

## Datasheet

# EUSM™ - Ethernet Universal Service Module



## Overview

The Fiber Driver Ethernet Universal Service Module (EUSM™) is the ultimate converter-based Optical Ethernet Demarcation device for bookend pair applications only. Flexible and cost-effective architecture reduces both operating and capital expenses (OpEx and CapEx) while providing premium services including full service level control over link connectivity and WAN/LAN segment provisioning. Native support for jumbo frame sizes up to 9600 bytes supports demanding Ethernet services such as distributed video and network storage arrays.

Located at the edge of the customer premises, the EUSM CO/CPE pair provides carrier-to-customer network interface that separates the upstream WAN from the downstream network: customer LAN or peer carrier network. The bookend EUSM pair uses extended OAM 802.3ah protocols to fully manage both ends of the point-to-point fiber optic link from a single manager at one end of the link. CO and CPE link ports on the respective EUSMs are controlled similarly from the managed side of the link.

## Flexibility

Flexible interface options reduce inventory needs and OPEX. With the flip of a DIP switch, the EUSM becomes a Fast Ethernet or Gigabit Ethernet service module.

The LAN access port is selectable between a copper (RJ-45) and an SFP-based fiber optic interface. Simpler inventory reduces OPEX dramatically.

In Fast Ethernet mode, the copper port offers dual speed (10/100Base-TX) and the fiber port provides 100 Mbps (100Base-FX). In Gigabit Ethernet mode, the copper port offers three speeds (10/100/1000Base-T) and the fiber port provides 1000 Mbps (1000Base-X).

The module features two redundant SFP-based network line (WAN) interfaces. The network line is 100 Mbps (100Base-FX) in Fast Ethernet mode and 1000 Mbps (1000Base-X) in Gigabit Ethernet mode.

## Applications

- CO/CPE “bookend” Ethernet demarcation
- Deployment of Transparent Line Service (TLS)
- Managed Ethernet signal repeater

## Highlights

- Fast or Gigabit Ethernet modes
- Carrier network converter-based service demarcation
- Centralized link (CO and CPE) full management through 802.3ah MRV extended OAM
- Copper or fiber access ports and redundant SFP optical trunks
- LAN and WAN ports with segment provisioning
- LAN and WAN segment monitoring with extensive hierarchical OAM, Ethernet, switching, and RMON MIB statistics
- MEF 9 and MEF 14 certified
- IOMatrix cNode level1 protocol support
- Advanced CoS (Class of Service)
  - Multi-layer traffic classification into 4 classes of service
  - Traffic classification parameters
    - Port ID
    - 802.1p
    - IPv4 and IPv6 DSCP/ToS
  - Strict priority queuing
  - IPv4 and IPv6 DSCP remarking
- Bandwidth provisioning and policing
  - By port
  - By EVC/flow
- Multi-layer parameter-based link aggregation (802.1ad)
- Advanced 802.1Q VLAN support
  - VLAN-aware access control
  - Support for provider bridging through Q-in-Q processing
  - VLAN translation
- Unfiltered traffic flow for Transparent Line Services (TLS)
- Storm Control
- End-to-end Ethernet service assurance (test and analysis)
  - Extensive port statistics
  - Ethernet Service Level Agent (E-SLA™)
  - Ethernet Port Advanced Loopback (E-PAL™)
  - Ethernet Traffic Generation Agent (E-TGA)
  - Ethernet Traffic Analysis Agent (E-TAA™)
- Fiber Driver chassis and management compatibility
- Hot-swap support

## Benefits

- Carrier-grade reliability at converter-level prices (CAPEX)
- Reduced OPEX and minimized truck-roll
- End-to-end Service Level Agreement (SLA) assurance tools

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Small form-factor pluggable (SFP) optical transceivers provide further flexibility by addressing a wide range of applications. SFPs are available for a range of optical fiber types, distances, and wavelengths including single fiber, short reach multi-mode, long haul single-mode, CWDM, DWDM, and other media variations.

