

## NUR-05W IMPLEMENTATION GUIDE



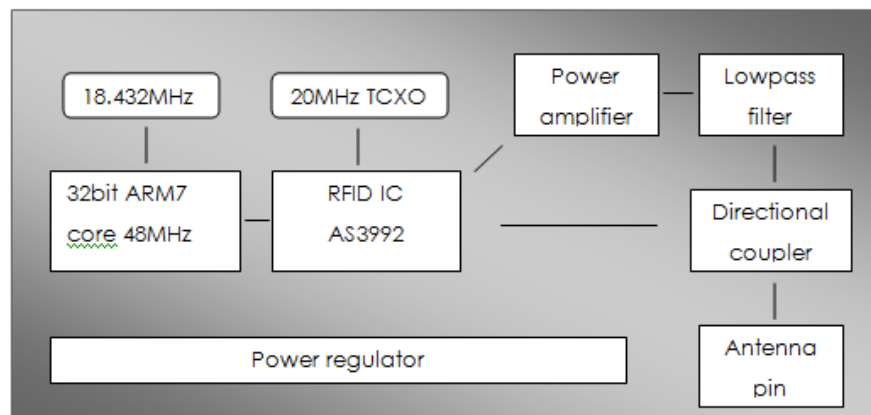
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## 1 GENERAL DESCRIPTION

NUR-05W is a compact UHF RFID reader / writer module. It is compatible with ISO18000-6C (EPC C1G2) standard. Module fulfills ETSI, FCC and IC radio regulations. It is also compatible with DRM (dense reader mode) requirements. Maximum output power is +27dBm and it can be adjusted via SW by steps of 1dB. Maximum receiver sensitivity is -86dBm.

### 1.1 Block diagram



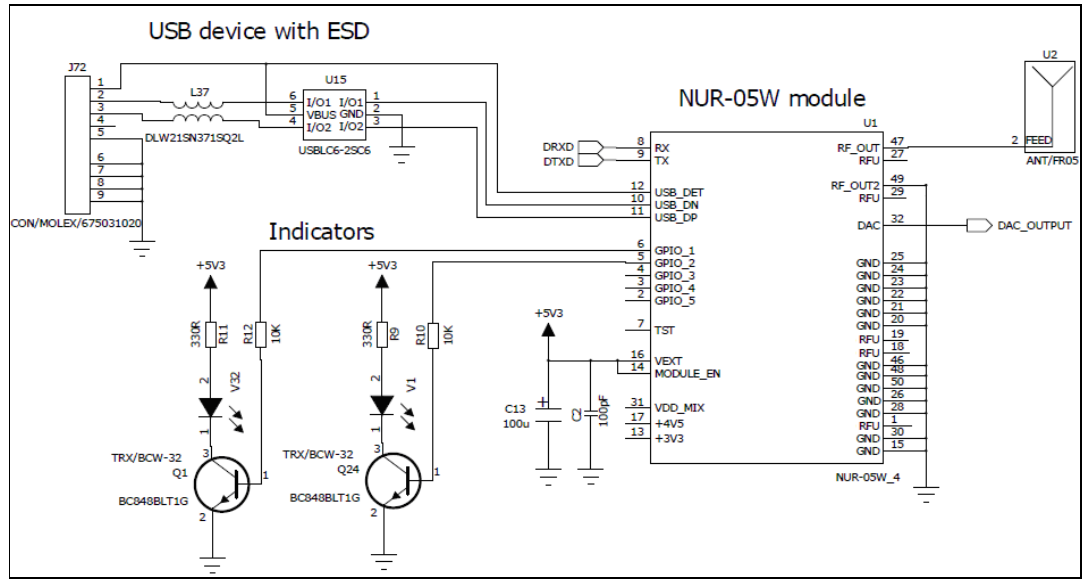
### 1.2 Key features

- Small footprint and SMT compatible
- ISO 18000-6C (EPC C1G2) full protocol support
- Low power consumption
- DRM compatible
- High performance with +27dBm output power (adjustable by 1dB steps)
- ETSI, FCC and IC compatible
- Selectable parameters, coding, link frequency and modulation
- UART and USB 2.0 communication
- 5 programmable GPIO

### 1.3 Typical application schematics

Typical application schematic including mini USB connector with ESD protection circuitry, 2 LED indicators, NUR-05W module and antenna.

Typical schematic.



