TRANZEO TR-6000

Tranzeo TR-6000 Series
User Guide

Covers the following models:
TR-6015, TR-6008, TR-6019, TR-6000,
TR-600, TR-650, TR-660, TR-6500,
TR-6519, TR-6600, TR-6619

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Safety Information

FCC Compliance

This device has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the device is operated in a residential environment. This device generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the user guide, may cause harmful interference to radio communication. In case of harmful interference, the users will be required to correct the interference at their own expense.

The users should not modify or change this device without written approval from Tranzeo Wireless. Modification will void warranty and authority to use the device.

For safety reasons, people should not work in a situation where RF exposure limits could be exceeded. To prevent this situation, the users should consider the following rules:

- Install the antenna so that there is a minimum of 100 cm (39.37 in) of distance between the antenna and people.
- Do not turn on power to the device while installing the antenna.
- Do not connect the antenna while the device is in operation.
- Do not collocate or operate the antenna used with the device in conjunction with any other antenna or transmitter.
- Use this product only with antennas of the same or lower gain as the following Tranzeo Antennas:

  > TR-OD24-12 – 2.4 GHz 12 dBi omni
  > TR-24H-90-17 – 2.4 GHz 17 dBi sector
  > TR-GD24-24 – 2.4 GHz 24 dBi grid

- In order to ensure compliance with local regulations, the installer MUST enter the antenna gain at the time of installation. See *Chapter 3: Wireless Settings*, for details.

Industry Canada Compliance

Operation of this device 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.

Safety Instructions

You must read and understand the following safety instructions before installing the device:

- This antenna's grounding system must be installed according to Articles 810-15,   810 -20, 810-21 of the National Electric Code, ANSI/NFPA No. 70-1993. If you have any questions or doubts about your antenna's grounding system, contact a local licensed electrician.
- Never attach the grounding wire while the device is powered.
- If the ground is to be attached to an existing electrical circuit, turn off the circuit before attaching the wire.
- Use the Tranzeo Power over Ethernet (POE) adapter only with approved Tranzeo models.
- Never install radio equipment, surge suppressors or lightning protection during a storm.

Lightning Protection

The key to lightning protection is to provide a harmless route for lightning to reach ground. The system should not be designed to attract lightning, nor can it repel lightning. National, state and local codes are designed to protect life, limb, and property, and must always be obeyed. When in doubt, consult local and national electrical codes or contact an electrician or professional trained in the design of grounding systems.

Professional Installation Required

The product requires professional installation. Professional installers ensure that the equipment is installed following local regulations and safety codes.

For TR-6500 series. These products require professional installation. Professional installer will enter the gain of the antenna in the software at the time of installation. The product's software will ensure compliance with safety codes and regulations.

Table of Contents

Chapter 1: Overview

Introduction

This next-generation wireless LAN device–the Tranzeo TR-6000 series– brings Ethernet-like performance to the wireless realm. Fully compliant with the IEEE802.11a standard, the TR-6000 series also provides powerful features such as the Internet-based configuration utility as well as WEP and WPA security.

Product Kit

The TR-6000 Series product kit contains the items shown below. If any item is missing or damaged, contact your local dealer for support.

TR-6000 Series device x 1

Ethernet boot cover x 1

Gasket x 1

Strain relief x 1

Keps nuts x 8

DC power adapter x 1

Mounting bracket x 1

U-bolt w/ 2 nuts x 1

Lock washers x 2

POE adapter x 1
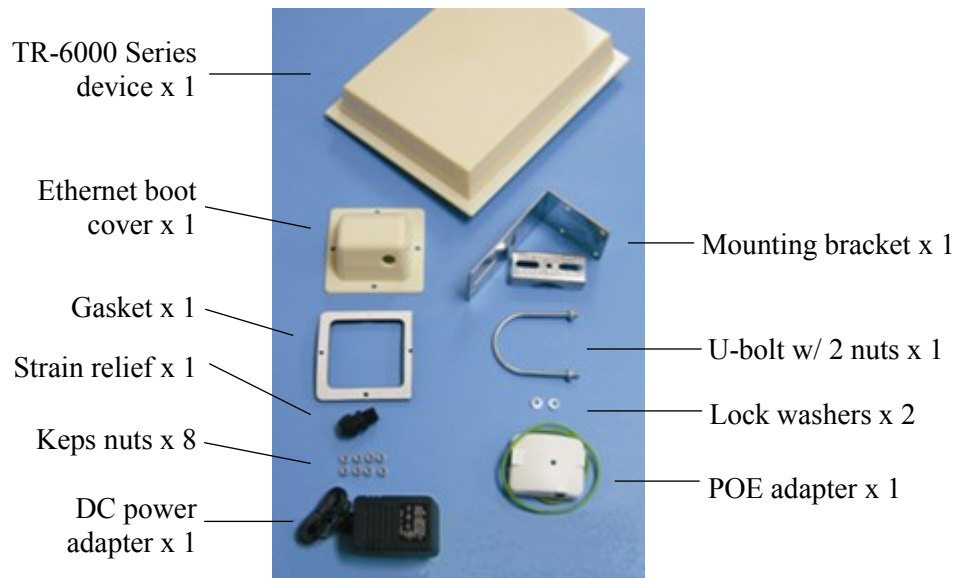
Product Description

The LEDs, ports and product information are located at the back of the TR-6000 Series radio, as shown in the picture.

LED Panel indicators

Serial number

MAC address

Ethernet ports

Studs for the boot cover

Studs for the mounting bracket

LED Panel Indicators

Label	Color	Indicators
Power	🔴 Red	**On:** Powered on **Off:** No power
LAN	🟢 Green	**On:** Ethernet link **Flashing:** Ethernet traffic **Off:** No Ethernet link
Radio	🟡 Amber	**On:** Radio link **Flashing:** Radio activity **Off:** No radio link
Signal (CPE Mode)	🔴 Red 🟡 Amber 🟢 Green	In CPE mode (Client Premises Equipment), light up in sequence to indicate signal strength.

Label	Color	Indicators
Signal (AP Mode)	🔴 Red	**On:** WEP/128 enabled **Flashing:** WEP/64 enabled **Off:** WEP off
	🟡 Amber	**On:** WPA/AES enabled **Flashing:** WPA/TKIP enabled **Off:** WPA off
	🟡 Amber	**On:** 5.8 operation **Off:** 5.3 operation **Flashing:** 2.4 operation
	🟢 Green	**On:** ACL enabled **Off:** ACL off
	🟢 Green	**On:** WDS enabled **Off:** WDS off

Label	Color	Indicators
Signal (PXP Mode)	🔴 Red 🟡 Amber 🟢 Green	In PXP mode (Point to Point), light up in sequence to indicate signal strength.

Chapter 2: Hardware Installation

The TR-6000 Series radios are easy to install, as you'll see in this chapter. Before starting, you will need to get the tools listed below and decide about the site and orientation of the device. Once ready, follow the instructions about how to install the Ethernet cable, mount the device, ground the antenna, and make the connections in order to get a proper installation.

Getting Ready

Tools Required

To install your TR-6000 Series radio you will need the following tools:

- 1/2" wrench x 1
- 3/4" wrench x 1
- 3/8" wrench x 1
- Cat 5 cable stripper x 1
- Cat 5 cable (to connect the radio to the POE adapter)
- RJ-45 patch cable
- RJ-45 crimper x 1
- RJ-45 connectors x 4
- #6 green grounding wire

Site Selection

Determine the location of the radio before installation. Proper placement of the device is critical to ensure optimum radio range and performance. You should perform a site survey to determine the optimal location.

Ensure the CPE is within line-of-sight of the access point. The line-of-sight is an ellipse, called Fresnel zone. This zone should be clear of obstacles since obstructions will impede performance of the device.
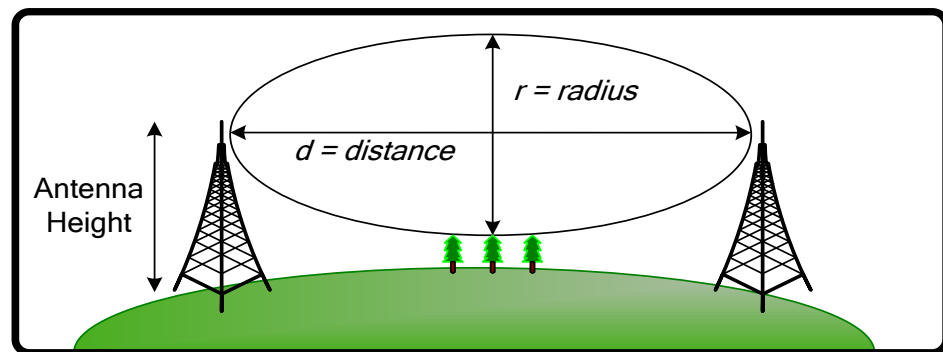
Fresnel zone

Polarity

Determine if the antenna's polarization will be horizontal or vertical before installation. The TR-6000 radios can be used in either polarity. The Ethernet boot cover should always be placed so that the cable runs toward the ground for maximum environmental protection.

Power Supply

Only use a power adapter approved for use with the TR-6000 Series radio. Otherwise, the product may be damaged and will not be covered by the Tranzeo warranty.

Installing the Ethernet Cable

Step 1:

Insert the strain relief, without the cap nut, into the port opening of the boot cover.

Step 2:

Using a 3/4" wrench, tighten the strain relief until it touches the boot cover.

IMPORTANT! Use hand tools only. Do not over tighten.

Step 3:

Put the cap nut back over the strain relief and insert the Cat 5 cable through it. Wire the cable following the EIA/TIA T568B standard, and attach the RJ-45 connectors to each end of the cable. (See *Appendix F: Wiring Standard*).


Step 4:

If you purchased the device with a dual port cover, repeat steps 1, 2, and 3 for the second port.

IMPORTANT! If you are not going to use the second port, insert the strain relief into the boot cover and tighten the cap nut to ensure a weather-tight seal, as shown in the picture.

Step 5:

Place the gasket—with the adhesive side facing up—over the 4 studs around the port of the radio. Flatten the gasket ensuring there are no gaps. Remove the backing.
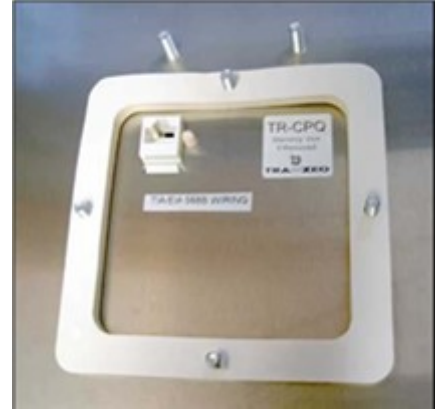
Step 6:

Plug the Cat 5 cable inserted in the boot cover into the port. Remember to place the boot cover according to the desired polarization, so that the strain relief faces the ground.

Step 7:

Fit the boot cover over the 4 studs and the gasket. Secure with 4 keps nuts. Tighten with a 3/8" wrench until the gasket is at least 50% compressed.

Step 8:

Make sure the cap nut of the strain relief is tightened properly to ensure a weather-proof seal.
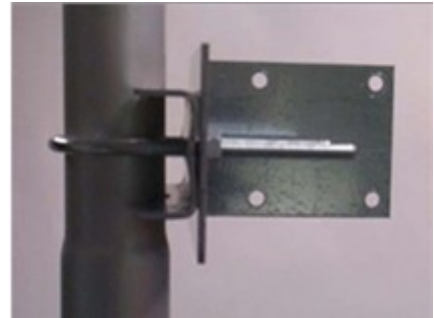
IMPORTANT! Hand tighten only. Do not over tighten as you may damage the weather-tight seal of the strain relief.

Mounting the Radio

Step 9:

Attach the mounting bracket to the pole using the U-bolt. Secure the U-bolt with the lock washers and the nuts. Align if necessary, and then tighten the nuts enough to prevent any movement.

Step 10:

Fit the radio to the mounting bracket. Secure the radio with keps nuts.

IMPORTANT! The strain relief must be always facing the ground.

Grounding the Antenna

Step 11:

Using a #6 green grounding wire, connect the grounding lug on the radio to a proper ground. See Appendix A: Grounding and Lighting Protection Information.

IMPORTANT: This device must be grounded. Connect the green grounding wire to a known good earth ground, as outlined in the National Electrical Code. See *Appendix A: Grounding and Lightning Protection Information* for details.

Connecting the Radio

Step 12:

Connect the Cat 5 cable from the radio into the RJ-45 jack marked "CPE" on the POE adapter. The POE adapter is not weather-proof and should be installed indoors.

