

Table of Contents

Preface

1 Introduction

1.1 Requirements Terminology	1-1
1.2 Requirement Labeling Conventions	1-2
1.2.1 Numbering of Requirement and Related Objects	1-2
1.2.2 Requirement Object Element Identification	1-3
1.3 Revision History	1-3
1.3.1 Changes from Issue 4 to Issue 5	1-3
1.3.2 Changes from Issue 3 to Issue 4	1-5
1.3.3 Changes from Issue 2 to Issue 3	1-9
1.3.4 Requirement Object Absolute Number Assignment	1-12

2 Network Compatibility

2.1 SONET NE Interfaces	2-2
2.1.1 Digital Signal Cross-Connect Interfaces	2-2
2.1.1.1 Electrical Cable Distance	2-3
2.1.1.2 Maintenance Signal Compatibility	2-3
2.1.2 Interface to Fiber Distributing Frames	2-3
2.1.3 Operations Systems Interface	2-4
2.1.4 Synchronization Interface	2-4
2.1.5 Power	2-4
2.2 End-to-End Performance Criteria	2-4
2.2.1 Availability and Reliability	2-5
2.2.2 Protection Switching Performance	2-5
2.2.3 Error Performance	2-6
2.2.4 Jitter	2-6
2.2.5 Transmission Delay	2-6

3 Rates and Formats

3.1 Synchronous Hierarchical Rates	3-1
3.2 Transport Format	3-2
3.2.1 Frame Structure of the STS-1	3-3
3.2.1.1 Transport Overhead	3-4
3.2.1.2 STS-1 Envelope Capacity and Synchronous Payload Envelope (SPE)	3-5
3.2.2 Frame Structure of the STS-N	3-7
3.2.3 STS Concatenation	3-8
3.2.3.1 Contiguous STS Concatenation	3-8
3.2.3.2 STS Virtual Concatenation	3-11
3.2.4 Virtual Tributary Structure	3-14
3.2.5 VT Concatenation	3-28
3.3 Layered Overhead and Transport Functions	3-29
3.3.1 SONET Interface Layers	3-30
3.3.1.1 Physical Layer	3-30
3.3.1.2 Section Layer	3-30

3.3.1.3	Line Layer	3-31
3.3.1.4	Path Layers	3-31
3.3.1.5	Interaction of the Layers	3-31
3.3.2	STS-1 Overhead Descriptions	3-33
3.3.2.1	Section Overhead	3-35
3.3.2.2	FEC Sub-Layer	3-37
3.3.2.3	Line Overhead	3-38
3.3.2.4	STS Path Overhead	3-42
3.3.3	VT Path Overhead	3-49
3.4	Payload Mapping	3-55
3.4.1	Sub-STS-1 Mappings	3-55
3.4.1.1	Mappings into Specific Size VT SPEs	3-56
3.4.1.1.1	Byte-Synchronous Mapping for DS1	3-57
3.4.1.1.1.A	DS1 Signaling and Framing Bit Transport	3-60
3.4.1.1.1.B	Line Codes and Pulse Density Assurance	3-63
3.4.1.1.2	Asynchronous Mapping for DS1	3-63
3.4.1.1.3	Asynchronous Mapping for DS1C	3-65
3.4.1.1.4	Asynchronous Mapping for DS2	3-67
3.4.1.2	Mappings That Apply to Multiple Sizes of VT SPEs	3-70
3.4.1.2.1	ATM to VT SPE Mapping	3-70
3.4.1.2.2	HDLC-Framed Signal to VT SPE Mapping	3-70
3.4.1.2.3	GFP to VT SPE Mapping	3-71
3.4.2	STS-1, STS-Nc, STS-1-Xv and STS-Nc-Xv Mappings	3-71
3.4.2.1	Mappings into Specific Size STS SPEs	3-72
3.4.2.1.1	Asynchronous Mapping for DS3 into an STS-1 SPE	3-72
3.4.2.1.2	Asynchronous Mapping for DS4NA into an STS-3c SPE	3-73
3.4.2.1.3	Asynchronous Mapping for FDDI into an STS-3c SPE	3-75
3.4.2.1.4	DQDB Metropolitan Area Network (MAN) Mapping into an STS-3c SPE	3-77
3.4.2.2	Mappings That Apply to Multiple Sizes of STS SPEs	3-78
3.4.2.2.1	ATM to STS SPE Mapping	3-78
3.4.2.2.2	HDLC-Framed Signal to STS SPE Mapping	3-79
3.4.2.2.3	GFP to STS SPE Mapping	3-80
3.5	Payload Pointers	3-80
3.5.1	STS Payload Pointer	3-80
3.5.1.1	Pointer Value	3-81
3.5.1.2	STS Frequency Justification	3-82
3.5.1.3	New Data Flag (NDF)	3-85
3.5.1.4	Concatenation Indicator	3-86
3.5.1.5	STS Payload Pointer Generation Rules	3-86
3.5.1.6	STS Payload Pointer Interpretation	3-88
3.5.2	VT Payload Pointer	3-88
3.5.2.1	VT Pointer Value	3-89
3.5.2.2	VT Frequency Justification	3-90
3.5.2.3	VT Size Indicator	3-91
3.5.2.4	New Data Flag	3-91
3.5.2.5	VT Payload Pointer Generation Rules	3-92
3.5.2.6	VT Payload Pointer Interpretation Rules	3-93

4 Physical Layer

4.1 Physical Layer Classifications	4-1
4.2 Optical Parameter Definitions and Interface Requirements	4-5
4.2.1 General	4-5
4.2.2 Optical Line Coding	4-6
4.2.3 Transmitter	4-6
4.2.3.1 Spectral Characteristics	4-7
4.2.3.2 Coupled Transmit Power	4-9
4.2.3.3 Extinction Ratio	4-9
4.2.3.4 Mask of the Eye Diagram	4-9
4.2.4 Receiver	4-13
4.2.4.1 Receiver Sensitivity and Overload	4-13
4.2.4.2 Receiver Reflectance	4-15
4.2.4.3 Optical Power Penalty	4-15
4.2.5 Optical Path	4-17
4.2.5.1 Reflections and ORL	4-17
4.2.5.2 Attenuation	4-19
4.2.5.3 Chromatic Dispersion	4-21
4.2.5.3.1 Identification of Dispersion-Limited Applications	4-21
4.2.5.3.2 Chromatic Dispersion for Applications Utilizing LEDs or MLM Lasers	4-22
4.2.5.3.3 Chromatic Dispersion for Applications Utilizing SLM Lasers	4-23
4.2.5.3.4 Chromatic Dispersion Accommodation	4-23
4.2.5.3.4.A Passive Dispersion Compensation	4-24
4.2.5.3.4.B Pre-Chirp	4-25
4.2.5.3.4.C Self Phase Modulation	4-25
4.2.5.4 Polarization Effects	4-26
4.2.5.4.1 Polarization Mode Dispersion	4-26
4.2.5.4.2 Polarization Dependent Loss	4-27
4.2.6 Optical Parameter Tables	4-27
4.3 Engineering of a Single-Mode Fiber Optic Transmission System	4-48
4.3.1 Terminal Equipment Transmission Design Information	4-48
4.3.1.1 General System Information	4-49
4.3.1.2 Transmitter Information	4-49
4.3.1.3 Receiver Information	4-50
4.3.1.3.1 General Information	4-50
4.3.1.3.2 Transmission Properties	4-51
4.3.1.4 Attenuators	4-52
4.3.1.5 Wavelength Division Multiplex Device	4-52
4.3.1.6 Passive Dispersion Compensation Devices	4-53
4.3.1.7 Optical Fiber Amplifiers	4-53
4.3.1.8 Connectors	4-53
4.3.1.9 Station Cable	4-54
4.3.1.10 Safety Margin	4-55
4.3.2 Cable Transmission Design Information	4-55
4.3.2.1 Parameters for a Specific Application	4-55
4.3.2.2 Global Fiber Parameters	4-58
4.3.3 Fiber Optic System Transmission Design and Analysis	4-60
4.3.3.1 Design Approach	4-60
4.3.3.2 Loss Budget Constraint	4-61

