RDL-3000 Family

Broadband Wireless Systems

RDL-3000-RMD

Radio Module

Product Manual

Copyright Information

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1 Product Overview

The RDL-3000 radio modules are each comprised of a proprietary Media Access Control (MAC) protocol engine and Time Division Duplexing (TDD)/ Orthogonal Frequency Division Duplexing (OFDM) digital radio.

The modules are not designed for stand-alone operation. The modules are sold as one component of a packaged system which includes a suitable housing for the module connectors for required external components including a power supply and antenna system. This is afterwards referred to as the 'final product'. The final product may be designed and manufactured by Redline or a licensed third party.

Frequency settings within the specified frequency ranges are software keyed to be compliant with specific regulatory agency requirements in the region of deployment.

Model RDL-3000-RMD

Canada:	3450-3650 MHz 3650-3675 MHz
United States:	3675-3700 MHz

Important: Read this entire document prior to installing or operating the module.

2 Conditions of Use

2.1 General Conditions

These modules are not provided for sale to the general public. The modules contain a proprietary radio interface and can not be directly connected to any standard telecommunications or computer devices. This manual is provided as supplement to technical and operational documentation and training provided by Redline and its agents.

Any operation or use of these modules in any manner not expressly specified within this manual or approved in writing by Redline (or its agents) is expressly forbidden and voids the users right to operate the module. This includes, but is not limited to, any modification of the module hardware or software, installation of the module in a non approved enclosure, and use with non approved antennas.

2.2 Country of Use

Refer to the regulatory notices in this document before installing or operating the module.

Operation of the final product requires a software 'key' that is available exclusively from Redline or its authorized agents. The software key is unique to each module and must be installed and activated before the radio will operate. The key contains sufficient security features that the professional installer and operator can not decode, modify, substitute, or otherwise circumvent the operational restrictions imposed by the 'key'.

The software 'key' limits the transmit power, operating frequency range, and channel bandwidth per the regulator domain governing the location where the radio will be deployed. The operator does not have the option to select the country or regulatory region of operation.

The software 'key' limits the mode of operation as a master or client. The client mode is 'passive listener' and while in this mode the module can not initiate any transmission without first receiving and decoding a valid authorization message from the master. A module with a key for client operation can not be changed by the installer to enable master mode operation. A module with a key for master operation can operate in master or client (passive) mode.

Operation in Canada

The RDL-3000-RMD is certified with limited modular approval for use as an 'intentional radiator' in Canada as:

IC: 4310A-RDL3000RMD

Operation in United States

The RDL-3000-RMD is certified with limited modular approval for use as an 'intentional radiator' in the United States as:

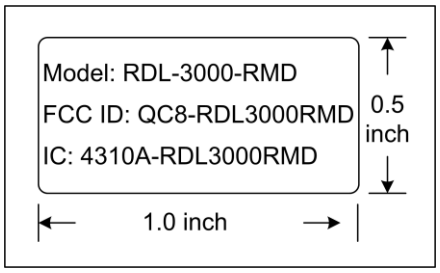
FCC ID: QC8-RDL3000RMD

2.3 Product Labeling

2.3.1 Module Label

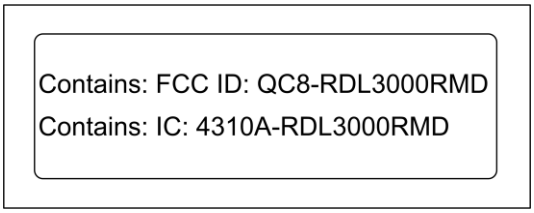
The modular transmitter will display a label referring to the Industry Canada IC and United States FCC registration numbers. An information label is applied directly to the modular transmitter (examples shown below).

Do not to remove any labels from the module.



2.3.2 External Label

Information labels are applied to the final product. The final product features a label on the outside surface listing the registration number for the enclosed module. Do not to remove any labels from the module or the final product.



3 Module Installation and Service

3.1 Installation into a Final Product

The modules must be installed only by trained professional technicians authorized by Redline or its agents. The module must be installed only into an approved enclosure (see Conditions of Use) and only at an approved manufacturing facility or service depot.

Redline shall retain complete control over the final installation of the module and will ensure compliance of the end product to all applicable regulations. The module must be installed only into an approved enclosure (see Conditions of Use) and only at an approved manufacturing facility or service depot.

Redline licensing of the modular transmitter includes monitoring to ensure compliance in the operation and use of the module as expressly specified within this manual. This includes restrictions against modification of the module hardware, approval of the final enclosure, operational restrictions for installers and end-users, and approval of antennas provided for use with the product.

