

MDS/MMDS Transceiver
TR2126SE

INSTALLATION AND OPERATION
GUIDE FOR SYSTEM OPERATORS

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Specifications subject to change without notice — Printed in Canada

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welcome to WaveCom!**



You have chosen an innovative solution from a leading technology design center in the ongoing TV & data delivery revolution.

No doubt you've been thinking that the future of your television delivery system includes new technologies such as **Digital TV, Internet Over Cable, Wireless Cable**. **By selecting WaveCom**, you are benefiting from the same design powerhouse that since 1988 has created custom RF and digital products for technology leaders such as AT&T, Cisco Systems, Cogeco, Comcast, and Cox Communications.

WaveCom designs and manufactures:

- | | | |
|----------------------------|---------------------------|----------------------------|
| ✓ Agile CATV Modulators | ✓ 256 QAM Upconverters | ✓ Digital Video Modulators |
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| ✓ Video-On-Demand Products | ✓ Wireless Cable MMDS | ✓ Wireless Cable LMDS |
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and more! Designs to fill the market needs of the CATV industry – both foreign and domestic.

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WaveCom's Corporate Mandate

is to be a leading worldwide designer and manufacturer of state-of-the-art communications equipment and components. Through the remarkable success of our customers and business partners, WaveCom innovations are achieving this goal.

SAFETY PRECAUTIONS

1. Before installing and operating this equipment, read all Safety, Installation and Operating sections. Retain this manual for future reference.
2. Follow all instructions — Failure to do so may result in damage to the unit or severe personal injury.
3. Servicing should not be attempted by the user. There are no user serviceable parts inside. Refer all servicing to factory qualified personnel.
4. Shock Hazard — An electrical shock hazard exists when the chassis cover is removed as is required to set internal controls. Always disconnect power from the unit before removing the cover.
5. Cleaning — Do not use liquid or aerosol cleaners. Use a damp cloth for cleaning.

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

CAUTION: To comply with FCC RF exposure requirements in section 1.1307, a minimum separation distance of 1.5 meters is required between this antenna and all persons.

LES PRÉCAUTIONS DE SÉCURITÉ

1. 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.
2. Suivez toutes instructions - si non, vous risquez d'endommager la machine ou de vous blesser sérieusement.
3. N'essayez, pas de réparer cet équipement vous même. Référez toutes revisions nécessaire au personnel qualifié de la manufacture.
4. Risque de choc - Il y a un risque de décharge électrique qui existe quand la couverture du châssis est enlevée, comme est nécessaire pour ajuster les contrôles internes. Il faut toujours couper l'électricité avant d'enlever le couvercle pour faire aucun ajustage.
5. Le nettoyage - n'utilisez pas de nettoyeurs aérosols ou liquides. Utilisez un tissu humide pour nettoyer.

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



Important Installation Instructions

CAUTION: To comply with FCC RF exposure requirements in section 1.1307, a minimum separation distance of 1.5 meters is required between this antenna and all persons.

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1.0 GENERAL INFORMATION

1.1 Functional Overview

The WaveCom **TR2126SE** is an MDS/MMDS Transceiver for use in wireless systems. The TR2126SE integrates an LNA, downconverter, upconverter, power amplifier, RF and IF diplexers to provide a one-box solution for two-way wireless RF communications. The TR2126SE 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 Module Features

- +27 dBm output for high reverse channel system gain
- Microprocessor controlled gain compensation over temperature
- Low Phase Noise
- Automatic transmit RF mute (transmits only when an IF signal is present)
- Fully weatherized unit, suitable for outdoor mounting
- Audible self install indicator (optional feature)

1.3 Specifications

UPCONVERTER SPECIFICATIONS

IF Input Frequency	14.375 to 26.375 MHz
RF Output Frequency	2150 to 2162 MHz
Output (1dB Compression Point)	+27 dBm
Gain	20 ± 2 dB across full temperature range
Gain Flatness	+/- 1 dB
In-band Spurious	-60 dBc
Out-of-band Spurious	-60 dBc
Phase Noise	-93 dBc/Hz @ 10 kHz -115 dBc/Hz @ 100 KHz
IF Level for RF Activation	+3 dBmV

