EX-5 Series

Digital Microwave Radio Module

Part Number: 5xxxxxxx

Date: 2007-06-29

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Linux Operating System	GNU GPL Version 2	www.gnu.org
BusyBox CLI	GNU GPL Version 2	www.gnu.org; www.busybox.net
GoAhead Web Server	Copyright (c) 2003 GoAhead Software, Inc. All Rights Reserved.	www.goahead.com
U-boot Boot Code	GNU GPL Version 2	www.gnu.org www.sourceforge.net
Net-SNMP	(see Copyright Notices on page 14)	www.sourceforge.net

About this Document

This manual provides a description of the Exalt EX-5 Series Digital Microwave Radio Module.

Revision History

Date	**Products and Release code**
2007-06-29	EX-5 Series Radio Module Guide

General Compliance and Safety

The usage of radio transmission devices is subject to specific regulatory requirements governed by regional legislation. In most cases, the specific device must be authorized for use in a given country and must be installed and adjusted in accordance with specific radio-frequency settings and in a manner that has been authorized specific to the device itself in accordance with the specific location of the device. Some users may be completely or partially restricted from use of the device. Please consult local governmental agency/agencies for regulatory requirements before use, or contact Exalt or your Exalt authorized dealer for assistance.

Do not modify this device in any way without the express written consent of Exalt. Modification voids the manufacturer warranty, and may also be illegal in accordance to government regulations. In addition, there are no user-serviceable parts or assemblies inside the product housing. There may also be voltages, signals, and mechanisms within the device that could be harmful to human safety.

The mounting of the system and associated peripherals and connections (inclusive of antenna mast, antenna, cabling, egress, lightning protection devices, grounding, power, and so on) may be subject to regional requirements for health and human safety. A qualified professional installer and an electrician may be required by law.

Exalt cannot warranty the device or be found liable for any unauthorized use or installation of the device.

Safety Icons

The following icons denote specific types of information.

✎ **Note** This symbol means take note. Notes contain helpful suggestions or references to materials not contained in the manual.

⚠ **Caution** This symbol means be careful. There is a risk of equipment damage, loss of data, or injury to persons. To reduce the risk, follow the instructions. This is a general warning, caution, or risk of danger.

⚠ **Warning** This warning symbol means there is a risk of electric shock. This situation could cause bodily injury. To reduce the risk, before working on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.

Safety Notices

1. Review this entire guide for important installation instructions BEFORE attempting to install this product.
2. The end-product is intended to be installed, used, and maintained by experienced telecommunications personnel only.
3. Do not move or alter the marking labels.

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List of Tables

Introduction

Exalt Communications, Inc. thanks you for your purchase. Our goal is to build the highest quality, highest reliability digital microwave radio products. This commitment to quality and reliability extends to our employees and partners alike. We appreciate any comments on how we can improve our products, as well as your sales and Customer Care experience.

Customer Care Hotline (USA):	(408) 871-9890
Toll-Free Customer Care Hotline (USA):	(877) EXALT-01 (392-5801)
Direct-Dial Telephone (USA):	(408) 871-1804
Website: Sales e-mail: Customer Care e-mail:	www.exaltcom.com sales@exaltcom.com support@exaltcom.com
Mailing Address:	Exalt Communications, Inc. 580 Division St. Campbell, CA 95008 USA

Related Documentation and Software

This manual makes reference to other documentation and software files that may be necessary. Any document or software mentioned in this manual can be found at:

http://www.exaltcom.com/support/downloads.htm

The Quick Start Guide provides any necessary username and password information to gain access to these documents.

The Exalt EX-5 Series of Digital Microwave Radio Module

The Exalt EX-5 Series of Digital Microwave Radios are the most advanced carrier-class point-to-point terrestrial radio communications devices operating in the 5250 to 5850 MHz frequency bands, respectively.

