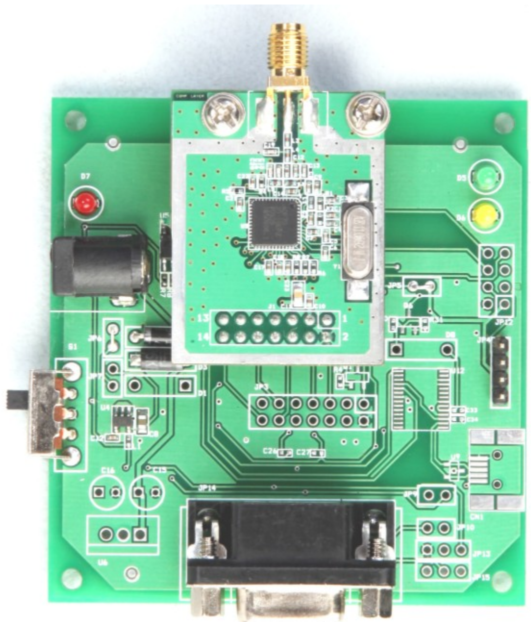

RDSRF-232-A4FZ
RS232 to RF User Configurable in 433 MHz
User Manual

Reindeer Technologies Pvt Ltd

Excellence through Innovation

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Chennai – 600017
India.

Document Revision History

Revision No.	Date	Description/Changes
1.0	26/2/2011	Initial Release

Table of Contents

1 Overview

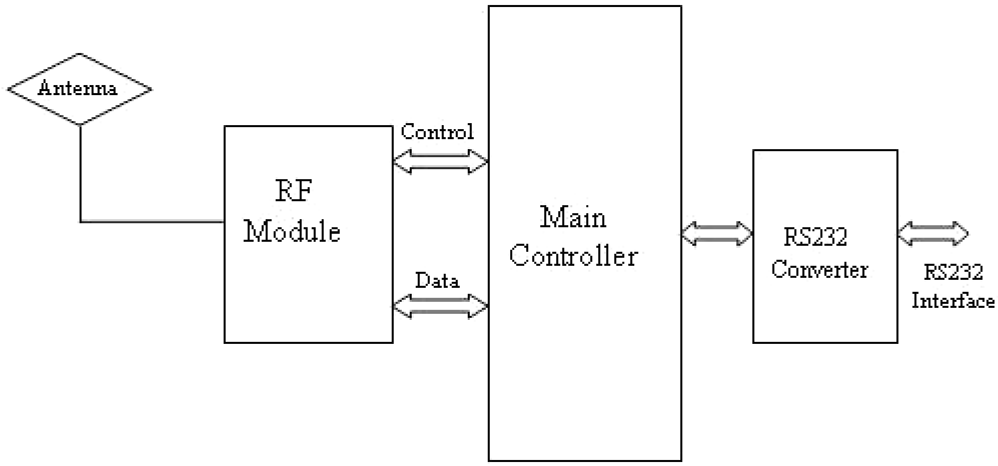


Figure 1: RDSRF-232-A4FZBlock Diagram

The RDSRF-232-A4FZ is single board high performance and low power serial to wireless solution. It is a complete plug and play system where the user can connect two boards and start a wireless communication between them instantaneously. The RDSRF-232-A4FZ can be integrated to existing systems without tedious software or hardware changes. These boards are intended to be used with systems which already have a RS232 interface. This device has a link budget of 120dB making it suitable for applications that require a robust communication from a range of 100 meters to 500 meters line of sight.

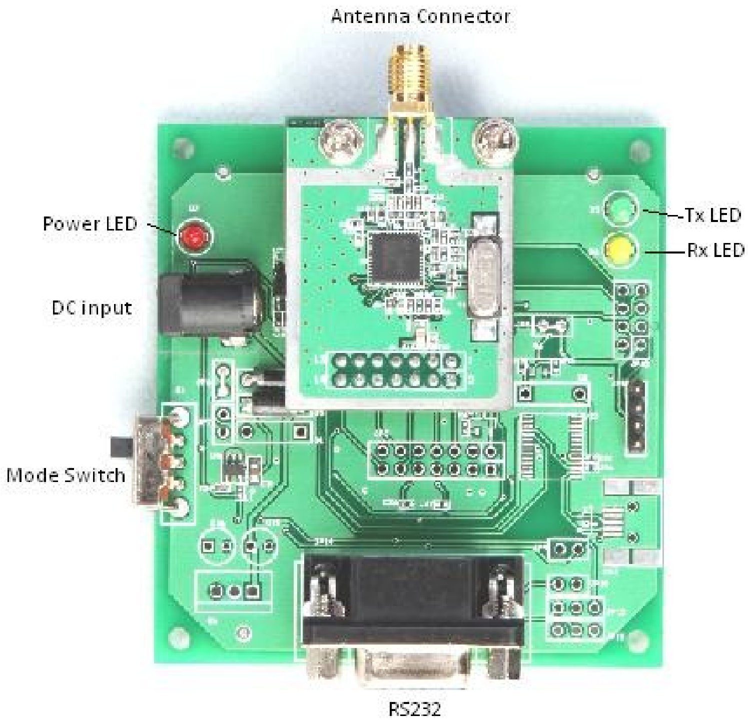
2 Features

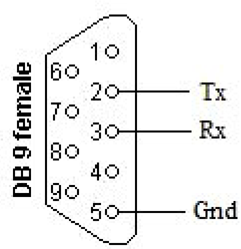
- Direct RS232 to RF converter with built-in level converter
- Transparent RS232 to antenna solution
- Input voltage 5V DC
- Low Power Consumption
- Standard serial and RF baud rates from 1.4 Kbps to 115.2 Kbps possible
- Long range communication from 100 meters to 1000 meters line of sight
- Software based user configuration of frequency, serial and RF baud rate, output power, addressing etc (available in selected models only)

3 Applications

- Direct RS232 wire replacement
- Industrial automation
- Crane control systems
- Textile instrumentation panels
- Instrumentation devices interface
- Digital weighing systems
- Wireless sensor networking
- Remote data logging
- Automated meter reading

4 Connection Details





Pins 1,4,6,7,8,9 are not connected

5 Theory of operation

The RDSRF-232-A4FZ operates in two different modes.

1) Receive Mode
2) Transmit Mode

5.1 Receive Mode

This is the default mode of operation after power on. In this mode the RF module will be in the listen mode, ready to receive data over the air and similarly the main controller will be in the wait mode to receive data either from the RF module or from the RS232.

When data is received from RF module the main controller will receive the data and will transfer it through the Tx line of the RS232 connector (ie. the DB-9 connector).

Upon successful reception of data, the Rx LED will blink to acknowledge the reception.

Alternatively if data is received from the RS232 the main controller will receive all the data and will switch the RF module to transmit mode. After this the data is sent over the air.

5.2 Transmit mode

The RDSRF-232-A4FZ will switch to transmit mode only if data is received by the main controller through the RS232 port. And after successful transmission of the entire data the Tx LED will blink and the RDSRF-232-A4FZwill switch back to receive mode automatically.

6 Data handling in RDSRF-232-A4FZ

The RDSRF-232-A4FZ can transmit or receive any kind of data whether it is in ASCII or hex or in any other format. It has the capability of handling even user defined protocols. The maximum packet size allowed is 1024 bytes per transmission. A small delay has to be present between two packets. This delay will depend on the serial, RF baud rates and also the packet size. The time delay calculation will be explained in detail in the following section.

If the user packet length exceeds 1024 bytes an error message will be displayed as shown below

<ERROR – Maximum Packet Size Exceeded>

The unit also has an inbuilt CRC check. A valid output is receiver on the output of the receiver only if the CRC check has passed. If the CRC check has failed the following error message will be displayed.

<ERROR – CRC Check Failed>

7 Time Delay Calculations

As discussed in the previous section the maximum allowed packet size in RDSRF-232-A4FZ is 1024 bytes. And a time delay is required in between two packets.

7.1 Example 1:

The serial port settings are

Baud Rate : 9600 bps
Parity : None
Data Bits : 8
Stop Bits : 1

The RF settings are

Baud Rate : 9600 bps

The time delay needed for a packet size of 1024 bytes can be calculated as shown below

Packet size = 1024 bytes

Time taken by the main controller to receive the entire packet = (1024 * 10)/9600.
= 1.066 Sec.

The time taken to transmit the entire packet = ((1024+1024+5)*8)/9600
= 1.711 Sec.

Adding both the time we get a total time of = 1.066+1.711
= 2.77 Sec

Adding an extra buffer time of 10% the total time delay between two packets of size 1024 byte will be 3 Sec.

7.2 Example 2:

The serial port settings are

Baud Rate : 9600 bps
Parity : None
Data Bits : 8
Stop Bits : 1

The RF settings are

Baud Rate : 9600 bps

The time delay needed for a packet size of 255 bytes can be calculated as shown below

Packet size = 255 bytes

Time taken by the main controller to receive the entire packet = (255 * 10)/9600.
= 0.266 Sec.

The time taken to transmit the entire packet = ((255+255+5)*8)/9600
= 0.429 Sec.

Adding both the time we get a total time of = 0.266+0.429
= 0.695 Sec or 695 ms.

Adding an extra buffer time of 10%, the total time delay between two packets of size 1024 byte will be 0.760 Sec or 760 ms.

7.3 General Equation for calculating time delay:

In general the time delay between packets can be calculated using the below equation.