4.3.3.3 Dispersion Limited Length 4-62
4.3.3.4 Design and Analysis Methodology 4-63
4.4 Electrical Interface Specifications 4-64

5 Network Element Architectural Features

5.1 Multiplex Procedures 5-1
5.1.1 Interleaving 5-1
5.1.2 Concatenation 5-5
5.1.3 Scrambling 5-6
5.1.4 An Example of STS-1 and OC-N Signal Composition 5-7
5.2 Overhead Function Usage 5-10
5.2.1 Generating and Processing Overhead 5-10
5.2.2 Orderwire 5-14
5.2.2.1 Orderwire Access 5-15
5.2.2.2 Orderwire System Communication 5-15
5.2.2.3 Orderwire Operations 5-16
5.2.3 User Channels 5-16
5.2.4 Remote Error Indications 5-17
5.2.5 Virtual Concatenation 5-18
5.2.5.1 Capacity Adjustment 5-18
5.2.5.2 Overhead Bit and Byte Usage 5-19
5.2.5.3 Differential Delay Accommodation 5-24
5.3 Automatic Protection Switching 5-25
5.3.1 Protection Switching Boundaries 5-25
5.3.2 Linear APS Architectures 5-25
5.3.2.1 1+1 Architecture 5-26
5.3.2.2 1:n Architecture 5-27
5.3.2.3 1:1 Case of the 1:n Architecture 5-28
5.3.3 Switch Initiation and Completion Criteria 5-28
5.3.3.1 Switch Initiation Criteria 5-28
5.3.3.2 Switch Initiation Time 5-29
5.3.3.3 Switch Completion Time 5-31
5.3.4 Restoral and Clearing of SD and SF Conditions 5-32
5.3.5 APS Channel Protocol 5-35
5.3.5.1 K1 Byte 5-36
5.3.5.1.1 Bit Assignments for the K1 Byte 5-36
5.3.5.1.2 K1 Byte Generation 5-38
5.3.5.2 K2 Byte 5-41
5.3.5.2.1 Bit Assignments for the K2 Byte 5-41
5.3.5.2.2 K2 Byte Generation Rules 5-41
5.3.5.2.3 Mode of Operation 5-42
5.3.5.3 Control of the Bridge 5-43
5.3.5.4 Control of the Selector 5-45
5.3.5.5 Transmission and Acceptance of Bytes K1 and K2 5-46
5.3.6 Linear APS Commands 5-49
5.3.6.1 Switch Commands 5-49
5.3.6.2 Control Commands 5-50
5.3.7 Switch Operation 5-51
5.3.7.1 1:n Architecture 5-51
5.3.7.1.1 1:n Bidirectional Mode 5-51

5.3.7.1.2	1:n Unidirectional Mode	5-56
5.3.7.2	1+1 Architecture	5-56
5.3.7.2.1	1+1 Bidirectional Mode	5-56
5.3.7.2.2	1+1 Unidirectional Mode	5-56
5.4	Network Synchronization	5-57
5.4.1	SONET NE Clock Applications	5-57
5.4.1.1	Physical Interface to Synchronization Network	5-58
5.4.1.2	TDEV and MTIE Measurements	5-59
5.4.2	Synchronization Status Messages	5-59
5.4.3	SONET Timing Modes	5-63
5.4.3.1	External Timing	5-64
5.4.3.2	Line Timing	5-64
5.4.3.3	Loop Timing	5-66
5.4.3.4	Through Timing	5-66
5.4.4	SONET Internal Clock	5-67
5.4.4.1	Stratum Clocks for SONET Applications	5-67
5.4.4.2	SONET Minimum Clock Applications	5-68
5.4.4.2.1	Free-Run Accuracy for SMCs	5-68
5.4.4.2.2	Holdover Stability for SMCs	5-69
5.4.4.2.3	Pull-in/Hold-in for SMCs	5-69
5.4.4.2.4	Wander Tolerance and Transfer for SMCs and Stratum 3 Clocks	5-70
5.4.4.3	All SONET Stratum Clocks and SMCs	5-73
5.4.4.3.1	Clock Hardware	5-73
5.4.4.3.2	Wander Generation	5-74
5.4.4.3.3	Phase Transients	5-76
5.4.4.3.4	Reference Validation and Transitions From Self-Timing to Normal Mode	5-81
5.4.4.3.5	Jitter and Errors During Synchronization Rearrangement Operations	5-81
5.4.4.3.6	Input Tolerance	5-82
5.4.4.3.7	Phase Build-Out	5-83
5.4.5	Timing Distribution	5-83
5.4.5.1	Timing Distribution on Derived DS1 Signals	5-84
5.4.5.2	Synchronization Status Messages for Derived DS1 Signals	5-90
5.4.5.2.1	Switching	5-90
5.4.5.2.2	Message Translation	5-90
5.4.5.3	Timing Distribution on Traffic-Carrying DS1 Payload Signals	5-92
5.4.6	SONET Timing Reference Switching and Entry Into Holdover	5-93
5.4.6.1	Timing Reference Failure Conditions	5-95
5.4.6.2	Performance During Timing Reference Switching	5-96
5.4.6.3	Revertive and Nonrevertive Timing Reference Switching	5-97
5.4.6.4	Synchronization Status Messages and Timing Reference Switching	5-97
5.4.7	Synchronization Status Message Validation and Generation	5-98
5.4.7.1	Message Validation	5-98
5.4.7.2	Message Reaction	5-99
5.4.7.3	Message Generation	5-100
5.4.7.3.1	Externally Timed NEs	5-101
5.4.7.3.2	Line-Timed NEs	5-104

