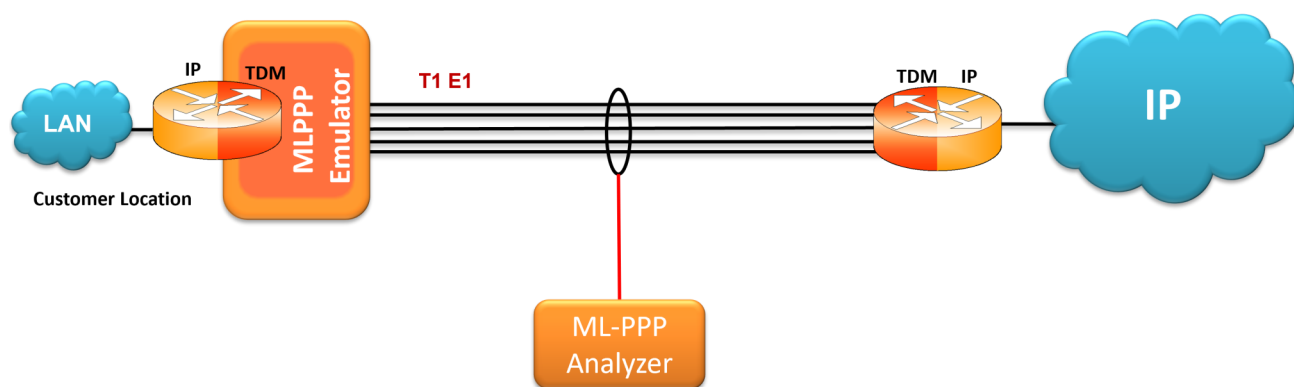# MC-MLPPP and PPP Emulation using Client Server



## Overview

The **Multi-Class Extension to Multi-Link PPP** allows a sender to fragment the packets of various priorities into multiple classes of fragments, and allows high-priority packets to be sent between fragments of lower priorities.

MLPPP bundles multiple link-layer channels into a single network-layer channel. Data sent through this channel will be distributed among all the links. It is a technique used to derive larger bandwidth pipe by aggregating smaller bandwidth pipes e.g. from multiple T1s or E1s.

GL's flexible and versatile **MC-MLPPP Emulator** is GUI based WCS client, which simulates MC-MLPPP and PPP protocols over T1 E1 links. The software is capable of generating and receiving MC-MLPPP/PPP traffic (with or without impairments). Traffic source can be sequence number, HDL files (containing packets/frames), flat binary file, user-defined frames (ASCII HEX file), and Ethernet data. The emulator can be configured as a router or as a Bridge to establish connection and to route traffic between LANs.

For more details, visit MC-MLPPP Emulation using Client-Server webpage.

## Main Features

- Performs MC-MLPPP as well as PPP simulation
- Supports LCP with the following negotiation options
  - **PPP options**: MRU (Maximum Receive Unit), ACFC (Address and Control Field Compression), PFC (Protocol Field Compression), Magic Number, LQR (Link Quality Reports), Authentication, and Link Bandwidth Control
  - **MLPPP Options**: MRRU (Maximum Received Reconstructed Unit), Short Sequence Header format, Long sequence header format, Endpoint Discriminator, PPP in MLPPP, and Multi-class
  - **Multi-Class Options**: Multilink Header Format
- Supports the following NCP: **IPCP** (RFC 1332 and RFC 1877), **BCP** (RFC 3518), and **PPPMuxCP** (RFC 3153)
- Transmit and receive Ethernet traffic over T1 E1 links by operating either in bridge or router mode
- User configurable timers, bandwidth using flags, and counters like Restart-timer, Max-Configure, Max-Terminate, and Max-Failure
- Supports PAP and CHAP authentication protocols and support for HDLC framing with CRC16, CRC32 or without CRC
- Supports up to 16 T1 E1 ports
- Supports hyper channels with discontinuous (sparse) timeslots
- Supports RTP Compression enabling IP/UDP/RTP compression conforming to RFC 2508
- Supports Van Jacobson Compression (RFC 1144) and IP Header Compression (RFC 2507 and RFC 3544)
- Dynamically add/remove (open/close) PPP links without loss in data
- Supports various impairments at PPP layer - CRC error, frame error, frame duplication, and more
- Supports various Fragment/Packet impairments for each Class at MLPPP level
- Provides detailed test (Tx/Rx) results per class / per link in GUI as well as through log files in command line

# Adding PPP links

Various PPP links (of any bandwidth varying from 8Kbps single sub-channel to n*64Kpbs channels) can be added to form the MLPPP bundle.

