EBX

High-Speed IP/Ethernet Data Link
Quick Start Guide

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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.

This product is licensed by The United States. Diversion contrary to U.S. law is prohibited. Shipment or re-export of this product outside of The United States may require authorization by the U.S. Bureau of Export Administration.

Please contact Intuicom, Inc. for further assistance and information.

Contents

1 - Overview

This guide provides the necessary steps for creation of a simple network with two EBX radios and two computers where neither computer is connected to the Internet. When Complete the network will look like the illustration below:

The steps for configuring a network are:

- Collecting Materials
- IP Address Configuration
- Wireless Network Configuration
- Wireless Network Test

2 – Collecting Materials

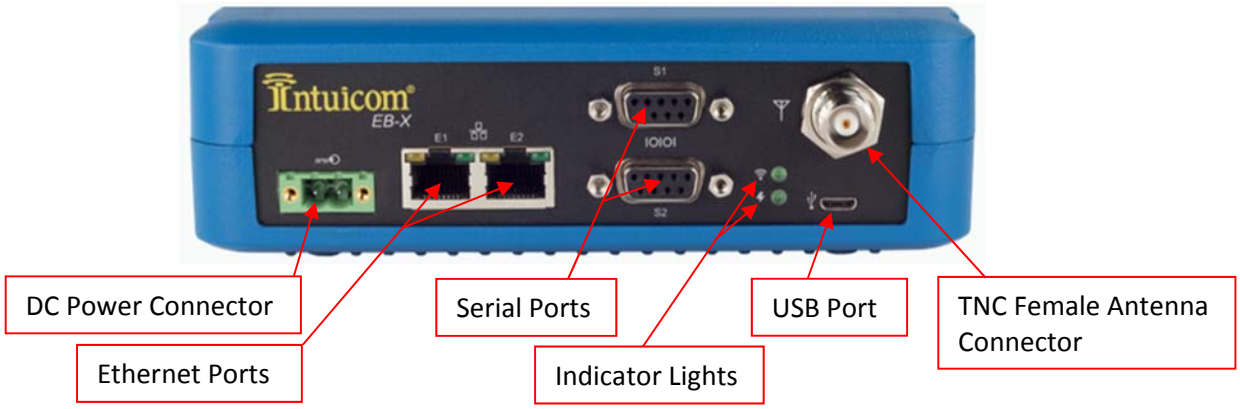
Materials included are:

- Two EBX Radios
- Two Power Supplies
- Two Cat5e Ethernet Cables

Additional materials needed for setup:

- Two TNC duck antennas
- Two PCs running Windows 7 or later
- Web Browser (Internet Explorer, Firefox, Chrome, etc.)

Front Panel Overview



3 - Documenting the Network

You will need to select one radio to be the Gateway and one radio to be the Endpoint, and it does not matter which radio you select for each role.

Configuring the network is a twostep process. First the IP Address configuration must be done for both computers and both EBX radios. Second is the wireless network configuration that must be programmed into each radio.

A - Computer IP Address Assignment

The IP Address of each computer can be accessed through the TCP/IPv4 Properties menu.

- Windows 7 – Control Panel\Network and Internet\Network Connections - Right click on Local Area Connection where the radio Ethernet cable is plugged in, and select "Properties". Then double click on "Internet Protocol Version 4 (TCP/IPv4). This will bring up the window where you can set the IP Address.
- Windows 10 – Search on "Control Panel" – Control Panel\Network and Internet\Network Connections - Right click on Local Area Connection where the radio Ethernet cable is plugged in, and select "Properties". Then double click on "Internet Protocol Version 4 (TCP/IPv4). This will bring up the window where you can set the IP Address.

The IP Address of both Computers and both radios must be in the same range. Additionally, you can set the default gateway to be the same in all four devices. Example below:

Device	IP Address	Subnet Mask	Default Gateway
Computer1	192.168.102.179	255.255.255.0	192.168.102.1
Computer2	192.168.102.183	255.255.255.0	192.168.102.1
EBX – Gateway	192.168.102.180	255.255.255.0	192.168.102.1
EBX – Endpoint	192.168.102.182	255.255.255.0	192.168.102.1

NOTE: If you are unsure how to change the IP Address on your computer, you can consult your Network Administrator or do a Google search on the subject.

4 – Assigning IP Address – EBX

Connect the power supply green female phoenix connector to the green male power supply connector on the front panel of the EBX radio (see page 6). Connect the Cat5e cable to either of the Ethernet ports on the front panel of the radio (see page 6).

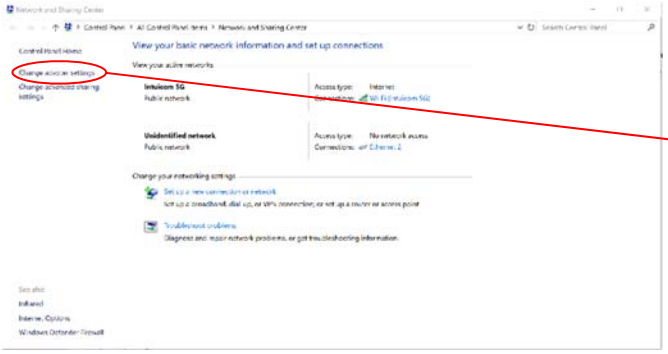
Default EBX Configuration:

- 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 you LAN Adapter in windows.

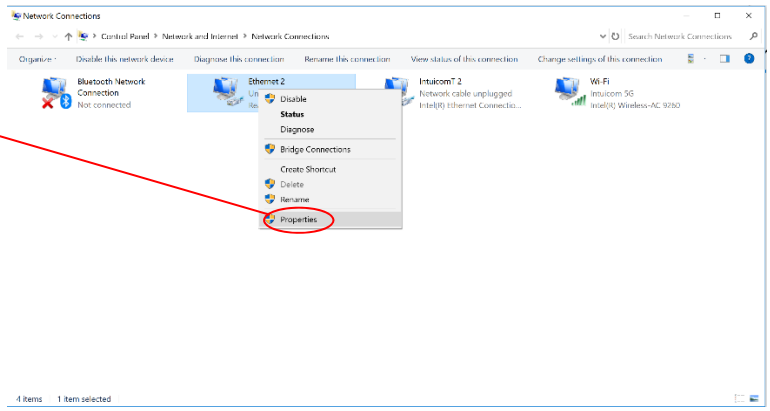
Navigate in windows to your Network and Sharing center and click on “Change adapter settings”.



Click on “Change adapter settings”

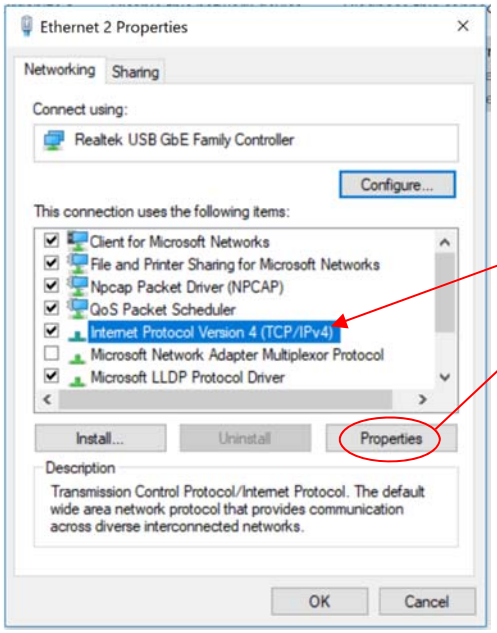
Right click on the Ethernet adapter connected to the radio and select “Properties”.

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.

