RM24100D

2.4GHz 100mW RS232 / RS485 / RS422 DSSS Radio Modem (IEEE 802.15.4 compliant)

Operating Manual – English 1.09

Introduction

The RM24100D radio modem acts as a wireless serial cable replacement and can wirelessly connect various devices together for a large range of applications. The RM24100D radio modems operate in the license free 2.4GHz ISM (industrial, scientific, medical) band and is capable of achieving long range line-of-sight communications up to 1km. With its durable polymide industrial din rail mount enclosure and industrial temperature grade electronics makes the unit perfect for industrial automation/SCADA systems and remote data acquisition. The RM24100D includes DSSS (Direct Sequence Spread Spectrum) radio technology to ensure reliable communication in noisy environments. The RM24100D also includes 128 bit AES encryption technology for secure wireless data transfer.

The RM24100D can operate in a peer-to-peer (no master/slave dependencies), point-to-point, point-to-multipoint, multipoint to multipoint and repeater network topology.
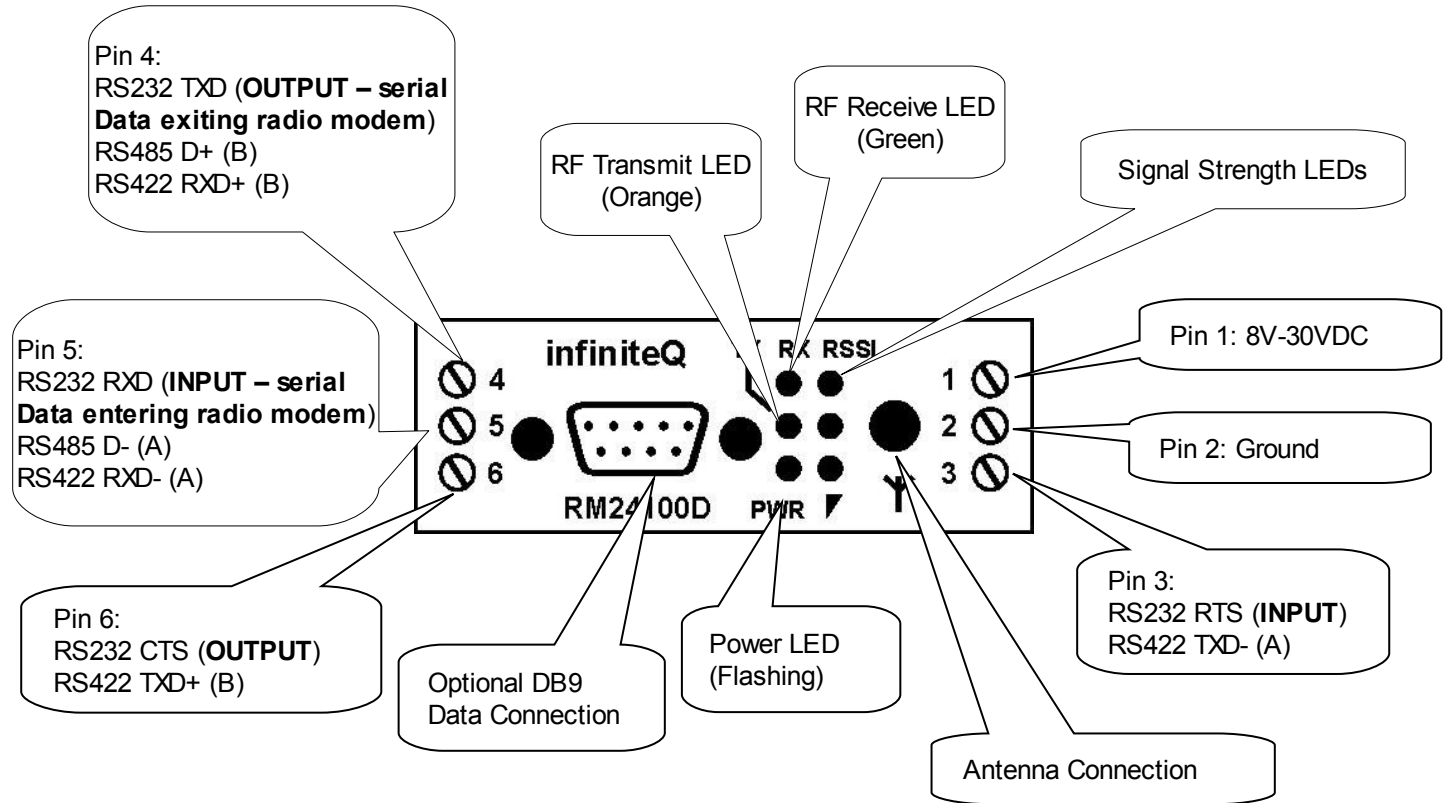
Features

