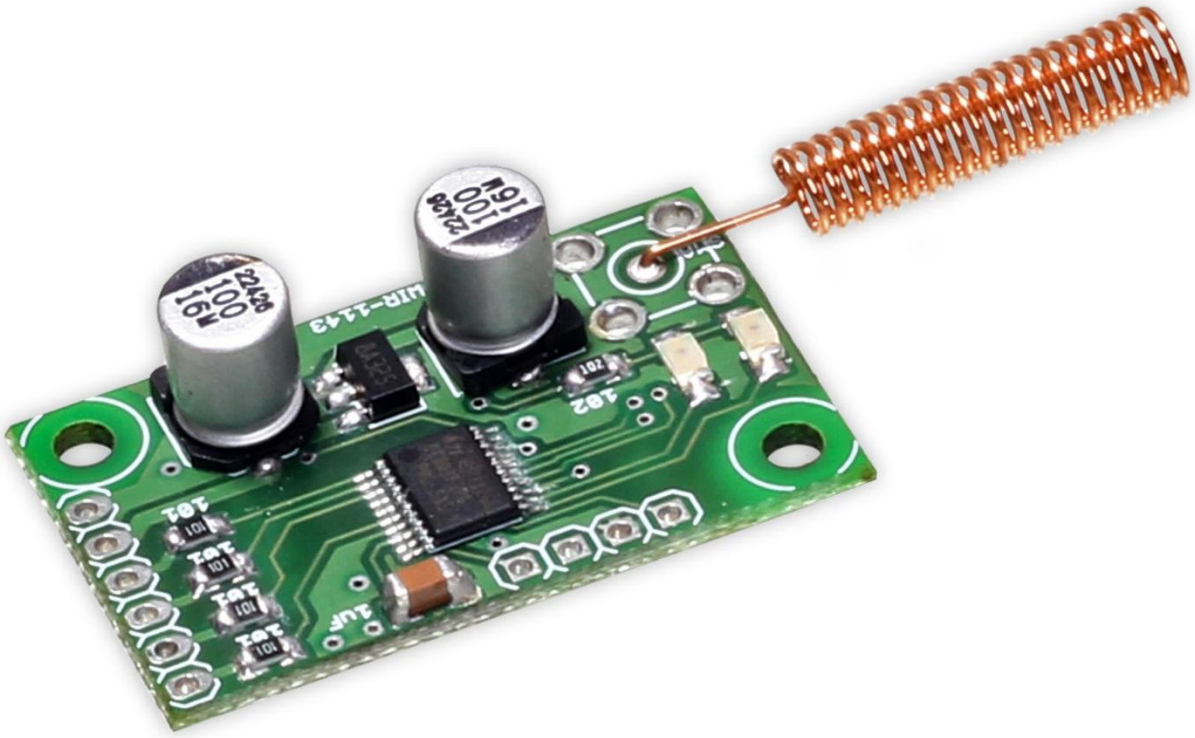


[WIR-1143]433MHzWireless Module (version 3.0) (3.3V)

Contents

1) Features:.... 4
2) Block Diagram.... **Ошибка! Закладка не определена.**
3) Description: 4
4) PIN Configurations.... 4
5) Module Specifications:.... 5
Hardware.... 5
LED Indications.... 5
Warnings.... 5
6) Usage Steps for simple wireless serial link:.... 5
Enabling Acknowledgement, Point-to-Point and Data Hopping.... 6
Entering Configuration Mode:.... 7
128–bit Advanced Encryption Standard (AES).... 8
7) Command List and Parameter Setting (version 1.4, Nov 2014).... 8
Representation of Hexadecimal Numbers:.... 9
Air Data Rate.... 10
UART Baud Rate.... 10
Carrier Frequency.... 10
Repeater Enabled.... 10
RF Transmit Power Level.... 10
Signal Strength Limit.... 11
Signal Strength Mode.... 11
8) Range.... 11
9) Flow Control.... 11
11) Exiting Command mode and Sleep Mode.... 12
12) Frequently Asked Questions (FAQ).... 12
Q1. How to obtain the Received Signal Strength (dBm)?.... 12
Q2. What is the Minimum strength value for robust point-to-point communications?.... 12
Q3. Can I increase the speed of communication?.... 12
Q4. Do more modules on the same network create increased data loss and also make communications slow?.... 12

