

# NORDIC ID NUR3-1W6 HARDWARE IMPLEMENTATION GUIDE

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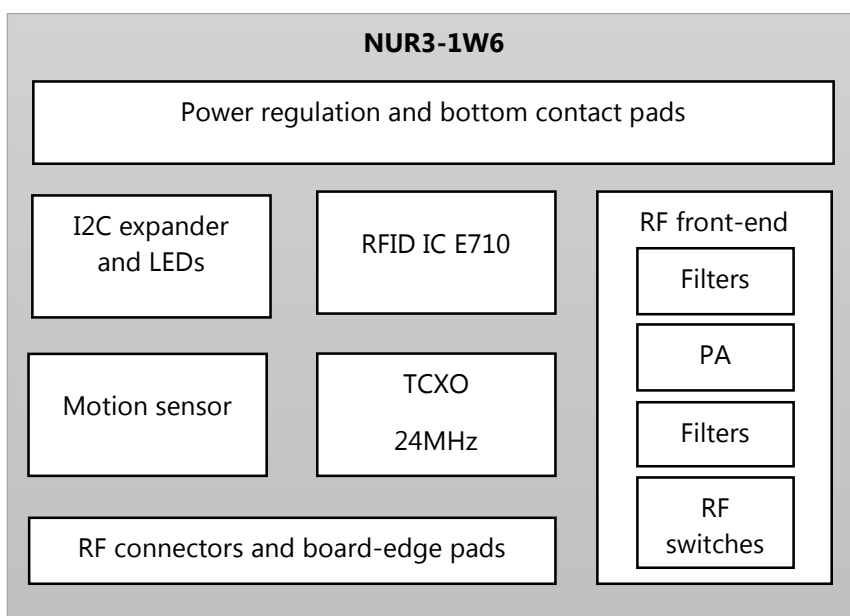
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## 1. GENERAL DESCRIPTION

Nordic NUR3-1W6 is a state-of-the-art RAIN UHF RFID reader / writer module. It is compatible with ISO18000-63 (EPC C1G2) standard. Module complies for CE/RED (ETSI), FCC and IC/ISED radio regulations. It is also compatible with DRM (dense reader mode) requirements. Maximum output power is +32dBm (region dependant) and it can be adjusted via SW API with 1 dB steps. Maximum sensitivity is -85dBm when measured according to RAIN recommendations.

### 1.1. BLOCK DIAGRAM

Nordic ID NUR3-1W6 block diagram shows the building blocks of the module.



Picture 1. Block diagram of NUR3-1W6 module.

### 1.2. KEY FEATURES

- High-end RAIN UHF RFID engine module
- ISO 18000-63 (EPC C1G2) full protocol support
- DRM compatible with high channel selectivity
- High performance with up to 32dBm output power (region dependant)
- Pre-programmed regulatory profiles (regions)
- SPI-interface for host control

- High sensitivity due to automatic carrier cancelation
- Tag replay quality indicators (RSSI, scaled RSSI, phase rotation angle and phase difference)
- Accurate RF output due to individual TX-calibration

### 1.3. TYPICAL APPLICATION

Typical application for the module is to be embedded into high performance fixed UHF RFID reader. The module in question will implement the UHF RFID functionality whereas the dedicated host part will form the platform for the end-product.

## 2. ELECTRICAL SPESIFICATIONS

This section provides information about the DC-, RF- and performance characteristics of the Nordic ID NUR3-1W6 module.

### 2.1. ABSOLUTE MAXIMUM RATINGS

Violating below values may cause permanent damage to the module. Also, correct operation of the module is not guaranteed if operating outside of the absolute maximum limits. NUR3-1W6 is ESD sensitive component so it must be handled with care.

Absolute maximum rating	Value
Operating temperature	-20°C to +55°C
Storage temperature	-30°C to +85°C
Supply voltage VCC_4V0	+6 V
Supply voltage VCC_3V3	+3.6V
Supply voltage VCC_1V8	+2.1V
Control and data signal pads	+2.1 V
Other pads	+2.1 V

Table 1. Absolute maximum ratings of the NUR3-1W6 module.

## 2.2. DC CHARACTERISTICS

Symbol	Parameter	Min	Typ	Max	Units
VCC_4V0	Supply voltage VCC_4V0	3.8	4.0	4.5	V
I <sub>vcc_4V0</sub>	Supply current (reading 32dBm TX power)	-	2.5	3	A
VCC_3V3	Supply voltage VCC_3V3	3.2	3.3	3.4	V
I <sub>vcc_3V3</sub>	Supply current	-	10	100	mA
VCC_1V8	Supply voltage VCC_1V8	1.7	1.8	1.9	V
I <sub>vcc_1V8</sub>	Supply current	-	5	10	mA
I <sub>source</sub>	Control and data signal pad source current	-	0,5	1	mA
I <sub>sink</sub>	Control and data signal pad sink current	-	0.5	1	mA
V <sub>low</sub>	Control and data signal pad input low-level voltage	-	0	0.15	V
V <sub>high</sub>	Control and data signal pad input high-level voltage	1.6	1.8	1.9	V

Table 2. DC characteristics of the NUR3-1W6 module ( $V_{ext} = TBD$  V and ambient temp +25°C).

## 2.3. RF CHARACTERISTICS

Symbol	Parameter	Min	Typ	Max	Units
Sens	Receiver sensitivity (S11 better than 15dB)	-	-	-TBD	dBm
P <sub>out</sub>	Output power range	3	-	32	dBm
P <sub>tolHigh</sub>	TX range from 27 to 32dBm	-0.5	P <sub>out</sub>	+0.5	dB
P <sub>tolMed</sub>	TX range from 17 to 26dBm	-1	P <sub>out</sub>	+1	dB
P <sub>tolLow</sub>	TX range from 1 to 16dBm	-2	P <sub>out</sub>	+2	dB
P <sub>tolTemp</sub>	TX variation over full temperature range	-1.5	P <sub>out</sub>	+1.5	dB
P <sub>adj</sub>	TX power adjustment step	1	1	1	dB

S11	VSWR requirement	-	1.5:1	-	50Ω
D <sub>r→t</sub>	Reader-to-tag data rates	-	TBD	-	kbps
D <sub>t→r</sub>	Tag-to-reader data rates	-	TBD	-	kbps

Table 3. RF characteristics of the NUR3-1W6 module (V<sub>ext</sub> = TBD V and ambient temp +25°C).