- **Transparent wireless link. The modem acts as a serial cable replacement**
- **License free operation in the 2.4GHz ISM (industrial, scientific, medical) band ***
- **Long Range – indoor/urban (+-90m/300ft), outdoor/line-of-sight (+-1km/0.6 miles). With a 2.1dBi dipole antenna**
- **Durable polymide industrial din rail mount enclosure**
- **8-30VDC switch mode power supply with built in 33V over voltage and reverse voltage protection**
- **Max transmit current of 200mA, average current while streaming data at 9600 baud approx. 50mA @ 12V**
- **Transmit power of 100mW (20dBm) EIRP with a 2.1dBi antenna**
- **DSSS (Direct Sequence Spread Spectrum) technology for increased reliability in noisy environments**
- **Peer-to-peer (no master/slave dependencies), point-to-point, point-to-multipoint, multipoint to multipoint and repeater network topology**
- **Easy interfacing connection via side terminals or by a standard DB9 female connector**
- **Built in LED's for power, transmit, receive and signal strength indication**
- **RSSI (received signal strength indicator) to give optimum antenna placement**
- **RPSMA (reverse polarity SMA) 50 ohm antenna connection allows for remote location of antenna**
- **Available in RS232, RS485 and 4-wire RS422, includes a selectable built in line termination resistor (RS485/RS422 model only)**
- **Serial interface data rate of 1200 to 115200 bps**
- **Industrial operating temperature range (-40°C to 85°C)**
- **Uses an agency approved radio module (US FCC part 15.247 / Industry Canada (IC) / Europe (CE)) ***
- **IEEE 802.15.4 compliant**
- **Free configuration software**

*Maximum transmit power output levels and local radio frequency regulator bodies must be obeyed in the country of operation.

1 Installation

Connect the RM24100D unit as indicated in the following diagram. Use of an external 1A fuse is recommended.

Pin 4:
RS232 TXD (**OUTPUT – serial Data exiting radio modem**)
RS485 D+ (B)
RS422 RXD+ (B)

RF Transmit LED (Orange)

RF Receive LED (Green)

Signal Strength LEDs

Pin 1: 8V-30VDC

Pin 5:
RS232 RXD (**INPUT – serial Data entering radio modem**)
RS485 D- (A)
RS422 RXD- (A)

Pin 2: Ground

infiniteQ

RM24100D

Pin 6:
RS232 CTS (**OUTPUT**)
RS422 TXD+ (B)

Optional DB9 Data Connection

Power LED (Flashing)

Pin 3:
RS232 RTS (**INPUT**)
RS422 TXD- (A)

Antenna Connection

DB9 Female Pinout (connecting cable must have a DB9 male connector):

DB9 Female Pin	RS232	RS485	RS422
1	**DCD** (Output from radio modem)		
2	**TXD (output)** (Serial data exiting radio modem)	**D+ (B)**	**RXD+ (B)**
3	**RXD (input)** (Serial data entering radio modem)	**D- (A)**	**RXD- (A)**
4	**DTR** (Input to Radio modem)		
5	**GROUND**	**GROUND**	**GROUND**
6	**DSR** (Output from radio modem)		
7	**RTS** (Input to Radio modem)		**TXD- (A)**
8	**CTS** (Output from radio modem)		**TXD+ (B)**
9	**POWER** (8-30VDC)	**POWER** (8-30VDC)	**POWER** (8-30VDC)

1.1 RS485/RS422 Communications (RS485/RS422 Models only)

The RS485/RS422 protocol allows for a wired connection to be established as far as 4000ft (1200m). RS232 only allows for a wired connection up to 100ft (30.5m). The RM24100D includes an on-board termination resistor which can be selected by linking J1 on the main PCB inside the unit. The termination resistor is 120 Ohms.

