

Figure 1

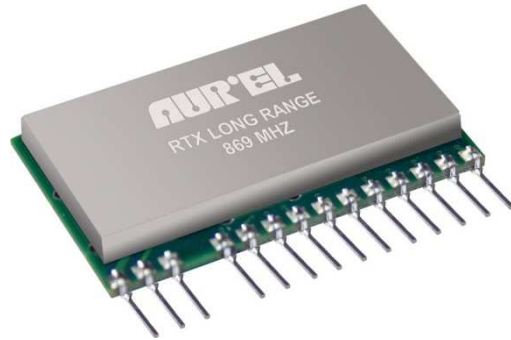


Figure 2

The RTX-LONG-RANGE-869MHz transceiver is a radio module half-duplex within 3km of distance, operating in the European radio frequency band 869.4 ÷ 869.65 MHz free of licenses and constraints from fees or territorial taxes. High sensitivity (-118dBm) and about +27dBm of output power guarantee +145dBm of budget link, enhancing 4-5 times the radio communication in the LPD up to 10mW.

It can operate in two different ways:

- **direct mode** with data modulation and demodulation based on proprietary protocol,
- **packet mode** with radio modem functionalities controllable with AT commands via UART port.

From 1 to 7 radio channels in function of the transmission rate with GFSK modulation. Blocking immunity compliant with class 1, excellent immunity to adjacent channels.

In order to guarantee flexibility of uses with battery the device is designed for 3.3V power supply, ideal for SCADA applications, the current supply is about 600mA at maximum TX power and 10µA in standby mode.

This device is built to be mounted on vertical position with similar dimensions of any standard Aurel receiver (38.1x24mm). A front shield is mounted in order to be compliant for the certification approvals.

### General characteristics

- **Direct or radio modem mode of transmission**
- **Store and forward of RS-232 signals**
- **No encoding or preamble required from the user in packet mode**
- **AT commands for internal register configuration**
- **HyperTerminal\* compatible**
- **Max number of channels: 7**
- **Small size (38,1x24x4,5 mm)**
- **Baud rate UART: 2400, 4800, 9600 bps**
- **TX Power: max 500 mW**
- **-118dBm of sensibility with data-rate 500bps**
- **Power supply: 3,3V**
- **Average coverage: 3000 m**

### Applications

- **Farming systems**
- **Irrigating systems**
- **PV solar cells monitoring**
- **Industrial control systems**
- **SCADA**
- **Alarm security systems**
- **Instrument monitoring**
- **AMR**

Le caratteristiche tecniche possono subire variazioni senza preavviso. AUREL S.p.A. non si assume la responsabilità di danni causati dall'uso improprio del dispositivo.

### Absolute Limits

Working temperatures	-20 °C ÷ +70 °C
Storage temperatures	-40 °C ÷ +100 °C
Power supply	+3,6V
Inner voltage range	-0.5 ÷ Vcc + 0.3V
Outer voltage range	-0.5 ÷ Vcc + 0.3V

### Technical specifications

	Min.	Tip.	Max.	Unità
<b>DC Levels</b>				
Power supply (pin 1 and 15)	2.7	3.3	3.6	V
Current supply (RX mode)		32		mA
Current supply (TX mode @ +27 dBm)	500	550	600	mA
Current supply (stand-by mode)		8	10	µA
Input high level range (digital input except for pin 8 "IN_DATA")	0.7xVcc		Vcc+0.3	V
Input low level range (digital input except for pin 8 "IN_DATA")	-0.5		0.3xVcc	V
Output high level range (note 6)	2.1		2.8	V
Output low level range (note 6)	0.2		0.45	V
Input high level range (pin 8 "IN_DATA" only, Vs = 3V)	1.3		2.2	V
Input low level range (pin 8 "IN_DATA" only, Vs = 3V)	-0.5		1.5	V
<b>RF TX</b>				
Frequency band	869,4÷869,65			MHz
TX Power (direct mode Pin 14 = 1)	25	27	29	dBm
TX Power (direct mode Pin 14 = 0)	20	21	23	dBm
TX Power (packet mode)	8		29	dBm
Modulation	GFSK			
Frequency deviation	±3.5			KHz
Spurious emission < 1GHz				-36 dBm
Spurious emission > 1GHz				-30 dBm
TX power on adjacent channel (note 2)				50 nW
<b>RF RX</b>				
RX sensitivity in direct mode	-115	-116	-120	dBm
IF band				12 KHz
RF band				600 KHz
Selectivity on adjacent channel (note 3)				50 dB
Saturation on adjacent channel (note 4)				≥87 dB
Receiver Bloking ±2MHz (note 5)	85		90	dB
Receiver Bloking ±10MHz (note 5)	85		94	dB
<b>Performance</b>				
Serial Bit rate <sup>1</sup>	9600	19200	115200	bps
RF transmission bit rate	600		9600	bps
Buffer size	1		63	Byte

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Outdoor range		3000		m
Number fo channels			7	n°
Channelized bandwidth		25		kHz
<b>Commutation times (note 7)</b>				
PWRDN → RX	5			ms
TX → RX		4		ms
RX → TX		3,5		ms
<b>Default settings (packet mode only)</b>				
Channel		(CN3) 869,5		MHz
TX power		27		dBm
Serial baud rate		9600		bps

**Table 1**

Note 1: Serial communication must be 8,n,1.

