TR500
UHF TRANSCEIVER

A Member of the BWIN™ Family of Products

Installation and Operation Guide

vecima® networks

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Preface

Thank you for purchasing this product from Vecima

Vecima Networks designs, manufactures and sells products that enable broadband access to cable, wireless and telephony networks. Vecima's hardware products incorporate original embedded software to meet the complex requirements of next-generation, high-speed digital networks. Service providers use Vecima solutions to deliver services to a converging worldwide broadband market, including what are commonly known as "triple play" (voice, video and data) and "quadruple play" (voice, video, data and wireless) services.

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Preface

This Installation and Operation Guide introduces TR500 and describes how it works. It is intended for engineers and technicians who are responsible for provisioning and maintaining TR500 and are familiar with wireless products and technology.

Note: The information contained in this manual is subject to change without notice.

About this Document

The major sections of this manual are as follows:

- **Chapter 1**—Provides general information on the TR500 UHF Transceiver.
- **Chapter 2**—Describes how to install and tune the TR500 UHF Transceiver.
- **Appendix A**—Lists the TR500 UHF Transceiver specifications.

Document Conventions

This manual uses the following special formats to emphasize key information. Be aware of all warnings and cautions before you begin to use TR500.

WARNING! Whenever you see this icon and heading, the associated text addresses or discusses a critical safety or regulatory issue.

CAUTION: Whenever you see this icon and heading, the associated text discusses an issue which could result in damage or abuse of the equipment. Carefully read and follow these instructions.

Note: Whenever you see this icon and heading, the associated text provides some important information not directly related to the topic.

Tip: Whenever you see this icon and heading, the associated text provides a tip for facilitating the installation, testing, or operation of the equipment or software.

Safety Precautions

Read and follow the following safety instructions before installing or operating a TR500 device.

CAUTION: To comply with Industry Canada RF exposure requirements in section 4.2 of RSS-102, a minimum separation distance of 0.25 meters is required between this antenna and all persons.

Pour conformer aux conditions d'exposition RF d'Industry Canada (section 4.2 du RSS-102), une distance minimum de séparation de 0.25 mètre est exigée entre l'antenne et toutes personnes.

WARNING! Do not work on the system or connect or disconnect cables during periods of lightning activity.

Ne pas travailler sur le système ni brancher ou débrancher les câbles pendant un orage du foudre.

WARNING! Before installing and operating this equipment, read all safety, installation and operating sections. Retain this manual for future reference. Follow all instructions - failure to do so may result in damage to the unit or severe personal injury.

Avant d'installer ou d'opérer cet équipement, lisez, toutes les sections de sécurités, d'installations et d'opérations. Gardez ce manuel comme source de référence. Suivez toutes instructions - si non, vous risquez d'endommager la machine ou de vous blesser sérieusement.

CAUTION: Cleaning - Do not use liquid or aerosol cleaners. Use a damp cloth for cleaning.

Le nettoyage - n'utilisez pas de nettoyeurs aérosols ou liquides. Utilisez un tissu humide pour nettoyer.

WARNING! Shock Hazard - An electrical shock hazard exists when the chassis cover is removed. Do not remove the cover. There are no user serviceable parts inside. Refer all servicing to factory qualified personnel.

Risque de choc - Il y a un risque de décharge électrique qui existe quand la couverture du châssis est enlevée. N'ouvrez pas le couverclé de l'appareil. Référez toutes revisions nécessaire au personnel qualifié de la manufacture.

WARNING! The TR500 and mast must be grounded correctly according to local and national electrical codes. Proper grounding is required for safety, equipment protection and best equipment operation. Ensure that the TR500 is properly grounded by attaching a grounding cable to a mounting bolt on the back of the TR500. Art. 820-40 of the NEC (US) provides guidelines for proper grounding and, in particular, specifies that the grounding cable(s) shall be connected to the grounding system of the building, as close to the point of cable entry as possible.

WARNING! Use a grounded AC power outlet and install proper grounding to avoid damage from lightning and power surges.

Getting Support

All Vecima products include 90 days of basic technical support at no charge. We encourage you to contact us then to ensure your Vecima equipment is utilized to its fullest potential.

We Support You...

By Phone:

You may contact our Wireless Applications Engineering Support (WAES) group directly by phone at 306-955-7075 and press “2” for technical support.

