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Switched Access Service Feature Group D

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1. Introduction

1.1. Overview

This Technical Reference (TR) describes Voice Grade (VG) Feature Group D (FGD) Switched Access Service (SAS) offered by the Ameritech Operation Companies (AOC) to their customers. This TR covers technical requirements, describes service features and defines valid interfaces.

Subscribes to SAS are Ameritech customers and include both Interexchange Carriers (ICs) and End Users (EUs). This document will differentiate the IC from the EU only when it becomes a technical necessity.

A customer requesting SAS in a Local Access and Transport Area (LATA) must establish one or more points within the LATA for connection of its facilities with those of the AOC. The AOC will provide SAS from its IntraLATA network to the customer's point of Termination (POT). A POT is a physical point where the access service terminates and the division of responsibility between the AOC and the customer occurs.

1.2. Purpose of This Document

This document is a companion document to Telcordia (formerly Bellcore) PUB TR-NWT-000334. The purpose of this document is to describe SAS FGD service and its use for the transport of Public Switched Digital Service (PSDS) or Integrated Services Digital Network (ISDN) traffic. This purpose is accomplished by providing transmission and interface technical details for this offering. Information and details for other Switched Access Services may be found in Telcordia (formerly Bellcore) PUB TR-NWT-000334 "Voice Grade Switched Access Service".

This document is not intended to provide specific ordering information, but is instead to be used as a technical aid and reference.

1.3. Applicability of Technical Specifications

The technical specifications presented in this document are applicable to FGD SAS only. Service installed prior to and after the effective date of the current issue of this technical reference will be maintained to the service specifications of the current issue.

2. Feature Group D (FGD)

2.1. Service Description

The LATA access for FGD provides a voice-transmission path, approximately 300 to 3000 Hz, between the POT and an End Office (EO) serving end users. LATA access is provided through trunk-side switching at a Stored Program Controlled (SPC) EO or Access Tandem (AT) switch.

Analog parameters are specified for FGD access from the POT to the EO. When routed via an AT, the transmission parameters of each segment are more stringent than those available for other feature groups or direct FGD access. Figure 1 illustrates these features. Note that the more stringent transmission type A1 parameters are provided on both the dedicated transmission path from the POT to the AT and on the common transmission path from the AT to the EO. Transmission type B1 is provided between the POT and the EO for FGD direct access.

FGD service terminating in the LATA has access to NXXs and miscellaneous services as well as other ICs' services, if they can be reached using NXX codes. Calls originating from the LATA reach the desired customer by the uniform access code of the form 10XXX. (When Carrier Identification Code-Expansion [CIC-E] becomes effective, the uniform access code will be in the form of 101XXXX.) No access code is needed if the end user"s telephone exchange service is arranged for presubscription. In this case, the number dialed by the end user shall be a 7- or 10-digit number for calls in the North American Numbering Plan (NANP) will prefix 0 or 1. For international calls outside the NANP, a 5- to 12-digit number may be dialed with prefix 01 or 011. In the terminating direction, FGD may not be switched to FGB, FGC, or FGD. (FGB and FGC are described in Telcordia (formerly Bellcore) TR-NWT-000334.)

2.2. FGD Configuration

The configuration used to derive the transmission path for FGD service from the POT directly to the EO are determined by the POT interface code requested by the IC, by the facilities used between the POT and the trunk-side termination at the EO, and by the supervisory signaling of that trunk termination. Direct FGD service between the POT and the EO is designed to meet transmission type B1.

The configurations used to derive the transmission path for FGD service from the POT to the AT are determined by the POT interface code (limited to interface codes applicable to transmission type A1), by the facility between the POT and the trunk termination at the AT, and by the supervisory signaling of that trunk termination. FGD between the POT and the AT is designed to meet transmission type A1. The overall performance of FGD service (i.e., POT-to-EO via an AT) must meet transmission type B1 specifications.

When FGD uses Common Channel Signaling/Signaling System 7 (CCS/SS7) signaling, no signaling will be done via the message channel. If Interface Group (IG) 6, 9, or 11 is specified with clear channel capability, FGD service may be used for the transport of "PSDS or ISDN Switched 56/64 Kbps Traffic" from suitably equipped digital offices. If the digital office is the AT, the EO and the common transmission path between the AT and the EO must also be digital.

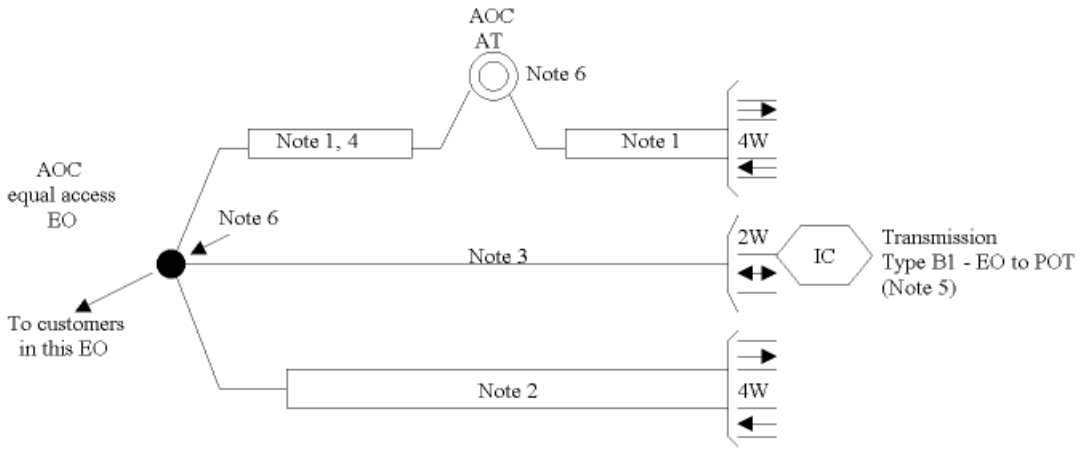
Trunk circuits between the POT and the AT must use trunk equipment capable of supporting transmission type A1 requirements regardless of the AT switch.

FGD tandem access is provided by means of one access tandem between any POT and EO. Interface group designations apply only to the configuration at the POT. Interface group 1 is offered only for direct FGD access to a 2-wire AOC EO. It is not available for direct access to a 4-wire AOC EO, i.e., a digital switch, or for FGD tandem access. The AOC facilities may be 2-wire or 4-wire, or both, but transmission is effective 2-wire and transmission B1 is applicable.

When interface groups 2, 6, 9 or 11 are used, the AOC facilities will be effective 4-wire. Transmission type B1 is applicable for direct POT to EO configurations. Transmission type A1 is applicable to both the POT to AT and AT to EO links of tandem access configurations.

The ACO will provide facilities and trunk terminations on the common transmission path between the AT and EOs which are capable of supporting transmission type A1. Transmission performance between the POT and EO via an AT will be equal to type B1 requirements for direct POT or EO configurations.

Figure 1. Feature Group D Service Configurations



3. Interface Code Availability By Interface Group For Feature Group D Services

The access-services connections-rate category provides for the capability and interface arrangements requested by the customer.

Access connections are provided in five separate interface groups. Each interface group provides a specified interface category (e.g., 2-wire, 4-wire, S1, etc.). Where transmission facilities permit, the individual transmission paths between the POT and the First Point of Switching (FPOS) may, at the option of the customer, be provided with optional features.

The POT interface code correlation to AOC switch supervisory signaling operation is classified into two categories by the entry in the column labeled “Availability.” These categories are defined as:

- S *(Standard)* - The standard combinations of POT interface code to AOC switch supervisory signaling operation are preferred for ease of fully automated design, maintenance, and/or administration. The POT interface code should be selected from these standard combinations where practical. They are currently available where AOC facilities permit, and they should be viewed as the longer-term replacement for transitional interface combinations (see below).

- T *(Transitional)* - The transitional combinations of POT interface code to AOC switch supervisory signaling operation will be available for new services where the standard interface combinations may be impractical due to existing equipment arrangements. Transitional combinations may have awkward operational or administrative characteristics that make them undesirable in a mature divested environment where fully autonomous design is the goal.