1.2 RSSI (Received Signal Strength Indicator) Red LEDS

3 LED's on: Very strong signal (>30db fade margin)
2 LED's on: Strong Signal (>20db fade margin)
1 LED on: Moderate Signal (>10db fade margin)
0 LED's on: Weak Signal (<10db fade margin)

1.3 Minimum connection required for the RM24100D

Power (ALL models): (8->30V DC), Ground
RS232: TXD,RXD, Ground
RS485: D+ (B), D- (A)
RS422: TXD+ (B), TXD- (A), RXD+ (B), RXD- (A)

2 Network Setup

2.1 Frequency Channel Selection

The RM24100D allows for IEEE 802.15.4 channel assignment which ranges from 2407.5 to 2467.5 MHz with 5MHz spacing between channels. The most likely cause of interference for the RM24100D will be from a wireless LAN (802.11b/ g access points). If interference is detected then the RM24100D can be configured to use another channel as in the list below. By default the RM24100D is shipped with the settings of channel 12 (0x0c). The RM24100D can handle 12 channels with 65535 modems per channel.

Center Frequency (MHz)	Nominal Occupied bandwidth	Channel
2410	2407.5-2412.5	12 (0x0c)
2415	2412.5-2417.5	13 (0x0d)
2420	2417.5-2422.5	14 (0x0e)
2425	2422.5-2427.5	15 (0x0f)
2430	2427.5-2432.5	16 (0x10)
2435	2432.5-2437.5	17 (0x11)
2440	2437.5-2442.5	18 (0x12)
2445	2442.5-2447.5	19 (0x13)
2450	2447.5-2452.5	20 (0x14)
2455	2452.5-2457.5	21 (0x15)
2460	2457.5-2462.5	22 (0x16)
2465	2462.5-2467.5	23 (0x17)

2.2 Network configuration

The RM24100D can be operated in a unicast or broadcast mode.

Unicast Mode (Default): Unicast mode is the only mode that supports retries. While in this mode, receiving modules send an ACK (acknowledge) of RF packet reception to the transmitter. If the transmitter does not receive an ACK, it will try to resend the packet up to 3 times. For 2 modems to communicate with each other, the destination address of the transmitter module must match the address of the receiver.

www.instrotech.com.au

Unicast Network configuration:

| Parameter	RF Modem 1	RF Modem 2
Source Address	0x01	0x02
Destination address high	0	0
Destination address low	0x02	0x01

Broadcast Mode: Any RF modem in range will accept a packet that contains a broadcast address. In this mode receiving modems do not send ACK's and transmitting modems do not automatically resend packets as in the case of unicast mode.