Operation of the final product requires the 'key' be controlled exclusively by the manufacturer. The 'key' must be unique to each module and must be installed and activated before the radio will operate. The key must contain sufficient security features to the professional installer and operator can not decode, modify, substitute, or otherwise circumvent the operational restrictions imposed by the 'key'.

The software 'key' must limit the transmit power, operating frequency range, and channel bandwidth per the regulator domain governing the location where the radio will be deployed. The operator does not have the option to select the country or regulatory region of operation.

The software 'key' must limit the mode of operation as a master or client. The client mode is 'passive listener' and while in this mode the module can not initiate any transmission without first receiving and decoding a valid authorization message from the master. A module with a key for client operation can not be changed by the installer to enable master mode operation.

Redline will review all final products for compliance to regulatory restrictions.

The manufacturer must meet all labeling described in section 2.3.

3.2 Module Servicing

The modules are not intended to be field serviceable, and contains no field serviceable or field replaceable parts. The module must be serviced only at an approved manufacturing facility or service depot.

 **Warning:** The modules are susceptible to damage from electrostatic charge. Electrostatic Discharge (ESD) must be avoided to prevent damaging or destroying the module. The module must always be store in an anti-static container/bag prior to installation and following removal from the product for servicing. Observe ESD precautions when handling the module.

3.3 Professional Installation

Devices containing the module require professional installation. It is the responsibility of the installer to understand the product operation by attending training as required, reading and understanding the product documentation, and ensuring that all building, safety and regulatory codes are met and the installation is complete and secure.

3.4 Safety Precautions

Installation and service must be done by personnel having technical training and experience necessary to be aware of hazards during installation and/or service of RF equipment. The installation and/or service must be done using procedures designed to minimize any danger to technical personnel or any other person.

3.5 Radio Frequency Safety

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF fields in excess of the general population limits as defined by FCC CFR 47, Part 2.1091 and OET Bulletin 65, Radio frequency radiation exposure evaluation for fixed devices & Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website and information from the websites listed below:

http://www.gpo.gov/fdsys/pkg/CFR-2009-title47-vol1/pdf/CFR-2009-title47-vol1-sec2-1091.pdf

http://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet65/oet65c.pdf

http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct-eng.php

Refer also to the regulatory statements included in this document.

4 Final Product Requirements

The following requirements apply to all final products incorporating the modules.

4.1 Deployment in the United States

4.1.1 Frequency Bands

Operation of the final product requires an FCC specific software 'key' that is available exclusively from Redline. This key restricts device operation to the IC 3675-3700 MHz band. The professional installer and operator can not modify or otherwise circumvent these operational restrictions.

4.1.2 Antenna Use and Transmit Power

FCC regulation part 90.1321 (governing operation in the 3650-3700 MHz band in the US) states that base station transmissions are limited to a maximum transmit power of 1 Watt/MHz (peak EIRP). If the antenna gain exceeds the allowed maximum for any Bandwidth/Frequency combination (see following tables), the power setting must be reduced by the same amount (dB) that the antenna gain exceeds the allowed maximum.

4.1.3 Certified Antennas

This device has been designed to operate with the antennas listed in the following table. Any additional antennas will be used only after authorization is obtained through Class II permissive change.

Table 1: FCC - Approved Antennas

Mfgr.	Part #	Mode	Frequency Range	Gain (dBi)	Size	Polarization
Redline	AFS-DBG-03120-01	Sectoral	3.3-3.8	14	2 ft (60 cm)	Dual
Redline	AFS-DBG-0360-01	Sectoral	3.3-3.8	15.5	2 ft (60 cm)	Dual
Redline	AFS-DBG-0390-01	Sectoral	3.3-3.8	15	2 ft (60 cm)	Dual
Redline	30-00328-40	Terminal	3.3-3.8	14	8 in (20 cm)	Dual

