



Restructured Private Line Channels Voice
Grade, Subvoice Grade, Audio, and Wired
Music Technical Descriptions

**RESTRUCTURED PRIVATE LINE CHANNELS
VOICE GRADE, SUBVOICE GRADE,
AUDIO, AND WIRED MUSIC
TECHNICAL DESCRIPTIONS**

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CONTENTS

1.	INTRODUCTION	1
	A. GENERAL	1
	B. RESPONSIBILITIES OF THE BELLSOUTH OTC	2
	C. RESPONSIBILITIES OF THE CUSTOMER	2
	D. MEANS OF CONNECTION	2
2.	SERIES 1000 – SUBVOICE SERVICES	3
	A. 1204 TYPE SERVICE	3
	B. 1205 TYPE SERVICE	3
3.	SERIES 2000 – VOICE GRADE SERVICE	3
	A. 2463, 2464 TYPE SERVICE	4
	B. 2260 TYPE SERVICE	5
	C. 2230, 2435 TYPE SERVICE	5
	D. 2432 TYPE SERVICE	5
	E. 2434 TYPE SERVICE	6
	F. 2231 TYPE SERVICE	6
	G. 2261, 2462 DSAS SERVICE	7
	H. 2261, 2462 TABS SERVICE	7
4.	SERIES 6000 – AUDIO AND WIRED MUSIC CHANNEL SERVICES	8
	A. TWO POINT AUDIO CHANNEL SERVICES	8
	B. WIRED MUSIC LOCAL CHANNELS	10
	C. SUMMARY OF AUDIO AND WIRED MUSIC CHANNELS	11
5.	MULTIPOINT FOR VOICE GRADE SERVICES	12
	A. MULTIPOINT EXAMPLES	12
	B. NUMBER OF POINTS	13
	C. MULTIPPOINTS EXCEEDING GUIDELINES	13
6.	SIGNALING FOR VOICE GRADE SERVICES	14
	A. MANUAL RINGDOWN	14
	B. AUTOMATIC RINGDOWN	14
	C. LOOP TYPES A, B, AND C	14
	D. CPE GRANDFATHER LOOP (1300-OHM)	14
	E. E&M SIGNALING	14
7.	CONDITIONING FOR VOICE GRADE SERVICES	15

A.	TYPE BASIC	15
B.	TYPE C1	15
C.	TYPE C2	15
D.	TYPE D1	15
	FIGURE 1 – BROADCAST MULTIPOINT EXAMPLE	19
	FIGURE 2 – CONFERENCE MULTIPOINT EXAMPLE	20
	FIGURE 3 – BROADCAST POLLING MULTIPOINT EXAMPLE	21
APPENDIX A – TRANSMISSION PARAMETERS		

RESTRUCTURED PRIVATE LINE CHANNELS VOICE GRADE, SUBVOICE GRADE, AUDIO, AND WIRED MUSIC TECHNICAL DESCRIPTIONS

1. INTRODUCTION

A. GENERAL

1.1 The purpose of this document is to provide technical descriptions of the intraLATA channel service offerings included in the Restructured Private Line Tariffs for the BellSouth Operating Telephone Companies, Southern Bell and South Central Bell (hereafter referred to as the BellSouth OTC's or OTC's). This document will help to clarify the interface and performance characteristics of the Private Line Services referenced in those tariffs. This document does not change or supersede any tariff requirement.

1.2 Private Line Channels are point-to-point or multipoint communications services used for direct connection between customer locations, or for customer access to a termination in a BellSouth OTC wire center other than Plain Old Telephone Service (POTS). This document covers only those services included in the Restructured Private Line Tariffs. It should be noted that, although they provide similar specifications, the service structure for intraLATA Private Line Channels created by Bell Communications Research, Inc. (Bellcore), and documented in its publication, TR-TSY-000965, does not apply to the BellSouth offerings.

NOTE: References to Bellcore TR's and Pub's will appear throughout this document. Further information regarding price and availability of Bellcore documents may be obtained by calling 1-800-521-CORE or 1-201-699-5800.

1.3 Most private line channels existing in earlier intraLATA tariffs have been retained in the restructured tariff environment. In the interest of establishing a common numbering structure, designations for channel type have been changed. The new format specifies a four digit numbering scheme, with the first digit specifying the class, or series, of service. A "1" in the first position designates the channel as a subvoice grade service. A "2" is used to indicate voice grade. A "6" indicates that the channel is suitable for wired music or program audio.

1.4 The second digit of the numbering scheme specifies the number of conductors used for metallic, or loop, transport. The digit "2" indicates a two wire facility. A "4" represents a four wire path. Unless otherwise specified, both two wire and four wire channels may be provided by various types of multiplex systems, on some of which the concept of separate paths for each direction of transmission is maintained by frequency allocation or time division techniques.

1.5 The third and fourth characters have no systematic meaning. These characters are used to further identify channels according to specific interface and performance characteristics which are tailored to the uses to which the channels are assumed to be matched, e.g., point-to-point half duplex voiceband data (60) or PBX off-premises station access (31).

1.6 Persons seeking further information about these service offerings should contact their BellSouth OTC business service representative. Inquiries involving design considerations for the manufacture of compatible equipment may be directed to the Information Exchange Manager (IEM) at the address listed in the forward to this document. The IEM will refer those who inquire to the appropriate BellSouth technical reference author.

B. RESPONSIBILITIES OF THE BELLSOUTH OTC

- 1.7 The BellSouth OTC will install and maintain private line channels in accordance with the requirements of the Restructured Private Line Tariffs, and with the interface and performance specifications listed herein. The responsibility of the OTC will extend from network interface to network interface, and does not include Customer Provided Equipment (CPE) or wiring.
- 1.8 No assurance is provided that CPE is either suitable for use with the service or that such CPE will operate satisfactorily. When the CPE is provided directly by the BellSouth OTC as a deregulated line of business, the OTC may so certify the equipment, but such assurances are offered as separate and distinct from the private line service itself.
- 1.9 AC and/or DC voltages may appear at the network interface of private line services, either as conditions normal to the operation of the channel, or due to either OTC initiated maintenance or exposure of outside plant facilities to lightning or 60Hz power sources. The OTC will insure that operating and test voltages are maintained within limits appropriate to accepted norms for personnel and equipment safety. Protective devices installed by the OTC will generally limit the maximum voltage which might appear as a result of lightning or 60Hz power cross to less than 1000 volts.

C. RESPONSIBILITIES OF THE CUSTOMER

- 1.10 Customer provided equipment and wiring shall be installed and maintained in a manner which insures that no harm shall occur to the personnel or equipment of the BellSouth OTC, or to other users of its facilities. Such assurance is best attained by the use of equipment certified under the rules of the FCC's Registration Program, and connected via the most simple means. Most private line services are now covered by the FCC's Registration Program, and associated CPE must be registered under the appropriate rules (Part 68, Title 47, of the Code of Federal Regulations). Such registration assures that the CPE itself will not cause harm to the network. Proper installation practices, particularly in regards to premises wiring, are still necessary to insure that the entire configuration is safe.
- 1.11 The Registration Program does not, at this time, apply to private line voiceband data, nor to subvoice or program services. Customer equipment connected to these services should not harm the network if it conforms to the specifications in this document. Again, installation practices can impact this. Upon notice from the OTC that the customer installation is causing, or is likely to cause, harm to the network, the customer shall disconnect his installation from the network and make such changes as are necessary to eliminate the hazard.
- 1.12 If the customer should experience difficulty with his overall service, he should determine that neither his CPE nor premises wiring is the cause of the problem. Troubles referred to the OTC will be verified and cleared by the OTC if found to be in its facilities. If, however, OTC personnel are dispatched and the problem is determined to be in customer facilities or practices, a maintenance of service charge may apply.

