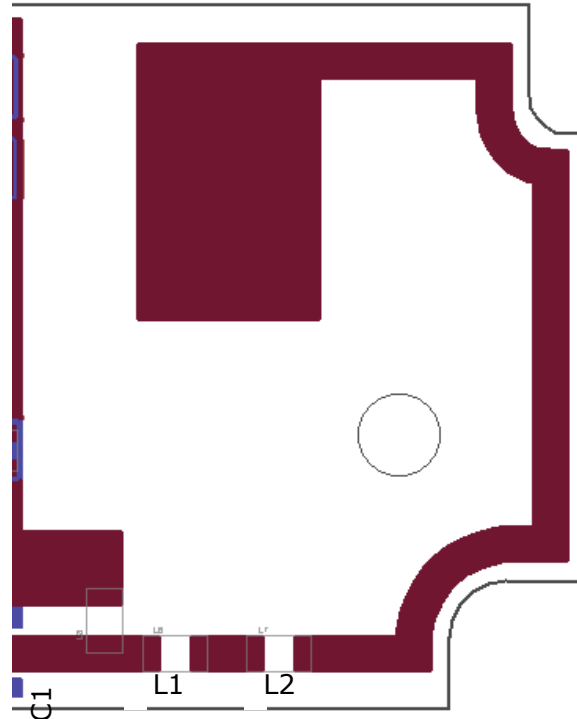
**Dimensions of the PCB antenna.**

Parameter of PCB	VALUE
PCB material	FR4, 2 layer
Thickness (total)	1,27mm
Shape	Rectangular with millings
Dimension	19*48,55 mm

Layer	Thickness in $\mu\text{m}$	Exact description
Solder Mask		Solder resist
Top Layer	35	Cu, >35um after electroplating
Core	1200	
Bottom Layer	35	Cu, >35um after electroplating
Solder Mask		Solder resist
Total	1270	

The PCB antenna uses three discrete matching components. The position of these components can be seen in figure below.

