

RC-WuTRx-XXX

Ultra-Low Power WakeUp Transceiver Module



Ultra Low Power WakeUp Transceiver allows to optimaze the power consumption for IoT application.

It is a transceiver module that uses «wake up receiver tecnique» to be used in very low consumption applications. The WakeUp-Receiver continuously monitors the wireless channel (without the use of a microcontroller) and recognizes if there are any radio signals addressed to him, in this case it returns the data received on the serial interface.

The device wakes up every 1000ms (this time is programmable) for a time of 250 μ sec. In these conditions the average of the consumption is 10 μ A with a Sensibility of -110dBm.

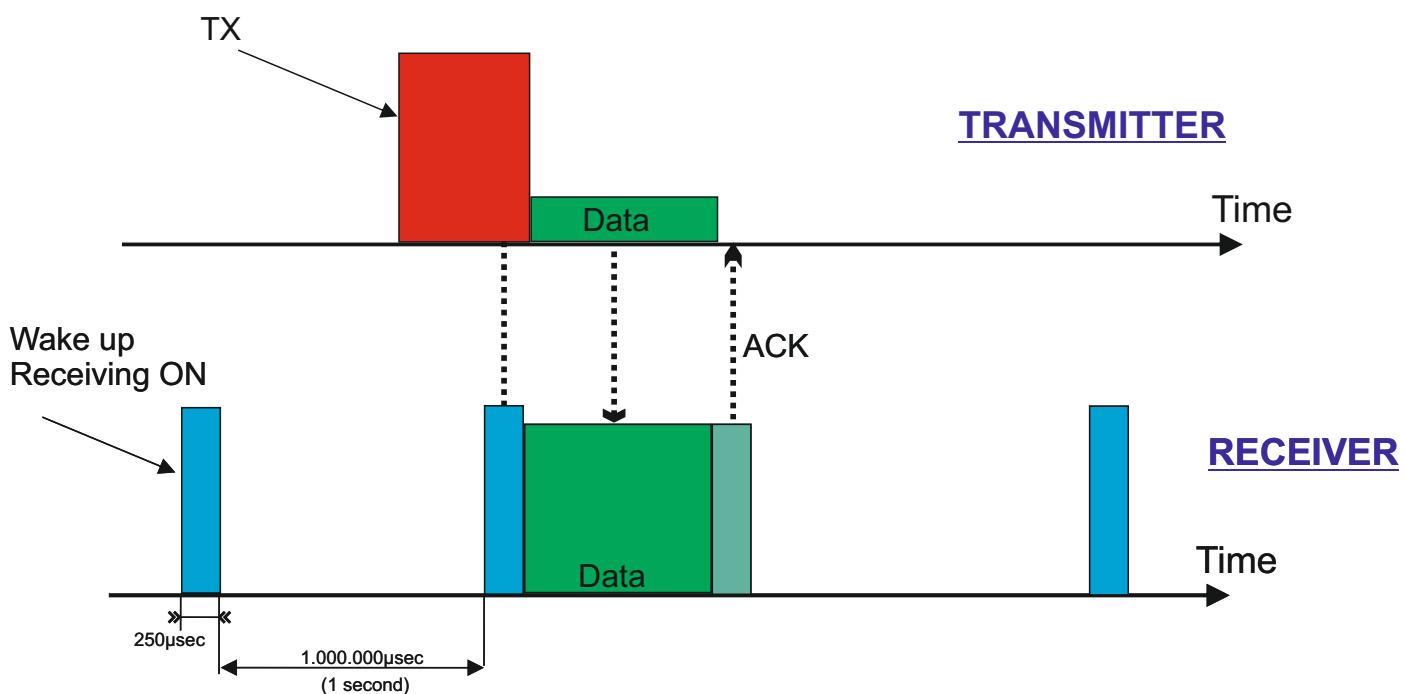
The device RC-WuTRx-XXX is based on the CC1310 device from Texas Instruments, and it is available at three frequencies : 433MHz - 868MHz and 915MHz.

Module Information :

RC-WuTRx- - XXX	Frequency
	434=434MHz
	868=868MHz
	915=915MHz

The functionalities of this device are the following :

- **Wireless Switch** the 4 outputs of the module A correspond to the 4 inputs of module B and the other way around.
- **Wireless Actuator** by serial port you can control 4 Output in monostable and bistable mode.
- **Radio Modem** have the functions of a complete radio modem and simply require CMOS/TTL data at the transmit input and the corresponding transceiver(s) output the same data. Preamble and CRC are automatically generated and added to the RF transmission.



The device can work in two modality :

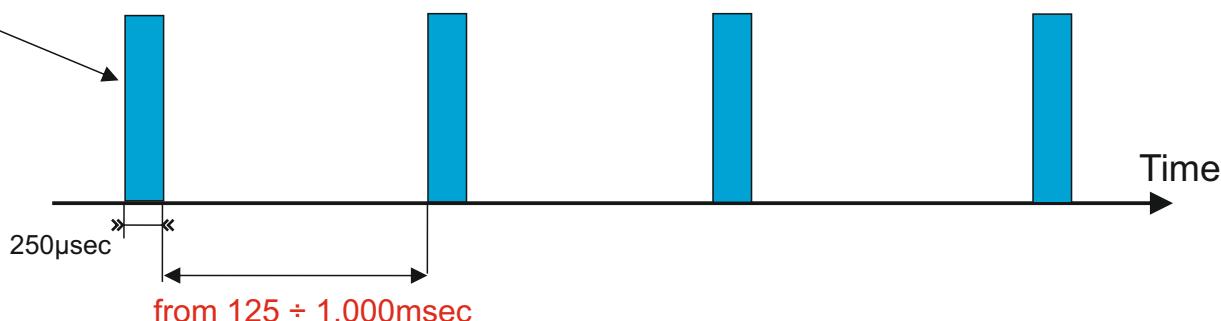
EP Mode	EU Mode
Average Consumption 1.2mA	Average Consumption 10.0µA
RX Sensibility -110dBm	RX Sensibility -110dBm
Bi-directional Capability : ACTIVE	Bi-directional Capability : TO ACTIVATE

In the modality EU (Ultra Low Consumption) the average of the consumption is around $10\mu A$ instead in modality EP (Low Consumption) the average of the consumption is around 1.2mA.

The device wakes up every 1000ms (this time is programmable) for a time of 250 μ sec.

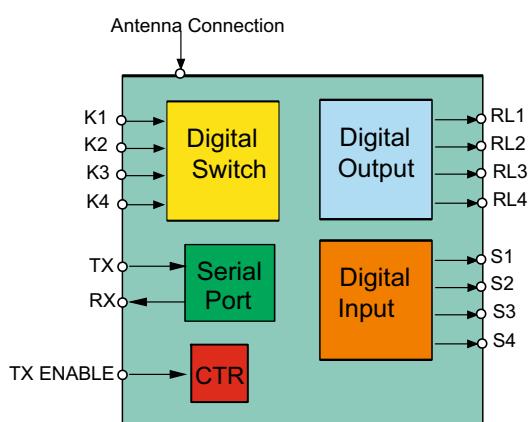
It recognizes if there are any radio signals addressed to him, in this case it analizes tha data received and decides which action to take (actuation, configuration, return data on the serial interface).

Wake up Receiving ON



It is possible to set the wake up time from 125ms to 1000ms (default), the analysis time is always equal to 250 μ sec.

1.0 Device Resources



CTR

In operating mode EU (Low consumption) allows you to enable the sending of commands to the corresponding module.

- DIGITAL SWITCH (K1,K2,K3,K4)

it is 4 digital inputs, by default at 1.

In the functionality denominated "Wireless Switch", when this input is put at GND, the digital output of the corrisponding module will be activated (K1-RL1, K2-RL2, K3-RL3, K4-RL4).

- DIGITAL OUTPUT (RL1,RL2,RL3,RL4)

These are 4 digital outputs, by default at 0.

In the functionality called "Wireless Switch" these outputs go to 1 when the Digital Switch of the module corresponding has been activated (K1-RL1, K2-RL2, K3-RL3, K4-RL4).

In the function called "Wireless Actuator" these outputs can be driven by the module corresponding by means of simple commands on the serial interface.

- DIGITAL INPUT (S1,S2,S3,S4)

These are 4 digital inputs, by default at 1.

In the function called "Wireless Actuator" the status of these digital inputs can be read by the corresponding module by sending simple commands on serial interface.

- SERIAL PORT (TX/RX)

The serial port is used to configure the device.

In the "Wireless Actuator" functionality to send commands or queries to the remote device.

In the "radio modem" functionality to send messages to the device remote.

2.0 EP Mode Functionality (Consumption = 1.2mA)

(EP Mode)
Consumption 1.2mA
Bidirectional

In this operating mode the average consumption is equal to about 1.2mA;

Wireless Switch Functionality

Using the digital switches K1 ÷ K4 of Device A (B), it will be possible to activate / deactivate the corresponding digital outputs RL1 ÷ RL4 of Device B (A) and vice versa.

Each time a command is made, an ACK is sent to the transmitter device.
Bidirectionality Active.

Wireless Actuator Functionality

By sending simple commands on the serial interface of Device A (B) it is possible to activate / deactivate the digital outputs RL1 ÷ RL4 of Device B (A) and vice versa.

By sending simple commands on the serial interface of Device A (B) it is possible to check the status of the digital inputs S1 ÷ S4 B (A) and vice versa.

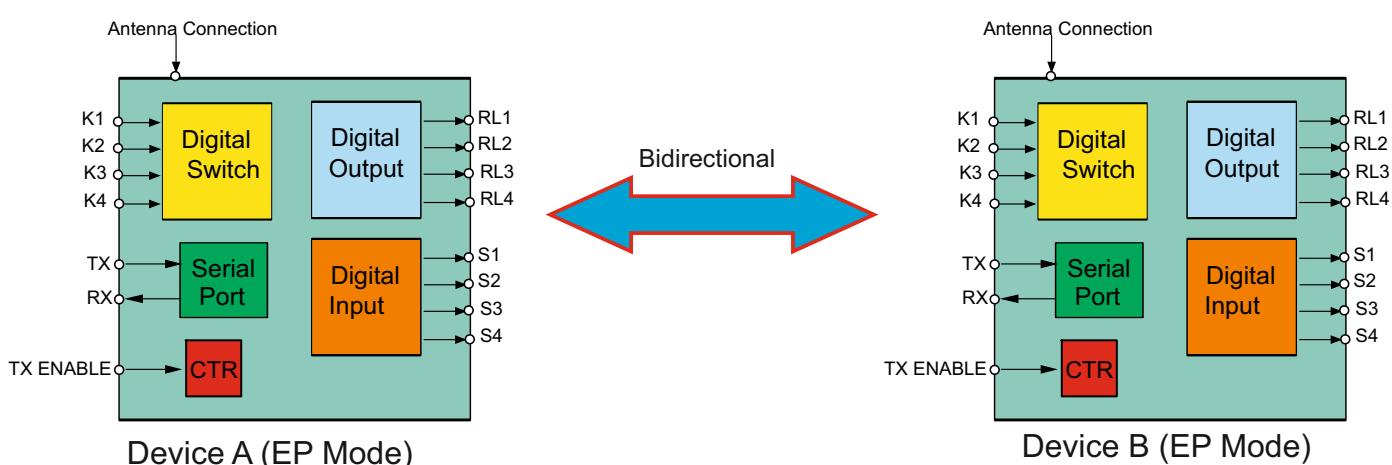
Each time a command is performed, an ACK is transmitted to the transmitter device on the serial interface "character da".

Bidirectionality Active

Radio Modem Functionality

With this function a Rs232 wireless link is realized, preamble and CRC are automatically generated and added to the RF transmission. The Device configured in EP Mode, immediately transmits the data presented on the serial interface.

Bidirectionality Active.



Remote Address = 01010101
Local Address = 02020202

Remote Address = 02020202
 Local Address = 01010101

Note:

The digital outputs RL1 ÷ RL4 can be configured in bistable or monostable mode.
In EP Mode, the TX ENABLE input is not used.

3.0 EU Mode Functionality (Consumption about 10µA)

Wireless Switch Functionality

Using the digital switches K1 ÷ K4 of Device A, it will be possible to activate / deactivate the corresponding digital outputs RL1 ÷ RL4 of Device B.

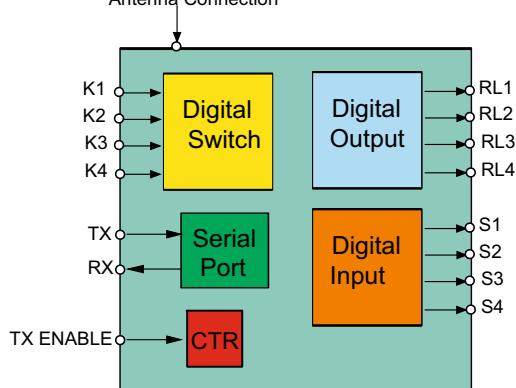
Wireless Actuator Functionality

By sending simple commands on the serial interface of Device A it is possible to activate / deactivate the digital outputs RL1 ÷ RL4 of Device B.

Radio Modem Functionality

By transmitting data on Device A, they will be present on Device B.

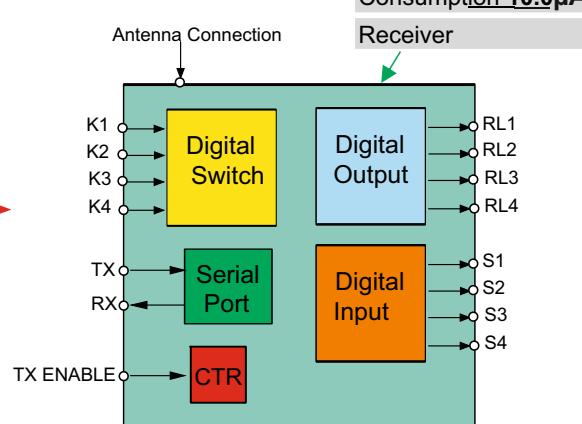
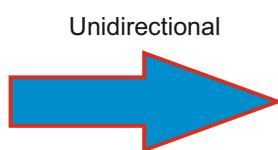
The Device A is configured in EP Mode (consumption 1.2mA) instead Device B is configured in EU Mode (consumption approximately 10.0µA).



Device A (EP Mode)

Remote Address = 01010101

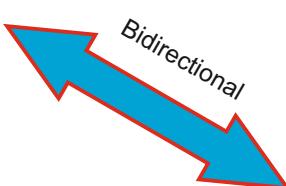
Local Address = 02020202



Device B (EU Mode)

Remote Address = 02020202

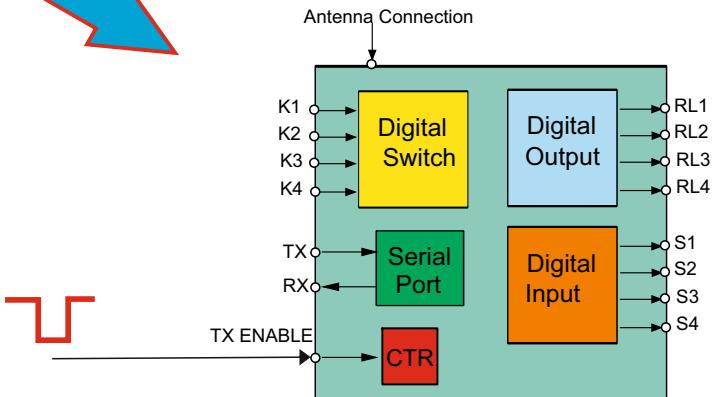
Local Address = 01010101



Note :

It is possible to use this device in two ways:

- As a simple ultra-low receiver module consumption (10µA) without any bidirectionality. (example DEVICE A -----> DEVICE B).
- Use this module with an external microcontroller to send a TX enable before the command. (example DEVICE A <-----> DEVICE C).

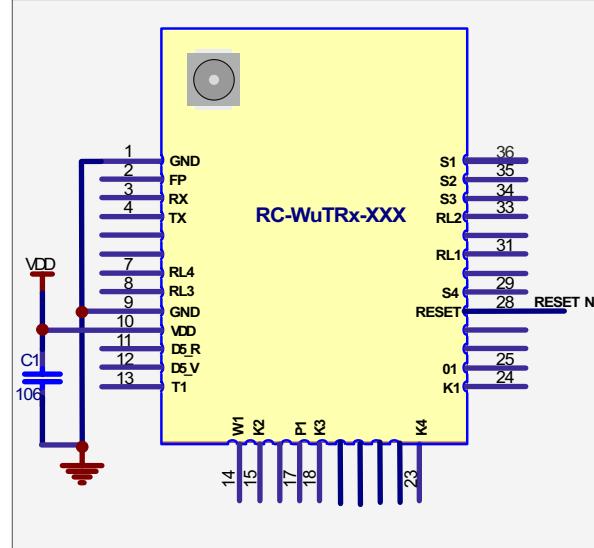
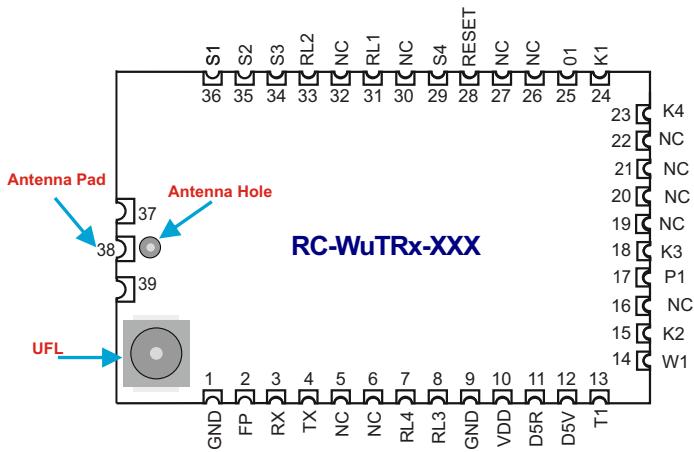


Device C (EU Mode)

Remote Address = 02020202

Local Address = 01010101

4.0 Connection



Reference Schematics

Pin Descriptions

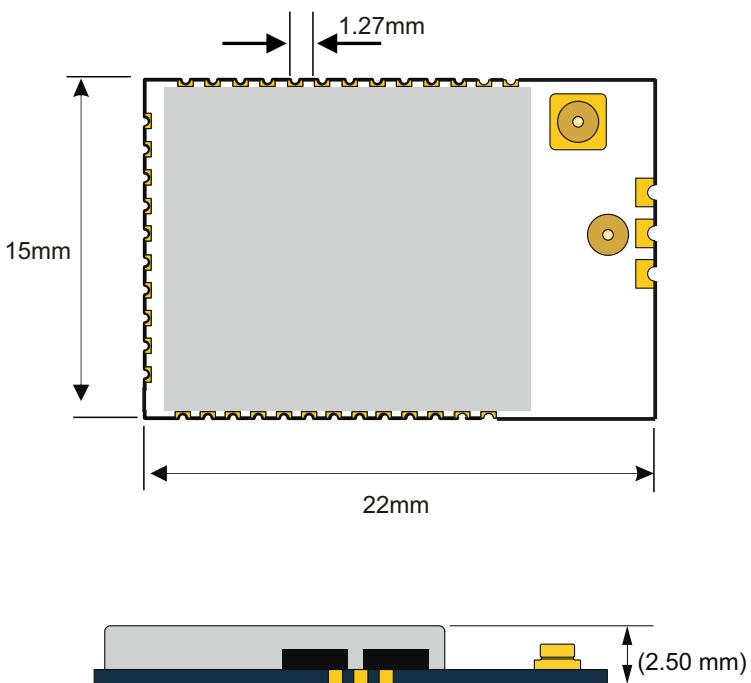
Pin Number	Name	I/O	Description
1,9,37,39	GND	—	Ground
5,6,16,19,20 21,22,26,27,30 32	NC	—	No electrical connection
02	FP(*)	I	Flash Memory Protection. Low = Write the data configuration in flash memory. High = Flash memory write protected.
03	RX	O	UART RX
04	TX	I	UART TX
07	RL4	O	Output RL4
08	RL3	O	Output RL3
10	VDD	—	Supply Voltage
11	D5R	O	Output Led Red Signalling
12	D5V	O	Output Led Green Signalling
13	T1	I	Switch to generate the carrier
14	W1	I	TX Enable
15	K2	I	Switch for RL2
17	P1	I	Switch for Test Mode
18	K3	I	Switch for RL3
23	K4	I	Switch for RL4
24	K1	I	Switch for RL1
25	01	I	Led test Mode
28	RESET	I	Reset (Active low, no internal pullup)
29	S4	I	Input S4
31	RL1	O	Output RL1
33	RL2	O	Output RL2
34	S3	I	Input S3
35	S2	I	Input S2
36	S1	I	Input S1
38	ANT	—	Antenna Connection

(*) this functionality is active after an HW RESET

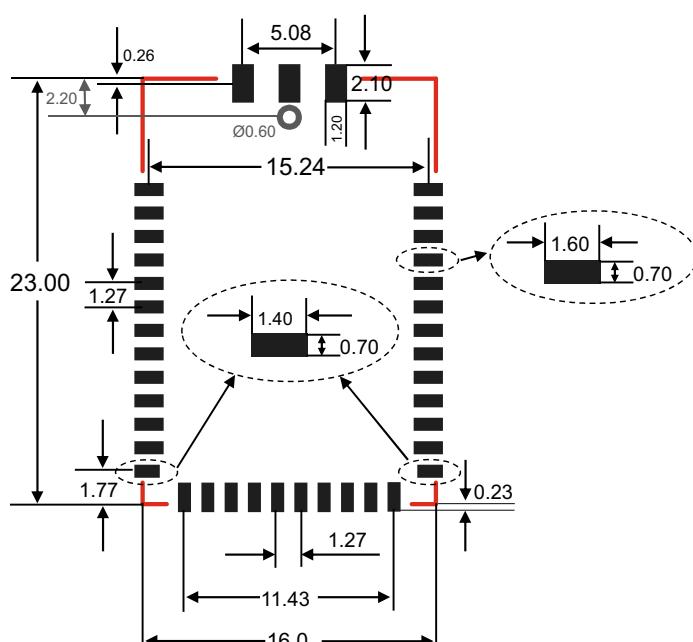
5.0 Electrical Specifications

Ultra-Low Power WakeUp Receiver Module					
Parameter	Symbol	Min.	Typ.	Max.	Units
Operating Voltage	V_{CC}	1.8	3.03	3.6	VDC
Supply Current RX Mode	I_{CRX}		5.50		mA
Supply Current TX Mode +10dBm	I_{CTX1}		13.40		mA
Supply Current TX Mode +14dBm	I_{CTX2}		23.50		mA
Supply Current Average Wake Up Time = 1000ms	I_{CTXAV}		10.00		μ A
Supply Current Average Wake Up Time = 125ms	I_{CTXAV1}		20.00		μ A
Operative Frequency (*)	F_{of}	865.00		870.00	MHz
Frequency Error	F_{pp}		± 10		ppm
RF Power Output 50ohm (*)	P_{oo}	0.0		+14.0	dBm
RF Sensibility 50kbps	S_d		-110.0		dBm
Data Rate	D_{CC}			4.0	Mbit/s
Operative Temperature	T_1	-30.0		+75.0	°C

6.0 Mechanical Dimension



Recommended PCB Layout



7.0 Operating Mode

The functionalities of the device RC-WuTRx-XXX are the following :

- Wireless Switch

It is a 4 channels wireless switch module with pairing function, it provides 4 channels signal input and 4 channels control output (bistable and monostable mode).

