

User Guide

EB-X

User Guide

*Detailed and Expert Setup Instructions
For the Intuicom EB-X*

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FCC Notification

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 and 2) this device must accept any interference received, including interference that may cause undesired operation. This device must be operated as supplied by Intuicom, Inc. Any changes or modifications made to the device without the express written approval of Intuicom, Inc. may void the user's authority to operate the device.

CAUTION: The model number EB-X has a maximum transmitted output power of 1W. It is recommended that the transmit antenna be kept at least 23 cm away from nearby persons to satisfy FCC RF exposure requirements.

This equipment 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 in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Note: Whenever any Intuicom, Inc. module is placed inside an enclosure a label must be placed on the outside of that enclosure which includes the module's FCC ID.

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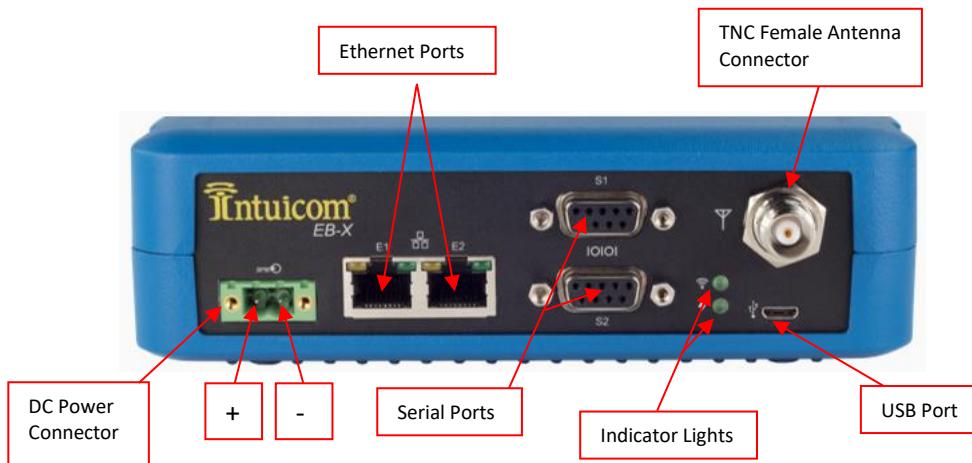
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1 – Overview

This guide provides a complete overview of the Intuicom EB-X 900 MHz transceiver. Below is an overview of the front of the unit, with labels depicting the connections and LEDs.

Front Panel Overview



The EB-X 900 MHz Transceiver:

- Operates in the unlicensed 900 MHz ISM Band (902-928 MHz).
- Provides a maximum of 30dBm transmit output power
- Is FCC compliant as both Frequency Hopping Spread Spectrum (FHSS) and a Digital Modulating (DM) radio.
- Provides a Linux- based application environment for deployment of applications at the edge.
- Has two Ethernet Ports, two serial ports, and one micro-USB port.

A – Communication Method

The EB-X uses Listen Before Talk (LBT) and Carrier Sense Multiple Access (CSMA). There are no assigned slots. The radios transmit when the channel is clear.

LBT – Is a contention-based protocol that allows many devices to use the same radio channel without pre-coordination.

CSMA – Is a media access control protocol in which each node verifies the absence of traffic before transmitting data.

- The Gateway broadcasts packets to all Endpoints and Endpoint-Repeaters within range.
- The Endpoint-Repeaters broadcast packets to all Endpoints and Endpoint-Repeaters within range.
- The Endpoint will send packets via unicast back to the Gateway or downstream to Endpoint-Repeaters.

- The Gateway acknowledges the Endpoint or Endpoint-Repeater packets.

Intuicom traditional protocol has a Gateway Time Slot and Endpoint Time Slot within a frame.

- The Gateway transmits in its time slot and listens in the Endpoint slot.
- The Endpoint transmits in its slot and listens in the Gateway slot.

B – Boost Technology

The EB-X incorporates a boost technology using four performance-enhancing algorithms used together or independently to improve throughput or link reliability in the most demanding RF environments.

C – Adaptive Spectrum Learning

Learns which RF signals are part of the EB-X network and which are not, reducing bad packet transmissions.

- Standard on all EB-X radios, the “Listen Before Talk” algorithm provides spectrum monitoring, delivering network intelligence and increasing throughput in noisy environments.

D – Forward Error Correction

The “fecRate” (on page 40) increases the reliability of the data transferred over the air at the cost of some transmission throughput.

- Improves sensitivity by 3dB to maximize the link range in noisy environments.
- Adds redundant information to a data stream to detect packet errors and corrects them to avoid retransmission of the packet.

E – Packet Aggregation

The “aggregateEnabled” (on page 41) setting increases throughput of small packets by combining multiple packets into a single packet, minimizing the number of packets required for transmission.

- Does NOT affect medium and large packets.

F – Packet Compression

When the “compressionEnabled” (page 40) setting is turned on, the outgoing packets are analyzed, if the data packet can be compressed, it will be, and sent compressed which results in fewer bits over the air.

G – Edge Computing Capabilities

The EB-X provides edge computing capabilities that allows for the development and deployment of Linux-based applications onto the radio. The application has access to the same computing resources as the radio, but is in a segregated section of the EB-X.

2 – Equipment

The contents of the EB-X package include 1) The EB-X Transceiver, 2) Cat5e Ethernet Cable, and 3) power supply. Contents of package are pictured below.



A – Additional Equipment

The list of user supplied equipment that may be necessary to complete or configure the unit is as follows:

- USB to micro-USB cable
- DB9 serial cables
- Antenna and or coaxial cables
- Computer

3 – Installation & Configuration Access

A – Antenna

Install an FCC-approved antenna.

The antenna must be placed outdoors and properly grounded.

Use extreme caution when installing antennas and follow all instructions included with the antenna.

Connect the antenna and or cable to the EB-X.

NOTE: The EB-X is equipped with a TNC Female antenna connector.

B – Power

The EB-X is approved to operate with an input voltage of +10 to 36VDC with at least 0.8 Amps.

Connect the power to the EB-X.

NOTE: The EB-X is equipped with a phoenix power connector. Refer to page 9 of this document for location and polarity of the power connector.

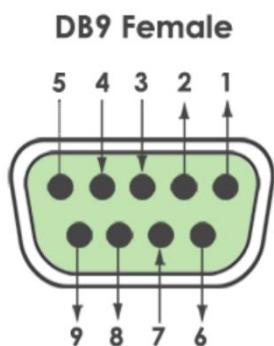
C – Ethernet

Connect the Cat5e cable to either Ethernet port on the EB-X and the other end to the computer's Ethernet port.

D – Serial Ports

The EB-X has two serial ports with DB9 Female connectors, labeled S1 and S2. See page 9 for location of these ports.

The pinouts of these two ports are provided in the diagrams below.



Pin	Assignment	Signal
1	Carrier Detect (CD)	Output
2	Transmit Data (Tx)	Output
3	Receive Data (Rx)	Input
4	Data Terminal Ready (DTR)	Input
5	Ground (-)	
6	Data Set Ready (DSR)	Input/Output
7	Ready to Send (RTS)	Input
8	Clear to Send (CTS)	Output
9	Not Connected	

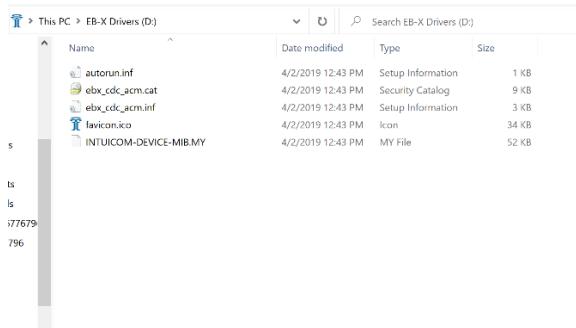
E – Micro USB Port

Connecting to the micro-USB port on the EB-X requires the use of a USB to micro-USB cable.

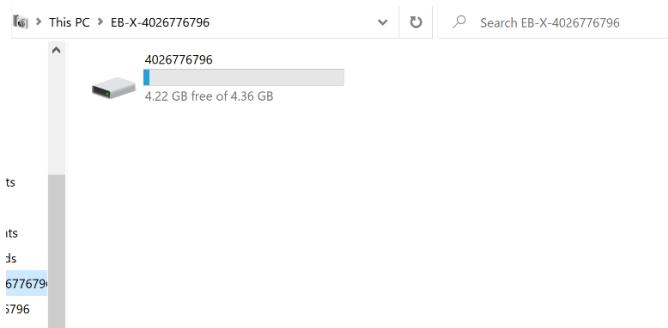
NOTE: The cable must be a USB data cable. Some smart phone charging cables that have USB to micro-USB connectors will not work for data connection to the EB-X radio.

When you connect the micro-USB port on the radio to a USB port on your PC, two file explorer windows will pop up. The first is the drivers, and the second is the file windows. In the file windows the radio storage will display as a drive with the radio serial number as the name. Examples below:

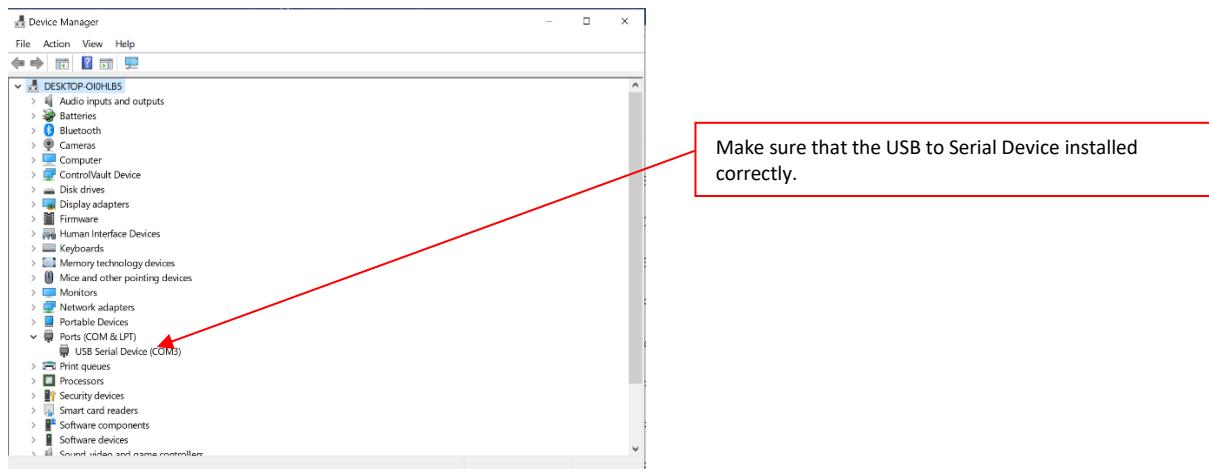
Drivers



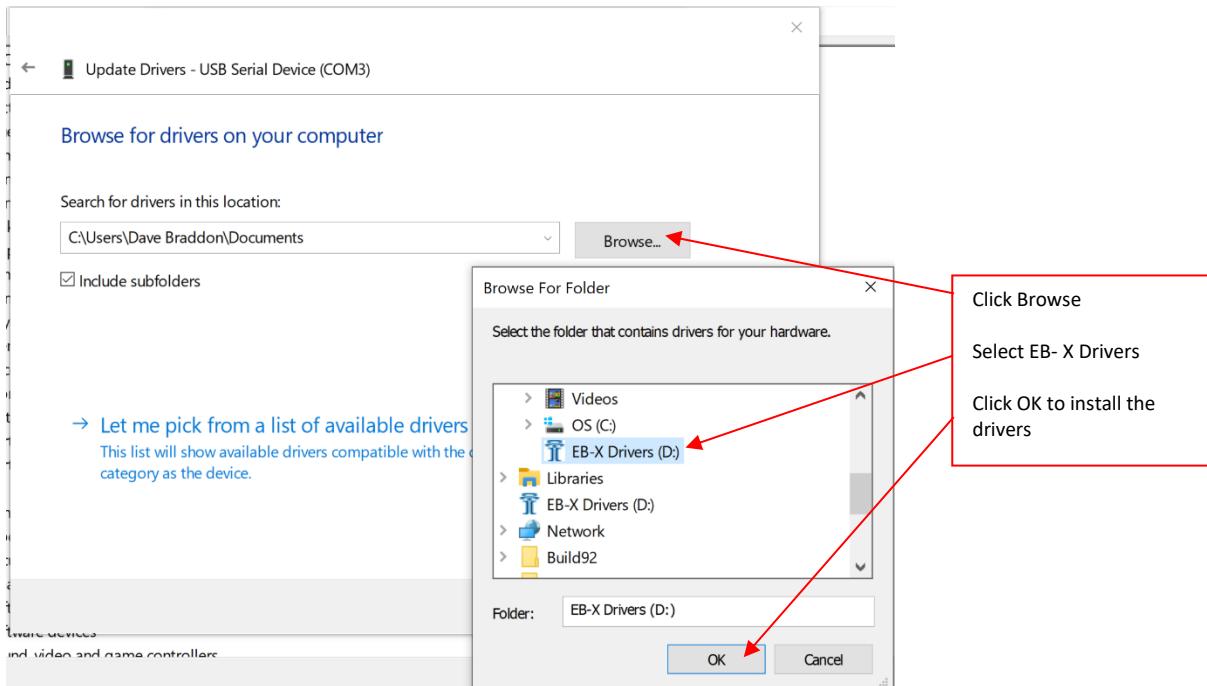
Files



Once the windows have opened navigate to Windows Device Manager – COM and LPT and make sure that the USB to Serial device drivers installed correctly.

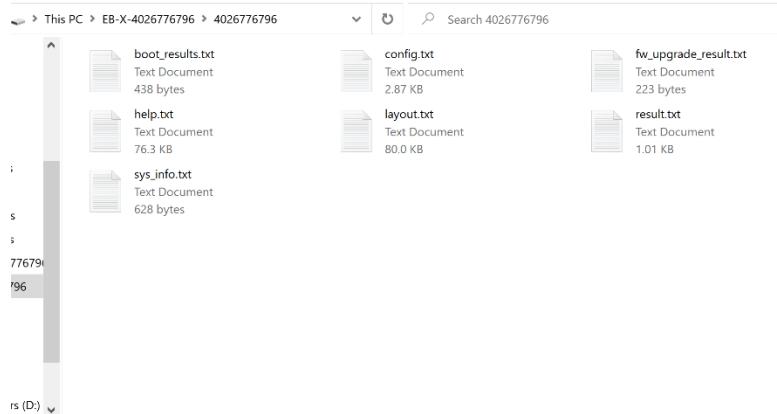


If the device shows up with any errors or with a yellow triangle, double click on the device, when the device window comes up, select the “Driver” tab at the top, then click on the “Update Driver” rectangular button, select the option to “Browse my computer for drivers”. On the next window click the “Browse” rectangular button, and in pop up window, select the drive that contains the EB-X Drivers and has the Intuicom logo next to it. and click “OK” to install the driver.



a – Files Window

When you double click on the drive in the Files window you will be able to see the .txt files loaded on to the EB-X.



Numerous functions can be performed on the EB-X through this window including:

- Upgrading Firmware
- Loading a specific configuration onto multiple EB-X units – Drag and Drop Configuration
- Restoring the radio to default configuration
- Restoring the password to default

The above functions will be covered in Appendix A, B, C, and D of this document.

F – Configuration Access

Configuring the EB-X can be done through various methods that include, terminal window via COM port access, via SSH Ethernet access, or through a web browser using the EB-X web pages.

a – Terminal Window – COM Port Access

Open a terminal emulator program such as Tera Term or Putty, and point the window to the COM port number that was installed into device manager, and set the following parameters on the serial port:

- Baud Rate = 115200bps
- Data Bit = 8
- Parity = N
- Stop Bit = 1
- Flow Control = None

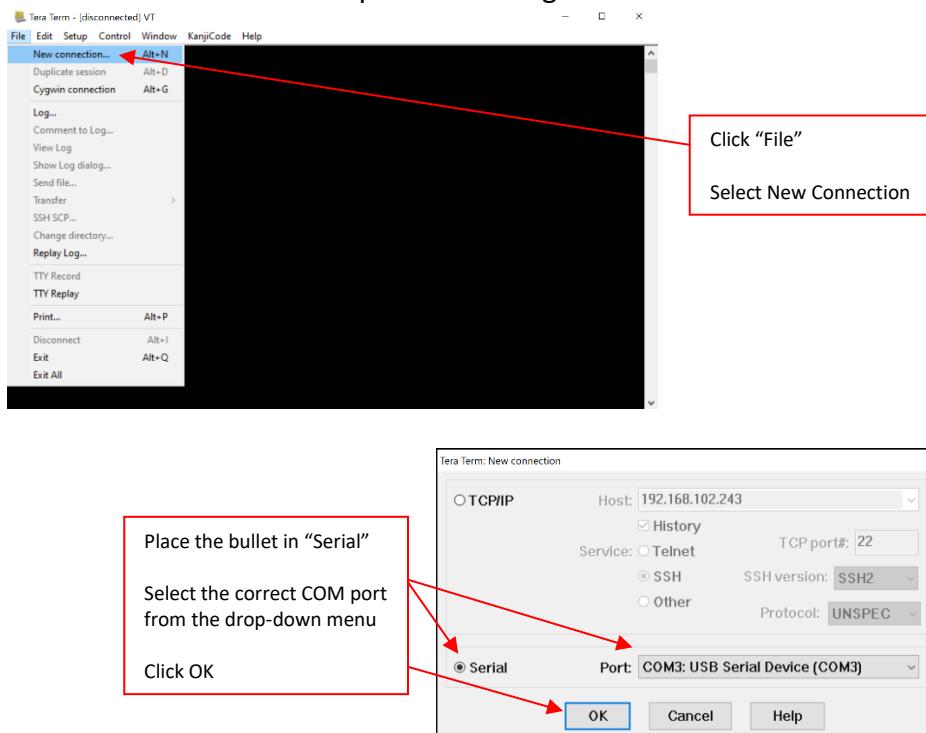
When the terminal window opens strike the enter key once to bring up the log in prompt. Login credentials are:

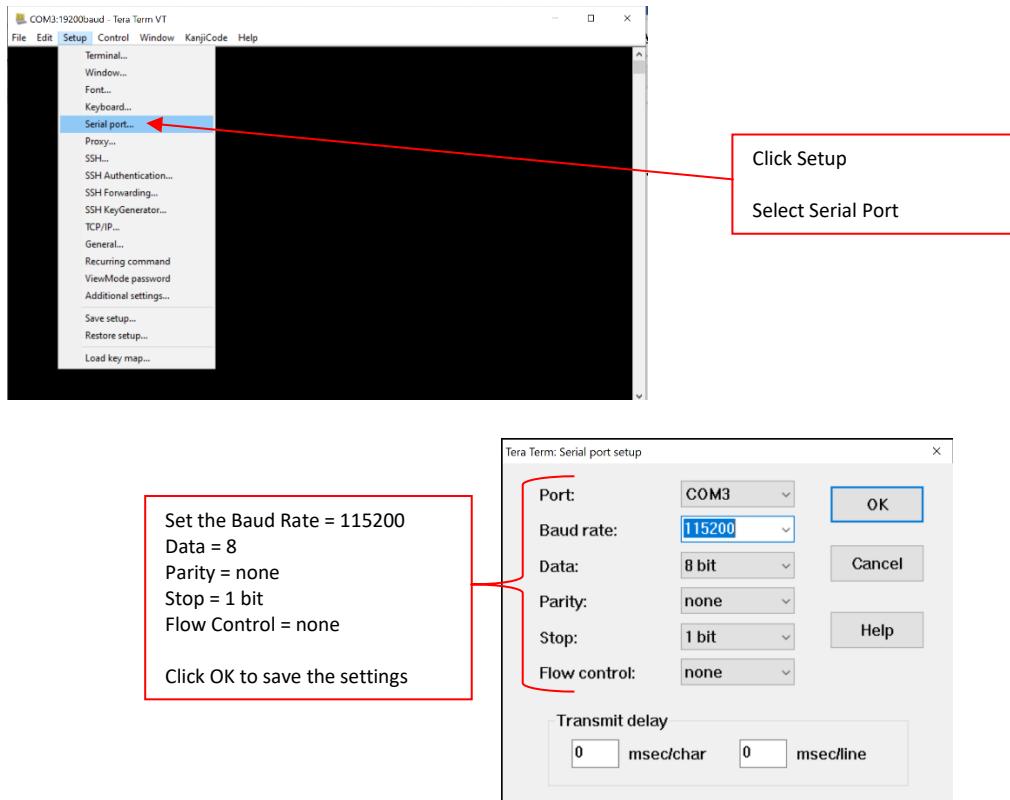
- Username = admin
- Password = admin

NOTE: Both the username and password are all lower case letters (no capitals).

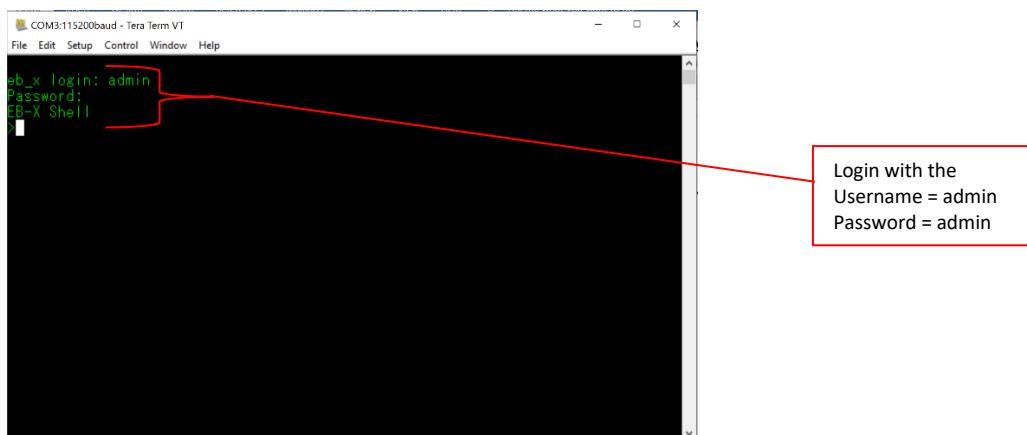
i – Tera Term Example

Open Tera Term and follow the steps below to login.



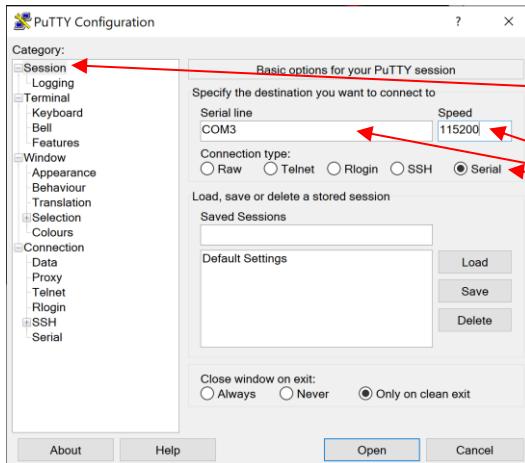


Strike the Enter key once to bring up the log in prompt

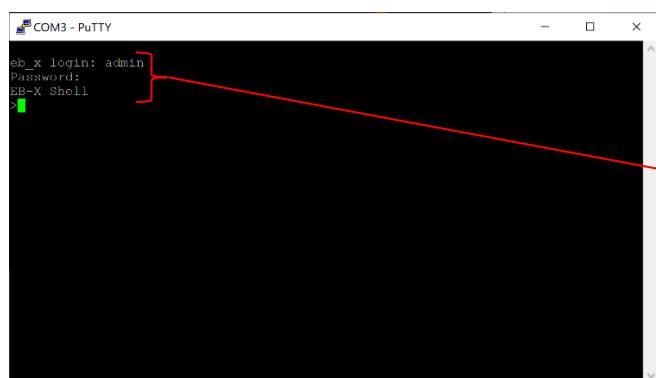
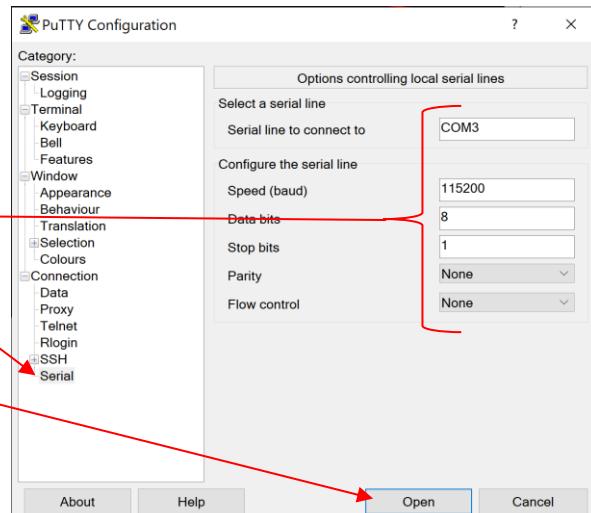


ii – Putty Example

Open Putty and follow the steps below to login.



Click on Serial Category
 Set Flow Control to none
 Make sure Data Bit, Stop Bit, and Parity are set to 8, N, 1
 Serial line to connect to should already read the COM port entered on Sessions Category
 Speed should already be set at 115200
 Click Open

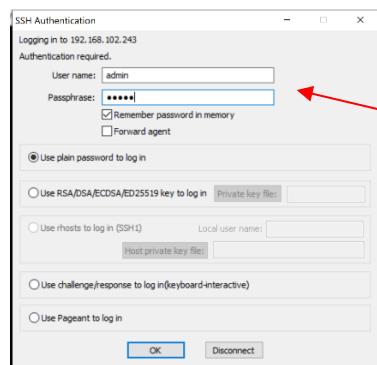
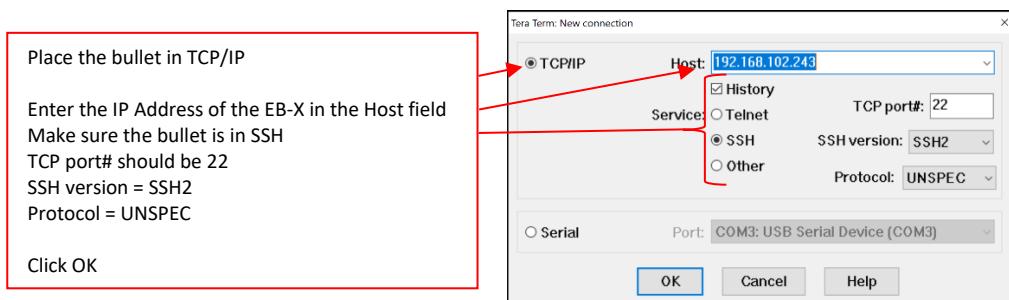
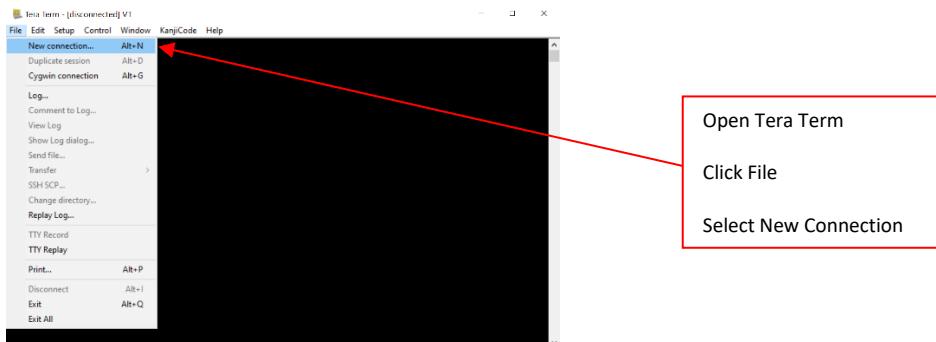


Type in:
 Username = admin
 Password = admin
 To log in

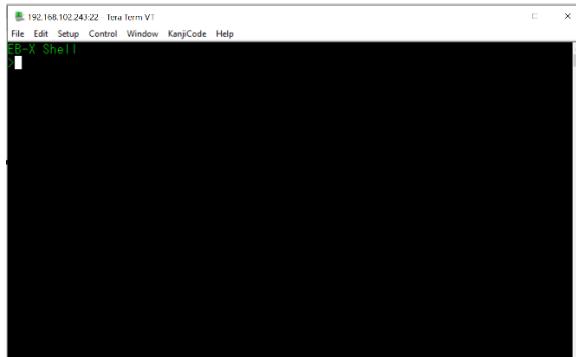
b – Terminal Window – SSH Access

i – Tera Term - Example

Open Tera Term and follow the instructions below to login to the terminal window via SSH connection over Ethernet.

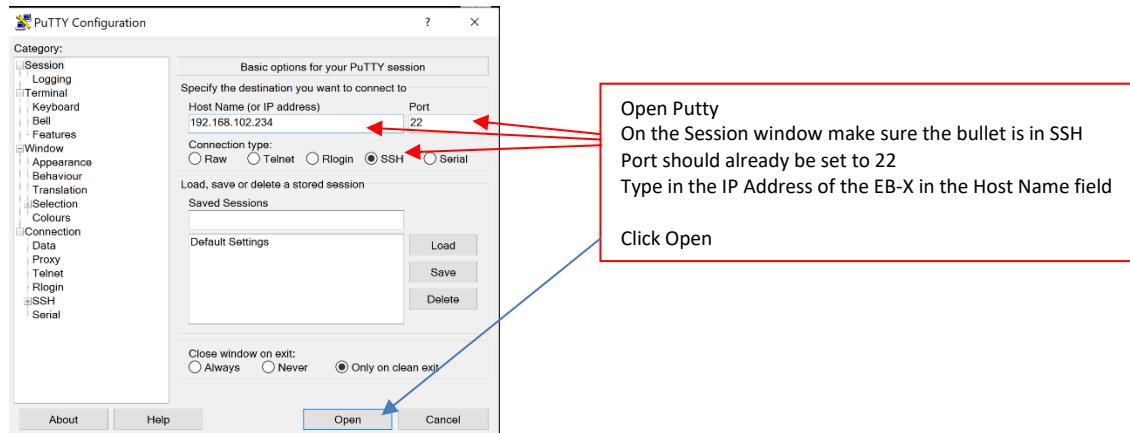


On the SSH Authentication window
Enter:
Username = admin
Password = admin
Click OK to Login

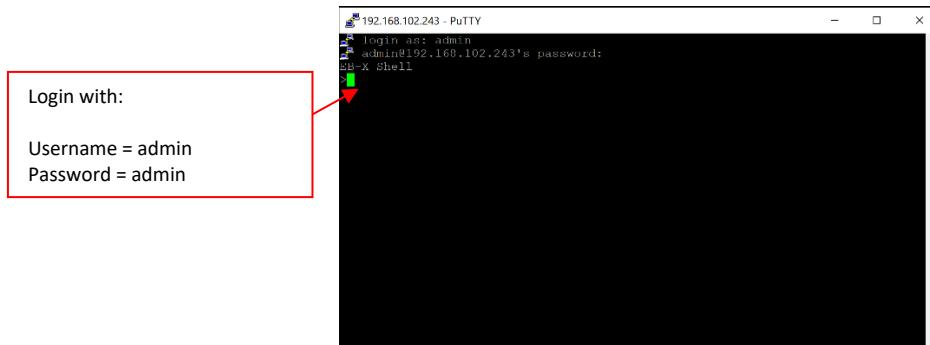


ii – Putty Example

Open Putty and follow the steps below to login to the terminal window via SSH connection.