Time delay between packets = Time 1 + Time 2 + (10% of (Time 1 + Time 2))

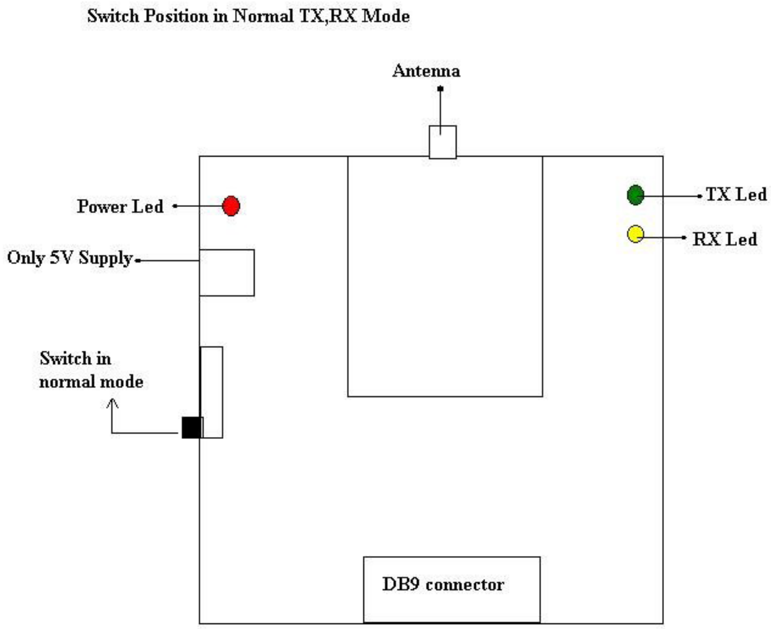
Where

Time 1 = (No. of bytes * 10) / serial baud rate

And

Time 2 = (((2 * No. of bytes) + 5) * 8) / RF Baud rate

8 User Configuration Mode



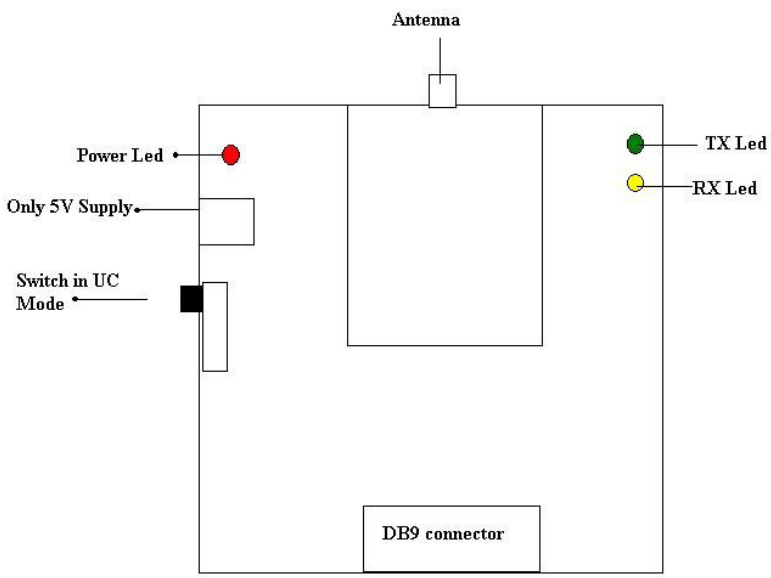


Figure3: Mode settings

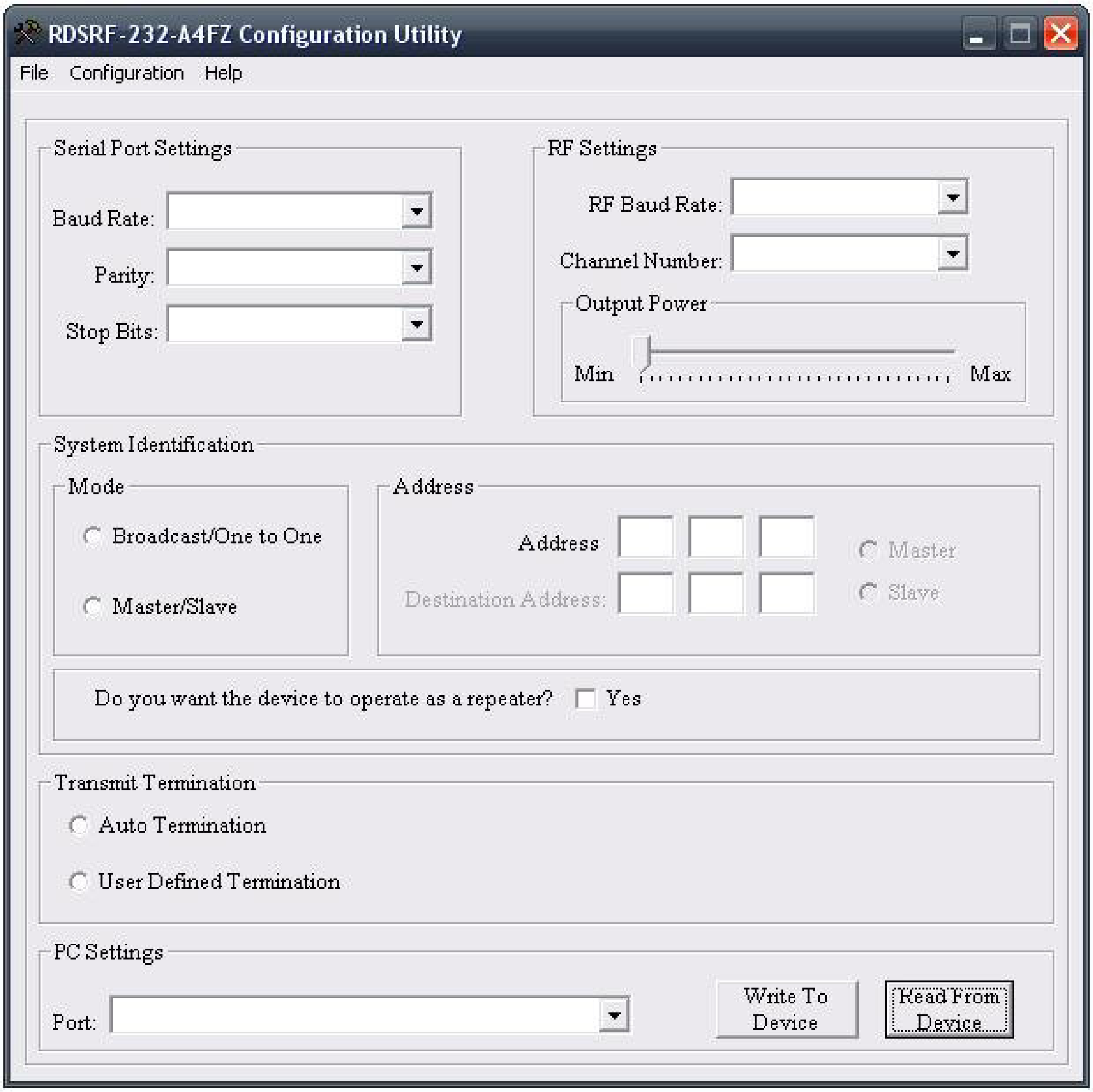


Figure4: Screenshot of Wireless Module Configuration Utility

Procedure for using the user configuration mode

1) Change the RDSRF-232-A4FZ to configuration mode by changing the switch position as shown in figure1.

2) Power on the unit.

3) Run the software on a PC having a serial port.

4) Select all the settings as mentioned below.
   - a) Serial baud rate
     The Serial baud rate can be varied from 1.2 Kbps to 115.2 Kbps.
   - b) Serial parity
     The Parity can be set to either Even, Odd or None.
   - c) Serial stop bits
     The stop bits can be set to either 1 or 2
   - d) RF baud rate
     The RF baud rate can be set from 1.4 Kbps to 38.4 Kbps
   - e) RF channel
     The RF channel can be varied from channel 0 to channel 18
   - f) RF power output
     The RF output can be varied from -16 to +13 dBm.
   - g) Address
     This option can be used to set the address of the devices
   - h) Select whether the unit behaves as a repeater.
   - i) Transmit Termination
     This option can be used to select whether the transmission should start automatically or based on any specific used command.
   - j) COM port
     This option is used to select the PC COM port

5) Now use the “Write to Device” button to download the settings to the unit.

6) Upon successful download the message “Programming Successful” is displayed, in case of any error the message “Programming Not Successful Reset the device and try again” will appear. In case of error power off the unit and repeat from step1.

Note:

Higher RF power output setting and lower RF baud rate setting will result in better communication range. More details on these settings are available in the software help file.

9. Ordering Information

Product part Number	Description
RDSRF-232-A4FZ	RS232 to RF Module in 433 MHz

10 Electrical Specifications

Parameter	Min	Max	Units
VCC – Power Supply		5	V DC
Operating Temperature	-40	+85	°C
RF output power		+13	dBm
Frequency of operation		433	MHz
Transmit Current consumption		33	mA
Receive current Consumption		30	mA

11 Accessories

The below mentioned accessories are available upon request. The cost of the product does not include these accessories.

1) Antenna

The antenna is mandatory for normal operation. The type of antenna can be selected from the wide ranges of antennae available in our website.

Note: - The device should not be operated without antenna.

2) Power Supply

Power adapters for the unit are available upon request.

3) Serial Cable

RS232 Serial cables are provided upon request

Note: - This product comes without a casing.

12. Contact Us

12.1 Technical Support

Reindeer Technologies Pvt Ltd has built a solid technical support infrastructure so that you can get answers to your questions when you need them.

Our technical support engineers are available Mon-Fri between 9:30 am and 6:00 pm Indian standard time. The best way to reach a technical support engineer is to send an email to *support@reindeersystems.com*. E-mail support requests are given priority because we can handle them more efficiently than phone support requests.

12.2 Sales Support

Our sales department can be reached via e-mail at *sales@reindeersystems.com* or by phone at 91-44-45022335/42606907.

Our sales department is available Mon-Fri between 9:30 am and 6:00 pm.