Q5. What is the maximum number of nodes that can operate on the same network? 12
Q6. Are configurations and mesh address values retained when module is reset or powered off? 12
Q7. How should a repeater module be configured in a mesh? 13
Q8. What is the significance of setting hops using the 'H' command? 13
Q9. What is the significance of Network Address? 13
Q10. How do I simply broadcast messages without waiting for an acknowledgement? 13
Q11. How do I ascertain that the module is waiting for acknowledgements? 13
Q12. What does the RED LED blink signify? 13
Q13. What does the GREEN LED blink signify? 13
Q14. What is the best way to mount this module in a casing or box? 14
Q15. Why isn't the range of my module reaching 2km? What do I need to get my module to give me a range of 2km? 14

1)Features:

- RF center frequency of 433MHz
- Small 22mm x 36mmx3mm form factor. Can fit into almost anything.
- Standard UART interface with hardware flow-control (Clear-to-Send CTS)
- Easy to integrate into current devices that support RS-485, RS-232, RS-422 or 3.3V TTL serial data
- Compatible to 3.3V power-supply and interface
- Maximum output power of +20dBm or 100mW.
- Robust network protocol for point-to-point and data hopping communication
- Listen-before-talk and random back-off algorithm
- 16bit node address and 16bit network address
- Acknowledgement based point-to-point communication with data hopping over repeaters
- Settable channels, baud-rate, air-data rate and RF transmit power
- Configurable parameters, signal-strength limit, ack timeout, network and point address
- Transparent AES Encryption and Decryption on all wirelessly transmitted data

2) Description:

The WIR-1143 module is a low-power wireless communication solution that is ideal for Smart Grid, home automation, smart lighting, industrial sensor data acquisition and remote control applications. This module integrates RF69, an extremely low-power sub-GHz transceiver, an MCU for wireless network control and hardware interface and matching circuitry. Right out- of-the-box this module supports simple point-to-multipoint serial communication over-the-air. It has a small 22mm x 36mm form-factor for easy integration.

This module allows OEMs to easily add wireless sub-GHz capability to their electronic devices. A simple cable replacement model allows the module to be used similarly to a standard serial interface. Full CE compliance and FCC compliance reduces time to market.

The WIR-1143 modules supports data-hopping, listen-before-talk with random back-off algorithm, end-to-end acknowledgement system, node addressing, network addressing and packet CRC. Nodes can be configured to enable hopping of data to increase the range of the communication link. The destination node address is configurable to setup an acknowledgement based point-to-point communication. Without setting the destination data will be broadcasted to all nodes on the same network address.

3) PIN Configurations

Pin No.	Pin Name (left to right)	Description
1	GND	Ground
2	VCC	3.2V – 3.6V supply voltage
3	CTS	Clear to send output to device

4	UART-TX	Module Serial Data input
5	UART-RX	Module Serial Data output
6	PROG	Enter configure mode (active-low)

5) Module Specifications:

Hardware

Parameter	Units	Min	Typ	Max
Channel Frequency	MHz	433MHz	433MHz	435MHz
Supply Voltage	Volt	3.1V	3.3V	3.6V
Current (TX)	mA	45	50	80
Current (RX/idle)	mA	22	23	24
Air Data Rate	kbps	19.2	Settable	76.8
RF Transmit Power	dBm	-10	Settable	+17
UART baud-rate	kbaud	9.6	Settable	115.2
VIH	Volt	2		
VIL	Volt			0.4
VOH	Volt	3	3.2	3.4
VOL	Volt	0	0.05	0.1
IO impedance	Ohm		1000	
OTA Range*	Meter		1km	2km

*Note – Range measurement made at max power of +20dBm, line-of-sight, 10m from ground with 20% Packet Error Rate (PER)

LED Indications

There are two LEDs for user feedback on each WIR-1143 modules.