### Ethernet Provider Services

Beyond the flexibility of physical interfaces, the EUSM offers a rich set of sophisticated features and tools designed to allow providers of Transparent Line Services (TLS) maximum monitoring and control over the demarcation device. These services can help assure a committed level of service (SLA) and easy identification and correction of potential customer interface issues before they become problems.

#### Ethernet Service Level Agent (E-SLA™)

To assure committed service levels, the EUSM incorporates a powerful Ethernet Service Level Agent (E-SLA™) that offers the service provider tools to continuously monitor and test the level of service of the deployed segment path from end to end.

The E-SLA™ includes the features described in the following sections.

#### Ethernet Port Advanced Loopback (E-PAL™)

Each interface supports E-PAL™. Ingress traffic is returned to the traffic originator for data path validation and SLA analysis.

E-PAL™ incorporates advanced loopback mechanisms with different levels of intrusion. Fully intrusive local or remote loopback returns all data to its source with no customer traffic passing. Other loopback mechanisms affect customer traffic in more limited ways by returning only selected traffic matching Ethernet header fields and combinations including Destination Address (DA) and VLAN ID (VID).

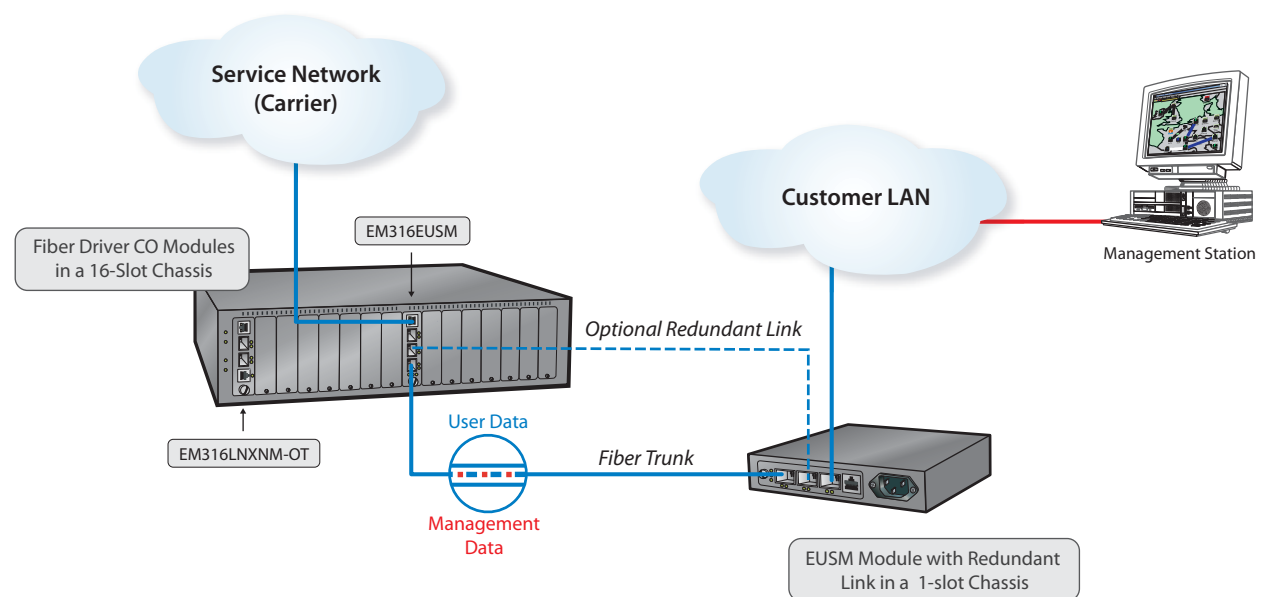
These E-PAL™ tools combine with the EUSM traffic generation and analysis agents to measure the end-to-end link and service performance.

Management and OAM traffic is always fully accessible to the EUSM agent.