Note 2: Test defined by the procedure of ETSI EN 300 220-1 V2.4.1 paragraph 7.6

Note 3: Test defined by the procedure of ETSI EN 300 220-1 V2.4.1 paragraph 8.3

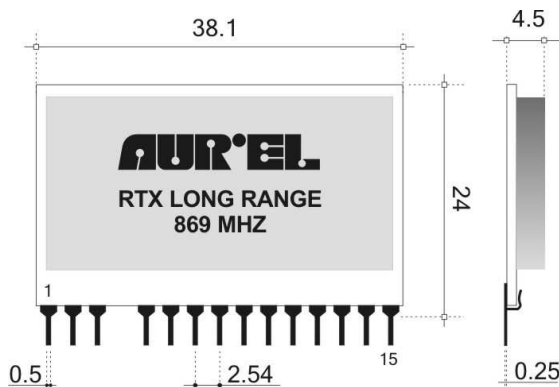
Note 4: Test defined by the procedure of ETSI EN 300 220-1 V2.4.1 paragraph 8.3.4

Note 5: Test defined by the procedure of ETSI EN 300 220-1 V2.4.1 paragraph 8.4

Note 6: Prova eseguita con alimentazione 3V, corrente 3mA.

Note 7: the device during the power on takes about 80msec for being active.

### Pin description



**Figure 3** pin-out of the device

### **Pin-out**

- 1)+V\_PA\_LNA
- 2)ANTENNA
- 3)GND
- 4)NC(pin assente)
- 5)DM/UART
- 6)ENABLE
- 7)TX\_RX / SP1
- 8) IN\_DATA / SP2
- 9)OUT-DATA(RX direct mode)
- 10)GND
- 11)CN0 / RTS
- 12)CN1 / CTS
- 13)CN2 / TX\_UART
- 14)PW\_TX / RX\_UART
- 15) +V\_RD

N° Pin	Nome	Descrizione
1	<b>+V_PA_LNA</b>	Input voltage for the front-end circuit. Connect to a stable power supply of 3,3V/1A. Place an electrolytic capacitor of 470-1000uF in proximity of the pin and GND.
2	<b>ANT</b>	Antenna pin connection, 50 ohm impedance.
3	<b>GND</b>	Ground connection.
5	<b>DM / UART</b>	Digital input, communication mode switch. With a pull down resistor of 22÷47K

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		<table border="1"> <thead> <tr> <th>DM/UART</th> <th>STATO</th> </tr> </thead> <tbody> <tr> <td>0/X</td> <td>Direct mode</td> </tr> <tr> <td>1</td> <td>Packet mode</td> </tr> </tbody> </table> <p><b>Table 2</b> 0 = GND, 1 = +Vcc, X = open</p>	DM/UART	STATO	0/X	Direct mode	1	Packet mode															
DM/UART	STATO																						
0/X	Direct mode																						
1	Packet mode																						
6	<b>ENABLE</b>	<p>Digital input, transceiver enable pin. With a pull down resistor of 22÷47K</p> <table border="1"> <thead> <tr> <th>PWRDN</th> <th>STATO</th> </tr> </thead> <tbody> <tr> <td>0/X</td> <td>Power down</td> </tr> <tr> <td>1</td> <td>Active</td> </tr> </tbody> </table> <p><b>Table 3</b> 0 = GND, 1 = +Vcc, X = open</p>	PWRDN	STATO	0/X	Power down	1	Active															
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1	Active																						
7	<b>TX_RX / SP1</b>	<p>In direct mode configuration (pin 5 = 0), this pin switches between TX or RX status.</p> <table border="1"> <thead> <tr> <th>TX/RX</th> <th>STATO</th> </tr> </thead> <tbody> <tr> <td>0/X</td> <td>Ricezione</td> </tr> <tr> <td>1</td> <td>Trasmissione</td> </tr> </tbody> </table> <p><b>Table 4</b> 0 = GND, 1 = +Vcc, X = open</p> <p>In packet mode configuration (pin 5 = 1), this pin switches between the bitrate communications. SP1 and SP2 pin must be set as follow:</p> <table border="1"> <thead> <tr> <th>SP1 Pin7</th> <th>SP2 Pin8</th> <th>UART data rate bps</th> </tr> </thead> <tbody> <tr> <td>0/X</td> <td>0/X</td> <td>9600</td> </tr> <tr> <td>0/X</td> <td>1</td> <td>19200</td> </tr> <tr> <td>1</td> <td>0/X</td> <td>115200</td> </tr> <tr> <td>1</td> <td>1</td> <td>Test mode (not implemented)</td> </tr> </tbody> </table> <p><b>Table 5</b> 0 = GND, 1 = +Vcc, X = open</p> <p>With a pull down resistor of 22÷47K</p>	TX/RX	STATO	0/X	Ricezione	1	Trasmissione	SP1 Pin7	SP2 Pin8	UART data rate bps	0/X	0/X	9600	0/X	1	19200	1	0/X	115200	1	1	Test mode (not implemented)
TX/RX	STATO																						
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0/X	1	19200																					
1	0/X	115200																					
1	1	Test mode (not implemented)																					
8	<b>IN_DATA / SP2</b>	<p>In direct mode configuration (pin 5 = 0) this pin is considered as <i>digital data input</i> with a frequency bit rate included in the range 10÷3000 Hz</p> <p>In packet mode configuration (pin 5 = 1), this pin switches between the bitrate communications (see Table 5).</p> <p>With a pull down resistor of 22÷47K</p>																					
9	<b>OUT-DATA</b> (RX direct mode)	<p>Digital data output in direct mode.</p> <p>Pin active only in direct mode.</p>																					
10	<b>GND</b>	<p>Pin to be connected on ground or the lower circuit voltage.</p>																					

Le caratteristiche tecniche possono subire variazioni senza preavviso. AUREL S.p.A. non si assume la responsabilità di danni causati dall'uso improprio del dispositivo.

