RTX-868-NB is a SMD multichannel narrow band transceiver operating in 868.00 - 868.60 MHz band allowing long distances with very low power consumption.

The device is suitable for battery powered sensors requiring very low power consumption, in particular for smoke and fire detection applications.

A typical scenario is an alarm sensor network in which each node is able to detect an alarm.
When a device detects the alarm, it activates a node local warning and it sends a broadcast RF message to notify the alert to all the other devices of the network.

RTX-868-NB has also the possibility to locally deactivate the alarm and notify the deactivation to all the devices of the network.

It is furthermore possible to test the link radio between two devices, an useful feature during the network installation.

For security reasons each radio communication is encrypted with AES 128 algorithm.

Main Features

- **Reduced dimensions (20 x 20 x 2.5 mm)**
- **40mW max RF output power**
- **Sensitivity -115dBm**
- **Blocking category 1**
- **10uA average current consumption**
- **Encrypted data transmission**

Applications

- **Smoke detector**
- **Fire detector**

Absolute maximum ratings

Operating Temperature	-20°C ÷ +70°C
Storage Temperature	-60°C ÷ +150°C
Supply Voltage	-0.5V ÷+5.5V
Input Voltage	-0.5V ÷+5.5V

Technical characteristics

	Min.	Typ.	Max.	Unit
DC levels				
Supply Voltage pin 9	2.1	3	3.6	V
Current consumption (Wake on Radio mode) [4]		10		uA
Current consumption (Rx continuous) [1]		16		mA
Current consumption (Tx continuous) [1]		65	70	mA
High level voltage in input	2.0		Vcc	V
Low level voltage in input	0		0.8	V
Pin output current	8			mA
RF TX				
Frequency [1]	868.1		868.5	MHz
Offset frequency at +25°C	+4		-4	KHz
RF channels [2]		5		
RF power [1]		15	16	dBm
ERP with Aurel antenna “ANT 868 SMA”		15		dBm
Modulation		GFSK		
Deviation GFSK modulation		±15		kHz
Channel bandwidth -3dB		40		kHz
Data-rate		4800		bps
Temperature Frequency stability -20+70°C	-9		+9	kHz
RF spurious emissions < 1GHz			-36	dBm
RF spurious emissions > 1GHz			-30	dBm
RF power in adjacent channel in TX			-36	dBm
Pin 1 ESD contact discharge protection (61000-4-2)		8		kV
Pin 1 ESD air discharge protection (61000-4-2)		15		KV
RF RX				
RX sensitivity		-115		dBm
RX Bandwidth		40		kHz
Data-Rate		4800		bps
Adjacent channel rejection		37		dB
AFC	-18		+18	kHz
Blocking category [3]		1		
Blocking test at ±2MHz [3]		-12		dBm
Blocking test at ±10MHz [3]		3		dBm
Blocking test at ±5% [3]		5		dBm

Note 1: Test carried out with 50 ohm load on pin 1 (antenna).
Note 2: See table 2 for frequency channel values.
Note 3: Test performed in accordance with 5.18 of ETSI EN 300 220-1 V3.1.1 (2017-02)
Note 4: Wake on Radio mode. RTX switches from power-down to RX-ON state every 10s.

Pin description

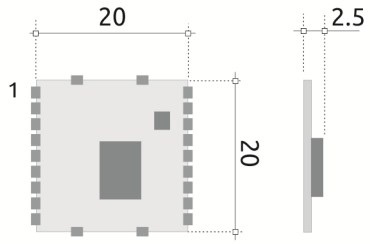

Figure 1: Pin-out and mechanical drawing

PIN-OUT

1) ANTENNA	12) GND
2) GND	13) RF CH Sel0
3) ALARM	14) NET Sel0
4) UART RX	15) RESET
5) UART TX	16) NET Sel1
6) TEST/DISABLE	17) OUT
7) RF CH Sel2	18) NET Sel2
8) RF CH Sel1	19) TEST MODE sel
9) Vcc	20) GND
10) GND	21) GND
11) GND	22) GND