- The GREEN led depicts the status of the module. It will blink every 2 sec when powered up and active.
- The RED led depicts whether the module is performing a packet transmission or reception process.

Warnings

- The maximum allowable voltage on any of the interface pins with respect to GND is 3.6V
- The maximum input voltage VCC with respect to GND is 3.6V
- The baud rate setting in configure mode is fixed 9600bps
- Do not leave the UART_TX input pin of the module open. The module will send junk data on the wireless channel. It must be pulled up to VCC if not used.

6) Usage Steps for simple wireless serial link:

- Connect the RXD line TXD line of the module to each other for null- modem setup or to Data terminal
- Connect a stable and regulated power supply to the GND and Vin pins

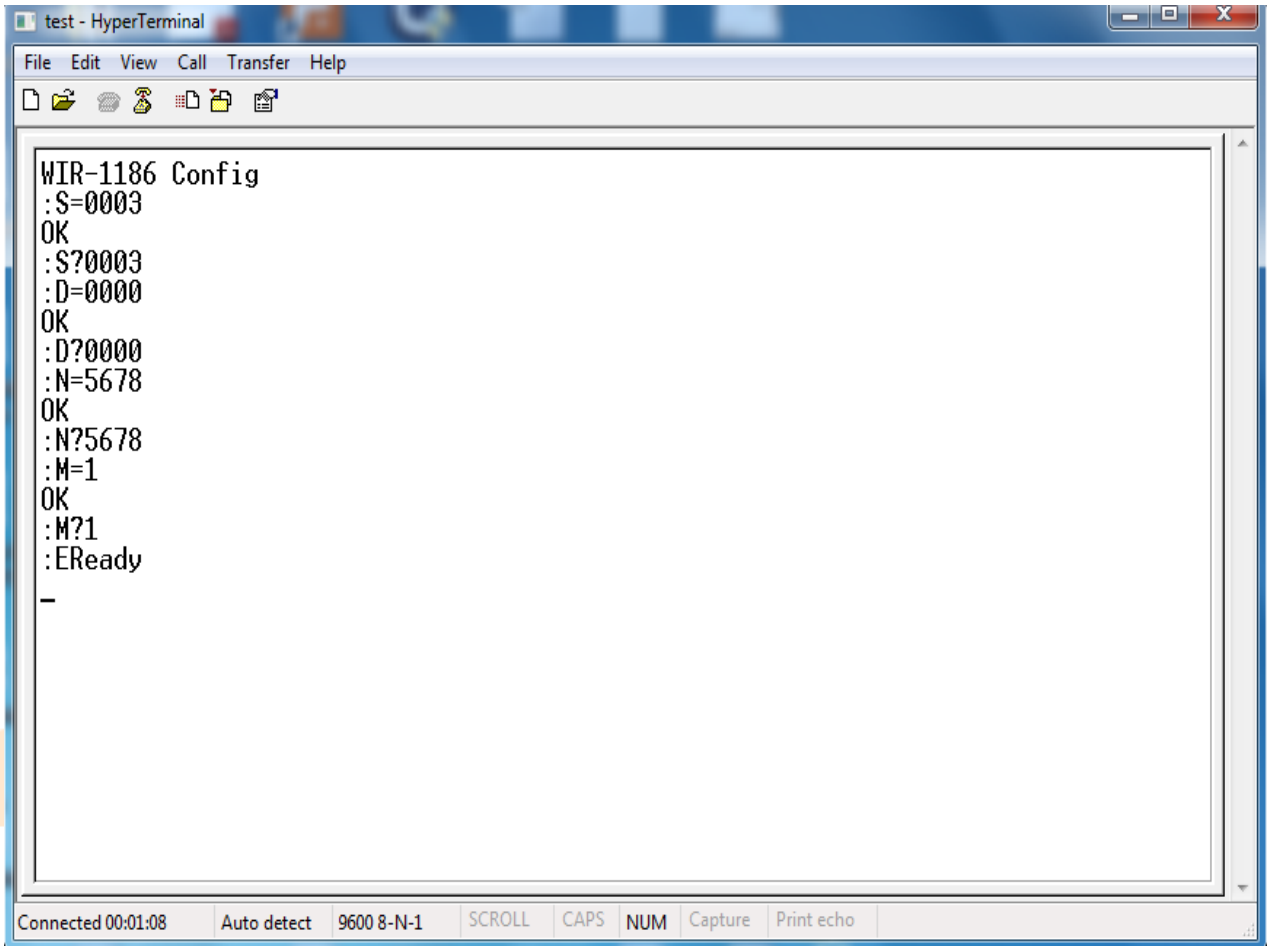
- Notice that the on board RED LED will blink every 2 sec. This means that the module is operating and actively in reception mode to receive any wireless data.
- Connect another module in the similar fashion as described in steps 1 to 3.
- Transmit UART data with baud rate of 9600bps on the TXD line (pin 4.) of the module
- The GREEN led will blink to show that it received the data
- The module at the other end will also blink its GREEN LED to indicate that it is received the data wirelessly
- Data will be received on the UART RXD (Pin 5.) pin of the other module

