

# ML650x Modems

**The ML650x Modems from Actelis® enable delivery of V.35, E1 (CESoPSN) together with high-speed carrier Ethernet services.**

**With either V.35 or E1 ports, or both and up to 60 Mbps of fiber-quality symmetrical Ethernet traffic over existing copper pairs, the ML650x modems provide a cost-effective solution for PBX backhaul, N x 64 kbps and Ethernet applications.**

Available in 2 and 4 copper pairs and fiber configurations, the ML650x modem can be deployed in a Point-to-Point configuration or as the CPE in an Ethernet Point-to-Multipoint configuration with Actelis' EFM aggregation platforms. With its superior performance and extensive functionality, the ML650x modems offer rapid service delivery over a converged Ethernet facility, allowing for complete future-proof utilization of the existing network infrastructure.

The ML650x family comes in 3 different versions, all having two electrical (RJ45) electrical Ethernet interfaces and in addition:

- ML650T with one E1 interface
- ML650V with one V.35 interface
- ML650VT with one E1 interface and one V.35 interface

The ML650x modem is Metro Ethernet Forum (MEF) compliant and it seamlessly integrates into carrier Ethernet networks. Equipped with two 10/100Base-T Ethernet interfaces, the ML650x platform is interoperable with any standard Ethernet switch, router or hub, and allows assignment of a service or a customer per port. The ML650x models let service providers create an intelligent Ethernet access edge with support for legacy services.

Powered by Actelis Networks' award-winning EFMplus™ technology, the rate, reach and reliability are increased significantly using advanced Dynamic Spectrum Management (DSM) and Symmetrical Vectoring techniques (also known as DRB. This technology doubles the rate/

reach in real-world field deployments. Combined with Actelis industry-leading XR239 EFM Repeaters, the reach can be extended even further.

All ML650x models provide 802.1q VLAN-aware wire-speed bridging, double tagging (VLAN stacking) for end-user VLAN transparency, L2 (Ethernet priority) and L3 (ToS/Diff-Serv) classification with four traffic classes, RSTP/STP, bandwidth monitoring, Multicast/Broadcast limiting, as well as IGMP snooping for video distribution applications.

Implementing the IEEE 802.3ah-2004 (EFM) long-reach, Ethernet over copper specification, the ML650x Modem bonds up to 4 copper pairs together to create a 2Base-TL aggregated link. The systems support current and evolving Ethernet QoS requirements and have the highest available packet throughput efficiency.

The ML650x modems provide proactive and dynamic tools for enhanced trouble shooting and monitoring capabilities. Advanced Carrier-class EFM OAM, including 802.3ah, CFM (802.1ag), Y.1731 (ITU) are supported by the product offering both physical link as well as service level end-to-end advanced troubleshooting mechanisms.

The ML650x modems can be managed In- and Out-of-Band by the MetaASSIST™ View graphical craft application and via the multiplatform Element Management System, MetaASSIST EMS The management protocols include standard TL1 command line interface and SNMP using standard MIBs for seamless integration with third-party Network Management Systems (NMS).



## Highlights

- T1/E1 Replacement with High Precision Synchronization
- CE 1.0
- Low CESoPSN Delay
- Standards-based IEEE 802.3ah Ethernet in the First Mile (EFM) 2Base-TL transport
- Rapid Service Deployment
- Superior Rate, Reach & Reliability
- Low Delay and Jitter for Voice and Video Transmission
- Carrier Class OAM - Y.1731, CFM, Y.1564, and EFM OAM
- Worldwide Spectral Compliancy
- FCC, UL, CE
- Environmentally Hardened

## Applications

- Nx64kbps backhaul
- E1 backhaul
- PBX backhaul
- Leased Lines Replacement
- Seamless Migration from all TDM to all Ethernet / Packet
- DSLAM, MSAP, BLC backhaul

## Markets Served

- ILECs, CLECs, IOCs, PTTs, Alternative Carriers, and Mobile Operators
- Federal, State and Local Government Agencies
- Education, Health Care, Utilities, and Private Campuses

## ML650x

### Specifications

#### Interfaces

- **10/100Base-T:** 2 ports,  
Connector: RJ45, Auto-MDIX

#### ML650T

- **E1:** 1 port  
Connector: RJ45/RJ48c

#### ML650V

- **V.35 DTE:** 1 port  
Connector: 26 Pin Male

#### ML650VT

- **E1:** 1 port  
Connector: RJ45/RJ48c
- **V.35:** 1 port  
Connector: 26 Pin Male

