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ASTi

Transforming Radio Bridge

Technical User Guide

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Product Name: Transforming Radio Bridge

ASTi Transforming Radio Bridge Technical User Guide

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1.0. Introduction

The Transforming Radio Bridge (TRB) for DIS is part of ASTi's new Windows product range. TRB is designed to execute on a standard Windows XP platform, and provides capability to 'bridge' DIS PDU's between two ethernet TCP/IP subnets. In addition to the basic bridging capability, TRB also provides the capability to perform optional filtering and/or transformations back and forth between the two subnets for the following:

- **DIS Exercise ID** – Provides filtering on exercise ID between the two subnets
- **DIS PDU Type** – Provides filtering on PDU type between the two subnets
- **Operating Frequency** – Provides filtering capability by conditionally bridging radio family PDU's for 'radios' operating at frequencies below 100,000 Hz and/or above 100,000 Hz
- **DIS Protocol Version** – Transforms between protocol versions 4, 5 and 6
- **Signal PDU Encoding Scheme** – Transforms encoding schemes with support for muLaw, CVSD, 16 bit PCM and ASTi Code 255 CVSD

TRB supports both standard TCP/IP broadcasting as well as TCP/IP multicasting.

If bridging is performed between two subnets, the subnets may be located on the same physical LAN or on two separate physical LAN's. Dual LAN operation requires two separate network interfaces on the PC. Bridging may also be performed between two different UDP port numbers on the same subnet.

TRB has an extremely easy-to-use GUI interface, and configuration for the required filtering and/or bridging functionality.

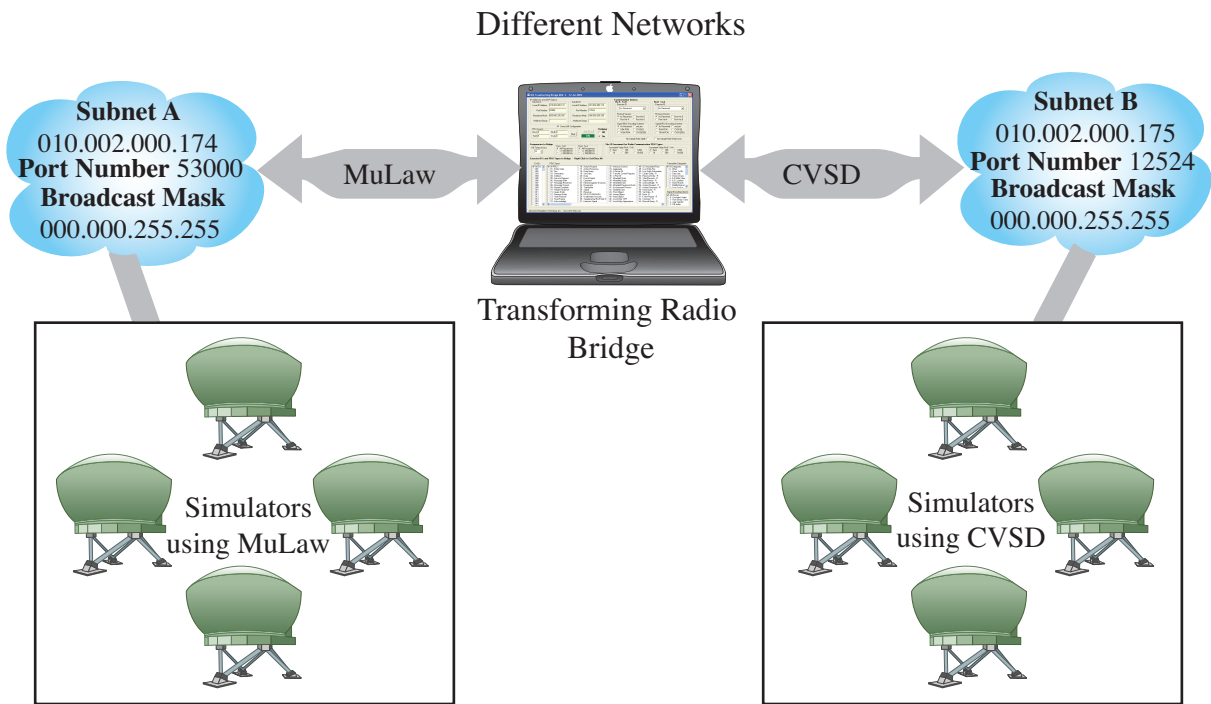


Figure 1: TRB Transforming MuLaw to CVSD through Different Networks

The diagram above demonstrates how TRB may be used to bridge two physically separate subnets on different networks.