## 2.4. PERFORMANCE CHARACTERISTICS

The performance of the NUR3-1W6 reader module is highly dependent on the test environment, used reader antenna, tag antenna and tag IC. In addition, interferences from other radio sources operating in the same frequency range may decrease the performance. Selected radio and inventory parameters do have a big influence to reading performance as well and those should be optimized to the size of the tag population in question.

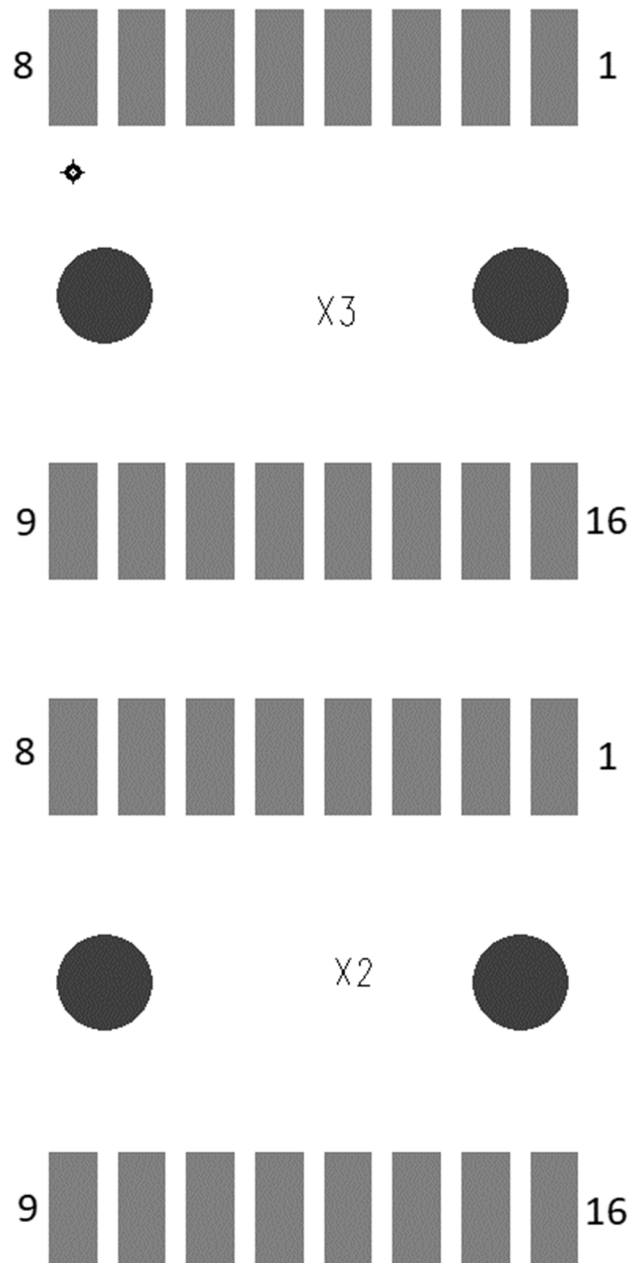
Symbol	Parameter	Min	Typ	Max	Units
R <sub>dist</sub>	Typical read distance with 5dBi antenna*	-	15	-	M
R <sub>rateLow</sub>	Maximum read rate (Robust RF profile)	-	-	250	tags/s
R <sub>rateMed</sub>	Maximum read rate (Nominal RF profile)	-	-	350	tags/s
R <sub>rateHigh</sub>	Maximum read rate (High speed RF profile)	-	-	900	tags/s
O <sub>temp</sub>	Operation ambient temperature range	20-	-	+55	°C
H <sub>rel</sub>	Relative humidity	10	-	95	%

Table 4. Performance characteristics of the NUR3-1W6 module (V<sub>ext</sub> = TBD V and ambient temp +25°C).

\*Measured using Avery Dennison Belt tag (with Impinj R6 IC)

### 3. BOTTOM PAD ASSIGNMENTS

#### 3.1. BOTTOM PAD DESIGNATION



Picture 2. NUR3-1W6 bottom pad numbering (top thru view).



## 3.2. SIGNAL-TO-PAD MAPPING

### Interface X2

Pad number	Signal name	Type	Description
1	GND	Supply	Ground
2	GND	Supply	Ground
3	GND	Supply	Ground
4	GND	Supply	Ground
5	VCC_4V0	Supply input	4V0 Main supply
6	VCC_4V0	Supply input	4V0 Main supply
7	VCC_4V0	Supply input	4V0 Main supply
8	VCC_4V0	Supply input	4V0 Main supply
9	E710_RESET_N	Input	RFID control signal to module
10	E710_ENABLE	Input	RFID control signal to module
11	E710_READY_N	Bidirectional	RFID control signal to module
12	E710_SPI_SS	Input	RFID control signal to module
13	E710_SPI_IRQ	Output	RFID SPI interface to module
14	E710_SPI_CLK	Input	RFID SPI interface to module
15	E710_SPI_MISO	Output	RFID SPI interface to module
16	E710_SPI_MOSI	Input	RFID SPI interface to module

Table 5. Interface X2 signal-to-pad mapping of the NUR3-1W6 module.

### Interface X3

Pad number	Signal name	Type	Description
1	NA	-	Reserved for future use
2	NA	-	Reserved for future use
3	GND	Supply	Ground
4	I2C_IO_DATA	Bidirectional	Data interface to IO expander
5	I2C_IO_CLK	Input	Data interface to IO expander
6	GND	Supply	Ground
7	NA	-	Reserved for future use

8	NA	-	Reserved for future use
9	NA	-	Reserved for future use
10	NA	-	Reserved for future use
11	NA	-	Reserved for future use
12	NA	-	Reserved for future use
13	GND	Supply	Ground
14	VCC_3V3	Supply Input	3V3 supply
15	VCC_1V8	Supply Input	1V8 supply
16	GND	-	Ground

Table 6. Interface X3 signal-to-pad mapping of the NUR3-1W6 module.