Table 1 lists the NCI codes available for interface groups 2, 6 and 9 with additional information defining the availability of each offering. The provision of some NCI codes generally requires placement of AOC equipment at the customer’s premises. (For E&M-type NCI codes, the placement of AOC equipment is required at the customer’s premises.) These codes are denoted with an asterisk (*).

Table 2 contains the set of DS codes that make up the digital high-capacity interface codes. Interface groups 6 and 9 are briefly described in Paragraphs 3.3 and 3.4.

Table 3 contains the set of FC codes that make up the optical high-capacity interface codes. Interface group 11 is briefly described in paragraph 3.5.

3.1. Interface Group 1

A. Interface group 1 provides 2-wire voice-frequency transmission and is terminated 2-wire at the POT. The interface is capable of transmission of voice and associated signals within the frequency bandwidth of approximately 300 to 3000 Hz. The transmission path between the customer POT and the FPOS may be composed of any configuration typically used in the telecommunications industry for

the transmission of voice and associated telephone signals within the frequency bandwidth of 300 to 3000 Hz.

B. Interface group 1 is not provided in association with FGD Access when the FPOS is an AT, or when the FPOS provides only 4-wire terminations.

C. The interface is ordinarily provided with a standard type of supervisory signaling and may also have an optional type. When the interface is associated with FGD Access, the standard signaling will be reverse-battery. The interface may, at the option of the customer, be provided with E&M lead supervisory signaling of DX supervisory signaling. Where this interface is associated with FGD Access, using Common Channel Signaling/Signaling System Seven (CCS/SS7), no signaling will be done via the message channel.

3.2. Interface Group 2

A. Interface group 2 provides 4-wire voice-frequency transmission at the POT. The interface is capable of transmission of voice and associated signals within the frequency bandwidth of approximately 300 to 3000 Hz. The transmission path between the POT and the FPOS may be comprised of any facility configuration typically used in the telecommunications industry for the transmission of voice and associated signals.

B. The interface is provided with a standard or optional type of supervisory signaling. When the interface is associated with FGD Access, the standard signaling will be reverse-battery. The interface may, at the option of the customer, be provided with SF supervisory signaling, E&M lead supervisory signaling, DX supervisory signaling, or tandem channel unit supervisory signaling. Where this interface is associated with FGD Access, using CCS/SS7, no signaling will be done via the message channel.

3.3. Interface Group 6

A. Interface group 6 provides DS1-level digital transmission at the POT. The interface is capable of transmitting electrical signals at a nominal 1.544 Mbps, with the capability to channelize up to 24 voice-frequency transmission paths.

B. The interface is provided with individual transmission path bit-stream supervisory signaling. However, Single Frequency (SF) supervisory signaling will be provided at the customer's request if the AOC is employing SF supervisory signaling over a part of the service between the POT and the AOC FPOS. Where this interface is

associated with FGD Access, using CCS/SS7, no signaling will be done via the message channel.

3.4. Interface Group 9

A. Interface group 9 provides DS3-level digital transmission at the POT. The interface is capable of transmitting electrical signals at a nominal 44.736 Mbps, with the capability to channelize up to 672 voice-frequency transmission paths.

B. The interface is provided with individual transmission path bit-stream supervisory signaling. However, SF supervisory signaling will be provided at the customer's request if the AOC is employing SF supervisory signaling over a part of the service between the POT and the AOC FPOS. Where this interface is associated with FGD Access, using CCS/SS7, no signaling will be done via the message channel.

3.5. Interface Group 11

A. Interface group 11 provides an optical interface. This interface is capable of transmitting asynchronous optical signals at multiples of the DS3 bit rate, either 12 or 24 DS3 equivalent channel capacities.

B. The interface is provided with individual transmission path bit-stream supervisory signaling. For Common Channel Signaling (CCS), see Section 4 following.

3.6. FGD Clear Channel Capability (CCC)

FGD Service equipped with CCS Signaling and the appropriate IG 6, 9, or 11 interface at the POT may be used for the transport of PSDS or ISDN Switched 64Kbps traffic between suitably equipped digital offices and the POT. If the digital office is an EO, then the AT and the common transport between the EO and the AT must also be digital.

The applicable NC codes for FGD CCC Service are:

- Transmission Type A1: SHSC
- Transmission Type B or B1: SDSC

Additional information on NC codes is available in Telcordia (formerly Bellcore) PUB SR-STS-000307, NC/NCI Code Dictionary Issue 2, December 1990.

3.7. Interface Codes 04DS(x)-(x)

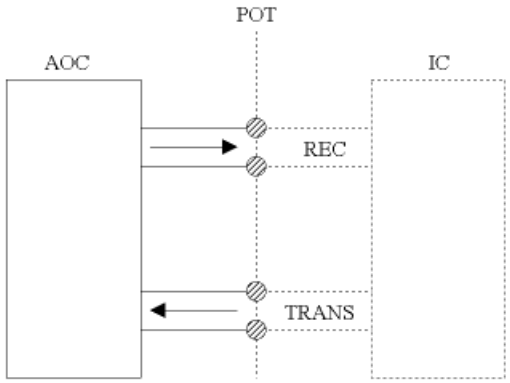
Description: Digital high-capacity interfaces

All interface codes with a DS protocol are digital high-capacity interfaces. Specifications for the high-capacity interfaces are provided in TA-TSY-000342, *High Capacity Digital Special Access Service - Transmission Parameter Limits and Interface Combinations.*

The digital high-capacity interface codes applicable to FGD are as follows:

- 04DS9-15
- 04DS9-15B
- 04DS9-15L
- 04DS9-15S
- 04DS9-1S
- 04DS9-44
- 04DS9-44L

Figure 2. Digital High-Capacity Interface



3.8. Interface Codes 02FCF-()

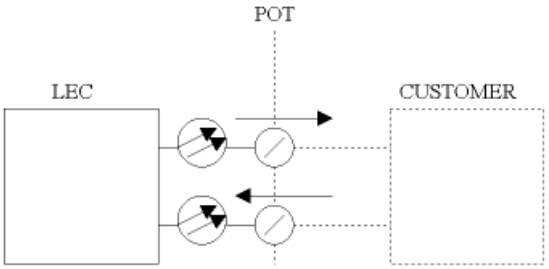
Description: Optical high-capacity interfaces

All interface codes with a FC protocol are optical high-capacity interfaces. A brief definition of these interfaces is given in Section 3.5 of this document.

The optical high-capacity interface codes are as follows:

- 02FCF-56
- 02FCF-12

Figure 3. Optical High-Capacity Interface



NOTE: Two fibers are required for full duplex operation.

Table 1
POT NCI Codes for SAS FG-D

Interface Group (Note 1)	AOC Switch Supervisory Signaling	POT NCI Code	Switched Access Service FGD	Availability (Note 2)
1	RV, EA, EB, EC	02DX3	X	T
	RV, EA, EB, EC	04EA3-E*	X	S
	RV, EA, EB, EC	04EA3-M*	X	S
	RV, EA, EB, EC	06EB3-E*#	X	S
	RV, EA, EB, EC	06EB3-M*#	X	S
	EA, EB, EC	06EC3*	X	T
	RV	02RV3-O	X	S
	RV	02RV3-T	X	S
	CCS	02NO2	X	S
2	RV, EA, EB, EC	04SF2	X	S
	EV, EA, EB, EC	04DX2	X	T
	RV, EA, EB, EC	06EA2-E*	X	S
	RV, EA, EB, EC	06EA2-M*	X	S
	RV, EA, EB, EC	08EB2-E*	X	S
	RV, EA, EB, EC	08EB2-M*	X	S
	EA, EB, EC	08EC2*	X	S
	RV	04RV2-O	X	S
	RV	04RV2-T	X	S
	CCS	04NO2	X	S
6	RV, EA, EB, EC	04DS9-15*	X	S
	RV, EA, EB, EC	04DS9-15B	X	S
	RV, EA, EB, EC	04DS9-15L*	X	S
	RV, EA, EB, EC	04DS9-15S	X	S
	RV, EA, EB, EC	04DS9-1S	X	S
	CCS	04DS9-15	X	S
	CCS	04DS9-15B	X	S
	CCS	04DS9-15S	X	S
	CCS	04DS69-1S	X	S
9	RV, EA, EB, EC	04DS6-44*	X	S
	RV, EA, EB, EC	04DS6-44L*	X	S
	CCS	04DS6-44†	X	S
11	LO, GO	02FCF-†	X	S
	RV, EA, EB, EC	02FCF-†	X	S
	CCS	02FCF-†	X	S

NOTES:

1. ISDN-related CCS provisioning of FGD is covered in TR-NWT-000938, "Network Transmission Interface and Performance Specifications Supporting Integrated Services Digital Network (ISDN)."

