



SLC[®] Series 5 Carrier System Channel Unit Application and Prescription Setting

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1. Overview

1.01 This practice provides guidelines for selecting the proper *SLC*[®] Series 5 Carrier System channel unit for a given special service circuit application and for determining channel unit options. AT&T 363-205-010 describes the *SLC* Series 5 Carrier System. Plug-in data sheets (AT&T 363-005-101 through -310) provide detailed information on the channel units and common units.

1.02 This practice is reissued for the reasons listed below:

- To add information on the AUA141 and AUA142 channel units.
- To add information on the dataport channel units AUA34B, AUA52B, and AUA152.
- To add information on the Integrated Services Digital Network (ISDN) channel units AUA90 and AUA93.
- To add information on the AUA75 private line automatic ringdown channel unit.
- To add information on the AUA117 DS1 digital connectivity unit.
- To incorporate changes made in the AT&T 915-710-116 Addendum 1, Issue 1, January 1990.

1.03 This practice contains admonishments in the form of **CAUTIONS**. **CAUTION** indicates the presence of a hazard that **will** or **can** cause minor personal injury or property damage if the hazard is not avoided.

1.04 AT&T welcomes your comments on this practice. Your comments will aid in improving the quality and usefulness of AT&T documentation. Please use the Feedback Form provided at the end of this practice.

1.05 Additional copies of this practice and any associated appendixes may be ordered from the AT&T Customer Information Center by using one of the applicable methods:

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AT&T employees should process their orders as follows:

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1.06 Every effort was made to ensure that the information in this practice was complete and accurate at the time of printing. However, information is subject to change.

1.07 Special services may be provided by specific or generic (provisional) channel units (CUs). The specific channel units include *SPOTS*[®] channel units (for 2-wire locally-switched special services), direct inward dial (DID) channel units (for direct inward dial trunks), the dual ringing repeater channel units (for manual and automatic ringdown service), dataport channel units (for digital data service), and ISDN channel units [for ISDN basic rate interface (BRI) service].

1.08 The *SPOTS* channel unit applications include the following:

- (a) PBX-CO trunk.
- (b) WATS line (to Class 5 CO).
- (c) WATS trunk (to Class 5 CO).
- (d) Off-premises extension line.
- (e) Secretarial line.
- (f) CO centrex

The DID channel units are used specifically for DID trunk applications of 2-wire special services. Since the *SPOTS* and DID channel units do not require option setting, they are not included in this practice. Refer to AT&T 915-710-115, *SLC Series 5 Carrier System Application Engineering*, for design guidelines for the applications listed above. Detailed descriptions are given in AT&T 363-005-119 and -120 for *SPOTS* channel units and 363-005-114 and -115 for DID channel units.

1.09 Table A lists the channel units included in this practice. The channel units are listed by type; the apparatus code, *CLEI** code, and the special service circuit functions of each unit are also shown. Tables and figures are located in the back of the practice.

1.10 The AUA45B (dual manual ringing repeater) and AUA75 (dual private line automatic ring) are special service channel units used specifically for 2-wire private line voice applications. The channel units have physical option switches on the printed wiring board for prescription setting. Refer to Part 4 - *Applications and Prescription Setting for the Dual Ringing Repeater and the Private Line Auto Ring (PLAR) Channel Units* to prepare the Work Order Record Detail (WORD) documents.

1.11 The AUA90 channel unit provides three fixed time slots (2B+D). The AUA93 channel unit provides up to three time slots (B1, B2, and

D+) and four types of service (D-only, B1+D, B2+D, or 2B+D). An option switch is provided on the AUA93 channel unit to select the type of service. In the Series 5 system, ISDN 2B+D service requires allocation of three time slots; this restricts the placement of ISDN channel units.

1.12 The AUA90 channel unit provides the full ISDN 2B+D service to the customer by using three DS0 time slots in the *SLC* System. The AUA93 channel unit uses up to three DS0 time slots (B1, B2, and D+) and provides four types of service (D-only, B1+D, B2+D, or 2B+D). It is not provisionable and does not have option switches. The AUA90 channel unit provides an ISDN basic access T interface directly to a customer's ISDN terminal (TE1 - terminal equipment 1). The basic access T-interface does away with the need for an NT1 (network termination - layer 1) at the customer location. Point-to-point and point-to-multipoint arrangements are allowed for customer terminals.

The AUA93 BRITE II is a 2-wire channel unit that complies with the *ANSI*/* publication TI.601-1988 for the U-interface digital subscriber line (U-DSL). The basic rate interface terminal equipment (BRITE II) channel units are not compatible with the BRITE alternate mark inversion (AMI) channel units. The AUA93 channel unit provides ISDN basic access in the line terminating Mode (LT-Mode) to the NT1 at the customer location. The digital subscriber loop (DSL) is a technology that provides full-duplex service on a single twisted metallic pair at a high enough rate to support ISDN basic access and additional framing, timing recovery, and operations functions.

1.13 The AUA90 channel unit provides the 4-wire "T" interface to the customer (the T interface is an international standard defined by the International Telephone & Telegraph Consultative Committee — CCITT). The AUA90 channel unit DS0 interface is compatible with the D4/*SLC* 96 AHG3 BRITE channel unit, which works with the AMI format (an AT&T defined ISDN interface). For

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more information on the AUA93 BRITE II channel unit, refer to AT&T 363-205-107, AUA93 BRITE II (U-Interface) channel unit for ISDN, installation and maintenance.

1.14 The generic channel units (AUA41, AUA42, AUA43, AUA44, AUA54, AUA141, and AUA142) can be provisioned for a wide range of voice-frequency special services. The dataport channel units (AUA34, AUA34B, AUA52, AUA52B, and AUA152) provide digital data service and can be provisioned for different data rates. The digital connectivity unit (DCU), AUA16, AUA17, and AUA117 provides a DS1 interface for 24 channels of a digroup and replaces 12 channel units. The far end of the Series 5 system may terminate the DS1 circuit with another DCU or with channel units.

1.15 The generic special service and dataport channel units require electronic provisioning before service can be provided. In the case of the B version dataports, provisioning will also involve setting option switches on the channel unit. For provisioning these channel units, options and transmission values from the WORD document are entered with the J99404TA craft interface unit (CIU) and passed on to the bank controller. The bank controller stores the provisioning information and programs the channel unit immediately (if the channel unit is installed) or when it is installed. The DCU can also be provisioned with the CIU, but in most cases, the bank controller will provision the DCU automatically.

1.16 The 4-wire voice frequency (VF) attenuation, equalization, and balance settings are calculated using data compiled for the D4 channel units. The CIU accepts the D4 settings and converts them to Series 5 values for the bank controller to program the channel units. With this approach, a 4-wire Series 5 circuit can be designed using D4 design information to prepare the WORD documents for circuits. Tables B and C list the proper Series 5 system 4-wire channel unit and function code for each corresponding D4 and SLC 96 carrier channel unit.

1.17 Low Bit-Rate Voice (LBRV) Operation: In conventional operation, 12 channel units fill up a digroup shelf; with 2-wire (dual circuit) channel units, the $2 \times 12 = 24$ eight-bit bytes fill the DS1 bit stream. With 4-wire channel units, the even-numbered DS0 channels (one per physical slot) are unused, and the digital line operates at half capacity. In LBRV operation, each channel unit uses 8 bits in the DS1 bit stream. For 2-wire channel units, each circuit is compressed from 8 bits to 4 bits using an adaptive delta modulation technique which results in very little degradation in signal quality. For 4-wire channel units, the 8 bits of that circuit are passed through to the DS1 bit stream without compression. Based on the channel unit *CLEI* code, the bank controller determines if the channel is to be compressed. The result of LBRV operation is that all of the channels associated with two digroup shelves are carried by just one DS1 digital line: up to forty-eight 2-wire channels (compressed) and up to twenty-four 4-wire channels. In a system with LBRV, a digital connectivity unit (DCU) can be used in either terminal on any digroup, but not in both terminals on the same digroup. Any combination of 2- and 4-wire channel units can be used in a digroup on LBRV, whether or not a DCU is used at the opposite terminal; only the 2-wire circuits will be compressed.

1.18 This practice is issued by:
AT&T Document Development Organization
2400 Reynolda Road
Winston-Salem, NC 27106

2. Channel Unit Functional Description

2.01 The AUA42, AUA142 and AUA43 channel units provide transmission and signaling for 2-wire *nonlocally-switched* special service circuits. These channel units may also be used in locally-switched circuits that require on-hook transmission, loop-reverse-battery signaling, or calling party identification. In foreign exchange mode, toll diversion and on-hook transmission features are available, and calling party identification is provided

automatically. These channel units permanently select the 2.5-second delayed busy option on trunk processing. The 2-wire channel units are dual channel units; they occupy one physical slot and provide two channels. Each channel operates independently. The AUA42 and AUA142 are current sink channel units; the AUA43 is a current feed channel unit. Loop range of the AUA42, AUA142, and AUA43 channel units is nominally defined by the carrier serving area (CSA).

2.02 Four channel units provide 4-wire voice frequency (VF) special services: the AUA41, AUA141 (current feed), the AUA44 (current sink), and the AUA54 (E&M signaling). Channel unit applications include foreign exchange and WATS lines and trunks, PBX tie trunks, private line data or voice, extending service beyond the CSA range of AUA42, AUA142, AUA43, and *SPOTS* channel units, off-premises station (OPS) lines that extend beyond the CSA. The function code for the application is selected during provisioning. These channel units permanently select the 2.5-second delayed busy option on trunk processing. The 4-wire channel units provide one service channel (using only the odd-numbered channel of the channel slot).

2.03 Data services are provided by the dataport channel units: AUA34, and AUA34B digital signal zero (DS0) and the AUA52, AUA52B, and AUA152 office channel unit (OCU). These channel units are designed for use in an end link of a Digital Data System (DDS) private line data circuit. Each channel unit provides one channel of service. The OCU may be used in the central office terminal (COT) or the remote terminal (RT); the DS0 is always used in the COT. The office timing unit (AUA3 OTU) is required in the COT for synchronizing the dataport channel units.

A. 2-Wire Voice Frequency (VF) Special Service Channel Units

2.04 AUA42 and AUA142 Channel Units: These channel units are intended primarily for 2-wire nonlocally-switched ground- and loop-start special services, 2-wire private lines, and DID trunks. The AUA42 and AUA142 may also be used

in locally-switched services. The channel units are designed to interface a switching machine, other transmission equipment, or CSA cable. The AUA42 and the AUA142 are functionally identical, but the AUA142 has an extra level of protection against a power line being connected across the metallic leads. The AUA42 and AUA142 channel units functions are as follows:

- **FXO:** The foreign exchange - office end (FXO) function is used for a loop- or ground-start application, nonlocally or locally switched. Typical nonlocally-switched applications are foreign exchange trunks and lines and PBX off-premises stations. For the FXO function, the channel units may be used in either the COT or RT, depending on the application.
- **DPT:** The dial-pulse terminating (DPT) function is used for DID application, with either dial pulse or multifrequency signaling. For this function, the channel units are located in the RT.
- **TO:** The transmission-only (TO) function is used for private line application with no DC signaling. For this function, the channel units may be located in either the COT or RT (when the RT is at the customer location). Sealing current is not provided.

Table D lists the transmission and signaling options, the range for each option, and the options for each function.

2.05 AUA43 Channel Unit: This channel unit is intended primarily for 2-wire nonlocally-switched ground- and loop-start special services, 2-wire private lines, and DID trunks. The AUA43 may also be used in locally-switched services. The channel unit may interface with a switching machine, other transmission equipment, or CSA cable. The AUA43 channel unit functions are as follows:

- **FXS:** The foreign exchange - station end (FXO) function is used for a loop- or ground-start application, nonlocally or locally switched. Typical nonlocally-switched applications are foreign exchange trunks

and lines and PBX off-premises stations. For the FXS function, the channel unit may be used in either the COT or RT, depending on the application.

- **DPO:** The dial pulse originating (DPO) function is used for a DID application, with either dial pulse or multifrequency signaling. For this function, the channel unit is located in the COT.
- **TO:** The transmission-only function is used for private line application with no DC signaling. For this function, the channel unit may be located in either the RT or COT. The AUA43 provides sealing current to break down the high resistance film which may build up at unsoldered hand-twisted splices.

Table E lists the transmission and signaling options, the range for each option, and the options for each function.

B. 4-Wire VF Special Service Channel Units

2.06 AUA41 and AUA141 Channel Units: The AUA41 and AUA141 four-wire channel units are intended for use in circuits with loop-start, ground-start, or duplex signaling, and in private line data circuits with no signaling. In loop-start/ground-start (LS/GS) applications, the units have the same functions as the D4 four-wire foreign exchange - station end (4FXS) channel unit plus toll diversion; in duplex signaling applications, it performs like the D4 four-wire duplex (4DX) channel unit. In private line data applications, the AUA41 and AUA141 are optioned for the transmission only function, with or without equalization, which causes it to perform like the D4 four-wire transmission-only (4TO) or 4ETO channel unit. Equalization is provided only in the transmit direction, except for mismatch equalization that is in both directions. The AUA41 and AUA141 channel units have a DC current feed interface for connecting to other transmission equipment or to cable terminated by other transmission equipment or a PBX. The AUA41 and the AUA141 are functionally identical, but the AUA141 has an extra

level of protection against a power line being connected across the metallic leads.

2.07 Table F lists the function codes, range of settings for each option, and the WORD entries for the AUA41 and AUA141 channel units. As shown in Table G, the function code defines the channel unit function and the signaling modes. The AUA41 and AUA141 channel units may be used at the COT or RT for the following functions:

- **4FXS:** Typical applications of the foreign exchange - station end function are foreign exchange trunks or lines and off-premises PBX station lines. Typically, the AUA41 and AUA141 will interface a long 4-wire loop to a customer location or a metallic extension to a foreign CO, with the cable pairs usually terminated by a 4- to 2-wire repeater. These applications normally do not use the AUA41 or AUA141 in a back-to-back arrangement (which is more suitable to the dual AUA43 2-wire channel unit).
- **4DX:** The primary application of the 4-wire duplex function is PBX tie trunks. For this application, the AUA41 and AUA141 are used at the RT if the RT faces cable. (Additional equipment at the customer location provides the DX to E&M conversion.) If the RT is at the customer location, the AUA54 four-wire channel unit (which provides an E&M interface) should be used instead. With the AUA41 or AUA141 in the COT, the 4DX function provides an interface for cable or another 4-wire duplex channel unit in an interoffice or loop carrier system.
- **4TO/4ETO:** Both the 4-wire transmission only and 4-wire equalized transmission only functions are used in private lines (voice or data). The 4ETO function is used when equalization of cable transmission characteristics is required. Otherwise, the 4TO function is used. Sealing current is provided (and cannot be disabled) for both the 4TO and 4ETO functions. In applications where no sealing current is required, the AUA54 and AUA44 may be

substituted.