In addition, the ability to simply bridge DIS PDU's between the two subnets, filtering and transformation capability may be used to do the following examples:

- **Reduce bandwidth requirement** – If subnet 'A' is a heavily loaded 100 Mbit LAN with potentially thousands of DIS entities and hundreds of DIS Radios, and subnet 'B' is 10 Mbit LAN with a small number of radios, by use of TRB connection to subnet 'A' may be achieved for the subnet 'B' nodes without any concern for the high PDU rate on subnet 'A'.
- **Reduce bandwidth requirement for simulated radios** – If subnet 'A' has a number of pseudo radio intercoms which need to be accessible to subnet 'B', bridging may be suppressed for all radio family PDU's for radios operating on frequencies below 100,000 Hz.
- **Extract PDU's for selected DIS exercises** – If subnet 'A' has a very high PDU rate due to several DIS Exercises being carried out simultaneously, the TRB would be able to extract PDU's from selected DIS Exercises of interest and 'connect' subnet 'B' to subnet 'A' only for the selected exercises and thus reduce the bandwidth requirements on subnet 'B'.
- **Interface applications with differing DIS protocol version requirements** – If a simulation site has a mixture of DIS applications that require different protocol versions, it would be possible to aggregate DIS nodes according to their protocol version requirements on two subnets, and use TRB to transform DIS protocol version between the two subnets.
- **Interface DIS radios with different encoding scheme requirements** – If a situation exists where a number of different DIS radios must interoperate in a DIS exercise, and some of the radios have different encoding scheme requirements (for example some radios only support muLaw while some other radios only support CVSD), by aggregating the different types of radios onto two different subnets, it would be possible to use TRB to transform the muLaw encoding to CVSD and vice-versa to enable the two sets of radios to interoperate.
- **For after action replays** where it might be required to play the recorded audio on the originating radios, a facility is provided to increment site ID's for all radio family PDU's to enable the radios to receive transmissions that they originated.

The above examples are by no means exhaustive. Other situations where the capabilities of TRB might be advantageous are limited only by the user's own imagination and ingenuity.

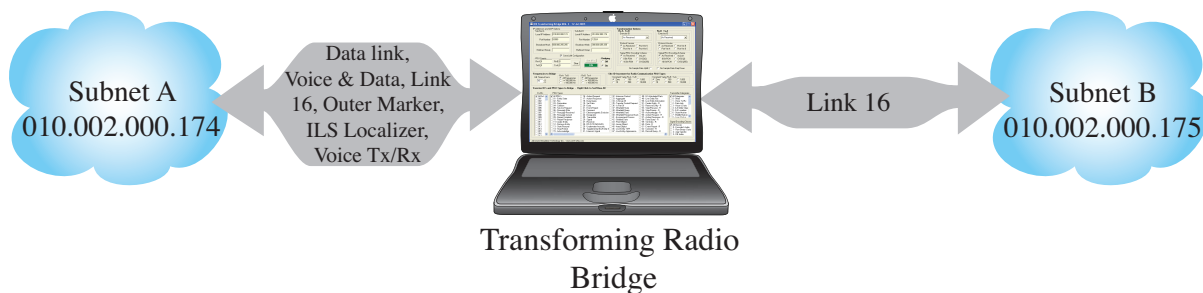


Figure 2: TRB filtering out all transmitter categories except Link 16

1.1. Product Licensing

TRB is licensed to run on a PC with a registered MAC address, and a separate license file will be issued in addition to the product installation CD. The license file will be installed in the directory c:\Documents and Settings\All Users\Documents\Asti License Files. Windows XP provides an alias for this path called My Computer\Shared Files.

Note: Only one MAC address located on the PC is required to be registered, and in the case of PC's with multiple NIC's, any of the available NIC's may be used for operation as long as the registered MAC address is physically available on the PC.