D. MEANS OF CONNECTION

- 1.13 Connections of customer installations to private line services are normally made through standard OTC provided jacks. These are described in Part 68 of the FCC's Rules. Wiring configurations are identified in the Committee T1 Technical Report - Carrier to Customer Installation Interface, Connector Wiring Configuration Catalog.

NOTE: Inquiries regarding the above mentioned report should be directed to the Exchange Carrier Association, 5430 Grosvenor Lane, Suite 200, Bethesda, Maryland 20814, or call 1-301-564-4505.

- 1.14** CPE used with services not covered by the FCC's Registration Program may be connected by means other than standard plugs and jacks. Screw terminal or punch down connections are typically used for subvoice and program services. Consult your OTC business service representative for more information.

2. SERIES 1000 – SUBVOICE SERVICES

- 2.1** The 1000 Series (1204 and 1205) Services are designed for use with customer provided power and signaling equipment or with OTC provided signaling equipment on a two-wire basis. It is expressly declared that metallic facilities are in continually decreasing supply and that the OTC does not hold itself in a position to make such facilities available. In addition, if modernization programs dictate the replacement of existing metallic facilities with non-metallic facilities such as fiber optics, the OTC will not be required to continue this service over metallic facilities.

- 2.2** These services are available in up to three serving central offices. The customer applied signal is limited to the following:

Current – Amperes rms.	AC and DC components per conductor, not to exceed 0.150
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Magnitude of the peak of the voltage between any conductor and ground –	Not to exceed 70.7 volts (50 volts rms) except continuous DC voltage not to exceed 135 volts.
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A. 1204 TYPE SERVICE

- 2.3** This service is provided only for two or three-point DC transmission (DC continuity). Exchange subscriber pairs and interoffice pairs, as required, will be used without regard to gauge, loading or resistance. Three-point service shall be provided via straight metallic bridging – either parallel or series as the customer requests. The Channel may contain up to 12KF of bridged tap. Bellcore Pub. 43401 – Transmission Specifications for Private Line Metallic Circuits – provides the technical description and signal power criteria for the customer.

B. 1205 TYPE SERVICE

- 2.4** This service is primarily intended for but not limited to protective alarm company services utilizing McCulloh loop operations. It is tariffed for up to twenty-six stations, intraexchange or interexchange. Additional stations will be provided based upon cost. Multipoint service is restricted to a maximum of three central offices which serve patron premises. The central office serving the central alarm reporting station is excluded from the maximum of 3 limitation unless it also in addition serves patrons premises. At the OTC option this service may be provided with DC continuity or on a derived channel using special security channel units. This service has a two-wire interface with two wire facilities suitable for unidirectional series operated signaling.

3. SERIES 2000 – VOICE GRADE SERVICE

- 3.1** This series of services is designed to provide specific voice grade offerings for both two point and multi-point use. Customers will provide their own station equipment consistent with FCC registration rules at all points of termination. Network Channel Terminating Equipment (NCTE – This is OTC equipment usually located on a customer's premises and used for transmission and/or signaling.) may be required for some services.

- 3.2** The 2000 Voice Grade Series Services meet all the parameters and specifications for voice grade services as specified in the tariff, and are normally defined in terms of facility interface and overall loss.

Signaling may or may not be included in these service offerings. It may be ordered separately under the tariff for some services. The customer may order these channel offerings and signaling offerings as required to meet a service need.

- 3.3 When used with CPE, the OTC is only responsible for the channel and signaling offerings from interface to interface as specified by the tariff. The OTC is not responsible for the customer's overall service, compatibility of the CPE equipment on each end, compatibility of our equipment or the interface to the CPE equipment, or compatibility to the desired service other than as provided by the Tariff.
- 3.4 Series 2000 channels may be used alternately for more than one customer service application, e.g., voice and data. When so configured, the switching and signaling equipment necessary to support the alternate arrangement must be provided by the customer.
- 3.5 Basic parameters and specifications for Series 2000 voice grade service (see Appendix A for more information on parameters) are described for the end to end operation as follows:

<u>Basic Parameters</u>	<u>For Speech Application</u>	<u>For Data Application</u>
Net Loss	Local Channel limit as specified in the following Local Channel descriptions. Losses or gains present in CPE have not been included.	
DC Resistance	Local Channel limit as specified in the following Local Channel descriptions. Does not imply or guarantee end to end DC continuity.	
Frequency Error	± 5 Hz	± 5 Hz
Frequency Response	(Referenced to 1004 Hz Loss)	
300 – 3000 Hz	-3dB to +12dB	-3dB to +12dB
500 – 2500 Hz	-2dB to +8dB	-2dB to +8dB
Envelope Delay Distortion		
800 – 2600 Hz	Not Controlled	Less than 1750 Microseconds
Signal to C-Notched Noise Ratio (-13dBm0 1004 Hz test signal)	Not Controlled	Noise level 24dB below signal level
Impulse Noise	Not Controlled of 6dB below a -13dBm0 rms 1004 Hz signal	15 counts in 15 minutes at a threshold
Phase Jitter	Not Controlled	10 degrees peak to peak
Non-Linear Distortion		
2nd order	Not Controlled	25dB below signal level
3rd order	Not Controlled	30dB below signal level

A. 2463, 2464 TYPE SERVICE

- 3.6 This service provides a four-wire (2463) or two-wire (2464) interface with four-wire facilities engineered for a 1004Hz net loss of 16dB suitable for full duplex data transmission (capable of simultaneous

two-way independent transmission in both directions, separate transmit and receive paths are provided between NCTE). The service may be two-point or multipoint as specified on the order, up to 20 points (see Paragraphs 5.12–5.14). The service shall meet all data application parameters and specifications as specified in the tariff. The Transmission Level Point (TLP) for the customer's transmit level at the interface shall be +13dB, and the TLP for the customer's receive level at the interface shall be –3dB. These TLP levels are established to accept 0dBm data transmission levels from the customer station equipment and maintain the OTC objective of a –13dBm0 average signal level. This service shall typically be provided utilizing NCTE at the customer premises. No signaling is offered for this type of service. Basic conditioning is provided. C1, C2, and D1 conditioning are also available. Bellcore Pub. 41004 may be consulted for an explanation of parameters. Where limits or conditioning categories differ from the tariff the latter applies. Section 7 of this document also provides additional information on conditioning.

B. 2260 TYPE SERVICE

- 3.7** This service provides a two-wire interface with effective two-wire facilities engineered to a 1004Hz net loss of 16dB suitable for half duplex data transmission in either direction but not both directions simultaneously (transmit and receive paths may share the same path). The service provided may be two-point only. The service will meet all data application parameters and specifications as specified in the tariff. The OTC TLP for the customer's transmit level at the interface shall be +13dB, and the TLP for the customer's receive level at the interface shall be –3dB. These TLP levels are established to accept 0dBm data transmission levels from the customer station equipment and maintain the OTC objective of a –13dBm0 average signal level. Transmission guidelines for voice grade data are presented in Bellcore Pub. 41004. No signaling options are available for this service type. Only basic conditioning is provided.

