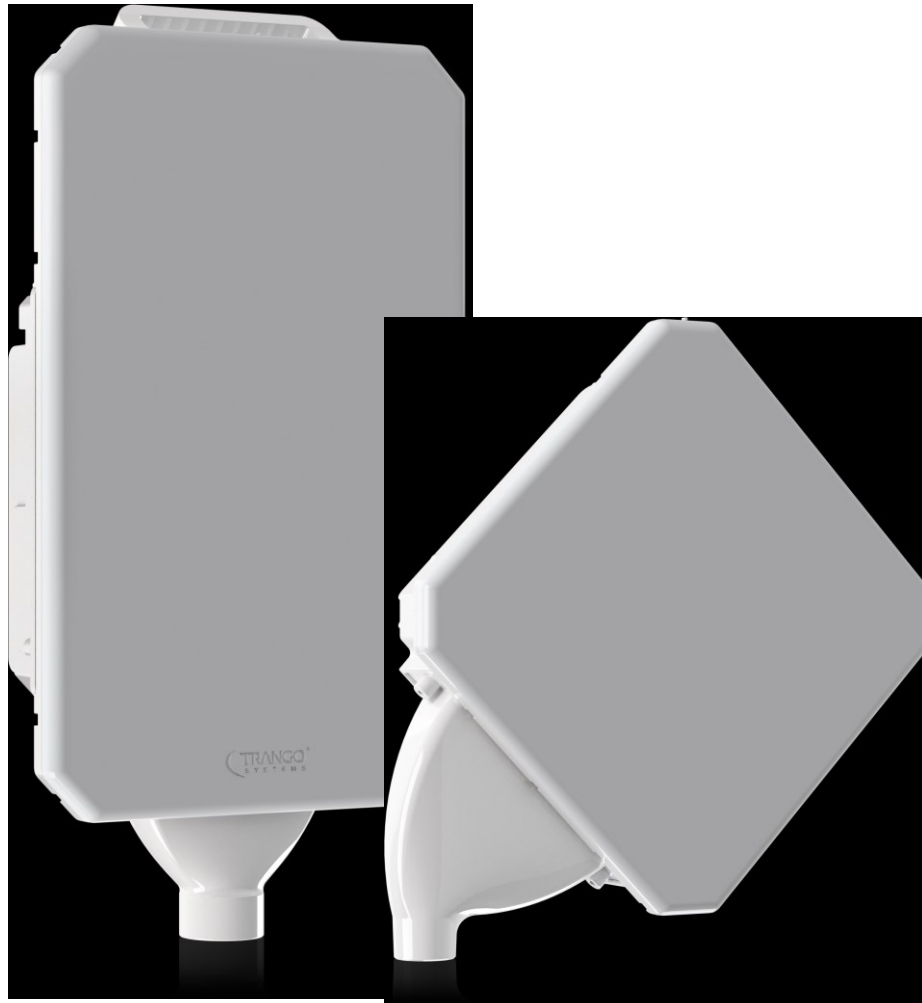




StrataPro[®] 24

24 GHz All-Outdoor 1-4 Gbps FDD Point to Point License-Free Microwave System
Models: SP24-SI, SP24-XI



Quick Start Guide

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Introduction

Thank you for purchasing the StrataPro 24 unlicensed point to point microwave system. This guide is designed to assist with basic installation and configuration of the system. For advanced settings, refer to the User Manual and application notes.

System Components

The basic link consists of the following items:

- 2 each all outdoor radio model SP24 radios.
- 2 each +56VDC PoE Injector (required only if Power over Ethernet is used)
- 2 each pole mount kits
- Cat5e/Cat6 shielded cabling with shielded plugs as needed.

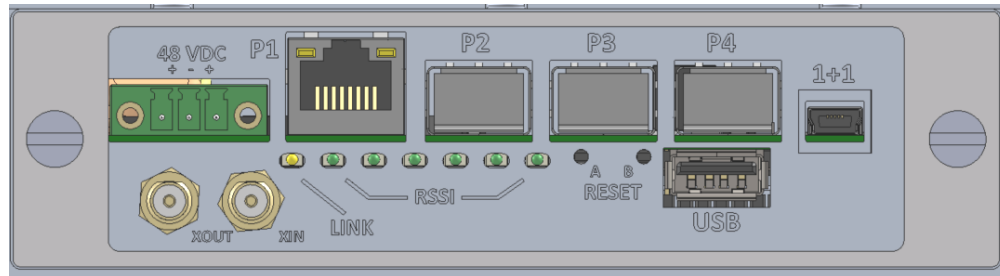
Additional items may be needed depending on the link configuration. A List of the most common part numbers used for the system is given in Table 1.

Part Number	Description
TLSP-24-SI	StrataPro [®] 24 US/IC system, Single Carrier 24.05-24.25 GHz
TLSP-24-XI	StrataPro [®] 24 US/IC system, XPIC Dual Carrier 24.05-24.25 GHz
SP24-SI	StrataPro [®] 24 All Outdoor Unit, Single Carrier US/IC 24.05-24.25 GHz
SP24-XI	StrataPro [®] 24 All Outdoor Unit, XPIC Dual Carrier US/IC 24.05 -24.25 GHz
SP24-SI-N	StrataPro [®] 24 All Outdoor Unit, Single Carrier NCC 24.00 -24.25 GHz
SP24-XI-N	StrataPro [®] 24 All Outdoor Unit, XPIC Dual Carrier NCC 24.00-24.25 GHz XPIC
PSUPPLY-WM-48-2	+48 VDC/1.8A Volt Direct Power Supply with Terminal Blocks
POE-GIGE-P56	Passive Gigabit +56V/56W PoE
POE-GIGE-AT60	802.3at Active Gigabit +56V/60W PoE w/Surge/Lightning Suppressor
CBLDAT-RSSI	BNC-M to Banana plug cable for RSSI voltage measurement
CBLDAT-MIMO-9	MIMO Coaxial Cable set (2ea 9 ft SMA cables) – 2 sets required per link
SP-KEY-1G	Software Key to enable 1100 Mbps Capacity for one pair of radios
SP-KEY-2G	Software Key to enable 2200 Mbps Capacity for one pair of radios
SP-KEY-A256	Software Key to enable AES 256 for one pair of radios
SP-KEY-CE	Software Key to enable Carrier Ethernet Features
SFP-Console	Serial Console SFP Module with DB9 Male Serial Interface
SFP-GigE-C-1	SFP 100/1000BaseT Copper RJ45
SFP-GigE-S	SFP Fiber Single Mode Module
SFP-GigE-M	SFP Fiber Multi Mode
CBLDAT-RIU5	1+1 HSB cable (45 in)

Table 1: StrataPro[®] 24 Part Numbers

Radio Unit Overview

Below is a picture showing the main interfaces of the SP24 after removing the port cover (loosen the two captive thumbscrews)



User Interfaces

P1 (RJ45) – Port 1 Ethernet Interface for Traffic and Management (Default). Autonegotiate 100/1000 BaseT. This port also supports PoE operation using the **POE-GIGE-56** Power Injector. This is the default traffic and management port.