- 5.4.7.3.3 Through-Timed NEs 5-104
- 5.5 Framing For SONET Signals 5-105
 - 5.5.1 SONET Signal Framing 5-105
 - 5.5.2 Multiframe Alignment 5-107
- 5.6 Jitter 5-108
 - 5.6.1 Network Interface Jitter Criteria 5-109
 - 5.6.2 SONET NE Jitter Criteria 5-111
 - 5.6.2.1 Jitter Transfer 5-112
 - 5.6.2.1.1 Category I Jitter Transfer 5-113
 - 5.6.2.1.2 Category II Jitter Transfer 5-115
 - 5.6.2.2 Jitter Tolerance 5-116
 - 5.6.2.2.1 Category I Jitter Tolerance 5-116
 - 5.6.2.2.2 Category II Jitter Tolerance 5-116
 - 5.6.2.3 Jitter Generation 5-119
 - 5.6.2.3.1 Category I Mapping Jitter 5-120
 - 5.6.2.3.2 Category I Jitter Generation Due to Pointer Adjustments, General 5-121
 - 5.6.2.3.3 Category I Jitter Generation Due to Single Pointer Adjustments 5-123
 - 5.6.2.3.4 Category I Jitter Generation Due to Bursts of Pointer Adjustments 5-124
 - 5.6.2.3.5 Category I Jitter Generation Due to Periodic Pointer Adjustments 5-126
 - 5.6.2.3.6 Category II Jitter Generation 5-131
 - 5.6.2.3.7 Pointer Adjustment Jitter to Bit Stuffing Jitter Conversion 5-131
 - 5.6.2.4 Jitter Enhancement 5-132
- 5.7 Phase Variations on Payload Signals 5-133
 - 5.7.1 Mapping Phase Variations 5-133
 - 5.7.2 Pointer Adjustment Phase Variations 5-135
 - 5.7.2.1 Single Pointer Adjustments 5-136
 - 5.7.2.2 Pointer Adjustment Bursts 5-137
 - 5.7.2.3 Periodic Pointer Adjustments 5-139
 - 5.7.3 Additional Issues Related to Phase Variations 5-141
 - 5.7.3.1 STS-1 Versus DS3 Based Phase Variation Limits 5-141
 - 5.7.3.2 Interpretation of Pointer Adjustment Burst Test Results 5-142

6 SONET Network Element Operations Criteria

- 6.1 Memory Administration 6-1
 - 6.1.1 Memory Administration Data 6-1
 - 6.1.2 Data Manipulation 6-2
 - 6.1.3 Administration of Operations Communications Information 6-4
 - 6.1.4 Regenerators 6-4
 - 6.1.5 Memory Backup and Restoration 6-4
 - 6.1.6 System Administration and Security 6-6
 - 6.1.6.1 NE Security Mechanism 6-7
 - 6.1.6.1.1 Identification and Authentication 6-8
 - 6.1.6.1.2 System Access Control 6-9
 - 6.1.6.1.3 Resource Access Control 6-9
 - 6.1.6.1.4 Audit 6-10
 - 6.1.6.2 DCC Security 6-10

6.1.7 Software Generics	6-12
6.1.8 Self Inventory	6-12
6.2 Maintenance	6-13
6.2.1 Alarm Surveillance	6-13
6.2.1.1 Directly Detected Defects and Failures	6-16
6.2.1.1.1 Loss of Signal	6-16
6.2.1.1.2 Loss of Frame	6-18
6.2.1.1.3 Loss of Pointer	6-21
6.2.1.1.4 Equipment Failures	6-25
6.2.1.1.5 Loss of Synchronization	6-26
6.2.1.1.6 APS Troubles	6-27
6.2.1.1.6.A Protection Switching Byte Failure	6-28
6.2.1.1.6.B Channel Mismatch Failure	6-29
6.2.1.1.6.C APS Mode Mismatch Failure	6-29
6.2.1.1.6.D Invalid APS Mode Failure	6-30
6.2.1.1.6.E Far-End Protection-Line Failure	6-31
6.2.1.1.6.F Other APS Conditions	6-32
6.2.1.1.7 DCC Failure	6-33
6.2.1.1.8 Signal Label Mismatch	6-33
6.2.1.1.8.A STS Payload Label Mismatch	6-34
6.2.1.1.8.B STS Path Unequipped	6-34
6.2.1.1.8.C VT Payload Label Mismatch	6-37
6.2.1.1.8.D VT Path Unequipped	6-38
6.2.1.1.9 Trace Identifier Mismatch	6-40
6.2.1.1.9.A STS Path Trace Identifier Mismatch	6-43
6.2.1.1.9.B VT Path Trace Identifier Mismatch	6-45
6.2.1.1.10 Failures Related to Virtual Concatenation	6-47
6.2.1.1.10.A Loss of Multiframe	6-48
6.2.1.1.10.B Sequence Indicator Mismatch	6-49
6.2.1.1.10.C Loss of Alignment	6-51
6.2.1.2 Alarm Indication Signal	6-52
6.2.1.2.1 Line AIS	6-52
6.2.1.2.2 STS Path AIS	6-54
6.2.1.2.3 VT Path AIS	6-55
6.2.1.2.4 DS _n AIS	6-57
6.2.1.2.5 Generic-AIS (OTN)	6-59
6.2.1.3 Remote Defect Indication and Remote Failure Indication	6-61
6.2.1.3.1 Line Remote Defect Indication (RDI-L) and Remote Failure Indication (RFI-L)	6-61
6.2.1.3.2 STS Path Remote Defect Indication (RDI-P) and Remote Failure Indications (RFI-P)	6-63
6.2.1.3.3 VT Path Remote Defect Indication (RDI-V) and Remote Failure Indication (RFI-V)	6-66
6.2.1.3.4 DS _n RDI and RAI Signals	6-71
6.2.1.4 Payload Defect Indication	6-73
6.2.1.4.1 STS Path Payload Defect Indication	6-74
6.2.1.4.2 VT Path Payload Defect Indication	6-76
6.2.1.5 Trunk Conditioning	6-76
6.2.1.6 Alarm Surveillance for Other Signals and Mappings	6-78
6.2.1.7 Alarm-Related Events	6-78