1.2. Trial Version of the Transforming Radio Bridge

A free trial version is available for customers to verify that TRB will satisfy their requirements. The trial version does not require licensing, and will be fully functional for 15 minutes after this time the application must re-started to continue execution.

2.0. Required Platform

TRB runs on a standard Windows platform, and will support up to two separate network interface cards (NIC). The use of two network interface cards is optional, and most of the filtering and transformation capabilities may be of benefit in a single subnet using two different port numbers.

2.1. Minimum Hardware Requirements

The minimum hardware requirement are:

- 800 MHz Intel compatible PC with 256 MB of RAM
- Available hard drive space of 15 MB
- Standard network interface card (NIC)
- Video card with a resolution of at least 1024 x 768
- Mouse
- Keyboard
- CD-ROM for the software installation

The minimum hardware platform recommendation demonstrates satisfactory application performance. The actual memory utilization is typically around 2 MB for the application.

Performance testing of TRB has indicated that the main limiting factor in performance capability is the total PDU's per second on the DIS LAN. Satisfactory performance has been demonstrated on a 2.4 GHz desktop with a configuration of 1,500 DIS radios, with 75 radio transmissions being simultaneously transformed between muLaw and CVSD.

2.2. Minimum Software Requirements

TRB software was designed to operate under Windows 2000 or Windows XP. The recommended operating system is Windows XP Professional.

For best results, it is recommended to use video settings of 1280 x 1024 with 32 bit color, a DPI setting of 96, and the Windows XP display 'Theme' option set to 'Classic'.

While any particular service pack is not required for TRB, all product testing was carried under Windows XP Professional (Version 5.1.2600, Service Pack 1, and Service Pack 2).

Note: While some additional latency is unavoidable, TRB introduces minimum additional latency. Even under severe loading conditions, additional latency should be below 10 ms.

3.0. Installation Procedure

To install TRB from the installation software CD:

1. Insert the CD-ROM and click the Transforming Radio Bridge Installer.exe file.
2. The 'Welcome' screen will open, hit 'Next' to continue.
3. The 'Transforming Radio Bridge Setup' screen will open, choose the destination for the file location. It is recommended to accept the default destination directories, but alternative locations may be selected.

Note: If installation is performed under the Windows 'Program Files' directory, it may be necessary to change the default directory/file access privileges to allow write access to the sub-directories.

4. Once the installation is complete click 'Finish', it will create a new directory called '**Transforming Radio Bridge**' and all required sub-directories and files will be extracted under that directory.

Once installation is complete, simply drag TRB to the desktop, the Windows Start Menu or to the Office Start bar for easy access.

3.1. Setting IP Options

After TRB installation, a dialog box will automatically display to enter the TCP/IP options for the two subnets. Simply select the IP address for each of the two subnets, along with the required broadcast mask or multicast group options.

Once the required IP selections are made, the required filtering and/or transforming options may be selected, and bridging may be started by simply selecting “**Bridging**” to ON.