2. See Section 3 for definitions of:

   S = Standard
   T = Transitional

* AOC equipment is generally required at the POT. (When associated with E&M-type NCI codes. AOC equipment is required at the POT.)
\# A Customer request for an impedance code of 2 may be honored at the discretion of the AOC.
† See Table 3 for the various Protocol Options associated with the DS3 equivalents at the optical interface.

Table 2.
Digital High-Capacity Interfaces

Interface Group	Bit Rate Interface Code	Digital	Supervisory Hierarchy Level	Signaling Per Channel
6	04DS9-15	1.544 Mbps	DS-1	Bit Stream/CCS
	04DS9-15B	1.544 Mbps	DS-1	Bit Stream/CCS
	04DS9-15L	1.544 Mbps	DS-1	Single Frequency (SF)
	04DS0-15S	1.544 Mbps	DS-1	Bit Stream/CCS
	04DS9-1S	1.544 Mbps	DS-1	Bit Stream/CCS
9	04DS6-44	44.736 Mbps	DS-3	Bit Stream/CCS
	04DS6-44L	44.736 Mbps	DS-3	Single Frequency (SF)

NOTE: See Paragraph 4 for related information concerning Common Channel Signaling (CCS).

Table 3.
Optical High-Capacity Interface

Interface Group	Bit Rate Interface Code	Digital	Supervisory Hierarchy Level	Signaling Per Channel
11	02FCF-56	560/565 Mbps	12	Bit Stream/CCS
	02FCF-12	1.12 Gb/s	24	Bit Stream/CCS

4. Common Channel Signaling (CCS)

Where signaling is done via Common Channel Signaling/Signaling System Seven (CCS/SS7), the existing NCI code set is appropriate with the addition of 02NO2 for non-high capacity interfaces. As in the other cases (e.g, E&M, GS, etc.), the information identifying the type of channel signaling is coded into the Network Channel (NC) code. Unlike the other cases, CCS-related signaling is separated from the message channel and provided over the CCS network.

Among the Switched Area Services, CCS is also associated with 800 Database. NC codes for this and any other CCS supported services can be found in SR-ISD-000307, “NC/NCI Code Dictionary.”

5. Digital Trunk Acceptance Tests

This section introduces optional digital trunk acceptance test guidelines which may be performed in lieu of normal acceptance tests. These tests can be performed when SAS Feature Group D Access is ordered from the AOC and delivered via a digital switch, on digital facilities, and without digital to analog conversion on the AOC portion of the circuit. In cases where the IC has a D/A conversion, the final choice of tests shall rest with the IC.

Digital Acceptance Tests consist of the following:

A cooperative test of the digital transmission facility (as specified below) except in those cases where segments of the service between the AT and EO have existed and are in service.

A cooperative acceptance test of the digital transmission facilities provided with an order for SAS Feature Group D Access service consists of the following:

- One signaling/operational test per trunk.
- One 1004 Hz loss and one C-Notch Noise test per trunk group per digroup in both directions of transmission.
- Error Ratio (BER) test in each direction of transmission using compatible Quasi/Pseudo Random Signal Source.
  - Acceptable BER should be 10(7) or better for a period of five minutes.
  - The test should be made between the EC DSX, closest to the AOC digital service, and the first IC DSX. The test shall be performed at a mutually agreed upon time during normal business hours, and generally should be performed prior to facility turn-up for service.
  - If the DS-1 facility is connected to a DS-3/HC-3 service, in lieu of cooperative acceptance tests, the AOC will provide a loop-back at the DSX-1 closest to the AOC digital switch toward the MUX and notify the IC the loop-back is in place. The IC can verify the integrity of the DS-1 through the DS-3/HC-3. BER parameters apply.

These procedures are consistent with industry agreement stated in the Network Operations Forum Installation and Maintenance Responsibilities Document for Feature Groups B, C and D.

6. FGD Technical Characteristics

FGD service configuration are illustrated in Figure 1. FGD may be routed directly from the POT to an AOC AT or EO. This service is terminated on the trunk side of the AOC switch. Wink-start, start-pulsing, and answer-supervisory signaling are sent by the terminating office. Disconnect-supervisory signaling is sent from the originating or terminating office.

When the FGD uses CCS/SS7, no signaling will be done via the message channel.

The AOC will establish a trunk group or groups for the IC to EO or AT switches where FGD is requested. When technical limitations exist, a separate trunk group will be established for each FGD arrangement. Different types of FGD or other switching arrangements may be combined in a single trunk group at the option of the AOC.

Access codes for FGD have the form 10XXX (or101XXXX). An access code is not required for calls to an IC or FGD SAS, if the EU's telephone exchange service is arranged for presubscription to that IC; or if the exchange service location is an AOC public coin telephone, which is presubscribed to a provider of MTS or WATS. The number dialed by the EU will be a 7- or 10-digit number for calls in the NANP. For international calls outside the NANP, a 5- to 12-digit number may be dialed. Prefixes of 0 or 1 may be required before dialing the address number in the NANP. Prefixes of 00 or 011 are required before dialing the address number for calls outside the NANP.

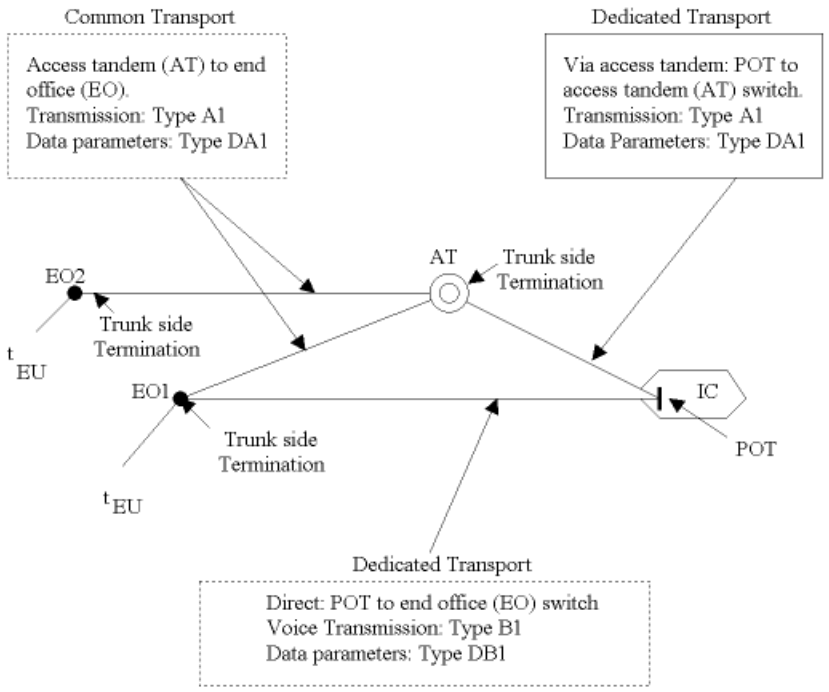
The IC may provide a WATS Dedicated Access Line (DAL) for use with FGD. A DAL provides a connection between a POT or a Centrex CO switch and a switch capable of screening WATS or similar services.

FGD is provided in the terminating direction, where equipment is available, with a 7-digit access to balance (100-type), milliwatt (102-type) test lines, a nonsynchronous or synchronous test line, an automatic transmission measuring (105-type) test line, a data transmission (107-type) test line, a loop-around test line, and short and open circuit test lines.

6.1. FGD Optional Features

See Telcordia (formerly Bellcore) Technical Reference TR-NPL-000258, *Compatibility Information for Feature Group D Switched Access Service,* October 1985 for details on FGD optional features.

Figure 4. Feature Group D Illustration



6.2. FGD Illustrative Applications

FGD is provided from an IC POT by a direct or AT connection to an EO as shown in Figure 4. The direct POT-to-EO configuration terminates on the trunk side of the AOC EO. The POT-to-AT configuration terminates on the trunk side of the AT switch.