The EX-5 Series radios connect voice and/or digital data from one location to another, obviating the need for copper or fiber connectivity, or enhancing existing connectivity by providing a redundancy solution, a primary solution, and/or additional capacity.

The EX-5 Series Digital Microwave Radio Module is installed in Exalt's EX-5 Series products. Please refer to the Installation and Management Guide for your end-product for detailed information on installation, set-up, troubleshooting, and maintenance.

There are no user serviceable parts inside the end-product including the EX-5 Series Module, opening the end-product voids all warranties.

Generally, the EX-5 Series products require a clear line-of-sight and proper path clearance to achieve a high-performance, reliable connection. Perform professional path engineering and site planning BEFORE installing this equipment.

> ✎ **Note: It is the professional installer's responsibility to ensure that the radio system is implemented in a legal fashion. Exalt is not liable for any unsafe or illegal installations.**

Radio A/B Configuration

Use the Exalt GUI to configure the radio terminals for Radio A and Radio B orientation. Since many other parameters also need to be set, and the Exalt GUI is needed for these configurations, this is the best way to completely configure the radio terminals.

Radios arrive from manufacture in default configuration, orientated as Radio B and configured as shown in Table 1.

Table 1 Factory Default Settings

Parameter	**EX-5**
Frequency	5788 MHz
Transmit Power	+4 dBm
Bandwidth	8 MHz
Mode	Mode 1
Link Distance	<10 miles
TDD Frame Size	2ms
Link Security Key	000000000000
Administration Password	password
User Password	password
IP Address	10.0.0.1
IP Mask	255.0.0.0
IP Gateway	0.0.0.0
Ethernet Interfaces	Enabled, 100/Full
AUX port NMS Access	In-Band
T1/E1 Settings (-16 models)	All Enabled, T1, B8ZS, AIS
T1/E1 Settings (std. models)	Disabled

Installation

Each Exalt Digital Microwave Radio Module is installed in an EX-5 Series product. There are no user-serviceable parts, Installation and Management need to be as described in the Installation and Management Guide applicable to the end-product.

Specifications

This section presents specifications for the EX-5 Series of Digital Microwave Radios.

Common System Specifications

Tuning Resolution	1MHz
Power Control Resolution	0.5dB
Selectable Modulation Modes	Mode 1 (QPSK); Mode 2 (16QAM)
Selectable Frame Lengths (ms)	0.5, 1, 2, 2.5, 4, 5

Maximum Aggregate User Capacity

Mbps	**Mode 1**	**Mode 2**
8 / 10 MHz	13	27
16 / 20 MHz*	27	54
64MHz*	110	216

Error Floor	10^{-12}
Frequency Stability	$\pm$7 ppm
Link Security	96-bit Security Code

*Not all Bandwidth and Mode combinations are available on all radio models, and some may require specific software license keys, which may be purchased from an authorized Exalt representative.

EX-5 System Specifications, 5.3 GHz Band

Frequency Band	5250 to 5350 MHz
Tunable Range	5260 to 5332 MHz
Output Power (at full power)	+13dBm (0.02W)
Output Power (at minimum power)	-7dBm
Selectable Channel Bandwidths	8MHz, 16MHz, 32MHz, 64MHz*

Receiver Threshold (BER=10^{-6})

dBm	**Mode 1**	**Mode 2**
8MHz	-86	-78
16MHz	-83	-75
32MHz	-80	-72
64MHz*	-77	-69

Maximum RSL	Mode 1: -25dBm error-free; 0dBm no damage
Non-overlapping channels	8MHz: 10; 16MHz: 5; 32MHz: 2; 64MHz*: 1
Regulatory Compliance	FCC 15.407; IC RSS-210; EN 301 893
Contains FCC ID	TTM-105P25M
IC ID	6254A-105P25I/R

Emission Designator(s)

8MHz	8M7W7D
16MHz	17M2W7D
32MHz	34M5W7D
64MHz*	67M9W7D

*For the EX-5 Series, a firmware option may be required to enable 64 MHz BW.

