APPENDIX A

System Specifications

Introduction

This appendix provides details on the Release 1.0 system specifications.

General

System Capacity:	1 or 2 shelves, each with 16 card slots. Requires 1 or 2 dedicated front slot(s) for NPMs. Requires 1 dedicated back slot for SCM. Up to 16 T1/E1 circuit ports. Up to 16 T1/E1 packet trunks. Up to 100 synchronous data ports. Up to 25 Voice, Data, and/or Frame Relay Module groups.
Enclosure Size:	IGX 16 Standalone/Rackmount: HT: 32.25 ins. (82 cm.), standalone; 31.75 ins. (80.7 cm.), rack WD: 19.9 inches (50.5 cm), standalone; 19 inches (48.3 cm.), rack DP: 26.75 inches (68 cm), standalone; 26 inches (66 cm.), rack IGX 32 Standalone/Rackmount: HT: 55.5 inches (141 cm.), standalone, 55 inches (139.7 cm) rack WD: 19.9 inches (50.5 cm), standalone; 19 inches (48.3 cm.), rack DP: 26.75 inches (68 cm), standalone; 26 inches (66 cm.), rack
Shipping Weight:	600 pounds (270 kilos) for a fully loaded IGX 32. 400 pounds (180 kilos) for a fully loaded IGX 16.
Clearance Requirement:	At least 30 inches front and rear clearance; nominal 12 inch side clearance.
Power Input Voltage:	AC system: 180 to 264 VAC, 47 to 63 Hz. DC system: –42 to –56 VDC. Each AC supply can provide up to 875 watts to a card shelf. Cabinet has space for 6 AC power supplies.
Current Requirements:	Configuration dependent: use Network Design Tool for exact requirements. For planning purposes, use:
• AC System	IGX 16/32: 16 Amps maximum at nominal voltage of 180 VAC.
• DC System	IGX 16: 24 Amps max. per circuit at –42 VDC (worst case) IGX 32: 44 Amps at nominal –48 VDC; 50 Amps at –42 VDC max. per circuit
Input AC Power Connector:	AC Power Distribution unit is the same for all cabinets shipped: IEC 16 Amp input connector. Six different power cords available, depending on country of destination. See Appendix C for a list.
DC Input Connections	DC power is the same for all IGX 16/32 cabinets shipped. DC: 3-screw pluggable terminal connectors.
Operating Environment:	0° to 40° C (32° to 104° F). Up to 85% relative humidity, non-condensing

Shock:	Withstands 10 G, 10 ms. at 1/2 sine wave.
Vibration:	Withstands 1/4 G, 20–500 Hz.
Heat Transfer to Room:	IGX 16: 4300 BTUs max, AC-powered system. 3600 BTUs in a DC-powered unit. IGX 32: 8600 BTUs max, AC-powered system. 6800 BTUs in a DC-powered unit.

Voice Circuit Support

Voice Channel Interface:	24-channel T1 (D4 format). 24-channel T1-ESF (using CVM). 30-channel framed CEPT E1. 31-channel framed CEPT E1.
Voice Compression Available:	32/24/16 Kbps ADPCM. 32 Kbps ADPCM. Voice Activity Detection compression.
Compression Algorithm:	ITU-T G.721, G.723, G.726. StrataCom 32 Kbps ADPCM.
PCM Encoding Types:	Accommodates μ-Law or A-Law encoding, End-to-end conversion available.
Channel Gain Control:	–8 dB to +6 dB.
Signalling Modes:	T1: Robbed bit or CCS (ISDN). E1: Channel Associative Signalling (CAS) or Common Channel Signalling (CCS).
Signalling Conditioning:	Various make-busy and forced idle routines during circuit alarm can be specified on a per-channel basis.
Quantizing Distortion Added:	2.5 Quantizing Distortion Units (QDU)s with 32 Kbps ADPCM over 1 hop plus 0.7 QDUs with Digital Loss PAD (μ-law or A-Law).