6.2.1.8	Control of Alarm Processing	6-92
6.2.1.8.1	Alarm Level Designations	6-92
6.2.1.8.2	Single Failure/Single Message	6-93
6.2.1.8.3	Independent Failures	6-96
6.2.1.8.4	Retrieval of an NE's Condition	6-98
6.2.1.8.5	Provisioning of Alarm Levels	6-99
6.2.1.8.6	Clear Messages	6-99
6.2.1.8.7	Non-Intrusive Detection of Defects and Declaration of Failures	6-99
6.2.2	Performance Monitoring	6-100
6.2.2.1	General Accumulation and Thresholding Criteria	6-106
6.2.2.2	Physical Layer PM	6-113
6.2.2.2.1	Physical Layer Parameters	6-113
6.2.2.2.2	Physical Layer PM Criteria	6-114
6.2.2.3	Section Layer PM	6-116
6.2.2.3.1	Section Layer Parameters	6-116
6.2.2.3.2	Section Layer PM Criteria	6-117
6.2.2.4	Line Layer PM	6-118
6.2.2.4.1	Near-End Line Layer Parameters	6-118
6.2.2.4.2	Far-End Line Layer Parameters	6-120
6.2.2.4.3	Line Layer PM Criteria	6-121
6.2.2.5	STS Path Layer PM	6-121
6.2.2.5.1	Near-End STS Path Layer Parameters	6-121
6.2.2.5.2	Far-End STS Path Layer Parameters	6-123
6.2.2.5.3	STS Path Layer PM Criteria	6-124
6.2.2.6	VT Path Layer PM	6-125
6.2.2.6.1	Near-End VT Path Layer Parameters	6-126
6.2.2.6.2	Far-End VT Path Layer Parameters	6-127
6.2.2.6.3	VT Path Layer PM Criteria	6-128
6.2.2.7	Monitoring at DS _n Interfaces	6-129
6.2.2.8	PM During Troubles	6-130
6.2.2.9	Intermediate-Path PM	6-138
6.2.3	Testing Process	6-144
6.2.3.1	Test Access	6-145
6.2.3.1.1	Fiber Access	6-145
6.2.3.1.2	SONET Signal Test Access	6-145
6.2.3.1.3	Digital Test Access	6-146
6.2.3.2	Diagnostics	6-147
6.2.3.2.1	Physical Layer	6-148
6.2.3.2.2	Section Layer	6-148
6.2.3.2.3	Signal Identification	6-150
6.2.3.2.3.A	Section, STS Path and VT Path Trace	6-150
6.2.3.2.3.B	STS and VT Path Signal Label	6-154
6.2.3.2.4	Error Monitoring	6-154
6.2.3.2.5	Internal Clock	6-154
6.2.3.3	Loopbacks	6-155
6.2.3.3.1	SONET Terminal Loopback	6-155
6.2.3.3.2	SONET Cross-Connect Loopback	6-156
6.2.3.3.3	SONET Facility Loopback	6-157
6.2.3.3.4	DS _n Loopback	6-158

6.2.4 Control Features 6–159

7 Other Generic Criteria

7.1 Physical and Environmental Criteria 7–1
7.1.1 Operational Environment for Equipment 7–1
7.1.2 Electromagnetic Compatibility (EMC) 7–2
7.1.3 Outside Plant Cable 7–2
7.2 Equipment Design 7–2
7.3 Documentation and Training 7–2
7.4 Safety 7–3
7.4.1 Station Equipment Safety 7–3
7.4.2 Fiber Optic Cable Safety 7–4
7.5 Quality and Reliability 7–4
7.5.1 Network Equipment Reliability 7–4
7.5.2 Fiber Optic Cable Quality and Reliability 7–5
7.5.3 Component Reliability Assurance 7–5
7.6 Human Factors 7–6

8 SONET Operations Communications

8.1 SONET Operations Communications Architecture 8–2
8.1.1 Architecture Overview 8–2
8.1.2 Operations Communications Protocol Overview 8–4
8.1.3 Gateway NE Requirements 8–6
8.1.4 Intermediate NE Requirements 8–7
8.1.5 End NE Requirements 8–7
8.1.6 Mediation Device 8–8
8.2 Communications Types 8–8
8.2.1 OS/NE Communications 8–8
8.2.2 MD/NE Communications 8–9
8.2.3 NE/NE Communications 8–9
8.2.4 Craftsperson/NE Communications 8–10
8.3 SONET Operations Communications Interface 8–11
8.3.1 Physical Layer 8–12
8.3.1.1 OS/NE 8–12
8.3.1.2 NE/NE – LAN 8–12
8.3.1.3 NE/NE – DCC 8–13
8.3.2 Data Link Layer 8–14
8.3.2.1 OS/NE 8–14
8.3.2.2 NE/NE – LAN 8–14
8.3.2.3 NE/NE – DCC 8–14
8.3.3 Network Layer 8–15
8.3.3.1 OS/NE 8–16
8.3.3.2 NE/NE – LAN and DCC 8–16
8.3.4 Transport Layer – OS/NE and NE/NE 8–19
8.3.5 Session Layer – OS/NE and NE/NE 8–20
8.3.6 Presentation Layer – OS/NE and NE/NE 8–20
8.3.7 Application Layer – OS/NE and NE/NE 8–21
8.3.7.1 ACSE 8–21
8.3.7.2 ROSE/CMISE 8–21
8.3.7.3 FTAM or FTP 8–21

8.3.7.4	Name/Address Translation Services	8-22
8.3.7.5	TL1	8-22
8.4	Interworking between OSs and SONET NEs	8-23
8.4.1	TL1/X.25 [OS] – TL1/OSI [SONET]	8-24
8.4.1.1	Determine Destination NSAP	8-24
8.4.1.2	Directing Autonomous Messages	8-25
8.4.1.3	Establishing Connections	8-27
8.4.1.4	SONET LAN Interworking	8-27
8.4.1.5	SONET DCC Interworking	8-28
8.4.1.6	SONET LAN and DCC Interworking	8-28
8.4.2	TL1/X.25 [OS] – CMISE [SONET]	8-29
8.4.3	CMISE [OS] – CMISE [SONET]	8-29
8.4.4	CMISE or TL1/OSI [SONET] – CMISE or TL1/OSI [SONET]	8-30
8.5	SONET Operations Communications Routing	8-30
8.5.1	Routing Overview	8-30
8.5.2	ES-IS Requirements	8-32
8.5.3	IS-IS Requirements	8-33
8.6	Craftsperson/NE Interfaces	8-34
8.6.1	Craftsperson/WS Interface	8-34
8.6.2	WS/NE Interface	8-35
8.7	TARP	8-35
8.7.1	Network Layer Protocol to Support TARP	8-36
8.7.2	TARP PDU Specification	8-36
8.7.2.1	TARP Lifetime (tar-lif)	8-37
8.7.2.2	TARP Sequence Number (tar-seq)	8-37
8.7.2.3	Protocol Address Type (tar-pro)	8-37
8.7.2.4	URC and TARP Type Code (tar-tcd)	8-37
8.7.2.5	TID Target Length (tar-tln)	8-38
8.7.2.6	TID Originator Length (tar-oln)	8-38
8.7.2.7	Protocol Address Length (tar-pln)	8-38
8.7.2.8	TID of Target (tar-ttg)	8-38
8.7.2.9	TID of Originator (tar-tor)	8-38
8.7.2.10	Protocol Address of Originator (tar-por)	8-39
8.7.3	TARP Data Cache	8-39
8.7.4	NE Applications That Use the TARP Processor	8-39
8.7.4.1	Find NET That Matches TID	8-39
8.7.4.2	Find TID That Matches NET	8-40
8.7.4.3	Send Notification of TID or Protocol Address Change	8-40
8.7.5	TARP PDU Processing	8-40
8.7.5.1	Origination of a TARP Type 1 PDU	8-41
8.7.5.2	Origination of a TARP Type 2 PDU	8-41
8.7.5.3	Origination of a TARP Type 3 PDU	8-42
8.7.5.4	Origination of a TARP Type 4 PDU	8-42
8.7.5.5	Origination of a TARP Type 5 PDU	8-42
8.7.5.6	Receipt of a TARP PDU	8-42
8.7.5.6.1	End Systems	8-42
8.7.5.6.2	Level 1 Intermediate Systems	8-43
8.7.5.6.3	Level 2 Intermediate Systems	8-43
8.7.5.7	Loop Detection Procedure (Performed by ISS)	8-43
8.7.5.8	Propagation Procedure (Performed by ISS)	8-44