EX-5 System Specifications, 5.4 GHz Band

Frequency Band	5470 to 5725 MHz
Tunable Range	5488 to 5715 MHz
Output Power (at full power)	+13dBm (0.02W)
Output Power (at minimum power)	-7dBm
Selectable Channel Bandwidths	8MHz, 16MHz, 32MHz*, 64MHz*

Receiver Threshold (BER=10^{-6})

dBm	**Mode 1**	**Mode 2**
8MHz	-86	-78
16MHz	-83	-75
32MHz	-80	-72
64MHz*	-77	-69

Maximum RSL	Mode 1: -25dBm error-free; 0dBm no damage
Non-overlapping channels	8MHz: 29; 16MHz: 14; 32MHz: 7; 64MHz*: 3
Regulatory Compliance	FCC 15.407; IC RSS-210; EN 301 893
Contains FCC ID	TTM-105P25M
IC ID	6254A-105P25I/R

Emission Designator(s)

8MHz	8M7W7D
16MHz	17M2W7D
32MHz	34M5W7D
64MHz*	67M9W7D

* For the EX-5 Series, a firmware option may be required to enable 64 MHz BW.

EX-5 System Specifications, 5.8 GHz Band

Frequency Band	5725 to 5850 MHz
Tunable Range	5731 to 5844 MHz
Output Power (at full power)	+24dBm (0.25W), Mode 1
	+21dBm (0.13W), Mode 2
Output Power (at minimum power)	+4dBm
Selectable Channel Bandwidths	8MHz, 16MHz, 32MHz*, 64MHz*

Receiver Threshold (BER=10^{-6})

(dBm)	**Mode 1**	**Mode 2**
8MHz	-86	-78
16MHz	-83	-75
32MHz	-80	-72
64MHz*	-77	-69

Maximum RSL	Mode 1: -25dBm error-free; 0dBm no damage
Non-overlapping channels	8MHz: 15; 16MHz: 7; 32MHz: 3; 64MHz*: 1
Regulatory Compliance	FCC 15.247; IC RSS-210; EN 302 502
Contains FCC ID	TTM-105P25M
IC ID	6254A-105P25I/R

Emission Designator(s)

8MHz	9M1W7D
16MHz	16M5W7D
32MHz	31M8W7D
64MHz*	61M6W7D

* For the EX-5 Series, a firmware upgrade may be required to enable 64 MHz BW.

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Appendix A - Regulatory Compliance

General Regulatory Notices

Exalt's EX-5 Series products are equipped with base software that does not include Regulatory License Key (RLK) information. The professional installer is required to enter the License Key based on regional regulations. License keys are issued by serial number, it is important that the license key used for installing the radio is the correct license key for the serial number on the product.

Dynamic Frequency Selection

Dynamic Frequency Selection (DFS) may be required by regional legislation in some frequency bands in order to avoid causing interference to radar systems. Prior to the start of any transmission, the device equipped with DFS monitors the spectrum and is not permitted to transmit on a part of the spectrum that is already in use for radar transmissions for a period of 30 minutes. During operation of the device, the spectrum is continually monitored by the DFS to detect if radar begins transmission on a frequency that is being used by the device to transmit on. If the DFS software detects radar, the device must move off channel within a specified time period so that the device transmission does not interfere with the radar transmission. The device equipped with DFS is required to stay off that part of the spectrum for a minimum of 30 minutes, after which time the device may then check the spectrum for radar transmissions and begin transmitting if no radar is detected.

Antennas

Table 2 lists antennas recommended for use with the EX-5 Series radios. In some countries, antennas exceeding a certain level of gain may be unlawful.

Table 2 lists antennas supported by the EX-5 family of Digital Microwave Radios.