By Email:

For non-urgent matters and information requests, you may reach our support group by e-mail at ***support@vecima.com***

Via World Wide Web:

Visit the Vecima Networks Web page at ***http://www.vecima.com***

- Get the latest news and announcements from Vecima Networks.
- Access product descriptions and information sheets.

Register for support portal access at ***http://waes.vecima.com***

- Download product related manuals, application notes and other information about Vecima wireless products.
- Access our online wireless products e-ticket system.

On-going Support Options:

After your initial 90 days of free support, you may wish to purchase one of our on-going support plans. Please contact your Vecima sales representative to select the Support Option that is best for you.

Warranty and Service Policies

Warranty Statement

Vecima Networks warrants its products to be free from defects in workmanship or materials for a period of two years. The warranty begins on the date of the original shipment from Vecima Networks to its customer. No claim may be allowed for expenses incurred in installation or use. No other expressed or implied warranties shall apply to the goods sold. Vecima Networks is not responsible for delayed shipments, other loss beyond Vecima Networks' control, or consequential damages of any kind arising in connection with the use of its products. This warranty is a return-to-factory warranty only. During the warranty period Vecima Networks will at its option, replace, repair or refund the price paid for any item which is returned for service. This warranty does not apply to units that have been misused physically or used in an inappropriate environment.

Service Policies

Return Material Authorization

Before returning any item for service, the customer must obtain a Returned Material Authorization (RMA) number from Vecima Networks. Vecima Networks will assign a unique RMA number for each item returned. Refer to the RMA number in all correspondence and clearly mark all applicable RMA numbers on the outside of each package returned.

How to Return an Item for Service

Step 1 Prepare the following information before contacting Vecima:

- Serial number and model number of the faulty product
- An adequate description of the fault
- The name of the company returning the item for repairs
- Information about where Vecima service representative can reach the customer – name, address, phone number, and email
- Complete return shipping address
- Complete billing address

Find the serial number on the label attached to the product:

Step 2 Contact Vecima Networks to obtain a Returned Material Authorization (RMA).

Email: support@vecimanetworks.com

Telephone: +1 306 955 7075. Press "3" for service department.

RMA service is available Monday to Friday from 8:30 AM to 4:30 PM central standard time (except statutory holidays).

Step 3 The repair center will provide the customer with an RMA number, determine if the item is covered under the applicable warranty period, and provide return shipping instructions.

Step 4 Ship the product to Vecima Networks. The repair center will provide the customer with shipping instructions when they send the customer the RMA number.

Ship each product to Vecima Networks in its original shipping container (or equivalent) via prepaid carrier, with appropriate insurance and customs documentation (where required). Clearly mark the RMA number on the outside of each package returned. Vecima Networks will not accept collect shipments, damaged shipments or shipments unaccompanied by an RMA number.

Repair Charges and Warranty Exemptions

Items returned beyond the warranty period or items that do not qualify for warranty service are subject to additional out-of-warranty repair charges. Descriptions of these charges and warranty exemptions are listed below:

- Repair turnaround time is typically 20-30 business days after receipt of the item at Vecima Networks. A flat rate repair charge will apply to all out-of-warranty items. Flat rate repair charges are subject to change without notice.
- Any faults due to customer error (i.e. - incorrect set-up or configuration settings) are subject to the current test fee and will be exempt from warranty.
- Items returned with inadequate fault descriptions are subject to the current test fee and are exempt from warranty.
- In the event that no fault is found, the item is subject to the current test fee and will be exempt from warranty.
- Any product exhibiting external damage (either from shipping, improper handling or use) will be subject to inspection. If said damages are determined to be the cause of failure, the item will be exempt from warranty. All repairs to correct the external damage are subject to time & materials charges (parts and labor at current rates).
- Items with damage caused by unauthorized repairs or by external devices are subject to current out-of-warranty flat rate repair charges and are exempt from warranty.
- All products returned for factory optioning are subject to the applicable current option charge plus test fee. Factory-optioned products carry the balance of the original warranty or a 90 day warranty, whichever is greater.

Note: The customer must approve all out-of-warranty repairs in writing. Vecima will not start any repairs until they receive the customer's purchase order or out-of-warranty repair authorization.