Building

Step 14

Step 12

Step 13

18V
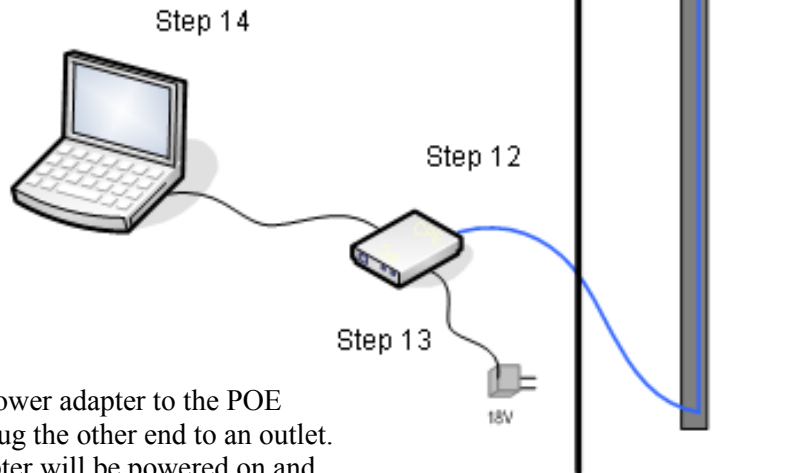
Step 13:

Connect the power adapter to the POE adapter and plug the other end to an outlet. The POE adapter will be powered on and the power indicator on the top panel will turn on. We recommend connecting the power adapter to an outlet with surge suppression capability with an uninterrupted power supply (UPS) for reduced outages.

IMPORTANT! Use the power adapter supplied with the radio. Otherwise, it may be damaged.

Step 14:

To configure the TR-6000 Series radio, connect the Ethernet cable to the POE adapter and to a computer. Ensure that the distance between the computer and the radio does not exceed 300 ft (90 m).

Note: If connecting to a hub or switch, a crossover cable may be required.

Best Practices

Follow these practices to ensure a correct installation and grounding.

- Always try to run long Cat 5 and LMR cables inside of the mounting pole. This helps to insulate the cable from any air surges.
- Keep all runs as straight as possible. Never put a loop into the cables.
- Test all grounds to ensure that you are using a proper ground. If using an electrical socket for ground, use a socket tester, such as Radio Shack 22-141.
- Keep a copy of the National Electrical Code Guide at hand and follow its recommendations.
- If you are in doubt about the grounding at the location, drive your own rod and bond it to the house ground. At least you will know that one rod is correct in the system.

Chapter 3: Configuration

The TR-6000 Series radios can be configured through an HTML configuration interface, accessible using any Internet browser. The configuration interface allows you to define and change settings, and also shows information about the performance of the device.

In this chapter we'll cover how to access the configuration interface, configure the TR-6000 Series radio, and interpret the information displayed in the interface.

Depending on whether the device is defined as an AP or CPE (infrastructure station), some menu options, windows, and fields in the interface may vary or may not appear at all. We'll indicate so when describing each window.

Connecting to the Radio

Before accessing the configuration interface, you have to change the network connection settings in your computer to be on the same subnet as the radio.

Changing the IP Address - Windows XP

1. In your computer, open Control Panel > Network Connections > Local Area Connection.

2. In Local Area Connection Status > General, click **Properties**.

3. In Local Area Connection Properties > General, select **Internet Protocol (TCP/IP)** and click **Properties**.

4. In Internet Protocol (TCP/IP) Properties > General, select **Use the following IP address**.

5. Enter your **IP address** and **Subnet Mask**. The default IP address of the radio is **192.168.1.100**, which cannot be used here.

6. Click **OK** and **Close**.
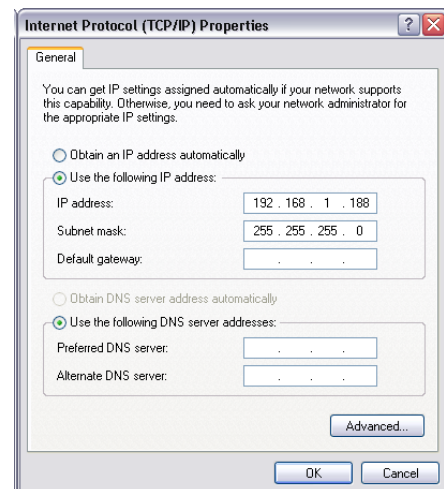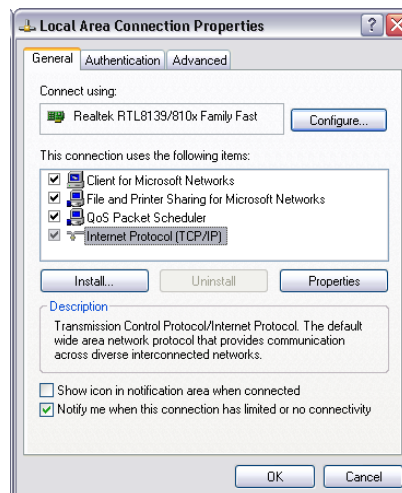
Changing the IP Address Using the Tranzeo Locator

The Tranzeo Locator is a utility that allows users to quickly change the IP address of the Tranzeo radios. It sends out a broadcast on the network and displays a list of other Tranzeo radios connected, from which you can configure the IP address for your device.

Note: The Locator cannot locate radios through routers.
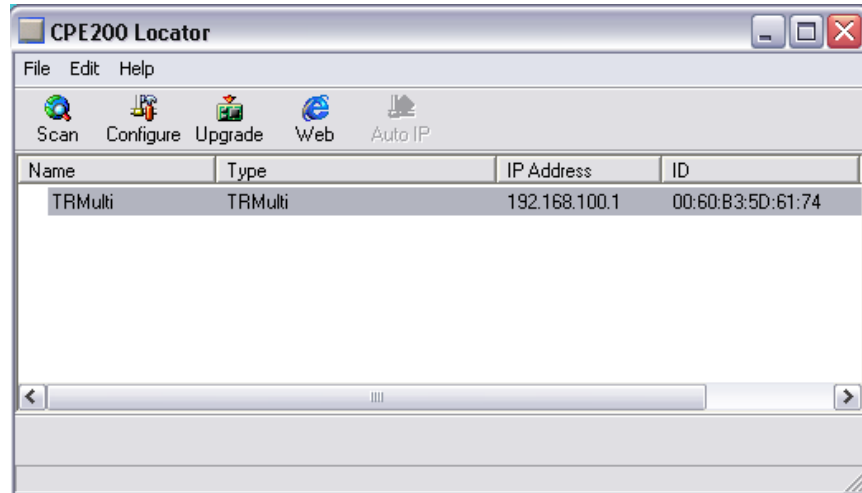
The Tranzeo Locator displays the following options:

Scan:	Locates Tranzeo radios connected to the network. A yellow icon appears before the name when the radio is not in the same subnet.
Configure:	Used to set a static IP address or set the radio into DHCP mode.
Upgrade:	Under development.
Web:	Opens a browser to access the configuration interface.
Auto IP:	To automatically set the radio to an IP address one number higher than the IP address of the computer.

Find the latest version of the Tranzeo Locator at www.tranzeo.com, under Tranzeo Support > Support Files > Radio Utilities.

Login into the Configuration Interface

After defining the network settings, follow these steps to login into the Tranzeo Configuration Interface.

1. Open your Internet browser (Internet Explorer, Netscape, or Firefox).

2. In the address bar, type your IP address (default IP: **http://192.168.1.100**).

3. In the login dialog, enter your **Username** and **Password** (if you're a first-time user, follow the instructions below).

4. Click **OK**. You will then access the configuration interface.
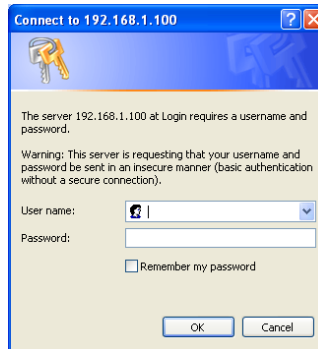
If you're a first-time user:

1. Enter the default username **admin** and the default password **default**.

2. In the Password Set/Reset window, change the **Administration** and **Recovery* passwords**. They cannot be left as default and must be different from each other. You can change the usernames too.

3. Click **Apply** to save the changes.

4. You will be prompted to enter your new username and password in the login dialog. You will then access the configuration interface.

* The recovery username and password are used to access the Password Set/Reset window if the administration password is lost.

Information Page

This is the first window of the configuration interface. It shows the main menu and information about the device settings, like wireless, network, and security settings.

The menu is divided in four sections:

- Setup Menu
- Security
- Status
- Network

Each section contains navigation links to the configuration windows, some of which may be different for access points and CPEs.

Information Page - AP

Information Page - CPE

Setup Menu

In this section you would be able to configure wireless and administrative settings for the TR-6000 Series radio.

Wireless Settings

This window displays the wireless configuration of the device. The contents are slightly different for access point and CPE.
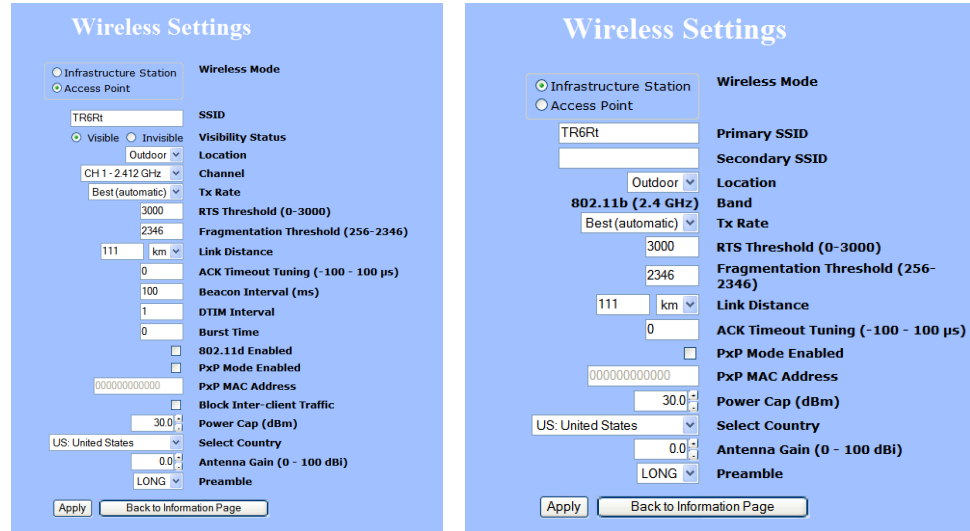
Wireless Mode:	Define if your device will operate as **Infrastructure Station** (CPE) or **Access Point**.
SSID:	The Service Set Identifier (SSID) is the name that identifies a specific wireless LAN. Devices must have the same SSID to communicate with each other. In Infrastructure Station mode (CPE), you can enter primary and secondary SSIDs when using two access points in the network. Clients will connect to the secondary access point when the primary is unavailable or goes down.
Visibility Status*:	You can set your access point to be **Visible** or **Invisible** to clients.
Location:	You can set the location of the radio to be **Outdoor** or **Indoor**.[1]
Channel*:	Select the channel that the access point and clients use.
TX Rate:	The transmission speed at which the radio and access point communicate with each other. Note: Setting this rate below the maximum possible does not limit bandwidth and often has a negative impact on the operation of your network.

* Feature available only in access point wireless mode.
[1]In the FCC Domain this setting has no effect.

RTS Threshold:	This is the maximum size for a packet to be sent automatically. When it exceeds the RTS threshold, the CPE sends first a 'request to send' (RTS) to the access point before sending the packet. Note: The more clients you have, the lower the value should be set.
Fragmentation Threshold:	This is the size at which packets are fragmented in order to be transmitted. Setting this value too low decreases the amount sent on each transmission. In noisy areas, this can improve performance. However, in quiet areas, this will decrease throughput.
Link Distance:	This is the distance between the CPE and access point. This setting is necessary to define the correct ACK timing. Setting this value too low or too high will result in low throughput and high retries.
ACK Timeout Tuning:	The time that the radio waits for an acknowledgment (ACK) from the access point accepting transmission before re-attempting to send the data. This is an offset from the ACK timing set by the link distance.
Beacon Interval*:	This is the rate at which the access point broadcasts its beacons.
DTIM Interval*:	The DTIM interval (Delivery Traffic Indication Message) helps to keep marginal clients connected by sending wake up frames.
Burst Time*:	This allows to send data without stopping. Note that other wireless devices in the network will not be able to transmit data for this number of microseconds.
802.11d Enabled*:	Check to operate in 802.11d mode.[1]
PxP Mode:	Follow the instructions in next page.
PxP Mac Address:	Follow the instructions in next page.
Block Inter-Client Traffic*:	Check to block wireless communications between clients on the access point.
Power Cap:	It is the maximum output power of the radio.
Country:	Select the country where the device is located. Setting an incorrect country may be considered a violation of the applicable law, as rules differ in each country.
Antenna Gain:	Select the gain of the antenna. This information must be set by the installer at the time of installation.
Preamble:	Select type: **Long** uses long preamble only, **Auto** (recommended) tries short preamble first, then long.

* Feature available only in access point wireless mode.
[1]In the FCC Domain this setting has no effect.

To operate the radio in PxP mode:

1. Set one radio to **Access Point** and the other to **Infrastructure Station**.

2. Enter the same **SSID** on both radios.

3. Set the **Channel** on the access point.

4. On both radios, enter the Mac address of the opposite radio in the **PxP Mac Address** field (no colons).

5. Check off **PxP Mode Enabled**.

Note:

In PxP mode, the LEDs on the radios will operate the same as in Infrastructure Station mode, with LEDs proportional to signal strength.