Each of the added links in the bundle can be configured with selected PPP, MLPPP, and Multi-class configuration options. PPP options can be selected for each link individually; however MC and MLPPP options are selected for the complete bundle.

As the transmission and reception is in progress, any of the PPP links in the bundle can be removed (terminated) or links can be added back to the bundle without loss in data.
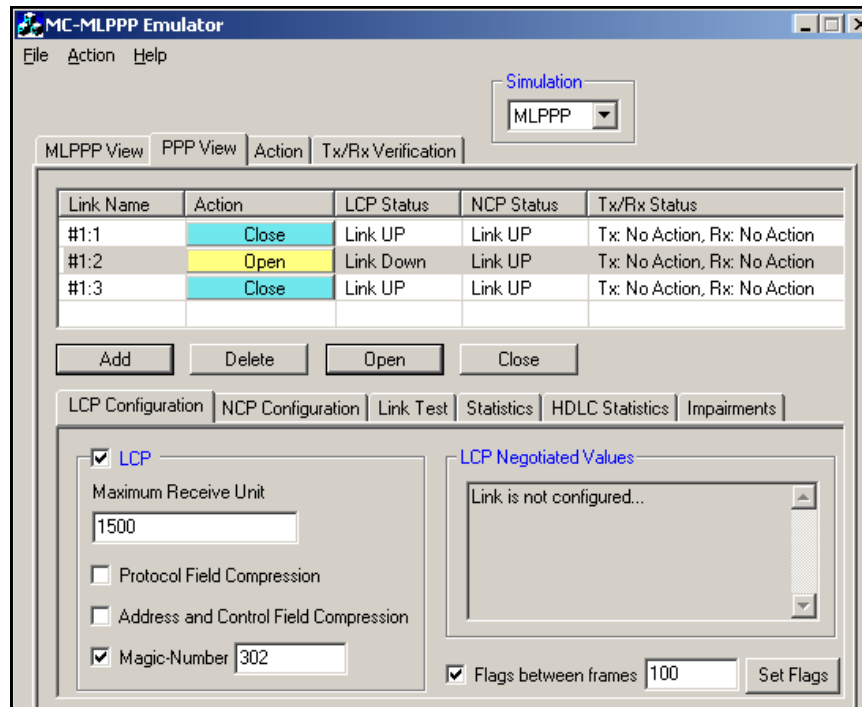


**Add PPP Links**

## Link Control Protocol (LCP) Negotiation Options

MC-MLPPP supports Link Control Protocol (LCP) to configure PPP links with the various negotiation options. Link configuration is an optional feature. LCP Negotiation at MLPPP Level includes 'PPP in MLPPP' option to configure PPP header in MLPPP payload.

If LCP is enabled for a link, then open action on that link performs Link Configuration (option negotiation) by exchanging LCP Configuration packets with peer end. If LCP configuration is disabled, then an open action on that link will make the link to go to UP state assuming that the peer end is also up.