- Wireless Actuator

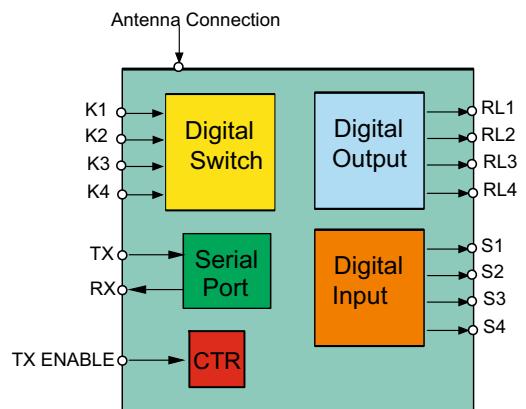
It is a 4 channels for home automation, it is possible use 1 unit as Transmitter (controllable via Rs232 serial interface) and by one or more RX units, with the possibility to switch 4 channels in bistable/monostable mode.

- Radio Modem

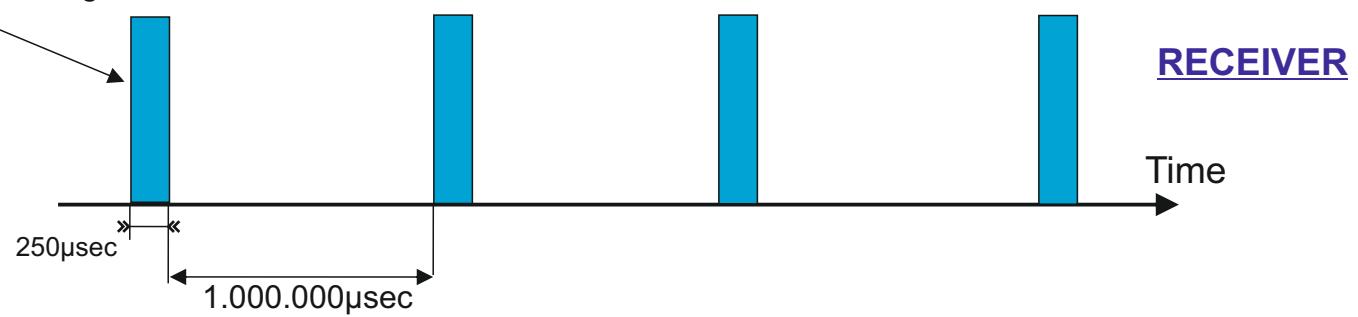
The way of use of the modem is very simple and provides a wireless RS232 link with a RF data rate up to 50 kbps. The module has the functions of a complete radio modem and simply requires CMOS/TTL data at the transmit input and the corresponding transceiver(s) output the same data. Preamble and CRC are automatically generated and added to the RF transmission.

- Low Consumption characteristics

The device wakes up every 1000ms (this time is programmable) for a time of 250 μ sec. It recognizes if there are any radio signals addressed to him, in this case it analyzes the data received and decides which action to take (actuation, configuration, return data on the serial interface).



Wake up
Receiving ON



The module can work in two modalities :

1) **Low Consumption Mode (EP)**

In this modality the average of the consumption is around 1.2mA; On each received data, an feedback ACK is immediately transmitted to the sender.

2) **Ultra Low Consumption Mode (EU)**

In this modality the average of the consumption is around 10 μ A, and there is not automatic feedback to the sender but the Transmission must be enabled from a microcontroller.

7.1 Wireless Switch

It is a 4 channels wireless switch module with pairing function, it provides maximum 4 channels signal input and maximum 4 channels control output (bistable and monostable).

About the configuration you can see par. **7.0, Local address and Remote Address** must be set up appropriately.

EP Mode.

The transmission of the K1 ÷ K4 command is immediately active, the command is immediately sent to the remote unit.

EU Mode

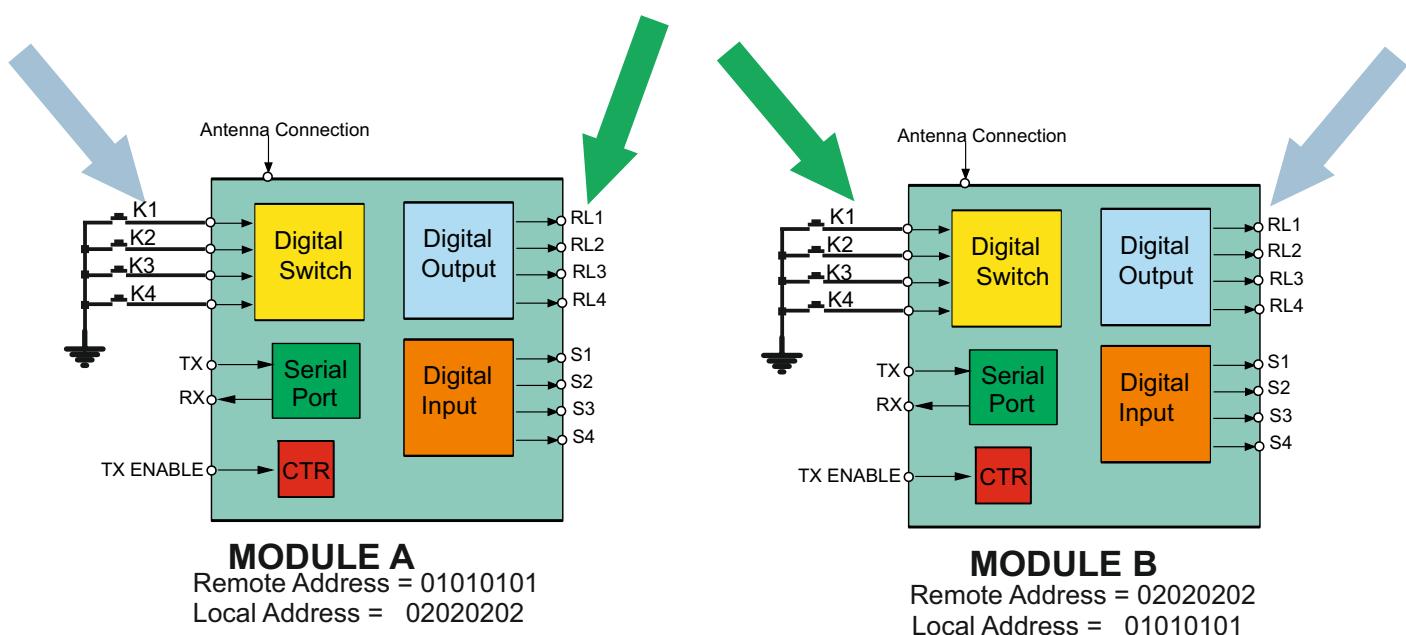
Before sending an actuation command K1 ÷ K4 it is necessary to enable the TX ENABLE (K5).

7.1.1 One to one operation

Example of communication between modules A and B :

The 4 output of **module A** (RL1÷RL4) is corresponding to the 4 input of **module B** (K1÷K4), by pressing the keys K1 ÷ K4 of module B the outputs RL1 ÷ RL4 (module A) will be activated or deactivated. RL1÷RL4 outputs, can be work in bistable/ monostable mode.

The 4 output of **module B** (RL1÷RL4) is corresponding to the 4 input of **module A** (K1÷K4), by pressing the keys K1 ÷ K4 of module A the outputs RL1 ÷ RL4 (module B) will be activated or deactivated. RL1÷RL4 outputs, can be work in bistable/ monostable mode.

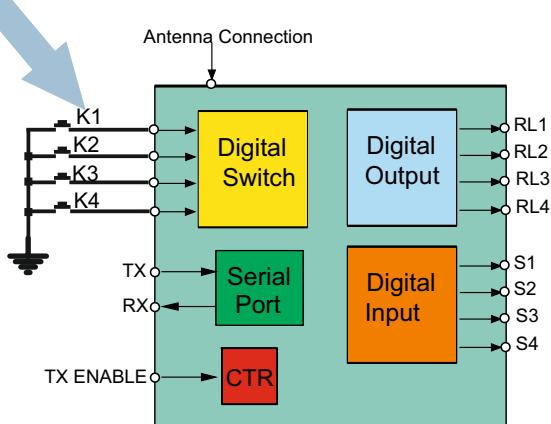


→ K1 MODULE A corresponds to RL1 MODULE B

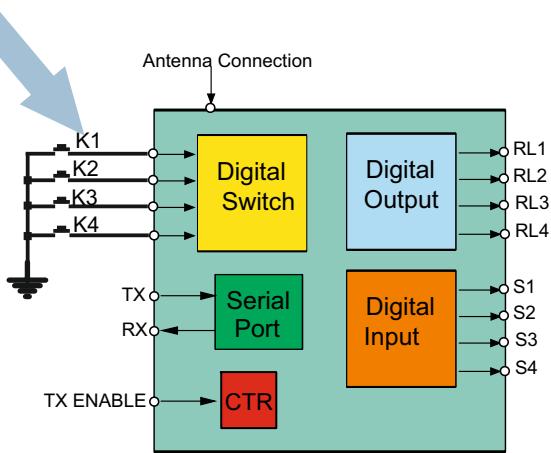
→ K1 MODULE B corresponds to RL1 MODULE A

7.1.2 One to many operation

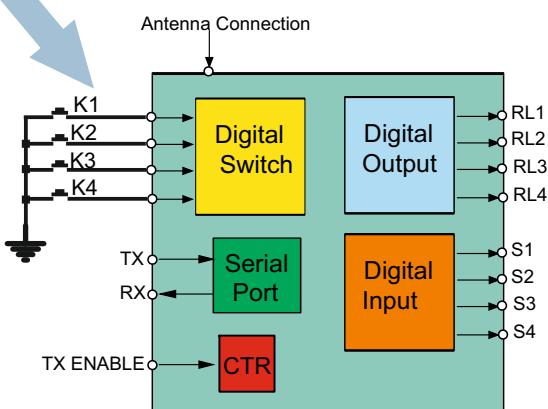
Example of communication between modules A , B, and C, in this case the Remote Address and Local Address are in default condition.
By changing remote and Local address you can get different types of configuration.



MODULE A
Remote Address = 7E7E7E7E
Local Address = 7E7E7E7E



MODULE B
Remote Address = 7E7E7E7E
Local Address = 7E7E7E7E



MODULE C
Remote Address = 7E7E7E7E
Local Address = 7E7E7E7E

- Push K1 **MODULE A** ---> RL1 of **MODULE B** and RL1 of **MODULE C** --> ACTIVE
- Push K1 **MODULE B** ----> RL1 of **MODULE A** and RL1 of **MODULE C** --> ACTIVE
- Push K1 **MODULE C** ----> RL1 of **MODULE A** and RL1 of **MODULE B** --> ACTIVE

7.2 Wireless Actuator

Wireless actuator for home automation, it is possible use 1 unit as Transmitter (controllable via Rs232 serial interface) and by one or more RX units with the possibility to switch 4 channels in bistable or monostable mode (RL1 ÷ RL4) for every RX units.

It is possible to have a "point to point" configuration

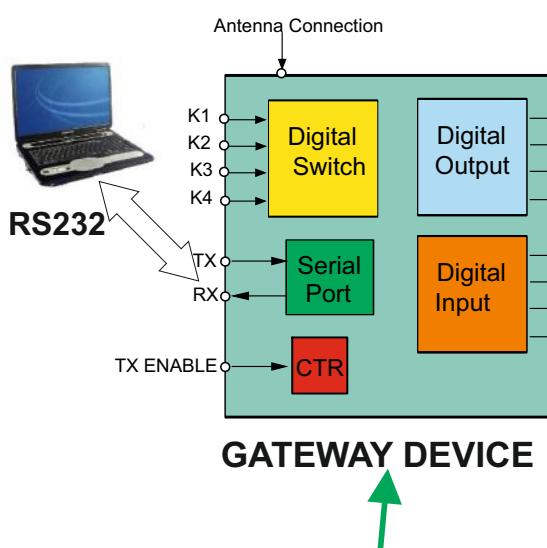
(No.1 TX unit - No.1 RX unit) or a "point-multipoint" configuration (No. 1 TX unit more RX Unit).

EP Mode

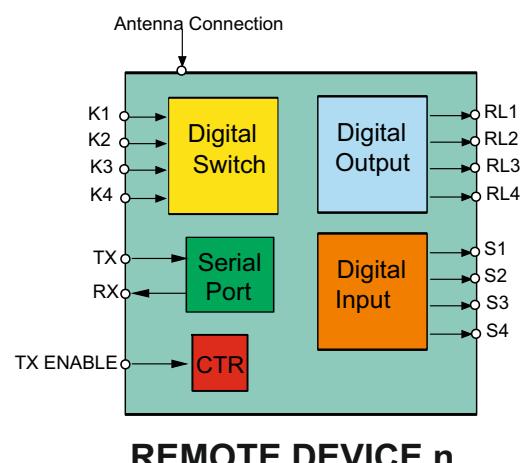
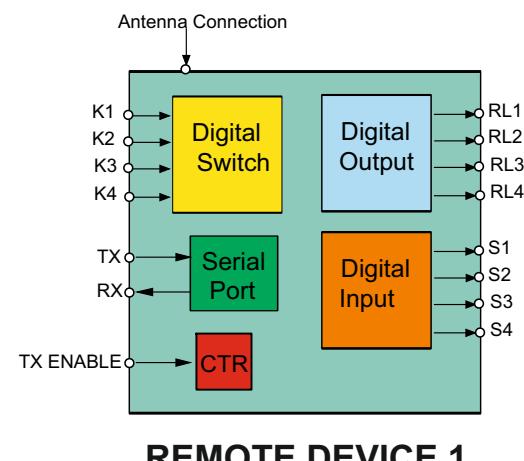
The transmission of commands on the serial interface is immediately active, the command is immediately sent to the remote unit.

EU Mode

Before sending commands on the serial interface it is necessary to enable the TX ENABLE (K5).



The remote address of this device is changed from time to time via the serial interface according to which remote device you want to reach.



7.3 Radio Modem Functionality

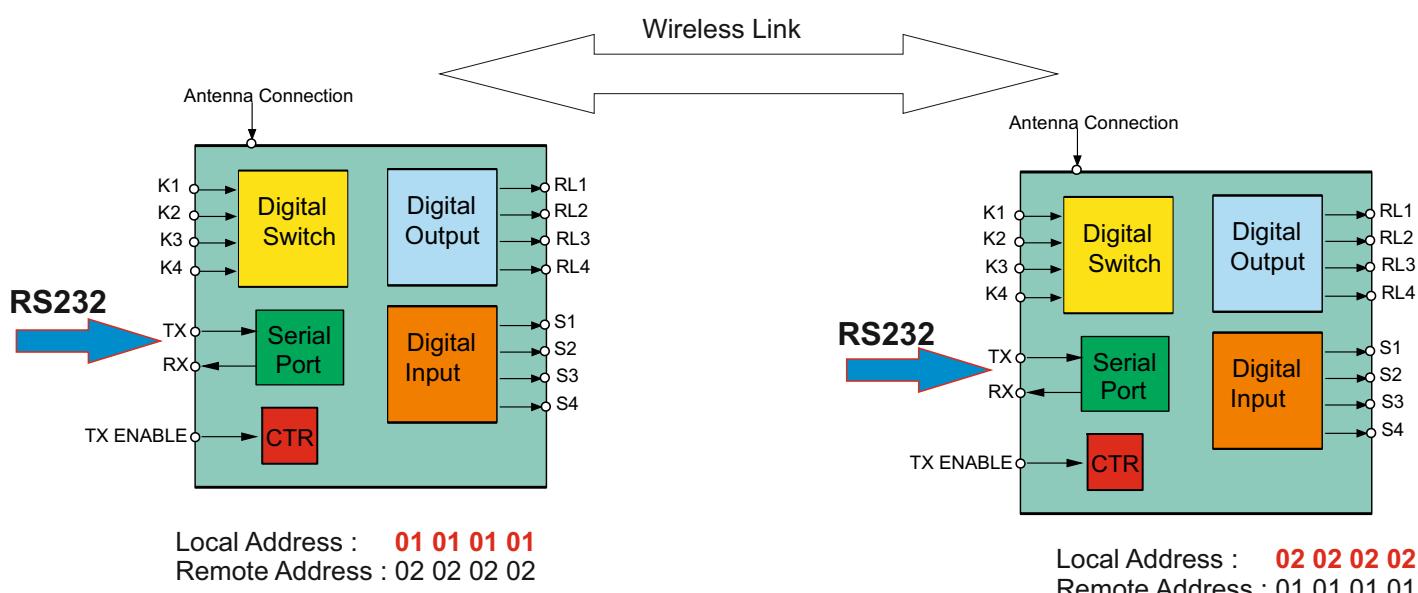
The RC-WuTRx-XXX Radio Modem has applications in many areas where reliable half duplex communications are required over ranges up to 200 meters (with the maximum RF Power it is possible to reach up to 400-500meters).

Since each RC-WuTRx-XXX can contain a unique address, multiple RC-WuTRx-XXX network can co-exist in the same area.

Each Radio Modem (RC-WuTRx-XXX) is pre-configured with a default address «7E 7E 7E 7E», this address can be modified during the configuration.

When the RC-WuTRx-XXX receives the data via RF, the first operation that makes is to check the address header and compares it with its address, only if the two addresses coincide it processes the data and output them on the serial interface otherwise all the data are discarded.

If the addresses are set appropriately, a network can be created.



EP Mode.

The transmission of commands on the serial interface is immediately active, the command is immediately sent to the remote unit.

EU Mode

Before sending commands on the serial interface it is necessary to enable the TX ENABLE (K5).