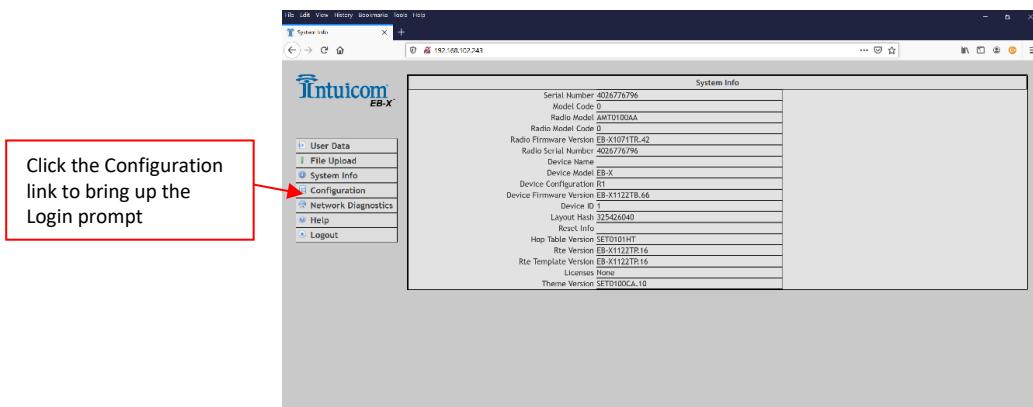


First time log in will be prompted for an encryption key and you will need to enter username and password. After your first login you will not be prompted for the key and the terminal window will prompt you for a username and password.



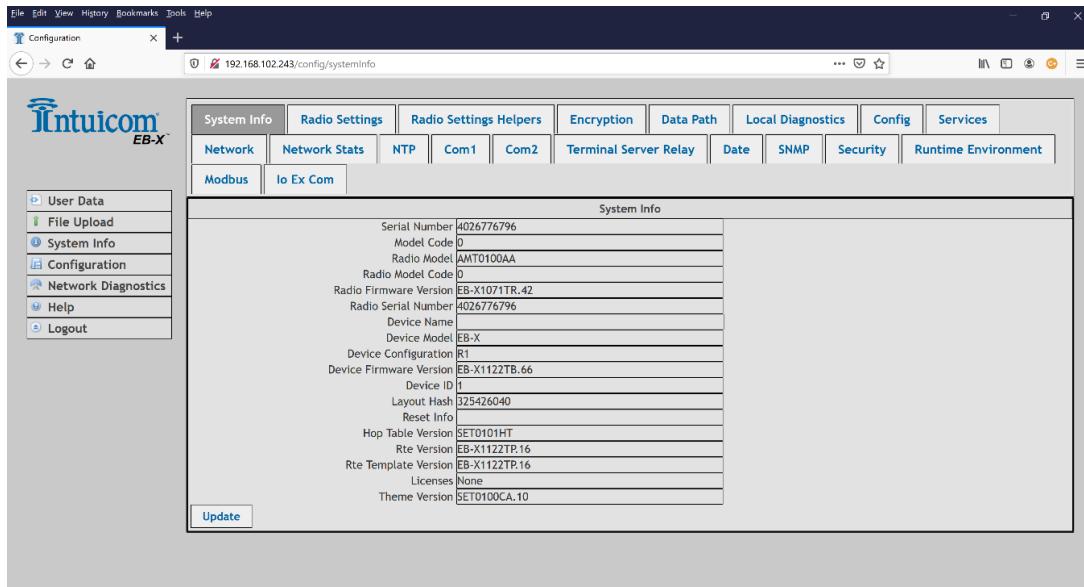
c – Web Browser Access

Open any internet browser that you regularly use to surf the web, and in the address line type in the IP Address of the EB-X radio and hit the enter key. This will take you to the System Info web page.





Once you are logged in you will be on the System Info web page and there will be buttons at the top of the page for each configuration page that can be accessed through the web browser interface.



System Info	
Serial Number	4026776796
Model Code	0
Radio Model	AMT0100AA
Radio Model Code	0
Radio Firmware Version	EB-X1071TR.42
Radio Serial Number	4026776796
Device Name	
Device Model	EB-X
Device Configuration	R1
Device Firmware Version	EB-X1122TB.66
Device ID	1
Layout Hash	325426040
Reset Info	
Hop Table Version	SET0101HT
Rte Version	EB-X1122TP.16
Rte Template Version	EB-X1122TP.16
Licenses	None
Theme Version	SET0100CA.10

4 – Basic Configuration

This section will cover the basic configuration of the EB-X radios necessary for a simple Gateway to Endpoint connection.

NOTE: The following sections of this user manual assume that the user has two EB-X radios on a bench in a test lab setup.

The EB-X radios have problems connecting without an antenna. Intuicom recommends the use of rubber duck antennas for bench or lab environments. If you do not have a rubber duck antenna, a simple paper clip can be unfolded and inserted into the center hole of the antenna jack on the front of the unit. Make sure the radio is positioned on its back so that the antenna jack and paper clip are oriented vertically.

WARNING: Touching the paper clip to the center hole on the antenna connector as well as to the outside threaded connector can damage the radio module internally to the unit. Please take special care not to let this happen as it can void the warranty on your EB-X radio.

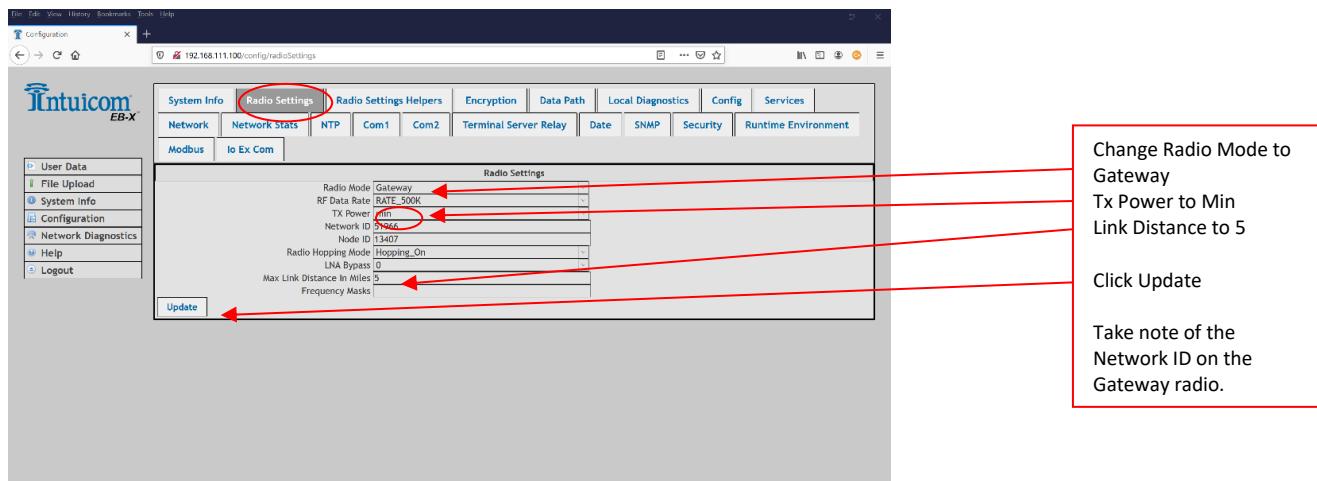
A – Basic Gateway Configuration

Power up the radio, and with an Ethernet patch cable connect your PC to either Ethernet port 1 or 2 on the EB-X. Open a browser and type the default IP Address of the EB-X radio into the address line of the browser, and log in according the instructions on page 19-20 of this document. Click on the “Radio Settings” button at the top of the page.

Change the following settings:

1. Radio Mode = Gateway
2. Tx Power = min
3. Max Link Distance in Miles = 5

Click “Update” button to write the settings to the radio. Next take note of the Network ID.

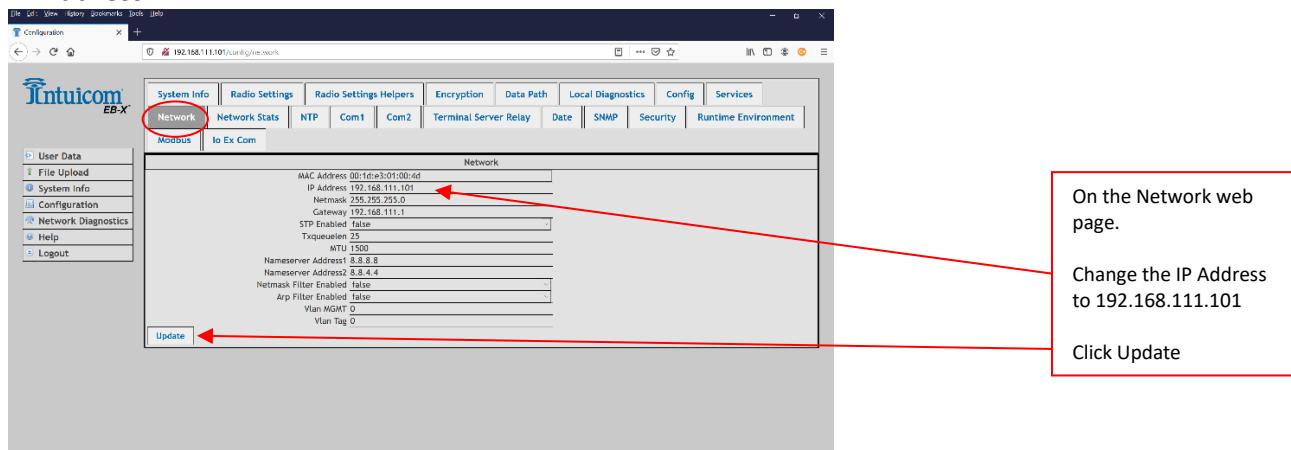


B – Basic Endpoint Configuration

Power up and log into the second radio that you will configure as the Endpoint connected to the Gateway, configured on the previous page.

Once logged in click on the “Network” and leave everything default except change the IP Address from 192.168.111.100 to 192.168.111.101, and click “Update” to write the new IP Address to the radio.

NOTE: Once you have changed the IP Address of the radio, you will need to log back in by the new IP Address.

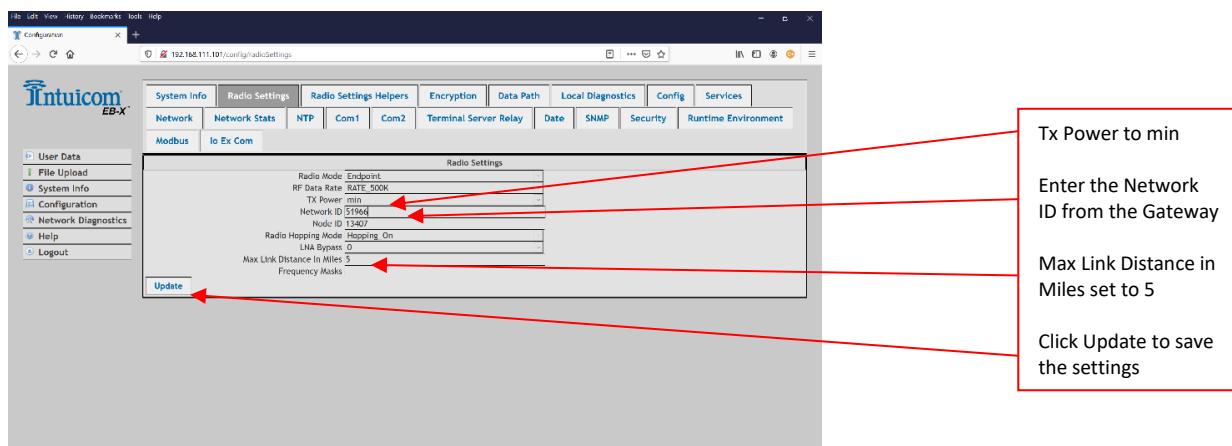


Next click on the “Radio Settings” button that will take you to Radio Settings web.

Change the following settings:

1. Tx Power = min
2. Enter the Network ID from the Gateway radio into the Network ID field.
3. Max Link Distance in Miles = 5

Click the “Update” button to write the settings to the radio.

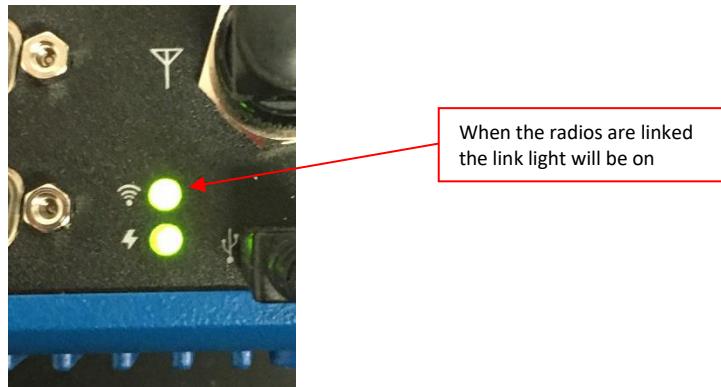


At this point the two radios should be wirelessly connected. The typical tests used to check the connection are to:

1. From the PC Command prompt run a ping test to both radios.
2. Bring up the web page of the remote radio (the one you are not plugged into via Ethernet cable).

C – Status Lights

When the EB-X is linked the status light with the wireless symbol will be lit.



5 – Assigning IP Address – EB-X

Connect the power supply green female phoenix connector to the green male power supply connector on the front panel of the EB-X radio (see page 9). Connect the Cat5e cable to either of the Ethernet ports on the front panel of the radio (see page 9).

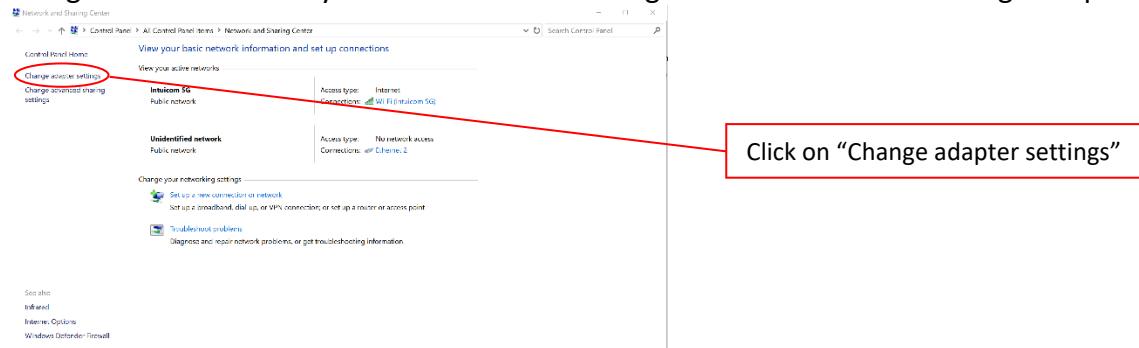
Default EB-X IP Address Configuration:

- IP Address = 192.168.111.100
- Subnet Mask = 255.255.255.0
- Default Gateway = 192.168.111.1

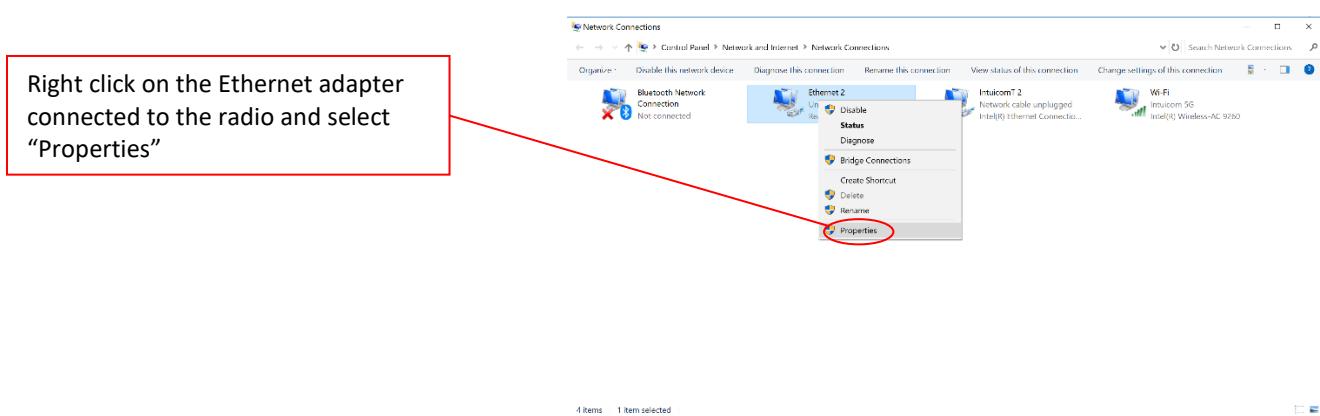
NOTE: The IP Address of your computer needs to be in the same range as the IP Address of the radio to be able to ping the radio and access the webpages.

TIP: Setting multiple IP Addresses on your LAN Adapter in Windows.

Navigate in windows to your Network and Sharing center and click on “Change adapter settings”.

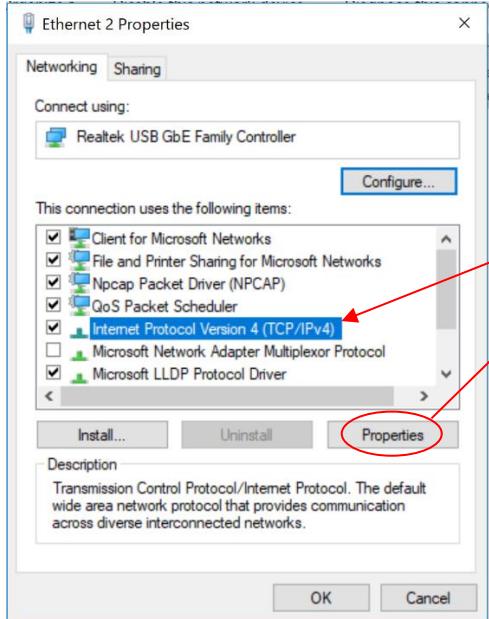


Right click on the Ethernet adapter connected to the radio and select “Properties”.



When the Ethernet Properties window appears click on “Internet Protocol Version 4 (TCP/IPv4)” in the window and click the “Properties” button.

This will bring up the Internet Protocol Version 4 (TCP/IPv4) Properties window.

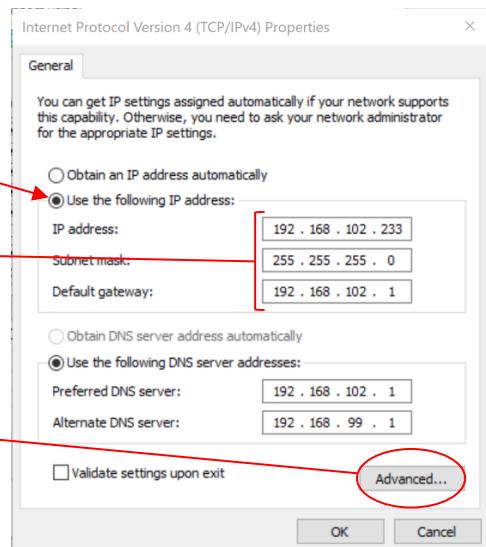


Click and highlight “Internet Protocol Version 4 (TCP/IPv4)” and click the “Properties” button

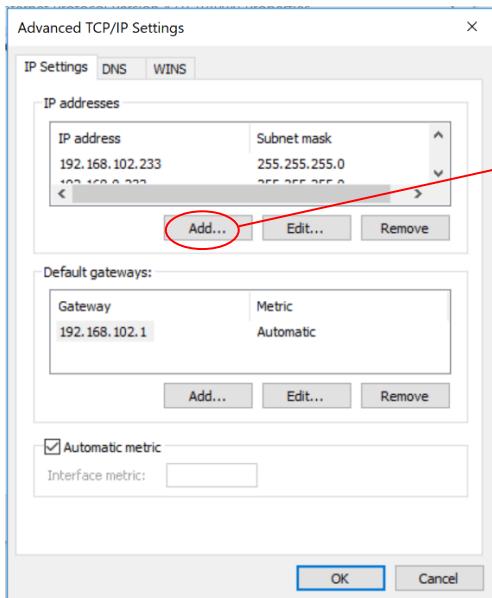
Make sure the bullet is selected for “Use the following IP address:”

Enter the IP address, Subnet Mask, and Default Gateway for your network or an IP Address in the range that you are going to program the EB-X radio to use when installed.

After you have entered your IP Address parameters click on the Advanced button

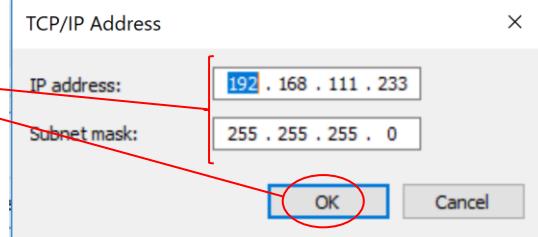


Upon clicking the “Advanced” button the “TCP/IP Advanced Settings” window will open up. Under the IP Addresses box click the “Add” button and in the pop-up window enter and IP Address in the default range of the radios.



In the Advanced TCP/IP Settings window –
Under IP Addresses box click the Add button

When the TCP/IP Addresses window opens
enter an IP Address and Subnet Mask in the
default range of the radios and then click
“OK”



After clicking “OK” on the TCP/IP Address window. Click “OK” on the Advanced TCP/IP Settings window, and then click “OK” on the Internet Protocol Version 4 (TCP/IPv4) window, and then click “Close” on the Ethernet Properties window and then close out the rest of your windows.

With your Ethernet Adapter set up with two IP Addresses you will be able to navigate the configuration settings webpages without having to change your computer’s IP Address continuously between the default range to your network range as you configure the radio with its new IP Address.

Next - Bring up Windows command prompt (DOS window), and run a continuous ping to the radio default IP Address. NOTE: Continuous ping command in windows is “ping – IP Address”. Example:

- Ping –t 192.168.111.100

You will need to hit the keys “Ctrl C” – Ctrl key while holding it strike the letter c – To end the ping.

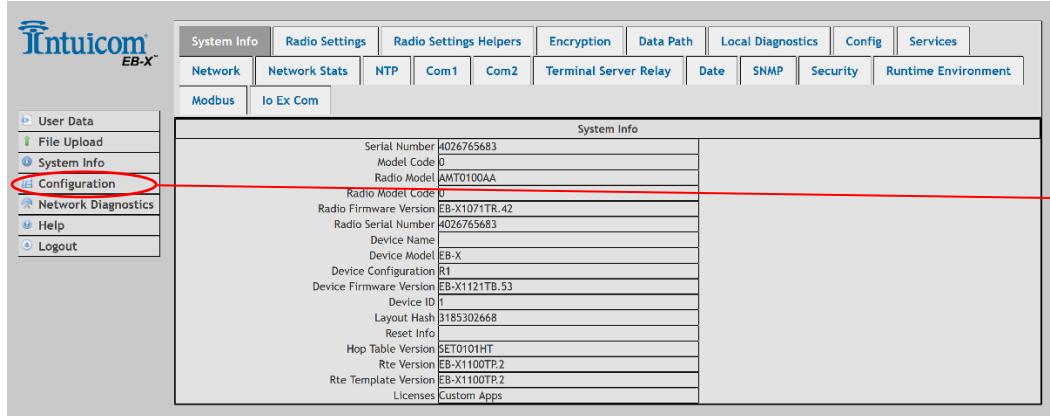
Run the ping until the radio begins to ping, stop the ping and bring up a browser and enter the URL on the address line of:

- 192.168.111.100

Depress the “Enter” key – this will bring up the System Info webpage. To configure the radio, click on the “Configuration” link in the left column and when prompted enter the default username and password.

- Username = admin
- Password = admin

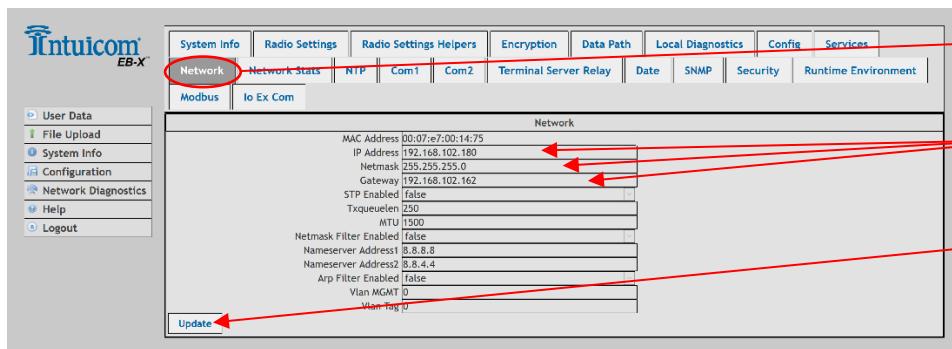
When first logged into the EB-X the webpage below will appear.



A screenshot of the Intuicom EB-X System Info webpage. The left sidebar menu has 'Configuration' highlighted with a red circle. The main content area shows 'System Info' details like Serial Number, Model ID, Radio Model, and various software versions. A red box highlights the 'Configuration' link in the sidebar, and another red box highlights the 'Serial Number' field in the main content area. A callout box on the right says: 'Click on Configuration and enter username and password when prompted'.

Once you have entered configuration mode the Update buttons will appear in the lower left of the window on the page.

Click on “Network” to bring up the webpage where you can configure the radio IP Address. Enter the IP Address, Netmask, and Gateway - IP settings and click update to save the settings.



A screenshot of the Intuicom EB-X Network configuration webpage. The 'Network' tab in the top navigation bar is highlighted with a red circle. The main content area shows network settings like IP Address, Netmask, and Gateway. Red arrows point from the text labels on the right to the corresponding input fields: 'IP Address' to the 'IP Address' field, 'Netmask' to the 'Netmask' field, and 'Gateway' to the 'Gateway' field. A red arrow also points to the 'Update' button at the bottom left. A callout box on the right says: 'Click on the “Network” tab', 'Enter the IP Address, Netmask, and Gateway settings', and 'Click “Update” to save the settings'.

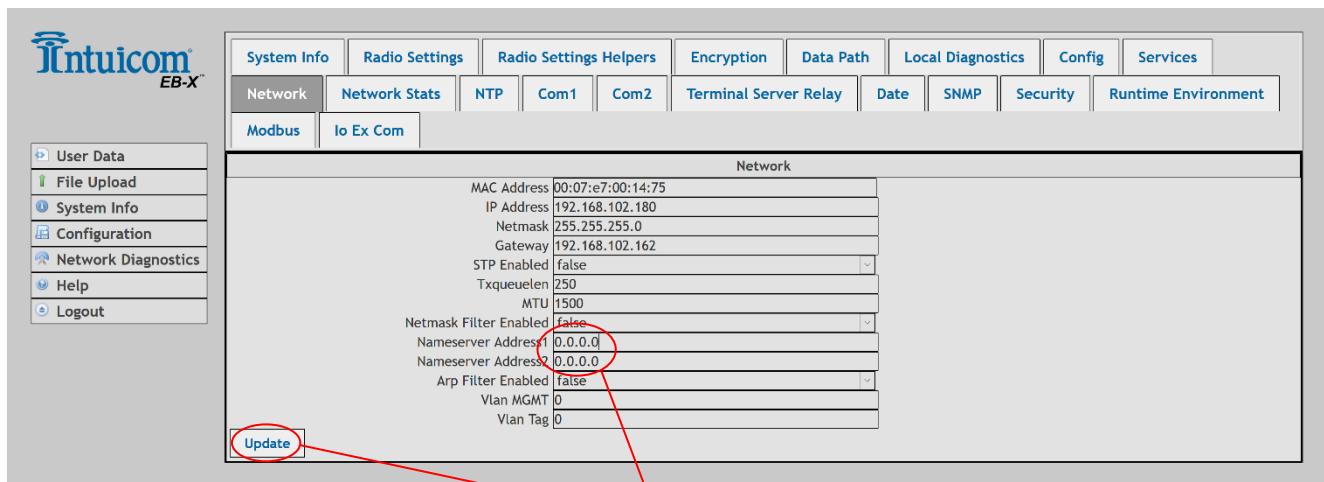
The EB-X is now configured with IP Address settings for your network.

NOTE: Intuicom suggests setting the Nameserver Address fields to all zeros (example below) so that the radios do not ARP for the addresses that are entered into these fields. This will keep unwanted network traffic down.

Definitions

DNS – Domain Name Server – Converts a URL into an IP Address. Example: www.yahoo.com is converted to the IP Address - 72.30.35.9.

ARP – Address Resolution Protocol – associates MAC Addresses to IP Addresses – Computers and network devices send out broadcast packets looking for an IP Address of a device and its associated MAC Address.