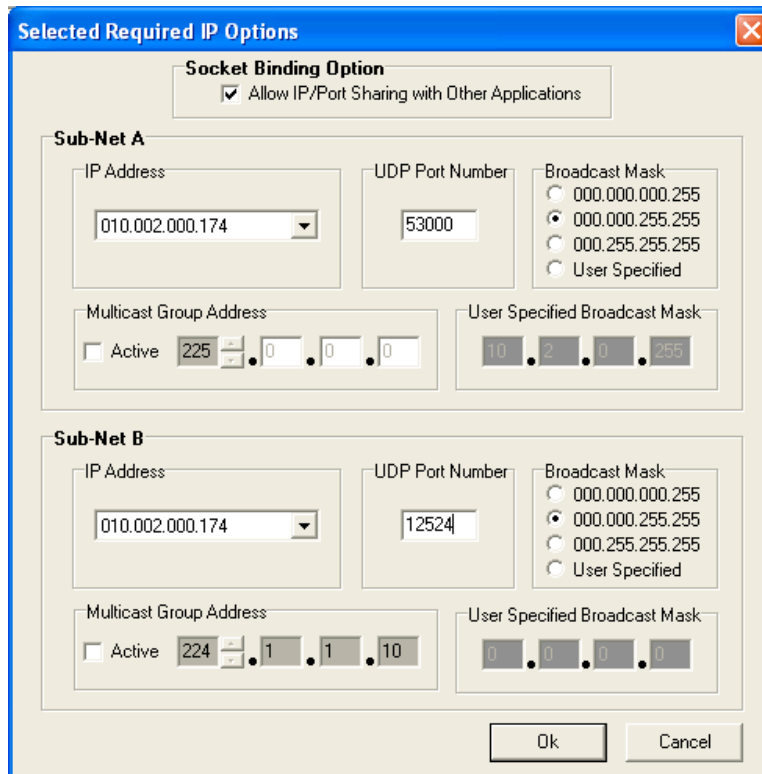


Figure 3: Selecting IP Address Options

3.1.1. Allowing IP Sharing

While TRB provides an option to allow IP sharing with other applications on the same PC, it is strongly recommended not to enable this option. TRB must be able to differentiate between DIS PDU's received, which is problematic when IP sharing. PDU's sent by TRB cannot be 'bridged' to the other subnet, this would result in an infinite loop situation.

Note: If this option is enabled, any other application running on the same PC that should have it's DIS PDU's bridged between the subnets will not operate correctly.

4.0. Transforming Radio Bridge Features

The TRB GUI provides the available filtering and transforming options. The various display and controls available on the GUI are described below.