Data Channel Support

Sync. Data Interfaces:	RS-232C/D, RS-449/422, V.24, X.21, and V.35 with IGX as DCE or DTE.
High-Speed Data Rates (HDM):	2.4 Kbps to 1.344 Mbps.
Low-Speed Data Rates:	2.4 to 19.2 Kbps per LDM port.
Ports per card:	LDI: 4 or 8. SDI: 4.
Control Leads Supported:	SDI: Per interface standards. SDI: Up to 7 in each direction for fast EIA. LDI: 3 in each direction for DCE and DTE for each port.
Control Lead Sync w/Data:	Control leads are sampled every 50 ms.: changes normally follow data within 100 to 1000 msec. Fast EIA lead is within 1 byte.
DS0A Interface:	Superrate, 56 Kbps to 512 Kbps (8 DS0s) per port. Subrate: One 2.4/4.8/9.6/19.2/ or 56 Kbps per DS0 Per Bell TR-TSY-000458, TR-TSY-000280, TR-TSY-000083, and TR-TSY-000077.
Data Clocking:	Synchronous and isochronous clocking. Normal, looped, and split clock configurations.
Pleisochronous Clock Range:	± 2 percent of nominal data rate.

Digital Data Service Interface

Ports per card:	Four.
Electrical Interface:	Digital Data System (DDS)—AT&T Pub. 62310, November 1987.
Interface Type:	DSU or OCU (software selectable).
Data Rates:	2.4, 4.8, 9.6, 19.2, and 56 Kbps (software selectable).
DDS Data Encoding:	Standard DDS Bipolar Return to Zero. Alternate Mark Inversion coding with bipolar violation sequences for zero suppression and control.
Data Compression:	Repetitive Pattern Suppression (RPS): 7, 8, or 16 bit pattern matching.
Synchronization Modes:	External (DSU only) Looped (OCU only).
Control Codes Recognized:	Idle. Zero Suppression. Out-of Service. Loopback Sequences.
Control Code Translation:	Translation of RTS to IDLE.
Alarm Code Translation:	Translation of the logical NOR of Out-of-Service Sync Fail. Excessive Bipolar Violations. No Signal to DSR (DSU only). No Signal to DTR (OCU only).
Connector:	ISO 4903, female DB-15 type connector.

T1 Interface

Line Rate:	1.544 Mbps, ± 50 bps (± 200 bps VCO lock range).
Line Code:	Bipolar AMI or B8ZS.
Framing Formats:	Fractional T1, adjacent or alternating channels. Minimum of four DS0 channels required.
Signal Level:	DSX-1 compatible.
Line Impedance:	Terminated = 100 Ohms nominal. Bridged = 1 Kohm.
Pulse Amplitude	Individual pulse amplitude 2.4 V–3.6 V (making a total base-to-peak amplitude of 6 V ± .6V)
Minimum Pulse Density:	Zero code suppression, either LSB or MSB.
Frame Format:	D4 or Extended Superframe (ESF).
VF Signalling:	Robbed bit D4 with A and B bits.
Max. Line Lengths:	Up to 533 feet with equalizers using ABAM cable.
Jitter Transfer:	Meets AT&T PUB 62411 specifications.
Jitter Tolerance:	Meets ANSI standards and AT&T PUB 62411 specs.
Connector:	DB 15 female.

T1 Interface on UFI-8T1

The following applies to each individual T1 line on the UFI-8T1:

Line Rate:	1.544 Mbps, ± 50 bps (± 200 bps VCO lock range).
Line Framing	ESF per AT&T TR 54016.
Frame Relay Interface	Meets ANSI T1.618, tw0-octet header.
Frame Relay Interface Rates	Either 56 Kbps or n x 64 Kbps, where 1 <= n <= 24. Sum of all n <= 24.
Number of Frame Relay Interfaces	1 - 24 occupied channels where 1 <= n <= 24, and the sum of all n <= 24.
Synchronization	Transmitter can be either loop-timed to receiver or synchronized to shelf (*normal mode*).
Line Code:	Bipolar AMI or B8ZS.
Framing Formats:	Fractional T1, adjacent or alternating channels. Minimum of four DS0 channels required.
Signal Level:	DSX-1 compatible.
Line Impedance:	Terminated = 100 Ohms nominal. Bridged = 1 KOhm.
Pulse Amplitude	Individual pulse amplitude 2.4 V - 3.6 V (making a total base-to-peak amplitude of 6 V ± .6V).
Minimum Pulse Density:	Zero code suppression, either LSB or MSB.
VF Signalling:	Robbed bit D4 with A and B bits.
Max. Line Lengths:	Up to 533 feet with equalizers using ABAM cable.
Input Jitter Tolerance:	Meets AT&T PUB 62411 specifications.
Output Jitter Tolerance:	Meets AT&T PUB 62411 specifications using normal mode synchronization.
Connector:	DB 15 female.
Physical Layer Alarms	Loss of Signal, (LOS) Out of Frame (OOF), Alarm Indicator Signal (AIS), Remote Alarm Indicator (RAI).