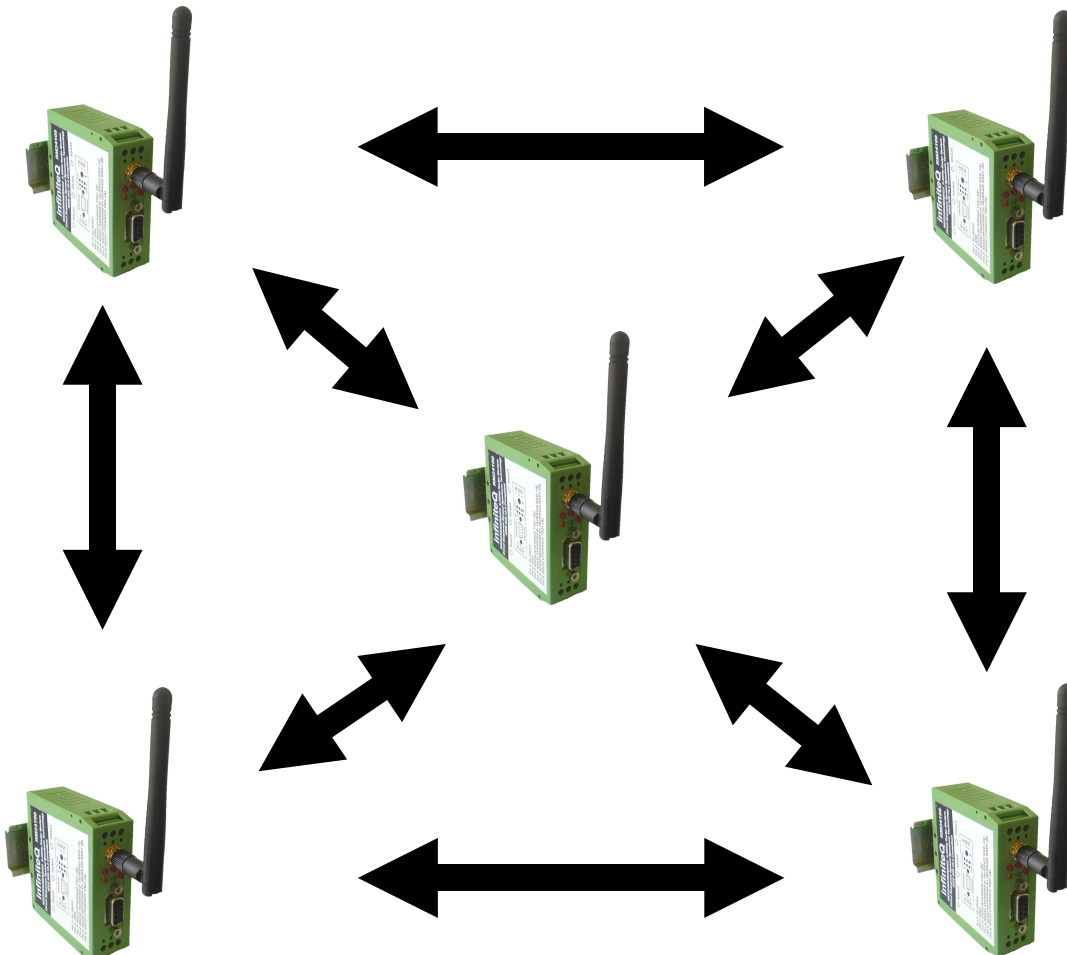Broadcast Network configuration (All modems in the network must be setup as):
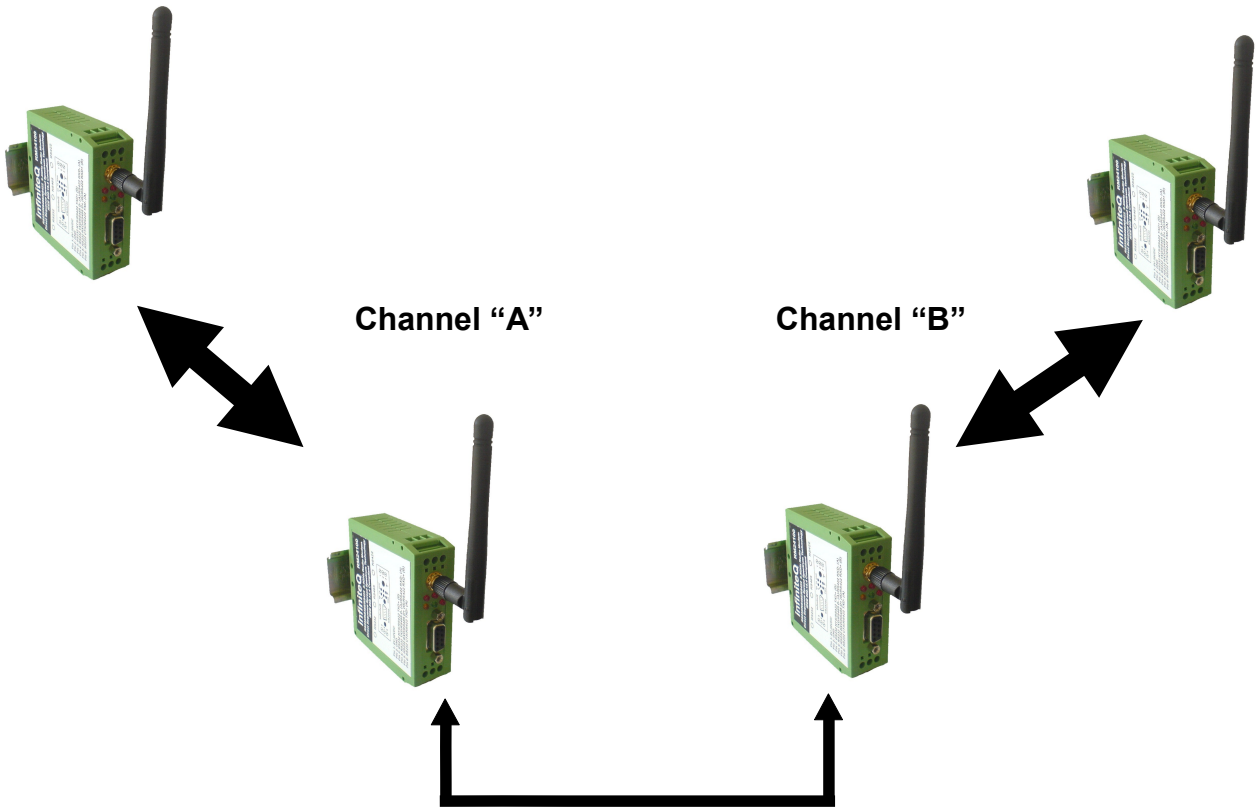Destination Low Address: 0x0000FFFF
Destination High Address: 0x00000000