Pin	Name	Description
1	**ANTENNA**	Antenna connection, 50 ohm impedance.
2	**GND**	Ground connection.
3	**ALARM**	Alarm input, active low (normally high with 65k ohm pull-up resistor).
4	**UART RX**	Not implemented.
5	**UART TX**	Not implemented.
6	**TEST/DISABLE**	Test and alarm disable input, active low (normally high with 65k ohm pull-up resistor).
7	**RF CH Sel2**	RF channel selection input, active low (normally high with 65k ohm pull-up resistor).
8	**RF CH Sel1**	RF channel selection input, active low (normally high with 65k ohm pull-up resistor).
9	**Vcc**	Connection to supply voltage 2,1V-3,6V / 100mA.
10	**GND**	Ground connection.
11	**GND**	Ground connection.
12	**GND**	Ground connection.
13	**RF CH Sel0**	RF channel selection input, active low (normally high with 65k ohm pull-up resistor).
14	**NET Sel0**	Network ID selection input, active low (normally high with 65k ohm pull-up resistor).
15	**RESET**	Input reset, active low.
16	**NET Sel1**	Network ID selection input, active low (normally high with 65k ohm pull-up resistor).
17	**OUT**	Output.
18	**NET Sel2**	Network ID selection input, active low (normally high with 65k ohm pull-up resistor).
19	**TEST MODE Sel**	Test mode selection input, active low (normally high with 65k ohm pull-up resistor).
20	**GND**	Ground connection.
21	**GND**	Ground connection.
22	**GND**	Ground connection.

Table 1: pin description

Operation

At power on the device activates the OUT pin (active high), it performs the initialization and it deactivates the OUT pin.

After the power on initialization the RTX-868-NB uses the WOR (Wake on Radio) functionality which enables the radio to periodically wake up from sleep mode and listen for incoming packets. The radio goes back to sleep mode unless a packet has been detected.
This technique, with 10 seconds wake up time, allows to receive valid RF packets with an average current consumption of about 10uA.
On the transmitter side it is of course necessary transmit a long packet preamble so that the receiver can wake up and detect the presence of the packet. This means that the transmitted radio packet is 12 seconds long.

The device is designed for battery powered, sensors network requiring very low power consumption, in particular for smoke and fire detection applications.
A typical scenario is a network of radio sensors for residential use, each integrating the RTX-868-NB, a sensor (e.g. smoke or fire sensor) connected to the ALARM input (pin 3) and an alert notification apparatus (e.g. warning horn) connected to the OUT pin (pin 17).

When the ALARM input (normally high with 65k ohm pull-up resistor) goes low and stays low at least 20msec the RTX-868-NB considers the alarm activated and then it:

1. activates the OUT pin (active high) for the local warning;
2. send the alarm RF radio packet (12 seconds long) : all the other devices of the network (see section below for network selection) receive the packet and then activate their OUT pin.

In a similar way it is possible to deactivate manually the alarm through the TEST/DISABLE input (pin 6) typically connected to a push button. If the TEST/DISABLE pin (normally high with 65k ohm pull-up resistor) goes low and it stays low at least 3 seconds, when it goes back high the device:

1. deactivates the OUT pin (pin low) for the local warning disable;
2. send the alarm disable RF radio packet (12 seconds long) : all the other devices of the network receive the packet and then deactivate their OUT pin.

RF CHANNEL and NETWORK ID selection

RF CH Sel0, RF CH Sel1 and RF CH Sel2 pins allow the user to select the RF channel in which the device works.
5 RF channels are available as shown in Table 2:

Channel num.	RF CH Sel2 pin.9	RF CH Sel1 pin.8	RF CH Sel0 pin.13	RF channel (MHz)
1	1	1	1	868.1
2	1	1	0	868.2
3	1	0	1	868.3
4	1	0	0	868.4
5	0	1	1	868.5

Table 2: RF channel selection

Note 5: RF CH Sel pins are normally high with 65k ohm pull-up resistor, it means that the value 1 corresponds to a pin connected to Vcc or not connected, the value 0 corresponds to a pin connected to ground.

It is mandatory that all the devices of the same installation work on the same RF channel.
In case of more than one installation in the same RF coverage area it is recommended to set each installation in a different RF channel.

NET Sel0, NET Sel1 and NET Sel2 pins allow the user to select the Network ID of an installation.
8 Network IDs are available and all the devices of the same installation must have the same ID.
The device considers a RF received packet valid only if it is transmitted by a node with the same NET Sel0, NET Sel1 and NET Sel2 pins configuration.
In this way more than one installation present in the same RF coverage area may be separated even if they work on the same RF channel.

