



System Specifications

This appendix contains information for the hardware that makes up a Cisco MGX 8850 switch. The descriptions apply to the enclosure, power systems, cooling system, and cards. The types of information consist of:

- Operational ranges, such as bits per second, voltage ranges, and temperature ranges
- Physical layer characteristics, such as line coding and line framing
- Standards compliance, supported protocols, and tolerances, such as parts per million (ppm) for clocks and jitter
- Per card capacities, such as types and sizes of memory, number of ports, and maximum number of connections

Enclosure and System Power Specifications

This section describes the physical characteristics and system power requirements for the MGX 8850 switch. For a list of the dimensions, weight, and power consumption for each card, see “Physical and Electrical Characteristics for Cards” in this appendix. For a list of the AC power plugs for domestic and international use, see Appendix B, “Cabling Summary.”

Table A-1 Enclosure and Electrical Characteristics

Item	Value
Card Slot Capacity	Supports combinations of full and single-height service modules. Two double-height slots reserved for PXMs. Up to 28 single-height slots for service modules or up to 14 double-height slots for service modules.
Enclosure Size, AC-powered system:	Height: 33.25 inches (45.5 cm). Width: 17.75 inches (45.08 cm) for all enclosure modules, so the rack must have this minimal, inner width. If a 19-inch rack cannot provide it, use a 23-inch rack. Depth: 27.0 inches (68.6 cm).
DC-powered system:	Height: 28 inches (71.1 cm). Width: 17.75 inches (45.08 cm) for all enclosure modules, so the rack must have this minimal, inner width. If a 19-inch rack cannot provide it, use a 23-inch rack. Depth: 27.0 inches (68.6 cm) with cable manager, 21.5 inches (54.6 cm) without cable manager.
Shipping Weight for Populated Enclosure:	DC: 190 lbs (87 Kgs) with 2 DC PEMs. AC: 230 lbs (104.5 Kgs).
Shipping Weight for Individual Components:	Single-height, front and back cards: 2.48 lbs (1.13 Kgs) Double-height, front and back cards: 6.0 lbs (2.73 Kgs) Card cage with boards: 160 lbs (72.73 Kgs) Exhaust plenum: 8 lbs Fan tray: 9.5 lbs Inlet plenum: 8 lbs AC power tray with power supplies: 45 lbs
Clearance Requirement for the Enclosure:	Minimum 30 inches front and rear; nominal 12-inch side clearance.
Power Input Voltage:	AC system: Normal operating range is 200–240 VAC, 47 to 63 Hz. The maximum voltage range is 180–264 VAC. DC system: –42 to –56 VDC. Each AC supply can provide up to 1200 watts.
Current Requirements, AC System	Configuration-dependent: use Network Design Tool for exact requirements. For general planning purposes: 14.4 Amps at a nominal voltage of 200 VAC. At the minimum voltage limit of 180 VAC, the current draw is a maximum of 16 Amps.
Current Requirements, DC System	Configuration-dependent: use Network Design Tool for exact requirements. For general planning purposes: 43.2 Amps at nominal –48 VDC; 49.4 Amps at –42 VDC maximum.
Input AC Power Connector:	IEC 16-Amp input connector. For a list of the AC power plugs for domestic and international use, see Appendix B, “Cabling Summary.”

Table A-1 Enclosure and Electrical Characteristics (continued)

Item	Value
DC Input Connections:	Three-position terminal block for 6 AWG wire (10 square millimeters) and #10 screw lugs designed for 6 AWG wire.
Operating Environment:	0–40 degrees Celsius (32–104 degrees Fahrenheit) normal operation (50 degrees Celsius or 122 degrees Fahrenheit up to 72 hours). Maximum 85% relative humidity.
Shock:	Withstands 10 G, 10 ms at 1/2 sine wave.
Vibration:	Withstands 1/4 G, 20–500 Hz.
Heat Transfer to Environment:	AC-powered: maximum 9560 BTUs. DC-powered: maximum 8200 BTUs.

Physical and Electrical Characteristics for Cards

For quick reference, Table A-2 shows physical dimensions and power consumption for each card. Detailed information for each card appears in the section of this appendix for a specific card.

Table A-2 Physical Characteristics and Power Consumption by Card

Module	Back Cards	Front Card Dimensions (inches)	Back Card Dimensions (inches)	Weight (front and back card)	Power Consumption
MGX-FRSM-8T1 MGX-FRSM-8E1 MGX-FRSM-8T1c MGX-FRSM-8E1c	8 T1, 8 E1	7.25 x 16.25	7.00 x 4.50	1.74 lbs/ 0.76 lbs	30 watts
MGX-FRSM-2CT3	2 T3	7.25 x 16.25	7.00 x 4.50	1.74 lbs/ 0.76 lbs	60 watts
MGX-FRSM-2T3E3	2 T3, 2 E3	7.25 x 16.25	7.00 x 4.50	1.74 lbs/ 0.76 lbs	60 watts
MGX-FRSM-HS2	2 HSSI	7.25 x 16.25	7.00 x 4.50	1.74 lbs/ 0.6 lbs	75 watts
MGX-CESM-8T1E1	8 T1, 8 E1	7.25 x 16.25	7.00 x 4.50	1.74 lbs 0.76 lbs	30 watts
MGX-CESM-T3E3	2 T3, 2 E3	7.25 x 16.25	7.00 x 4.50	1.74 lbs/ 0.76 lbs	60 watts
MGX-AUSM/B-8T1E1	8-T1, 8-E1	7.25 x 16.25	7.00 x 4.50	1.74 lbs 0.76 lbs	30 watts

Table A-2 Physical Characteristics and Power Consumption by Card (continued)

Module	Back Cards	Front Card Dimensions (inches)	Back Card Dimensions (inches)	Weight (front and back card)	Power Consumption
RPM	4-Ethernet, 1-FE (RJ45/mm f), 1-FDDI (smf, mmf) Up to 2 back cards	15.65 x 15.9	7.00 x 4.125	4.80 lbs	110 watts
PXM1	2 T3/E3, OC-3c/ST M-1, OC12c/ST M-4, VI	15.65 x 15.83	7.00 x 4.5	4.80 lbs	100 watts

Electromagnetic Compatibility and Immunity

This section lists the national and international standards for electromagnetic compatibility and immunity to which this Cisco product complies. It consists of a list of reference documents, a table that indicates applicability of the standards, and the test levels for mandatory and non-mandatory CE mark immunity.