System Info		Radio Settings		Radio Settings Helpers		Encryption		Data Path		Local Diagnostics		Config		Services																															
Network		Network Stats		NTP		Com1		Com2		Terminal Server Relay		Date		SNMP		Security		Runtime Environment																											
Modbus		Io Ex Com																																											
Network																																													
<table border="1"> <tr> <td>MAC Address</td> <td>00:07:e7:00:14:75</td> </tr> <tr> <td>IP Address</td> <td>192.168.102.180</td> </tr> <tr> <td>Netmask</td> <td>255.255.255.0</td> </tr> <tr> <td>Gateway</td> <td>192.168.102.162</td> </tr> <tr> <td>STP Enabled</td> <td>false</td> </tr> <tr> <td>Txqueuelen</td> <td>250</td> </tr> <tr> <td>MTU</td> <td>1500</td> </tr> <tr> <td>Netmask Filter Enabled</td> <td>false</td> </tr> <tr> <td>Nameserver Address</td> <td>0.0.0.0</td> </tr> <tr> <td>Nameserver Address</td> <td>0.0.0.0</td> </tr> <tr> <td>Arp Filter Enabled</td> <td>false</td> </tr> <tr> <td>Vlan MGMT</td> <td>0</td> </tr> <tr> <td>Vlan Tag</td> <td>0</td> </tr> </table>																				MAC Address	00:07:e7:00:14:75	IP Address	192.168.102.180	Netmask	255.255.255.0	Gateway	192.168.102.162	STP Enabled	false	Txqueuelen	250	MTU	1500	Netmask Filter Enabled	false	Nameserver Address	0.0.0.0	Nameserver Address	0.0.0.0	Arp Filter Enabled	false	Vlan MGMT	0	Vlan Tag	0
MAC Address	00:07:e7:00:14:75																																												
IP Address	192.168.102.180																																												
Netmask	255.255.255.0																																												
Gateway	192.168.102.162																																												
STP Enabled	false																																												
Txqueuelen	250																																												
MTU	1500																																												
Netmask Filter Enabled	false																																												
Nameserver Address	0.0.0.0																																												
Nameserver Address	0.0.0.0																																												
Arp Filter Enabled	false																																												
Vlan MGMT	0																																												
Vlan Tag	0																																												
Update																																													

Set Nameserver Addresses to 0.0.0.0 and click Update

6 – System Info

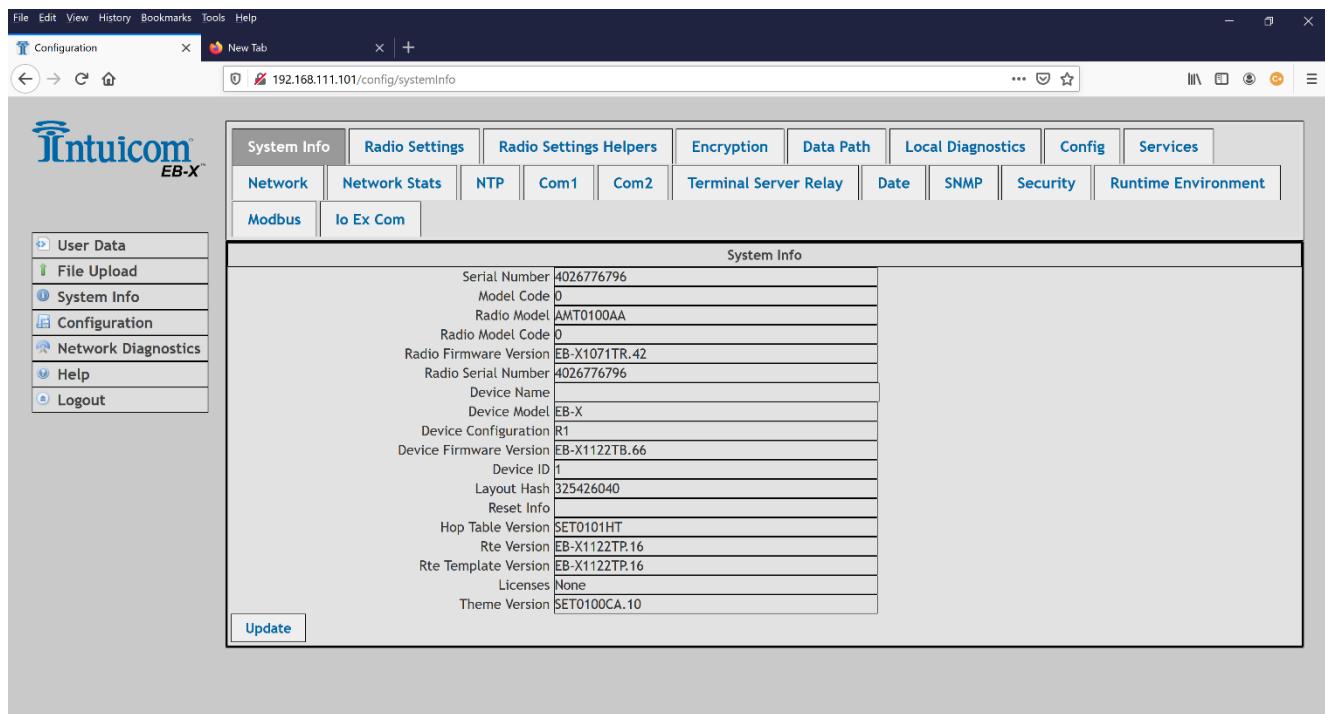
The System Info page is a read only page that will provide the user relevant information about the EB-X radio.

Users may need to refer to this page when calling for technical support.

Relevant information may include:

- 1) Serial Number
- 2) Radio Model
- 3) Radio Firmware Version
- 4) Device Firmware Version
- 5) Hop Table Version
- 6) Licenses

NOTE: The Update button does not change any settings on the System Info webpage.



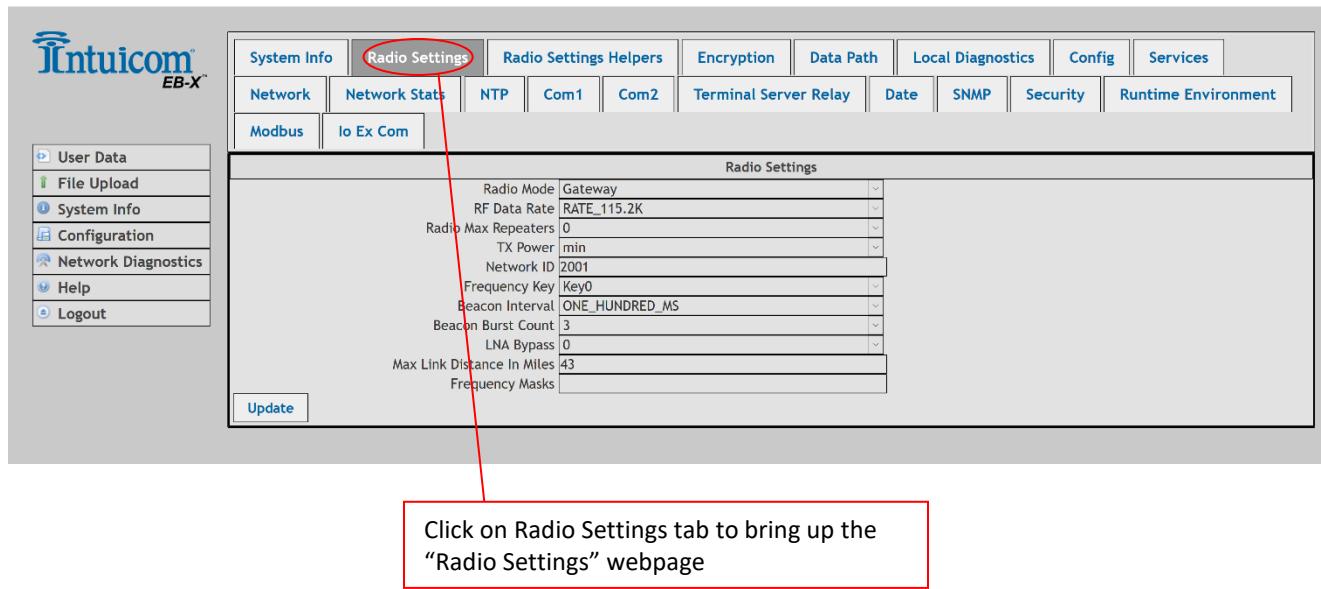
The screenshot shows a web browser window with the URL `192.168.111.101/config/systemInfo`. The page title is "Configuration". The left sidebar includes links for User Data, File Upload, System Info (which is selected), Configuration, Network Diagnostics, Help, and Logout. The main content area has a navigation bar with tabs: System Info, Radio Settings, Radio Settings Helpers, Encryption, Data Path, Local Diagnostics, Config, and Services. Under System Info, there are sub-tabs: Network, Network Stats, NTP, Com1, Com2, Terminal Server Relay, Date, SNMP, Security, and Runtime Environment. The "Io Ex Com" tab is currently active. A large table titled "System Info" displays various device parameters. At the bottom of the table is a blue "Update" button. The table data is as follows:

System Info	
Serial Number	4026776796
Model Code	0
Radio Model	AMT0100AA
Radio Model Code	0
Radio Firmware Version	EB-X1071TR.42
Radio Serial Number	4026776796
Device Name	
Device Model	EB-X
Device Configuration	R1
Device Firmware Version	EB-X1122TB.66
Device ID	1
Layout Hash	325426040
Reset Info	
Hop Table Version	SET0101HT
Rte Version	EB-X1122TP.16
Rte Template Version	EB-X1122TP.16
Licenses	None
Theme Version	SET0100CA.10

7 – Configuring Radio Settings

While in Configuration mode on the radio click on the “Radio Settings” tab.

NOTE: Radio Settings will need to be updated once Radio Mode and RF Data Rate are selected for the additional options to be available for programming.



A – Radio Mode

For a standard network one of the radios will be set up as a Gateway and the other radio as an Endpoint. See pages 21 – 23.

a – Standard Network Configuration

In a standard network configuration one radio will be set up as a Gateway, or a Gateway_Repeater (explained on page 31). All other radios will be set up as Endpoints, and Endpoints that bridge connectivity from Endpoints that cannot connect directly to the Gateway will be setup as Endpoint_Repeaters.

b – Peer to Peer Configuration

The EB-X radios can be set up in a peer to peer network where all radios can communicate with all the other radios that they can pick up a signal from. In this type of network configuration Endpoints can communicate directly with each other without sending data through the Gateway radio. Endpoints that bridge connectivity from Endpoints that cannot pick up a signal to other Endpoints in the network, are setup as Endpoint_Repeaters. For this type of network hopping must be turned off.

c – Gateway, Gateway Repeater, Endpoint Repeater, and Endpoint

Settings under Mode are Gateway, and Endpoint, and additional settings are Gateway_Repeater and Endpoint_Repeater.

i – Gateway

The Gateway radio controls hopping for the entire network. So, if hopping is turned on, a Gateway radio must be configured on the network, as it controls the hopping pattern for itself and all Endpoints and Endpoint_Repeaters connected to it. Additionally, Endpoint to Endpoint communications does not function through the Gateway or directly with each other in a standard network configuration.

A Gateway is also required for the use of the network diagnostics webpage. This webpage will only function on an EB-X that is configured as a Gateway or Gateway Repeater.

NOTE: With hopping on peer to peer functionality will not work. If Endpoints cannot pick up a signal from each other, peer to peer communications will not take place.

ii – Gateway Repeaters

If Endpoint to Endpoint communications through the Gateway is necessary, then the Gateway can be configured as a Gateway_Repeater. This will allow communications from Endpoint to Endpoint through the Gateway.

NOTE: There can be only one Gateway in any set of radios programmed to communicate with each other. It does not matter if it is programmed as a Gateway, or a Gateway_Repeater, you cannot have more than one in any wireless network where all radios have the same network ID.

ii – Endpoint Repeaters

If an Endpoint on the network cannot pick up a RF signal from the Gateway, but it can pick up a signal from the closest Endpoint, and that Endpoint has a direct connection to the Gateway. The Endpoint_Repeater setting can be used on the Endpoint that has a connection to the Gateway, and can pick up the signal from the further away Endpoint that cannot connect directly to the Gateway. This will allow Endpoints that cannot connect to the Gateway to connect to the closest Endpoint_Repeater in the network.

Endpoint_Repeater setting can also be used in a peer to peer network with hopping off, where some of the Endpoints cannot pick up a signal from any other Endpoint in the network, except the one closest to it. This can be used to achieve a daisy chain topology where Endpoints are connected to Endpoint_Repeaters, connected to the next Endpoint, which is connected to the next Endpoint_Repeater, and so on, down the line.

iii - Endpoints

In a standard or peer to peer network any radio that communicates directly with the Gateway, Gateway_Repeater, other Endpoints, or an Endpoint_Repeater is configured as an Endpoint. The frequency key and network ID must match the other radios in the network for wireless communications

B – RF Data Rate

The available settings under RF Data Rate are 1) RATE_4M, 2) RATE_1M, 3) RATE_1.5M_BETA_FEATURE, 4) RATE_500K, 5) RATE_250K, and 6) RATE_115.2K

NOTE: RATE_1.5M_BETA_FEATURE is not covered in this manual.

At the RATE_115.2K and RATE_250K settings the hopping capability is automatically enabled and only the Beacon Interval can be adjusted with the settings.

At the RATE_500K, RATE_1M, and RATE_4M settings hopping capabilities are optional and user selectable.

a – General Guide Lines for RF Data Rate Settings:

- 1) Link Distances of 40 miles or longer – Use RATE_115.2K
- 2) Link Distances of 20 to 40 miles – Use RATE_115.2K or RATE_250K
- 3) Link Distances 10 to 20 miles – Use RATE_115.2, RATE_250K, RATE_500K
- 4) Link Distances 10 miles or less – Use any of the RF Date rates up to and including RATE_4M

NOTE: RATE_4M needs a -65dB signal strength or stronger to achieve higher bandwidth links. Also, the antenna will need to be at least 10 feet high or higher to allow Fresnel zone clearance for the higher throughput setting.

Data rate selection will also be dependent on line of sight and height of the antenna above ground. For links with a compromised line of sight the lower RF Data Rates are suggested, and for links where the antenna is not more than 10 feet above ground the same is suggested.

NOTE: If you have questions related to the calculations of Fresnel zone, range, bandwidth, or any other theoretical consideration please contact Intuicom Technical Support.

C – Radio Max Repeaters

This setting has to be enabled when repeaters are used on the network with a maximum setting of 3. More than 3 repeaters can be used in a wireless network, however repeater slot settings on the Endpoint_Repeater will have to be reused if there are more than three repeaters (see pages 71-76 for more information about repeaters).

D – Tx Power

Maximum transmit power is 30dB and should be adjusted to an optimum signal strength of -50 to -70dB, with -50dB being the optimum reading.

NOTE: When working in a lab or bench top environment set the Tx Power to “min”.

E – Network ID

The network ID must match on all radios in a network with 1 to 4 digits are allowed in the network ID.

F – Node ID

This is an auto generated ID that is displayed on the Endpoint radio. This is only programmable in the Command Line Interface.

Suggestion is to leave it at default as it is not programmable in the webpage interface.

G – Frequency Key

Frequency Key 0 through 16 are available.

For the 115.2K RF Data Rate setting:

Key0 – Key14 use the Classic hop table

Key15 – uses standard randomized hop table

Key16 – uses sequential hop table in reverse order of center frequencies

For all other Data Rates settings:

Key0 – Uses the standard randomized hop table

Key1 – Uses the sequential hop table in reverse order of center frequencies.

NOTE: Frequency Key selection is only available on the Gateway radio. The endpoint will coordinate with the Gateway and use whatever frequency key is programmed on the Gateway.

H – Radio Frequency

This setting is only available for the RATE_500K through RATE_4M when hopping is turned off.

Available frequency ranges for the Data Rates are:

RATE_4M = 904.5504 – 925.7472

RATE_1M = 903.0528 – 927.0144

RATE_500K = 902.7072 – 927.3600

RATE_250K = 902.5344 – 927.4176

RATE_115.2K = 902.4768 – 927.5904

NOTE: The frequency cannot be programmed for the 115.2K and 250K settings. The frequencies shown are for information purposes and are displaying the high and low frequencies used in the hopping pattern.

Example: When hopping is set to on, the radio frequency line is not available for configuration. If you want to turn hopping off and set the radio to a fixed frequency you will need to select hopping off from the drop down, and write the settings to the radio by clicking the “Update” button before the frequency field will be available for you to configure.

I – Radio Hopping Mode

As stated in the RF Data Rate section above this setting is not available when the unit is programmed to RF Data Rates of RATE_115.2K, and RATE_250K. When using the RATE_4M, RATE_1M, and RATE_500K settings the Radio Hopping Mode will be available for programming.

a - Additional Hopping Information

EB-X radios are peer to peer radios. All radios can communicate with all other radios that they can pick up the radio signal from. For this type of wireless communication to take place hopping must be turned off. All radios must be programmed as Endpoints, and they all must be able to pick up a signal from the other Endpoints in the network.

When hopping is off a Gateway radio is not necessary. Having a Gateway radio in the network will not cause any problems, it is simply unnecessary. All radios can be configured as Endpoints. However, if you want to use the Network Diagnostics web page in the EB-X you will have to configure one of the radios as a Gateway and connect to the Gateway when you run Network Diagnostics.

When hopping is on there MUST be a Gateway radio in the network, because the Gateway radio controls the hopping timing. When hopping is on Endpoint-to-Endpoint communications will not take place directly. The Gateway must be configured as a Gateway_Repeater and then Endpoint to Endpoint communications can take place through the Gateway radio.

J – Beacon Interval

Available selections for the Beacon Interval are

- 1) FOUR_HUNDRED_MS
- 2) TWO_HUNDRED_MS
- 3) ONE_HUNDRED_MS
- 4) FIFTY_MS
- 5) TWENTY_FIVE_MS

The faster the beacon intervals are set, the lower the throughput of the radio will be. The one hundred millisecond beacon interval is close to the interval used by the previous generation Intuicom products. Adjusting the beacon interval to two and four hundred milliseconds will provide a slightly higher throughput across the wireless link when compared with the one hundred millisecond beacon interval.

For this example, this setting will not be available because we programmed hopping to off in the previous section.

NOTE: With Endpoint repeaters in the network and hopping on, and beacon interval set to 25 and 50 milliseconds the network delay may be so great that it will drop pings to some of the Endpoints. Solution is to increase the beacon interval.

K – Beacon Burst Count

Available settings are 1 through 7. This is the number of beacons that are sent out by the radio at the interval time. Default setting is 3. Intuicom recommends setting the beacon burst count no lower than 2, and to use the default of 3, unless instructed by Intuicom support to set it to a different number.

Increasing the number of beacons in a noisy environment may improve RF link reliability.

Decreasing the number of beacons in an environment where noise is minimal may improve throughput.

L – LNA Bypass

Enter 1 in the text box to bypass the Low Noise Amplifier and lower the receive signal by 10dB.

Enter 0 in the text box to enable the Low Noise Amplifier (LNA) and boost the radio receive signal by 10dB.

M – Max Link Distance In Miles

This setting does affect the wireless link performance. It should be set to the approximate distance between radios. Default setting is 20.

Minimum Value = 5

Maximum Value = 120

NOTE: As previously stated, the radio settings will have to be updated as each setting is selected. This is because some radio settings will add lines to the Radio Settings page when updated, and some of the lines will disappear as other settings are updated.

N – Frequency Masks

Hop table frequency masking, masks the channels that fall within the range plus or minus ½ the channel bandwidth.

Format of the Frequency Mask is:

- XXX is a value between 902-927 MHz
- YYYY is a value of .0000-.9999 MHz

There are three frequency ranges to mask:

1) Single Channel Format – A single entry masks the specific frequency plus the bandwidth on each side of the center frequency as a function of the RF Data Rate.

Format is = xxx.yyyy, xxx.yyyy, xxx.yyyy

2) Range of Channels Format – If a radio channel intersects with mask limits, it will be masked and not used.

Format = xxx.yyyy-xxx.yyyy, xxx.yyyy-xxx.yyyy

3) Combination of Channels Format

Format = xxx.yyyy-xxx.yyyy,xxx.yyyy

Follow the steps below to enter and check frequency masks on the Radio Settings web page.

1. In the “Frequency Masks” text box, enter the exact specified format of the frequency range to mask.
2. Click the Update button
3. Wait a few seconds for the radio to process the command.
4. Refresh the radio web page and review the “Frequency Masks” text box to verify the mask was accepted.
5. If the frequency mask setting is NOT what was requested, click the Radio Settings Helpers webpage link.
6. On the Radio Settings Helpers webpage review the frequency mask errors to determine the error that exists in the frequency mask String.

8 – Radio Settings Helpers

This webpage is used to determine the error that exists in the frequency mask string.

NOTE: This window is only available if the Radio Hopping Mode is set to on.

Frequency Mask errors should help the user determine the errors in the frequencies they have masked using the various formats in the previous section.

For further information contact Intuicom Support.

9 – Encryption Settings

Encryption settings must match on all radios in the network to maintain over-air compatibility. When enabling encryption start with the furthest Endpoints in the network, then repeaters, then the Gateway last. As encryption is enabled on each radio it will drop off the network until the rest of the radios have been configured with the same encryption at which point, they will all reconnect and resume communications.

A – Encryption Mode

Two encryption modes are:

- 1) AES_CTR = Counter Mode
- 2) AES_CCM = Counter Mode with Message Integrity Check

B – Active Key

By default, it is set to Off which disables encryption. To enable encryption the options are to use Key1-16. When key is set to off this is a read only setting.

Whichever key you select you will need to set that key to a hexadecimal format where numbers 0-9 and letters a-f can be used. **No other characters can be used in the key.**

128-bit encryption will have a hexadecimal key of exactly 32 characters. **Any number of characters other than 32 will not program the key.**

Example = 1234567890abcdef1234567890abcdef

256-bit encryption will have a hexadecimal key of exactly 64. **Any number of characters other than 64 will not program the key.**

Example = 1234567890abcdef1234567890abcdef1234567890abcdef1234567890abcdef

No colons are used in the key to separate the numbers and or letters. **If you use colons in the key it will not program.**

The same exact key must be used on all radios in the network for them to communicate.

SUGGESTION: Type the key up in a notepad document and copy and paste it into each radio to avoid typing errors.

Once the key is programmed you will no longer be able to read the key as it will simply say 128 bit key or 256 bit key. Example is in the screen shot on the next page.

Intuicom
EB-X
System Info
Radio Settings
Encryption
Data Path
Local Diagnostics
Config
Services
Network
Network Stats

NTP
Com1
Com2
Terminal Server Relay
Date
SNMP
Security
Runtime Environment
Modbus
Io Ex Com

Encryption	
Encryption Mode	AES_CTR
Active Key	Key1
	128-bit key.
	Key2 256-bit key.
	Key3 Key has not been set.
	Key4 Key has not been set.
	Key5 Key has not been set.
	Key6 Key has not been set.
	Key7 Key has not been set.
	Key8 Key has not been set.
	Key9 Key has not been set.
	Key10 Key has not been set.
	Key11 Key has not been set.
	Key12 Key has not been set.
	Key13 Key has not been set.
	Key14 Key has not been set.
	Key15 Key has not been set.
	Key16 Key has not been set.

10 – Data Path

The Data Path page allows the user to program Compression, Aggregation, and Forward Error Correction along with other settings that assist with over the air data transmission.

A – Compression Enabled

When compression is enabled, the outgoing packets are analyzed and if they can be compressed, they will be prior to transmission to reduce the number of bits sent over air.

Settings are:

True = Compression is enabled

False = Compression is disabled

NOTE: When compression is enabled ping times increase as the radio has to analyze and compress packets prior to transmission over air.

B – Over The Air Max Fragment Size

Default setting is 1000 and values from 64 to 1000 can be entered into the field. This setting does not have to match on all radios on the network.

Smaller Fragment Size will increase link reliability in high RF noise environment.

Larger Fragment Size will decrease link reliability in high RF noise environment.

Smaller Fragment Size will decrease data throughput over air.

Larger Fragment Size will increase data throughput over air.

For this example, leave the default setting of 1000.

C – FEC Rate

Forward Error Correction settings must match on all radios on the network to maintain over the air compatibility.

Settings Are:

RATE_1_1 = Disabled and is the default setting.

RATE_7_8 = Enabled

- 1) Reduces throughput by 13% when enabled.
- 2) Improves RF sensitivity by 3dB to maximize range in noisy RF environments.
- 3) Adds redundant information to a data stream to detect packet errors and corrects them to avoid retransmission of packets.
- 4) May increase net throughput in noisy environments by reducing errors and retries.

NOTE: FEC is not needed for TCP/IP data streams as TCP/IP is error correcting by itself.

For this example, leave FEC Setting at default (RATE_1_1) disabled.

D – Aggregate Enabled

When Aggregate is enabled, it increases throughput of small packets by combining multiple packets into a single packet to minimize the number of packets required for transmission. This setting does not need to match on all radios in a network.

Settings Are:

False = Disabled – this is the default setting

True = Enabled

- 1) Increases latency by 20 msec and reduces poll rates.
- 2) May increase throughput as fewer and larger packets are sent over the air.
- 3) Does not affect medium to large packets.

For this example, leave Aggregate disabled at its default setting of False.

E – Route Min Signal Margin Threshold

This setting is only used when there are repeaters in the network, and designates the minimum signal margin in dB for the next hop to be considered as part of the packet route. When repeaters are enabled, the packets take the path through the radio network with the minimum number of hops. By increasing the threshold value, the possible routes can be reduced to allow a particular routing path to be preferred over others.

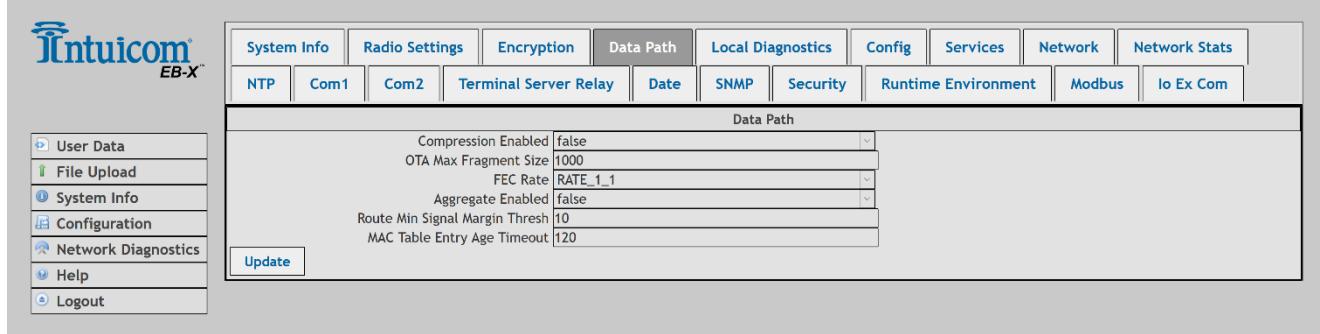
Default setting is 10 – for 10 dB.

Settings are:

Minimum value = -5

Maximum value = 60

Data Path Settings



The screenshot shows the Intuicom EB-X web interface with the following details:

- Header:** Intuicom EB-X, System Info, Radio Settings, Encryption, Data Path (highlighted), Local Diagnostics, Config, Services, Network, Network Stats.
- Sub-Header:** NTP, Com1, Com2, Terminal Server Relay, Date, SNMP, Security, Runtime Environment, Modbus, Io Ex Com.
- Section:** Data Path
- Form Fields:**
 - Compression Enabled: false
 - OTA Max Fragment Size: 1000
 - FEC Rate: RATE_1_1
 - Aggregate Enabled: false
 - Route Min Signal Margin Thresh: 10
 - MAC Table Entry Age Timeout: 120
- Buttons:** Update

11 – Local Diagnostics

The Local Diagnostics webpage is read only.

Only the first 7 lines of information on the Local Diagnostics page are covered in this manual. For additional information on the rest of the information on the Local Diagnostics page contact Intuicom Technical Support (Appendix I, page 101).

A – Signal Level

This is the receive signal strength for the radio in dB.

Optimum = -50 to -70 dB

NOTE: a signal strength of -65 or stronger is needed for a RATE_4M wireless link, and antennas need to be at least 10 feet off the ground to get the proper Fresnel zone clearance for the 4M links as well.

Intuicom does not have a recommended maximum signal strength for the EB-X radio. -50 to -70 dB is optimum but if Tx Power is set to “min” and the signal is -20 dB (30 dB stronger than the optimum range) this is acceptable and will not damage the radio with too much electrical energy coming in the antenna.

B – Signal Margin

This is the difference between the signal level either the receive sensitivity or the noise level, whichever is higher, for the configured RF Data Rate.

Optimum = 20 or higher

C – Noise Level

This is the amount of noise detected on the link in dB.

Optimum = -100 to -120dB

NOTE: Receiver sensitivity for the EB-X is -98 dB. Margin is computed to the receiver sensitivity value when noise is in the range of -99 to -120 dB. When noise is stronger than -98 dB margin is computed to the noise level.

D – VSWR

Voltage Standing Wave Ratio = The percentage of power reflected back into the radio from the antenna and cable.

Optimum = 0

Acceptable = 1 through 10

Readings above 10 require troubleshooting the antenna and cable:

Connectors tight

Connectors crimped properly to cable (not loose or able to pull them off)

Connectors sealed properly

Antenna in good shape no elements or connector loose or rattling

Surge Suppressor connections tight

Jumper cable from radio to suppressor tight, connectors crimped properly

E – Tx Success

This is the number of packets transmitted across the wireless link without retransmit.

Optimum = 90 to 100%

F – Tx Availability

This is the percentage of packets that were transmitted without back-off.

Optimum = 90 to 100.

G – Rx Success

Percentage of packets that were correctly received across the wireless link.

Optimum = 90 to 100%

Local Diagnostics Screen Shot of first 7 lines

Local Diagnostics										
User Data		File Upload		System Info		Configuration		Network Diagnostics		Local Diagnostics
NTP	Com1	Com2	Terminal Server Relay	Date	SNMP	Security	Runtime Environment	Modbus	Io Ex Com	
Local Diagnostics										
Signal Level	-48									
Signal Margin	35									
Noise Level	-102									
VSWR	0									
TX Success	100									
TX Availability	99									
RX Success	99									

The above screen shot of local diagnostics displays optimum readings for a wireless link.

12 – Config Web Page

No settings are available on the webpage that comes up when the Config button is clicked.

13 – Services Webpage

The only setting on the services webpage is the Command Line Interface timeout value. This value is specified in seconds, and is the number of seconds the SSH or USB port interface will remain logged in with no activity before automatically logging the user out.

14 – Network

Assigning an IP Address and setting the DNS server IP Addresses to zero are covered on pages 24 thru 28 of this manual. In this section the full list of information and settings on the Network webpage are covered.

A – MAC Address

This is a read only line and displays the MAC Address of the Ethernet bridge in the EB-X. Both Ethernet ports on the EB-X will display the same MAC Address.

B – IP Address

This is the field where you enter the IP Address of the EB-X.

C – Netmask

This is the field where you enter the subnet mask of the EB-X radio.

D – Gateway

In their file you will enter the default gateway for your network that the EB-X radio will use.

E – STP Enabled

From this drop-down menu users can turn Spanning Tree Protocol on by setting the drop down menu to “true” or off by setting the drop down menu to “false”.

F – Txqueuelen

This setting specifies the number of packets to hold in the transmit queue. Default setting is 25.

- Minimum value is 1
- Maximum value is 1000

G – MTU

MTU stands for Multiple Transmission Units – Default is set to the standard of 1500.

- Minimum value is 100
- Maximum value is 65521

H – Nameserver Addresses

There are two fields available for Nameserver Address1 and Nameserver Address2. These are the fields where you enter the Domain Name Service addresses. The default is set to the Google DNS server address of 8.8.8.8 and 8.8.4.4.

NOTE: If your network is closed and not connected to the Internet, and you do not have DNS server on your network that is used internally. Intuicom suggests setting both of these fields to 0.0.0.0. This will stop the radio from sending ARP (Address Resolution Protocol) requests out on the

network looking for the DNS Server addresses that are programmed into the Nameserver Address fields.

I – Netmask Filter Enabled

This setting can be turned on or off by selecting “true” for on, or “false” for off from the drop-down menu.

Enabling the Netmask filter enables a bridge firewall to restrict network communication to the current IPv4 subnet. Features of this bridge firewall are:

- Allows only IPV4, TCP, UDP, ICMP (ping), and ARP communication that is in the same subnetwork as the radio to enter the radio (wireless) network.
- VLAN tagged packets are filtered out because the radio is not considered on the VLAN and therefore VLAN packets cannot be on the same subnet.
- Enabling Netmask Filter can prevent non-radio traffic from adversely affecting the performance of the radio (wireless) network.