8.7.6 Management of the TARP Processor	8-45
8.7.7 TARP Echo Function	8-46
8.7.8 Manual TARP Adjacencies	8-46
8.7.9 TARP Example	8-47
8.7.10 TARP Pseudocode	8-48

Appendix A: Deleted Requirement-Object List

A.1 Requirement Objects Deleted as of Issue 2	A-1
A.2 Requirement Objects Deleted as of Issue 2, Revision 1	A-2
A.3 Requirement Objects Deleted as of Issue 2, Revision 2	A-2
A.4 Requirement Objects Deleted as of Issue 3	A-3
A.5 Requirement Objects Deleted as of Issue 4	A-4
A.6 Requirement Objects Deleted as of Issue 5	A-7

Appendix B: Fiber Optic Transmission System Design Worksheets

Appendix C: SONET Operations Communications Lower Layers Protocol Profile

C.1 Introduction	C-1
C.1.1 Source Documents	C-1
C.1.1.1 Base Standards	C-1
C.1.1.2 International Standardized Profiles	C-2
C.1.1.3 Alliance for Telecommunications Industry Solutions	C-2
C.1.1.4 Telcordia Requirements	C-2
C.1.2 Notations Used in the SONET Lower Layer Profile	C-2
C.1.2.1 Status Symbols	C-2
C.1.2.2 Profile Symbols	C-2
C.1.2.3 Support Symbols	C-4
C.1.2.4 References	C-4
C.2 LAPD SONET Protocol Profile	C-4
C.2.1 Notations	C-4
C.2.1.1 Abbreviations	C-4
C.2.1.2 Status Symbols	C-5
C.2.1.3 Additional Symbols	C-5
C.2.2 Protocol Capabilities (PC)	C-6
C.2.3 Frames - Protocol Data Units (FR)	C-8
C.2.4 System Parameters (SP)	C-9
C.3 LLC Protocol Profile	C-10
C.3.1 Abbreviations and Special Symbols	C-10
C.3.1.1 Status Symbols	C-10
C.3.1.2 Item References	C-10
C.3.2 Claimed Conformance to ISO/IEC 8802-2:1989/Amd. 1, Amd. 2 and Amd. 4	C-11
C.3.3 LLC Type 1 Operation - Unacknowledged Connectionless Mode	C-11
C.3.3.1 LLC Type 1 - Supported PDU Types	C-11
C.3.3.2 LLC Type 1 - Supported Parameters in PDUs on Transmission	C-12
C.3.3.3 LLC Type 1 - Supported Parameters in PDUs on Receipt	C-13
C.3.3.4 LLC Type 1 - Miscellaneous	C-13
C.4 ISO 8473 Protocol Profile	C-15

C.4.1	Notations	C-15
C.4.1.1	Status Symbols	C-15
C.4.1.2	Additional Symbols	C-15
C.4.2	Major Capabilities	C-16
C.4.3	End Systems	C-16
C.4.3.1	Applicability	C-16
C.4.3.2	Supported Functions	C-17
C.4.3.3	Supported PDUs	C-18
C.4.3.4	Supported Parameters	C-19
C.4.3.4.1	DT Parameters	C-19
C.4.3.4.2	ER Parameters	C-20
C.4.3.4.3	Inactive Network Layer Protocol PDU Parameters	C-20
C.4.3.5	Timers	C-21
C.4.4	Intermediate Systems	C-21
C.4.4.1	Applicability	C-21
C.4.4.2	Supported Functions	C-22
C.4.4.3	Supported PDUs	C-23
C.4.4.4	Supported Parameters	C-24
C.4.4.4.1	DT Parameters	C-24
C.4.4.4.2	ER Parameters	C-25
C.4.4.5	Timer and Parameter Values	C-25
C.5	ISO 9542 SONET Protocol Profile	C-26
C.5.1	Notations	C-26
C.5.1.1	Status Symbols	C-26
C.5.1.2	Other Symbols	C-26
C.5.2	PICS Proforma: ISO 9542:1988 – End System	C-26
C.5.2.1	Supported Functions	C-27
C.5.2.2	Supported PDUs	C-27
C.5.2.3	Supported Parameters	C-28
C.5.2.4	Supported Parameter Ranges	C-29
C.5.3	PICS Proforma: ISO 9542:1988 – Intermediate System	C-29
C.5.3.1	Supported Functions	C-29
C.5.3.2	Supported PDUs	C-30
C.5.3.3	Supported Parameters	C-30
C.5.4	Supported Parameter Ranges	C-31
C.6	ISO/IEC 10589 Protocol Profile	C-31
C.6.1	Notations (Status Symbols)	C-31
C.6.2	Protocol Summary: ISO/IEC 10589 General	C-32
C.6.2.1	System Environment: General	C-33
C.6.2.2	Subnetwork Dependent Functions: General	C-33
C.6.2.3	Update Process: General	C-34
C.6.2.4	Decision Process: General	C-35
C.6.2.5	Forward/Receive Process: General	C-35
C.6.3	Protocol Summary: ISO/IEC 10589 Level 1 Specific Functions	C-36
C.6.3.1	Level 1 Subnetwork Dependent Functions	C-36
C.6.3.2	Level 1 Update Process	C-36
C.6.3.3	Level 1 Decision Process	C-36
C.6.4	Protocol Summary: ISO/IEC 10589 Level 2 Specific Functions	C-37
C.6.4.1	Level 2 Subnetwork Dependent Functions	C-38
C.6.4.2	Level 2 Update Process	C-38