2.08 For the 4FXS, 4DX, and 4ETO functions, the AUA41 and AUA141 may be used with nonloaded cable: for 26 gauge, up to 25 kft; for 19 gauge, up to 66 kft. For loaded cable, the transmission range of this unit is 15 dB. Signaling range depends on the application. (For example, DX signaling range is substantially greater than the range for LS/GS applications.) Transmission and signaling ranges are comparable to the ranges of D4 four-wire channel units and metallic facility terminal (MFT) 4-wire repeaters. Because cable that conforms to the CSA design rules has a loss much less than 15 dB, the AUA41 or the AUA141 can serve a customer located well outside the CSA for a given Series 5 RT.

2.09 AUA44 Channel Unit: The AUA44 four-wire channel unit is intended for use in nonlocally-switched loop- and ground-start special services. The AUA44 channel unit can be used in circuits with loop-start, ground-start, or tandem signaling. In loop-start/ground-start applications, the unit functions like the D4 4FXO channel unit; in tandem applications, the unit functions like the D4 tandem (TDM) channel unit. The FXO function is selected for loop-start/ground-start applications where a 4-wire channel unit is required at the office end of a Series 5 loop-start/ground-start circuit or at the PBX end of a Series 5 off-premises station (loop-start) line. The AUA44 has a DC current sink interface for connecting to other transmission equipment or to cable terminated by other transmission equipment. Equalization is provided only in the transmit direction, except for mismatch equalization that is in both directions.

2.10 Table H lists the function codes, range of settings for each option, and the WORD entries for the AUA44 channel unit. As shown in Table I, the function code defines the channel unit function and the signaling modes. The functions for the AUA44 channel unit are listed below.

- **4FXO:** For the foreign exchange - office end function, the channel unit is always located at the COT (office end). For off-premises station applications, the channel unit is

located at the PBX end of the circuit which can be at the COT or RT. These applications are always 2-wire at the AUA44 end; therefore, when the AUA44 channel unit interfaces a loop or a metallic extension to a foreign switch, the cable will be terminated by a 4- to 2-wire repeater.

- **4TDM:** The 4-wire tandem (4TDM) function provides a back-to-back carrier interface for loop- or ground-start circuits. It can also be used for two-state signaling circuits such as tie trunks; but in those cases, the AUA54 is preferred. For LS/GS applications, the AUA44 with the TD____ function code is used in the RT at the customer location.

2.11 For the 4FXO function, the AUA44 may be used with nonloaded cable: for 26 gauge, up to 25 kft; for 19 gauge, up to 66 kft. For loaded cable, the transmission range of this unit is 15 dB. Because cable that conforms to the CSA design rules has a loss much less than 15 dB, the AUA44 can serve a customer located well outside the CSA for a given Series 5 RT.

2.12 AUA54 Channel Unit: The AUA54 four-wire channel unit can be used in circuits requiring E&M or pulse link repeater (PLR) type signaling to provide a tie trunk interface to a PBX or a back-to-back carrier arrangement with an interexchange carrier. In tie trunk applications, the E&M function provides the normal tie trunk interface. The PLR function provides the inverted E&M signaling interface required by certain terminal equipment as specified by Part 68 of the FCC Rules.

2.13 The AUA54 has the same functions as the D4 J98726CJ 4E&MS (SLC 96 Carrier System only) channel unit. The AUA54 channel unit can accommodate signal levels test level points (TLPs) ranging from -17.5 dB to +8.0 dB in the transmit direction and -17.0 dB to +8.5 dB in the receive direction (the same as the levels for the J98726CJ 4E&MS). The AUA54 channel unit (and the J98726CJ 4E&MS) can be used only in an RT at a customer location. Using an AUA54 channel unit in the COT is not recommended, because the AUA54 requires special connections to the COT

backplane for the E&M leads. The AUA54 may interface with a PBX, automatic call distribution (ACD), or other transmission or signaling equipment located in the same building. The AUA54 does not provide equalization.

2.14 Table J lists the function codes, range of settings for each option, and the WORD entries for the AUA54 channel unit. As shown in Table K, the function code defines the channel unit function and the signaling modes. The AUA54 channel unit functions are listed below.

- **4E&M:** The E&M function is used in PBX tie trunks to provide the E&M signaling interface. It converts the DC signal from the PBX M lead into pulse code modulation (PCM) signaling pulses for the digital line. Similar pulses from the digital line are converted into a DC signal and sent to the PBX over the E lead.
- **PLR:** The primary application of the PLR function is in PBX tie trunks. It provides the E&M signaling interface with inverted polarity. The channel unit converts the DC signal from the PBX E lead into PCM signaling pulses for the digital line. Similar pulses from the digital line are converted into a DC signal and sent to the PBX over the M lead.

C. Dataport Channel Units

2.15 AUA52 OCU and AUA152 OCU Dataport Channel Units: The AUA52 and AUA152 office channel units (OCUs) dataport are intended primarily for use in an end link of a Digital Data System (DDS) private line data service. The end link is the part of the service between a customer and the local central office. The AUA52 and AUA152 OCUs may also be used in a local data service. For DDS applications, the AUA52 and AUA152 OCUs are always located in the RT. For local data applications, the channel units may be used in the COT as well as the RT. The OCU dataport provides adequate sealing current when the equivalent external load is less than 4050 ohms. The AUA52 OCU and the AUA152 OCU are functionally identical, but the AUA152 provides an

extra level of protection against a power line being connected across the metallic lead.

2.16 The AUA52 and AUA152 OCUs provide one channel of service and serve as the interface between full-duplex synchronous digital data (bipolar return-to-zero format) on a 4-wire customer loop and the digital line PCM bit stream. The customer data rate may be 2.4, 4.8, or 9.6 kb/s (called subrates) or 56 kb/s.

2.17 In a system *without* low bit-rate voice, all 48 channel unit slots can be equipped with AUA52 and AUA152 OCU dataports. In a system *with* low bit-rate voice, an AUA52 or AUA152 OCU provisioned for second channel error correction the adjacent (next higher numbered) slot must be left vacant; an OCU should not be installed in the highest-numbered slot of a digroup (23/24, 47/48, 71/72, or 95/96). Otherwise, the AUA52 and AUA152 can be used in any channel unit slot adjacent to any other Series 5 channel units.

2.18 Options, function code, and WORD entries for the AUA52 and AUA152 OCUs are summarized in Table L; the options are explained below:

- **Subscriber Data Rate:** Select customer data rates of 2.4, 4.8, 9.6, or 56 kb/s.
- **Error Correction (SCEC, NONE, or MVEC):** With second channel error correction (SCEC) selected, both time slots (channels) associated with a plug-in slot are used. The odd-numbered channel is used for data, and the even-numbered channel is used for error correction. In systems with low bit-rate voice, the error-correcting channel uses the time slot normally used by the adjacent next-higher numbered channel unit. For majority vote error correction (MVEC), the odd-numbered time slot carries both the data signal and the error correction information (as four identical copies of the data signal). For 56 kb/s service, the error correction options are SCEC or NONE. For a data service at one of the subrates, any of the error correction options may be chosen, although MVEC is the normal selection.

- **All-Zero-Code Allowed (YES or NO):** When the All-Zero-Code option is set to YES, the AUA52 and AUA152 OCU will allow eight consecutive zeros to be transmitted toward the digital line. If the option is set to NO, two of the zeros, in a string of eight zeros, will be set to ones. This option should always be set to NO if the line interface unit (LIU) is set for Zero Code Suppression. If the LIU is set for B8ZS line coding, either YES or NO may be chosen for the All-Zero-Code Allowed option.
- **Secondary Channel Used (YES or NO):** This option should not be confused with SCEC. A secondary channel is a low-speed telemetry channel added to the customer's data bits. The secondary channel option should be selected only when suitable customer premises equipment is available.

2.19 AUA52B OCU Dataport Channel Unit: The AUA52B OCU dataport is primarily used in an end-link of a DDS private line data service. The end-link is the part of the service between a customer and the local central office. The AUA52B OCU may also be used to provide local data service. For DDS applications, the AUA52B OCU is always located in the RT. For local data applications, the unit may also be used in the COT as well as the RT. The AUA52B OCU supplies the proper sealing current to the T/R and T1/R1 leads when the external load is less than 4050 ohms. Like the AUA152 OCU, the AUA52B OCU provides an extra level of protection against a power line being connected across the metallic lead.

2.20 The AUA52B OCU is backward compatible with all the features of the AUA52 and AUA152 OCUs. The AUA52B is an enhanced version of the AUA52 OCU, with the following additional features:

- 19.2 kb/s data rate
 - 64-kb/s clear channel capability
 - Faceplate loopback status indicator
- Faceplate controlled local loopback occurring at the pulse code modulation (PCM) bit stream
 - 4-wire bridging access faceplate jack, compatible with 19 kb/s test equipment.
- 2.21** The AUA52B OCU provides one channel of service and serves as the interface between full-duplex synchronous digital data (bipolar return-to-zero format) on a 4-wire customer loop and the PCM bit stream. The digital rate may be 2.4, 4.8, 9.6, or 19.2 kb/s (called subrates), or 56 or 64 kb/s (called fullrates). The unit transmits and receives a bipolar return-to-zero (RZ) signal on the 4-wire loop. The maximum cable loss that can be tolerated is 34 dB measured at a frequency equal to one-half the customer's primary data rate. The line drivers and receivers present a balanced 135-ohm impedance across the signal frequency range.
- 2.22** In a system *without* low bit-rate voice, all 48 channel unit slots can be equipped with AUA52B OCU dataports. In a system *with* low bit-rate voice, an AUA52B OCU provisioned for second channel error correction the adjacent (next higher numbered) slot must be left vacant; an OCU should not be installed in the highest-numbered slot of a digroup (23/24, 47/48, 71/72, or 95/96). Otherwise, the AUA52B OCU can be used in any channel unit slot adjacent to any other Series 5 channel units.
- 2.23** The channel unit offers several options. An error correction option is provided to avoid the need to qualify the T-carrier facility for DDS services. There are three error correction methods — the appropriate method depends on the customer data rate. All error correction methods ensure a 10^{-8} error-rate performance for a 10^{-3} error rate facility. The unit provides a zero-code option to guarantee a sufficient ones density on the T-facility. A secondary channel option, when selected, provides to the end-user a low-speed telemetry channel.
- 2.24** The two switch-settable options are as follows:

- 19.2 (Enable, Disable). Setting the options for a data rate of 19.2 kb/s requires that the 19.2 option switch on the AUA52B OCU be set to the ENABLE position. This action overrides the subscriber data rate set by the CIU. Other CIU options are set as required. When enabling the 19.2 option, a green faceplate light emitting diode (LED) lights to indicate the switch setting.
- CC (Enable, Disable). Provisioning the unit for 64 kb/s clear channel service requires setting the clear channel (CC) switch to the ENABLE position — the remaining options must be set using the CIU as follows:
 - Subscriber data rate — 56
 - Error Correction — SCEC, if secondary channel error correction is desired
 - All Zero Code Allowed — YES
 - Secondary Channel Used — YES.

2.25 When the two switch-settable options are set to DISABLE, the AUA52B OCU operates identically to the AUA52 OCU and AUA152.

2.26 Options, function code, and WORD entries for the AUA52B and are summarized in Table L; the options are explained below:

- **Subscriber Data Rate:** Select customer data rates of (2.4, 4.8, 9.6, or 56 kb/s).



NOTE:

For 19.2 kb/s service, any of the valid subrates can be entered (2.4, 4.8, 9.6, or 56 kb/s).

- **Error Correction (SCEC, NONE, or MVEC):** For a 56-kb/s service, the error correction options are SCEC or NONE. For a data service at one of the subrates, any of the error correction options may be chosen, although MVEC is the normal selection. When SCEC is used, both PCM time slots associated with a plug-in slot are used — the odd-numbered time slot is used for data

and the even-numbered time slot is used for error correction. For MVEC, the odd-numbered time slot is used for both purposes. When the AUA52B OCU is optioned for 19.2 kb/s service, the MVEC option invokes the single time slot error correction method described in *Contribution to the ANSI T1 Standards Project*, document #T1ZX1.4/89-023.

- **All-Zero-Code Allowed (YES or NO):** When the ALL-ZERO-CODE option is set to YES, the AUA52B OCU will allow eight consecutive zeros to be transmitted toward the digital line. If the option is set to NO, two of the zeros, in a string of eight zeros, will be set to ones. This option should always be set to NO if the line interface unit (LIU) is set for ZERO CODE SUPPRESSION. If the LIU is set for B8ZS line coding, either ALL-ZERO-CODE option may be chosen. For 64 kb/s clear channel service, this option is set to YES and the LIU must be optioned for B8ZS.
- **Secondary Channel Used (YES or NO):** This option should not be confused with SCEC. A secondary channel is a low-speed telemetry channel added to the customer's data bits. The secondary channel capability should be used only when suitable customer premises equipment is available.

2.27 AUA34 DS0 Dataport Channel Unit: The AUA34 digital signal zero (DS0) dataport channel unit is intended primarily for use in an end link of a Digital Data System (DDS) private line data circuit. The end link is the part of the service between a customer and the local central office. The customer data rate may be 2.4, 4.8, or 9.6 kb/s (called subrates) or 56 kb/s. The DS0 dataport is always located in the COT.

2.28 The AUA34 DS0 dataport provides one channel of service and serves as the interface between a synchronous DS0 64 kb/s bit stream (bipolar non-return-to-zero format) on the 4-wire metallic side of the channel and the digital line PCM bit stream. For most applications, the 4-wire T/R side of the dataport will interface another

DS0 dataport channel unit in an interoffice carrier system. The interoffice carrier connects the Series 5 DDS end link to a DDS hub office.

2.29 In a system *without* low bit-rate voice, all 48 channel unit slots can be equipped with AUA34 channel units. In a system *with* low bit-rate voice and AUA34 DS0 dataport provisioned for SCEC, the adjacent (next higher numbered) slot must be left vacant and thus should not be installed in the highest-numbered slot of a digroup (23/24, 47/48, 71/72, or 95/96). Otherwise, the AUA34 can be used in any channel unit slot adjacent to any other Series 5 channel units.

2.30 The AUA34 DS0 dataport operates with one of two function codes: DS0A or DS0B. For data service at the subrates (2.4, 4.8, or 9.6 kb/s), use DS0A. For 56 kb/s data service, use DS0B. The DDS network hierarchy has been organized such that at the 64 kb/s DS0 level, a DS0 signal can represent:

- (1) A signal from one customer, either at 56 kb/s or at a subrate where the customer's signal has been byte-replicated 4, 9, or 19 times (for 9.6, 4.8, or 2.4 kb/s, respectively)
- (2) A multiplexed signal containing a number of subrate customers' signals which have been interleaved.