Table 2 EX-5 supported antennas

Manufacturer	Model #	Description	Mid-band Gain dBi (mid-band)	3dB (Azimuth/Elevation) Beamwidth (degrees)
Andrew	P2F-52-N	2-foot Dish	29.4	5.4
Andrew	P3F-52-N	3-foot Dish	33.4	3.8
Andrew	P4F-52-NXA	4-foot Dish	34.9	3.0
Andrew	P6F-52-NXA	6-foot Dish	37.6	1.8
Andrew	HP2F-52-NPA	2-foot HP Dish	29.0	5.4
Andrew	HP3F-52-NPA	3-foot HP Dish	33.0	3.8
Andrew	HP4F-52-NPA	4-foot HP Dish	34.5	3.0
Andrew	HP6F-52-NPA	6-foot HP Dish	37.2	1.8
Andrew	FPA5250D06-N	6-inch Panel	18.0	19.3
Andrew	FPA5250D12-N	1-foot Panel	23.6	9.6
Gabriel	DFPS.5-52	6-inch Panel	18.0	19.0
Gabriel	DFPD1-52	1-foot Panel	23.5	9.4
Gabriel	DFPD2-52	2-foot Panel	28.0	4.6
Gabriel	QF2-52-N	2-foot Dish	28.5	5.6
Gabriel	QF2.5-52-N	2.5-foot Dish	31.2	4.4
Gabriel	QF4-52-N	4-foot Dish	34.8	2.7
Gabriel	QF6-52N	6-foot Dish	37.8	1.9
Gabriel	HQF2-52-N	2-foot HP Dish	28.2	5.7
Gabriel	HQF4-52-N	4-foot HP Dish	34.4	2.8
Gabriel	HQF6-52-N	6-foot HP Dish	37.4	1.9
MTI	MT-485001	7.5-inch Panel	19.0	18.0
MTI	MT-485002	1-foot Panel	23.0	9.0
MTI	MT-486004	18-inch Panel	26.0	6.0
MTI	MT-486001	2-foot Panel	28.0	4.5
Radio Waves	FP.5-5-18	6-inch Panel	18.0	20.0
Radio Waves	FP1-5-24	1-foot Panel	23.8	10.0
Radio Waves	FP2-5-28	2-foot Panel	28.0	4.5
Radio Waves	SP1-5.2	1-foot Dish	22.5	11.1
Radio Waves	SP2-5.2	2-foot Dish	29.0	6.1
Radio Waves	HP2-5.2	2-foot HP Dish	28.6	6.1
Radio Waves	SP3-5.2	3-foot Dish	32.0	4.0
Radio Waves	SP4-5.2	4-foot Dish	34.8	3.0
Radio Waves	SP6-5.2	6-foot Dish	37.9	2.0
RFS	SPF2-52A	2-foot Dish	27.9	6.2
RFS	SPF3-52A	3-foot Dish	31.4	4.2
RFS	SPF4-52A	4-foot Dish	33.9	3.1
RFS	SPF6-52A	6-foot Dish	37.4	2.1
RFS	SDF4-52A	4-foot HP Dish	33.9	3.1

Manufacturer	Model #	Description	Mid-band Gain dBi (mid-band)	3dB (Azimuth/Elevation) Beamwidth (degrees)
RFS	SDF6-52A	6-foot HP Dish	37.4	2.1
RFS	MA0528-19AN	7.5-inch Panel	19.0	18.0
RFS	MA0528-23AN	1-foot Panel	23.0	9.0
RFS	MA0528-28AN	2-foot Panel	28.0	4.5

Region 1 Specifics

Region 1 is designated for USA and Canada installations.

✎ **Note:** The professional installer is responsible to ensure that RF output power is properly adjusted to not exceed the regulatory limit.

Federal Communications Commission (FCC), United States

The device is allowed to be used provided it does not cause interference to other devices. It is not guaranteed to provide protection against interference from other electronic and radio devices.

The system has been tested and found to comply with the limits of 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 of 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.

Shielded cables and I/O cords must be used for this equipment to comply with the relevant FCC regulations.