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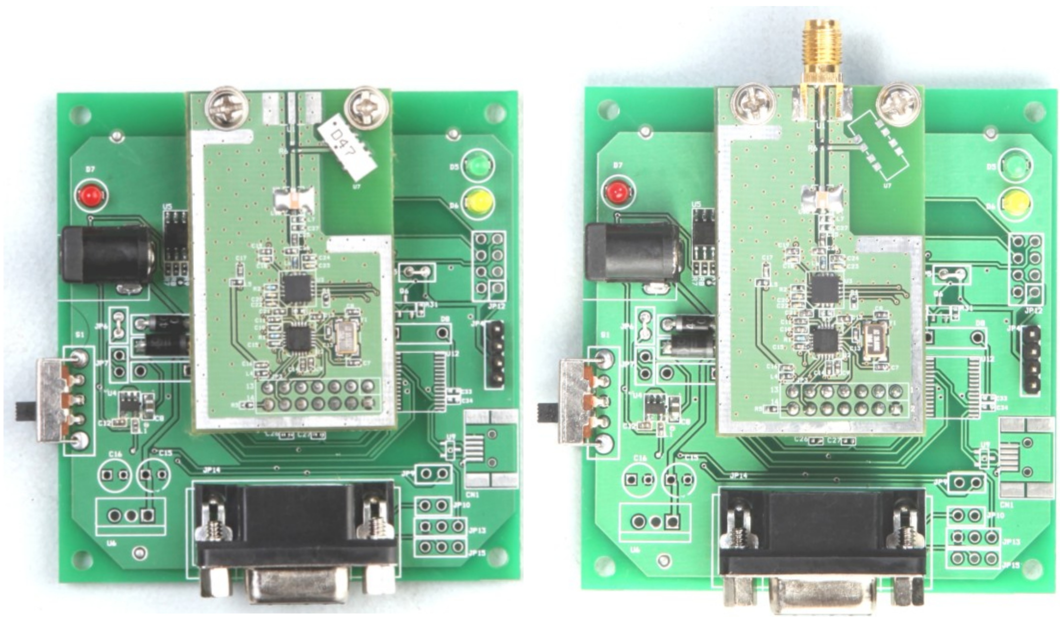
Website: *www.reindeersystems.com*



RDSRF-232-T24FZ-LR-SMA/CA
RS232 to RF User Configurable in 2.4 GHz
User Manual

Reindeer Technologies Pvt Ltd

Excellence through Innovation

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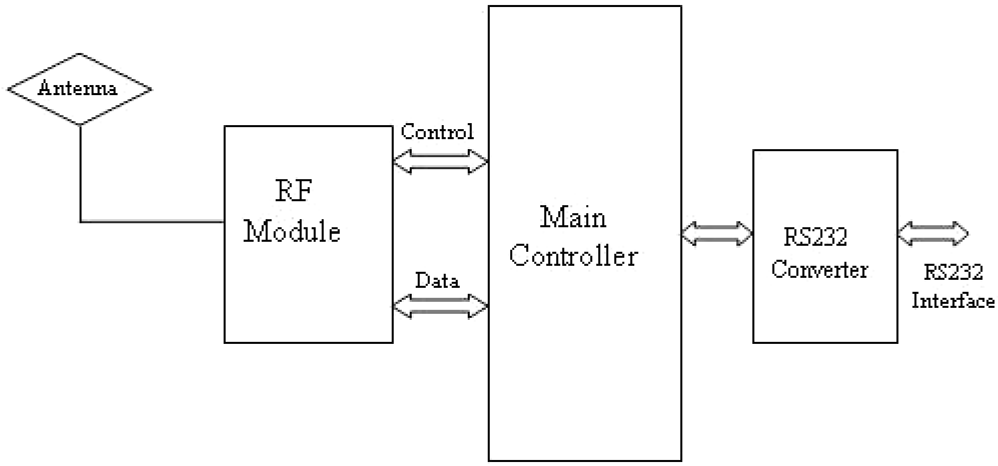


Figure 1: RDSRF-232-T24FZ-LR-SMA/CA Block Diagram

The RDSRF-232-T24FZ-LR-SMA/CA is single board high performance and low power serial to wireless solution. It is a complete plug and play system where the user can connect two boards and start a wireless communication between them instantaneously. The RDSRF-232-T24FZ-LR-SMA/CA can be integrated to existing systems without tedious software or hardware changes. These boards are intended to be used with systems which already have a RS232 interface.

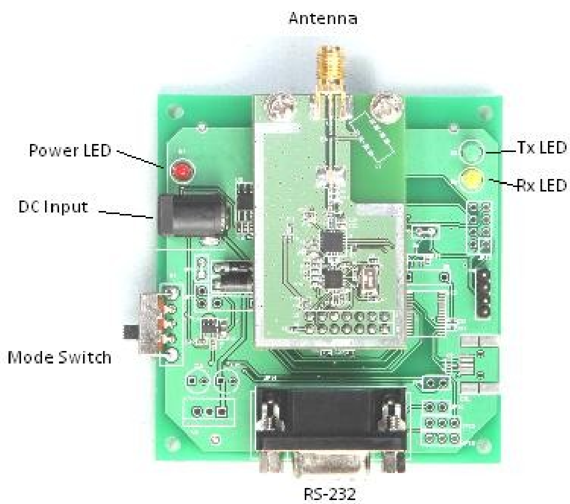
2 Features

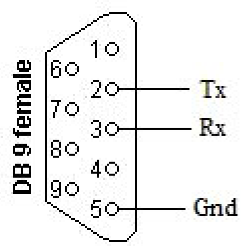
- Direct RS232 to RF converter with built-in level converter
- Transparent RS232 to antenna solution
- Input voltage 5V DC
- Low Power Consumption
- Standard serial and RF baud rates from 1.4 Kbps to 115.2 Kbps possible
- Long range communication from 100 meters to 1000 meters line of sight
- Software based user configuration of frequency, serial and RF baud rate, output power, addressing etc (available in selected models only)

3 Applications

- Direct RS232 wire replacement
- Industrial automation
- Crane control systems
- Textile instrumentation panels
- Instrumentation devices interface
- Digital weighing systems
- Wireless sensor networking
- Remote data logging
- Automated meter reading

4 Connection Details





Pins 1,4,6,7,8,9 are not connected

5 Theory of operation

The RDSRF-232-T24FZ-LR-SMA/CA operates in two different modes.

1) Receive Mode
2) Transmit Mode

5.1 Receive Mode

This is the default mode of operation after power on. In this mode the RF module will be in the listen mode, ready to receive data over the air and similarly the main controller will be in the wait mode to receive data either from the RF module or from the RS232.

When data is received from RF module the main controller will receive the data and will transfer it through the Tx line of the RS232 connector (ie. the DB-9 connector).

Upon successful reception of data, the Rx LED will blink to acknowledge the reception.

Alternatively if data is received from the RS232 the main controller will receive all the data and will switch the RF module to transmit mode. After this the data is sent over the air.

5.2 Transmit mode

The RDSRF-232-T24FZ-LR-SMA/CA will switch to transmit mode only if data is received by the main controller through the RS232 port. And after successful transmission of the entire data the Tx LED will blink and the RDSRF-232-T24FZ-LR-SMA/CA will switch back to receive mode automatically.

6 Data handling in RDSRF-232-T24FZ-LR-SMA/CA

The RDSRF-232-T24FZ-LR-SMA/CA can transmit or receive any kind of data whether it is in ASCII or hex or in any other format. It has the capability of handling even user defined protocols. The maximum packet size allowed is 1024 bytes per transmission. A small delay has to be present between two packets. This delay will depend on the serial, RF baud rates and also the packet size. The time delay calculation will be explained in detail in the following section.

7 Time Delay Calculations

As discussed in the previous section the maximum allowed packet size in RDSRF-232-T24FZ-LR-SMA/CA is 1024 bytes. And a time delay is required in between two packets.

7.1 Example 1:

The serial port settings are

Baud Rate : 9600 bps
Parity : None
Data Bits : 8
Stop Bits : 1

The RF settings are

Baud Rate : 9600 bps

The time delay needed for a packet size of 1024 bytes can be calculated as shown below

Packet size = 1024 bytes

Time taken by the main controller to receive the entire packet = (1024 * 10)/9600.
= 1.066 Sec.

The time taken to transmit the entire packet = ((1024+1024+5)*8)/9600
= 1.711 Sec.

Adding both the time we get a total time of = 1.066+1.711
= 2.77 Sec

Adding an extra buffer time of 10% the total time delay between two packets of size 1024 byte will be 3 Sec.

7.2 Example 2:

The serial port settings are

Baud Rate : 9600 bps
Parity : None
Data Bits : 8
Stop Bits : 1

The RF settings are

Baud Rate : 9600 bps

The time delay needed for a packet size of 255 bytes can be calculated as shown below

Packet size = 255 bytes

Time taken by the main controller to receive the entire packet = (255 * 10)/9600.
= 0.266 Sec.

The time taken to transmit the entire packet = ((255+255+5)*8)/9600
= 0.429 Sec.

Adding both the time we get a total time of = 0.266+0.429
= 0.695 Sec or 695 ms.

Adding an extra buffer time of 10%, the total time delay between two packets of size 1024 byte will be 0.760 Sec or 760 ms.

7.3 General Equation for calculating time delay:

In general the time delay between packets can be calculated using the below equation.