The one-customer case is designated a DS0A signal, and the multiple-customer signal is designated DS0B. However, a DS0 signal comprising a 56 kb/s customer signal is often treated as a DS0B signal in a DDS office because multiplexing is not involved in the process of conversion to DS0B format. These definitions have been applied to dataport channel units as follows:

- When the digital signal zero - data port (DS0-DP) carries a subrate signal (that will be multiplexed in the conversion to the DS0B format), the function code is DS0A.
- When the DS0-DP carries a 56 kb/s signal (which does not pass through a multiplexer enroute to the DS0B stage), the function code is DS0B.

2.31 Options, function codes, and WORD entries for the AUA34 DS0 dataport are summarized in Table M; the options are explained below:

- **Error Correction (SCEC, NONE, or MVEC):** With SCEC selected, both time slots (channels) associated with a plug-in slot are used. The odd-numbered channel is used for data, and the even-numbered channel is used for error correction. In systems with low bit-rate voice, the error-correcting channel uses the time slot normally used by the adjacent next higher-numbered channel unit. For MVEC, the odd-numbered time slot carries both the data signal and the error correction information (as four identical copies of the data signal). For 56 kb/s service, the error correction options are SCEC or NONE. For a data service at one of the subrates, either of the error correction options (SCEC or MVEC) may be chosen, although MVEC is the normal selection.
- **All-Zero-Code Allowed (YES or NO):** When the All-Zero-Code option is set to YES, the AUA34 will allow eight consecutive zeros to be transmitted toward the digital line. If the option is set to NO, two of the zeros in a string of eight zeros will be set to ones. This option should always be set to NO if the LIU is set for Zero Code Suppression. If the LIU is set for B8ZS line coding, either YES or NO may be chosen for the All-Zero-Code Allowed option.

2.32 AUA34B DS0 Dataport Channel Unit: The AUA34B DS0 dataport channel unit is intended primarily for use in an end-link of a DDS private line data service. The end-link is the part of the service between a customer and the local central office. The customer primary data rate may be 2.4, 4.8, 9.6, or 19.2 kb/s (called subrates), or 56 or 64 kb/s (called fullrates). The AUA34B DS0 dataport channel unit is always located in the COT.

2.33 The AUA34B DS0 dataport channel unit is backward compatible with all the features of the AUA34 DS0 dataport channel unit. The AUA34B is an enhanced version of the AUA34,

with the following additional features:

- 19.2 kb/s data rate capability
- Faceplate loopback status indicator
- 4-wire bridging access faceplate jack which also connects the clock sources necessary to drive DDS-type test sets.

2.34 The AUA34B provides one channel of service and serves as the interface between a synchronous DS0 64 kb/s bit stream (bipolar non-return-to-zero format) on the 4-wire tip/ring side of the unit and the digital line PCM bit stream. The customer data, at a data rate less than or equal to 64 kb/s, is embedded in the 64 kb/s bit stream. For most applications, the 4-wire tip/ring side of the CU will face another DS01 dataport CU in an interoffice carrier system, which connects the Series 5 Carrier System DDS end-link to a DDS hub office. The DS0 signal at the Tip and Ring interface has a range limitation of 1500 feet. The line drivers and receivers present a balanced 135-ohm impedance across the signal frequency range.

2.35 In a system *without* low bit-rate voice, all 48 channel unit slots can be equipped with AUA34B channel units. In a system *with* low bit-rate voice and the AUA34B provisioned for 56 kb/s and SCEC, the adjacent (next higher numbered) slot must be left vacant and thus should not be installed in the highest-numbered slot of a digroup (23/24, 47/48, 71/72, or 95/96). Otherwise, the AUA34B can be used in any channel unit slot adjacent to any other Series 5 channel units.

2.36 The AUA34B DS0 dataport operates with one of two function codes: DS0A or DS0B. For data service at the subrates (2.4, 4.8, or 9.6 kb/s), use DS0A. For 56 kb/s data service, use DS0B. The DDS network hierarchy has been organized such that at the 64 kb/s DS0 level, a DS0 signal can represent:

- (1) A signal from one customer, either at 56 kb/s or at a subrate where the customer's signal has been byte-replicated 5, 10, or 20 times (for 9.6, 4.8, or 2.4 kb/s, respectively)

- (2) A multiplexed signal containing a number of subrate customers' signals which have been interleaved.

The one-customer case is designated a DS0A signal, and the multiple-customer signal is designated DS0B. A DS0 signal comprising a 56 kb/s customer signal is often treated as a DS0B signal in a DDS office because multiplexing is not involved in the process of conversion to DS0B format. These definitions have been applied to dataport channel units as follows:

- When the DS0-DP carries a subrate signal (that will be multiplexed in the conversion to the DS0B format), the function code is DS0A.
- When the DS0-DP carries a 56 kb/s signal (which does not pass through a multiplexer enroute to the DS0B stage), the function code is DS0B.

2.37 Three error correction options are provided to avoid the need to qualify the T-carrier facility for DDS services. All methods ensure a 10^{-8} error-rate performance for a 10^{-3} error-rate facility. The appropriate error correction method depends on the customer data rate. The unit also provides a zero-code option to guarantee a sufficient ones density on the T-facility.

⇒ NOTE:

If error correction is desired when the customer data rate is 19.2 kb/s, a board-mounted switch must also be set. This switch is used in conjunction with error correction options set by the CIU.

2.38 Options, function codes, and WORD entries for the AUA34B DS0 dataport are summarized in Table M; the options are explained below:

- **Function Code (DS0-A or DS0-B)** : Choose DS0-A for customer data service at a subrate (2.4, 4.8, 9.6, or 19.2 kb/s). Choose DS0-B for a 56 or 64 kb/s service.

- **Error Correction (SCEC, NONE or MVEC):** For a DS0-B signal format (full-rate service), the error correction options are SCEC or NONE. For a DS0-A signal format, any of the error correction options may be chosen, although MVEC is the normal selection. When 19.2 kb/s error correction is desired, the on-board 19.2-switch should be set to the ENABLE position prior to installing the unit — this arms the 19.2 kb/s error correction feature. The 19.2-faceplate LED will illuminate indicating the arming of the 19.2 function. Selecting the MVEC option in conjunction with the 19.2-switch option invokes the 19.2 kb/s error correction feature per the format described in contributions to the ANSI T1 Standards Project, document #T1ZX1.4/89-023. When SCEC is used, both PCM time slots associated with a plug-in slot are used — the odd-numbered time slot is used for data and the even-numbered time slot is used for error correction. For MVEC, the odd-numbered time slot is used for both.
- **All-Zero-Code Allowed (YES or NO):** When the All-Zero-Code option is set to YES, the AUA34B will allow eight consecutive zeros to be transmitted toward the digital line. If the option is set to NO, two of the zeros, in a string of eight zeros, will be set to ones. This option should be set to NO if the LIU is set for Zero Code Suppression. If the LIU is set for B8ZS line coding, either All-Zero-Code option may be chosen. For 64 kb/s clear channel capability, this option is set to YES and the LIUs must be optioned for B8ZS.

D. Digital Connectivity Unit (DCU)

2.39 The digital connectivity unit (DCU) replaces 12 channel units which normally provide A/D and D/A conversion for 24 channels of one digroup. It also transmits blue signal and yellow alarm as required to indicate system failures to the digital network. The DCU is designed for metallic circuits carrying a DS1 signal with the Fs (D4) framing format. Such circuits include interoffice DS1 facilities, higher-level digital facilities, the Digital

Access and Cross-Connect System (DACS), another DCU, a D type channel bank or digital data bank, or a digital PBX. The DCU consists of two units, the DCU-L (AUA16) and DCU-R (AUA17 or AUA117) which may be used at one or both ends of a system equipped with MC97755A1 and MC97756A1 bank control units (BCUs). In systems with low bit-rate voice, the DCU can be used in either end of the system, but not in both ends of the same digroup. Either pair, AUA16/AUA17 or AUA16/AUA117, operates correctly in the J1C182AD-1 or J1C182AA-1 COT and/or the J1C182AE-1, J1C182AF-1, J1C182AB-1, or J1C182AC-1 RT. The DCU is not compatible with previous BCUs (MC97722/23, MC97724, and MC97725/26) nor with later BCUs.

2.40 Each channel of the DCU is conditioned to carry either VF or data signals. This control is based on the type of channel unit (message or special service VF, dataport, or DCU) installed or provisioned at the distant end, or by provisioning with the CIU. When a far-end channel is provisioned or has a nonprovisionable channel unit installed in it, the DCU channel does not have to be provisioned manually because the bank controller reads the channel unit identification (ID) and provisions the DCU channel automatically. In this case, the far end channel unit ID overrides any provisioning of the DCU channel. With a DCU installed at both ends of the digroup, the time slot in each DCU may be provisioned for VF or data service; until the service type is provisioned, the bank controller sets each time slot in the DCU for VF service (default).

2.41 When the DCU channel is provisioned for VF service (with the signaling carried by the 8th bit every 6th frame), the DCU will maintain the current signaling state during a loss of incoming signal lasting up to 2 seconds. This ensures that a 2-second hit on the external DS1 line will not drop the connection.

3. 2-Wire E *SPOTS*® Channel Unit Applications

A. Channel Unit Capabilities

3.01 The 2-wire channel units provide transmission treatment for 2-wire special service circuits over loops or interoffice trunks within the carrier serving area (CSA). Specifications of the transmission properties for 2-wire E *SPOTS* channel units are given in Table N. (CSA guidelines are summarized in Part 12.) The channel units provide signaling over CSA cable for RT applications and over loops or interoffice cable with resistance of 1500 ohms or less for COT applications. When the current feed channel unit (AUA43) is used at the COT over a loop, the ringing range is limited by the ringing voltage supplied from the central office. The AUA43 can support 4 ring equivalent number (REN) (ringer equivalence number) or 5 C4A ringers over a loop with resistance less than or equal to 1000 ohms. For loops with a resistance between 1000 and 1500 ohms, the AUA43 can ring only 3 REN or 4 C4A ringers. When the AUA42/AUA142 is used at the COT and the signaling range is outside CSA limits (loop resistance more than 750 ohms), an MFT 2-2 repeater and signaling unit (for dial pulse correction) are needed.

B. Circuit Applications

3.02 A total of 29 circuits, which are grouped into 18 applications, are shown in Figures 1 through 18. These applications show some typical special service circuits which can be designed with AUA42/AUA142 and AUA43 channel units. Included with each circuit application are the design transmission level points (TLPs), typical end-to-end trunk or line loss objectives for the application [for example, Figure 1 (1.1) shows a line loss objective of 3.5 dB], and the set of functions and options for the Series 5 channel units in the circuit. Circuits with the same set of channel unit functions and options are grouped into one application. In addition to CSA cable, some circuits contain cable labeled non-CSA cable. Non-CSA cable is frequently encountered in special services

circuits and may be loaded or nonloaded.

3.03 These applications illustrate the following types of service:

- Foreign exchange (FX) lines or WATS lines (Figures 1 through 3)
- FX trunks or WATS trunks (Figures 4 through 6)
- Off-premises station (OPS) lines (Figures 7 through 12)
- PBX-CO trunks with toll diversion (Figure 13)
- Plain old telephone service (POTS) lines (Figure 14)
- Direct-inward-dial (DID) trunks (Figure 15)
- 2-wire private line data (Figures 16 through 18).

3.04 These applications are arranged such that for services (1) through (5) (Figures 1 through 14), the AUA42/AUA142 and AUA43 channel units operate with the FX function; for DID trunks (Figure 15), they operate with the DP function; and for private line data services (Figures 16 through 18), they operate with the TO function. Loop-start signaling is used with FX lines, WATS lines, OPS lines, and POTS lines with on-hook transmission. Ground-start signaling is used with FX trunks and PBX-CO trunks with toll diversion. The DID trunks use loop-reverse-battery signaling. For locally-switched DID circuits, the AUA36 and AUA56 DID channel units should be used (AT&T 915-710-115).

3.05 Calling Party Identification (CPI): Calling party identification (CPI) provides information about the caller to the called party before answer. During this silent interval after the first alerting 2-second ringing phase, data are sent from the CO to the customer premises equipment (CPE) with the transmission level of -13.5 ± 1 dBm into a 900 ohm load (Reference: Bell Communications Research Technical Reference, *SPCS Customer Premises Equipment Data Interface*, TR-TSY-000030 Issue 1, November

1988 and *CLASSSM Feature: Calling Number Delivery*, TR-TSY-000031 Issue 3, January 1990.)

3.06 This CPI feature is automatically provided by the AUA42/AUA142 or AUA43 channel unit when it is provisioned for the FX function with the on-hook transmission (OHT) option (OHT = YES). The transmission path to the CPE is established within 15 msec following the completion of the first alerting signal and is then disabled after 5 ± 0.5 seconds or when the next ringing is applied. In the other transmission direction, the AUA42/AUA142 or AUA43 channel unit provides infinite loss during this CPI period. With a signal of -13.5 dBm at 2200 Hz input to the 2-wire channel (900 ohms structural impedance for the AUA42/AUA142 and 600 ohms structural impedance for the AUA43), the level across a 600-ohm load with no DC hold on the T/R of the AUA43 channel unit is around -23 dBm (assuming that the AUA42/AUA142 has 0 dB gain provisioned).

3.07 On-Hook Transmission (OHT): OHT allows data to be transmitted between the CO and the CPE using the voice path when it is idle. The AUA42/AUA142 and AUA43 channel units have an OHT option (OHT = YES or NO) with the FX function. When this option is selected (OHT = YES), the channel units maintain transmission paths for both directions in the on-hook condition and return to the FX function in the off-hook condition. In the on-hook condition with OHT selected, both channel units provide approximately 9.2 dB loss in the receive direction and 4.4 dB loss in the transmit direction (with the AUA42/AUA142 matched into 900 ohms and the AUA43 matched into 600 ohms). These conditions provide adequate gain for expected applications and ensure sufficient margin against singing. On-hook transmission should be used *only* for loop-start services and *only if needed* by the customer. The customer may need OHT for meter-reading services or energy management services that use in-band signaling. Another application is a burglar alarm service that uses in-band signaling without going off hook.

3.08 Forward Disconnect: A pair of AUA42/AUA43 or AUA142/AUA43 channel units automatically provides forward disconnect. This feature operates in loop- and ground-start modes with a filter threshold of 0.35 to 0.5 seconds to provide open switching interval protection. Forward disconnect is disabled when on-hook transmission is provisioned (OHT = YES).