The applicable standards for electromagnetic compatibility and immunity:

- NEBS Systems Requirements (GR-1089-CORE, GR-63-CORE).
- EN 55022/08.94 (EMC Directive 89/336/EEC).
- EN 50081-1/01.92 and EN 50082-1/01.92 (Generic Immunity Requirements), International Electromechanical Commission (IEC 1000-4-2 through IEC 1000-4-13 / European Norm designation EN 61000-4-2 through EN 61000-4-13).
- Cisco Systems Electronic Design Validation Test (EDVT) Plan ABC-123, Rev A, dated 1/29/1996.
- Cisco Systems Mechanical Environmental Design and Qualification Guideline (ENG-3396, Rev. 7).
- European Telecommunication Standards Institute (ETSI) ETS 300 386-1 (December 1994).

Details on how each standard applies in this Cisco product appear in Table A-3.

Table A-3 Electromagnetic Compatibility and Immunity

Category	AC-Powered (220 VAC)	DC-Powered (-48V)
U.S.A EMC	FCC Part 15, Class A	not applicable
Japan EMC	Austel 3548 Class A	not applicable
Australia EMC	VCCI Class A	not applicable

Table A-3 Electromagnetic Compatibility and Immunity (continued)

Category	AC-Powered (220 VAC)	DC-Powered (-48V)
CE M mark (EMC and immunity)	EMC: EN 55022 Class A Immunity: <ul style="list-style-type: none"> • EN 50082-1 (generic immunity) • EN 61000-4-2 through -5 (mandatory) • EN 61000-4-6 through -13 (not mandatory) 	not applicable
NEBS (EMC and immunity)	not applicable	EMC: GR-1089-CORE Class A (radiated and magnetic fields) and line conductance. Immunity: GR-1089-CORE ESD (8 KV contact) RS (10 V/meter) CS (clause 3.3.3) European Telecom Standards (ETSI) for Surge: ETSI 300 386-1, DC power leads only (200 VAC–1000 VAC)
EDVT	Cisco Systems: Electronic Design Validation Test (EDVT) Plan ABC-123, Rev. A, dated 1/29/1996	Cisco Systems: Electronic Design Validation Test (EDVT) Plan ABC-123, Rev. A, 1/29/1996—DC power cycling portions only.
MDVT	Cisco Systems: Mechanical Environmental Design and Qualification Guideline, ENG-3398, Rev. 7.	NEBS requirements, physical: (GR-63-CORE, Issue 1, October, 1995). See mandatory CE mark immunity tests in forthcoming list.

The levels for the mandatory CE mark immunity tests are:

- For IEC 1000-4-2 (ESD), the test level is 4.
- For IEC 1000-4-3 (RS), the test level is 3.
- For IEC 1000-4-4 (EFT), the test level is 4.
- For IEC 1000-4-5 (Surge), the test level is 3.

The levels for the non-mandatory CE mark immunity tests are:

- For IEC 1000-4-6 and ENV 50141 (conducted disturbances induced by RF fields), the test level is 3.
- For IEC 1000-4-7 and EN 610009-3-2 (harmonics and interharmonics), the test level is Class B.
- For IEC 1000-4-8 (Power Frequency Magnetic Fields), the test level is 3.

- For IEC 1000-4-9 (pulse magnetic field), the test level is 3.
- For IEC 1000-4-10 (damped oscillatory magnetic field), the test level is 3.
- For IEC 1000-4-11 (voltage dips, interruptions, and variations), no test level applies, as defined by the manufacturer per the functionality of EUT.
- For ENV 50140 (RF immunity at 800 MHz), the test level is 3.

Processor Switching Module Specifications

This section contains general specifications for the Processor Switching Module (PXM). The information in Table A-4 includes information for the two types of back cards—the PXM-UI user interface for switch and the uplink card for trunking and CPE access.

Table A-4 PXM Specifications

Category	Description
Maximum switch fabric throughput.	1.2 Gbps.
Control access: These ports exits on the PXM-UI back card.	Control port: RJ-45 connector, EIA/TIA 232, DTE mode, asynchronous interface 19,200 baud, 1 start, 1 stop, no parity. Maintenance port: RJ-45 connector, EIA/TIA 232, DTE mode, asynchronous interface 9600 baud, 1 start bit, 1 stop bit, no parity bits. LAN port: RJ-45 connector, 10-baseT, 802.3 Ethernet.
Uplink ports and connectors: An uplink card can have one of these number and type of connectors. The wavelength on optical lines is 1310 nm.	2 T3 ports, BNC connectors 2 E3, BNC connectors 4 OC3 multi-mode fiber, SC connectors 4 OC3 single-mode fiber, intermediate reach, SC connectors 4 OC3 single-mode fiber, long reach, SC connectors 1 OC12 single-mode fiber, intermediate reach, SC connectors 1 OC12 single-mode fiber, long reach, SC connectors
Number of logical ports:	32 across all physical ports on the uplink card (regardless of line type).

Table A-4 PXM Specifications (continued)

Category	Description
<p>LEDs on PXM front card:</p> <p>LEDs display status, but alarm history is a switch.</p>	<p>Status for the card:</p> <ul style="list-style-type: none"> • Green means active. • Red means failed. • Yellow indicates the standby card. <p>LAN activity: flashing green indicates activity.</p> <p>Node alarm:</p> <ul style="list-style-type: none"> • Red indicates major alarm. • Yellow indicates minor alarm. <p>Node power (note that each AC power supply also has an LED):</p> <ul style="list-style-type: none"> • “DC OK A” is green for okay or red for trouble. • “DC OK B” is green for okay or red for trouble. <p>Alarm history: ACO</p> <p>Port interface (per port):</p> <ul style="list-style-type: none"> • Green means active and okay. • Red means active and local alarm. • Yellow means active and remote alarm. • No light means inactive or not provided.
LEDs on back cards:	Green means active. No light means inactive or not provided.
<p>Synchronization:</p> <p>These clock sources satisfy Stratum 4 requirements.</p>	<p>8 KHz clock derived from the following sources:</p> <ul style="list-style-type: none"> • Internal 8 KHz clock (10 ppm). • Service modules or trunk line interfaces. • External BITS clock port. • T1 clock rate 1.544 MHz +/- 50 bps. • E1 clock rate 2.048 MHz +/- 100 bps (can be either sync or data signal).
BITS clock interface:	<p>T1 with an RJ-45 connector.</p> <p>E1 with an SMB connector.</p>
Trunk history counters:	<p>Ingress, per connection:</p> <p>Number of received cells with CLP=0.</p> <p>Number of received cells with CLP=1.</p> <p>Egress, per connection:</p> <p>Number of received cells.</p> <p>Number of transmitted cells.</p> <p>Number of received cells with EFCI bit set.</p> <p>Number of transmitted cells with EFCI bit set.</p>