## 2 ELECTRICAL CHARACTERISTICS

### 2.1 Absolute maximum ratings

Violating these values may cause damage to module. Also correct operation is not guaranteed if operating outside these values.

| Absolute maximum ratings | Value          |
|--------------------------|----------------|
| Operation temperature    | -20°C to +55°C |
| Storage temperature      | -30°C to +85°C |
| Supply voltage           | +6.0V          |
| Other inputs             | +5.5V          |

### 2.2 DC characteristics

Typical values (VEXT = 5.3V @ +25°C)

| Symbol            | Parameter                          | Min | Typ | Max    | Units |
|-------------------|------------------------------------|-----|-----|--------|-------|
| V <sub>ext</sub>  | Supply voltage                     | 5.0 | 5.3 | 5.5    | V     |
| I <sub>ext</sub>  | Supply current                     | -   | -   | 500    | mA    |
| I <sub>med</sub>  | GPIO 1,2,3,4 source / sink current | -   | -   | 8      | mA    |
| I <sub>high</sub> | GPIO 5 source / sink current       | -   | -   | 16     | mA    |
| V <sub>low</sub>  | GPIO input low-level voltage       | -   | -   | 0.8    | V     |
| V <sub>high</sub> | GPIO input high-level voltage      | 2.0 | -   | -      | V     |
| V <sub>en</sub>   | Module enable voltage              | 1.2 | -   | Supply | V     |

### 2.3 RF characteristics

Typical values (VEXT = 5.3V @ +25°C)

| Symbol           | Parameter               | Min | Typ | Max   | Units |
|------------------|-------------------------|-----|-----|-------|-------|
| S <sub>ens</sub> | Receiver sensitivity    | -46 | -   | -86   | dBm   |
| S <sub>adj</sub> | Sensitivity adjust step | -   | 10  | -     | dB    |
| P <sub>out</sub> | Output power            | 8   | -   | 27    | dBm   |
| P <sub>adj</sub> | Power adjust step       | -   | 1   | -     | dB    |
| S <sub>11</sub>  | VSWR requirement        | -   | -   | 1,5:1 | @50Ω  |

### 2.4 Performance characteristics

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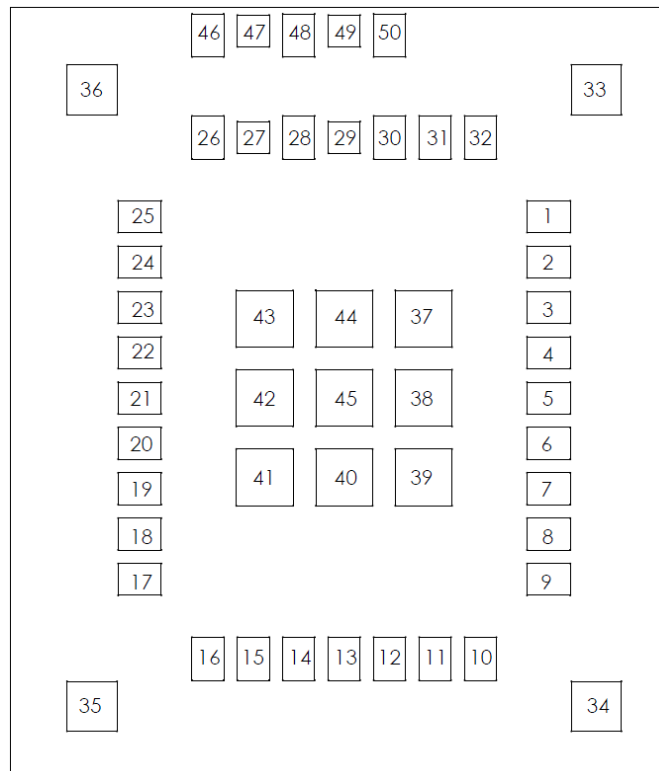
Typical values (VEXT = 5.3V @ +25°C)

| Symbol            | Parameter  | Min | Typ | Max | Units  |
|-------------------|--|-----|-----|-----|--------|
| R <sub>dist</sub> | Typical reading distance with 2.15dBi dipole antenna | -   | 5   | -   | m      |
| R <sub>rate</sub> | Typical reading rate                                 | -   | 150 | -   | tags/s |
| O <sub>temp</sub> | Operation temperature                                | -20 | -   | +55 | °C     |
| H <sub>rel</sub>  | Relative humidity                                    | 10  | -   | 95  | %      |

### 3 PIN ASSIGNMENTS

#### 3.1 Pin designation

Through top view.