**LCP Configuration**

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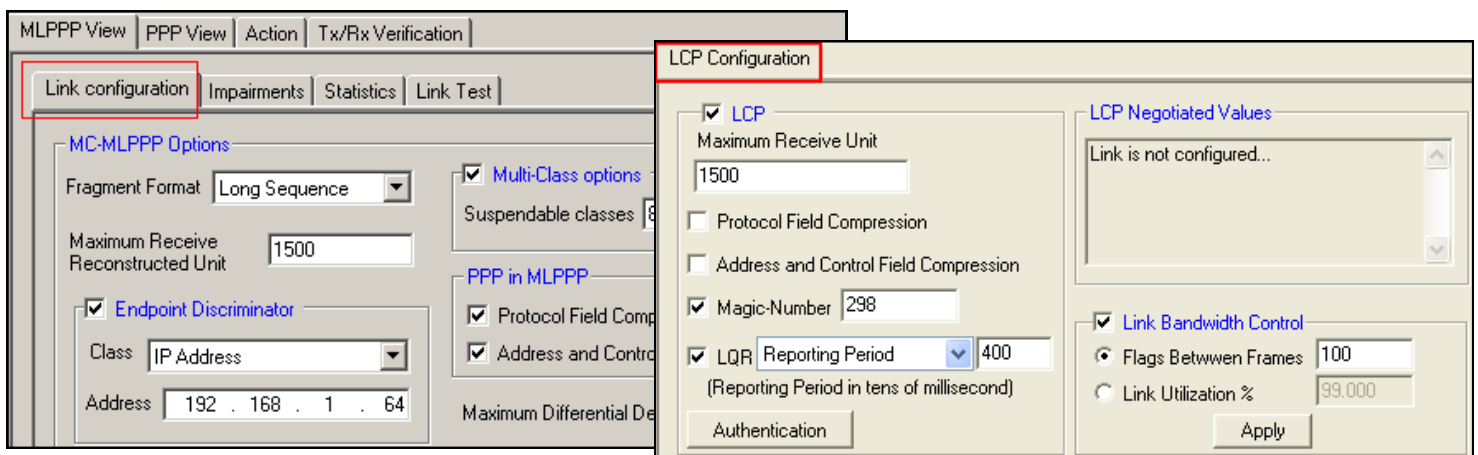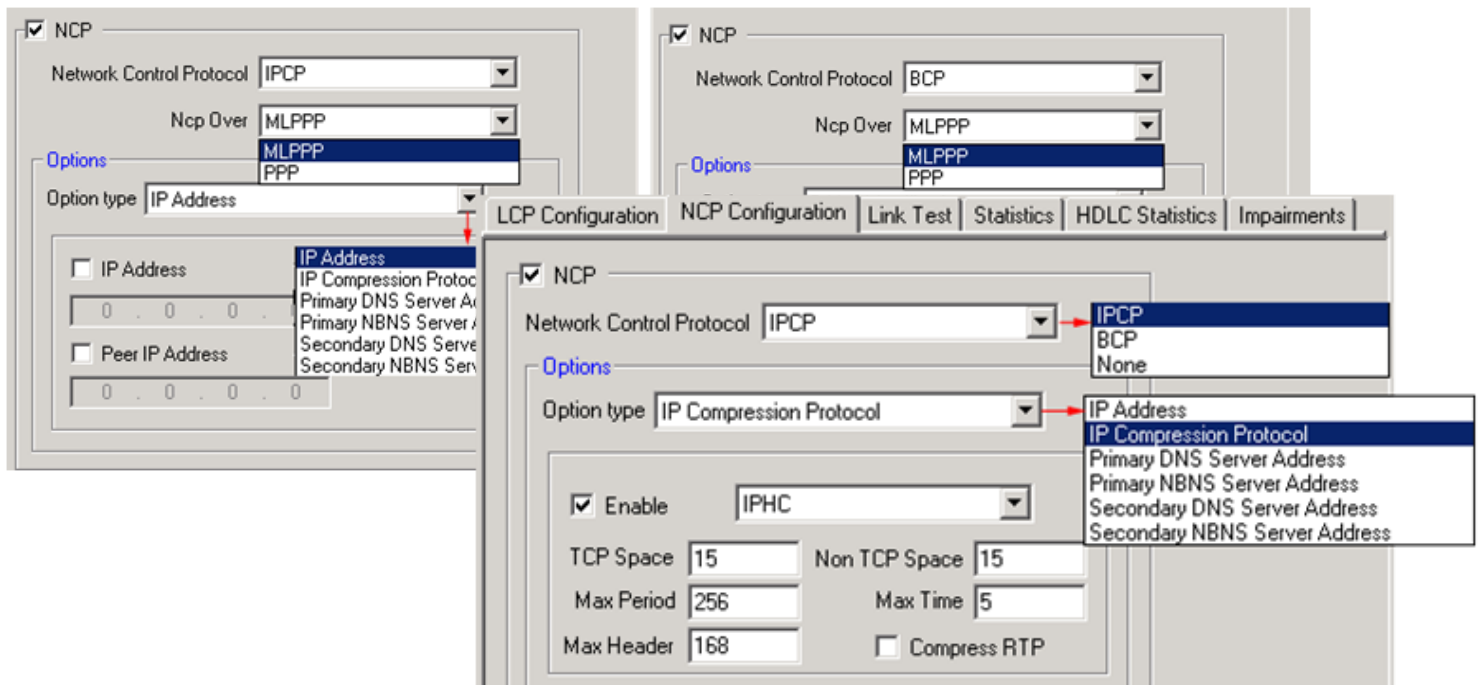
# Common Configuration