Table A-4 PXM Specifications (continued)

Category	Description
Connection capacities supported by PXM:	Maximum number of connections: 16,000 bi-directional channels for local switching. 32,000 bi-directional channels for switching across uplink card. Maximum aggregate bandwidth: 600 Mbps local switching (service module to service module). 1,200 Mbps switching across uplink. Cell memory: 256K cells.
Processor clock speed and memory specifics:	Clock speed: 200 MHz internal, 50 Mhz external. Flash memory: 2 Mbytes. DRAM: 64 Mbytes, upgradeable to 128 Mbytes. Secondary cache: 512 Kbytes. BRAM: 128 Kbytes. Hard disk: 4 Gbytes.
Alarm indicators (audible and visual):	Central office-compatible alarm indicators and controls through a DB15 connector.
Maintenance features:	Internal isolation loopback. External remote loopback. Hot-pluggable.
Card dimensions:	Front card: 15.65 inches by 16.83 inches (39.75 cm by 42.75 cm). Back cards: 7.25 inches by 4.125 inches (18.42 cm by 10.48 cm).
Power:	Requires -48 VDC, dissipates 100 W.

MGX-AUSM/B-8T1E1 Interface Characteristics

This section contains details for the MGX-AUSM/B-8T1E1. For physical characteristics, see Table A-5. For the T1 and E1 characteristics, see Table A-6 and Table A-7, respectively. For ATM interface characteristics, see Table A-8. For statistics and counters, see Table A-9.

Table A-5 Physical Characteristics of the Eight-Port MGX-AUSM/B

Category	Description
LED Indicators Per Card:	Active (green), Standby (yellow), Fail (red)
LED Indicators Per Line:	One per line: Active and OK (green), Active and Local Alarm (red) Active and Remote Alarm (yellow)

Table A-5 Physical Characteristics of the Eight-Port MGX-AUSM/B

Maintenance and Serviceability:	Facility loopback via loop up/down per ANSI T1.408 and ATT TR 62411 (T1), CCITT G.7xx (E1) Facility loopback via management console internal problem isolation loopbacks Hot pluggable
Card Size:	Front card: 7.25" x 16.25" (18.43 cm x 41.28 cm) Back cards: 7" x 4.5" (17.78 cm x 11.43 cm)
Power:	-48VDC, 30 W
Safety:	EN 60950 2nd edition (including EN 41003) UL 1950 2nd edition
Compliance:	T1: Accunet 62411 E1: G.703, G.823
ESD:	IEC 1000-4-2

Table A-6 T1 Interface Characteristics

Category	Description
Line Interface:	RJ48 (100 Ω) on the LM-RJ48-8T1 back card
Line Rate:	1.544 Mbps \pm 50 bps (T1)
Synchronization:	Transmitter can be: loop-timed, Receiver, or synchronized to node (normal mode)
Line Code:	Bipolar 8 Zero Substitution (B8ZS) per ANSI T1.408 (T1)
Line Framing:	Extended Superframe Format (ESF 24 frame multiframe) per ANSI T1.408
ESF Maintenance:	Bit-oriented alarm and loopback messages of ESF Data Link per ANSI T1.408
Input Jitter Tolerance:	Per ATT TR 62411
Output Jitter:	Per ATT TR 62411 using normal mode synchronization
Physical Layer Alarms:	LOS, OOF, AIS, RAI
Physical Layer Performance Statistics:	LCV, LES, LSES, CV, ES, SES, SEFS, AISS, UAS

Table A-7 E1 Interface Characteristics

Category	Description
Line Interface Connector:	RJ48 (120 Ω) on LM-RJ48-8E1, or SMB (75 Ω) on LM-BNC-8E1
Line Rate:	2.048 Mbps \pm 100 bps
Synchronization:	Transmitter can be: loop-timed, Receiver, or synchronized to shelf (normal mode)

Table A-7 E1 Interface Characteristics (continued)

Category	Description
Line Code:	HDB3 (E1)
Line Framing:	16-frame multiframe as in G.704
Input Jitter Tolerance:	As specified in ITU G.823 for 2.048 Mbps
Output Jitter Generation:	As specified in ITU G.823 for 2.048 Mbps
Physical Layer Alarms:	LOS, OOF, AIS, RAI
Physical Layer Statistics:	LCV, LES, LSES, CV, ES, SES, SEFS, AISS, UAS

Table A-8 ATM Interface Characteristics

Category	Description
Standards:	ATM UNI v3.1, ITU-T G.804, per CCITT I.361.
Channel Configuration:	1000 per card, across any of the T1 or E1 ports.
VPI/VCI Ranges:	VPI: 0–255. VCI: 0–4096.
Traffic Classes:	CBR, VBR, VBR+.
UPC Parameters:	PCR, SCR (VBR), CCDV (CBR).
Congestion Control Support:	ForeSight (towards Network for VBR+).
ForeSight Parameters:	MIR, PIR, Rate Up, Rate Down, QIR, QIR Timeout, IBS.