C. Circuit Design Considerations

3.09 Zero dB Bit stream: The circuits in Figures 1 through 13 and Figure 15 are designed with 2-wire channel unit gain set so that the bit stream level of the Series 5 system is zero TLP. This makes the Series 5 system easier to cross-connect with other digital systems in the network. In the private line data circuits (Figures 16 through 18); the TLP of the bit stream is set at +7 with +13 dB TLP input level; that is, the bit stream level is -6 dBm for a 0 dBm input. To achieve a 0 dBm bit stream level, the input data test tone (Data Alignment Tone) must be adjusted at +6 dBm level.

3.10 2-Wire Back-to-Back VF Interface at CO: Many of the circuits (Figures 2, 3, 5, 6, 8 through 12, 17, and 18) contain a 2-wire Series 5 special service channel unit which interfaces cross-office with other 2-wire transmission equipment. The AUA42/AUA142 and AUA43 channel units have a number of balance settings to provide satisfactory hybrid balance for this back-to-back hybrid arrangement.

3.11 In most circuits with interoffice connections, the Series 5 end-links (Series 5 plus CSA cable) have 1.5 dB of loss. This guideline of 1.5 dB of fixed end-link loss provides equal loss in both directions and allows the widest range of cable lengths and connecting equipment (to Series 5) without exceeding the cross talk and gain transfer limits of that equipment. This guideline does not apply to the following:

- Private line data circuits (which have variable loss)
- OPS lines with Series 5 back-to-back (Figure 10), which have 2.0 dB of loss for both Series 5 end-links

- Circuits with unusual TLPs at the customer location.

3.12 Metallic Facility Terminal (MFT) Interface:

These circuits (Figures 3.1, 3.2, 6.1, 6.2, 8.1 and 9.1) use a 2-wire MFT channel unit to interface a Series 5 AUA42/AUA142 or AUA43 channel unit. The MFT channel unit is a 2-2 terminal repeater (for example, J99343PA, PB, or PG) with the B-side always facing non-CSA cable and the A-side facing the AUA42/AUA142 or AUA43 channel unit. If an MFT signaling unit is needed, the NOR, RV and NOR, RV/T switches in the 2-2 repeater must be set to RV and RV/T (that is, the reverse mode for B to A signaling) except in the OPS line circuit (Figure 8.1). The OPS line circuit requires A to B signaling from the PBX side, and the NOR, RV and NOR, RV/T switches should be set to NOR. For circuits (Figures 3.1, 3.2, 6.1, 6.2, and 9.1) a signaling unit is required for dial pulse correction when the non-CSA loop or trunk has more than 750 ohms resistance facing the AUA42/AUA142 channel unit. In these circuits, a combined function unit (CFU), J99343GG, GH, GK, or GL, can also be used. The signaling option (LS/GS) and cable type (L/NL) determine which combined function unit to use, as summarized in Figures 19 and 20.

3.13 D() Channel Unit Interface: These circuits (Figures 2.1, 2.2, 2.3, 5.1, 5.2, 5.3, 8.2, 9.2, 11, 12, and 18) use D() channel units to interface a Series 5 AUA42/AUA142 or AUA43 channel unit at CO. The D() channel units are 2-wire FXS, FXO, foreign exchange-station end/gain transfer (FXS/GT), foreign exchange-office end/gain transfer (FXO/GT), foreign exchange-office end/loop start (FXO/LS), foreign exchange-station end/loop start (FXS/LS), and TO channel units. Gain transfer (FXS/GT or FXO/GT) is usually required if the D() channel unit faces a loop between the CO and customer premises (Figures 8.2 and 9.2). The FXS/LS and FXO/LS channel units can be used in circuits that use loop-start signaling.

3.14 Voiceband Alarm Circuits: Figures 16 through 18 illustrate circuit designs for 2-wire voiceband alarm applications. End-to-end loss of alarm circuits might be 16, 10, or 8 dB; the figures

assume end-to-end loss of 16 dB. Network channel terminating equipment (for example, the 150A CSU) must provide attenuation of at least 6 dB to avoid excessive cross talk in maximum length cables; this 2-way attenuation tends to reduce severely the range of loop cables which can be served. To ensure that all CSA loops can be served, a special test level has been defined, called the data alignment tone (DAT) level. The DAT level is 6 dB lower than TLP level and 7 dB higher than data level. Using DAT levels for circuit alignment, CSA loops with maximum loss can be accommodated while maintaining the bit stream level at 0.0 dB; whereas, if data levels are used, loop loss must be limited to 0.5 dB or less if the bit stream level is maintained at 0.0 dB. The WORD can specify DAT levels with a note at line 002: "Levels shown are offset from TLP by 6 dB in both directions."

3.15 The AUA43 channel unit is used in both COT and RT (Figure 16) to provide sealing current in the voiceband alarm circuit. The circuits shown in Figures 16 through 18 are designed for tonal signals with a small peaking factor. These circuit designs should not be used for voice traffic which has a high peaking factor; the +7 TLP carrier level in the circuit design would cause clipping and, except for short loops, excessive cross talk. These circuits (Figures 16 through 18) can also be used in private line data applications; however, AT&T 880-420-102 specifies that if any portion of a private line data circuit is 4-wire, the entire circuit must be designed as 4-wire unless the circuit uses only one direction of transmission.

3.16 Zero Loss Impedance Compensator: All of the FX trunks in Figures 4 through 7 are shown without impedance compensation at the customer location. If impedance compensation is needed, setting the impedance compensator to zero loss allows use of the same circuit TLPs.

3.17 Use of AUA42/AUA142 and AUA43 Channel Units for Single Party or 2-Wire Locally Switched Applications: In order to provide toll diversion, the AUA42/AUA142 or AUA43 channel units may be substituted for the SPOTS channel units normally used. Such circuits

do not require design; the AUA42/AUA142 and AUA43 are treated like *SPOTS* channel units (AUA39/AUA150). Settings for 2-wire locally-switched special services are shown in Figure 14 for a PBX-CO trunk. Settings that emulate *SPOTS* channel units are recommended for PBX-CO applications; these circuits are typically tested by MLT, and circuit-designed settings frequently are not compatible with MLT procedures.

4. Applications and Prescription Settings for the Dual Ringing Repeater and the Private Line Auto Ring (PLAR) Channel Units

A. Dual Ringing Repeater

4.01 AUA45B Channel Units: The dual ringing repeater channel unit (AUA45B) provides 2-wire private line point-to-point manual ringdown service. In this application, pushing a button at the calling station generates ringing (AC) current to the channel unit. This signals the channel unit at the other end of the carrier system, which responds by sending ringing to the called station. The AUA45B is a dual channel unit; it occupies one physical slot in the dual channel bank and provides two channels of service. Each channel operates independently.

4.02 AUA45B Option Switches: The AUA45B has three option switches:

- Channel unit location (COT or RT)
- Transmit and receive channel loss, a switch for each channel (0 or 3 dB).

These switches are located on the printed wiring board and must be set manually; they *cannot* be set electronically with the CIU.

4.03 AUA45B Testing: A faceplate jack provides test access to tip and ring leads of each channel. The AUA45B channel unit has no test detectors or test relays and cannot be tested with

the pair gain test controller (PGTC) or extended test controller (XTC). This channel unit cannot be provisioned or tested with the CIU; the CIU displays "SLOT=POTS-LIKE" for a channel slot that has an AUA45B unit installed.

4.04 AUA45B Transmission and Signaling:

The 2-wire interface is a dry, transformer-coupled circuit without DC source or sink capability. Structural impedance is 900 ohms in series with 2.16 μ F. The balance network is also 900 ohms in series with 2.16 μ F. The AUA45B has no busy indicators: transmission is always enabled unless the channel unit is either sending or detecting ringing. The terminal-to-terminal voice-frequency transmission specifications are given in Table O.

4.05 The AUA45B channel unit detects and originates AC ringing on the tip/ring (T/R) interface. It will detect AC only or AC with DC superimposed ringing between 16 and 33 Hz. AC signals greater than 40 Vrms across tip and ring are treated as ringing. The AUA45B will repeat the input timing of the ringing signal unless ringing is tripped by a DC closure on the T/R interface. Ringing can be tripped only during the ringing interval. Ringing specifications are given in Table P.

4.06 AUA45B Circuit Design Considerations:

Loop range of the AUA45B is not limited to CSA design rules. The maximum cable loss for an end-to-end circuit should not exceed 9 dB, split in any proportion between the two end cable links. The total combined loop resistance (not including the terminating equipment) should not exceed 1500 ohms.

4.07 At the COT, the ringing range of the AUA45B channel unit is limited by the ringing voltage supplied by the central office. (The COT must be wired to a negative superimposed ringing source.) The AUA45B can support 3 REN in a COT application with a 20 Hz 86 Vrms central office ringing source and a maximum cable resistance of 1500 ohms. At the RT, the AUA45B can support 4 REN (RT ringing 20 Hz 100 Vrms) with a maximum cable resistance of 1500 ohms.

4.08 AUA45B Compatibility: The AUA45B channel unit is compatible only with another AUA45 channel unit at the other end of the *SLC* Series 5 Carrier System. At the 2-wire interface, the AUA45B is compatible with a D4 2RD/PLAR (J98726SN) channel unit optioned for ringdown (RD) with repeat input timing. (See AT&T 855-351-105, D4 Channel Unit Application Engineering, for D4 channel unit options.)

4.09 AUA45B Application and Prescription Setting: Figure 21 shows a typical application of the AUA45B channel unit. A pair of AUA45Bs can be set to provide a channel loss of 0 dB, 3 dB, or 6 dB. The loss switch should be set so that the channel loss plus the cable loss is as close as possible to the circuit design loss objective (10 dB maximum).

4.10 When the AUA45Bs are used in tandem with D4 channel units (Figure 22), the channel loss switch on both channel units (in the COT and RT) should be set to 0 dB. In this application, the maximum cable loss for an end-to-end circuit should not exceed 9 dB, split in any proportion between the two cable end links. The levels for the D4 units should be set according to the cable loss at each end of the circuit as if the Series 5 system were not in the circuit. This approach will provide consistent designs for tandem manual ringdown arrangements using Series 5, and allows use of the standard D4 design procedures for the D4 units.

4.11 The AUA45B channel unit can be used in certain types of alarm service — those services that use transmission-only supervision and that use voice-frequency signals within the passband of the unit.

B. Private Line Auto Ring (PLAR)

4.12 AUA75 Channel Units: The AUA75 channel unit is designed for 2-wire private line point-to-point automatic ringdown services. The AUA75 channel unit provides an interface that automatically causes ringing at the far-end called station when a near-end calling station goes off-hook. The far-end, called station, rings at 2 seconds on and 4 seconds off until it is taken off-

hook (answered). During the ringing, an audible ringback tone (generated by the far-end channel unit) is transmitted toward the calling station to alert the caller that the called station is being rung. When the called party answers (goes off-hook), ringing is tripped and a talk path is established between the two stations. At the conclusion of the call and after both stations are on-hook, the calling sequence can be repeated. Each channel unit occupies one physical slot in the channel bank and provides two channels of service — each channel operates independently.

4.13 AUA75 Option Switches: The AUA75 channel unit has four option switches:

- Channel unit location, (COT or RT)
- Signaling compatibility for both channels, (D3 or D4)
- Transmit and receive channel loss, a switch for each channel (0 or 3 dB).

⇒ NOTE:

D4 signaling compatibility should always be selected unless this is an integrated network access (INA) system and both channels from this channel unit terminate in D3 PLAR channel units in a remote D3 bank.

The option switches for the AUA75 are physically located on the printed wiring board of the channel unit. These switches cannot be set electronically by the CIU.

4.14 AUA75 Testing: The faceplate jack provides convenient access to the tip and ring of the odd and even channels and, faceplate LEDs indicate specific conditions.

4.15 Test relays are contained in the AUA75 channel unit. The mechanized loop test (MLT) accesses the PLAR circuit at the RT drop via the XTC. In addition to the traditional Switched Maintenance Access System (SMAS) access in the CO, Switched Access Remote Testing System (SARTS) is also available to access the PLAR

circuit at the bit stream and RT drop via the XTC. The AUA75 is not channel testable (for example, diagnostics) by either the PGTC or XTC. The CIU displays "SLOT=POTS-LIKE" for a channel slot that has an AUA75 unit installed.

4.16 AUA75 Transmission and Signaling: The unit provides a VF interface with a structural impedance of 900 ohms in series with 2.16 μ F. The balance network is also 900 ohms in series with 2.16 μ F. On-hook transmission is provided in this unit, with on-hook transmission loss of 3 dB in both receive and transmit directions.

4.17 The AUA75 channel unit provides a loop-start interface to a customer station. The loop current ranges from 30 to 18 milliamperes for loops ranging from 0 to 1,750 ohms (including station set). The AUA75 terminal-to-terminal VF transmission specifications are given in Table Q.

4.18 When the AUA75 is used in a COT bank, that bank must be wired to a negative superimposed ringing source. The ringing range of the AUA75 is limited by the ringing voltage supplied by the CO. The unit can support 3 REN in a COT application with a 20 Hz 86 Vrms CO ringing source and the maximum cable resistance of 1300 ohms. The unit can support 4 REN in an RT application (RT ringing source of 20 Hz 100 Vrms) with the maximum cable resistance of 1300 ohms. Ringing specifications are given in Table R.

4.19 AUA75 Circuit Design Considerations: The AUA75 is not limited to CSA design rules. The maximum cable loss for an end-to-end circuit should not exceed 9 dB, split between the two end cable links. The resistance of either cable cannot exceed 1300 ohms, assuming 450 ohms for the station equipment.

The on-hook transmission capability has been included in the AUA75. When station sets at both ends of the PLAR circuit are on-hook, end-to-end voiceband transmission is enabled with 3 dB of loss in both the transmit and receive directions in the AUA75, regardless of the settings of the 0 and -3 dB option switches.

4.20 AUA75 Compatibility: The AUA75 channel unit is compatible with another AUA75 channel unit at the Series 5 system. At the 2-wire interface, the AUA75 is compatible with D1D, D3, D4 and D5 FXO channel units. The AUA75 is bit stream compatible (signaling and PCM) with D3, D4, and D5 two-wire PLAR channel units.

4.21 AUA75 Application and Prescription

Setting: Figure 23 shows a typical application of the AUA75 channel unit. The pair of AUA75s can be set to provide a channel loss of 0, 3, or 6 dB. When setting the CU loss switches, the total channel loss plus cable loss should be as close to the design objective (10 dB maximum) as possible.

4.22 When the AUA75s are used in tandem with the D() channel units (Figure 24), the channel loss switches on both AUA75s should be set to 0 dB. The levels for the D() channel units should be set according to the cable loss at each end of the circuit, as if the Series 5 channels were not in the circuit. This design approach will provide consistent designs for tandem PLAR arrangements using Series 5 system, and allows a designer to adhere to the standard D-bank design procedures for the D() channel units.