## TCM 410J



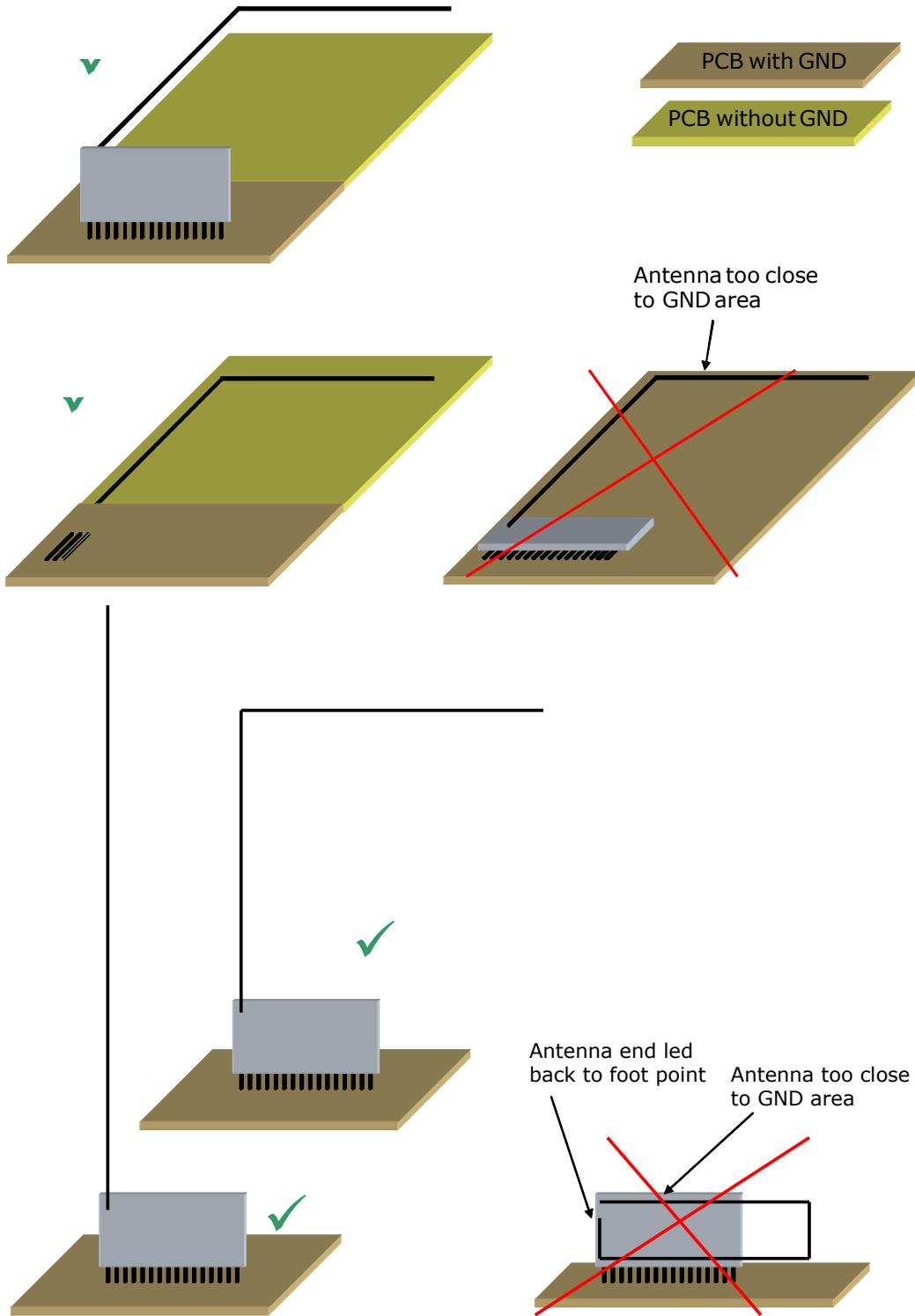
**Position of matching components**

The antenna was matched to  $50\Omega$  input impedance at the feed point. A compromise for a good matching when plugged into a laptop and when plugged to the end of a USB cable was chosen. Several environments in the proximity of the antenna were also evaluated for this compromise. The following table shows the values of the proposed components.

Component	Value
C1	3.3pF
L1	12nH
L2	12nH

0603 components were used for the antenna matching. For the capacitor general purpose COG capacitors with 5% tolerance are sufficient. The inductors should be wire wound inductors from the Würth WE-KI series or the Murata LQW series.

### 4.3 Recommendations for laying a whip antenna



#### 4.4 Power supply requirements

In order to provide a good radio performance, great attention must be paid to the power supply and a correct layout and shielding. It is recommended to place a 22  $\mu$ F ceramic capacitor between VDD and GND close to the module (material: X5R, X7R, min 6.3 V to avoid derating effects).

In addition, an HF SMD EMI Suppression Ferrite Bead such as the Würth WE-CBF HF SMD EMI Suppression Ferrite Bead (Würth order number 742863160) shall be inserted in the power supply line.

For best performance it is recommended to keep the ripple on the power supply rail below 10 mVpp (see 3.4).



All GND pins must be connected to GND. Be careful not to create loops! The ground must be realized ideally on both sides of the PCB board with many Vias. At least there must be a short star connection. Otherwise RF performance can be reduced!

#### 4.5 Layout recommendations



The length of lines connected to I/Os should not exceed 5 cm.



It is recommended to have a complete GND layer in the application PCB, at least in the area below the module and directly connected components (e.g. mid-layer of your application PCB).

Due to unisolated test points there are live signals accessible on the bottom side of the module.