### 3.3. SIGNAL DESCRIPTIONS

Signal name: GND	Pads: X2: 1, 2, 3, 4 X3: 3, 6, 13, 16
These pads are used for grounding and to improve the thermal performance. They should be connected to Host board GND net.	
Signal name: VCC_4V0	Pads: X2: 5, 6, 7, 8
These pads are used for powering RFID IC and power amplifiers. When you have relative high impedance power source it is recommended to use 200µF (low ESR), 100nF and 100pF capacitors near the VCC_4V0 input pads to maintain stable operating voltage for the reader module.	
Signal name: E710_RESET_N	Pad: X2: 9
This pad is used for resetting RFID IC. (Active low)	
Signal name: E710_ENABLE	Pad: X2: 10
This pad is used for enabling the interface to the module. (Active high)	
Signal name: E710_READY_N	Pad: X2: 11
This pad is used for recognizing when the RFID IC is ready for communication. (Active low)	
Signal name: E710_SPI_SS	Pad; X2: 12
This pad is has slave select function when using SPI interface. (Active low)	

Signal name: E710_SPI_IRQ	Pad: X2: 13
This pad is has interrupt function when using SPI interface. (Active low)	
Signal name: E710_SPI_CLK	Pad: X2: 14
This pad is clock input when using SPI interface. (max. 4MHz)	
Signal name: E710_SPI_MISO	Pad: X2: 15
This pad is master in slave out when using SPI interface.	
Signal name: E710_SPI_MOSI	Pad: X2: 16
This pad is master out slave in when using SPI interface.	
Signal name: NA	Pad: X3: 1, 2, 7, 8, 9, 10, 11, 12
These pads are reserved for future use.	
Signal name: I2C_IO_DATA	Pad: X3: 4
This pad is I2C data signal.	
Signal name: I2C_IO_CLK	Pad: X3: 5
This pad is I2C clock signal.	
Signal name: VCC_3V3	Pad: X3: 14
This pad is 3V3 input for level shifter, IO expander and pheriperals.	
Signal name: VCC_1V8	Pad: X3: 15
This pad is 1V8 input for level shifter, IO expander and pheriperals.	

Table 7. Signal descriptions of NUR3-1W6 module.

## 4. END-DEVICE INTEGRATION CONSIDERATIONS

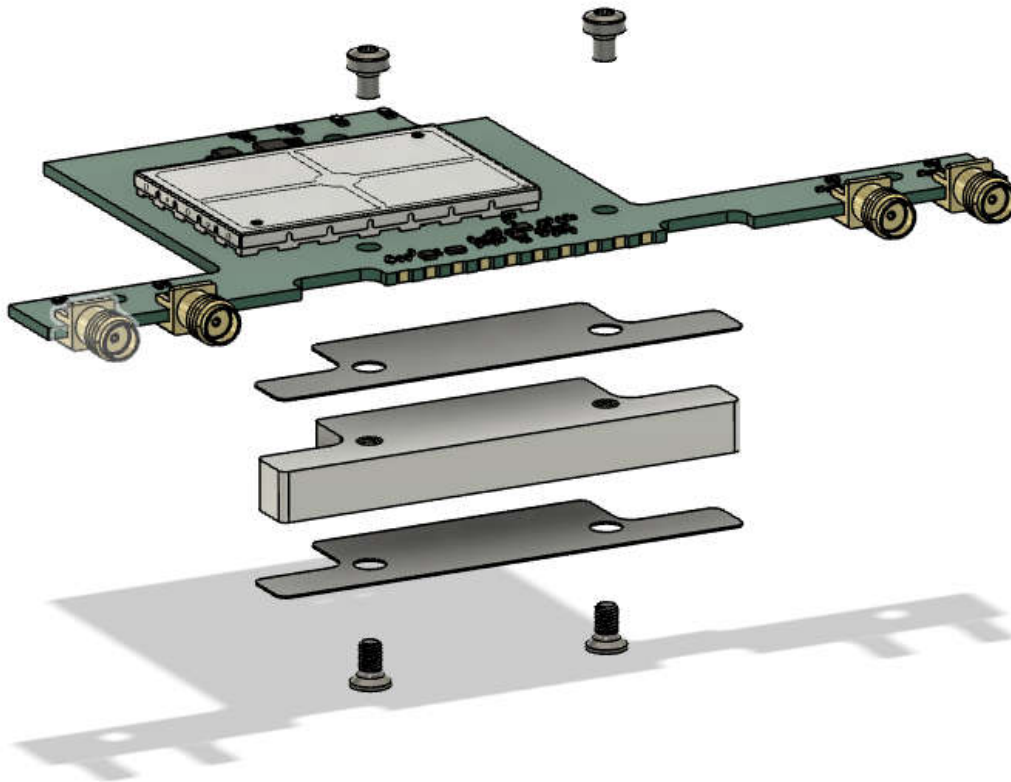
This section covers end-device integration considerations. Design guidance's presented below needs to be followed to guarantee a proper operation of the Nordic ID NUR3-1W6 UHF RFID module.

### 4.1. ANTENNA REQUIREMENTS.

Poor VSWR of the antenna leads to situation where significant portion of the transmitted signal will reflect to the module from the antenna. NUR3-1W6 module has automatic leakage cancellation system that decreases the effect of the reflected signal. This system can handle up to 10dBm power levels at the receiver port (up to 20dBm at the module's antenna port). The automatic leakage cancellation is automatically on when module is operating in normal mode.

## 4.2. HEAT TRANSFER CONSIDERATIONS

For NUR3-1W module to operate normally in different ambient temperatures, a proper heat dissipation design needs to be followed. Recommendation is that heat transfer block is used to maximize the heat transfer from the module into the chassis of the end device. In below picture you can see the reference implementation.



Picture 4. Reference heat mitigation implementation of the NUR3-1W6 module.