The PPP configuration parameters include Max-Configure, Restart-timer, Max-Terminate and Max-Failure. The HDLC configuration allows configuring the CRC parameters for HDLC frames. The PPP Multiplexing feature allows sending multiple PPP encapsulated packets in a single PPP Multiplexed frame. PPP Mux configuration includes enabling of Multiplex PPP option, negotiation of PPP Mux CP for the default PID option, and multiplexing criteria of sub frames to form a multiplexed PPP frame.
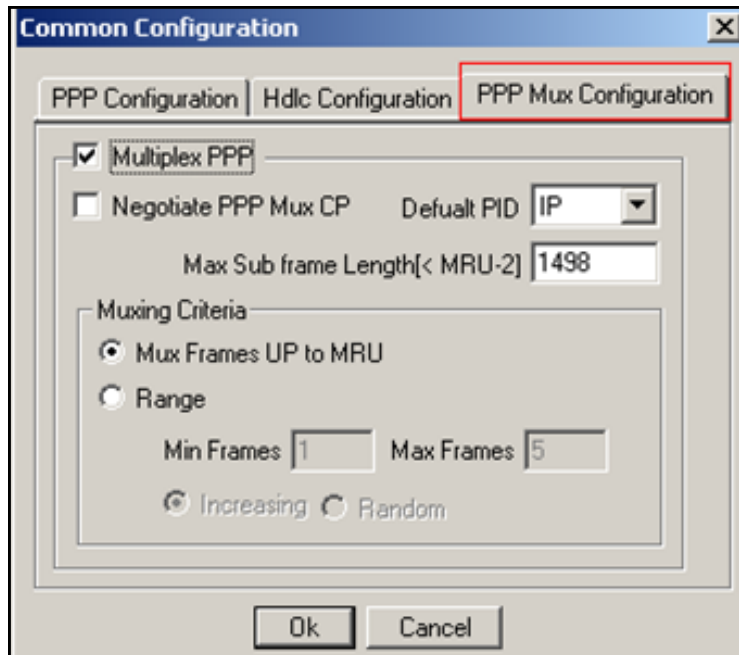


**Common Configuration**

# Network Control Protocol Configuration

Once LCP enters open state, NCP configuration allows negotiation of IPCP, BCP, and PPP Mux Control Protocol (Popup). In MLPPP Simulation, NCP negotiation starts as soon as any PPP link in the bundle goes to LCP UP state. In MLPPP Simulation, NCP can be configured to send Packets over PPP links in the bundle or on the MLPPP bundle.



**NCP Configuration**

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# Link Test using Echo Request/Reply

Link Testing is used for testing link connectivity. When the status of the link is up, it will test by sending LCP keep alive messages (Echo Req/Reply). The Link Test provides test parameters along with the statistics of number of requests sent and number of replies received. Link Test can be performed over PPP links in the bundle and/or on the MLPPP bundle.



