Demarcation point for SLA-based Ethernet business services and mobile backhaul

The ETX-205A Carrier Ethernet demarcation device offers Ethernet demarcation functionality for business services as well as cell-site gateway functionality for 2G, 3G, and 4G/LTE mobile backhauling applications. It provides end-to-end service control and performance management across packet networks.

The device delivers SLA-based business services to the customer premises over native Ethernet interfaces, terminating over any type of packet network.

ETX-205A transports up to five Gbps of user traffic while ensuring SDH/SONET-like performance and Five Nines reliability.

ETX-205A delivers IP VPN, VoIP, and dedicated Internet access over the same physical link as a Layer-2 LAN-to-LAN service, all with differentiated quality of service and end-to-end monitoring. It can also deliver E1, T1, and NxDS0 circuits.

Incorporating RAD’s SyncToP™ synchronization and timing over packet feature set, ETX-205A utilizes standard technologies to ensure highly accurate phase and frequency recovery and distribution over both the physical and packet layers.
ETX-205A
Carrier Ethernet Demarcation Device

All ETX-205A units are equipped with SFP/copper combo Ethernet ports, enabling flexible mixture of fiber optic and copper interfaces in one device. The SFP ports accommodate a wide range of Fast Ethernet and Gigabit Ethernet SFP transceivers, allowing service providers to seamlessly connect customers located at different distances from the device.

MARKET SEGMENTS AND APPLICATIONS

ETX-205A is used in the following applications:

- Ethernet demarcation device – ETX-205A separates the service provider network, the access provider network, and the customer network, providing proactive service monitoring and easy fault localization for Ethernet and pseudowire services throughout the entire network (see Figure 1).
- Mobile demarcation device – ETX-205A is installed at the operator tower and controller sites equipped with Ethernet and PDH ports, connecting the 2G/3G/4G/LTE NodeB or eNodeB to the packet network, providing sophisticated synchronization and traffic management as well as service assurance capabilities, including proactive service monitoring and fault identification throughout the entire network (see Figure 2).

ETHERNET

Classification
Traffic is mapped to the Ethernet flows using very flexible classification criteria based on incoming port (port-based all-to-one bundling), VLAN ID, VLAN priority, IP precedence, DSCP, Ethertype, and IP/MAC source/destination address. Classification is defined for both VLAN tagged as well as untagged traffic.

Layer-2 Control Processing
The device can be configured to pass through Layer-2 control frames (including other vendors’ L2CP frames, and with optional MAC change) across the network, to peer supported protocols (IEEE 802.3-2005 and LACP), or to discard the L2CP frames.

OAM
Featuring ultra fast, hardware-powered processing, ETX-205A performs OAM and PM measurements in line rate with maximum precision, offering the following powerful benefits:

- Immediate detection of loss of continuity (LOC), ensuring under 50 ms protection switching
- Highly accurate frame loss measurements of live traffic
- Flow-level (per CoS) monitoring, enabling simultaneous processing of multiple OAM sessions with E-LAN and E-Tree support
- Non-disruptive MAC and IP level loopback testing of network integrity.

Figure 1. Ethernet Demarcation Device
ETX-205A provides these types of Ethernet OAM:

- Single-segment (link) OAM according to IEEE 802.3-2005 for remote management and fault indication, including remote loopback, dying gasp with SNMP trap, and MIB parameter retrieval. Active and passive mode are supported.

- End-to-end connectivity OAM based on IEEE 802.1ag that enables Ethernet service providers to monitor their services proactively and guarantee that customers receive the contracted SLA.

- End-to-end service and performance monitoring based on ITU-T Y.1731. Fault monitoring and end-to-end performance measurement include delay, delay variation, frame loss and availability.

Traffic Management/QoS
Different service types require different levels of QoS to be provided end-to-end. QoS can be defined per subscriber as well as per service. QoS has three aspects: rate limitation, traffic shaping, and traffic prioritization.