P2 (SFP) - Port 2 Ethernet Interface for Traffic and Management. Autonegotiate 100/1000 BaseT for Copper SFP and 1000 Base-X or 2500 Base-X for Fiber. Use only Trango approved SFP modules.

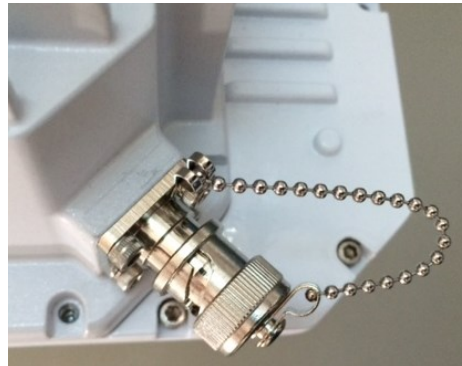
P3 (SFP) - Port 3 Ethernet Interface for Traffic and Management. Autonegotiate 100/1000 BaseT for Copper SFP and 1000 Base-X for Fiber. Use only Trango approved SFP modules. With the optional **SFP-Console** cable this port can be directly connected to a PC Serial port.

P4 (SFP) - Port 4 Ethernet Interface for Traffic and Management. Autonegotiate 100/1000 BaseT for Copper SFP and 1000 Base-X for Fiber. . Use only Trango approved SFP modules.

NOTE: DO NOT CONNECT POE to SFP ports AS THE SFP MODULE WILL BE DAMAGED

48VDC - Direct Power Terminal Block for applying direct +48 VDC nominal power to the unit. Usable range is +43 to +57 VDC

BNC – Output of DC voltage proportional to the RSSI level. The chart below gives the voltage vs RSL.



BNC Connector w/Cap

The BNC Voltage = $0.1 + 0.04 \times (90 + \text{RSL})$ Volts, where RSL = -90 to -20 dBm

RSL(dBm)	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20
BNC Voltage (V)	0.10	0.30	0.50	0.70	0.90	1.10	1.30	1.50	1.70	1.90	2.10	2.30	2.50	2.70	2.90

Reset A/B – The Reset buttons (recessed in the hole) operate as described below – Note that all LEDs will blink on/off once per second while holding as a way to count the seconds elapsed.

- 1) Hold for more than 3 seconds, but less than 6 seconds
 - a. The IP address will be reset to defaults based on button
 - i. 192.168.100.100 for Reset “A”
 - ii. 192.168.100.101 for Reset “B”
 - b. The CLI management passwords will be reset to default
 - c. The Web interface passwords will be reset to default.
 - d. The SNMP read/write/trap community strings will be set to defaults.
 - e. The CLI prompt will be reset.

- 2) Hold for more than 6 seconds: The unit will reset the system configuration to the factory defaults, but **NOT** reset the items in (1) above. The unit **WILL REBOOT** automatically.
 - a. The TX and RX Frequencies will be reset to allow a link to be established as follows:
 - i. TX/RX Frequency of 24.1/24.2 GHz for Reset “A”
 - ii. TX/RX Frequency of 24.2/24.1 GHz for Reset “B”

Link LED – **Green** LED is solid on when linked with the far end unit, and Flashing when not linked. LED will be solid at system power up for up to 2 minutes.

RSSI LEDs – **Amber** LEDs are lit up based on the M1 RSSI according to the following table:

0 LEDs:	RSSI < -65 dBm
1 LED:	RSSI > -65 dBm
2 LEDs:	RSSI > -60 dBm
3 LEDs:	RSSI > -55 dBm
4 LEDs:	RSSI > -50 dBm
5 LEDs:	RSSI > -45 dBm
6 LEDs:	RSSI > -40 dBm

Xin/Xout (XI model only) – Input/Output coaxial connection to second MIMO radio for use in 4x4 MIMO configuration –Radios must be spaced at the optimum distance for proper operation (See manual for details). **CBLDAT-MIMO-9** kit required for spacings up to 3 meters. Connect Xin to Xout on second radio.

USB Port – Reserved for Future Use - Do not connect

1+1– 1+1 Hot Standby port for monitoring connection to Hot Standby Radio. The Standby unit should be as close as possible to the Active Unit and aligned with the far end. **CBLDAT-RIU5** cable required for each end of link.

Note that this cable carries monitoring information for the Standby unit to determine if the Active unit is operating properly. If the cable is removed during operation then the Standby will activate. Ensure that the cable is securely installed. See Full User Manual for more details.

Radio Management

There are three ways to manage the StrataPro System:

- 1) In-Band Management (IBM) without a VLAN using the management port (default P1). Only traffic coming into the radio from management port or the RF with the Radio MAC address will be forwarded to the CPU and all other traffic will be forwarded to over the link. **This is the default configuration.**
- 2) In- Band Management (IBM) **with** a VLAN using the management port (default P1). . Only traffic coming into the radio on the management port or the RF with a matching VLAN ID and the Radio MAC address will be forwarded to the CPU. All other traffic will be forwarded over the link. The VLAN tagging option must be enabled and the VLAN ID set.
- 3) Out- of- Band Management (OBM). The system will pass management traffic coming into the OBM port to the CPU and not forward any traffic across the link from this port. Disable IBM to enable OBM on the current management port.

Using the web interface is the easiest way to set up the system. Both sides of the link can be set via a web session with only one radio.

Management of the radio may be done via the following interfaces:

- 1) Web Browser
- 2) Telnet
- 3) SSH
- 4) Console port

This Quick Start Guide covers the basic Web based setup. For other interfaces, please read the User Manual.