FGD provides a voiceband channel between the POT and the EO. FGD segments have two types of voiceband transmission. Transmission type B1 uses a 2-wire interface at the POT with a 2-wire termination at the directly connected EO, a 4-wire interface at the POT with a 2- or 4-wire termination at the EO, and is only applicable for direct POT-EO configurations. Transmission type A1 uses a 4-wire interface at the POT and the AT. If the AT is an analog switch, a 4-wire trunk termination is used. The facility between the AT and EO also uses transmission type A1. Transmission type A1 has more stringent limits than any other transmission type.

FG-D - CCC may be used for the transport of switched digital data (PSDS-56 and ISDN 56/64) between a digital EO and the POT or a digital AT and the POT.

FGD provides SAS equal access for all ICs.

6.3. FGD Transmission Parameter Limits

The transmission objectives for FGD equal access service conform to a fixed loss plan for the switched network. FGD access is designed to provide equal transmission performance (as perceived by the EU) between the POT and the AOC EO, whether routed directly or via an AT.

Figure 4 illustrates the FGD equal access transmission plan. The overall AOC-switch-to-IC-switch loss objectives depend on the loss of both the IC-switch-to-POT and the AOC-switch-to-POT segments of the trunk. FGD segments are provided with either transmission type A1 or B1 performance as follows:

- When routed directly to the EO, transmission type B1 is provided.
- When routed to an AT, only transmission type A1 is provided for both the POT-to-AT and AT-to-EO trunks.

Overall POT to EO requirements for FGD provide transmission type B1 performance whether routed directly or via an AT.

Transmission type B1 performance is provided via interface groups 1, 2, 6, 9 and 11. Transmission type A1 performance uses interface groups 2, 6, 9 and 11.

The Modification of Final Judgement (MFJ) requires the AOC to provide an equal access plan to all ICs. Equal transmission will be achieved when trunks are designed as specified in Table 4. The requirements for loss apply between the EO and IC switch, for both direct trunks and connections via access tandem. This goes beyond exchange access which is only the segment between the EO and the POT. Achievement of the desired loss requires AOC/IC cooperation. Compliance with the loss requirements is achieved by provision of the proper levels at the EO and POT.

The design loss is given in Table 4, except as stated in Notes 1 and 2. It is assumed that access tandems are designated as digital or an analog TP2 (i.e., -2 TLP at the switch center). The requirements are independent of routing and the facility type(s) in the connection.

For tandem access, there is an alternate design loss (IC option) for arrangements in which the trunks between the access tandem and the IC switch have a digital POT and interface with the switches as follows:

- digitally with a digital IC switch and at VF with an analog TP2 access tandem
- at VF with an analog TP0 IC switch and at VF with an analog TP2 access tandem
- at VF with an analog TP2 IC switch and digitally with a digital access tandem

The alternative design loss for these arrangements is given in Table 5, except as stated in Notes 1 and 2.

The result of these exceptions and the alternate designs in the tables is a range of acceptable loss values for exchange access. The plan embodied in these requirements achieves a total loss for the combined access and egress links (EO to IC switch + IC switch to EO) of nominally 6 dB, ranging from a low to 4 dB for the case of an analog combined AT/EO at each end or the case of cable with 2-dB loss at each end, to a high of 10 dB for the case of an alternate-design trunk at each end and cable with 4-dB loss at each end. For each design case of Table 4 and Table 5, the access line (loop) interface is assumed to be analog. If the EO is a digital switch, the specified loss includes the effects of encode/decode operations.

Table 4.
FGD Design Loss in dB Between EO Access Line (Loop) Interface (Analog) and Center of IC Switch

IC Switch Type	EO to IC	IC to EO	Notes
Digital	0	6	1, 2
Analog (TP0)	0	6	1, 2
Analog (TP2)	3	3	1, 2

The following notes give exceptions to the basic requirements of Table 4.

NOTES:

1. If a cable facility without gain is used in the access connection, the loss can vary by ± 1 dB.

2. If the EO is at an analog combined AT/EO, the loss in each direction is 1-dB less. The 4-wire interface at the analog AT should consist of a 4-wire trunk circuit with an inter-processor trunk, a 2.0 -dB switched pad, or the equivalent.

Table 5
FGD Alternate Design Loss in dB Between EO Access Line (Loop) Interface (Analog) and Center of IC Switch for Tandem Access Using the Applicable Arrangements

IC Switch Type	EO to IC	IC to EO	Notes
Digital	1	7	1, 2
Analog (TP0)	1	7	1, 2
Analog (TP2)	4	4	1

NOTES:

1. If a cable facility without gain is used in the access connection, the loss can vary by ± 1 dB.

2. If the EO is at an analog combined AT/EO, the loss in each direction is 1-dB less. The 4-wire interface at the analog AT should consist of a 4-wire trunk circuit with an inter-processor trunk, a 2.0 -dB switched pad, or the equivalent.

The fixed-loss plan assigns a loss to the entire connection (EU to EU) and this loss is inserted at the receiving end office. The actual requirements, as indicated in this document, are in the form of TLPs at the POT and the AOC switch, which are compatible with equal access transmission design.

Transmission levels at the POT will depend on the interface selected by the IC. Tables 11, 12 and 13 specify the TLPs for equal access-type trunks.

Below is a list of tables that address FGD transmission parameter limits.

Parameter	Tables
Loss deviation, attenuation distortion, And echo control	6
Message circuit noise	7
C-notched noise	8
Data	9

Table 6
FGD Loss Deviation, Attenuation Distortion,
and Echo Control Limits

Voice Transmission Parameters	Type A1 4-Wire Transmission at POT Interface				Type B1 4-Wire Transmission at POT Interface			
	AL		IAL		AL		IAL	
	Digital	Analog	Digital	Analog	Digital	Analog	Digital	Analog
Loss deviation from EML at 004 Hz (dB) (Note 7)	± 0.7	± 0.7	± 1.5	± 2.0	± 0.7	± 0.7	± 2.0	± 2.5
Attenuation distortion (dB) (Notes 1, 2, 3 and 8) 404 and 2804 Hz	-0.5 to + 1.5	-1.0 to + 2.5	-1.0 to + 2.0	-1.5 to + 3.0	-1.0 to + 2.0	-1.5 to + 3.5	-1.5 to + 2.5	-2.0 to + 4.0
Echo control (Notes 4, 5, 6 and 9) (a) Measures at the POT to EO (Direct): ERL	NA	NA	NA	NA	21	21	16	16
SRL	NA	NA	NA	NA	14	14	11	11
(b) Measured at the POT to AT: ERL	27	27	25	25	NA	NA	NA	NA
SRL	20	20	18	18	NA	NA	NA	NA
(c) Measure at the POT to EO (via the AT): ERL	21	21	16	16	NA	NA	NA	NA
SRL	14	14	11	11	NA	NA	NA	NA

AL = Acceptance Limit
IAL = Immediate Action Limit
ERL = Echo Return Loss
SRL = Singing Return Loss
NA = Not applicable

NOTES:

1. Loss deviation at 404 Hz and 2804 Hz relative to the AML at 1004 Hz. The “+” means more loss and the “-” means less than at the reference frequency.

2. In the case of analog facilities POT-EO, when the POT is an interface with SF signaling, an IAL of -1.0 to + 3.5 dB, and an AL of -1.0 to + 2.5 dB apply between the AOC's SF unit, and the POT.

3. In the case of analog facilities POT-AT, when the POT is an interface with SF signaling, an IAL of -1.0 to + 3.0 dB, and an AL of -0.5 to + 2.5 dB apply between the AOC's SF unit, and the POT.

4. Echo control is specified in dB as return loss at 2-wire interfaces and as Equal Level Echo Path Loss (ELEPL) at 4-wire interfaces.

5. Both the low-band and high-band test must meet the SRL limits specified.

6. Measured only if the AT and/or EO is a 2-wire switch.

7. In the case of POT 2-wire transmission interface, the acceptance limits for loss deviation are ± 0.7 with gain and ± 1.2 without gain. The IAL is ± 2.0 dB for digital facilities and ± 2.5 for analog facilities.

8. In the case of POT 2-wire transmission interface, the acceptance limit for attenuation distortion is -1.5 to + 5.0, and the IAL is -2.0 to + 5.5 for analog facilities. The AL is -1.0 to + 2.0 and the IAL is -1.5 to + 2.5 for digital.