Table A-9 MGX-AUSM/B-8T1E1 Statistics and Counters

Counter Type	Description
Per Port:	Number of cells received from the interface. Number of cells received with unknown VPI/VCI. Last known VPI/VCI received from the port. Number of cells discarded due to error in Cell Header. Number of cells received with non zero GRC field. Number of cells transmitted to the interface. Number of cells transmitted for which EFCI was set. Number of egress cells discarded due to service interface physical alarm.
Endpoint (channel):	

Table A-9 MGX-AUSM/B-8T1E1 Statistics and Counters (continued)

Counter Type	Description
Ingress:	Number of cells received from port. Number of cells received from the port with CLP = 1. Number of cells received from the port with EFCI = 1. No. of cells from the port discarded due to queue exceeded QDepth. Number of cells (with CLP) set) discarded due to queue exceeded CLP threshold. Number of cells from the port for which CLP was set due to UPC violations.
ATMizer channel counters:	
Ingress:	Number of cells transmitted to Cellbus. Number of cells to cell bus for which EFCI was set. Number of cells to cell bus discarded due to shelf alarm.
Egress:	Number of cells received from the Cellbus. Number of cells discarded due to queue exceeded QDepth (per Egress Q). Number of cells discarded due to queue exceeded CLP threshold (per Egress Q). Number of cells received with CLP = 1.
Other Counters:	
Ingress:	Number of OAM cells discarded. Number of AIS cells received from the port. Number of RDI (FERF) cells received from the port. Number SegmentLpBk cells received from the port. Number of SegmentLpBk cells transmitted to Cellbus.
Egress:	Number of OAM cells discarded. Number of AIS cells transmitted to the port. Number of SegmentLpBk cells transmitted to the port. Number of SegmentLpBk cells received from the port.
Diagnostic Statistics:	Peak Queue Depth (Ingress: per channel).

MGX-FRSM-2CT3 Specifications

This section provides details for the following topics:

- Transport technology standards with which the card complies. (See Table A-10.)
- General physical attributes of the card, such as LEDs on the faceplate. (See Table A-11.)
- Line and framer characteristics. (See Table A-12 and “MGX-FRSM-2CT3 Framer” section.)
- Line alarms. (See “MGX-FRSM-2CT3 Line Alarms” section.)

Table A-10 Frame Relay Interface Standards

Interface	Standard
Frame Relay Interface	ANSI T1.618, 2-octet header
ATM Layer	CCITT I.361 and ATM UNI v3.1
AAL Layer	AAL5 per Draft CCITT I.363
FR-Cell Interworking	Per Draft CCITT I.555 and I.36x.1, as summarized in "ATM-to-Frame Relay Interoperability Implementation Agreement" v 1.0

Table A-11 MGX-FRSM-2CT3 Front Card Physical Characteristics

Feature	Significance or Value
Power	48 V DC, 50 W (estimated)
Card Status Indicator LEDs	Active (Green) Failed (Red) Standby (Yellow)
Line Status Indicator LEDs	Active & Okay (Green) Active & Local Alarm (Red) Active & Remote Alarm (Yellow)
Reliability	> 85000 hours MTBF (target)
Card Size	7.25 inches by 16.5 inches

Table A-12 MGX-FRSM-2CT3 Line Level

Feature	Significance or Value
Number of T3 Lines	Two
Line Interface Connector	75 ohm BNC
Line Rate	44.736 Mbps +/- 20 ppm
Line Coding	B3ZS
Transmit Timing	Normal or Loop timed
Input Jitter Tolerance	Per TR-TSY-000499
Output Jitter	0.05 UI maximum with jitter-free input clock
Output Pulse	Per T1.102.1993

MGX-FRSM-2CT3 Framer

The MGX-FRSM-2CT3 line framer:

- Supports M13 or C-bit parity format.
- Performs required inversion of second and fourth multiplexed DS1 streams per ANSI T1.107.

- Generates loop-up code to the far-end device to loop back any of the DS1s or entire DS3 signal stream by way of the FEAC channel.
- Automatically detects the incoming loop-up codes from the far-end device as well as loop back any of the DS1s or entire DS3 signal stream back to the far-end device. The loopback occurs at the M13 framer chip.

MGX-FRSM-2CT3 Line Alarms

For line alarms, the MGX-FRSM-2CT3 supports:

- Detection and generation of Remote Alarm Indicator (RAI) signal (also known as FERF and Yellow signal)
- Detection and generation of Alarm Indication Signal (AIS)
- Detection of Out Of Frame (OOF) condition
- Detection of Loss Of Frame (LOS) condition
- Automatic generation of Far End Block Error (FEBE)

MGX-FRSM T3 and E3 Specifications

This section provides details for the MGX-FRSM-2T3E3. Where appropriate, it has separate sections for T3 and E3 technologies. Topics consist of

- Transport technology standards with which the card complies. (See Table A-13.)
- General physical attributes of the card, such as LEDs on the faceplate. (See Table A-14.)
- Line and framer characteristics for T3 operation. (See Table A-14 and “T3 Framer Level.”)
- Line and framer characteristics for E3 operation. (See Table A-16 and “E3 Framer Level.”)
- Line alarms. (See “MGX-FRSM T3 and E3 Line Alarms.”)

Table A-13 Frame Relay Interface Standards

Interface	Standard
Frame Relay Interface	ANSI T1.618, 2-octet header
ATM Layer	CCITT I.361 and ATM UNI v3.1
AAL Layer	AAL5 per Draft CCITT I.363
FR-Cell Interworking	Per Draft CCITT I.555 and I.36x.1, as summarized in “ATM-to-Frame Relay Interoperability Implementation Agreement” v 1.0

Table A-14 MGX-FRSM-2T3E3 Front Card Physical Characteristics

Feature	Significance or Value
Power	48 V DC, 50 W (estimated)
Card Status Indicator LEDs	Active (Green), Failed (Red), Standby (Yellow)
Line Status Indicator LEDs	Active & Okay (Green), Active & Local Alarm (Red), Active & Remote Alarm (Yellow)
Reliability	> 85000 hours MTBF (target)
Card Size	7.25 inches by 16.5 inches

MGX-FRSM T3 Line

The T3 line characteristics appear in Table A-14.