J – Arp Filter Enabled

This setting can be turned on by selecting “true”, and turned off by selecting “false” from the drop-down menu.

The Arp Filter setting enables a bridge firewall that limits ARP (Address Resolution Protocol) requests from entering the radio that are not on the same subnet as the radio.

K – VLAN Settings

The EB-X radio is configured so that the wireless interface and the Ethernet ports are bridged together. With this setup the EB-X will pass all VLAN traffic if it is installed into a trunk connection between two switches. The only problem that users may experience is that they are unable to ping the radio when it is installed on a trunk connection. In order to set up the EB-X so that it can be reached on a trunk link there are three necessary steps.

- 1) Assign an IP Address in the same range as the rest of the network management devices such as routers and switches.
- 2) Define the Management VLAN in the EB-X.
- 3) Set the Management VLAN to Tagged (If necessary) or leave it untagged (if necessary).

a – Vlan MGMT

In the Vlan MGMT field enter the numeric ID of the management VLAN on your network.

b – Vlan Tag

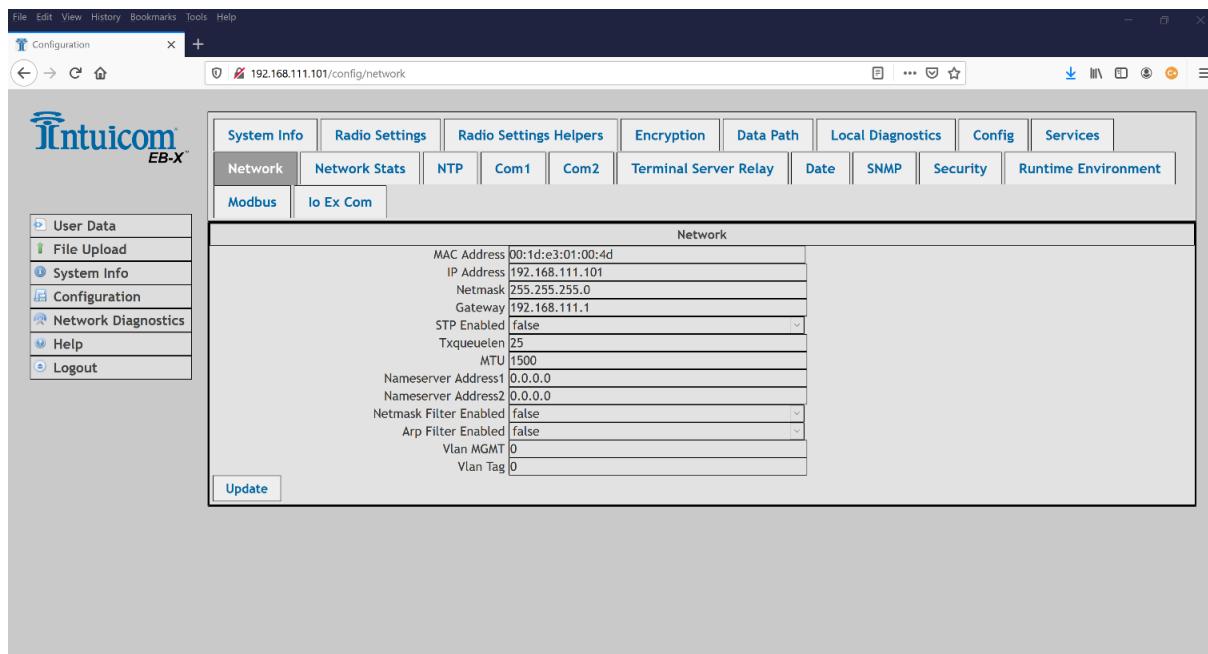
In the Vlan Tag field enter the numeric ID of the VLAN that you want to tag. Typically, this is set to the same ID that is defined in the Vlan MGMT setting.

WARNING: If you set either the Vlan MGMT or the Vlan Tag field, you will no longer be able to access the radio when directly plugged into the Ethernet Port. You will need to access the radio

through the micro-USB port outlined on pages 15 thru 19 of this manual. Once on the command line in the terminal window you will need to run three commands.

- 1) network.vlanMgmt=0
- 2) network.vlanTag=0
- 3) save

By setting the management vlan to zero and the vlan tag to zero you disable them. Once you have saved the settings to the EB-X you should be able to ping and log into the radio webpages by IP Address.



15 – Network Stats

The Network Stats webpage is a read only webpage, and must be refreshed to update the statistics displayed on this page. The following information provides a general overview of each line on the Network Stats webpage.

A – RX Bytes

The number of bytes received by the wireless interface.

B – RX Packets

The number of Ethernet packets received by the wireless interface.

C – RX Dropped

This line reports the number of Ethernet packets received by the wireless interface that were dropped by the Ethernet interface.

D – RX Errors

This line reports the number of Ethernet packets that were received by the wireless interface with errors.

E – TX Bytes

This line reports the number of Ethernet packets received by the Ethernet ports and sent out of the wireless link.

F – TX Packets

This line reports the number of Ethernet Packets received from the Ethernet ports and sent over the wireless link.

G – TX Dropped

This line reports the number of Ethernet packets received by the Ethernet ports but were dropped because the transmit queue is full.

H – TX Errors

This line displays the number of Ethernet packets received by the Ethernet ports that were in error.

16 – NTP

The NTP webpage provides the ability to set the time and date on the EB-X.

A – NTP Reference

The NTP Reference line can be set to “NETWORK_TIME_SERVER” or “REFCLK_LOCALCLK” from the drop-down menu. By Selecting “NETWORK_TIME_SERVER” the EB-X will synchronize its clock with a time server.

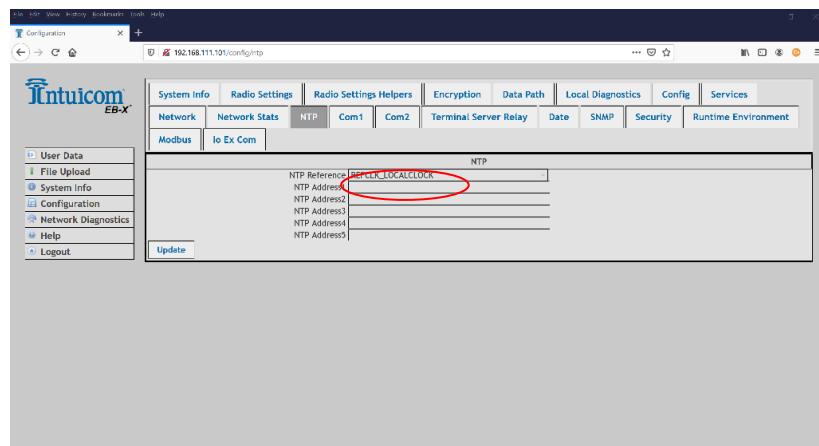
By selecting “REFCLK_LOCALCLK” you will need to enter the time manually into the EB-X.

B – NTP Address1-5

If you have a time server on your network, you can enter the IP Address of your local timeserver into the NTP-Address1 field. If you have multiple time servers on your network each of the IP Addresses can be entered into NTP Address1 thru 5.

If the EB-X radios on your network have access to the internet you can enter the URL “time.nist.gov” into the NTP Address1 line, and the EB-X will synchronize its time with the government time server.

The remaining NTP Address lines can be left blank, or you can enter 0.0.0.0 as an IP Address. Either setting will work for the unused address lines.

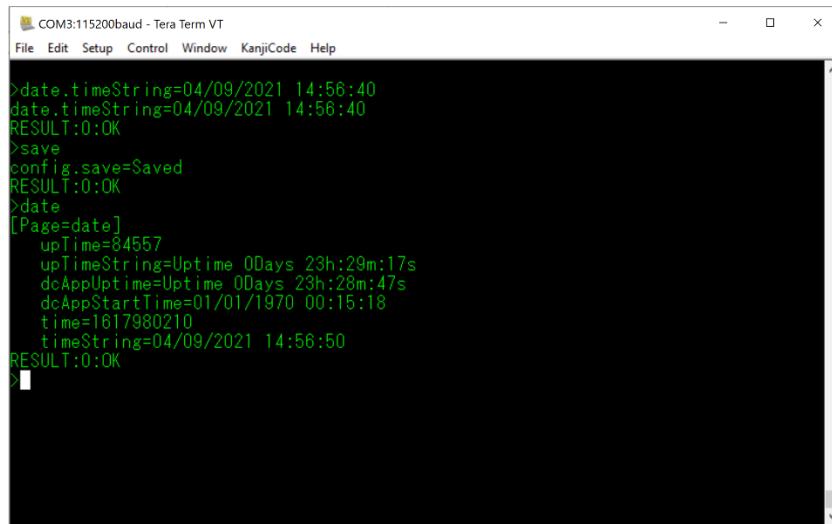


C – Manually Setting the Time

If you set the NTP Reference to “REFCLK_LOCALCLK” and update the settings. You will need to log into the terminal window and manually set the date and time on the EB-X. Terminal window access is explained on pages 15 thru 19 of this manual.

Once you have logged into the terminal window you will need to run the following command:

- 1) dateTimeString=MM/DD/YYYY HH:MM:SS
- 2) save



The screenshot shows a terminal window titled "COM3:115200baud - Tera Term VT". The window contains the following text:

```
>date.timeString=04/09/2021 14:56:40
date.timeString=04/09/2021 14:56:40
RESULT:0:OK
>save
config.save=Saved
RESULT:0:OK
>date
[Page=date]
  upTime=84557
  upTimeString=Uptime 0Days 23h:29m:17s
  dcAppUptime=Uptime 0Days 23h:28m:47s
  dcAppStartTime=01/01/1970 00:15:18
  time=1617980210
  timeString=04/09/2021 14:56:50
RESULT:0:OK
>
```

17 – Com Ports

The EB-X comes with two DB9 Serial Ports that can be configured in a variety of ways. Not all of the features are covered in this document. The following are the functions and a brief description of each follow below.

A) Mode

- a. RS232 – this is the only option available at this time in the webpage interface for the Serial Port Operation Mode. RS485 and RS422 are **NOT** available on the EB-X.

B) Handler

- a. ModbusRTU, ModbusPassthru, Setup, and Off – Not active at this time.
- b. CLI – When selecting this parameter, the Command Line Interface can be brought up by connecting a Terminal Emulator program to the COM port with the same Baud Rate, Data Bit, Parity, Stop Bit, and Flow Control settings that are set on the COM port configuration screen, and then hit enter to bring up the login prompt. Same terminal commands are used to display and program the radio through this interface that are used through the micro-USB port and SSH TCP/IP connections.
- c. Trace – Not covered in this document.
- d. Terminal Server – Set up is covered in sections below.

C) **Baud Rate** – This is the port speed designated in Kilobits per second.

D) **Data Bit** – Options are 7 and 8.

E) **Parity** – Options are None, Odd, and Even.

F) **Duplex** – Only available option is full, half duplex is not available on the EB-X because RS485 and RS422 are not available.

G) **Flow Control** – Options are Off, and Hardware.

NOTE: Baud Rate, Data Bit, Parity, Stop Bit, and Flow Control settings must match the settings on any serial device connected to the port for communications to be achieved.

H) **Delay Before SendingMS** – This is the programmed delay that the radio will observe before sending data out the COM port. Time is in milliseconds.

I) **Break Before Send Us** – this is the number of milliseconds that the radio will wait before sending a break command.

J) **Terminal Server Port** – Default for COM1 is 5041, and for COM2 is 5042. This is the TCP port number that TCP/IP devices will use to communicate with the device connected to the COM port.

K) **Terminal Server Time Out** – This is the amount of time the radio will wait with no traffic before dropping the connection to the COM port.

L) **Tx Bytes** – This is a read only parameter and shows the number of bytes transmitted out the COM port.

M) **Rx Bytes** – This is also a read only parameter and shows how many bytes are received by the COM port.

N) **Connection Drops** – Again a read only parameter showing how many times the connection to the COM port was dropped.

A – COM Port TCP/IP Communications Setup

To set up a TCP/IP to serial connection to a device connected to the Gateway radio or any of its Endpoints follow the instructions below.

Mode – Set to RS232

Handler – Terminal Server

Baud Rate, Data Bit, Parity, Stop Bit, Flow Control – Set to the same settings as the serial device connected to the COM port

Duplex – Set to Full

Delay Before Send MS – Set to default (0)

Break Before Send Us – Set to default (0)

Terminal Server Port – Set to default or whatever port the application being used requires it to be set for communications to be achieved

Terminal Server Time Out – Set to default (300)

If a Terminal Emulations program is being used to establish communications to a device or PC connected to the COM port it will need to be configured for RAW or Other data (not telnet or SSH), and set up for the IP Address of the radio and the Terminal Server Port set on the COM port settings in the EB-X configuration screen as described above.

Example: 192.168.111.100:5041 for COM 1

Verification of this connectivity can be achieved with our setup by running a Terminal Emulator Program with a DB9 to USB cable connected to COM1 on the Endpoint radio and to a USB port on the computer, as well as a Terminal Emulator Program running on the computer connected to the Ethernet port on the Gateway Radio.

With COM1 on the Endpoint radio set up with the settings shown below:

Baud Rate = 115200

Data Bit = 8

Parity = None

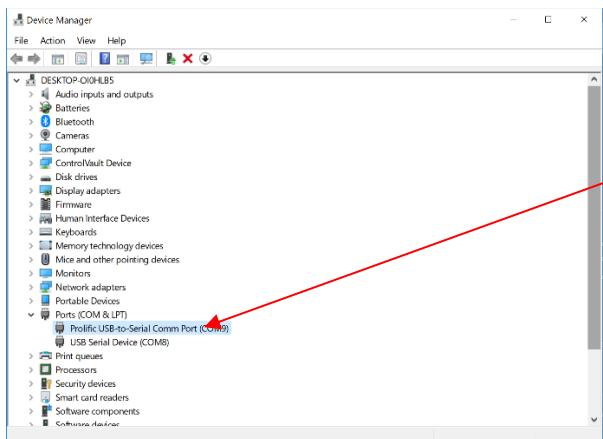
Stop Bit = 1

Flow Control = None

Plug in the USB to serial connector to an open USB port on the computer connected to the Endpoint radio, and connect the DB9 end to S1 port on the front of the radio.

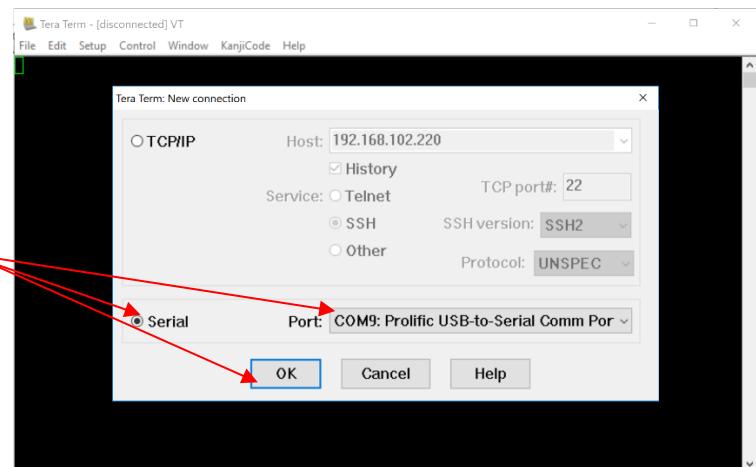
Open Device Manager and note what COM port the USB to Serial Adapter installed on.

Open Tera Term and click on File and New Connection and place the bullet in Serial and make sure the COM port where the adapter installed (see Device Manager for COM port number) is selected in the drop down next to the Serial selection, and click OK.

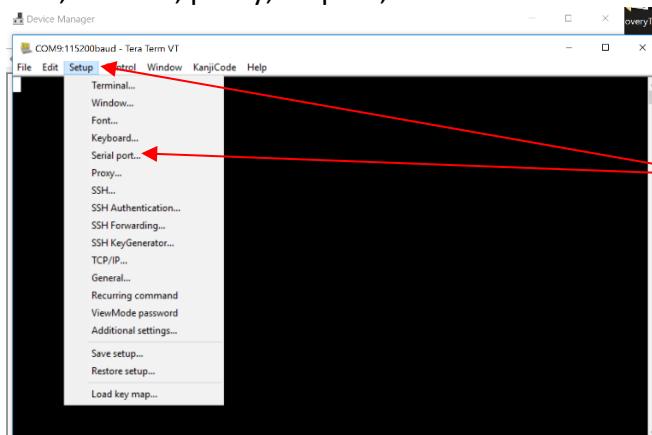


Open Device Manager and expand Ports (COM & LPT) option and note what COM port the USB to Serial Adapter installed itself on.

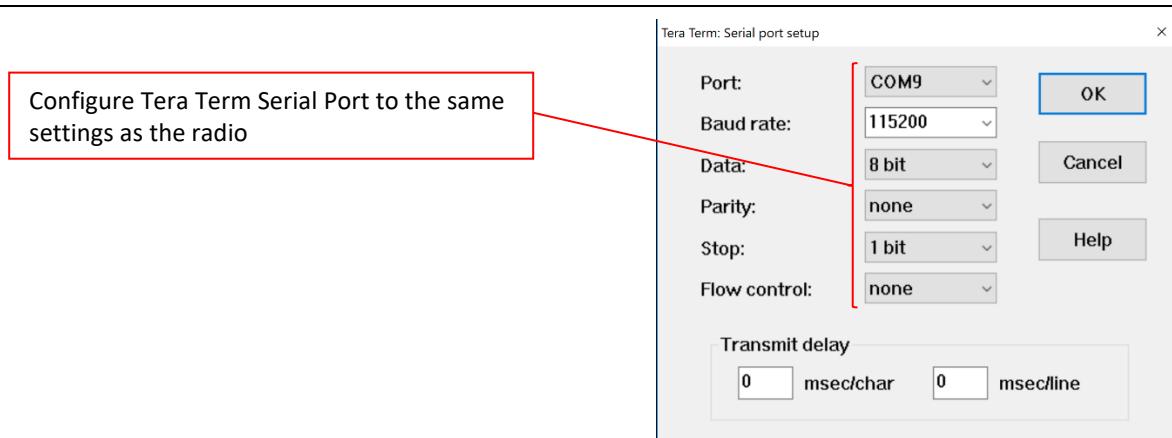
Open Tera Term and click File – New Connections.
Make sure the bullet is in Serial and the COM port where the USB to Serial adapter is installed is selected.
Click OK



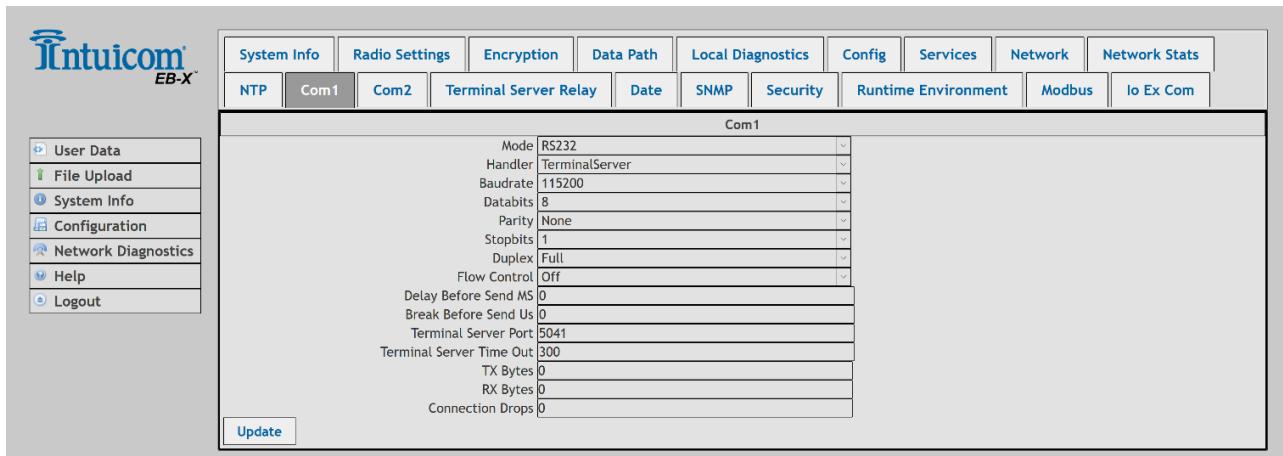
After you have selected the COM Port click on the Setup menu at the top of the Tera Term screen and select Serial Port from the drop-down menu. In the Serial Port configuration menu set the baud rate, data bit, parity, stop bit, and flow control to match the settings on the radio.



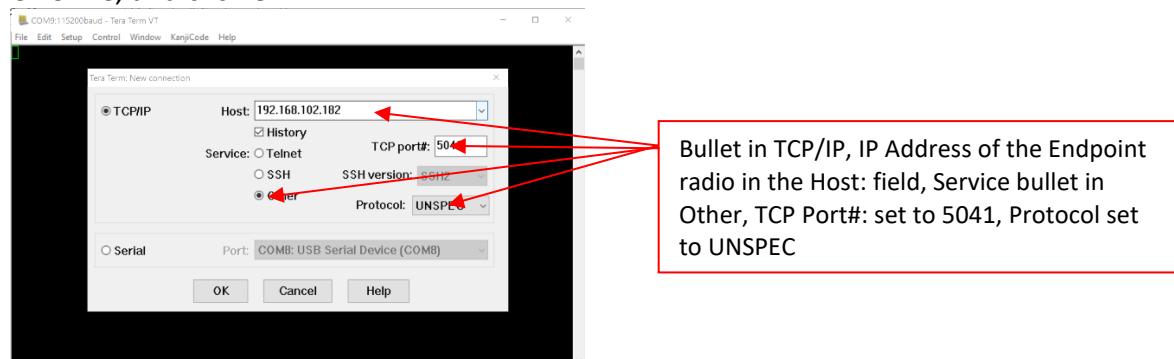
Click Setup and select Serial port... from the drop-down menu.



The EB-X COM1 screen should be configured as follows:



For the computer connected to the Gateway radio Ethernet port open Tera Term and click on File and select New Connection from the drop-down menu. In the New Connection window make sure the bullet is placed in the TCP/IP option, in the “Host:” line enter the IP Address of the Endpoint radio, make sure the Service has the bullet in “Other”, set the port to 5041, and the protocol to UNSPEC, and click OK.



Once the setup is complete you can type characters into the terminal window connected to the Endpoint and they will appear in the Tera Term window on the computer connected to the Gateway Ethernet Port.

If you type characters into the TCP/IP Terminal window connected to the Gateway you will have to hit the enter key to get them to appear in the Terminal window connected to the Endpoint.

NOTE: If you want the characters to appear in the Endpoint window without hitting the enter key you will need to edit the TERATERM.INI file. Locate it in the C:/Programs(x86)/Tera Term folder and double click, to open it – if it asks you for a program to open it in search and select either Notepad or Word Pad. Once the document opens type “Ctrl+F” to open the find window and search for “EnableLine Mode” and change the setting from

```
EnableLineMode=on  
To  
EnableLineMode=off
```

Click file and save and close the file and reopen Tera Term and reset up the TCP/IP connection and the characters will appear as you type them without having to hit enter key to send them.

B – Serial To Serial COM Port Setup

a – Terminal Server Relay

To achieve serial to serial connections with the EB-X radio you will need to enable the Terminal Server Relay function, along with the correct setup on the serial port.

For this example, we will be using COM1 on the radio. If you are using COM2 the same port setup will apply however, a different selection will be used for the Terminal Server Relay function.

Set up COM1 as:

```
Mode = RS232  
Handler = Terminal Server
```

Baud Rate, Data Bit, Parity, Stop Bit, and Flow Control will need to be set to the same settings as the device connected to the port.

Leave all the other settings default.

Complete this same setup on the Gateway and Endpoint radios or for all Endpoint radios.

Next Click on the tab in the configuration window for Terminal Server Relay, and on each of the radios (Gateway and all Endpoints) select the option:

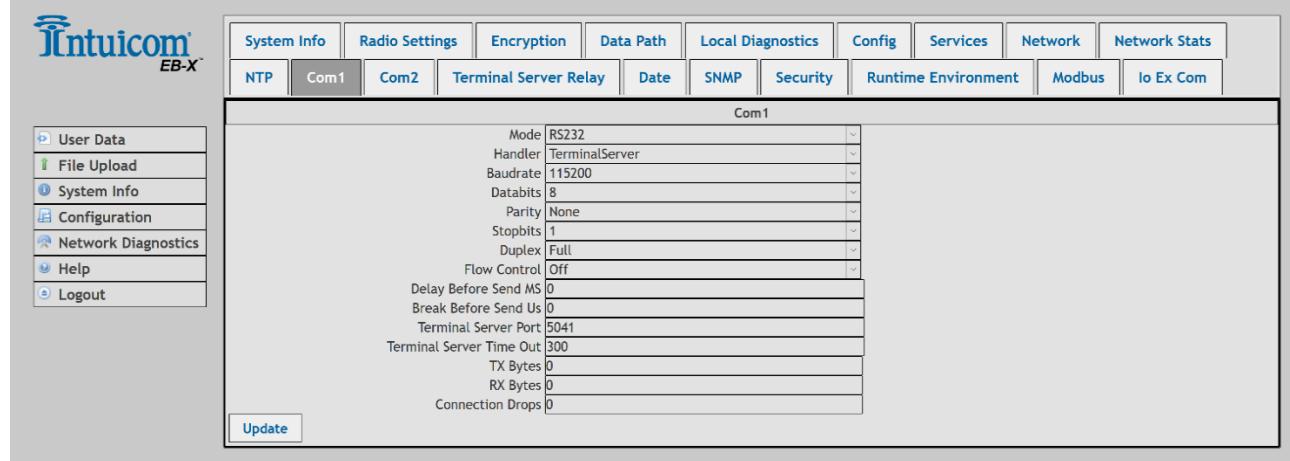
LOCAL_COM1_TO_REMOTE_COM1

In the Gateway Radio leave the Remote Termserv IP Address set to default (0.0.0.0).

For every Endpoint radio set the Remote Termserv IP Address to the IP Address of the Gateway Radio. Click Update to save the settings.

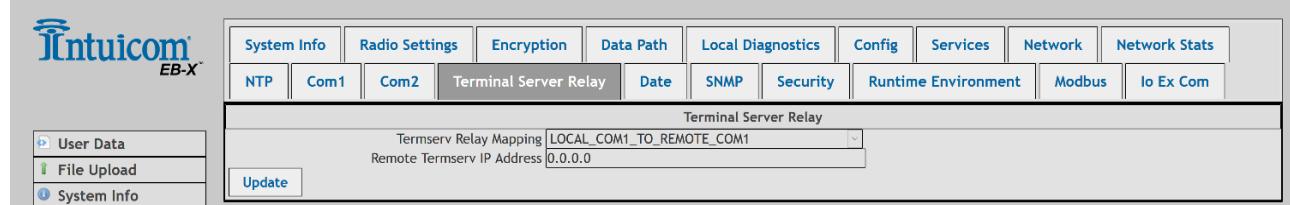
NOTE: If you are only running one Endpoint you can enter its IP Address in the Gateway Remote Termserv IP Address field, although it is not necessary.

Gateway and Endpoint COM1 Settings



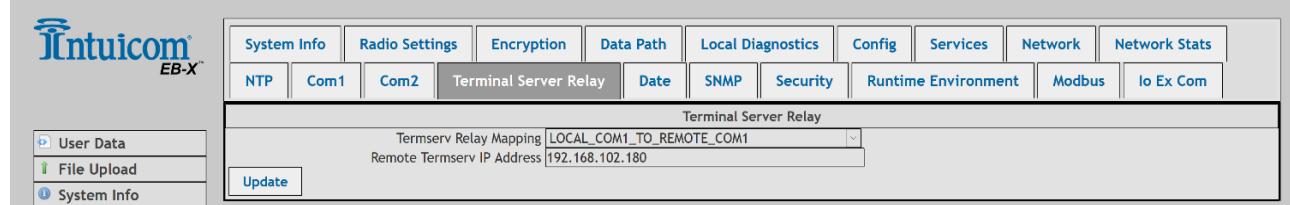
Com1	
Mode	RS232
Handler	TerminalServer
Baudrate	115200
Databits	8
Parity	None
Stopbits	1
Duplex	Full
Flow Control	Off
Delay Before Send MS	0
Break Before Send Us	0
Terminal Server Port	5041
Terminal Server Time Out	300
TX Bytes	0
RX Bytes	0
Connection Drops	0

Gateway Terminal Server Relay Configuration



Terminal Server Relay	
TermServ Relay Mapping	LOCAL_COM1_TO_REMOTE_COM1
Remote TermServ IP Address	0.0.0.0

Endpoint Terminal Server Relay Configuration



Terminal Server Relay	
TermServ Relay Mapping	LOCAL_COM1_TO_REMOTE_COM1
Remote TermServ IP Address	192.168.102.180

Data sent into COM1 on the Gateway will come out COM1 ports on all the Endpoints, and data sent to an Endpoint COM1 port will come out COM1 on the Gateway.

NOTE: The Baud Rate, Data Bit, Parity, Stop Bit, and Flow Control settings can differ from the Gateway to the Endpoints and on each Endpoint and communications will still run without errors or problems across the wireless links. The COM port settings on the radio are necessary for communications to the device connected to it but are not necessary for data sent across the wireless link.

With our setup communications can be checked by opening Tera Term window and connecting the computer at the Endpoint to S1 on the radio using a COM port or USB to Serial Adapter as explained on pages 53 thru 56 in this manual.