C. 2230, 2435 TYPE SERVICE

- 3.8** This service is intended for private line voice applications. It provides a two-wire interface with effective two-wire facilities (2230) or a four-wire interface with four-wire facilities (2435) engineered for a 1004Hz net loss of up to 10dB (2230) or 16dB (2435). Multipoint service is limited to 20 points (see Paragraphs 5.12–5.14). Larger systems may be provided based upon cost. The service will meet the voice application parameters and specifications as specified in the tariff. The OTC TLP for the customer's transmit level at the interface shall be 0dB, and the TLP for the customer's receive level at the interface shall not be less than (more loss than) –10dB (2230) or –16dB (2435). Transmission equipment required for gain and other parameters should be located in OTC central offices. Transmission design should be consistent with system guidelines and objectives for voice grade transmission as documented in the tariff and Bellcore Pub. 43201. This service is provided with no signaling. The customer may order Automatic Ringdown or Manual Ringdown signaling for this service offering separately under the tariff.

D. 2432 TYPE SERVICE

- 3.9** This channel service offering is intended for tie trunk use between PBX's and is limited to a two point service.
- 3.10** Under the FCC First Report and Order Docket No. 79–143, Part 68 of its Rules and Regulations were modified to allow for the direct connections of terminal equipment to certain Private Line Services. This order established a Register-Only Date of May 1, 1983 after which all terminal equipment and systems, which themselves have not previously been directly connected to the network, intended for direct connection must be registered. Certain equipment previously connected to the network is grandfathered and may remain connected for the life of the equipment.

3.11 Designs for Registered tie trunks are identified by the Facility Interface Code (FIC). Interface specifications can be found in Bellcore Pub's 62114 through 62119. Additional information on private line networks can be found in Bellcore Pub. 43201. The FIC will identify a registered tie trunk interface as:

- (1) 2 wire lossless
- (2) 4 wire lossless
- (3) 4 wire conventional term set

And the E&M signaling interface type as:

- (1) Type I
- (2) Type II

Either Type I or Type II will have:

- (1) Registered equipment provide ground on E lead to originate, or
- (2) Registered equipment provide battery on M lead to originate.

3.12 Signaling is limited to E&M and is ordered separately.

E. 2434 TYPE SERVICE

3.13 This service is two point only and provided for tie line (trunk) use between a customer premise PBX and a CENTREX-CO or ESSX® service, or two CENTREX-CO's or ESSX® services. Registration rules apply to the PBX end of a channel and are covered in Bellcore Pub's 62114 through 62119. Bellcore Pub. 43201 provides additional information on private PBX type networks.

3.14 Signaling is limited to E&M and is ordered separately.

3.15 For analog tie trunks the loss from center of switch to center of switch is $VNL+2S+2S$, where 2S is a 2dB switchable pad. For digital switches providing ESSX® service, loss can be programmed into the received direction when a trunk is connected to a line circuit. For this situation 6dB should be used. This would give an end to end loss of 6dB for an all-digital private line network.

E. 2231 TYPE SERVICE

3.16 This channel service offering is intended for PBX off premises station use. For all off premise stations both registered and grandfathered, the service order will identify the signaling range capabilities of the PBX by Facility Interface Code (FIC) or by USOC as follows:

<u>USOC</u>	<u>FIC</u>	<u>Range Limits of PBX</u>
SAL	OL13A	0 to 199 ohm
SAU	OL13B	200 to 899 ohm
SAY	OL13C	900 ohm or greater

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- 3.17** The BellSouth OTC will design Type 2231 channels to insure compliance with either of two requirements. Where metallic facilities without signal regeneration can be provided between the PBX and the far end customer interface, the resistance introduced by the OTC facility will not exceed the lower limit of the range supported by the given FIC. Where signaling regeneration has to be interposed, the OTC will limit the effective resistance of the facility to support a minimum loop current of 16mA. For the OL13A FIC, the limit shall be 200 ohms. For the OL13B code, it shall be limited to 800 ohms. The OL13C FIC is expected to operate satisfactorily with up to 1800 ohms of effective resistance.

G. 2261, 2462 DSAS SERVICE

- 3.18** “Dataphone” Select-A-Station is a multipoint private line service composed of private line channels, dedicated central office equipment and customer premises station equipment. Technical Reference Pub. 41014 discusses customer interface requirements. Point-to point voiceband connections are set up between the master station and each remote station. Two way transmission between the master and remote stations is allowed, but transmission between remote stations is not available. This service does not provide broadcast communications to remote stations, alternative voice service, or DC continuity.
- 3.19** Channel Types 2261 are DSAS channels with 2-wire customer interface and effective 2-wire facilities for use between the PDSS* or SDSS* and the remote two-wire station.
- 3.20** Channel Types 2462 are DSAS channels with 4-wire interface and four-wire facilities for use between the PDSS* and SCU* and between the PDSS* and the SDSS* and between the PDSS* or SDSS* and a remote 4-wire station.

*PDSS = Primary Data Station Selector
 SDSS = Secondary Data Station Selector
 SCU = Selector Control Unit

H. 2261, 2462 TABS SERVICE

- 3.21** Telemetry/Alarm Bridging Service or TABS is a multi-station, voice frequency, private line service offering designed to provide connections between a master station and a number of remote stations simultaneously. TABS can be provided as Split Band-Active Bridging only. The Split Band-Active Bridging System provides a private line configuration similar to but less sophisticated than DSAS.
- 3.22** Split-band active bridging is a bridging system which divides the voice band into two separate portions, one in each direction of transmission. Typically the band is divided around 1600 to 1800 Hz. With split-band, active bridging, a signal from the master station is broadcast to all remote stations; however, signals from the remote stations are received only by the master station. This service allows only one layer of tandem bridging.
- 3.23** The private line channels used in the TABS System can be categorized by pair count, loss and roll-off requirements as shown in the following Chart 1.

Chart 1

TABS Private Line Channels

Channel	Slope Req.	From	To
2W 8dB	500-2800 (-2, +8)	Master Station	Bridge
		Bridge	Remote Station
4W 8dB	500-2800 (-1, +3)	Master Station	Bridge
	300-3000 (-2, +6)		
4W 0dB	500-2800 (-1, +3)	Hub Bridge	Remote Bridge
	300-3000 (-2, +6)		

3.24 The 2W 8dB local channel is a type 2261 channel. The 4W 8dB local channel is a type 2462 channel. The 4W 0dB channel is an interoffice channel and will be provided as a 2462 type channel.

4. SERIES 6000 – AUDIO AND WIRED MUSIC CHANNEL SERVICES

4.1 The intrastate audio private line channel services are specially equipped two-point audio channels provided for one way directional transmission. Channels to connect the music source to a multipoint distribution system in separate wire centers are provided and installed as two-point audio channels. (Note: Broadcast services are provided in the Interstate Access Tariff.)

A. TWO POINT AUDIO CHANNEL SERVICES

4.2 Any one of the following three service arrangements comprises a two-point audio private line channel service:

- (1) Two local channels connected in the same wire center serving area or two local channels not in the same wire center serving area connected by an interoffice channel.
- (2) One local channel feeding a music distribution amplifier, or one local channel and an interoffice channel feeding a music distribution amplifier.
- (3) One interoffice channel originating from a music distribution amplifier and terminating in another distribution amplifier.