The radio has two levels of access, View and Config. View allows only viewing of the various parameters while config allows changing them. The default login and passwords for each level are:

View Level Login: **admin**
 Password: **trango**

Config Level Login: **config**
 Password: **trango**

WEB BROWSER SETUP

The best performance is obtained using Google Chrome as the browser.

When using the web in config mode, changes can be entered and changed on the link by pressing the “**Apply Changes**” button. The changes will take effect immediately but **will not** be saved to FLASH memory. If a reboot is performed, the last saved configuration of the system will be reloaded.

To permanently save the changes after verifying the changes, press the “**Save Changes**” button. This will overwrite the configuration file in FLASH so that the next time the radio is rebooted the changes will take effect.

When purchased as a link, one radio will be programmed with the IP address **192.168.100.100** and the other will be **192.168.100.101**. The radios are setup with a default 100 MHz channel bandwidth with IBM enabled on Port 1. Traffic can be carried on any port over the link.

After logging into the config level and selecting the Link Setup Page, the IP address, Netmask, and Gateway should be changed as appropriate for both radios. Press the “**Save Changes**” button to the left to save the IP address. When properly linked the display should show the locked indications at the top of each page.

INSTALLATION REQUIREMENTS

TOOLS

- Flat head Screwdriver for port cover attachment
- 13 mm or ½" Socket wrench for standard mount assembly
- 8 mm or 5/16" Socket wrench for attaching radio to mount and ground lug.
- Multimeter with CABLDAT-RSSI for antenna alignment

PATH

- Line of sight (LOS) with no obstructions in the Fresnel Zone
-

MOUNTING STRUCTURE

- Building or 1.5 to 3 inch diameter pole with < 1.5 degrees vertical or horizontal movement under windload.
- Radios must be mounted at least 8 feet off the ground for best performance

POWER

- 110 or 240 VAC if using PoE Adapter
- +43 to +57 VDC/1.5 Amp Regulated Power Supply if using direct input

GROUNDING

- Min 10 AWG grounding cable with #10 Spade Lug, maximum length 1 m/3 feet

CABLING

- Cat 5e or Cat6 Shielded Twisted pair with shielded plugs. The cable shield should be electrically connected to the plug shell. If using PoE the cable to the radio should be no longer than 250 feet total.

SYSTEM CONFIGURATION:

The radios come preconfigured from the factory and will link up with no change to user settings. The only change that must be made is to set the static IP address of the radios. Follow the steps below to set the IP address and verify the RF link before installation.

- 1) Apply power using the PoE or with direct power (+56VDC)
- 2) Set up a Personal computer which has it's local IP and subnet mask set as follows:
 - IP: 192.168.100.10**
 - Subnet: 255.255.255.0**
 - Gateway: 192.168.100.1**

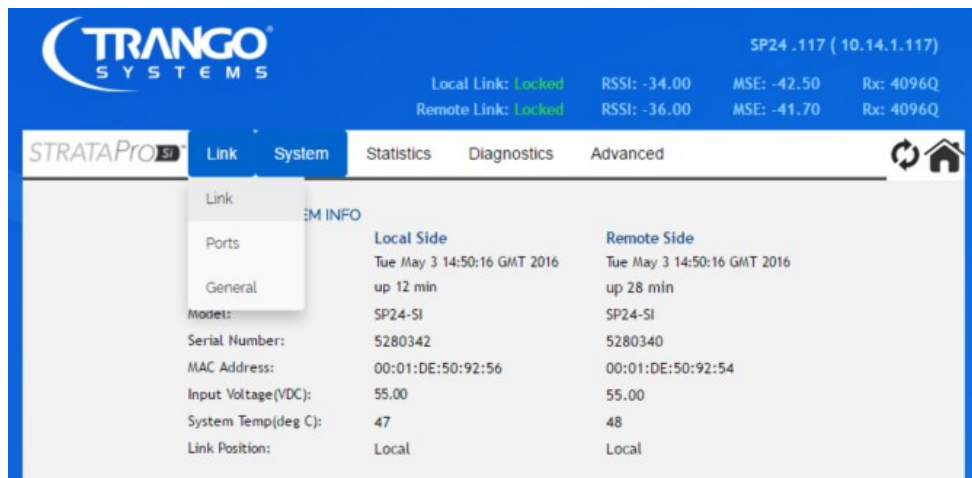
- 3) Connect the PC Ethernet to the PoE injector Data In port and verify the Ethernet link comes up.
- 4) Log into either Radio unit using a browser using the default IP addresses of 192.168.100.100/192.168.100.101 with the following credentials:

user: **admin** password: **trango**

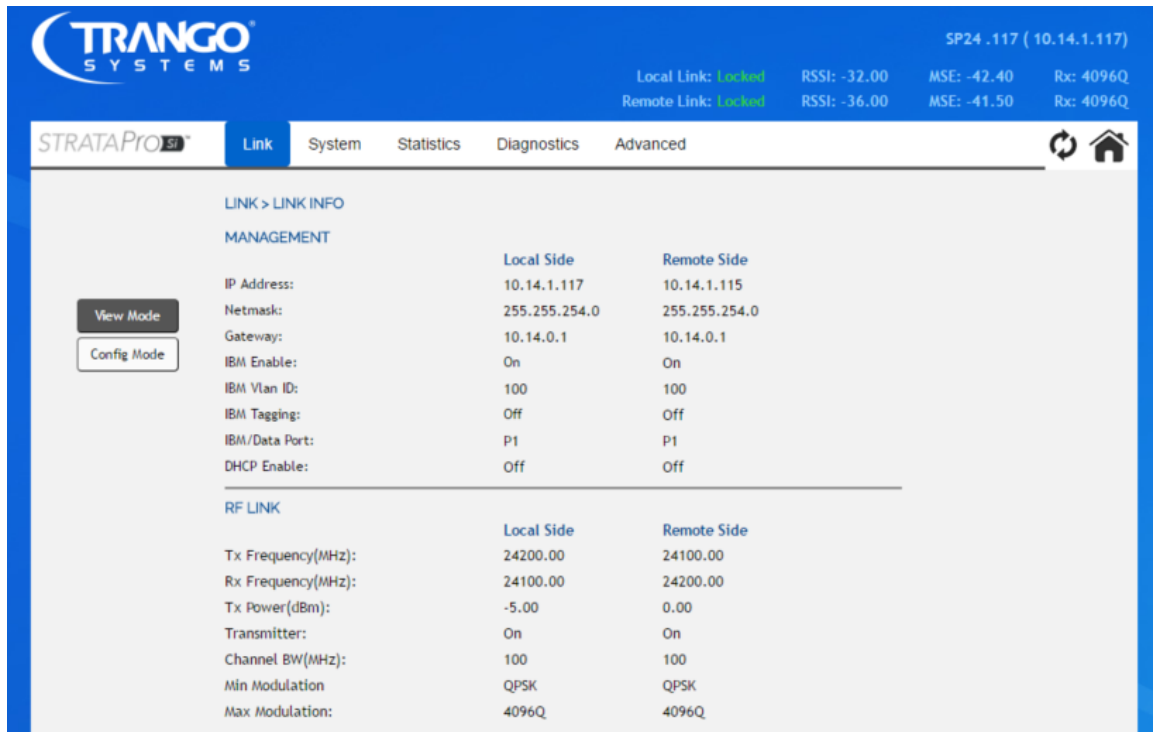


Log In Page

- 5) Navigate to the Link Info page as shown below.

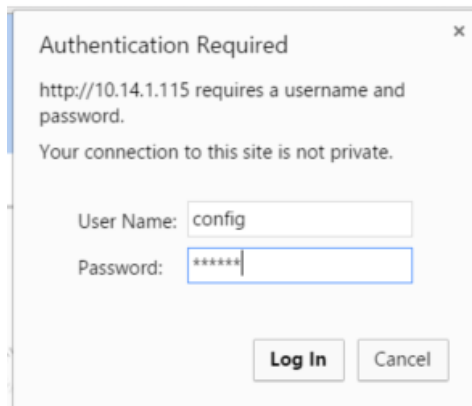


The Link Info page shown below displays the current radio IP settings and RF settings for the link. If the link is locked then the remote side information will be shown. To make changes to the current settings, click the Config Mode button to log into Config Mode.

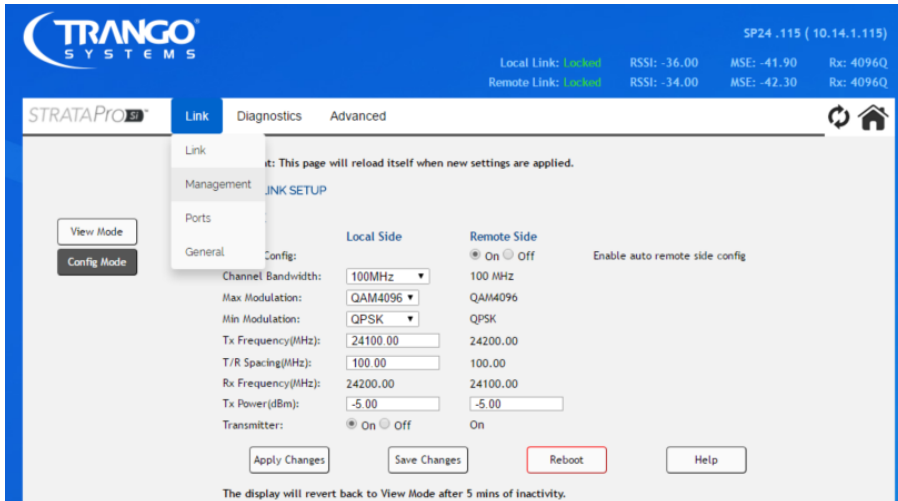


6) Log into the Config Mode with the following credentials:

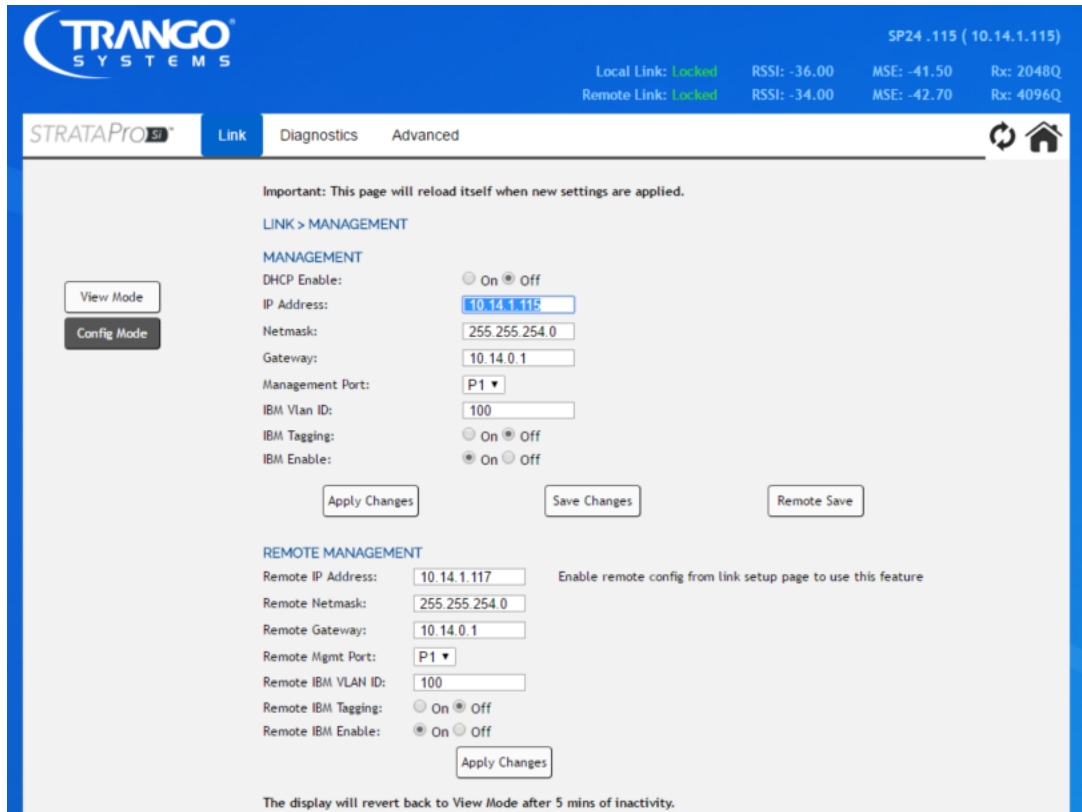
user: **config** password: **trango**



7) After entering config mode select **Link > Management** to go to the IP settings page.