Changes or modifications not expressly approved in writing by Exalt may void the user's authority to operate this equipment.

This device must be professionally installed.

To comply with regulations, the output power of this device may need to be adjusted in accordance to the associated transmission system.

The antenna associated with the EX-5 family shall be mounted in a location that is at least 10'/3m away from humans that may be subject to long-term or continuous exposure.

Important: Where required by regional regulations, DFS is enabled by the system keys and cannot be disabled.

United States Compliance

The EX-5 product families operate under FCC Rule Parts 15.247 and/or 15.407 as a license-exempt device. They may only be used as a point-to-point transmission device for fixed or temporary-fixed (non-mobile) installations. The devices are subject to the following restrictions:

- Do not use external amplifiers to boost the power or overcome transmission system losses, unless the specific amplifier/cable/antenna combination has expressly been authorized by the FCC. The output power must never exceed +30 dBm.
- Cross-border transmissions are expressly prohibited, except with written permission from both the FCC and the governing body of the neighboring country (Cofetel for Mexico; Industry Canada for Canada).
- Use only parabolic dish antennas or directional flat-panel antennas. No other types of antennas (omni-directional, yagi, and so on) are authorized. Parabolic dishes of either grid or solid type are allowed. Maximum mid-band gain of each type of antenna certified is:
    - EX-5 models:
        - Parabolic dish: 37.9 dBi (6'/1.8m diameter)
        - Directional flat panel: 28 dBi (~2'/61cm square)

Industry Canada (IC), Canada

This device complies with RSS-210 of Industry Canada. Operation is subject to the following two conditions:

4. this device may not cause interference, and
5. this device must accept any interference, including interference that may cause undesired operation of the device.

Antennas Supported in Canada

The EX-5 family has been designed to operate with the antennas listed in Table 2 which have a maximum gain of 37.9 dBi. Antennas not included in the list or having a gain greater than 37.9 dBi are prohibited for use with this device. The required antenna impedance is 50 Ohms.

The antenna associated with the EX-5 family shall be mounted in a location that is at least 10’/3m away from humans that may be subject to long-term or continuous exposure.

Important: Where required by regional regulations, DFS is enabled by the system keys and cannot be disabled.

Canada Compliance

EX-5 models operate under RSS-210 of Industry Canada regulations. Operation is subject to the following conditions, unless express permission is granted by Industry Canada to operate in a different manner:

- External amplifiers cannot be used to boost the power or to overcome transmission system losses, unless the specific amplifier/cable/antenna combination is expressly authorized by Industry Canada.
- Cross-border transmissions are expressly prohibited, except with written permission from both Industry Canada and the governing body of the neighboring country (FCC for USA)
- Only parabolic dish antennas or directional flat-panel antennas may be used. No other types of antennas (omni-directional, yagi, and so on) are authorized. Parabolic dishes of either grid or solid type are allowed. Maximum gain of each type of antenna allowed is:
    - EX-5 models:
        - Parabolic dish: 37.9 dBi (6'/1.8m diameter)
        - Directional flat panel: 28 dBi (~2'/61cm square)

EX-5 EIRP for the US and Canada

5250-5350 MHz Band

For the EX-5 models within the 5250–5350 MHz band, the maximum transmit power is 30 dBm. The maximum output of the radio is +13 dBm.

$$P = CP - G + L$$

where:

P = Maximum transmitter output power of radio, in dBm

CP = Maximum Conducted Power of transmitter output power of radio, in dBm

G = Specified gain of antenna, in dBi, from 5250 to 5350 MHz

L = Total transmission system losses of all elements between the radio's RF connector and the antenna's RF connector (all cables, connectors, lightning suppressors), in dB, as specified or measured between 5250 and 5350 MHz

5470-5725 MHz Band

For the EX-5 models within the 5470-5725 MHz band, the maximum EIRP allowed is 30 dBm. The maximum output power of the radio is +13 dBm.

$$P = CP - G + L$$

where:

P = Maximum transmitter output power of radio, in dBm

CP = Maximum Conducted Power of transmitter output power of radio, in dBm

G = Specified gain of antenna, in dBi, from 5470 to 5725 MHz

L = Total transmission system losses of all elements between the radio's RF connector and the antenna's RF connector (all cables, connectors, lightning suppressors), in dB, as specified or measured between 5470 and 5725 MHz

5725-5850 MHz Band

For the EX-5 models within the 5725–5850 MHz band, the maximum EIRP allowed is 61.9 dBm. The maximum output power of the radio is +24 dBm in Mode 1 and +21 dBm in Mode 2.

$$P = CP - G + L$$

where:

P = Maximum transmitter output power of radio, in dBm

CP = Maximum Conducted Power of transmitter output power of radio, in dBm

G = Specified gain of antenna, in dBi, from 5725 to 5850 MHz

L = Total transmission system losses of all elements between the radio's RF connector and the antenna's RF connector (all cables, connectors, lightning suppressors), in dB, as specified or measured between 5725 and 5850 MHz

Region 2 Specifics

The countries that are covered by this region are: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Great Britain, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Netherlands, Switzerland, and Turkey.

✎ **Note:** The professional installer is responsible to ensure that RF output power is properly adjusted to not exceed the regulatory limit.

Europe/ITU (ETSI and CE Mark)

The EX-5 family complies with ETS 301 893 for the 5.3 and 5.47 GHz bands for license-exempt use for most countries recognizing ETSI or ITU band assignments. This band is not yet harmonized for all countries recognizing ETSI or ITU band assignments These bands require Dynamic Frequency Selection (DFS) and Transmitter Power Control (TPC) for radar-detection and avoidance. There is a +30dBm EIRP limit applied to this band. Transmitter power must be adjusted accordingly with respect to the RF cabling losses and antenna gains associated with each terminal.

The EX-5 family complies with ETS 302 502 for the 5.8 GHz band. This band is not yet harmonized for all countries recognizing ETSI or ITU band assignments. Consult the individual country regulations or your Exalt Communications representative for details. This band requires DFS and TPC for radar-detection and avoidance. There is a +33dBm EIRP limit for use of the 10MHz BW setting (called 8MHz on GUI), and a +36dBm EIRP limit for use of the 20MHz BW setting (called 16MHz on GUI).

All models comply with the requirements for CE Mark (EN 60950-1 and IEC 60950-1) and EMC (EN 301 489-17). No substitutions shall be made, and all wiring and grounding instructions contained in this manual must be followed to ensure safety in accordance to the standards.

Declaration of Conformity to the R&TTE Directive 1999/5/EC

English:	This equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
Deutsch:	Dieses Gerät entspricht den grundlegenden Anforderungen und den weiteren entsprecheneden Vorgaben der Richtlinie 1999/5/EU.
Dansk:	Dette udstyr er i overensstemmelse med de væsentlige krav og andre relevante bestemmelser i Directiv 1999/5/EF.
Español:	Este equipo cumple con los requisitos esenciales asi como con otras disposiciones de la Directive 1999/5/EC.
¸ëëçíáò:	Áõôüò ï åîïðëéóìüò óõììïñöþíåôáé ìå ôéò ïõóéþäåéò áðáéôÞóåéò êáé ôéò ëïéðÝò äéáôÜîåéò ôçò Ïäçãßáò 1999/5/ÅÊ.
Français:	Cet appareil est conforme aux exigencies essentialles et aux autres dispositions pertinantes de la Directive 1999/5/EC.
Íslenska:	Þessi búnaður samrýmist lögboðnum kröfum og öðrum ákvæðum tilskipunar 1999/5/ESB.
Italiano:	Questo apparato é conforme ai requisiti essenziali ed agli altri principi sanciti dalla Direttiva 1999/5/EC.
Nederlands:	Deze apparatuur voldoet aan de belangrijkste eisen en andere voorzieningen van richtlijn 1999/5/EC.
Norsk:	Dette utstyret er i samsvar med de grunnleggende krav og andre relevante bestemmelser i EU-directiv 1999/5/EC.
Português:	Este equipamento satisfaz os requisitos essenciais e outras provisões da Directiva 1999/5/EC.
Suomalainen:	Tämä laite täyttää direktiivin 1999/5/EY oleelliset vaatimukset ja on siinä asetettujen muidenkin ehtojen mukainen.
Svenska:	Denna utrustning är i överensstämmelse med de väsentliga kraven och andra relevanta bestämmelser i Direktiv 1999/5/EC.