Vecima will return items to the customer as follows:

- **For items still under warranty**—Vecima Networks Inc. will return items via prepaid ground carrier. The customer is responsible for any additional costs incurred, including customs clearance and duties. The customer will be responsible for any additional charges incurred from alternative shipping methods.
- **For items no longer under warranty**—Vecima Networks will return items via prepaid ground carrier at the customer's expense. The customer is responsible for any additional costs incurred, including customs clearance and duties. The customer will be responsible for any additional charges incurred from alternative shipping methods.

Warranty Coverage of Items Returned for Repair

Vecima Networks will replace or repair returned items. After repairing the items, Vecima will test them to ensure that they are fully functional. Repair turnaround time is typically 20-30 business days after receipt of the item at Vecima Networks.

Repaired items have a 90-day warranty from the date of return. This warranty only applies to problems related to the originally reported fault. Unrelated problems will be subject to a flat rate repair charge. Cosmetic issues not impacting the functional performance of the product will not be covered under the 90-day warranty period. If the customer returns an item for a repeat failure, the customer must request a new RMA number for the item for it to be covered under the 90-day warranty.

Once Vecima has assigned an RMA number, they will determine if the item is covered under the applicable 90-day warranty period. If the unit is no longer covered by warranty and the customer still wants to proceed with the repair, Vecima requests that the customer sends a repair purchase order form by fax or email. Vecima will apply a flat rate repair charge to do the necessary repairs.

Chapter 1

Introduction

1.1 Functional Overview

The Vecima Networks TR500 is a subscriber transceiver for use in wireless systems. The TR500 and antenna are situated outdoors and connected to a cable modem indoors by standard RG-59 cable. A single RF connector on the weatherproofed enclosure provides the interface to the transmit/receive antenna for rapid setup. The transceiver is configured to work with standard cable modem frequency plans and levels, permitting direct connection. The transceiver also includes an RF mute function to reduce power consumption and broadband noise emissions.

1.2 TR500 Features & Benefits

- +24 dBm output for high reverse channel system gain
- Low phase noise
- Automatic transmit RF mute (transmits only when an IF signal is present)
- Fully weatherized unit, suitable for outdoor mounting

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Chapter 2

Installation

This chapter explains how to mount and install a TR500 Broadband Wireless Transceiver. Before performing any of the procedures in this chapter, read all of the installation instructions to ensure that you understand all of the tool requirements and safety guidelines.

2.1 Unpacking the TR500

Carefully remove the equipment from its packing material and set it on a solid surface, such as a table or desk. If it appears damaged in any way, notify the carrier, and keep all packing materials for inspection by the carrier's agent.

Table 2.1 Parts List

Quantity	Description	Part Number
1	V-bolt	ZB1/4-10
2	1/4” x 20 flange locknuts	ZN1/4-07
1	#8 - 32 x 3/8” thread cutting screw	ZB832-14
2	#8 internal tooth lock washer	ZW8-02
2	6” length of sealing tape	ZMTAPE-04

Note: The #8 - 32 x 3/8” thread cutting screw Part Number ZB832-14 and two #8 internal tooth lock washers Part Number ZW8-02 are pre-installed in the chassis ground attachment location by the factory.

2.2 Mounting the TR500

The TR500 was designed for mounting to a pole with a diameter of 1.0" to 1.75". Please ensure that the pole used is attached securely to the building or other mounting location.

Mounting the Unit

1) Measure the required length of ground wire (not supplied) and crimp on a ring terminal (not supplied) to one end of the ground wire.

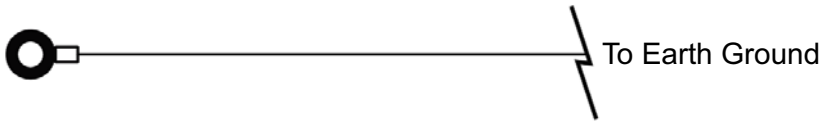


Figure 2-1: Ground wire and ring terminal

2) Position the pole catch, that is part of the TR500 chassis, against the pole.