#### 3.2 Pin mapping

| Pin number | Signal name | Pin type      | Description              |
|------------|-------------|---------------|--------------------------|
| 1          | RFU         | Bidirectional | RFU, DNU (do not use)    |
| 2          | GPIO_5      | Bidirectional | 3.3V GPIO (5V tolerant)  |
| 3          | GPIO_4      | Bidirectional | 3.3V GPIO (5V tolerant)  |
| 4          | GPIO_3      | Bidirectional | 3.3V GPIO (5V tolerant)  |
| 5          | GPIO_2      | Bidirectional | 3.3V GPIO (5V tolerant)  |
| 6          | GPIO_1      | Bidirectional | 3.3V GPIO (5V tolerant)  |
| 7          | TST         | Input         | Should not be connected  |
| 8          | RX          | Input         | Data from Host to Module |
| 9          | TX          | Output        | Data from module to Host |

|    |           |               |                                     |
|----|-----------|---------------|-------------------------------------|
| 10 | USB_DN    | Bidirectional | USB – (device port)                 |
| 11 | USB_DP    | Bidirectional | USB + (device port)                 |
| 12 | USB_DET   | Input         | Used only for USB detection         |
| 13 | +3V3      | Supply output | NC or bypass capacitor to GND       |
| 14 | MODULE_EN | Input         | Driving high will enable the module |
| 15 | GND       | Supply input  | Ground                              |
| 16 | VEXT      | Supply input  | Module power supply                 |
| 17 | +4V5      | Supply output | NC or bypass capacitor to GND       |
| 18 | RFU       | Bidirectional | RFU, DNU (do not use)               |
| 19 | RFU       | Bidirectional | RFU, DNU (do not use)               |
| 20 | GND       | Supply input  | Ground                              |
| 21 | GND       | Supply input  | Ground                              |
| 22 | GND       | Supply input  | Ground                              |
| 23 | GND       | Supply input  | Ground                              |
| 24 | GND       | Supply input  | Ground                              |
| 25 | GND       | Supply input  | Ground                              |
| 26 | GND       | Supply input  | Ground                              |
| 27 | RFU       | Bidirectional | RFU, DNU (do not use)               |
| 28 | GND       | Supply input  | Ground                              |
| 29 | RFU       | Bidirectional | RFU, DNU (do not use)               |
| 30 | GND       | Supply input  | Ground                              |
| 31 | VDD_MIX   | Supply output | NC or bypass capacitor to GND       |
| 32 | RFU       | Output        | RFU, DNU (do not use)               |
| 33 | GND       | Supply input  | Ground                              |
| 34 | GND       | Supply input  | Ground                              |
| 35 | GND       | Supply input  | Ground                              |
| 36 | GND       | Supply input  | Ground                              |
| 37 | GND       | Supply input  | Ground                              |
| 38 | GND       | Supply input  | Ground                              |
| 39 | GND       | Supply input  | Ground                              |
| 40 | GND       | Supply input  | Ground                              |
| 41 | GND       | Supply input  | Ground                              |
| 42 | GND       | Supply input  | Ground                              |
| 43 | GND       | Supply input  | Ground                              |
| 44 | GND       | Supply input  | Ground                              |
| 45 | GND       | Supply input  | Ground                              |
| 46 | GND       | Supply input  | Ground                              |



|    |        |               |                       |
|----|--------|---------------|-----------------------|
| 47 | RF_OUT | Bidirectional | 50Ω RF output/input   |
| 48 | GND    | Supply input  | Ground                |
| 49 | RFU    | Bidirectional | RFU, DNU (do not use) |
| 50 | GND    | Supply input  | Ground                |

### 3.3 Signal description

**Signal name: GND** **Pin number(s): 15, 20-26, 28, 30, 33-46, 48, 50**

These pins are used for grounding and to improve thermal performance. They should be connected to Host board GND net.

**Signal name: GPIO\_X** **Pin number(s): 2-6**

These pins are used as general purpose IO. They can be configured via SW API as input or output ports. IO voltage level is 3.3V. GPIO\_1, GPIO\_2, GPIO\_3 and GPIO\_4 have current capability of 8mA and GPIO\_5 has 16mA.

**Signal name: TST** **Pin number(s): 7**

Pin is used for production testing purposes only. Should not be connected.

**Signal name: RX** **Pin number(s): 8**

Pin is used for module UART input signal. Logic level is 3.3V. If UART is used for communication pin should be connected to Host MCU serial TX port.

**Signal name: TX** **Pin number(s): 9**

Pin is used for module UART output signal. Logic level is 3.3V. If UART is used for communication pin should be connected to Host MCU serial RX port.

**Signal name: USB\_DN** **Pin number(s): 10**

Pin is used as USB\_D- device port. It is advised to use external ESD protection component if connected to user accessible USB connector.

**Signal name: USB\_DP** **Pin number(s): 11**

Pin is used as USB\_D+ device port. It is advised to use external ESD protection component if connected to user accessible USB connector.