8.0 Configuration Mode

8.1 868MHz version. Configuration registers

Register	Byte	Name	Description	Text Value	HEX Value
01	0	Remote Address	MSB	~	7E
	1			~	7E
	2			~	7E
	3		LSB	~	7E
02	4	Local Address	MSB	~	7E
	5			~	7E
	6			~	7E
	7		LSB	~	7E
03	8	RF CHANNELS	865.0 MHz	2	32
			865.2MHz	4	34
			865.4MHz	6	36
			865.6MHz	8	38
			865.8MHz	:	3A
			866.0 MHz	<	3C
			866.2MHz	>	3E
			866.4MHz	@	40
			866.6MHz	B	42
			866.8MHz	D	44
			867.0MHz	F	46
			867.3MHz	H	48
			867.4MHz	J	4A
			867.6MHz	L	4C
			867.8MHz	N	4E
			868.0 MHz	P	50
			868.2 MHz	R	52
			868.4 MHz	T	54
			868.6 MHz	V	56
04	9	RF TX POWER	868.8 MHz	X	58
			869.0 MHz	Z	5A
			869.2 MHz	\	5C
			869.4 MHz	^	5E
			869.6 MHz	<	60
			869.8 MHz	b	62
			870,0 MHz	d	64

In RED the default parameters

Nota :

The configuration operations must be carried out when the module is powered by a voltage greater than 2.5Volt and pin 2 (FP) is in 0 (Low) condition, when FP is at level logical 1 (High) the flash memory is write protected.

Register 01 - Remote Address

Value Range : 01010101 - FEFEFefe
Default Value : 7E7E7E7E

Register 02 - Remote Address

Value Range : 01010101 - FEFEFefe
Default Value : 7E7E7E7E

Register 03 - RF CHANNELS

Value Range : 32 - 64
Default Value : 50

The RF Channel is calculated in the following mode:

FREQ = 860 + (ASCII code / 10) + (Rest division / 10)
for example to character «R» (HEX 52) corresponds to the frequency 868.2 Mhz because :

«R» Ascii Code = 82 ---> Frequency = 860 + int(82/10)

Result + rest division (82/10) = 860+8+0.2 = 868.2

Register 04 - RF TX POWER

Value Range : 30 - 3E
Default Value : 3A

The Power value is calculated in the following mode :

Power = Ascii code - 48
For example to the character «7» (HEX 37) correspond the value 7dBm because :
«7» Ascii code = 55 -----> Power = 55 - 48 = 7

8.2 433MHz version. Configuration registers

Register	Byte	Name	Description	Text Value	HEX Value
01	0	Remote Address	MSB	~	7E
	1			~	7E
	2			~	7E
	3		LSB	~	7E
02	4	Local Address	MSB	~	7E
	5			~	7E
	6			~	7E
	7		LSB	~	7E
03	8	RF CHANNELS	430.0MHz	2	32
			430.2MHz	4	34
			430.4MHz	6	36
			430.6MHz	8	38
			430.8MHz	:	3A
			431.0MHz	<	3C
			431.2MHz	>	3E
			431.4MHz	@	40
			431.6MHz	B	42
			431.8MHz	D	44
			432.0MHz	F	46
			432.2MHz	H	48
			432.4MHz	J	4A
			432.6MHz	L	4C
			432.8MHz	N	4E
			433.0MHz	P	50
			433.2MHz	R	52
			433.4MHz	T	54
			433.6MHz	V	56
			433.8MHz	X	58
			434.0MHz	Z	5A
			434.2MHz	\	5C
			434.4MHz	^	5E
			434.6MHz	<	60
			434.8MHz	b	62
			435.0MHz	d	64
04	9	RF TX POWER	0 dBm	0	30
			2 dBm	2	32
			4 dBm	4	34
			6 dBm	6	36
			8 dBm	8	38
			10 dBm	:	3A
			12 dBm	<	3C
			14 dBm	>	3E

In RED the default parameters

Register 01 - Remote Address

Value Range : 01010101 - FEFEFefe
Default Value : 7E7E7E7E

Register 02 - Remote Address

Value Range : 01010101 - FEFEFefe
Default Value : 7E7E7E7E

Register 03 - RF CHANNELS

Value Range : 32 - 64
Default Value : 50

The RF Channel is calculated in the following mode:

FREQ = 425 + (ASCII code / 10) + (Rest division / 10)
for example to character «R» (HEX 52) corresponds to the frequency 433.2MHz because :

«R» Ascii Code = 82 ---> Frequency = 425+ int(82/10)

Result + rest division (82/10) = 425+8+0.2 = 433.2

Register 04 - RF TX POWER

Value Range : 30 - 3E
Default Value : 3A

The Power value is calculated in the following mode

Power = Ascii code - 48
For example to the character «7» (HEX 37) correspond the value 7dBm because :
«7» Ascii code = 55 -----> Power = 55 - 48 = 7

8.3 915MHz version . Configuration registers

Register	Byte	Name	Description	Text Value	HEX Value
01	0	Remote Address	MSB	~	7E
	1			~	7E
	2			~	7E
	3		LSB	~	7E
02	4	Local Address	MSB	~	7E
	5			~	7E
	6			~	7E
	7		LSB	~	7E
03	8	RF CHANNELS	912.0MHz	2	32
			912.2MHz	4	34
			912.4MHz	6	36
			912.6MHz	8	38
			912.8MHz	:	3A
			913.0MHz	<	3C
			913.2MHz	>	3E
			913.4MHz	@	40
			913.6MHz	B	42
			913.8MHz	D	44
			914.0MHz	F	46
			914.2MHz	H	48
			914.4MHz	J	4A
			914.6MHz	L	4C
			914.8MHz	N	4E
			915.0MHz	P	50
			915.2MHz	R	52
			915.4MHz	T	54
			915.6MHz	V	56
			915.8MHz	X	58
			916.0MHz	Z	5A
			916.2MHz	\	5C
			916.4MHz	^	5E
			916.6MHz	<	60
			916.8MHz	b	62
			917.0MHz	d	64
04	9	RF TX POWER	0 dBm	0	30
			2 dBm	2	32
			4 dBm	4	34
			6 dBm	6	36
			8 dBm	8	38
			10 dBm	:	3A
			12 dBm	<	3C
			14 dBm	>	3E

In RED the default parameters

Register 01 - Remote Address

Value Range : 01010101 - FEFEFefe
Default Value : 7E7E7E7E

Register 02 - Remote Address

Value Range : 01010101 - FEFEFefe
Default Value : 7E7E7E7E

Register 03 - RF CHANNELS

Value Range : 32 - 64
Default Value : 50

The RF Channel is calculated in the following mode:

FREQ = 907+ (ASCII code / 10) + (Rest division / 10)
for example to character «R» (HEX 52) corresponds to the frequency 915.2MHz because :

«R» Ascii Code = 82 ---> Frequency = 907+ int(82/10)

Result + rest division (82/10) = 907+8+0.2 = 915.2

Register 04 - RF TX POWER

Value Range : 30 - 3E
Default Value : 3A

The Power value is calculated in the following mode :

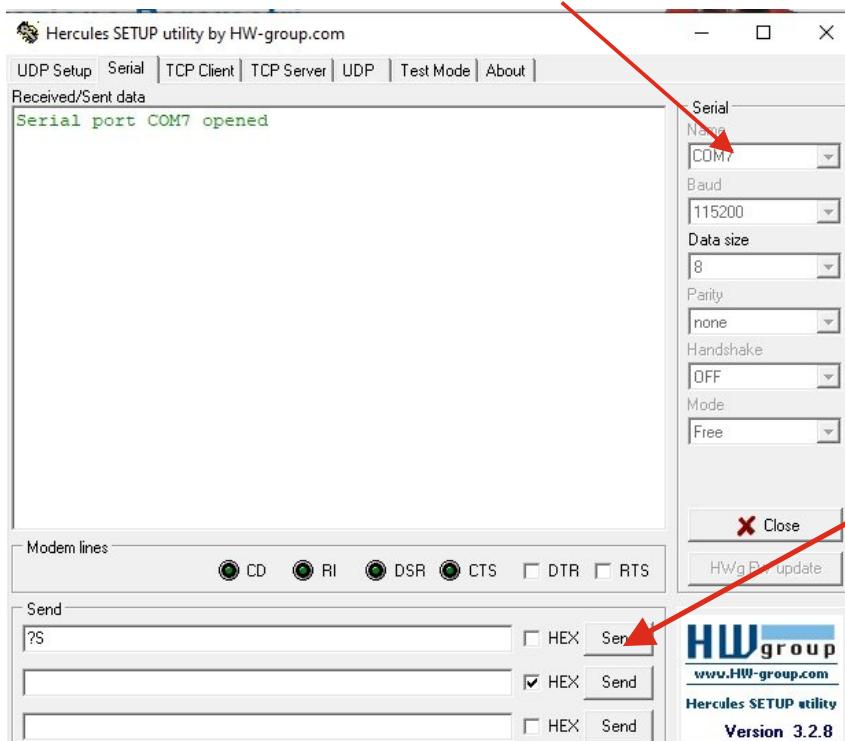
Power = Ascii code - 48

For example to the character «7» (HEX 37) correspond the value 7dBm because :
«7» Ascii code = 55 -----> Power = 55 - 48 = 7

8.4 Configuration Parameters

Parameter configuration example, using the evaluation board supplied with the evaluation kit and the software called "Hercules SETUP utility". This is a freeware utility that can be downloaded freely.

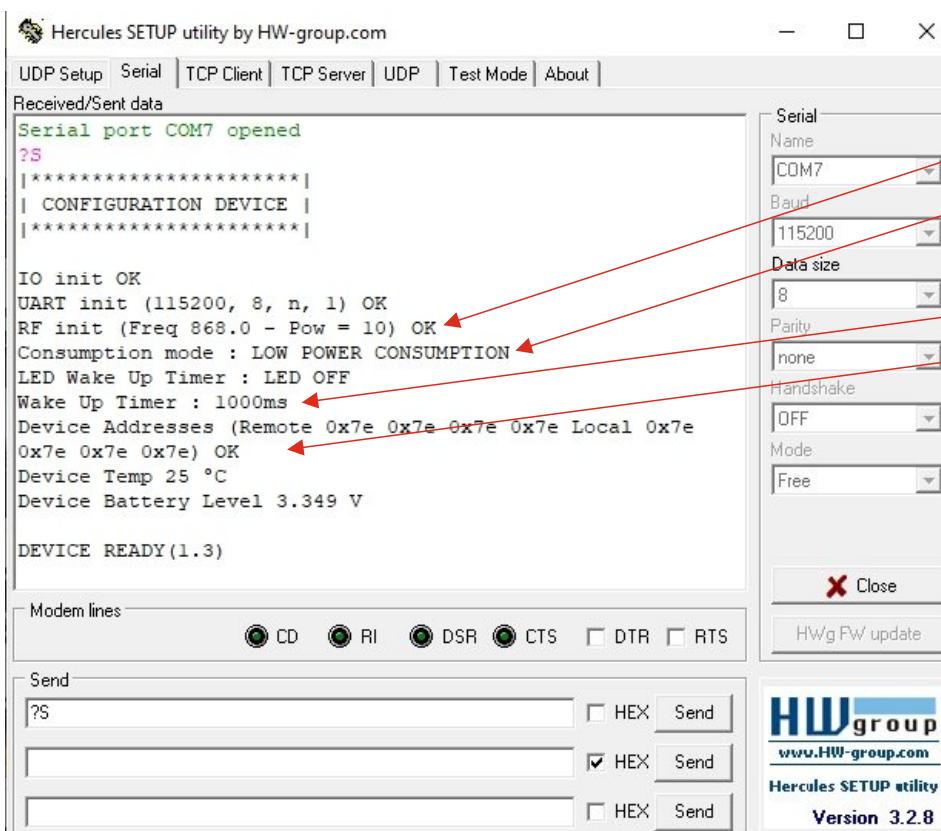
1) Open the serial port as follows:



Software used : Hercules SETUP utility (free use)

Serial Port Configuration

2) Send the command «? S» for view the current configuration



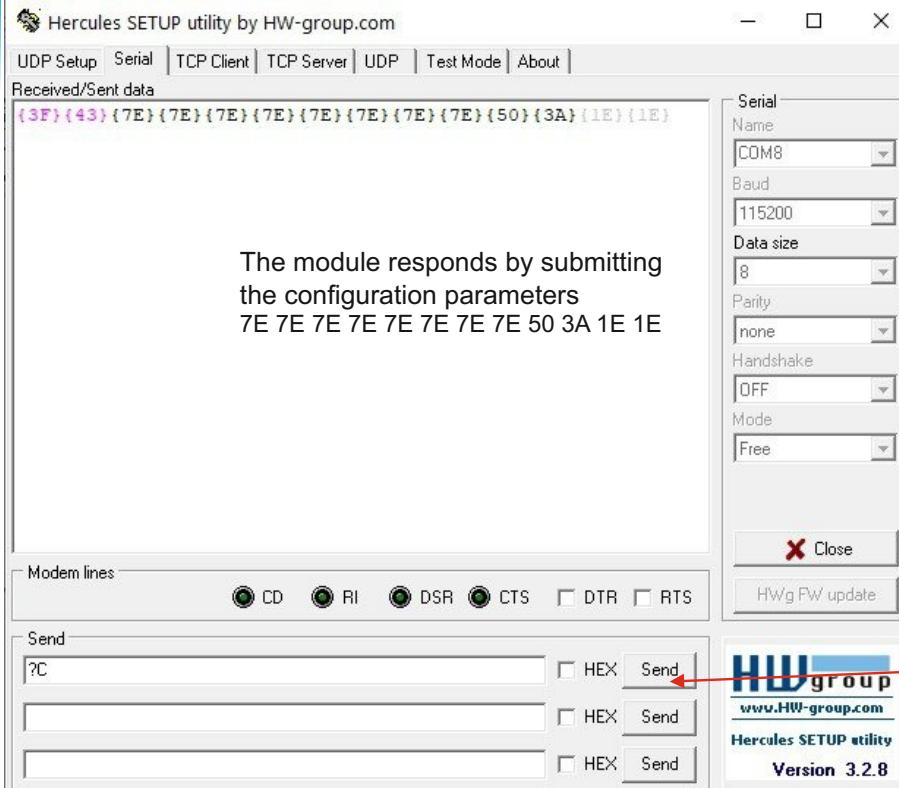
Frequency=868MHz Power=10dBm

Modality = EP Mode / EU Mode

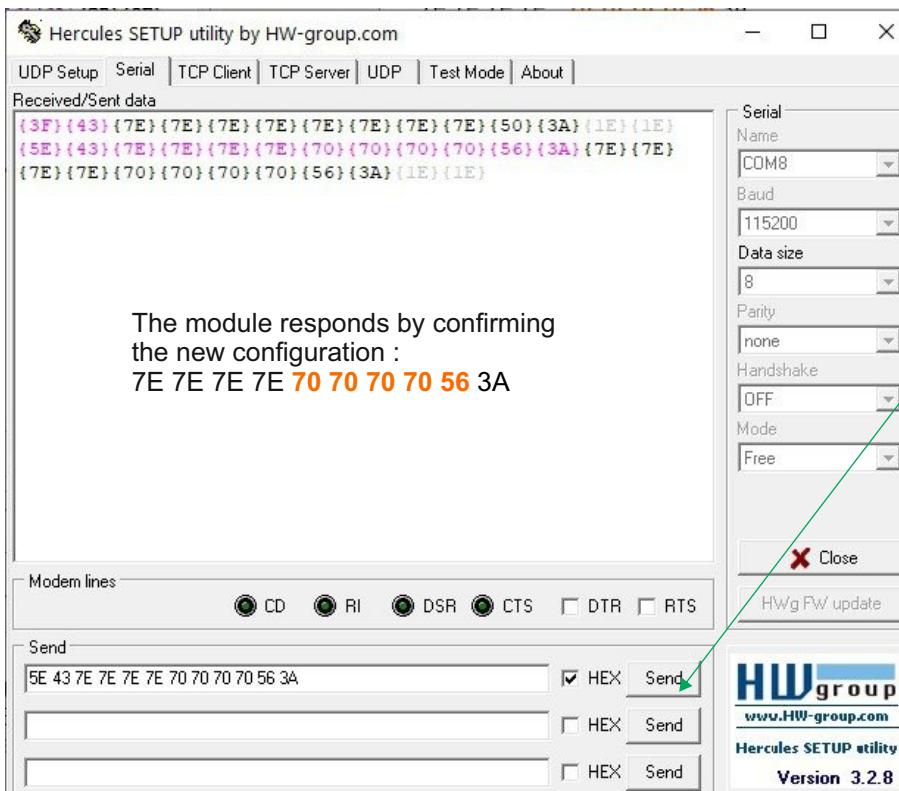
WakeUp Time (Default 1000mS)

Remote and Local Address
Default 7e7e7e7e 7e7e7e7e

3) Send the "? C" command to view only the configuration parameters

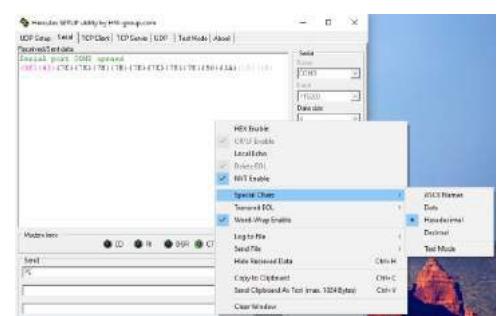


4) Invio nuova configurazione



Set the Hercules software to receive hexadecimal character (press the right mouse button and :

- In the Special Chars menù choice HEX
- Choice HEX Enable



Send the command «C»

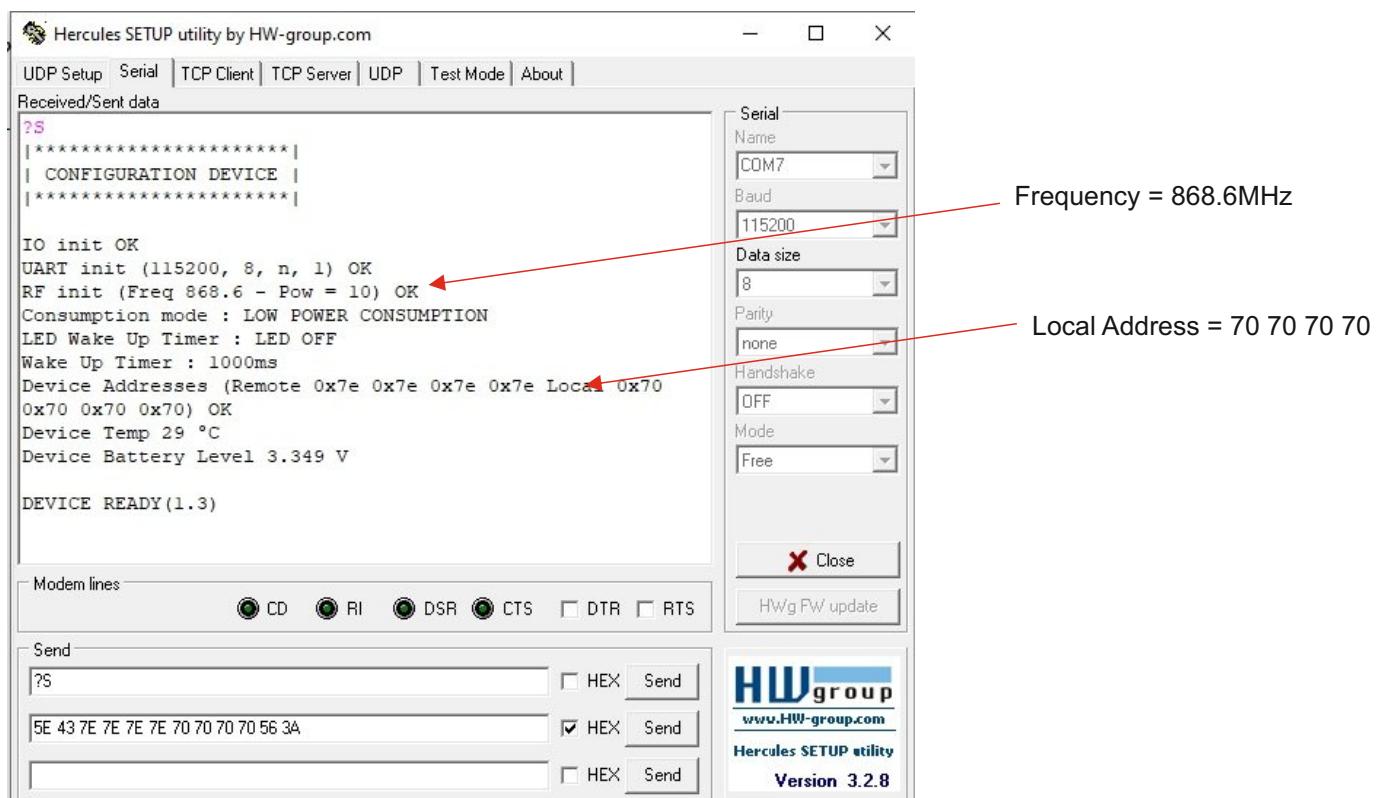
By pressing this button the new configuration is transmitted
7E 7E 7E 7E 70 70 70 70 56 3A
(hexadecimal string)
Parameters in red have been changed

70 70 70 70 Local address

56 Frequency = 868.6MHz

5) Send the "? S" command to view the current configuration

Set the Hercules software to receive hexadecimal character (press the right mouse button and :
 - In the Special Chars menu choose Text Mode



Note :

The configuration operations must be carried out when the module is powered by a voltage greater than 2.5Volt and pin 2 (FP) is in condition 0 (Low), when FP is at logic level 1 (High) the flash memory is write protected.