Administrative Settings
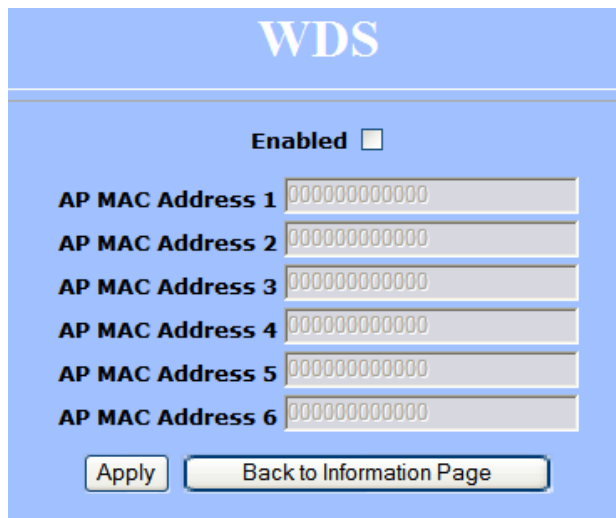
Use this window to upgrade the software, change your password, and define SNMP parameters.

Upgrade Software:	Enter the location of the software update file or **Browse** to locate it in your computer. Click **Upgrade Software**. If the radio does not refresh the Information Page after 1 minute, press **Refresh**, **Reload** or **F5**. Verify the new firmware is installed correctly.
Defaults:	Returns all settings to factory defaults, including passwords.
Reboot:	Restarts the system without changing settings.
Rollback:	To undo the most recent change.
Device Name:	It is the network name of the device. This name appears in the Locator and on the Tranzeo stations list.
User Name:	This is the login username.
Password:	Enter a new password if you want to change it.
Confirm Password:	Re-type the new password.
Extended Wireless Information:	Enables extended information (name and IP address), which is only displayed with Tranzeo access points.
Signal/Status LEDs:	Un-check to turn off the LED panel indicators.
SNMP Parameters:	Here you set the **Read Community** string and Contact/Location information. It's highly recommended that you change the **Read Community** string immediately to prevent unauthorized scanning of your network. You can also select the traffic counter format that you would like to use.

WDS (AP only)

The Wireless Distribution System (WDS) is a modification to the 802.11 standards that allows access points to communicate directly with each other. WDS allows users to spread out coverage to a larger area without the need for a backhaul link. The tradeoff is that overall throughput is greatly affected for all users of the access points linked.

WDS is not recommended for use with large numbers of clients or when throughput needs to be maximized. In both cases, a dedicated PxP link should be used. However, in areas of low density, WDS can allow an ISP to extend coverage into an area at very low cost.

To set up WDS:

1. Select **Enabled** to activate WDS and click **Apply**.

2. Go to the Administrative Settings window and change the settings to **Defaults**.

3. Go to the Wireless Settings window and set the same **Channels** for both access points.

4. In the WDS settings window, enter the **Mac address** of the peer. Do not insert colons or commas.

5. Click **Apply**.

Note:

♦ WDS links don't appear in the Station List or Performance windows. To monitor the link's strength and performance, use PxP mode.

♦ Throughput is cut by 50% per link.

♦ WDS does not support WPA encryption.

♦ All links need to be on the same channel.

Tranzeo Wireless Technologies   *Chapter 3: Configuration*

Security

In this section you can configure both basic and advanced security settings for your device.

Basic Security Settings

In this window you can define WEP parameters. WEP provides security by encrypting data so that it's protected when transmitted from one point to another.

Enabled:	Check to turn on WEP security protocol.
Authentication:	Select your system to be open or shared. **Open** is always recommended.
Key Length:	This is the level of encryption. Note that 64 bit is referred to as 40 bit on some systems.
Default Key:	Select the default WEP key from the list.
Activate Keys:	Enter the four WEP keys you want to activate. Keys must be entered in HEX only.

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Advanced Security Settings

In this window you can enter WPA parameters. WPA provides a higher level of security, enhancing the security features of WEP.

WPA Mode:	Select the WPA mode.
Backward Compatible:	Select **TKIP** or **AES** backwards compatibility if required.
Cipher Type:	Select the level of encryption.
PSK:	Enter your PSK password.
Update Interval:	This is the interval at which the PSK password will be updated.
WPA Enterprise:	Ensures that only authorized network users can access the network. Enter the information about the RADIUS server from your Internet Service Provider.

Access Control (AP only)

This feature allows you to control the accessibility from wireless devices, in other words, to allow or deny access from other radios. It applies only to devices working as access points.

Enable Access	Enable to control accessibility from wireless devices.
Edit Mode:	Check to make changes in access control settings.
Authorized Station Devices:	This is the list of the authorized devices. To change current settings, check the devices and click **Copy All** or **Copy Selected**. The devices will appear in the **Mac Address** box on the right. Note: If you are working via a radio link, add first the address of the station you are connecting from. Otherwise, you will be locked out of the radio.
Available Station Devices:	This list contains the devices available but not authorized. To authorize them, check the devices and click **Copy All** or **Copy Selected**. The devices will appear in the **Mac Address** box on the right.
Manually Authorize Stations:	In this box you can perform different actions like authorize, deauthorize and delete devices listed here.

Status

This section displays information about the status and performance of your radio. Most options and information cannot be modified in this section.

Stations List (AP only)

This window displays a list of the stations associated with the access point and their connection statistics.

Stations List

Please click on name or ip address to change device's name or ip address.

					Noise Floor (dBm) -103	
#	Name	MAC Address	IP Address	Status	Signal (dBm)	Speed (Mbps)

Save Changes   Back to Information Page

Name:	This information appears here when the device is a Tranzeo 6000 and the **Extended Wireless Information** option in the Administrative Settings window is checked. Otherwise, the field will be blank. You can manually enter a name by left clicking on the field and typing in. However, if the **Extended Wireless Information** option is turned on at the client, the name you entered will be overwritten with the name on the client.
Mac Address:	The Mac addresses of the associated stations.
IP Address:	Works as with the **Name**. It appears when the **Extended Wireless Information** option in the Administrative Settings window is checked.
Status:	Indicates if the station is associated or WDS BSSID.
Signal:	This is the radio frequency power in dBm as detected at the access point. A strong link is defined by both the AP signal and the client signal. Links should also be at least 10 dB higher than the receive sensitivity of the weakest element or the noise floor, whichever is higher, on both sides.
Speed:	This is the radio speed of the link. Speed is based on both signal strength and the quality of the link. If the link is losing a lot of packets due to poor Fresnel zones or interference, the speed will be lower than the strength can support.

AP List (CPE only)

This window displays information about the access points associated with the CPE and the connection statistics.

You can set an access point's SSID as your primary SSID by clicking on the MAC address when it's displayed as a link. This will automatically reboot the radio.

AP List

Available Access Points

MAC Address	Name	IP Address	SSID	Noise Floor (Dbm)	Signal (Dbm)	Channel	Encryption	Access Control	Authentication	802.1x	Status
0060B3E90D67	TR6Rt	192.168.1.120	TR6Rt	-103	-92	1	WPA (TKIP)	Disabled	Off	Disabled	Probed BSSID

ARP Table

This table lists the devices that have communicated with your device via TCP. There should be a limited number of entries in this table, especially if the interstation blocking is turned on at the access point.

ARP Table

#	MAC Address	IP Address
1	00051B00B91A	192.168.1.50

Back to Information Page

Statistics

This section is divided in 3 windows: LMAC (Lower Mac), UMAC (Upper Mac), and Ethernet, which can be accessed from the Statistic Summary Page.

Statistics Summary Page

Runtime Statistics Settings
- ☑ Enable LMAC TX/RX Statistics
- ☑ Enable LMAC Interrupt Statistics
- ☑ Enable LMAC Radio Media Statistics
- ☑ Enable Ethernet Statistics

Apply Settings

Notes

| LMAC Statistics Page | UMAC Statistics Page | Ethernet Statistics Page |

LMAC Statistics

The LMAC functions occur in the radio chipset. While the UMAC divides the statistics into clean and failed packets, LMAC defines why packets failed.

This window contains three tabs: TX, RX and INT. TX and RX values are useful to ISPs and other users. The INT (internal) statistics are intended for use by Tranzeo Wireless Technical Support.

You can click onto each speed level and see how the traffic breaks down. In the TX statistics, there should little to no Tries at Series 2, 3 or 4. The radio will try to send a packet 4 times at Series 1 and then will try the next series 4 times. In the RX statistics, you should look for bad CRCs and bad decrypts for signs of RF interference or Fresnel interference links. Bad PHYs generally are caused when the radio is unable to decode the packets due to noise.

LMAC Statistics

Select Refresh Rate (s)   ⦿ 30   ○ 45   ○ 60   Sample

RX TX INT

Rate	Total	Good	Bad	Tries	RSSI
1 Mbps	208	0	208	0	0
2 Mbps	0	0	0	0	0
5 Mbps	0	0	0	0	0
11 Mbps	0	0	0	0	0
6 Mbps	0	0	0	0	0
9 Mbps	0	0	0	0	0
12 Mbps	0	0	0	0	0
18 Mbps	0	0	0	0	0
24 Mbps	0	0	0	0	0
36 Mbps	0	0	0	0	0
48 Mbps	0	0	0	0	0
54 Mbps	0	0	0	0	0

Rate	Bad Overwritten	Bad CRC	Bad Decrypt	Bad PHY Underrun	Bad PHY Panic	Bad PHY Radar
	Bad PHY Abort	Bad PHY Inter	Bad PHY OFDM	Bad PHY CCK	Bad Michael	Bad Cache

Please click on a rate to check the detailed statistics.

| Back to Information Page | Back to Statistics Summary Page |

<u>Note</u>:
Communication between access points and CPEs always occurs at the lowest rate. In a normal link, you should see a fair number of transactions at the lowest rate.

UMAC Statistics

The UMAC functions occur in the unit's processor. The UMAC statistics are likely the most useful for radio troubleshooting. This window breaks down the statistics into clean and failed packets.

The failed packets should be less than 10% in a normal operating environment. In the TX statistics, there should be little to no Retransmits at Series 2, 3 or 4. Life Statistics are reset on each reboot.

UMAC Statistics

Select Refresh Rate (s)	⦿ 10	○ 15	○ 20	Sample

		Previous Statistics	Life Statistics
	Sample Period (in sec)	10.000	2300.509
RX	Bytes	0	0.000
	Packets	0	0
	Clean Packets	0 (0.0%)	0 (0.0%)
	Failed Packets	0 (0.0%)	0 (0.0%)
TX	Bytes	3895	875.854 KB
	Packets	95	21875
	Clean Packets	95 (100.0%)	21875 (100.0%)
	Retransmit Series 0	0 (0.0%)	0 (0.0%)
	Retransmit Series 1	0 (0.0%)	0 (0.0%)
	Retransmit Series 2	0 (0.0%)	0 (0.0%)
	Retransmit Series 3	0 (0.0%)	0 (0.0%)
	Total Failed Packets	0 (0.0%)	0 (0.0%)

Ethernet Statistics

In this window, excessive collisions are usually a sign that the radio and the device it is linked to are not on the same duplex settings. One is at full while the other is at half. Try locking both to the same values.

Collisions do normally occur on an Ethernet network and are generally handled by the Carrier Sense Multiple Access with Collision Detect (CSMA/CD) mechanism. Alignment, length and excessive FCS errors could the result of a bad radio link, or a bad Ethernet cable.

Ethernet Statistics

Select Refresh Rate (s)	⦿ 30	○ 45	○ 60	Sample

		Ethernet 1	Ethernet 2
TX	Total	360	0
	Dropped by Software	0	0
	Dropped by Link	0	0
	Collision	0	0
	Late Collision	0	0
	Excessive Collision	0	0
RX	Total	236	0
	Dropped by HRT	0	0
	Dropped by DSR	0	0
	Dropped by Software	0	0
	Frames over 2048 bytes	0	0
	Frames over 1518 and less than 2048 bytes	0	0
	FCS Error	0	0
	Length Error	0	0
	Alignment Error	0	0

System Performance

This window shows information about the memory usage and the CPU. Many browsers do not allow infinite refreshes of a page through scripts, so this window may stop updating. If it does, simply change the refresh rate to another value to restart the process.
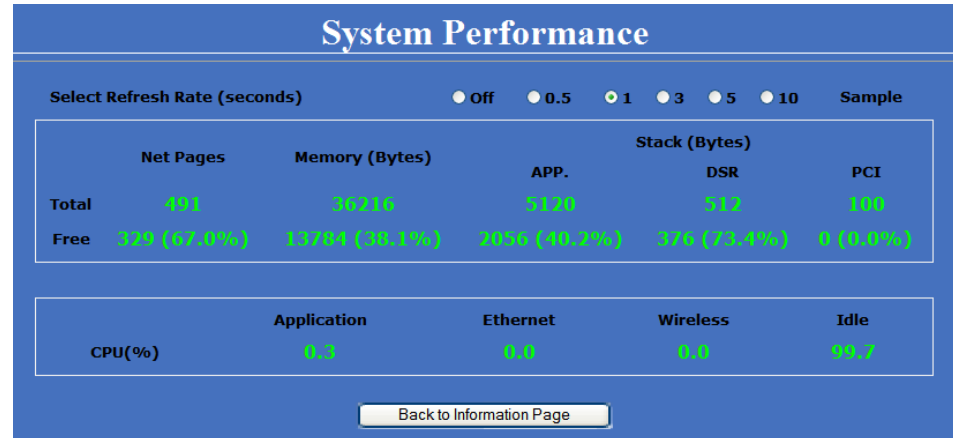
Select Refresh Rate:	Set the time for automatic refreshes.
Net Pages:	This is the memory used for data transmission
Memory:	This is the total memory of the system.
Stack:	This section displays the memory used and available for each stack: App. (applications), DSR, and PCI. This information is relevant for programmers.