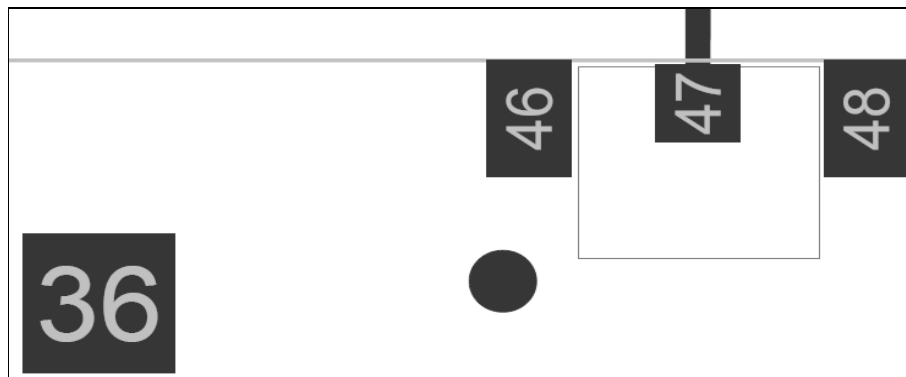
|   |   |
|---|---|
| <b>Signal name: USB_DET</b>   | <b>Pin number(s): 12</b>                        |
| <p>This pin is used only for USB connection detection. It is advised to use external ESD protection component if connected to user accessible USB connector. Current is not drawn from this input pin.</p>  |   |
| <b>Signal name: +3V3</b>  | <b>Pin number(s): 13</b>                        |
| <p>Pin is connected to internal regulator output. Pin is used for production testing and it can be left unconnected. Also bypass capacitor to GND can be used on this pin to improve noise filtering. Value for capacitor is 10-100pF.</p>  |   |
| <b>Signal name: MODULE_EN</b>   | <b>Pin number(s): 14</b>                        |
| <p>Driving this pin to high will enable the NUR-05W module. It is internally connected to onboard voltage regulators enable input. Trigger level is 1.2V. Module will wake up in 50ms. If external power switch is used to toggle ON and OFF, this pin can be connected directly to VEXT.</p> |   |
| <b>Signal name: VEXT</b>  | <b>Pin number(s): 16</b>                        |
| <p>This pin is used for power supply input for NUR-05W module. It is recommended to use 100<math>\mu</math>F (low ESR) and 100pF capacitor near the VEXT input pin to maintain stable operating voltage for module.</p>   |   |
| <b>Signal name: +4V5</b>  | <b>Pin number(s): 17</b>                        |
| <p>Pin is connected to internal regulator output. Pin is used for production testing and it can be left unconnected. Also bypass capacitor to GND can be used on this pin to improve noise filtering. Value for capacitor is 10-100pF.</p>  |   |
| <b>Signal name: RFU</b>   | <b>Pin number(s): 1, 18, 19, 27, 29, 32, 49</b> |
| <p>These pins are reserved for future use. Do not connect these pins.</p>   |   |
| <b>Signal name: VDD_MIX</b>   | <b>Pin number(s): 31</b>                        |
| <p>Pin is connected to internal regulator output. Pin is used for production testing and it can be left unconnected. Also bypass capacitor to GND can be used on this pin to improve noise filtering. Value for capacitor is 10-100pF.</p>  |   |
| <b>Signal name: RF_OUT</b>  | <b>Pin number(s): 47</b>                        |
| <p>50<math>\Omega</math> impedance RF output / input pin. Trace to this pin should be also matched to 50 <math>\Omega</math>. See more details from design considerations section.</p>  |   |

## 4 DESIGN CONSIDERATIONS

### 4.1 RF output and antenna requirement

RF output impedance is  $50\Omega$  so it is important to keep the trace leaving from RF\_OUT pin in that same impedance level to avoid reflections and mismatch of RF signal. It is recommended to do copper pour keep out area to Host board top layer according to picture below. Other layers can be filled with copper.

Recommended host board copper keep out area.



Antenna is one of the most important elements in UHF RFID system. For the reader / writer module point of view it is very important that used antenna has low VSWR value. VSWR should be better than 1.5:1 @  $50\Omega$  to avoid decrement in sensitivity performance of the receiver. If reflected power due to poor matching of antenna is high enough will that power eventually block the input mixers. With nominal sensitivity settings NUR-05W module can handle about +15dBm power level coming backwards to RF\_OUT pin without decrement in performance.