Please follow the following advices to prevent interference with your application circuit:

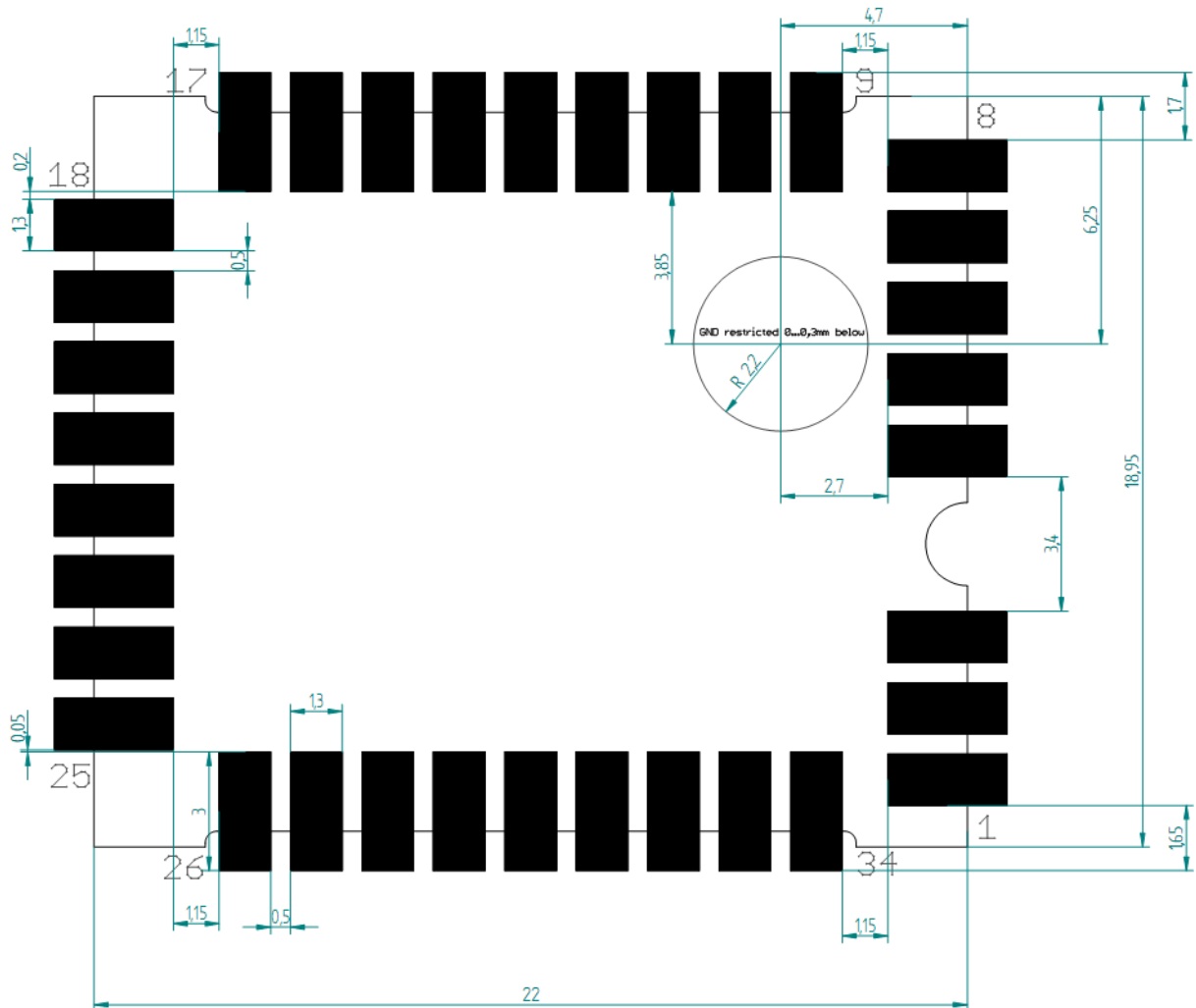
- We suggest avoiding any copper structure in the area directly underneath the module (top-layer layout of your application PCB). If this is not possible in your design, please provide coating on top of your PCB to prevent short circuits to the module. All bare metal surfaces including vias have to be covered (e.g. adequate layout of solder resist).
- It is mandatory that the area marked by the circle in the figure below is kept clear of any conductive structures in the top layer and 0.3 mm below. Otherwise RF performance will be degraded!