Enabling Point-to-Point and Data Hopping

- Enter configuration mode by pulling-down the PROG pin
- The module will send "WIR-1143 Config" on its UART output
- Use the command list below to configure the modules parameters
- The 'S' command can be used to read and write the 16-bit address of the node. Note that this should be unique within the network for true point to point communication
- The 'D' command is used to enable Point-to-Point communication and to set the address of the destination node. Now data will only be received by a node with this address.
- The 'M' command can be used to enable the repeater feature on the node. The node will begin to bounce data to other nodes and thus extend the reach of the wireless network

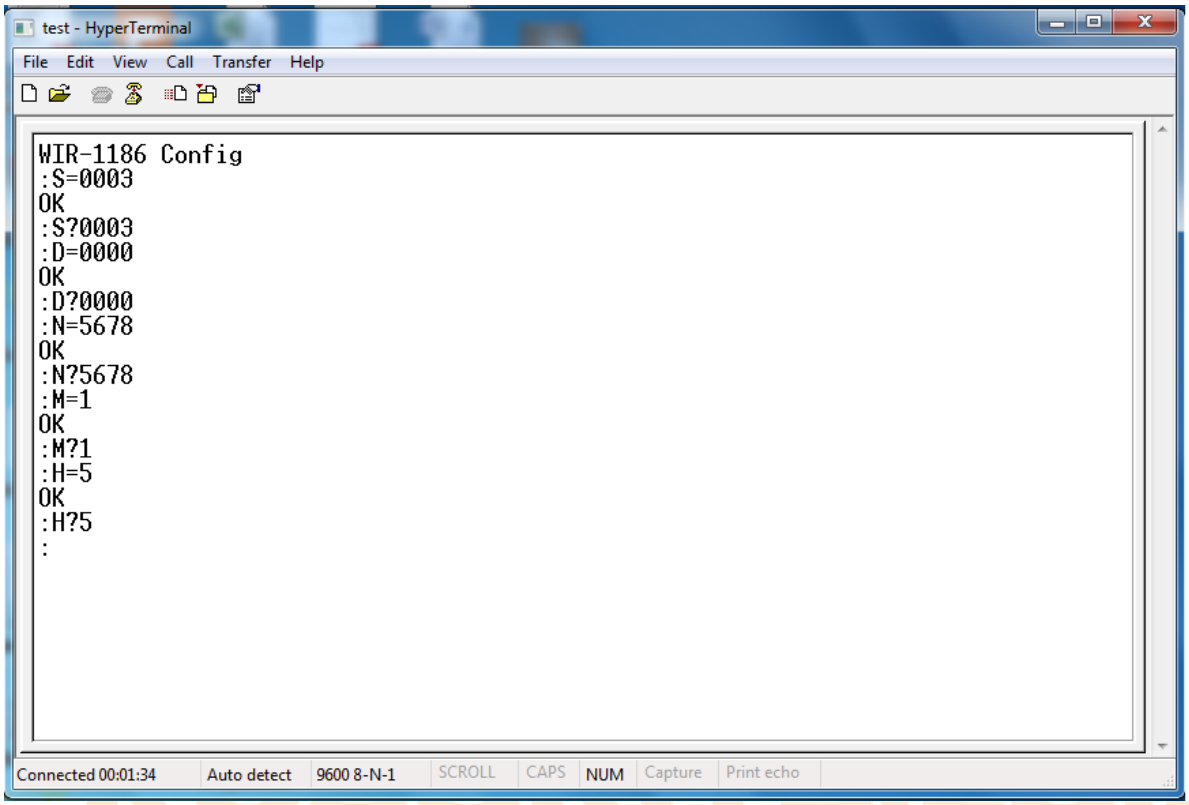
Using Repeater mode

- When the communication range cannot be met directly between two nodes a repeater can be placed in between the two nodes to bounce the packets and increase the range of the link.
- To enable the repeater enter configuration mode.
- Use 'S' command to set a 'unique' 16 bit source address of the repeater module.
- Set the 'M' command value to enable data hopping of the repeater module.
- Set the hop limit (H) to a 'non zero' value.
- Note that all the three nodes are in the same network i.e. 16 bit network address 'N' command is the same on each module.
- The parameters for air data-rate and channel no. 'A',and 'C' should be identical.



Entering Configuration Mode:

Configuration mode can be entered by pulling-down the PROG (pin 3.) to GND. See an example of operating in configuration mode.



Setting of each parameter can be read using their command character followed by a '?' and a carriage return. A new setting value can be written by using the '=' character instead of the '?' character followed by the value to be written and a carriage return. The 'E' command followed by a carriage return is used to exit out of config mode.

128–bit Advanced Encryption Standard (AES)