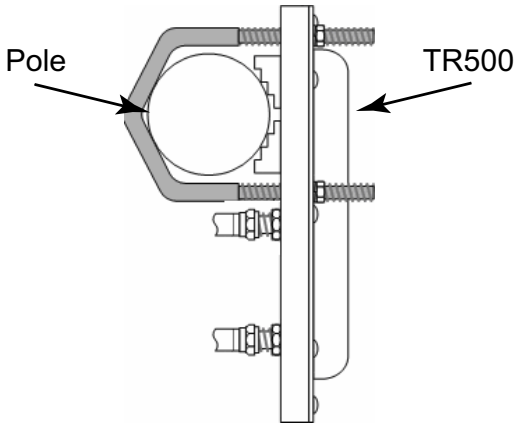


Figure 2-2: Positioning the pole catch

3) Insert the V-Bolt around the pole and through the holes either side of the TR500 pole catch.

4) Thread a ZN1/4-07 lock nut onto each arm of the V-Bolt and tighten to secure the TR500 to the pole.

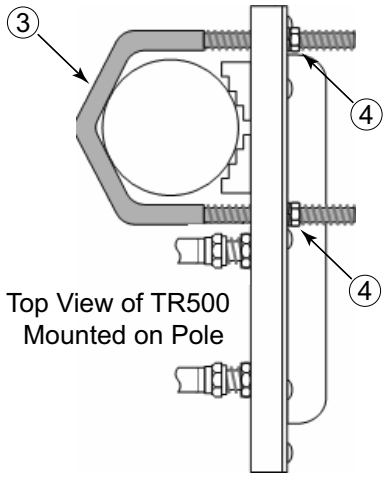


Figure 2-3: Securing the TR500 to the pole

5) Place an #8 lock washer onto the #8-32 screw, followed by the ground wire / ring terminal from step 1, followed by a second #8 lock washer and thread this assembly into the ground attachment point provided and tighten.

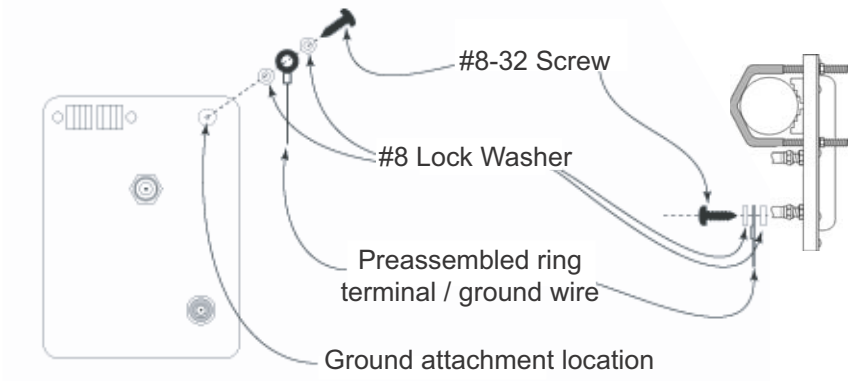


Figure 2-4: Ground wire assembly and connection

2.3 Mounting the Antenna

Mount the antenna according to the manufacturer's instructions.

Note: The TR500 is intended for use with planar arrays and Yagi antennas. Please consult **Table 2.1** for further information.

Table 2-1 Antenna List

Transceiver	Power	Antenna Type	Antenna Gain
[Watts]	[dBm]		[dBi]
0.25	+24	Yagi	10 dBi
0.25	+24	Flat planar array	9 dBi
0.25	+24	Window mount planar array	7 dBi

2.4 Connecting the Antenna

Connect the TR500 to the antenna via the F-connector. After connection, the F connector must be waterproofed with the supplied rubber sealing tape. See **"2.6 Water Proofing the Connections"** on page 7 for details.

Vecima recommends F connectors should be tightened to a maximum torque of 30 in/lb. A 7/16" torque wrench should be used to prevent over tightening. The use of excessive torque can cause damage to the transceiver connectors or internal circuitry.