Network Configuration

In this window you can control the network configuration of the device. First, you must define if your radio will operate as a bridge or router. The content of the window varies depending on your selection.

When changing modes, the radio may need to reboot before certain features become available.

Bridge Mode

Cloning MAC Address:	This feature allows the radio to copy the MAC address of the device you have connected to the network. This is useful when you change your device and don't want to register a new MAC address, or when dealing with some PPPoE and Radius implementations. When the device is cloning a MAC address, it can only be managed from the LAN side. To clone a MAC address, check the **MAC Address** box and enter the MAC address in the field **Cloning into**. Uncheck to restore the original MAC address.
IP Mode:	You can select to use **Static** IP or **DHCP Client** (dynamic). <u>Note</u>: If a DHCP server is not available, the device will try to get an IP. If has no success, it will use a fallback IP address. The fallback IP is the address that is set in the static address fields.
WAN:	Enter the information related to the WAN interface: IP Address, Subnet Mask, Gateway, DNS1, DNS2, and Domain Name.
Ethernet Port Speed:	Set as **Auto** by default.

Router Mode

From this window you can access specific windows to configure the DHCP Server, QoS, Static Routes, Port Filtering, and Port Forwarding. If the feature is available, it will appear like a link. To open an item, just click on it. These features are described in the next pages.

MTU:	The Maximum Transmission Unit (MTU) refers to the size of the largest packet that the router can pass. The default value is 1500 bytes. If PPPoE is used, you should change the MTU to match the PPPoE server, typically 1492 bytes.
Allow Pinging:	Enables ping responses on WAN interface.
Allow Access to Web Server:	Allows access from WAN interface or change the port the WAN server responds to web server requests. Note: Access to web server from LAN interface is always enabled and set at port 80.
Cloning MAC Address:	See description in Bridge Mode.
IP Mode:	You can select to use **Static IP**, **DHCP Client** (dynamic), or **PPPoE**. Note: If a PPPoE server is not available, the device will try to get an IP. If has no success, it will use a fallback IP address. The fallback IP is the address that is set in the static address fields.

WAN:	Enter the information related to the WAN interface: IP Address, Subnet Mask, Gateway, DNS1, DNS2, and Domain Name.
LAN:	Enter the information related to the LAN interface: IP address and subnet mask.
DHCP Server:	Check the box and click **Apply** to enable this feature. Click on the item (which now appears as a link) to open the DHCP Server configuration window.
Routing:	Enables NAT, QoS, and Static Routes. NAT should always be enabled when using private addressing. Click on **QoS** or **Static Routes** to configure.
Port Management:	Check the box and click **Apply** to enable port filtering and port forwarding. Click on any item to open the configuration window.
Ethernet Port Speed:	Set as **Auto** by default.

Note:

Many Ethernet devices do not auto-negotiate properly. If you see large numbers of dropped pings, you may have collisions. Try locking the device at 10/half as a troubleshooting step. If the packet losses stop, step up to 100/full. If the device the radio is connecting cannot support 100/full, you should replace the device or place a switch in line.

DHCP Configuration

This window shows the configuration of the DHCP server.

IP Parameters

Subnet Mask:	Enter your subnet mask in this field.
Address Starting from:	Indicates the first address in the DHCP pool.
Number of Addresses:	Indicates the number of addresses in the DHCP pool.
Gateway:	Select **This Unit** to use the gateway set on the WAN interface. Select **Other** to use a different gateway.
Lease Time:	Indicates the expiration time for the IP address assigned by the DHCP server.

DNS

Server IP Address:	Select **WAN Assigned** to use the DNS server IP addresses assigned on the WAN side. To use different DNS servers, select **Static**, in which case you must enter the **Primary** and **Secondary** IP addresses.
Domain Name:	Apply the same configuration as for **Server IP Address**.
WINS:	Apply the same configuration as for **Server IP Address**.

IP Routing

This window is intended for those users who have a strong understanding of IP routing. Here you can see the System Routes, create your User Routes, and set the Default Route.

IMPORTANT! Be careful when making changes since misconfiguration could result in serious network problems and even the loss of functionality.

IP Routing

System Routes

Interface	IP Address	Subnet Mask	Gateway	Metric
WAN	192.168.1.255	255.255.255.255	0.0.0.0	1
WAN	192.168.1.100	255.255.255.255	0.0.0.0	1
WAN	192.168.1.0	255.255.255.0	0.0.0.0	1
LAN	192.168.100.255	255.255.255.255	0.0.0.0	1
LAN	192.168.100.1	255.255.255.255	0.0.0.0	1
LAN	192.168.100.0	255.255.255.0	0.0.0.0	1

User Routes

Interface	IP Address	Subnet Mask	Gateway	Metric
Off	0.0.0.0	0.0.0.0	0.0.0.0	0
Off	0.0.0.0	0.0.0.0	0.0.0.0	0
Off	0.0.0.0	0.0.0.0	0.0.0.0	0
Off	0.0.0.0	0.0.0.0	0.0.0.0	0
Off	0.0.0.0	0.0.0.0	0.0.0.0	0
Off	0.0.0.0	0.0.0.0	0.0.0.0	0
Off	0.0.0.0	0.0.0.0	0.0.0.0	0
Off	0.0.0.0	0.0.0.0	0.0.0.0	0

Default Route

Select	Interface	Gateway
⦿ System	WAN	192.168.1.1
◯ User	WAN	0.0.0.0

[Apply] [Back to Information Page]

Interface:	Specify if the interface is **WAN** or **LAN**. Select **Off** to disable the route.
IP Address:	This is the IP address or network that the packets will be attempting to access.
Subnet Mask:	Specifies the part of the destination IP that represents the network address and the part that represents the host address. Note: 255.255.255.255 represents only the host entered in the Destination IP field.
Gateway:	Indicates the next hop if this route is used. A gateway of 0.0.0.0 means there is no next hop and the IP address matched is directly connected to the router on the interface specified.
Metric:	This is the number of hops it will take to reach the destination. A hop occurs each time data passes through a router from one network to another. If there is only one router between your network and the destination network, then the metric value would be 1.
Default Route:	This option allows you to change the default route of the radio. Make changes with extreme caution.

Quality of Service Configuration (QoS)

In this window you can use the QoS features and set rules to prioritize the traffic.

Quality of Service Configuration

Uplink Speed (Mbps):   4 Mbps

Dynamic Fragmentation: ☑ Automatic Classification: ☑

Rules

# enabled	Name	Protocol	Source IP		Source Port		Destination IP		Destination Port	
	Priority	Range	Range	To	Range	To	Range	To	Range	To
0 ☐ 0		0	0.0.0.0	0.0.0.0	0	0	0.0.0.0	0.0.0.0	0	0
1 ☐ 0		0	0.0.0.0	0.0.0.0	0	0	0.0.0.0	0.0.0.0	0	0
2 ☐ 0		0	0.0.0.0	0.0.0.0	0	0	0.0.0.0	0.0.0.0	0	0
3 ☐ 0		0	0.0.0.0	0.0.0.0	0	0	0.0.0.0	0.0.0.0	0	0
4 ☐ 0		0	0.0.0.0	0.0.0.0	0	0	0.0.0.0	0.0.0.0	0	0
5 ☐ 0		0	0.0.0.0	0.0.0.0	0	0	0.0.0.0	0.0.0.0	0	0
6 ☐ 0		0	0.0.0.0	0.0.0.0	0	0	0.0.0.0	0.0.0.0	0	0
7 ☐ 0		0	0.0.0.0	0.0.0.0	0	0	0.0.0.0	0.0.0.0	0	0

Apply   Back to Information Page

Uplink Speed:	This is the maximum speed of the uplink (from the source to the destination). The order and size of traffic is determined based on this value.
Dynamic Fragmentation:	Check to reduce delay for high-priority traffic and adaptive fragmentation where the fragmentation is determined by the uplink speed. This feature greatly improves the gaming and VOIP experience.
Automatic Classification:	This feature automatically classifies traffic and gives priority to certain applications. Applications such as VOIP and gaming are automatically given priority.
Enabled:	Check to activate a rule.
Priority:	Enter the priority of the rule between 0 and 255.
Name:	Enter the name of the rule here.
Protocol:	Enter the protocol number here. Common options are: 0 for ANY, 1 for ICMP, 6 for TCP, and 17 for UDP. See Appendix C for Protocol List.
Source IP Range:	Enter the range of IP addresses on the LAN side where the rule would apply. To cover all LAN IPs, enter 0.0.0.0. For a single IP, enter the IP in both boxes.
Source Port Range:	Enter the range of ports on the LAN side where the rule would apply. To cover all ports, enter 0. For a single port, enter this port in both boxes.
Destination IP Range:	Enter the range of IP addresses on the WAN side where the rule would apply.
Destination Port Range:	Enter the range of ports on the WAN side where the rule would apply.

Port Forwarding

This feature allows the radio to forward requests for certain ports to devices behind a router. For example, you have a web server on a private IP that you want to be accessible to the world. You can forward all requests on port 80 to 192.168.1.2. For this to work, you have to change the management port of the radio from port 80 on the Network Configuration window.

In this window, you can create, edit, delete, and manage rules for port forwarding. A list of port forwarding rules appears at the bottom.

Enable Port Forwarding:	Click to apply rules from the Rules list.
Forward Rule ID:	Enter the rule ID here to retrieve its information.
Edit / Delete:	Click to modify or remove the selected rule.
Enabled / Disabled:	Activate or deactivate the selected rule.
External Port:	Enter the port to which requests will be forwarded.
Internal Port:	Enter your port here.
Internal Address:	Enter your IP address.
Protocol:	Select the protocol used for this rule.
New:	Click to create a new rule. Fields will be cleared.
Add:	After creating a rule, click this button to include the new rule in the Port Forwarding Rules list.
Update:	Click to apply changes after editing or deleting a rule.

Port Filtering

This feature allows the radio to block requests to and from devices behind the router. A list of the devices filtered appears at the bottom of the window.

Enable Port Filtering:	Click to apply the rules enabled from the Filter list.
WAN / LAN:	Select the network.
Filter Rule ID:	Enter the filter rule ID here to retrieve its information.
Edit / Delete:	Click to modify or eliminate the selected filter.
Allow / Deny:	The rule can either allow or deny ports.
New:	Click to create a new filter. Fields will be cleared and you may enter the information for the new filter.
Add:	After creating a filter, click this button to include the new filter in the Filter list.
Source IP Range:	Enter the range of IP addresses on the LAN side where the rule would apply.
Destination IP Range:	Enter the range of IP addresses on the WAN side where the rule would apply.
Source Port Range:	Enter the range of ports on the LAN side where the rule would apply.
Destination Port Range:	Enter the range of ports on the WAN side where the rule would apply.
ICMP Type:	This allows you to block certain types of ICMP as a prevention against port scanning and some viruses.
Protocol:	Select the protocol used for this rule.
Update:	Click to apply changes after editing or deleting a filter.

Appendix A: Grounding and Lightning Protection Information

What is a proper ground?

This antenna must be grounded to a proper earth ground. According to the National Electrical Code Sections 810-15s and 810-21, the grounding conductor shall be connected to the nearest accessible locations of the following:

- The building or structure grounding electrode
- The grounded interior metal water piping system
- The power service accessible means external to enclosure
- The metallic power service raceway
- The service equipment enclosure
- The grounding electrode conductor

Why is coiling the LMR or Cat 5 bad?

The myth is that lighting follows the path of least resistance. It actually follows the path of least impedance. Coiling cables creates an air-wound transformer, which lowers the impedance. This means you are in fact making your radios a more appealing target for surges.

What standard does Tranzeo Wireless equipment meet?

This radio exceeds International Standard IEC 61000-4-5 when properly grounded. For a copy of the full testing report, see Report Number TRL090904 - *Tranzeo Surge Protection board* located on the Tranzeo website (www.tranzeo.com).

Is lightning damage covered by the warranty?

No. Lightning is not covered by the warranty. If you follow the instructions, your chances of lightning damage are greatly reduced, but nothing can protect a radio from a direct lightning strike.

Where to ground the device?

This radio must be grounded at the pole and at the POE. This is because the radio is between the exterior antenna and the POE ground. See the examples below.