Time delay between packets = Time 1 + Time 2 + (10% of (Time 1 + Time 2))

Where

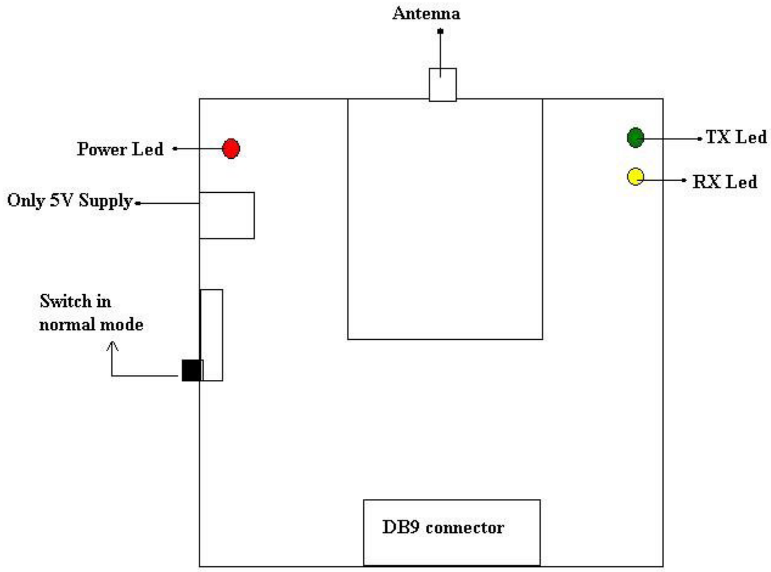
Time 1 = (No. of bytes * 10) / serial baud rate

And

Time 2 = (((2 * No. of bytes) + 5) * 8) / RF Baud rate

8 User Configuration Mode

Switch Position in Normal TX,RX Mode



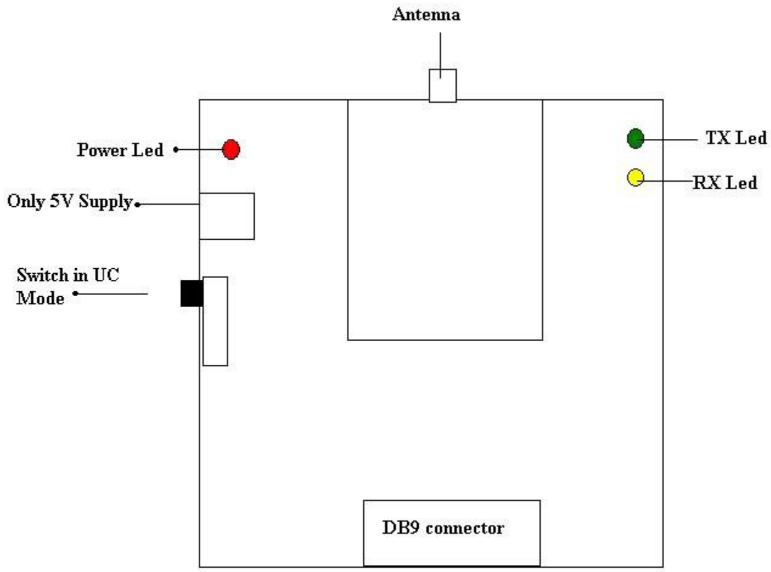


Figure3: Mode settings

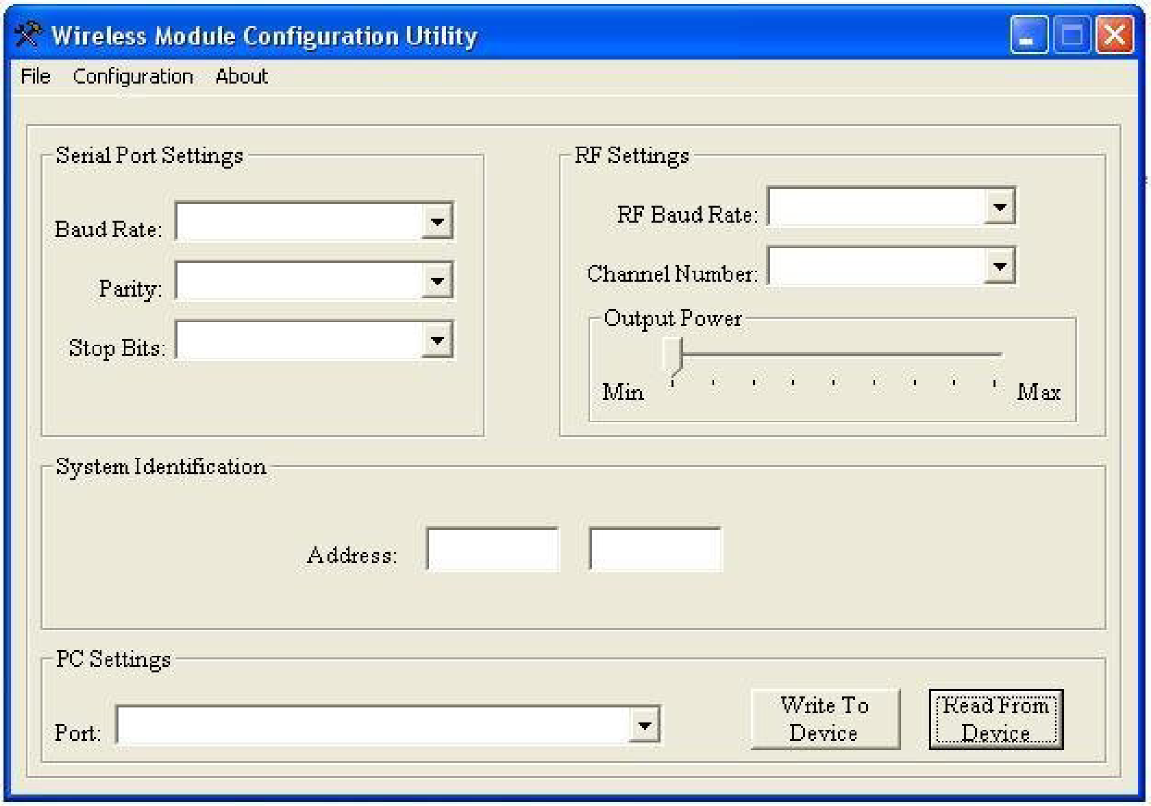


Figure4: Screenshot of Wireless Module Configuration Utility

Procedure for using the user configuration mode

1) Change the RDSRF-232-T24FZ-LR-SMA/CA to configuration mode by changing the switch position as shown in figure1.

2) Power on the unit.

3) Run the software on a PC having a serial port.

4) Select all the settings as mentioned below.

a) Serial baud rate

The Serial baud rate can be varied from 1.2 Kbps to 115.2 Kbps.

b) Serial parity

The Parity can be set to either Even, Odd or None.

c) Serial stop bits

The stop bits can be set to either 1 or 2

d) RF baud rate

The RF baud rate can be set from 1.4 Kbps to 250 Kbps

e) RF channel

The RF channel can be varied from channel 0 to channel 18

f) RF power output

The RF output can be varied from -5 to +20 dBm.

g) Address

This option can be used to set the address of the devices

h) Select whether the unit behaves as a repeater.

i) Transmit Termination

This option can be used to select whether the transmission should start automatically or based on any specific used command.

j) COM port

This option is used to select the PC COM port

5) Now use the "Write to Device" button to download the settings to the unit.

6) Upon successful download the message "Programming Successful" is displayed, in case of any error the message "Programming Not Successful Reset the device and try again" will appear. In case of error, power off the unit and repeat from step 1.

Note:

Higher RF power output setting and lower RF baud rate setting will result in better communication range.

9. Ordering Information

Product part Number	**Description**
RDSRF-232-T24FZ-LR-SMA	RS232 to RF Module in 2.4 GHz with External Antenna
RDSRF-232-T24FZ-LR-CA	RS232 to RF Module in 2.4 GHz with Internal Antenna

10 Electrical Specifications

Parameter	Min	Max	Unit
Vcc – Power Supply	5	5	V
Operating temperature	-40	+85	°C
RF Output Power	-5	+20	dBm
Frequency of operation	2.40	2.5	GHz
Transmit Current @+20 dBm		90	mA
Receive Current		33	mA

11 Accessories

The below mentioned accessories are available upon request. The cost of the product does not include these accessories.

1) Antenna

The antenna is mandatory for normal operation. The type of antenna can be selected from the wide ranges of antennae available in our website.
Note: - The device should not be operated without antenna.

2) Power Supply

Power adapters for the unit are available upon request.

3) Serial Cable

RS232 Serial cables are provided upon request

Note: - This product comes without a casing.

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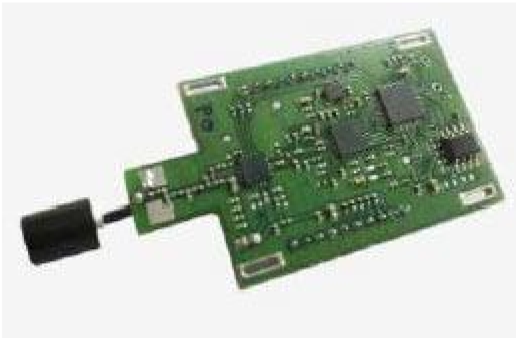

RDM-A8FZLR
Long Range RF Transceiver Module for 850 to 870 MHZ
Datasheet

Reindeer Technologies Pvt Ltd

Excellence Through Innovation

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Rajamannar Street, T Nagar,
Chennai – 600017
India.

Document Revision History

Revision No.	Date	Description/Changes
1.0	14/3/2011	Initial Release

Table of Contents

1. General Description

This document describes the hardware and firmware features of RDM-A8FZLR, long range RF Module. The module works as a high power RF transceiver, to transmit the data given through the UART. The module has UART data interface and do the RF transmission at 865MHz to 867MHz (License free frequency band for RFID operations in India). The integrated RF front end gives an output power of +27dBm. Most of the RF parameters and other network parameters can be configured to the module through the AT command interface which makes it flexible for use. The UART data transfer between the Host processor and the high power UART module is done with three handshaking signals (RTS/CTS/EOF).