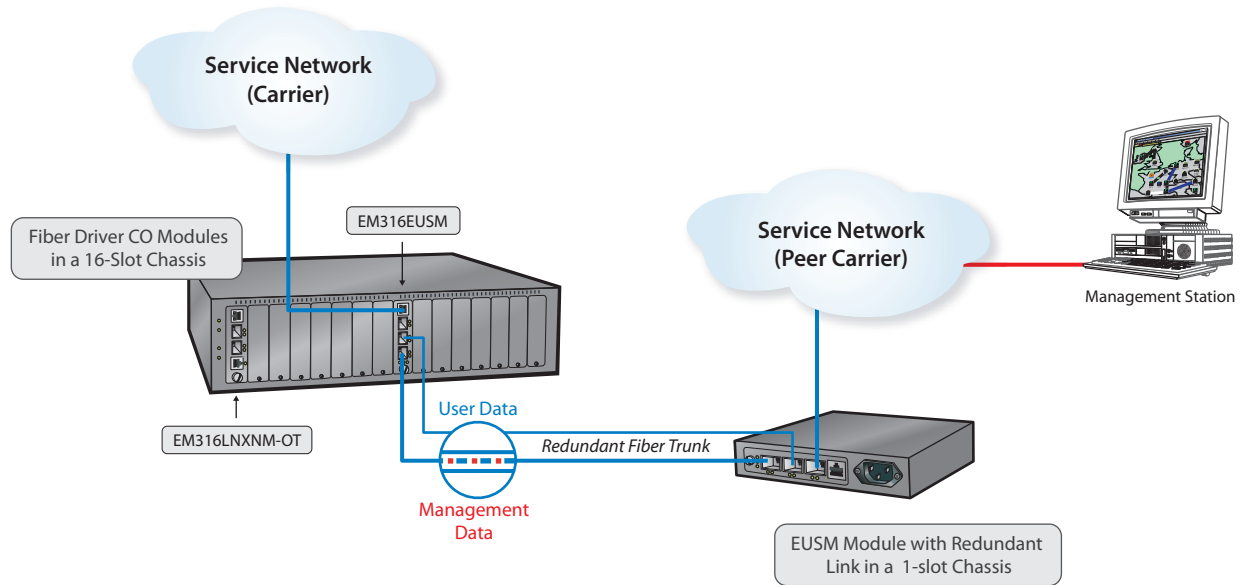
#### Ethernet Traffic Generation Agent (E-TGA)

Ethernet traffic generation agents (E-TGA) are configurable for sustained and burst rates, packet size distribution up to 100%, and all Ethernet packet MAC fields and data load.

### Peer Application #1: Customer Demarcation



## Peer Application #2: Carrier Demarcation



### Ethernet Traffic Analysis Agent (E-TAA™)

The E-TAA uses port statistics and/or trunk transit measurements to determine link or service path availability, delay, jitter, and packet loss in line with ITU-T Y.1731.

### Optical Performance Monitoring

The EUSM implements a powerful set of optical performance monitoring tools compliant with the SFP Digital Diagnostics (DD) standard (SFF-8472). Through DD, the EUSM provides real-time monitoring and reporting of SFP operating parameters such as optical TX/RX power, voltage, and temperature. It also provides static component information such as vendor code, serial number, wavelength, maximum bandwidth supported, and other device specifications. The intelligent SFP agent provides alarm and warning indications to the EUSM when pre-defined thresholds are crossed to identify potential problems in optical transmission. Network administrators may avoid service outages with preemptive action prompted by threshold alarms.

### Copper Ethernet TDR (E-TDR™)

E-TDR can identify transmission line opens, shorts, or impedance mismatches on CAT5 or CAT6 copper cables on a network site.

### Ethernet OAM

Operations, Administration, and Management (OAM) metrics available through a demarcation device significantly determine the SLA options supported by a service provider. The EUSM incorporates IEEE, ITU, and MEF OAM standards extended with unique MRV enhancements that support network monitoring, service provisioning, and speedy fault isolation through the network remotely from the network operation center (NOC).