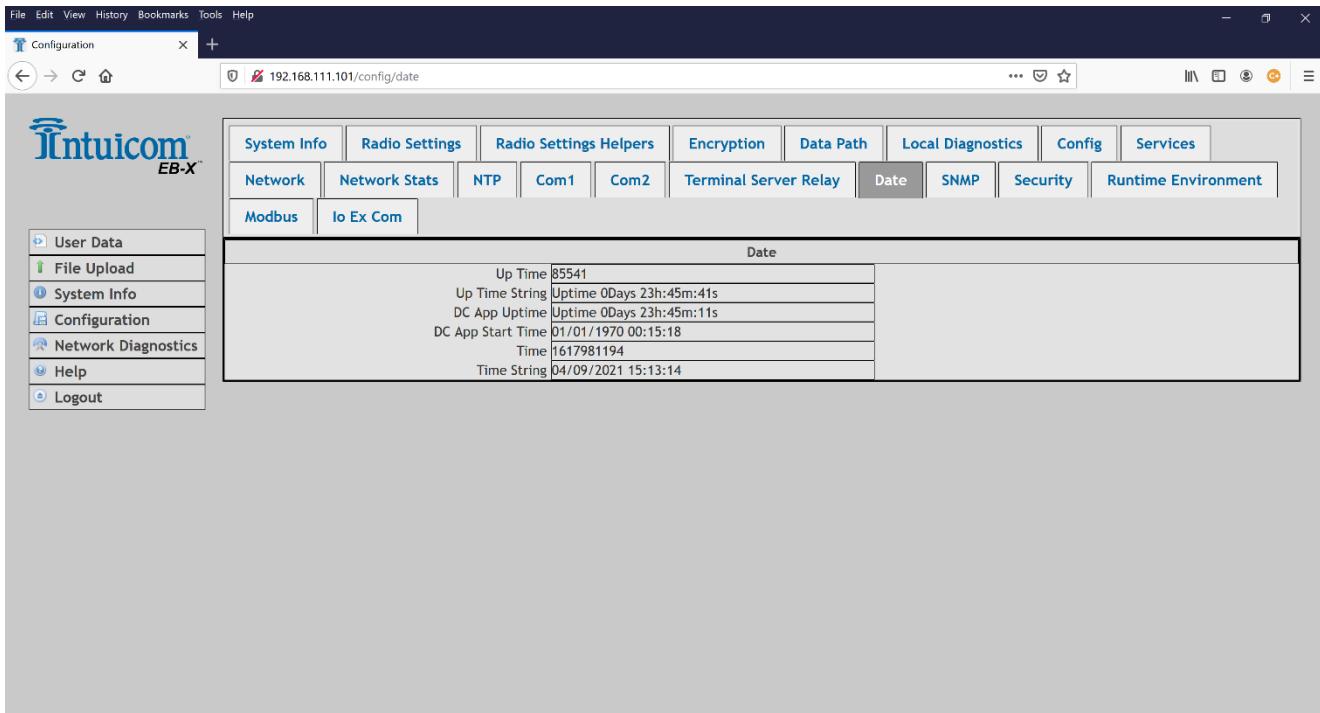
Follow the exact same instructions connecting the computer at the Gateway to port S1 on the radio. Configure Tera Term for the Gateway in the same manner as the Endpoint matching the settings on COM1 in the Gateway webpage.

Once the both computers are connected to S1 ports on the radios at both ends. Type characters in the terminal window connected to the Gateway and they will come out on the terminal window connected to the Endpoint. When typing in a terminal window connected to the Endpoint the characters will come out on the Gateway terminal window.

This will verify that you have serial to serial connections across the wireless link, and have correctly configured the serial ports, and terminal server web pages.

18 – Date

The Date webpage is read only. Setting the time and date on the EB-X is covered on pages 50 thru 51 of this manual.



The screenshot shows a web browser window with the following details:

- Header:** File, Edit, View, History, Bookmarks, Tools, Help.
- Title Bar:** Configuration (with a plus icon), 192.168.111.101/config/date.
- Toolbar:** Back, Forward, Stop, Refresh, Home, Address bar, Favorites, Help.
- Left Sidebar:** Intuicom EB-X logo, User Data, File Upload, System Info, Configuration, Network Diagnostics, Help, Logout.
- Top Navigation:** System Info, Radio Settings, Radio Settings Helpers, Encryption, Data Path, Local Diagnostics, Config, Services, Network, Network Stats, NTP, Com1, Com2, Terminal Server Relay, Date (highlighted in grey), SNMP, Security, Runtime Environment, Modbus, Io Ex Com.
- Content Area:** A table titled "Date" containing the following data:

Up Time	85541
Up Time String	Uptime 0Days 23h:45m:41s
DC App Uptime	Uptime 0Days 23h:45m:11s
DC App Start Time	01/01/1970 00:15:18
Time	1617981194
Time String	04/09/2021 15:13:14

19 – SNMP

The EB-X has support for SNMP versions 1, 2c, and 3. Some of the settings must be accomplished via the command line interface. Instructions on how to access the command line for the EB-X can be found on pages 15 thru 19 of this manual.

A – SNMP V1

The first line on the SNMP webpage is “V1 Enabled”. To enable SNMP version one, from the drop-down menu select “true” and click update. To disable SNMP version one, from the drop-down menu select “false” and click update.

B – SNMP V2C

The second line of the SNMP webpage is “V2C Enabled”. To enable SNMP V2C, select “true” from the drop-down menu, and to disable it select “false”. Click “Update” to save your settings.

C – SNMP V3

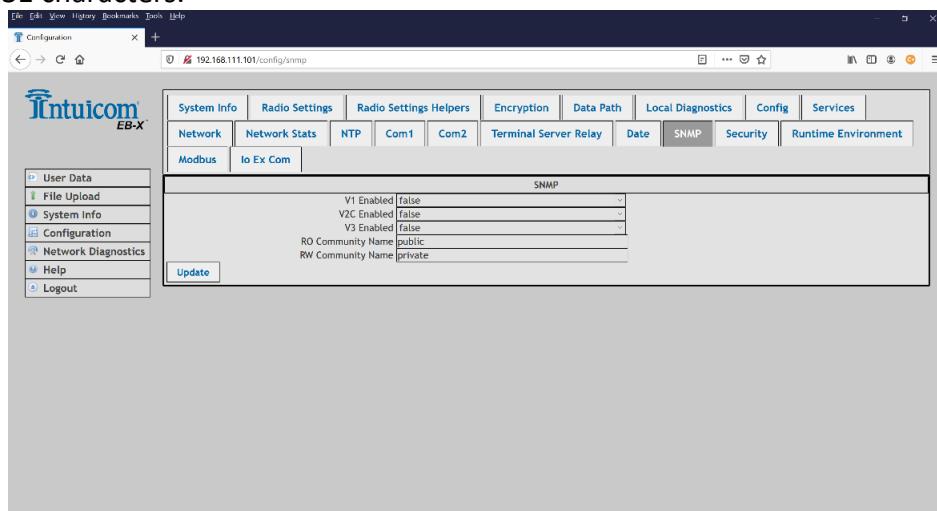
The third line of the SNMP webpage is “V3 Enabled”. To enabled SNMP V3 select “true” from the drop-down menu, and to disable it select “false”. Click “Update” to save your settings.

D – RO Community Name

On the fourth line of the SNMP webpage, to set the Read Only community name, type in the name of the read only community you are using with your SNMP deployment, and click “Update” to save your settings. By default, the Read Only Community name is set to “public”, and has a maximum of 31 characters.

E – RW Community Name

On the last line of the SNMP webpage, the Read Write community name can be set. Enter the name of the Read Write community you are using with your SNMP deployment and click “Update” to save your settings. By default, the Read Write Community name is set to “private”, and has a maximum of 31 characters.



F – CLI SNMP Useful Commands

The following are a list of commands that may be needed when configuring or modifying SNMP Settings. These are Command Line Interface commands and are not available on the webpage.

a – View Users

snmpUser=show

b – Remove User

snmpUser=remove <username>

c – Add User

snmpUser=add <username>

d – Modify User

snmpUser=modify <username>

i – Add or Modify Options

For AES Encryption and Passphrase – AES <passphrase>

For DES Encryption and Passphrase – DES <passphrase>

For MD5 Authentication and Passphrase – MD5 <passphrase>

For SHA Authentication and Passphrase – SHA <passphrase>

For Read Only access – ReadOnly

For Read Write access – ReadWrite

ii – Examples

snmpUser=add Bob AES bobspassword

snmpUser=modify Bob ReadWrite

NOTE: Meta Information Base can be found in Appendix G of this manual.

20 – Security

The Security webpage has two settings available; these are explained below.

A – Enable PTP Interface

To enable the PTP Interface, from the drop-down menu select “true”, and to disable it select “false”, click “Update” to save the setting. By default, the PTP Interface is enabled.

When the PTP Interface is enabled the EB-X appears in Windows Explorer as drive with the radio serial number. Opening the drive will display the files present in the EB-X.

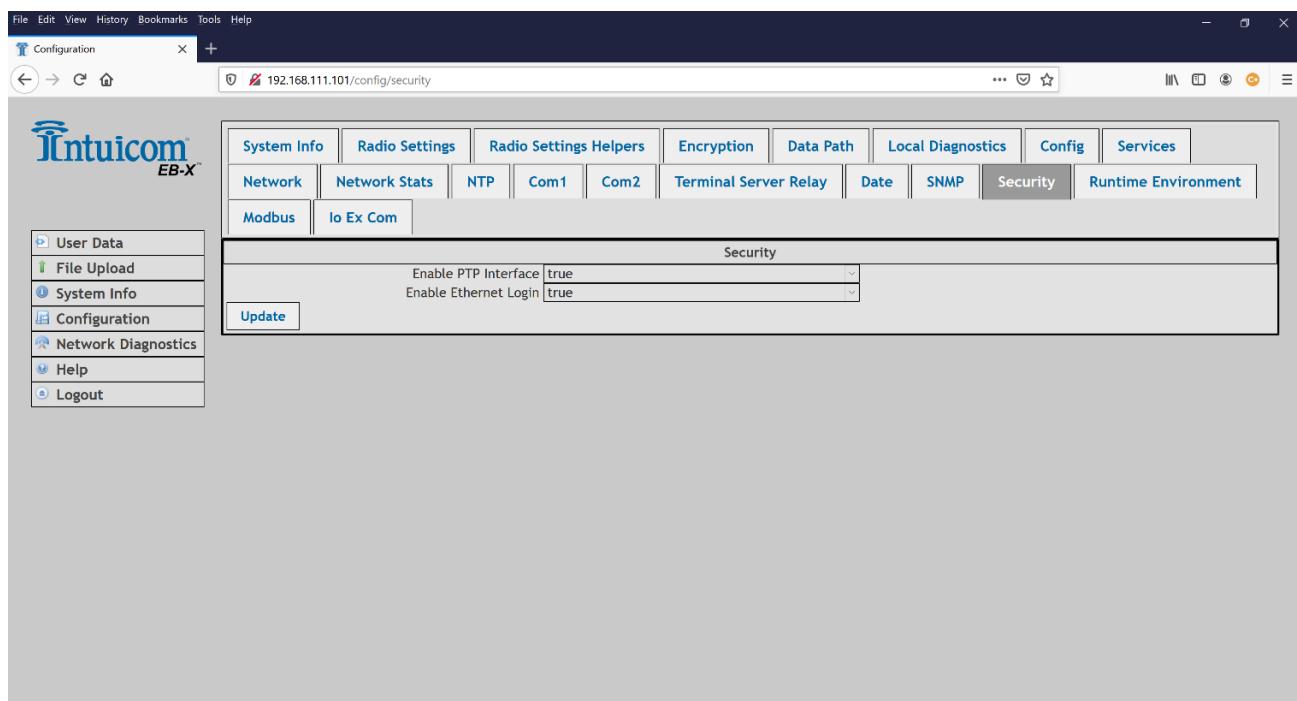
When the PTP Interface is disabled the EB-X will no longer appear in Windows Explorer as drive with the unit serial number.

NOTE: Disabling PTP Interface will not prevent serial connections through the micro-USB connection on the front of the EB-X. See page 9 for location of micro-USB connection.

B – Enable Ethernet Login

To enable SSH Ethernet login to the terminal window select “true” from the drop-down menu, to disable it select “false” from the drop-down menu. Click “Update” to save your settings.

By default “Enable Ethernet Login” is set to “true” and SSH logins are allowed. Once this setting is changed to “false” SSH terminal login will no longer be available.



21 – Runtime Environment

This is a read only webpage that provides information specific to the Linux Runtime Environment.

A – Rte Version

The first line on the webpage reports the version number for the active IQ application environment. If this setting is blank the application has not been initialized.

B – Rte Template Version

The second line reports the version number for the template IQ application environment. This is the application environment applied when executing the command on the CLI “rteReset=hard”.

C – Rte Installed By Apps Version

The third line reports the version of the firmware used to install the IQ runtime application environment. The firmware that installed the IQ runtime application environment may be different version than the application environment itself.

D – Additional Runtime Environment Commands

On the CLI the command “runtimeEnvironment.rteReset” setting designates the upgrade or reset of the IQ runtime environment. The available tags are:

a – Cancel

runtimeEnvironment.rteReset=Cancel – is used to remove the rteReset=Hard command BEFORE the next boot of the EB-X.

b – Hard

runtimeEnvironment.rteReset=Hard – is used to completely reset the file system of the runtime application environment to match the latest installed developer package.

This will stage the development runtimeEnvironment to be applied on the next reboot.

The runtime application environment takes place at the time of next boot.

WARNING: ALL User-generated content and settings in the IQ ARE DELETED after the next reboot.

c – Now

runtimeEnvironment.rteReset=Now – This reboots the EB-X and copies the Linux application runtime environment into the runtime locations.

This will take 3 to 4 minutes to complete.

The screenshot shows a web browser window for the Intuicom EB-X configuration interface. The URL is 192.168.111.101/config/runtimeEnvironment. The top navigation bar includes File, Edit, View, History, Bookmarks, Tools, and Help. A Configuration tab is selected. The main menu has tabs for System Info, Radio Settings, Radio Settings Helpers, Encryption, Data Path, Local Diagnostics, Config, Services, Network, Network Stats, NTP, Com1, Com2, Terminal Server Relay, Date, SNMP, Security, and Runtime Environment. The Runtime Environment tab is active. On the left, there's a sidebar with User Data, File Upload, System Info, Configuration, Network Diagnostics, Help, and Logout. The central content area is titled 'Runtime Environment' and displays the following information:

Rte Version	EB-X1122TP.16
Rte Template Version	EB-X1122TP.16
Rte Installed By Apps Version	EB-X1122TB.66

22 – Modbus

The Modbus webpage provides three settings in order to program the EB-X to function in a Modbus setup.

A – Modbus Device ID

On this line enter the Modbus Device ID, and click “Update” to save the setting. Options are 1 thru 247 for device IDs.

This parameter designates the Modbus device ID the local device responds to during a modbus TCP request over the network, or a modbus RTU over TCP request coming via COM1 or COM2.

B – Modbus TCP

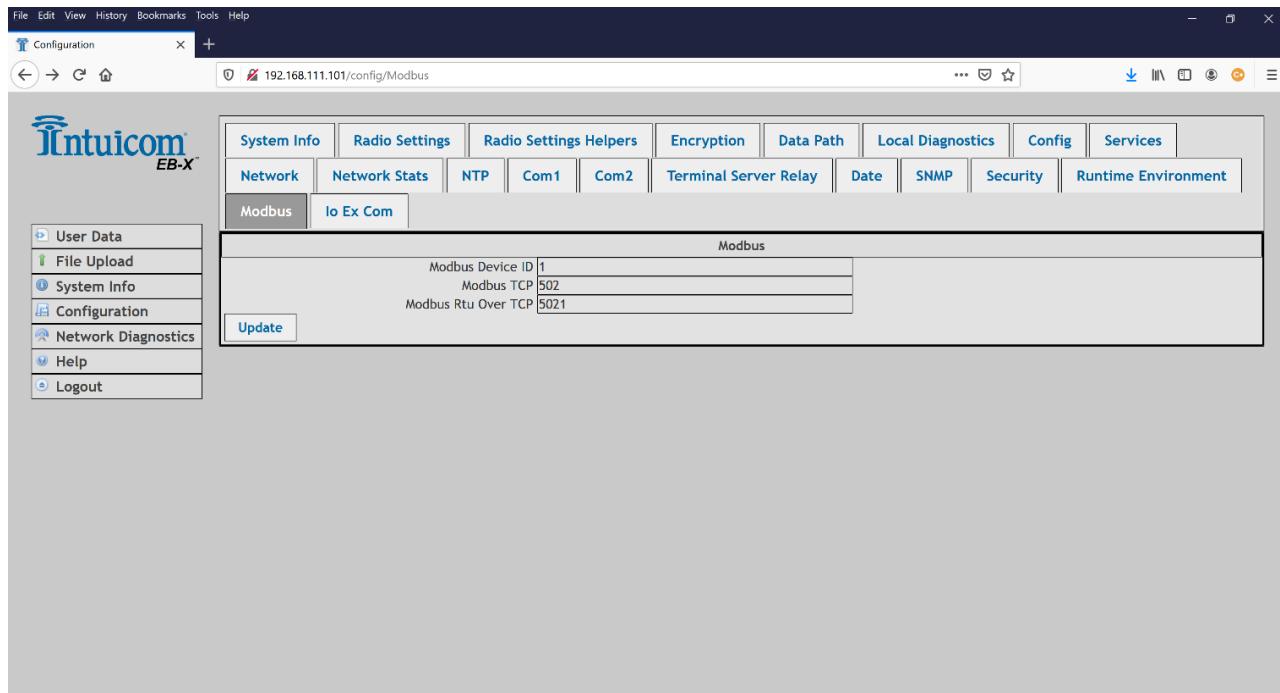
On this line enter the TCP port used for Modbus TCP requests, click “Update” to save the setting. Options are 0 to 65535.

This is the parameter that designates the TCP port used for Modbus TCP requests. By default it is set to the standard Modbus TCP port 502. Setting the port to 0 will disable Modbus TCP.

C – Modbus Rtu Over TCP

On this line enter the TCP port used for Modbus RTU over TCP, click “Update” to save the setting.

This parameter designates the TCP port that will be used for Modbus RTU (serial Modbus) TCP requests.



D – Additional Modbus Commands

On the CLI interface (see pages 15 thru 19 on how to access the CLI or Terminal Window interface), the following commands are used for additional Modbus information or configuration.

a – Modbus Layout

modbus.modbusLayout is a read only command and will display the Modbus map for the local device.

Example

```
>modbusLayout
radioSettings.radioMode type:uint32_t Protocol
address:31001 Number registers:2 Modbus FC:4 Address:1000
radioSettings.rfDataRate type:uint32_t Protocol
address:31003 Number registers:2 Modbus FC:4 Address:1002
radioSettings.radioMaxRepeaters type:uint32_t Protocol
address:31005 Number registers:2 Modbus FC:4 Address:1004
...
rfStats.DownRateAvg2 type:double Protocol address:32121
Number registers:4 Modbus FC:4 Address:2120
RESULT:0:OK
>
```

b – Modbus Read

modbus.read is a read only command and it creates a Modbus request from the CLI.

Command Options are:

- Bool
- Byte
- FloatABCD
- FloatBADC
- FloadCDAB
- Fload DCBA
- IntABCD
- IntBADC
- IntCDAB
- IntDCBA
- LongABCD
- LongBADC
- LongCDAB
- LongDCBA
- Raw
- Unsigned
- Signed

Example

```
>read --srcId=1 --srcAddress=1000 --srcFc=FC4 --
type=longABCD --numElements=4
```

```
Id:1 Fc:4 Address: 1000 Type: LongABCD Value: 0
Id:1 Fc:4 Address: 1002 Type: LongABCD Value: 4000000
Id:1 Fc:4 Address: 1004 Type: LongABCD Value: 0
Id:1 Fc:4 Address: 1006 Type: LongABCD Value: 1
RESULT:0:OK
>
```

c – Modbus Read Coils

modbus.readCoils parameter creates a Modbus request to read coils from the CLI

Example

```
>readCoils --srcId=1 --srcAddress=100 --srcFc=FC1 --
numElements=4
Id:1 Fc:1 Address: 100 Value: 1
Id:1 Fc:1 Address: 101 Value: 1
Id:1 Fc:1 Address: 102 Value: 1
Id:1 Fc:1 Address: 103 Value: 1
RESULT:0:OK
```

d – Modbus Write

modbus.write creates a Modbus write request from the CLI to write to a holding register.

Command Options are:

- Bool
- Byte
- FloatABCD
- FloatBADC
- FloadCDAB
- Fload DCBA
- IntABCD
- IntBADC
- IntCDAB
- IntDCBA
- LongABCD
- LongBADC
- LongCDAB
- LongDCBA
- Raw
- Unsigned
- Signed

Example

```
>write --srcId=1 --srcAddress=100 --type=intabcd --
value=1024
RESULT:0:OK
```

e – Modbus Write Coils

modbus.writeCoils – creates a Modbus write request from the CLI to write to the coils.

Example

```
>writeCoils --srcId=1 --srcAddress=100 --value=0x55 --
numElements=4
RESULT:0:OK
```

E – Modbus Use Cases

The Modbus feature allows for radio diagnostics and radio settings to be read via Modbus.

Settings are read only.

The three methods of connecting to the radio are:

- Modbus TCP
- Modbus RTU over TCP
- Modbus RTU using COM1 or Modbus RTU using COM2

Serial ports COM1 or COM2 can be configured for Modbus pass thru.

This will take any request that comes in through any one of the three methods and convert it to a serial Modbus RTU request. This request is sent out the configured serial port to a serial Modbus device.

This allows the EB-X to act as a Modbus TCP to serial Modbus gateway.

F – Connecting to Device via Modbus**a – Modbus TCP**

Steps

- 1) On the EB-X connect to port 502.
- 2) Use the Modbus TCP Protocol.
- 3) Use the CLI or webpage to change the port from 502 if needed.

b – Modbus RTU over TCP

Steps

- 1) On the EB-X connect to port 5021
- 2) Use the Modbus RTU Protocol.
- 3) Use the CLI or webpage to change the port from 5201 if needed.

c – Modbus RTU using COM1

Steps

- 1) Connect the Modbus device to S1 or COM1 serial port.
- 2) Configure the COM port parameters to match the Modbus Serial RTU device.
- 3) Change COM1 handler to ModbusRTU
- 4) Send in Modbus requests via COM1.

d – Modbus RTU using COM2

Steps

- 5) Connect the Modbus device to S2 or COM2 serial port.
- 6) Configure the COM port parameters to match the Modbus Serial RTU device.
- 7) Change COM2 handler to ModbusRTU
- 8) Send in Modbus requests via COM2.

G – Reading Local Diagnostics and Radio Settings using Modbus

Set the local Modbus Device ID on the Modbus webpage line 1, click update to save the setting.

a – Reading from an External Modbus RTU Serial Device using COM1

Steps

- 1) Connect the device to the COM1 or S1 serial port.
- 2) Configure the COM1 to match the device settings baud rate, data bit, etc.
- 3) Change the COM1 handler to ModbusPassThru.

NOTES:

- Incoming requests that are not for the local EB-X device or for the IOEX are sent out COM1
- Responses are returned out the port that the request came in on.
- The protocol is converted from Modbus TCP to Modbus RTU and back when necessary.

b – Reading from the External Modbus RTU Serial Device using COM2

Steps

- 1) Connect the device to COM2 or S2 serial port
- 4) Configure the COM2 to match the device settings baud rate, data bit, etc.
- 5) Change the COM2 handler to ModbusPassThru.

NOTES:

- Incoming requests that are not for the local EB-X device or for the IOEX are sent out COM2
- Responses are returned out the port that the request came in on.
- The protocol is converted from Modbus TCP to Modbus RTU and back when necessary.

23 – IO Ex Com

The IO Ex Com webpage is used to set the device ID for the use of the EB-X in a SCADA input output setup. This feature is not yet available on the EB-X.

A – IO Ex Device ID

Enter the device ID (1 – 247) and click “Update” to save the setting.

NOTE: The EB-X at this time is not programmed for use with Input Output SCADA modules so there is no need to set this parameter.

24 – Repeater setup

On any EB-X wireless network you can only have one Gateway. It can be set up as a Gateway_Repeater or a Gateway, but no matter how the Gateway is configured there can only be one of them on the network.

Two Gateway options are available in the EB-X radio. These options are Gateway, and Gateway_Repeater.

Gateway setting is used for a typical wireless network where communications is needed from the Gateway to all Endpoints and Endpoints to the Gateway.

As stated in the Radio Settings section of this document, if the Endpoint radios can pick up the signal from each other they will communicate with each other. In a wireless network where all the Endpoints can pick up on the signal from each other. A Gateway is not necessary as all radios can be set as Endpoints. If you want to use the Network Diagnostics webpage on the EB-X you will have to set up one of the radios as a Gateway and run the Network Diagnostics when connected to the Gateway, because the Network Diagnostics page will not run on an Endpoint radio.

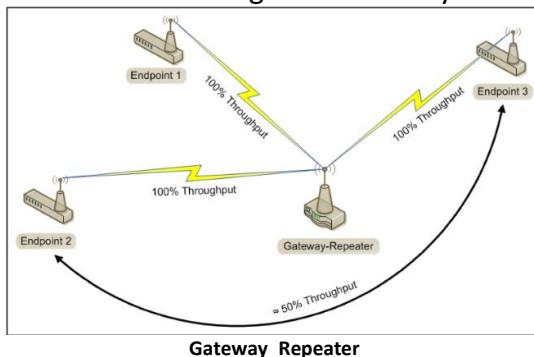
If Endpoints cannot pick up the signal from each other, then the Gateway radio will have to be set up as a Gateway_Repeater so that it will repeat the signal from Endpoint to Endpoint, and provide communications from Endpoint to Endpoint through the Gateway Radio.

If an Endpoint cannot pick up the signal from the Gateway, the closest Endpoint to it, that it can pick up a signal from the further away Endpoint, and also has Gateway communications, will need to be set up as an Endpoint_Repeater. This will allow the Endpoint that cannot pick up a signal from the Gateway to establish communications to the Gateway radio through the Endpoint_Repeater.

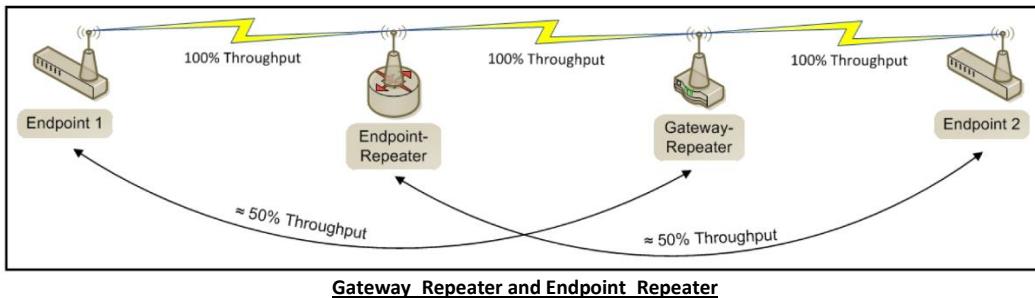
NOTE: When using a Gateway_Repeater or an Endpoint_Repeater a loss of bandwidth or throughput will be experienced. The diagrams on the next page show network topology and the loss of throughput for the different links.

Gateway_Repeater Network

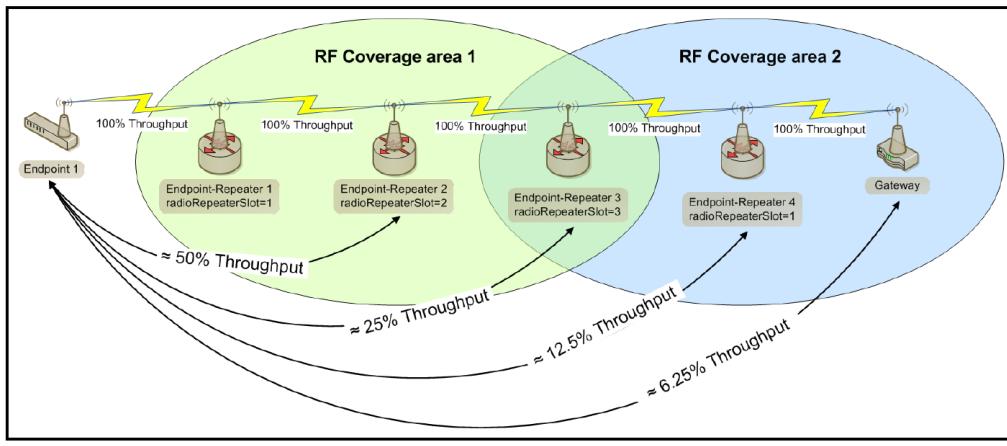
In the diagram below the Endpoints cannot pick up the wireless signal from each other. So, they have to establish communications to each other through the Gateway.



In the diagram below Endpoint 1 cannot pick up the signal from the Gateway_Repeater but it can pick up the signal from the Endpoint_Repeater. Gateway_Repeater provides communications between both Endpoints and the Endpoint_Repeater.



In this diagram multiple Endpoint_Repeaters and the radio repeater slot settings are shown. Note the loss of throughput to the Gateway when multiple repeaters are used.



A – Repeater Settings

Images below show the settings for a simple 1 repeater wireless network with Endpoints connected to the Endpoint_Repeater and directly to the Gateway_Repeater. These are the settings for the second diagram on the previous page labeled “Gateway_Repeater and Endpoint_Repeater”.

a – Hopping Off

The first examples are for a wireless network with hopping set to off. When hopping is off, there is no Radio Max Repeaters setting available on the Gateway, and no Repeater Slot setting available on the Endpoint_Repeater, as they are not needed when hopping is off. A data Rate of 500K is used, Network ID 2019, at 915.000 MHz frequency

Gateway_Repeater Settings

Intuicom EB-X

System Info		Radio Settings		Encryption		Data Path		Local Diagnostics		Config		Services		Network		Network Stats	
NTP	Com1	Com2	Terminal Server Relay	Date	SNMP	Security									Modbus	Io Ex Com	
Radio Settings																	
Radio Mode: Gateway_Repeater RF Data Rate: RATE_500K TX Power: min Network ID: 2019 Radio Frequency: 915.0000 Radio Hopping Mode: Hopping_Off LNA Bypass: 0 Max Link Distance In Miles: 12																	
Update																	

Endpoint_Repeater Setting

Intuicom EB-X

System Info		Radio Settings		Encryption		Data Path		Local Diagnostics		Config		Services		Network		Network Stats	
NTP	Com1	Com2	Terminal Server Relay	Date	SNMP	Security									Modbus	Io Ex Com	
Radio Settings																	
Radio Mode: Endpoint_Repeater RF Data Rate: RATE_500K TX Power: min Network ID: 2019 Node ID: 1196 Radio Frequency: 915.0000 Radio Hopping Mode: Hopping_Off LNA Bypass: 0 Max Link Distance In Miles: 12																	
Update																	

Endpoint1 Settings – Connected to the Repeater

Intuicom EB-X

System Info		Radio Settings		Encryption		Data Path		Local Diagnostics		Config		Services		Network		Network Stats	
NTP	Com1	Com2	Terminal Server Relay	Date	SNMP	Security									Modbus	Io Ex Com	
Radio Settings																	
Radio Mode: Endpoint RF Data Rate: RATE_500K TX Power: min Network ID: 2019 Node ID: 1197 Radio Frequency: 915.0000 Radio Hopping Mode: Hopping_Off LNA Bypass: 0 Max Link Distance In Miles: 12																	
Update																	

Endpoint2 Settings – Connected to Gateway_Repeater

Intuicom EB-X

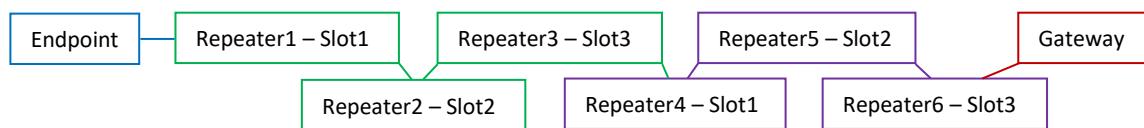
System Info		Radio Settings		Encryption		Data Path		Local Diagnostics		Config		Services		Network		Network Stats	
NTP	Com1	Com2	Terminal Server Relay	Date	SNMP	Security									Modbus	Io Ex Com	
Radio Settings																	
Radio Mode: Endpoint RF Data Rate: RATE_500K TX Power: min Network ID: 2019 Node ID: 1198 Radio Frequency: 915.0000 Radio Hopping Mode: Hopping_Off LNA Bypass: 0 Max Link Distance In Miles: 12																	
Update																	

NOTE: The only difference between the Endpoint connected to the Repeater and the Endpoint connected to the Gateway_Repeater is the node ID. These must be different on every radio on the network.

b – Hopping On

When hopping is on the Radio Max Repeaters setting is available and it must be set to the number of repeaters on the network with a Maximum of 3.