Grounded Radio

A grounded radio causes the surge to pass directly to ground, bypassing the radio.
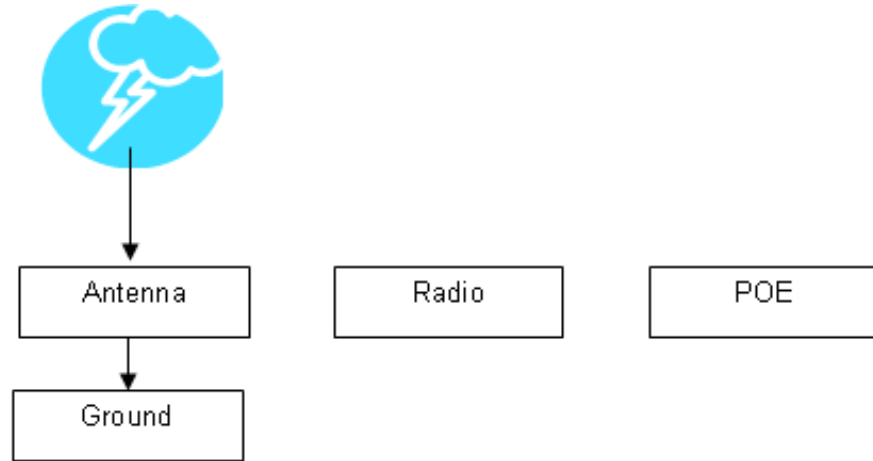
Ungrounded Radio

An ungrounded radio causes the surge to pass through the radio. In this case, the radio most likely will be damaged.
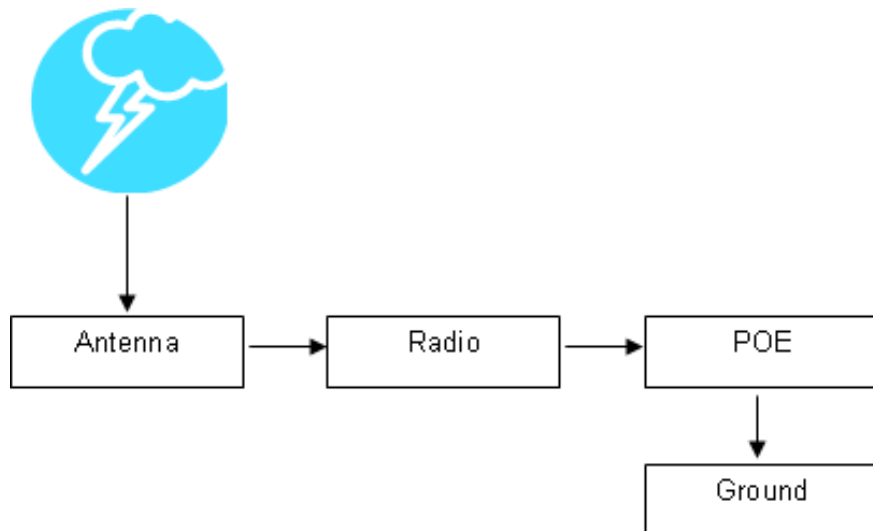
Grounded POE

In this case, the surge will be picked up by the Cat 5 cable and since the POE is grounded, the route for the surge is through the POE to ground.
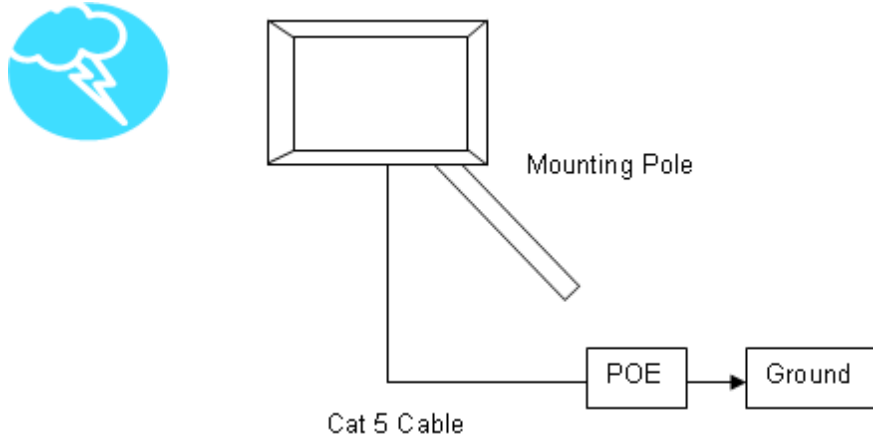
Ungrounded POE

In this case, the surge will be picked up by the Cat 5 cable and since the POE is not grounded, the route for the surge is through the radio to the antenna, and out through the building.
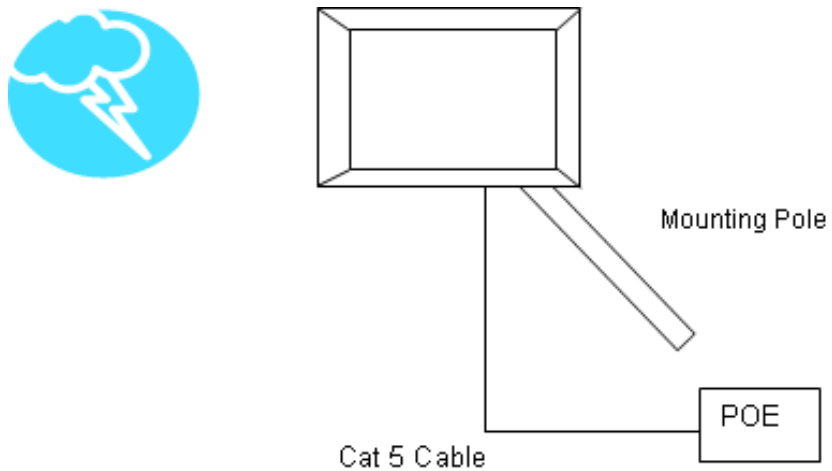
Appendix B: Quality of Service Configuration (QoS)

Tranzeo Wireless Technologies' software ensures a consistently high quality online experience through the use of powerful Quality of Service (QoS) mechanisms. The key to making this applicable in a WISP environment is the Intelligent Stream Handling, a patent-pending algorithm that autonomously manages the flow of traffic going to the Internet without the need for user configuration. As a result, real-time, interactive traffic—such as gaming, VoIP, and video teleconferencing—is automatically given the appropriate priority when other users and applications use the connection. In addition, Intelligent Stream Handling minimizes the impact of large packet, lower priority traffic on latency-sensitive traffic and eliminates delays. Tranzeo software effectively eliminates the lag and breakup problem in online gaming and other voice and video applications.

In today's broadband environment, the impact of just one data stream running in parallel with a real-time application can be quite dramatic. Using NetIQ's Chariot VoIP test measurement over a connection, it can be demonstrated that introducing a single FTP transfer in the upstream direction will reduce the Mean Opinion Score (MOS) for a G.729 VoIP codec from a very good 4.4 to a completely unacceptable level of 1 immediately. Using the same scenario with Tranzeo's QoS enabled, the voice quality remains consistently high with an MOS of 4.4, and maintains that level even with multiple FTP streams.

Automatic Traffic Classification

Tranzeo software has the capability of continually monitoring and classifying traffic on the Internet connection, and dynamically adjusting the way individual streams are handled at any point in time. This enables latency-sensitive traffic—such as voice, games, or even web page requests— to be given a relatively high priority. As a result, these packets are sent to their destination first, reducing delay and jitter. Less time-sensitive traffic—such as email or file transfers—are sent at lower priority. Since Intelligent Stream Handling operates automatically without the need for user configuration, it is able to effectively use 255 priority levels for fine-grained control of the packet streams.

Rate Matching

A process called "rate matching" determines the bandwidth of the broadband uplink automatically so that it can shape the traffic to smooth the flow between the router and the Internet. This eliminates the potential bottlenecks and delays that can be caused by "bursty" data traffic.

Dynamic and Adaptive Link Fragmentation

Low priority traffic is also fragmented to reduce the latency and jitter that can be introduced by long packets. Intelligent Stream Handling adjusts the fragment size based on the uplink speed and also stops fragmenting long packets when no latency-sensitive traffic is waiting to be sent, to improve the overall efficiency of the broadband link and ensure voice can sustain a high MOS rating.

QoS Block Diagram

Tranzeo software has the capability of continually monitoring and classifying traffic on the Internet connection, and dynamically adjusting the way individual streams are handled at any point in time. This enables latency-sensitive traffic, such as voice, games or even web page requests, to be given a relatively high priority. As a result, they are sent to their destination first, reducing delay and jitter. Less time-sensitive traffic such as email or file transfers are de-prioritized.

Intelligent Stream Handling adjusts the fragment size based on the uplink speed and also stops fragmenting long packets when no latency-sensitive traffic is waiting to be sent, to improve the overall efficiency of the broadband link and ensure voice can sustain a high MOS (Mean Opinion Score) rating.

A process called "rate matching" determines the bandwidth of the broadband uplink automatically so that it can shape the traffic to smooth the flow between the router and the Internet. This eliminates the potential bottlenecks and delays that can be caused by "bursty" data traffic.

High Priority → **Automatic Classification** → High Priority → **Dynamic Fragmentation** → High Priority → **Rate Matching** → High Priority → Internet

Non-latency-sensitive traffic → **Queue**

Low-priority or excess traffic → **Queue**
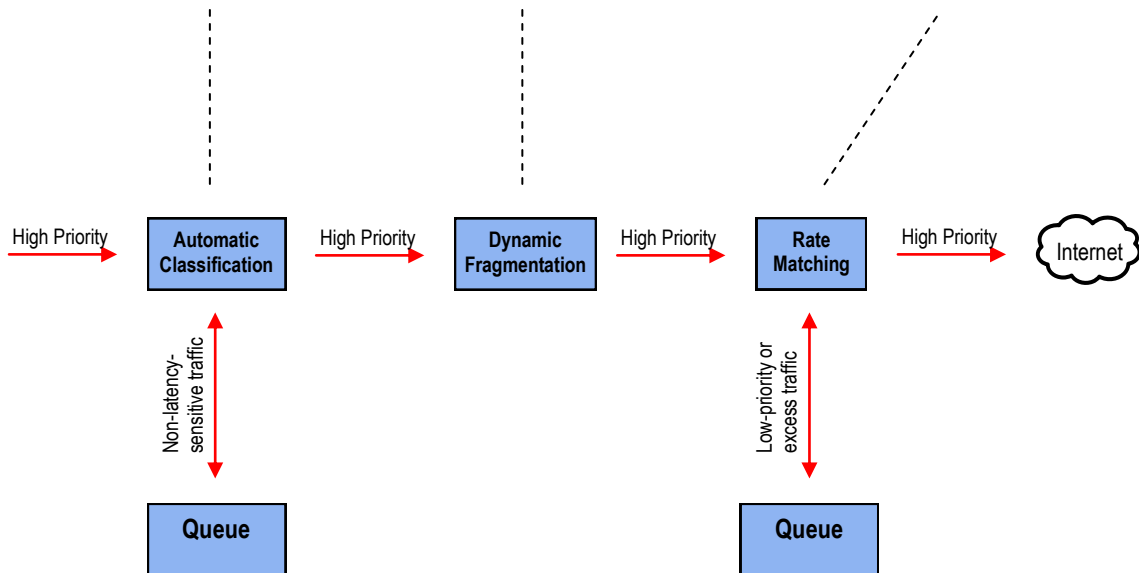
Network QoS Example

In this case, no user is ever able to draw more than their fair share of the available up stream bandwidth, even if the communication is between two stations on the same access points.

Internet

Bandwidth Shaper

5A PxP

30 MB

5A PxP
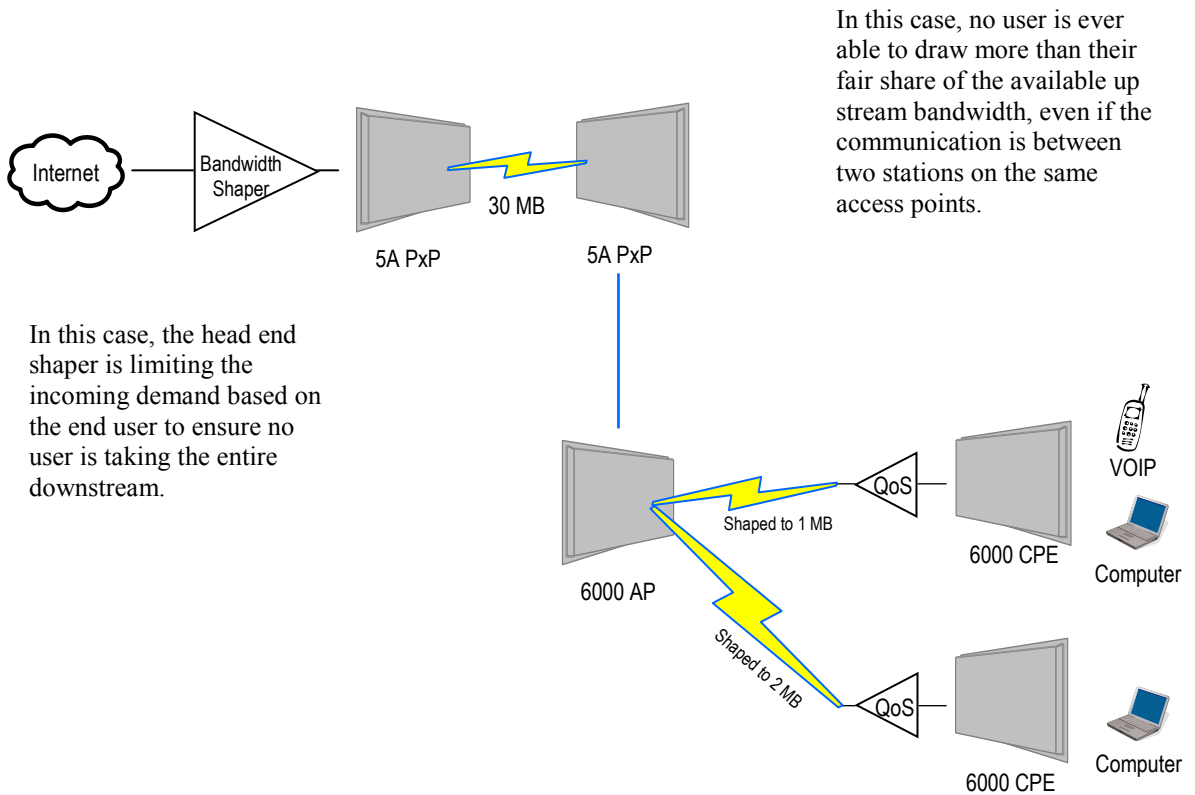
In this case, the head end shaper is limiting the incoming demand based on the end user to ensure no user is taking the entire downstream.