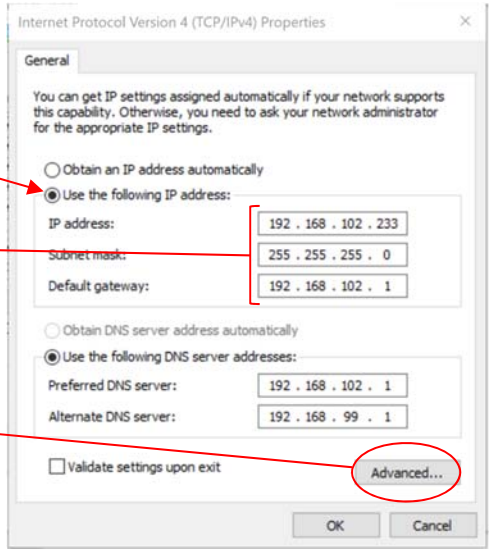


Click and highlight "Internet Protocol Version 4 (TCP/IPv4)" and click the "Properties" button

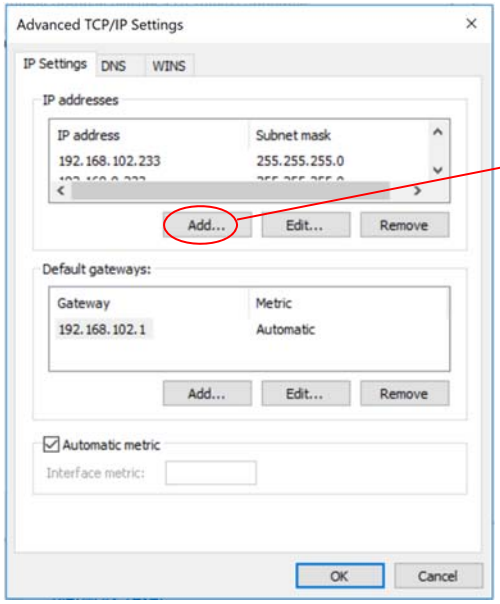
Make sure the bullet is selected for "Use the following IP address:

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

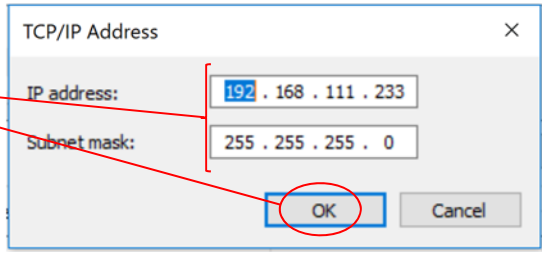


Upon clicking the "Advanced" button the "TCP/IP Advanced Settings window will open up. Under the IP Addresses box click the "Add" button and in the pop-up, window enter and IP Address in the default range of the radios.



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

When the TCP/IP Addresses window opens enter and 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 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 computers 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 –t *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.

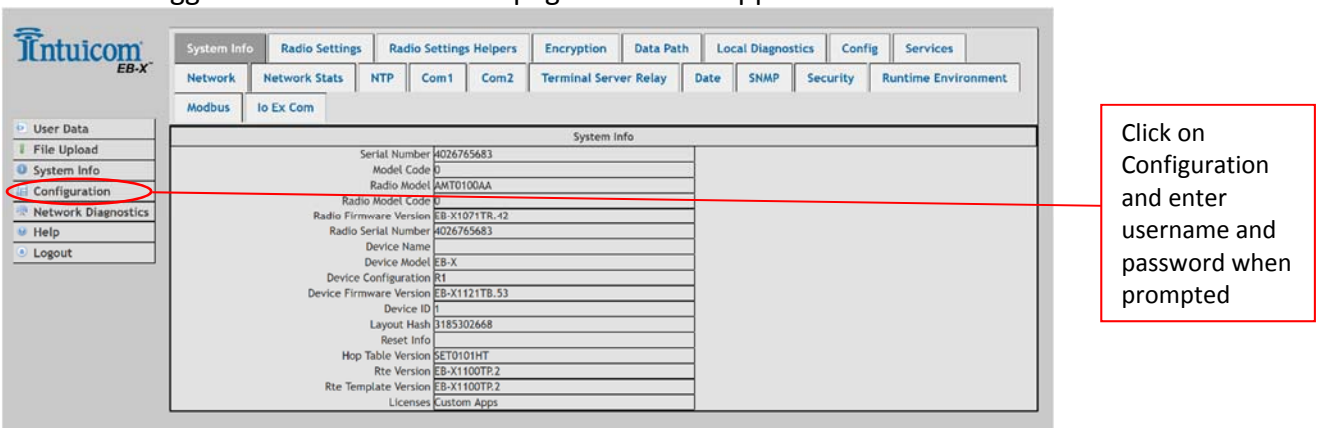
Run the ping until the radio begins to ping, stop the ping and bring up a browser and enter the URL on the address line of:

- 192.168.111.100

And hit enter – 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.

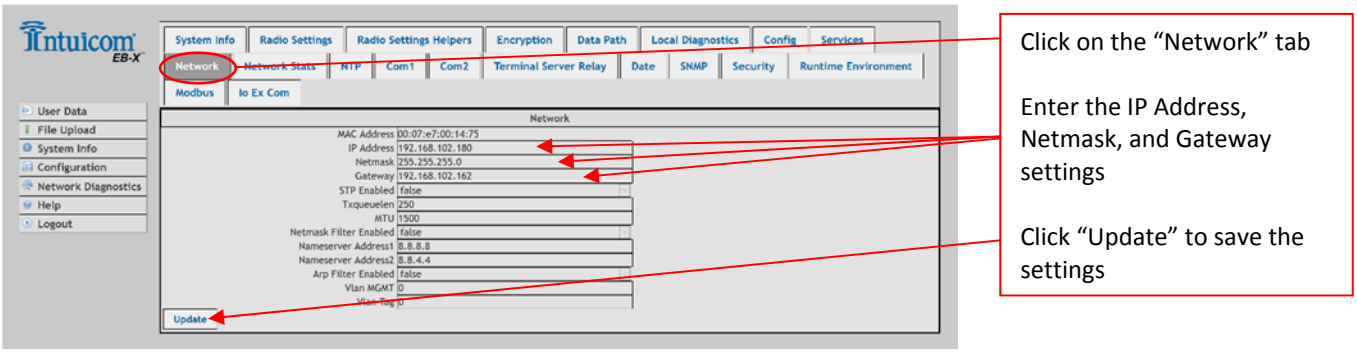
- Username = admin
- Password = admin

When first logged into the EBX the webpage below will appear.



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.



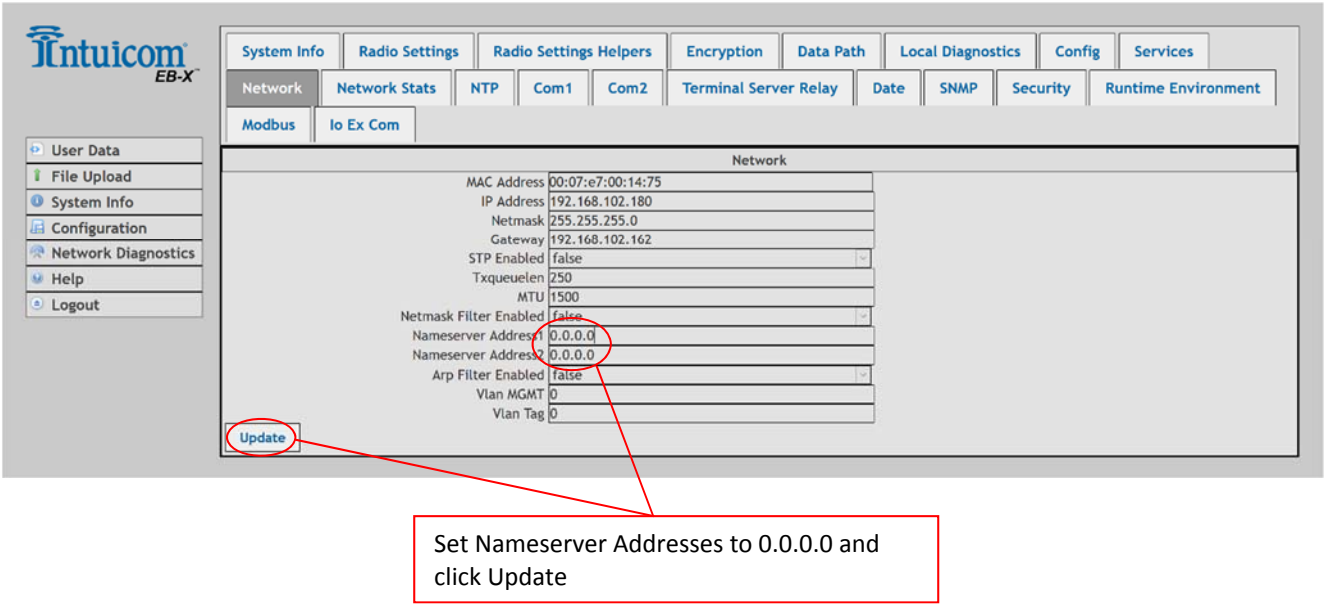
The EB-X is now configured with IP Address settings for your network.

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 it's associated MAC Address.