- 8) If the RF link is locked, both the local and remote radio IP settings can be changed from the same page at the same time. Click the Remote Config Mode button to “ON”, then click Apply Changes button. Navigate to the Management Page. The Remote IP should now be modifiable. Set both the local and remote IP settings as desired and click Apply Changes button again. If the link is not locked then each radio IP can be set individually via a separate browser session.

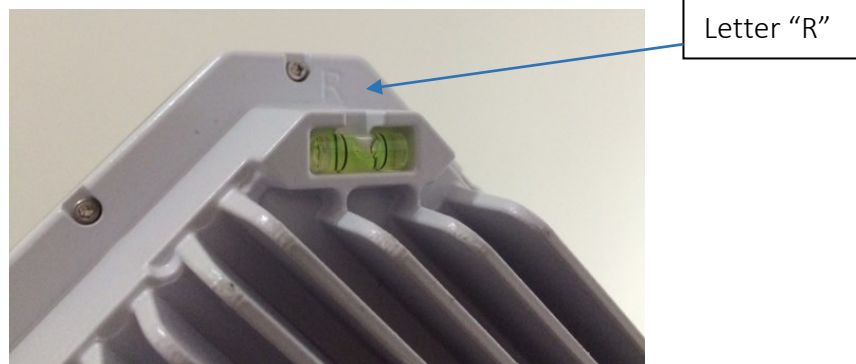


FIELD INSTALLATION:

- 1) Install the pole mount to the back of the StrataPro Unit using the 4 #10-32 Bolts/lockwashers and install on pole as shown below. Install the radio to the mount first.

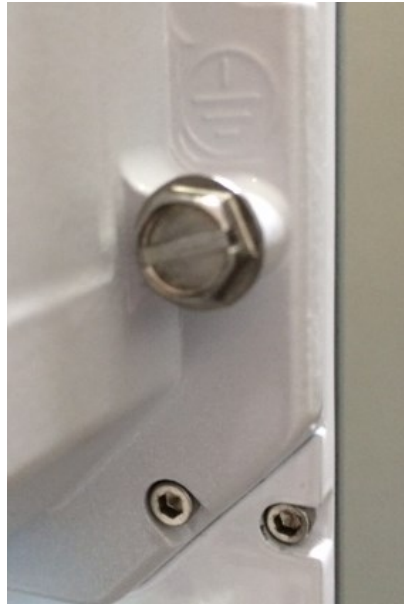


- 2) Attach the StrataPro 24 Unit + Mount to the mounting pole (3 inch diam typical) with “R” indicator at the 12 O’Clock position - Adjust the mounting bolts to ensure that the bubble level is centered. This unit will be transmitting Right Slant Polarization and receiving Left Slant Polarization from the perspective of the installer. **IMPORTANT: Install the far end unit exactly the same way, with the “R” at the top.** Because this system uses slant polarization, the units will be cross polarized.



- 3) If it is desired to use Left Slant Polarization, the “L” should be oriented at the 12 O’Clock position on BOTH ENDS. Typically this will not be necessary unless multiple links are co-located.

- 4) Install the ground wire to earth ground on the pole or building structure. Use a minimum 10 AWG grounding cable with #10 Spade Lug, maximum length 1 m/3 feet



- 5) Run the Ethernet/PoE Cable through the port cover/cord grip as shown below then connect to the radio Port 1 (Built In RJ45).



- 6) Power up the radio by first plugging the cable into the PoE Unit, then plugging the PoE unit into the AC power source. Connect the Data Port of the PoE on one radio to a laptop computer or switch.
- 7) Align the radios using the BNC RSSI output or RSSI LEDs to obtain the expected RSL. The antenna beamwidth is 3.5 degrees in both the horizontal and vertical directions.
- 8) Link LED should light up solid green on both ends when the radio is locked on the RF signal.
- 9) Verify both radios are reachable by pinging the IP address of the radio units.

- 10) Install the port covers and tighten the thumbscrews and cord grip. The cord grip should be oriented towards the ground as shown.



- 11) Start passing Traffic on any port. NOTE: All ports are mapped by default to the same port on the other side of the link, and traffic is isolated between ports on the same radio.

Power Supply

Trango can provide power supplies for rack mount and desktop applications. Contact your sales representative for more options on available power supplies. The power supply should be kept in a weatherproof, temperature controlled environment within the operating temp of 0 to 40 deg C.

Direct Power Option

The StrataPro24 can be direct powered using a +48 Volt DC source with a terminal block connection at the unit. No smaller than AWG18 wiring is recommended. As long as the minimum voltage of -43 Volts DC is maintained at the StrataPro24 unit, the system will operate normally. This option is also preferred for applications using fiber for the data.

Power Over Ethernet (PoE) Option

When utilized with a POE-GIGE-P56 or POE-GIGE-AT60 PoE, the StrataPro 24 can be powered over the same Cat5e/Cat6 Shielded Twisted Pair (STP) that is used for the Main data/management connection.

Features

The StrataPro 24 basic features are briefly described here. For more information on advanced features and a full command line interface listing, please reference the individual Application Notes and Full User Manual available online at www.trangosys.com.

Traffic Capacity

With QAM4096 modulation in a 120 MHz channel, the link can support capacities up to 1100 Mbps full duplex for large packets per carrier.

No restrictions are put on the channel size or modulation levels that can be set by the user, however the capacity is restricted based on the license key installed.

The base model comes with **500** Mbps full duplex license and there are upgrade keys available that can open the entire radio capacity:

SL-Key-1G:

Description: Unlocks throughput capacity from 500 up to 1000 Mbps Full Duplex payload (1000 Mbps each direction) – Covers one link – (2 license keys provided)