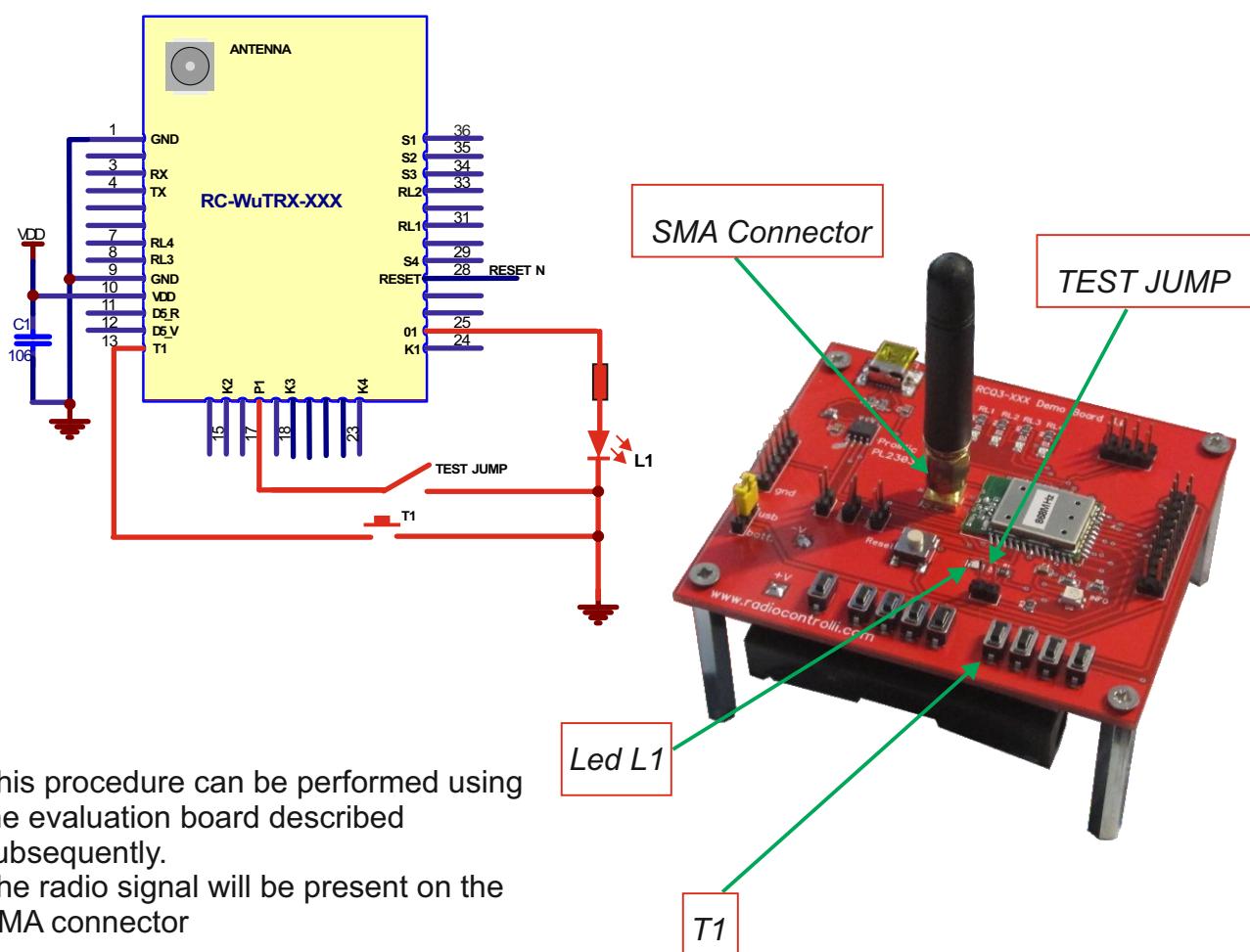
- Set FP to 0 (Low)
- Carry out a hardware reset of the module (pin 28 active low)
- The Module is ready to be configured
- Set FP to 1 (High)
- Reset the module (pin 28 active low)
- The module's flash memory is write protected

8.5 Configuration Check (Test Procedure)

It is possible to entry in Test Mode with the following procedure :

- 1) Close the TEST JUMP
- 2) The L1 will turn ON
- 3) Push T1 button.

With this operation the carrier with frequency and amplitude value previously set (see previous paragraphs) will be available on the antenna connector (UFL).

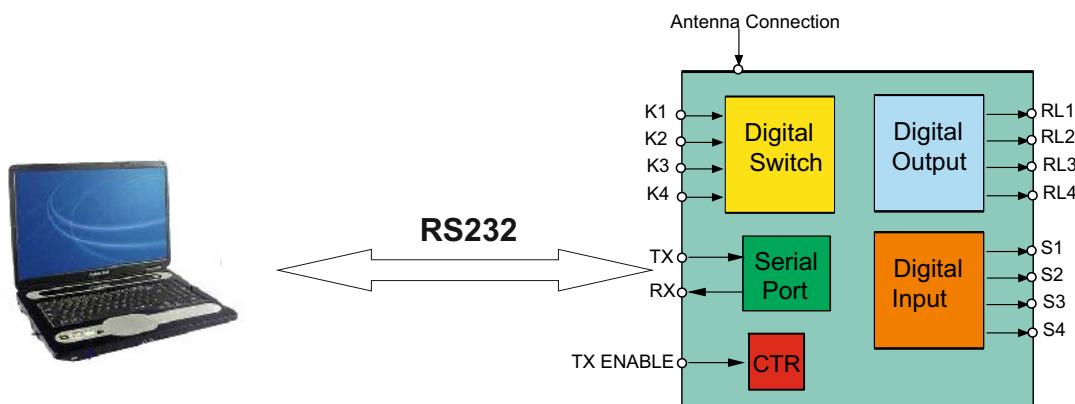


This procedure can be performed using the evaluation board described subsequently.

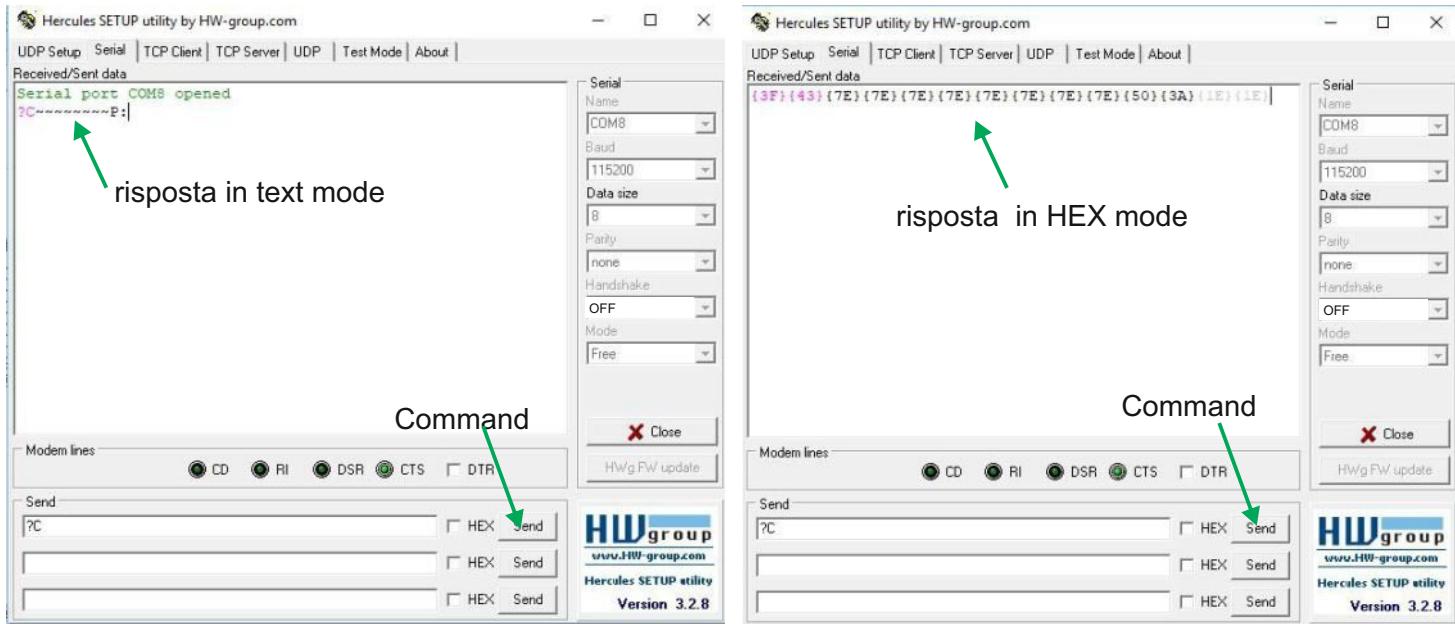
The radio signal will be present on the SMA connector

9.0 Local Commands List (device in EP Mode)

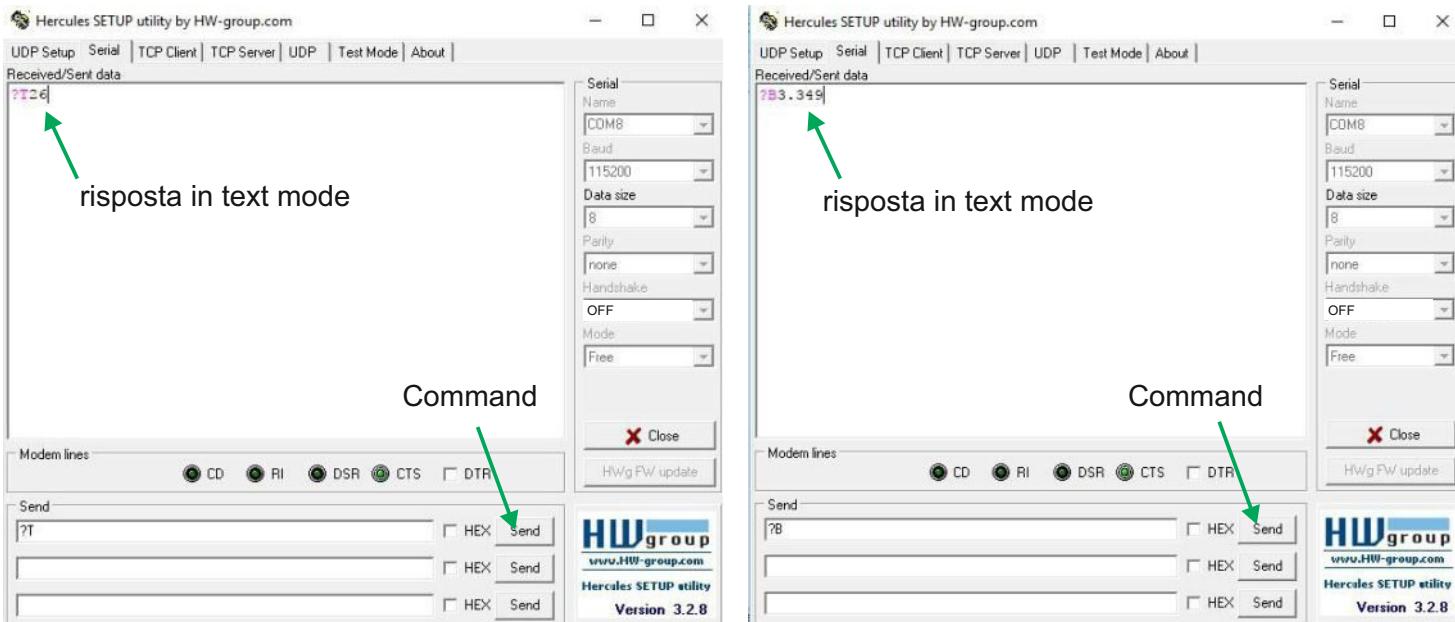
Local Command	Description	Example
1 ?C	Returns the configuration parameters : 1) Remote Address, 2) Local Address, 3) Frequency, 4) Power Value	see par. 9.1
2 ?T	Returns the temperature value (°C)	see par. 9.2
3 ?B	Returns the value of battery (Volt)	see par. 9.2
4 ?O	Returns the local output state	see par. 9.3
5 ?I	Returns the local input state	see par. 9.3
6 ?M	Returns the local monostable state	see par. 9.5
7 ?TM	Returns the value monostable timer	see par. 9.7
8 ?PM	Returns the value wake up timer	see par. 9.3
9 ?V	Return the local Fw version	see par. 9.4
10 ?BR	Return the local UART Baud Rate	see par. 9.4
11 ?H	Help	see par. 9.6
12 ?S	Returns the general information	see par. 9.6
13 ^C+CONF	Allows to modify the configuration of the module example : ^C~~~~~T2 (text) or 5E 43 7E 7E 7E 7E 7E 7E 7E 54 32 (Hex)	see par. 8.4
14 ^B+BAUDRATE	Value accepted : 115200,57600,38400,19200,9600,4800,2400,1200 Example : ^B115200 . After this command you must reset the device.	see par. 9.8
15 ^M +xM or xB	Change from monostable/bistable mode	see par. 9.5
16 ^E + P or U	Change from Low Power Consumption to Ultra Low Power Consumption.	see par. 9.9
17 ^R + 1 or 0	Wake Up Timer LED On/Off	see par. 9.11
18 ^P + 1 to 4	Change Wake Up Timer	see par. 9.10
19 ^T +<hex>	Change Local Monostable Timer. After this command it's necessary reset the device.	see par. 9.7



9.1 «?C» Command



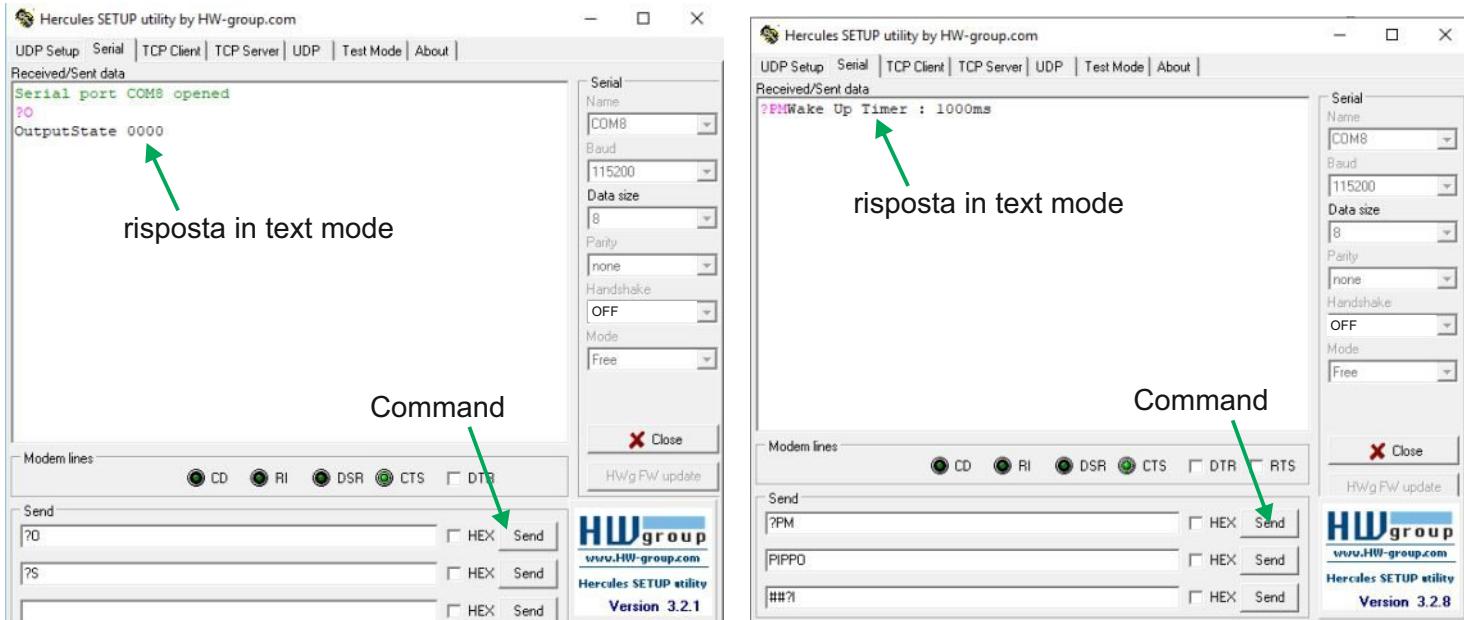
9.2 «?T» e «?B» Command



Returns the value in ° C.

Return the value in Volt.

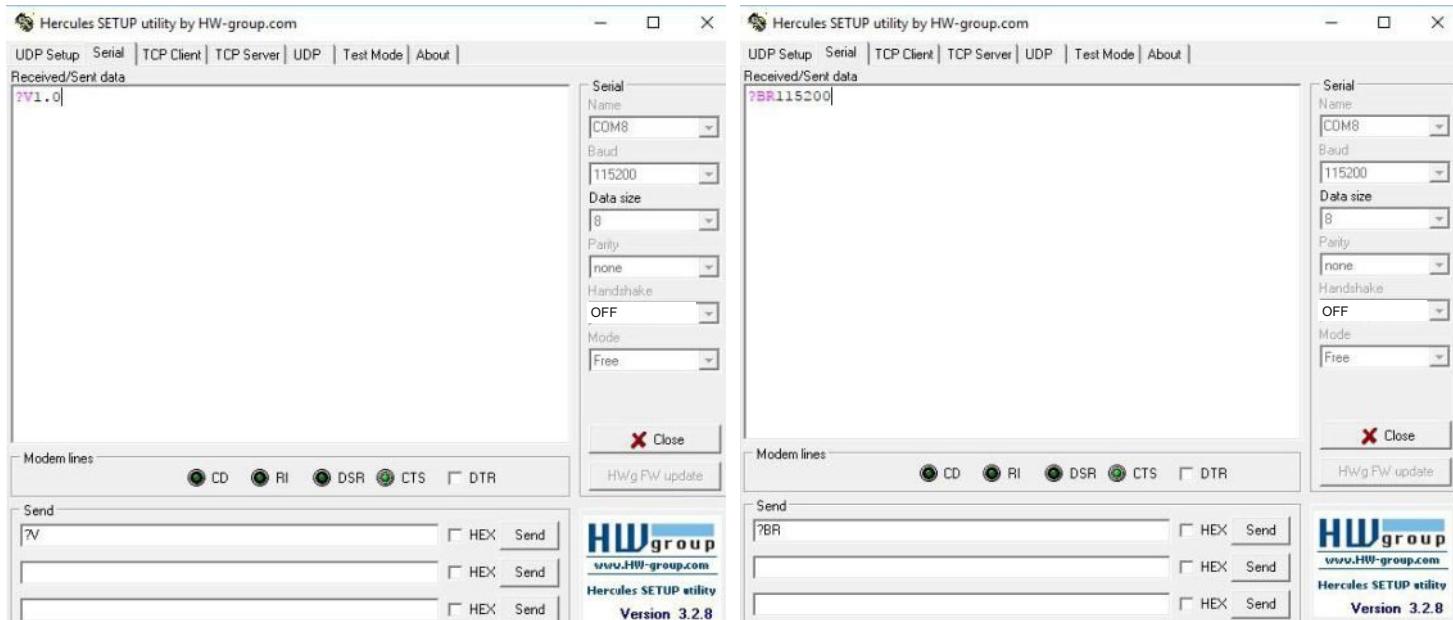
9.3 «?O» e «?PM» Command



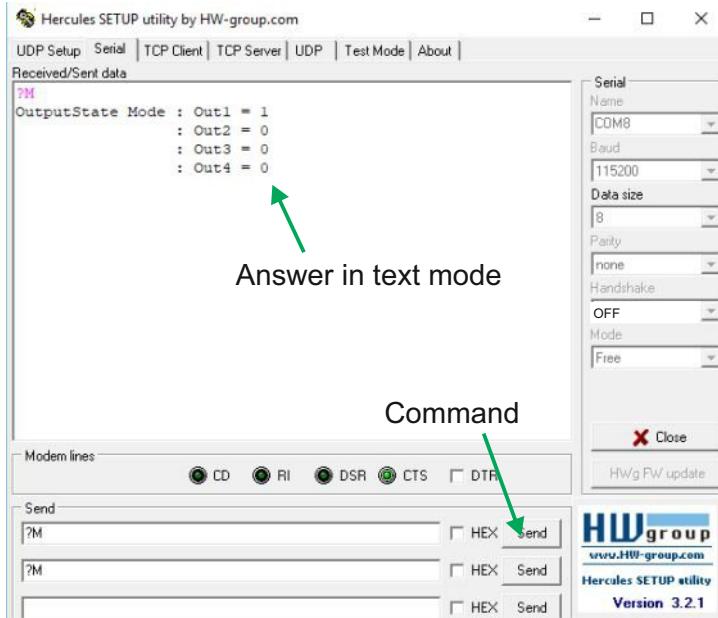
0000 means that the 4 outputs RL1÷RL4, they are low level.