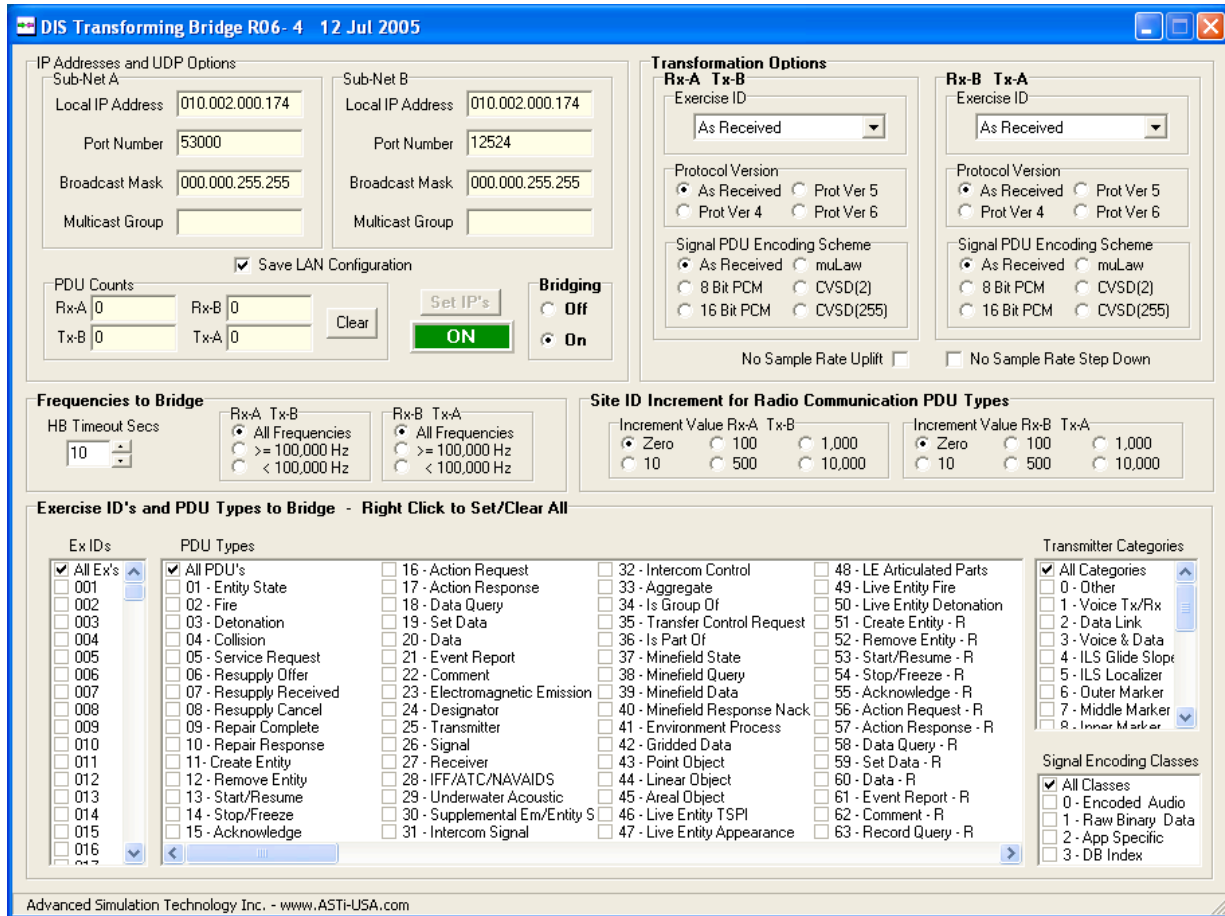


Figure 4: Transforming Radio Bridge

4.1. IP Address and UDP Options Display Group

The display group shows the current IP address, port number, and broadcast mask or multicast group for the two subnets. To modify any of these selections, click on the ‘Set IP’s’ button located immediately below this display group. When setting IP’s be sure that bridging is **not** active at the time. The various filtering and/or transforming options may be selected or changed at any time, even while bridging is active.

4.2. PDU Counts

PDU counts displays the counts of the received and bridged PDU’s and are only active while bridging is on. Note that the bridged PDU counts might be less than the received PDU counts if any of the filters are active, and the bridged PDU count may be greater than the received PDU counts if the ‘encoding scheme transformation to a less efficient’ mode is selected.

4.3. Bridging Off/On Control

Bridging PDU’s may be activated/de-activated by clicking on this control. The colored status display will turn green to indicate the bridging state is on. When the bridging state is off the colored status display will turn red and read ‘OFF.’ The bridging must be turned off to enable the ‘Set IP’s’ button.

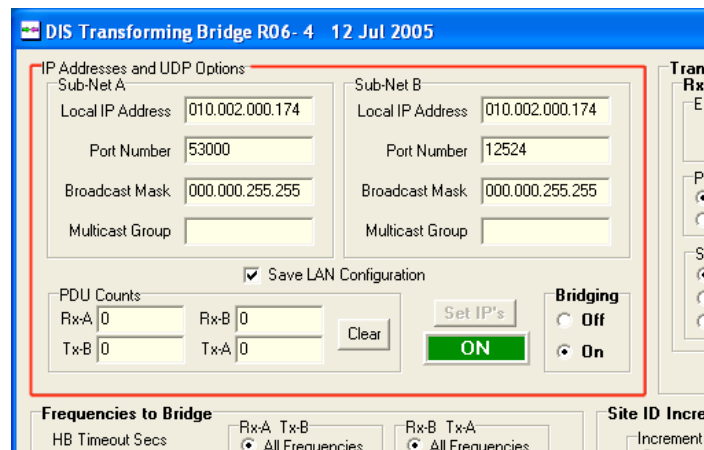


Figure 5: IP Address and UDP Options

4.4. Exercise ID and PDU Types to Bridge

This control group may be seen on the bottom half of the GUI, and provides facilities to select the filtering options required. Bridging may be selected for one or more exercise ID's or all exercise ID's. Only PDU's for the selected exercise ID will be bridged.

In addition to the exercise ID, each of the 255 individual PDU types may be selected for bridging, or the "All PDU's" selection may be checked to bridge all PDU's. The various filtering options selected will be maintained from one execution of TRB to the next. The user may also choose to filter groups of PDU types by using the 'Transmitter Categories' and 'Signal Encoding Classes.'