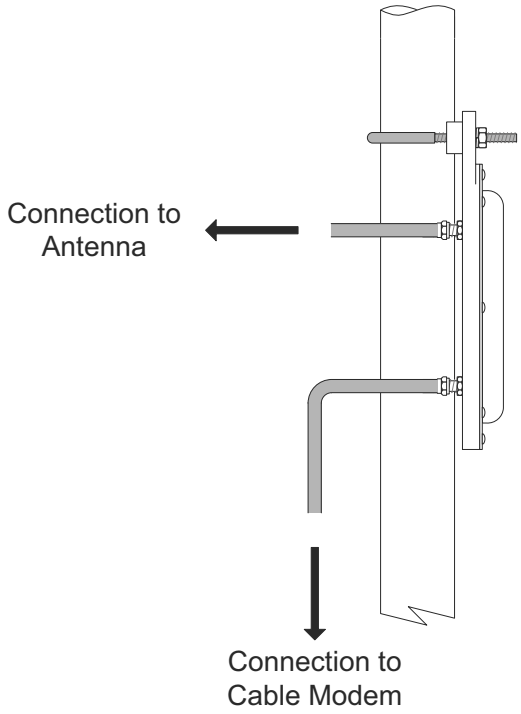


Figure 2-5: Connection to the Antenna

2.5 Connecting the IF Cable

Connect one end of an RG-59 or RG-6 cable to the TR500 F-connector. After connection, the F connector must be waterproofed with the supplied rubber sealing tape. See **"2.6 Water Proofing the Connections"** on page 7 for details.

Vecima recommends F connectors should be tightened to a maximum torque of 30 in/lb. A 7/16" torque wrench should be used to prevent over tightening. The use of excessive torque can cause damage to the transceiver connectors or internal circuitry.

2.6 Water Proofing the Connections

Many transceiver problems can be attributed to environmental conditions (including vibration), which can loosen cables and permit moisture to penetrate the connectors. It is highly recommended to seal the connectors using a technique similar to the one described below. This will provide moisture protection and keep the connections tight. For your convenience, Vecima Networks has provided two 6 inch lengths of sealing tape to use on the two connections of the TR500.

To water proof the connection follow these steps:

1) Wrap the antenna connection using the section of rubber sealing tape provided by Vecima.

Starting at the TR500 end, stretch the tape and wrap it around the connector as close as possible to the body of the TR500. Overlap the tape by approximately one-half of its width so that it can form a seal with itself. Extend the wrapping to approximately one-inch past the end of the connector.

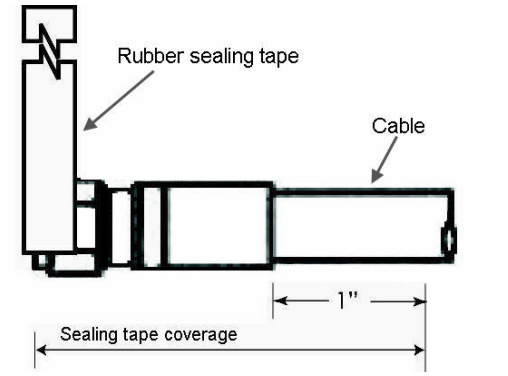


Figure 2-6: Waterproofing the connection - Step 1

2) Cover the sealing tape with electrical tape.

Start approximately one inch further down the cable, and stretch the tape, overlapping by one-half. Wrap to the TR500 end, then without breaking the tape, wrap back down to the cable end.

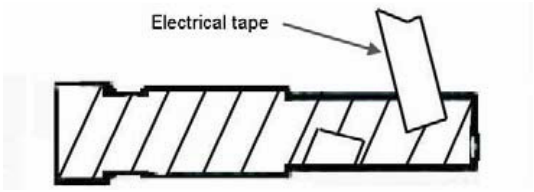


Figure 2-7: Waterproofing the connection - Step 2

3) When done, the connection should be tightly wrapped with tape, with a good seal to the cable.

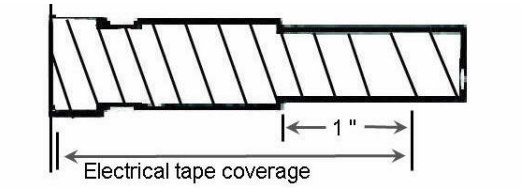


Figure 2-8: Waterproofing the connection - Step 3

2.7 Connecting the Power Inserter

WARNING! Always unplug the power supply before making or changing connnections to the power inserter.

CAUTION: The power inserter should be installed as near to the building entrance as possible. If this is not possible, then a grounding block for the transceiver cable must be installed at the service entrance.

WARNING! If the power inserter is not connected correctly, the TR500 will not operate, and there is the potential to damage the cable modem.

Connect the TR500 F-Connector to the power inserter, located indoors with the cable modem. Vecima recommends that the F connectors should be tightened to a maximum torque of 30 in/lb. A 7/16" torque wrench should be used to prevent over tightening. The use of excessive torque can cause damage to the transceiver connectors or internal circuitry.