4.23 Nongain transfer FXS and/or FXO CUs may be substituted for the FXS/GT and/or FXO/GT CUs when loops with less than 4.5 dB of loss are used on the respective end of the circuit. For example, if the FXO/GT CU is replaced with an FXO CU, L2 can vary in loss from 0.0 to 4.5 dB. If L1 has loss less than 4.5 dB, then the FXS/GT CU may be replaced with an FXS CU.

4.24 The configuration shown in Figure 25 would be used when the Series 5 RT is configured as an INA bank or the PLAR circuits are routed through a DCU to a D-bank. In this configuration (Figure 25), the maximum cable loss for an end-to-end circuit should not exceed 9 dB, split between the two end cable links, and the channel loss switch on the AUA75 should usually be set to 0 dB. The levels for the D() channel unit should be set according to the cable loss at both ends of the circuit, with the Series 5 channel not contributing to

the channel loss.

4.25 In the INA configuration, there will be nonstandard bit stream levels, and also nonstandard TLPs at the access points of the D() channel bank. In the direction from the CO toward the INA-RT with the AUA75, the bit stream TLP will be L2-10, which can be up to 10 dB lower than the normal 0 dB TLP. The value of L2-10 will vary from -10 dB with a 0 dB loop to -1 dB with a 9 dB loop. The 0 dB loop will be the most common since the INA-RT is intended to be located very close to the customer equipment. In the direction from the INA-RT with the AUA75 toward the CO, the bit stream TLP will be -L2, which can be up to 9 dB lower than the normal 0 dB TLP. The value of -L2 will vary from 0 dB with a 0 dB loop to -9 with a 9 dB loop. Again, the 0 dB loop will be most common, so the TLPs toward the CO will be normal.

4.26 When D3 compatibility is selected on an AUA75 CU, and only one channel is in service on the AUA75, a D3 2-wire private line auto ring (2WPLAR) CU must be plugged into the empty slot of the D3 bank corresponding to the channel not in service. This will prevent the unterminated AUA75 channel from *ringing falsely* by providing the proper on-hook code to the AUA75. There is no need to connect a phone to either the unused AUA75 channel or the unused D3 PLAR CU.

4.27 If a D3 bank is used, it is advisable to have the circuits go through a Digital Cross-Connect System (DCS) to sort out channel numbering differences between the Series 5 Carrier System and the D3 banks.

5. 4-Wire VF Channel Unit Applications

A. Circuit Applications

5.01 The Series 5 system 4-wire VF channel units have transmission and signaling applications that are similar to the D4 and D5 four-wire VF channel units. Specifications of the transmission

properties are given in Table N. The differences in application are described later in this section.

5.02 Circuit applications for these three 4-wire VF channel units can be grouped into three categories: tie trunks using E&M-type signaling, circuits with loop-start/ground-start signaling, and private line data circuits without signaling. Figures 26 through 28 show some representative circuits, which can be designed with 4-wire Series 5 special service channel units. Included with each circuit application are possible function codes shown below each Series 5 channel unit. Also shown are the design TLPs for the circuit at each significant location in each direction of transmission and the typical end-to-end trunk or line loss objectives for the application [for example, Figure 27A shows a line loss objective of 3.5 dB].

5.03 Tie Trunks: Tie trunks interconnect PBXs.

In the first example (Figure 26A), the PBXs are served by the same CO, with the RT at the customer location. In this case, the AUA54 unit can be used in the RT, directly interfacing the PBX in accordance with AT&T Technical References PUB 62114, 62115, 62118, and 62119. PUBs 62114 and 62118 describe facility interfaces which use the E&M functions of AUA54, while PUBs 62115 and 62119 use the PLR functions of AUA54. PUBs 62114 and 62115 describe the PBX interface in 4-wire zero-loss trunk circuits; the TLP at the interface is -2.0 in each direction. PUBs 62118 and 62119 describe the PBX interface in conventional term set (CTS) trunk circuits. The CTS interface calls for the network to provide 4 dB more gain to compensate for the loss of the term set in the 2-wire PBX; thus, the TLPs are +2.0 toward the PBX and -6.0 toward the network. As shown in Figure 26A, the COT channel unit, AUA41/AUA141, faces the PBX over a section of outside plant loop cable which might range in length from a few hundred feet to several miles. Duplex (DX) signaling is used between the AUA41/AUA141 and a DX-to-E&M converter at the customer location.

5.04 Figures 29A, 29B, 29C, and 29D show the functionality of the E&M circuits of the AUA54 CU and the connecting equipment.

5.05 The second tie trunk example (Figure 26B) shows an interoffice circuit where the AUA41/AUA141 in the COT interfaces an interoffice carrier using DX signaling. In order to use the AUA54 channel unit to interface the D() channel bank across the CO using E&M/PLR signaling it is necessary to equip the COT with the ED-7C700-20 E&M cable assembly on a digroup basis. This arrangement is not illustrated.

5.06 Loop-Start/Ground-Start: Figure 27 shows five circuit examples of the loop-start/ground-start application.

- **Foreign Exchange Line:** In this application, the telset is within the CSA serving the RT, and an AUA43 channel unit serves the 2-wire loop. At the COT, the AUA44 (4-wire) channel unit has enough transmission and signaling range to reach to the foreign office. In all Series 5 applications where both a 2- and 4-wire channel unit are used in the same circuit, the odd-numbered channel of the 2-wire channel unit must be assigned to the circuit.
 - **4-Wire PBX-CO Trunk:** AT&T 851-320-101 provides standard designs for foreign exchange and WATS special services with a 4-wire service-terminating arrangement at the customer premises to connect to a registered PBX or ACD. The example shown in Figure 27B is a PBX-CO trunk, but foreign exchange trunks are even more applicable to this 4-wire facility interface. Here the switching machine interface is a 2-wire AUA42/AUA142 channel unit operating with the FXO function code, and the remainder of the circuit is 4-wire to the PBX (or ACD). The figure and the AT&T Practice assume that the tariffed interface is 4-wire with 600 ohms impedance and levels of -3.5 TLP toward the PBX and 0.0 TLP toward the network. This means that without network channel terminating equipment (NCTE), the maximum loop loss at 1 kHz is 9 dB for loaded cable and 9.5 dB for nonloaded cable; otherwise, levels at the RT would violate cross talk rules. If the cable is loaded, the AUA41/AUA141 should be
- optioned for 1200-ohm impedance, and the ICL of the cable must be calculated based on 1200 ohms at one end and 600 ohms at the other end.
- **Foreign Exchange Trunk:** Figure 27C shows two 4-wire channel units in a foreign exchange trunk circuit. At the RT, the AUA41/AUA141 provides connection to a PBX which is beyond the CSA. The AUA41/AUA141 FXS function provides ground start signaling with current feed. At the COT, the AUA44 provides a 4-wire FXO-type signaling connection to another carrier. Even though a 2-wire special service interface could be used at the COT, the 4-wire arrangement is preferable because it avoids a pair of hybrids without additional cost.
 - **Off-Premises Station (OPS) Circuit:** In this circuit, the RT channel unit is 4-wire to handle the metallic extension beyond the CSA. The AUA44 provides the FXO-type signaling required to face the PBX on an OPS circuit, and the AUA41/AUA141 at the COT maintains 4-wire transmission across the office to a D() channel bank. Both the AUA41/AUA141 and AUA44 are compatible with distinctive ringing.
 - **Foreign Exchange Trunk or Line to Interexchange Carrier (Figure 27E):** In this circuit, the tandem function code is used for the AUA44 in an RT at the customer location. This arrangement can be used if the IXC (for example, AT&T-C) is using a D() channel bank with tandem channel units available. The network interface for this case is covered by Interface Codes 6EX2-A and 6EX2-B described in Chapter 6 of AT&T Technical Reference PUB 62501 and 6EX2-B in Bellcore TR-NPL-000334. (In the 12/83 issue of PUB 62501, interchange the receive (RCV) and transmit (XMT) levels for the 6EX2-A and 6EX2-B interface codes.) The AUA44 can also be provisioned with the tandem function code to handle 2-state signaling such as E&M and loop-reverse-battery; however, it is not

recommended since tandem signaling is not included in the FCC Part 68 registered interface for E&M circuits; instead, the AUA54 should be used.

5.07 Private Line Data: Most private line data circuits are designed 4-wire throughout.

Transmission only (TO) channel units are used in T-carrier terminals; the equalized (ETO) channel units are used for most metallic extensions. Figure 28 shows an interoffice circuit with the AUA41/AUA141 in the RT provisioned for the TO4 or ETO4 function code, and the AUA41/AUA141 in the COT provisioned for the TO4 function code. The maximum loop loss is shown as 14 dB, rather than 15 dB as in the previous figures, because standard design of data circuits recommends +5 dB for the maximum TLP entering the cable instead of the +6 dB cross talk limit for VF circuits. For an interface without sealing current battery, replace either Series 5 channel unit in Figure 28 with an AUA44 provisioned for the FX__ function code; sealing current can flow through the AUA44 but no battery is applied.

B. Circuit Design Considerations

5.08 Back-to-Back Carrier Arrangements at the CO: When it is impractical to use Series 5 COT channel units with E&M or tandem signaling (signaling leads are not terminated in the COT), special back-to-back arrangements are available. The E&M signaling is replaced by DX signaling, and tandem connections are replaced by a pair of 4-wire channel units with the FXO/FXS functions. These arrangements are illustrated in Figures 29B, 30C, and 30D. Transmission levels are shown for the office connections, but as standard designs are developed for these applications, the values may change. For tie trunks, the TLP output is -2.0 dB from the AUA41/AUA141 channel unit in the COT. This is the TLP value specified by Part 68 of the FCC Rules for a 4-wire zero-loss tie trunk interface. For loop-start/ground-start (Figure 30) and private line data (Figure 31) circuits, the TLP leaving the COT channel unit is 0.0 dB; this value is the same as the TLP on the Series 5 digital line and is consistent with the AT&T standard design practice for private line data circuits, AT&T 880-420-102.

5.09 For those COT applications where E&M-type connections must be made, a special wiring harness is available. The ED-7C700-20 E&M cable assembly is fitted onto the four E&M-type COT backplane pins of all 12 channel unit slots of a digroup. This allows the E&M connections for the AUA44 and AUA54 channel units to be terminated at the distributing frame. Customer Information Release AT&T 363-099-076IR and SD-7C116-02 (issue 4B or later) contain detailed information on the ED-7C700-20 cable assembly.

5.10 The E&M cable assembly can be used in the COT to allow more conventional design for the following circuit applications:

- (a) **Tie Trunk (Figure 26B):** In the figure, replace the AUA41/AUA141 (at COT) with an AUA54 provisioned for PLR(1/2) function code. Replace the 4DX channel unit with a 4E&M channel unit. The TLP between channel units changes from -2 to +7.0 toward the AUA54 and from -2 to -16.0 toward the 4E&M channel unit.
- (b) **FX Trunk (Figure 27C):** For the AUA44, select the TDS(A/B) function code, and replace the FXS channel unit with a TDM channel unit. The TLP between channel units changes to -2.1 in each direction.
- (c) **Off-Premises Station (Figure 27D):** For the AUA41/AUA141, select the TDO(A/B) function code, and replace the 4FXO channel unit with a TDM channel unit. The TLP between channel units changes to -2.1 in each direction.

5.11 Arrangements at the Network Interface:

The J1C182AC and J1C182AF are RTs designed for use at the customer location. These RTs bring out the E&M signaling leads to a connector so that the four registered tie trunk interfaces are readily accessible. The AUA54 channel unit can be optioned for Type I and Type II E&M interfaces. Transmission characteristics of the D4, D5, and Series 5 channel units are so similar that identical prescription setting tables are used. The 4-wire ground-start interface to a PBX is described in A. Circuit Applications, paragraph

5.06, 4-Wire PBX-CO Trunk. These E&M leads are also used to implement a tandem interface (*not* registered by the FCC) to another carrier terminal used by an interexchange carrier. The tandem interface is provided by the AUA44 CU. Figure 33 shows how the two signaling paths in each direction are implemented with a tandem interface.

5.12 Signaling Range at Customer Location:

Connections between the AUA54 channel unit and the PBX or other customer terminal cannot be exposed to the outside plant environment. Within this constraint, however, the RT and customer terminal can be separated by several kilofeet of inside wiring. The signaling range is limited by the AUA54 channel unit to 250 ohms for Type I signaling and 500 ohms loop resistance for Type II signaling. However, the actual limit may depend on the customer terminal. AT&T Technical Reference PUB 48002 specifies that PBXs should be able to detect E lead signals through 150 ohms, and PUB 43801 specifies that D banks should be able to detect M lead signals through 150 ohms. These specifications imply the same range for PLR signaling where the E&M lead functions are reversed. Thus, to design for a separation greater than 150 ohms, the E&M signaling characteristics of the customer terminal should be considered.

5.13 Simplex Connections: The guidelines for selecting simplex connections (normal or reversed) for 4-wire VF channel units apply to both duplex and loop-start/ground-start signaling applications (Table S). If the terminal at the other end of the 4-wire metallic extension is a D() channel bank or Series 5, one of the channel units must be optioned as normal (NOR) and the other as reversed (REV). If the distant terminal is MFT, customer premises facility terminal (CPFT), or Omniport NCTE, both the Series 5 channel unit and the distant repeater are optioned the same (both NOR or both REV).

5.14 Mismatch Equalization: When the NCTE does not have active equalization, the 4-wire channel unit facing the cable can be pre- and post-equalized by selecting 150 ohms impedance. (The CIU automatically applies the equalization in both the transmit and receive directions.) Selection of

150/600 ohm impedance results in a loss/frequency characteristic which complements nonloaded cable and is equivalent to a fixed value of slope equalization. The range of cable lengths which can be equalized this way is somewhat limited, but can be increased by also using mismatch equalization at the NCTE. Tables T through X give the ranges of cable lengths which can be equalized by this method.

5.15 Sealing Current Treatment for Data Circuits:

The AUA41/141 CU provides transmission only service for private line data applications. This channel unit, in the TO4 and ETO4 function codes, applies -48 V battery and ground to the transmission lead simplexes to establish a source of sealing current. The sealing current source cannot be disabled. The AUA44 and AUA54 CUs can be used in place of the AUA41, in certain arrangements, to realize a data circuit without a source of sealing current at both ends of the Series 5 system. The several circuit arrangements involving these two CUs in private line data service are explained below. (These arrangements are not provided in TIRKS* computer programs).