Furthermore, any distortive signals (e.g. bus signals or power lines) should not be routed underneath the module. If such signals are present in your design, we suggest separating them by using a ground plane between module and these signal lines.

TCM 410J

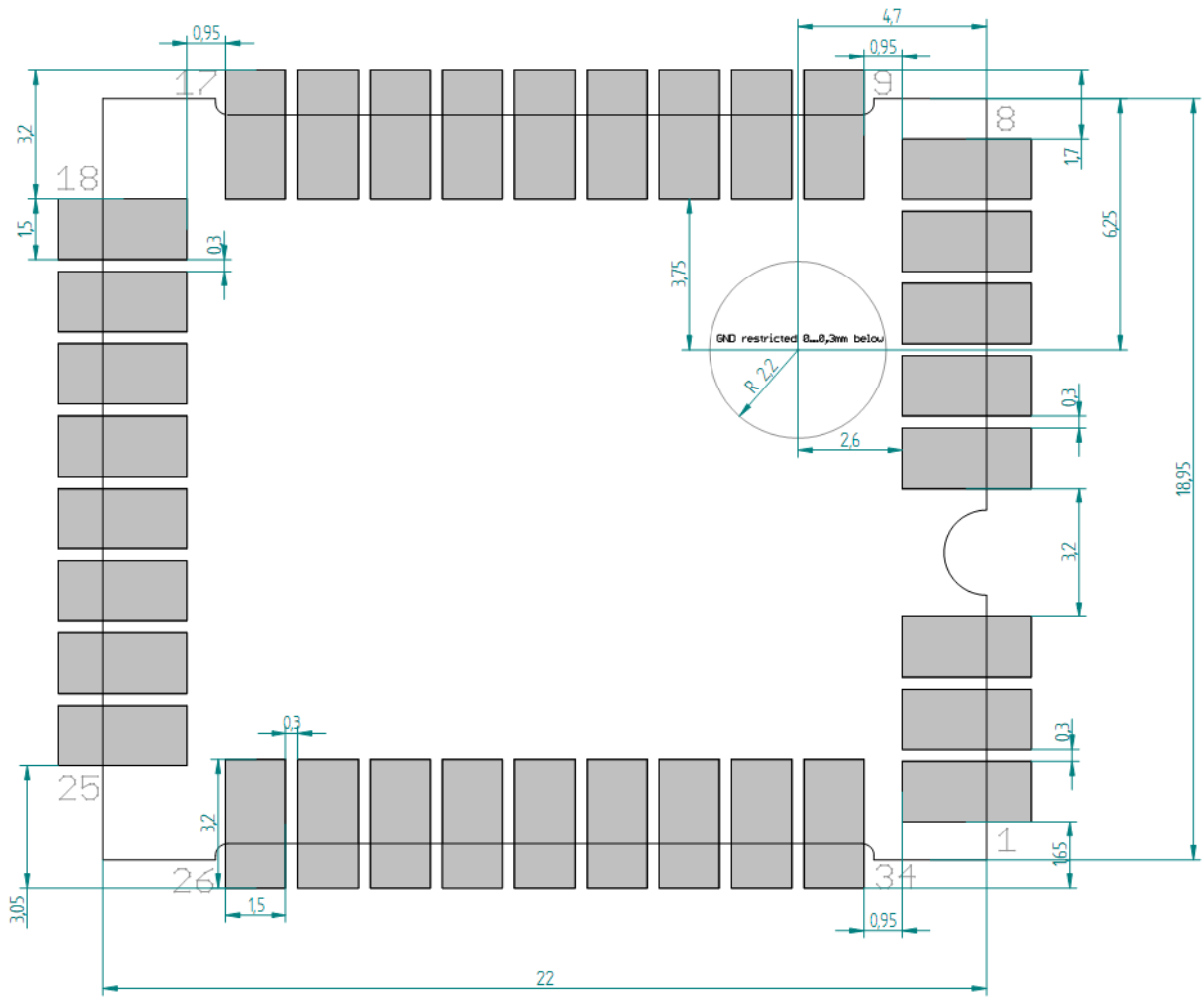
4.5.1 Recommended foot pattern

Top layer



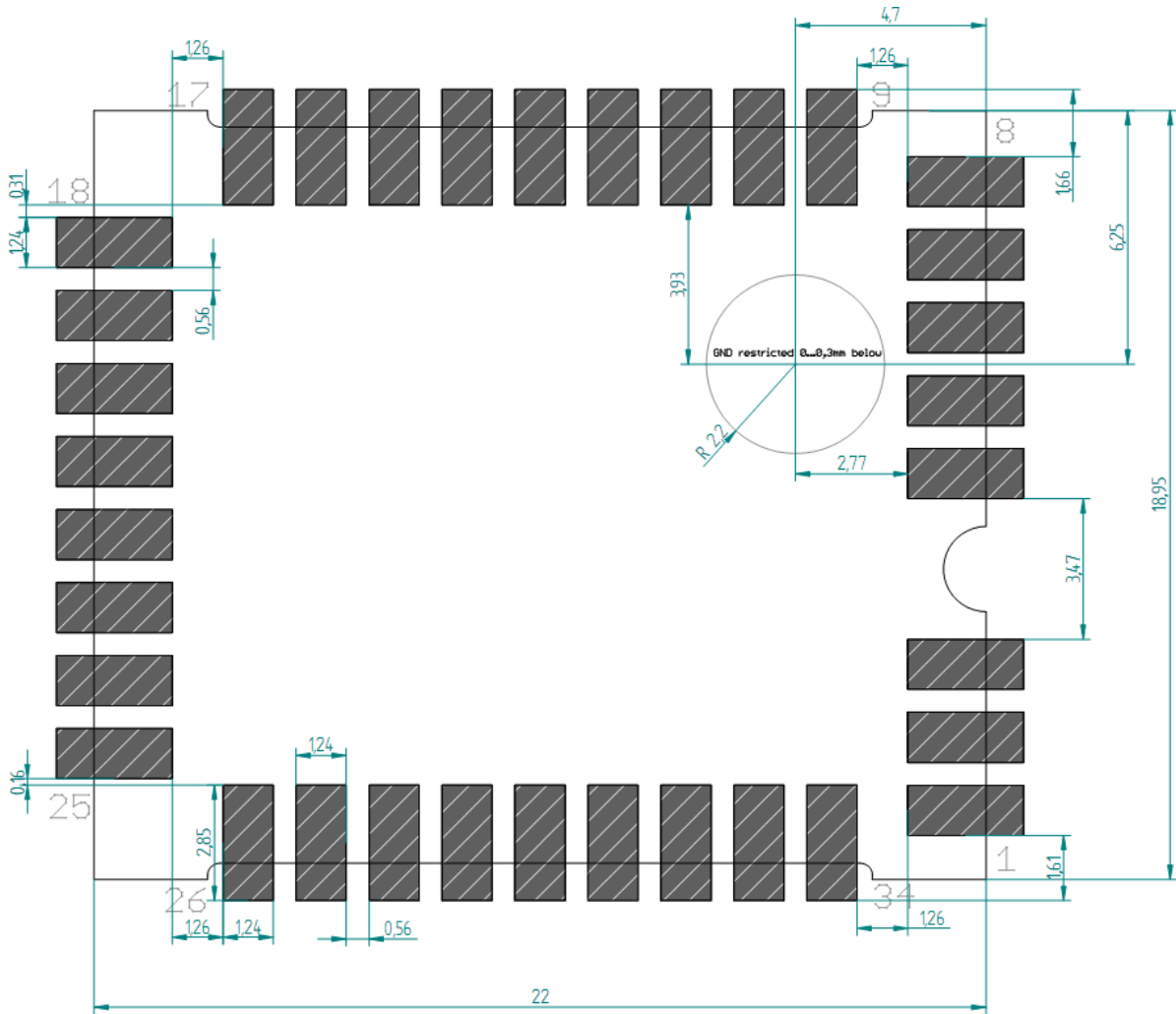
TCM 410J

**Solder resist top layer**



TCM 410J

Solder paste top layer



The data above are also available as EAGLE library.