6000 AP

Shaped to 1 MB

QoS

6000 CPE

VOIP

Computer

Shaped to 2 MB

QoS

6000 CPE

Computer

Appendix C: Protocol List

Dec	Keyword	Protocol
0	HOPOPT	IPv6 Hop-by-Hop Option
1	ICMP	Internet Control Message
2	IGMP	Internet Group Management
3	GGP	Gateway-to-Gateway
4	IP	IP in IP (encapsulation)
5	ST	Stream
6	TCP	Transmission Control
7	CBT	CBT
8	EGP	Exterior Gateway Protocol
9	IGP	private interior gateway
10	BRM	BBN RCC Monitoring
11	NVP-II	Network Voice Protocol
12	PUP	PUP
13	ARGUS	ARGUS
14	EMCON	EMCON
15	XNET	Cross Net Debugger
16	CHAOS	Chaos
17	UDP	User Datagram
18	MUX	Multiplexing
19	DCN-MEAS	DCN Measurement
20	HMP	Host Monitoring
21	PRM	Packet Radio Measurement
22	XNS-IDP	XEROX NS IDP
23	TRUNK-1	Trunk-1
24	TRUNK-2	Trunk-2
25	LEAF-1	Leaf-1
26	LEAF-2	Leaf-2
27	RDP	Reliable Data Protocol
28	IRTP	Internet Reliable Transaction
29	ISO-TP4	ISO Transport Class 4
30	NETBLT	Bulk Data Transfer
31	MFE-NSP	MFE Network Services
32	MERIT-INP	MERIT Internodal Protocol
33	SEP	Sequential Exchange
34	3PC	Third Party Connect
35	IDPR	Inter-Domain Policy Routing Protocol
36	XTP	XTP
37	DDP	Datagram Delivery
38	IDPR-CMTP	IDPR Control Message Transport Proto
39	TP++	TP++ Transport Protocol
40	IL	IL Transport Protocol
41	IPv6	Ipv6
42	SDRP	Source Demand Routing
43	IPv6-Route	Routing Header for IPv6
44	IPv6-Frag	Fragment Header for IPv6
45	IDRP	Inter-Domain Routing
46	RSVP	Reservation Protocol
47	GRE	General Routing Encapsulation
48	MHRP	Mobile Host Routing Protocol
49	BNA	BNA
50	ESP	Encap Security Payload for IPv6

Dec	Keyword	Protocol
51	AH	Authentication Header for IPv6
52	I-NLSP	Integrated Net Layer Security
53	SWIPE	IP with Encryption
54	NARP	NBMA Address Resolution
55	MOBILE	IP Mobility
56	TLSP	Transport Layer Security using Kryptonet key management
57	SKIP	SKIP
58	IPv6-ICMP	ICMP for IPv6
59	IPv6-NoNxt	No Next Header for IPv6
60	IPv6-Opts	Destination Options for IPv6
61		any host internal protocol
62	CFTP	CFTP
63		any local network
64	SAT-EXPAK	SATNET and Backroom EXPAK
65	KRYPTOLAN	Kryptolan
66	RVD	MIT Remote Virtual Disk
67	IPPC	Internet Pluribus Packet Core
68		any distributed file system
69	SAT-MON	SATNET Monitoring
70	VISA	VISA Protocol
71	IPCV	Internet Packet Core Utility
72	CPNX	Computer Protocol Network Executive
73	CPHB	Computer Protocol Heart Beat
74	WSN	Wang Span Network
75	PVP	Packet Video Protocol
76	BR-SAT-MON	Backroom SATNET Monitoring
77	SUN-ND	SUN ND PROTOCOL-Temporary
78	WB-MON	WIDEBAND Monitoring
79	WB-EXPAK	WIDEBAND EXPAK
80	ISO-IP	ISO Internet Protocol
81	VMTP	VMTP
82	SECURE-VMTP	SECURE-VMTP
83	VINES	VINES
84	TTP	TTPord Protocol
85	NSFNET-IGP	NSFNET-IGP
86	DGP	Dissimilar Gateway Protocol
87	TCF	TCF
88	EIGRP	EIGRP
89	OSPFIGP	OSPFIGP
90	Sprite-RPC	Sprite RPC Protocol
91	LARP	Locus Address Resolution
92	MTP	Multicast Transport Protocol
93	AX.25	AX.25 Frames
94	IPIP	P-within-IP Encapsulation
95	MICP	Mobile Internetworking Control
96	SCC-SP	Semaphore Communications Sec.
97	ETHERIP	Ethernet-within-IP Encapsulation
98	ENCAP	Encapsulation Header
99		any private encryption scheme
100	GMTP	GMTP

Dec	Keyword	Protocol	Dec	Keyword	Protocol
101	IFMP	Ipsilon Flow Management	121	SMP	Simple Message Protocol
102	PNNI	PNNI over IP	122	SM	SM
103	PIM	Protocol Independent Multicast	123	PTP	Performance Transparency
104	ARIS	ARIS	124	ISSIS	ISIS over IPv4
105	SCPS	SCPS	125	FIRE	
106	QNX	QNX	126	CRTP	Combat Radio Transport
107	A/N	Active Networks	127	CRUDP	Combat Radio User Datagram
108	IPComp	IP Payload Compression	128	SSCOPMCE	
109	SNP	Sitara Networks Protocol	129	IPLT	
110	Compaq-Peer	Compaq Peer Protocol	130	SPS	Secure Packet Shield
111	IPX-in-IP	IPX in IP	131	PIPE	Private IP Encapsulation within IP
112	VRRP	Virtual Router Redundancy	132	SCTP	Stream Control Transmission
113	PGM	PGM Reliable Transport	133	FC	Fibre Channel
114		any 0-hop protocol	134	RSVP-E2E-IGNORE	
115	L2TP	Layer Two Tunneling Protocol	135		Mobility header
116	DDX	D-II Data Exchange (DDX)	136	UDPLite	
117	IATP	Interactive Agent Transfer	137	MPLS-in-IP	
118	STP	Schedule Transfer Protocol	138-252		Unassigned
119	SRP	SpectraLink Radio Protocol	253		Use for experimentation and testing
120	UTI	UTI	254		Use for experimentation and testing
			255		Reserved

Appendix D: Common TCP Ports

Visit http://www.iana.org/assignments/port-numbers for a full list of well known port numbers.

Keyword	Port	Description
ECHO	7	Echo
SYSTAT	11	Active Users
QOTD	17	Quote of the day
MSP	18	Message Send Protocol
FTP-DATA	20	File Transfer (Data Channel)
FTP	21	File Transfer (Control)
TELNET	23	Telnet
SMTP	25	Simple Mail Transfer
NAME	42	TCP Nameserver
BOOTPS	67	Bootstrap Protocol Server
BOOTPC	68	Bootstrap Protocol Client
TFTP	69	Trivial File Transfer
WWW	80	World Wide Web
KERBEROS	88	Kerberos
POP3	110	TCP post office
NNTP	119	USENET
NFS	2049	Network File System
SIP	5060, 5061	SIP

Appendix E: Channel Allocations

The following tables list the channel numbers and center frequencies used for 802.11a and 802.11b/g. Note that while all of these frequencies are in the unlicensed ISM and U-NII bands, not all channels are available in all countries. Many regions impose restrictions on output power as well as indoor and outdoor use on some channels. These regulations are rapidly changing, so always check your local regulations before transmitting.

These tables show the center frequency for each channel. Channels are 22 MHz wide in 802.11b/g and 20 MHz wide in 802.11a.

802.11b/g			
Channel #	Center Frequency (GHz)	Channel #	Center Frequency (GHz)
1	2.412	8	2.447
2	2.417	9	2.452
3	2.422	10	2.457
4	2.427	11	2.462
5	2.432	12	2.467
6	2.437	13	2.472
7	2.442	14	2.484

802.11a			
Channel #	Center Frequency (GHz)	Channel #	Center Frequency (GHz)
34	5.170	52	5.260
36	5.180	56	5.280
38	5.190	60	5.300
40	5.200	64	5.320
42	5.210	149	5.745
44	5.220	153	5.765
46	5.230	157	5.785
48	5.240	161	5.805

Appendix F: Wiring Standard

TIA/EIA-568-B is a set of standards for cabling telecommunications products and services. Follow these standards, as described in the diagram below, to wire the Cat 5 cable during installation of the Tranzeo radio (see Step 3 in Chapter 2: Hardware Installation - Installing the Ethernet Cable).

Ethernet Cable

Pin	Color
	Brown / White
	White / Brown
	Green / White
	White / Blue
	Blue / White
	White / Green
	Orange / White
	White / Orange

Created by Lee O. Silverman
Copyright 1998
Distribute freely without modification
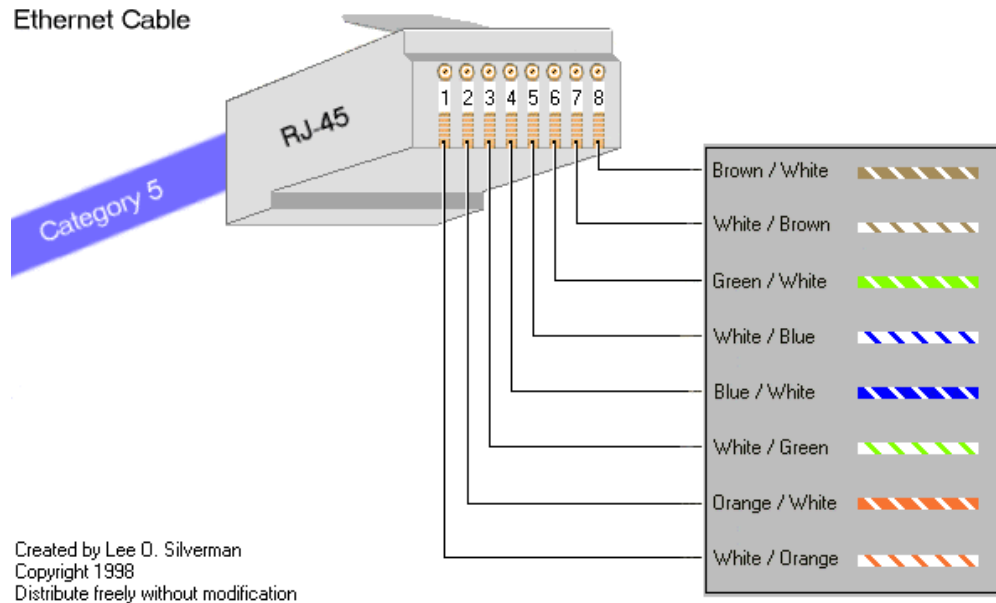
Appendix G: Routing Quick Start Guide

What do you mean by a routable subnet?

To many people, routing can be a black art. So many explanations of routing explain the binary logic behind it, but not how to actually use it. This document is designed to offer some practical advise on routing based on some of the common questions our customers ask us. It is not intended to be the definitive source of all routing info. For a detailed description, just do an Internet search for routing.

So how does this IP thing work?

Many customers are familiar with a peer-to-peer network, and have never had to deal with connecting two networks together. In a simple Peer-to-Peer network, every machine talks to every other machine. This works well when there are 10 machines on the network, but just imagine if there were one million machines on the network. The answer is to split the millions of units into manageable pieces, or subnets.

Whenever you set up a new machine on an IP network, the minimum IP requirements contain three things, the address of the machine, the subnet mask for the machine, and the default gateway. Let's imagine that you just moved to a new neighborhood. You need to know three major things to get around, the address of your house, the street you live on, and since you haven't got your internet access set up yet, where the mailbox is to send your change of address cards. In simple English, the IP info is the house number of the machine, the sub net mask says what street its on and the default gateway is where the mailbox is located. On a network, the mailbox is a router.

So how Do I figure out the Subnet Mask?

Figure out how many IP's you want to give each location. Find in the maximum IP column the value closest to, but greater than the number of IP's you want to give out. That is the column you should use for your network

| Maximum Number of IP's per Subnet	Maximum Number of Subnets	Sub Net Mask to Use	Total IP's Available
6	32	255.255.255.248	192
14	16	255.255.255.240	224
30	8	255.255.255.224	240
62	4	255.255.255.192	248
126	2	255.255.255.128	252
254	1	255.255.255.0	254

So what is a gateway?

On an IP network, machines can only send data to *here* or to *there*. *Here* is the IP's that are within the subnet. If the data isn't from here, how does it get to *there*? The answer is that the device sends it to the Gateway.