2. Features

- Long range, high performance transceiver Module
- Frequency bands
  850 MHz to 870 MHz
- Data rates supported
  1 kbps to 300 kbps
- 3.3 to 3.6 V power supply
- Configurable Power outputs
- Receiver sensitivity (BER)
  −116 dBm at 1.0 kbps, 2FSK, GFSK
  −107.5 dBm at 38.4 kbps, 2FSK, GFSK
  −102.5 dBm at 150 kbps, GFSK, GMSK
  −100 dBm at 300 kbps, GFSK, GMSK
  −104 dBm at 19.2 kbps, OOK
- Very low power consumption
  18mA in PHY_RX mode (Max front-end gain)
  247mA in PHY_TX mode (27dBm output)
  30 µA in PHY_SLEEP Mode
  17 µA in PHY_SLEEP Mode (Deep Sleep Mode 1)
- RF output power of 9 dBm to +24.1dBm
- Digital received signal strength indication (RSSI) Request
- 240 byte Packet Buffer for TX/RX data
- Efficient UART data interface
- AT Command Interface for Configuration of parameters

3. Applications

- Smart Metering
- IEEE 802.15.4g
- Wireless MBUS
- Home Automation
- Process and Building Control
- Wireless Sensor Networks (WSNs)
- Wireless Healthcare

4. Pin Configuration and Function Description

The High power UART module has 2 x 10 headers (JP3 and JP4) for interfacing with host microcontroller. Figure 1 shows the pin diagram of high power UART Module. And the description of each pin's functionality is given in Table 4.1. All the pins operate at the voltage levels of 0V to 3.3V. The supply for the High Power UART Module should be 3.3V regulated power supply capable of delivering maximum current of 300mA. TDO, TDI, TMS and TCK pins can be used to upgrade the firmware of the processor. The RF module has three general purpose I/Os which can be customized for a particular application Scenario.

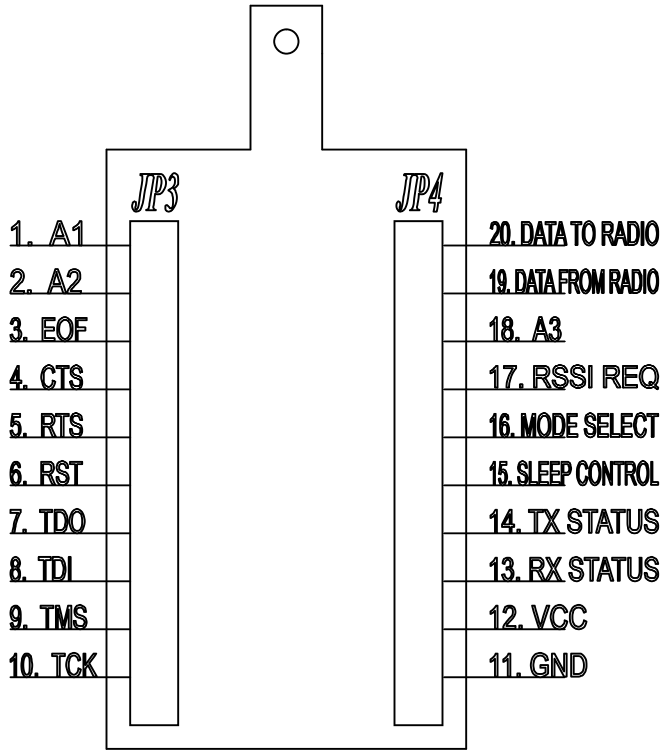


Figure 1. High Power UART Module –Pin Diagram

4.1 Pin Descriptions for High Power UART Module

S.No	Pin Signal	Direction	Description
1.	A1	I/O	General Purpose Input/Output
2.	A2	I/O	General Purpose Input/Output
3.	EOF	I	End of Frame: This signal is used to indicate the end of frame for the UART data given from the host processor. The rising edge is given at this pin to indicate the end of frame.
4.	CTS	O	Clear To Send: This is the signal given by the RF module to indicate that the module is ready to receive further UART data.
5.	RTS	I	Request to Send: This signal has to be given from the host processor as a request to send UART data. If the RF module is not busy, it will give CTS in response.

6.	RST	I	Reset: It is the reset signal of the processor in the RF Module.
7.	TDO	O	Test data output port.
8.	TDI	I	Test data input
9.	TMS	I	Test mode select. TMS is used as an input port for device programming and test.
10.	TCK	I	Test clock. TCK is the clock input port for device programming and test.
11	GND	I	Ground or Negative of 3.3V Supply.
12.	VCC	I	Positive of 3.3V supply.
13.	RX STATUS	O	The logic level of this signal toggles after every reception. This can be used to check the reception status
14	TX STATUS	O	The logic level of this signal toggles after every RF transmission. This can be used to check the transmission status.
15	SLEEP CONTROL	I	When the rising edge is detected at this pin, the RF module goes into sleep state. The RF module wakes up if UART reception happens or the rising edge at any one of the following pins - RSSI REQ/MODE SELECT/ SLEEP CONTROL /RTS/ RST.
16.	MODE SELECT	I	The rising edge at this pin causes the RF module to enter into the Command Mode. Entering into command mode enables the host processor to give the AT Commands to change the settings.
17.	RSSI REQ	I	RSSI REQUEST: This signal is used to get the RSSI value. Once the rising edge at this pin is detected, the RF module gives 1 byte RSSI value in dBm (without sign) to UART.
18.	A3	I	General Purpose I/O
19.	DATA FROM RADIO	O	UART Data Output from the RF Module to the Host Processor.
20.	DATA TO RADIO	I	UART data input to the RF module from the host processor.

5. Electrical Specifications

5.1 General Specifications

Parameter	Min	Typ	Max	Unit
Frequency Range	850		870	MHz
Data Rate	1		300	Kbps
Operating Temperature	-40		+85	°C
Supply Voltage	3.3		3.6	V
Transmit Current Consumption				
9 dBm		73.8		mA
11 dBm		75.8		mA
17 dBm		101.8		mA
20 dBm		167.0		mA
22 dBm		203.4		mA
Receiver Current Consumption		20		mA
Sleep Current Consumption		17		µA

5.2 Transmitter Specifications

Parameter	Min	Typ	Max	Unit
Maximum Power		+27		dBm
Minimum Power		9		dBm
Harmonics				
Second Harmonic		-34.8		dBm
Third Harmonic		-33		dBm
Fourth Harmonic		-62		dBm
Fifth Harmonic		-56		dBm

5.3 Antenna Specifications

Parameter	Min	Typ	Max	Unit
Frequency Range	850		870	MHz
Bandwidth		25		MHz
Wavelength		¼ wave		
VSWR		≤ 2		
Impedance		50		Ohm

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although this product features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

6. Interfacing with Microcontroller

6.1 General

To interface the High Power RF Module with the host processor the typical hardware connections has to be done as shown in Figure 2.

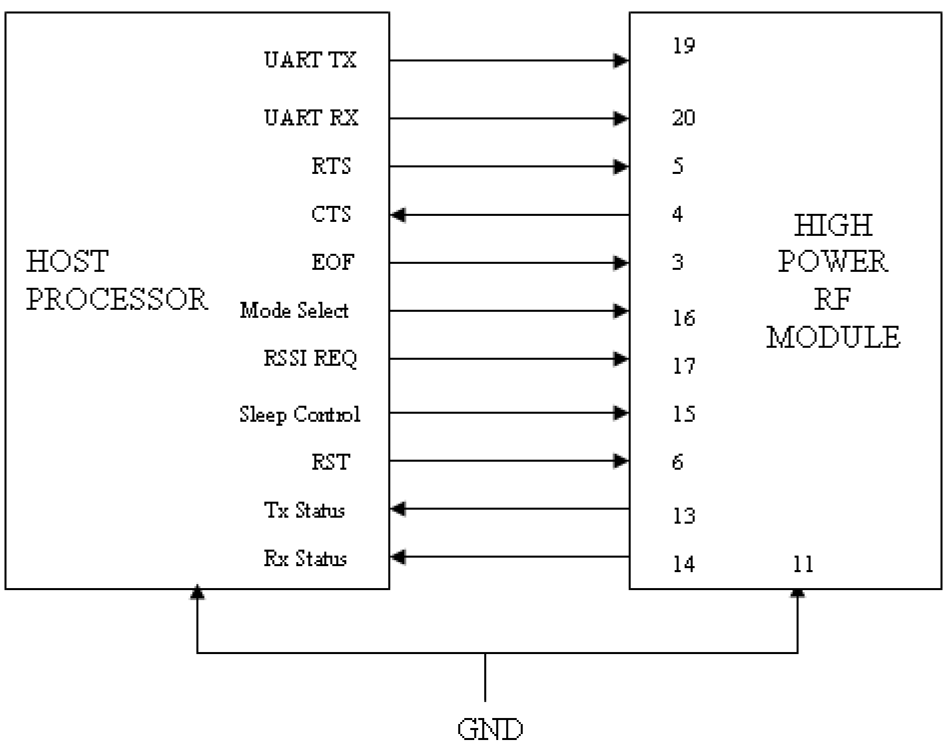


Figure 2: Typical Hardware Connection Diagram

To transmit the data wirelessly, the host processor has to send the data through UART to the RF module. This data transfer has to happen after the two way handshake using RTS/CTS. That is, when the host processor has the data to transmit, it has to send the

RTS signal. After detecting the rising edge of the RTS signal, the RF module issues a CTS signal if it is not busy. It is recommended to connect the CTS signal to the interrupt of the host processor. Figure 3 shows the signals associated with the basic data transfer. After getting the CTS signal, the host processor can send the UART data to RF module with the baud rate set by the processor. The default baud rate used is 19200 bps. And the baud rate for the UART communication can be changed by the AT Commands. After the transmission of UART data, the End Of Frame (EOF) has to be given to initiate the wireless transmission of the data. Otherwise if the EOF is not given from the host processor for 200ms then the RF module transmits the data.