AES encryption is transparently performed on all data that is transmitted over-the-air and then decrypted at reception before it is printed on UART. The key used for the encryption and decryption process must be the same to recover the original data. The Key is stored in non-volatile memory onboard the module and can be read/written to using the 'K' command in command mode.

7) Command List and Parameter Setting (version 1.4, Nov 2014)

This command list is applicable only in Configuration Mode. Once in Configuration mode the normal functions of the module are suspended. It will no longer be able to receive or send packets. The configuration values of these parameters are stored in a non-volatile memory on board the module. It is not required to set the parameters on a regular basis except for the destination node address which should be written before any point-to-point communication is required.

Parameter	Command Char	Value Range	Parameter Min	Default	Parameter Max	Memory Storage
Air Data Rate	'A'	XX*	38.4kbps	38.4kbps	100kbps	EEPROM
UART Baud Rate	'B'	XX*	9.6kbaud	9.6kbaud	115.2kbaud	EEPROM
RF Channel Frequency	'C'	XX*	433MHz	433MHz	435MHz	EEPROM
Destination ID	'D'	XXXX*	0000	0000	FFFF	RAM
Exit Command Mode	'X'	None	None	None	None	RAM
Hop Limit	'H'	XX*	0	5	100	EEPROM
Repeater Enabled	'M'	XX*	No	No	Yes	EEPROM
Network ID	'N'	XXXX*	0000	00000000	FFFFFFFF	EEPROM
RF TX Power Level	'P'	XX*	-24dBm	+20dBm	+20dBm	EEPROM
Route RSSI Limit	'R'	XX*	-110dBm	-100dBm	-40dBm	EEPROM
Hardware ID	'S'	XXXX*	0000	0000	FFFF	EEPROM
Verbose Mode	'V'	0-1	0	0	1	EEPROM
Deep Sleep	'Z'	None	None	None	None	RAM
128bit Key	'K'	16.. XX*				EEPROM
Restart Module	'E'	None	None	None	None	RAM
Enable Encryption	'I'	0-1	0	1	1	EEPROM

*Representation of Hexadecimal Nos. (For 8bit, 32bit and 128-bit data types in command mode):

Representation of Hexadecimal Numbers:

Destination ID, Network ID and Hardware ID are 16-bit numbers displayed in hexadecimal representation. This means that the hexadecimal number is converted to ASCII before printed on a terminal. Similarly, when a value is entered in an ASCII format it is converted to hexadecimal and stored as a 16-bit number.