4.1.4 Operation in the 3675-3700 MHz Band

Table 2: FCC - RDL-3000-RMD EIRP Measurement Results for 5 MHz						
Port	**Modulation**	**Frequency, MHz**	**Power setting**	**Peak output power, dBm/5 MHz**	**EIRP limit, dBm/25 MHz**	**Maximum Antenna Gain, dBi**
1	BPSK	3677.5	23	22.66	37	14.34
		3685	23	22.32	37	14.68
		3697.5	23	22.35	37	14.65
	QPSK	3677.5	23	22.58	37	14.42
		3685	23	22.25	37	14.75
		3697.5	23	22.38	37	14.62
	16-QAM	3677.5	23	22.35	37	14.65
		3685	23	22.73	37	14.27
		3697.5	23	22.56	37	14.44
	64-QAM	3677.5	23	22.42	37	14.58
		3685	23	22.27	37	14.73
		3697.5	23	22.68	37	14.32
2	BPSK	3677.5	23	22.76	37	14.24
		3685	23	22.36	37	14.64
		3697.5	23	22.38	37	14.62
	QPSK	3677.5	23	22.74	37	14.26
		3685	23	22.63	37	14.37
		3697.5	23	22.59	37	14.41
	16-QAM	3677.5	23	22.82	37	14.18
		3685	23	22.59	37	14.41
		3697.5	23	22.47	37	14.53
	64-QAM	3677.5	23	22.73	37	14.27
		3685	23	22.52	37	14.48
		3697.5	23	22.48	37	14.52

Table 3: FCC - RDL-3000-RMD EIRP PSD Measurement Results for 5 MHz						
Port	**Modulation**	**Frequency, MHz**	**Power setting**	**Peak output power, dBm/5 MHz**	**EIRP limit, dBm/25 MHz**	**Maximum Antenna Gain, dBi**
1	BPSK	3677.5	23	17.60	30	12.40
		3685	23	17.33	30	12.67
		3697.5	23	17.29	30	12.71
	QPSK	3677.5	23	17.53	30	12.47
		3685	23	17.31	30	12.69
		3697.5	23	17.33	30	12.67
	16-QAM	3677.5	23	17.31	30	12.69
		3685	23	17.58	30	12.42
		3697.5	23	17.42	30	12.58
	64-QAM	3677.5	23	17.27	30	12.73
		3685	23	17.45	30	12.55
		3697.5	23	17.69	30	12.31
2	BPSK	3677.5	23	17.74	30	12.26
		3685	23	17.32	30	12.68
		3697.5	23	17.36	30	12.64
	QPSK	3677.5	23	17.66	30	12.34
		3685	23	17.53	30	12.47
		3697.5	23	17.42	30	12.58
	16-QAM	3677.5	23	17.23	30	12.77
		3685	23	17.28	30	12.72
		3697.5	23	17.31	30	12.69
	64-QAM	3677.5	23	17.68	30	12.32
		3685	23	17.34	30	12.66
		3697.5	23	17.36	30	12.64

Table 4: FCC - RDL-3000-RMD EIRP Measurement Results for 10 MHz						
Port	**Modulation**	**Frequency, MHz**	**Power setting**	**Peak output power, dBm/5 MHz**	**EIRP limit, dBm/25 MHz**	**Maximum Antenna Gain, dBi**
1	BPSK	3680	23	22.22	40	17.78
		3685	23	22.33	40	17.67
		3695	23	22.04	40	17.96
	QPSK	3680	23	21.72	40	18.28
		3685	23	22.36	40	17.64
		3695	23	22.02	40	17.98
	16-QAM	3680	23	22.27	40	17.73
		3685	23	22.34	40	17.66
		3695	23	22.00	40	18.00
	64-QAM	3680	23	22.25	40	17.75
		3685	23	22.30	40	17.70
		3695	23	21.80	40	18.20
2	BPSK	3680	23	22.34	40	17.66
		3685	23	22.30	40	17.70
		3695	23	22.06	40	17.94
	QPSK	3680	23	22.37	40	17.63
		3685	23	22.36	40	17.64
		3695	23	22.07	40	17.93
	16-QAM	3680	23	22.42	40	17.58
		3685	23	22.33	40	17.67
		3695	23	22.00	40	18.00
	64-QAM	3680	23	22.52	40	17.48
		3685	23	22.41	40	17.59
		3695	23	22.12	40	17.88

Table 5: FCC - RDL-3000-RMD EIRP PSD Measurement Results for 10 MHz						
Port	**Modulation**	**Frequency, MHz**	**Power setting**	**Peak output power, dBm/5 MHz**	**EIRP limit, dBm/25 MHz**	**Maximum Antenna Gain, dBi**
1	BPSK	3680	23	14.33	30	15.67
		3685	23	14.38	30	15.62
		3695	23	14.03	30	15.97
	QPSK	3680	23	13.69	30	16.31
		3685	23	14.39	30	15.61
		3695	23	14.02	30	15.98
	16-QAM	3680	23	14.42	30	15.58
		3685	23	14.49	30	15.51
		3695	23	14.03	30	15.97
	64-QAM	3680	23	14.37	30	15.63
		3685	23	14.43	30	15.57
		3695	23	13.9	30	16.10
2	BPSK	3680	23	14.59	30	15.41
		3685	23	14.52	30	15.48
		3695	23	14.07	30	15.93
	QPSK	3680	23	14.5	30	15.50
		3685	23	14.55	30	15.45
		3695	23	14.09	30	15.91
	16-QAM	3680	23	14.54	30	15.46
		3685	23	14.49	30	15.51
		3695	23	14.09	30	15.91
	64-QAM	3680	23	14.6	30	15.40
		3685	23	14.63	30	15.37
		3695	23	14.1	30	15.90