The Wake up time is equal to 1000mseconds

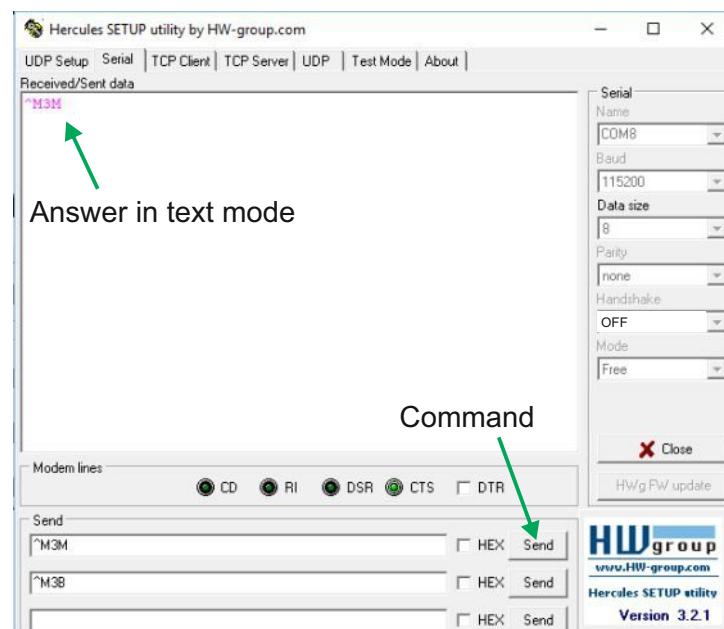
9.4 «?V» e «?BR» Command



9.5 «?M» e «^M» Command



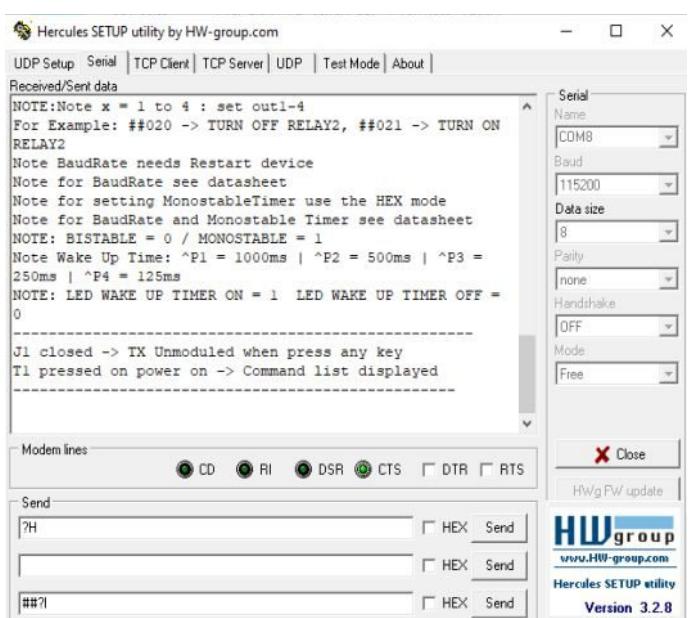
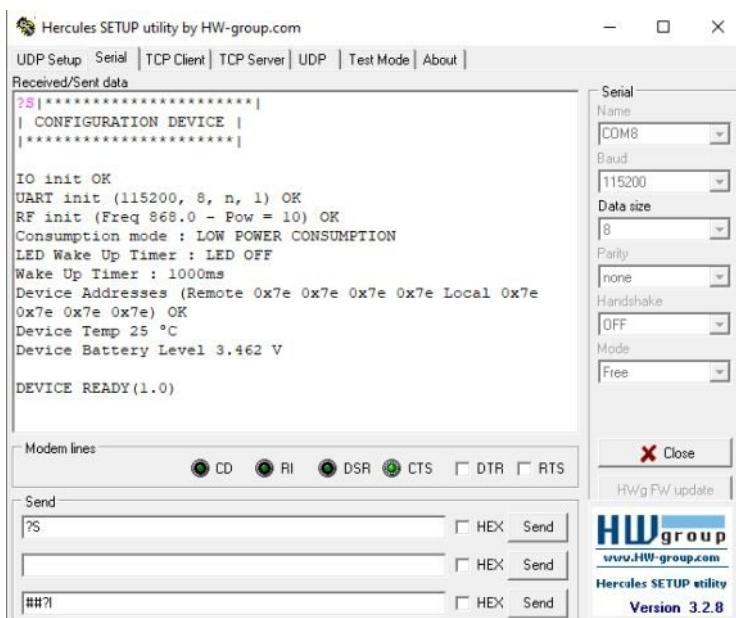
«? M» Provides information on how the channels were previously configured :
 OUT1=1= Monostable mode
 OUT2=0= Bistable mode
 OUT3=0= Bistable mode
 OUT4=0= Bistable mode



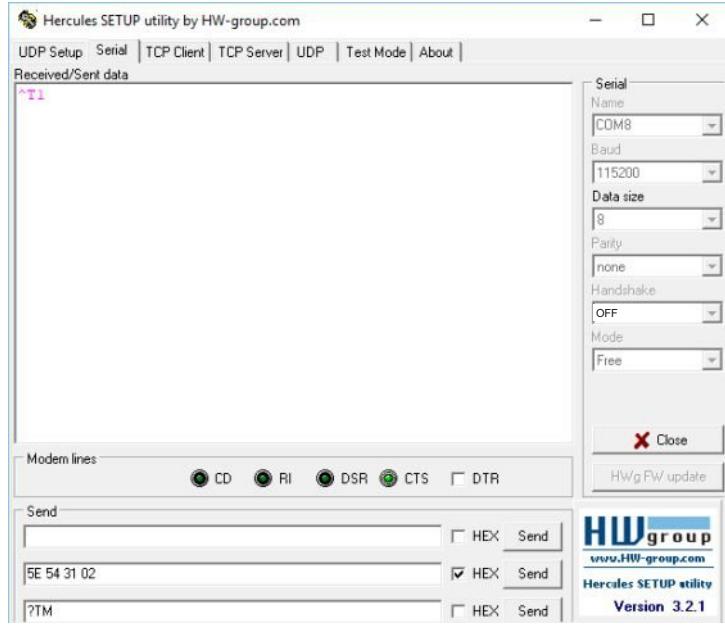
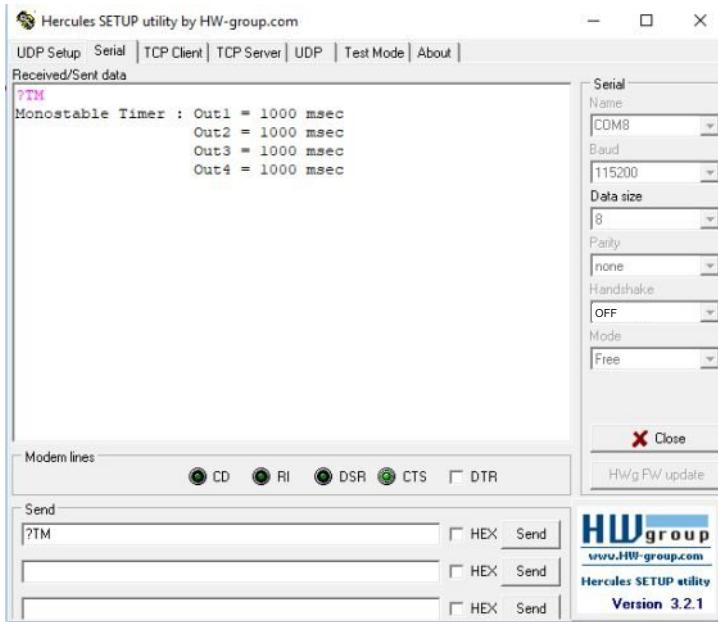
«^M + xM or xB» channels configuration
 M (monostable) o B (bistable) .
 Example :

^M1M Channel 1 in Monostable Mode
 ^M2B Channel 2 in Bistable Mode

9.6 «?S» and «?H» Command

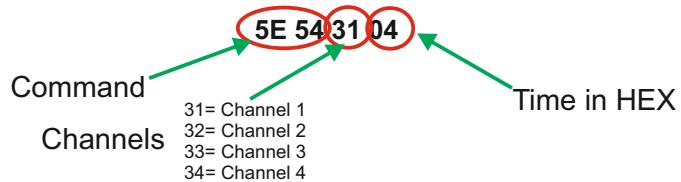


9.7 «?TM» e «^T+Hex» Command



«?TM» provides the Mostable time for the 4 channels

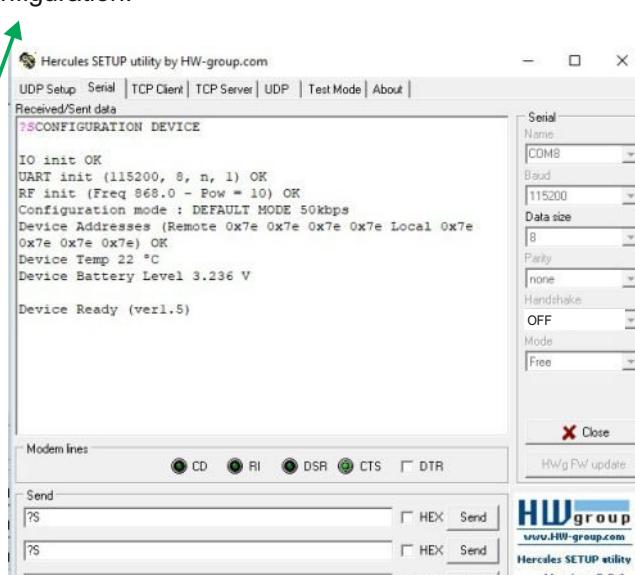
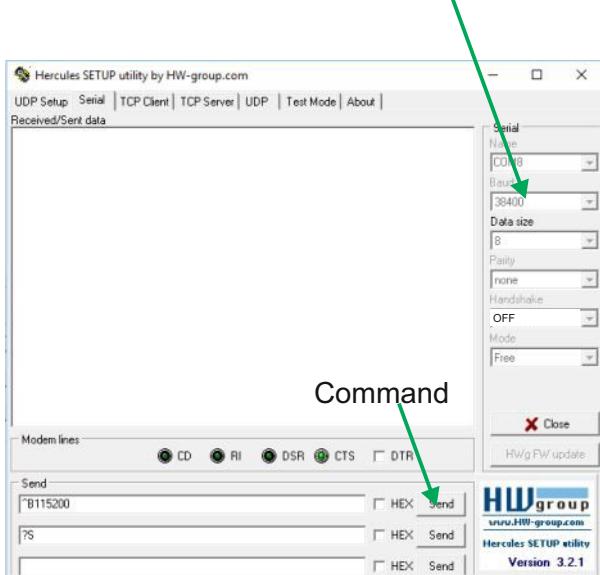
Command transmission in hex



9.8 «^B+Baudrate»

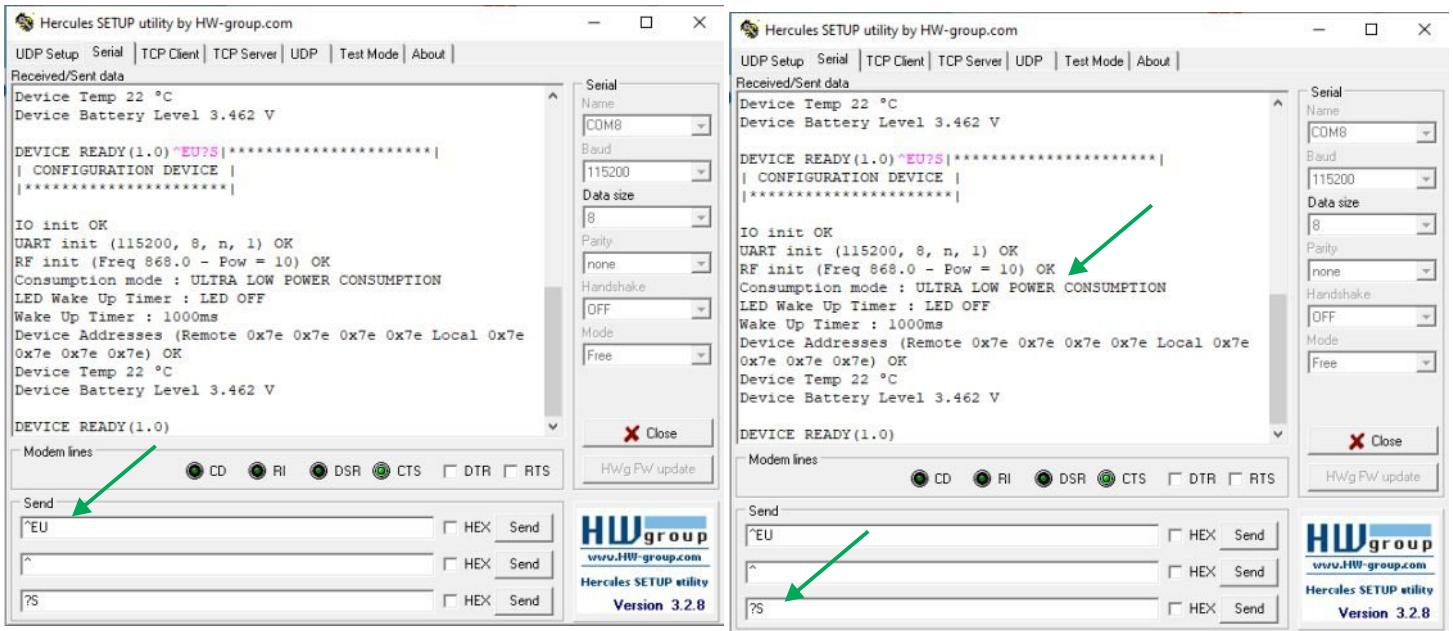
The device is initially configured at 38400 baud rate

Open the serial port at 115200 as baud rate
Send the command «?S» and check the new one configuration.

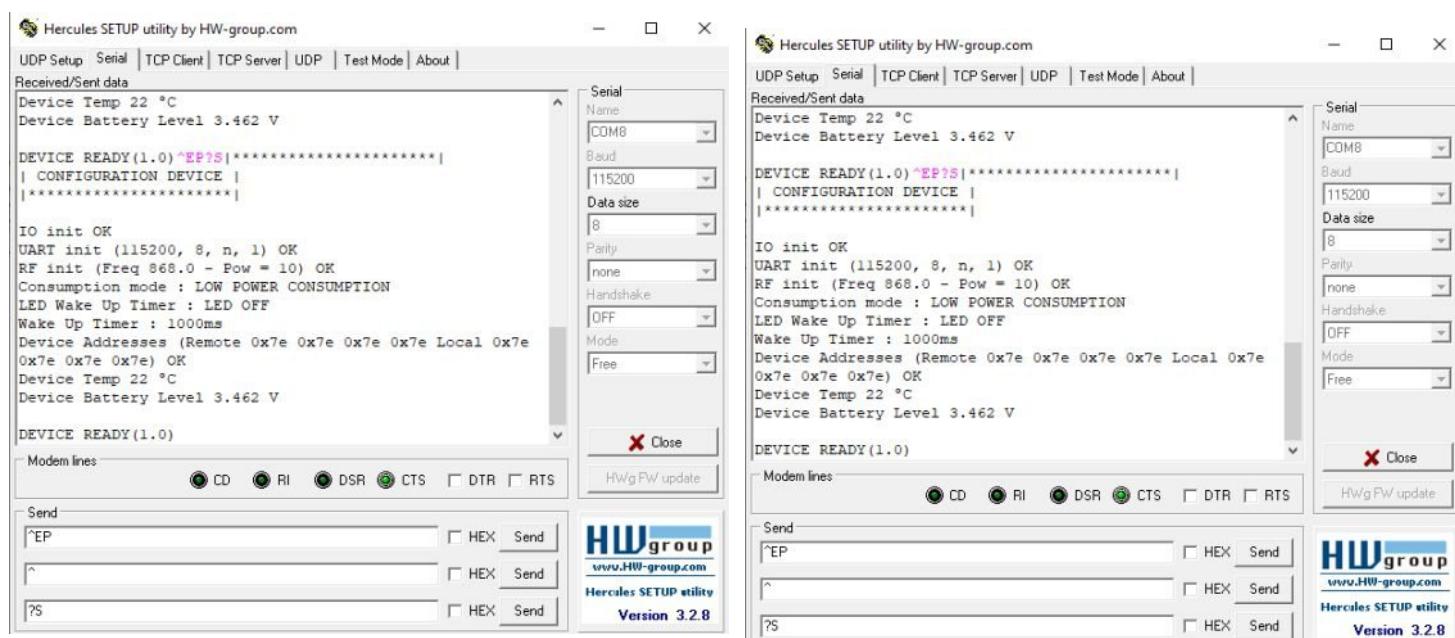


After sending the command ^ B115200 it is necessary to perform a hardware RESET.

9.9 «^E» Command



The "[^] EU" command configures the device in EU (Ultra Low Consumption Mode), after sending this command it is possible to check the new configuration using the "? S" command.

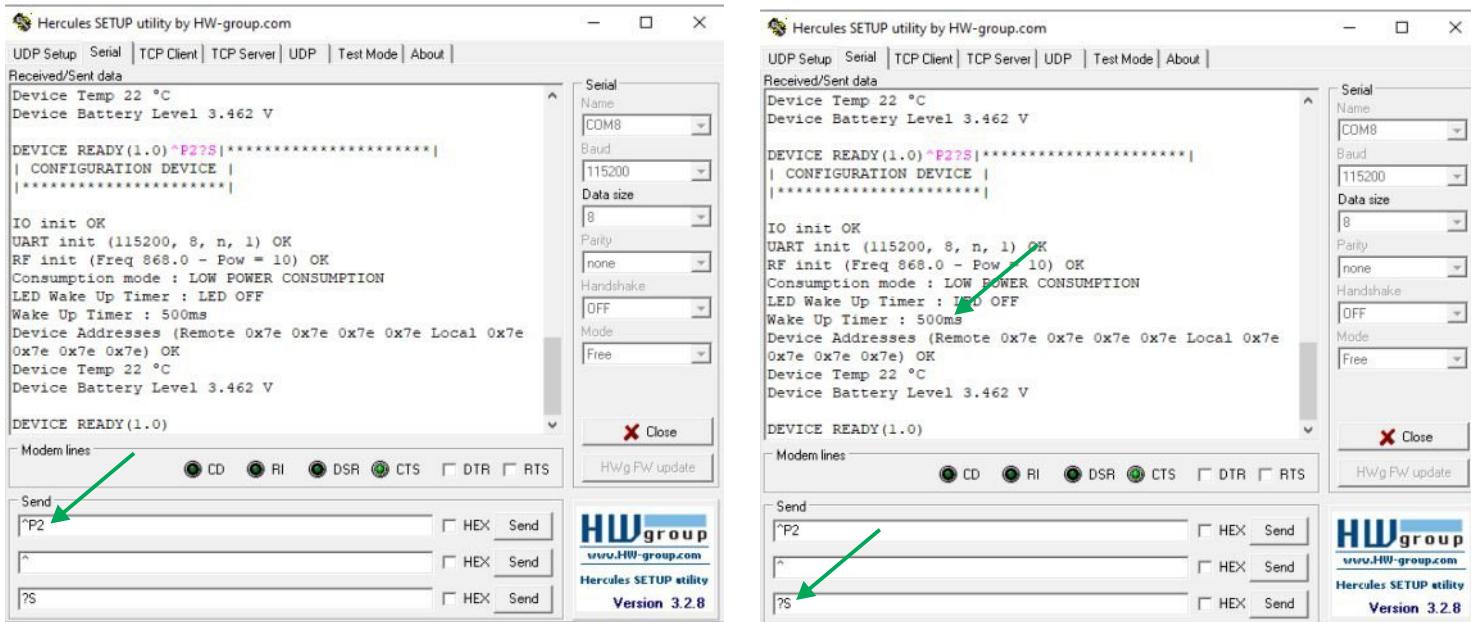


The "[^] EP" command sets the device to EP Mode, after sending this command is possible tocheck the new configuration using the "? S" command.