For Example:

If Hardware ID is 0x01AA, when the "S?\r\n" string is sent to the module, at 9600bps in command mode, it will display 01AA on a terminal screen. This would be four bytes sent and in decimal it would read as below. These are the ASCII values for these characters.

Byte1: 48
Byte2: 49
Byte3: 65
Byte4: 65

While writing the Destination ID to 0x01BB the string"D=01BB\r\n" must be sent to the module in command mode at 9600bps.

Air Data Rate

Value Stored	Setting
0	19.2kbps
1	38.4kbps
2	76.8kbps

UART Baud Rate

Value Stored	Setting
0	9.6kbaud
1	19.2kbaud
2	38.4kbaud
3	57.6kbaud
4	115.2kbaud

Carrier Frequency

Value Stored	Setting
0	433MHz
3	433.5MHz
6	434MHz
9	434.5MHz
24d or 0x18	435MHz

Repeater Enabled

Value Stored	Setting
0	No Data-Hopping
1	Repeater Function Enabled for Data Hopping

RF Transmit Power Level

Value Stored	Setting
0	+20dBm
1	+10dBm
2	+4dBm
3	-2dBm
4	-8dBm
5	-14dBm
6	-20dBm
7	-24dBm

Signal Strength Limit

Value Stored	Setting
0	-100dBm
1	-90dBm
2	-80dBm
3	-70dBm
4	-60dBm
5	-50dBm
6	-40dBm
7	-30dBm

Signal Strength Mode

Value Stored	Setting
0	Disabled
1	Enabled Signal Strength Display

*Note-This mode should not be used during data transfer. It is only used to check the route formation and healing process and to debug any problems with the network

8) Range

The WIR-1143 module and design have been tested for half duplex communication and reliability in multiple indoor and outdoor settings. Indoor settings and settings involving construction, concrete and metal can vary the results considerably.

- Open Field Range @ 1m from ground: ~270meters
- Open Field Range @ 10m from ground: ~450meters
- Open Field Range @ 30m from ground: ~1000meters

9) Flow Control

The WIR-1143 offers data flow control hardware to allow for zero data over-run and loss when sending large files and data packets. The internal data buffer on the WIR-1143 module is 128bytes. When the data terminal sends a large file for wireless transmission the module will except 128bytes and then set the CTS pin LOW to alert the data terminal to wait for the CTS to back HIGH before sending more data over UART.

11) Exiting Command mode and Sleep Mode

'X' command will exit command mode without resetting the transceiver and MCU, so all RAM variables in transceiver variables are intact. E' command will hard reset the MCU and transceiver. All transceiver registers and RAM registers will be reinitialized on start-up. 'Z' command is deep power down. Transceiver is put in ShutDown and MCU is in lowest power level. Toggle the PROG pin to exit this power down mode. MCU will reset after power down

12) Frequently Asked Questions (FAQ)

Q1. How to obtain the Received Signal Strength (dBm)?

In the configuration mode set 'V' =1 for the module. Now instead of displaying the data received in the packets it will display the signal strength of the received packet. The Signal Strength will be printed in a hexadecimal format and it represents the strength in (–dBm). So, if the strength is printed as "3C" then the signal strength is -60dBm.

Q2. What is the Minimum strength value for robust point-to-point communications?

The RF sensitivity of this module design is around -97dBm. It is advised to set the distance between two nodes so that the signal strength is no-less than -90dBm. This will guarantee less than 1% Packet Error Rate.

Q3. Can I increase the speed of communication?

Yes, the air-data rate and the baud-rate are parameters that can be adjusted to increase the speed of the communication link. Note, that in configuration-mode the module will only operate at 9600bps.

Q4. Do more moduleson the same network create increased data loss and also make communications slow?