DOWNCONVERTER SPECIFICATIONS

RF Input Frequency	2500 to 2686 MHz
IF Output Frequency	222 to 408 MHz
Nominal Gain	32 ± 2 dB
Gain Flatness	+/- 1.5 dB; ± 0.3 dB/ 6 MHz
Noise Figure	≤5.0 dB @ 20C, typically 4.0 dB
Output 3rd Order Intercept	+22 dBm at nominal gain
WCS Rejection	70 dB
Combined Image and PCS Rejection	85 dB
Spurious	-65 dBm max.
Phase Noise	-93 dBc/Hz @ 10 kHz -115 dBc/Hz @ 100 kHz

GENERAL

Frequency Setting & Stability	± 7.5 kHz (-40 to +60°C)
Frequency Stability Over Time	<±10 kHz over 10 years
RF Connector	N female, 50 ohms
IF Connector	F female, 75 ohms
Input/Output VSWR	2:1
DC Supply	12 to 24 V, 12 Watts max.
Operating Temperature	-40 to +60°C (-40 to +140°F)
Size	6" x 8" x 0.9" (15.24 x 20.32 x 2.29 cm)
Mounting	Pole mount (1" to 1.75" (25mm to 44mm) diameter)

Specifications subject to change without notice.

2.0 INSTALLATION

2.1 Unpacking the Unit

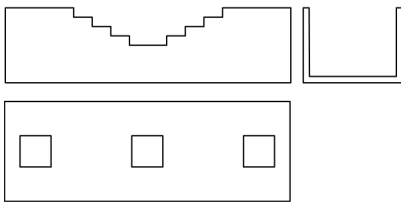
Carefully remove the equipment from its packing material and set it on a solid surface, such as a table or desk. If it appears damaged in any way, notify the carrier, and keep all packing materials for inspection by the carrier's agent.

2.2 Mounting the Unit

2.2.1 Mounting the TR2126SE

The following hardware is included in the box for mounting the TR2126SE to the pole:

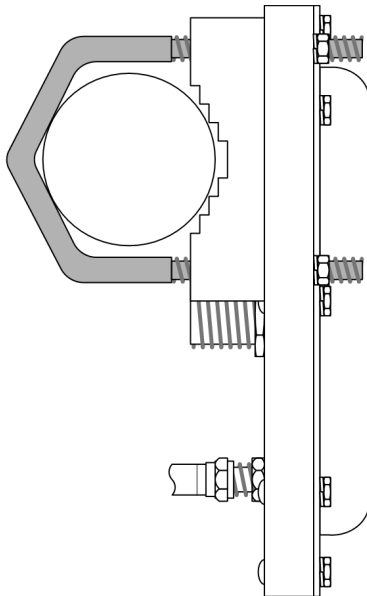
- 1 pole catch



- 1 V-bolt
- 2 1/4"x20 flange locknuts for connecting V-bolt and pole catch to the pole

The TR2126SE 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. Simply secure the TR2126SE unit to a pole as shown in Figure 2.2A with F-Connector on the bottom.

DIAGRAM 2.2A: MOUNTING THE UNIT



Top view of TR2126SE
mounted on pole

2.2.2 Mounting the Antenna

Mount the antenna according to the manufacturer's instructions.