The subnet mask tells the machine who is nearby, and who is not. That's all it knows. So for example, lets take a machine with an IP address of 10.10.1.1 on a subnet mask of 255.255.255.0 and a Gateway of 10.10.1.254. The machine has some information for a machine at the address of 10.1.2.1. The subnet mask of 255.255.255.0 tells the computer that everything that that has an address starting with 10.10.1 is in the same network. There is a complicated formula to figure out what the subnet mask means, but above is a table of values for some common situations. Since 10.1.2 does not equal 10.10.1, the data is sent to the Gateway, which is also called a Router.

So what is a Router?

Note: The following is a super simple explanation of a router.

Routers are like a bad boss, they either shout out information to anyone within earshot or they if don't know what to do with the information, they pass the information on to someone else to deal with. This is commonly referred to as shouting or routing. Routers shout at the machines inside the network, and route the data addressed to machines located outside their network.
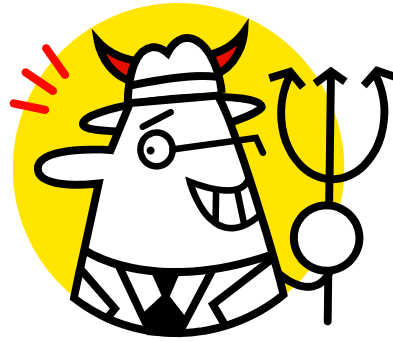
Routers also are like bad bosses in that they have two faces, a public face, and a private face. In network terms, this means that they have two IP addresses, one a private network, (referred to as the LAN Side) and one on a public network (referred to as the WAN side).   Any traffic it receives that is addressed for an IP within the Local Range of the subnet, its shouts out "This is for one of you idiots." Any traffic it receives that is for an IP that is outside of the range, it politely passes to its Gateway, saying "Would you mind sending this for me?"

To make routing work, the WAN IP needs to be on a different subnet than the LAN one. Just like any other device using IP, when it has a Packet on the public side, it decides if the packet is for here or there.

Examples

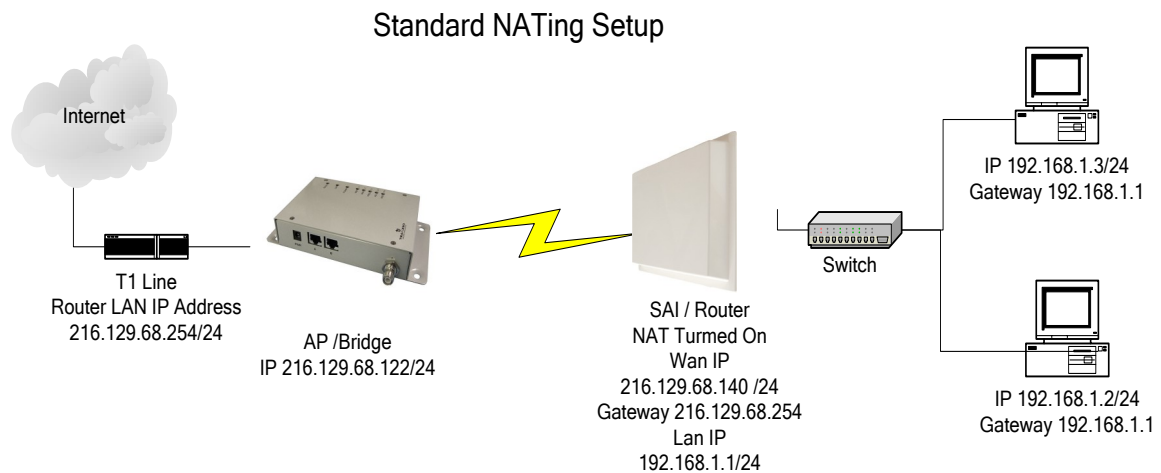#### Connecting Multiple Clients to the Internet using NAT

Assuming that you have a full Class C sub net (216.129.68.X), you have 254 possible IP's to use, from 1 to 254. The Subnet mask for this can be written as 255.255.255.0 or /24. In order to connect clients to the Internet, you can make use of Private IP and NAT.

Let's keep it simple for now, and use some default values. The Tranzeo Radio uses the default IP address of 192.168.1.1, and a sub net mask of 255.255.255.0 (or /24) and issues IP addresses using DHCP on that subnet.

Now our network looks like this:

One subnet that consists of IP's ranging from 192.168.1.1 to 192.168.1.254. Using the shout / route rule, any IP in the 192.168.1.x group shouts to any other IP in that group, but needs to route to any other IP outside that range. The Gateway, by convention in this document, in placed at the bottom of the range.

By placing client PCs in this one subnet, and the WAN side of the Radio on the public subnet, we can offer multiple private IPs that will be able to access the Internet. So lets look at an example

Standard NATing Setup

Internet

T1 Line
Router LAN IP Address
216.129.68.254/24

AP /Bridge
IP 216.129.68.122/24

SAI / Router
NAT Turmed On
Wan IP
216.129.68.140 /24
Gateway 216.129.68.254
Lan IP
192.168.1.1/24

Switch

IP 192.168.1.3/24
Gateway 192.168.1.1

IP 192.168.1.2/24
Gateway 192.168.1.1

Public IP's to less than 10 Clients Through One Radio

Assuming that you have a full Class C sub net, 216.129.68.X, you have 254 possible IP's to use, from 1 to 254. The Subnet mask for this can be written as 255.255.255.0 or /24. However, you want to give each client a public IP. If the client has only PC or a router to attach, then bridge mode will work fine. See example below. Bridge mode is just like using a switch, the data is not touched as it passes through the radio. However, bridge mode only bridges up ten devices, if you need to provide public IPs to more than 10 devices on the same radio, you will need to use the router mode.

Lets look at an example

Standard Public IP Setup,
Bridging less than 10 PCs
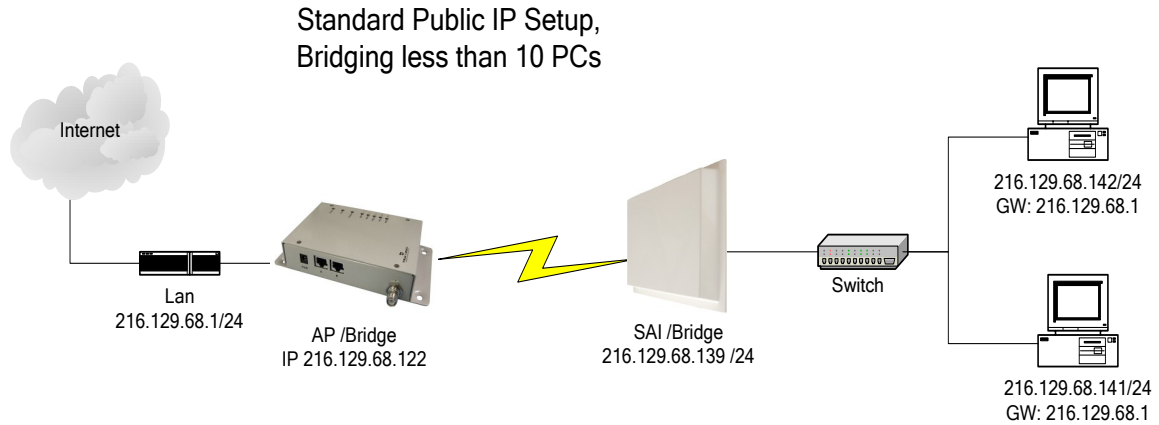
Public IP's to multiple Clients Through One Radio

Assuming that you have a full Class C sub net, 216.129.68.X, you have 254 possible IP's to use, from 1 to 254. The Subnet mask for this can be written as 255.255.255.0 or /24. However, you want to give each client a public IP. If the client has less than 10 PC's or an external router to attach, then bridge mode will work fine. See example above. But, if they need to have more than 10 computers on a public IP, you need to subnet your class C license.
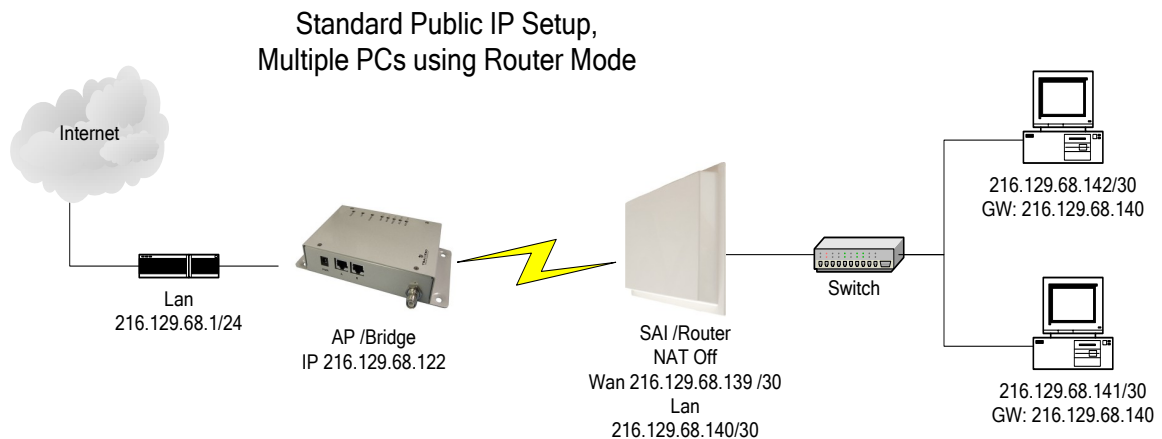
Let's keep it simple for now, and divide your class C into 2 blocks of 126 licenses each. You'll note that ½ of a full class C is not 128 licenses. Every time you divide a subnet, you need to dedicate more IP's for use as broadcasts. To divide into two blocks, we use 255.255.255.128 as our subnet mask. 255.255.255.128 can also be written as /25.

Now our network looks something like this
One subnet consists IP 216.129.68.1 to 219.129.68.127 and the other consists of 216.129.68.129 to 216.129.68.254. Using the shout / route rule, then any IP in the first group shouts to any other IP in that group, but need to route to any other IP on the network. The Gateway, by convention in this document, in placed at the bottom of the range.

By placing client PCs in one subnet, and the WAN side of the Radio on the other subnet, we can offer multiple public IPs that will route. Unlike in the NATing example, we don't need the Router to translate public to private IP, so make sure that NAT is disabled.

So lets look at an example

Standard Public IP Setup,
Multiple PCs using Router Mode

Internet

Lan
216.129.68.1/24

AP /Bridge
IP 216.129.68.122

SAI /Router
NAT Off
Wan 216.129.68.139 /30
Lan
216.129.68.140/30

Switch

216.129.68.142/30
GW: 216.129.68.140

216.129.68.141/30
GW: 216.129.68.140

Appendix H: PxP Install Checklist

The following are some of the steps you should go through when planning a Point to Point (PxP) link.

Step 1: Finding the Location

- Determine the 2 endpoint locations.
- Calculate the distance between the locations.
- Find the heights of the locations

Link Distance _____

Tower Heights _____

> *Free Space Loss*
>
> **Free space attenuation** = 36.6 + 20log F + 20log D where F = frequency in MHz and D = distance in miles

Step 2: Check the Line of

- Make sure that the line of sight is clear of obstruction.
- Check your Fresnel clearance with calculations to verify that you have enough room in the center of the path.
- Take photos of the line of sight from both sides of the proposed link.
- See example 1 below.

r = radius

d = distance

Antenna Height

Fresnel zone
The cross section radius of the Fresnel zone is the highest in the center of the RF LoS which can be calculated as:

$$r = 43.3\sqrt{d/(4f)}$$

where r = radius in feet,
d = distance in miles,
and f = frequency in GHz.
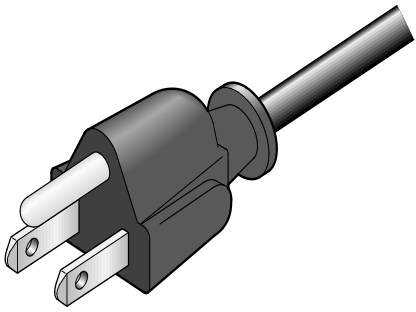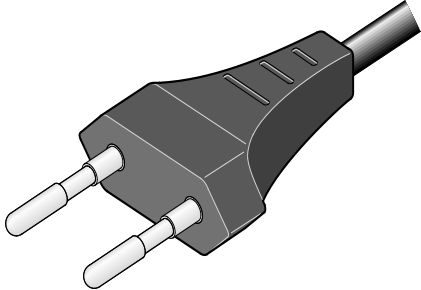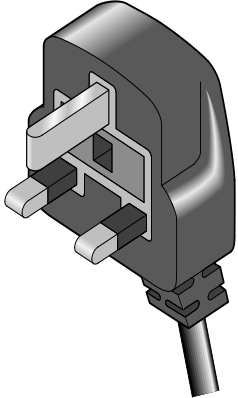
Example 1: Fresnel Zone Calculation

Step 3: Choose Hardware

- Select the hardware appropriate for the distance and type of link that you are installing

Appendix I: Glossary of Terms

AP: Access Point
ARP: Address Resolution Protocol
CPE: Client Premise Equipment
CTS: Clear To Send
DFS: Dynamic Frequency Selection
DHCP: Dynamic Host Configuration Protocol
DNS: Domain Name Server
DTIM: Delivery Traffic Indication Message
EIRP: Effective Isotropic Radiated Power
FTP: File Transport Protocol
HTML: HyperText Markup Language
HTTP: HyperText Transport Protocol
IP: Internet Protocol
ISP: Internet Service Provider
LAN: Local Area Network
MTU: Maximum Transmission Unit
NAT: Network Address Translation
NIC: Network Interface Card
NOC: Network Operation Center
POP: Post Office Protocol or Point Of Presence
PxP: Point to Point
P2P: Peer to Peer
PPPoE: Point-to-Point Protocol over Ethernet
QOS: Quality Of Service
RADIUS: Remote Authentication Dial-in User Service
RF: Radio Frequency
RTS: Request To Send
SMTP: Simple Mail Transport Protocol
SNMP: Simple Network Management Protocol
TCP: Transmission Control Protocol
TPC: Transmit Power Control
UDP: User Datagram Protocol
VPN: Virtual Private Network
WAN: Wide Area Network
WEP: Wired Equivalent Privacy
WDS: Wireless Distribution System
WINS: Windows Internet Naming Service
WISP: Wireless Internet Service Provider
WPA: Wi-Fi Protected Access

Appendix J: Tranzeo Electrical Plugs

Electrical Plug Type	Letter	Description
	F	**FCC / North American adapter**
	C	**ETSI / Euro adapter**
	A	**FCC / Euro adapter**
	U	**ETSI / UK adapter**
	M	**FCC / UK adapter**

* 24 volt version shown.