4.3 There are four different levels of fidelity for which a two-point intraexchange audio channel service may be provided. These channel types are 6210, 6211, 6212, and 6213 and are described as follows:

(1) Channel Type 6210

4.4 A unidirectional two wire service without equalization or specified transmission loss. No equipment will be placed on the circuit to improve the loss. The local channel and interoffice channel portions of this type service are provided on normally available voice grade exchange plant and interoffice facilities.

(2) Channel Type 6211

4.5 A unidirectional two wire service without equalization engineered for a 1004 Hz maximum loss of 12dB. The local channel and interoffice channel portions of this type service are provided on normally available voice grade exchange plant and interoffice facilities.

(3) Channel Type 6212

- 4.6 A unidirectional two wire service engineered for a 1004 Hz maximum pre-equalized loss of 12dB and equalized to ± 1 dB of the 1004 Hz loss from 100 to 5000 Hz. The local channel or interoffice portions of this type service can be provided on nonloaded or special program loaded facilities or program carrier. Where a program carrier system is employed two or more voice grade message channels must be used.

(4) Channel Type 6213

- 4.7 A unidirectional two wire service engineered for a 1004 Hz maximum pre-equalized loss of 12dB and equalized to ± 1 dB of the 1004 Hz loss from 50 to 8000 Hz. The local channel and interoffice portions of this type service can be provided on either nonloaded, program loaded, or "T" carrier. Where "T" carrier is employed, three or more voice grade message channels must be used.

(5) Signal Required From Customer

- 4.8 The nominal impedance shall be 150 ohms, or 600 ohms.
- 4.9 The maximum signal shall be a +8 VU as measured on a standard VU meter.
- 4.10 Minimum input level – The peak level portions of speech or music introduced into the line should be maintained at, or just below, the maximum allowable input level of +8 VU. Too low an input level may require excessive amplification by the customer at the receiving end of the line, thus greatly increasing the level of the received line noise in relation to the desired signal.

(6) Signal Delivered To The Customer

- 4.11 The nominal impedance shall be 150 ohms or 600 ohms.
- 4.12 The level to the customer is determined by the type of service ordered.
- 4.13 Output level, Unequalized lines (Type 6211) – For a fixed input level, the output level will depend upon the length and gauge of the conductors used for the service. The 1004 Hertz loss of an unequalized circuit will be equal or less than 12dB. For a line with a 1004 Hertz loss of 12dB and a +8 VU input signal, the received signal level will be -4 VU.
- 4.14 Output level, Equalized line (Types 6212 & 6213)– For a fixed input level, the output level will depend upon the loss of the wire facilities, the equalizer loss and the gain of intermediate amplifiers if such amplifiers are required. The maximum equalized 1004 Hz loss is 32dB.
- 4.15 Frequency Response – Equalized lines:
 Type 6212 = 100 Hertz to 5000 Hertz
 Type 6213 = 50 Hertz to 8000 Hertz
 Within (+) or (-) one dB of 1004 Hertz response
- 4.16 Noise at Receiving End – For effective program transmission the noise level at the receiving end of a service should be very low in relation to the received signal level. If a steady test tone (1004 Hertz) is applied to the sending end of a service at 0dBm, the level of the received signal should be greater than the receiving end idle circuit noise level (measure with no input signal) by the value indicated.

Type of Audio Circuit	Minimum Signal Noise Difference
Type 6210	42dB – “C” Message Weighting
Type 6211	42dB – “C” Message Weighting
Type 6212	42dB – Program Weighting
Type 6213	42dB – Program Weighting

4.17 Protective Equipment (part of line terminating equipment):

- (a) Non-Equalized Channels (Types 6210 and 6211) – An isolation or repeat coil may be required at each end of the line to provide impedance matching. Where high voltage is present a protection set is required. This equipment contains lamps, carbon blocks, and fuses to protect the OTC’s facilities from excessive voltage or current.
- (b) Equalized Channels (Types 6212 and 6213) – An isolation or repeat coil is required on the sending end of the line and an isolation coil and possibly an equalizer are required at the receiving end.
- (c) Protection Set – When a service is terminated at a location where high voltage is present a protection set is required. This equipment contains lamps, carbon blocks, and fuses to protect the telephone lines from excessive voltage or current.

B. WIRED MUSIC LOCAL CHANNELS

4.18 A wired music multipoint distribution service consists of one or more distribution amplifiers feeding multiple wired music local channels within a wire center area. Local channels and interoffice channels required to connect the music source to the wired music multipoint distribution system or to connect distribution amplifiers in separate wire centers are provided as two point audio channels.

4.19 The service arrangement for wired music local channels are within a wire center area between the premises of the patrons of the wired music service and a distribution amplifier located in the serving wire center.

4.20 Distribution amplifiers provided by the OTC are required to receive signals from a source provided by the customer and to transmit the appropriate signal level to the multiple wired music local channels which the amplifiers may feed. Distribution amplifiers are provided at the serving wire center.

4.21 Wired music local channels are provided at four different levels of fidelity:

(1) Channel Type 6214

4.22 A two wire local channel engineered without equalization and no maximum loss.

(2) Channel Type 6215

4.23 A two wire local channel engineered for a 1004 Hertz maximum loss of 14dB without equalization.

(3) Channel Type 6216

4.24 A two wire local channel engineered for a 1004 Hertz maximum pre-equalized loss of 14dB and equalized to ± 4 dB of the 1004 Hertz loss from 100 to 5000 Hertz.

(4) Channel Type 6217

- 4.25 A two wire local channel engineered for a 1004 Hertz maximum pre-equalized loss of 14dB and equalized to ± 4 dB of the 1004 Hertz loss from 50 to 8000 Hertz.

(5) Signal Delivered To The Customer

- 4.26 The nominal impedance shall be 150 ohms or 600 ohms.
- 4.27 The level to the customer is determined by the type of service ordered.
- 4.28 Output level, Unequalized lines (Type 6215) – For a fixed input level, the output level will depend upon the length and gauge of the conductors used for the local channel. The 1004 Hertz loss of an unequalized local channel will be equal to or less than 14dB. For a line with a 1004 Hertz loss of 14dB and a +8 VU input signal, the received signal will be -6 VU.
- 4.29 Output level, Equalized lines (Types 6216 and 6217) – For a fixed input level, the output level will depend upon the loss of the wire facilities, the equalizer loss and the gain of intermediate amplifiers if such amplifiers are required. The maximum equalized 1004 Hz loss is 34dB.
- 4.30 Frequency Response – Equalized Lines:
 Type 6216 = 100 Hertz to 5000 Hertz
 Type 6217 = 50 Hertz to 8000 Hertz

 Within (+) or (-) 4dB of 1004 Hertz response
- 4.31 Noise at Receiving End – For effective music distribution the noise level at the receiving end of a local channel should be low in comparison to the received signal level. At the end of the longest loop (14dB), the corresponding noise level shall be a maximum of 36dBm.
- 4.32 Protective Equipment (part of line terminating equipment) – An isolation or repeat coil may be required at the receiving end of the line to provide impedance matching between the customer’s equipment and the OTC facility.
- 4.33 Protection Set – When a local channel is terminated at a location where high voltage is present a protection set is required. This equipment contains lamps, carbon blocks and fuses to protect OTC facilities from excessive voltage or current.

