Digital Microwave Radio Module

TTM-105P25N

Part Number: 5xxxxxxx Date: 21 July 2009

Exalt 5 GHz Radio Module Guide

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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 5 GHz Digital Microwave Radio Module.

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.

Table of Contents

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: www.exaltcom.com Sales e-mail: sales@exaltcom.com Customer Care e-mail: support@exaltcom.com

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580 Division St.
Campbell, CA 95008
USA

The 5 GHz Digital Microwave Radio Module

The Exalt Digital Microwave Radios are the most advanced carrier-class point-to-point terrestrial radio communications devices operating in the 5250 to 5875 MHz frequency bands, respectively.

The 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 Digital Microwave Radio Module is installed in Exalt's 5 GHz 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 radio Module, opening the end-product voids all warranties.

Generally, the 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.

Table 1 Factory Default Settings

Parameter	
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

Installation

Each Exalt Digital Microwave Radio Module is installed in a 5 GHz radio 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 5 GHz Digital Microwave Radios.

Common System Specifications

Tuning Resolution 1MHz, where permitted by local regulations
Power Control Resolution 0.5dB
Selectable Modulation Modes Mode 1 (QPSK); Mode 2 (16QAM), Mode 3 (64QAM)
Selectable Frame Lengths (ms) 0.5, 1, 2, 2.5, 4, 5

Maximum Aggregate User Capacity

Mbps	**Mode 1**	**Mode 2**	**Mode 3**
8/10 MHz	13	27	35
16/20 MHz*	26	55	109
32/40MHz	38	81	120

Frequency Stability ±7 ppm

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

System Specifications, 5.3 GHz Band

Frequency Band 5250 to 5350 MHz
Output Power (at full power) +22 dBm
Selectable Channel Bandwidths 8MHz, 16MHz, 32MHz

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

dBm	**Mode 1**	**Mode 2**	**Mode 3**
8 MHz	-88	-85	-82
16 MHz	-80	-77	-74
32 MHz	-74	-71	-68

Regulatory Compliance FCC 15.407; IC RSS-210; EN 301 893, EN 302 502

Contains FCC ID TTM-105P25N IC ID 6254A-105P25N

Emission Designator(s)

8 MHz	8M0W7D
16 MHz	16M0W7D
32 MHz	32M0W7D

System Specifications, 5.4 GHz Band

Frequency Band 5470 to 5725 MHz
Output Power (at full power) +22 dBm
Channel Bandwidths 8 MHz, 16 MHz, 32 MHz

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

dBm	**Mode 1**	**Mode 2**	**Mode 3**
8 MHz	-88	-85	-82
16 MHz	-80	-77	-74
32 MHz	-74	-71	-68

Regulatory Compliance FCC 15.407; IC RSS-210; EN 301 893

Contains FCC ID TTM-105P25N IC ID 6254A-105P25N

Emission Designator(s)

8 MHz	8M0W7D
16 MHz	16M0W7D
32 MHz	32M0W7D

System Specifications, 5.8 GHz Band

Frequency Band 5725 to 5875 MHz

Output Power: +22 dBm

Selectable Channel Bandwidths 8MHz, 16MHz, 32MHz

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

dBm	**Mode 1**	**Mode 2**	**Mode 3**
8 MHz	-88	-85	-82
16 MHz	-80	-77	-74
32 MHz	-74	-71	-68

Regulatory Compliance FCC 15.247; IC RSS-210; EN 302 502

Contains FCC ID TTM-105P25N IC ID 6254A-105P25N

Emission Designator(s)

8 MHz	8M0W7D
16 MHz	16M0W7D
32 MHz	32M0W7D

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Appendix A - Regulatory Compliance

General Regulatory Notices

Exalt's 5 GHz 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 3dB (Azimuth/Elevation) Beamwidth (mid-band) (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 4 m 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:

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

Antennas Supported in Canada

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

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 4 m 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.

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