If there are more than 3 repeaters on the network set it to 3, arrange the repeaters in the network with the repeater programmed to slot 1 closest to the Endpoint, and sequentially number the repeaters from the Endpoint 1,2,3, and after 3 repeat the slot number of 1,2,3 in order again if needed. Example below:



Again, make sure each radio on the network has a unique Node ID, and Network ID matches across all radios connected to the Gateway or Gateway_Repeater. This example like the one above uses the mode of RATE_500K, Network ID 2019, and hopping is on.

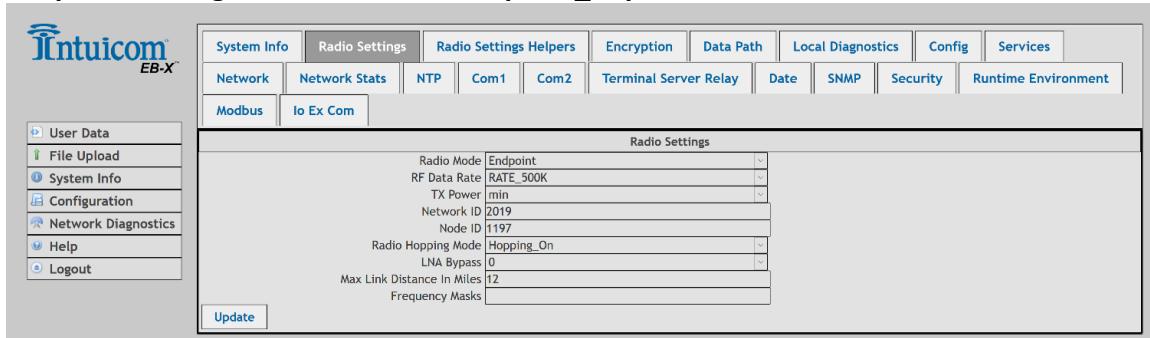
Gateway_Repeater Settings

System Info		Radio Settings		Radio Settings Helpers		Encryption		Data Path		Local Diagnostics		Config		Services																							
Network		Network Stats		NTP		Com1		Com2		Terminal Server Relay		Date		SNMP		Security		Runtime Environment																			
Modbus		Io Ex Com																																			
User Data		File Upload		System Info		Configuration		Network Diagnostics		Help		Logout		Radio Mode: Gateway_Repeater		RF Data Rate: RATE_500K		Radio Max Repeaters: 1		TX Power: min		Network ID: 2019		Frequency Key: Key0		Radio Hopping Mode: Hopping_On		Beacon Interval: FOUR_HUNDRED_MS		Beacon Burst Count: 3		LNA Bypass: 0		Max Link Distance In Miles: 12		Frequency Masks: [empty]	
<input type="button" value="Update"/>																																					

Endpoint_Repeater Settings

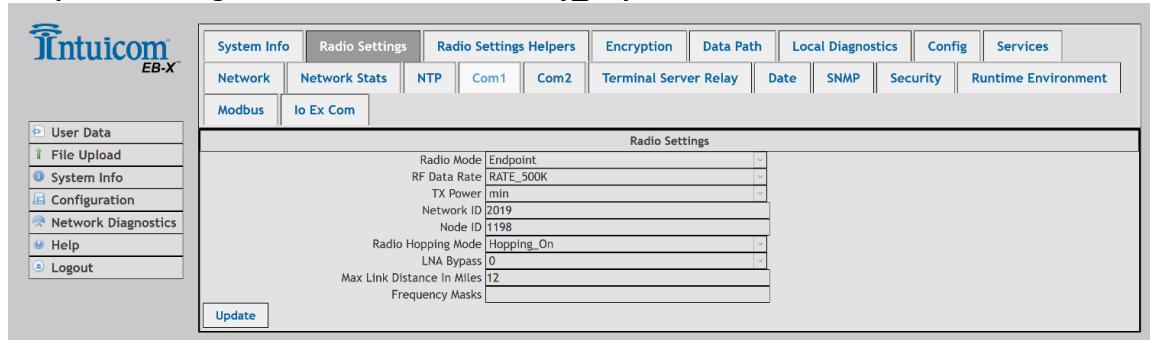
System Info		Radio Settings		Radio Settings Helpers		Encryption		Data Path		Local Diagnostics		Config		Services																							
Network		Network Stats		NTP		Com1		Com2		Terminal Server Relay		Date		SNMP		Security		Runtime Environment																			
Modbus		Io Ex Com																																			
User Data		File Upload		System Info		Configuration		Network Diagnostics		Help		Logout		Radio Mode: Endpoint_Repeater		RF Data Rate: RATE_500K		Radio Repeater Slot: 1		TX Power: min		Network ID: 2019		Node ID: 1196		Radio Hopping Mode: Hopping_On		Beacon Interval: FOUR_HUNDRED_MS		Beacon Burst Count: 3		LNA Bypass: 0		Max Link Distance In Miles: 12		Frequency Masks: [empty]	
<input type="button" value="Update"/>																																					

Endpoint Settings – Connected to Endpoint_Repeater



The screenshot shows the Intuicom EB-X web interface. The top navigation bar includes tabs for System Info, Radio Settings, Radio Settings Helpers, Encryption, Data Path, Local Diagnostics, Config, and Services. Under Radio Settings, sub-tabs include Network, Network Stats, NTP, Com1, Com2, Terminal Server Relay, Date, SNMP, Security, and Runtime Environment. The sub-menu on the left lists User Data, File Upload, System Info, Configuration, Network Diagnostics, Help, and Logout. The main content area displays the Radio Settings configuration page. The Radio Mode is set to "Endpoint". Other settings include RF Data Rate (RATE_500K), TX Power (min), Network ID (2019), Node ID (1197), Radio Hopping Mode (Hopping_On), LNA Bypass (0), Max Link Distance In Miles (12), and Frequency Masks. A blue "Update" button is at the bottom.

Endpoint Settings – Connected to Gateway_Repeater



This screenshot is identical to the one above, showing the Intuicom EB-X web interface for an Endpoint connected to a Gateway_Repeater. The Radio Settings page shows the same configuration parameters: Radio Mode set to "Endpoint", RF Data Rate (RATE_500K), TX Power (min), Network ID (2019), Node ID (1198), Radio Hopping Mode (Hopping_On), LNA Bypass (0), Max Link Distance In Miles (12), and Frequency Masks. The "Update" button is also present.

c – Route Minimum Signal Margin Settings

On the Data Path webpage, the 5th setting from the top of the page is “Route Min Signal Margin”. This is the setting that you will use dictate the route through a repeater network. In cases where the Endpoints cannot pick up a signal from any other radio on the network, this setting can be set to -4 dB. In cases where the Endpoint can pick up a signal from another Endpoint or Endpoint_Repeater it will be necessary to set this value.

Allowable values in this field are: -5 to 60.

You will need to remember we are dealing with margin, and margin is the difference from the Noise Floor or Receiver Sensitivity (whichever is stronger) to Signal Strength.

d – Suggested procedure for setting the - Route Min Signal Margin

- 1) Power off all the radios on the network besides the repeater where you want the Endpoint to connect, and the Endpoint.
- 2) At either the Endpoint or the Endpoint_Repeater log into the radio through the Ethernet port, and select the Local Diagnostics web page.
- 3) Bring up the Windows Command prompt and ping the IP Address of the remote radio. (Make sure it is connected), and make sure the link light on the front of the radio has a solid green light. See page 9 for location.
- 4) Take a look at the Local Diagnostics web page.
- 5) Note the Signal Strength and Margin.
- 6) Power off the Endpoint_Repeater and power on the next closest radio to the Endpoint.

- 7) If you do not get a link light to the next closest radio, set the Route Min Signal Margin to -4 on both the Endpoint and the Endpoint_Repeater, and leave it.
- 8) If you do get a link light to the next closest radio to the Endpoint_Repeater. Bring up Windows Command prompt and ping the remote radio, if you can ping it. Log into your local radio and bring up the Local Diagnostics page, and note the signal strength and margin.
- 9) Margin to the further away radio will be less than the margin to the closest radio, because the receiver sensitivity remains the same, but the signal is weaker, so the number will be less than the first connection.
- 10) Set the Route Min Signal Margin on both the Endpoint and the Endpoint_Repeater to a value half way between the lower margin value and the higher.

Example: Margin on the closest radio to the Endpoint is 46 dB. Margin of the further away radio link is 30 dB. Set the Route Min Signal Margin on both the Endpoint and Endpoint_Repeater to 38 dB, and on the next closest unit to the Endpoint, set its value to -4 dB.

NOTE: The value will be too strong for the further away radio to log on and low enough so that the closer radio will. By setting the value on the next closest unit to the Endpoint to -4dB it will effectively disable it from trying to connect to the next closest radio.

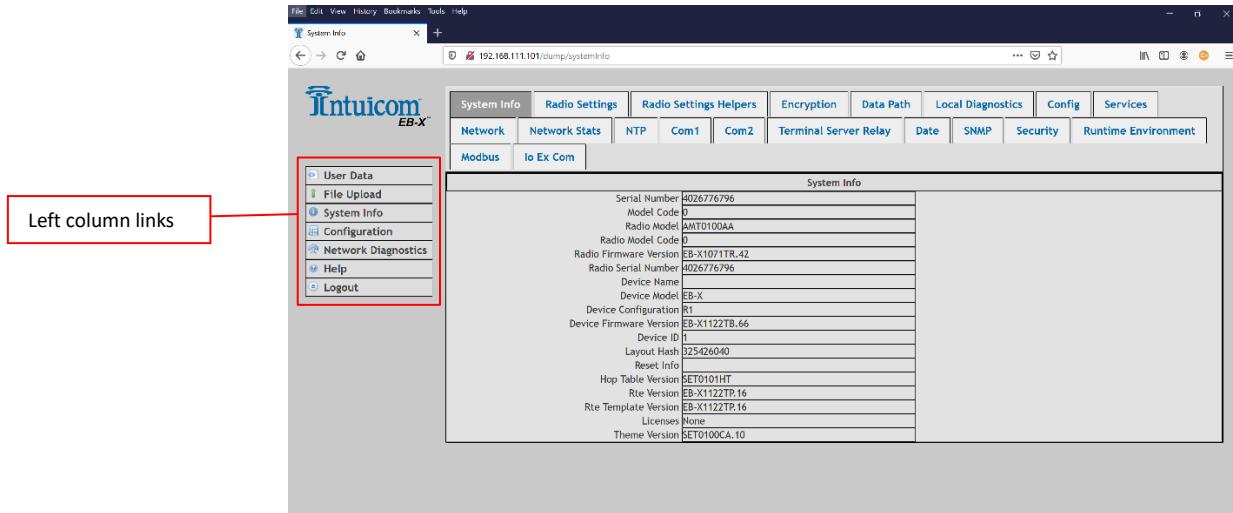
NOTE: You will only have to perform this procedure if more than one radio can connect to the Endpoint that does not have signal to the Gateway.



Data Path	
Compression Enabled	true
OTA Max Fragment Size	1000
FEC Rate	RATE_1_1
Aggregate Enabled	false
Route Min Signal Margin Thresh	38
MAC Table Entry Age Timeout	120

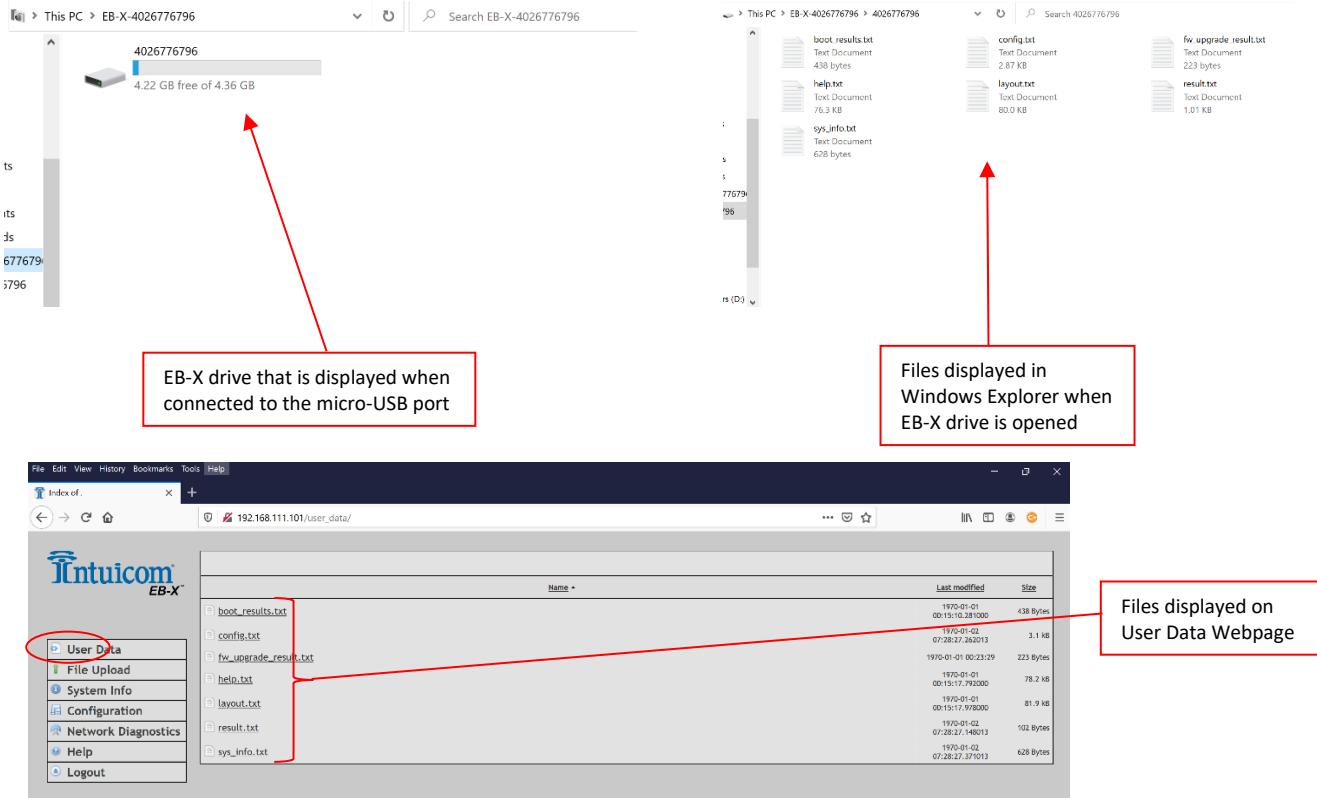
25 – Left Column Web Pages

On the left side of all the webpages there is a column of links. An explanation of these links follows.



A – User Data

The User Data webpage is a webpage that contains the same radio files that are accessed through the micro-USB port. The micro-USB port displays a drive with the serial number of the radio when connected or upon boot up. Image below.



The top-left screenshot shows a Windows File Explorer window with a drive labeled '4026776796'. The top-right screenshot shows another view of the same drive contents. The bottom screenshot shows the 'User Data' page of the Intuicom EB-X web interface, which lists the same files as the drives.

EB-X drive that is displayed when connected to the micro-USB port

Files displayed in Windows Explorer when EB-X drive is opened

Files displayed on User Data Webpage

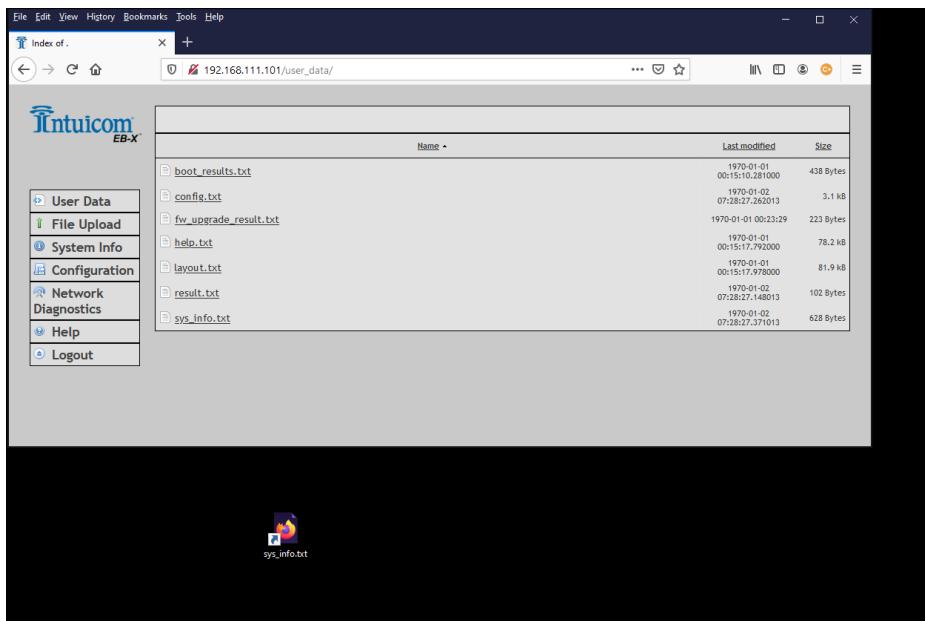
Name	Last modified	Size
boot_results.txt	1970-01-01 00:15:03.1000	438 Bytes
config.txt	1970-01-02 07:28:37.362013	3.1 kB
fw_upgrade_result.txt	1970-01-01 00:15:03.1000	223 Bytes
help.txt	1970-01-01 00:15:03.1000	78.2 kB
layout.txt	1970-01-01 00:15:17.978000	81.9 kB
result.txt	1970-01-02 07:28:17.148013	101 Bytes
sys_info.txt	1970-01-02 07:28:27.371013	628 Bytes

The content of each of the files can be viewed by clicking on the file. Below is a screen capture of the contents of the Sys_Info file.



```
[Page systemInfo]
systemInfo.serialNumber=4026776796
systemInfo.modemCode=0
systemInfo.radioModel AMT0100AA
systemInfo.radioModelCode=0
systemInfo.radioFirmwareVersion=EB-X10/1TR.42
systemInfo.radioSerialNumber 4026776796
systemInfo.deviceName=
systemInfo.deviceModel=EB-X
systemInfo.deviceConfiguration R1
systemInfo.deviceFirmwareVersion=EB-X1122TB.66
systemInfo.deviceId=1
systemInfo.layoutHash 325426040
systemInfo.resetInfo=
systemInfo.hopTableVersion=SFT0101HT
systemInfo.rteVersion EB-X1122TP.16
systemInfo.rteTemplateVersion=EB-X1122TP.16
systemInfo.iconName=None
systemInfo.themeVersion SET0100CA.10
```

Each of the files can be saved in an HTML format by simply dragging the file from the User Data browser window onto your desktop. Where it will save as a browser file. In the screen shot below, the Sys_Info.txt file has been dragged and dropped onto the desktop and saved as a Firefox file.

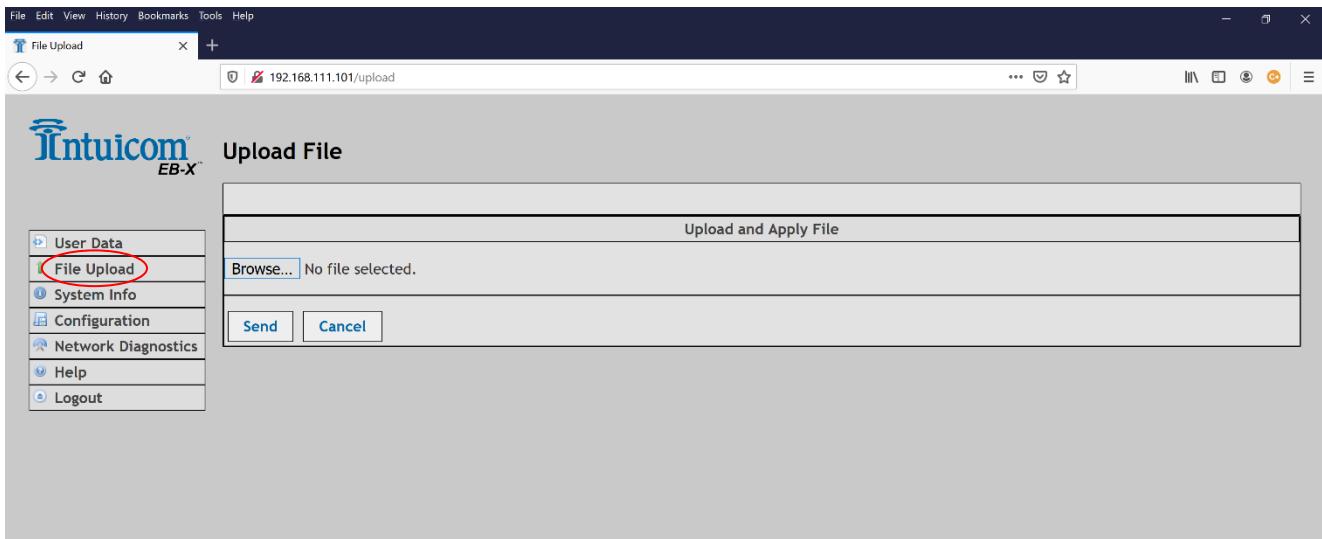


The contents of each file can be copied out of the browser and pasted into a notepad or text editor program and saved as a .txt file.

B – File Upload

The file upload webpage is used to upload files into the EB-X. This window can be used to upload a configuration file, or for upgrading firmware by uploading a unit, or radio firmware.

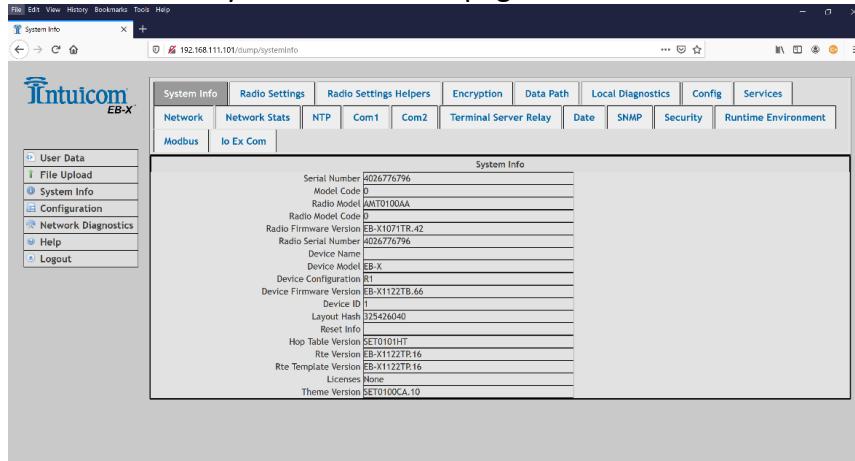
To upload files simply click the “Browse” button and navigate to the file location, and select it, click “Open” and then click “Send”.



NOTE: More information on upgrading firmware, and uploading, or drag and drop configuration is found in Appendix A of this document.

C – System Info

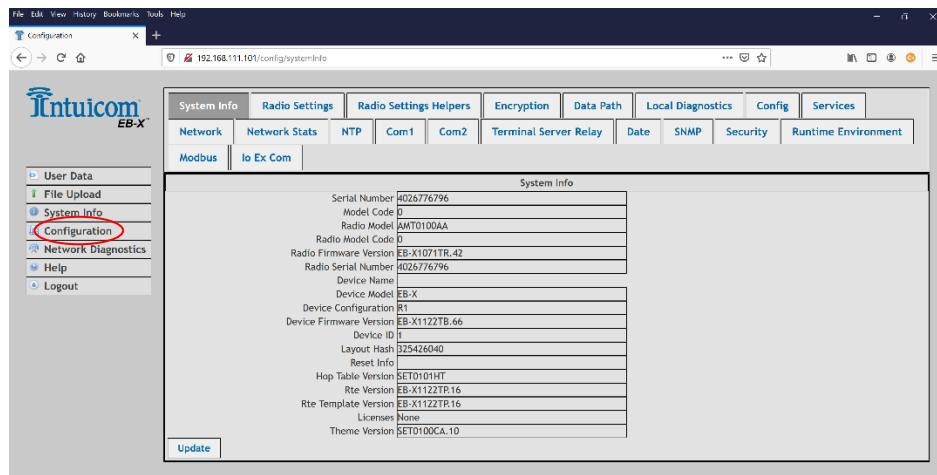
The System Info page is the first page displayed when you type the IP Address into the address line of the browser. This is a read only information webpage.



D – Configuration

When clicking on the Configuration link a login prompt will appear unless you have already logged into the radio. The System Info page will be displayed with an Update button in the lower left corner (the update button is not used on the System Info webpage as it is read only).

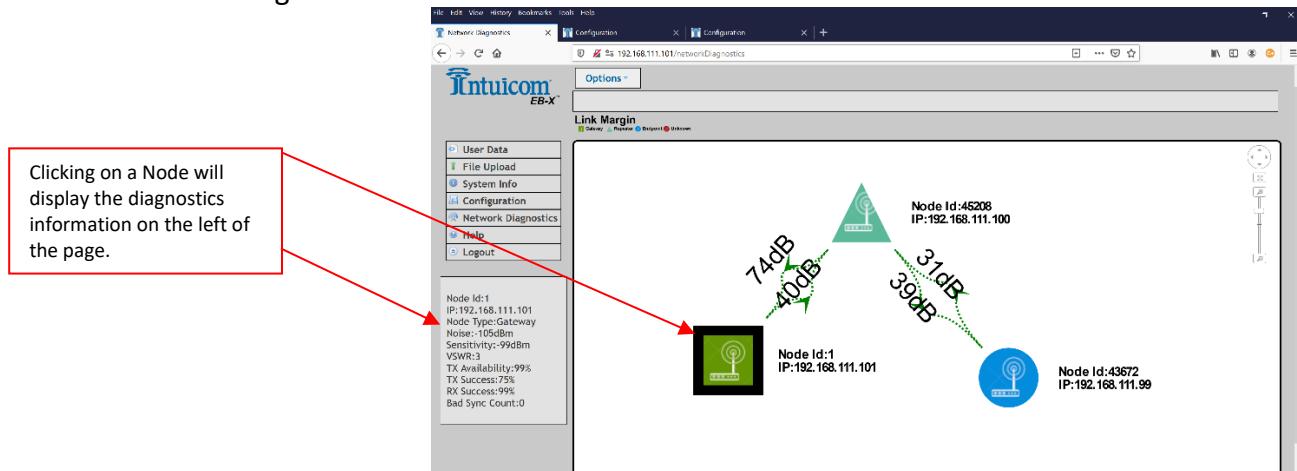
Detailed information on each of the web pages access through the Configuration link is covered on pages 30 thru 76 of this manual.



E – Network Diagnostics

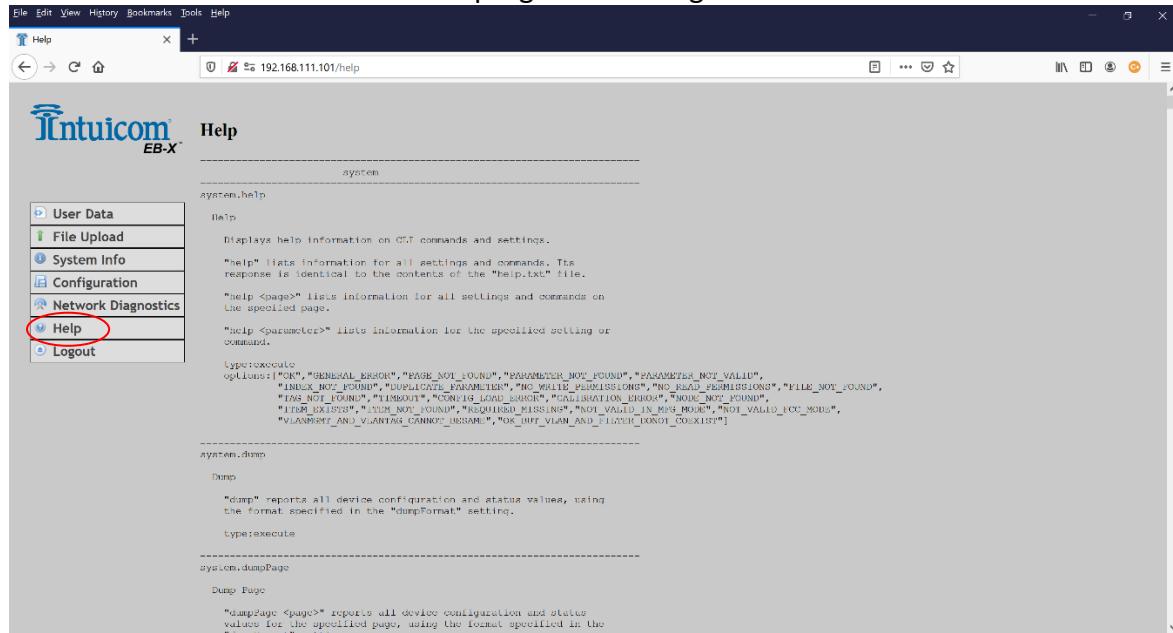
A Gateway is required on the network to use the network diagnostics webpage. When you click on the Network Diagnostics link the webpage will provide a status bar at the top that gives the progress of the Gateway scanning the network. The network diagnostics will:

- Discover Endpoints and Endpoint-Repeaters on the network
- Show Hops and their paths from the Gateway
- Show link quality including RSSI, Margin, and Noise
- Show Neighbors



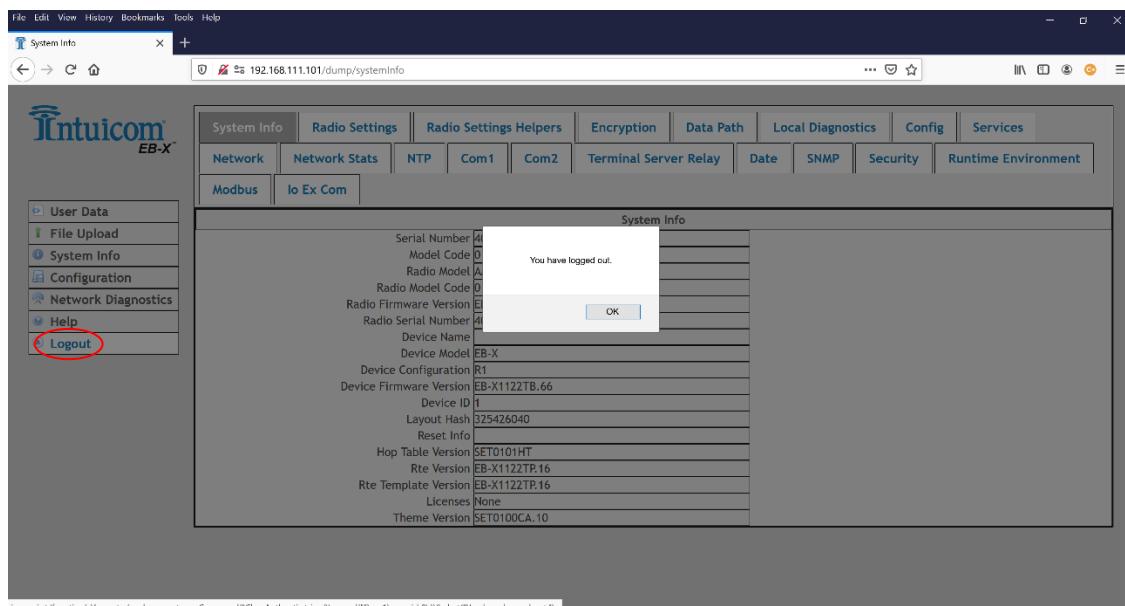
F – Help

The Help link will display the Help webpage. The help webpage provides a comprehensive list of commands used on the CLI interface to program and diagnose the EB-X.