C. SUMMARY OF AUDIO AND WIRED MUSIC CHANNELS

4.34 In summary there are eight Channel Types, 6210 through 6217, and four arrangement types which make up the audio and wired music service offering. The arrangement types can be summarized as follows:

<u>ARRANGEMENT</u>	<u>SERVICE</u>	<u>FROM</u>	<u>TO</u>
1	AUDIO	STATION	STATION
2	AUDIO	STATION	DIST. AMP (CO)
3	AUDIO	DIST. AMP (CO)	DIST. AMP (CO)
4	WIRED MUSIC	DIST. AMP (CO)	STATION

- 4.35 Some pertinent technical parameters are summarized in Table 2.
- 4.36 Table 3 is a chart showing the various arrangement types that are available with the various channel services.

5. MULTIPOINT FOR VOICE GRADE SERVICES

- 5.1 Multipoint service is specifically available for Service Types 2230, 2435, 2463 and 2464. There are only four types of bridging available for private line services; voice bridging and data bridging, two and four wire.
- 5.2 All tariffed multipoint channels should be limited to a maximum of 20 points. The effective two wire channels may be two wire up to about 5 or 6 stations.
- 5.3 Conference bridging will normally be provided for multipoint arrangements involving Service Types 2230 and 2435. Split bridging will normally be provided for multipoint arrangements involving Service Types 2463 and 2464. Bridging arrangements other than those described above requested by the customer should be handled on a special charge basis.
- 5.4 Bridging equipment will be provided in Serving Offices (local central offices) and/or Primary Serving Offices (toll offices) to provide multipoint service. The OTC engineer shall select the bridging points based upon facility and equipment availability.

A. MULTIPOINT EXAMPLES

- 5.5 Multipoint channels are used to communicate among three or more customer locations. There are three basic types of multipoint channels. They are broadcast, conference, and broadcast polling. There are also combinations of these arrangements as well as configurations designed to meet special customer requirements. The conference multipoint is most commonly used for voice grade services. Conditioning is available for the data services.

(1) Broadcast Multipoint

- 5.6 The broadcast multipoint consists of a single master data station which transmits to two or more remote stations. Figure 1 illustrates a simple 6-point multipoint with five remote stations served from two bridging locations. There is no return path from the remote stations back to the master station, and the remote stations cannot communicate with each other. The broadcast multipoint uses a 2-wire channel arranged for simplex (one way) operation. The station interface is two wire.
- 5.7 Broadcast multipoints can be considered as a collection of 2-point networks in terms of analog transmission performance and channel availability.

(2) Conference Multipoint

- 5.8 The conference multipoint consists of a number of stations connected together so that transmissions from any station are received by all other stations. Only one station at a time may transmit. Figure 2 illustrates a 7-point conference multipoint. Since more than six points are involved, it is shown using 4-wire channels.
- 5.9 Customers may find it economically advantageous to order conference multipoints provided on 2-wire channels. Because of the inherent stability problems on large 2-wire conference multipoints these networks are restricted to a maximum of six points.
- 5.10 The availability of 4-wire conference multipoint channels will usually be satisfactory for up to 20 stations. If 2-wire stations are used on such a network it may not be possible to provide an electrically stable network for much in excess of 20 points, and fewer if there is an impedance problem with the channel terminating equipment, even if the 4-wire to 2-wire conversion is done at the interface of the channel with the modem. If 4-wire stations having electrically independent transmit and receive

sides are used, channels having large numbers of points are physically possible. Usually, however, other considerations (see Section on Number of Points) will be limiting before the 20 point availability guideline is reached.

(3) Broadcast Polling Multipoint

5.11 The broadcast polling multipoint consists of a single master station and two or more remote stations, sometimes called “slaves”. Transmissions from the master station are received by all remote stations. Transmissions from the remote stations are received only by the master station. Figure 3 illustrates a broadcast polling multipoint. A 4-wire channel is required. This is the most commonly ordered multipoint for data applications. In a typical operation, requiring 4-wire channels, the master station is transmitting carrier continuously to all remote stations. The master station polls a remote station by sending a discrete address code which will be recognized by the particular remote station polled. All remote stations receive the poll but only one is activated by the address information in the poll. If the remote station has no business to transact with the master, a negative response is made and the master polls another remote station. If the remote station has business to transact with the master, a positive response is made and the transaction is completed before the next poll is made. Any transactions between remote stations must be made through the master, since no direct communication is possible between the remote stations. Networks designed for broadcast multipoint polling must be 4-wire. Two-wire multipoints could be used for broadcast polling operation, but every remote station would receive all messages generated anywhere in the network, and some of the advantages of the broadcast polling design would be lost. Although 2-wire stations could be used on small networks (fewer than six points), 4-wire stations having electrically independent transmit and receive sides may be required to eliminate echo and stability problems on large networks. The comments on the number of points for 4-wire conference multipoints apply to this case as well, with the exception that traffic considerations frequently do not limit the number of stations to as few as 20.

B. NUMBER OF POINTS

5.12 The variety of transmission facilities involved in implementing channels, the variability of the channel parameters on these facilities, variations in modem impedances, the type of channel provided (2-wire or 4-wire), and a number of other physical and administrative factors make it difficult to establish precise rules for the maximum number of points on a multipoint network. The following should be considered in addition to mileage limitations. The complexity of networks consisting of more than approximately 20 points is such that the time required to restore service following outages, and the increased number of outages as the number of points increases, cause channel availability to be less than can be tolerated by many data systems. This is the origin of the recommendation that careful consideration to channel availability be given if systems requiring more than 20 points are contemplated.

5.13 The recommendation on the number of points to be provided under the tariff is as follows:

- (1) 2-wire – No more than 6 points and/or 4000 circuit miles.
- (2) 4-wire – No more than 20 points and/or 4000 circuit miles.

C. MULTIPPOINTS EXCEEDING GUIDELINES

5.14 The OTC at the request of the customer, will attempt to design and build multipoint channels based upon cost which exceed 20 points or the mileage limitations, provided the customer acknowledges that he understands increased outages may result or the analog parameter limits may be exceeded. On channels exceeding 4000 facility miles, individual transmission facility limits will be met, but end-to-end analog or digital transmission performance will not be supported. The OTC reserves the right to refuse

to provide a channel which cannot be made stable, since high level signals may be generated which would interfere with other services.

6. SIGNALING FOR VOICE GRADE SERVICES

6.1 There are five types of signaling services offered. The following paragraphs describe these services.

A. MANUAL RINGDOWN

6.2 This service is provided when the customer desires the local channel to pass ringing current to the other end when applied at either end. With this service all stations may be alerted by the ringing signal, or there may be code-select ringing where each station has its own code. In either case the ringing signal is sent from the CPE to the channel and must conform to the signal specifications in Bellcore TR-TSY-000515 (Section 15 of the LSSGR - LATA Switching Systems Generic Requirements).

B. AUTOMATIC RINGDOWN

6.3 This service is provided when the customer desires the local channel to ring the other end when there is a loop seizure from either end. This is the basic Private Line Automatic Ringdown (PLAR) service. With this service the channel will provide in both directions talk battery, ringing current and audible ringback tone. Upon detection of off-hook from the calling station, ringing will be sent to the called station and audible ringback to the calling station. An off-hook condition at the called station will trip (remove) ringing and establish talk battery in both directions. See American National Standard Institute document T1.401-1988 for additional information.

