

# ISDN PRIMARY RATE ACCESS TRANSPORT SYSTEM REQUIREMENTS

## Contents [Telcordia TR-TSY-000754-Documentation Information](#)

1. Introduction.....	1-1
1.1 Purpose.....	1-1
1.2 Relationship To Interface Standard And ISDN Reference Configuration.....	1-1
1.3 Document Organization.....	1-2
1.4 Key Changes From Technical Advisory.....	1-3
1.5 Key Related Bellcore Documents.....	1-3
1.6 Requirements Conventions.....	1-4
2. Transport Overview.....	2-1
2.1 Network Interface.....	2-1
2.2 Service Capabilities.....	2-2
2.3 Transport Architectures.....	2-4
2.3.1 T1 Carrier Transport.....	2-6
2.3.2 Multiplexer Transport -Asynchronous Case.....	2-6
2.3.3 Multiplexer Transport - Integrated/Byte-Synchronous Case.....	2-7
2.3.4 Multiplexer Transport- Nonintegrated/Byte-Synchronous Case.....	2-8
2.3.5 DCS Transport.....	2-8
2.4 Network Element Functionality.....	2-9
2.5 Operations System Communications.....	2-10
2.6 Network Maintenance and Performance Monitoring.....	2-10
2.6.1 Performance Monitoring.....	2-10
2.6.2 Digital Testing.....	2-11
2.6.3 Alarms for Service Affecting Troubles.....	2-11
2.7 Multicarrier Access.....	2-12
2.7.1 Network Constraints.....	2-12
2.7.2 Maintenance Considerations.....	2-13
2.7.3 Operations Communications.....	2-13
3. Customer-Network Interface Requirements.....	3-1
3.1 General.....	3-1
3.2 Terminating Impedance.....	3-1
3.2.1 Impedance and Return Loss.....	3-1
3.2.2 Longitudinal Balance.....	3-1
3.3 Powering Arrangements.....	3-2
3.4 Physical Interconnection at the NI.....	3-2
3.5 Signal Specifications.....	3-2
3.5.1 Transmission Rate and Synchronization.....	3-2
3.5.2 Clear Channel Capability.....	3-4

---

3.5.3	Line Code .....	3-4
3.5.4	Standard Pulse Characteristics .....	3-4
3.5.5	Network Signal at the/VI .....	3-5
3.5.6	Customer Installation Signal at the NI .....	3-6
3.6	Interference .....	3-6
3.6.1	General .....	3-6
3.6.2	Near-End Crosstalk .....	3-7
3.6.3	Longitudinal Noise .....	3-8
3.6.4	Power-Related Metallic Noise .....	3-8
3.6.5	Impulse Noise .....	3-8
3.7	Wander, Jitter and Phase Transients .....	3-9
3.7.1	General .....	3-9
3.7.2	Wander .....	3-9
3.7.3	Jitters .....	3-10
3.7.4	Phase Transients .....	3-11
3.8	Basic Frame Format and Channel Combinations .....	3-12
3.8.1	Basic Frame Definition .....	3-12
3.8.2	Channel Time Slot Assignment Rules .....	3-12
3.8.3	Bit Transmission Order .....	3-13
3.8.4	Codes for Idle Channels and Idle Time Slots .....	3-14
3.9	Extended Superframe Format (ESF) .....	3-14
3.9.1	Framing Bit Allocation .....	3-14
3.9.2	Cyclic Redundancy Check (CRC) .....	3-14
3.10	ESF Embedded Operations Channel (EOC) .....	3-15
3.10.1	Bit-Oriented Messages .....	3-16
3.10.2	Performance Report Message (Message-Oriented Signal) .....	3-17
3.10.3	EOC Idle Code .....	3-19
3.10.4	Network Applications on the EOO .....	3-19
3.11	Alarm Transmissions .....	3-20
3.11.1	Remote Alarm Indication [RAI] Signal .....	3-20
3.11.2	Alarm Indication Signal [AIS] .....	3-20
3.12	Network Access to Loopbacks Located in the CI .....	3-21
3.12.1	Line Loopback Activation .....	3-21
3.12.2	Payload Loopback Activation .....	3-21
3.12.3	Line and Payload Loopback Deactivation .....	3-22
3.12.4	Line and Payload Loopback Retention .....	3-22
3.12.5	Forwarding of AIS Due to CI Initiated Line Loopbacks .....	3-23
4.	DS1 Interface Connector .....	4-1
4.1	Physical Interface to the Network Facility and the CI .....	4-1
4.2	Connector Powering and Simplex Configurations .....	4-2
4.2.1	Span Line Powering .....	4-2
4.2.2	ac Powered DS1 Interface Connector .....	4-3
4.2.3	External dc Powered DS1 Interface Connector .....	4-3
4.3	Longitudinal Balance .....	4-4