- C.6.4.3 Level 2 Decision Process C-39
- C.6.4.4 Level 2 Forward/Receive Process C-39
- C.7 ISO/IEC 8073 Protocol Profile C-40
 - C.7.1 Notations C-40
 - C.7.1.1 Status Symbols C-40
 - C.7.2 Protocol Implementation for TP4/CLNS (C4L:) C-40
 - C.7.2.1 Annex B – NCMS C-40
 - C.7.2.2 Classes Implemented C-40
 - C.7.3 Initiator/Responder Capability for Protocol Classes 0-4 C-41
 - C.7.4 Supported Functions C-41
 - C.7.4.1 Supported Functions for Class 4 (C4L:) C-41
 - C.7.5 Supported TPDUs C-43
 - C.7.6 Supported Parameters of Issued TPDUs C-44
 - C.7.6.1 Parameter Values for CR TPDUs (C4L:) C-44
 - C.7.6.2 Supported Parameters for Class 4 TPDUs (C4L:) C-44
 - C.7.7 Supported Parameters for Received TPDUs C-46
 - C.7.8 User Data in Issued TPDUs C-46
 - C.7.8.1 Class 4 (C4L:) C-47
 - C.7.9 User Data in Received TPDUs C-47
 - C.7.10 Negotiation C-48
 - C.7.10.1 Class Negotiation - Initiator C-48
 - C.7.10.2 TPDUs Size Negotiation C-48
 - C.7.10.3 Use of Extended Format C-49
 - C.7.10.4 Expedited Data Transport Service C-49
 - C.7.10.5 Non-Use of Checksum (C4L AND T4F29:) C-49
 - C.7.10.6 Use of Selective Acknowledgment (See note 20) C-50
 - C.7.10.7 Use of Request of Acknowledgment (See note 21) C-50
 - C.7.11 Error Handling C-50
 - C.7.11.1 Action on Receipt of a Protocol Error C-50
 - C.7.11.2 Actions on Receipt of an Invalid or Undefined Parameter in a CR TPDUs C-51
 - C.7.11.3 Actions on Receipt of an Invalid or Undefined Parameter in a TPDUs other than a CR TPDUs C-52
 - C.7.12 Timers and Protocol Parameters C-52
- C.8 TARP Protocol Implementation Conformance Statement C-53
 - C.8.1 Major Function C-53
 - C.8.2 Supported PDUs C-54
 - C.8.3 Protocol Specifications C-54
 - C.8.3.1 TARP PDU CLNP Specifications C-54
 - C.8.3.2 TARP PDU Specifications C-55
 - C.8.3.3 Protocol Timer Specifications C-55
 - C.8.4 Major Capabilities C-56
 - C.8.5 TARP Processor Management C-57
 - C.8.5.1 LDB Entry Timer Parameters C-57
 - C.8.5.2 LDB Flush Timer Parameters C-58
 - C.8.5.3 Provisionable TARP PDU Fields C-58

Appendix D: SONET Operations Communications Upper Layers Protocol Profile

- D.1 Introduction D-1

D.2 Source Documents	D-1
D.2.1 Base Standards	D-1
D.2.2 PICS Proforma	D-1
D.2.3 International Standardized Profiles	D-2
D.2.4 Telcordia Requirements	D-2
D.3 Goals of SONET Upper Layers Profile	D-2
D.4 Structure of SONET Upper Layers Profile	D-2
D.5 Notations Used in the SONET Upper Layers Profile	D-3
D.5.1 Abbreviations	D-3
D.5.2 Status Column	D-3
D.5.3 Profile Column	D-3
D.5.4 Support Column	D-4
D.5.5 PICS Numbers	D-4
D.6 SONET Upper Layers Profile: ACSE	D-4
D.6.1 Additions Beyond Existing ISP Requirements	D-4
D.6.2 Profile Tables	D-5
D.7 SONET Upper Layers Profile: Presentation Layer	D-9
D.7.1 Additions Beyond Existing ISP Requirements	D-9
D.7.2 Profile Tables	D-10
D.8 SONET Upper Layers Profile: Session Layer	D-16
D.8.1 Additions Beyond Existing ISP Requirements	D-16
D.8.2 Profile Tables	D-17

References

Glossary

Requirement-Object Index

List of Figures

Figure 2-1	Simplified Diagram Depicting SONET Section, Line and Path Definitions	2-1
Figure 2-2	Diagram Illustrating SONET Section, Line and Path Definitions	2-2
Figure 3-1	STS-1 Frame	3-4
Figure 3-2	Bit Position Numbering	3-4
Figure 3-3	STS-1 Synchronous Payload Envelope	3-6
Figure 3-4	STS-1 SPE with STS-1 POH and STS-1 Payload Capacity Illustrated	3-6
Figure 3-5	STS-1 SPE in Interior of STS-1 Frames	3-7
Figure 3-6	STS-N Frame	3-8
Figure 3-7	STS-Nc SPE	3-10
Figure 3-8	Transport Overhead Assignment, OC-3 Carrying an STS-3c SPE	3-10
Figure 3-9	Mapping of the STS-1-Xv Payload Capacity Into X STS-1 SPEs	3-12
Figure 3-10	Mapping of the STS-3c-Xv Payload Capacity Into X STS-3c SPEs	3-13
Figure 3-11	VT Sizes	3-15
Figure 3-12	VT Structured STS-1 SPE: All VT1.5s	3-16
Figure 3-13	VT1.5 Locations	3-17
Figure 3-14	VT Structured STS-1 SPE: All VT2s	3-18
Figure 3-15	VT2 Locations	3-19
Figure 3-16	VT Structured STS-1 SPE: All VT3s	3-20
Figure 3-17	VT3 Locations	3-21
Figure 3-18	VT Structured STS-1 SPE: All VT6s	3-22
Figure 3-19	VT6 Locations	3-23
Figure 3-20	Example of VT Structured STS-1 SPE	3-24
Figure 3-21	Correspondence Between Labels and Numbers for the Example in Figure 3-20	3-25
Figure 3-22	VT Superframe and Envelope Capacity	3-26
Figure 3-23	VT SPE and Payload Capacity	3-27
Figure 3-24	Mapping of the VTn-Xv Payload Capacity Into X VTn SPEs	3-29
Figure 3-25	Optical Interface Layers	3-33
Figure 3-26	Transport and STS Path Overhead Byte Designations	3-34
Figure 3-27	STS Path Status Byte (G1)	3-48
Figure 3-28	VT Path Overhead Byte (V5)	3-49
Figure 3-29	Z7 Bit 1 Multiframe Definition	3-53
Figure 3-30	H4 Byte Coding Sequence for VT-Structured STS-1 SPEs	3-56
Figure 3-31	Byte-Synchronous Mapping for DS1 Payload	3-58
Figure 3-32	Byte-Synchronous DS1 Signaling and Framing Bit Assignments	3-59
Figure 3-33	Asynchronous Mapping for DS1 Payload	3-65
Figure 3-34	Asynchronous Mapping for DS1C Payload	3-67
Figure 3-35	Asynchronous Mapping for DS2 Payload	3-69
Figure 3-36	Asynchronous Mapping for DS3 Payload	3-73
Figure 3-37	Asynchronous Mapping for DS4NA Payload	3-74
Figure 3-38	Asynchronous Mapping for FDDI	3-76
Figure 3-39	DQDB Mapping into an STS-3c SPE	3-78
Figure 3-40	Bit Allocation for H4 Byte in DQDB Mapping	3-78
Figure 3-41	STS Payload Pointer (H1, H2) Coding	3-81
Figure 3-42	STS Pointer Offset Numbering	3-82
Figure 3-43	Positive STS Pointer Adjustment Operation (Increment)	3-84

