



Radio Bridge User Guide

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Product Name: Voisus

Radio Bridge User Guide

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Revision history

Date	Revision	Version	Comments
4/19/2017	B	0	Updated "Virtual-to-live radio bridge" and "Live-to-virtual radio bridge" topics; made minor style and grammar edits to content.
7/13/2017	B	1	Updated screenshot in "Edit Voice Rx/Tx settings."
2/12/2018	C	0	Fixed broken hyperlinks to <i>ACENet Technical User Guide</i> on Support site. Added "(Optional) Create a radio relay" and "Set up an ED-137 radio." Made minor style and grammar edits to content. Added Rockwell Collins FSR configurations to "Install live radios."
6/13/2018	C	1	Fixed page break display error in "Create and run a scenario."
3/20/2019	C	2	In "Install live radios," updated AI-S cable number and reformatted table caption for "Rockwell Collins FSR settings."
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4/3/2024	E	3	Made a minor edit to the WAN diagram description in "System architecture."

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1.0 Introduction

The Voisus Radio Bridge performs two major functions:

- *Voice Rx/Tx*: connect real radios to your network and stream live, over-the-air traffic to and from Voisus operators and the Distributed Interactive Simulation (DIS) network.
- *Remote Control*: remotely control live radios over the network.



Figure 1: Remote Control diagram

1.1 Voice Rx/Tx

ASTi's Voice Rx/Tx connects live and simulated training environments, distributing live, over-the-air voice traffic via data networks. It is officially supported for the following radio transceivers (RTs):

Description	Model
SINCGARS, SIP	RT-1523C/D
SINCGARS, ASIP	RT-1523E/F
Falcon II	PRC-117
Multiband Inter/Intra Team Radio (MBITR), JTRS Enhanced MBITR (JEM)	PRC-148
LOS Transceiver	URC-200

Table 1: Radio transceiver types

Other radio types are supported by manually configuring In Gain, In Threshold, Out Gain, and Rx Delay. ASTi recommends that manual configurations are done with support to ensure optimal performance.

1.2 Radio Bridge features

Voisus Radio Bridge includes the following features:

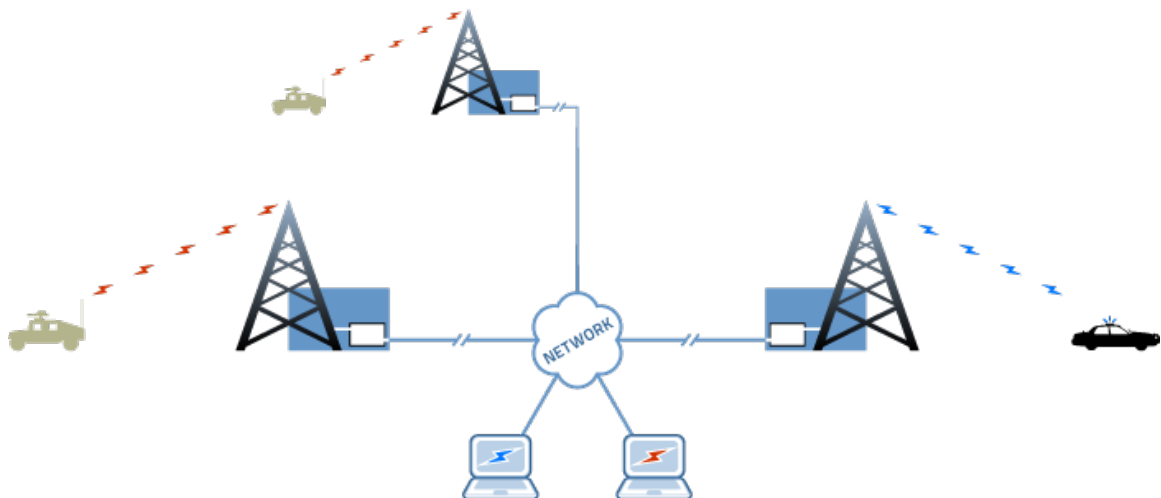
- *Radio retransmission*: extends live radio communication among distant sites through data networks.



- *Radio interoperability*: bridge incompatible radio systems and join multiple radio nets into conferences.



- *Flexibility*: combine a wide variety of live and simulated radios.



1.3 System architecture

Live base station radios connect to ACE-RIU, AI-S, or AI-Delta interface devices over a local area network (LAN) to a Voisus server, bridging live radios to the simulated training environment:

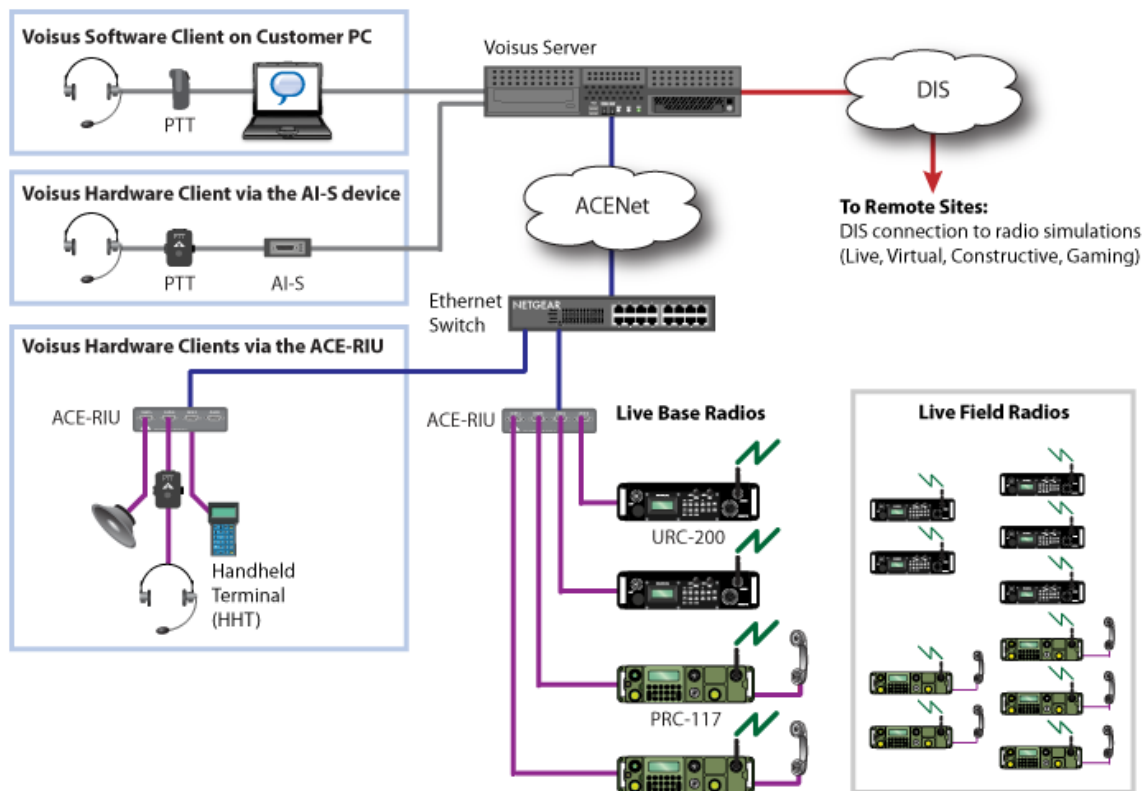


Figure 2: Radio Bridge LAN architecture

The AI-Delta also supports wide area network (WAN) connections, transmitting and receiving routable network traffic for maximum flexibility. You might use the AI-Delta's WAN feature to connect to portable kits via 5G cell network or link radios hosted on completely separate network segments. As long as the AI-Delta can connect to the Voisus server, everything just works.

In a Joint Operations Center setup, for example, six Voisus clients and an AI-Delta with two PRC-119 SIP radios connect via a LAN, while five remote radio sites connect to AI-Deltas and link to the Voisus server over the WAN:

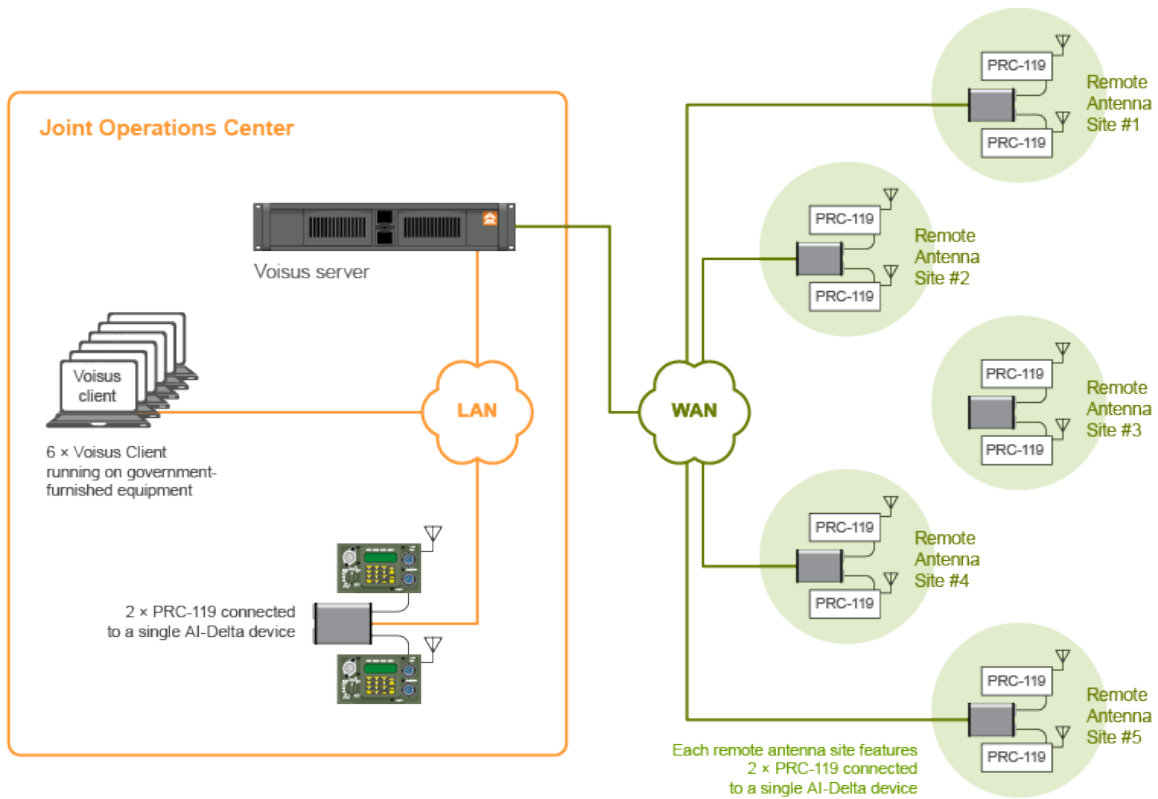


Figure 3: Radio Bridge WAN architecture

2.0 Voice Rx/Tx operation

Figure 4, "Voice Rx/Tx" below shows the Voice Rx/Tx process:

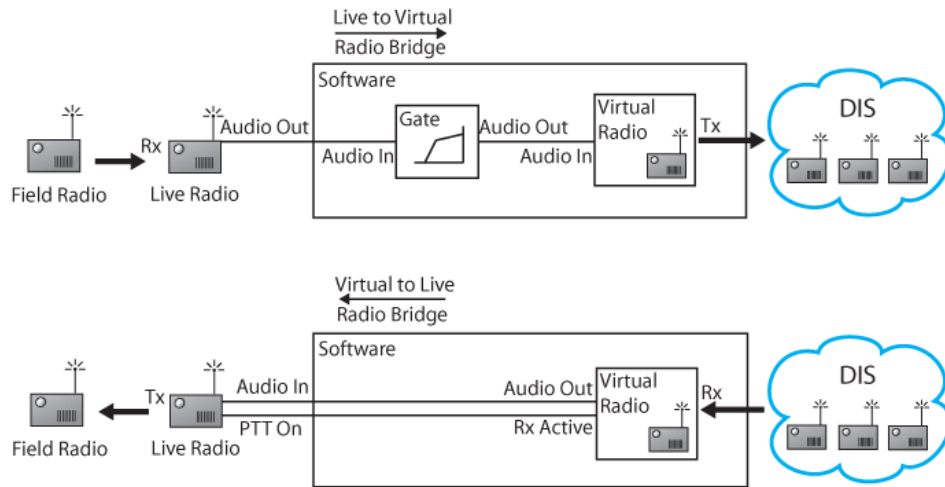


Figure 4: Voice Rx/Tx

2.1 Live-to-virtual radio bridge

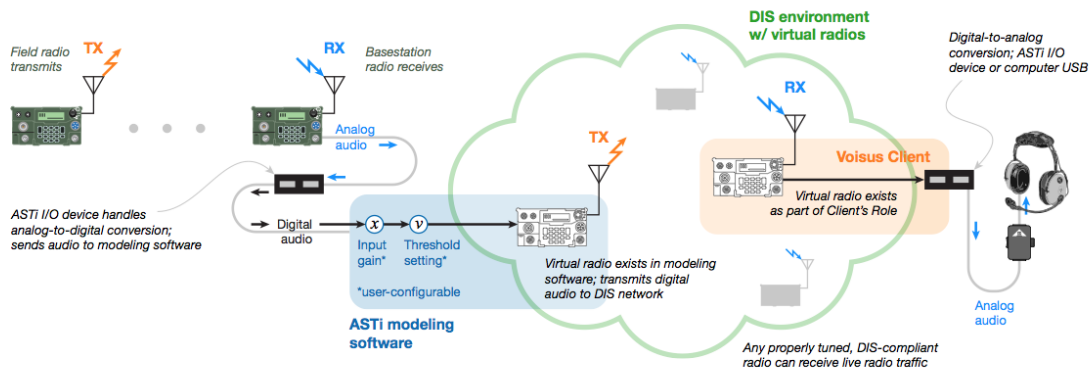


Figure 5: Live-to-virtual radio bridge

When the base station radio receives a transmission, the following sequence of events occurs:

1. A live field radio transmits audio to a base station radio, which is connected to an ASTi input/output (I/O) device (e.g., AI-S, ACU2, ACE-RIU).
2. The I/O device converts the audio from analog to digital and sends it to the ASTi modeling software.
3. The I/O device relays the digital audio to a virtual radio in the ASTi modeling software.

4. The ASTi modeling software contains input gain and threshold settings. The input gain controls the audio level, while the threshold setting determines whether or not the virtual radio transmits.
5. When the live radio is idle, the audio falls below the threshold. When it is actively receiving, the audio rises above the threshold. As a result, the virtual radio only transmits when the live radio is actively receiving.
6. The ASTi modeling software sends the audio to an in-tune virtual radio in the Distributed Interactive Simulation (DIS) environment. This virtual radio exists as part of the Voisus client's role.
7. An ASTi I/O device or computer USB port connects the receiving operator to the Voisus client. The I/O device or computer converts the digital audio back to analog.
8. The operator receives the audio in his or her headset.

2.2 Virtual-to-live radio bridge

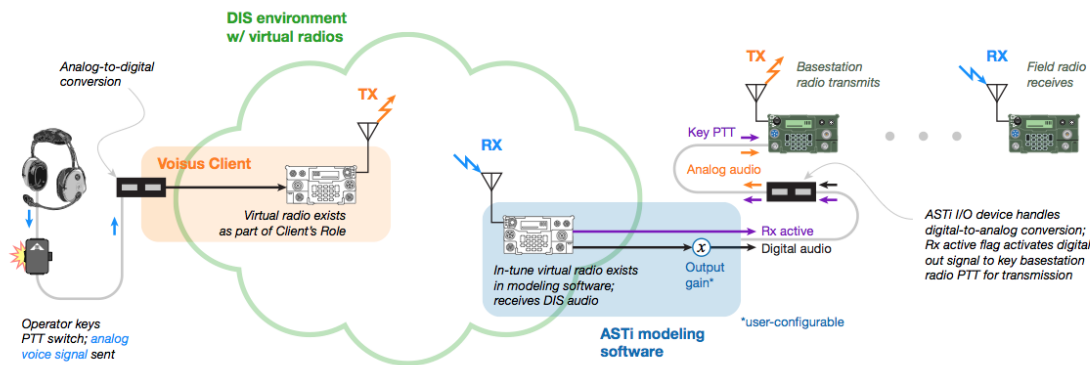


Figure 6: Virtual-to-Live Radio Bridge

When an operator transmits audio using a radio bridge, the following sequence of events occurs:

1. The operator presses the press-to-talk (PTT) button and speaks into his or her microphone.
2. The PTT device transmits the analog voice signal from the headset to the input/output (I/O) device (e.g., AI-S, ACU2, ACE-RIU).
3. The I/O device converts the audio from analog to digital and sends it to the Voisus client.
4. The Voisus client sends the digital audio to a virtual radio that exists as part of its role.
5. The virtual radio transmits the audio to an in-tune virtual radio in the ASTi modeling software.

6. The ASTi modeling software adjusts the audio's volume according to the output gain setting.
7. The I/O device receives the digital audio and converts it back to analog.
8. When the base station radio receives the analog signal, the digital keying signal replicates PTT functionality, allowing the radio to transmit audio.
9. The live field radio receives the audio from the base station radio.

2.3 Live-to-Virtual and Virtual-to-Live transition

Transitions between transmit states occur after a period of measured inactivity. If a live radio is sensed as actively receiving, it must cease receiving before it can transmit. Likewise, if a virtual radio is actively receiving, it must cease receiving before it can transmit.

3.0 Radio Bridge setup

This section discusses how to set up a Radio Bridge device:

- Install live base and field radios
- Add and name new hardware channels
- Manage scenarios
- Edit the Comm Plan
- Set Distributed Interactive Simulation (DIS) options
- Set Voice Rx/Tx options
- *(Optional)* Create a radio relay

3.1 Install live radios

Follow the steps below to install and set up the live base radios and live field radios. The live base radios are the radios that are connected to audio distribution devices (i.e., ACE-RIU and AI-S devices). The live field radios are the remote radios out in the field. To install a live radio, follow these steps:

1. Set the following on the live base radio:

Setting	SINGARS RT-1523C/D	SINGARS RT-1523E/F	PRC-117	PRC-148	URC-200
Volume	Max (Full CW)	9	9	4	Max (Full CW)
Mic Gain	Whisper = OFF	Whisper = OFF	N/A	Mic Lvl = High	N/A
Squelch	ON	ON	ON	ON	ON
Model	SC or FH	SC or FH	SC or FH	SC or FH	SC or FH
COMSEC	PT or CT	PT or CT	PT or CT	PT or CT	PT or CT

Table 2: Base radio settings

For the Rockwell Collins Fixed-Site Radio (FSR), set the following:

Setting	Value
Handset	70
Rx Master	50
Volume Rx	61
Volume Tx	19
Mute	OFF
Squelch	ON
Model	SC or FH
COMSEC	PT or CT

Table 3: Rockwell Collins FSR settings

2. (Optional) The PRC-148 requires additional configuration:
 - a. Set MODE/Audio Path to TOP AUDIO.
 - b. Disconnect the PRC-148 from the ACE-RIU or AI-S.
 - c. Switch the Audio Path to TOP AUDIO. "Hot switching" the radio's audio path may cause the ACE-RIU to go offline, requiring system reboot.
3. Connect the base radio's handset connection point to an ACE-RIU or AI-S using the appropriate cable:

Device	ASTi Cable
ACE-RIU	CA-D9M-NC6M-25-C
AI-S	CA-D15M-U329-25-A

Table 4: Base radio cables

4. Ensure that the ACE-RIU or AI-S device is connected to the Voisus server.



Note: The ACE-RIU connected to the live radio must be labeled "ACE-RIU Radio," indicating that its jumper settings will interface with live radios. For more details, go to "ACE-RIU Configuration for Radio Bridge and Remote Control" in the [ACE-RIU Technical User Guide](#).

5. Set unique SC frequencies or FH net settings for each base radio. These settings must be unique to ensure proper system performance.

6. If MODE-FH or COMSEC-CT settings are selected on any of the radio nets, follow the proper procedures for loading the FH Data or COMSEC Keys into the base and field radios. For fill procedure details, refer to the radio's manual.
7. Ideally, the base radio should be installed so that a high-fidelity radio link with field radios is established using LOW transmit power on the base radio. OE-254 (i.e., tower) antennas are highly recommended for increasing ranges, improving RF link fidelity and greatly reducing the chance of Radio Frequency Interference (RFI).

The base radio may be set to MEDIUM transmit power, but the possibility of RFI between the base radio and the ASTi system is increased. If system malfunctions occur, such as spurious transmissions or increased audio noise, reestablish the base radio to field radio links using LOW power.

Base radios should not use HIGH transmit power. RFI will occur between the base radios and the ASTi system.

8. Set the nets on field radios with MODE and COMSEC panel settings that match the corresponding nets on the base radios.
9. The final step in the live radio installation procedure is to perform a standard radio check between each set of base and field radios as part of the system operational check-out.