Table A-15 T3 Line Level

Feature	Significance or Value
Number of T3 Lines	Two
Line Interface Connector	75 ohm BNC
Line Rate	44.736 Mbps +/- 20 ppm
Line Coding	B3ZS
Transmit Timing	Normal or Loop timed
Input Jitter Tolerance	Per TR-TSY-000499
Output Jitter	0.05 UI maximum with jitter-free input clock
Output Pulse	Per T1.102.1993

T3 Framing Level

For the framing characteristics of T3 operation, the MGX-FRSM-2T3E3:

- Supports C-bit parity and M13 DS3 format.
- Frames to a DS3 signal with a maximum average reframe time per TR-TSY-000009 and TR-TSY-000191.
- Detects the alarm indication signal (AIS) in milliseconds in the presence of a 10^{-3} bit error rate.
- When in-frame, indicates M-bit or F-bit framing errors as well as P-bit errors. In C-bit parity mode, it also indicates both C-bit parity errors and far end block errors.

MGX-FRSM E3 Line

For characteristics of the line on an MGX-FRSM-2T3E3 with an E3 back card:

Table A-16 E3 Line Level

Feature	Significance or Value
Number of E3 Lines	Two
Line Interface Connector	75 ohm BNC
Line Rate	34.368 Mbps +/- 20 ppm
Line Coding	HDB3
Transmit Timing	Normal or Loop timed
Input Jitter Tolerance	Per G.823
Output Jitter	0.05 UI maximum with jitter-free input clock per G.823
Output Pulse	Per G.703

E3 Framer Level

For line framing, the E3 operation of the MGX-FRSM-2T3E3 complies with G.751.

MGX-FRSM T3 and E3 Line Alarms

For line alarms, the MGX-FRSM-2T3E3 supports:

- Detection and generation of Remote Alarm Indicator (RAI) signal (also known as FERF and Yellow signal)
- Detection and generation of Alarm Indication Signal (AIS)
- Detection of Out Of Frame (OOF) condition
- Detection of Loss Of Frame (LOS) condition
- Automatic generation of Far End Block Error (FEBE)

Statistics and Counter Specifications

For lists of applicable statistics and counters, “Counters and Statistics for FRSM-VHS Cards” in this appendix.

MGX-FRSM-HS2 Specifications

The MGX-FRSM-HS2 is the Frame Relay module with two HSSI ports. The topics in this section are:

- Transport technology standards with which the card complies. (See Table A-17.)

- General physical attributes of the card, such as LEDs on the faceplate. (See Table A-18.)
- Line and framer characteristics. (See Table A-19.)

For lists of the counters and statistics that are available on the MGX-FRSM-VHS series of cards, see “Counters and Statistics for FRSM-VHS Cards” in this appendix.

Table A-17 Frame Relay Interface Standards

Interface	Standard
Frame Relay Interface	ANSI T1.618, 2-octet header
ATM Layer	CCITT I.361 and ATM UNI v3.1
AAL Layer	AAL5 per Draft CCITT I.363
FR-Cell Interworking	Per Draft CCITT I.555 and I.36x.1, as summarized in <i>ATM-to-Frame Relay Interoperability Implementation Agreement</i> v 1.0

Table A-18 MGX-FRSM-HS2 Physical Characteristics

Feature	Significance or Value
Power	48 V DC, 50 W (estimated) The SCSI2-2HSSI back card consumes 5 watts at 5 VDC and 6 watts at -5 VDC.
Card Status Indicator LEDs	Active (Green) Failed (Red) Standby (Yellow)
Line Status Indicator LEDs	Active & Okay (Green) Active & Local Alarm (Red) Active & Remote Alarm (Yellow)
Reliability	> 85000 hours MTBF (target)
Card Size	Front card: 7.25” x 16.25” (18.43 cm x 41.28 cm) Back card: 7” x 4.5” (17.78 cm x 11.43 cm)

Table A-19 MGX-FRSM-HS2 Line Characteristics

Feature	Significance or Value
Number of HSSI Lines	Two
Connector Type	SCSI-2
Line Rate	44.736 Mbps +/- 20 ppm
Line Coding	B3ZS
Line Framing	not applicable
Line Alarms	<ul style="list-style-type: none"> • Control lead is inactive • Recovered clock does not match configured line rate

Table A-19 MGX-FRSM-HS2 Line Characteristics (continued)

Feature	Significance or Value
Synchronization	Transmitter may be either loop-timed to Receiver (DTE mode), or synchronized to shelf, (DCE mode)
Input Jitter Tolerance	Per TR-TSY-000499
Output Jitter	0.05 UI maximum with jitter-free input clock
Output Pulse	Per T1.102.1993

Counters and Statistics for FRSM-VHS Cards

This section lists counters and statistics that apply to most types of cards in the FRSM-VHS group (MGX-FRSM-2CT3, MGX-FRSM-2T3E3, and MGX-FRSM-HS2).

Counter
Received frames lost due to aborts
Received frames lost due to illegal header (EA bit)
Received frames lost due to CRC errors
Received frames with bit alignment errors
Received frames with unknown DLCI
Received frames with illegal frame length
Received good frame
Transmit frames lost due to under-run/Abort count
Transmit good frame
LMI status inquiry request count
LMI signaling protocol (keep alive time-out count)
LMI sequence number error count
LMI status transmit count (in response to request)
LMI update status transmit count (in response to configuration changes)
Frames with FECN set count
Frames with BECN set count
DE frames discarded count
Number of frames reassembled but discarded due to service interface physical layer alarm

Table A-20 Service-Related Statistics

Service Statistic
Number of received frames
Number of bytes received
Number of frames received with DE=1
Number of frames received but discarded
Number of received bytes discarded
Number of frames received but discarded due to:
CRC error
Illegal frame length
Alignment error
Abort
Number of frames reassembled and transmitted
Number of frames reassembled and transmitted with DE=1
Number of frames discarded due to reassembly errors
Number of frames transmitted
Number of bytes transmitted
Number of frames transmitted with DE set
Number of frames transmitted during LMI logical port alarm
Frames FECN set count
Frames BECN set count
Number of transmit frames discarded
Number of transmit bytes discarded
Number of transmit frames discarded due to:
CRC error
Illegal frame length
Alignment error
Abort
DE egress queue threshold exceeded
Physical link failure

Table A-21 ATM Cell-Related Statistics

ATM Cell Statistic
Number of cells transmitted to PXM
Number of cells discarded due to intershelf link alarm
Number of cells transmitted with CLP bit set

Table A-21 ATM Cell-Related Statistics (continued)

ATM Cell Statistic
Number of AIS cells transmitted
Number of FERF cells transmitted
Number of BCM cells transmitted
Number of end-end loop-back cells transmitted
Number of segment loop-back cells transmitted
Number of cells received from PXM
Number of cells received with CLP bit set
Number of AIS cells received
Number of FERF cells received
Number of BCM cells received
Number of end-end loop-back cells received
Number of segment loop-back cells received
Number of OAM cells discarded due to CRC-10 error

Table A-22 Diagnostic-Related Statistics

Diagnostic Statistic
Header of last cell with unknown LCN
Header of last received frame with unknown DLCI
ECN current queue depth

Table A-23 Troubleshooting-Related Statistics

Troubleshooting Statistic
ECN current queue depth, per channel

MGX-FRSM-8T1 Specification

This section provides information on the operation of the MGX-FRSM-8T1 card set. Topics are:

- General physical information about the card set. (See Table A-24.)
- System-level interface. (See Table A-25.)
- Information about the Frame Relay service. (See Table A-24.)
- Statistics and counters. (See Table A-27.)