NOTE: Information regarding pricing and availability of ANSI documents may be obtained by calling 1-212-354-3300.

C. LOOP TYPES A, B, AND C

6.4 This loop signaling option is available on registered off-premises stations under Channel Type 2231. The Type A refers to a port classification of A which has a supervisory range of 0 to 199 ohms of external resistance to a station set. Type B and C are for 200 to 899 and 900 or greater ohms, respectively to a station set. For design purposes the minimum of the above ranges are used to specify the design range. Hence for Type A the design range is 0 ohm, for B it is 200 ohms and for Type C is 900 ohms. Thus for Type A, a signaling enhancement device is always required as part of the channel's equipment. Descriptions of these interfaces are given in Pub. 62113 (also see Paragraph 3.17). Under current tariff guidelines these channels do not guarantee distinctive ringing.

D. CPE GRANDFATHER LOOP (1300-OHM)

6.5 This service is provided for grandfathered CPE off-premises stations when the customer desires the local channel to repeat loop seizure, dial pulse and disconnect in one direction, and repeat ringing in the other direction with a maximum PBX end supervision of 1300-ohms. Loop start operation is the standard provision, and the customer should specify which end is the office or PBX end and which is the station end. The customer should be notified that his ringing supply must be grounded for proper operation. If the CPE PBX can not supervise 1300 ohms, a signaling range extension device will be required. This signaling option does not guarantee the support of distinctive ringing.

E. E&M SIGNALING

6.6 This service is provided when the customer desires E&M leads for signaling over the local channel. This is the basic signaling required for PBX tie trunks. The local channel will be equipped with E&M NCTE. Interface specifications can be found in Bellcore Pub's 62114 through 62119.

7. CONDITIONING FOR VOICE GRADE SERVICES

7.1 Conditioning is specifically available for Service Types 2463 and 2464. Conditioning provides for improvement in the attenuation distortion and envelope delay distortion parameters (C-Type conditioning) or the signal to noise ratio and non-linear distortion parameters (D-Type conditioning). Specifications for conditioning offerings apply to the overall channel service. C1 and C2 conditioning are available on multipoint services.

7.2 The following is a description of the conditioning types offered in the tariff:

A. TYPE BASIC

7.3 This offering is standard with two point data services (2463, 2464, and 2260). For two point circuits, the attenuation distortion relative to 1004 Hz shall not exceed -3dB to +12dB between 300 and 3000 Hz nor -2dB to +8dB between 500 to 2500 Hz. The envelope delay distortion shall not exceed 1750 microseconds between 800 and 2600 Hz.

B. TYPE C1

7.4 This offering is limited to circuits with no more than twenty local channels, and/or 4000 circuit miles, and/or 4 midlinks (channels between bridges). For two point service the attenuation distortion relative to 1004 Hz shall not exceed -1dB to +3dB between 1004 and 2400 Hz nor -2dB to +6dB between 300 and 2700 Hz nor -3dB to +12dB between 2700 and 3000 Hz. The envelope delay distortion shall not exceed 1000 microseconds between 1000 and 2400 Hz.

C. TYPE C2

7.5 This offering is limited to circuits with no more than twenty local channels, and/or 4000 circuit miles, and/or 4 midlinks (channels between bridges). For two point circuits the attenuation distortion relative to 1004 Hz shall not exceed -1dB to +3dB between 500 and 2800 Hz nor -2dB to +6dB between 300 and 3000 Hz. The envelope delay distortion shall not exceed 500 microseconds between 1000 and 2600 Hz, 1500 microseconds between 600 and 2600 Hz, nor 3000 microseconds between 500 and 2800 Hz.

D. TYPE D1

7.6 This offering is limited to two non-switched local channels. It controls signal to noise and non-linear distortion. The signal to C-notched noise ratio shall be 28dB or greater. The signal to second order non-linear distortion shall be 35dB or greater and the signal to third order non-linear distortion shall be 40dB or greater. This offering is available only where facilities and conditions permit.

TABLE 1

SYNOPSIS OF SUBVOICE AND VOICE GRADE LOCAL CHANNELS

CHANNEL/ TYPE	APPLI-/ CATION/	LOSS/ (dB)/	XMT / RCV ¹ /			TYPE /	TYPE /	COND. /	MULTI- /		SIG. /
			OBJ /	TLP /	TLP /				INTER- /	FACI- /	
			AT /	AT /	CUST. /	FACE /	LITIES /	ABLE? /	ABLE? /	ABLE /	
1204	DATA	(2)	(2)	(2)	2W	2W	NO	YES	NONE		
1205	DATA	(2)	(2)	(2)	2W	2W	NO	YES	NONE		
2230	VOICE	10	0	10	2W	2W	NO	YES	RD		
2231	VOICE	4.5	0	4.5	2W	2W	NO	NO	LOOP		
2260	DATA	16	+13	-3	2W	2W	NO	NO	NONE		
2261	DATA	(2)	(2)	(2)	2W	2W	NO	YES	NONE		
2432	VOICE	(2)	(2)	(2)	2/4W	4W	NO	NO	E&M		
2434	VOICE	(2)	(2)	(2)	2/4W	4W	NO	NO	E&M		
2435	VOICE	16	0	16	4W	4W	NO	YES	RD		
2462	DATA	(2)	(2)	(2)	4W	4W	NO	YES	NONE		
2463	DATA	16	+13	-3	4W	4W	YES	YES	NONE		
2464	DATA	16	+13	-3	2W	4W	YES	YES	NONE		

¹ The "Receive TLP at Customer" levels for voice applications may be higher than stated (i.e., less loss) if the objective allows less loss. This is normally due to situations where facility loss is less than the maximum objective loss and additional equipment would be required to increase circuit loss.

² See text or applicable references.

TABLE 2

SYNOPSIS OF AUDIO AND WIRED MUSIC CHANNEL SERVICES

<u>CHANNEL TYPE</u>	<u>CHANNEL DESCRIPTION</u>	<u>MAX 1004Hz LOSS (dB)</u>	<u>FREQ. SLOPE REQ. (dB)</u>	<u>FREQ. RANGE (Hz)</u>
6210	AUDIO	NONE	NON-EQUALIZED	
6211	AUDIO	12	NON-EQUALIZED	
6212	AUDIO	12*	±1	100 TO 5000
6213	AUDIO	12*	±1	50 TO 8000
6214	WIRED MUSIC	NONE	NON-EQUALIZED	
6215	WIRED MUSIC	14	NON-EQUALIZED	
6216	WIRED MUSIC	14*	±4	100 TO 5000
6217	WIRED MUSIC	14*	±4	50 TO 8000

* Pre-equalized loss

TABLE 3
CHANNEL AND ARRANGEMENT TYPES FOR AUDIO AND WIRED MUSIC

<u>TYPE</u>	CHANNEL TYPE							
	AUDIO				WIRED MUSIC			
	<u>6210</u>	<u>6211</u>	<u>6212</u>	<u>6213</u>	<u>6214</u>	<u>6215</u>	<u>6216</u>	<u>6217</u>
1	Y	Y	Y	Y				
2	Y	Y	Y	Y				
3	Y	Y	Y	Y				
4					Y	Y	Y	Y

ARRANGEMENT TYPES

- 1 STATION - TO - STATION
- 2 STATION TO DIST. AMP
- 3 DIST. AMP TO DIST. AMP
- 4 DIST. AMP TO STATION

BLANK SPACES INDICATE SERVICE NOT AVAILABLE.