<p>11 12 13</p>	<p><b>CN0 / RTS CN1 / CTS CN2 / TX_UART</b></p>	<p>In direct mode (pin 5 = 0), pin 11 (CM0), pin 12 (CN1), pin 13 (CN2) set the radio channel frequency.</p> <table border="1" data-bbox="549 394 1394 582"> <thead> <tr> <th colspan="8">DIRECT-MODE pin5 = 0</th> </tr> <tr> <th>Canale RF</th> <th>CN1</th> <th>CN2</th> <th>CN3</th> <th>CN4</th> <th>CN5</th> <th>CN6</th> <th>CN7</th> </tr> </thead> <tbody> <tr> <td>Frequenza (MHz)</td> <td>869,45</td> <td>869,475</td> <td>869,5</td> <td>869,525</td> <td>869,550</td> <td>869,575</td> <td>869,6</td> </tr> <tr> <td>PIN11_CN0</td> <td>0 / X</td> <td>1</td> <td>0 / X</td> <td>1</td> <td>0 / X</td> <td>1</td> <td>0 / X</td> </tr> <tr> <td>PN12_CN1</td> <td>0 / X</td> <td>0 / X</td> <td>1</td> <td>1</td> <td>0 / X</td> <td>0 / X</td> <td>1</td> </tr> <tr> <td>PIN13_CN2</td> <td>0 / X</td> <td>0 / X</td> <td>0 / X</td> <td>0 / X</td> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table> <p style="text-align: center;"><b>Table 6</b> 0 = GND, 1 = +Vcc, X = open</p> <p>In packet mode (pin 5 = 1), pin 11 (RTS), pin12 (CTS), pin 13 (TX_UART), pin 14 (RX_UART) allow to interact with a serial connection for data exchange and register programming through AT commands.</p> <table border="1" data-bbox="549 728 1434 833"> <thead> <tr> <th>PIN</th> <th>Descrizione</th> </tr> </thead> <tbody> <tr> <td>PIN11_RTS</td> <td>Not implemented</td> </tr> <tr> <td>PN12_CTS</td> <td>Not implemented</td> </tr> <tr> <td>PIN13_TX_UART</td> <td>Serial data output, 1 start bit (0V), 8 data bit and 1 stop bit (3V).</td> </tr> </tbody> </table> <p style="text-align: center;"><b>Table 7</b></p> <p>With a pull down resistor of 22÷47K, disabled in power down configuration (pin 6 = 0).</p>	DIRECT-MODE pin5 = 0								Canale RF	CN1	CN2	CN3	CN4	CN5	CN6	CN7	Frequenza (MHz)	869,45	869,475	869,5	869,525	869,550	869,575	869,6	PIN11_CN0	0 / X	1	0 / X	1	0 / X	1	0 / X	PN12_CN1	0 / X	0 / X	1	1	0 / X	0 / X	1	PIN13_CN2	0 / X	0 / X	0 / X	0 / X	1	1	1	PIN	Descrizione	PIN11_RTS	Not implemented	PN12_CTS	Not implemented	PIN13_TX_UART	Serial data output, 1 start bit (0V), 8 data bit and 1 stop bit (3V).
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<p>14</p>	<p><b>PW_TX / RX_UART</b></p>	<p>In direct mode (pin 5 = 0), it's possible to set the transmitter power outup of about 6 dBm. This setting can be useful in case of an antenna connection with power gain of 6-8 dBm in order to comply the limits of the EN 300 220-1 paragraph 7.2.3.</p> <table border="1" data-bbox="655 1021 1318 1149"> <thead> <tr> <th>PW_TX (pin14)</th> <th>STATO</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>RF output, max power (+27dBm)</td> </tr> <tr> <td>0/X</td> <td>RF output (+21dBm)</td> </tr> </tbody> </table> <p style="text-align: center;"><b>Table 8</b></p> <p>In packet mode (pin 5 = 1), pin 11 (RTS), pin12 (CTS), pin 13 (TX_UART), pin 14 (RX_UART) allow to interact with a serial connection for data exchange and register programming through AT commands.</p> <table border="1" data-bbox="549 1272 1434 1350"> <thead> <tr> <th>PIN</th> <th>Descrizione</th> </tr> </thead> <tbody> <tr> <td>PIN14_RX_UART</td> <td>Serial data input, 1 start bit (0V), 8 data bit and 1 stop bit (3V). The line must be controlled at high level logic (3V).</td> </tr> </tbody> </table> <p style="text-align: center;"><b>Table 9</b></p>	PW_TX (pin14)	STATO	1	RF output, max power (+27dBm)	0/X	RF output (+21dBm)	PIN	Descrizione	PIN14_RX_UART	Serial data input, 1 start bit (0V), 8 data bit and 1 stop bit (3V). The line must be controlled at high level logic (3V).																																														
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<p>15</p>	<p><b>+V_RD</b></p>	<p>Input voltage for the radio circuitry. Connect to a stable power supply of 3,3V/1A. Place an electrolytic capacitor of 470-1000uF in proximity of the pin and GND.</p> <p style="text-align: center;"><b>Table 10</b></p>																																																								

### Operating modes:

The operating mode of the RTX-LONG-RANGE can be summarized as follow:

1. **DIRECT MODE**
2. **PACKET MODE**
3. **POWER DOWN MODE**
4. **COMMAND MODE**

#### *1. DIRECT MODE (pin 5 = 0)*

Direct mode allows radio frequency data transfer clearly, without data packaging.

The packet must contain a preamble long enough and a data encoding (e.g. Manchester) in order to balance the voltage mean value of the analog demodulator, moreover the single data must be contained in a time slot between 20ms and 350 $\mu$ s (both high and low part).

Main settings like RF channel, RF power and TX/RX or Power down can be edit via hardware with the available I/O.

It's not possibile to set the transceiver with AT commands, the purpose of the direct mode is to allow custom protocol uses assuring continuity of utilization with older radio system.

#### Transmission

TX in direct mode can be activated by setting high the pin 7 (TX\_RX). The sending data will be forwarded via radio through the pin 8.

#### Reception

RX in direct mode can be activated by setting low the pin 7 (TX\_RX). Received data will be available on pin 9.