Peer-to-peer/ point-to-point topography (Broadcast/Unicast Mode)
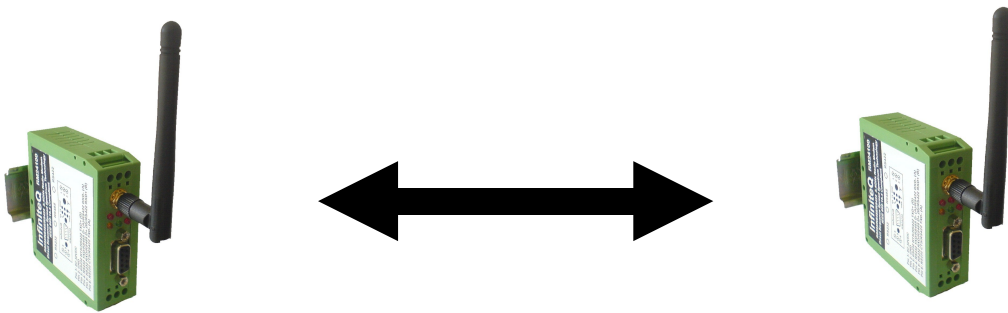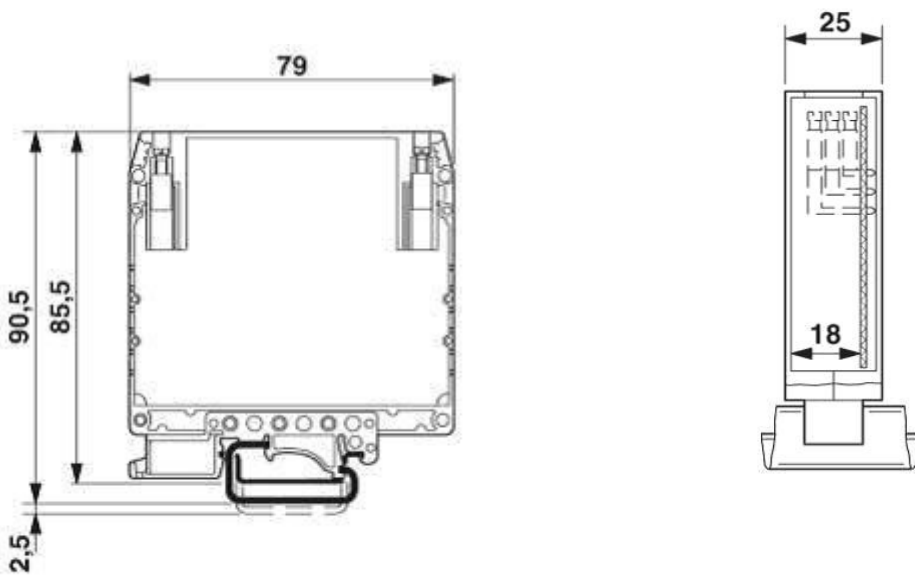

Point-to-multipoint topography (Broadcast Mode)

Repeater mode (Utilizing two separate frequency channels)

Channel "A"   **Channel "B"**

Cable Connection (Connect Rx to Tx, Tx to Rx and Ground to Ground)