Network ID	NET Sel2 Pin.18	NET Sel1 Pin.16	NET Sel0 Pin.14
1	0	0	0
2	0	0	1
3	0	1	0
4	0	1	1
5	1	0	0
6	1	0	1
7	1	1	0
8	1	1	1

Table 3: Network ID selection (see Note 5)

RF channel and Network ID settings are detected only at power on therefore for any changes of the setting it is necessary to turn off the device, modify the setting and turn on the device again or reset the device (pin 15 connected to GND).

To avoid an increase of current consumption don't change RF channel and Net selection pins status when the device is powered on.

TEST MODE selection

It is possible to test the link radio between two devices, in the following way:

1. Connect the TEST MODE Sel pin to GND on the two devices: in this way both devices are in RF receive mode waiting for a RF test packet or for the TEST/DISABLE input (pin 6) forced low.
2. If on the Device 1, the TEST/DISABLE (pin.6) goes low and it stays low at least 20 msec, when it goes back high the device sends a RF TEST packet.
3. If the Device 2 is in radio coverage (pin.19 LOW, pin.6 High), it receives the test packet, it sends the RF ACK packet and it activates the OUT pin.17 for 300msec.
4. If the Device 1 receives the ACK packet it activates the OUT pin.17 for about 3 seconds. If the ACK packet is not received the Device 1 blinks three times the OUT pin.

TEST MODE setting is detected only at power on therefore for any changes of the setting it is necessary to turn off the device, modify the setting and turn on the device again, or reset the device (pin 15 connected to GND).
To avoid an increase of current consumption don't change TEST MODE Sel pin status when the device is powered on.

DEVICE USAGE

In order to obtain the performances described in the technical specifications and to comply with the operating conditions which characterize the certification, the transceiver should be mounted on a printed circuit taking into account the following:

Power Supply:

1. RTX-868-NB must be supplied from very low voltage safety source protected against the short circuits. maximum voltage variations allowed: 2.1 ÷ 3.6 V. However it is preferable to maintain a stable voltage to a predetermined value in the range of voltage as specified above, using a "fast transient response" voltage regulator.
2. Decoupling, close to the transceiver, with a ceramic capacitor of minimum 100nF.
3. Connect electrolytic capacitor 100uF, low ESR, close to pin 9 (Vcc).

Input pin interface:

Put 100pF capacitors close to the corresponding general purpose digital inputs pins, connected between them and the ground plane.

Ground:

The ground must surround at the best the welding area of the module and must also be realized in the lower face of the PCB in order to obtain the optimal result, with the through holes connecting the two ground planes.

Antenna:

Connect pin 1 (antenna) to the coaxial connector or antenna, with 50 ohm constant impedance microstrip width 3.2 mm for PCB with thickness 1.6 mm and width 1.6 mm for PCB with thickness 1mm.
The antenna is a typical rigid copper wire (insulated or not) of 8cm length and cross-section at least of 0.5 mm² placed vertically to the ground plane. Other placements of antenna (bend, coil) will work but performance are not predictable.
As an alternative to connect the module to an external antenna, connect an SMA connector into PCB using 50 ohm microstrip line.

Reference Rules

RTX-868-NB transceiver is compliant with the european set of rules **EN 300 220-2**, and **EN 301 489-3**.
The transceiver must be supplied by a very low voltage safety source protected against short circuits.
The usage of the module is foreseen inside enclosures that guarantee the **EN 61000-4-2** normative not directly applicable to the module itself.
This device is compliant with **EN 62479**, connected to the electromagnetic field human exposition, if used with temporal duty cycle not higher than 1% like foreseen in CEPT 70-03 recommendation.

CEPT 70-03 Recommendation

RTX-868-NB recommendation is referred to the 868.0 - 868.6 MHz harmonized bandwidth and therefore, in order to comply with local regulations, the device must be used on the time scale with maximum duty-cycle time of 1% (equivalent to 36 seconds of usage on 60 minutes).

Firmware version summary

Release date	Firmware version	Changes from the previous version
07/03/2019	1.0	First stable version

User manual revision summary:

Release date	Revision user manual	Changes from the previous revision
19/03/2019	1.0	Preliminary