#### Channel Select

With the pins 11,12 and 13 it's possible to set the work frequency of the transceiver (see Table 6). **The change of the frequency will start to be applied only once the device is in RX status.**

#### RF power settings

Pin 14 (PW\_TX) allows to reduce the output RF power of about 6 dB, see Table 8 for further details. **The change of the RF power will start to be applied only once the device is in RX status.**

### 2. PACKET MODE ( $pin5 = 1$ )

When a start bit (0V active-low signal) is transmitted via serial communication to the transceiver's RX\_UART (pin 14) the device activates the RF transmission.

It works with a "store&forward" sequence such as:

- Unit A: receiving data from serial / Unit A: start RF transmission
- Unit B: receiving data from the radio channel / Unit B: transmitting data via serial

The *end of storing time* via serial communication from the Unit A (pin 14, RX\_UART) is defined by a timeout 1.5 bytes long sent at the data rate defined.

The maximum length of the TX packet is 63 bytes. If the RX\_UART pin receives a longer packet, discard the whole item and won't transmit the data. Data is transmitted only when the serial communication is ended; in the same way, the RX device will forward the data on the serial bus only if it's valid.

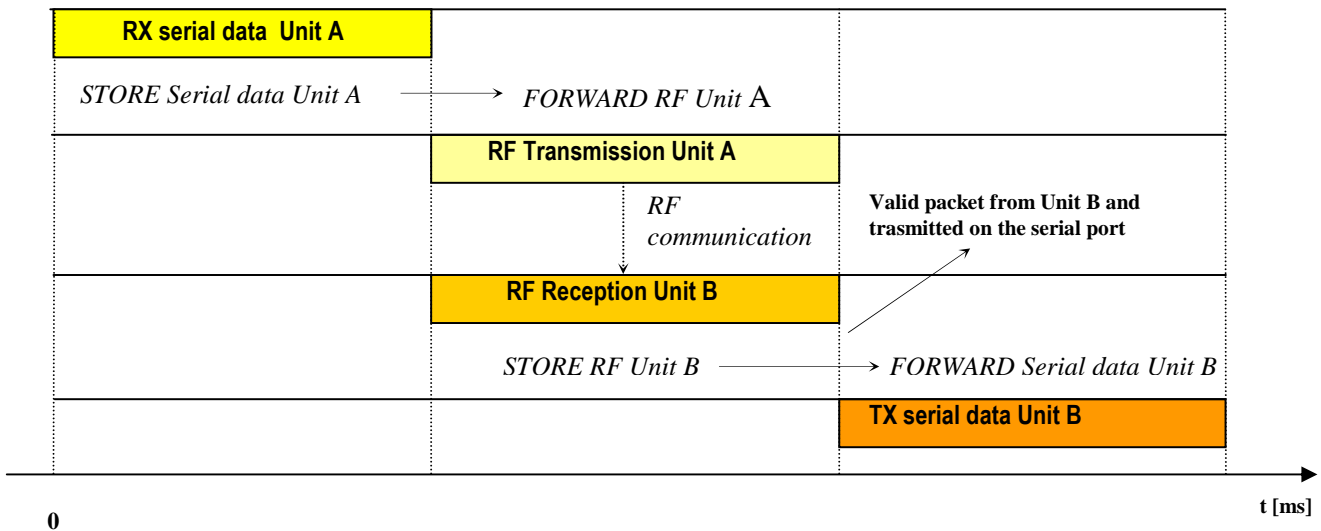


Figure 4

The timing of the transmission is proportional to the data rate and the data length (number of bytes) to be transmitted. For the Unit A, it's not possible to store data while the device is communicating via radio, they won't be saved in the buffer. About Unit B, data can't be sent via serial while the RX radio is working.

In Figure 5 is shown a two-packets transmission case. Packet 1 is been transmitted via serial communication to the unit A, then forwarded via RF to the unit B; the data then will be available through serial.

The transmission of the second packet must be taken after the completion of the unit B serial communication. This time span is required in order to avoid overlap and data loss risks, because of that it's necessary to consider a *safety time interval* between multiple transmissions. This interval will depends on the number of bytes of the first packet, the serial data rate of the unit B and the time of flight  $T_{RF}$  [ms].

Time of flight rely on the transmission radio set on *register S8* and from some fixed times of demodulating signal.

Refer to Table 11 for the correct time of flights.

Radio transmission (register S8)	Time of flight for radio transmission of 1 Byte
0= 600bps	200ms
1= 1200bps	100ms
2= 2400bps	50ms
3= 9600bps	12,5ms

**Table 11**

For example, 30 Bytes at 1200bps means:

$$\left(\frac{1}{1200\text{bps}}\right) = 0,833\text{ms} \quad (\text{single bit time at 1200bps})$$

$$0,83 \times 8 \times 29 = 193,2\text{ms} \quad (\text{time of flight for 29 bytes at 1200bps})$$

$$100 + 193,2 = 293,2\text{ms} \quad (\text{total time of flight } T_{RF} [\text{ms}] \text{ obtained adding the value from the table 11})$$