Traffic policing is applied per flow or group of flows, and operates according to the dual token bucket mechanism based on user-configurable CIR + CBS and EIR + EBS. Traffic can be limited to the line rate or the data rate.

Forwarding
Every flow per EVC or EVC.cos has its own queues and scheduler supporting strict priority and weighted fair queues (WFQ). Queue blocks of eight queues per EVC are scheduled and shaped, forming an H-QoS model with shaped services and prioritized classes of service. The WRED mechanism is used for smart packet drop.

The VLAN priority bit in Ethernet frames can be modified at network ingress according to the ‘color’ of the frame. This allows service consistency and QoS continuity across color-aware (drop eligible enabled) as well as color-unaware networks.

Smart SFPs
Integrated management of MIRIC smart SFPs provides TDM (E1/T1/E3/T3/OC-3/STM-1) connectivity over PDH or SDH legacy networks. ETX-205A supports configuration and statistic collection for the smart SFP TDM port.

E1/T1 PSEUDOWIRE
Services
ETX-205A enables delivery of legacy TDM services over packet networks.

Encapsulation
TDM traffic can be encapsulated in the following modes:

- CESoPSN – CES (Circuit Emulation Services) over PSN, for framed E1/T1 traffic, per IETF RFC 5086
- SAToP – Structure-Agnostic TDM over Packet, for unframed E1/T1 traffic, per IETF RFC 4553.

The encapsulated pseudowire connections can be transmitted over the following types of PSN transport networks:

- UDP/IP (UDP over IP)
- MEF 8 (Ethernet).

OAM
The following TDM OAM is provided:

- Connectivity verification.
- PW parameter validation
- Delay measurements with 1µsec resolution

Forwarding

Quality of Service (QoS)
The quality of service prioritization technique differs according to the transport network type:

- MEF 8 – Outgoing pseudowire packets can be assigned to a queue directly. Priority is also defined by means of Layer-2 p-bit marking
- UDP/IP – Outgoing pseudowire packets can be assigned a ToS value that defines the egress priority queue and the Layer-2 p-bit marking. The priority queue of the egress router interface can be assigned directly or via DSCP. Additionally, the Layer-2 p-bit marking can be done via DSCP value or assigned directly.
ETX-205A
Carrier Ethernet Demarcation Device

RESILIENCY

Dying Gasp
ETX-205A reports power failures to defined network management stations by sending an IEEE 802.3-2005 message or SNMP trap, thus enabling the unit to properly disconnect from the network with notification of the reason for the service problem.

Fault Propagation
The unit provides a user-configurable fault propagation mechanism in the network-to-user or user-to-network direction.

When a link failure is detected or OAM failure received, ETX-205A can shut down the affected port or forward the OAM failure message. The fault propagation mechanism enables routers and switches connected to both ends of the link to reroute the traffic to the redundancy path.

Link Protection
ETX-205A provides the following network interface protection modes:
- 802.3ad link aggregation (LAG), providing 1:1 link protection with Link Aggregation Control Protocol (LACP) support
- Dual homing (1:1), allowing ETX-205A units to be connected to two different upstream devices.

Ethernet Path Protection
ETX-205A applies standard ITU-T G.8031 Ethernet Linear Protection switching for fast protection of one or more EVCs from end to end. The standard implementation ensures interoperability with third-party devices. With standard APS functionality, Ethernet OAM messages provide bandwidth-efficient unidirectional or bidirectional 1:1 protection.

The EVC protection path can be configured on the same network port, enabling the transport network to provide an alternative path for the working and protecting paths. It can also be configured on separate network ports, adding protection at the access layer and enabling load balancing on network interfaces by splitting traffic between the two network ports.

The performance of the hardware-based Ethernet OAM together with protection switching for physical layer failure ensures fast protection in any scenario.

The flow level protection provides a full set of manual commands for maintenance purposes.