3.2 Set up hardware

Next, you must set up your hardware in the Voisus web interface. Voisus supports two types of hardware:

- ASTi audio distribution device, such as an ACU2 or AI-S
- ED-137 radio

If your setup uses an audio distribution device, go to Section 3.2.1, "Set up an ACENet audio distribution device" on the facing page. If your setup uses an ED-137 radio, go to Section 3.2.2, "Set up an ED-137 radio" on page 13.

3.2.1 Set up an ACENet audio distribution device

To add and name new AI-S or ACU2 hardware channels in the Voisus web interface, follow these steps:

1. From the top right, go to **Manage** () > **Hardware Devices**.

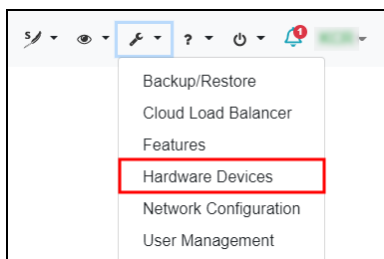


Figure 7: Hardware Devices navigation

2. On the **AI-S** tab, under **Other AI-S devices**, find the new ACENet device, and select the corresponding check box. Devices are listed by MAC address.

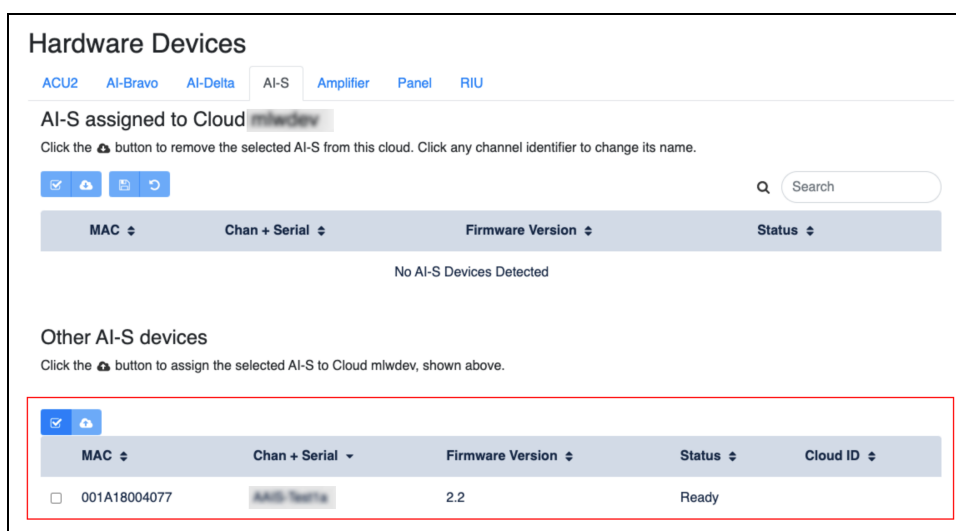
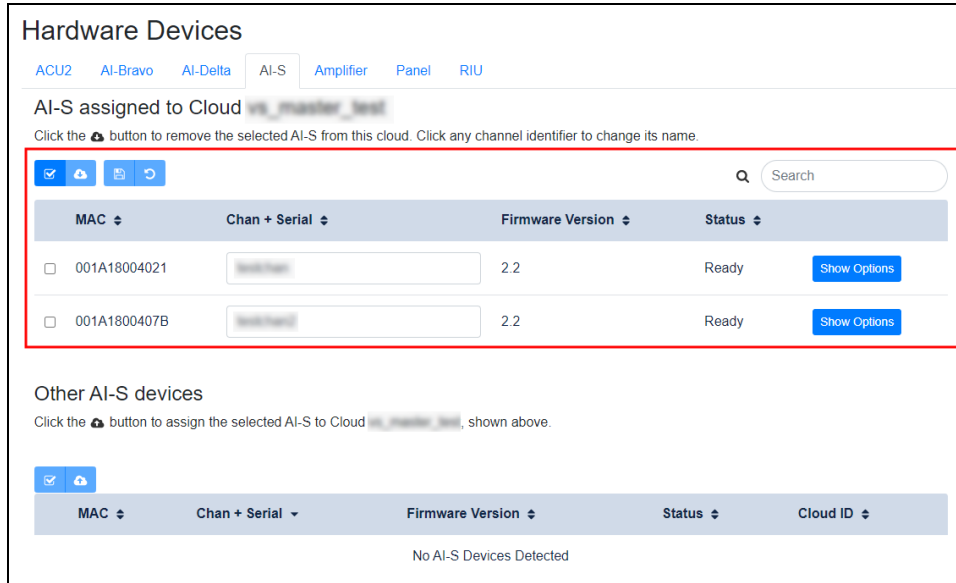


Figure 8: Other devices


3. Select **Add to Cloud** (), and the AI-S appears under **AI-S assigned to cloud**.



Hardware Devices


ACU2 AI-Bravo AI-Delta **AI-S** Amplifier Panel RIU

AI-S assigned to Cloud **rs_masthead_test**

Click the  button to remove the selected AI-S from this cloud. Click any channel identifier to change its name.

MAC	Chan + Serial	Firmware Version	Status	
<input type="checkbox"/> 001A18004021	<input type="text" value="rs_masthead_test"/>	2.2	Ready	Show Options
<input type="checkbox"/> 001A1800407B	<input type="text" value="rs_masthead_test"/>	2.2	Ready	Show Options

Other AI-S devices

Click the  button to assign the selected AI-S to Cloud **rs_masthead_test**, shown above.