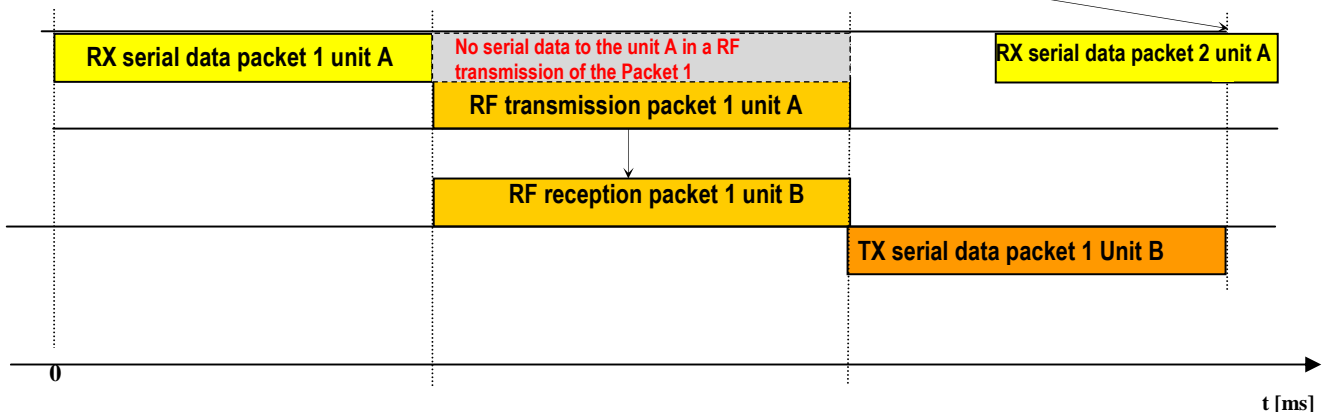
The RTX LONG RANGE UART port uses 8bit + 1 start bit and 1 stop bit, the serial transmission rate is defined by the pin 7 and 8 (SP1 and SP2, see Table 5).

Considering a 9600bps data rate (pin 7 = 0 and pin 8 = 0) the required time for 30 Bytes of data is:

$$\left(\frac{1}{9600}\right) \times 10 \times 30 = 31,25\text{ms}$$

The last byte of the second packet must be transmitted to the unit A after that unit B has ended the serial transmission of the first packet

The last byte of the second packet must be transmitted to the unit A after that unit B has ended the serial transmission of the first packet



**Figure 5**



### 3. POWER DOWN MODE

At low logic level or in tristate condition of the pin 6 (ENABLE), the device is in power down mode, forcing the current supply to 10  $\mu$ A: in this conditions the transceiver is unable to receiving or transmitting and a high logic level (+3V) restore the normal operative conditions.

NOTE 1, only for fw versions 0.85 and above: at first powering on of the device, it's highly suggested to set high the pin 6 (ENABLE) only after the power supply is in stable conditions (+3V) and reset it in order to be in power down mode. This operation will guarantee the declared current supplies in power down mode.

NOTE 2, only for fw versions 0.85 and above: after the power down mode, the device will be in Packet Mode, even if it was in Command Mode first.

NOTE 3: in Power Down mode, pin 7 and pin 8 (TX\_RX/SP1 and IN\_DATA/SP2 respectively) are in pull down configuration. To avoid current leaks ( $\sim 200\mu$ A) it's suggested to set in tri-state or high impedance conditions.

### 4. COMMAND MODE (Module programming)

The Command Mode state allows the user to set the configuration parameters. The programming is done by 'AT' commands on the TX\_UART line (pin 13) at the transmission data rate set by SP1 and SP2 (pin 7 and pin 8). The module will answer on RX\_UART line (pin 14).

In order to enter in Command Mode, from Packet Mode it's necessary to transmit on TX\_UART (pin 13) a sequence of 3 ASCII characters '+++'. While in Command Mode it's not possible to radio communicate with the device.

It's suggested to use a RS232 or USB to Serial converter from a PC, connect RX and TX pins, RTS and CTS are not implemented. Use a serial communication software such as Hyperterminal or RealTerm with the following configurations:

- Data Rate defined by SP1 and SP2 (see Table 5);
- 1 bit START;
- 8 bit DATA;
- 1 bit STOP;
- No Parity;
- +CR;
- +LF.

Sending from the Terminal a message as +++ it will let to receive in response *OK*, which means the communication link is up and running.

Write *ATCC* in order to exit the Command Mode status (an OK answer will be received as well).

### **Registri e Comandi disponibili**

The available commands refers to read/write of registers. Each register define a functionality parameter of the device.

These commands come first with a declaration "AT" as modem PSTN standard.

Here below the command list, for their uses refer to the examples after the table.

AT	COMANDO	<CR>
Uppercase characters before every command or register instruction	Commands are defined by one or more characters	Every command will be followed by a Carriage Return <CR>

**Table 12**

Registro	Nome	Funzione	Valori	R/W
S2	CHANNEL	Working radio channel	0 = 869,45MHz 1 = 869,475MHz 2 = 869,5MHz (default) 3 = 869,525MHz 4 = 869,55MHz 5 = 869,575MHz 6 = 869,6MHz	R/W
S3	RF POWER	Output RF power	0 = +8 dBm 1 = +16dBm 2 = +22dBm 3 = +25dBm 4 = +27dBm (default)	R/W
S8	RADIO_SPEED	Data rate of the RF communication	0= 600bps 1= 1200bps (default) 2= 2400bps 3= 9600bps	R/W
S15	VERSION	Firmware version	Variable	R

**Table 13**

Comando	Nome	Funzione
WR	WRITE	Writing register values on EEPROM
CC	COMMAND CLOSE	Exit from Command Mode

**Table 14**

### Commands and register operation answers

Affermative answer:           **OK<CR><LF>**

Negative answer:               **ERROR<CR><LF>**

Forbidden operation:           **TBD**

Consider

- <CR> Carriage Return, ASCII 13;
- <LF> Line Feed, ASCII 10;
- <bl> ASCII 32.

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**Register reading**

**Syntax:** `ATSx<CR><LF>` [x = 1, ...,16 register to be read]

**Answer :** the value in the register once the command is been successful

Note that the register value is in ASCII.

**Example:** '16' is the sequence of the ASCII code 0x31,0x36, corresponding to '1' and '6'. As well the same procedure must be applied in writing of the register activity.

**Register writing**

**Syntax:** `ATSx=Y<CR><LF>` [x = 2, 3, 4 register to be written,  
y = value to be inserted]

**Answer:** see "*Commands and register operation answer*"

The values written on the registers changes the operativity of the module, which will be lost if not saved in EEPROM with the specific command "ATWR".