E1 Interface

Line Rate:	2.048 Mbps, ±50 bps (±200 bps VCO lock range).
Line Code:	Bipolar AMI or HDB3.
Line Impedance:	120 ohms (balanced) or 75 ohms, balanced or unbalanced.
Minimum Pulse Density:	Zero code suppression via HDB3 coding.
Frame Format:	Unframed, 32-channel (G.703). Framed: 30 or 31-channel CEPT multiframe per ITU-T G.704.
VF Signalling:	CAS or CCS.
Max. Line Lengths:	E1 output complies with G.703, so cabling must not exceed -6dB/1000 feet at 1024 kHz (applies to 75 ohm coax or 120 ohm twisted pair up to 350 meters or 1000 feet).
Jitter:	Meets G.823.
Electrical Interface:	Complies with G.703 Specification.
Connector:	DB 15 female or BNC.

E2 Interface

Required Hardware	AIT front card on the IPX, BTM front card on the IGX. The back card is the AIT-E2
Line Rate:	8.448 Mbps
Line Coding:	HDB3.
Cell Delineation	HEC
Physical medium	Coaxial
Line Length:	50 feet maximum; 6 feet nominal
Connector:	BNC, 75 Ohms.
Synchronization	Master/slave (NOTE: loop timing to IPX or IGX is allowed.)
Interfaces per card	One
Applicable Standards:	E2 specification and G.703.

HSSI Interface

Required Hardware	AIT front card on the IPX or BTM front card on the IGX. The back card is the AIT-HSSI.
Line Rate:	Presettable, programmable for the range 4 - 50.84 Mbps: increments depend on the attached DSU.
Line Coding:	NRZ.
Cell Delineation	PLCP
Physical medium	Multi-conductor, 25 twisted pairs in a ribbon cable, 110 Ohms.
Line Length:	50 feet maximum; 6 feet nominal
Connector:	50-pin, 50 mil SCSI type.
Synchronization	None—accepts DSU clocks
Interfaces per card	Single port.
Applicable Standards:	High Speed Serial Interface specification, March, 1990
	I.432, G.804.

E1 Interface for UFI-8E1

The following applies to each individual E1 line on the UFI-8E1:

Line Interface Connector	DB15 (120 Ohms), BNC (75 Ohms)
Line Rate:	2.048 Mbps, ±50 bps (±200 bps VCO lock range).
Frame Relay Interface	Meets ANSI T1.618, two-octet header.
Number of Frame Relay Interfaces	1–31 occupied channels where 1 <= n <= 31, and the sum of all n <= 31
Frame Relay Interface Rate	Either 56 Kbps or n x 64 Kbps, where 1 <= n <= 31. Sum of all n <= 31.
Line Code:	Bipolar AMI or HDB3.
Line Impedance:	120 ohms (balanced) or 75 ohms, balanced or unbalanced.
Minimum Pulse Density:	Zero code suppression via HDB3 coding.
Frame Format:	Unframed, 32-channel (G.703). Framed: 30 or 31-channel CEPT multiframe per ITU-T G.704.
VF Signalling:	CAS or CCS.
Max. Line Lengths:	E1 output complies with G.703, so cabling must not exceed -6dB/1000 feet at 1024 kHz (applies to 75 ohm coax or 120 ohm twisted pair up to 350 meters or 1000 feet).
Input Jitter Tolerance:	Meets G.703.
Output Jitter Tolerance:	Meets G.703.
Electrical Interface:	Complies with G.703 Specification.
Connector:	DB 15 female or BNC.
Physical Layer Alarms	Loss of Signal, (LOS) Out of Frame (OOF), Alarm Indicator Signal (AIS), Remote Alarm Indicator (RAI)

T3 Interface

Line Rate:	44.736 Mbps ±20 ppm, asynchronous.
Line Code:	B3ZS.
Clock Source Mode:	Internal (Asynchronous).
Signal Level:	DSX-3.
Framing Formats:	M13 mode, C-bit parity.
Alarms Processed:	AIS. LOS. Remote Alarm Indication. Loss Of Framing.
Line Errors Counted:	BPV. Parity Bit Errors.
Receiver Input Impedance:	Terminated = 75 ohms.
Transmission Modes:	Point-to-Point or Drop and Insert.
Jitter:	Meets ACCUNET T45 specification (Pub 54014).
Connector:	75 ohm BNC.
Max. Line Lengths:	450 ft. (137 m.) to DSX-3 using 75 ohm coaxial cable.
Indicators:	RED Alarm. YELLOW Alarm. LOS. AIS.