Figure 3-44	Negative STS Pointer Adjustment Operation (Decrement)	3–85
Figure 3-45	VT Payload Pointer (V1, V2) Coding	3–89
Figure 3-46	VT Pointer Offsets	3–90
Figure 4-1	Optical System Interfaces (Points S and R)	4–5
Figure 4-2	SONET Eye Diagram Mask (OC-1 through OC-12)	4–10
Figure 4-3	SONET Eye Diagram Mask (OC-48 through OC-768)	4–11
Figure 4-4	Cable Configuration for Cabled Fiber Cutoff Wavelength Measurement	4–56
Figure 4-5	Wavelength Dependent Attenuation Characteristics	4–57
Figure 4-6	Example Global Fiber Attenuation Characteristics	4–59
Figure 4-7	Example Global Fiber Dispersion Characteristics	4–60
Figure 4-8	Engineering of a Fiber Optic Regenerator Section	4–61
Figure 4-9	Regenerator Section, Sources of Loss	4–62
Figure 4-10	STS-1 Electrical Interface Pulse Mask	4–67
Figure 4-11	STS-1 Electrical Interface Eye Diagram Mask	4–68
Figure 4-12	STS-3 Transmitter Pulse Mask Corresponding to a Binary Zero	4–70
Figure 4-13	STS-3 Transmitter Pulse Mask Corresponding to a Binary One	4–71
Figure 4-14	STS-3 Eye Diagram Mask	4–72
Figure 5-1	Example of Byte-Interleaving Sequence, STS-12	5–3
Figure 5-2	Byte-Interleaving Example, Multiple Level Inputs	5–5
Figure 5-3	Frame Synchronous Scrambler (Functional Diagram)	5–7
Figure 5-4	Example of STS-1 and OC-N (N < 768) Signal Composition	5–9
Figure 5-5	Switch Initiation Time Criteria	5–31
Figure 5-6	Linear APS Switch – 1:n Architecture (in released position)	5–44
Figure 5-7	Linear APS Switch – 1+1 Architecture (in released position)	5–45
Figure 5-8	1:n Linear APS Architecture Example	5–52
Figure 5-9	OC-N and OC-M Example	5–57
Figure 5-10	External-Timing Mode Example	5–64
Figure 5-11	Line-Timing Mode Example	5–65
Figure 5-12	Loop-Timing Mode	5–66
Figure 5-13	Through-Timing Mode Example	5–67
Figure 5-14	OC-N Input and Output Wander Time Deviation	5–72
Figure 5-15	Time Deviation of Filtered Network Input to SONET NEs	5–73
Figure 5-16	MTIE for SONET Clocks	5–75
Figure 5-17	Time Deviation for SONET Clocks	5–75
Figure 5-18	MTIE for Phase Transients from SONET Clocks	5–78
Figure 5-19	Phase-Transient for Stratum 3 Clock and SMC Entry into Holdover	5–79
Figure 5-20	MTIE Masks for Input/Output Phase Transients	5–80
Figure 5-21	DS1 Timing References Derived from a Single OC-N “Interface” Example	5–84
Figure 5-22	DS1 Timing References Derived from Different OC-N “Interfaces” Example	5–85
Figure 5-23	Time Deviation for Derived DS1 Signals	5–89
Figure 5-24	Example Implementation of R5-234 and R5-235	5–104
Figure 5-25	Example Implementation of R5-241 and R5-242	5–104
Figure 5-26	Example Implementation of R5-243	5–105
Figure 5-27	Category I DS1 and DS3 Jitter Transfer Mask	5–114
Figure 5-28	Category II Jitter Transfer Mask	5–115
Figure 5-29	SONET Category II Jitter Tolerance Mask	5–118

Figure 5-30	Single Pointer Adjustment Test Sequence	5-124
Figure 5-31	Maximum Rate Pointer Burst Test Sequence	5-125
Figure 5-32	Phase Transient Pointer Burst Test Sequence	5-125
Figure 5-33	Periodic VT1.5 Pointer Adjustment Test Sequence (26-1 Pattern)	5-128
Figure 5-34	Periodic STS Pointer Adjustment Test Sequence (87-3 Pattern)	5-129
Figure 5-35	Periodic Pointer Adjustment Test Sequence (Continuous Pattern)	5-130
Figure 5-36	DS1 Mapping Phase Variation Limits	5-134
Figure 5-37	DS3 Mapping Phase Variation Limits	5-135
Figure 5-38	Single VT Pointer Adjustment Phase Variation Limits	5-136
Figure 5-39	Single STS-1 Pointer Adjustment Phase Variation Limits	5-137
Figure 5-40	Maximum Rate Pointer Burst Phase Variation Limits	5-138
Figure 5-41	Phase Transient Pointer Burst Phase Variation Limits	5-139
Figure 5-42	Periodic VT Pointer Adjustment Phase Variation Limits	5-140
Figure 5-43	Periodic STS-1 Pointer Adjustment Phase Variation Limits	5-141
Figure 6-1	General Defect Detection and Failure Declaration Model	6-15
Figure 6-2	Maintenance Signals for SONET Layers	6-52
Figure 6-3	Reverse PN-11 Process	6-60
Figure 6-4	STE Maintenance Signals	6-78
Figure 6-5	LTE Maintenance Signals	6-79
Figure 6-6	STS PTE (Asynchronous Mapping for DS3) Maintenance Signals	6-80
Figure 6-7	STS PTE (VT-Structured STS-1 SPE) Maintenance Signals	6-81
Figure 6-8	VT PTE (Asynchronous Mapping for DS _n into VT _n) Maintenance Signals, DS _n Interface	6-82
Figure 6-9	VT PTE (Asynchronous Mapping for DS1 into VT1.5) Maintenance Signals, DS3 Interface with Embedded M13 Multiplex	6-83
Figure 6-10	VT PTE (Byte-Synchronous Mapping for DS1 into a Single VT1.5) Maintenance Signals, DS1 Interface	6-84
Figure 6-11	VT PTE with DS0 Rearrangement Functions (Byte-Synchronous Mapping for DS1 into VT1.5) Maintenance Signals and Trunk Conditioning, OC-N and DS1 Interfaces	6-85
Figure 6-12	VT PTE with DS0 Rearrangement Functions (Byte-Synchronous Mapping for DS1 into VT1.5) Maintenance Signals and Trunk Conditioning, OC-N and DS1 Interfaces (Continued)	6-86
Figure 6-13	DS0 PTE (Byte-Synchronous Mapping for DS1 into VT1.5) Maintenance Signals and Trunk Conditioning	6-87
Figure 6-14	SONET Maintenance Signals for Internal Equipment Failures	6-88
Figure 6-15	Alarm Timing Requirements for Directly Detected Defects and Failures	6-89
Figure 6-16	AIS Timing Requirements	6-90
Figure 6-17	Derived RFI Timing Requirements	6-91
Figure 6-18	RFI-V Signal Timing Requirements (for Byte-Synchronous DS1 Mapping)	6-91
Figure 6-19	SONET PM Accumulation and Thresholding Model	6-103
Figure 6-20	SONET PM Accumulation and Thresholding Model (Continued)	6-104
Figure 6-21	SONET PM Accumulation and Thresholding Model (Continued)	6-105
Figure 6-22	Intermediate-Path PM for Non-PJ-Related Parameters	6-139
Figure 6-23	Examples of Intermediate-Path PM for STS PJ-Related Parameters	6-140
Figure 6-24	Section Layer Diagnostic	6-149