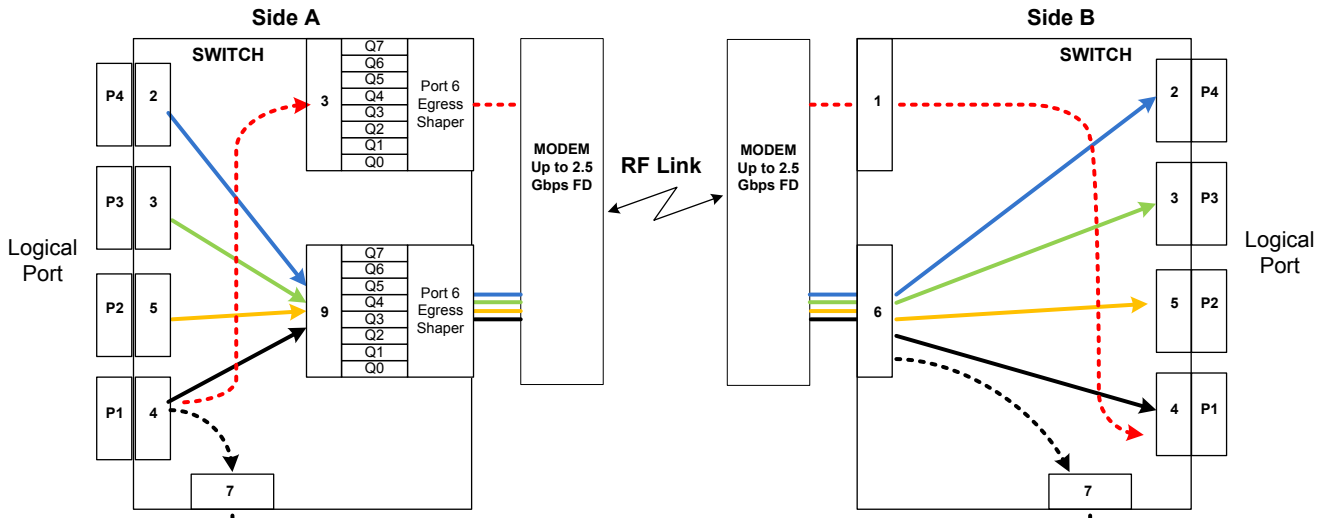
SP-Key-2G:

Description: Unlocks throughput capacity up to Maximum capacity Full Duplex payload (Approx. 2500 Mbps each direction) – Covers one link – (2 license keys provided)

Port Mapping/QoS

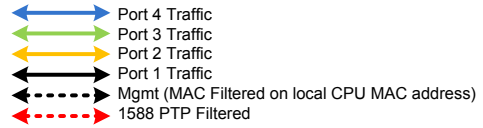
StrataPro utilizes Port Mapping which maps all traffic coming into a given port to the same port on the other side of the link. Ports are isolated from each other.

The QoS scheduler is processed at the interface to the Modem section of the radio to ensure that the highest priority packets from each port get forwarded in congestion conditions. QoS is set up by default to process packets based on the PCP Field in the VLAN tag of the radio.



Smart Mode Switch functionality:

- 1) Traffic entering ports on side A will only show up at same port on side B. Single, Double and untagged traffic can be sent across. Each incoming port is assigned a different PVID to map the traffic to Port 9. Ingress ports are configured as unaware hybrid. Port 6 is a trunk port with all frames being tagged on egress.
- 2) Management traffic from a designated local port or the modem port will be MAC filtered and sent to CPU port. Not user traffic at management port. ACL rule to redirect traffic with CPU MAC to port 7
- 3) 1588 PTP messages only will be filtered and sent to Port 1 which is a high priority fixed latency modem port. ACL rule to redirect 1588 PTP messages(untagged, tagged, UDP, TCP) to port 1.
- 4) MAC learning is disabled.



StrataPro Traffic Flow A to B side

Multilayer Header Compression

When dynamic multilayer header compression is enabled, up to 1.5 Gbps per carrier capacity (IPv4) can be achieved for small packets without the dependency on traffic payload. Up to 2048 headers are stored in a database and the Ethernet header is replaced with a 2 or 4 byte tag. The tag is re-mapped to the correct Ethernet header on the far end of the link. Statistics are available to show the effectiveness of the Header Compression Engines. There are two engines used for compressing the streams, one primarily for L2 portion of the header, and another for the L3-L4 portions of the header.

A higher percentage indicates better compression effectiveness. For a single stream of IPV4 with UDP the percentage can be as high as 60%.

Custom channel size and T/R Frequency Duplex Spacing

The 24 GHz unlicensed spectrum is typically very clear due to the narrow antenna beamwidths required. However, if collocated systems on the same path are required,

operation of each link on a non overlapping frequency pair may be advised. The StrataPro 24 allows custom TX and RX center frequency to help with co-location.

The system can support user selectable channel sizes of 10, 30, 60, 75, 100, or 120 MHz.

Recommended settings for each channel size are shown in Appendix 1

Advanced Adaptive Coding and Modulation (AACM)

Advanced Adaptive Coding and Modulation provides error-free hitless changing of the modulation level for a fixed channel width to allow the link to be maintained during weather related fading, interference, or other channel degradation that leads to poor signal quality. Instead of the link dropping and no traffic passing, the link will be maintained with a lower capacity until the channel degradation is removed, at which time the link will return to the normal modulation level.

The transitions between modulation levels are controlled by pre-set MSE thresholds and each transition is made without dropping packets since both ends of the link coordinate the transition automatically. The available modulation levels are 4096 QAM, 2048 QAM, 1024 QAM, 512 QAM, 256 QAM, 128 QAM, 64 QAM, 32 QAM, 16 QAM, and QPSK.

The user can set both a maximum and minimum modulation level which the radio will operate within. Both sides of the link should have the same min and max modulation levels for proper operation. Typically it is best to always use QPSK as the minimum modulation level to maintain the link during deep fading.

GPS Coordinates

Allows entering/saving the GPS Coordinates manually to assist in plotting the endpoints of each link on third party management software link SNMP managers and Google Earth/Maps. The coordinates must be entered by the user manually.

Spectrum

This feature allows the user to check for interference by displaying what the modem is receiving at it's input. The spectrum is shown relative to the current receive channel and any interference will be displayed. Use of this feature does not affect traffic over the link. This feature does not show the actual RF spectrum, but rather the filtered spectrum that is being used by the modem. It is used to diagnose interference only.

Link Management

The StrataPro 24 can be managed through the following methods:

Graphical User Interface (GUI):

Web Browser: Remote access via in band and out of band methods with view/configuration level access (single user + password).

The StrataPro24 is compatible with any standard web browser such as Chrome, Firefox, Safari and Internet Explorer. Chrome is the recommended browser.

The basic setup web page allows the following items to be:

Set and saved

- Transmit Frequency
- Channel Bandwidth and Modulation Range
- Transmit Power for each ACM profile
- Target RSSI
- Turn Opmode On and set default to ON
- IP address, IBM on/off and subnet
- Status snapshot
- Config Save

Viewed

- Link Name, coordinates, and Network time
- Local and Remote RSSI, BER, MSE, link status
- Transmit Freq Range allowed
- Max TX power allowed
- Current capacity based on profile and utilization
- Model and Software version
- Link to Trango Support Page

Additional Web pages provide advanced setup of the various features and provide detailed monitoring and troubleshooting

Command Line Interfaces

SSH – Encrypted remote access via in band and out of band methods with separate view and configuration level access (password protected)

Telnet – Remote access via in band and out of band methods with separate view and configuration level access (password protected)

Console – Local Access using a serial cable for bench configuration with separate view and configuration level access (password protected).