### 4.2 Power supply

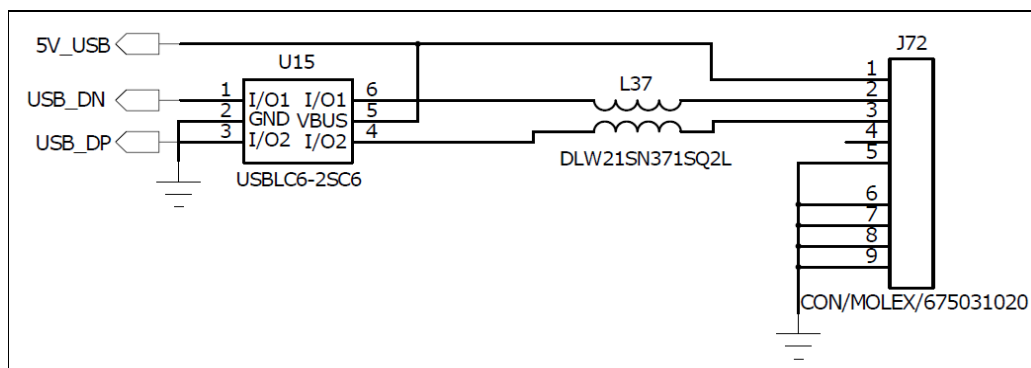
NUR-05W has internal linear regulators to get better power supply noise rejection. Still it is important to provide low noise and stable supply power to NUR-05W module. Voltage ripple should be kept under 50mVpp. It is recommended to add minimum of  $200\mu\text{F}$  low ESR and  $100\text{pF}$  capacitors next to VEXT pin.

+3V3, +4V5 and VCC\_MIX are internal regulator outputs and they can be left open or connected to GND via 10-100pF bypass capacitors to get better noise rejection. Mainly these pins are used for testing purposes at production.

### 4.3 USB device port

USB\_DP, USB\_DN and USB\_DET pins are used to provide 2.0 compliant USB device port. It must be remembered that only one communication method can be used to communicate with NUR-05W module at the time. Connecting USB will automatically prevent communication via serial port. It is advised to use external ESD protection component if connected to user accessible USB connector. Below is the reference schematics used in NUR-05W EVB board.

NUR-05W EVB schematics for mini USB connector with ESD protection.



Used components.

| Ref | Description        | Manufacturer        | Part code      |
|-----|--------------------|---------------------|----------------|
| U15 | ESD protection     | ST Microelectronics | USBLC6-2SC6    |
| L37 | Common mode choke  | Murata              | DLW21SN371SQ2L |
| J72 | Mini USB connector | Molex               | 67503-1020     |

## 5 RF PARAMETERS

### 5.1 Output power

Maximum output power is +27dBm (500mW). Power can be adjusted by 1dB steps. There is 19 steps so minimum output value is 8dBm what equals 6mW power. When using high output power it must be remembered that then antennas VSWR comes even more important. Because high output power combined with antenna with poor VSWR means that lot of power is reflected back to receiver.

### 5.2 Receiver sensitivity

Maximum sensitivity of receiver is -86dBm. Receiver can handle +15dBm power coming backwards to RF\_OUT pin.

### 5.3 Modulation

It is possible to use ASK (amplitude shift keying) or PR-ASK (phase reversed amplitude shift keying) modulation. Tags that are compliant with ISO18000-6C (EPC C1G2) must support both of these modulations. PR-ASK has lower transmission data rate and because of that it has narrower output spectrum. That's why it is recommended to be used when operating in DRM mode. In other hand some older tag IC might work better with ASK modulation, because it is easier to tag to demodulate ASK modulated transmission. By default the modulation is set to PR-ASK.

### 5.4 Link frequency

Link frequency affects to frequency offset of tags replay in order to readers carrier wave. For example when used link frequency is 256 kHz, tag will replay at frequency of reader transmission frequency  $\pm$  256 kHz. Selectable parameters are 160, 256 and 320 kHz. Tags that are compliant with ISO18000-6C (EPC C1G2) must support all these parameters. Link frequency also affects tag to reader data rate which is calculated by formula below:

$$\text{Tag to reader data rate} = (\text{Link frequency} / \text{Miller coding})$$

By default link frequency is set 256 kHz. Default settings must be used when operating in DRM mode.