9.10 «^P» Command

The "^\P" command can accept the following values:

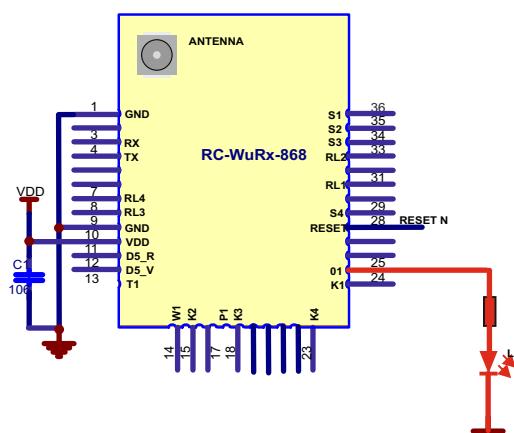
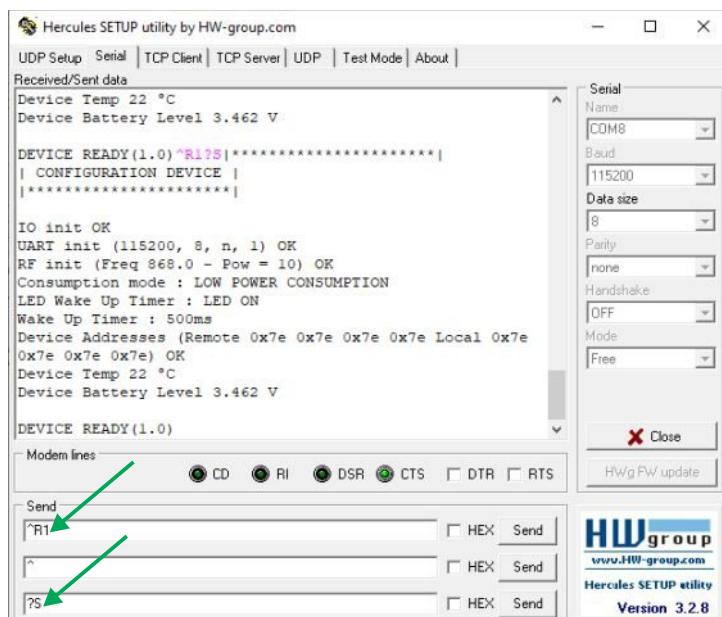
P=1 ---> Wake Up Timer = 1000msec P=2 ---> Wake Up Timer = 500msec
 P=3 ---> Wake Up Timer = 250msec P=4 ---> Wake Up Timer = 125msec



9.11 «^R» Command

The "^\R" command can accept the following values:

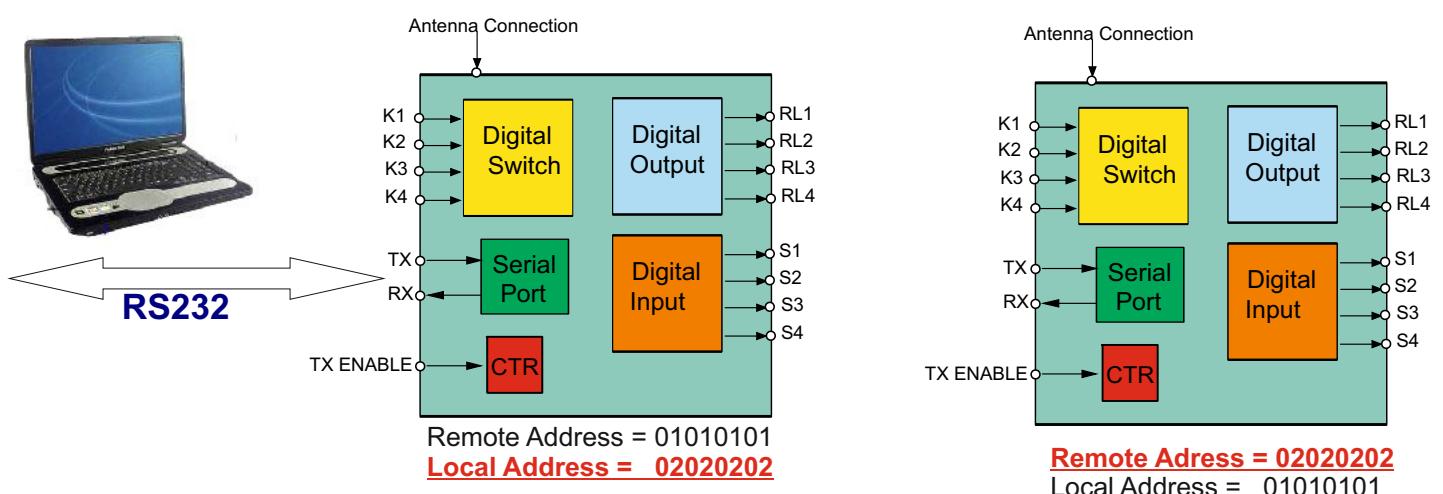
R=1 ---> LED ON R=0 ---> LED OFF



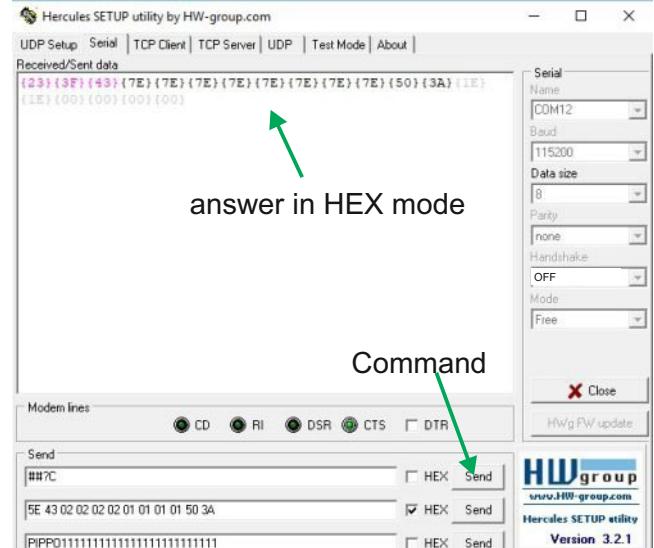
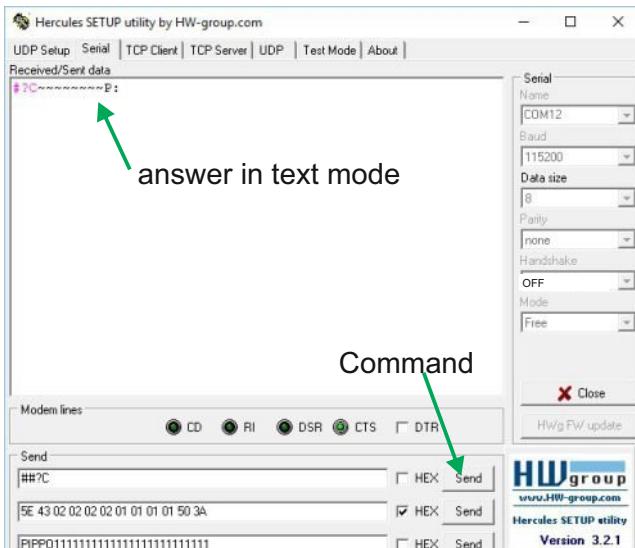
10.0 Remote Commands List

Remote Command	Description	Example	Note
1 ##?C	Returns the configuration parameters : 1) Remote Address, 2) Local Address, 3) Frequency, 4) Power Value	See par. 10.1	
2 ##?T	Returns the temperature value (°C)	See par. 10.2	
3 ##?B	Returns the value of battery (Volt)	See par. 10.2	
4 ##?O	Returns the value of the Remote Output State	See par. 10.3	
5 ##?I	Returns the value of the Remote Input State	See par. 10.3	
6 ##?M	Returns the value of the monostable state	See par. 10.7	
7 ##?V	Returns the FW version	See par. 10.6	
8 ##?RS	Returns the RSSI value	See par. 10.6	
9 ##?BR	Returns the value of UART BaudRate	See par. 10.5	
10 ##0x0	Remote Relay OFF	See par. 10.8	(*)
11 ##0x1	Remote Relay ON	See par. 10.8	(*)

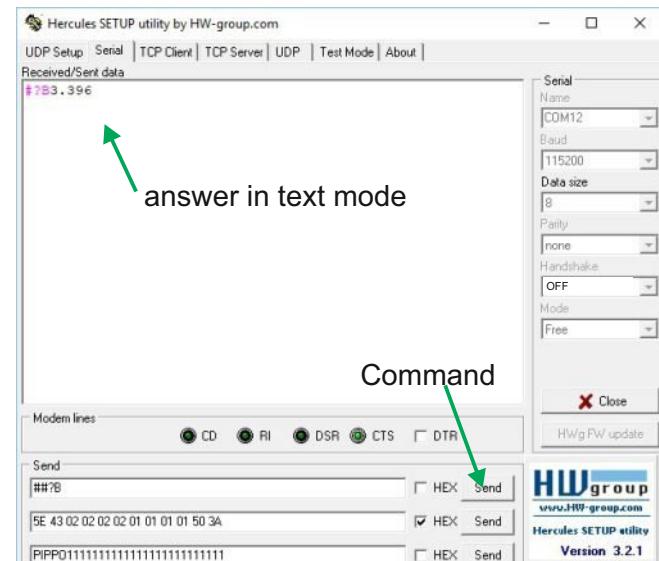
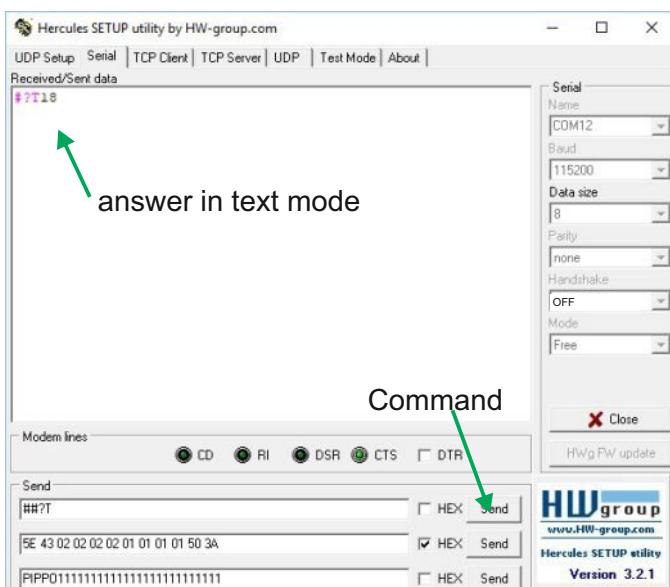
(*) Commands also executable in EU mode (very low consumption)



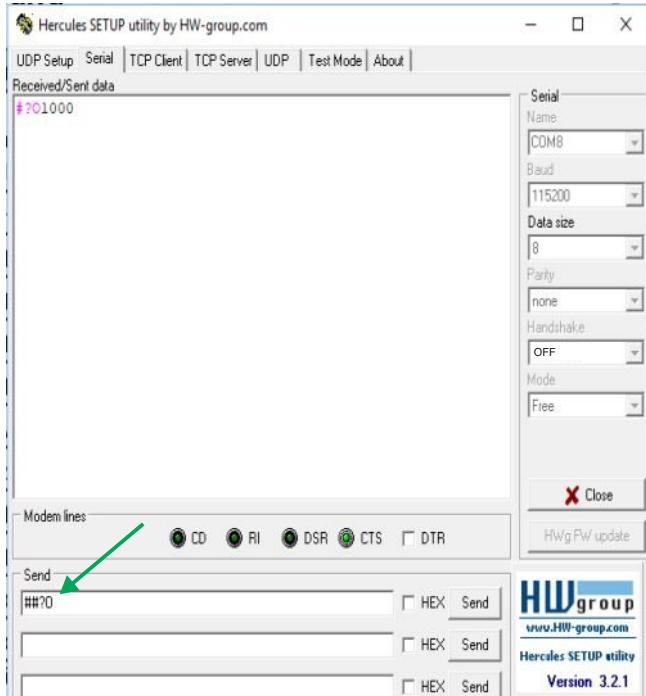
10.1 «##?C» Command



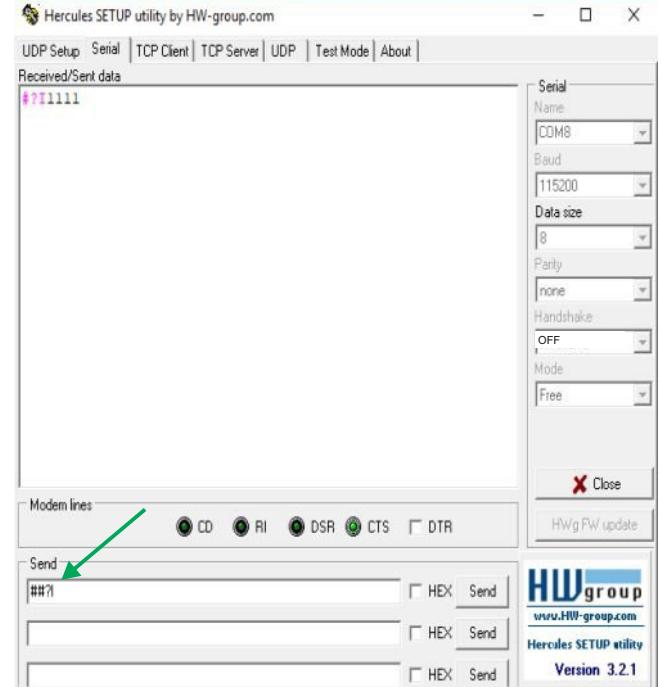
10.2 «##?T» e «?B» Command



10.3 «##?O» e «##?I» Command

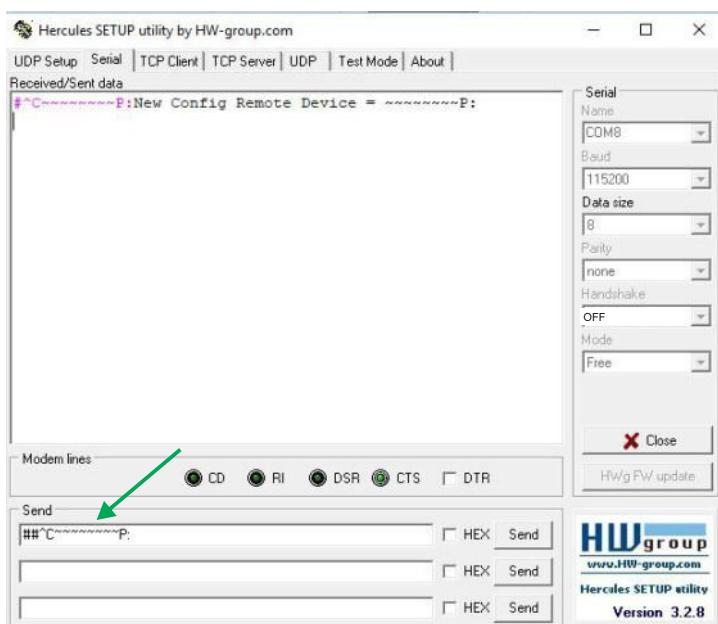


"1000" means that the digital output RL1 is high level instead the digital outputs RL2, RL3, RL4 are at low level.