**Link Test**

# Traffic Generation and Verification

In MLPPP Simulation the traffic is generated and received on the entire MLPPP bundle for various classes. In PPP simulation, PPP traffic can be generated and received on each PPP link individually. Tx parameters are used to generate traffic and Rx parameters are used as reference to verify the received frames. The MC-MLPPP permits transmission and reception of following source/sink types: sequence numbers, frames from HDL file, raw data from flat binary file, user-defined frame from ACSII based HEX file, and network traffic.
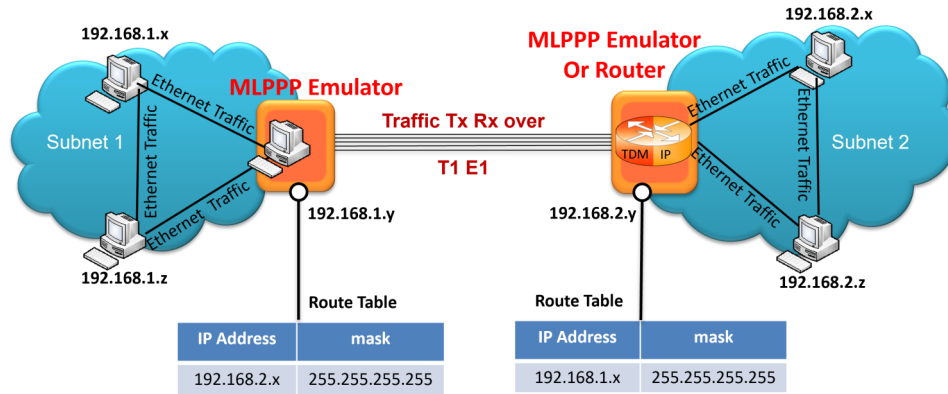
**Network traffic (LAN traffic)** allows user to receive traffic from Ethernet, convert to PPP traffic and send through T1 E1 line and vice versa. MLPPP emulator can be configured in router mode or in bridge mode to establish connection.

**Traffic Mode (MLPPP)** option is used to maintain timing between frames while forwarding packets from Ethernet to T1 E1 and vice versa, i.e., the time difference between the consecutive packets captured from NIC card will be maintained while transmitting on T1 E1 and vice versa.



**Traffic Generation and Reception**

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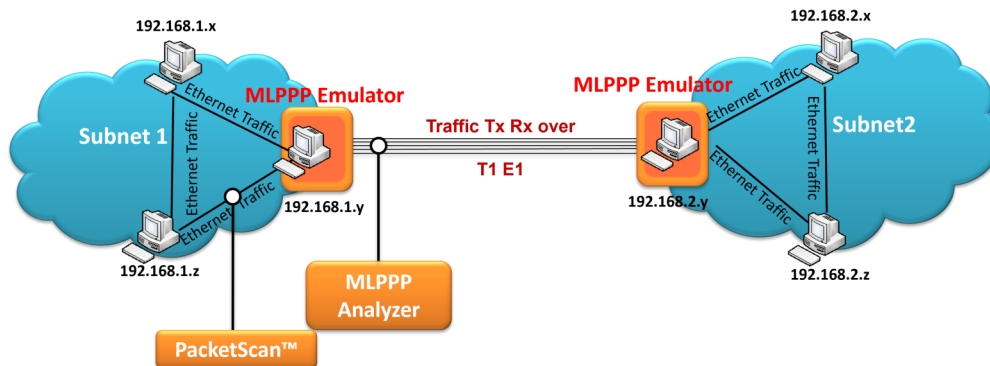
# MLPPP Emulator as a Router

The Emulator allows user to setup routing table by configuring IP-Address and Mask. Once configured, the Emulator forwards the IP packets which match routing criteria over MLPPP links. Emulator respond to all ARP requests whose IP addresses present in routing table. The Emulator allows user to configure which MLPPP class can be used based on the parameters set in Priority Dialog table - Packet Length, Source IP Address, Destination IP Address, and IP Type of Service (TOS).



| Route Table | |
|---|---|
| IP Address | mask |
| 192.168.2.x | 255.255.255.255 |

| Route Table | |
|---|---|
| IP Address | mask |
| 192.168.1.x | 255.255.255.255 |

**MLPPP Emulator as a Router**

# MLPPP Emulator as a Bridge

When the emulator is configured to act as bridge between two networks, all ARP and traffic (checked against the priority table) received from the network is encapsulated as BPDU (Bridging Protocol Data Unit) and streamed over T1 E1 links. The Emulator on another network removes BPDU header, either converts to Ethernet traffic or adds Ethernet header and streams to the destination.