In order to ensure good solder quality a solder mask thickness of 150 µm is recommended.

In case a 120 µm solder mask is used, it is recommended to enlarge the solder print. The pads on the solder print should then be 0.1 mm larger than the pad dimensions of the module as specified in chapter 0. (not relative to the above drawing).

Nevertheless an application and production specific test regarding the amount of soldering paste should be performed to find optimum parameters.

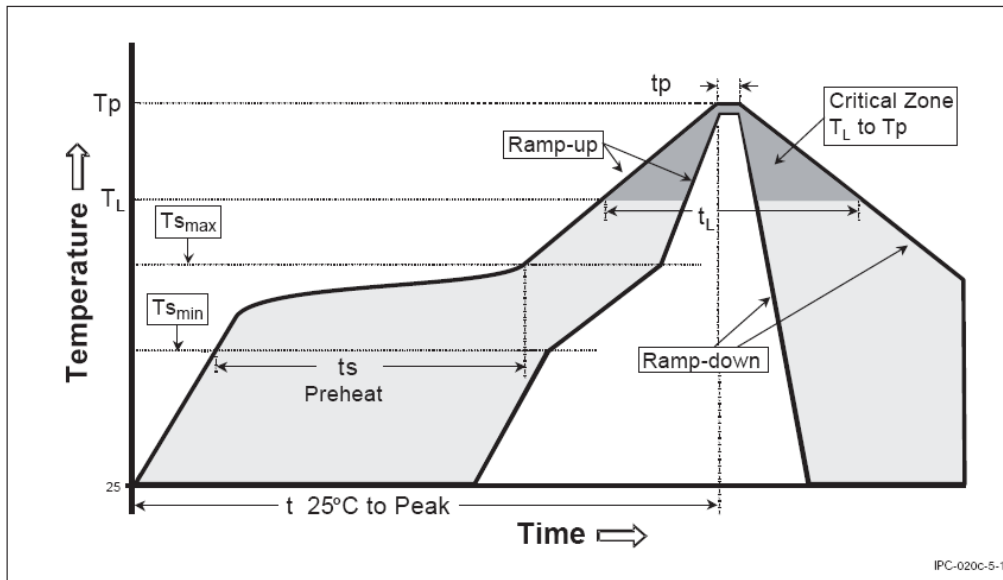
TCM 410J

### 4.6 Soldering information

TCM 410J shall be soldered according to IPC/JEDEC J-STD-020C standard.

Profile Feature	Pb-Free Assembly
Average Ramp-Up Rate ( $T_{S_{max}}$ to $T_p$ )	3° C/second max.
<b>Preheat</b>	
- Temperature Min ( $T_{S_{min}}$ )	150 °C
- Temperature Max ( $T_{S_{max}}$ )	200 °C
- Time ( $t_{S_{min}}$ to $t_{S_{max}}$ )	60-180 seconds
Time maintained above:	
- Temperature ( $T_L$ )	217 °C
- Time ( $t_L$ )	60-150 seconds
Peak/Classification Temperature ( $T_p$ )	260 °C
Time within 5 °C of actual Peak Temperature ( $t_p$ )	20-40 seconds
Ramp-Down Rate	6 °C/second max.
Time 25 °C to Peak Temperature	8 minutes max.

Note 1: All temperatures refer to topside of the package, measured on the package body surface.



TCM 410J shall be handled according to Moisture Sensitivity Level MSL4 which means a floor time of 72 h. TCM 410J may be soldered only once, since one time is already consumed at production of the module itself.