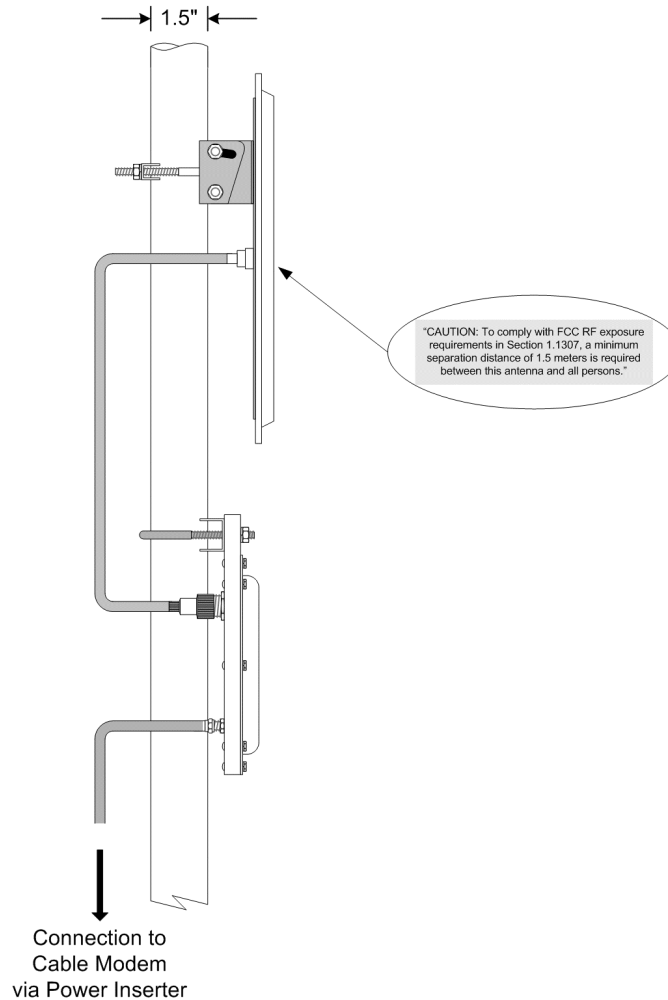
- ☛ The TR2126SE is intended for use with flat planar arrays and dipole/parabolic reflectors. Please consult table 2.2B for further information.

☛ **Table 2.2B: Antenna List**

Transceiver Power		Antenna Type	Antenna Gain
(Watts)	(dBm)		(dBi)
0.316	25	Flat planar array	12
0.316	25	Flat planar array	18
0.316	25	Dipole/parabolic reflector	21
0.316	25	Dipole/parabolic reflector	24

- ☛ Included with the TR2126SE unit is a self-adhesive label for application to the antenna. To operate the TR2126SE in compliance with FCC regulations, you must apply the included label to the antenna. Peel off the protective backing from the label and affix it to the antenna such that the label is readable from a distance of 5 feet.

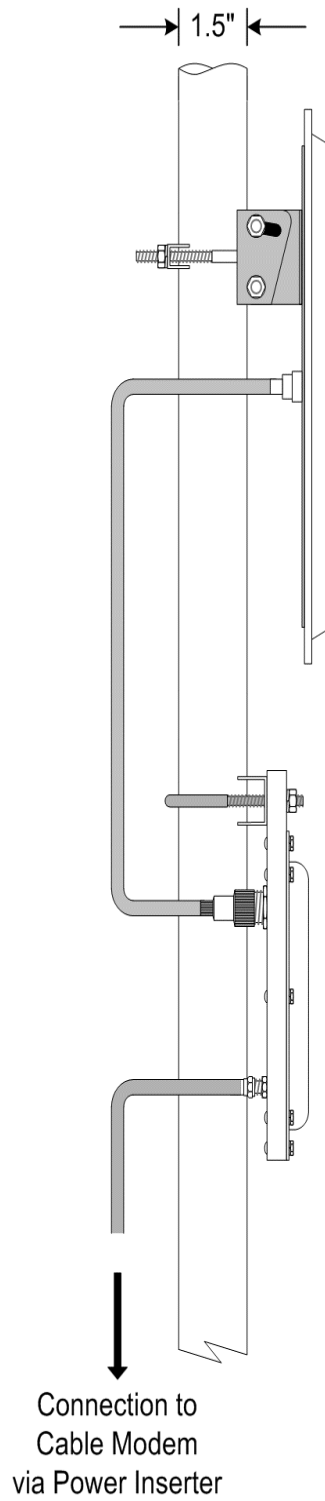
DIAGRAM 2.2C: APPLYING THE SELF-ADHESIVE LABEL



2.3 Connection to the Antenna

Connect the TR2126SE to the Antenna via the N-Connector

DIAGRAM 2.3A: CONNECTION TO THE ANTENNA



2.4 Connection to the Power Inserter and Cable Modem

Connect the TR2126SE F-Connector to the power inserter, located indoors with the cable modem. Connect the power inserter to the Cable Modem. If the TR2126SE is equipped with the optional self install feature, insure that the power inserter is connected to the Cable Modem, only after the antenna is aligned.