9. In the case of POT 2-wire transmission interface, acceptance limits are 18 dB for ERL and 10 dB for SRL. The IALs are 13 dB for ERL and 6 dB for SRL.

Table 7
C-Message Noise Limits and Feature Group D (See Notes 1,2)

Mileage Limits	Transmission Type A1		Transmission Type B1	
	Digital	Analog	Digital	Analog
IAL				
0 to 50	28	33	30	34
51 to 100	28	35	30	36
101 to 200	28	37	30	38
201 to 400	28	40	30	41
➢ 400	28	42	30	43
AL				
0 to 50	26	30	28	31
51 to 100	26	32	28	33
100 to 200	26	34	28	35
201 to 400	26	37	28	38
> 400	26	39	28	40

All Limits in dBrnC0

NOTES:

1. For analog channels derived from cable facilities only or from digital facilities with cable extensions, the limits are the same as the digital limits if the cable is 15 miles or less; add 3 dB if the cable is longer than 15 miles.

2. For a digital EO using digital loss, add 1 dB to the digital acceptance limits for the terminal (POT-to-EO) direction.

Table 8.
C-Notched Noise - Limits for Feature Group D (Measured with - 16dBm0 Holding Tone Applied)

Limits	Transmission Type A1		Transmission Type B1	
	Digital	Analog	Digital	Analog
IAL	40	45	42	47
AL	39	41	41	43

All Limits in dBrnC0

NOTES:

1. C-notched noise measurements are not required for analog noncompandored facility combinations.

2. In the case of digital EOs using digital loss, 2 dB should be added to the limit values for digital facilities, while 1 dB should be added for analog facilities.

3. For analog channels derived from digital facilities with cable extensions, the limits are the same as the digital limits.

4. Limits apply to all facility lengths.

Table 9
FGD Data Transmission Limits

Data Transmission Parameters	Data Type DA1				Data Type DB1				POT-EO
	IAL		RL		IAL		RL		
	Digital	Analog	Digital	Analog	Digital	Analog	Digital	Analog	SAL (Note 6)
Signal to C-notched noise ratio (Notes 1, 2, 3)	34dB	30.5 dB	35 dB	34.5 dB	32 dB	28.5 dB	33 dB	32.5 dB	31 dB
Envelope delay distortion (Note 4)									
(a) 604 Hz	400 µs	1200 µs	350 µs	1050 µs	720 µs	1450 µs	600 µs	1300 µs	1500 µs
(b) 2804 Hz	210 µs	800 µs	195 µs	590 µs	400 µs	1100 µs	350 µs	800 µs	1000 µs
Intermodulation distortion									
(a) Second order (R2)	46 dB	34 dB	52 dB	38 dB	RFS	33 dB	42 dB	37 dB	40 dB
(b) Third order (R3)	50 dB	32 dB	52 dB	52 dB	RFS	31 dB	42 dB	34 dB	40 dB
Amplitude Jitter									
(a) 4Hz to 300 Hz	3.9%	6.4%	2.9%	3.4%	5.8%	8.9%	3.8%	4.7%	6%
(b) 20 Hz to 300 Hz	3.3%	4.6%	2.7%	2.5%	4.7%	4.7%	3.4%	3.6%	5%
Phase Jitter									
(a) 4 Hz to 300 Hz	2.7° p-p	11.0° p-p	1.8° p-p	10.0° p-p	4.4° p-p	14.4° p-p	3.0° p-p	11.0° p-p	10° p-p
(b) 20 Hz to 300 Hz	2.5° p-p	7.0° p-p	1.5° p-p	5.8° p-p	3.4° p-p	7.7° p-p	2.5° p-p	6.1° p-p	6.5° p-p
Frequency shift, impulse noise, phase hits, gain hits and dropouts.	RFS	RFS	RFS	RFS	RFS	RFS	RFS	RFS	RFS

RL = Restoral Limit
SAL = Service Affecting Limit
IAL = Immediate Action Limit
RFS = Requires Further Study

NOTES:

1. Using a -13dBm0 1004 Hz holding tone.

2. In the case of measurements with digital losses in the test path, reduce digital values by 2 dB, analog IAL by 0.5 dB, and analog RL by 1.5 dB.

3. For analog channels derived from digital facilities with cable extensions of one mile or less, the limits are the same as the digital limits.

4. These measurements reflect the minimums relative to EDD at 1704 Hz and 1804 Hz.

5. Specifications unavailable. See Telcordia (formerly Bellcore) Publication TR-NWT-000334, Issue 2, September 1990.

6. In some cases, Service Affected Limits (SAL) are more restrictive than the associated RL and IAL values. The AOCs are committed only to providing performance according to the RL and IAL values shown.

7. FGD Interface Code Availability

Table 10 lists the available interface codes for FGD services. The codes S and T in the "Availability" column indicates the offering as standard or transitional as defined in Section 3.

Table 10
FGD POT Interface Code Combinations

AOC Switch Supervisory Signaling	POT Interface Codes	Availability
Loop reverse battery (RV)	*02RV3-T, *02RV3-O, *04EA3-M, 04DA, *04EA3-E, *06EB3-M, *06EB3-E, *04RV2-T, *04RV2-O, *06EA2-M, *06EA2-E, *08EB2-M, *08EB2-E, **04SF2, 08EC2, 02FCF	S
	04DX2†, 02DX3†,	T
E&M	#04EA3-M, #04EA3-E, 06EB3-M, 06EB3-E, 06EA2-M, 06EA2-E, 08EB2-M, 08EB2-E, 04DS, **04SF2, 08EC2, 04AH, 02FCF	S
	02DX3, 04DX2, 06EC3	T
CCS	02N02, 04N02, 04DS, 02FCF	S

* When the AOC utilizes carrier facilities, E&M lead supervisory signaling will generally be the standard signaling at the POT (with SF or DX as alternatives).

† Only available when the AOC utilizes carrier facilities.

An IC request for an impedance code of 2 may be honored at the discretion of the AOC.

** Where AOC facilities are available.

7.1. FGD Transmission Level Points (TLPs) and Interface Codes

Tables 11 and 12 list TLPs at the AOC switch and at the POT for FGD circuits. Table 13 shows the digital signal and corresponding interface code at the POT.

Table 11
FGD TLPs at the AOC Switch

Access Arrangement	Transmission Type	AOC TLP (Measured at Switch Test Position)		Notes
		Trans	Rec	
Digital Direct	B1	0	-6	1, 7
Analog Direct	B1	0	-6	1-6, 10
Digital Access Tandem	A1	0	-6	1, 7
Analog Access Tandem	A1	0	-5	8, 9, 10

NOTES:

1. A receive TLP of -5 dB may be provided when specified if the IC switch has a 2-dB test pad value.

2. For POT 2-wire transmission interface without gain, transmit TLP [TLP(t)] is 0, and TLP(R) is -4 to -7. See Notes 4 and 5.

3. For POT 2-wire transmission interface with gain, transmit TLP [TLP(T)] is 0, and TLP(R) is -6. See Notes 1, 4 and 6.

4. The IC does not specify receive TLPs for POT 2-wire transmission interface. They are determined by the POT transmit TLP and the AOC circuit loss.

5. The receive TLP at the AOC switch for POT 2-wire transmission interface without gain is equivalent to the POT transmit TLP minus 2 to 4 dB.

6. The receive TLP at the ACO switch for POT 2-wire transmission interface with gain is equivalent to the POT transmit TLP minus 3 dB.

7. In a digital switch, the signal at the switch reference point is equivalent to DRS.

8. The transmit TLP at the switch reference point is -2 dB. The receive TLP at the switch reference point is 2 dB more positive than at the test position.

9. A receive TLP of -4 dB will be provided when specified if the IC switch has a 2 -dB test pad value. A receive TLP of -6 dB may be provided for a 1 -dB ICL combination trunk (IC switch is digital).

10. When the IC is in the position of having an analog TP0 switch, the receive TLP at the analog AOC switch will be determined by discussions with the AOC.