- RT CU is the AUA41/141 provisioned for the TO4 or ETO4 function code. The COT CU is the AUA44 provisioned for FXO3 (or any FX_) function code. The AUA41/141 sends the all-1s signaling code which causes the AUA44 to close the simplex connection between the two pairs of transmission leads. This arrangement supplies sealing current at the RT and allows sealing current at the COT if the interfacing equipment supplies it. Equalization is available at both COT and RT. Because the operation of this circuit depends on signaling transmitted by the AUA41, if a DCS is interposed between the COT and RT the DCS must preserve signaling integrity as it transmits the data.

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- RT CU is the AUA41/141 provisioned for TO4 or ETO4 function code. The COT CU is the AUA54 provisioned for EM4C (or any other) function code. In this case the AUA54 blocks sealing current. Note that the AUA54 cannot interface outside plant, so this arrangement is limited to intra-CO connections. No connections are made to the signaling leads of the AUA54; thus, it is not necessary to install an ED-7C700-20 E&M wiring harness on the COT backplane.
- RT CU is the AUA41/141 provisioned for TO4 or ETO4 function code. The digital circuit emanating from the RT terminates at a foreign CO, in a D-bank. (This circuit might be nailed up through the serving CO switch, or perhaps redirected to the foreign CO by a DCS.) The D-bank CU should be a 4TO or 4ETO type, with sealing current treatment as desired.
- RT CU is the AUA44 provisioned for FX03 (or any FX__) function code and the COT is the AUA41 provisioned for TO4 or ETO4. Sealing current is sourced at the COT and allowed at the RT, and equalization is available at both ends. An intervening DCS must preserve bit stream signaling toward the AUA44.
- RT CU is the AUA54 blocking sealing current and the COT is the AUA41 sourcing sealing current.
- RT CU is the AUA54 blocking sealing current and the D-bank CU at the foreign CO terminal is a 4TO or 4ETO type.

Other combinations of RT and COT or distant D-bank CUs may be capable of private line data service without the sourcing of sealing current at both ends.

6. Dataport Channel Unit Applications

6.01 The most likely use of Series 5 system

dataports is to extend DDS service to a customer location by providing digital connection between that location and the nearest DDS central office. If the serving CO contains DDS equipment (other than carrier terminals with DDS ports) it is considered a DDS office, and the DS0 dataport channel unit (DS0-DP) interfaces the DDS network across this office. If the nearest DDS office is not the serving CO, a DS0-DP interfaces a dataport in an interoffice carrier terminal. Alternatively a digital cross-connect system (DCS) can terminate signals at the DS1 level and rearrange them for transmission over interoffice return. A second application of Series 5 Carrier System dataports is in a local digital circuit not part of the DDS system. These applications are discussed in the paragraphs that follow.

6.02 For all dataport applications, the Series 5 Carrier System must be synchronized to the (DDS) composite clock. It is recommended that the clock source be a DDS terminal, DDS office clock source, or synchronization distribution expander (J98726W). The COT must be equipped with an AUA3 office timing unit (OTU) to receive the clock signal. For planned applications where a Series 5 Carrier System must receive composite clock from a D4 source, the OIU-2 J98726AL-2,L2 or OIU-4 J98726AY-2,L2 should be used. Depending on the office wiring arrangement, earlier versions of the D4 office interface unit with composite clock [J98626AL-()] may or may not work with the Series 5 Carrier System OTU — in particular, the J98726AL-1. An OTU is not required in the RT since the RT is loop-timed to the COT.

A. DDS Application

6.03 The DDS provides full duplex private line digital data service at different data rates; DDS is tariffed and maintained by AT&T for inter-LATA circuits and by the telephone company for intra-LATA circuits. The DDS circuit design considerations are covered in AT&T 880-604-102. The design of DDS loops is treated in AT&T 880-601-115. Customer and network interface specifications are given in AT&T Technical Reference PUBs 41021 and 62310.

6.04 A typical DDS circuit application is shown in Figure 30. The OCU-DP in the RT interfaces the customer loop, and the DS0-DP in the COT interfaces the DDS network. There is no change in circuit layout or dataport optioning if the RT is at the customer location.

B. Local Digital Circuit

6.05 A local digital circuit may be limited to the serving CO or may extend through several COs in a given LATA. In both cases, the OTU can be connected to a non-DDS clock source. Figure 31 shows a strictly local circuit, which uses an OCU-DP in the COT to interface the nearby customer's data loop. If the circuit extends through a distant CO using an interoffice carrier link, the COT dataport would be a DS0-DP interfacing a DS0 dataport in the interoffice carrier terminal.

7. VF Channel Unit Compatibility

7.01 2-Wire Channel Units (AUA42/AUA142, AUA43): Figure 32 shows end-to-end compatibility of 2-wire Series 5 channel units with each other and with the 4-wire channel units. Compatibility is based on the function codes of both channel units. The AUA42/AUA142 is end-to-end compatible with the AUA43 2-wire channel unit and the AUA41/AUA141 and AUA44 4-wire channel units. The AUA43 channel unit is end-to-end compatible with the AUA42/AUA142 2-wire channel unit and the AUA41/AUA141 and AUA44 4-wire channel units. For private line applications (no DC signaling), the AUA43 channel unit is end-to-end compatible with another AUA43 channel unit and with the AUA41/AUA141 4-wire channel unit. When the AUA42/AUA142 or AUA43 is used with a 4-wire channel unit in the same circuit (2-wire at one end and 4-wire at the other end of the Series 5 system), the 2-wire channel unit must be provisioned on the odd-numbered channel. In this application, the even-numbered channel cannot be used for service.

7.02 4-Wire VF Channel Units: Figure 32 shows end-to-end compatibility of the 4-wire Series 5 VF channel units with other 2- and 4-wire Series 5 VF channel units in terms of the function codes of both units. The AUA41/AUA141 is end-to-end compatible with the AUA54 channel unit (tie trunk applications), the AUA44 channel unit (loop-start and ground-start applications), another AUA41/AUA141 (tie trunk and private line applications), the AUA42/AUA142 2-wire channel unit (loop-start and ground-start applications), and the AUA43 2-wire channel unit (private line applications). The AUA44 is end-to-end compatible with the AUA41/AUA141 channel unit, the AUA42/AUA142 and AUA43 2-wire channel units, and another AUA44 channel unit. The AUA54 is end-to-end compatible with the AUA41/AUA141 channel unit (5SCU7DOAXX) or, for tie trunk applications, another AUA54 channel unit. (Using an AUA54 channel unit in the COT is not recommended, because the AUA54 requires special connections to the COT backplane for the E&M leads.) The AUA44 channel unit provisioned for the TDM function is not *back-to-back* compatible with the D3 tandem channel unit J98718SF.

7.03 Dataport Channel Units: An AUA52/AUA52B/AUA152 OCU DP is end-to-end compatible with another AUA52/AUA52B/AUA152 or with the AUA34/AUA34B DS0 dataport channel unit. An AUA34/AUA34B DS0 DP is end-to-end compatible only with an AUA52/AUA52B/AUA152 OCU DP. (When providing 2.4, 4.8, 9.6, or 56 kb/s service, AUA52/AUA52B/AUA152 can be used interchangeably and likewise for the AUA34/AUA34B. Only the AUA34B and AUA52B are used for providing 19.2 and 64 kb/s clear channel service.

8. Provisioning Description

8.01 Provisioning is the process of preparing the channel unit for service by defining its function and setting the options. Channel units may have option switches that must be set before installation, but channel units have option

information that must be written into memory registers located on the channel unit. The CIU and the bank controller [the alarm display unit (ADU) and the BCU] are used to provision the channel units. The CIU plugs into the channel test unit (CTU) at the COT to access the bank controller which programs the channel units. The COT bank controller communicates with the RT bank controller via the data link. Thus, RT and COT channel units can be provisioned from the COT using the CIU. (The CIU can also be used at the RT for the same purpose.)

8.02 After the CIU establishes 2-way communication with the bank controller, the CIU will present a sequence of prompts to the user (the provisioning dialog). These prompts follow the entries on the WORD document which contains circuit design information and the specific channel unit option settings. To provision a channel, the user simply enters the specified value from the WORD document as indicated by the CIU prompt. Certain new CUs (eq, AUA34B) require CIU provisioning as if they were originals (eq, AUA34). The *CLEI* for the original CU must still be entered into the CIU. At the end of provisioning, the CIU will display a completion message. The CIU comes with a user's guide, Select Code 500-206, and is also described in AT&T 363-205-101. AT&T 363-205-402 (TOP) covers provisioning and alignment testing of special service channels.

8.03 All transmission and signaling options are entered manually into the CIU, which translates them as necessary. The CIU transmits the information to the bank controller, which stores it in nonvolatile system memory electronically erasable programmable read-only memory (EEPROM). The bank controller then writes the options into the channel unit registers when the channel unit is installed. Thus, a channel can be provisioned before the channel unit is installed.

8.04 If the channel unit is already installed, the bank controller writes the option information into the channel unit registers immediately after receiving the information from the CIU. Unplugging the channel unit does not erase the option information stored in system memory; reinstalling

the channel unit causes the options to be rewritten immediately into the channel unit.

8.05 Provisioning Flow: The provisioning dialog between the craftsman and the CIU details the function and option settings for each channel unit. The flow of this dialog for the 2-wire channel units is shown in Figure 32. Figure 33 shows the flow for the 4W-0 (AUA54), 4W-1 (AUA41/AUA141), and 4W-2 (AUA44) channel units. Figures 34 through 38 show the flow for the dataports. After the *CLEI* code has been entered, the CIU prompts the user for the function code which identifies the application in which the generic channel unit will be used. For example, 2-wire channel units can be used in loop start/ground start, loop-reverse-battery, or transmission-only applications. Upon entry of the function code, the CIU and bank controller can set many of the logic states (although these settings are retained in a buffer until the provisioning dialog has been completed). Following this is the dialog for entering transmission coefficients and miscellaneous options unique to that channel unit. If provisioning data already exists in EEPROM for the intended channel unit, prompts indicate the existing setting for these coefficients and options and allow craftsman to confirm that setting by depressing **RETURN**.



CAUTION:

With an AUA43 or AUA41/AUA141 channel unit installed and connected to a telephone or PBX, provisioning the circuit for loop- or ground-start signaling immediately makes the circuit prone to continuous ringing. This can occur if the wrong channel unit is installed at the other end, or if the installed channel unit (at the other end) is incorrectly provisioned (for example, an AUA42/AUA142 provisioned for the DPT function code in a circuit designed for an FXO function code.) There are at least 11 different channel units which, in the idle state, when installed and provisioned (if provisionable), will cause the AUA41/AUA141 or AUA43 to produce continuous ringing. Before provisioning an AUA41/AUA141 or AUA43 for the FX_ function, verify that the other end has an

empty slot or has the proper channel unit installed and provisioned for the correct function code (if provisionable).

8.06 Provisioning 2-Wire Channel Units: The function codes for the AUA42/AUA142 and AUA43 are listed in Tables D and E. The proper channel unit and its function and option settings must be determined for each type of circuit. This data becomes part of the WORD document and is used for provisioning. Each 2-wire channel unit has three functions depending on the signaling options required in the circuit. For circuits with loop- or ground-start signaling, select FXO for the AUA42/AUA142 channel unit and FXS for the AUA43 channel unit. Circuits with loop-reverse-battery signaling use the DPT function in the AUA42/AUA142 channel unit and the DPO function in the AUA43 channel unit. If no signaling is required, the TO function is selected for the AUA42/AUA142 and the AUA43 channel units.

8.07 The transmission and signaling characteristics of the 2-wire channel units are in the catalog of standard designs, allowing 2-wire circuits to be designed using the *TIRKS* Compute module. Each channel of these dual channel units is provisioned independently. The actual CIU prompts and some corresponding WORD document entries are listed in Table Y. In Figure 32, the transmission gain is normally provisioned by prompting for gain. By contrast, Figure 33 (4-wire channel units) uses D4 attenuator settings for inputs to the CIU to obtain 4-wire Series 5 channel unit gain settings.

8.08 No additional craftsperson action is required for the channel unit to begin carrying traffic (assuming cross-connects have been made and the distant channel unit is operational). This might be thought to run the risk of singing, since, in general, the cross-connects will not have been made. However, the AUA43 channel unit is designed so that transmission is reduced sufficiently to prevent singing unless there is loop closure or unless operation is transmission only (TO).

8.09 Provisioning 4-Wire VF Channel Units:

Table S can be used to find the proper function code for the 4-wire channel units for a specific application. The function codes in the 4-wire dialog are rather specific. (See Tables G, J, and L.) These codes represent a number of provisioning options which would otherwise have to be entered by the craftsperson via prompts. The 4W-0, 4W-1, and 4W-2 channel units are provisioned as if they were D4 channel units. When the settings are entered, the CIU and the bank controller translate the D4 transmission coefficients and option settings to the corresponding Series 5 settings.

8.10 Provisioning Dataports: Dataport options consist of a few operational settings. There are no transmission settings because the OCU-DP is designed to transmit across any cable with up to 31 dB of loss at half the data rate. Such cable ranges extend beyond the limits of the CSA range. The option settings and guidelines for their selection are given below.

- (a) **Subscriber Data Rate:** The AUA52 OCU-DP is optioned for subscriber data rate which can be 2.4, 4.8, 9.6, or 56 kb/s. The three lower rates are frequently classified as a subrate, while 56 kb/s is classified as fullrate. The AUA52B adds two data rates, 19.2 kb/s and 64 kb/s clear channel. The AUA52B, therefore, has four subrates and two full rates. The DS0-DP is not explicitly optioned for data rate, but is implicitly optioned for subrate versus full rate. The DS0-DP selection is made by entering **DS0A** or **DS0B** in response to the **Function Code** prompt. The DS0A signal format consists of a byte-stuffed 64 kb/s DS0 signal comprising one customer's data. A DS0B signal format is a 64 kb/s signal without byte stuffing; it can consist of one 56 kb/s data rate signal or a multiplex of up to 20 subrate customers' signals. For Series 5 Carrier System dataport applications, DS0B refers to 56 or 64 kb/s service.
- (b) **Error Correction:** Different error correction methods can be chosen for dataport circuits to improve the SLC Series 5 digital data

error rate to 10^{-8} or better. Both dataports are optioned either for error correction (either type) or no error correction. For 56 kb/s full rate service, the only usable type of correction is SCEC which operates by sending an error correction signal over the unused, even-numbered channel associated with that physical channel slot. Normally, SCEC will be selected for every full rate circuit. The SCEC can also be used on subrate circuits in applications where other types of correction, cannot be used. The other types are MVEC and 19.2 error correction. The MVEC takes advantage of the byte stuffing done in subrate circuits by the OCU-DP. In such cases, each byte is repeated at least four times, and the receiving circuitry of the DS0-DP takes a majority vote among the five candidates for each bit. The 19.2 error correction is a method unique to 19.2 kb/s circuits. It is described in *Contribution to the ANSI T1 Standards Project*, document #T1ZX1.4/89-023. There is one subrate application where MVEC is not recommended. This application involves multipoint service where the master is served by a Series 5 system without a sub-rate data multiplexer (SRDM) in the master leg and with several slaves connected through a DDS multipoint junction unit (MJU) using HL68-coded circuit packs. These subrate MJU applications can instead be error-corrected by selecting SCEC.