3 Dimensional Drawings

4 Specifications

Frequency range	2.4GHz ISM band (2407.5-2467.5MHz)
Protocol	IEEE 802.15.4 compliant
Modulation	OQPSK (Offset Quadrature Phase Shift Keying)
Spread Spectrum Technology	DSSS (Direct Sequence Spread Spectrum)
Number of channels	12 direct sequence channels
Transmit Power	63mW (18dBm) conducted, 100mW (20dBm) EIRP with a 2.1dBi dipole antenna (Output transmit power is configurable via software) *,**
Receiver sensitivity	(1% Packet Error Rate) -100dBm
Range (2.1dBi dipole antenna)	Indoor/urban (+-90m/300ft), outdoor/line-of-sight (+-1km/0.6 miles)
RF data rate	250 kbps
Antenna connection	RPSMA (reverse polarity SMA)
Antenna impedance	50 ohms unbalanced
Antenna	2.4GHz 2.1dBi omni-direction dipole antenna
Enclosure Material	Polymide (PA 6.6)
Enclosure Color	Green
Enclosure Dimensions	79mmx90.5mmx25mm (din rail mount)
Data Connection	Side terminals or DB9 female
Operating Temperature Range	-40°C to 85°C (14°F to 122°F) industrial temperature range
Humidity	<85% non-condensing
Supply Voltage	8 to 30VDC switch mode power supply with built in 33V over voltage and reverse voltage protection
Current Consumption	Approximately 200mA (@18dBm transmit power Average current while streaming data at 9600 baud approx. 50mA @12V
Baud Rate	1200 to 115200 bps(non-standard baud rates also supported)
Agency approved radio module	US FCC Part 15.247, Industry Canada (IC), Europe (CE) *,**
RS485/RS422 Termination resistor (RS485/RS422 models only)	Jumper selectable 120 Ohms (Jumper J1 internal on PCB)

*When operating in Europe the maximum transmit power output level must not exceed 10dBm. Additionally, European regulations stipulate an EIRP power maximum of 12.86dBm (19mW).
**Maximum transmit power output levels and local radio frequency regulator bodies must be obeyed in the country of operation.

5 Antenna Range

Various antennas can be used to increase/enhance the range of the radio modems. Below is an indicative drawing of various antennas and there ranges/directions of propagation.
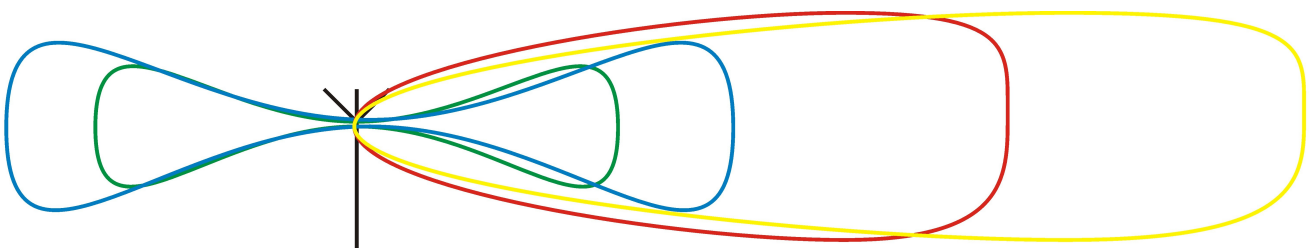
■ 2dBi (Omni)   ■ 5dBi (Omni)   ■ 10dBi (Patch)   ■ 14dBi (Patch)

6 Agency Certifications

6.1 United States (FCC)

The internal RF module in the RM24100D has been tested to comply with Part 15 of the FCC rules and regulations.

Important:

The internal RF module has been certified for remote and base radio applications. This module has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: Re-orient or relocate the receiving antenna, Increase the separation between the equipment and receiver, Connect equipment and receiver to outlets on different circuits, or Consult the dealer or an experienced radio/TV technician for help.

RF Exposure

WARNING: To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operations at closer than this distance is not recommended. The antenna used for this transmitter must not be co-located in conjunction with any other antenna or transmitter.

TCB

GRANT OF EQUIPMENT AUTHORIZATION

Certification
Issued Under the Authority of the
Federal Communications Commission
By:

TCB

Timco Engineering, Inc.
849 NW State Road 45
P.O. Box 370,
Newberry, FL 32669

Date of Grant: 11/02/2005

Application Dated: 11/02/2005

MaxStream Inc.
355 South 520 West
Suite 180P.O. Box ,
Lindon, UT 84058

Attention: David Steed

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: OUR-XBEEPRO
Name of Grantee: MaxStream Inc.
Equipment Class: Digital Transmission System
Notes: XBEE-PRO OEM RF MODULE

Grant Notes	FCC Rule Parts	Frequency Range (MHZ)	Output Watts	Frequency Tolerance	Emission Designator
20	15C	2410.0 - 2470.0	0.086		

Limited Modular Approval. Professional installation is required. Power output listed is conducted. This is an OEM transmitter module approved for use in products operating as a mobile or fixed transmitting device. Final antenna installation and operating configurations of this transmitter including antenna gain and minimum cable loss must not exceed the EIRP of the configuration used for MPE compliance. Operations is limited to 2410-2465MHz, set by programming restrictions, for certain antennas as described in this filing. The antenna(s) used for this transmitter must be installed to provide the separation distances, as described in this filing, and must not be co-located or operating in conjunction with any other antenna or transmitter. Grantee must coordinate with OEM integrators to ensure the end-users of products operating with this module are provided with operating instructions and installation requirements to satisfy RF exposure compliance. Separate approval is required for all other operating configurations, including portable configurations with respect to 2.1093 and different antenna configurations.