4.1.5 FCC Notices

The following notices about deployment in the USA are included in training and documentation provided to professional installers and operators of the final product:

1. The final product must be professionally installed.
2. WARNING -- FCC RF Exposure Warnings:

   To satisfy FCC RF exposure requirements for RF transmitting devices, the following distances should be maintained between the antenna of this device and persons during device operation:

Table 6: FCC - RDL-3000-RMD Recommended Safe Distances		
3675	PMP	50 cm (19.7 in) or more

   To ensure compliance, operation at closer than these distances is not recommended. The antenna used for this transmitter must not be collocated in conjunction with any other antenna or transmitter.
3. FCC Information to Users @ FCC 15.105:

   NOTE: This equipment 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:

   - Reorient or relocate the receiving antenna.
   - Increase the separation between the equipment and receiver.
   - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
   - Consult the dealer or an experienced radio/TV technician for help.

   Where DFS is required by regional regulations, this function is permanently enabled at the factory and can not be disabled by the installer or end-user.
4. FCC Information to Users @ FCC 15.19:

   This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

   (1) This device may not cause harmful interference.

   (2) This device must accept any interference received, including interference that may cause undesired operation.
5. FCC Information to Users @ FCC 15.21:

   Warning: Changes or modifications not expressly approved by Redline Communications could void the user's authority to operate the equipment.

Federal Communications Rules for Operation in USA

FCC Part 90 guidelines for deployment of RDL-3000-RMD systems in the frequency band of 3650-3700 MHz for “restricted” CBP (Contention Based Protocol) in USA includes restrictions on the maximum EIRP.

To comply with these guidelines, the following EIRP limitations are applied for deployment in this band:

i) Max EIRP of 25 Watts/25 MHz (equivalent to 1 Watt/1 MHz)

ii) Peak EIRP Power Density of 1 Watt in any 1 MHz slice of spectrum.

To ensure compliance with these restrictions, refer to the following important notices:

1. The 3650-3700 MHz frequency range is a licensed band in the USA and operators must have a valid spectrum license to operate RDL-3000-RMD equipment using this band.
2. The RDL-3000-RMD requires a Redline FCC-specific options key that is mandatory for operation within the USA. This options key enforces the FCC approved operating range of 3675-3700 MHz.
3. The RDL-3000-RMD outdoor transceiver and antenna must be professionally installed.
4. Changes or modifications not expressly approved by Redline Communications could void the user’s authority to operate the equipment.
5. Do not operate an RDL-3000-RMD outdoor transceiver until you have confirmed the FCC specific options key is loaded and active (operating range restricted to 3675-3700 MHz). When the FCC-specific options key is installed, the operator is not able to set an RF frequency that exceeds the allowed range of 3675-3700 MHz.
6. The RDL-3000-RMD transmit power settings must not exceed values stated in the RDL-3000 Family User Manual.

4.2 Deployment in Canada

4.2.1 Frequency Bands

Operation of the final product requires a software 'key' that is available exclusively from Redline. This key restricts device operation to the IC 3450-3650 MHz or 3650-3675 MHz band. The professional installer and operator can not modify or otherwise circumvent these operational restrictions.

4.2.2 Antenna Use and Transmit Power

The module supports operation with 2x2 MIMO antenna systems with two transmit chains and two receive chains. The module may be used with any compatible antenna and using the channel size and output power level specified by the IC regulations.

4.2.3 Power and EIRP Results (MIMO Operation)

Operation in the 3450-3650 MHz Band

The power setting for RSS-192 3450-3650 MHz is +23 dBm for all frequencies and channel bandwidths.

Operation in the 3650-3675 MHz Band

The power setting for RSS-197 3650-3675 MHz is +23 dBm for all frequencies and channel bandwidths. If the antenna gain exceeds the allowed maximum for any Bandwidth/Frequency combination (see following table), the power setting must be reduced by the same amount (dB) that the antenna gain exceeds the allowed maximum.