**Save Command of the registers value in EEPROM**

**Syntax:** `ATWR<CR><LF>`

**Answer:** see "*Commands and register operation answer*"

Automatically after the values are saved in EEPROM it will exit from Command Mode section.

**Exit from Command Mode**

**Syntax:** `ATCC<CR><LF>`

**Anser:** see "*Commands and register operation answer*"

Without ATCC or ATWR commands, the system will go out Command Mode section after 60 seconds of inactivity.

### Practical scheme in DIRECT-MODE

Direct Mode allows transmission and reception of data.

- Transmission is activated by setting high pin 7 (TX\_RX), the data will be transmitted through the connector J8 (see Figure 6);
- Reception is activated by setting low pin 7 (TX\_RX), the data will flow on connector J9 (see Figure 6) once it will be available.

Available signal data must have a period length between 20ms and 350µs (single bit high + low level). It's suggested to use a Manchester, Miller or similar encoding technique. It's not advised to use a UART connected directly to the pin 8.

The dip-switch 1 to 3 of S2 select the radio channel (CN0, CN1, CN2) during the RX or RX → TX, POWER\_DOWN → TX. During the TX period they are disabled.

The dip-switch 4 (PW\_TX) of S2 define the RF power output, downgrading it in the case of an antenna with 6-8 dB of gain is used.

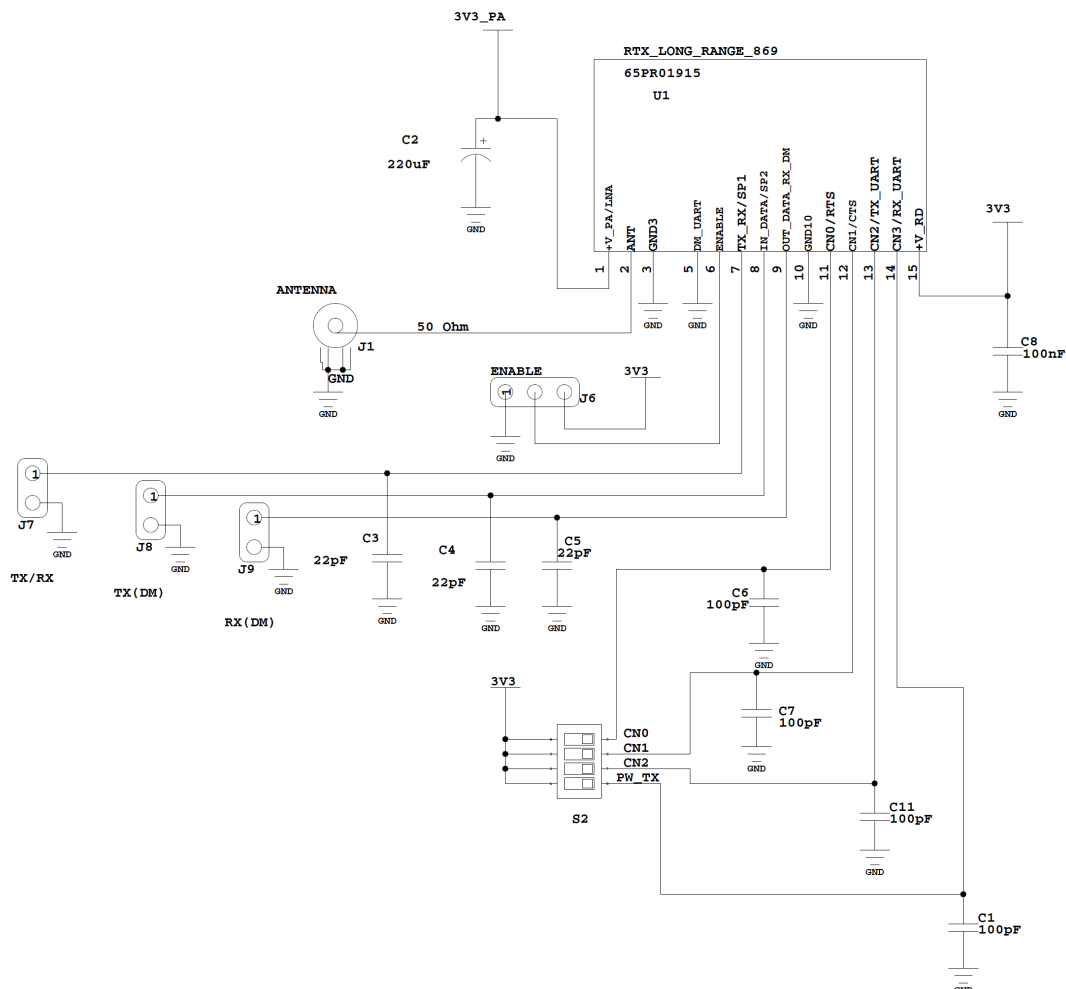


Figure 6

Le caratteristiche tecniche possono subire variazioni senza preavviso. AUR°EL S.p.A. non si assume la responsabilità di danni causati dall'uso improprio del dispositivo.

### Practical scheme in PACKET-MODE

See Figure 7 for the circuitual schematic, the dip-switch S1 select the data rate of the UART interface; TX, RX and radio module settings are defined by the serial asynchronous communication from the pin 13 and 14 of the module.

CTS and RTS are not implemented yet, and with the pin 9 will be left in open-circuit.

The device will operate in RX mode, once data is transmitted on pin 14 RX\_UART it will switch to TX mode.