MAC	Chan + Serial	Firmware Version	Status	Cloud ID
No AI-S Devices Detected				

Figure 9: Assigned to cloud

4. Create a unique channel identifier for each channel connected to a base radio.

3.2.2 Set up an ED-137 radio

The **ED-137 Radios** page manages network connections and press-to-talk (PTT) settings for radios compatible with the ED-137 standard.



Important: Contact ASTi to ensure Voisus's ED-137 functionality is compatible with your particular radio type.

To set up a hardware channel on an ED-137 radio, follow these steps:

1. From the top-left navigation bar, go to **Radio Bridge** () > **ED-137 Radios**.

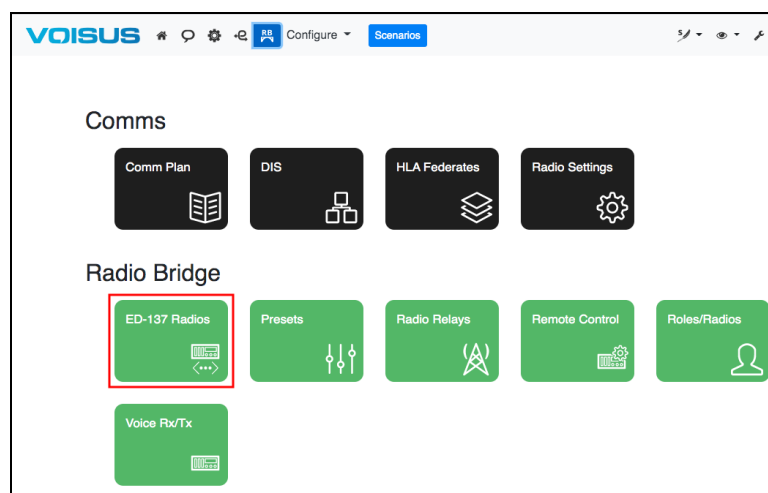



Figure 10: ED-137 Radios navigation

2. To add a new radio, select **Add ED-137 Radio** (). A new radio appears in the list. The radio's default name is **ED-137-N**, where *N* represents the next available number (e.g., ED-137-1).
3. (Optional) Under **Name**, enter a unique name for the radio.
4. In **IP Address**, enter *xxx.xxx.xxx.xxx*, where *xxx.xxx.xxx.xxx* is the IPv4 address of an ED-137 radio. In a typical configuration, this radio serves as the destination for outgoing streams and the source for incoming streams.
5. (Optional) **Remote Source IP** allows you to designate one radio as a transmitter and another as a receiver. In **Remote Source IP**, enter *xxx.xxx.xxx.xxx*, where *xxx.xxx.xxx.xxx* is the IPv4 address of an alternative ED-137 radio. If this setting is blank, the radio specified in **IP Address** acts as both the transmitter and receiver.

- In **Port**, enter the radio's designated ED-137 port number (e.g., **50010** for Rockwell Collins FSR radios). The ED-137 radio and the Voisus server may both receive audio on this port.



***Note:** Voisus automatically sets the Real-Time Transport Control Protocol (RTCP) port one value higher than the RTP port.*

- Choose the **ED-137 Version** appropriate for your radio (e.g., **ED-137 A** for Rockwell Collins FSR radios, **ED-137 B** for Jotron radios).
- PTT ID** assigns a unique ID to the radio's associated press-to-talk (PTT) device. The ED-137 standard uses this value to identify which operator is triggering the PTT button. For best results, leave the default value of **0**. Acceptable values range from 0–15.
- Select **PTT Type**, and then select **Normal**, which labels the transmission as a standard PTT event.

Figure 11, "ED-137 Radios" below shows **ED-137 Radios**:

Name	IP Address	Remote Source IP	Port	ED-137 Version	PTT ID	PTT Type
<input type="checkbox"/> Ed137-1	127.0.0.1	127.0.0.1	50010	ED-137 A	0	Normal

Figure 11: ED-137 Radios

3.3 Create and run a scenario

To create and run a new scenario, follow these steps:

- Create a new scenario. If desired, use the **RadioBridge4** or **RadioBridge8** example scenarios, which are preset with virtual nets in the Comm Plan.
- Run the scenario, and open it.

For more information about scenario operation, go to "Scenarios" in the [Voisus Client User Guide](#).

3.4 Edit Comm Plan settings

If necessary, edit the net names, frequencies, waveforms, and other parameters to match the virtual radio nets that will bridge to the live radio. To learn more about the Comm Plan, go to "Comm Plan" in the [Voisus Client User Guide](#).

3.5 Set up DIS options

Set up Distributed Interactive Simulation (DIS) options for your specific exercise. To learn more about DIS setup, go to "DIS" in the [Voisus Client User Guide](#).

3.6 Edit Voice Rx/Tx settings

On **Voice Rx/Tx**, map the live radio's channel identifier to a virtual net.

Figure 12: Voice Rx/Tx

3.6.1 Add a live radio

To add a live radio in the Voisus web interface, follow these steps:

1. To add a new radio, select **Add Radio Bridge** (+).
2. Enter a name for the radio.
3. Select **Channel Identifier**, and choose a channel identifier associated with the live radio. Channel identifiers are named on **Hardware Devices**.
4. Select **Virtual Net**, and choose a virtual net for communication between the live radio and virtual radios. The live radio will now be able to communicate with simulated radios over the virtual net.