Table 12.
FGD TLPs and Interface Codes at the POT

Transmission Type	TLP at POT		Interface Codes	Notes
	Rec	Trans		
A1, B1	-2 to –6 [4]	+5 to –3 [0]	04SF2, 04RV2-T, 04NO2 04RV2-O, 04DX2	1
	-16	+7	04SF2	5
	+7	-16	04SF2	6
	-16	+7	08EB2-E, 06EA2-E	2, 4
	+7	-16	08EB2-M, 06EA2-M, 08EC2	2, 4
	-16 to + 7 [-16]	-16 to + 7 [+7]	08EB2-E, 08EB2-M, 06EA2-E, 06EA2-M, 08EC2, 04NO2	3, 4
B1, 2-wire w/o gain	-2 to –4	-3	02DX3, 04EA3-E, 02NO2, 06EC3, 04EA3-M, 06EB3-E, 06EB3-M, 02RV3-O, 02RV3-T	7, 8, 9
B, 2-wire w/gain	-3	-3	02DX3, 04EA3-E, 06EC3, 06EB3-M, 02RV3-O, 02RV3-T, 06EA3-M, 06EB3-E	7, 8, 9

[ ] Denotes recommended TLP

NOTES:

1. The AOC may not be able to provide the entire range of TLPs shown due to crosstalk and/or equivalent limitations.

2. These +7 and -16 TLPs are nominal values; the ranges of TLPs implemented will be +6 to +7 and -15 to -16, respectively. The specific TLPs within these ranges will be de-

termined by the E-lead originate entity (IC or AOC). The deviation from the nominal TLP values should be minimized. The deviation is provided to accommodate wiring losses between the POT and the transmission equipment.

3. This wider range of TLPs is only available with AOC concurrence.

4. To achieve these TLPs, AOC equipment is required at the POT.

5. Applicable only where the AOC SF (i.e., E, F, G signaling and T-CXR SF channel units) equipment is provided at the IC POT.

6. Applicable only where the AOC carrier system is terminated at the POT. This excludes T-CxR equipped with SF channel units at the POT (see note 5).

7. The IC does not specify receive TLPs for POT 2-wire transmission interfaces. They are determined by the AOC circuit loss.

8. A -2 dB transmit TLP may be specified if the IC switch has a 2-dB test pad value.

9. When the IC is the position of having an analog TP0 switch, the transmit TLP at the POT will be determined by discussions with the AOC.

Table 13.
FGD Digital Signal and Interface Code at the POT

Transmission Type	Interface Code	Digital Signal at POT (Note 1)	
		Rec	Trans
A1, B1	04DS*	DRS	DRS
A1 (Note 2)	04DS*	DRS + 1	DRS
A1 (Note 3)	04DS*	DRS	DRS + 1

NOTES:

1. For combination trunks, the receive signal at the POT will be DRS + 1 when the IC switch is digital, and the transmit signal will be DRS + 1 when the IC has an analog TP2 switch.

2. For combination trunk with ICL=0, AT is analog, IC is digital.

3. For combination trunk with ICL=0, AT is digital, IC is analog.

* See Table 2 for available Digital High Capacity Interface codes.

8. Glossary

Acceptance (Cooperative) Tests

Those tests performed by the Ameritech Operating Company (AOC) in cooperation with the customer are a prenegotiated time to establish new or additional access services.

Acceptance Limit (AL)

The maximum value of, or deviation from, a design parameter that is allowed at service turnup or customer acceptance.

Access Code

See carrier access code.

Access Tandem (AT)

The AOC switching system that provides a concentration and distribution function for originating/terminating traffic between an end office and an IC POT.

Ameritech Operating Company

The regulated entity providing Voice Grade Switched Access Service and supporting the proposed generic requirements offered in this Technical Reference.

Attenuation Distortion

The change in attenuation with frequency relative to the attenuation at a reference frequency; the reference frequency is 1004 Hz unless otherwise specified. Attenuation distortion is controlled either at specified frequencies, or throughout a frequency band. (See also Slope).

Automatic Number Identification (ANI)

The provision of the billing number associated with the line from which the call attempt originated.

Balance (100-Type) Test Line

An arrangement of a central office that provides for balance and noise testing.

C-Message Noise

The frequency-weighted, short-term average noise within an idle channel. The frequency weighting, called C-message, is used to account for the variations in 500-type telephone set transducer efficiency and user annoyance, to tones as a function of frequency.

C-Notched Noise

The C-message, frequency-weighted noise on a channel with a holding tone, which is removed at the measuring end through a notch (very narrow-band) filter.

CCC

Clear Channel Capability.

CCS

An out-of-band common channel signaling system transported over a packet switching network independent of the network used for message traffic.

Call

The sequence of events begun when an end user makes a request for service and provides an address code, and concluded when communication between the end users are terminated.

Call Attempt

An end-user attempt for which the complete address code (e.g., 0-, 911, IOXXX_NPA_NXX_XXXX) is provided to the servicing dial-tone office.

Carrier

See Interexchange Carrier or Customer.

Carrier Access Code

This is the uniform code assigned to an individual IC. It has the form of 10XXX but will be expanded to 101XXXX with the implementation of FG-D CIC expansion.

Central Office (CO)

A local switching system (or a portion thereof) and its associated equipment located at a wire center.

Central Office Code (also Central Office Prefix)

The first three digits of the seven-digit telephone number assigned to an end user.

Centralized Automatic Reporting on Trunks (CAROT) Testing

A type of testing that includes the capacity for measuring operational and transmission parameters.

Channel

An electrical or photonic, in the case of fiber optic-based transmission systems, communications path between two or more points of termination.

Channelize

The process of multiplexing-demultiplexing voice-bandwidth channels using analog or digital techniques.

Combination Trunk

A trunk that interfaces at VF with a switching system at one end, uses digital-transmission facilities, and interfaces digitally with a digital-switching system at the other end.

Common Line

A line, trunk, pay telephone line, or other facility provided under the general and/or local exchange service tariffs of the AOC, and terminated on a local switching system, that may be used to make and/or receive exchange service calls, IntraLATA message service calls, InterLATA message service calls, or international calls.

Customer

Denotes any individual, partnership, association, joint-stock company, trust, corporation, or governmental entity or any other entity that subscribes to the services described in this document including both Interexchange Carriers and end users.

dBm

A unit for expression of power level in decibels relative to one milliwatt.

dBrn

A unit used to express noise power relative to one picowatt (-90 dBm).

dBrnc

Noise power in dBrm, measured with C-message weighting.

dBrnc0

Noise power in dBrmc referred to or measured at a zero transmission level point (0 TLP).

Data Transmission (107-Type) Test Line

An arrangement that provides for a connection to a signal source providing test signals for 1-way testing of data and voice transmission parameters.

Decibel (dB)

The logarithmic unit of signal power ratio most commonly used in telephony. It is used to express the relationship between two signal powers, usually between two acoustic, electric, or optical signals; it is equal to ten times the common logarithm of the ratio of the two signal powers.

Deviation

The departure from a standard or specified value.

Dialed Number Identification Service (DNIS)

An optional feature offered for Dedicated Access Line (DALs) that enables trunk-side termination of the DAL and includes 4-digit outpulsing of an identification number to the end user. This 4-digit outpulsing allows an end user having a single service group, with multiple 800 numbers, to identify which 800 number was dialed.

Digital Reference Signal (DRS)

The digital representation of a 0-dBm analog signal with a frequency in the range of 1004 to 1020 Hz. This is an interim definition until a standard is developed.

Dual-Tone Multifrequency Signaling (DTMF)

A signaling method that employs signals consisting of two sinusoidal voice-frequency components, one from a group of four low frequencies and the other from a group of four high frequencies.

Echo Control

The control of reflected signals in a telephone channel.

Echo Path Loss (EPL)

Ten times the common logarithm of the ratio of the power of the incident signal to the power of the reflected signal, expressed in decibels. If the signal powers are expressed in decibels relative to a reference power, e.g., dBm, the echo path loss in decibels is the difference between the incident and reflected signal powers.

Echo Return Loss (ERL)

A frequency-weighted measure of return loss over the middle of the voiceband (approximately 560 to 1965 Hz), where talker echo is most annoying (See Table 9 of IEEE Std. 743-1984.)