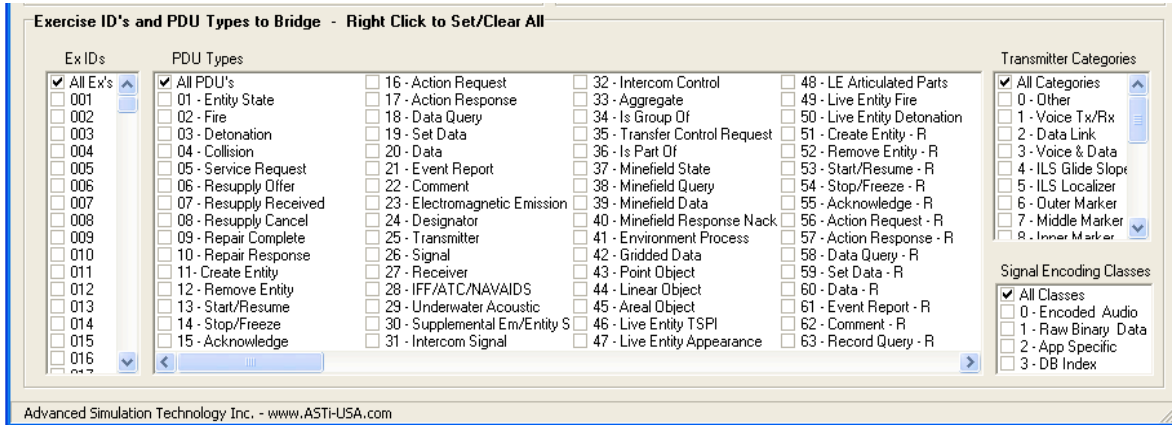


Figure 6: Exercise ID's and PDU Types to Bridge

If any of the filtering options are activated, a yellow box reading 'Filter On' will display to show that filtering of PDU's is active.

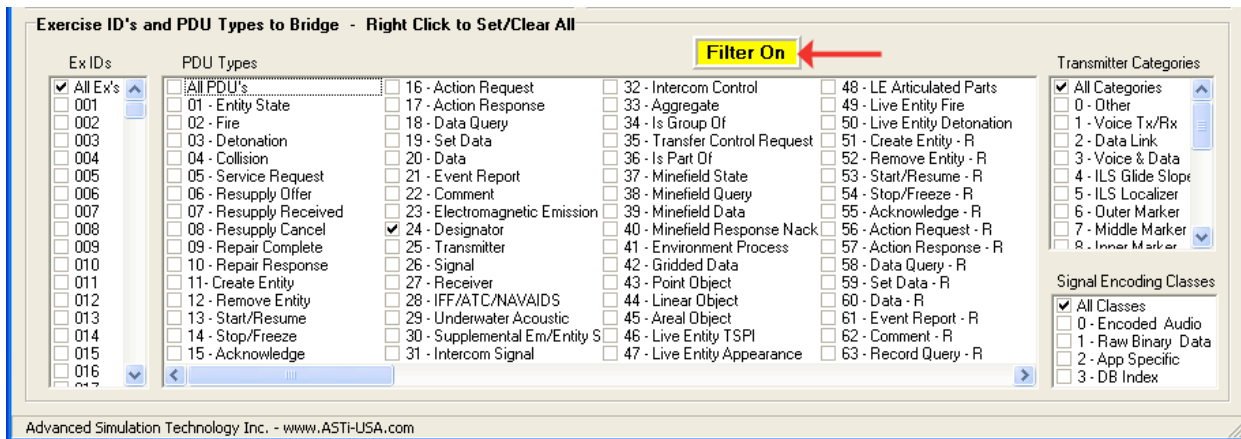


Figure 7: Filtering PDU's

4.4.1. Frequencies to Bridge

This subgroup allows selection of frequencies to be bridged from subnet ‘A’ to subnet ‘B’ and subnet ‘B’ to subnet ‘A’. The option divides simulated radios into two groups based on operating frequency. Group 1 is any radio operating on frequencies less than 100,000 Hz (usually considered to be ‘intercoms’), and Group 2 is any radio operating at frequencies 100,000 Hz and above (simulated radios). Bridging for each group may be selected independently.

The heartbeat (HB) value in seconds associated with this option is used to define how long a transmitter is considered to exist following the receipt of a transmitter PDU. Note that signal PDU’s will also be accepted as a heartbeat indication after receiving a transmitter PDU for the Site/Application/Entity/Radio combination.