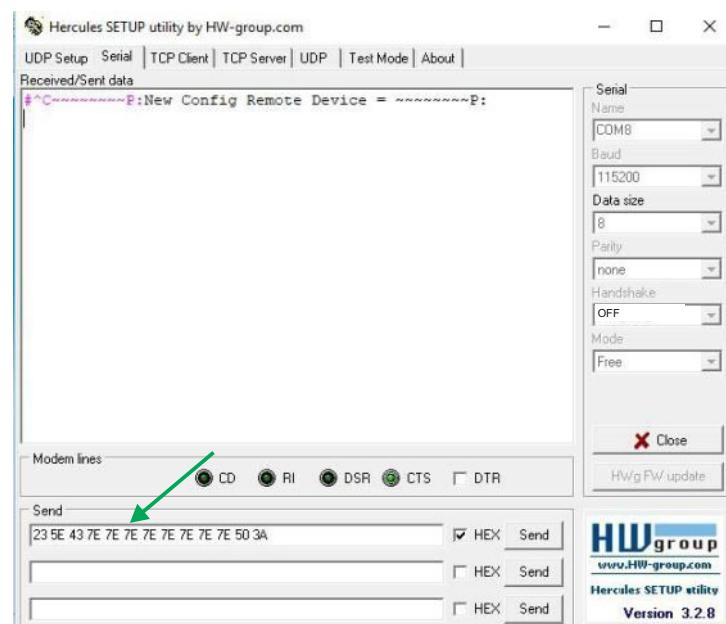


It means that all digital inputs are high level

10.4 «##^C»+ Configuration Command

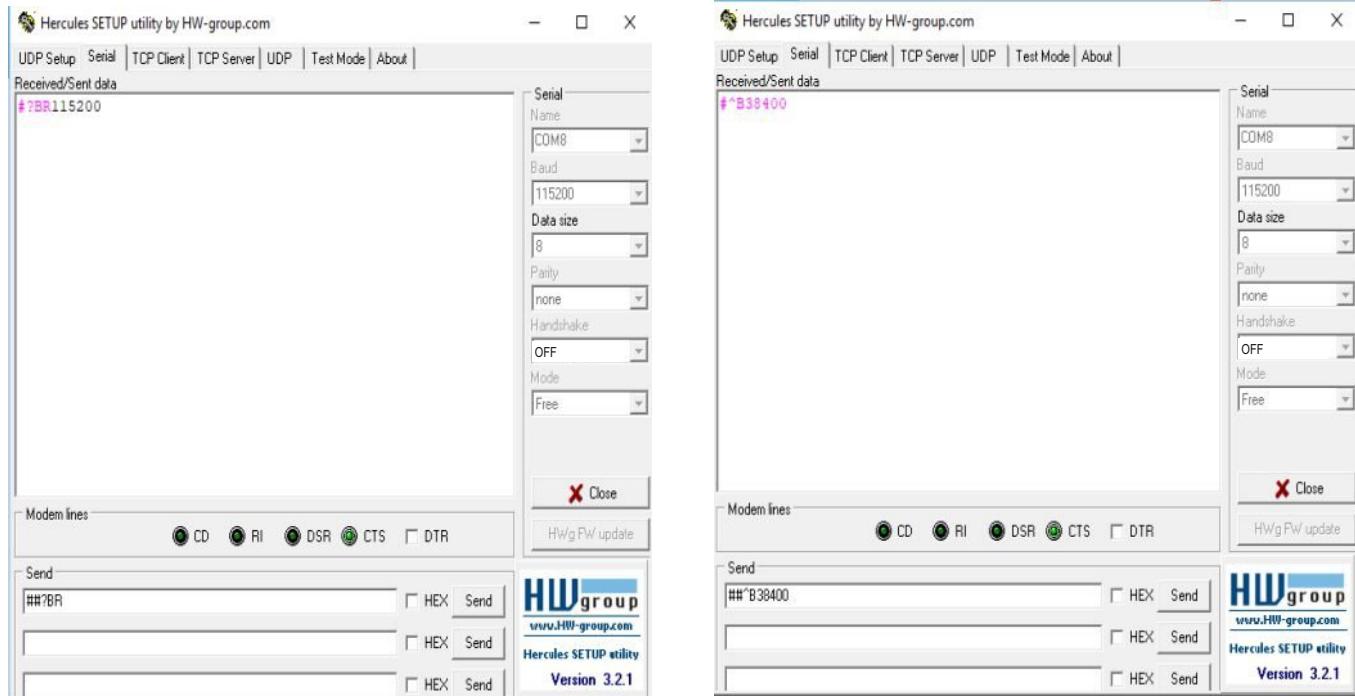


TEXT Mode



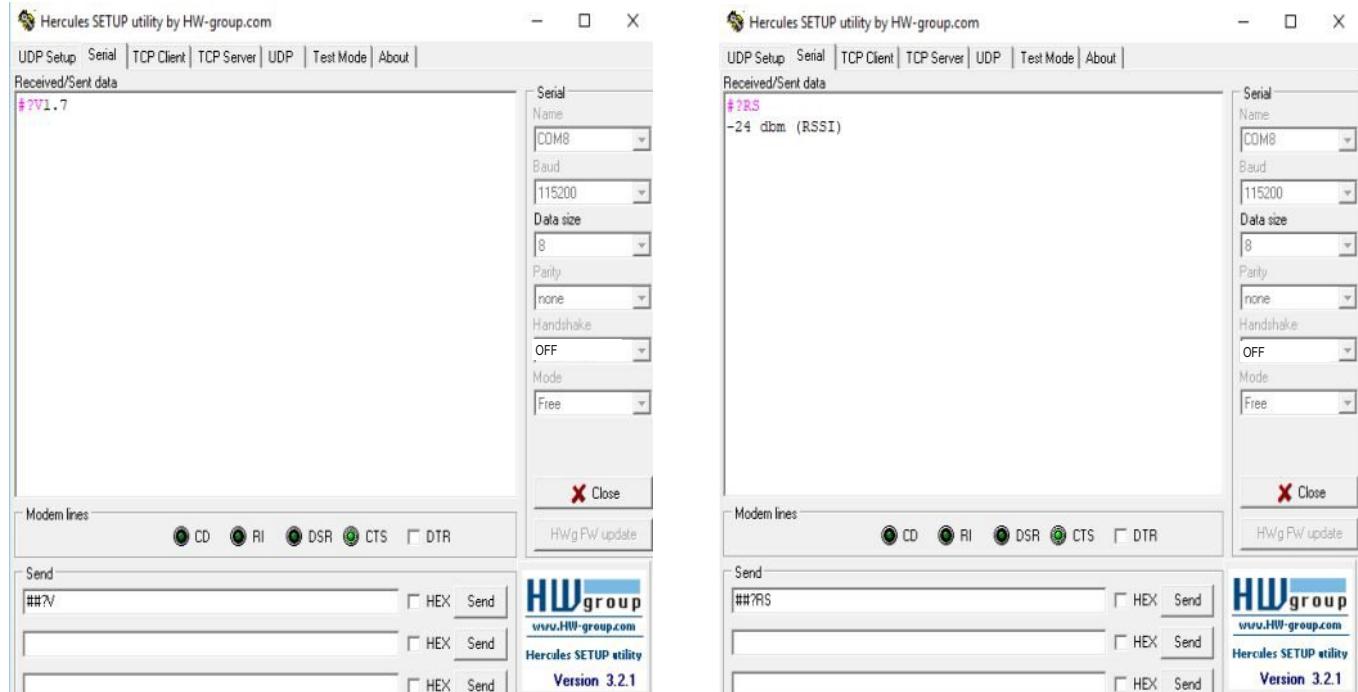
HEX Mode

10.5 «##?BR» Remote baud rate «##^B» Change baud rate Command

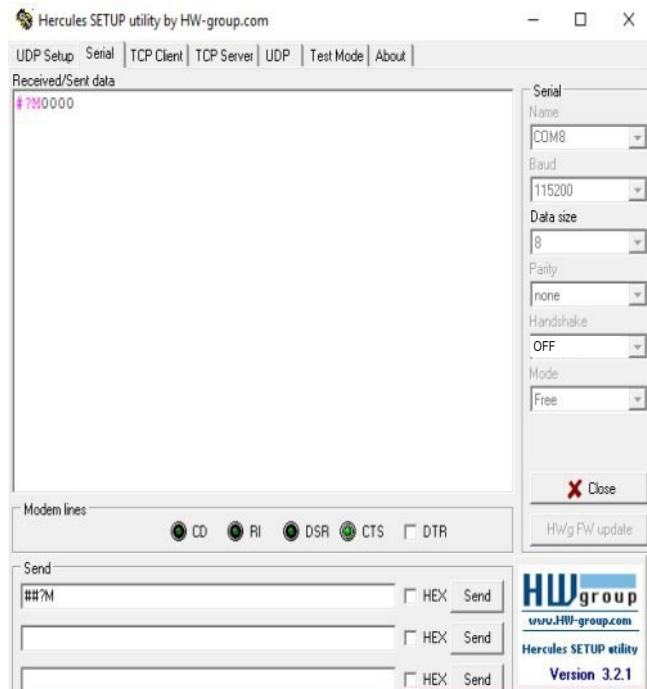


The remote device is changed at 38400 baud rate
after this instruction is necessary an HW reset.

10.6 «##?V» Fw version «##^RS» Remote RSSI Command



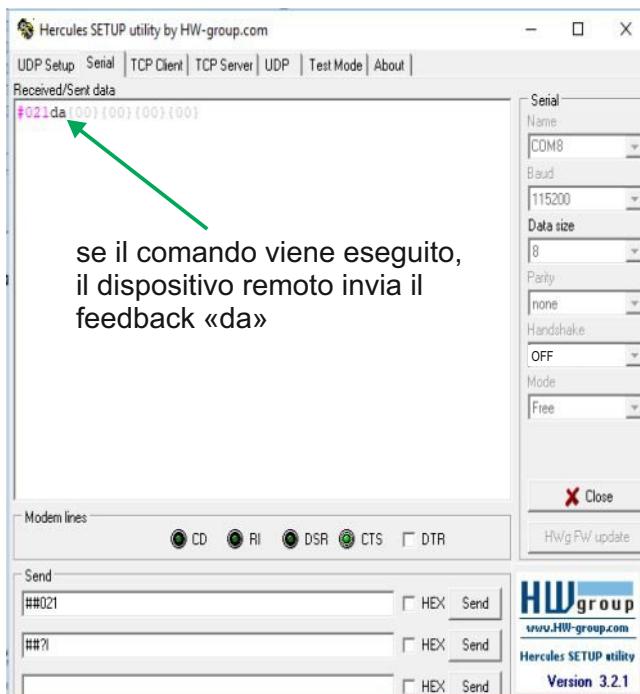
10.7 «##?M» Monostable state Command



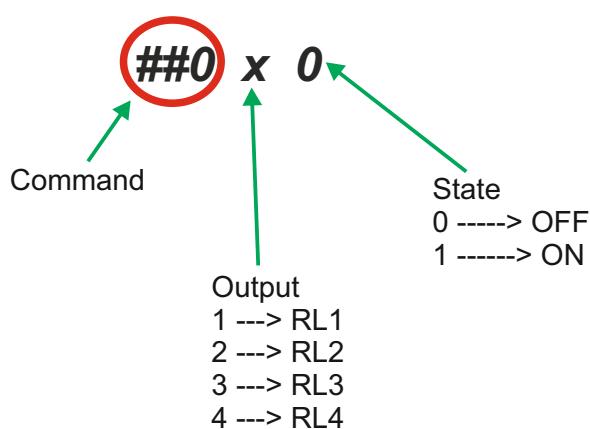
In this case all 4 digital outputs are set in bistable mode.

0= Bistable
1= Monostable

10.8 «##0x0» and «##0x1» Remote Relay ON/OFF



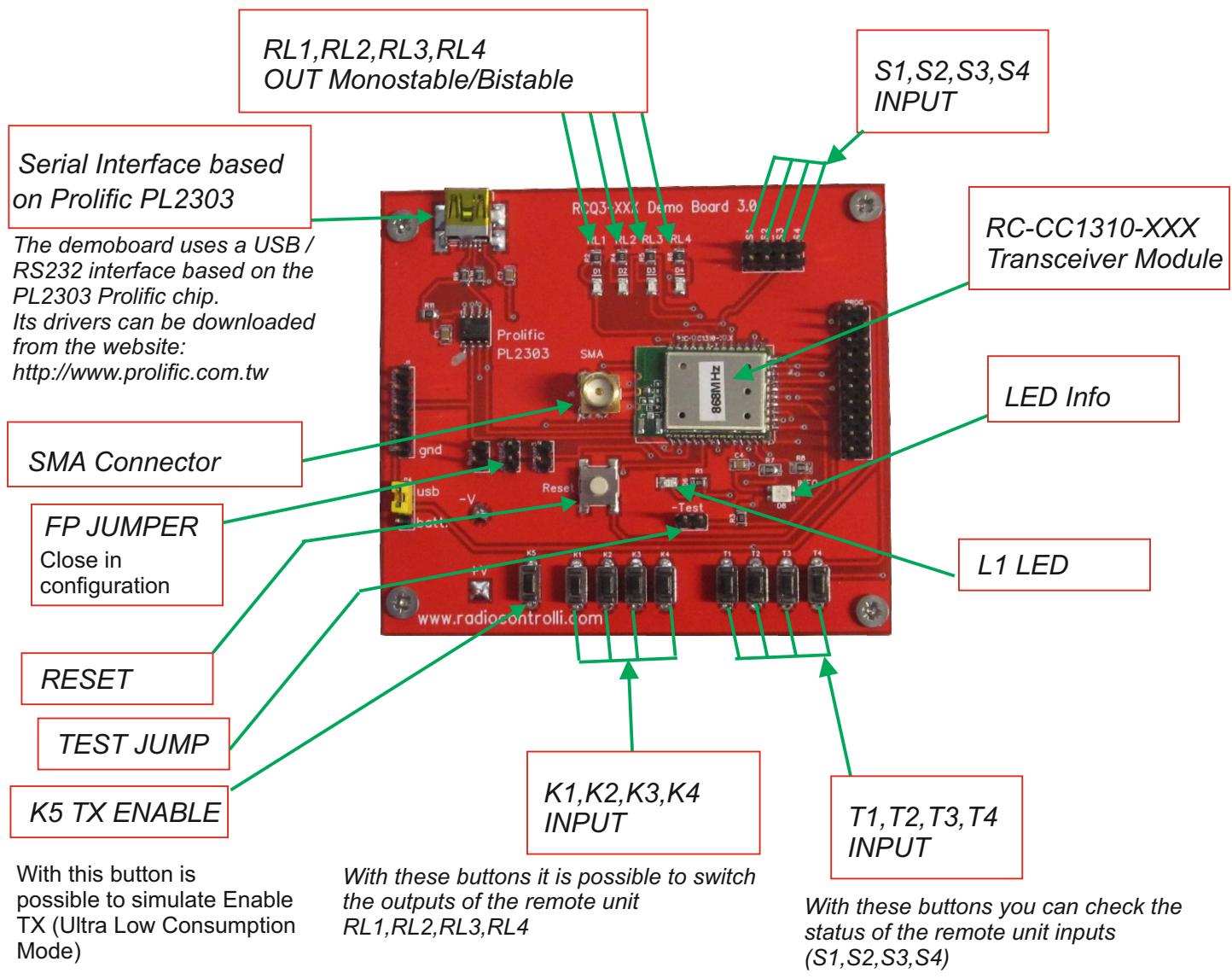
se il comando viene eseguito,
il dispositivo remoto invia il
feedback «da»



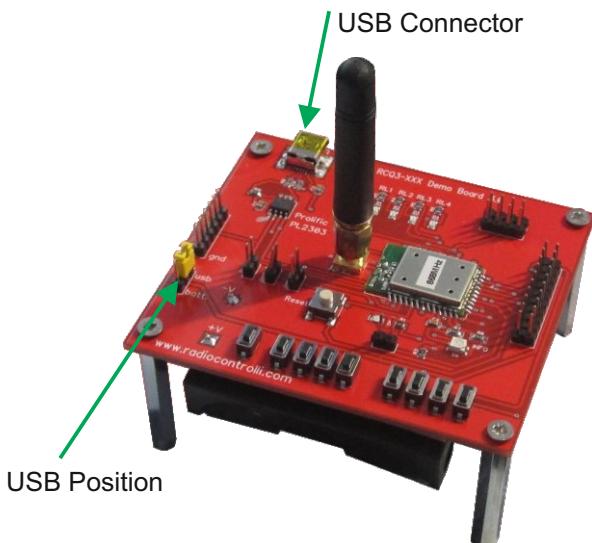
11.0 Evaluation Kit - Quick Guide

The Evaluation Kit is composed By :
 - N.2 Evaluation Board with SMA Antenna
 - N.2 USB cables

11.1 Evaluation Board Description

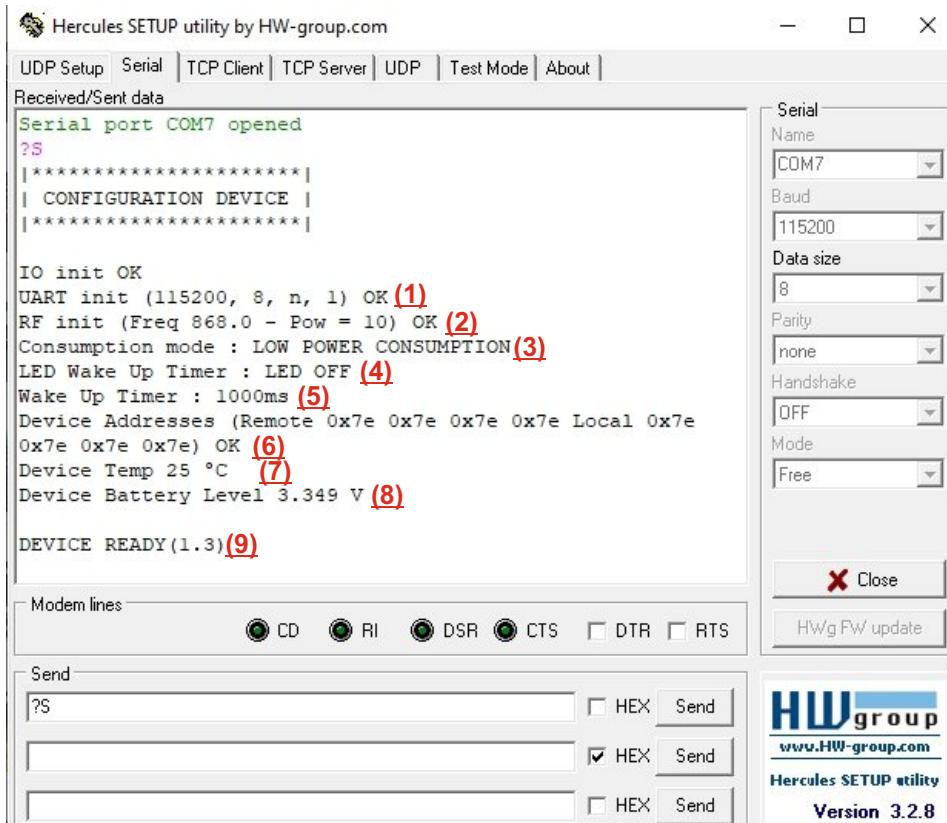


11.2 Check Configuration Parameters



- Make sure the jumper is in the USB position (USB powered)
 - Connect the Personal computer to the USB connector check the correct recognition of the drivers Prolific, in case of problems these drivers can be downloaded from the website: <http://www.prolific.com.tw>.
 - After locating the serial port, open the Hercules software as indicated below.
- (*) It is possible to use any "serial port terminal" for convenience we use the Hercules software, freeware downloadable from the website www.hw-group.com.

- Open the serial port as shown in the figure
- Use the "? S" command to check the default configuration



The screenshot shows the Hercules SETUP utility interface. On the left, the 'Received/Sent data' window displays the following log output:

```

Serial port COM7 opened
?S
***** CONFIGURATION DEVICE *****
IO init OK
UART init (115200, 8, n, 1) OK (1)
RF init (Freq 868.0 - Pow = 10) OK (2)
Consumption mode : LOW POWER CONSUMPTION (3)
LED Wake Up Timer : LED OFF (4)
Wake Up Timer : 1000ms (5)
Device Addresses (Remote 0x7e 0x7e 0x7e 0x7e Local 0x7e
0x7e 0x7e 0x7e) OK (6)
Device Temp 25 °C (7)
Device Battery Level 3.349 V (8)

DEVICE READY(1.3)(9)

```

On the right, the 'Serial' configuration panel shows the following settings:

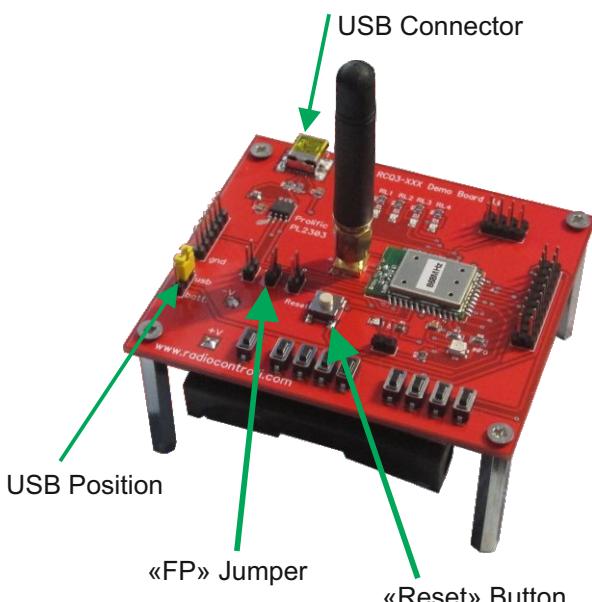
Name	COM7
Baud	115200
Data size	8
Parity	none
Handshake	OFF
Mode	Free

Red numbers (1) through (9) are overlaid on the log output to indicate specific configuration parameters. To the right of the log, red text provides additional context for each number:

- (1) **Serial Port parameters**
- (2) **RF Parameters (frequency / power)**
- (3) **EP / EU operating mode**
EP= Low Power Consumption
EU= Ultra Low Power Consumption
- (4) **Led WakeUp Timer (see par. 9.11)**
- (5) **Wake Up Timer**
- (6) **Local Address and Remote Address Configuration.**
- (7) **Temperature (°C)**
- (8) **Battery Voltage**
- (9) **Fw version**

The bottom right corner of the interface displays the HW group logo and the text 'Hercules SETUP utility Version 3.2.8'.

11.3 Edit Configuration Parameters



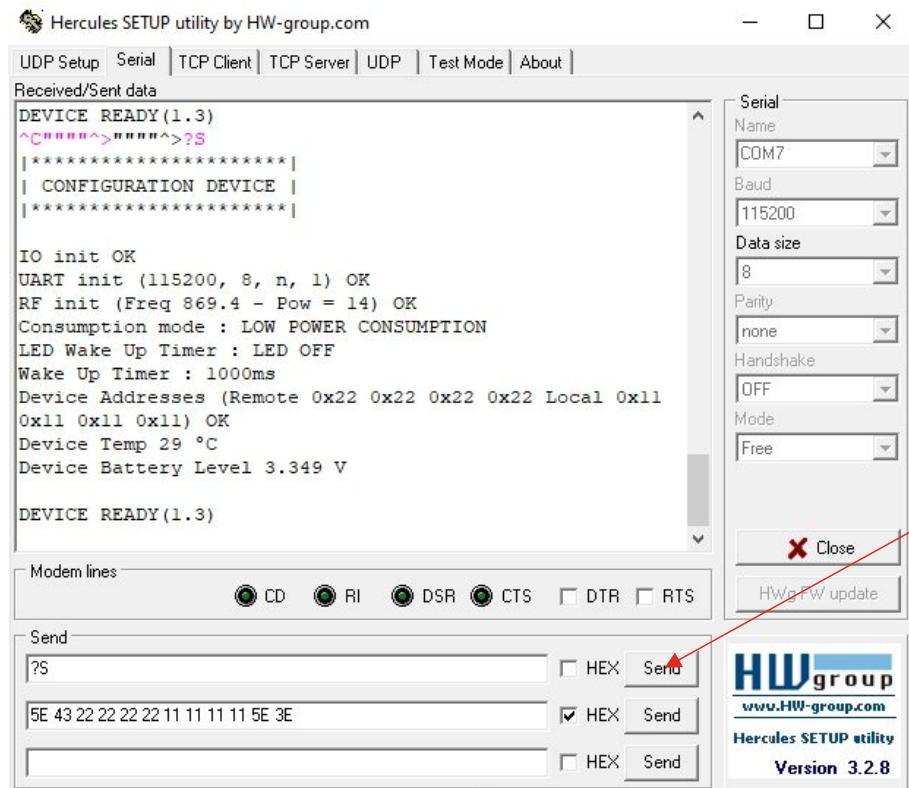
- From the hardware point of view to be able to modify the parameters must be FP jumper (FP signal = 0) the jumper must be done.
- After inserting the FP jumper perform a Hardware reset, using the RESET button.
- From this moment it is possible to modify the parameters of configuration.