20: All electrical and mechanical devices employed for spurious radiation suppression, including any modifications made during certification testing, must be incorporated in each unit marketed.

6.2 Europe (ETSI)

The internal RF Module in the RM24100D has been certified for use in several European countries.

When operating in Europe the maximum transmit power output level must not exceed 10dBm (Lowest power level setting). Additionally, European regulations stipulate an EIRP power maximum of 12.86dBm (19mW).

CERTIFICATE OF COMPLIANCE

NOT TRANSFERABLE

This Verification Certificate is hereby issued to the named GRANTEE and is VALID ONLY for the equipment identified hereon for use under the rules and regulations listed below:

MANUFACTURER'S NAME/ADDRESS:	Digi International Inc.
Address:	Digi International Inc 11001 Bren Road East Minnetonka, MN 55343 USA
Contact Person:	Mr. Paul Dahl Phone #: 801-765-9885 Fax #: 801-765-9895 Email Address: Paul.dahl@digi.com
Equipment Type:	Short Range Devices (SRD), Equipment Type I
Product Name:	XBee-PRO 868
Model No.:	ProS5
RF Output Power:	0 dBm to +27 dBm erp
ITU Emission Designator:	37K9F1D
Transmitter Operating Frequency Range:	869.400 - 869.650 MHz
Receiver Operating Frequency Range:	869.400 - 869.650 MHz
Year of manufacture:	2008
Country Of Manufacture:	USA
The above product has been tested by UltraTech Engineering Labs Inc., and found to comply with:	European Telecommunications Standards Institute (ETSI) EN 301 489-1 V1.8.1 (2008-04) & EN 301 489-3 V1.4.1 (2002-08) – Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Electromagnetic Compatibility (EMC) Standard for Radio Equipment and Services; Part 1: Common technical requirements & Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 40 GHz.

Approved by: Tri M. Luu, P.Eng.
V.P. – Engineering

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Telephone (905) 829-1570   Facsimile   (905) 829-8050
Website: www.ultratech-labs.com   Email: xlc@ultratech-labs.com, tri@ultratech-labs.com

ANSI	FC	(VLU)	Industry Canada	NVLAP	BSMI	Korea MIC-RRL
0685	31040/SIT	C-1376	46390-2049	200093-0	8L2-IN-E-1119R	2005-82 & 83

EC Declaration Of Conformity

We,   Digi International Inc.
       11001 Bren Road East
       Minnetonka
       Minnesota 55343
       USA

Declare under our sole responsibility that the products:

XBee PRO S1 2.4GHz radio transceiver family

To which this declaration relates are in conformity with the essential requirements and other relevant requirements of the *R&TTE Directive (1999/5/EC)*

The product is compliant with the following standards and/or other normative documents:

Safety (article 3.1a) EN60950-1:2001
EMC (article 3.1b) ETSI EN 301 489-1 v1.7.1 (2007-04) in accordance with the specific requirements of ETSI EN 301 489-17 v1.2.1 (2002-08)
Spectrum (article 3.2) ETSI EN 300 328 v1.7.1 (2006-10)

Technical File reference: XB24 CE-technical file

Authorized signature for and on behalf of Digi International Inc.

Date: 12/5/08

Name: JOEL YOUNG

Position: SR VP

Place of issue: USA

DIGIDCC001 Iss 1 (30-03-06)