SNMP – Remote control and monitoring via in-band and out-of band methods using any third party Network Management Software (NMS).

Standard MIB II System Level and Enterprise MIB Blocks are supported with monitoring for all major link health and traffic related metrics.

Firmware Update

Remote update of the system firmware is available via FTP or by pulling the image from the PC desktop using the Web GUI.

bootimage upgrade – upgrades the flash memory with the new software following FTP of new firmware into the system. A system reboot is required after performing this command to load the new firmware

bootimage toggle – Returns the firmware to the previous version as shown in the *version* command. A system reboot is required after performing this command to load the previous firmware

Appendix A - Product Specification

Mechanical

Parameter	Specification
Construction	Cast Aluminum Alloy with removable port access plate and 1" NPT Strain Relief
Finish	Silver-White Powdercoat
Size	SP24-SI: 8.5 x 8.5 x 2.5 in SP24-XI: 14 x 8.5 x 2.5 in
Weight	SP24-SI: < 5 lbs SP24-XI: < 9 lbs
Mounting	SP24-SI, -XI: Die Cast Articulating Pole/Wall mount bracket
Transmit Polarization Indicator	"L" and "R" marking at top of Radio (SI Model) with bubble level to ensure orthogonality. Position sensor inside the radio to determine L, R, H or V pol
Antenna Alignment	3.5 degree sight for aligning the internal antenna on -SI, -XI models.
Grounding Lug	#10-32 Stainless Steel Bolt

Environmental

Parameter	Specification
Operating Temperature Range	-40 deg C to +65 deg C - Functional -40 deg C to +55 deg C - Spec Compliant
Storage Temperature	-40 deg C to +75 deg C
Cold Start Temp	-33 deg C
Humidity	100% Condensing

Wireless Compliance

Parameter	Specification
FCC	CFR47 Part 15.249 (24 GHz Point to Point Device) CFR47 Part 15 Class A unintentional radiator
Canada	RSS 210 (Annex 12) (24 GHz)
Taiwan	NCC Compliant

Wireless Parameters

Parameter	Specification
Frequency Range	24.05 to 24.25 GHz (std models), 24.00 to 24.25 GHz (-N)
Channel Sizes Supported	10 , 30, 60, 75, 100 symmetric (all models) 120/75, 75/120 MHz asymmetric (all models) 120 MHz Symmetric for -N models
Frequency Duplex	Selectable 100 , 120, 130 MHz depending on channel width
Modulation Levels	QAM4096, QAM2048, QAM1024, QAM512, QAM256, QAM128, QAM64, QAM32, QAM16, QPSK
Transmit RF power output	FCC: Approx +33 dBm EIRP all modulations Industry Canada: Conducted 0 dBm for all antenna sizes Conducted Power Max@4096QAM: 4 dBm Conducted Power Max@2048QAM: 5 dBm

	Conducted Power Max@1024QAM and lower 6 dBm Conducted Power Min all modulations: -15 dBm
Transmitter Power Accuracy	+/- 2 dB
Transmitter Frequency Accuracy	+/- 5 ppm (2.5 ppm TCXO)
Transmitter Center Frequency Synthesizer step size	1 MHz
Transmitter Output Power (Muted)	< -50 dBm
Adaptive Modulation Type	Error Free, Hitless through each transition

Receive Sensitivity

RX Sensitivity level for 10E-6 BER (dBm)										
Channel Width (MHz)	QPSK*	QAM 16	QAM 32	QAM 64	QAM 128	QAM 256	QAM 512	QAM 1024	QAM 2048	QAM 4096
10	-89.7	-84.2	-80.9	-77.9	-75.0	-72.1	-69.1	-65.9	-62.7	-59.8
30	-85.0	-79.5	-76.2	-73.2	-70.3	-67.4	-64.4	-61.2	-58.0	-55.1
60	-82.0	-76.5	-73.2	-70.2	-67.3	-64.4	-61.4	-58.2	-55.0	-52.1
75	-82.0	-76.5	-73.2	-70.2	-67.3	-64.4	-61.4	-58.2	-55.0	-52.1
100	-79.7	-74.2	-70.9	-67.9	-65.0	-62.1	-59.1	-55.9	-52.7	-49.8
120	-79.0	-73.5	-70.2	-67.2	-64.3	-61.4	-58.4	-55.2	-52.0	-49.1

Downshift Levels from next higher modulation

Min RX level before Downshift to next modulation (dBm)										
Channel Width (MHz)	QPSK*	QAM 16	QAM 32	QAM 64	QAM 128	QAM 256	QAM 512	QAM 1024	QAM 2048	QAM 4096
10	-89.7	-81.5	-78.2	-75.2	-72.3	-69.4	-66.4	-63.2	-60.0	-57.1
30	-85.0	-76.8	-73.5	-70.5	-67.6	-64.7	-61.7	-58.5	-55.3	-52.4
60	-82.0	-73.8	-70.5	-67.5	-64.6	-61.7	-58.7	-55.5	-52.3	-49.4
75	-82.0	-73.8	-70.5	-67.5	-64.6	-61.7	-58.7	-55.5	-52.3	-49.4
100	-79.7	-71.5	-68.2	-65.2	-62.3	-59.4	-56.4	-53.2	-50.0	-47.1
120	-79.0	-70.8	-67.5	-64.5	-61.6	-58.7	-55.7	-52.5	-49.3	-46.4

Table 1 (RX Sensitivity)

Power

Parameter	Specification
Input Voltage Range (Direct)	+40 to +57 VDC
Input Voltage Range (PoE)	+43 to 57 VDC (At RJ45 PoE Port)
Power Consumption	<30 Watts –SI, <50 Watts –XI model

User Interfaces

Description	Specification
Ethernet Traffic Ports and/or In Band Management (IBM)	P1: RJ45 - 10/100/1000BaseT P2: SFP – 2500/1000/100 Base-X SFP modules supported P3, P4: SFP – 1000/100Base-X SFP modules supported: SFP-GigE- C-1 (1000/100BaseT) SFP-GigE-S (1000BaseLX Single Mode Fiber) SFP-GigE-M (1000BaseLX Multimode Fiber) SFP-2.5 Gigabit TBD