## 4.3. POWER SUPPLY

The NUR3-1W6 has internal linear power regulators for improving the power supply noise rejection capabilities. However, it is still important to supply low noise and stable power for the NUR3-1W6 module. The voltage ripple should be kept under 200mVpp, and it is recommended to add a minimum of 200µF low ESR, 100nF and 100pF capacitors next to the power supply feed contact.

## 4.4. SPI COMMUNICATION INTERFACE

Host control is established via SPI interface exposed thru NUR3-1W6 modules bottom contacts. Max SPI clock speed is 4Mhz.

## 4.5. I2C IO EXPANDER AND LEDS

NUR3-1W6 provides visual LED indicators which Host can control thru I2C interface exposed thru bottom pad contacts. LEDs are driven by on-board I2C IO expander IC.

## 5. RF AND INVENTORY SETTINGS

Using a proper set of RF and inventory settings is mandatory for reaching the optimal reading performance.

### 5.1. RF SETTINGS

RF settings are mainly the ones which influences how RF transmitter operates within the Nordic ID NUR3-1W6 UHF reader module. There are certain settings which user can change like TX output power level and the used RF-profile.

#### 5.1.1. TX POWER LEVEL

Nordic ID NUR3-1W6 UHF RFID module has the maximum TX output power of 32dBm (1.6W). Note that max TX power is region dependent (please see the table 8). The TX power can be adjusted by 1dB steps via Nur API. In total, there are 30 steps yielding the minimum output power value of 3dBm.

If you have configured more than one antenna to be used, you can set and store individual output power level for each of the antennas in question. This per antenna output power setting is also available via Nur API. Note that if per antenna power level is set this overrides the general TX power level setting.

Region in use	Max TX power
EU lower band	+30dBm (TBD)
EU upper band	+32dBm (TBD)
FCC	+30dBm
Others	+32dBm (TBD)

Table 8. Maximum TX power level for different regions.

#### 5.1.2. RF PROFILES

Nordic ID NUR3-1W6 UHF RFID module supports three different RF profiles. The profiles are Robust, Nominal and High speed. It's important to select the correct RF profile based on use case and environment. More detailed description about the RF profiles can be found below:

### **Robust**

- Robust RF profile is intended to be used in challenging environments. It provides the best filtering against the interfering signals coming from nearby reader(s), other signal sources and from reflective environment. This profile uses link frequency of 250 kHz and Miller 4 coding scheme providing read rates up to 250 tags/s. Due to the low data speed and best filtering the Robust RF profile provides the best sensitivity.

### **Nominal**

- Nominal RF-profile is the default setting of Nordic ID NUR3-1W6 UHF RFID module. It uses link frequency of 300 kHz and Miller 2 coding providing read rates up to 350 tags/s.

### **High speed**

- High speed RF profile is intended to be used in use cases where the highest read rates are required. It uses link frequency of 600 kHz and FM0 coding and provides read rate

## 5.1.3. RF-OUTPUT CONNECTORS

NUR3-1W6 module has 4 RF-outputs ports equipped with RP SMA female connectors. One antenna port is used at the time. There is a RF-switch selecting the port in use. The switch is controlled by the firmware.

Note that NUR3-1W6 module is not sold to third parties so module is only used in Nordic ID products. This means that Nordic ID has full control for the antennas used together with the module.

## 5.1.4. REGION

Nordic ID NUR3-1W6 has pre-defined region settings defining frequency and channel sets for operating under different radio regulations. Globally the regulations vary depending on the country or part of the world. Refer to Nur API documentation for list of pre-defined countries. When module ships from production it is locked to the pre-selected region setting (based on SKU) and cannot be changed by the user.

## 5.1.5. ANTENNA CONTROL

Used antenna port can be selected via NurApi. Also, automatic antenna setting is available. When used, module will automatically switch between enabled antenna ports.

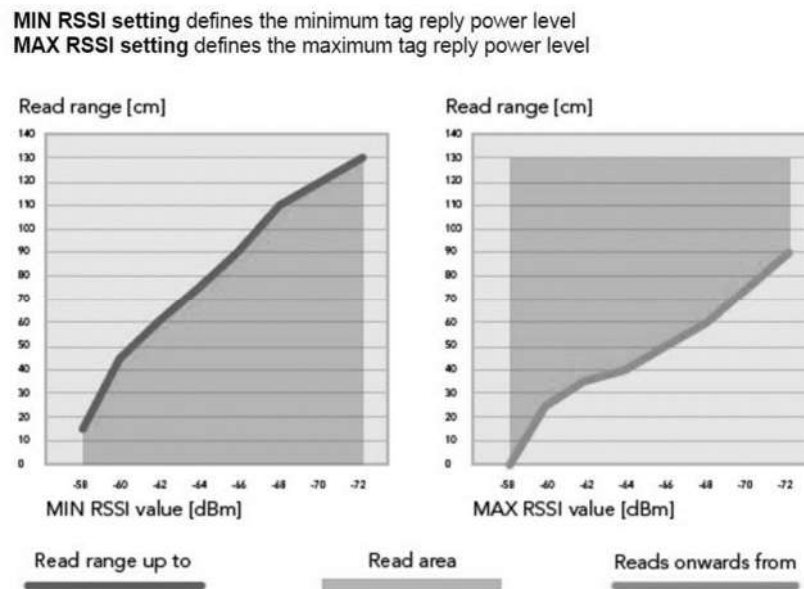
### 5.1.6. DYNAMIC POWER SAVE MODE

NUR3-1W6 module has dynamic power save modes which can be enabled via NurApi. By default, the power save is off. There are three depths for the dynamic power save mode to select from: 100ms, 500ms and 1000ms. The power save mode works in a way that when module reads continuously (applies only when using inventory stream -command) it goes to sleep if there are no tags in the field. The sleep time is defined by the depth value. After the sleep period is elapsed module starts to read again and so on. If there are one or more tags in the field the module will not go into sleep.

Using dynamic power saving is highly recommended in use cases where reader is reading continuously. This will decrease the interferences to other readers and helps heat mitigation in high ambient temperature environments.