G – Logout

Clicking on the Logout link will bring up a pop-up window that lets you know you have logged out.



Appendix A – Upgrading Firmware

There are two firmware files that are used to upgrade the firmware on the EB-X.

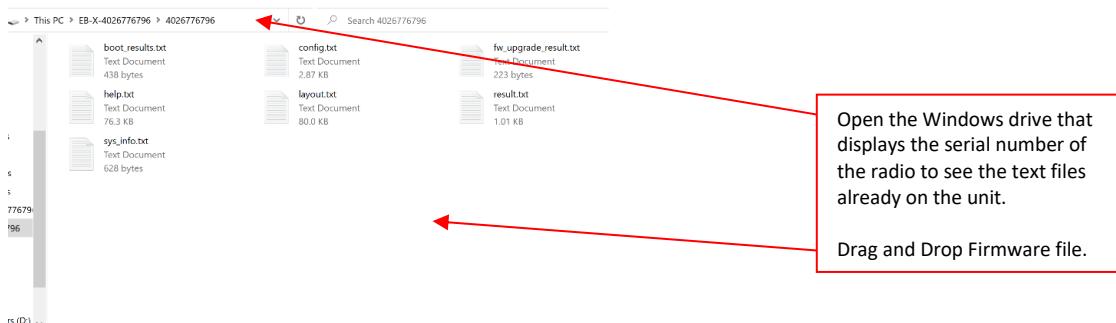
- 1) The Device Firmware
- 2) The Radio Firmware

Additionally, there are two ways to upgrade the firmware on the EB-X.

- 1) Through Windows Explorer file window – micro-USB connection
- 2) Through the File Upload webpage – Ethernet connection

1 – Windows Explorer File Window

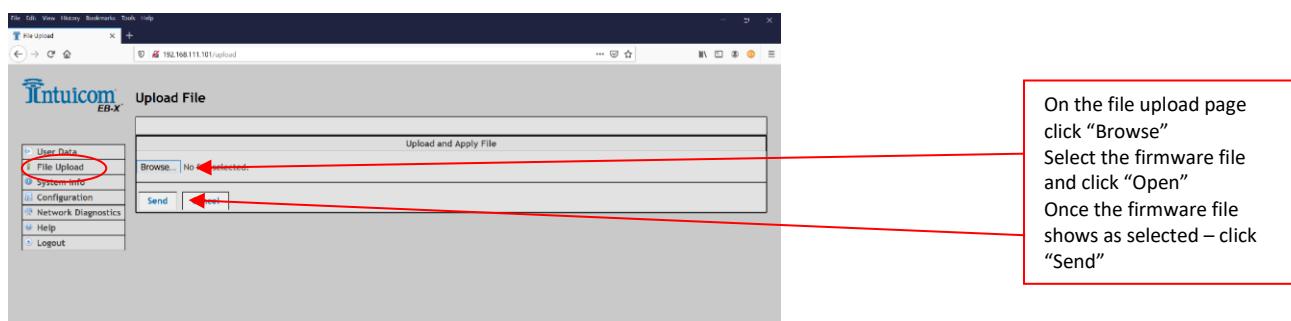
Using a micro-USB to USB cable connected to your PC, when the files window opens, and the radio has completed its boot up. Drag the firmware file into the files window. Once the file has copied to the EB-X it will automatically reboot the radio and come up on the new firmware.



NOTE: The **device** firmware file is large enough where you will see a windows progress bar on the status of the file being copied to the radio. The **radio** firmware file is so small you will **not get a status pop up window**, and the radio will reboot and come up on the new radio firmware.

2 – File Upload Webpage

Click on the “File Upload” link in the left column, click the browse button, select the firmware file on your PC, click “Open”, click “Send”, and once the file has uploaded to the EB-X it will reboot and come up on the new firmware version.



Appendix B – How to Change the Password

The only way to change the default password on the EB-X radio is from the command line. There is no way to change the password in the web browser interface.

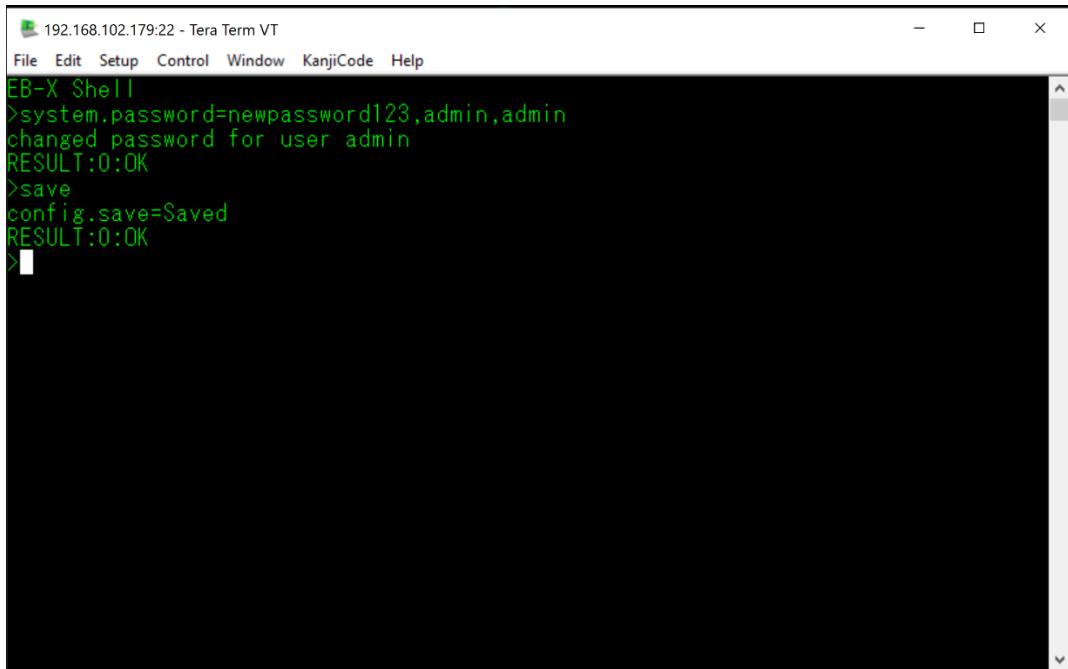
To change the password, log into the command line either through the USB connection (see pages 15-17), or through an SSH connection (see pages 18-19).

Once on the command line the command is:

```
system.password=oldpassword,newpassword,newpassword
```

Hit enter, and you should receive the reply “changed password for user admin” and on the next line y “RESULT:0:OK”.

Next type “save” (without quotation marks) and hit enter to save the new password.



A screenshot of a terminal window titled "192.168.102.179:22 - Tera Term VT". The window shows the following command-line session:

```
File Edit Setup Control Window KanjiCode Help
EB-X Shell
>system.password=newpassword123,admin,admin
changed password for user admin
RESULT:0:OK
>save
config.save=Saved
RESULT:0:OK
>
```

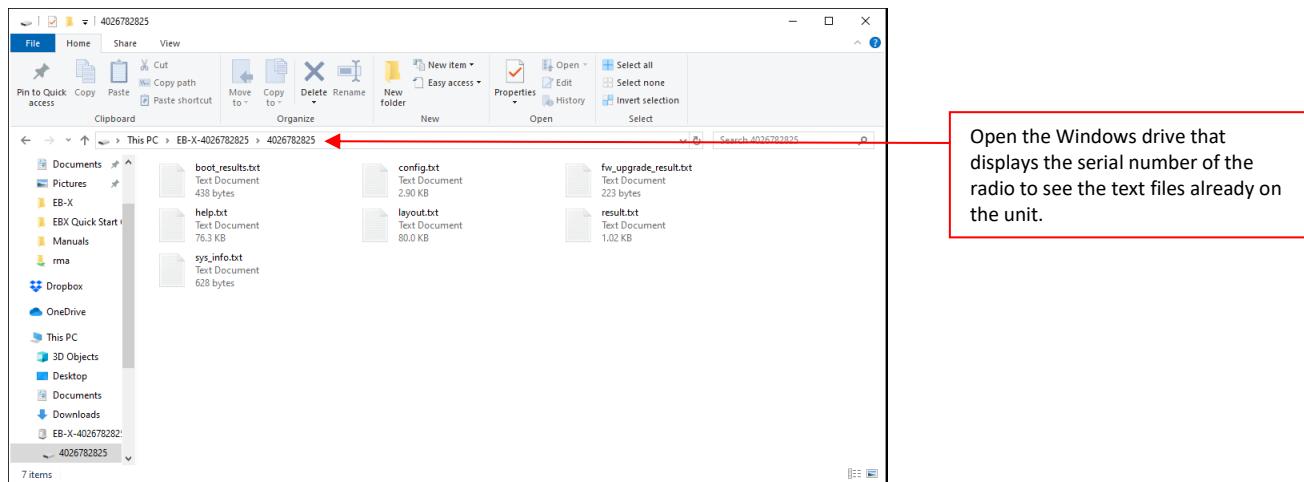
Appendix C – Restoring to Factory Defaults

If you have changed the password on the radio and cannot log into the configuration screens or the terminal window, and you do not know the IP Address to the radio, you can restore the radio to default by following the procedure below.

- 1) Open a Notepad document.
- 2) Copy and paste these two lines into the document:

```
system.passwordRestoreDefaults
config.factoryDefaults=set
```

- 3) Save the document with the name: config.cfg
- 4) Plug into the Micro USB port on the radio and when the two drives come up in Windows Explorer.
- 5) Open the drive for the files (not the drivers). This is the window with the name “EB-X-radio *serial number*”. When you open the drive in Windows Explorer you will see the image for a camera drive, and when you click on that you will see the text files that are already on the radio. Screen shot below.



- 6) Drag and drop the config.cfg file you just created into the window.
- 7) Bring up a Command prompt and run: “ping -t 192.168.111.100.”
- 8) After the radio reboots and starts pinging you can log into the webpages by the default IP Address with the default credentials of Username: admin and Password: admin.

NOTE: Do not confuse the “config.txt” file with the “config.cfg” file. The “config.txt” file contains the settings that are already on the radio. The “config.cfg” file will program the radio with the settings contained in the file. In this case we are programming the radio to default settings.

Appendix D – Drag and Drop Configuration

1 – Programming Multiple Endpoints

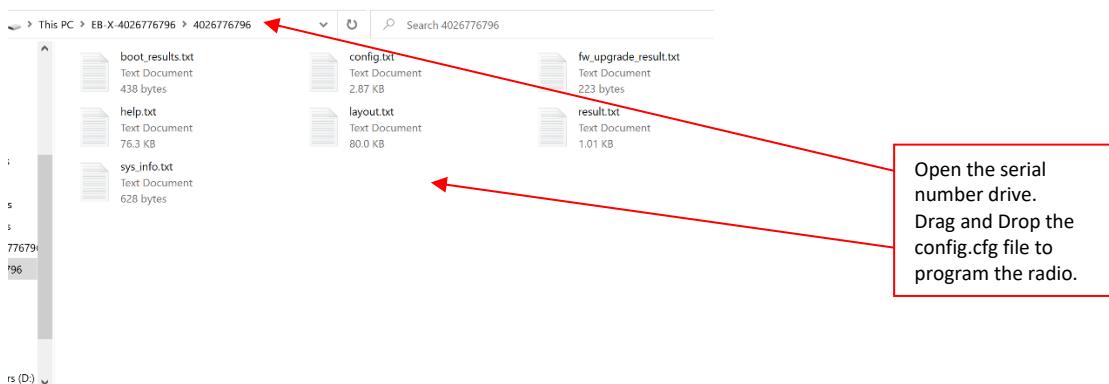
The EB-X can be configured by dragging and dropping a **config.cfg** file into the files window. This can save users quite a bit of time if multiple Endpoint radios need to be programmed for connection to a single Gateway. See the steps below:

- 1) Users can program the Gateway, and the first Endpoint, verifying the wireless connection.
- 2) Once the Endpoint is configured, open the files window and drag the config.txt file onto your PC, change the file name from config.txt to **config.cfg**.
- 3) Plug in and boot up the next EB-X to be configure as an Endpoint, with the micro-USB port connected. Once the drive window opens, double click on the drive to open the files window.
- 4) Drag the **config.cfg** file into the files window. This will program the radio with the same settings as the first Endpoint.
- 5) Then log into the webpage and change the IP Address and Node ID so they are unique.
- 6) Repeat the above steps for each Endpoint to be programmed to connect with the Gateway radio programed in step 1.

NOTE: Either the config.cfg file will need to be edited with the unique IP Address and Node ID for each Endpoint, or the user will need to log into each Endpoint and program it's IP Address and Node ID manually, because each radio in the network must have a unique IP Address and Node ID.

2 – Saving Backup Configs

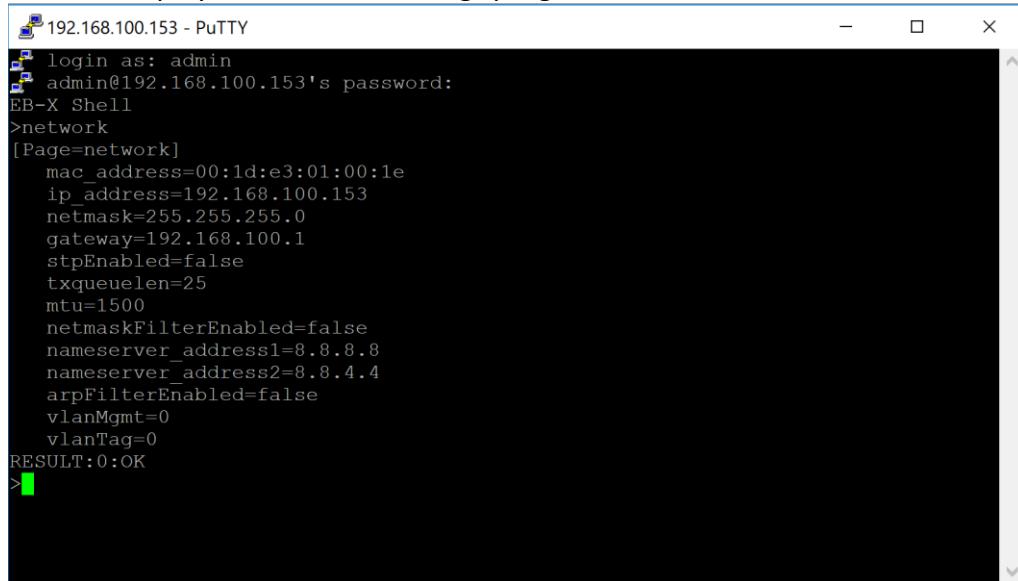
Additionally, users can save the config.txt files for each EB-X radio on their network, rename them config.cfg, and use these files to reprogram replacement radios in the event that any of them fail. Since all the files are named config.cfg or config.txt, separate folders for each EB-X name and location can be created, and the config.txt files saved into the specific folders.



Appendix E – Useful Terminal Commands

If the IP Address of the EB-X is not known, log into the Command Line Interface and run the command: **network**.

This will display the network settings programmed into the radio.



```
192.168.100.153 - PuTTY
login as: admin
admin@192.168.100.153's password:
EB-X Shell
>network
[Page=network]
mac_address=00:1d:e3:01:00:1e
ip_address=192.168.100.153
netmask=255.255.255.0
gateway=192.168.100.1
stpEnabled=false
txqueuelen=25
mtu=1500
netmaskFilterEnabled=false
nameserver_address1=8.8.8.8
nameserver_address2=8.8.4.4
arpFilterEnabled=false
vlanMgmt=0
vlanTag=0
RESULT:0:OK
>
```

1 – IP Address Commands

The command

network.ip_address=x.x.x.x

Where x.x.x.x is the ip address you want to program the radio with will change the ip address.

network.netmask=x.x.x.x

Will set the subnet mask, where x= either 0 or 255.

network.gateway=x.x.x.x

Where x.x.x.x is the ip address of the default gateway on your network.

After entering any commands to program the EB-X you must enter the command **save** to save your settings.

2 – Radio Settings

The command

RadioSettings – will display the current wireless settings on the radio.

3 – Help

The command

Help – will display the manual of all the available command line entries that can be used to program and troubleshoot the EB-X.

Appendix F – VLAN Settings

The EB in the name of the radio stands for Ethernet Bridge. The wireless port and Ethernet port are bridged together. When the radios are placed in line between trunk ports they will pass all the VLAN traffic, tagged or untagged. The only reason to set the Management Vlan number in the EB-X radio is so you can ping the radio when it is on the trunk link.

VLAN Guide Lines

- 1) IP Address of the radios should be in the same range as the switches and routers on the network.
- 2) For most applications the Management Vlan number is all that needs to be entered into the radio.
- 3) Depending on the switch manufacturer, the trunk port may have to be set to tagged or untagged in order to ping the radios once the management Vlan has been set.
 - a. For CISCO routers and switches leave the vlan untagged.

CAUTION – Once the management vlan is set in the radio you will not be able to ping the radio or access the webpages while directly connected to it. Suggestion is to use the USB port to access the command line and change the setting there.

For the following example the management vlan id is 1.

1 – Setting the Vlan via Web Page

You can set the vlan setting on the web page by logging into the radio and selecting the network tab. In the second to last line on the page is “Vlan MGMT”. In this example it is set to 1. Simply type the Vlan ID number into the field and click “Update”.

System Info	Radio Settings	Encryption	Data Path	Local Diagnostics	Config	Services	Network
Network Stats	NTP	Com1	Com2	Terminal Server Relay	Date	SNMP	Security
Runtime Environment	Modbus	Io Ex Com					

Network

MAC Address	00:1d:e3:01:01:1c
IP Address	192.168.102.181
Netmask	255.255.255.0
Gateway	192.168.102.1
STP Enabled	false
Txqueuelen	25
MTU	1500
Nameserver Address1	0.0.0.0
Nameserver Address2	0.0.0.0
Netmask Filter Enabled	false
Arp Filter Enabled	false
Vlan MGMT	1
Vlan Tag	0

Network Tab

Vlan MGMT – set to 1

“Update” to save the setting

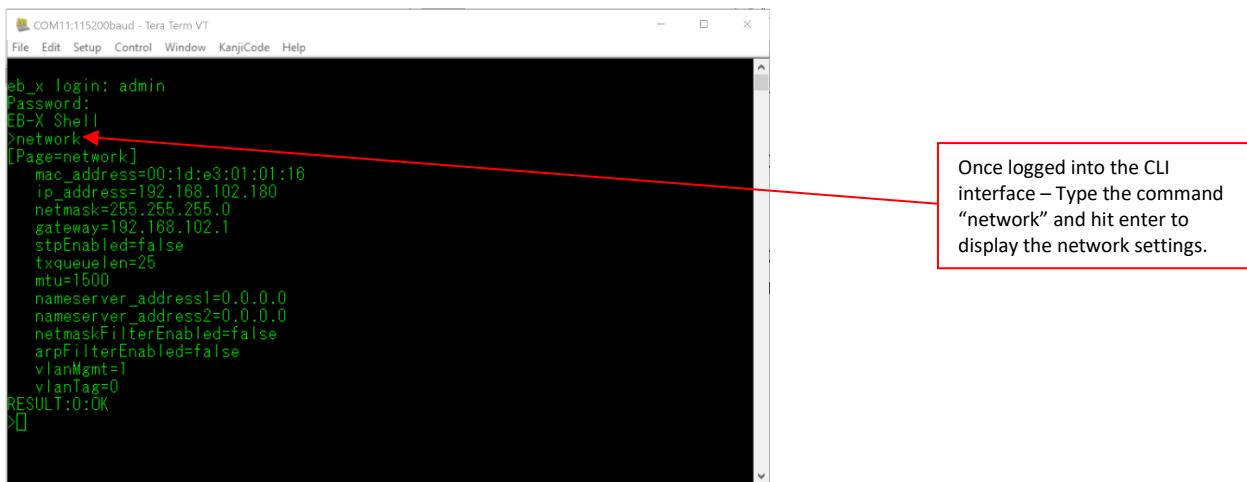
Remember once you click “Update” you will no longer be able to access the radio by IP Address when directly connected to the radio. The unit will need to be connected on a trunk port or line to be able to ping it and log into the web pages.

The Vlan MGMT setting can also be changed via the Command Line Interface (CLI).

2 – Setting the Vlan via Terminal Window

If you cannot ping or access the radio through the IP Address then you will need to connect to the radio via the USB port. This procedure is outlined on page 12-14 of this manual.

Once you have logged into the CLI, type the command “network” and hit enter. This will display your network settings. If the Vlan MGMT is set to anything other than 0 (zero) then you will need to change the setting back to 0 to disable the setting so you can gain access to the radio while directly connected to it.



```
COM11:115200baud - Tera Term VT
File Edit Setup Control Window KanjiCode Help

eb_x login: admin
Password:
EB-X Shell
>network
[Page=network]
mac_address=00:1d:e3:01:01:16
ip_address=192.168.102.180
netmask=255.255.255.0
gateway=192.168.102.1
stpEnabled=false
txqueueLen=25
mtu=1500
nameserver_address1=0.0.0.0
nameserver_address2=0.0.0.0
netmaskFilterEnabled=false
arpFilterEnabled=false
vlanMgmt=1
vlanTag=0
RESULT:0:OK
>
```

Once logged into the CLI interface – Type the command “network” and hit enter to display the network settings.

The command to change the management Vlan is “network.vlanMgmt=0” or whatever Vlan ID you need to program for your network. Type the command and hit enter. Then type “save” and hit enter to save the setting.

SUGGESTION: When setting up Vlans on your network, Intuicom recommends that the radios be configured for a wireless connection. Once the radios are connected wirelessly, configure your switches so the trunk ports are passing all necessary traffic when they are cabled together on the trunk ports. After the Vlan Configuration has been configured on the switches. Connect the radio into the trunk ports, and log into the CLI interface using micro-USB port and the Terminal window. Then adjust one setting at a time until you can ping the radios and access the web pages while connected on the trunk port.

First set the vlanMgmt=# (where # is the ID of your management vlan) setting on both radios and see if you can ping them and access the web pages.

Vlan Tag Setting

If not, you may need to set the Vlan Tag setting to the same number as your management Vlan and retest to see if you can ping the radios when on the trunk port.

NOTE: It may be necessary to adjust the tag setting on both switches and radios in order to access the radios while on the trunk port.

Appendix G – EB-X MIB
EB-X MIB – CPU Usage

Objective Type	Syntax	Max Access	Status	Description	::=
ssCpuUser	Integer32	Read-only	Deprecated	The percentage of CPY time spent processing user-level code, calculated over the last minute.	{systemStats 9}
ssCpuSystem	Integer32	Read-only	Deprecated	The percentage of CPU time spent processing system-level code, calculated over the last minute.	{systemStats 10}
ssCpuIdle	Integer32	Read-only	Deprecated	The percentage of processor time spent idle, calculated over the last minute.	{systemStats 11}
SSCpuNice	Integer32	Read-only	Deprecated	The percentage of processor time spent nice, calculated over the last minute.	{systemStats 12}

EB-X MIB – Disk Usage

Objective Type	Syntax	Max Access	Status	Description	::=
dskTable	Sequence of DskEntry	Not Accessible	Current	Disk watching information. Partitions to be watched are configured by the snmpd.conf file of the agent.	{ucdavis 9}
dskEntry	DskEntry	Not Accessible	Current	An entry containing a disk and its statistics. Index = { dskIndex }	{dsk Table 1}
				DskEntry ::= SEQUENCE { dskPath DisplayString, dskDevice DisplayString, dskTotal Integer32, dskAvail Integer32, dskUsed Integer32, dskPercent Integer32, dskPercentNode Integer32 }	
dskPath	DisplayString	Read-only	Current	Path where the disk is mounted.	{dskEntry 2}
dskDevice	DisplayString	Read-only	Current	Path of the device for the partition.	{dskEntry 3}
dskTotal	Integer32	Read-only	Current	Total size of the disk / partition (kBytes).	{dskEntry 6}
dskAvail	Integer32	Read-only	Current	Available space on the disk.	{dskEntry 7}
dskUsed	Integer32	Read-only	Current	Used space on the disk.	{dskEntry 8}
dskPercent	Integer32	Read-only	Current	Percentage of space used on disk.	{dskEntry 9}
dskPercentNode	Integer32	Read-only	Current	Percentage of nodes used on disk.	{dskEntry 10}

EB-X MIB – Memory Usage

Objective Type	Syntax	Max Access	Status	Description	::=
memTotalSwap	Integer32	Read-only	Current	The total amount of swap space configured for this host.	{memory 3}
memAvailSwap	Integer32	Read-only	Current	The amount of swap space currently unused or available.	{memory 4}
memTotalReal	Integer32	Read-only	Current	The total amount of real / physical memory installed on the host.	{memory 5}
memAvailReal	Integer32	Read-only	Current	The amount of real / physical memory currently unused or available.	{memory 7}
memShared	Integer32	Read-only	Current	The total amount of real or virtual memory currently allocated for use as shared memory. This object will not be implemented on hosts where the underlying operating system does not explicitly identify memory as specifically reserved for this purpose.	{memory 13}
memBuffer	Integer32	Read-only	Current	The total amount of real or virtual memory currently allocated for use as memory buffers. This object will not be implemented on hosts where the underlying operating system does not explicitly identify memory as specifically reserved for this purpose.	{memory 14}

EB-X MIB – Memory Usage

Objective Type	Syntax	Max Access	Status	Description	::=
memCached	Integer32	Read-only	Current	The total amount of real or virtual memory currently allocated for use as cached memory. This object will not be implemented on hosts where the underlying operating system does not explicitly identify memory as specifically reserved for this purpose. Units are in kB	{memory 15}
memUsedReal	Integer32	Read-only	Current	The amount of real / physical memory currently used or available. Units are in kB	{memory 18}
memspeed	Integer32	Read-only	Current	The Speed of real / physical memory. Units are in Hz	{memory 19}

Intuicom - MIB

Object	Description	Access	Syntax
fwtPlusModemStatusTable	This table gives basic status information for each radio modem in the system.	Not Accessible	
fwtPlusModemStatusTableEntry	A row containing status information for a specific radio modem.	Not Accessible	
fwtPlusModemSerial	The serial number for the radio the given status table entry line is for.	Not Accessible	Guage32
fwtPlusModemSignal	The received signal level for this radio modem, in dBm.	Read-only	Integer32
fwtPlusModemNoise	The detected noise for this radio modem, in dBm.	Read-only	Integer32
fwtPlusModemSupplyVoltage	The supply voltage to this radio modem, in units of 1/100th of a volt.	Read-only	Integer32
fwtPlusModemRxRate	The current receive rate as a percentage of the maximum, in units of one Hundredth of a percent.	Read-only	Guage32
fwtPlusModemReflectedPower	The current amount of reflected RF power.	Read-only	Guage32
fwtPlusModemTemperature	The current temperature of this radio modem in degrees Celsius.	Read-only	Integer32
fwtPlusModemRange	The current approximate range of this radio modem from its peer, in meters.	Read-only	Guage32
fwtPlusModemTxRate	The current transmit rate as a percentage of the maximum, in units of one Hundredth of a percent.	Read-only	Guage32
fwtPlusModemSNDelta	The current margin (absolute) between the received signal and the noise at this radio.	Read-only	Integer32
fwtPlusModemVendorString	The name of the vendor of this radio modem.	Read-only	DisplayString
fwtPlusModemConnectedTo	The received signal level that the upstream radio receives from this radio, in dBm.	Read-only	Guage32
fwtPlusModemUpstreamSignal	The received signal level that the upstream radio receives from this radio, in dBm.	Read-only	Integer32
fwtPlusModemUpstreamNoise	The noise level that the upstream radio receives from this radio, in dBm.	Read-only	Guage32
fwtPlusModemDisconnectCount	The number of times this radio has lost its RF link.	Read-only	Guage32
fwtPlusModemPacketRxCount	The number of Ethernet packets the radio has received over its RF link.	Read-only	Guage32

Intuicom - MIB			
Object	Description	Access	Syntax
fwtPlusModemPacketTxCount	The number of Ethernet packets the radio has sent over its RF link.	Read-only	Gauge32
fwtPlusModemPacketDroppedCount	The number of Ethernet packets the radio has dropped	Read-only	Gauge32
fwtPlusModemPacketBadCount	The number of BAD / corrupt Ethernet packets the radio has received over its RF link.	Read-only	Gauge32
fwtPlusModemControlTable	This table contains some parameters which may be adjusted for each radio modem in the system.	Not Accessible	INTEGER
fwtPlusModemControlTableEntry	A row containing adjustable parameters for a specific radio modem.	Not Accessible	INTEGER
fwtPlusModemNetworkMode	The network mode to be used by a radio modem.	Read-Write	Gauge32
fwtPlusModemMode	The modem mode to be used by a radio modem.	Read-Write	Gauge32
fwtPlusModemFrequencyKey	The frequency key to be used by a radio modem.	Read-Write	Gauge32
fwtPlusModemMinPacketSize	The minimum packet size to be used by a radio modem.	Read-Write	Gauge32
fwtPlusModemMaxPacketSize	The maximum packet size to be used by a radio modem.	Read-Write	Gauge32
fwtPlusModemTxPower	The transmit power to be used by a radio modem.	Read-Write	Gauge32
fwtPlusModemRetryTimeout	How many times a radio modem should try to transmit a packet before timing out.	Read-Write	Gauge32
fwtPlusModemRFDataRate	The RF data rate to be used by a radio modem. Permissible values are 1200,867,614, 154, or 115, depending on the series of radios.	Read-Write	Gauge32
fwtPlusModemBroadcastRepeat	The number of times a Gateway will send out a packet of information before moving on to the next.	Read-Write	Gauge32
fwtPlusModemNetworkID	A numerical ID that radios use to decide which network they are allowed to link to.	Read-Write	Gauge32
fwtPlusModemRepeaters	Allows for repeaters in the network, or not.	Read-Write	INTEGER
fwtPlusModemRxSubnetID	A numerical ID that radios use to decide which subnet they are allowed to link to.	Read-Write	Gauge32
fwtPlusModemTxSubnetID	A numerical ID that radios use to decide which subnet they will transmit on.	Read-Write	Gauge32
fwtPlusModemReboot Set	Set to 1 to reboot radio. This will force any changes to take effect.	Read-Write	INTEGER
fwtPlusModemMaxSlaveRetry	The maximum number of times an Endpoint can attempt to deliver data to the Gateway before it discards the data.	Read-Write	Gauge32
fwtPlusModemSystemName	A textual identifier for a given system.	Read-Write	DisplayString
fwtPlusModemControlFreqZoneTable	This table describes the available frequency zones for a radio modem and allows them to be selectively enabled and disabled.	Not Accessible	
fwtPlusModemControlFreqZoneTableEntry	A row describing a specific frequency zone and whether it is enabled or disabled.	Not Accessible	