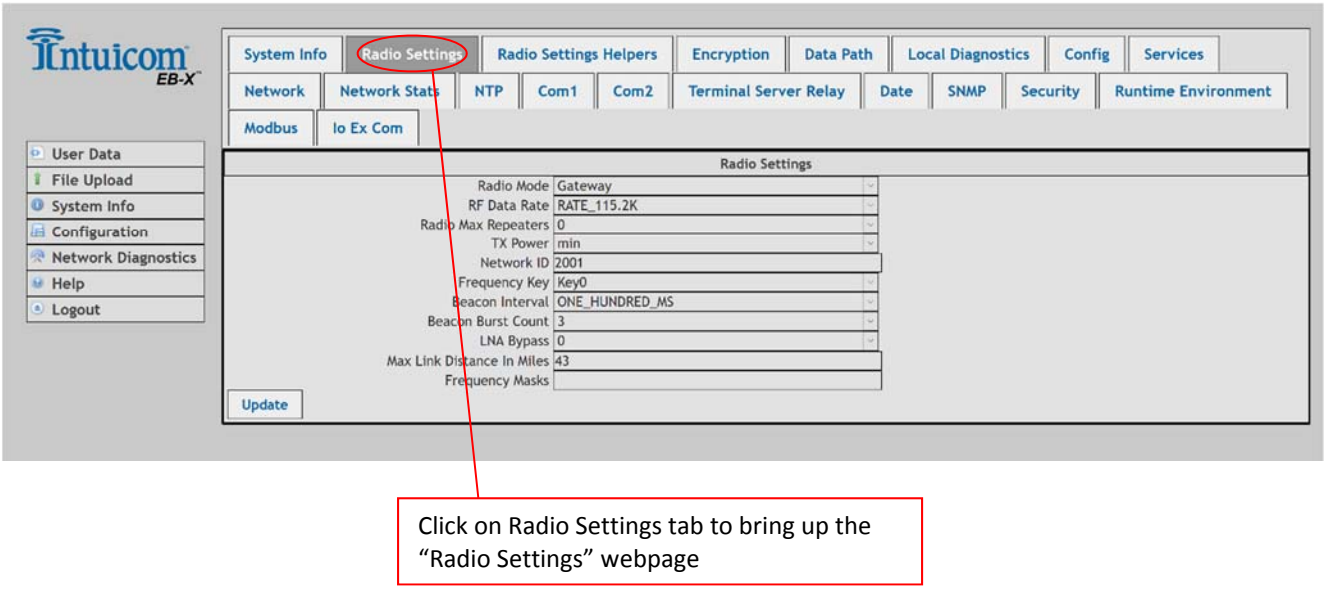


Set Nameserver Addresses to 0.0.0.0 and click Update

5 - 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.



Click on Radio Settings tab to bring up the “Radio Settings” webpage

A - Radio Mode

For a simple network one of the radios will be set up as a Gateway and the other radio as an Endpoint.

Additional Settings under Mode are Gateway_Repeater and Endpoint_Repeater. These settings will be covered in a later section of this document.

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.

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.

For this example, use the RATE_4M setting.

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 33-41 for more information about repeaters).

For this example, set it to zero (0).

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.

For this example, 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.

For this example, program both radios to Network ID of 2000.

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.

For this example, 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.

For this example, use Key0.

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.

For this example, use 915.0000.

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. In this example we are using the RATE_4M setting and the Radio Hopping Mode will be an available setting for programming.

For this example, set it to Hopping_Off.

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.

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. Endpoints can communicate with each other if they can pick up the radio signal from the other Endpoints.

If the Endpoints and Endpoint Repeaters can only pick up the radio signal from the Gateway and cannot hear each other, then to achieve Endpoint to Endpoint communications the Gateway radio must be configured as a Gateway_Repeater. This will allow the Gateway_Repeater to repeat the signal from one Endpoint to the other.

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.

For this example, the setting will not be available as we have programmed hopping to off.

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.

For this example, set it to 0.

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

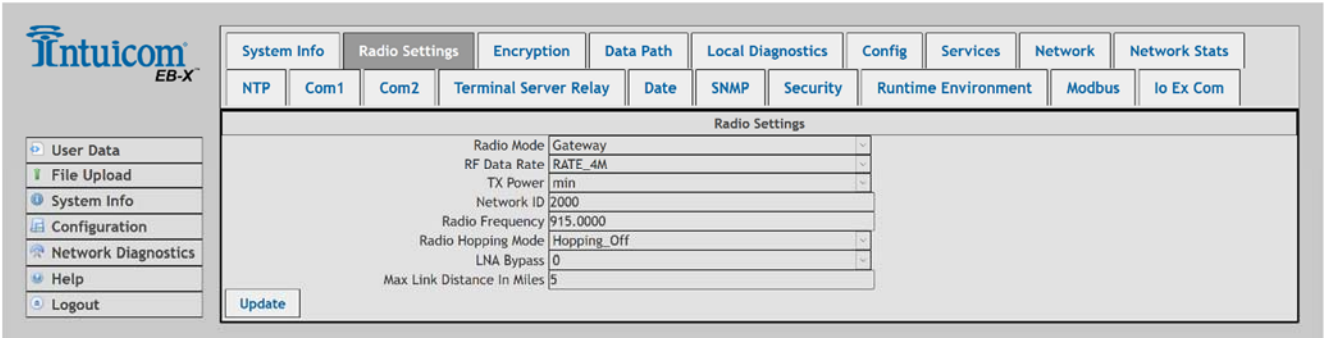
For this example, set it to 5.

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.

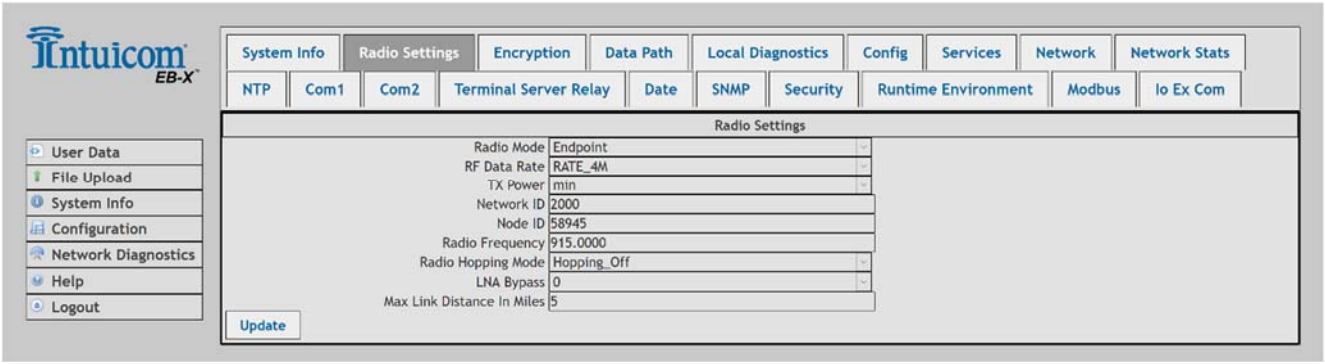
Example: When hopping is set to on, the radio frequency line is not available for configuration. If you want to turn hopping off and set the radio to a fixed frequency you will need to select hopping off from the drop down, and write the settings to the radio by clicking the “Update” button before the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

After the distance is set to 5, update the radio for the last time and make sure that they Radio Settings page appears as follows for the Gateway and Endpoint.

Radio Settings - Gateway



Radio Settings - Endpoint



6 - 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.

128-bit encryption will have a hexadecimal key of 32 characters or less.

Example = 1234567890abcdef1234567890abcdef

256-bit encryption will have a hexadecimal key of 64 characters or more.

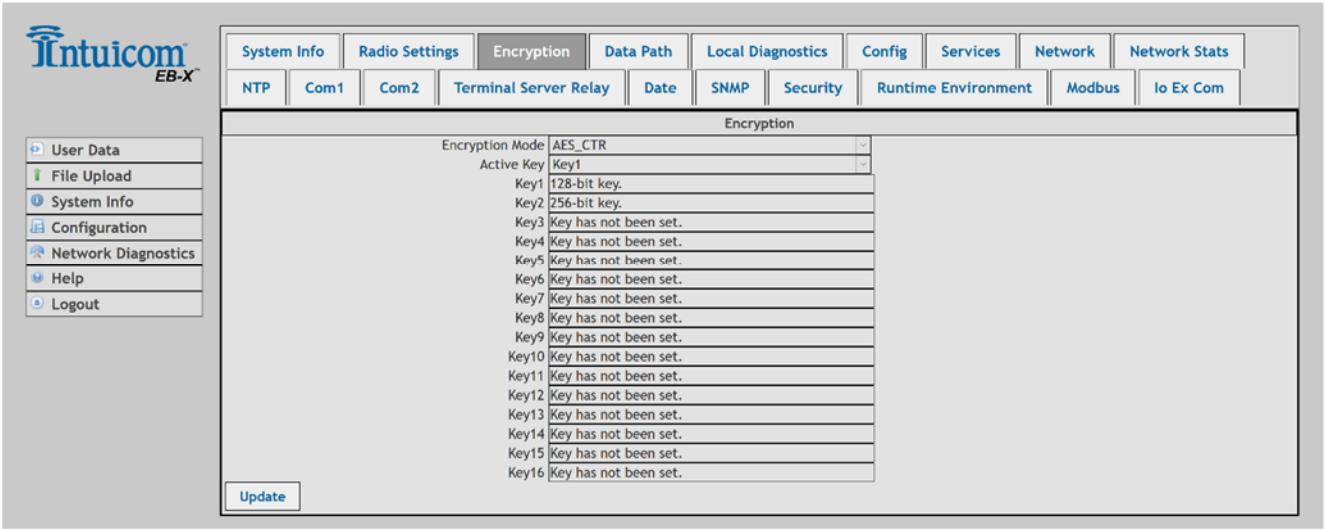
Example = 1234567890abcdef1234567890abcdef1234567890abcdef1234567890abcdef

No colons are used in the key to separate the numbers and or letters.