Effective 2-Wire

Effective 2-wire channels for switched access service will have 2-wire interfaces at both the POT and the AOC switch. The effective 2-wire channel may be an actual 2-wire facility, such as a 2-wire metallic loop, or it may contain a 4-wire facility section such as a carrier system with a 2-wire metalic extension. An effective 2-wire channel will contain at least one 2-wire segment

and its expected performance will be that of a 2-wire channel. With effective 2-wire transmission, the channel may allow simultaneous transmission in both directions, but it is not possible to ensure the independent transmission of information simultaneously in both directions.

Effective 4-Wire

Effective 4-wire channels may be terminated with a 2-wire interface at the AOC switch, but there must be a 4-wire interface at the POT. An effective 4-wire channel is composed of all 4-wire facilities with no intermediate 2-wire segments. Its expected performance will be that of a 4-wire channel. Effective 4-wire transmission allows simultaneous transmission of information in both directions over the channel; however, when terminated 2-wire, it is not possible to ensure the independent transmission of information simultaneously in both directions. The method of implementing effective 4-wire transmission (physical, time domain separation or frequency domain separation) is at the discretion of the AOC.

End Office (EO)

A destination of a switching system that occupies the lowest level of the public switched network hierarchy. It is the designation of a switching system that connects lines to lines to trunks (a local switching system).

End User (EU)

Any individual, partnership, association, corporation, government agency, or any other entity that (a) obtains a common line or uses a pay telephone in the operating territory of the AOC or (b) subscribes to services provided by an IC or uses the services of an IC when the IC provides service (s) for its own use.

Entry Switch

See First Point of Switching.

Envelope Delay Distortion (EDD)

A measure of the linearity of the phase-versus-frequency characteristic of a channel.

Equal Level Echo Path Loss (ELEPL)

The measure of echo path loss at a 4-wire interface that is corrected by the difference between the transmit and receive TLPs.

ELEPL = EPL-TPL(transmit) + TLP(receive)

Exchange

A unit established by the AOC for the administration of communications service in a specified geographic area that usually embraces a city, town, or village and its environs.

Expected Measured Loss (EML)

The calculated value of the 1004-Hz loss that one would expect to measure between two specified test points with the proper terminating impedances. It is the sum of the customer and test access loss including any test pads.

Facilities

Any cable, poles, conduit, microwave, or carrier equipment, wire center distributing frames, central office switching equipment, computers (both hardware and software), business machines, etc., utilized to provide (1) the services offered by the AOC, or (2) the services provided by an IC for its own use or for an end user's use.

Feature Group (FG)

A Feature Group defines for Switched Access Service the type of connection to an AOC switching system (i.e., line side or trunk side) and the access calling pattern (e.g., 950-0XXX, 950-1XXX, 10XXX, NXX-XXXX).

First Point of Switching (FPOS)

The first AOC location of which switching occurs on the terminating path of a call proceeding from the POT to the terminating end office and, at the same time, the last AOC location at which switching occurs on the originating path of a call proceeding from the originating end office to the POT.

Frequency Shift

The difference between the frequency of a signal applied at the input of a channel and the frequency of that signal at the output of the channel.

Gain/Frequency Characteristic

The gain-versus-frequency characteristic of the channel over the bandwidth provided.

IC Terminal Location

See Point of Termination (POT)

Immediate Action Limit (IAL)

The bound of acceptable performance and the threshold beyond which the AOC will accept a customer's trouble report and take immediate corrective action.

Impedance Balance

A measure of the degree of equality of the two impedances that are connected to the two conjugate port of a hybrid set (or equivalent circuit). It can be determined from the equation given for return loss, and requirements are usually expressed as a minimum ERL and a minimum SRL. Measurements must be performed in a manner that takes into account the gains and/or losses of the 4-wire portion of the circuit, including the hybrid.

Impulse Noise

Any momentary occurrence of noise on a channel significantly exceeding the normal noise peaks. It is evaluated by counting the number of occurrences that exceed a threshold.

Inserted Connection Loss (ICL)

The 1004-Hz loss between defined points (such as outgoing switch appearances) inserted by switching a circuit into an actual operating condition.

Interface Code

A four-part code that describes the interface between the AOC and the customer. It identifies the number of conductors at the interface, the protocol code, the nominal impedance, and a protocol option.

Interexchange Carrier (IC) or Interexchange Common Carrier

Any individual, partnership, association, joint-stock company, trust, governmental entity, or corporation engaged for hire in interstate or foreign communication by wire or radio, between two or more exchanges.

Intermodulation Distortion

A measure of the nonlinearity of a channel. It is measured using four tones, and analyzing the ratios (in decibels) of the transmitted composite 4-tone signal power to the second-order (R2) products of the tones, and the third-order (R3) products of the tones.

ISDN (Integrated Services Digital Network)

ISDN is a network in which the same digital switches and digital paths are used to establish connections for different services, i.e., telephony, data.

Kbps

Kilobits per second.

Local Access and Transport Area (LATA)

A geographic area established by the AOC for the provision and administration of communications service. It encompasses designated exchanges that are grouped to service common social, economic, and other purposes.

Local Switching System

A switching system that connects lines to lines, and lines to trunks. It may be located entirely at one wire center, or may be geographically dispersed as in some host-remote configurations.

Local Tandem Switch

An AOC switching system by which local and/or LATA access calls are switched to and from an end office.

Loop-Around Test Line

An arrangement in a central office that provides a means for making 2-way transmission tests on a manual basis. This arrangement has two terminations, each reached by means of separate 7-digit numbers.

Loss Deviation

The departure of the actual loss from the designed value.

Mbps

Megabits per second.

Milliwatt (102-Type) Test Line

An arrangement in a central office that provides a 1004-Hz tone at 0 dBm0 for 1-way transmission measurements.

Multifrequency (MF) Signaling

A signaling method in which a combination of two out of six voiceband frequencies are used to represent a digit or a control signal.

Multiplex

a techniques to use a signal transmission channel to provide several transmission channels, such as by sharing the time of the channel (time-division multiplexing) or superimposing many frequencies at the same time (frequency-division multiplexing) in order that many signal sources and sinks may communicate during a given time period.

Network Channel Interface (NCI) Code

See Interface Code.

Network Control Signaling

The transmission of signals used in the telecommunications system that perform functions such as supervision (control, status, and charge signals), address signaling (e.g., dialing), calling and called number identifications, rate of flow, service selection, error control, and audible tone signals (call-progress signals indicating reorder or busy conditions, alerting, coin denominations, coin collect and coin return tones) to control the operation of the telecommunications system.

Nonsynchronous Test Line

An arrangement in step-by-step central offices that provides operational tests that are not as complete as those provided by the synchronous test lines, but can be made more rapidly.

North American Numbering Plan (NANP)

A 3-digit area code or Numbering Plan Area (NPA) code and a 7-digit telephone number made up of a 3-digit central office code plus a 4-digit station number.

Off-hook

The supervisory state indicative of the active (in-use) condition.

On-hook

The supervisory state indicative of the idle condition.

Open-Circuit Test Line

An arrangement in a central office that provides an ac open-circuit termination of a trunk or line by means of an inductor of several henries.

Phase Jitter

The unwanted phase variations of a signal.

Point of Termination (POT)

The point of demarcation within a customer-designated premises at which the AOCs responsibility for the provision of access service ends.

Premises

Denotes a building or portion(s) of a building occupied by a single customer or end user either as a place of business or residence. Adjacent buildings and the buildings on the same continuous property occupied by the customer not separated by a public thoroughfare, are also considered the customer's premises.

Presubscription

An AOC service that permits each EU served from an equal access end office switching system to route automatically, without the use of access codes, all the EU's interLATA calls to one IC of the EU's choice. The EU may also gain access to other ICs by using appropriate access code (e.g., 10XXX).

Protocol Code

A component of an interface code that is readily associated with the basic electrical function of the interface.

Restoral Limit (RL)

The bound on performance that is allowed when corrective action is taken to restore a parameter after an IAL feature. Performance as measured by a parameter is satisfactory if the value of the parameter is equal to or better than the limit.

Return Loss

A measure of the similarity between the two impedances at a junction. The higher the return loss, the higher the similarity. It is the ratio (in decibels) of the power incident upon the junction to the power reflected from the junction. If the two impedances at the junction are *Z(1)* and *Z(2)*, return loss =

$$20 \log_{10} \left| \frac{Z_1 + Z_2}{Z_1 - Z_2} \right| \text{ dB.}$$

Service Affecting Limit (SAL)

A parameter value consistent with minimum service objectives that are necessary to support high-speed modems. When any parameter value exceeds the SAL, voiceband data performance may be adversely affected, depending on the performance of the remainder of the connection.