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 TR2126SE

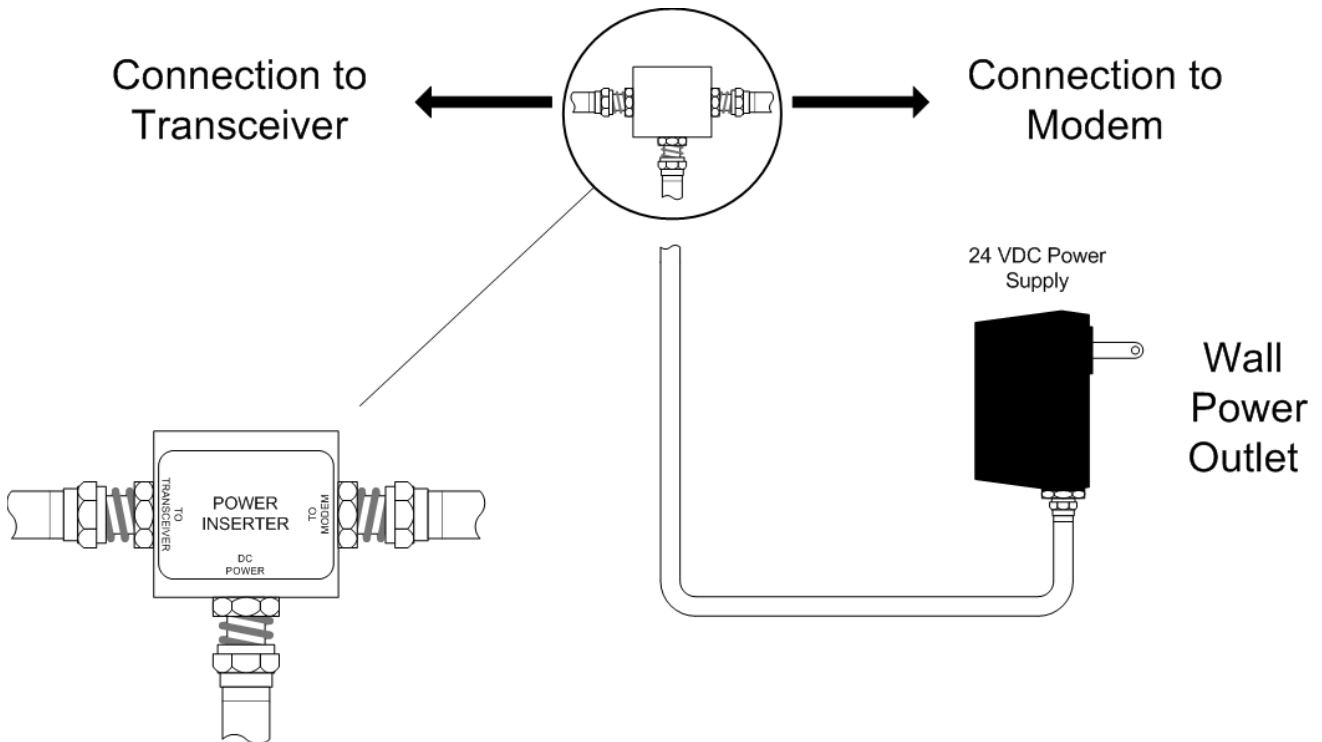
WARNING!



If the power inserter is not connected correctly, the TR2126SE will not operate, and there is the potential to damage the cable modem.

Ensure that all wires and cables are hooked up before plugging into the AC adapter/power supply (i.e. hook up to the power supply last).