For 5 GHz radios, the following standards were applied:
- Radio: EN 301 893, EN 302 502
- EMC: EN 301 489-1, EN 301 489-17
- Safety: EN 60950-1, IEC 60950-1

The following CE mark is affixed to the product:

EU WEEE

Exalt is committed to meeting the requirements of the European Union's Waste Electrical and Electronic Equipment (WEEE) Directive. The Directives require producers of electrical and electronic equipment to finance the take-back for re-use or recycling of their products placed on the EU market after 13 August 2005.

Exalt products that are within the scope of the Directives are labeled with a crossed-out "wheelie-bin" symbol as required by the Directives. This indicates that the product was placed on the market after 13 August 2005 and that end-users should segregate the product from other wastes at end-of-life.

The WEEE Directives are being implemented in each of the 28 EU and European Economic Area (EAA) countries through national legislation. This has resulted in considerable variation in the detailed requirements across the EU, many of which require presence in the EU. As a result, Exalt's WEEE compliance approach is to require the

distributors and/or resellers in the EU to comply with each country's national legislation by registration of the distributor or reseller as the producer and for the reseller/distributor to carry out and fulfill the legislative requirements of each national compliance scheme.

Below is the crossed out wheelie bin symbol as required by the WEEE Directive.

EU RoHS

RoHS is the acronym used to refer to the European Union (EU) Directive 2002/95/EC on the Restriction of the use of certain hazardous substances in electrical and electronic equipment. Hazardous materials are those chemicals and substances that are legislatively, market, or customer banned or restricted for use in products and/or manufacturing. There are six (6) RoHS substances: lead (Pb), cadmium (Cd), mercury (Hg), hexavalent chromium (Cr+6), polybrominated biphenyls (PBB) and polybrominated diphenylethers (PBDE). Other countries may be introducing legislation that results in similar restrictions of hazardous substances. Many Exalt products will continue to use lead-based solder under the exemption allowed for network infrastructure equipment. Small amounts of lead, cadmium, mercury, hexavalent chromium, PBB, and PBDE can also be found in a few electrical and electrical components.

Europe Compliance

The EX-5 family operates under EN 301 893 and EN 302 502 rules as a license-exempt device. All of these permitted devices must be professionally installed. They may only be used as a point-to-point transmission device for fixed or temporary-fixed (non-mobile) installations. The devices are subject to the following restrictions:

- Do not use external amplifiers to boost the power or overcome transmission system losses, unless the specific amplifier/cable/antenna combination has expressly been authorized by the specific country regulations. The output power must never exceed that specified.
- Use only parabolic dish antennas or directional flat-panel antennas. No other types of antennas (omni-directional, yagi, and so on) are authorized. Parabolic dishes of either grid or solid type are allowed. Maximum mid-band gain of each type of antenna certified is:
    - EX-5 models:

- Parabolic dish: 37.9 dBi (6'/1.8m diameter)
- Directional flat panel: 28 dBi (~2'/61cm square)

EX-5 EIRP by Country

Table 13 summarizes the maximum power by band and country for Exalt's EX-5 series products.