---

4.4	Input Impedance.....	4-5
4.5	Insertion Loss.....	4-5
4.6	Line Build-Out.....	4-5
4.7	Operational Requirements.....	4-6
4.8	Signal Loopback.....	4-6
4.8.1	Manual Control.....	4-7
4.8.2	ESF EOC Control.....	4-7
4.9	Loopback Indication Signal.....	4-9
4.10	Signal Regeneration.....	4-9
4.11	Timing Jitter.....	4-10
5.	Network Element Line Units.....	5-1
5.1	Common Requirements for LUs.....	5-2
5.1.1	Terminating Impedance and Return Loss.....	5-2
5.1.2	Longitudinal Balance.....	5-2
5.1.3	LU Operation in an Interference Environment.....	5-2
5.1.4	LU Operation in a Jitter and Wander Environment.....	5-2
5.1.5	Operation Systems/Network Element (OS/NE) Support.....	5-4
5.2	Terminating Line Unit (TLU) General Requirements.....	5-4
5.2.1	Requirements for TLU Meeting DSX-1 Interface.....	5-4
5.2.2	Requirements for TLU Meeting Network Interface (NI).....	5-5
5.2.3	Common TLU Transmitter and Receiver Requirements.....	5-6
5.2.4	TLU Framing Requirements.....	5-6
5.3	Intermediate Line Unit (ILU) General Requirements.....	5-8
5.3.1	Requirements for ILU Meeting DSX-1 Interface.....	5-8
5.3.2	Requirements for ILU Meeting Network Interface (NI).....	5-9
5.3.3	Common ILU Transmitter and Receiver Requirements.....	5-10
5.4	LU Performance Monitoring and Maintenance Capabilities.....	5-11
5.4.1	Performance Monitoring Capabilities.....	5-11
5.4.2	Maintenance Capabilities.....	5-19
5.5	Stand-Alone Monitoring Unit (MU).....	5-22
5.6	Carrier Group Alarm (CGA) System.....	5-23
5.6.1	CFA Declaration.....	5-24
5.6.2	Trunk Conditioning.....	5-25
5.6.3	Removal From Service.....	5-25
5.6.4	Service Restoral.....	5-25
6.	Network Element Requirements.....	6-1
6.1	ISDN Switch.....	6-1
6.1.1	Channel Identification And Association.....	6-1
6.1.2	Idle Codes and Bit Transmission Order.....	6-1
6.1.3	Synchronization.....	6-2
6.1.4	Operations Communication.....	6-2
6.2	Asynchronous Multiplexer Systems.....	6-4
6.2.1	Clear Channel Transport.....	6-5