Table A-24 General Card Specifications

Category	Description
Indicators per card:	Active (Green), Standby (Yellow), Fail (Red)
Indicators per line:	Active & Okay (Green) Active & Local Alarm (Red) Active & Remote Alarm (Yellow)
Line Interface connector:	RJ-48 when used with RJ48-8T1 back card.
Line Rate:	1.544 Mbps \pm 50 bps
Line Framing:	ESF per ATT TR 54016
Maintenance/Serviceability Features:	Internal Problem Isolation Loopbacks Hot-pluggable cards
Reliability, MTBF:	> 65000 hours
Card Size:	MGX-FRSM-8T1: 7.25" x 16.25" LM-DB15-8T1: 7.0" x 4.5" Power: -48 VDC, 30W with 8 active T1 lines

Table A-25 System Interface

Category	Description
ATM Layer:	Per CCITT I.361 and ATM UNI v3.1
AAL Layer:	AAL5 per Draft CCITT I.363
FR-Cell Interworking:	Per Draft CCITT I.555 and I.36x.1, as summarized in Frame Relay Forum, FR/ATM PVC Interworking Implementation Agreement FRF.5

Table A-26 Frame Relay Service With T1 Lines

Category	Description
Synchronization:	Transmitter may be either loop-timed to Receiver or synchronized to shelf (called normal mode)
Input Jitter Tolerance:	Per ATT TR 62411
Output Jitter Generation:	Per ATT TR 62411 using normal mode synchronization
Physical Layer Alarms:	LOS, OOF, AIS, RAI
Number of Frame Relay Ports:	One—a single Frame Relay stream occupying <i>N</i> consecutive time slots
Frame Relay Interface Rates:	Either of the following: <ul style="list-style-type: none"> • 56 Kbps • <i>N</i> x 64 Kbps (where <i>N</i> is the number of consecutive time slots)
Frame Relay Interface:	Per ANSI T1.618, 2-octet header

Table A-26 Frame Relay Service With T1 Lines (continued)

Category	Description
Frame Relay Performance Counters (per Port; n x DS0):	Received frames discarded due to Aborts Received frames discarded due to illegal header (EA bit)(s) Received frames discarded due to CRC errors(s) Received frames discarded due to alignment errors(s) Received frames discarded due to unknown DLCI(s) Received frames discarded due to illegal frame length(s) Received frames discarded due to DE threshold exceeded Received frames with DE already set Received frames with FECN already set Received frames with BECN already set Received frames tagged FECN Received frames(s) Received bytes(s) Transmit frames discarded due to underrun Transmit frames discarded due to Abort Transmit frames discarded due to egress Q-depth exceeded(s) Transmit bytes discarded due to egress Q-depth exceeded(s) Transmit frames discarded due to egress DE threshold exceeded Transmit frames(s)
	Transmit bytes(s) Transmit Frames with FECN set(s) Transmit Frames with BECN set(s)
	LMI receive status inquiry request count(s) LMI transmit status inquiry request count LMI invalid receive status count(s) LMI signaling protocol (keep alive time-out count)(s) LMI sequence number error count(s) LMI receive status transmit count (in response to request) LMI transmit status transmit count (in response to request) Transmit frames during LMI alarm(s) Transmit bytes during LMI alarm(s) LMI update status transmit count (in response to configuration changes)
Diagnostics (per port):	Last unknown DLCI received

Table A-27 List of Counters

Category	Description
Channels (endpoints) per card:	256, which you can allocate across any of the interfaces
Service Counters: Note that an (s) at the end of the description means the data in the counter is usable as a statistic.	Number of frames received(s) Number of bytes received(s) Number of frames received with DE already set(s) Number of bytes received with DE already set(s) Number of frames received with unknown DLCI Number of frames received but discarded(s) Number of received bytes discarded(s) Number of received bytes discarded due to exceeded Q-depth(s) Number of frames received and discarded due to: intershelf alarm exceeded DE threshold(s) exceeded Q depth(s) Number of frames received with FECN set Number of frames received with BECN set Number of frames received tagged FECN Number of frames received tagged BECN
	Number of frames transmitted(s) Number of bytes transmitted(s)
	Number of frames transmitted with DE set(s) Number of frames discarded due to reassembly errors(s) Number of frames transmitted during LMI logical port alarm(s) Number of frames transmitted with FECN set(s) Number of frames transmitted with BECN set(s) Number of transmit frames discarded(s) Number of transmit bytes discarded Number of transmit frames discarded due to: CRC error(s) egress Q depth exceeded(s) egress DE threshold exceeded source abort physical link failure (T1) ATM cells: Number of cells transmitted to PXM Number of cells transmitted with CLP bit set Number of OAM AIS cells transmitted(s) Number of OAM FERF cells transmitted(s) Number of BCM cells transmitted Number of OAM end-end loopback cells transmitted(s) Number of OAM segment loopback cells transmitted Number of cells received from PXM Number of cells received with CLP bit set Number of OAM AIS cells received(s) Number of OAM FERF cells received(s) Number of BCM cells received Number of OAM end-end loopback cells received(s) Number of OAM segment loopback cells received Number of OAM cells discarded due to CRC-10 error(s)

Table A-27 List of Counters (continued)

Category	Description
Statistics:	If any of the counters in the preceding category of Service Counters includes an "(s)," you can configure it for statistics usage.
Diagnostics:	Last unknown LCN received, Number of cells with unknown LCN.