**MLPPP Emulator as a Bridge**

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# Impairments

Various impairments can be introduced before frames are transmitted or during traffic generation. In PPP simulation frames are impaired by applying impairment to a particular PPP link. One can specify a limited number of impairments or continuous impairment.

Insert / delete bytes and bitwise AND / OR / XOR types of impairments affect a frame by impairing frame data, while insert / delete frame, CRC error, frame error, and frame duplication affect an entire frame.
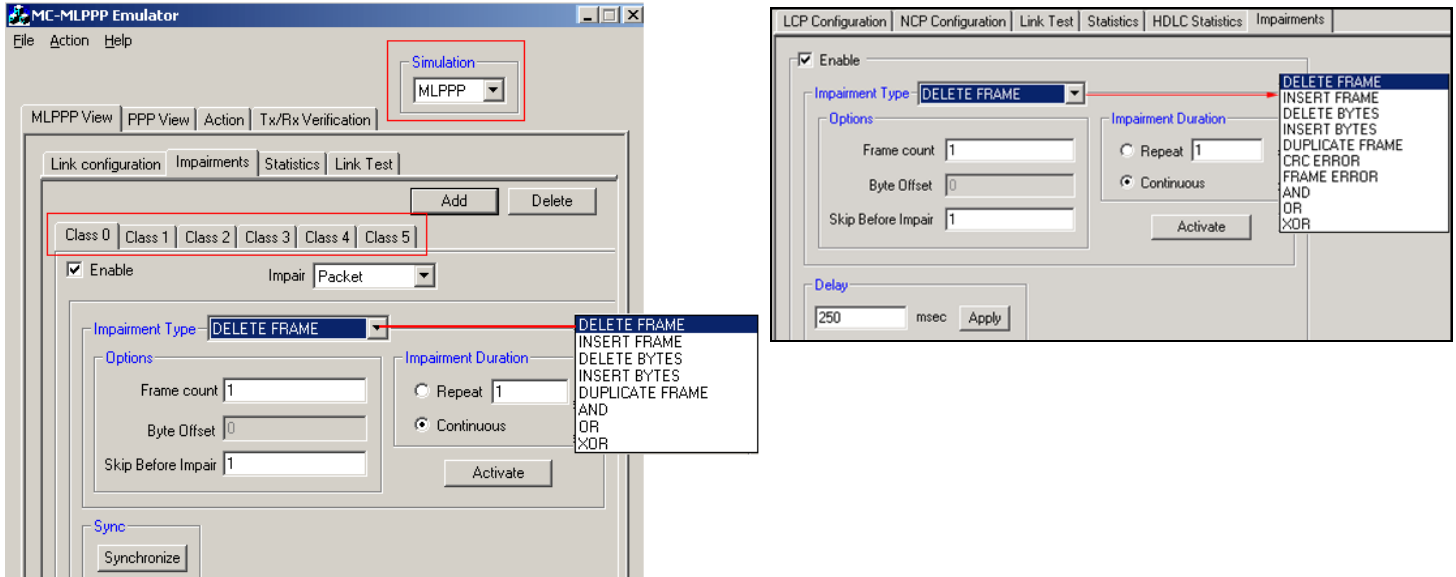


**Impairments**

# MC - MLPPP using Command Line Interface

All the actions performed in GUI can also be executed through command line interface. The MLPPPTerr module is used for performing High Throughput MLPPP Tx/Rx using Client-Server. It displays the command syntax, sends and receives MLPPP/PPP frames with or without impairments, and logs the events.