#### Synchronization

- **Standards Compliance:**  
ITU-T G.703 + G.704 Short & Long
- **Line Codes:** ITU-T G.703, G.704, GR-499  
**Framing:** Framed / Fractional  
**Service Loopback:** Facility and Equipment
- **Reference clock from CO (ML2300N) -**  
Symbol Clock over SHDSL

#### CES Protocols

- **CESoPSN**
- **CES Delay:** < 5 ms

#### High Speed Link (Bonded Copper Pairs)

- **Protocol:** IEEE 802.3ah 2Base-TL
- **Line code:** ITU-T G.991.2 rev. 2
- **Bandwidth:** Up to 60 Mbps (symmetrical).
- **Cut line protection:** Resiliency to multiple failures
- **Number of Copper Pairs:** 2 or 4 pairs  
Connector: RJ45 (per modem/pair)
- **End-to-end Delay:** 2-4 ms (typical)
- Spectral Compliance ITU-T G.991.2 (Annex A,B,F,G), ETSI TS 101 524 (Annex E), ANSI T1.417, T1.426 Per country regulatory compliant spectral modes
- **Symmetrical Vectoring, Cross-talk Cancellation Dynamic Rate Boost (DRB)**
- **Sealing Current** 48VDC/4mA nominal

#### Management (Out-of-Band)

- 10/100Base-T Connector: RJ45, Auto-MDIX
- Craft EIA RS-232 (DCE) Connector DB9

#### Ethernet Bridge Features

- Dynamic Bridging IEEE 802.1, 8K MAC addresses
- Discovery Mechanisms LLDP
- VLAN Tagging IEEE 802.1Q
- **VLAN:** 4K range (255 simultaneously)
- L2CP Tunneling
- Aging: Configurable
- MTU: 1632
- Double Tagging Q-in-Q
- RSTP, STP IEEE 802.1d
- Link Aggregation IEEE 802.3ad
- Provider Bridges IEEE 802.1ad
- IGMP snooping IGMP v1/v2
- **OAM:** IEEE 802.3ah clause 57 (EFM OAM) Dying Gasp, IEEE 802.1ag, ITU Y.1731, Ethernet loopback with MAC swap

#### Management Protocols

- ITU-T G.826 PM for Line and Path
- ITU-T G.704/G.707 SSM
- SNMP: SNMP V3, V2C, V1
- IP addresses: IPV4 and IPV6
- Command Line Interface:  
TL1, Industry Standard CLI
- Remote Access Telnet
- Secure Access (option) SSH v2
- Time Synchronization SNTP v3
- File Transfer FTP, TFTP
- IEEE 802.3ah EFM OAM: Dying Gasp
- User Authentication RADIUS and/or local passwords

#### Applications

- EMS MetaASSIST EMS
- Craft GUI MetaASSIST View

#### Quality of Service

- Classes of Service 4
- Scheduler SP, WFQ
- Classification L2 802.1p/Q priorities, L3 ToS/Diff Serv

#### Front Panel Indicators (LEDs)

- Power
- Status
- Alarm
- Synch
- MLP per modem/pair
- ACT (Activity) per Ethernet/HSL port
- LNK (Link) per Ethernet/HSL/T1/E1 port
- ERR (Error) Alarm per T1/E1/External Clock port

#### Alarm Contacts

- Terminal Block 2 Input, 1 Output

#### Physical

- **Dimensions:** Height: 1.6" / 40mm (1U)  
Depth: 11.0" / 280mm Width: 8.4" / 213mm
- **Weight:** 3.75 lbs / 1.7 Kg
- **Mounting Rack:** 2 units in 19", 23" or ETSI racks  
Desktop, Wall Mount
- **Power DC:** -48/-60 VDC nominal, <22 Watt  
**AC:** 90-264 VAC, 47-63 Hz, 25-30 Watt (per model)

#### Environmental

- **Operating Temp:** -5° to +50°C
- **Storage Temp:** -20° to +65°C
- **Relative humidity:** Up to 95%, non-cond.

#### Regulatory Approval/Certifications

Metro Ethernet Forum

- CE 1.0 - MEF 9, 14

Safety

- UL 60950, CSA C22.2 60950-1
- EN 60950-1, IEC 60950-1
- IS 13252, IS 8473

EMC

- FCC Part 15 Class B; ICES-003 Class B
- ETSI EN 300 386 Class B
- CISPR 22
- ETSI ETS 300 132-2
- ITU-T K20, K.21

NEBS

- Level III (GR-1089-CORE, GR-63-CORE)

CE

- EMC and Safety

Environmental

- GR-63-CORE & ETSI ETS 300 019

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