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.



For this example, leave the defaults with Active Key set to off.

7 - 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

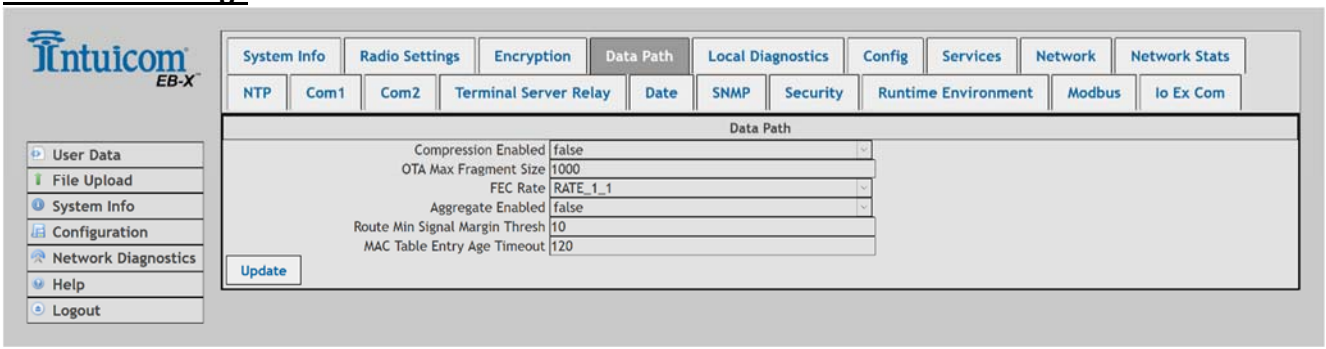
This setting is only used when there are repeaters in the network, and designates the minimum signal margin in dB for the next hop to be considered as part of the packet route. When repeaters are enabled the packets take the path through the radio network with the minimum number of hops. By increasing 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 miles.

Settings are:
Minimum value = -5
Maximum value = 60

For this example, leave the default setting of 10.

Data Path Settings



8 - Additional Pages

For the additional pages available in the EB-X leaving them at default settings will work for the present example. For a full description of these pages and their settings please refer to the EB-X Users guide.

Pages not covered in this Quick Start Guide are:

1) Config
2) Services
3) Network States
4) NTP
5) Date
6) SNMP
7) Security
8) Runtime Environment
9) Modbus
10) Lo Ex Com

9 - 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 refer to the EB-X Users Guide.

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%

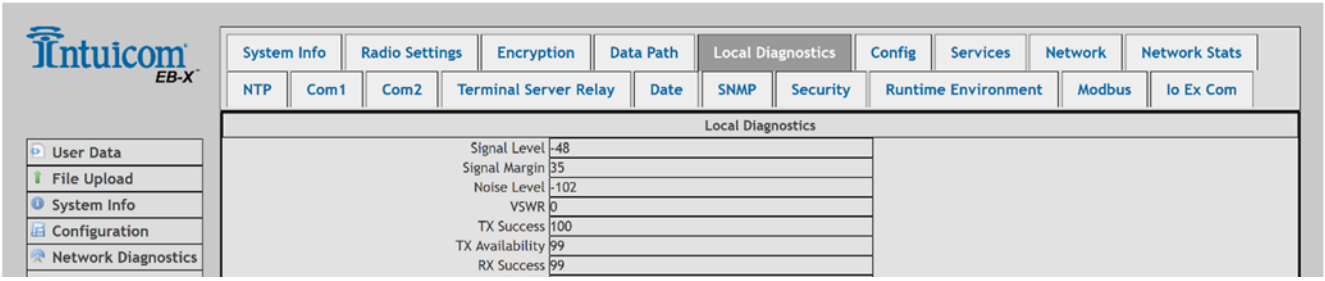
F - Tx Availability

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



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

10 – 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 only available through the Terminal (CLI) interface.

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, Databits, Parity, Stopbits, 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) **Baudrate** – This is the port speed designated in Kilobits per second.
D) **Databits** – Options are 7 and 8.
E) **Parity** – Options are None, Odd, Even.
F) **Duplex** – Only available Option is full – if half duplex is desired it will have to be programmed through the command line interface.
G) **Flow Control** – Options are Off, and Hardware.

NOTE: Baudrate, Databits, Parity, Stopbits, 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 programed 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 parameters 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
Baudrate, Databits, Parity, Stopbits, 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 decribed above..

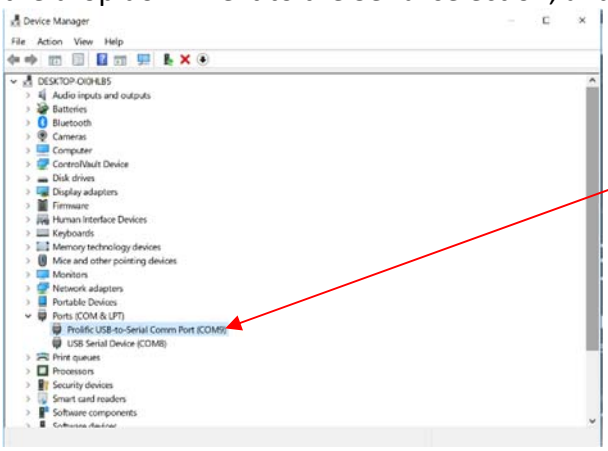
Example: 192.168.111.100:5041 for COM 1

Verification of this connectivity can be achieved with our Quick Start 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:
Baudrate = 115200
Databits = 8
Parity = None
Stopbits = 1
Flow Control = None

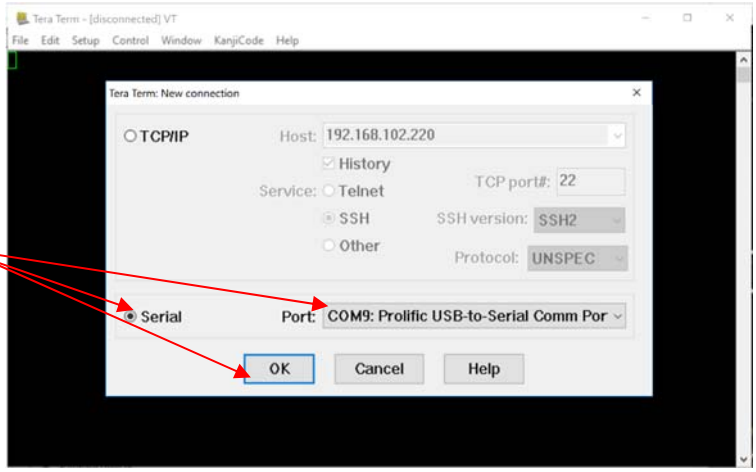
Plug in the USB to serial connector to an open USB port on the computer connected to the Endpoint radio, and connect the DB9 end to S1 port on the front of the radio.
Open Device Manager and note what COM port the USB to Serial Adapter installed on.

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.

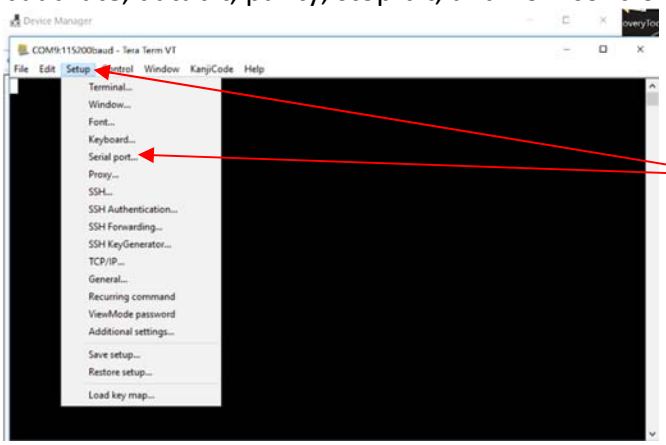


Open Device Manager and expand Ports (COM & LPT) option and not what COM port the USB to Serial Adapter installed itself on.