Figure 2. Mobile Backhauling
TIMING AND SYNCHRONIZATION

ETX-205A implements the RAD SyncTop™ synchronization suite (see Figure 2), allowing cellular backhaul providers to meet the necessary synchronization requirements without the need to invest in dedicated timing equipment at every base station. ETX-205A timing features include:

- Synchronous Ethernet (SyncE) per ITU-T G.8261-G.8264
- IEEE 1588v2 Precision Time Protocol, slave, working in the following modes:
  - Frequency – Slave reconstructs remote clock using sync and delay request/response from master to slave (no time-related status/alarms, or TOD)
  - Time – Slave uses regenerated frequency. A high quality (PRC/PRS) CSM clock improves the time reconstruction. Time-related status/alarms and TOD are provided
  - Frequency and time – Slave provides time information in addition to frequency.
- IEEE 1588v2 Precision Time Protocol transparent clock with hardware-based time stamping as well as ToD (time of day) synchronization
- External clock in/out interfaces (T3/T4) supporting 2MHz, 2M bits, and T1 frequencies
- 1 PPS, 10 MHz signal phase and frequency synchronization
- Primary/secondary clock redundancy with stratum 3/3E holdover performance.

MANAGEMENT AND SECURITY

The following security protocols are provided by ETX-205A to ensure client server communication privacy and correct user authentication:

- SNMPv3
- RADIUS (client authentication)
- TACACS+ (client authentication, authorization, and accounting)
- SSH (secure shell communication session)
- SFTP (secure file transfer).

Command Line Interface (CLI)

Databases and scripts of commonly used commands can be easily created and applied to multiple units using command line interface.

Loopback Tests

Layer-2 and/or layer-3 network integrity can be tested by a non-disruptive loopback performed per flow, with swapping of MAC address and optionally IP address. When the loopback is activated, ETX-205A exchanges the source and destination MAC/IP addresses of the incoming packets. This loopback passes through Ethernet bridges (MAC address) and routers (IP address).

Ports

The unit can be managed using the following ports and applications:

- Local management via an ASCII terminal connected to the RS-232 port
- Out-of-band management via a dedicated management port.
- Remote inband management via user or network ports routed via separate VLANs, Telnet, or an SNMP-based management system.

MONITORING AND DIAGNOSTICS

RFC-2544

The device provides a built-in RFC-2544 wire-speed traffic generator and analyzer for unidirectional and bidirectional testing of throughput, latency, and frame loss. Based on standard OAM messages, the tests can be simultaneously performed over multiple flows, at the EVCoS level. Enhanced RFC-2544 functionality provides service-oriented KPI analysis. SLA conformance is measured per service bandwidth and packet size, within a user-defined amount of time, for faster service introduction.

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Specifications

CAPACITY
Max. Frame Size
12,288 bytes

ETHERNET INTERFACES
Number of Ports
Up to 2 network ports (redundancy)
Up to 5 user ports (port 2 can function as network or user)
Type
SFP/copper combo port:
Fiber optic:
Fast Ethernet (100BaseFx, 100BaseLX10, 100BaseBx10, 100BaseT), SFP-based
Gigabit Ethernet (1000BaseSx, 1000BaseLX10, 1000BaseBx10, 1000BaseT), SFP-based
Packet over PDH and SDH: MiRICi SFPs
Copper: 10/100/1000BaseT (built-in)
Connector
SFP slot or RJ-45

E1 INTERFACES
(E1/T1 ports configured to E1 mode; relevant only for 4E1T1 ordering option)
Number of Ports
4
Compliance
G.703, G.732n
Data Rate
2.048 Mbps
Line Coding
HDB3
Impedance
120Ω, balanced
75Ω, unbalanced (via adapter cable)
Connector
Electrical, RJ-45

T1 INTERFACES
(E1/T1 ports configured to T1 mode; relevant only for 4E1T1 ordering option)
Number of Ports
4
Compliance
ANSI T1.101, ANSI T1.403
Data Rate
1.544 Mbps
Line Coding
B8ZS
Framing
Unframed or ESF
Impedance
100Ω, balanced
Connector
Electrical, RJ-45