Service Terminating Arrangement

Equipment furnished by the AOC that is utilized for the termination of AOC-provided access service. This equipment provides a clearly delineated interface that facilities the design, isolation, and testing of the access service where the service is connected with customer-provided communications systems.

Seven-Digit Manual Test Line

An arrangement that enables the customer to select balance, milliwatt and synchronous test lines by manually dialing a seven-digit number over the associated access connection.

Short-Circuit Test Line

An arrangement in a central office that provides for an ac short-circuit termination of a trunk or line by means of a capacitor of at least four microfarads.

Signal-to-C Notched Noise Ratio

The ratio, in decibels, of a test signal to the corresponding C-notched noise.

Signal-to-Noise Ratio (S/N Ratio)

The ratio of the signal power to the noise power at a given point in a given system (usually expressed in decibels).

Simplex Signaling

Signaling in which two conductors are used for a single channel. A center-tapped coil, or its equivalent approved by an AOC, can be used at both ends for this purpose. The arrangements may be a 1-way signaling scheme suitable for intraoffice use, or the simplex legs may be connected to (full) duplex signaling circuits.

Singing Return Loss (SRL)

The frequency-weighted measure of return loss at the edges of the voiceband (260 to 500 Hz and 2200 to 3400 Hz), where signaling (instability) problems are most likely to occur. (See IEEE Std. 743-1984, Table 10, for SRL low, and Table 11 for SRL high.)

Slope (also Three-Tone Slope or Gain Slope)

The loss at 404 and 2804 Hz relative to that at 1004 Hz.

Special Access Service

A service that provides a transmission path within a LATA to directly connect a POT to an end-user premises or to another POT.

Stability

The property of maintaining a constant value during a specified time interval. Variations from the initial value may be called drift if the change is relatively slow, and jitter or noise if the change is relatively fast.

Stored Program Control (SPC)

A switching system comprised of a set of instructions within computer memory specifying operations to be performed, which expands the capability of the system to selectively route traffic.

Supervision

The function of initiating a call request, holding a connection, or releasing a connection.

Switched Access Service (SAS)

A service that provides 2-point electrical communication paths within a LATA between a POT and an AOC end office and/or access tandem switch. Paths are capable of the transmission of voice and associated telephone signals within the frequency bandwidth of approximately 300 to 3000 Hz.

Switched Services Network (SSN)

These private switched networks provide private line services and utilize trunks and access lines linked by common control or stored program switching arrangements in order to switch calls between customer locations. The switching equipment is located in central offices and may be shared by other switched services networks and/or the message network. The equipment at customer locations generally consists of standard Private Branch Exchanges (PBXs).

Synchronous Test Line

An arrangement in a central office that performs marginal operational tests of supervisory and ring-tripping functions.

Synchronous Transmission

Transmission in which the occurrence time of a specified significant instant in each byte, character, word, block, or other unit of data, such as the leading edge of a start signal, occurs in a specified time relationship with a preceding signal in the channel, in accordance with a specified timing pulse, or in accordance with a specified time frame.

Transmission Level Point (TLP)

A point in a transmission system at which the ratio, usually expressed in decibels, of the power of a test signal at that point to the power of the test signal at a reference point, is specified. For example, a zero transmission level point (0 TLP) is an arbitrarily established point in a communication circuit to which all relative levels at other points in the circuit are referred.

Transmission Measuring (105-Type) Test Line/Responder

An arrangement in a central office that provides far-end access to a responder and permits 2-way level, noise and return loss measurements to be made on trunks from a near-end office.

Trunk

A communications path connecting two switching systems in a network, used in the establishment of an end-to-end connection.

Trunk Group

A set of trunks that are traffic-engineered as a unit of the establishment of connections between switching systems in which all of the communications paths are interchangeable.

Trunk-Side Connection

The connection of a transmission path to the trunk side of a local switching system.

2-Wire to 4-Wire Conversion

An arrangement that converts a 4-wire transmission path to a 2-way transmission path to allow a 4-wire facility to connect to a 2-wire entity, such as a trunk circuit or switching system.

Variation

A measure of stability. Expresses a change within a given time interval.

Voice-Bandwidth Channel

A channel with frequency response characteristics to effectively transmit voice-frequency signals (A frequency range of about 300 to 3000 Hz.)

Voice Grade (VG)

A term used to describe a channel, circuit, facility, or service that is suitable for the transmission of speech, digital or analog data, or facsimile, generally with a frequency range of about 300 to 3000 Hz.

Voiceband

Relating to the frequency spectrum from 300 to 3000 Hz.

Wide Area Telecommunications Service (WATS)

This type of service permits an end user to make calls to selected InterLATA or IntraLATA regions for a fixed monthly charge. A form of WATS, called inward WATS, permits callers within specified geographic regions to call the inward WATS customer without incurring a charge.

Wire Center

The location of one or more local switching systems (or a portion thereof). A location at which customer loops converge.

9. Acronyms

ADPCM - Adaptive Differential Pulse Code Modulation

AH - Analog Multiplexed Signaling

AL - Acceptance Limit

AML - Actual Measured Loss

ANI - Automatic Number Identification

AOC - Ameritech Operating Company

AT - Access Tandem

CAC - Compandored Analog Carrier

CAROT - Centralized Automatic Reporting on Trunks

CCS - Common Channel Signaling

CCS/SS7 - Common Channel Signaling/Signaling System Seven

CO - Central Office

DAL - Dedicated Access Line

DA1 - Data Parameters for Transmission Type A1

DB - Data Parameters for Transmission Types B and C

DB1 - Data Parameters for Transmission Type B1

DCS - Digital Cross-Current Systems

DNIS - Dialed Number Identification Service

DRS - Digital Reference Signal

DS - Digital Multiplexed Signaling

DS-L - SF Signaling for Digital Multiplexed Interface

DTMF - Dual Tone Multifrequency

DX - Duplex Signaling

EAEO - Equal Access End Office

EA-E - Type I E&M Lead Signaling (Customer originates on E lead)

EA-M - Type I E&M Lead Signaling (Customer originates on M lead)

EB-E - Type II E&M Lead Signaling (Customer originates by a loop closure between E and SG leads)

EB-M - Type II E&M Lead Signaling (Customer originates by a loop closure between M and SB leads)

EC - Type III E&M Lead Signaling

EDD - Envelope Delay Distortion

ELEPL - Equal Level Echo Path Loss

EML - Expected Measured Loss

ENFIA - Exchange Network Facility for Interstate Access

EO - End Office

EPL - Echo Path Loss

ERL - Echo Return Loss

EU - End User

EX - Tandem Signaling

FCC - Federal Communications Commission

FG - Feature Group

FGD - Feature Group D

FPOS - First Point of Switching

FX - Foreign Exchange

Gbps - Giga-bits per second

GS - Ground-Start Signaling

IAL - Immediate Action Limit

IC - Interexchange Carrier

ICL - Inserted Connection Loss

ISDN - Integrated Services Digital Network

ISS - IntraLATA Switched Service

JIS - Jurisdictional Interstate Service

kbps - kilo-bits per second

LATA - Local Access and Transport Area

LS - Loop-Start Signaling

LT - Local Tandem

Mbps - Mega-bits per second

MF - Mutlifrequency

MFJ - Modification of Final Judgement

NA - Not Applicable

NANP - North American Numbering Plan

NCAC - Noncompandored Analog Carrier

NCI - Network Channel Interface

NPA - Numbering Plan Area

ONAL - Off-net Access Line

PBX - Private Branch Exchange

PCM - Pulse Coded Modulation

POT - Point of Termination

RL - Restoral Limit

RV - Reverse-Battery

SAL - Service Affecting Limit

SAS - Switched Access Service

SF - Single-Frequency Signaling

SPC - Stored Program Control

SRL - Singing Return Loss

SSN - Switched Services Network

TLP - Transmission Level Point

VF - Voice Frequency

VG - Voice Grade

VNL - Via Net Loss

WATS - Wide Area Telephone Service

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