Intuicom - MIB			
Object	Description	Access	Syntax
fwtPlusModemFreqZoneIndex	An index used to identify a specific frequency zone for a specific radio modem.	Not Accessible	Guage32
fwtPlusModemFreqZoneDescr	A textual description of a specific frequency zone for a specific radio modem.	Read-Write	DisplayString
fwtPlusModemFreqZoneEnabled	If the value of this object is true (1) then the referenced frequency zone is enabled for the relevant radio modem. If the value of this object is false (2), then the frequency zone is disabled.	Read-Write	TruthValue
fwtZumLinkSerialNumber	Serial Number	Read-Write	Unsigned32
fwtZumLinkModelCode	Model Code	Read-Write	Unsigned32
fwtZumLinkRadioModel	Radio model	Read-Write	DisplayString
fwtZumLinkRadioModelCode	Radio Model Code	Read-Write	Unsigned32
fwtZumLinkRadioFirmwareVersion	Radio Firmware Version	Read-Write	DisplayString
fwtZumLinkRadioSerialNumber	Radio Serial Number	Read-Write	DisplayString
fwtZumLinkDeviceName	Device Name	Read-only	DisplayString
fwtZumLinkDeviceModel	Device Model	Read-only	DisplayString
fwtZumLinkDeviceConfiguration	Device Configuration	Read-only	DisplayString
fwtZumLinkDeviceFirmwareVersion	Device Firmware Version	Read-only	DisplayString
fwtZumLinkDeviceId	Device Identifier	Read-only	Unsigned32
fwtZumLinkLayoutHash	Unique Layout Identifier	Read-only	DisplayString
fwtZumLinkResetInfo	Reset Information	Read-only	DisplayString
fwtZumLinkHopTableVersion	Radio Hop Table Version	Read-only	DisplayString
fwtZumLinkRteVersion	Runtime Environment Version	Read-only	DisplayString
fwtZumLinkRteTemplateVersion	Runtime Template Environment Version	Read-only	DisplayString
fwtZumLinkLicenses	License Information	Read-only	DisplayString
fwtZumLinkRadioMode	Radio Operational Mode	Read-Write	ZUMLINK_RADIO_MODE_THOR
fwtZumLinkRfDataRate	RF Link Data Rate	Read-Write	ZUMLINK_RADIO_MODE_THOR
fwtZumLinkRadioMaxRepeaters	Max Repeater slots in the Network	Read-Write	Unsigned32
fwtZumLinkRadioRepeaterSlot	Repeater Slot	Read-Write	Unsigned32
fwtZumLinkTxPower	Transmit Power	Read-Write	ZUMLINK_RADIO_MODE_THOR
fwtZumLinkNetworkId	Network Identifier	Read-Write	Unsigned32
fwtZumLinkNodeId	Node ID	Read-Write	Unsigned32
fwtZumLinkFrequencyKey	Frequency Key	Read-Write	ZUMLINK_RADIO_MODE_THOR
fwtZumLinkRadioFrequency	Operating Center Frequency in MHz	Read-Write	Float32TC
fwtZumLinkRadioHoppingMode	Radio Hopping Mode	Read-Write	ZUMLINK_RADIO_HOPPING_MODE
fwtZumLinkBeaconInterval	Beacon Interval	Read-Write	ZUMLINK_BEACON_INTERVALS
fwtZumLinkBeaconBurstCount	The Number of beacons to send per beacon time.	Read-Write	Unsigned32
fwtZumLinkLnaBypass	LNA Bypass	Read-Write	Unsigned32
fwtZumLinkMaxLinkDistanceInMiles	The max link distance in miles	Read-Write	Unsigned32
fwtZumLinkFrequencyMasks	Frequency Masks	Read-Write	DisplayString
fwtZumLinkFrequencyMasksErrors	Frequency Masks Error	Read-Write	DisplayString
fwtZumLinkEncryptionMode	Encryption mode	Read-Write	ZUMLINK_ENCRYPTION_MODE
fwtZumLinkActiveKey	The active selected key	Read-Write	ZUMLINK_ENCRYPTION_KEYS
fwtZumLinkSetKeySelect	Selection of the next encryption key to be modified	Read-Write	ZUMLINK_ENCRYPTION_KEYS
fwtZumLinkSetKeyValue	Set the value of the selected key.	Read-Write	DisplayString
fwtZumLinkCompressionEnabled	If compression is enabled out going packets well be sent compressed if the compressed packet is smaller	Read-Write	TruthValue
fwtZumLinkOtaMaxFragmentSize	OTA Max Fragment Size	Read-Write	Unsigned32
fwtZumLinkFecRate	Sets te FEC (forward Error Correction) Rate	Read-Write	ZUMLINK_FES_RATES
fwtZumLinkAggregateEnabled	Enables the aggregation of smaller packets to enhance throughput.	Read-Write	TruthValue

Intuicom - MIB			
Object	Description	Access	Syntax
fwtZumLinkRouteMinSignalMarginThresh	The radio route minimum signal level threshold in dB.	Read-Write	INTEGER
fwtZumLinkMacTableEntryAgeTimeout	The number of seconds before an inactive entry in the MAC Table ages out and becomes expired.	Read-Write	INTEGER
fwtZumLinkSignalLevel	Signal Level	Read-only	INTEGER
fwtZumLinkSignalMargin	Signal Margin	Read-only	INTEGER
fwtZumLinkTimestamp	Diagnostics Time Stamp	Read-only	Unsigned32
fwtZumLinkRadioTx	Radio Tx Data Packets	Read-only	Unsigned32
fwtZumLinkRadioRx	Radio Rx Data Packets	Read-only	Unsigned32
fwtZumLinkRadioReliableTx		Read-only	Unsigned32
fwtZumLinkRadioReliableRx		Read-only	Unsigned32
fwtZumLinkRadioRexmit		Read-only	Unsigned32
fwtZumLinkRadioAckTx		Read-only	Unsigned32
fwtZumLinkRadioNoAckTx		Read-only	Unsigned32
fwtZumLinkRadioTimedOut		Read-only	Unsigned32
fwtZumLinkRadioBadAckRx	Radio Bad ACK Received	Read-only	Unsigned32
fwtZumLinkRadioTooLong		Read-only	Unsigned32
fwtZumLinkRadioTooShort		Read-only	Unsigned32
fwtZumLinkRadioBadSync	Radio Bad Synchronization	Read-only	Unsigned32
fwtZumLinkRadioBadCRC	Radio Bad CRC on Rx Packets	Read-only	Unsigned32
fwtZumLinkRadioContentionDrop	Radio Contention Drop	Read-only	Unsigned32
fwtZumLinkRadioSendingDrop		Read-only	Unsigned32
fwtZumLinkRadioLLTx	Radio Low Level Transmit	Read-only	Unsigned32
fwtZumLinkRadioLLRx	Radio Low Level Receive	Read-only	Unsigned32
fwtZumLinkCntSTX		Read-only	Unsigned32
fwtZumLinkCntETX		Read-only	Unsigned32
fwtZumLinkCntBadSync		Read-only	Unsigned32
fwtZumLinkCntBadBCC		Read-only	Unsigned32
fwtZumLinkInterfaceDataTx		Read-only	Unsigned32
fwtZumLinkInterfaceDataRx		Read-only	Unsigned32
fwtZumLinkInterfaceBytesTx		Read-only	Unsigned32
fwtZumLinkInterfaceBytesRx		Read-only	Unsigned32
fwtZumLinkResetsDetected		Read-only	Unsigned32
fwtZumLinkResetsSent		Read-only	Unsigned32
fwtZumLinkResetStats	Reset Statistics	Read-Write	ZUMLINK_NOW_OPTION
fwtZumLinkMonitoredNodeId	Monitor Node	Read-Write	Unsigned32
fwtZumLinkChannelDiagsTable	Show Channel Diagnostics	Not Accessible	
fwtZumLinkChannelDiagsEntry	A row containing diagnostics for a channel	Not Accessible	
fwtZumLinkChannelDiagsIdx	Index to a set of diagnostics for a channel	Not Accessible	Unsigned32
fwtZumLinkChannelDiagsFreq	Channel Diagnostics Frequency	Read-only	Float32TC
fwtZumLinkChannelDiagsRSSI	Channel Diagnostics RSSI	Read-only	INTEGER
fwtZumLinkChannelDiagsMargin	Channel Diagnostics Margin	Read-only	INTEGER
fwtZumLinkChannelDiagsNodeId	Channel Diagnostics Node ID	Read-only	Unsigned32
fwtZumLinkNodeDiagsTable	Show Monitored Node Diagnostics	Not Accessible	
fwtZumLinkNodeDiagsEntry	A row containing diagnostics for a node.	Not Accessible	
fwtZumLinkNodeDiagsNodeId	Node Diagnostics Node ID	Read-only	Unsigned32
fwtZumLinkNodeDiagsFreq	Node Diagnostics Frequency	Read-only	Float32TC
fwtZumLinkNodeDiagsRSSI	Node Diagnostics RSSI	Read-only	INTEGER
fwtZumLinkNodeDiagsMargin	Node Diagnostics Margin	Read-only	INTEGER
fwtZumLinkMacTableClear	Clear the MAC to node ID mapping table and force routes to be relearned.	Read-Write	ZUMLINK_NOW_OPTION
fwtZumLinkNoiseLevel	Noise Level	Read-only	INTEGER
fwtZumLinkVSWR	VSWR	Read-only	Unsigned32
fwtZumLinkTxSuccess	Transmit Success Percentage	Read-only	Unsigned32
fwtZumLinkTxAvailability	Transmit Availability Percentage	Read-only	Unsigned32

Intuicom – MIB			
Object	Description	Access	Syntax
fwtZumLinkRxSuccess	Receive Success Percentage	Read-only	Unsigned32
fwtZumLinkReset		Read-Write	ZUMLINK_RESET_OPTION
fwtZumLinkFactoryDefaults		Read-Write	ZUMLINK_FDR_OPTIONS
fwtZumLinkSave		Read-Write	ZUMLINK_NOW_OPTIONS
fwtZumLinkTimeOutCli	The number of seconds of idle before CLI connection will be closed.	Read-Write	Unsigned32
fwtZumLinkMac_address		Read-only	MacAddress
fwtZumLinklp_address	IP address of unit when DHCP is enabled.	Read-Write	IpAddress
fwtZumLinkNetmask	Netmask of unit when DHCP is enabled.	Read-Write	IpAddress
fwtZumLinkGateway	Gateway of unit when DHCP is enabled.	Read-Write	IpAddress
fwtZumLinkStpEnabled	Spanning Tree Protocol is enabled or disabled.	Read-Write	TruthValue
fwtZumLinkTxqueueulen	Sets the Ethernet transmit packet queue length.	Read-Write	Unsigned32
fwtZumLinkMtu	Sets the MTU frame size for the unit.	Read-Write	Unsigned32
fwtZumLinkNetmaskFilterEnabled	Enable or disable bridge firewall.	Read-Write	TruthValue
fwtZumLinkNameserver_address1	DNS for name-to-address resolution.	Read-Write	IpAddress
fwtZumLinkNameserver_address2	DNS for name-to-address resolution.	Read-Write	IpAddress
fwtZumLinkRx_bytes	Number bytes of Ethernet packets received from the radio network.	Read-only	Unsigned32
fwtZumLinkRx_packets	Number of Ethernet packets received from the radio network.	Read-only	Unsigned32
fwtZumLinkRx_dropped	Number of Ethernet packets received from the radio network that were dropped at the Ethernet interface.	Read-only	Unsigned32
fwtZumLinkRx_errors	Number of Ethernet packets received from the radio network that were had Ethernet errors.	Read-only	Unsigned32
fwtZumLinkTx_bytes	Number bytes of Ethernet packets received from the Ethernet port and sent over the radio network.	Read-only	Unsigned32
fwtZumLinkTx_packets	Number Ethernet packets received from the Ethernet port and sent over the radio network.	Read-only	Unsigned32
fwtZumLinkTx_dropped	Number Ethernet packets received from the Ethernet port but dropped because the txqueue was full.	Read-only	Unsigned32
fwtZumLinkTx_errors	Number Ethernet packets received from the Ethernet port that were in error.	Read-only	Unsigned32
fwtZumLinkNtpReference	Clock reference for NTP.	Read-Write	ZUMLINK_NTP_REFERENCE
fwtZumLinkNtpRestart	Cause the NTP system to restart.	Read-Write	ZUMLINK_NOW_OPTION
fwtZumLinkNtpDate	Set the local time from other NTP servers on the network.	Read-Write	ZUMLINK_NOW_OPTION
fwtZumLinkNtp_address1	Server to be used for syncing time. Use 0.0.0.0 to skip this server.	Read-Write	DisplayString
fwtZumLinkNtp_address2	Server to be used for syncing time. Use 0.0.0.0 to skip this server.	Read-Write	DisplayString
fwtZumLinkNtp_address3	Server to be used for syncing time. Use 0.0.0.0 to skip this server.	Read-Write	DisplayString
fwtZumLinkNtp_address4	Server to be used for syncing time. Use 0.0.0.0 to skip this server.	Read-Write	DisplayString
fwtZumLinkNtp_address5	Server to be used for syncing time. Use 0.0.0.0 to skip this server.	Read-Write	DisplayString
fwtZumLinkCom1Mode	Com Port Mode	Read-Write	ZUMLINK_UART_MODE
fwtZumLinkCom1Handler	Protocol of the com port	Read-Write	ZUMLINK_UART_HANDLER
fwtZumLinkCom1Baudrate	Com port baud rates	Read-Write	ZUMLINK_UART_BAUDRATES

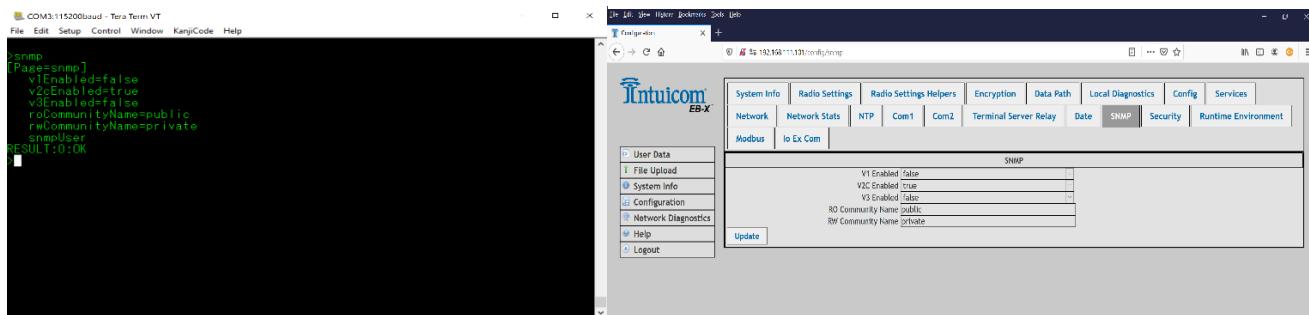
Intuicom – MIB			
Object	Description	Access	Syntax
fwtZumLinkCom1Databits	Com port data bits	Read-Write	ZUMLINK_UART_DATABITS
fwtZumLinkCom1Parity	Com port parity	Read-Write	ZUMLINK_UART_PARITY
fwtZumLinkCom1Stopbits	Com port number of stop bits	Read-Write	ZUMLINK_UART_STOPBITS
fwtZumLinkCom1Duplex	Com port is full or half duplex	Read-Write	ZUMLINK_UART_DUPLEX
fwtZumLinkCom1FlowControl	Com port hardware flow control is not supported.	Read-Write	ZUMLINK_UART_FLOWCONTROL_OFF
fwtZumLinkCom1DelayBeforeSendMs	Com port will delay sending in Ms to allow the other side to switch from tx to rx mode.	Read-Write	Unsigned32
fwtZumLinkCom1BreakBeforeSendUs	Com port will send a break signal for at least the number of microseconds specified before sending the data.	Read-Write	Unsigned32
fwtZumLinkCom1TerminalServerPort	The TCP port number to use when handler is set to Terminal Server.	Read-Write	Unsigned32
fwtZumLinkCom1TerminalServerTimeOut	Terminal Server TimeOut	Read-Write	Unsigned32
fwtZumLinkCom1TxBytes	The total bytes sent out of the Com port.	Read-only	Unsigned32
fwtZumLinkCom1RxBytes	The total bytes received from the Com port.	Read-only	Unsigned32
fwtZumLinkCom1ConnectionDrops	The number of terminal server connections dropped due to inactivity.	Read-only	Unsigned32
fwtZumLinkCom2Mode	Com port mode	Read-Write	ZUMLINK_UART_MODE
fwtZumLinkCom2Handler	Protocol of the com port	Read-Write	ZUMLINK_UART_HANDLER
fwtZumLinkCom2Baudrate	Com port baud rate	Read-Write	ZUMLINK_UART_BAUDRATES
fwtZumLinkCom2Databits	Com port data bits	Read-Write	ZUMLINK_UART_DATABITS
fwtZumLinkCom2Parity	Com port parity	Read-Write	ZUMLINK_UART_PARITY
fwtZumLinkCom2Stopbits	Com port number of stop bits	Read-Write	ZUMLINK_UART_STOPBITS
fwtZumLinkCom2Duplex	Com port is full or half duplex	Read-Write	ZUMLINK_UART_DUPLEX
fwtZumLinkCom2FlowControl	Com port hardware flow control is on or off	Read-Write	ZUMLINK_UART_FLOWCONTROL
fwtZumLinkCom2DelayBeforeSendMs	Com port will delay sending in Ms to allow the other side to switch from tx to rx mode.	Read-Write	Unsigned32
fwtZumLinkCom2BreakBeforeSendUs	Com port will send a break signal for at least the number of microseconds specified before sending the data.	Read-Write	Unsigned32
fwtZumLinkCom2TerminalServerPort	The TCP port number to use when handler is set to TerminalServer.	Read-Write	Unsigned32
fwtZumLinkCom2TerminalServerTimeOut	Terminal Server Time Out	Read-Write	Unsigned32
fwtZumLinkCom2TxBytes	The total bytes sent out of the Com port.	Read-only	Unsigned32
fwtZumLinkCom2RxBytes	The total bytes received from the Com port.	Read-only	Unsigned32
fwtZumLinkCom2ConnectionDrops	The number of terminal server connections dropped due to inactivity.	Read-only	Unsigned32
fwtZumLinkTermServ_relay_mapping	Options for streaming between serial device servers.	Read-Write	ZUMLINK_TERMSERV_RELAY_MAPPING
fwtZumLinkRemote_termserv_ip_address	IP address of remote terminal server.	Read-Write	IpAddress
fwtZumLinkUpTime	The number of seconds since the unit restarted.	Read-only	Unsigned32
fwtZumLinkUpTimeString	The number days, hours:minutes:seconds since the unit restarted.	Read-only	DisplayString
fwtZumLinkDcAppUptime	The number of seconds since the main app restarted.	Read-only	DisplayString
fwtZumLinkDcAppStartTime	The timestamp of when the main app restarted	Read-Write	DisplayString
fwtZumLinkTimeString	The current time.	Read-only	DisplayString

Intuicom – MIB			
Object	Description	Access	Syntax
fwtZumLinkFileTransferStatus	File Transfer Status	Read-Write	DisplayString
fwtZumLinkV1Enabled	SNMP V1 Enable / Disable	Read-Write	TruthValue
fwtZumLinkV2cEnabled	SNMP V2C Enable / Disable	Read-Write	TruthValue
fwtZumLinkV3Enabled	SNMP V3 Enable / Disable	Read-Write	TruthValue
fwtZumLinkRoCommunityName	Read-Only Community Name	Read-Write	DisplayString
fwtZumLinkRwCommunityName	Read-Write Community String	Read-Write	DisplayString
fwtZumLinkEnablePtpInterface	Enable PTP interface	Read-Write	TruthValue
fwtZumLinkEnableEthernetLogin	Enable SSH logins	Read-only	TruthValue
fwtZumLinkNeighborTableNumNeighbors	Number of Neighbors	Read-only	Unsigned32
fwtZumLinkNeighborTableNodeId	Device Node ID	Read-only	Unsigned32
fwtZumLinkNeighborTableNodeType	Node Type	Read-only	Unsigned32
fwtZumLinkNeighborTableIpAddress	Neighbor IP Address	Read-only	IpAddress
fwtZumLinkNeighborTableMacAddress	Neighbor MAC Address	Read-only	MacAddress
fwtZumLinkNeighborTableDeviceName	Device Name	Read-only	DisplayString
fwtZumLinkNeighborTableFwVersion	Device Node ID	Read-only	DisplayString
fwtZumLinkNeighborTableCounter	Neighbor Table Counter	Read-only	Unsigned32
fwtZumLinkNeighborTable	This table gives detailed status information for each neighbor of this node.	Not Accessible	
fwtZumLinkNeighborEntry	A row containing status information for a specific neighbor.	Not Accessible	
fwtZumLinkNeighborNodeId	Neighbor Node ID	Read-only	Unsigned32
fwtZumLinkNeighborIpAddress	Neighbor IP Address	Read-only	IpAddress
fwtZumLinkNeighborMacAddress	Neighbor MAC Address	Read-only	MacAddress
fwtZumLinkNeighborNodeType	Neighbor Node Type	Read-only	Unsigned32
fwtZumLinkNeighborRSSI	Neighbor RSSI	Read-only	INTEGER
fwtZumLinkNeighborLinkMargin	Neighbor Link Margin	Read-only	INTEGER
fwtZumLinkNeighborCounter	Neighbor Table Counter	Read-only	Unsigned32
fwtZumLinkNeighborTimestamp	Time When Node Info Received	Read-only	Unsigned32
fwtZumLinkNetworkTableDiscoveryState	Start or Stop Network Discovery	Read-Write	INTEGER
fwtZumLinkNetworkTableDiscoveryStatus	Get Discover Network Status	Read-only	DisplayString
fwtZumLinkNetworkTableNumNodes	Number of nodes in network	Read-only	Unsigned32
fwtZumLinkNetworkTableTimeStamp	Timestamp for when network table was last updated	Read-only	Unsigned32
fwtZumLinkNetworkTable	This table gives detailed status information for each neighbor of this node.	Not Accessible	
fwtZumLinkNetworkEntry	A row containing status information for a specific node.	Not Accessible	
fwtZumLinkNetworkNodeId	Device ID	Read-only	Unsigned32
fwtZumLinkNodeType	Node Type / Role	Read-only	Unsigned32
fwtZumLinkNetworkIpAddress	IP Address	Read-only	IpAddress
fwtZumLinkNetworkMacAddress	MAC Address	Read-only	MacAddress
fwtZumLinkNetworkDeviceName	Device Name	Read-only	DisplayString
fwtZumLinkNetworkFwVersion	Firmware Version	Read-only	DisplayString
fwtZumLinkNetworkHopCount	Number of hops from node id	Read-only	Unsigned32
fwtZumLinkNetworkNeighborTable	Neighbor Nodes	Not Accessible	Unsigned32
fwtZumLinkNetworkNeighborEntry	A row containing status information for a specific neighbor node.	Not Accessible	INTEGER
fwtZumLinkNetworkNeighborNodeId	Neighbor Node ID	Read-only	Unsigned32
fwtZumLinkNetworkNeighborRSSI	RSSI From Neighbor Node	Read-only	Unsigned32
fwtZumLinkNetworkPathTable	List of nodes in path from current node where info is gathered to current node.	Not Accessible	
fwtZumLinkNetworkPathEntry	A row containing status information for a node in the path.	Not Accessible	
fwtZumLinkNetworkPathIdx	Index to a node in the path	Not Accessible	Unsigned32
fwtZumLinkNetworkPathNodeId	Node In Path From Current Node	Read-only	Unsigned32
fwtZumLinkNetworkPathRSSITable	RSSI values between all the nodes along the path.	Not Accessible	

Intuicom - MIB			
Object	Description	Access	Syntax
fwtZumLinkNetworkPathRSSIEntry	A row containing RSSI for a node along the path.	Not Accessible	
fwtZumLinkNetworkPathRssiIdx	Index to a pair of source and destination nodes along the path.	Not Accessible	Unsigned32
fwtZumLinkNetworkPathRssiSrc	Source Node	Read-only	Unsigned32
fwtZumLinkNetworkPathRssiDst	Destination Node	Read-only	Unsigned32
fwtZumLinkNetworkPathRssiSrcDstRSSI	Source Destination RSSI	Read-only	INTEGER
fwtZumLinkNetworkPathRssiDstSrcRSSI	Source Destination RSSI	Read-only	INTEGER

1 – SNMP Write Access

- 1) Verify that v2c is enabled – see page 60.
- 2) Make a note of the rwCommunityName – see page 60, the default is private and it was not changed in this example.
- 3) Either from the Command Line, or on the webpage check the snmp rwCommunityName and make sure v2c is enabled.



- 4) Perform the Read/Write using the “snmp.rwCommunityName identified in Step 2.

Example

```
~$ snmpset -mFREEWAVE-TECHNOLOGIES-MIB -Pu -v2c -c private 192.168.2.10
fwtZumLinkRadioMode.0 i gateway
FREEWAVE-TECHNOLOGIES-MIB::fwtZumLinkRadioMode.0 = INTEGER: gateway(0)
~$ snmpget -mFREEWAVE-TECHNOLOGIES-MIB -Pu -v2c -c private 192.168.2.10
fwtZumLinkRadioMode.0
FREEWAVE-TECHNOLOGIES-MIB::fwtZumLinkRadioMode.0 = INTEGER: gateway(0)
~$ snmpset -mFREEWAVE-TECHNOLOGIES-MIB -Pu -v2c -c private 192.168.2.10
fwtZumLinkRadioMode.0 i endpoint
FREEWAVE-TECHNOLOGIES-MIB::fwtZumLinkRadioMode.0 = INTEGER: endpoint(1)
~$ snmpget -mFREEWAVE-TECHNOLOGIES-MIB -Pu -v2c -c private 192.168.2.10
fwtZumLinkRadioMode.0
FREEWAVE-TECHNOLOGIES-MIB::fwtZumLinkRadioMode.0 = INTEGER: endpoint(1)
```

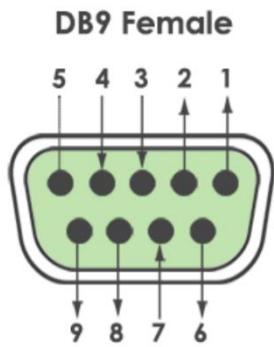
- 5) After adjusting the settings issue the “save” command.

NOTE: This is the same workflow as the CLI.

```
~$ snmpset -mFREEWAVE-TECHNOLOGIES-MIB -Pu -v2c -c private 192.168.2.10
fwtZumLinkSave.0 i now
FREEWAVE-TECHNOLOGIES-MIB::fwtZumLinkSave.0 = INTEGER: now(1)
```

Appendix H – Serial Port Pinout

Below are diagrams of the EB-X Serial Ports and pin functions.



Pin	Assignment	Signal
1	Carrier Detect (CD)	Output
2	Transmit Data (Tx)	Output
3	Receive Data (Rx)	Input
4	Data Terminal Ready (DTR)	Input
5	Ground (-)	
6	Data Set Ready (DSR)	Input/Output
7	Ready to Send (RTS)	Input
8	Clear to Send (CTS)	Output
9	Not Connected	

Appendix I – Intuicom Technical Support

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4909 Nautilus Court, Ste 111
Boulder, CO 80301 USA
(303) 449-4330 ext 735
(720) 587-9190
support@intuicom.com
dbraddon@intuicom.com

Appendix J – Warranty

LIMITED WARRANTY TO END-USERS

Intuicom, Inc.
4909 Nautilus Court North, Suite 111 BOULDER,
CO 80301

- A. Standard Limited Warranty for Software Products. For Products that include a software license, INTUICOM makes a limited warranty to the End User that the software will perform substantially in accordance with the accompanying written materials and that the transfer media on which the Product is provided will be free from defects in materials or workmanship under normal use and service for a period of ninety (90) days from the date of delivery (the "Limited Warranty") pursuant to the software license included with the Product. The software license specifically disclaims all other warranties relating to the Products, including any and all other warranties with respect to the performance of the Products.
- B. Hardware and Other Equipment Manufactured By Intuicom. Hardware products manufactured by INTUICOM include a limited warranty for defects in materials or workmanship under normal use and service for a period of one (1) year from the date of delivery. Intuicom, at its sole discretion, will repair or replace hardware covered under this limited warranty. Cables, antennas or other accessories manufactured by INTUICOM include a limited warranty for defects in materials or workmanship under normal use and service for a period of ninety (90) days from the date of delivery. Repairs not covered under this limited warranty will be billed as set forth in INTUICOM's current Hardware Service Policy and Instructions.
- C. Hardware Manufactured By Others. INTUICOM makes no warranties whatsoever with respect to Hardware manufactured by third parties. Customers shall look only to the original manufacturer of the Hardware, pursuant to the terms of any manufacturer warranty for any alleged defects and indemnifies and holds INTUICOM harmless from and against any claims by any party related directly or indirectly to any defects in the Hardware, and functional failure, improper operation, failure to operate according to specifications or any other matter related to the Hardware. INTUICOM shall not be liable or responsible for the failure of the Manufacturer to perform under or honor any warranty with respect to the Hardware. Customer acknowledges and agrees that Customer shall have the risk of any loss, damage or functional failure related to the HARDWARE and shall have the responsibility for maintaining the proper operation of the HARDWARE and complying with all maintenance guidelines and specifications from the Manufacturer and all other conditions to receiving warranty coverage from the Manufacturer.
- D. No Other Warranty. EXCEPT FOR THE EXPRESS STANDARD LIMITED WARRANTY REFERENCED ABOVE, INTUICOM GRANTS NO OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING THE PRODUCTS, THEIR FITNESS FOR ANY PURPOSE, THEIR QUALITY, THEIR MERCHANTABILITY OR OTHERWISE. INTUICOM DOES NOT MAKE BY VIRTUE OF THIS AGREEMENT OR ANY PRODUCT ORDER, AND HEREBY EXPRESSLY DISCLAIMS, ANY OTHER REPRESENTATION OR WARRANTY OF ANY KIND WITH RESPECT TO THE PRODUCTS.
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