5250–5350 MHz band

For the EX-5 models within the 5250–5350 MHz band, the maximum transmit power is 23 dBm. The maximum output of the radio is +13 dBm.

$$P = CP - G + L$$

where:

P = Maximum transmitter output power of radio, in dBm

CP = Maximum Conducted Power of transmitter output power of radio, in dBm

G = Specified gain of antenna, in dBi, from 5250 to 5350 MHz

L = Total transmission system losses of all elements between the radio's RF connector and the antenna's RF connector (all cables, connectors, lightning suppressors), in dB, as specified or measured between 5250 and 5350 MHz

5470–5725 MHz band

For the EX-5 models within the 5470-5725 MHz band, the maximum EIRP allowed is 30 dBm. The maximum output power of the radio is +13 dBm.

$$P = CP - G + L$$

where:

P = Maximum transmitter output power of radio, in dBm

CP = Maximum Conducted Power of transmitter output power of radio, in dBm

G = Specified gain of antenna, in dBi, from 5470 to 5725 MHz

L = Total transmission system losses of all elements between the radio's RF connector and the antenna's RF connector (all

cables, connectors, lightning suppressors), in dB, as specified or measured between 5470 and 5725 MHz

5725-5850 MHz band

For the EX-5 models, within the 5725-5850 MHz band, the maximum transmit power with respect to specific country EIRP regulations is determined based on the channel bandwidth. The EIRP power limit is 33 dBm for 10 MHz channels and 36 dBm for 20 MHz channels. The Exalt EX-5 series maximum transmitter conducted power is +24 dBm. Use the following equation to determine the EIRP:

$$P = CP - G + L$$

where:

P = Maximum transmitter output power of radio, in dBm

CP = Maximum Conducted Power of transmitter output power of radio, in dBm

G = Specified gain of antenna, in dBi, from 5725-5850 MHz

L = Total transmission system losses of all elements between the radio's RF connector and the antenna's RF connector (all cables, connectors, lightning suppressors), in dB, as specified or measured between 5725 and 5850 MHz

Table 3 Region 2 Country Specific Power Levels for EX-5 Series

Country	**Maximum EIRP Output Power, 5.3 GHz band**	**Maximum EIRP Output Power, 5.4 GHz band**	**Maximum EIRP Output Power, 5.8 GHz band (BW dependent) see note 1**
Austria	23 dBm	30 dBm	5 dBm
Belgium		30 dBm	
Cyprus	23 dBm	30 dBm	
Czech Republic	23 dBm	30 dBm	5 dBm
Denmark	23 dBm	30 dBm	33/36 dBm
Estonia	23 dBm	30 dBm	
Finland	23 dBm	30 dBm	
France	23 dBm	30 dBm	33/36 dBm
Germany	23 dBm	30 dBm	33/36 dBm
Great Britain	23 dBm	30 dBm	33/36 dBm
Hungary	23 dBm	30 dBm	33/36 dBm
Iceland	23 dBm	30 dBm	33/36 dBm
Ireland	23 dBm	30 dBm	33/36 dBm
Italy	23 dBm	30 dBm	33/36 dBm
Liechtenstein	23 dBm	30 dBm	5 dBm
Lithuania	23 dBm	30 dBm	33/36 dBm
Luxembourg	23 dBm	30 dBm	
Netherlands	23 dBm	30 dBm	33/36 dBm
Norway	23 dBm	30 dBm	33/36 dBm
Poland	23 dBm	30 dBm	33/36 dBm
Portugal	23 dBm	30 dBm	5 dBm
Romania	23 dBm	30 dBm	33/36 dBm
Slovak Republic	23 dBm	30 dBm	5 dBm
Slovenia			33/36 dBm
Sweden	23 dBm	30 dBm	33/36 dBm
Switzerland	23 dBm	30 dBm	5 dBm
Turkey	23 dBm	30 dBm	33/36 dBm

Note 1: If the output power is designated as 33/36 dBm, the EIRP is limited to 33 dBm for 10 MHz bandwidth transmissions and 36 dBm for 20 MHz bandwidth transmissions.

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