Table 7: IC - RDL-3000-RMD Power & EIRP Results: 3650-3675 MHz

Bandwidth (MHz)	Frequency (MHz)	Settings RF1 & RF2	RF1 (dBm)	RF2 (dBm)	Combined PSD (dBm)	EIRP Limit (dBm)	Margin	Max. Antenna Gain (dBi)
3.5 MHz	3651.75	23	17.490	17.550	20.53	30.0	9.47	9
	3662.50	23	17.393	17.658	20.54	30.0	9.46	9
	3673.25	23	17.718	17.628	20.68	30.0	9.32	9
5 MHz	3652.50	23	16.022	16.054	19.05	30.0	10.95	10.5
	3662.50	23	16.164	15.995	19.09	30.0	10.91	10.5
	3672.50	23	16.132	16.161	19.16	30.0	10.84	10.5
7 MHz	3653.50	23	14.634	14.527	17.59	30.0	12.41	12
	3662.50	23	14.542	14.610	17.59	30.0	12.41	12
	3671.50	23	14.750	14.609	17.69	30.0	12.31	12
10 MHz	3655.00	23	13.008	12.959	15.99	30.0	14.01	14
	3662.50	23	12.940	13.037	16.00	30.0	14.00	14
	3670.00	23	13.022	13.069	16.06	30.0	13.94	13.5
14 MHz	3657.00	23	11.837	11.771	14.81	30.0	15.19	15
	3662.50	23	11.869	11.859	14.87	30.0	15.13	15
	3668.00	23	11.751	11.832	14.80	30.0	15.20	15
20 MHz	3660.00	23	10.205	10.094	13.16	30.0	16.84	16.5
	3662.50	23	10.220	10.145	13.19	30.0	16.81	16.5
	3665.00	23	10.264	10.290	13.29	30.0	16.71	16.5

4.3 Industry Canada Notices: Deployment in Canada:

This Class B Digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

The following notices about deployment in Canada are included in training and documentation provided to professional installers and operators of the final product:

1. The final product must be professionally installed.
2. WARNING -- IC RF Exposure Warnings

   To satisfy IC RF exposure requirements for RF transmitting devices, the following distances should be maintained between the antenna of this device and persons during device operation:

Table 8: IC - Recommended Safe Distances		
Frequency (MHz)	**Deployment**	**Separation Distance**
3500	PMP	34 cm (13.4") or more

   To ensure compliance, operation at closer than these distances is not recommended. The antenna used for this transmitter must not be collocated in conjunction with any other antenna or transmitter.

IC regulations governing operation in the 3450-3700 MHz band are subject to licensing, pursuant to subsection 4(1) of the Radiocommunication Act.

This equipment complies to RSS-192 in the frequency band 3450-3650 MHz and RSS-197 guidelines for deployment of systems in the frequency band of 3650-3675 MHz, for restricted CBP (Contention Based Protocol).

IC regulations governing operation in the 3450-3675 MHz band states that base station transmissions are limited to a maximum transmit power of 1 Watt/MHz.

Déploiement aux le Canada

Cet appareil Digitale de Classe B rencontre toutes les normes du Canadian Règlement Brouilleur Équipement.

Les avis suivants à propos du déploiement au Canada sont inclus dans la formation et la documentation fournies aux installateurs professionnels et les opérateurs du produit final:

3. Le produit final doit être installé par un professionnel.
4. AVERTISSEMENT - IC avertissements d'exposition RF

   Pour satisfaire les exigences d'IC en ce qui a trait aux expositions aux RF pour RF dispositifs de transmission, les distances suivantes doit être maintenue entre l'antenne de ce dispositif et des personnes pendant le fonctionnement du dispositif:

Table 9: IC - Avis RF Distances de séparation sécuritaire recommandées		
Fréquence (MHz)	**Déploiement**	**Distance de Séparation**
3500	PMP	34 cm (13.4") ou plus

   Pour assurer la conformité , l'operation à une distance moindre que celles-ci n'est pas recommandé. L'antenne utilisée pour ce transmetteur ne doit pas être co-localisé avec une autre antenne ou transmetteur.

Règlements qui régissent le fonctionnement IC dans la bande 3450-3700 MHz sont soumises à autorisation en vertu du paragraphe 4 (1) de la Loi sur la radiocommunication.

Cet équipement est conforme à RSS-192 dans la bande de fréquences 3450-3650 MHz et RSS-197 des lignes directrices pour le déploiement de systèmes dans la bande de fréquences 3650-3675 MHz d', pour limité le CBP (protocole de contention après). Réglementation régissant le fonctionnement d'IC dans les états de bande 3450-3675 MHz que les transmissions des stations de base sont limités à un maximum de puissance d'émission de 1 Watt / MHz (pire de crête).

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