### 5.5 RX coding (miller coding)

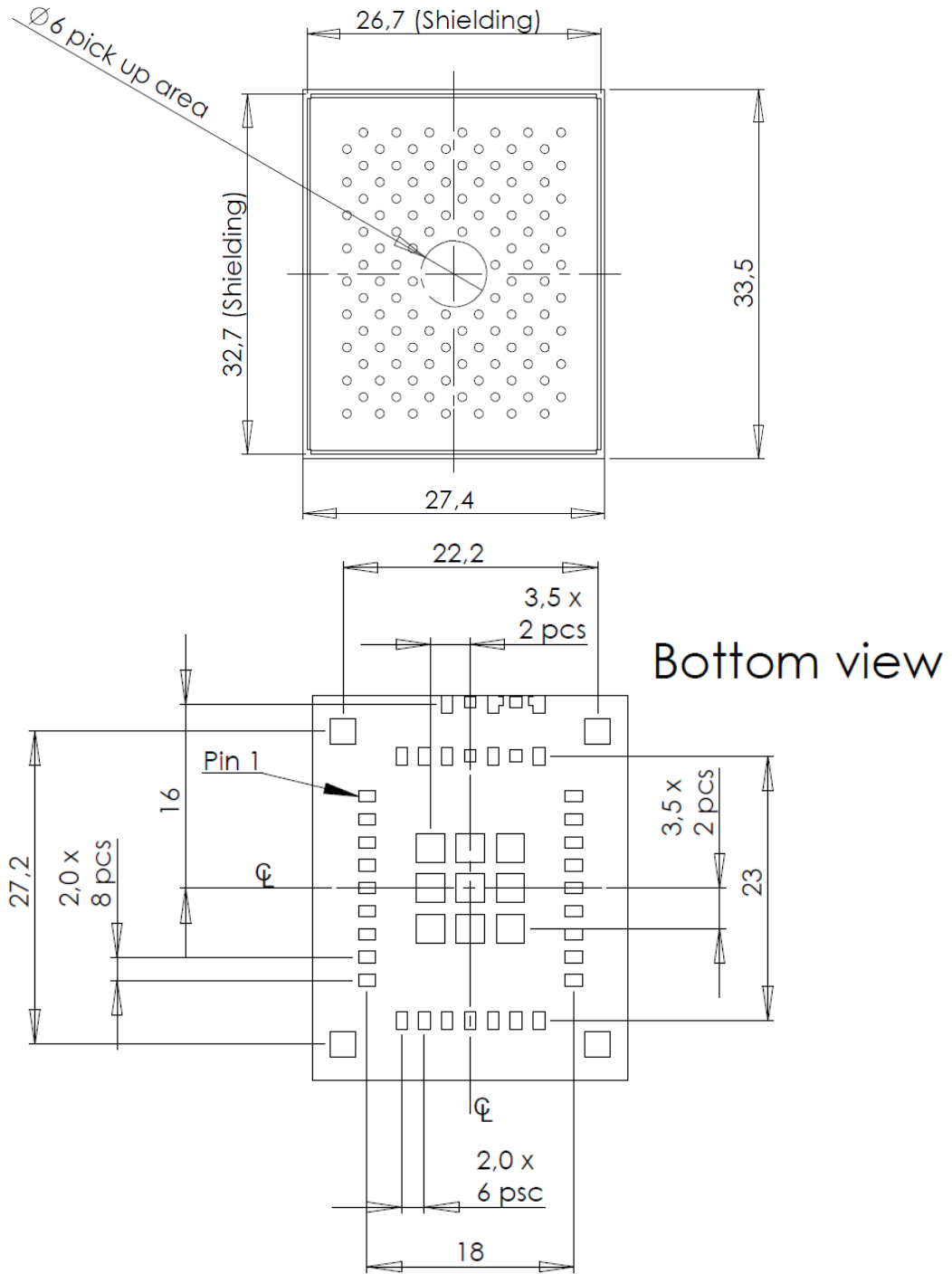
Like stated above miller coding scheme affects also tag to reader data rate. In practice miller coding affects the number of clock cycles that tag uses to modulate one symbol. So when using higher Miller coding scheme tag to reader data rate will be slower but at the same time it is more robust to interferences. Also tags response spectrum is more concentrated around the link frequency when using high miller scheme. This allows receiver to use narrower channel filters. Selectable values are 2, 4 and 8. When operating on DRM mode values 4 or 8 should be used. By default Miller 4 is used.

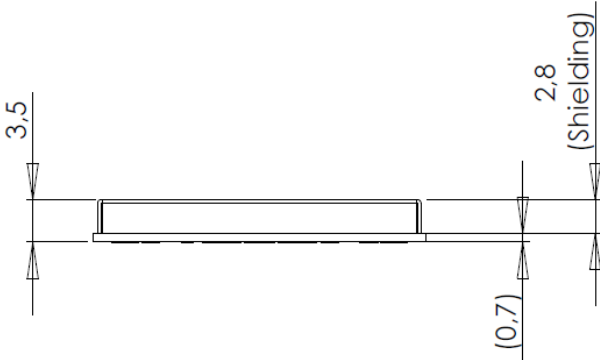
### 5.6 Q-value

Q-value defines the amount of open response slots that tags can use per one inventory round. Number of slots can be calculated by formula  $2^Q$ . It is advised to use twice as much slots compared to amount of tags that you have in your readers reading field simultaneously. Selectable values are 0 – 15 and value 0 means automatic Q-value adjustment. By default Q-value is set to 0.

**6 DIMENSIONS**

**6.1 Mechanical dimensions**







## 7 REGULATORY AGENCIES INFORMATION

When OEM prefers to leverage Nordic ID's grants and certifications of the NUR-05W UHF RFID module, the host device documentation shall include regulatory compliance information on the NUR-05W module. Corresponding to the applicable regulatory agencies the following sections outline regulatory compliance information needed in the user documentation and external labels for the host devices into which the NUR-05W is integrated.