### EUSM Ethernet OAM – the hierarchical approach

The connectivity of Ethernet bridge devices across Metro Ethernet or other transport networks creates dedicated or virtual Ethernet circuits. An end-to-end service architecture requires an administrative domain hierarchy with corresponding titles for OAM reference.

At the point-to-point link level, the EUSM fully implements the 802.3ah standards with an MRV enhancement for full pair (CO and CPE) provisioning and monitoring from the service provider NOC or point of presence (POP). The EUSM module incorporates built-in SLA assurance tools that provide delay, jitter, and frame loss performance statistics for demarcation and intermediate points of service. These statistics are fully compliant with IEEE, ITU EthOAM, and MEF standards.

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### High Availability Optical Links

The EUSM offers service protection options through its two self-healing SFP network line interfaces. Several redundancy schemes are implemented to safeguard service delivery even during some network failures.

- Physical layer 1:1 redundancy based on loss of optical signal (SD) and Ethernet link detection with a switching time of under 1 microsecond (SFP dependent)
- 802.3ah OAM 1:1 redundancy in single and dual homing configurations with fast corrective response
- 802.3ad 1+1 redundancy based on link aggregation with aggregated bandwidth efficiency over each link

The EUSM network line interfaces are always open for OAM management traffic with some access restrictions on the secondary link.

### Ethernet Class of Service – E-CoS

The EUSM module provides service intelligence necessary for optimizing QoS CIR, PIR, and burst size parameters on individual ports and classes of service, as defined in the MEF 9 and 14 models.

Hierarchical Class of Service (CoS)

- Multi-layer traffic classification into 4 hardware Classes of Service (CoS)
- IPv4 and IPv6 DSCP remarking
- Strict priority queuing
- Flow (EVC) based bandwidth policing
- Fine granularity port based rate limiting

The hardware can classify the service for each packet at wire speed based on port ID, 802.1p, and IPv4 and v6 DSCP/ToS.

For network convergence applications that have a clear boundary between customer and carrier networks, CoS layers (IP ToS v4 or v6) may be marked to preserve priorities or mapped into predefined protection profiles set by the carrier.

In addition to CoS classification and administration, the EUSM provides more advanced quality of service capabilities. The EUSM QoS engine incorporates fine grain flow (EVC) oriented bandwidth monitors as well as port based views.

The EUSM classifies VLAN traffic with ingress and egress tagging and de-tagging as part of the overall Ethernet virtual private network (VPN). It also offers provider bridging through Q-in-Q processing (multiple stacked VLAN IDs), VLAN-aware access control as well as VLAN tag translation services.

Contact your MRV Communications representative or visit <http://www.mrv.com> for additional information on Fiber Driver EM316EUSM modules and applications.

### DEVICE MANAGEMENT

- Link management through 802.3ah with MRV extensions
  - Single EM316LNxNM-OT IP/SNMP agent management of multiple links
  - Full CO/CPE monitoring and provisioning using 802.3ah with MRV extensions
  - Graphical web management through an embedded MegaVision-J application on the EM316LNxNM-OT
  - MegaVision Pro®
- EM316LNxNM-OT shelf network management
  - Out-of-band RS-232 console CLI
  - TCP/IP v4
  - Secure Access
    - SSH and optional Telnet CLI access
    - SNMP v1 and v3
    - Radius authentication
  - ASCII format for simple system configuration
  - System software and microcode download
  - Automatic system provisioning (default operation)
  - System monitoring and provisioning