Example Changing configuration parameters, you want to obtain the following new configuration:

Frequency	:	869.4MHz
Power	:	14dBm
Device Address Local	:	11 11 11 11
Device Address Remote	:	22 22 22 22

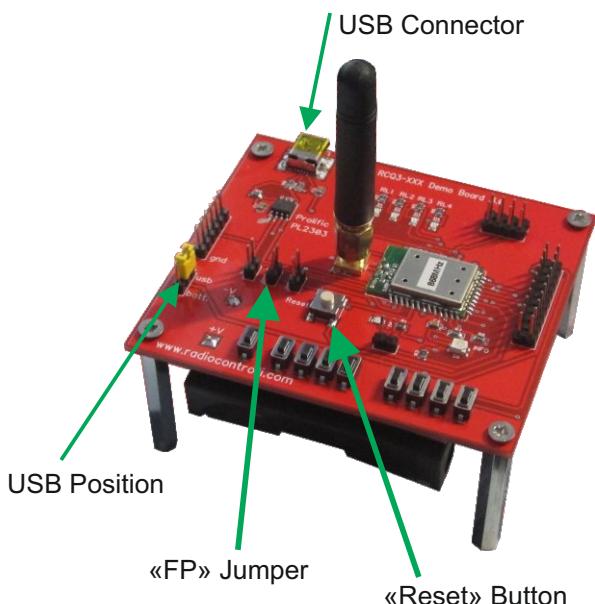
The screenshot shows the Hercules SETUP utility interface. On the left, there's a terminal window displaying device configuration data. On the right, the 'Serial' configuration panel is open, showing settings for Name (COM7), Baud (115200), Data size (8), Parity (none), Handshake (OFF), and Mode (Free). Below the serial panel is a 'HWg FW update' button. At the bottom, there's a 'Send' section with two input fields. The top field contains the string '5E 43 22 22 22 11 11 11 11 5E 3E'. The bottom field also contains '5E 43 22 22 22 11 11 11 11 5E 3E'. Red arrows point from the text 'The following string is sent:' and 'dove' to the respective fields in the 'Send' section.

The following string is sent:
5E 43 22 22 22 11 11 11 11 5E 3E
dove
5E=869.4MHz
3E=14dBm



Send command «? S» to verify the new configuration

From the screen above you can see the configuration changes made.



- Remove the FP jumper (FP signal = 1).
 - Perform a hardware reset, using the RESET button.
 - From this moment it will not be possible to modify the configuration parameters.

12 «Wireless Switch» Functionality - EP Mode

(EP Mode)

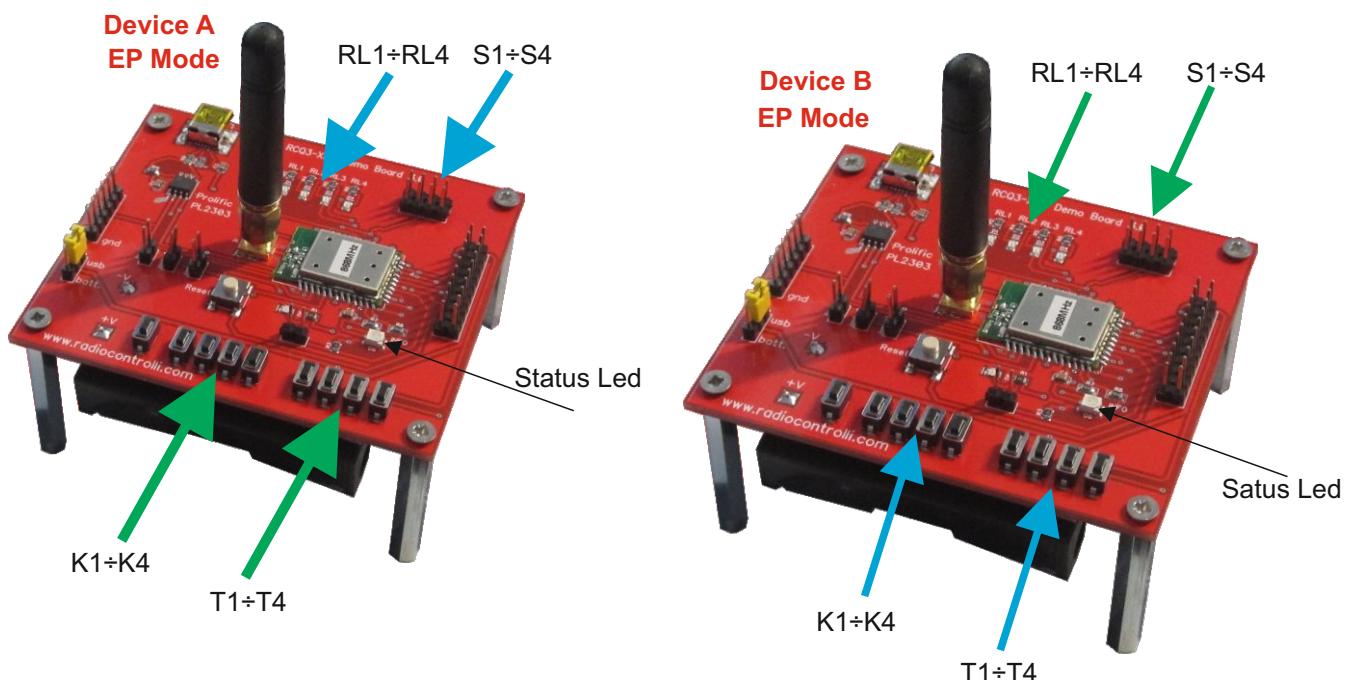
Consumption 1.2mA

Bidirectional

Both units are configured in EP Mode.

The digital outputs RL1 ÷ RL4 can be configured in monostable or bistable mode, by default they are configured in monostable.

Each time a command is executed, the TX unit receives the feedback of the command executed. The «Status Led» indicated in the figure will light up (return receipt of the command sent).



1
Press keys K1 ÷ K4 (Device A) and check on the remote unit (Device B) the change of state of the digital outputs RL1, RL2, RL3, RL4

1
Press keys K1 ÷ K4 (Device B) and check on the remote unit (Device A) the change of state of the digital outputs RL1, RL2, RL3, RL4

2
Press keys T1 ÷ T4 (Device A) and check the status of the LED; If the status LED is colored green it means that the digital input S1 ÷ S4 (Device B) is at logic level 1. If the status LED is red it means that the digital input S1 ÷ S4 (Device B) is at logic level 0.

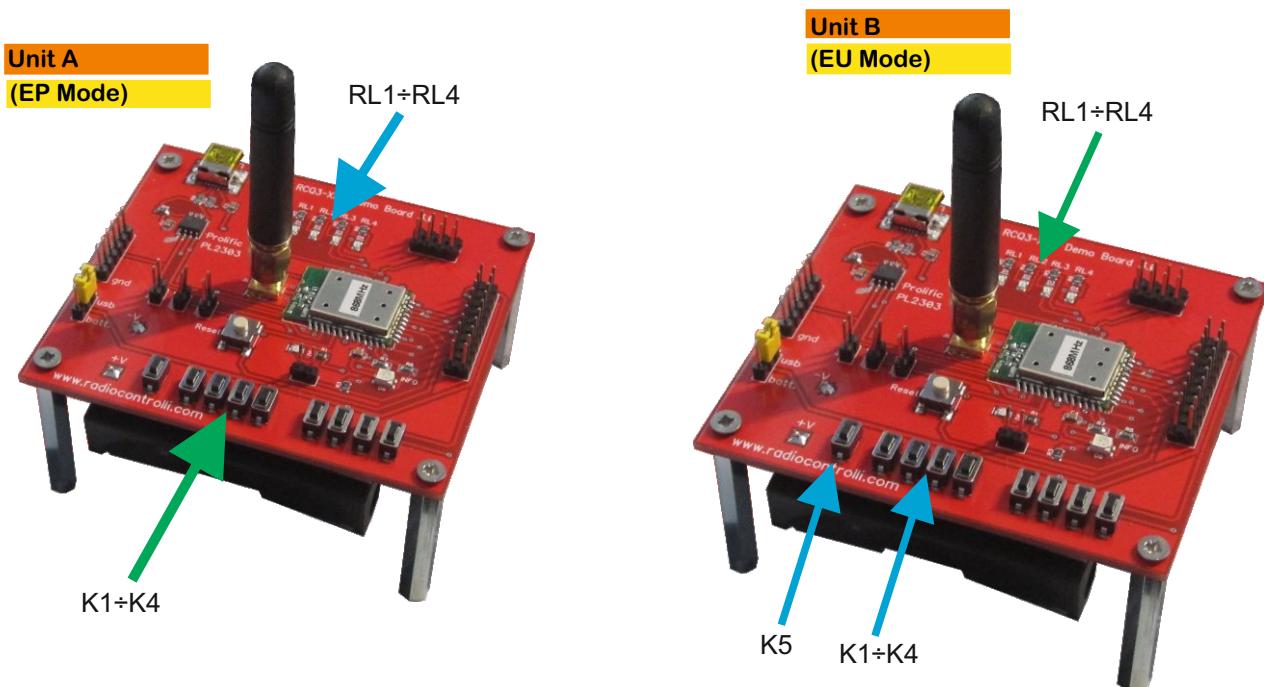
2
Press keys T1 ÷ T4 (Device B) and check the status of the LED; If the status LED is colored green it means that the digital input S1 ÷ S4 (Device A) is at logic level 1. If the status LED is red it means that the digital input S1 ÷ S4 (Device A) is at logic level 0.

13 «Wireless Switch» Functionality - EU Mode

In this example of use, unit A is configured in EP Mode (consumption 1.2mA) instead unit B is configured in EU Mode (consumption 10µA).

Unit B will always be listening (WakeUp Timer 1sec) for the commands sent by unit A.

In order to transmit commands from unit B to unit A it will be necessary to enable the TX ENABLE (in the evaluation board it corresponds to the K5 key).



1 Command transmission from A ----> B

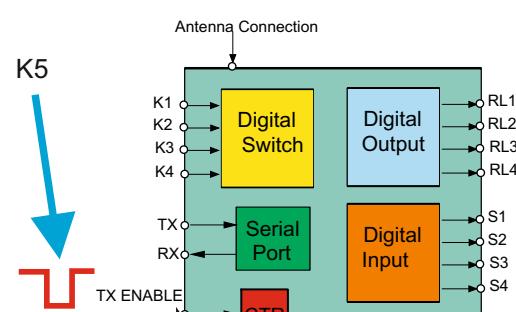
Press the K1 ÷ K4 keys of unit A and check on unit B the status change of the digital outputs RL1 ÷ RL4.



2 Command transmission from B ----> A

Enable transmission of commands by pressing the K5 key.

Press the K1 ÷ K4 keys of unit A and check on unit B the status change of the digital outputs RL1 ÷ RL4.



14 «Wireless Actuator» Functionality

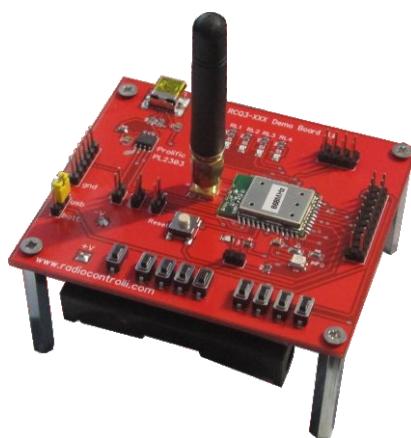
The GATEWAY unit must be configured in EP Mode instead the other units can be configured in EU mode (consumption around 10µA); It is possible to control the outputs RL1 ÷ RL4 of the units Unit 1, Unit 2, Unit «n».

Below there is a table of commands that can be executed on the remote units in EP Mode and EU Mode.

Serial Port connection



GATEWAY Unit
(EP Mode)



Unit 1
(EU Mode)



Unit 2
(EU Mode)

The remote address of the GATEWAY is changed from time to time through the serial interface according to which remote device you want to reach.



Unit n
(EU Mode)

Remote Command	Description	EP Mode	Eu Mode
1 ##?C	Returns the configuration parameters	Enabled	Disable
2 ##?T	Returns the temperature value (°C)	Enabled	Disable
3 ##?B	Returns the value of battery (Volt)	Enabled	Disable
4 ##?O	Returns the value of the Remote Output State	Enabled	Disable
5 ##?I	Returns the value of the Remote Input State	Enabled	Disable
6 ##?M	Returns the value of the monostable state	Enabled	Disable
7 ##?V	Returns the FW version	Enabled	Disable
8 ##?RS	Returns the RSSI value	Enabled	Disable
9 ##?BR	Returns the value of UART BaudRate	Enabled	Disable
10 ##0x0	Remote Relay OFF	Enabled	Enabled
11 ##0x1	Remote Relay ON	Enabled	Enabled
12			
13			

15 «Radio Modem» Functionality

With this function, a Rs232 wireless link is created, preamble and CRC are automatically generated and added to the RF transmission.

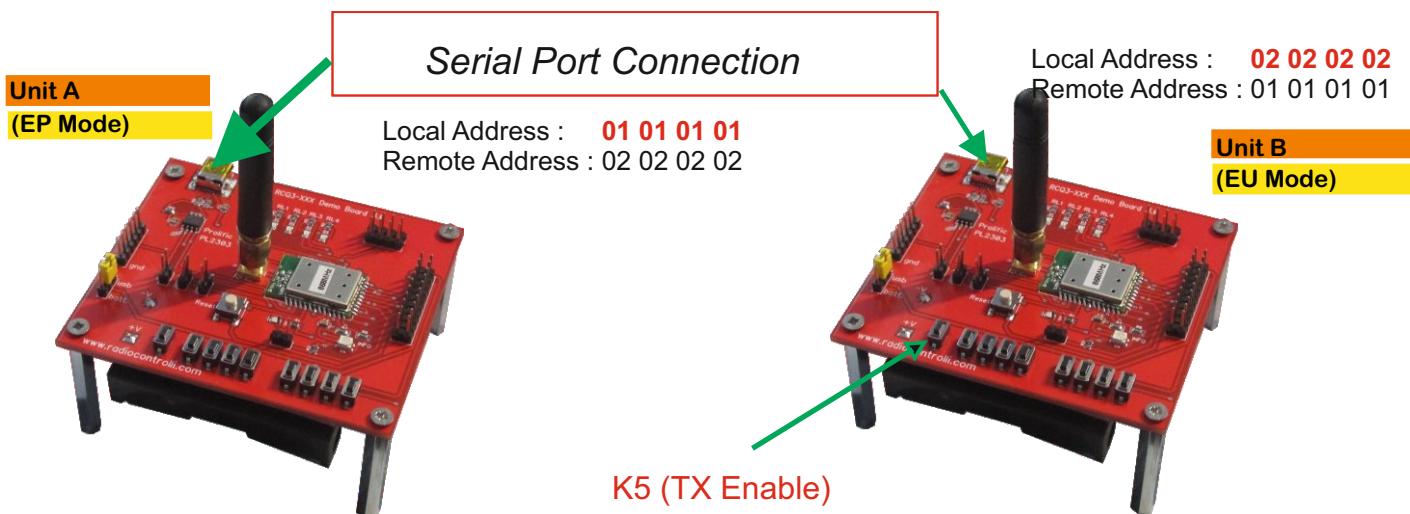
The Device configured in EP Mode immediately transmits the data presented on the serial interface.

If both devices are configured in EP Mode, the system is bidirectional, all characters appearing on the serial interface of Unit A are transmitted to unit B and vice versa.

Example of such one-to-one two-way communication can be found on the next page.

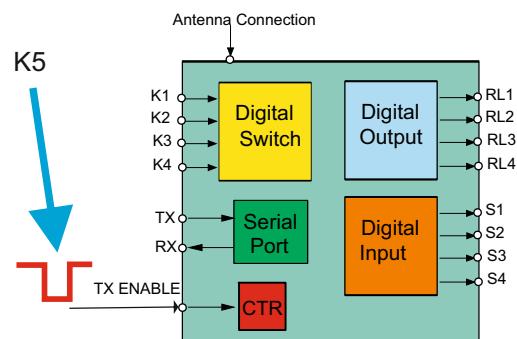
The Radio Modem function can also be used in low consumption mode (EU Mode)

In the example below, unit A is configured in EP Mode and unit B is configured in EU Mode (low consumption).



1 Data transmission from A ----> B

After the appropriate configurations (address) all the data presented on the serial interface of unit A are immediately transmitted to unit B.



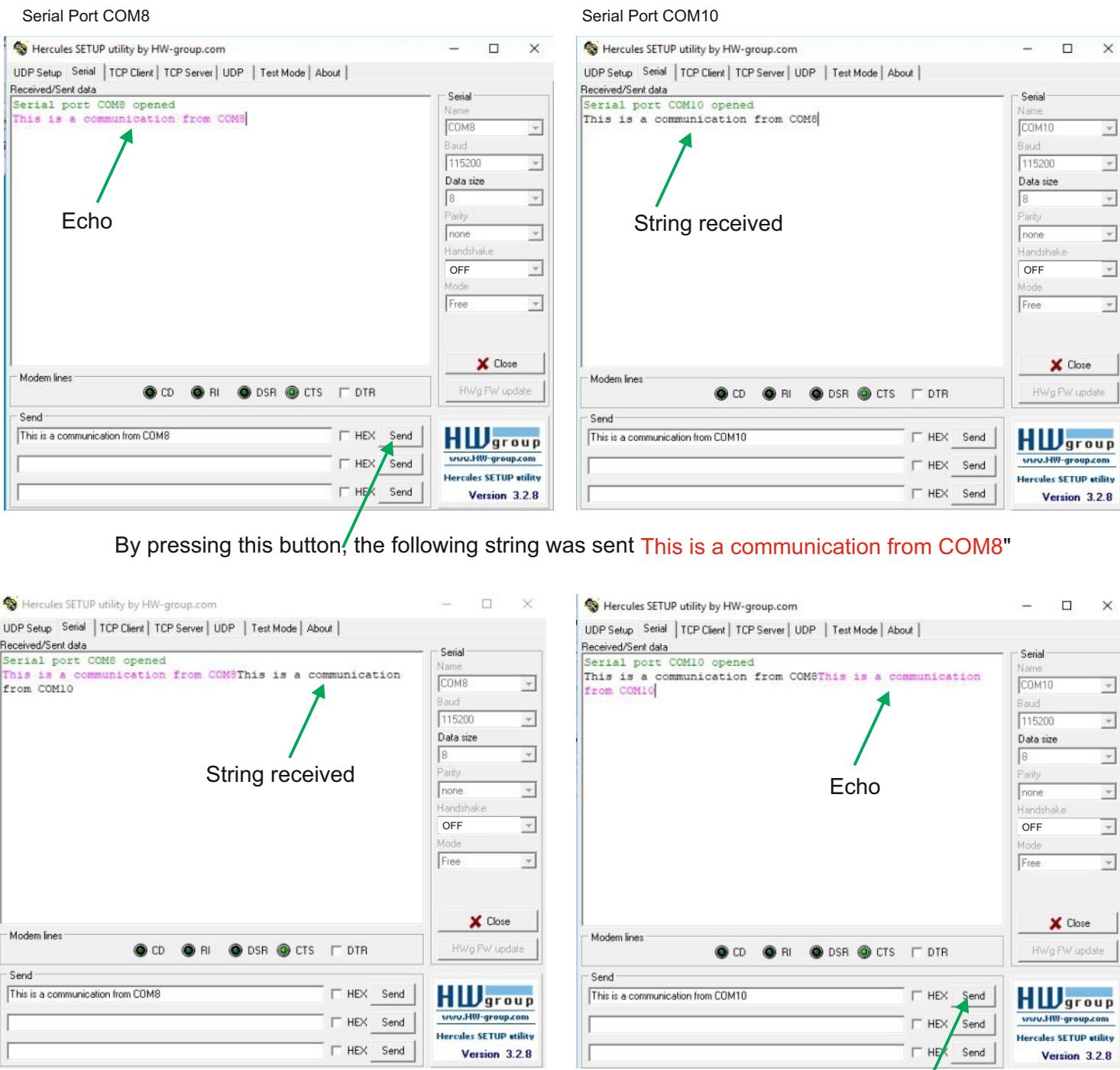
2 Command transmission from B ----> A

Unit B configured in EU Mode is not immediately enabled for data transmission. For which it is necessary:

- 1) Enable TX ENABLE (K5 on evaluation board).
- 2) After enabling the data presented on the serial interface are transmitted to unit A.

15.1 Example of Radio Modem communication (One to One)

This example was performed using the Hercules SETUP software (free use).
The maximum length of the single packet that can be transmitted is 25 bytes.



By pressing this button, the following string was sent **This is a communication from COM8"**

By pressing this button, send the following string:

"This is a communication from COM10"

16 Electrical schematics