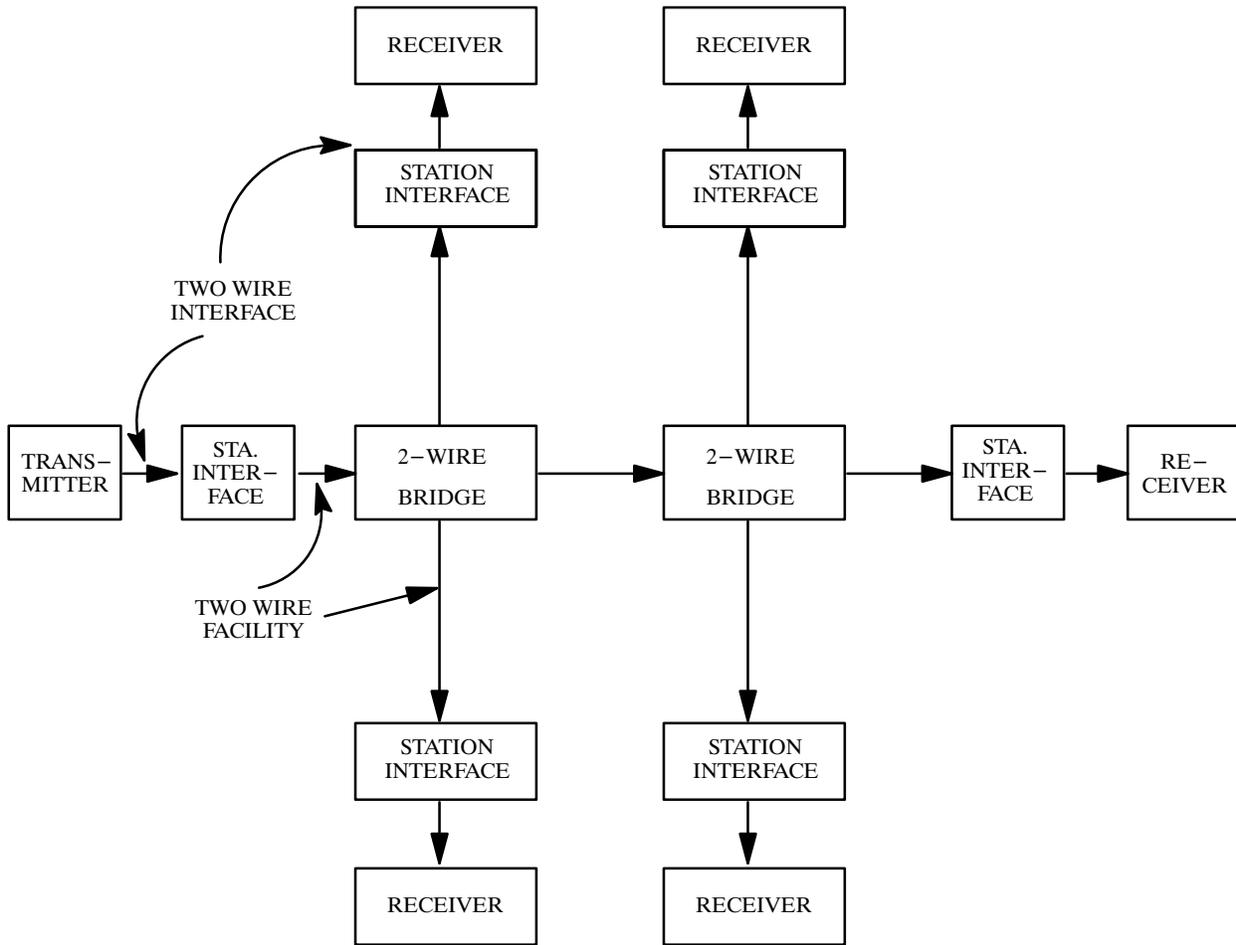


FIGURE 1 - BROADCAST MULTIPOINT EXAMPLE

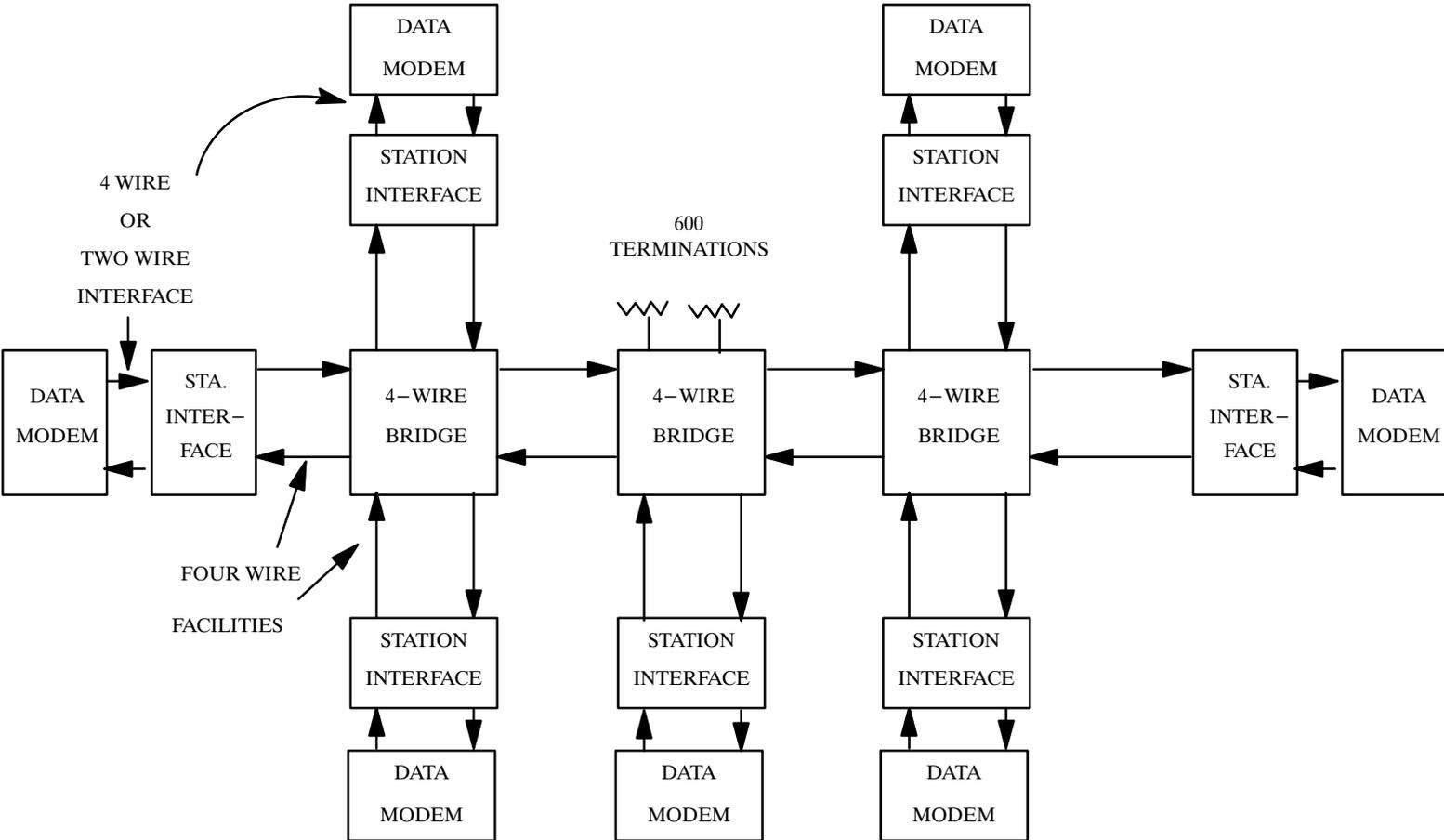


FIGURE 2 - CONFERENCE MULTIPPOINT EXAMPLE

FIGURE 2 – CONFERENCE MULTIPOINT EXAMPLE

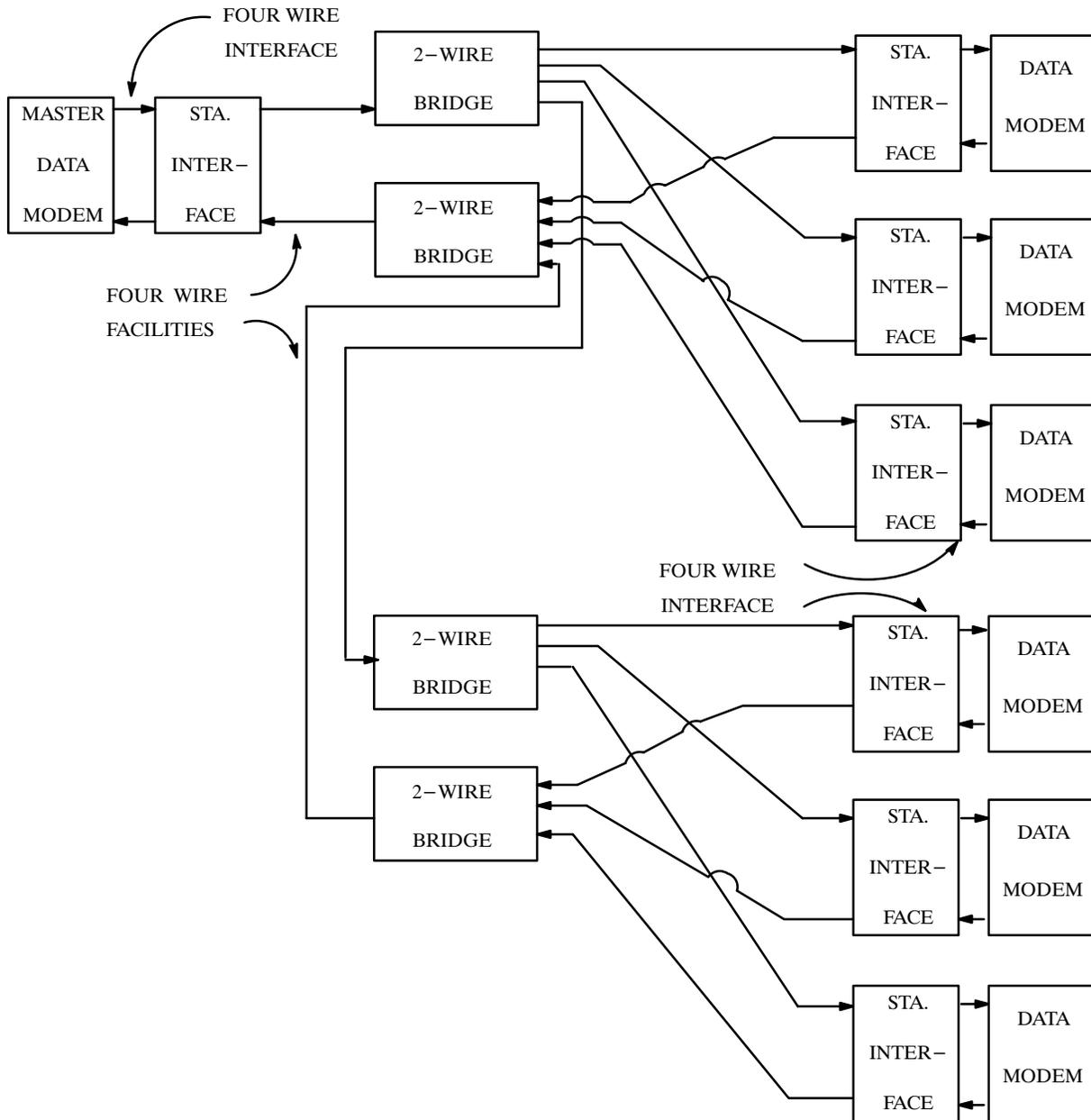


FIGURE 3 – BROADCAST POLLING MULTIPOINT EXAMPLE

TRANSMISSION PARAMETERS

1. GENERAL

This appendix explains or defines the transmission parameters used in this document to specify the performance of private line offerings. Where additional information may be required, other references are given.

2. LOSS

Loss is specified and measured in terms of transducer loss at 1004Hz. Transducer loss (L_T) of a linear two-port network is expressed in dB (decibels) and is:

$$L_T = 10 \log_{10} \left| \frac{\text{Power Available From the Source}}{\text{Power Delivered to the Load with Network Facilities Inserted}} \right|$$

To make this measurement, one would need an oscillator at one end of the channel and a detector at the other end, each with the impedance specified for that end of the channel. At the CPE end this is normally 600 ohms; and at the central office, this is normally 900 ohms.

3. FREQUENCY RESPONSE

This parameter indicates the departure from a uniform response relative to 1004 Hz. A "+" means more loss, and a "-" means less loss than the loss at 1004 Hz.

4. FREQUENCY ERROR

The difference in Hz of the receive frequency from the transmitted frequency is the Frequency Error parameter.

5. SIGNAL TO C-NOTCHED NOISE RATIO