### 5.1.7. RSSI FILTERS

Nordic ID NUR3-1W6 module has internal RSSI filters which can be used to limit the read range. By applying the filters, you can set the limits which tag replay must met to be registered. MIN RSSI –value means that tag replay signal needs to be equal or stronger than the defined value. Otherwise, tag is not read. MAX RSSI value in other hand means that signal strength must be lower than the filter value. There are separate RSSI filter values for inventory, read and write operations. These can be set individually.



Picture 5. Read range limited by RSSI filters (100mW TX power level with 0dBi antenna gain used).

## 5.2. INVENTORY SETTINGS

By selecting the proper RFID inventory parameters, you can optimize the modules reading performance for different tag populations and use cases.

### 5.2.1. Q-VALUE

The 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 many slots compared to number of tags that you have in your readers reading field simultaneously. Selectable values are 0 – 15 where 0 means automatic Q-value adjustment. In this automatic mode the reader will adjust Q-value between sequential rounds based on the number of found tags and collisions. By default, the Q-value is set to 0.

Q-value	Response slots	Q-value	Response slots
0	Automatic	8	256
1	2	9	512
2	4	10	1024
3	8	11	2048
4	16	12	4096
5	32	13	8192
6	64	14	16384
7	128	14	32768

Table 8. Relation between the Q-value and the number of response slots for a round.

### 5.2.2. SESSION

There are 4 session options which you can use when initializing inventory round. Every session has two target states A and B. By default, Gen2 tags are at state A if tag has not been read recently. When tag is read it flips to state B and does not reply to readers query made using a target A. The table below describes the persistence of tag's state machine when using different session values. For example, when using session 0 the tag will come back to state A immediately when tag power is lost. Usually, tag loses the power when reader stops the inventory round or changes the channel.

Persistence when tag power is ON is not defined by the ISO18000-63 when using session settings S0, S2 and S3. With session 1 the tag will keep it state over 500ms but less than 5s. With session values 2 and 3 tags will keep it states over 2s when tag power is lost. Time can vary depending what tag IC is used.

Session flag	Persistence: Tag powered	Persistence:
S0	Indefinite	None
S1	500ms < t < 5s	500ms < t < 5s
S2	Indefinite	t > 2s
S3	Indefinite	t > 2s



Table 9. Persistence characteristics of ISO18000-63 tags.

### 5.2.3. ROUNDS

The rounds setting defines how many query rounds is done inside one inventory round. After every inventory round the reader will send data to the Host. Selectable values are 0 – 10. In the legacy readers the Rounds setting 0 is automatic adjustment which is not supported with NUR3-1W6 module. With NUR3-1W6 UHF RFID module Rounds 0 corresponds to Rounds setting 2. By default, rounds setting is set to 0.

This setting can help the reader to find all the tags that are in the readers reading field when using session 0. Because tags which are found in query round 1 do not replay in the following query rounds. When using session 1/2/3 this does not make any significant difference because tags that are read are quiet anyways.

Inventory round		
Query round 1	Query round 2	Query round n

Table 10. Relation between inventory round and query round (Rounds setting).

### 5.2.4. SELECTING THE RIGHT SETTINGS

General guidance is that Q-value should be adjusted so that there are 1.5 – 2 times more response slots compared to the number of tags simultaneously on the readers field-of-view. If reader will face many different tag populations than automatic Q-adjustment (Q=0) setting will be a good choice.

Besides Q-value one important parameter is session. In general, it could be stated that if the size of tag population is measured in thousands rather than in hundreds it is wise to use sessions 2 or 3. Because then every tag will be read only once making the mass inventory efficiency much better. Rounds 1 setting is also advised to be used with session 1 or 2 or 3.

## 6. TAG SIGNAL AND SYSTEM QUALITY INDICATORS

Tag signal quality indicators can be used for multiple use cases like assessment of the distance between the reader antenna and the tag. When parameters are used in a statistical way you could use these to assess is tag stationary or not. Also, you could prevent certain operations, like tag writing, if signal strength is not high enough.

Reflected power value can be used to verify that matching of the system and antenna is in proper level.

## 6.1. TAG REPLAY QUALITY INDICATORS

Tag replay quality indicator values are reported to the host system together with read data of the tag. Note, that to also obtain the tag phase rotation value or phase difference value, you need to enable this functionality first via NurApi. Please refer to Nur API documentation for more detailed information.

### 6.1.1. TAG REPLAY RSSI VALUE (SIGNAL STRENGTH INDICATOR)

When reading a tag NUR3-1W6 module also returns received signal strength indication values. Two values are returned for each read tag. One is the absolute power level (dBm) and second is the scaled RSSI value of the tags backscatter signal. Scaled RSSI value is scaled between 0 – 100. 0 corresponds to minimum signal level the module can receive and 100 with maximum.

### 6.1.2. TAG REPLAY PHASE ROTATION VALUE

Nordic ID NUR3-1W6 UHF RFID module can provide the tag phase rotation value of the tags replay signal (in relation the to the transmitted signal). Dynamic range for this value is from 0 to 360 degrees.

### 6.1.3. TAG REPLAY PHASE DIFFERENCE VALUE

Nordic ID NUR3-1W6 UHF RFID module can measure tag phase value at the beginning of the EPC reception and at the end of that same reception. Phase difference is then calculated the provided to host via NurApi. Phase difference value other than zero is an indication that tag in relation to the reader is moving (or something is the nearby environment is changing).