Once the dry pack bag is opened, the desired quantity of units should be removed and the bag resealed within two hours. If the bag is left open longer than 30 minutes the desiccant should be replaced with dry desiccant. If devices have exceeded the specified floor life time of 72 h, they may be baked according IPC/JEDEC J-STD-033B at max. 90°C for less than 60 h.

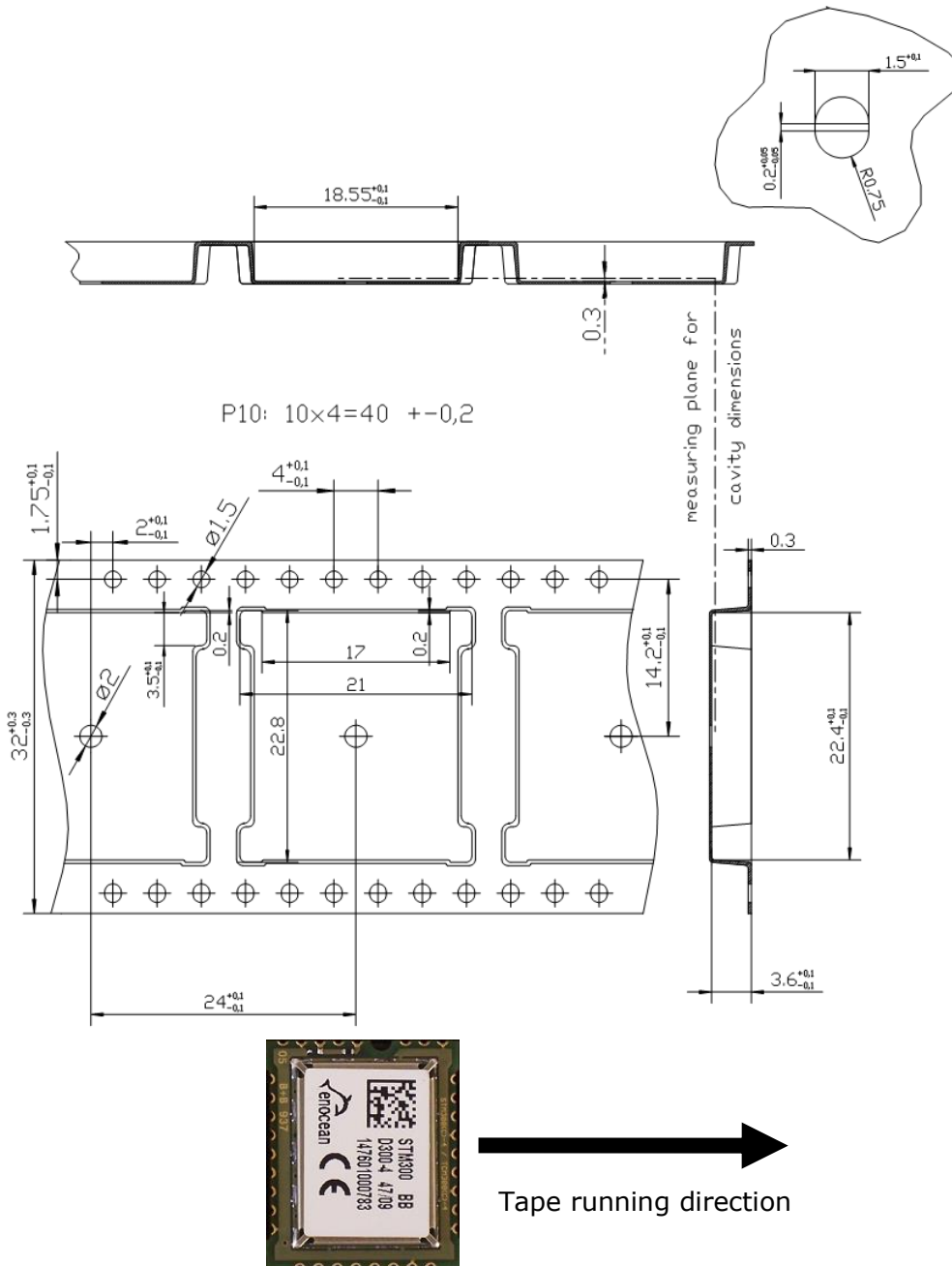
Devices packaged in moisture-proof packaging should be stored in ambient conditions not exceeding temperatures of 40 °C or humidity levels of 90% r.H.