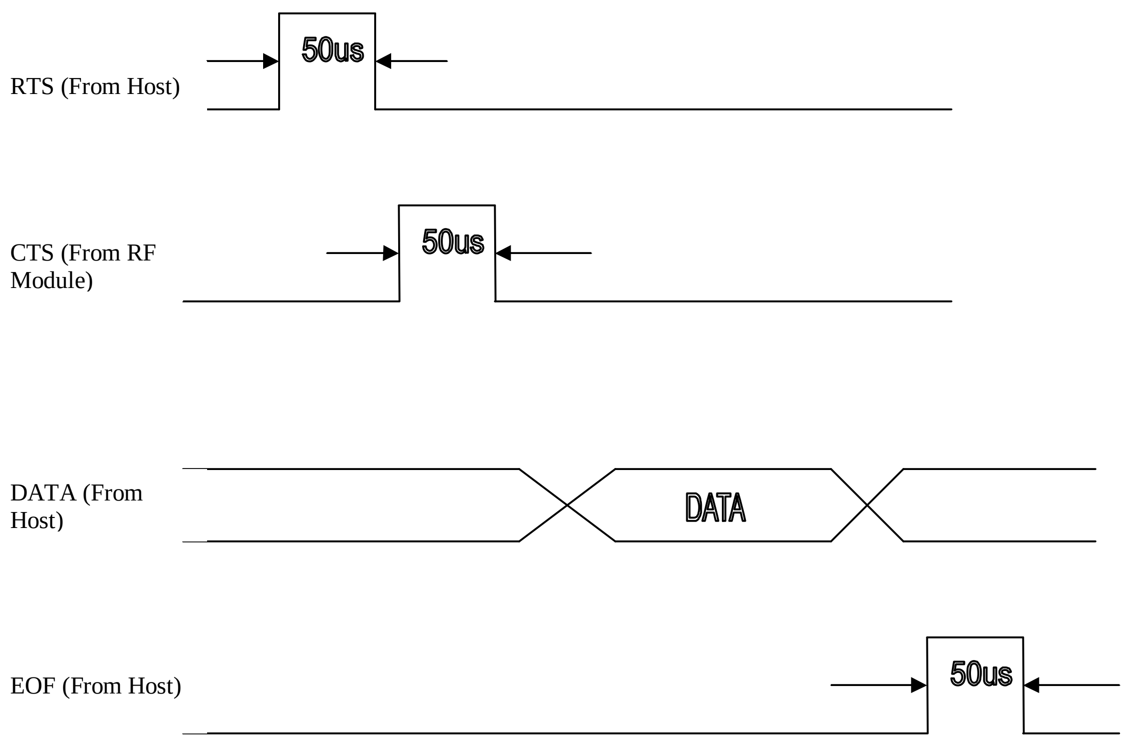


Figure 3. Timing Diagram for basic data transfer between host processor and RF Module

The RF module contains the buffer of 512 bytes. So the host processor can give 512 bytes of UART data at one go. And the RF module stores it in the buffer and transmits it as multiple wireless packets of packet size 90 bytes. The default packet size is 90 bytes. The packet size can be changed by using the AT commands. The RF module uses the Cyclic Redundancy Check (CRC) to ensure the message integrity of the received wireless packets. The RF module detects the rising edge of the RTS and EOF input signals. The RF module gives the CTS signal with a pulse width of 50us. It is recommended to use the edge triggered external interrupt line of the host processor to detect the CTS signal.

6.2 OTHER SIGNALS:

6.2.1 Sleep Control:

The 15th pin of the high power RF module is the sleep control pin. When the RF module detects the rising edge at this pin, it goes to the sleep state. The current consumption of the radio module at the sleep state is measured as 1.3mA. The RF module wakes up from the sleep state when either UART reception happens or RSSI REQ/MODE SELECT/RST signal is given.

Figure 4: Timing Diagram for Sleep Control Signal

6.2.2 RSSI Request:

The 17th pin of the RF module is RSSI Request pin. When the RF module detects the rising edge at this pin, it measures the Received Signal Strength Indicator (RSSI) value and gives it a one byte RSSI value without sign to UART. For example if the RSSI measured is -55dBm, then the one byte RSSI given to the host processor is 55_d (0x37).

Figure 5: Timing Diagram for RSSI Request Signal

6.2.3 Mode Select:

The 16th pin of the RF module is Mode Select pin. When the RF module detects the rising edge at this pin, the RF module enters into Command Mode. There are two modes of operation for the RF module.

They are

1. Data Mode – In this mode, the user data from the host processor has been received through UART and subsequently that will be transmitted wirelessly.

2. Command Mode – In this mode, the AT commands from the host processor has been received through UART and the replies are sent back from the RF module.

The Command mode can be entered either through giving consecutive three '+'s from the host processor to RF module through UART or by issuing a pulse as shown in Figure 6. To exit from the command mode, an AT command ATGEX<CR> is used.

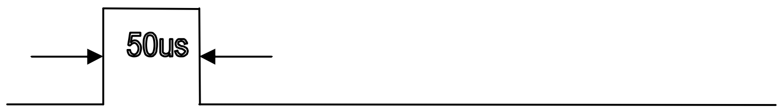


Figure 6.Timing Diagram for Mode Select Input

6.2.4 RST:

The 6th pin of RF module is the hardware reset pin. When the logical low signal (0V) is given to this pin, it resets the RF module and the firmware execution restarts.

6.2.5 TX STATUS & RX STATUS

The 13th and 14th pin are the Tx Status and Rx Status pins. These pins can be used to indicate the wireless transmit and receive status. After every wireless transmission and reception, the signal level at this pin toggles to indicate the transmission and reception.

6.3. DATA FRAME FORMAT:

Figure 7 shows the wireless packet frame format. The 10 byte preamble and 3 byte Sync word are included with the packet by the transceiver. The first byte of the 9 byte header is packet length and the rest of the 8 bytes are the source address and destination address. The maximum payload length should be less than or equal to 211 bytes. This length can be configured by the AT command ATSPK, referred in the page number 28. The two byte CRC ensures the message integrity. The wireless reception happens only if the CRC matches in the receiver.

Preamble	Sync Word	Packet Length	Source Address	Destination Address	Payload	CRC

Preamble: 10 bytes

Sync word: 3 bytes

Source Address: 4 bytes

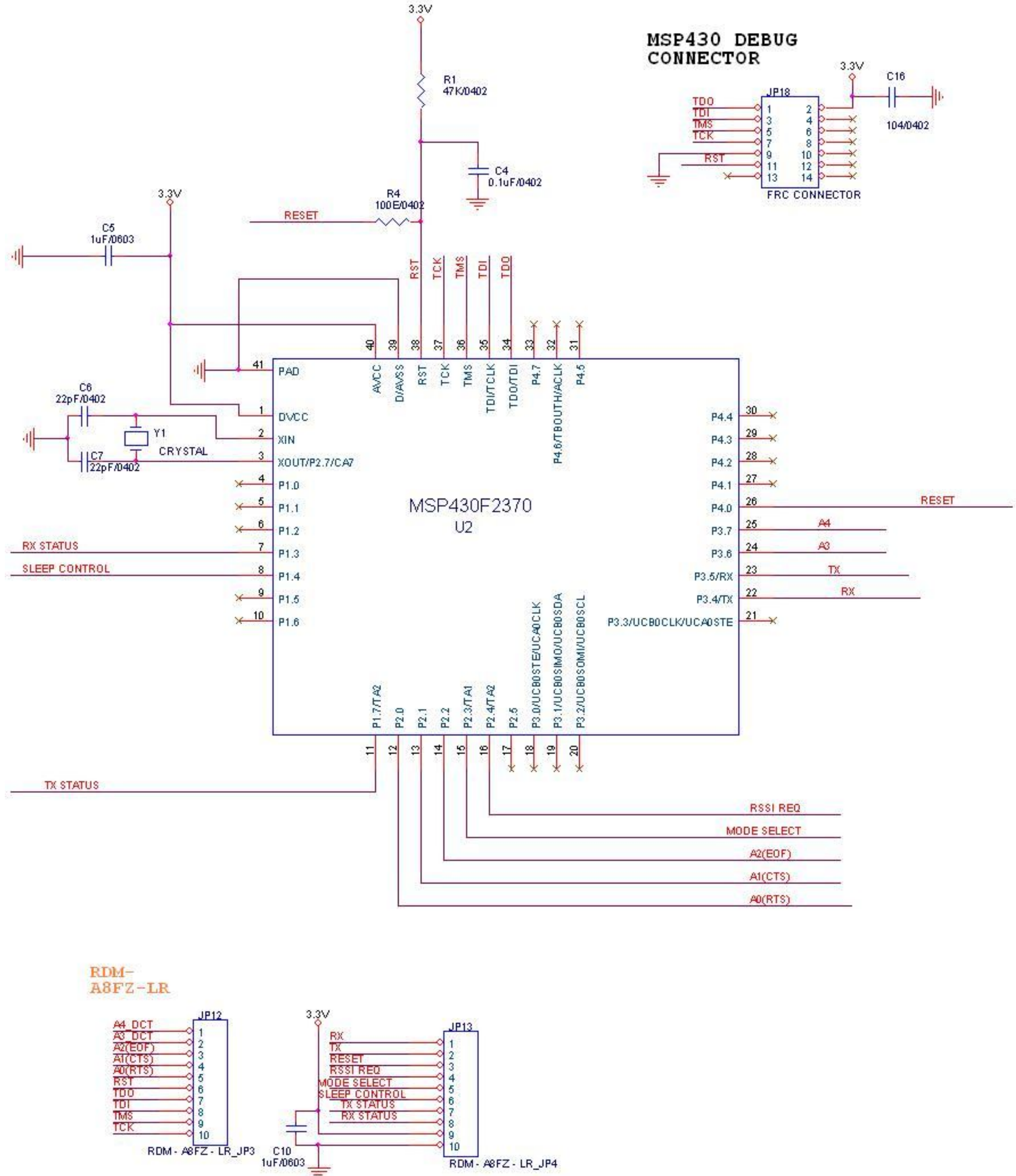
Destination Address: 4 bytes

Packet length: 1 byte

Payload: up to 211 bytes

Figure 7: Data Packet format

6.4. EXAMPLE CIRCUIT:



7. AT COMMANDS

1. **Command:**

ASCII Value - +++

Hex Command - 2B 2B 2B.

Response:

ASCII Value - ..OK..

Hex Command - 0D 0D 4F 4B 0D 0D.