- (c) **All-Zero-Code:** When the All-Zero-Code option is set to YES for either dataport, the dataport allows eight consecutive zeros to be transmitted toward the digital line. If the option is set to NO, two of the zeros, in a string of eight zeros, are changed to ones by the transmitting dataport. (This change does not affect customer data because both the original and modified bytes are control bytes.) Digital signals transmitted on Series 5 digital lines must maintain a minimum density of ones to prevent the clocks in the repeaters from dropping out. The LIUs may be optioned for zero code suppression (ZCS) or B8ZS line coding. With ZCS, an

all-zeros *dataport* byte is not changed as it is passed onto the T1 line. (Bit position 7 of any all-zeros voice byte is permanently changed to a one.) The B8ZS line coding satisfies the minimum ones density requirement of the digital line without producing a bit error. If the LIU is optioned for ZCS, the All-Zero-Code dataport option should be set to NO. If the LIU is optioned for B8ZS, the All-Zero-Code dataport option can be set to YES or NO.

- (d) **Secondary Channel:** This is a feature of DDS which provides an additional low-speed telemetry channel for customer use, available with each of the subrate and 56 kb/s. If the customer orders this feature, the secondary channel option should be selected for the OCU-DP. Although the secondary channel option is set to YES for 64 kb/s clear channel service, the secondary channel cannot be used for customer communications. Technical Reference PUB 62120 describes the secondary channel features of DDS.

9. DCU Application and Provisioning

A. Circuit Design Considerations

9.01 The AUA3 office timing unit is required in the COT for DCU operation at either end of the Series 5 system. The DCU does not provide line powering and is not designed to interface the outside plant. This limits RT applications of the DCU to a customer location or an outside plant RT which is supplemented by a line-powering T1 repeater in the same enclosure. At the COT, the usual DS1 interface requirements apply, for example, a terminal to DSX-1 spacing of 655 feet maximum. (Reference: Bellcore Technical Advisory TA-NPL-000320 *Fundamental Generic Requirements and Design Considerations for Metallic Digital Signal Cross-Connection Systems — DSX-1, -1C, -2, -3* Issue 2, September 1986.) In an RT at a customer location, the DS1 interface requirements are given in Technical Reference

PUB 62411 (*Accunet*® T1.5 Service Description and Interface Specifications, October 1985), and in Part 68 of the FCC Rules and Regulations.

9.02 Low Bit-Rate Voice (LBRV)

Considerations: There are two restrictions when a DCU is used with LBRV. In a system with LBRV, a DCU can be used in either terminal on any digroup, but not in both terminals on the same digroup. For a dataport that is provisioned for SCEC, the next higher-numbered physical slot must be left vacant (and such a dataport cannot be used in the highest numbered slot of a digroup). (This restriction applies only in a system with LBRV when the SCEC option is used.)

B. Channel Unit Compatibility

9.03 The DCU is end-to-end compatible with another DCU (unless the system uses LBRV) or with channel units (with some restrictions). Compatibility depends on the characteristics of the channel units and the filter effect of the Fs framing format used at the DCU DS1 interface. The filter effect is a result of using 2-channel signaling (A,B bits) on channel units which normally operate with 4-channel signaling (A,B,C,D bits of the extended framing format of the Series 5 system). Current applications do not include message channel units in digroups equipped with the DCU.

9.04 Special Service Channel Unit

Compatibility: Series 5 special service channel units (SSCUs) are generally compatible through the DCU with other matching channel units. The Fs framing has little filtering effect because these units signal using A=C and B=D except for circuits which require toll diversion. Tables Z, AA, and AB list SSCU compatibility in DCU applications. No toll diversion function codes are included in these tables. (In the AUA42/AUA142 and AUA43, toll diversion is a provisioning option which cannot be used when the channel unit is connected through a DCU.)

C. Applications

9.05 DCU at COT: Applications of a DCU in a

COT are shown in Figures 41 and 42. The DCU is connected through a DSX-1 cross-connect to an M12 or M13 multiplexer, a DCS digital cross-connect panel, a T1 line (office repeater interface), or to another DCU in a back-to-back Series 5 COT. In these applications (Figure 41), the digroup can be terminated at the RT by up to 12 channel units.

9.06 DCU at RT: Applications of a DCU in the RT are shown in Figures 42 and 43. The DCU-equipped RT is normally located in the customer's building to avoid exposure of the T1 line cable to the outside plant environment because the metallic DS1 interface of the DCU has not been hardened. (The AUA16 metallic DS1 interface is virtually identical to that of the AUA61 Line Interface Unit which was designed for a DSX-1 or office repeater.) The DCU at the RT will interface a variety of customer-provided equipment, including channel banks such as a D4-type channel bank or a D4 digital data bank, or a digital PBX (for example, AT&T System 75 or 85). In applications where the customer is an interexchange carrier, the DCU at the RT may interface a digital facility terminal such as a T1 repeater, multiplexer, or digital radio terminal.

9.07 DCU at COT and RT: Figure 42 illustrates a DCU located in the COT and RT. The primary application of a DCU-DCU arrangement is to provide a "transparent" DS1 pipe between the network interface and the serving CO. This arrangement allows the telephone company to provide a DS1 loop on short notice at moderate additional cost. The DCU-DCU arrangement also offers facility protection and better alarming than some of the alternative T1 line configurations.

9.08 An example of the DCU-DCU arrangement is the extension of *Accunet* T1.5 service from an AT&T-Communications serving office to a customer location. At the COT, the DS1 signal is passed on to an interoffice DS1 facility for connecting to the AT&T serving office (unless the COT office itself contains the AT&T point-of-interface). AT&T Technical References PUB 62411 (*Accunet* T1.5 Service Description and Interface Specifications, October 1985) and PUB 54015 (*Customer Controlled Reconfiguration, a*

Service Function of Accunet T1.5, January 1984) describe the *Accunet* T1.5 service and several customer options.

9.09 Signaling in an analog (VF) DS0 channel in the Series 5 bit stream is transmitted using the 8th bit of every 6th frame; this is called robbed-bit-signaling (RBS). In a back-to-back DCU arrangement, the signaling bit in VF channels is usually moved to another frame, which causes a slight degradation in voice quality (no worse than that caused by DACS or a 4 ESS™ switch). The DCU is provisioned for data signals (for example, DDS channels) to suppress RBS so that the information bytes of a DDS signal are not converted falsely to control bytes, and vice versa. Since, by default the DCU is provisioned for analog (RBS) channels, no manual provisioning is required for a DS1 signal containing only analog channels. However, in order to use a back-to-back DCU arrangement, the telephone company must either ensure that the customer does not plan to use any of the channels for data (DDS) service, or determine from the DS1 customer which channels will contain DDS-type circuits and provision the DCUs accordingly.

D. Provisioning

9.10 Each DCU channel can be provisioned with the CIU for either VF signals (with RBS every sixth frame) or for digital data (without robbed-bit signaling — NRBS). In many cases, the channel is set for RBS or NRBS without CIU provisioning as follows:

- (1) If the near end is not provisioned when the DCU is installed, the bank controller decides on RBS or NRBS based on the code of channel unit or DCU that is installed or provisioned at the far end. The only situation that results in NRBS is when the distant end has been provisioned for dataport service.
- (2) If the near end has already been provisioned for a DCU, the bank controller decision is based on code of channel unit installed or provisioned at the far end, unless the far end has also been provisioned for a DCU. In this

case (DCU at both ends), the bank controller decision for each end is based only on the DCU channel provisioning at that end.

So, by default, the DCU channel at either end is provisioned for RBS unless one of the following conditions exists to cause NRBS provisioning:

- The distant end has been provisioned for a dataport channel unit.
- Both ends are provisioned for a DCU, and the near end channel is also provisioned for NRBS.

For Redlined DCU channels (with PRQ SSP on WORD header), the channel should be provisioned using the CIU to assign redline status to the channel at each end.

9.11 Since the CIU will accept only the *CLEI* code for DCU-R, the WORD document should list 5SCS500A as the *CLEI* code for the DCU.

10. 2-Wire VF Channel Unit Prescription Setting

10.01 The prescription settings are determined by the cable makeup data, far-end termination, and the structural impedance of the channel unit. For actual cable measurement refer to AT&T 363-205-110, *SLC® Series 5 Carrier System, Cable Measurement Method for Determining Provisioning Setting for Special Service Channel Unit, Loop Transmission System*.

A. Channel Unit Impedance Selection

10.02 Structural Impedance: There are two choices of the structural impedance for the AUA42/142, AUA43 2-wire channel units: 600 ohms in series with 2.16 μ F or 900 ohms in series with 2.16 μ F. The following is a summary of the selection guidelines.

- (1) Select the 600-ohm structural impedance for the 2-wire channel unit if it is in the RT or if it faces a loop or an interoffice trunk cable.

- (2) Select the 900-ohm structural impedance for the COT channel unit if it faces the switch or other transmission devices through office wiring or is used back-to-back with MFT or a 900-ohm D() channel unit.
- (3) When the 2-wire special service channel units are used for single-party (POTS) service, locally-switched 2-wire circuits, or DID trunk applications, select the 600-ohm structural impedance for the RT channel unit and 900 ohms for the COT channel unit.

B. Channel Unit Gain Calculation

10.03 The gain for the transmit path, XMT (GN), and for the receive path, RCV (GN), is determined by the bit stream level of the Series 5 carrier and the input or the output levels on T, R leads of the channel unit. They are given by the following two equations:

$$\text{XMT(GN)} = (\text{TLP})b - (\text{TLP})t$$

$$\text{RCV(GN)} = (\text{TLP})r - (\text{TLP})b$$

where:

(TLP)b = the signal level of the bit stream

(TLP)t = the channel unit input level on T, R leads

(TLP)r = the channel unit output level on T, R leads.

When the channel unit faces cable, the input and output levels are calculated from the 1 kHz cable loss (Part 13). The values obtained from these equations should be rounded off to the nearest 0.25 dB for inclusion in the WORD document.

10.04 Note that (TLP)b is zero in all voice circuits (Figures 1 through 13 and 15) except 2-wire locally-switched specials and single-party services. For private line data circuits (Figures 16 through 18), (TLP)b = 7; this level is zero if the circuit design is based on the level of the Data Alignment Tone. For 2-wire locally-switched specials and single-party applications, XMT(GN) and RCV(GN) should be set to zero.

C. Balance and Equalization on Single-Gauge CSA Cable

10.05 Balance Setting Calculation: Three tables provide hybrid balance settings: Table AC for the AUA43 channel unit, Table AD for the AUA42/AUA142 channel unit, and Table AE for applications facing transmission devices through office wiring. Use Table AC or AD as follows:

- (1) Determine the distant termination and use the appropriate 600-ohm, 900-ohm, or telset (AUA43) column.
- (2) Locate the length nearest the facility length.
- (3) Read across to the proper gauge column and find the balance setting.

When the channel unit faces an electronically-derived channel at the CO, balance settings depend on the length of the office wiring, as shown in Table AE.

10.06 A few special cases for balance settings of the circuits in Figures 1 through 18 are listed below:

- BAL = 0, 1, or 2 depending on the length of office wiring where the 2-wire channel unit faces a switch or a channel unit.
- BAL = 3 for the RT channel unit when it faces a PBX and the RT is at customer location.
- BAL = 4 for the RT channel unit when it faces a telset and the RT is at customer location.
- BAL = 0 for the COT channel unit and BAL = 15 for the RT channel unit when the circuit design is single party or 2-wire locally-switched special service.

10.07 Equalizer Setting Calculation: The prescription settings listed in Table AF are for the equalizer in AUA43 and AUA42/AUA142 on single-gauge facilities with 600- or 900-ohm terminations. Use the table as follows:

- (1) Determine the distant termination and use the appropriate 600- or 900-ohm column.
- (2) Locate the length nearest to the facility length.
- (3) Read across to the proper gauge column and find the equalizer setting.

10.08 A few special cases for equalizer settings of the circuits in Figures 1 through 18 are listed below:

- SL = 0 for the COT channel unit when it faces a switch or a channel unit through office wiring.
- SL = 0 for the RT channel unit when the RT is on customer premises.
- SL = 7 for the COT channel unit and the RT channel unit when the circuit design is single party or 2-wire locally-switched special service.

D. Balance and Equalization: 2-Gauge CSA Cable [with or Without Bridged Taps (BT)]

10.09 Cable Conversion: When the facility has more than one gauge of cable or contains cable with bridged taps, it must be converted to an equivalent-length single-gauge facility for calculating balance and equalizer settings. The longest length of cable is selected as the major gauge; the remaining length (minor gauge) is converted to the equivalent length of major gauge cable. Conversion factors for equivalent length vary with the structural impedance and far-end termination. Two tables provide the conversion factors for 600-ohm structural impedance: Table AG for 600-ohm terminations, and Table AH for 900-ohm terminations.

10.10 Facilities Using MAT Cable: Any 25-gauge MAT cable segment must first be converted to an equivalent length of 26-gauge (high-capacitance) cable *before* determining major and minor gauges. Multiply the MAT cable length by 0.77 to get the equivalent 26-gauge cable length. This length is used to determine major and minor

gauges; it is also used in the procedures for converting 2-gauge cable to an equivalent single-gauge facility.

10.11 2-Gauge Cable: Procedures for calculating balance and equalizer settings are as follows:

- (1) Determine the impedance on the distant end of the cable sections (600 or 900 ohms).
- (2) Use the appropriate constant (K) from Table AG (600 ohms) or Table AH (900 ohms).
- (3) Convert the minor gauge to the equivalent length of major gauge:

$$EL = L(\text{minor}) \times K$$

where:

EL = the major gauge equivalent length

L(minor) = the length of the gauge being converted

K = the constant from Table AG or Table AH.

- (4) Add the equivalent length to the length of the major gauge. The resulting length is the equivalent length of single-gauge cable.
- (5) Follow the single-gauge cable procedures using the equivalent length of single-gauge in place of the facility length to find entry points for Tables AC through AE for balance settings and Table AF for equalizer settings.

10.12 Bridged Taps (BT): Bridged taps on the cable can be converted to an equivalent length of cable using Table AI. The bridged tap should be converted based on one of the following:

- The gauge of cable to which the bridged tap is connected.
- The gauge of the longest length of cable when the bridged tap is connected between two different gauges or when the location of the bridged tap is unknown.