TCM 410J modules shall be soldered within 6 months after delivery!



TCM 410J

4.7 Tape & Reel specification



TCM 410J

## 5 AGENCY CERTIFICATIONS

The modules have been tested to fulfil the approval requirements based on the built-in firmware.

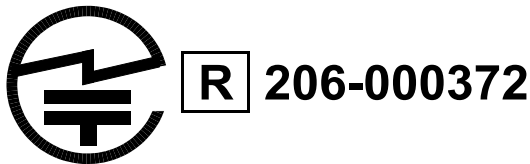


**When developing customer specific firmware based on the API for this module, special care must be taken not to exceed the specified regulatory limits, e.g. the duty cycle limitations!**

### 5.1 Japanese Type Approval

TCM 410J complies with the Japanese radio law and is certified according to ARIB STD-T108.

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



If the certification label cannot be recognized from outside (e.g. installation in a host) appropriate information must be referenced in the user manual.



Notified Body Directive 99/5/EC  
Notified Body EMC Directive 2004/105/EC  
RF CAB under the Japan-EC MRA  
FCB under the Canada-EC MRA  
TCB under the USA-EC MRA  
  
RF CAB ID No. 206

Annex to Certificate Registration No. JU000372D  
Date 2013-08-09  
Page 1 of 1

Designated by the German Regulator Bundesnetzagentur to act as a  
Recognised Foreign Conformity Assessment Body in accordance with the Japan-EC MRA

### CONSTRUCTION TYPE CONFORMITY CERTIFICATE for Specified Radio Equipment

Registration No. JU000372D  
Certificate Holder: EnOcean GmbH, Kolpingring 18a, 82041 Oberhaching, Germany  
Product Category: Article 2, Paragraph 1, Item 8 (Y)  
Product Designation: STM 400J, TCM 410J, USB 400J  
Product Description: Scavenger Transceiver Module, Transceiver Module, USB Gateway  
Software Release No. -  
Manufacturer: Katek GmbH, Bahnhofstraße 108, 83224 Grassau, Germany

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

The scope of evaluation relates to the submitted documents only.  
This Certificate confirms that the listed product has demonstrated conformity with the relevant technical regulations defined in the attached Annex. It is only valid in conjunction with the Annex.

Unterzeichner:  
2013-08-09  
  
Klaus Knörig  
Recognised Foreign Conformity Assessment Body

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

#### Technical Construction File (TCF) Details

<b>Technical Standards and Specifications</b>		
The product complies with:		
Ordinance Regulating Radio Equipment (Radio Regulatory commission No.18, 1950)		
Chapter I	General Provisions	
Chapter II	Transmitting Equipment	
Chapter III	Receiving Equipment	
Chapter IV	Article 49.14	
<b>Documentation submitted for the Type Certification</b>		
Test Report No. EMCC-110010CC	Issue Date 2013-07-10	Issued by EMCCcons DR. RAŠEK GmbH & Co. KG
Product documentation		
Antenna specifications		
Block diagram		
Component layout		
Internal & external photographs		
Label sample		
Schematic diagrams		
User manual		
Quality System documentation		
ISO 9001 Certificate for manufacturer		
<b>Technical characteristics</b>		
Type of modulation:	FSK	
Emission designator:	F1D	
Operating frequency range:	928.35 MHz	
Rated transmitter output power:	1 mW	
Maximum antenna gain:	2.15 dBi	
<b>Other Information</b>		
The device is certified for operation with the following antenna(s):		
ANT 300, helical antenna, 2.15 dBi gain		
Whip antenna, 64mm, -3.89 dBi gain		
USB 400J, top loaded PCB spiral antenna, 1.14 dBi gain		

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