Direct Power	3 Position Latching screw terminal Block supports redundant supply
RSSI Voltage	BNC-Female (CBLDAT-RSSI recommended) RSSI of Modem 1 presented as a DC Voltage
1+1 HSB	Mini USB – Custom cable required
MIMO Xin and Xout	SMA-Female (-XI Model only)
Reset IP/Config	2 Momentary Push Buttons Left- A side default, Right -B side default Hold for < 3 seconds, reset IP/set DHCP to off, keep config Hold for > 6 seconds reset default config
Antenna	SP24-SI: Integrated 30 dBi Cross pol (L/R slant) SP24-XI: Integrated 30 dBi Dual pol (H/V)

Indicators

Parameter	Specification
Ethernet Speed Indication- P1	10 Mbps= no LED, 100 Mbps=Green only, 1000 Mbps=Green and Amber
Ethernet Activity Indicator – P1	Green LED blinks upon activity
RSSI/Link Indicator LEDs	LED1(Green) Solid=Locked<-70 dBm, Blinking = Unlocked LED2(Yellow) Solid=>-65 dBm LED3(Yellow) Solid=>-60 dBm LED4(Yellow) Solid=>-55 dBm LED5(Yellow) Solid=>-50 dBm LED6(Yellow) Solid=>-45 dBm LED7(Yellow) Solid=>-40 dBm

Ethernet Performance

Parameter	Specification
Packet Size/Type	64-9.6K Bytes , IPV4, IPV6
Max Layer 2 Capacity	>1.0 Gbps FD (2 Gbps Aggregate) base models >2.0 Gbps FD (4 Gbps Aggregate) –XI, (XPIC)
Latency	< 160 uS for 1518 byte packets, @ 95% capacity load <80 us for 64 byte packets, @95% capacity load (per RFC2544 store and forward)

Ethernet Capacity (1518 byte IPV4-TCP packets in a single VLAN)

Capacity(Mbps) for 1518 Byte packets										
Channel Width (MHz)	QPSK	QAM 16	QAM 32	QAM 64	QAM 128	QAM 256	QAM 512	QAM 1024	QAM 2048	QAM 4096
10	16.2	32.5	40.6	48.7	56.8	64.9	73.0	81.1	89.3	97.4
30	48.7	97.4	121.7	146.1	170.4	194.7	219.1	243.4	267.8	292.1
60	97.4	194.7	243.4	292.1	340.8	389.5	438.2	486.9	535.6	584.2
75	97.4	194.7	243.4	292.1	340.8	389.5	438.2	486.9	535.6	584.2
100	162.3	324.6	405.7	486.9	568.0	649.2	730.3	811.4	892.6	973.7
120	193.2	386.4	483.0	579.6	676.2	772.8	869.4	966.0	1062.6	1159.2

Table 2 (Full Duplex Traffic Capacity SP24-SI, -XI double these numbers)

Quality of Service Performance

Parameter	Specification
VLAN Priority	Maps incoming packet into one of the 8 queues based on VLAN tag PCP field.
Port Priority	User can assign all untagged packets into a one of 8 queues – Set per port
Scheduler options (Modem Port)	<ol style="list-style-type: none">1) Strict for all Queues2) Deficit Weighted Round Robin (DWRR)3) Queues 0-5 WRR, Queue 6-7 Strict4) Queues 0-3 WRR, Queues 4-7 Strict
Queues	8 Queues
Ingress Rate Limiting	From 10 to 1000 Mbps per Input port

Appendix B

StrataPro 24 Recommended Operating Frequencies

10 MHz Channels

Min Center Freq: 24055 MHz

Max Center Freq: 24245 MHz

T/R Spacing: 100 MHz

<u>Low Center Freq</u>	<u>High Center Freq</u>
24055	24155
24065	24165
24075	24175
24085	24185
24095	24195
24105	24205
24115	24215
24125	24225
24135	24235
24145	24245

30 MHz Channels

Min Center Freq: 24065 MHz

Max Center Freq: 24235 MHz

T/R Spacing: 100 MHz

<u>Low Center Freq</u>	<u>High Center Freq</u>
24065	24165
24095	24195
24125	24225

60 MHz Channels

Min Center Freq: 24085 MHz

Max Center Freq: 24215 MHz

T/R Spacing: 100 MHz

<u>Low Center Freq</u>	<u>High Center Freq</u>
24100	24200

75 MHz Channels

Min Center Freq: 24088 MHz

Max Center Freq: 24212 MHz

T/R Spacing: 100 MHz

<u>Low Center Freq</u>	<u>High Center Freq</u>
24100	24200

100 MHz Channels

Min Center Freq: 24100 MHz

Max Center Freq: 24200 MHz

T/R Spacing: 100 MHz

Low Center Freq

24100

High Center Freq

24200

120/75 Assym. MHz Channels

Min Center Freq: 24100 MHz

Max Center Freq: 24200 MHz

T/R Spacing: 100 MHz

Low Center Freq

24100

High Center Freq

24200

COMPLIANCE

FCC

FCC ID: NCY-SP24

The StrataPro 24 System is used for point-to-point operation only, and requires professional installation due to FCC limits on radiated output power.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference,
- (2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial environment. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with these instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in any particular installation. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

WARNING:

Intentional or unintentional changes or modifications must not be made unless under the express consent of the party responsible for compliance. Any such modifications could void the user's authority to operate the equipment and will void the manufacturer's warranty. To comply with RF exposure requirements, the following antenna installation and device operating configurations must be satisfied. The antenna for this unit must be fixed and mounted on outdoor permanent structures with a separation distance of at least two meters from all persons. Furthermore, it must not be co-located or operating in conjunction with any other antenna or transmitter.

Industry Canada

IC: 2945A-SP24

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Les changements ou modifications non approuvés expressément par la partie responsable de la conformité pourrait annuler l'autorité de l'utilisateur à faire fonctionner l'équipement.

RF Exposure Warning

This transmitter must be installed to provide a separation distance of at least 2 meters from all persons and must not be located or operating in conjunction with any other antenna or transmitter except as listed for this products certification..

This device has been designed to operate with Trango Systems Internal 30 dBi Dual Polarization Array Antenna only.