This is a measurement of the amount of noise on a channel when a signal is present. When making this measurement, a -13 dBm0, 1004 Hz holding tone is applied at the transmitting end of the channel. This tone operates signal dependent devices. At the receiving end, the level of the tone is measured and removed. Then the noise is measured through a C-message filter (see Bellcore TR-TSY-000007 for description of filter characteristics), and the ratio of noise to the 1004 Hz level is the signal to C-notched noise ratio.

6. IMPULSE NOISE

Impulse Noise is characterized by large peaks or impulses above the average noise level. It is measured with an instrument which counts impulses greater than a selected threshold value. A 1004 Hz holding tone is transmitted to operate any signal dependent devices. This tone is notched out at the receive end. Measurements are made through a C-message filter.

7. ENVELOPE DELAY DISTORTION

A linear phase vs. frequency characteristic is needed for distortionless transmission. This is difficult to measure; however, performance can be approximated by measuring Envelope Delay Distortion (EDD). EDD is explained and defined in Bellcore Pub. 41004.

8. PHASE JITTER

Various sources cause the instantaneous phase or zero crossing of a signal to jitter at a rate normally less than 300 Hz. Further explanation of this parameter is given in Bellcore Pub. 41008.

9. NON-LINEAR DISTORTION

This parameter is measured by sending four equal level tones, with two centered at 860 Hz and two centered at 1380 Hz. The power of the second-order and third-order intermodulation products is then expressed as dB below the receive signal. Additional information may be found in Bellcore Pub. 41008 and 41009.