## 6.2. REFLECTED POWER VALUE

This measurement can be used to check what is the matching of the antenna(s) and feed line(s). When this function is triggered NUR3-1W6 module puts carrier wave ON at full power and measures the absolute power level that is coming to the receiver port of the module. For the backwards compatibility reasons there is a fixed difference in actual reflected power level and the level reported by the module. You can calculate the real absolute reflected power level coming to the RF port of the module by using below formula:

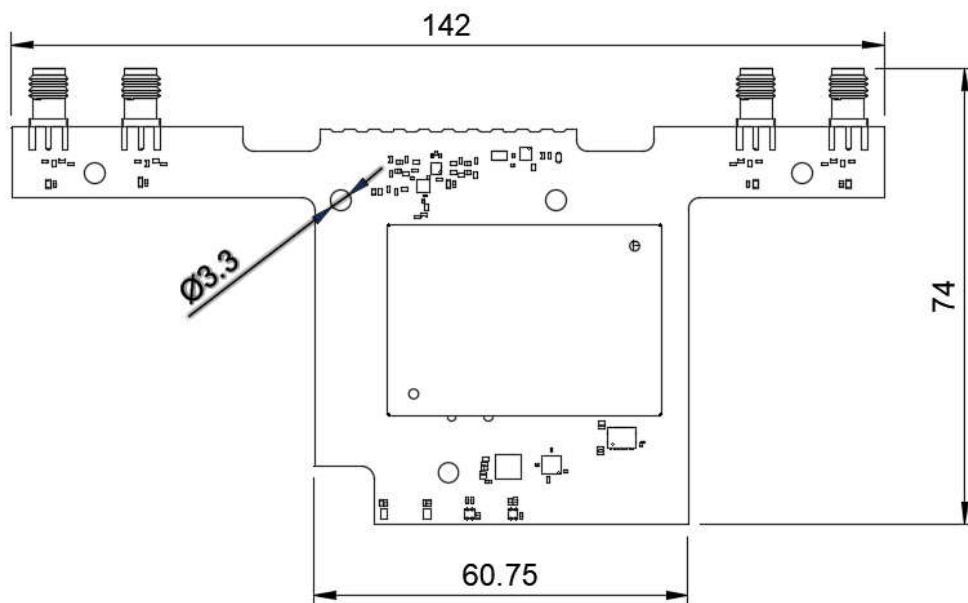
$$\text{Reflected power level (in dBm)} = (\text{Reported reflected power level by the module}) + 25$$

This feature can also be used for antenna detection. If there is no antenna connected to the port, the reflected power value will be close to the level of transmitted signal.

## 7. MECHANICAL DIMENSIONS

Mechanical dimensions are presented in this section. 3D step model of the NUR3-1W6 module is available on request. Please contact Nordic ID support if needed.

### 7.1. MODULE DIMENSIONS



Picture 6. Mechanical dimension top view of the NUR3-1W6.

### 7.2. PACKING

TBD

## 8. REGULATORY INFORMATION

When OEM prefers to leverage Nordic ID's grants and certifications of the NUR3-1W6 UHF RFID module, the host device documentation shall include regulatory compliance information on the NUR3-1W6 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 NUR3-1W6 is integrated.

When leveraging Nordic ID's grants and certifications, antenna shall be considered, in view of the fact, that the NUR3-1W6 module has met the essential regulatory requirements with the maximum antenna

gain stated in the context of particular regulatory compliance information (Antenna requirements). Using the antenna which meets the requirements, OEM integrator may demonstrate with less effort that the device with the integrated NUR3-1W6 module complies with the requirements.

## 8.1. EUROPEAN UNION AND EFTA COUNTRIES

### USER GUIDE REQUIREMENTS

This apparatus complies the essential requirements of the Radio Equipment Directive (RED) 2014/53/EU. In order to prove presumption of conformity with the essential requirements of the Radio Equipment Directive (RED) 2014/53/EU, following requirements and test methods have been applied to the apparatus:

- article 3.2: ETSI EN 302 208 v3.3.0
  - Radio Frequency Identification Equipment operating in the band 865 MHz to 868 MHz with power levels up to 2 W and in the band 915 MHz to 921 MHz with power levels up to 4 W; Harmonised Standard for access to radio spectrum
  
- article 3.1b: ETSI EN 301 489-1 v2.2.0
  - Tests must be performed when module is integrated in host product.
  
- article 3.1b: ETSI EN 301 489-3 v2.1.1
  - Tests must be performed when module is integrated in host product.
  
- article 3.1a: EN 60950-1:2006 + A1:2010 + A11:2009+A12:2011+ A2:2013
  - Tests must be performed when module is integrated in host product.

EN 62479: 2010

- Human exposure

EN 62311: 2008

- Human exposure limits

This apparatus complies EU Directive 2011/65/EU, Reduction of Hazardous Substances (RoHS).

Česky

[Czech]

[Nordic ID] tímto prohlašuje, že tento [RFID Radio module NUR3-1W6] je ve shodě se základními požadavky a dalšími příslušnými ustanoveními směrnice 2014/53/ES.

Dansk

[Danish]

Undertegnede [Nordic ID] erklærer herved, at følgende udstyr [RFID Radio module NUR3-1W6] overholder de væsentlige krav og øvrige relevante krav i direktiv 2014/53/EF.

Deutsch

[German]

Hiermit erklärt [Nordic ID], dass sich das Gerät [RFID Radio module NUR3-1W6] in Übereinstimmung mit den grundlegenden Anforderungen und den übrigen einschlägigen Bestimmungen der Richtlinie 2014/53/EG befindet.

Eesti

[Estonian]

Käesolevaga kinnitab [Nordic ID] seadme [RFID Radio module NUR3-1W6] vastavust direktiivi 2014/53/EÜ põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele.

English

Hereby, [Nordic ID], declares that this [RFID Radio module NUR3-1W6] complies with the essential requirements and other relevant provisions of Directive 2014/53/EU.

Español

[Spanish]

Por medio de la presente [Nordic ID] declara que el [RFID Radio module NUR3-1W6] cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 2014/53/EU.

Ελληνική

[Greek]

ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ [Nordic ID] ΔΗΛΩΝΕΙ ΟΤΙ [RFID Radio module NUR3-1W6] ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 2014/53/ΕΚ.

Français

[French]

Par la présente [Nordic ID] déclare que l'appareil [RFID Radio module NUR3-1W6] est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 2014/53/EU.

Italiano

[Italian]

Con la presente [Nordic ID] dichiara che questo [RFID Radio module NUR3-1W6] è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 2014/53/EU.