---

6.2.2	Line Loopback .....	6-5
6.2.3	Synchronization .....	6-5
6.2.4	Operations Communications .....	6-6
6.3	Digital Loop Carrier Systems Supported Via SONET Facilities .....	6-6
6.3.1	Transport Method For Individual PRA Terminations On Switch As One Or More DS1 Facilities .....	6-7
6.3.2	Transport Method For Multiplexed PRA Terminations On Switch Within A SONET OC-N Facility .....	6-7
6.3.3	Synchronization .....	6-8
6.3.4	Operations Communication .....	6-9
7.	Miscellaneous Requirements for LUs .....	7-1
7.1	Physical Requirements .....	7-1
7.1.1	Shock and Vibration .....	7-1
7.1.2	Fire Resistance .....	7-1
7.2	Environmental Requirements .....	7-1
7.2.1	Temperature and Humidity .....	7-2
7.2.2	Altitude .....	7-3
7.2.3	Acoustical Noise .....	7-3
7.2.4	Airborne Contaminants .....	7-3
7.2.5	Electrical Protection .....	7-3
7.2.6	Electromagnetic Emission and Immunity .....	7-4
7.2.7	Electrostatic Discharge .....	7-4
7.3	Electrical Safety .....	7-4
7.4	Quality and Reliability .....	7-4
7.4.1	Hardware Reliability Predictions .....	7-5
7.4.2	Device Reliability .....	7-5
7.4.3	Physical Design .....	7-5
7.4.4	Software Quality .....	7-6
7.4.5	Manufacturing Process .....	7-6
7.4.6	Product Support .....	7-6
7.4.7	Customer Verification of Quality and Reliability .....	7-7
7.5	System Administration .....	7-7
7.5.1	Documentation and Supplier Information .....	7-7
7.5.2	Transmission Performance Information .....	7-7
8.	Compliance Testing .....	8-1
9.	Glossary of Acronyms .....	9-1
10.	Referenced Documents .....	10-1

## List of Figures

Figure 1-1.	ISDN Primary Rate Access Reference Configuration.....	1-6
Figure 2-1.	ISDN Primary Rate Access Architectures.....	2-14
Figure 2-2.	Multi-Carrier Access Arrangement .....	2-17
Figure 3-1.	Standard Pulse Template and Corner Points For The Determination Of Network and CI Signal Characteristics .....	3-24
Figure 3-2.	Pulse Amplitude Envelope with 60 Hz Longitudinal Currents .....	3-25
Figure 3-3.	1% NEXT Model for 25 Disturbors .....	3-26
Figure 3-4.	Simulated DS1 NEXT and Actual DS1 NEXT PSDs .....	3-27
Figure 3-5.	Waveform for Longitudinal Noise .....	3-28
Figure 3-6.	Frequency Weighting Functions for Jitter Specifications .....	3-29
Figure 3-7.	Bit Assignments Within DS1 Frames.....	3-30
Figure 3-8.	Possible Failure Locations and Resulting Alarm Transmissions .....	3-31
Figure 3-9.	Performance Report Message Structure .....	3-32
Figure 4-1.	Deployment of the DS1 Interface Connector at the NI .....	4-12
Figure 4-2.	Loop Power Option Configuration .....	4-13
Figure 4-3.	Through Power Option Configuration.....	4-14
Figure 4-4.	DS1 Interface Connector Port Designations.....	4-15
Figure 5-1.	Terminating Line Unit (TLU) Block Diagram .....	5-27
Figure 5-2.	Intermediate Line Unit (ILU) Block Diagram.....	5-28
Figure 5-3.	Carrier Failure Alarm (CFA) Timing .....	5-29
Figure 6-1.	Operations Interworking for PRA Transport over T1 Carrier.....	6-13
Figure 6-2.	Operations Interworking for PRA Transport over SONET-based IDLC.....	6-14
Figure 6-3.	Phase-Alignment of DS1 F Bit and Payload in VT1.5/Byte-Synchronous DS1 Mapping.....	6-15



## List of Tables

Table 3-1.	Extended Superframe Format Bit Assignments .....	3-33
Table 3-2.	Assigned Bit-Oriented ESF EOC Messages.....	3-34
Table 3-3.	Bit-Oriented ESF EOC Codewords Reserved For Future Standardization	3-36
Table 3-4.	DS1 ESF EOC - Performance Report Message - Example .....	3-37
Table 5-1.	Accumulation of Performance Monitoring Parameters During Failure Events/Conditions.....	5-30