The power inserter has three connections:

- DC POWER - Connect to wall adapter with RG-59 cable with F connectors
- TO MODEM - Connect to cable modem (install modem only after the antenna is aligned)
- TO TRANSCEIVER - Connect to TR500

Ensure that the connection to the TR500 is made before plugging in the AC adapter/power supply (i.e. hook up the power supply last).

Connect the power inserter to the Cable Modem. If the antenna is to be aligned with the self-install feature, ensure that the power inserter is connected to the Cable Modem, only after the antenna is aligned.

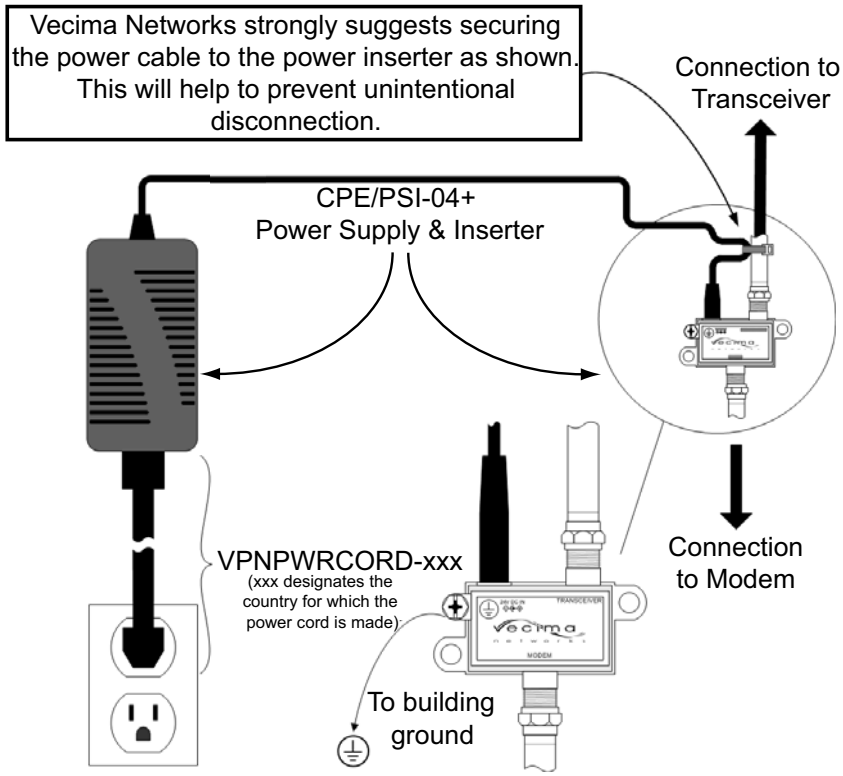


Figure 2-9: Connecting the Power Inserter and Power Supply

Appendix A

Specifications

Feature	Specification
Transmit	
IF Input Frequency	See Table below
RF Output Frequency	See Table below
Linear Output Power	+24 dBm QPSK +23 dBm 16QAM
Output P1db	+27dBm
Gain	18 ± 2dB at 20°C
Gain Stability	± 2.0 dB over -40 to +60°C
Gain Flatness (Frequency Response)	± 1.5 dB over Transmit Band
Phase Noise	< -90 dBc/Hz @ 10 kHz
Spectral Mask	RSS-196
IF Level for RF Activation	-45 dBm +/- 3dB
RF Activation Response Time	< 2 microseconds
Receive	
RF Input Frequency	See Table below
Gain	18 ± 2 dB at 20°C
Gain Flatness (Frequency Response)	± 1.5dB over receive RF band
Noise Figure	4.5dB typical, 6.5dB maximum
Modem Port	
IF Connector	F female, 75 ohms
IF Return Loss	≤-10dB over transmit and receive IF bands
IF Spurious Emissions	≤-35 dBm from 100-860 MHz excluding receive RF bands ≤-85 dBm over receive RF bands

Feature	Specification
RF Port	
RF Connector	F female, 75 ohms
RF Return Loss	≤-9 dB in transmit and receive bands
RF Spurious Emissions	RSS196
General	
Frequency Stability	± 5 kHz (-40 to +60°C)
Power Requirement	+18 to +28 V, (+24V nominal)
Power Consumption	11W maximum
Operating Ambient Temperature	-40 to +50°C
Size	6.0” x 8.0” x 1.5” (15.2 x 20.3 x 3.8cm)
Mounting	Pole mount, 1” to 1.75” diameter pole