MGX-FRSM-8E1 Specification

This section provides information on the operation of the MGX-FRSM-8E1 card set. Topics are:

- System-level interface. (See Table A-28.)
- General physical information about the card set. (See Table A-29.)
- Information about the Frame Relay service. (See Table A-30.)
- Statistics and counters. (See Table A-31.)

Table A-28 System Interface

Category	Description
ATM Layer:	Per ITU-T I.361 and ATM UNI v3.1
AAL Layer:	AAL5 per Draft CCITT I.363
FR-Cell Interworking:	Per Draft CCITT I.555 and I.36x.1, as summarized in Frame Relay Forum, FR/ATM PVC Interworking Implementation Agreement FERF.5

Table A-29 General Card Specifications

Category	Description
Line Interface connector:	RJ-48 when used with RJ-48-8E1 line module SMB when used with SMB-8E1 line module
Line Rate:	2.048 Mbps \pm 100 bps
Synchronization:	Transmitter may be either loop-timed to Receiver or synchronized to shelf (<i>normal mode</i>)
Input Jitter Tolerance:	Per G.703
Output Jitter Generation:	Per G.703
Physical Layer Alarms:	LOS, OOF, AIS, RAI
Indicators per card:	Active (Green), Standby (Yellow), Fail (Red)
Indicators per line:	Active & Okay (Green) Active & Local Alarm (Red) Active & Remote Alarm (Yellow)
Maintenance/Serviceability Features:	Internal Problem Isolation Loopbacks Hot-pluggable cards

Table A-29 General Card Specifications (continued)

Category	Description
Reliability, MTBF:	> 65000 hours
Card Size:	MGX-FRSM-8E1: 7.25" x 16.25" (18.43 cm x 41.28 cm) RJ48-8E1: 7.0" x 4.5" (17.78 cm x 11.43 cm) SMB-8E1: 7.0" x 4.5" (17.78 cm x 11.43 cm)
Power:	-48V DC, 30W with 8 active E1 lines

Table A-30 Frame Relay Service with E1 Lines

Category	Description
Number of Frame Interfaces:	1–31 occupying n , where $1 < n < 31$. Sum of all < 31 for CCS or 1–30 for CAS.
Frame Relay Interface Rates:	Either 56 Kbps or $n \times 64$ Kbps, where n is the same as defined in the preceding item the preceding item “Number of Frame Interfaces.”
Ingress:	8000 cell buffer shared between virtual channels/paths standard usage parameter control (UPC) Selective Cell Discard Virtual Circuit Queuing EFCI setting per VC
Egress:	8000 cell storage capacity shared between four ports Up to 12 user-selectable egress queues per port Selective Cell Discard EFCI setting per Queue
Frame Relay Interface:	Per ANSI T1.618, 2-octet header
Frame Relay Performance Counters (per Port; $n \times$ DS0):	Received frames discarded due to Aborts Received frames discarded due to illegal header (EA bit)(s) Received frames discarded due to CRC errors(s) Received frames discarded due to alignment errors(s) Received frames discarded due to unknown DLCI(s) Received frames discarded due to illegal frame length(s) Received frames discarded due to DE threshold exceeded Received frames with DE already set Received frames with FECN already set Received frames with BECN already set Received frames tagged FECN Received frames(s) Received bytes(s)

Table A-30 Frame Relay Service with E1 Lines (continued)

Category	Description
	Transmit frames discarded due to underrun Transmit frames discarded due to Abort Transmit frames discarded due to egress Q-depth exceeded(s) Transmit bytes discarded due to egress Q-depth exceeded(s) Transmit frames discarded due to egress DE threshold exceeded Transmit frames(s) Transmit bytes(s) Transmit Frames with FECN set(s) Transmit Frames with BECN set(s) LMI receive status inquiry request count(s) LMI transmit status inquiry request count LMI invalid receive status count(s) LMI signaling protocol (keep alive time-out count)(s) LMI sequence number error count(s) LMI receive status transmit count (in response to request) LMI transmit status transmit count (in response to request) Transmit frames during LMI alarm(s) Transmit bytes during LMI alarm(s) LMI update status transmit count (in response to configuration changes)
Diagnostics (per port):	Last unknown DLCI that arrived

Table A-31 List of Counters

Category	Description
Channels (Endpoints):	256 per card—can be allocated across any of the frame relay interfaces
Counters:	Service Counters: Number of frames received(s) Number of bytes received(s) Number of frames received with DE already set(s) Number of bytes received with DE already set(s) Number of frames received with unknown DLCI Number of frames received but discarded(s) Number of received bytes discarded(s) Number of received bytes discarded due to exceeded Q-Depth(s) Number of frames received and discarded due to: <ul style="list-style-type: none"> • intershelf alarm • exceeded DE threshold(s) • exceeded Q depth(s) Number of frames received with FECN set Number of frames received with BECN set

Table A-31 List of Counters (continued)

Category	Description
	Number of frames received tagged FECN Number of frames received tagged BECN Number of frames transmitted(s) Number of bytes transmitted(s) Number of frames transmitted with DE set(s) Number of frames discarded due to reassembly errors(s) Number of frames transmitted during LMI logical port alarm(s) Number of frames transmitted with FECN set(s) Number of frames transmitted with BECN set(s) Number of transmit frames discarded(s) Number of transmit bytes discarded Number of transmit frames discarded due to: CRC error(s) egress Q depth exceeded(s) egress DE threshold exceeded source abort physical link failure (T1)
	ATM cells: Number of cells transmitted to PXM Number of cells transmitted with CLP bit set Number of OAM AIS cells transmitted(s) Number of OAM FERF cells transmitted(s) Number of BCM cells transmitted Number of OAM end-end loopback cells transmitted(s) Number of OAM segment loopback cells transmitted Number of cells received from PXM Number of cells received with CLP bit set Number of OAM AIS cells received(s) Number of OAM FERF cells received(s) Number of BCM cells received Number of OAM end-end loopback cells received(s) Number of OAM segment loopback cells received Number of OAM cells discarded due to CRC-10 error(s) Statistics: All of the above counters followed by an(s) can be configured as statistics. Diagnostics: 8Last unknown LCN received Cells with unknown LCN count Card General

MGX-SRM-3T3/B Specification

Specifications for the MGX-SRM-3T3/B appear in Table A-32.