DIAGRAM 2.4A: CONNECTION TO CABLE MODEM VIA POWER INSERTER



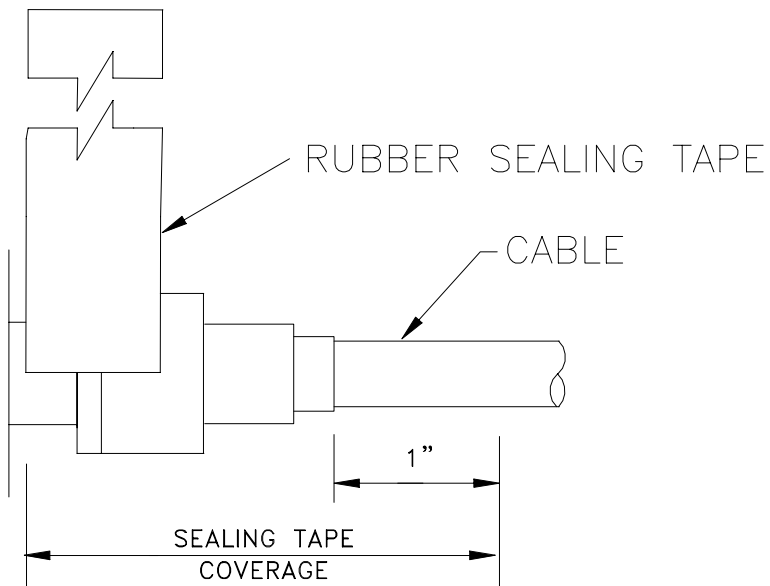
2.5 Waterproofing Connections

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, WaveCom has provided two 6 inch lengths of rubber self-amalgamating sealing tape to use on the two connections of the TR2126SE. The diagrams below show the N connector, but the F connector also should be sealed using the same technique.

STEP 1

Use one 6" section of rubber sealing tape. Starting at the TR2126SE end, stretch the tape and wrap it around the connector as close as possible to the wall of the TR2126SE. Overlap the tape by approximately one-half of it's width so that it can form a seal with itself. Extend the wrapping to approximately one inch past the end of the connector.

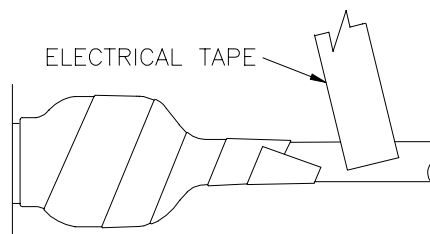
DIAGRAM 2.5A: WATERPROOFING CONNECTION – STEP 1



STEP 2

Cover the sealing tape with electrical tape (not provided). Start approximately one inch further down the cable, and stretch the tape, overlapping by one-half. Wrap to the TR2126SE end and without breaking the tape, wrap back down to the cable end.

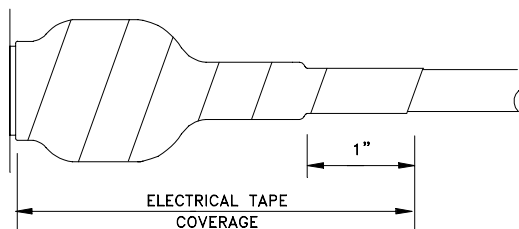
DIAGRAM 2.5B: WATERPROOFING CONNECTION – STEP 2



STEP 3

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

DIAGRAM 2.5C: WATERPROOFING CONNECTION – STEP 3



3.0 TUNING THE ANTENNA

Note: This section applies only to TR2126SE transceivers fitted with the optional self-install feature.

3.1 Preparation for Tuning

Before tuning the antenna insure that the Cable Modem is not connected to the power inserter. The Cable Modem signal will prevent the signal strength indicator from responding to very weak receive signals.

3.2 Signal Strength and Alignment

The TR2126SE is equipped with an audible alignment aid that simplifies the setup process. It permits the antenna to be aligned to the hub site without the use of the cable modem or any test equipment.

The aid consists of a level detector for the full receive band, and a beeper sealed into the unit that sounds at a rate that increases with increasing level. The beeper is activated only for about 3 to 10 minutes each time power is applied to the TR2126SE.