Warranty Terms For Canada / US

1. The following Tranzeo Wireless manufactured products are warranted against defects in material and workmanship for a period of one year from date of purchase, under normal use.
   - All products manufactured prior to May 1st, 2006
   - All TR-CPE200-N
   - All TR-CPE200-15
   - All TR-CPE200-19
   - All Antennas
   - All Cables
2. All Tranzeo Wireless Power Over Ethernet and power supplies adaptors are covered by a 90 day warranty.
3. All other Tranzeo Wireless CPE, AP and Backhaul Radio products manufactured after May 1st, 2006 are warranted against defects in material and workmanship for a period of two years from date of manufacture, under normal use.
4. Tranzeo Wireless manufactured products are covered by a Parts and Labor Depot Warranty. Depot warranty means the customer is responsible for delivering the defective product to the designated service depot for repair or replacement.
5. Tranzeo Wireless will repair or replace a product that was found to be defective by Tranzeo during the warranty period at its discretion.
6. All non-Tranzeo manufactured products carry the Original Equipment Manufacturer's warranty, which is passed on by Tranzeo Wireless. Warranty Claims against non-Tranzeo manufactured products must be filed with the appropriate manufacturer.
7. This warranty does not cover dealer labor cost for removing and reinstalling the machine for repair nor for any expendable parts that are readily replaced in normal use.
8. The sole responsibility of Tranzeo Wireless Systems under this warranty shall be limited to repair of this product, or replacement thereof, at the sole discretion of Tranzeo Wireless Systems.
9. All RMA items shipped to Tranzeo Wireless must be freight prepaid. Tranzeo Wireless will pay the return freight via a service of Tranzeo Wireless Technologies' choice. Customer is responsible for payment of any shipping upgrades.

Warranty Terms For The European Union

1. All Tranzeo Wireless Power Over Ethernet and power adaptors are covered by a 90 day warranty.
2. All other Tranzeo Wireless manufactured CPE; AP and Backhaul Radio products are warranted against defects in material and workmanship for a period of two years from date of purchase, under normal use.
3. Products must be used in accordance with relevant local regulations. Only products designed for and marketed to the European Market by Tranzeo will be honored for warranty service.
4. Tranzeo Wireless manufactured products are covered by a Parts and Labor Warranty. The customer is responsible for delivering the defective product to the designated service depot for repair or replacement.
5. Tranzeo Wireless will repair or replace a product that was found to be defective by Tranzeo during the warranty period at its discretion.
6. All non-Tranzeo manufactured products carry the OEM's warranty, which is passed on by Tranzeo Wireless.   Warranty Claims against non-Tranzeo manufactured products must be filed with the appropriate manufacturer.
7. This warranty does not cover dealer labor cost for removing and reinstalling the machine for repair nor for any expendable parts that are readily replaced in normal use.

8. VAT, Customs and other local taxes are the responsibility of customer.
9. The sole responsibility of Tranzeo Wireless Systems under this warranty shall be limited to repair of this product, or replacement thereof, at the sole discretion of Tranzeo Wireless Systems.
10. All RMA items shipped to Tranzeo Wireless must be freight prepaid. Tranzeo Wireless will arrange the return freight. Customer is responsible for payment of any shipping costs. Shipping costs must be pre-paid before the item is shipped.

Warranty Terms For The Rest of the World

1. The following Tranzeo Wireless manufactured products are warranted against defects in material and workmanship for a period of one year from date of purchase, under normal use.
   - TR-CPE200-N
   - TR-CPE200-15
   - TR-CPE200-19
2. All Tranzeo Wireless Power over Ethernet adaptors are covered by a 90 day warranty.
3. All other Tranzeo Wireless manufactured CPE; AP and Backhaul Radio products are warranted against defects in material and workmanship for a period of two years from date of purchase, under normal use.
4. Tranzeo Wireless manufactured products are covered by a Parts and Labor Warranty. The customer is responsible for delivering the defective product to the designated service depot for repair or replacement.
5. Tranzeo Wireless will repair or replace a product that was found to be defective by Tranzeo during the warranty period at its discretion.
6. All non-Tranzeo manufactured products carry the OEM's warranty, which is passed on by Tranzeo Wireless. Warranty Claims against non-Tranzeo manufactured products must be filed with the appropriate manufacturer.
7. This warranty does not cover dealer labor cost for removing and reinstalling the machine for repair nor for any expendable parts that are readily replaced in normal use.
8. VAT, Customs and other local taxes are the responsibility of customer.
9. The sole responsibility of Tranzeo Wireless Systems under this warranty shall be limited to repair of this product, or replacement thereof, at the sole discretion of Tranzeo Wireless Systems.
10. All RMA items shipped to Tranzeo Wireless must be freight prepaid. Tranzeo Wireless will arrange the return freight. Customer is responsible for payment of any shipping costs. Shipping costs must be pre-paid before the item is shipped.

Limitation of Warranty

This warranty does not apply if the Product:
- has been opened and/or altered, except by Tranzeo Wireless technical personnel,
- has been painted in way shape or form,
- has been damaged due to errors or defects in cabling
- has not been maintained in accordance with instructions supplied by Tranzeo Wireless,
- has been subjected to abnormal physical or electrical stress, including lightening strike, misuse, negligence, or accident;
- removal of serial number label, or
- equipment sold under resale agreements, i.e. Amplifiers, Antennas.

Who to Contact for an RMA?

There are 3 ways to discuss any technical difficulties and request an RMA #:

1. Fill out our online RMA Request Form at support@tranzeo.com
2. Call our Technical Support Center at 604-460-6002
3. Or email our RMA Department at rma@tranzeo.com

What information will be required?

- Dealer Username and Password
- Customer name/ID # and contact information
- Warranty Status (Data of purchase)
- Problem Description
- Part Number or Serial Number
- Troubleshooting actions taken so far

Warranty Repair

a) RMA number is valid for 90 days only.
b) If the product is not received within 90 days, the RMA will be cancelled.
c) Tranzeo Wireless will carefully test and evaluate all returned products and will repair or replace defective products that are under warranty at no charge.
d) If the malfunction is due to a manufacturing defect, it will be repaired, tested, aligned and calibrated as necessary, with strict adherence to factory specified procedures and parts, to working order.
e) If the malfunction is due to an issue not covered by warranty, a $35.00 evaluation fee will be charged, plus the actual costs of the repair. Tranzeo's current shop rate is $70.00 per hour, plus parts.
f) When your unit is returned to you, you must restore configuration and or applications before full use can resume.
g) If the product cannot be repaired, a refurbished replacement product will be provided.
h) However, if Tranzeo Wireless cannot duplicate the problem or condition causing the return, the unit will be returned to the customer at the customers cost as: "No Problem Found" and a $35.00 evaluation fee may be charged.
i) Repaired or replaced product will be subject to the original warranty period but not less than 30 days.
j) All items must be shipped pre-paid. Tranzeo Wireless will not accept any collect packages. Tranzeo will pay the shipping to return your products. We recommend insuring the package using the values from our commercial invoice.
k) Be sure to package the items well. Original packaging should be used for shipping. Tranzeo is not responsible for further damage caused to the unit due to inadequate packaging.
l) We recommend that you use a shipping service with tracking (i.e. UPS/FedEx ground) to ship your RMA. Tranzeo will not accept any packages that arrive with charges owing.
m) Be sure to include the password for each device. Any device that arrives without a password may be subject to a $60 rebuilding charge per unit.

Out of Warranty Replacements

Product that is out warranty will be repaired on a fee for service basis at Tranzeo's shop rate of $70.00 per hour plus parts. A $75.00 deposit is charged for all non-warranty repairs when the RMA is issued.

Any goods left for more than 90 days without instructions will be considered abandoned and be disposed of.

What to ship?

Products that are returned for RMA work should be shipped in the original package and include the items that that are to be repaired. All returned product must reference the RMA # on the outside of the box. A returned product without clearly marked RMA# will be refused and returned to sender.

How to ship?

- We recommend that you use a shipping service with tracking (i.e. UPS/FedEx ground) to ship your RMA.
- Products returned for warranty repair or out-of-warranty replacement, must be marked with a valid RMA number and shipped FOB Destination, Prepaid.
- Approximate turnaround time is 7 business days for warranty repairs and replacements.
- Shipping Time is generally 7 business days to any location in the United States.
- Tranzeo Wireless will refuse any item that does not have an RMA# clearly marked on the outside of the box.
- Tranzeo Wireless is NOT responsible for any damage to the products during transit by the shipping company.
- All claims for shipment errors must be made within 3 days after receipt of shipment.

Warranty Disclaimer

Except in only the limited express warranty set forth above, there are no expressed or implied warranties of merchantability and fitness for a particular purpose. In no event will Tranzeo Wireless Systems be liable for any direct, special, or consequential damages arising out of, or in connection with, the delivery, use, inability to use, or performance of this product.

Goods Damaged in Transit

Tranzeo Wireless Technologies ships all item FOB Factory. This means that title for the item transfers to the buyer once the courier picks up the package. If there is damage, a claim must be filed with the courier by the owner of the goods, which is the buyer. Shipping damage is not covered by the warranty. Damage claims are between the recipient of the goods and the courier.

Shipping Firms do have legal obligations and limitations as to when and how much to compensate for damage, but only if the claim is filed on time and in the correct manner. You must file the claim as soon as possible.

Making a Damage Claim

If you receive a shipment that appears to have been <u>damaged</u> by the shipper during shipping, take the steps on the on the box (shown below), then contact us so we have a record of the incident.   We will assist in any way we can in filing and advocating for your claim.

If you choose to accept the shipment and sign for it, have the shipper stay with you while you open and inspect the contents of the container for any additional damage that was not visible before opening. Make sure the shipper notes all damage on the shipping bill before you sign. By signing the waybill, you release the Shipping Company from all obligations unless the damage is clearly noted.

If it is possible to take any photos of the damage and forward to the shipper and us, Before signing the shipping bill (for receipt of the shipment), **have the shipper note on the shipping bill the exact details of the damage.**

If the damage appears to be <u>very extensive</u>, you still should not <u>refuse the shipment</u>. Refusing the shipment will delay your claim.

Appendix L: How Can We Improve?

Please take a moment to help us improve your experience with Tranzeo Wireless. Please fax the completed questionnaire to 604-460-6005. Each month we will draw for a free gift.

Product Quality

Was this your first order from Tranzeo Wireless?
- ☐ Yes
- ☐ No

Was your order complete?
- ☐ Yes
- ☐ No, I was missing:
  _____

How would you rate our website?
- ☐ Very Informative
- ☐ Generally good
- ☐ Quality varies
- ☐ Poor quality

How would you rate our packaging?
- ☐ Consistent high quality
- ☐ Generally good
- ☐ Quality varies shipment to shiment
- ☐ Poor quality

How would you rate our order process?
- ☐ Consistent high quality
- ☐ Generally good
- ☐ Quality varies daily
- ☐ Poor quality

How would you rate our Technical Support?
- ☐ Consistent high quality
- ☐ Generally good
- ☐ Quality varies each time
- ☐ Poor quality

Service and Environment

Did you Sales Rep answer all your questions and explain your best options?
- ☐ Yes
- ☐ No

How long did you wait for your product after ordering?
- ☐ 1 to 3 days
- ☐ 3 to 5 days
- ☐ More than 5 days

How would you rate the Tranzeo Wireless staff you have dealt with to date?
- ☐ Friendly and helpful
- ☐ Average
- ☐ Varies on each call
- ☐ Poor service

Was the entire experience positive?
- ☐ Yes
- ☐ No
If No why?:_____

Additional Comments

_____

_____

About You (optional)

Name		E-mail	
Address		Phone	
City, State, ZIP Code			
May we add you to our mailing list, which offers news and exciting promotions? ☐ Yes ☐ No			

Thank you for your participation!

Appendix M: Notes