Table A-32 MGX-SRM-3T3/B Specifications

Category	Description
Connectors	BNC-3T3, with three pairs of BNC connectors
T1/E1 Line Interface Connector on Service Modules	No connectors required for primary service module. If the MGX-SRM-3T3 provides 1:N redundancy, the standby service module requires a special back card: R-RJ48-8T1 or R-RJ48-8E1.
T1 Channel Rate	T1: 1.544 Mbps \pm 75 bps (50 ppm)
Transmit Clocking	Normal or looped clocking
Input Jitter Tolerance	Per AT&T Accunet T1.5 Service 1990-T1 Per G.703-E1
Physical Layer Alarms	Indicated in respective Service Modules
Physical Layer Performance Statistics	N/A
LED Indicators Per Card	Active (green), Failed (red), Standby (yellow)
BERT	Active (green), Errors (yellow)
1 to N Redundancy	Active (green)
Indicator for each T3 lone	Active (green)
Maintenance/Serviceability Features	DS1 Loopback towards service modules Hot pluggable
Reliability	>85000 hours MTBF
Card Size	Front card 7.25" (18.43 cm) x 16.25" (41.28 cm) Back card 7" (17.78 cm) x 4.5" (11.43 cm)
Power	48 VDC, 50 W
Loopback codes	Fractional T1 inband loopback - ANSI T1/E1-2/92-003 R3 DS0 loopback - TA-TSY-000055 TA-TSY-000057 TA-TSY-0000476
Monitoring trouble codes	TA-TSY-000077 TA-TSY-0000280 ATT TR-62310

Circuit Emulation Service for T3 and E3

The physical layer characteristics for the MGX-CESM-T3 and MGX-CESM-E3 are the same as the MGX-CESM-T3 and MGX-CESM-E3, respectively. For these characteristics, refer to Table A-14 and Table A-16. The available counters appear in the lists that follow. The categories are:

- T3 and E3 line framers
- AAL1 SAR

- Transmitted and received ATM cells

The counters for the T3 and E3 line framers are:

- F-Bit error count (T3)
- P-Bit error Count (T3)
- CP-Bit error Count
- FEBE Count
- BPV Count

The counters for AAL1 SAR are:

- Number of OAM cells received
- Number of OAM cells dropped. FIFO Full
- Number of SN CRC's not correctable
- Number of Cells with SN different than SN+1
- Number of Cells received from UTOPIA Interface
- Number of Cells transmitted to UTOPIA Interface
- Number of Conditioned Cells transmitted to UTOPIA Interface
- Number of Cells not sent due to line resynchronization

The counters for transmitted ATM cells are:

- Number of cells transmitted to PXM
- Number of cells discarded due to intershelf link alarm
- Number of cells transmitted with CLP bit set
- Number of AIS cells transmitted
- Number of FERF cells transmitted
- Number of BCM cells transmitted
- Number of end-end loop-back cells transmitted
- Number of segment loop-back cells transmitted

The counters for received ATM cells are:

- Number of cells received from PXM
- Number of cells received with CLP bit set
- Number of AIS cells received
- Number of FERF cells received
- Number of BCM cells received
- Number of end-end loop-back cells received
- Number of segment loop-back cells received
- Number of OAM cells discarded due to CRC-10 error

The diagnostics report the header of last cell with an unknown logical connection number LCN.

Circuit Emulation Service Module for T1 Operation

This section contains operational details for the MGX-CESM-8T1 and MGX-CESM-8E1.

Table A-33 CESM 8T1 Card Information

Category	Description
Back Card	RJ48-8T1
Line Rate	T1: 1.544 Mbps \pm 75 bps (50 ppm)
Transmit Clocking	Normal clock or SRTS generated
Line Coding	B8ZS AMI
Frame mode	SF ESF
Line alarms	Loss of signal (LOS) Loss of frame (LOF) Loss of multiframe (LOMF) Remote loss of signal or frame (RAI) All ones received (AIS) Bipolar violation
Alarm indication times	Near end alarm up-count Near end alarm down-count Near end alarm maximum count Far end alarm up-count Far end alarm down-count Far end alarm maximum count
Supported OAM cells	AIS FERF End-to-end loopback Segment loopback RTD loopback BCM
Physical Layer Performance Statistics	N/A
LED Indicators Per Card	Active (green), Failed (red), Standby (yellow)
BERT	T1 E1 1.2
1 to N Redundancy	Active (green)
Indicator for each T1	Active (green)
Reliability, MTBF	
Card Size	Front card: 7.25" x 16.25" (18.43 cm x 41.28 cm) Back card: 7" x 4.5" (17.78 cm x 11.43 cm)
Power	48 VDC, 50 W
Loopbacks	On or Off

Circuit Emulation Service Module for E1 Operation

This section contains operational details for the MGX-CESM-8E1.

Table A-34 CESM 8E1 Card Set Details

Category	Description
Back Card	RJ48-8E or SMB-8E1
Line Rate	E1: 2.048 Mbps \pm 100 bps (50 ppm)
Transmit Clocking	Normal clock or SRTS generated
Line Coding	HDB3 AMI
Frame mode	single frame multiframe
Line alarms	Loss or signal (LOS) Loss of frame (LOF) Loss of multiframe (LOMF) Remote loss of signal or frame (RAI) All ones received (AIS) Bipolar violation
Alarm indication times	Near end alarm up-count Near end alarm down-count Near end alarm maximum count Far end alarm up-count Far end alarm down-count Far end alarm maximum count
Supported OAM cells:	AIS FERF End-to-end loopback Segment loopback RTD loopback BCM
Physical Layer Performance Statistics	N/A
Indicators:	
Card-level	Active (green), Failed (red), Standby (yellow)
BERT	Active (green), Errors (yellow)
1 to N Redundancy	Active (green)
Indicator for each T1	Active (green)
Reliability, MTBF	
Card Size	Front card: 7.25" x 16.25" (18.43 cm x 41.28 cm) Back card: 7" x 4.5" (17.78 cm x 11.43 cm)
Power	48 VDC, 50 W
Loopbacks	On or Off