Yes and No. A properly configured network with a reasonable application layer protocol should work just fine, irrespective of the number of modules/nodes on the network. But, an incorrectly configured network with too many repeaters or with an unreasonable application layer can definitely slow down or disrupt the network.

Q5. What is the maximum number of nodes that can operate on the same network?

As the WIR-1143 supports 16-bit address for source and destination it can support up to 2^16 nodes on the same network.

Q6. Are configurations and mesh address values retained when module is reset or powered off?

Yes, the WIR-1143 stores all its configurations in non-volatile memory with is retained for the next time the module is powered up.

Q7. How should a repeater module be configured in a mesh?

A module/node that is designated as a repeater should have a configured unique source address using the 'S' command. It should then be enabled as a repeater by assigning the "M=1" command. Now the node will bounce all data packets it receives and thus will extend the range between two nodes in the mesh.

Q8.What is the significance of setting hops using the 'H' command?

The number of hops signifies the number or repeaters expected between a pair of nodes communicating between each other within a mesh. Each hop over a repeater takes a finite amount of time. The Hop Number setting using the 'H' command helps set the wait time for expected acknowledgement. The more the number of repeater hops the longer the acknowledgement will take make it back to the transmitting node. Setting the right amount of hops will guarantee that the transmitter will not initiate a retry even though an acknowledgement for it is on the way. The number of hops will add latency to the communication. It is advised to use flow control CTS pin to make sure the module is not over flowed with data.

Q9. What is the significance of Network Address?

The 16-bit network address signifies the set of modules that are allowed to communicate with each other. This gives an opportunity for multiple modules to operate in the same geographical territory and on the same RF channel.

Q10. How do I simply broadcast messages without waiting for an acknowledgement?

By simply setting the destination address 'D' command to 0000 the module can broadcast the message to all the nodes that are in the same network address without expecting an acknowledgement from them. This is the simplest and fastest way to get data to multiple nodes.

Q11. How do I ascertain that the module is waiting for acknowledgements?

Set the source address and destination address and set the hop number to a value greater than 5. Now when you sent a chunk of data on UART the module will attempt to send it and will wait for an acknowledgement. If the acknowledgement is not received in a finite time signified by the hop number the module will retry a transmission with the same data packet. So, in the same that a node with the specified address does not exist in the network the RED LED of the transmitting module will blink 5 times to signify 5 retries. This is how you would know that it is waiting for an acknowledgement.

Q12. What does the GREEN LED blink signify?

The GREEN led depicts the status of the module. It will blink every 2 sec when powered up and active.

Q13. What does the RED LED blink signify?

The RED led blinks whenever there is a transmission and reception made by the module.

Q14. What is the best way to mount this module in a casing or box?

This module should be mounted in a plastic or non-conductive box and should be around 3mm away from the box surfaces. Conductive material and other electronics must not block away the module from the walls of the box.

Q15. Why isn't the range of my module reaching 2km? What do I need to get my module to give me a range of 2km?

2km is the maximum achievable range in an open-to-air line-of-sight environment with the transmitter and receiver modules mounted at >30m from the surface of the ground. Under these conditions a 2km range can be achieved.

Service and Support

Service and support for this product are available from Robokits India. The Robokits Web site (http://www.robokits.co.in) maintains current contact information for all Robokits products.

Limitations and Warrantees

The **433-435MHz Wireless serial link[WIR-1143]**is intended for personal experimental and amusement use and in no case should be used where the health or safety of persons may depend on its proper operation. Robokits provides no warrantee of suitability or performance for any purpose for the product. Use of the product software and or hardware is with the understanding that any outcome whatsoever is at the users own risk. Robokits sole guarantee is that the software and hardware perform in compliance with this document at the time it was shipped to the best of our ability given reasonable care in manufacture and testing. All products are tested for their best performance before shipping, and no warranty or guarantee is provided on any of them. Of course the support is available on all of them for no cost.

Disclaimer

This product and its documentation are supplied on an as-is basis and no warranty as to their suitability for any particular purpose is either made or implied.

This document provides preliminary information that may be subject to change without notice.