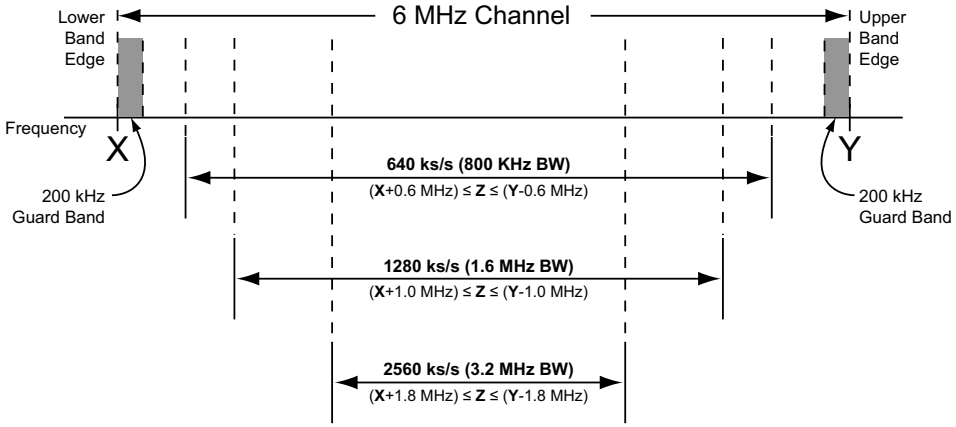
	IF Input Frequency (TX)	RF Output Frequency (TX)	RF Input Frequency (RX)
TR500/SU01+	30-42 MHz	530-542 MHz (CH24-25)	578-602 MHz (CH32-35)
TR500/SU02+	30-42 MHz	542-554 MHz (CH26-27)	578-602 MHz (CH32-35)
TR500/SU03+	30-42 MHz	548-560 MHz (CH27-28)	584-602 MHz (CH33-35)
TR500/SU04+	24-42 MHz	680-698 MHz (CH49-51)	614-644 MHz (CH38-42)
TR500/SU05+	30-42 MHz	662-674 MHz (CH46-47)	560-578 MHz (CH29-31)
TR500/SU06+	24-42 MHz	560-578 MHz (CH29-31)	518-536 MHz (CH22-24)
TR500/SU07+	24-42 MHz	650-668 MHz (CH44-46)	602-620 MHz (CH36-38)
TR500/SU08+	30-42 MHz	614-626 MHz (CH38-39)	530-560 MHz (CH24-28)
TR500/SU09+	24-42 MHz	680-698 MHz (CH49-51)	560-578 MHz (CH29-31)
TR500/SU010+	30-42 MHz	686-698 MHz (CH50-51)	650-668 MHz (CH44-46)

CAUTION

Although the TR500/SUxx subscriber transceiver is capable of transmitting in the RRBS upstream band in either a 12 MHz or 18 MHz wide bandwidth (depending on the model), care must be taken to transmit in the 6 MHz band that is dictated by the operator's license. To comply with the RSS196 Radio Standard, a 200kHz guard band must exist at the top and bottom of the assigned band. Channel center frequencies must be spaced as follows:

640 ks/s modulation (800kHz bandwidth): Center frequency must be ≥ 600 kHz from the assigned band edge
1280 ks/s modulation (1.6MHz bandwidth): Center frequency must be ≥ 1 MHz from the assigned band edge
2560 ks/s modulation (3.2MHz bandwidth): Center frequency must be ≥ 1.8 MHz from the assigned band edge

The following diagram illustrates the channel center frequency placement required to comply with RSS196:



where:

X = Lower Band Frequency in MHz
Y = Upper Band Frequency in MHz (X + 6 MHz)
Z = Channel Center Frequency Range in MHz

For example. The TR500/SU01+ can transmit from 530 to 542 MHz. If the operator is assigned 530 to 536 MHz (**X** = 530, **Y** = 536), and the operator is using 1280ks/s modulation, the channel center frequency (**Z**) must be within 531 (**X**+1.0) to 535 (**Y**-1.0) MHz.

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