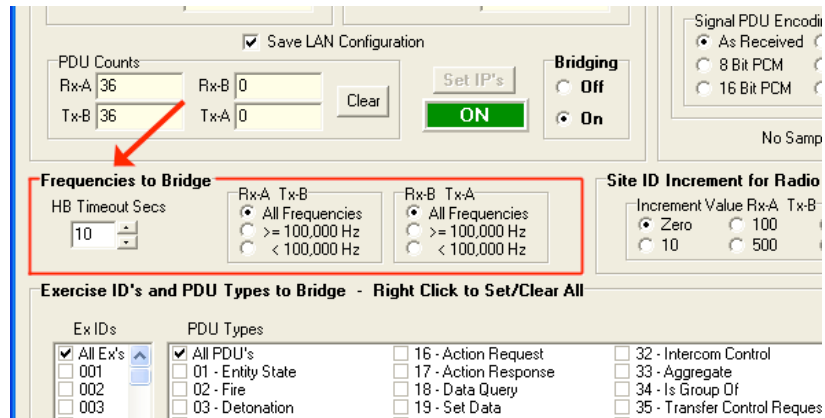


Figure 8: Frequencies to Bridge

4.4.2. Site ID Increment Option

This subgroup allows site ID’s for any radio family PDU to be incremental by a selected constant as they are bridged between the two subnets. This facility may be found useful when changing site ID’s for radio family PDU’s during ‘after action’ replay of PDU recordings. If this option is selected, all site ID’s contained in any radio family PDU will be incremental, including for example the transmitting entity ID in the receiver PDU.

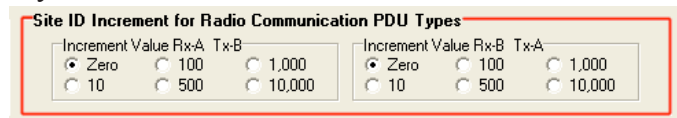


Figure 9: Site ID Increment Values

4.5. Transformation Options

The 'Transformation Options' control group provides two control subgroups to select the required transformations for PDU's received on subnet 'A' and transmitted on subnet 'B', and the transformations for PDU's received on subnet 'B' and transmitted on subnet 'A'.

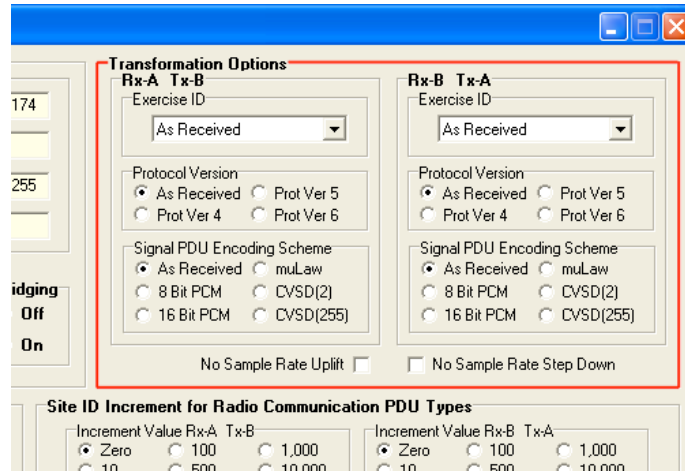


Figure 10: Transformation Options

4.5.1. Exercise ID

This subgroup allows selection of any exercise ID that is required. If a value is selected for this option, all PDU's will be transformed to the specified exercise ID when bridging.

4.5.2. Protocol Version

This subgroup allows selection of any protocol transformation that is required. If a value is selected for this option, all PDU's will be transformed to the specified protocol version when bridging.

4.5.3. Signal PDU Encoding Scheme

This subgroup allows selection for transforming into the required encoding scheme. For example, if muLaw is selected for the Rx-A Tx-B subgroup, all signal PDU's received on subnet 'A' that are encoded with a non muLaw supported encoding scheme, will be transformed to muLaw prior to transmit on subnet 'B'.

Any received signal PDU's that are already in the selected encoding scheme will be bridged without any transformation, as will any signal PDU's received with an un-supported encoding scheme.

The various transforming options selected will be saved from one execution of the application to the next.

4.6. Bridging PDU's from an Application Running on the Same PC

Bridging PDU's from an application running on the same PC is possible, but the configuration options must be set accordingly. TRB will not receive any PDU's that are transmitted from the same IP address that TRB is bound to, therefore the 'other' application must use a different IP address on the same subnet. This is easily achieved in broadcasting. As Windows 2000 and Windows XP both support multiple IP addresses per NIC, simply set up multiple IP addresses and ensure that each application is bound to a different IP address.

However, in the case of multicast transmissions, regardless of the IP address the application is actually bound to, it is not possible to select which IP address will be used for the actual multicast transmission. Therefore, it is not possible for TRB to receive multicast transmissions from another application running on the same PC.