When leveraging Nordic ID's grants and certifications, antenna shall be taken into account in view of the fact that the NUR-05W module has met the essential regulatory requirements with the antennas listed in the context of particular regulatory compliance information (Approved Antennas). Using the antenna that is an approved one, OEM integrator may demonstrate with less effort that the device with the integrated NUR-05W module is in compliance with the requirements.

### 7.1 7.1 European Union and EFTA countries

#### 7.1.1 User's Guide Requirements

This apparatus is in compliance with the essential requirements of the R&TTE Directive 1999/5/EC. In order to prove presumption of conformity with the essential requirements of the R&TTE Directive 1999/5/EC the following requirements and test methods have been applied to the apparatus:

- article 3.2: ETSI EN 302 208 v1.3.1  
Radio spectrum matters for Radio Frequency Identification (RFID) equipment operating in the band 865 MHz to 868 MHz with power levels up to 2W
- article 3.1b: ETSI EN 301 489-1 v1.9.1  
Common ElectroMagnetic Compatibility (EMC) requirements
- article 3.1b: ETSI EN 301 489-3 v1.4.1  
Specific ElectroMagnetic Compatibility (EMC) conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 40 GHz
- article 3.1a: EN 60950-1:2005  
General requirements for Safety of Information Technology Equipment

This apparatus is in compliance with EU Directive 2003/95/EC, Reduction of Hazardous Substances (RoHS).

Česky

[Czech]

[name of manufacture] tímto prohlašuje, že tento [type of apparatus] je ve shodě se základními požadavky a dalšími příslušnými ustanoveními směrnice 1999/5/ES.

**Dansk****[Danish]**

Undertegnede [name of manufacture] erklærer herved, at følgende udstyr [type of apparatus] overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF.

**Deutsch****[German]**

Hiermit erkläre [name of manufacture], dass sich das Gerät [type of apparatus] in Übereinstimmung mit den grundlegenden Anforderungen und den übrigen einschlägigen Bestimmungen der Richtlinie 1999/5/EG befindet.

**Eesti****[Estonian]**

Käesolevaga kinnitab [name of manufacture] seadme [type of apparatus] vastavust direktiivi 1999/5/EÜ põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele.

**English**

Hereby, [name of manufacture], declares that this [type of apparatus] is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

**Español****[Spanish]**

Por medio de la presente [name of manufacture] declara que el [type of apparatus] cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE.

**Ελληνική****[Greek]**

ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ [name of manufacture] ΔΗΛΩΝΕΙ ΟΤΙ [type of apparatus] ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 1999/5/ΕΚ.

**Français****[French]**

Par la présente [name of manufacture] déclare que l'appareil [type of apparatus] est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/CE.

**Italiano****[Italian]**

Con la presente [name of manufacture] dichiara che questo [type of apparatus] è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.

**Latviski****[Latvian]**

---

Ar šo [name of manufacture] deklarē, ka [type of apparatus] atbilst Direktīvas 1999/5/EK būtiskajām prasībām un citiem ar to saistītajiem noteikumiem.

**Lietuvių****[Lithuanian]**

Šiuo [name of manufacture] deklaruoją, kad šis [type of apparatus] atitinka esminius reikalavimus ir kitas 1999/5/EB Direktyvos nuostatas.

**Nederlands****[Dutch]**

Hierbij verklaart [name of manufacture] dat het toestel [type of apparatus] in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EG.

**Malti****[Maltese]**

Hawnhekk, [name of manufacture], jiddikjara li dan [type of apparatus] jikkonforma mal-ħtiġijiet essenzjali u ma provvedimenti oħrajn relevanti li hemm fid-Dirrettiva 1999/5/EC.

**Magyar****[Hungarian]**

Alulírott, [name of manufacture] nyilatkozom, hogy a [type of apparatus] megfelel a vonatkozó alapvető követelményeknek és az 1999/5/EC irányelv egyéb előírásainak.

**Polski****[Polish]**

Niniejszym [name of manufacture] oświadcza, że [type of apparatus] jest zgodny z zasadniczymi wymogami oraz pozostałymi stosownymi postanowieniami Dyrektywy 1999/5/EC.

**Português****[Portuguese]**

[name of manufacture] declara que este [type of apparatus] está conforme com os requisitos essenciais e outras disposições da Directiva 1999/5/CE.

**Slovensko****[Slovenian]**

[name of manufacture] izjavlja, da je ta [type of apparatus] v skladu z bistvenimi zahtevami in ostalimi relevantnimi določili direktive 1999/5/ES.

**Slovensky****[Slovak]**

[name of manufacture] týmto vyhlasuje, že [type of apparatus] spĺňa základné požiadavky a všetky príslušné ustanovenia Smernice 1999/5/ES.