MANAGEMENT
Ethernet Management Port
Type: 10/100BaseT
Connector: RJ-45
Control Port
Interface: V.24/RS-232 DCE
Connector: RJ-45
Format: Asynchronous
Data rate: 9.6, 19.2, or 115.2 kbps

TIMING
Station Clock
(relevant only for SYE and PTP options)
Type: Balanced E1, unbalanced E1 (via an adapter cable)
Connector: RJ-45
TOD/1PPS Port
(relevant only for PTP option)
Connector: RJ-45

External Clock
(relevant only for PTP option)
Connector: BNC
1PPS Port
(relevant only for PTP option)
Connector: BNC

GENERAL
Compliance
MEF 6 (E-Line – EPL and EVPL), MEF 10, MEF 9, MEF 14: EPL and EVPL, MEF 20,
IEEE 802.3, 802.3u, 802.1q, 802.1p, 802.3ad, 802.3-2005, 802.1ag,
ITU-T Y.1731, G.8031, G.8262, RFC-2544
Indicators
PWR (green): On – Device is powered up
TST/ALM (red): On – Active alarm
Blinking – Active loopback
LINK/ACT on Eth ports (green):
On – Ethernet link connected
Blinking – Active loopback
LOC on E1/T1 ports (red):
On – Local synchronization loss
REM on E1/T1 ports (red):
On – Remove synchronization loss
SD on station clock (green):
On – Station clock port connected

Power
AC power supply:
100–240 VAC, 50/60 Hz
Wide-range DC power supply:
24/48 VDC nominal (20 to 72 VDC)
Power Consumption: 17W max

Physical
Height: 43.7 mm (1.7 in)
Width: 440 mm (17.4 in)
Depth: 240 mm (9.5 in)
Weight: 3.1 kg (6.8 lb)

Environment
Temperature:
ETX-205A: 0 to 50°C (32 to 122°F)
ETX-205A/H: -20 to 65°C (-4 to 149°F)
Humidity: Up to 90%, non-condensing
Table 1. ETX Family Comparison Table

<table>
<thead>
<tr>
<th>Feature</th>
<th>ETX-203AM (Ver. 4.3B)</th>
<th>ETX-203AX (Ver. 4.3B)</th>
<th>ETX-205A (Ver. 4.3B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth</td>
<td>100/1000 Mbps per port, depending on license option</td>
<td>100/1000 Mbps per port, depending on license option</td>
<td>100/1000 Mbps per port</td>
</tr>
<tr>
<td>Ethernet Ports (net/net/user)</td>
<td>Module/4 SFP/copper combo</td>
<td>1/1/4 SFP/copper</td>
<td>1/1/4 SFP/copper combo</td>
</tr>
<tr>
<td>Network interface</td>
<td>Network module: 2 × GbE, 4W SHDSL, or 8W SHDSL</td>
<td>Up to 2 × GbE or FE SFP or copper ports</td>
<td>Up to 2 × GbE or FE SFP/copper combo ports</td>
</tr>
<tr>
<td>User interface</td>
<td>Up to 5 × GbE or FE SFP or copper ports</td>
<td>Up to 5 × GbE or FE SFP or copper ports</td>
<td>Up to 5 × GbE SFP/copper combo ports</td>
</tr>
<tr>
<td>Number of flows (EVC.cos) / shapers / MEPs</td>
<td>192/2/128 or 192/30/128, depending on license option</td>
<td>192/2/128 or 192/30/128, depending on license option</td>
<td>192/30/128</td>
</tr>
<tr>
<td>Service type</td>
<td>EPL and EVPL (flow-based)</td>
<td>EPL and EVPL (flow-based)</td>
<td>EPL and EVPL (flow-based)</td>
</tr>
<tr>
<td>Forwarding mode</td>
<td>Flow-based</td>
<td>Flow-based</td>
<td>Flow-based</td>
</tr>
<tr>
<td>Bandwidth profile</td>
<td>CIR/CBS, EIR/EBS per EVC-CoS</td>
<td>CIR/CBS, EIR/EBS per EVC-CoS</td>
<td>CIR/CBS, EIR/EBS per EVC-CoS</td>
</tr>
<tr>
<td>Max. frame size</td>
<td>GbE uplink: 12,288 bytes SHDSL uplink: 2,000 bytes</td>
<td>12,288 bytes</td>
<td>12,288 bytes</td>
</tr>
<tr>
<td>E1/T1, E3/T3, OC-3/STM-1 bridging</td>
<td>Via smart SFP, with integrated management</td>
<td>Via smart SFP, with integrated management</td>
<td>Via smart SFP, with integrated management</td>
</tr>
<tr>
<td>E1/T1 TDM pseudowire</td>
<td>No</td>
<td>No</td>
<td>4 E1/T1 interfaces</td>
</tr>
<tr>
<td>Timing options</td>
<td>1588v2 TC (Transparent Clock)</td>
<td>1588v2 TC (Transparent Clock)</td>
<td>Synchronous Ethernet (SyncE), 1588v2 slave, 1588v2 TC (Transparent Clock)</td>
</tr>
<tr>
<td>Management interface</td>
<td>Command line</td>
<td>Command line</td>
<td>Command line</td>
</tr>
<tr>
<td>Temperature-hardened option</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Power supply</td>
<td>AC or DC</td>
<td>Universal AC/DC</td>
<td>AC or DC</td>
</tr>
<tr>
<td>Power supply redundancy</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
ETX-205A
Carrier Ethernet Demarcation Device