3.6.2 Advanced configuration

Show Options displays advanced settings that can be used to fine-tune the audio characteristics of the live radio interface. In most cases, with a standard, supported live radio, you shouldn't need to modify these parameters. Use the following advanced settings for advanced configuration:

- **Preset:** if changes are made to the settings, select **Save as...** to save them for future use. **Load...** applies presets saved to your server.

- **Settings:** fine-tune the audio characteristics of the live radio interface.
 - **In Gain:** a gain multiplier applied to live radio receive audio. This gain is applied before the audio gets to the detection logic. A larger value results in network operators receiving live radio audio at a higher level.
 - **In Threshold:** a value in dB used as a threshold for detecting receive audio from the live radio.
 - **Out Gain:** a gain multiplier applied to live radio transmit audio. A larger value results in live radio operators (e.g., in the field) receiving transmissions from network operators at a higher level.
 - **Rx Delay (secs):** a delay value in seconds used to prevent spurious live radio retransmissions (i.e., "chatter") that can occur with certain radio types. This is sometimes referred to as "hang time" or "drop out delay." In most cases, you won't need to adjust this value.
- **Status:** view Rx/Tx status for live-to-virtual communications.

3.7 (Optional) Add a Radio Bridge patch

In the Voisus web interface, you can patch audio among multiple radio bridges. As a result, Voisus can transmit a reception on one Radio Bridge to all of the other bridges in a patch.

To add a patch to the Voisus web interface, follow these steps:

1. From the top-left navigation bar, go to **Radio Bridge** () > **Patches**.

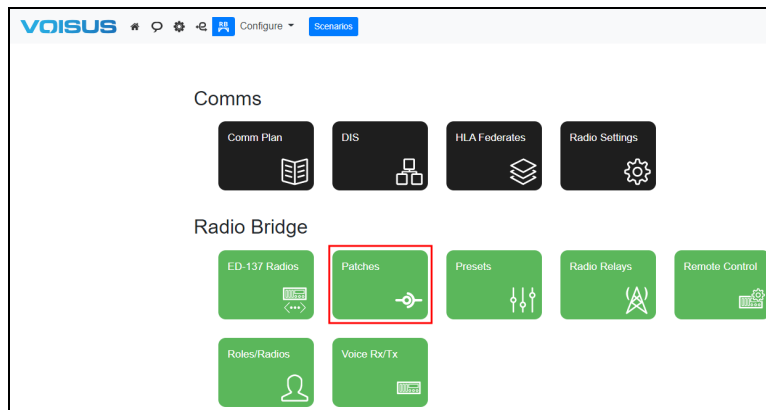



Figure 13: Patches navigation

2. To add a patch, on **Patches**, select **Create Patch** ().
3. In **Name**, enter a unique name for the patch. By default, the name is **Patch-N**, where *N* is the patch number.

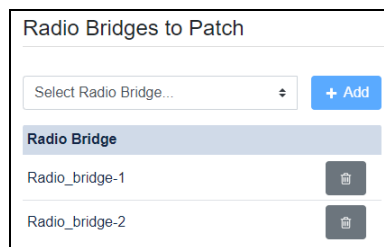
4. (Optional) In **Description**, enter a brief description of the patch.



The figure shows a form titled "Example Patch". It contains two input fields: "Name" with the value "Example Patch" and "Description" with the value "This is an example of a Radio Bridge patch."

Figure 14: Patch Name and Description

5. Select the drop-down box under **Radio Bridges to Patch**, and choose a bridge. To add bridges to the Voisus web interface, go to Section 3.6, "Edit Voice Rx/Tx settings" on page 15.
6. Select .



The figure shows a form titled "Radio Bridges to Patch". It contains a drop-down menu labeled "Select Radio Bridge..." with a plus icon. To the right of the drop-down is a blue button labeled "+ Add". Below the drop-down is a table with the following structure:



Radio Bridge	
Radio_bridge-1	
Radio_bridge-2	

Figure 15: Patched bridges

7. Repeat Steps 5–6 to add more bridges. The virtual radios in these bridges can now communicate with one another.

3.8 (Optional) Create a radio relay

Radio relay receives audio on a specified main (i.e., relay) net and retransmits it to one or more member net(s). Likewise, member nets can also receive and transmit audio back to the relay net. If a member net receives and transmits audio to the relay net, other member nets do not receive the transmission. The radio relay technique can extend the radio signal longer distances. Radio relay is also applicable to cross-banding and radio aggregation. If multiple member nets receive audio simultaneously, the audio is mixed and sent to the relay net for retransmission.

Figure 16, "Radio relay diagram" below shows an example of a radio relay configuration:

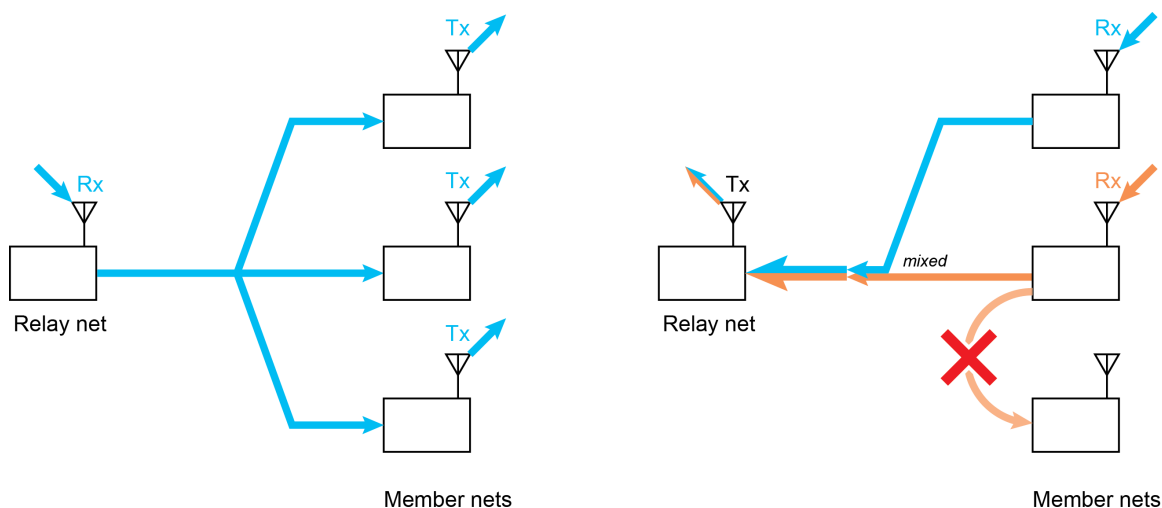


Figure 16: Radio relay diagram

To create a new radio relay, follow these steps:

1. From the top-left navigation bar, go to **Voisus Clients** (RB icon) > **Radio Relays**.

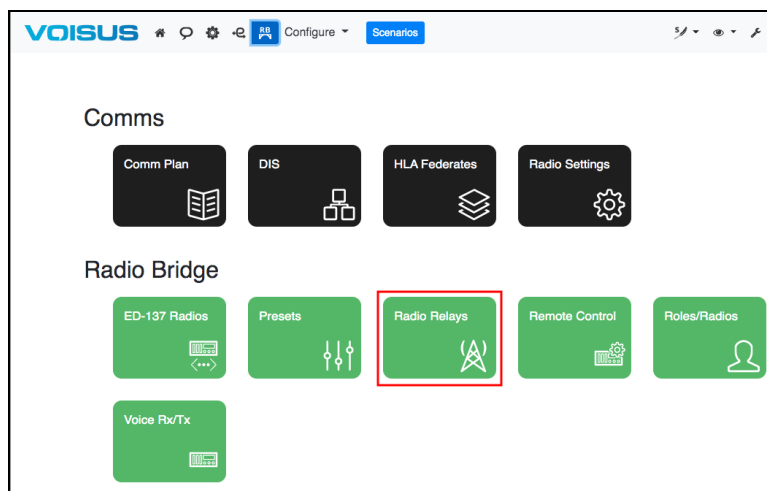


Figure 17: Radio Relays navigation

2. To add a new relay, on **Radio Relays**, select **Create Relays** (+).
3. In **Relay Name**, enter a unique name for the relay.
4. Enable **Relaying**.
5. Select **DIS Exercise**, and choose a domain. The default setting is **default_domain**. DIS exercises are set on **DIS Networking**. For more information about DIS, go to "DIS settings" in the *Voisus Client User Guide*.

6. Select **Relay Net**, and choose a net. These net are set in the Comm Plan. For more information about the Comm Plan, go to "Comm Plan" in the *Voisus Client User Guide*.
7. To add a member net, select **Member Net(s)**, choose a net, and select + Add. Nets are set in the Comm Plan. For more information about the Comm Plan, go to "Comm Plan" in the in the *Voisus Client User Guide*.

Radio_relay-1

Relay Name

Radio_relay-1

Relaying

ON

DIS Exercise

default_domain

Relay Net

Select a net...

Member Net(s)

Select a net...

+ Add

Figure 18: Radio Relays

4.0 Remote control

ASTi's Remote Radio Control has the ability to control live radio assets remotely through the Voisus web interface and the Voisus Client for Tablets & Desktops. Live radios may operate in the same room or in a facility miles away. Quickly and conveniently set up radios over the network from any computer with a suitable web browser. Make changes on the fly without interrupting training, and monitor the radio state to ensure radios are functioning correctly.

Remote Radio Control is currently available for the following radios:

- URC-200
- PRC-117F
- PRC-117G
- PRC-152
- Rockwell Collins Fixed-Site Radio (FSR)

To learn more about other live radios, contact ASTi.

4.1 Equipment

The following sections describe hardware and radio control kit equipment needed for remote control.

4.1.1 Hardware

The following hardware is required for remote radio control:

- Voisus server
- Audio distribution device



Note: Label the ACE-RIU connected to the live radio "ACE-RIU Radio," indicating that its jumper settings are set to interface with live radios. For more details, go to "ACE-RIU Configuration for Radio Bridge and Remote Control" in the [ACE-RIU Technical User Guide](#).

4.1.2 Radio control kit

ASTi sells a radio control kit for each supported radio, which includes the following:

- *Serial Data Cable*: connects the live radio to the Serial Data Converter.
- *Serial Data Converter*: a compact module that converts serial data protocol from radio RS-232 to RIU RS-422. It is powered through the serial data line.
- *Modular Data Cable*: connects the Serial Data Converter to the ACE-RIU serial data port.

Live Radio	Conversion Kit P/N
URC-200	RCK-URC-200-01
PRC-117F	RCK-PRC-117F
PRC-117G	RCK-PRC-117G

Table 5: Radio control kit cables

4.2 Remote control setup

If remote control qualifies as part of your ASTi solution, its setup documentation is included on the Docs CD that shipped with your system(s). If you cannot find it, contact ASTi to receive a new CD or individual documents at your request.