**Suomi****[Finnish]**

[name of manufacture] vakuuttaa täten että [type of apparatus] tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.

#### Svenska

#### [Swedish]

Härmed intygar [name of manufacture] att denna [type of apparatus] står i överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.

### 7.1.2 Labeling Requirements

The 'CE' marking must be in a visible area on the OEM product.

### 7.1.3 Approved Antennas

|                                  |                    |
|----------------------------------|--------------------|
| <b>Manufacturer:</b>             | Poynting           |
| <b>Antenna Description:</b>      | RFID patch antenna |
| <b>Manufacturer Part Number:</b> | PATCH-A0025        |
| <b>Gain:</b>                     | 7 dBi              |

## 7.2 7.2 FCC

**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 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.

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.

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

This NUR-05W transmitter module is authorized to be used in other devices only by OEM Integrators under the following conditions:

1. The antenna(s) must be installed such that a minimum separation distance of 20cm is maintained between the radiator (antenna) & user's/nearby people's body at all times.
2. The transmitter module must not be co-located with any other antenna or transmitter.

When the conditions above are met, typically no further transmitter testing is required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

The antenna used with the NUR-05W transmitter module can have a gain of 8 dBi at the maximum. Higher gain antennas may be used if cable loss compensates the exceeded antenna gain. For example 2dB antenna cable loss reduces EIRP so that 10dBi antenna may be used.

#### **Note**

In the event that these conditions can't be met (for certain configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can't be used on the final product. In these circumstances, the OEM integrator will be responsible for reevaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user manual of the end product.

For the User's Guide the required FCC statements outlined in the User's Guide Requirements section must be in a prominent location.

#### **7.2.1 User's Guide Requirements**

"To comply with FCC's RF radiation exposure requirements, the antenna(s) used for this transmitter must be installed such that a minimum separation distance of 20cm is maintained between the radiator (antenna) & user's/nearby people's body at all times and must not be co-located or operating in conjunction with any other antenna or transmitter."

"This device complies with Part 15 of the FCC Rules"

"Any changes or modifications to the transmitting module not expressly approved by Nordic ID Oy could void the user's authority to operate this equipment"

### 7.2.2 Labeling Requirements

The end product must be labeled in a visible area as follows:

**“Contains Transmitter Module FCC ID: SCCNUR05W”**

or

**“Contains FCC ID: SCCNUR05W”**

### 7.2.3 Approved Antennas

#### Option 1:

|                           |   |
|---------------------------|---|
| Manufacturer:             | HUBER-SHUNER  |
| Antenna Description:      | RFID Reader Antenna; Polarization: linear vertical; Frequency range: 902-928MHz |
| Manufacturer Part Number: | SPA-915/70/8/0/V  |
| Gain:                     | 8 dBi   |

#### Option 2:

|                            |   |
|----------------------------|---|
| Manufacturer:              | Nordic ID   |
| Antenna Description:       | RFID Reader Antenna; Linear polarization: dipole; Frequency range: 902-928MHz |
| Manufacturer Product Name: | Nordic ID Merlin UHF RFID   |
| Gain:                      | 2 dBi   |

#### Option 3:

|                            |  |
|----------------------------|--|
| Manufacturer:              | Nordic ID  |
| Antenna Description:       | RFID Reader Antenna; Cross polarization: dipole; Frequency range: 902-928MHz |
| Manufacturer Product Name: | Nordic ID Merlin Cross Dipole UHF RFID                                       |
| Gain:                      | 5 dBi  |

## 7.3 Industry Canada

Demonstrating the compliance 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.

*Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.*

To leverage the Nordic ID's IC grant, the device with the integrated NUR-05W module shall be met the following conditions:

1. The antenna used with the NUR-05W module must be installed so that the distance of the antenna from all persons can be maintained at least 20 cm in every situation.
2. The antenna(s) used with the NUR-05W module must not be collocated in conjunction with any other antenna or transmitter that is capable of transmitting at the same time.

When the conditions above are met, typically no transmitter testing is required, although the OEM integrator shall demonstrate that the end-product is in compliance with the other regulatory requirements.

There is no user's documentation requirements other than that the required FCC statements outlined in the FCC section are in a prominent place in the user's guide.

### 7.3.1 Labeling Requirements

The end product must be labeled in a visible area as follows:

**"Contains IC: 5137A-NUR05W"**

### 7.3.2 Approved Antennas

*This radio transmitter 5137A-NUR05W has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.*

|                           |   |
|---------------------------|---|
| Manufacturer:             | HUBER-SHUNER  |
| Antenna Description:      | RFID Reader Antenna; Polarization: linear vertical; Frequency range: 902-928MHz |
| Manufacturer Part Number: | SPA-915/70/8/0/V  |
| Gain:                     | 8 dBi   |
| Impedance:                | 50Ω   |