7 Ordering Information

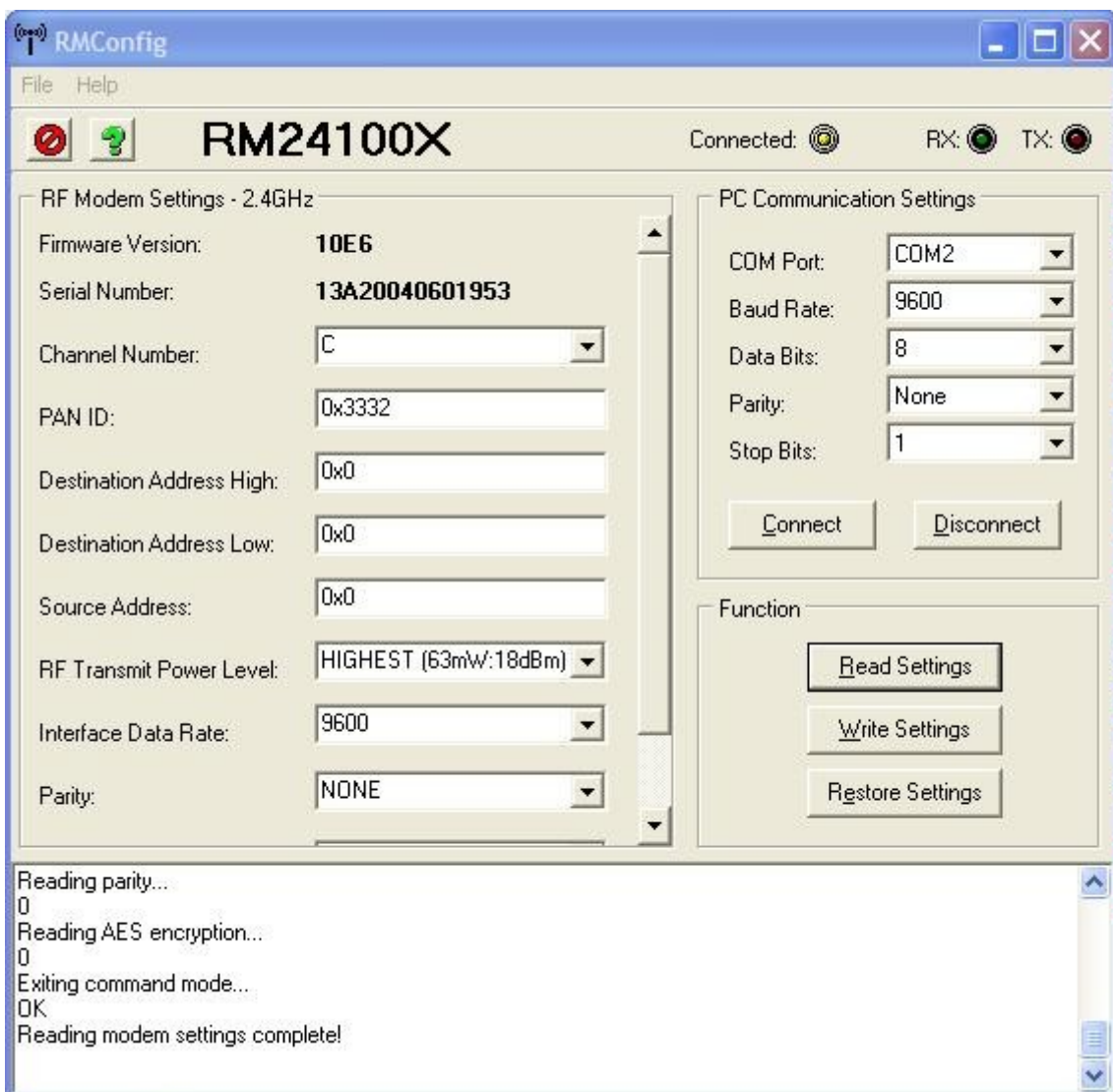Please order according to the following code listed below.

RS232: RM24100D-RS232
RS485: RM24100D-RS485
RS422: RM24100D-RS422

8 Configuration Software

Please use our free configuration software to change channel numbers, PAN IDs, destination/source addresses, RF transmit power levels, interface data rate and parity.

9 Warranty

This product carries a warranty for a period of one year from date of purchase against faulty workmanship or defective materials, provided there is no evidence that the unit has been mishandled or misused. Warranty is limited to the replacement of faulty components and includes the cost of labor. Shipping costs are for the account of the purchaser.

> **Note:** Product warranty excludes damages caused by unprotected, unsuitable or incorrectly wired electrical supplies, inductive loads and damage caused by unprotected communication lines, or any non use of the equipment for which is intended.

10 Disclaimer

Operation of this instrument is the sole responsibility of the purchaser of the unit. The user must make themselves familiar with the operation of this instrument and the effect of any possible failure or malfunction. The manufacturer its agents, agencies, partners nor the like take any responsibility for the use of this equipment for any reason whatsoever and shall not be held liable for any damages or loss whatsoever resulting out of the use of this equipment.

> The manufacturer reserves the right to alter any specification without prior notice been given.

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