Figure 6-25	SONET Terminal Loopback Example	6-156
Figure 6-26	SONET Cross-Connect Loopback	6-156
Figure 6-27	SONET Facility Loopback	6-157
Figure 6-28	DSn Terminal Loopback	6-158
Figure 6-29	DSn Facility Loopback	6-159
Figure 8-1	SONET Operations Communications: Example NE and Interface Types	8-1
Figure 8-2	Example SONET Operations Communications Architecture	8-2
Figure 8-3	Example Intra-site LAN and Point-to-Point DCC	8-3
Figure 8-4	Example Operations Communications Network for a Survivable Ring	8-3
Figure 8-5	Operations Communications Functions	8-4
Figure 8-6	Interactive CMISE/OSI Protocol Stacks for SONET Operations Communications	8-5
Figure 8-7	SONET NSAP Format	8-18
Figure 8-8	IDP Encoding	8-18
Figure 8-9	TL1/X.25 – LAN Interworking	8-28
Figure 8-10	TL1/X.25-LAN-DCC Interworking	8-29
Figure 8-11	Example Routing Domain	8-32
Figure 8-12	Craftsperson/NE Communications Network	8-34
Figure 8-13	Manual TARP Adjacencies	8-47
Figure 8-14	TARP Example	8-47

List of Tables

Table 3-1	Line Rates for Standard SONET Interface Signals (through N = 768)	3-2
Table 3-2	STS Path Signal Label Assignments	3-45
Table 3-3	STS Path Signal Label Assignments for Signals with Payload Defects	3-46
Table 3-4	VT Path Signal Label Assignments (Non-Extended)	3-52
Table 3-5	Extended VT Path Signal Label Assignments	3-54
Table 3-6	VTn and VTn-Xv SPE Attributes	3-55
Table 3-7	STS SPE Attributes	3-71
Table 3-8	VT Size Indicator	3-91
Table 4-1	Application Categories	4-3
Table 4-2	Attenuation and Group Delay Distortion as a Function of Frequency	4-12
Table 4-3	Tolerance Values of the Attenuation of the Optical Reference Receiver	4-13
Table 4-4	Maximum Attenuation and Range Values	4-20
Table 4-5	Maxwellian DGD Probabilities	4-27
Table 4-6	SR-1 OC-1 Through OC-48 Optical Parameters	4-28
Table 4-7	SR OC-192 Optical Parameters	4-29
Table 4-8	SR OC-768 Optical Parameters	4-30
Table 4-9	IR OC-1 Optical Parameters	4-31
Table 4-10	IR OC-3 Optical Parameters	4-32
Table 4-11	IR OC-12 Optical Parameters	4-33
Table 4-12	IR OC-48 Optical Parameters	4-34
Table 4-13	IR OC-192 Optical Parameters	4-35
Table 4-14	IR OC-768 Optical Parameters	4-36
Table 4-15	LR OC-1 Optical Parameters	4-37
Table 4-16	LR OC-3 Optical Parameters	4-38
Table 4-17	LR OC-12 Optical Parameters	4-39
Table 4-18	LR OC-48 Optical Parameters	4-40
Table 4-19	LR OC-192 Optical Parameters	4-41
Table 4-20	LR OC-768 Optical Parameters	4-42
Table 4-21	VR OC-12 Optical Parameters	4-43
Table 4-22	VR OC-48 Optical Parameters	4-44
Table 4-23	VR OC-192 Optical Parameters	4-45
Table 4-24	UR OC-12 Optical Parameters	4-46
Table 4-25	UR OC-48 Optical Parameters	4-47
Table 4-26	STS-1 Electrical Interface Criteria	4-66
Table 4-27	STS-3 Electrical Interface Criteria	4-69
Table 5-1	Possible Starting Positions for an STS-Mc SPE in an OC-768 Signal .	5-4
Table 5-2	SONET Overhead Generating and Processing Criteria	5-12
Table 5-3	H4 Byte Usage in STS Virtual Concatenation Applications	5-21
Table 5-4	Z7 Bits 1 and 2 Usage in VT Virtual Concatenation	5-23
Table 5-5	Clearing Time Criteria for BER-based SF and SD Conditions	5-33
Table 5-6	K1 Byte, Bits 1 through 4: Type of Request	5-37
Table 5-7	Channel Number Code Assignments, K1 Bits 5 to 8 (and K2 Bits 1 to 4)	5-38
Table 5-8	1:n Bidirectional Switching Example	5-52

Table 5-9	Synchronization Status Message Definitions	5-60
Table 5-10	Example Reference Selection Using Synchronization Status Messages	5-98
Table 5-11	Parameters for Network Interface Jitter Requirements	5-111
Table 5-12	Category I Mapping Jitter Limits	5-120
Table 5-13	Pointer Test Sequence Parameters	5-121
Table 5-14	Jitter Due to Single Pointer Adjustments	5-123
Table 5-15	Jitter Generation Limits for Periodic Pointer Adjustment Sequences	5-127
Table 5-16	SONET Jitter Generation	5-131
Table 6-1	STS-1 Numbers in OC-N Signals	6-3
Table 6-2	STS Signal Label Mismatch Defect Conditions	6-36
Table 6-3	VT Signal Label Mismatch Defect Conditions	6-39
Table 6-4	RDI-P Bit Settings and Interpretation	6-66
Table 6-5	RDI-V Bit Settings and Interpretation	6-70
Table 6-6	Hierarchy of Near-End Failures	6-95
Table 6-7	Hierarchy of Far-End Failures	6-96
Table 6-8	PM Register Sizes and Default Thresholds	6-110
Table 6-9	Section BIP Errors to Trigger a Section SES	6-117
Table 6-10	Line BIP Errors to Trigger a Line SES (Near-End and Far-End) . .	6-119
Table 6-11	STS Path BIP Errors to Trigger an STS Path SES (Near-End and Far-End)	6-122
Table 6-12	VT Path BIP Errors to Trigger a VT Path SES (Near-End and Far-End)	6-126
Table 6-13	Section Layer PM Accumulation During Defects	6-132
Table 6-14	Near-End Line Layer PM Accumulation During Defects	6-133
Table 6-15	Near-End STS Path Layer PM Accumulation During Defects	6-134
Table 6-16	Near-End VT Path Layer PM Accumulation During Defects	6-135
Table 6-17	Far-End Line Layer PM Accumulation During Defects	6-136
Table 6-18	Far-End STS Path Layer PM Accumulation During Defects	6-137
Table 6-19	Far-End VT Path Layer PM Accumulation During Defects	6-138
Table 8-1	TARP PDU Fields	8-37
Table 8-2	TARP Types	8-38
Table 8-3	TARP Timers	8-40
Table 8-4	Provisionable TARP PDU Fields	8-45