Description:

This AT Command is used to make the RF Module to enter the Command Mode. The time delay between consecutive '+'s should be less than 10ms.

2. **Command:**

ASCII Value - ATGWR<CR>

Hex Command - 41 54 47 57 52 0D.

Response:

ASCII Value - OK..

Hex Command - 4F 4B 0D 0D.

Description:

This AT Command is used to store the set parameters to permanent memory. This AT command has to be used after the AT command for setting a configuration parameter. When this AT command is issued after the AT command for setting a configuration parameter, it returns "OK.." as the response. If this AT Command is issued after an AT command which is not used to set the configuration parameter, then the response for this AT command will be "ERROR".

3. **Command:**

ASCII Value - ATTEMP<CR>

Hex Command - 41 54 54 45 4D 50 0D.

Response:

ASCII Value - OK..

Hex Command –4F 4B 0D 0D.

Description:

This AT Command is used to Store the set parameters to Temporary memory without affecting the settings stored in permanent memory. After reset these parameters will be lost. This AT command can be used after setting a configuration parameter using another AT command. This AT command is redundant and practically there is no need to use this AT command as AT command for setting the configuration parameter itself, stores the set value in the temporary memory.

4. **Command:**

ASCII Value - ATGEX<X><CR>

Hex Command - 41 54 47 45 38 0D.

Response:

ASCII Value - EXIT..

Hex Command - 45 58 49 54 0D 0D.

Description:

This AT Command is used to exit from command mode. There are three modes. They are Command Entry Mode, Command Mode and Data Mode. In the Command Entry mode, three consecutive '+'s are required to transit to the command mode. In this mode, data other than '+' will be discarded. DCT will go to Command Entry mode after exiting the Data mode or Command Mode automatically. Command Mode can be entered either by "+++" given to UART or by giving an pulse to MODE SELECT pin. Issuing ATEXT<CR> command will make

DCT to transit from Command Mode to Command Entry Mode. Issuing the RTS pulse makes the DCT to go to Data mode.

5. Command:

ASCII Value - ATNCH<CR>

Hex Command - 41 54 4E 43 48 0D.

Response:

ASCII Value – (Channel No.).

Hex Command –(X) 0D 0D, Where X is the Channel No.

Default Value/Factory Settings: 0x00

Description:

7.1. Channel number and its corresponding Frequencies

CHANNEL NUMBER	RF REQUENCY (IN MHz)
0	865.1
1	865.3
2	865.5
3	865.7
4	865.9
5	866.1
6	866.3
7	866.5
8	866.7

9	866.9

This AT Command is used to read the RF Frequency channel (X) used for wireless transmission and reception between modules. Range of X = (0 - 9). The central frequencies corresponding to each Channel Number is given below. The License Free Frequency band of 865-867MHz (in India) has been used by DCT.

6. **Command:**

ASCII Value - ATNCH<X><CR>

Hex Command - 41 54 4E 43 48(X) 0D,   Where X is the Channel No.

Response:

If the parameters are with in 0 to 9 and the RF channel has been successfully changed, then it returns the following.

ASCII Value - OK..

Hex Command - 4F 4B 0D 0D.

If the parameter value is greater than 9 it returns the string "ERROR"

Default Value/Factory Settings: 0x00

Description:

This AT Command is used to set the RF Frequency channel (X) used for wireless transmission and reception between modules. Range of X = (0 - 9).The central frequencies associated with the channel number are given in Table 7.1.

7. **Command:**

ASCII Value - ATNMY<CR>

Hex Command - 41 54 4E 4D 59 0D.

Response:

ASCII Value – (Source Address).

Hex Command –(X) 0D 0D, Where X is the RF module 32-bit source address.

Default Value/Factory Settings: 0x01000000

Description:

This AT Command is used to read the RF module 32-bit source address(X). Range of X = (0 - 0xFFFFFFFF). This 4 byte source address will be the part of header in the wireless packet.

8. **Command:**

ASCII Value - ATNMY<X><CR>

Hex Command - 41 54 4E 4D 59(X) 0D, Where X is the RF module 32-bit source address.

Response:

ASCII Value - OK..

Hex Command - 4F 4B 0D 0D.

Default Value/Factory Settings: 0x01000000

Description:

This AT Command is used to set the RF module 32-bit source address(X). The host processor can set the source address for the DCT which is the part of the header in the wireless packet transmission. Range of X =(0 - 0xFFFFFFFF).

9. **Command:**

ASCII Value - ATNDA<CR>

Hex Command - 41 54 4E 44 41 0D.

Response:

ASCII Value – (Dest. Address).

Hex Command –(X) 0D 0D,   Where X is the RF module 32-bit destination address.

Default Value/Factory Settings: 0x01000000

Description:

This AT Command is used to read the RF module 32-bit destination address(X). This 4 byte destination address is part of the header in the wireless packet. This field is used for unicast data transfer where the data is intended for a particular receiver. Range of X =(0 - 0xFFFFFFFF).

10. Command:

ASCII Value - ATNDA<X><CR>

Hex Command - 41 54 4E 44 41 (X) 0D,   Where X is the RF module's 32-bit destination address.

Response:

ASCII Value - OK..

Hex Command - 4F 4B 0D 0D.

Default Value/Factory Settings: 0x01000000

Description:

This AT Command is used to set the RF module 32-bit destination address(X). This 4 byte destination address is part of the header in the wireless packet. This field is used for unicast data transfer where the data is intended for a particular receiver. Range of X = (0 - 0xFFFFFFFF).

11. Command:

ASCII Value - ATNRR<CR>

Hex Command - 41 54 4E 52 52 0D.

Response:

ASCII Value – (Retries).

Hex Command –(X) 0D 0D, Where X is the number of packet retries.

Default Value/Factory Settings: 0x00

Description:

This AT Command is used to read the number of packet retries(X). Range of

X =(0 - 6).

Note: The packet retries has not been implemented in the firmware. The host processor can handle the packet retries as transparent wireless to UART reception is given by DCT.

12. Command:

ASCII Value - ATNRR<X><CR>

Hex Command - 41 54 4E 52 52 (X) 0D, Where X is the number of Packet retries.

Response:

ASCII Value - OK..

Hex Command - 4F 4B 0D 0D.

Default Value/Factory Settings: 0x00

Description:

This AT Command is used to set the number of packet retries(X). Range of X = (0 - 6).

Note: The packet retries has not been implemented in the firmware. The host processor can handle the packet retries as transparent wireless to UART reception is given by DCT.

13. Command:

ASCII Value - ATNPI<CR>

Hex Command - 41 54 4E 50 49 0D.

Response:

ASCII Value – (PAN ID).

Hex Command –(X) 0D 0D,   Where X is the number of PAN ID.

Default Value/Factory Settings: 0xFFFF

Description:

This AT Command is used to read the PAN(Personal Area Network) ID(X). Range of X =(0 – 0xFFFF).

14. Command:

ASCII Value - ATNPI<X><CR>

Hex Command - 41 54 4E 50 49(X) 0D,   Where X is the PAN ID.

Response:

ASCII Value - OK..

Hex Command - 4F 4B 0D 0D.

Default Value/Factory Settings: 0xFFFF

Description:

This AT Command is used to set the PAN(Personal Area Network) ID(X). Range of X =(0 – 0xFFFF).

15. Command:

ASCII Value - ATNMD<CR>

Hex Command - 41 54 4E 4D 44 0D.

Response:

ASCII Value – (MODE).

Hex Command –(X) 0D 0D, Where X is the mode of operation.

Default Value/Factory Settings: 0x00

Description:

This AT Command is used to read the mode of operation(X).

Range of X = (0 – Normal mode, 1 – Acknowledged mode)

Note: The current firmware works only on Normal Mode. ACK has to be handled by the Host Processor.

16. Command:

ASCII Value - ATNMD<X><CR>

Hex Command - 41 54 4E 4D 44(X) 0D, Where X is the mode of operation.

Response:

ASCII Value - OK..

Hex Command - 4F 4B 0D 0D.

Default Value/Factory Settings: 0x00

Description:

This AT Command is used to set the mode of operation(X).

Range of X =(0 – Normal mode, 1 – Acknowledged mode)

17. Command:

ASCII Value - ATPSM<CR>

Hex Command - 41 54 50 53 4D 0D.

Response:

ASCII Value – (SLEEP MODE).

Hex Command –(X) 0D 0D, Where X is the Sleep mode.

Default Value/Factory Settings: 0x00

Description:

This AT Command is used to read the Sleep mode(X).

Range of X =(0 – None, 1 – Pin Assert, 2 – Cyclic)

18. Command:

ASCII Value - ATPSM<X><CR>

Hex Command - 41 54 50 53 4D(X) 0D, Where X is the Sleep mode.

Response:

ASCII Value - OK..

Hex Command - 4F 4B 0D 0D.

Default Value/Factory Settings: 0x00

Description:

This AT Command is used to set Sleep mode(X).

Range of X =(0 – None, 1 – Pin Assert, 2 – Cyclic)

19. Command:

ASCII Value - ATPST<CR>

Hex Command - 41 54 50 53 54 0D.

Response:

ASCII Value – (SLEEP TIME).

Hex Command –(X) 0D 0D, Where X is the Sleep time.

Default Value/Factory Settings: 0x000A

Description:

Sleep time reference for different sleep modes. The sleep time is in milli seconds. The maximum sleep time which can be given is 65535 ms or 65.535 Seconds. Range of X = (0 – 0xFFFF).

20. Command:

ASCII Value - ATPST<X><CR>

Hex Command - 41 54 50 53 54(X) 0D, Where X is the Sleep time.

Response:

ASCII Value - OK..

Hex Command - 4F 4B 0D 0D.

Default Value/Factory Settings: 0x000A

Description:

Sleep time reference for different sleep modes. Range of X = (0 – 0xFFFF). The sleep time is in milliseconds. The maximum sleep time which can be given is 65535 ms or 65.535 Seconds. This time is used as the sleep time during the cyclic sleep mode. Range of X = (0 – 0xFFFF).