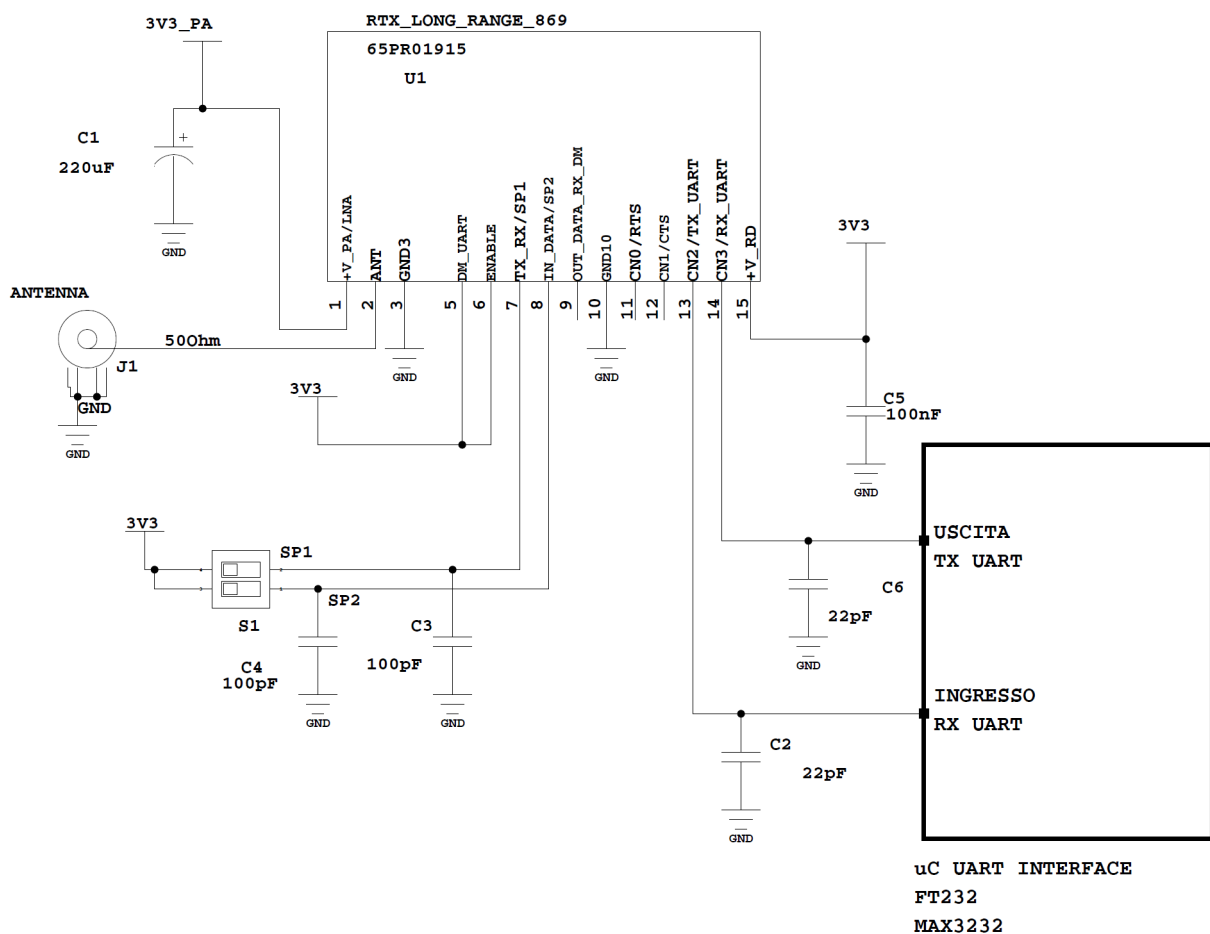


Figure 7

Le caratteristiche tecniche possono subire variazioni senza preavviso. AUREL S.p.A. non si assume la responsabilità di danni causati dall'uso improprio del dispositivo.

### Power supply

Considering a power device, the transceiver in TX mode will supply current peaks of about 600mA. It's necessary to use a stable power supply which will keep a stable voltage source and with fast transient response. Therefore it's highly recommended to use "fast transient response" voltage regulator in case they're needed. Here below a suggested scheme for this module.

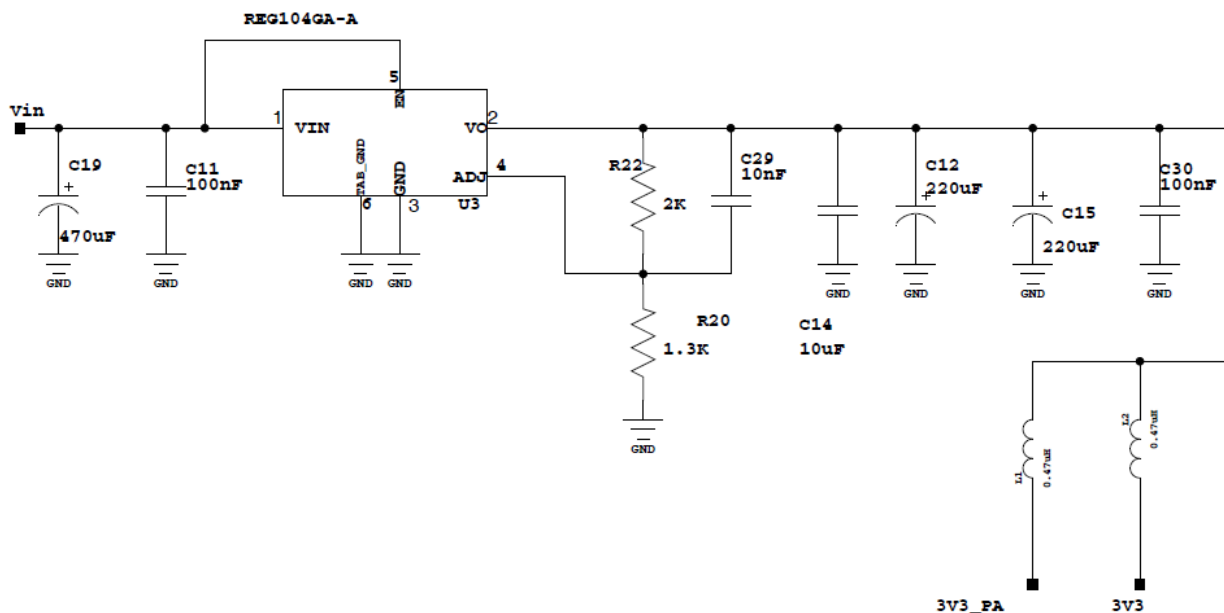


Figure 8 Stable power supply 3V-1A DC-DC

### DEVICE APPLICATION

In order to obtain the detailed technical characteristics, the device must be mounted on a printed circuit with the following considerations.