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

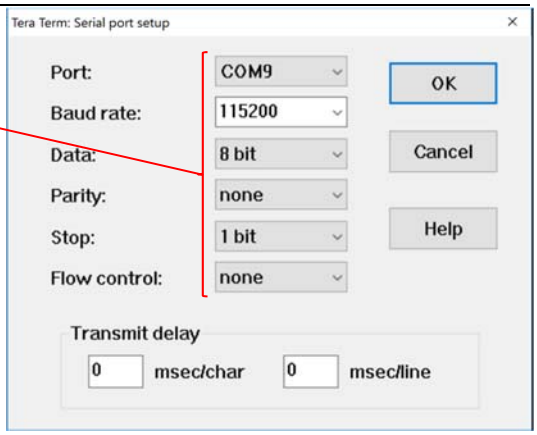


After you have selected the COM Port click on the Setup menu at the top of the Tera Term screen and select Serial Port from the drop-down menu. In the Serial Port configuration menu set the baudrate, databit, parity, stop bit, and flow control to match the settings on the radio.

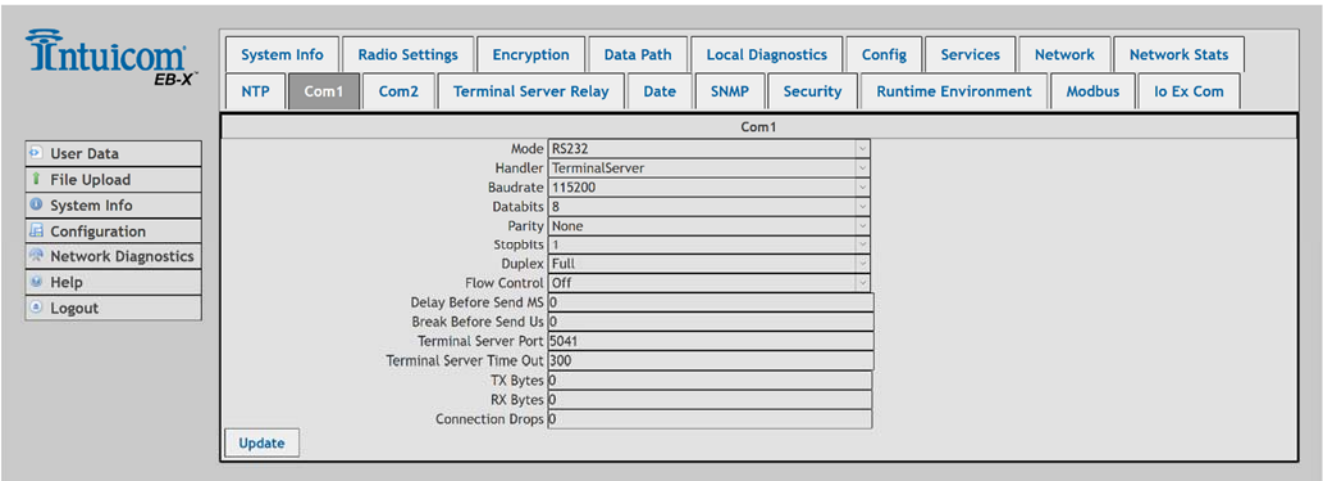


Click Setup and select Serial port… from the drop-down menu.

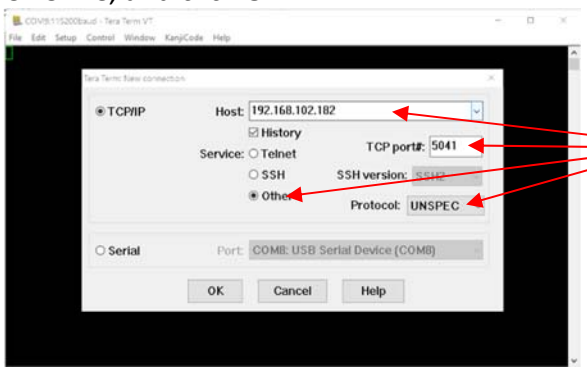
Configure Tera Term Serial Port to the same settings as the radio



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.



Bullet in TCP/IP, IP Address of the Endpoint radio in the Host: field, Service bullet in Other, TVP Port#: set to 5041, Protocol set to UNSPEC

Once the set up 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

To achieve serial to serial connections with the EB-X radio you will need to enable to 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
Baudrate, Databits, Parity, Stopbits, 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:

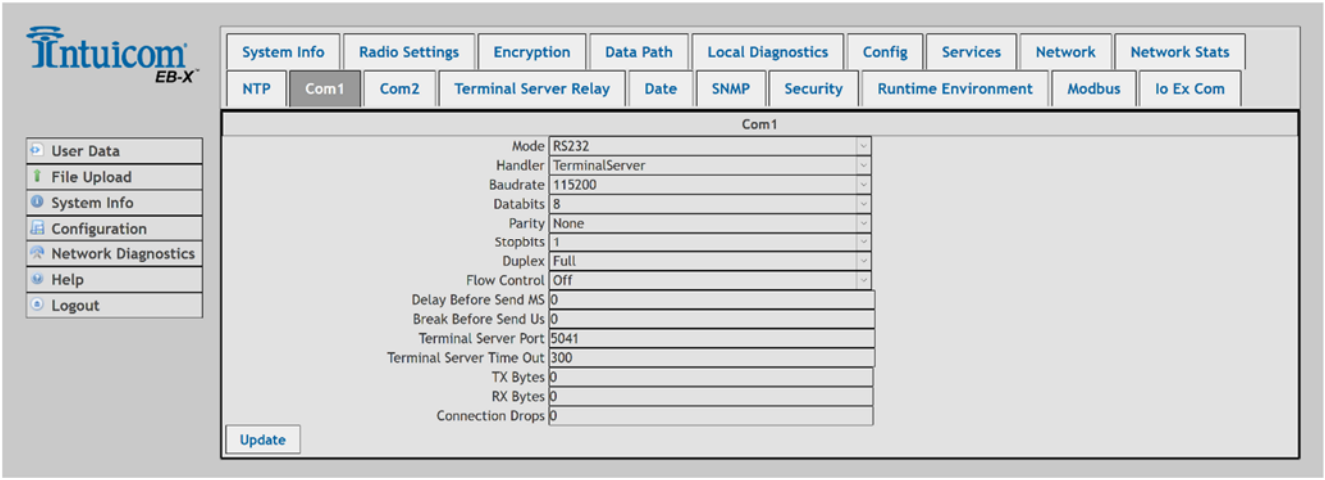
LOCAL_COM1_TO_REMOTE_COM1

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. For this example, set it to 192.168.102.180.

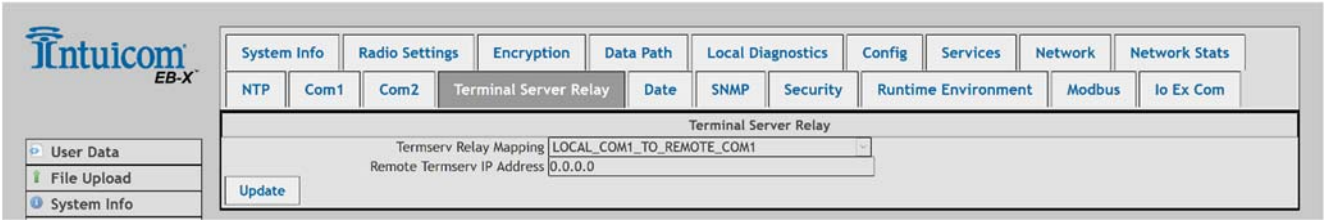
Click Update to save the settings.

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.

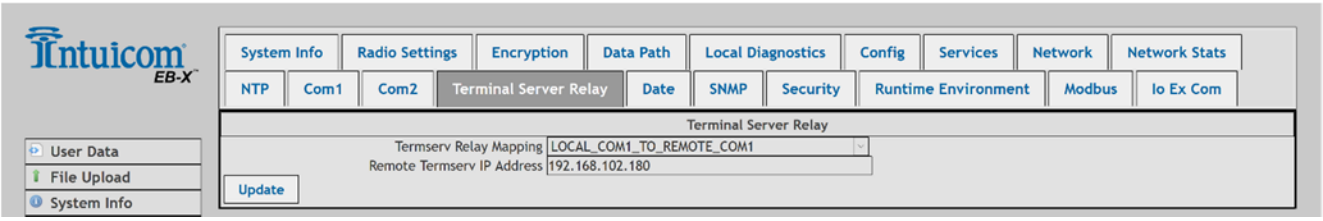
Gateway and Endpoint COM1 Settings



Gateway Terminal Server Relay Configuration



Endpoint Terminal Server Relay Configuration



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 Baudrate, Databits, Parity, Stopbits, 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 Quick Start 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 27 and 28 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.