21. Command:

ASCII Value - ATPBS<CR>

Hex Command - 41 54 50 42 53 0D.

Response:

ASCII Value – (TIME).

Hex Command –(X) 0D 0D, Where X is the time before sleep.

Default Value/Factory Settings: 0x000A

Description:

This AT Command is used to read the time before sleep. In other words wake up time (time for which the DCT is in wake up state) can be read by this command. This time is used as the wake on time for DCT during cyclic sleep mode (X).

Range of X =(0 – 0xFFFF).

22. Command:

ASCII Value - ATPBS<X><CR>

Hex Command - 41 54 50 42 53(X) 0D, Where X is the time before sleep.

Response:

ASCII Value - OK..

Hex Command - 4F 4B 0D 0D.

Default Value/Factory Settings: 0x000A

Description:

This AT Command is used to set the time before sleep. That is the time for which the DCT is in wake up state. . This time is used as the wake on time for DCT during cyclic sleep mode (X).

Range of X = (0 – 0xFFFF).

23. Command:

ASCII Value - ATSTO<CR>

Hex Command - 41 54 53 54 4F 0D.

Response:

ASCII Value – (TIMEOUT).

Hex Command –(X) 0D 0D,   Where X is the packetization time out.

Default Value/Factory Settings: 0xC8

Description:

This AT Command is used to read the packetization time out. In Data mode, if EOF has not been given after the data transmission to DCT through UART, then the DCT waits for this timeout period and if this time elapses then the data will be transmitted wirelessly. This timeout is given in milli seconds (X)

Range of X (0 -255 ms)

24. Command:

ASCII Value - ATSTO<X><CR>

Hex Command - 41 54 53 54 4F(X) 0D,   Where X is the packetization time out.

Response:

ASCII Value - OK..

Hex Command - 4F 4B 0D 0D.

Default Value/Factory Settings: 0xC8

Description:

This AT Command is used to set the packetization time out. In Data mode, if EOF has not been given after the data transmission to DCT through UART, then the DCT waits for this timeout period and if this time elapses then the data will be transmitted wirelessly. This timeout is given in milli seconds (X)

Range of X (0 – 255 milli Seconds)

25. Command:

ASCII Value - ATSPK<CR>

Hex Command - 41 54 53 50 4B 0D.

Response:

ASCII Value – (SIZE).

Hex Command –(X) 0D 0D,   Where X is the RF packet size.

Default Value/Factory Settings: 0x5A (90 decimal)

Description:

This AT Command is used to read RF packet size. If the data given to DCT through UART is above this packet size then the UART data will be made as multiple wireless packets of size set by this command. (X) .

Range of X =(0 – 211).

26. Command:

ASCII Value - ATSPK<X><CR>

Hex Command - 41 54 53 50 4B(X) 0D,   Where X is the RF packet size.

Default Value/Factory Settings: 0x5A (90 decimal)

Response:

ASCII Value - OK..

Hex Command - 4F 4B 0D 0D.

Description:

This AT Command is used to set RF packet size(X).

Range of X =(0 – 211 decimal).

27. Command:

ASCII Value - ATSBR<X><CR>

Hex Command - 41 54 53 42 52(X) 0D, Where X is the RF packet size.

Default Value/Factory Settings: 0x00

Response:

ASCII Value - OK..

Hex Command - 4F 4B 0D 0D.

7.2 Value to be set and its corresponding RF Baud Rate

SET VALUE	RF BAUD RATE (in kbps)
0	12
1	14.4
2	19.2
3	24
4	28
5	33.6

6	38.4
7	43.2
8	48
9	50

28. Command:

ASCII Value – ATPOP <X><CR>

Hex Command - 41 54 50 4F 50<X> 0D,

Response:

ASCII Value - OK..

Hex Command - 4F 4B 0D 0D.

Default Values/Factory Settings: 0x0

Description:

This AT Command is used to set the output power. The output power level changes from 9dBm – 24.1dBmRange of X =(0x00 – 0x0C).

7.3 Set Value Vs Output Power

SET VALUE	OUTPUT POWER (in dBm)
0x00	9
0x01	11
0x02	13
0x03	15
0x04	17
0x05	18
0x06	19
0x07	20.8
0x08	22.2

0x09	23.3
0x0A	23.8
0x0B	24
0x0C	24.1

29. Command:

ASCII Value – ATSBD <X><CR>

Hex Command - 41 54 53 42 44 <X> 0D,

Response:

ASCII Value - OK..

Hex Command - 4F 4B 0D 0D.

Default Values/Factory Settings: 0x05

Description:

This AT Command is used to set the Serial baud rate.

Range of X =(0x00 – 0x07).

The serial baud rate level changes from 1200 to 115200 bps

7.4. Set Value Vs Serial Baud Rate

SET VALUE	Serial Baud Rate (in bps)
0x00	1200
0x01	2400
0x02	4800
0x03	9600
0x04	19200
0x05	38400
0x06	56000
0x07	115200

30. Command:

ASCII Value – ATDSY <X Y Z><CR>

Hex Command - 41 54 44 53 59 <x Y Z>0D,

Response:

ASCII Value - OK..

Hex Command - 4F 4B 0D 0D.

Default Values/Factory Settings: 0x10 0x20 0x30

<X Y Z> - X, Y, Z are three byte sync word which should be DC free and different from preamble bytes which are 0xAA.

Description:

This AT Command is used to set the destination Sync word. Usually the default sync value for the source and the destination will be the same. When the multiple modules are transmitting in a same location, then it is recommended to have different sync words for source and destination. The transceiver will receive the packet when the sync word in the packet matches with its sync word. The destination sync word is the sync word which gets transmitted with the packet.

Note: This same command given without parameters can be used to read the 3 byte destination sync word

31. Command:

ASCII Value – ATSSY <X Y Z><CR>

Hex Command - 41 54 54 53 59 0D,

Response:

ASCII Value - OK..

Hex Command - 4F 4B 0D 0D.

Default Values/Factory Settings: 0x10 0x20 0x30

<X Y Z> - X, Y, Z are three byte sync word which should be DC free and different from preamble bytes which are 0xAA.

Description:

This AT Command is used to set the Source Sync word. Usually the default sync value for the source and the destination will be the same. When the multiple modules are transmitting in a same location, then it is recommended to have different sync words for source and destination. The transceiver will receive the packet when the sync word in the packet matches with **source sync word**. The destination sync word is the sync word which gets transmitted with the packet.

Note: This same command given without parameters can be used to read the 3 byte source sync word. The reply for this AT command contains the 3 byte source sync word.

32. Command:

ASCII Value – ATCST <X><CR>

Hex Command - 41 54 43 53 54 <X> 0D,

Response:

ASCII Value - OK..

Hex Command - 4F 4B 0D 0D.

Default Values/Factory Settings: 90

Description:

This AT Command is used to set the carrier sense threshold which can be used in the collision avoidance algorithm. The RF module has a persistent Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA) algorithm for a collision free data transmission. The parameter for this command is carrier sense threshold in dBm (without sign). That is the default carrier sense threshold '90' indicates the carrier sense threshold of -90dBm.

7. Mechanical Drawings

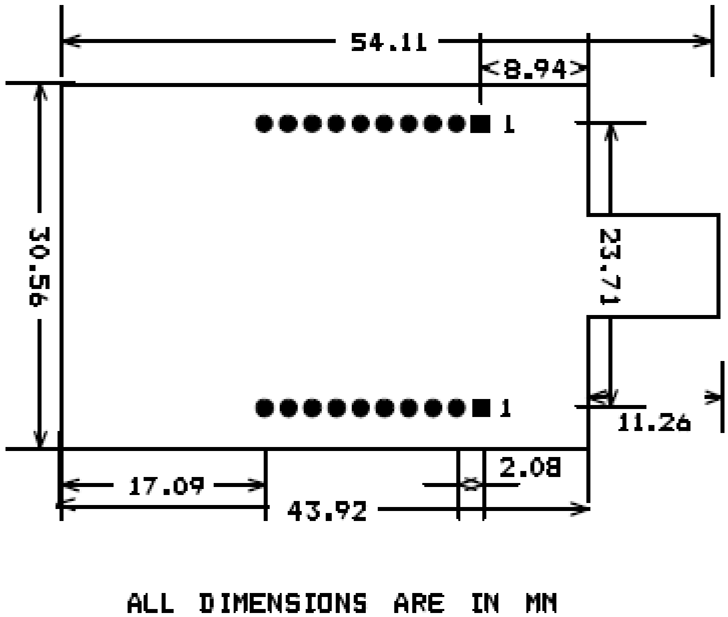


Figure 8: Mechanical dimensions of High Power RF Module

9. Custom Applications

For cost-sensitive and custom applications, such as wireless sensors and AMR, Reindeer Technologies can embed the application software directly into a microcontroller built into the module. For more information on this service, please contact Reindeer Technologies.

10. Reference

For detailed information about programming the RDM-A8FZLR module, please consult the current ADF7023 datasheet which can be found at http://www.analog.com.

11. Ordering Information

Product part Number	Description
RDM_A8FZLR	Long Range RF Transceiver Module (850 – 870 Mhz)

12. Contact Us

12.1 Technical Support

Reindeer Technologies Pvt Ltd has built a solid technical support infrastructure so that you can get answers to your questions when you need them.

Our technical support engineers are available Mon-Fri between 9:30 am and 6:00 pm Indian standard time. The best way to reach a technical support engineer is to send an email to *support@reindeersystems.com*. E-mail support requests are given priority because we can handle them more efficiently than phone support requests.

12.2 Sales Support

Our sales department can be reached via e-mail at *sales@reindeersystems.com* or by phone at 91-44-45022335/42606907.

Our sales department is available Mon-Fri between 9:30 am and 6:00 pm.

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Excellence Through Innovation

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