E3 Interface

Line Rate:	34.368 Mbps ±20 ppm, asynchronous.
Line Code:	HDB3.
Clock Source Mode:	Internal (Asynchronous).
Signal Level:	ITU-T G.703
Framing Formats:	ITU-T G.804, G.832,
Alarms Processed:	AIS. LOS. Remote Alarm Indication. Loss Of Framing.
Line Errors Counted:	BPV. Parity Bit Errors.
Receiver Input Impedance:	75 ohms unbalanced.
Transmission Modes:	Point-to-Point or Drop and Insert.
Jitter:	per ITU-T G.823.
Connector:	75 ohm BNC.
Max. Line Lengths:	137 m. (450 ft.) using specified cable.
Indicators:	RED Alarm YELLOW Alarm LOS AI.

Frame Relay Interface

Type of Service:	Permanent Virtual Circuit (PVC)
Data Interface:	Per ITU-T I.122 and ANSI T1/E1 Standards
Data Transfer Protocol:	LAP-D frame level core functions
Input Data Format:	High Level Data Link (HDLC) protocol
Input Data Frame Length:	Maximum is 4096 bytes
Frame Integrity Check:	Frame Check Sequence and CRC check of data frame. If CRC fails, data frame is discarded at receiving node.
Input Data Rate per Port:	56 Kbps to 2.048 Mbps
No. of Physical Ports per Card:	4 ports on FRI-X.21 and FRI-V.35 1 port on FRI-T1 and FRI-E1 8 ports on UFI-8T1 and UFI-8E1 cards
No. of PVCs per Port:	252 per FRM card, distributed in any combination. 1000 per UFM card, distributed in any combination.
Port Electrical Interface:	ITU-T V.35. IGX can act as a DCE or DTE for direction of control leads and timing.
Data Clocking:	Normal or looped.
Virtual Circuit Identifier:	Data Link Connection Identifier (DLCI).
Control Protocol:	Local Management Interface with XON/XOFF type flow control. IGX sets FECN and BECN bits in frame relay frame.
Bundled Connections:	252 virtual circuits per FRM 1024 virtual circuits per node.
Billing Time Accuracy:	Upon request from user device, IGX will provide GMT from any node accurate to within 1 second.

ATM Interface

Type of Service:	Permanent Virtual Circuit (PVC)
Interface Types:	User-to-Network (UNI) and Network-to-Network (NNI) per ITU I.361 and I.363
Data Rates:	T3 or E3
ATM Layer:	Physical Layer Convergence Protocol per AT&T publication TA-TSY-00772 and 000773 for T3; ITU I-361 with HEC for E3
Cell Rate:	96,000 cells/sec. for T3, 80,000 cells/sec. for E3
Adaptation Layer:	AAL5
No. of Ports per card:	4
No. of PVCs per card:	255
VPI Addressing Range:	0-255
VCI Addressing Range:	0-65535
Traffic Queues:	CBR, VBR and ABR
Management Protocol:	Interim Layer Management Interface (ILMI)

Network Synchronization

External Clock Sources:	IGX synchronizes to the nearest, highest-stratum clock available. Any E1 or T1 circuit line, trunk, or optional external clock input can be used as a clock source.
Internal to Node Source:	T1: 1.544 MHz, ±10 ppm (Stratum 4). E1: 2.048 MHz, ±10 ppm (Stratum 4).
Clocking Hierarchy:	Dynamic primary, secondary, and tertiary clocking.

Network Management Control

Network Control Terminal:	StrataView Plus workstation and StrataCom software required for graphical display of network status, statistics gathering and display, and automatic downloading of software.
Control Terminal:	DEC VT100, WYSE 85, Televideo 970 or equivalent terminal for basic system configuring and alarm monitoring.
Remote Alarm Reporting:	Auto-dial modem connects to one of two control ports on each IGX node for automatic reporting of network alarms.
Remote Diagnostics:	Auto-answer modem connects to one of two control ports on each IGX node for remote diagnostic access by StrataCom ISC or other authorized personnel.
Network Control Ports:	Two ports per node, (one RS 232C interface and one Ethernet LAN port).
Alarm Notification:	Status of all trunks and nodes in network distributed to and stored by each individual node. Reported to StrataView Plus workstation at connecting node.
External Alarms:	Meets Bellcore Compatibility Bulletin #143 and AT&T Technical Reference PUB 43801 DS1 (T1) facility alarm requirements when equipped with DTI group.
Indicators and Controls:	Active and Fail lights on all cards and power supplies.