To use the aid, first mount the TR2126SE and the antenna with the antenna mounts left loose to permit alignment. Connect the antenna to the TR2126SE ANTENNA port, and apply DC power to the TR2126SE through the MODEM port when you are ready to begin. The beeper will start sounding. Point the antenna in the general direction of the hub site, then move the antenna to maximize the rate of the beeper. The highest rate heard represents the highest receive signal level and the best alignment. Tighten the antenna mounts. The beeper will automatically mute between 3 and 10 minutes after the unit was powered up, turning off faster with higher received signal level.

The detector operates over a wide level range. Installations that are closer to the hub site and consequently receive a larger signal will have a higher beep rate than an installation further out. In each case, finding the alignment with the highest beep rate indicates the best alignment.

Note that the TR2126SE alignment aid does not discriminate between signals in the receive band. If signals other than those from the hub are present, this could result in a misalignment. In this case, a conventional alignment technique would need to be employed.

3.3 Resetting the Beeper

To reset the timer for alignment, simply unplug the power supply from its AC connection. Wait 5 seconds, then plug the power supply back into its AC connection. The beeper will begin beeping as soon as power is available.

4.0 WARRANTY STATEMENT AND SERVICE POLICY

4.1 Warranty Statement

WaveCom 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 WaveCom 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. WaveCom is not responsible for delayed shipments, other loss beyond WaveCom's 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 WaveCom 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 physically or environmentally abused.

4.2 Service Policies: How to Return an Item for Service:

Before returning any item for service, an R.M.A. (Returned Material Authorization) number must be assigned by WaveCom. A unique R.M.A. number will be assigned for each item being returned. When requesting an R.M.A. number, please be prepared to provide the model, WaveCom serial number, original invoice number, your purchase order number and an adequate fault description. The serial number of a unit can be found on a barcode label similar to the one pictured below. R.M.A. service is available Monday to Friday from 8:30 a.m. to 4:30 p.m. CST (statutory holidays excepted).



To obtain an R.M.A. number you may:

Call: (306) 955-7075, press '0' for Operator, or '3' for Service Dept.

Fax: (306) 384-0086 — Attention: R.M.A. Request

Email: support@WaveCom.ca

Once an R.M.A. number has been assigned, please refer to it in all correspondence and make certain that all applicable R.M.A. numbers are clearly marked on the outside of each package being returned. You must also ensure that each product is shipped to WaveCom in its original shipping container (or equivalent) via Prepaid carrier, with appropriate insurance and customs documentation (where required). WaveCom will not accept collect shipments, damaged shipments or shipments unaccompanied by an R.M.A. number.

For items still under Warranty – Items will be returned from WaveCom Electronics Inc. to its customer via prepaid ground carrier. The customer is responsible for any additional costs incurred, including custom clearance and duties. Any alternate means of shipment must be requested by the customer and will be subject to additional charges.

For items no longer under Warranty – Items will be returned from WaveCom Electronics Inc. to its customer via prepaid ground carrier at the customer's expense. The customer is responsible for any additional costs incurred, including custom clearance and duties. Any alternate means of shipment must be requested by the customer and will be subject to additional charges.

Shipping Instructions will be provided by the repair center when the RMA number is sent to the customer.

4.3 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 below:

- 1) Repair turnaround time is typically 5-14 business days after receipt of the item at WaveCom. A Flat Rate Repair Charge will apply to all out-of-warranty items. Flat Rate Repair Charges are subject to change without notice.
- 2) Any faults due to customer error (ie - incorrect set-up or configuration settings) are subject to the current Test Fee and will be exempt from warranty.
- 3) Items returned with inadequate fault descriptions are subject to the current Test Fee and are exempt from warranty.
- 4) In the event that no fault is found, the item is subject to the current Test Fee and will be exempt from warranty.
- 5) 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).
- 6) 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.
- 7) 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.

All out-of-warranty repairs must be approved by the customer in writing. No repairs will be made until the customer's Purchase Order or Out-Of-Warranty Repair Authorization is received.



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