11 – 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 radio can be set to 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.

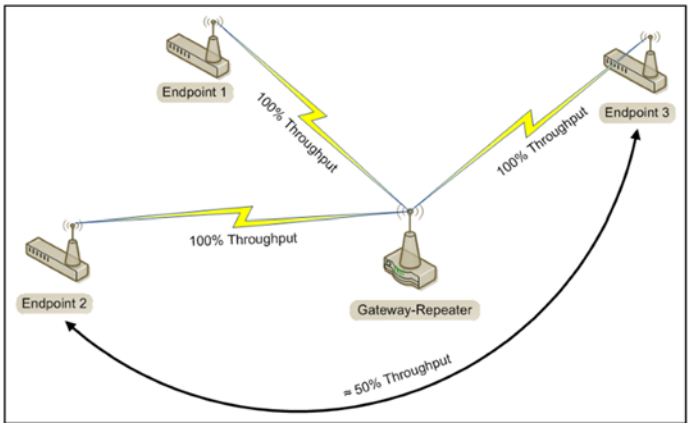
If Endpoints cannot pick up the signal from each other, then the Gateway radio will have to be set up as a Gateway_Repeater so that it will repeat the signal from Endpoint to Endpoint, and provide communications from Endpoint to Endpoint through the Gateway Radio.

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.

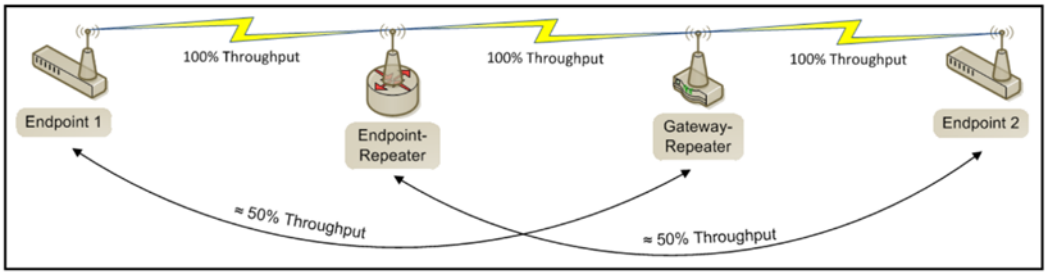
Gateway_Repeater Network

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.



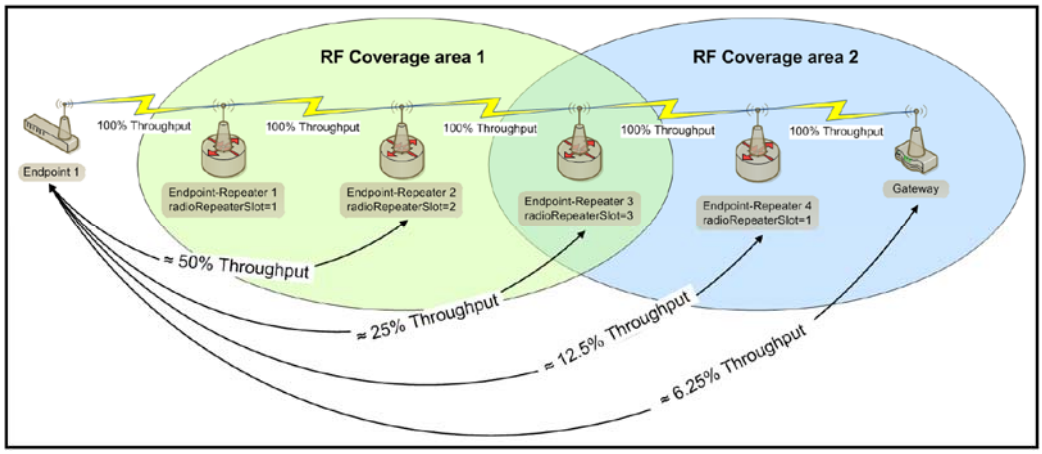
Gateway_Repeater

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.



Gateway_Repeater and 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.



Multiple Endpoint_Repeaters

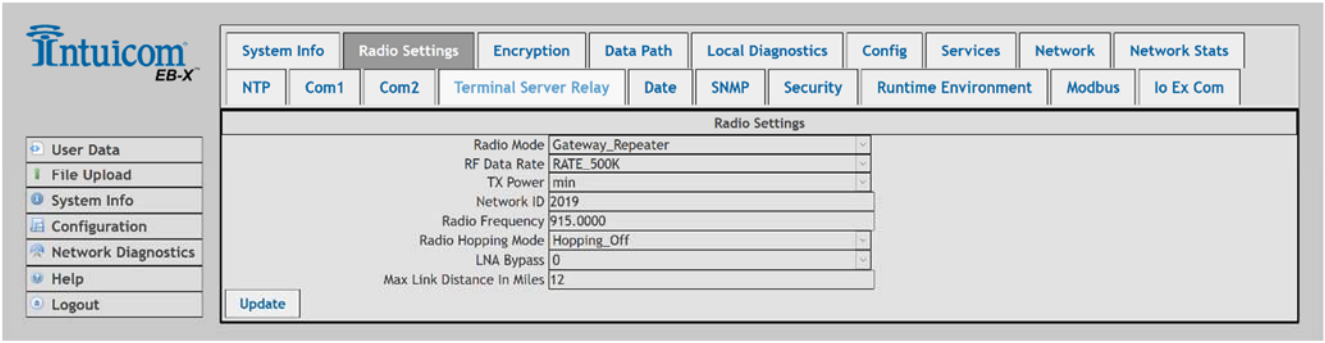
Repeater Settings

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”.

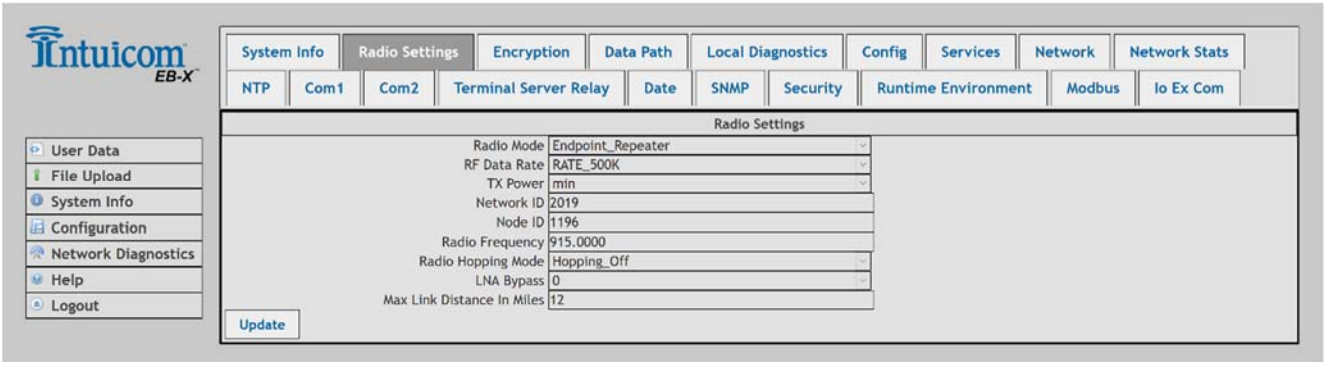
Hopping Off

The first examples are for a wireless network is with hopping is 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