Latviski

[Latvian]

Ar šo [Nordic ID] deklarē, ka [RFID Radio module NUR3-1W6] atbilst Direktīvas 2014/53/EK būtiskajām prasībām un citiem ar to saistītajiem noteikumiem.

Lietuvių

[Lithuanian]

Šiuo [Nordic ID] deklaruoja, kad šis [RFID Radio module NUR3-1W6] atitinka esminius reikalavimus ir kitas 2014/53/EB Direktyvos nuostatas.

Nederlands

[Dutch]

Hierbij verklaart [Nordic ID] dat het toestel [RFID Radio module NUR3-1W6] in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 2014/53/EG.

Malti

[Maltese]

Hawnhekk, [Nordic ID], jiddikjara li dan [RFID Radio module NUR3-1W6] jikkonforma mal-ħtiġijiet essenzjali u ma provvedimenti oħrajn rilevanti li hemm fid-Dirrettiva 2014/53/EU.

Magyar

[Hungarian]

Alulírott, [Nordic ID] nyilatkozom, hogy a [RFID Radio module NUR3-1W6] megfelel a vonatkozó alapvető követelményeknek és az 2014/53/EU irányelv egyéb előírásainak.

Polski

[Polish]

Niniejszym [Nordic ID] oświadcza, że [RFID Radio module NUR3-1W6] jest zgodny z zasadniczymi wymogami oraz pozostałymi stosownymi postanowieniami Dyrektywy 2014/53/EU.

Português

[Portuguese]

[Nordic ID] declara que este [RFID Radio module NUR3-1W6] está conforme com os requisitos essenciais e outras disposições da Directiva 2014/53/EU.

Slovensko

[Slovenian]

[Nordic ID] izjavlja, da je ta [RFID Radio module NUR3-1W6] v skladu z bistvenimi zahtevami in ostalimi relevantnimi določili direktive 2014/53/ES.

Slovensky

[Slovak]

[Nordic ID] týmto vyhlasuje, že [RFID Radio module NUR3-1W6] spĺňa základné požiadavky a všetky príslušné ustanovenia Smernice 2014/53/ES.

Suomi

[Finnish]

[Nordic ID] vakuuttaa täten että [RFID Radio module NUR3-1W6] on direktiivin 2014/53/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.

Svenska

[Swedish]

Härmed intygar [Nordic ID] att denna [RFID Radio module NUR3-1W6] står i överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 2014/53/EG.

## **LABELING REQUIREMENTS**

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

## ANTENNA REQUIREMENTS

Maximum allowed ERP power is 33dBm when operating in ETSI lower band. NUR3-1W6 has maximum output power of 30dBm. Meaning that 5dBi is the maximum allowed antenna gain without cable losses (ETSI lower band). When module is set to operate in ETSI upper band, maximum ERP power is 36dBm. This means maximum antenna gain of 6dBi.

Formula how to calculate maximum allowed antenna gain when operating in ETSI lower band:

$$30 \text{ dBm} - 2.15 \text{ (dipole gain)} + [\text{antenna gain dBi}] - [\text{cable attenuation dB}] < 33\text{dBm}$$

Formula how to calculate maximum allowed antenna gain when operating in ETSI upper band:

$$32 \text{ dBm} - 2.15 \text{ (dipole gain)} + [\text{antenna gain dBi}] - [\text{cable attenuation dB}] < 36\text{dBm}$$

### Beamwidth restrictions while operating in ETSI lower band:

For transmissions  $\leq 500$  mW e.r.p. there shall be no restriction on beam width.

For transmissions of  $> 500$  mW e.r.p. to  $\leq 1\,000$  mW e.r.p. beam widths shall be  $\leq 180^\circ$

For transmissions of  $> 1\,000$  mW e.r.p. to  $2\,000$  mW e.r.p. beam widths shall be  $\leq 90^\circ$

### Beamwidth restrictions while operating in ETSI upper band:

For transmissions  $\leq 1000$  mW e.r.p. there shall be no restriction on beam width.

For transmissions of  $> 1000$  mW e.r.p. to  $\leq 2\,000$  mW e.r.p. beam widths shall be  $\leq 180^\circ$

For transmissions of  $> 2\,000$  mW e.r.p. to  $4\,000$  mW e.r.p. beam widths shall be  $\leq 90^\circ$

## 8.2. FCC

This equipment has been tested and found to comply with the Part 15 C of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates 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 C 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.

**Note:** User of the module cannot change the region setting of the module. When FCC region is set, the module operates in frequency band of 902 – 928Mhz.

**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 NUR3-1W6 transmitter module is authorized to be used in other devices only by OEM Integrators under the following conditions:

**Note:** If the antenna with max gain 6dBi is used, host product manufacturer must ensure that antenna must be installed such that the safe minimum separation distance can be maintained between the antenna (radiator) and user's/nearby people's body at all times. By doing so, RF exposure evaluation is not required. This is for general population. See how to calculate allowed module power and antenna gain. It might be required to use attenuator between module and antenna to get exposure inside the limits.

## Maximum Permissible Exposure FCC

47 CFR Sections 1.1307, 1.1310, 2.1091,

447498 D01 General RF Exposure Guidance v06

### 2.1 General population /Un-controlled Environments (FCC)

where:

$$S = \frac{PG}{4\pi R^2}$$

S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

1. The transmitter module must not be co-located with any other transmitter, except with those that are within the limits shown in the NUR3-1W6 filing.
2. The transmitter module can only be used when host integration is done according to strict compliance with the OEM instructions provided.

When incorporate NUR3-1W6 into the host product and the conditions above are met, still some testing including transmitter of NUR3-1W6 may be required. The OEM integrators have full responsibility for testing their end-product for other compliance requirements, for example digital device emissions, PC peripheral requirements. Guidance for required tests can be asked from certification service provider which is typically companies having qualified TCB/FCB.

**Note:** NUR3-1W6 module is approved as mobile. 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 host product manufacturer must do either a permissive change authorization with the grantees permission, or a Change of ID followed by Permissive Change as allowed under FCC policies. It also might happen that original FCC ID can't be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the host product (including the transmitter) and obtaining a separate FCC authorization.