**Example**

run task "MLPPPTerrE1:TxRx";

inform task 1 "SIMULATION MLPPP;

inform task 1 "TX: CLASS 0 FRAMES 100 SEQNUM MSB1 FIXLEN 2048";

inform task 1 "RX: CLASS 0 FRAMES 200 SEQNUM LSB4 FIXLEN 1024 LOG 'D:\log\frame1.log' ";

**Adding Impairments**

- Supports limited / continuous number of impairments
- Types of impairments at PPP level - CRC error, frame error, frame duplication, and more
- Fragment and Packet impairments at MLPPP level

**Example**

inform task 2 "ERROR REP 8 SKIP 5 #2:1 OFFS 8 INS abcd";

Impairs 8 frames by inserting extra octets (abcd) at an offset of 8 from the beginning of the frame. Skip 5 indicates to keep 5 frames intact and impair the 6th, and repeat same thing for 8 times.

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# Data Verification using Statistics

**MLPPP Statistics**: This provides important statistics information about the MLPPP bundle such as Number of transmitted / received octets, frames, fragments, lost fragments, and so on.

**PPP and HDLC Statistics** - PPP Statistics provides important statistics information for the selected PPP link, while HDLC statistics displays the errors that occur during file transmission like the Tx / Rx Under / Over Runs, Number of PPP packets with bad FCS and Frame Errors.

**Tx/Rx Verification** - Traffic verification provides the overall statistics for all classes (MLPPP Simulation) or links (PPP Simulation). The statistics include number of Transmitted, Received, Matched, Modified, Inserted and Deleted frames.



| Class No | Tx Cnt | Rx Cnt | Matched Cnt | Modified Cnt | Inserted Cnt | Deleted Cnt |
|---|---|---|---|---|---|---|
| 0 | 951 | 1682 | 1528 | 4 | 0 | 4 |
| 1 | 950 | 589 | 564 | 4 | 0 | 567 |
| 2 | 1835 | 160 | 156 | 0 | 0 | 0 |
| 3 | 1452 | 125 | 59 | 2 | 0 | 60 |
| 4 | 949 | 79 | 74 | 0 | 0 | 73 |
| 5 | 949 | 237 | 156 | 0 | 77 | 0 |
| 6 | 949 | 158 | 156 | 0 | 0 | 0 |
| 7 | 949 | 79 | 74 | 0 | 0 | 73 |
| 8 | 949 | 79 | 74 | 0 | 0 | 73 |
| 9 | 949 | 79 | 74 | 0 | 0 | 73 |
| 10 | 949 | 79 | 74 | 0 | 0 | 73 |
| 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 11831 | 3346 | 2989 | 10 | 77 | 996 |

**Statistics and Tx Rx Verification**

# Buyer's Guide

| Item No | Product Description |
|---------|---------------------|
| XX635 | w/PPP Emulation |
| XX636 | w/MC-MLPPP Emulation |

| Item No | Related Software |
|---------|------------------|
| XX634 | w/ Client-server Multi-Channel HDLC Emulation and Analysis, File based High Throughput HDLC Record/Playback |
| XX135 | Real-time MLPPP Protocol Analyzer (T1 or E1) |
| OLV135 | Offline MLPPP Analyzer |
| XX136 | PPP and MLPPP Packet Analysis – Real-time Packet Voice, Video, and Fax Analysis |
| XX655 | Client-Server MFR Emulation (requires XX600, XX634) |

| Item No | Related Hardware |
|---------|------------------|
| PTE001 | tProbe™ Dual T1 E1 Laptop Analyzer with Basic Analyzer Software |
| PTE025 | Data Communications Board for Interfaces RS-232, RS-449, EIA-530, V.35, and many others |
| XTE001 | Dual Express (PCIe) T1 E1 Boards |
| FTE001 | QuadXpress T1 E1 Main Board (Quad Port– requires additional licenses) |
| ETE001 | OctalXpress T1 E1 Main Board plus Daughter Board (Octal Port– requires additional licenses) |

**Note**: PCs which include GL hardware/software require Intel or AMD processors for compliance.

For more details, visit MC-MLPPP Emulation using Client-Server webpage.

Document Number: XX635, XX636-01