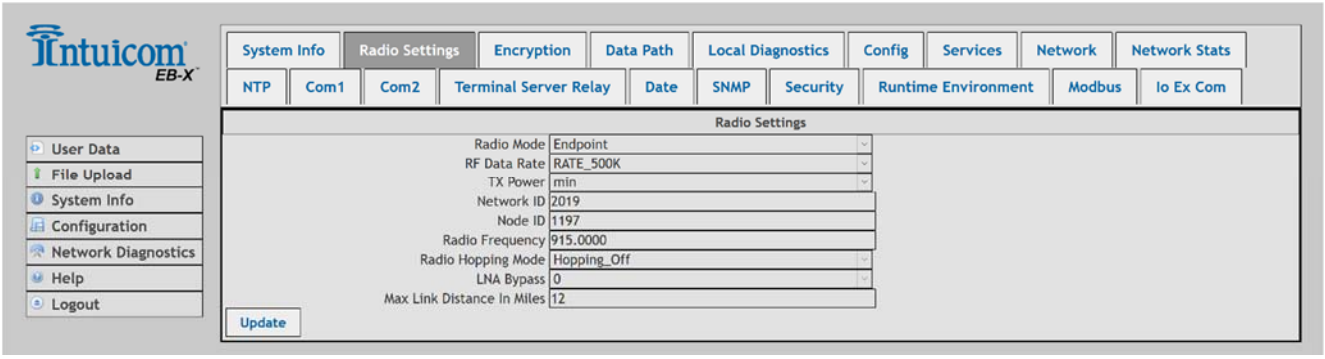
Gateway_Repeater Settings



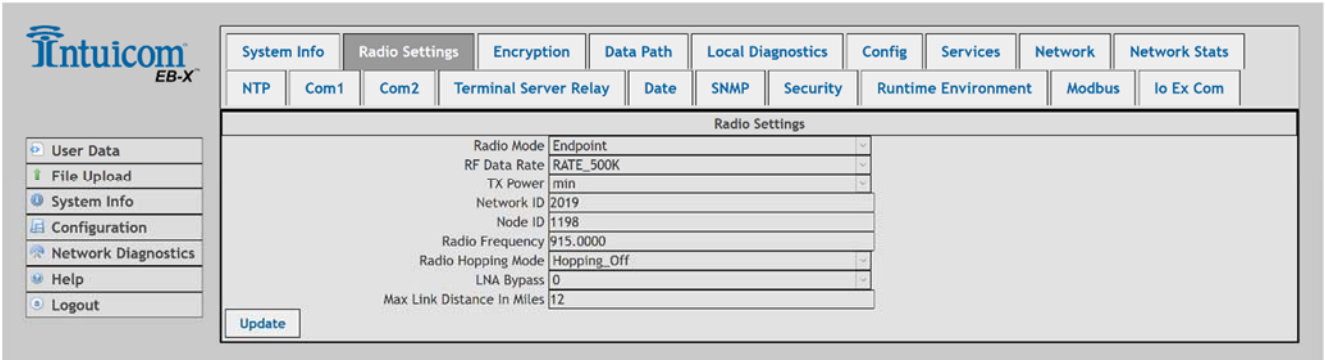
Endpoint_Repeater Setting



Endpoint1 Settings – Connected to the Repeater



Endpoint2 Settings – Connected to Gateway_Repeater

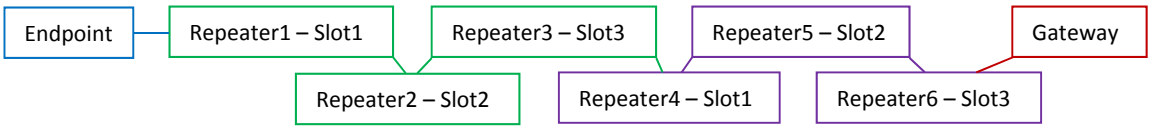


NOTE: The only difference between the Endpoint connected to the Repeater and the Endpoint connected to the Gateway_Repeater is the node ID. These must be different on every radio on the network.

Hopping On

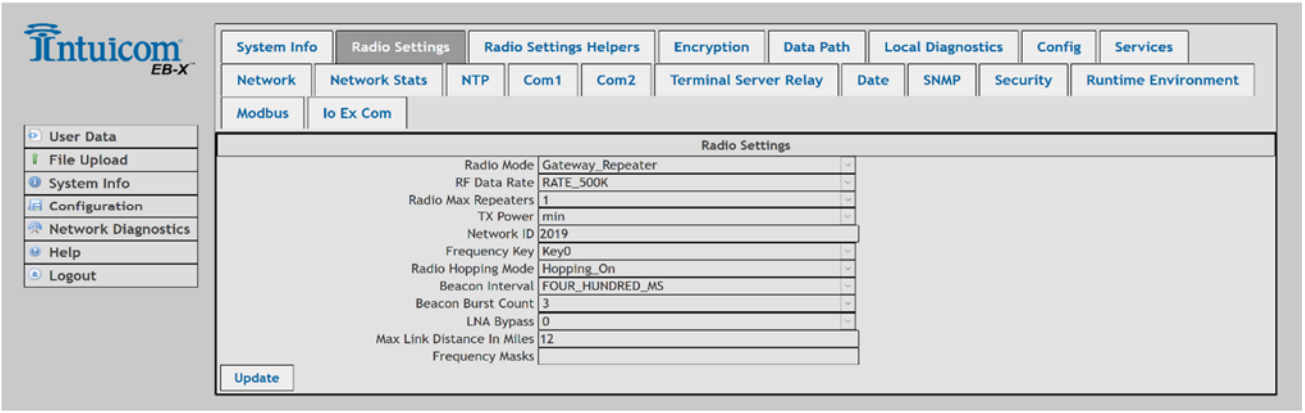
When hopping is on the Radio Max Repeaters setting is available and it must be set to the number of repeaters on the network with a Maximum of 3.

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:

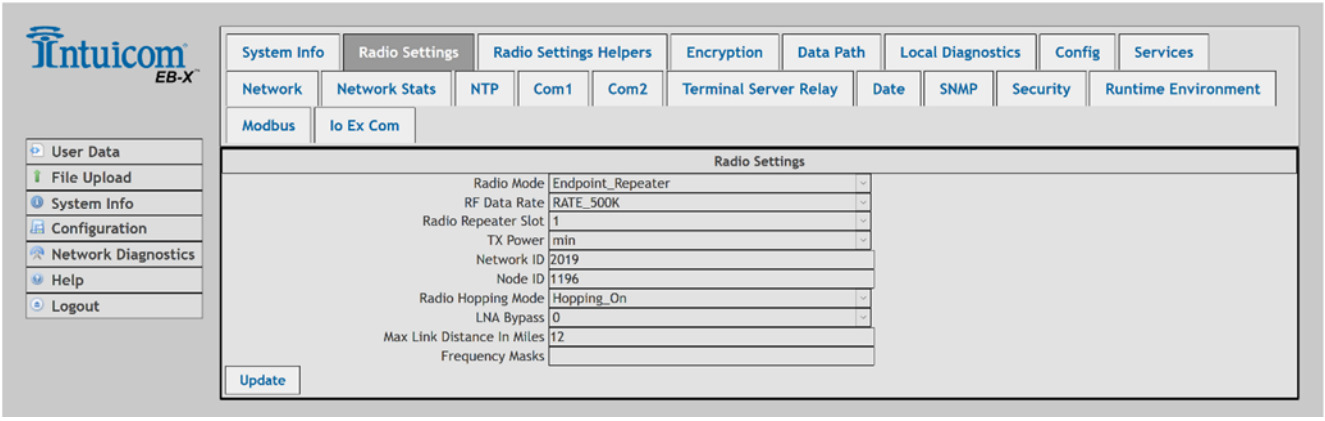


Again, make sure each radio on the network has a unique Node ID, and Network ID matches across all radios connected to the Gateway or Gateway_Repeater. This example like the one above uses the mode of RATE_500K, Network ID 2019, and hopping is on.