The OEM integrator must 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 host product.

Host product antenna(s) must be always connected with coaxial cable directly to the RP SMA connectors of NUR3-1W6 module. Host product manufacturer / OEM integrator is responsible of external antenna connector(s) for their product and they shall contact Nordic ID for further instructions.

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

### 8.2.1. USER'S GUIDE REQUIREMENTS

The texts in quotation marks below are the required FCC statements in the user's guide. The note given in brackets is not an FCC statement, but it gives the required information on the first required FCC statement.

"To comply with FCC's RF radiation exposure requirements in general population environment, the antenna(s) used for this transmitter must be installed such that a minimum separation distances of 20 cm (7.87 inch) 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 C 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"

### 8.2.2. LABELING REQUIREMENTS

The host product must be labelled with the following identification information in a visible area:

**"Contains Transmitter Module FCC ID: SCCNUR31W6"**

or

**"Contains FCC ID: SCCNUR31W6"**

### 8.2.3. ANTENNA REQUIREMENTS

Antenna type used in certification is patch type.

Contact Nordic ID for more information.

### 8.3. ISED EN

This device contains licence-exempt transmitter / receiver that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS. 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.

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

To leverage the Nordic ID's grant given by ISED, the device with the integrated NUR3-1W6 module shall be met the following conditions:

1. User of this device or nearby people must not compromise the minimum separation distance of 20cm (7.87 inch), in any situation.
2. The antenna(s) used with the NUR3-1W6 module must not be co located in conjunction with any other transmitter or its antenna that is capable of transmitting at the same time, except the transmitter-antenna configurations that are within the limits of the NUR3-1W6's grant given by ISED.
3. The integration of the module into the host shall comply with the OEM design instructions provided.

When the conditions above are met, still some testing including transmitter is required, it is responsibility of the OEM integrator to demonstrate that the host product complies with regulatory requirements.

There are no user's documentation requirements other than are required by Science and Economic Development Canada statements outlined in the ISED section in a prominent place in the user's guide.

**Note:** User of the module cannot change the region setting of the module. When ISED region is set, the module operates in frequency band of 902 – 928Mhz.

### 8.3.1. LABELLING REQUIREMENTS FOR THE HOST DEVICE

The host product must be labelled with the following identification information in a visible area:

**“Contains IC: 5137A-NUR31W6”**

### 8.3.2. ANTENNA REQUIREMENTS

Antenna type used in certification is patch type.

Maximum allowed antenna gain is 6dBi.

Contact Nordic ID for more information.

## 8.4. ISED FR

Cet appareil contient un émetteur / récepteur exempt de licence conforme à la norme RSS d'Innovation, Sciences et Développement économique Canada. Son fonctionnement est soumis aux deux conditions suivantes: (1) cet appareil ne doit pas causer d'interférences et (2) cet appareil doit accepter toute interférence, y compris les interférences pouvant entraîner un fonctionnement non souhaité de l'appareil.

En vertu de la réglementation de Science et Développement économique Canada, cet émetteur radio ne peut fonctionner qu'avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Science et Développement économique Canada. Pour réduire le risque d'interférences radio avec d'autres utilisateurs, le type d'antenne et son gain doivent être choisis de manière à ce que la puissance rayonnée isotrope équivalente (p.i.r.e.) ne soit pas supérieure à celle nécessaire au succès de la communication.

Pour tirer parti de la subvention accordée par l'ISED au Nordic ID, l'appareil avec le module intégré NUR2-1W doit remplir les conditions suivantes:

1. Le gain d'antenne maximal autorisé est indiqué plus loin dans ce document. L'utilisateur de cet appareil ou les personnes à proximité ne doivent en aucun cas compromettre la distance de séparation minimale de 20cm (7.87 inch).
2. La ou les antennes utilisées avec le module NUR3-1W6 ne doivent pas être placées en même temps que tout autre émetteur ou son antenne capable d'émettre en même temps, à l'exception des configurations émetteur-antenne qui sont dans les limites de la subvention NUR2-1W accordée par ISED.
3. L'intégration du module dans l'hôte doit être conforme aux instructions de conception OEM fournies.

Lorsque les conditions ci-dessus sont remplies, même si certains tests, y compris le transmetteur, sont requis, il incombe à l'intégrateur OEM de démontrer que le produit hôte est conforme aux exigences réglementaires.

Il n'existe aucune exigence en matière de documentation utilisateur autre que celle requise par les déclarations de Sciences et Développement économique décrites dans la section ISED à un endroit bien en vue dans le guide de l'utilisateur.

Observation:

L'utilisateur du module ne pourra pas changer les paramètres région du module. Quand le paramètre région ISED est sélectionné, le module fonctionne sur la bande de fréquence 902-928Mhz.

#### 8.4.1. EXIGENCES APPLICABLES AUX APPAREILS HÔTES

Le produit fini doit disposer d'étiquette mentionnant les information suivantes d'identification sur une surface visible:

**"Contains IC: 5137A-NUR31W6"**

#### 8.4.2. EXIGENCES D'ANTENNE

Le gain d'antenne maximum autorisé est de 6 dBi.

### 8.5. TELECOM

TBD

#### 8.5.1. ANTENNA REQUIREMENTS

TBD

## 9. ABOUT NORDIC ID

Nordic ID is at the centre of today's real-time item tracking and reliable RFID technology. We help organizations fight the damaging effects of item loss, facilitate streamlined business procedures, and stay ahead of the competition.

We are ready to help you take advantage of our wide range of products and services designed to fit your needs. Contact us now, and we will help you to tackle your challenges and get your business to the next level.

**Nordic ID**

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## 10. VERSION HISTORY

<u>Version</u>	<u>Date</u>	<u>Modifications</u>
0.1	16 <sup>th</sup> June 2021	Initial draft
0.2	5 <sup>th</sup> July 2021	Added certification details
0.3	2 <sup>nd</sup> September 2021	Modified TX power and regulatory sections
1.0	21 <sup>st</sup> October 2021	Section 5.1.3 and 5.1.4 modified/added