Ordering

RECOMMENDED CONFIGURATIONS
ETX-205A/AC/19
ETX-205A/AC/19/SYE
ETX-205A/AC/19/PTP
ETX-205A/AC/19/4E1T1
ETX-205A/AC/19/4E1T1/PTP
ETX-205A/ACR/19
ETX-205A/ACR/19/SYE
ETX-205A/ACR/19/PTP
ETX-205A/ACR/19/4E1T1
ETX-205A/ACR/19/4E1T1/PTP
ETX-205A/DC/19
ETX-205A/DC/19/SYE
ETX-205A/DC/19/PTP
ETX-205A/DC/19/4E1T1
ETX-205A/DC/19/4E1T1/PTP
ETX-205A/DCR/19
ETX-205A/DCR/19/SYE
ETX-205A/DCR/19/PTP
ETX-205A/DCR/19/4E1T1
ETX-205A/DCR/19/4E1T1/PTP
ETX-205A/ACDC/19
ETX-205A/ACDC/19/SYE
ETX-205A/ACDC/19/PTP
ETX-205A/ACDC/19/4E1T1

SPECIAL CONFIGURATIONS
ETX-205A/?/19/~/

Legend

? Enclosure type (Default=Regular enclosure):
H Industrially-hardened enclosure

Note: The ETX-205A/H version requires industrially-hardened SFP transceivers.

! Power supply (swappable):

AC Single AC power supply
ACDC Single AC power supply and single DC power supply
ACR Dual AC power supply
DC Single DC power supply
DCR Dual DC power supply

~ Timing:
SYE SyncE full support
PTP SyncE and 1588v2 clock recovery support

SUPPLIED ACCESSORIES
Power cord (one per power supply)
RM-34 Rack mount hardware kit for one unit
CBL-RJ45/D9/F/6FT Control port cable with male RJ-45 and female DB-9 connector

OPTIONAL ACCESSORIES
WM-34 Wall mount hardware kit for one unit
ETX-205A_PS/!

Legend

AC Single AC power supply
DC Single DC power supply

CBL-RJ45/2BNC/E1/X Balanced E1 (RJ-45) to unbalanced E1 (2 BNC) adapter cable