## METRO ETHERNET SERVICES

- Jumbo frames (9600 bytes) at any speed and port
- High availability optical links
- Physical interfaces performance monitoring
  - SFP Digital Diagnostics (SFF-8472)
  - Copper Ethernet Cable Diagnostics (E-TDR)
- Advanced Class of Service (CoS)
  - Multi-layer traffic identification into 4 classes of service
  - Traffic classification parameters
    - Port ID
    - 802.1p
    - IPv4 and IPv6 DSCP/ToS
  - Strict priority queuing
  - IPv4 and IPv6 DSCP remarking
- Advanced QoS with low granularity rate policing
  - By port
  - By EVC/flow
- Multi-layer link aggregation based on parameters (802.1ad)
- Advanced 802.1Q VLAN support
  - VLAN-aware access control
  - Support for provider bridging through Q-in-Q processing (stacked)
  - VLAN translation
- Flooding storm control for loops and denial of service attacks
- Pure (unfiltered) traffic flow for Transparent Line Services (TLS)
  - No MAC address learning
  - Transparent flow control (TLS)
  - End-to-end errored packets (except runts)
- Fault propagation
  - Link Integrity (LIN)
  - Hierarchical OAM connectivity fault propagation
- Hierarchical OAM
  - IEEE 802.3ah with MRV extensions
- Ethernet Service Level Agent (E-SLA™)
  - Extensive port statistics
  - Ethernet-like MIB
  - OAM statistics (OAM MIB)
  - RMON MIB (groups 1,2,3 and 9)
  - Ethernet Port Advanced Loopback (E-PAL™)
    - Local and remote loopback
      - Intrusive port loopback
      - Non-intrusive port loopback per
        - VLAN
        - Destination MAC address
        - VLAN and destination MAC address
        - MAC address swap with exception list
  - Ethernet Traffic Generation Agent (E-TGA)
    - Configuration options
      - Rate and burst
      - Packet sizes
      - Ethernet packet
        - MAC header
        - Data field (fixed, random, etc.)
  - Ethernet Traffic Analysis (E-TAA™)
    - Unidirectional and bidirectional in line with ITU-T Y.1731 (EthOAM)
    - Delay
    - Jitter
    - Packet loss



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### Physical Specifications

<b>Operating Temperature Range</b>	0°C to 50°C (32°F to 122°F)
<b>Storage Temperature</b>	-40°C to 70°C (-40°F to 158°F)
<b>Relative Humidity</b>	85% maximum, non-condensing
<b>Approximate Dimensions</b>	25 mm x 90 mm x 175 mm deep (1" x 3.5" x 7" deep)
<b>Approximate Weight</b>	218 g (7.7 oz)
<b>Regulatory Compliance</b>	FCC Part 15 (Class A); IC (Class A); EMC Directive: Emission (Class A) and Immunity; RoHS Directive;
	China RoHS; REACH Directive; WEEE Directive

### Ordering Information

Model	Function	Protocol	Connectors <sup>1</sup> Port/Link	Wavelength (nm) Port / Link	Budget (dB) Port / Link	Range <sup>2</sup> Port / Link
<b>EM316EUSM</b>	Fast and Gigabit Optical Ethernet Universal Service Module - copper or fiber (SFP-based) access ports and redundant SFP optical trunks; advanced remote management 802.3AH with MRV extensions	Ethernet / Fast Ethernet / Gigabit Ethernet	RJ-45 & SFP/SFP (x2)	N/A or SFP Dependent	N/A or SFP Dependent	1-100 m or SFP Dependent

<sup>1</sup> Default connectors listed, others optional.

<sup>2</sup> All specifications, distance claims and operational parameters are based on industry average fiber cable performance; 9µ Single-mode performance of 0.25 dB/km for 1550 nm and 0.5 dB/km for 1310 nm, and 62.5µ Multi-mode performance of 3 dB/km for 850 nm and 1.5 dB/km for 1300 nm. For non-standard fiber applications or additional information contact MRV Communications

For additional information including pricing, availability and configuration options, contact your MRV Communication sales representative.

MRV has more than 50 offices throughout the world. Addresses, phone numbers and fax numbers are listed at [www.mrv.com](http://www.mrv.com). Please e-mail us at [info@mrv.com](mailto:info@mrv.com) or call us for assistance.

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