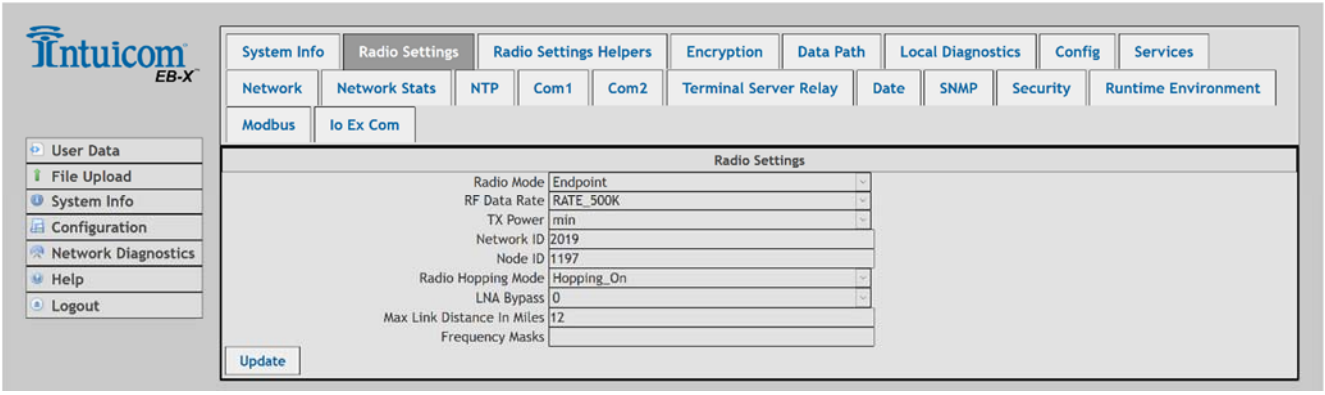
Gateway_Repeater Settings



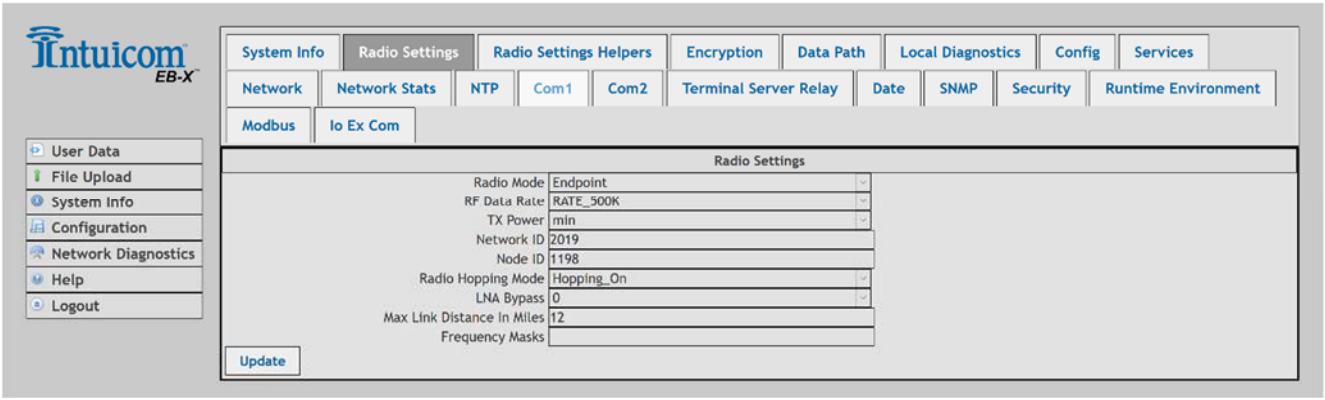
Endpoint_Repeater Settings



Endpoint Settings – Connected to Endpoint_Repeater



Endpoint Settings – Connected to Gateway_Repeater



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.

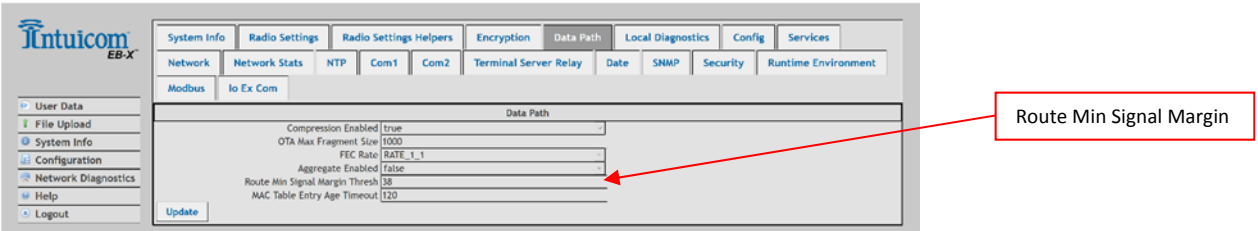
Suggested procedure for setting the - Route Min Signal Margin

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 6 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 closes 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 closes 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 closes unit to the Endpoint, set it's value to -4 dB.

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.



Appendix A – Command Line Interface Access

There are two ways users can access the Command Line Interface on the EB-X radio. First method is through the micro USB port, and second is through the Ethernet interface using SSH. Both methods require the user to have a terminal emulator program.

A – Micro USB Port Access

Using a Micro USB to USB cable with the radio powered on, plug the micros USB end of the cable into the radio in the port below the antenna connector. See page 6 of this document for location.

Plug the USB end of the cable into a USB port on your computer. Driver should automatically install once it is plugged in.

When the driver installs you will be able to see an EB-X Drivers drive a EBX Files Drive that will come up in Windows Explorer (the same Windows Explorer pop up comes up when you plug in a thumb drive).

Once the drives appear, open Device Manager on your PC and expand the Ports (COM & LPT) menu and note which COM port the USB Serial Device installed on.

Open your terminal emulator software and set it up for a serial connection on the COM port that Windows installed the driver on and configure it for:

Baudrate = 115200
Databits = 8
Parity = None
Stopbits = 1
Flow Control = None

When the terminal window comes up hit the enter key to bring up the log in prompt, and enter the user name - admin, and hit enter, type in the password – admin and hit enter and it will come up on the command line.

If you are using this access method because you do not know the IP Address that has been programmed into the radio type the command – network and hit enter and the network settings will be displayed. You can then use the IP Address to log into the webpages for the radio, provided the IP Address of your network adapter on your PC is in the same range.

B – SSH Terminal Access

To access the CLI through SSH terminal you will need to know the IP Address of the radio.

Make sure you can ping the radio.
Open your terminal emulator software and configure it for an SSH connection to the IP Address of the radio.

When the terminal window opens hit enter to bring up the log in prompt, and enter the user name - admin, and hit enter, type in the password – admin, and hit enter and it will come up on the command line.

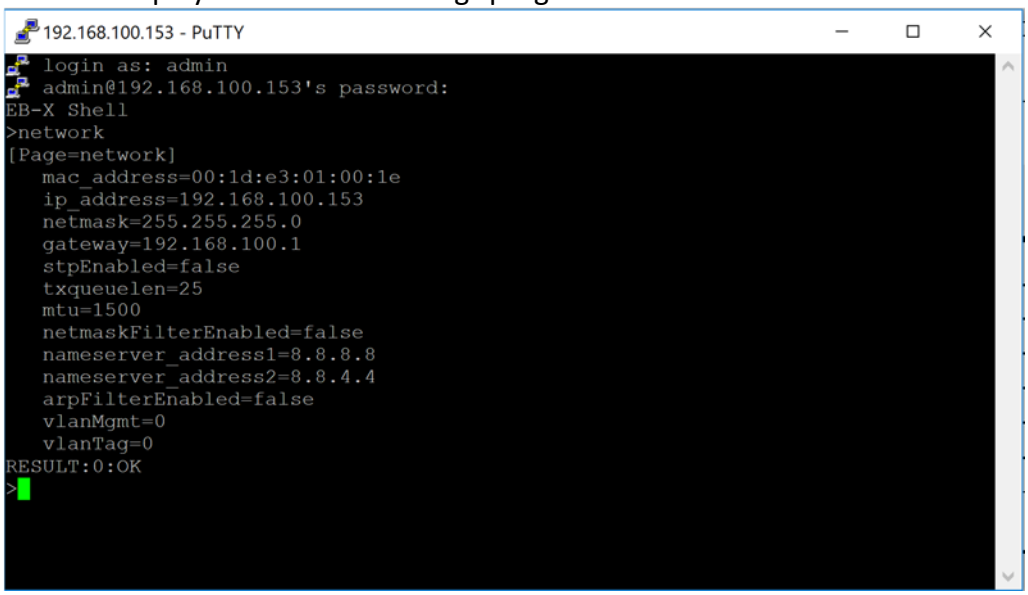
NOTE: When attempting to configure a remote radio over a low bandwidth wireless link such as 115.2K or 250K it will be preferable to use the SSH terminal because the web pages will take an extremely long time to load.

See pages 28 and 29 for Tera Term Screen shots.

Appendix B – Useful Terminal Commands

If the IP Address of the EB-X is not known follow the procedure in Appendix A to log into the Command Line Interface and run the command: **network**.

This will display the network settings programmed into the radio.



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=255.255.0.0

Will set the subnet mask.

network.gateway=x.x.x.x

Where x.x.x.x is the subnet mask you want to program the radio with.

If you have set the Management vlan in the radio, or vlan tag, and cannot access the radio when connected to the Ethernet port.

network.vlanmgmt=0

Will set the vlanMgmt setting to zero and restore Ethernet port access by IP Address.

network.vlantag=0

Well set the vlanTag setting to zero and restore Ethernet port access.

For a full list of commands type help at the command line and hit enter it you will see a full list of commands. These can also be found on the help webpage.

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 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) when you click on the Windows Explorer window to display files and folders you will see the image for a camera drive, and when you click on that you will see the .txt and other files on the radio.
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.

Appendix D – Intuicom Technical Support

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Appendix E - Warranty

LIMITED WARRANTY TO END-USERS

Intuicom, Inc.
4900 Nautilus Court North, Suite 100 BOULDER,
CO 80301

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