#### Power Supply

1. It must be supplied with a power source at very low voltage protection against shortcircuits. Maximum voltage variations allowed between 2.1 ÷ 3.6V. However it's highly suggested to maintain the voltage more stable as possible between the values declared on the Table 1 with a proper fast transient response power supply as per Figure 8.
2. Decoupling in the proximity of the transmitter with a capacitor of at least 100 nF.
3. Connect an electrolytic capacitor of 220 ÷ 470  $\mu$ F, low ESR, in the proximity of pin 1(+V\_PA/LNA)

**Pin connections**

Use capacitor of 22÷100pF in proximity between signal connections and ground. The value of the capacitor vary depending of the pin, see Figure 6 , Figure 7 and Figure 8 for more informations.

**Ground**

Ground must surround the welding points of the pins and must be done in both faces of the circuit board. Use pass-through holes in order to connect both ground floors.

**Antenna**

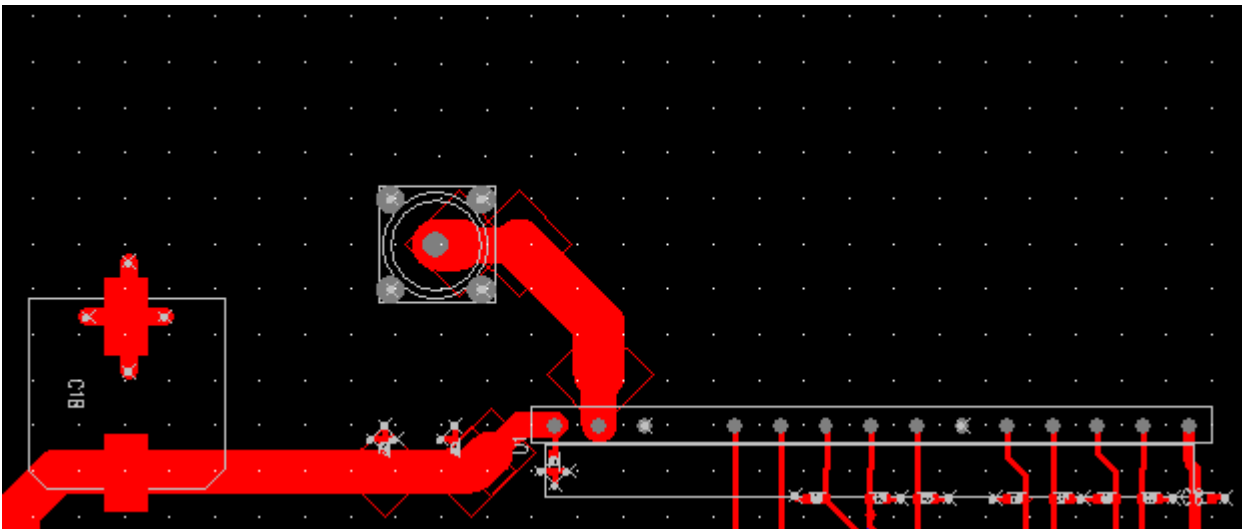
Connect pin 2 to the coaxial connector or antenna directly, with a microstrip at impedance of 50R; width of 3.2mm for vetronite of 1.6mm thick, width of 1.6mm for vetronite of 1mm thick.

Tipycal antenna is a copper wire 8 cm long and minimal section of 0.5 mm<sup>2</sup> upright placed of the ground floor. Other disposal maybe work with unpredictable behaviour. For an external antenna use a SMA connector with a microstrip 50 ohm, see Figure 9.

The proposed layout shows the connections of the device on the top layer, the ground extended on the lower layer surrounds the radio module. The connection line of the antenna has 50R of impedance, 3.2 mm width for FR4 double sided with 1.6 mm of thickness.

Pin 1 is connected to the power supply with a strip 2mm width and electrolytic capacitor of 220 µF (C18) to the ground.

In/out pin of the module are connected with capacitors of between 22÷100 pF to the ground.



**Figure 9 example of layout: connecting lines are on the upper layer and ground is in the bottom layer. Ground side of the capacitors are connected with passing-through holes with shortest paths.**

### CEPT 70-03 Recommendation

The RTX-LONG-RANGE 869MHZ operates in a harmonized frequency band and in respect of the legislations, the device must be used with maximum duty cycle of 10% per hour (6 minutes per hour).

### Reference regulation

The RTX-LONG-RANGE 869MHZ comply the European regulations **EN 300 220-2** and **EN 301 489-3**. The transceiver must be powered with a extra-low voltage power supply protected against short circuit. Applications of the module must be considered only inside a proper container in order to comply regulation **EN 61000-4-2**. In particular, it must be user responsibility to take care of the antenna connection in order to tolerate electrostatic charges expected from the mentioned regulation. This module comply to the regulation **EN 62479**, referring to the human exposition to electromagnetic fields with duty cycle lower than 4%. If must be used a greater duty cycle, the device need to be placed at a higher or equal distance than 5 mm from the human body with a dipole antenna, monopole, planar inverted F-antenna (PIFA) and inverted F antenna (IFA). Otherwise regulations relative to human body exposure must be reevaluated considering the antenna and the minimal distance to the body.

### Revisions

Rev3.7	First revision.
Rev3.8	Wrong number on pin 13 e 14, paragraph 4 Command Mode