Procedures for calculating balance and equalizer settings for cable with bridged taps are as follows:

- (1) Find the bridged tap length in Table AI that is nearest to the actual length of the bridge.
- (2) Find the gauge of cable selected for bridged tap conversion in Table AI and read the equivalent length from the column.
- (3) Add the equivalent length from Table AI to the cable facility used for the conversion.
- (4) Follow the single-gauge or 2-gauge cable procedures to find balance and equalizer settings.

E. Example: Prescription Setting Calculations for a 2-Wire Circuit

10.13 Consider a foreign exchange line with carrier interface as shown in Figure 2 (2.1). Assume it has the following:

- 9 kft of 24-gauge cable between the RT and a telset
- 250 ft of cable at the local CO
- An end-to-end line loss objective of 3.5 dB.

10.14 The prescription settings of the 2-wire channel units for this circuit are determined as follows:

- (1) To provide the loop-start (LS) signaling for this FX line, select the FXO function code for AUA42/AUA142 in the COT and the FXS function code for AUA43 in the RT.
- (2) Since the AUA43 faces a loop, choose the 600-ohm structural impedance (IMP = 600) for RT channel unit. The AUA42/AUA142 is back-to-back with a D() channel unit; this requires the 900-ohm structural impedance (IMP = 900) for the COT channel unit.
- (3) With 9 kft of 24-gauge cable terminated on a telset, the AUA43 channel unit balance setting table (Table AC) gives BAL = 12 for the RT channel unit. From Table AE, the balance setting for the COT channel unit (AUA42/AUA142) with office wire length of 250 ft is BAL = 1.

- (4) At the COT, the AUA42/AUA142 unit has the following:

$$XMT(GN) = 2.0 \text{ and } RCV(GN) = -1.5$$

The cable loss for 9 kft of 24-gauge cable with both ends terminated at 600 ohms is $L = 3.2$ dB. Given $(TLP)_b = 0.0$, the input and output levels of the RT channel unit are as follows:

$$(TLP)_t = -3.2 \text{ and } (TLP)_r = L - 3.5 = -0.3$$

- (5) Round these two values to the nearest 0.25 to obtain the gain settings for the AUA43 channel unit (at the RT) as follows:

$$XMT(GN) = 3.25 \text{ and } RCV(GN) = -0.25$$

- (6) Using Table AF, the slope settings are $SL = 0$ for the COT AUA42/AUA142 channel unit and $SL = 2$ for the RT AUA43 channel unit.

These function codes and prescription settings are summarized for both channel units as follows:

	AUA42/AUA142	AUA43
Function	FXO	FXS
IMP	900	600
BAL	1	12
XMT(GN)	2.0	3.25
RCV(GN)	-1.5	-0.25
SL	0	2
SIG OPTION	LS	—

11. 4-Wire VF Channel Unit Prescription Setting

A. Channel Unit Impedance Selection

Guidelines for selecting impedance of 4-wire CUs are these:

- Non-loaded cable with electronic equalization — 600 ohms
- Non-loaded cable with impedance mismatch equal — 150 ohms

- Loaded cable — 1200 ohms.

B. Channel Unit Attenuation (Gain) Calculation Without Equalization

11.01 This section contains the equations for determining the transmit and receive attenuation for the channel units in applications not requiring equalization. The equations require that the switching machine or customer equipment transmission level points (TLPs), the cable loss, and the channel unit insertion losses (Table AJ) be known. For actual cable measurement refer to AT&T 363-205-110, *SLC[®] Series 5 Carrier System, Cable Measurement Method for Determining Provisioning Setting for Special Service Channel Unit, Loop Transmission System*.

11.02 These equations are based on the D4 standard level points. The CIU will make all conversions to the Series 5 standard level points for the bank controller.

11.03 Transmit Path Calculations:

$$ATT(t) = 8.5 + G(t) + TLP(t)$$

where:

ATT(t) = transmit attenuation

G(t) = transmit insertion gain or loss from Table AJ

TLP(t) = signal level received on T and R leads.

11.04 Receive Path Calculations:

$$ATT(r) = 4.0 + G(r) - TLP(r)$$

where:

ATT(r) = receive attenuation

G(r) = receive insertion gain or loss from Table AJ

TLP(r) = signal level received on T1, R1 leads.

C. Channel Unit Equalization Other Than 150-Ohm Mismatch Equalization

11.05 This section contains directions for selecting slope (SL), height (HT), and bandwidth (BW) settings for the channel units for applications using active equalization.

11.06 Nonloaded Cable Applications - Single Gauge:

For single-gauge facilities, the prescription equalizer settings may be taken directly from Table AO (19-gauge), Table AP (22-gauge), Table AQ (24-gauge), Table AR (25-gauge MAT cable), and Table AS (26-gauge cable). The proper table is selected according to the gauge of the cable. Use the tables as follows:

- (1) Round the facility length to the nearest whole number in kft to obtain the table entry point.
- (2) From the table, record the BW, HT, SL, and equalizer gain (EQL GN).
- (3) Determine cable loss (Part 13).

Correct the cable loss to one-tenth of a dB (0.1 dB) accuracy. This can be done by interpolating from the cable loss given in Tables AO - AS or by calculating the total resistance and referring to Figure 44 or 45. The cable loss value is used to calculate the attenuator settings.

Example: Given 14.6 kft of 26-gauge cable:

- Round off to 15 kft to get table entry point.
- From Table AS, 15 kft of 26-gauge cable has the following settings: BW=13, HT=6, SL=3, and EQL GN = 1.6 dB (used to calculate attenuator settings later).
- In Table AS, 15 kft has 7.6 dB of loss; 14 kft has 7.1 dB of loss. By interpolation, 14.6 kft of 26-gauge cable has 1 kHz loss $L = 7.4$ dB.

Or use Figure 44 to determine cable loss:

- (1) Calculate total resistance = cable length x cable resistance from Table AK where cable length = 14.6 kft

- (2) Cable resistance for 26-gauge nonloaded cable from Table AK = 83.3 ohms/kft at 68°F
- (3) Therefore, resistance = $14.6 \times 83.3 = 1216$ ohms.
- (4) From Figure 44, 1-kHz loss $L = 7.4$ dB.

11.07 Nonloaded Cable Applications - Two

Gauges: When the facility has two different gauges of nonloaded cable, prescription settings may be obtained as follows: use Table AT for 24- and 22-gauge combinations, Table AU for 26- and 22-gauge combinations, and Table AV for 26- and 24-gauge combinations. The proper table is selected according to the gauge of the cable. Facilities with 19-gauge cable combinations are reduced to an equivalent single-gauge facility to get prescription settings. (See procedure for mixed 19-gauge cable). To find equalizer settings for 2-gauge cable sections as follows:

- (1) Determine the table entry point by adding the length of the two gauges together and rounding to the nearest kft for the working length (WL). Enter the table at WL and round the finer gauge to the nearest whole number.
- (2) Obtain BW, HT, SL, and EQL GN from the table.
- (3) Obtain the cable loss using Figure 44.

Example: Given a facility composed of 10.4 kft of 24-gauge cable and 8.2 kft of 26-gauge cable:

- (1) Determine table points by finding WL (working length):

$10.4 \text{ kft } 24\text{-gauge} + 8.2 \text{ kft } 26\text{-gauge} = 18.6$ kft or rounding,

WL = 19 kft.

Round the finer gauge (26) to the nearest kft ($8.2 = 8.0$). The table entry points are as follows:

WL = 19 kft, 8 kft of 26-gauge and 11 kft of 24-gauge.

- (2) From Table AV:

BW=14, HT=8, SL=2, and EQL GN = 1.6 dB (will be used to calculate attenuator settings).

- (3) Use Figure 44 to determine the cable loss of 8.2 kft of 26-gauge and 10.4 kft of 24-gauge as follows:

Total length = $10.4 + 8.25 = 18.6$ kft.

Total resistance = $8.2 (83.3) + 10.4 (51.9) = 1223$ ohms (Table AK gives cable resistance/kft).

From Figure 44, cable loss = 8.1 dB.

11.08 Nonloaded Cable Applications - More Than Two Gauges:

To determine prescription equalizer settings for facilities composed of more than two gauges, the facility must be converted to an equivalent 2-gauge facility. The two longest segments are designated the major gauges and the remaining segments of cable are minor gauges. The minor segments are then converted to major gauge equivalent lengths using Table AL. The proper table is selected by the two resulting major gauges. The two major gauge equivalent lengths are used to select the proper table and table entry points. The rules for conversion of a minor gauge to the equivalent major gauge are as follows:

- (1) Convert a minor gauge to the major gauge that is in closest physical proximity in the actual makeup of the cable.
- (2) Convert the minor gauges to the major gauge that is nearest in gauge size.

11.09 Facilities Using MAT Cable:

Any 25-gauge MAT cable segment must first be converted to an equivalent length of 26-gauge (high-capacitance) cable *before* determining major and minor gauges. Multiply the MAT cable length by 0.77 to get the equivalent 26-gauge cable length. This length is used to determine major and minor gauges and to convert minor gauge to major gauge. However, the *actual* length of MAT cable is

used to determine cable loss from Figure 44 or 45.

11.10 Equalizer Settings: To determine the equalizer settings for facilities composed of more than two gauges as follows:

- (1) Select the two longest sections of cable as the major gauges. The remaining sections are minor gauges.
- (2) Convert a minor gauge to a major gauge.
 - (a) Select the proper constant from Table AL.
 - (b) Multiply the length of the minor gauge by the constant.
 - (c) Add the results to the length of the major gauge.
- (3) Repeat (2) for all minor gauges.
- (4) Use the results of (3) to enter the tables for 2-gauge facilities (Tables AT, AU, or AV).
- (5) Obtain BW, HT, SL, and EQL GN from the table.
- (6) Compute the cable loss using Figure 44 and the *actual* cable gauges and lengths as entry points, not the converted gauges and lengths obtained in (2) and (3) or from converting MAT cable.

Example: Given a cable facility composed of the following:

- (1) 8.8 kft of 22-gauge
- (2) 3.6 kft of 24-gauge
- (3) 6.6 kft of MAT cable
- (4) 7.6 kft of 26-gauge

Perform the following steps:

- (a) Convert 25-gauge MAT cable segment to equivalent length of 26-gauge:

$6.6 \text{ kft } 25\text{-gauge MAT cable} \times 0.77 = 5.1 \text{ kft equivalent length of } 26\text{-gauge.}$

- (b) Select 22- and 26-gauge segments as the major gauges.
- (c) Convert 24-gauge to 22-gauge:

$3.6 \text{ kft } 24\text{-gauge} \times 1.17 \text{ (24 to 22 conversion constant)} = 4.2 \text{ kft equivalent length of } 22\text{-gauge.}$

$8.2 \text{ kft } 22\text{-gauge} + 4.2 \text{ kft } 22\text{-gauge equivalent} = 12.4 \text{ kft } 22\text{-gauge table entry.}$
- (d) Add the 25-gauge MAT cable equivalent length to the 26-gauge segment length:

$7.6 \text{ kft } 26\text{-gauge} + 5.1 \text{ kft } 25\text{-gauge MAT cable equivalent} = 12.7 \text{ kft } 26\text{-gauge table entry.}$
- (e) From (c) and (d) above, WL equals:

$12.4 \text{ kft } 22\text{-gauge} + 12.7 \text{ kft } 26\text{-gauge} = 25.1 \text{ kft or } WL = 25 \text{ kft.}$

Round the finer gauge (26) to the nearest whole number:

$12.7 \text{ kft} = 13 \text{ kft } 26\text{-gauge.}$

Table AU entry points are:

$WL = 25 \text{ kft}$

$26\text{-gauge} = 13 \text{ kft and } 22\text{-gauge} = 12 \text{ kft (rounded to the nearest whole number).}$
- (f) From Table AU:

$BW=14, HT=8, SL=6, \text{ and } EQL \text{ GN} = 3.5 \text{ dB.}$
- (g) Calculate the parameters for determining 1-kHz cable loss from Figure 44:

$3.6 \text{ kft } 24\text{-gauge} + 8.2 \text{ kft } 22\text{-gauge} + 7.6 \text{ kft } 26\text{-gauge} + 5.1 \text{ kft } 25\text{-gauge MAT cable equivalent} = 24.5 \text{ kft total length.}$

$187 \text{ ohms } 24\text{-gauge} + 269 \text{ ohms } 22\text{-gauge} + 633 \text{ ohms } 26\text{-gauge} + 432 \text{ ohms } 25\text{-gauge MAT cable actual resistance of } 6.6 \text{ kft (not converted length)} = 1521 \text{ ohms total}$

resistance.

From Figure 44, cable loss equals 10.5 dB.

11.11 Nonloaded Cable Applications - Bridged

Taps: The procedure for determining equalizer settings for nonloaded cable with bridged taps requires that the bridged tap (BT) be converted to an equivalent length of cable (Table AM). The gauge of the BT does not matter since loss and amplitude distortion are caused primarily by cable capacitance. The four gauges of cable (19, 22, 24, 26) considered in this bridged tap section have essentially the same capacitance (0.083 μ F) per mile. The BT should be converted to an equivalent length as follows:

- (1) If the BT is connected at the junction of two gauges, convert to the equivalent length of the longer gauge.
- (2) If not, convert the BT to an equivalent length of gauge to which it connects.
- (3) If the location of the BT is unknown, convert to the gauge which makes up the largest part of the facility.

Example: Given a cable facility composed of 12 kft of 26-gauge cable with a 3.6 kft BT:

- (a) Convert the BT to an equivalent length of 26-gauge cable from Table AM. For this BT length, the equivalent 26-gauge length would be approximately 2.4 kft.
- (b) Add the facility length to the equivalent length of BT:

12 kft facility length + 2.4 kft = 14.4 kft total facility length 26-gauge.
- (c) From the appropriate single-gauge table, determine the equalizer settings. Use Table AS with an entry point of 14 kft:

BW=13, HT=6, SL=2, and EQL GN = 1.1 dB.
- (d) Determine the cable loss from Figure 44:

Total resistance 12 kft 26-gauge = 1000 ohms.

Total length 12 kft 26-gauge + 3.6 kft BT = 15.6 kft.

From Figure 44, cable loss = 6.6 dB.

11.12 Nonloaded and Loaded Cable - Mixed 19-

Gauge: Since only small quantities of 19-gauge cable exist in outside plant, it is not included in the 2-gauge tables. When 2-gauge facilities containing 19-gauge cable are encountered, the facility should be reduced to an equivalent single gauge as follows:

- (1) Select the longer of the two gauges as the major gauge and the shorter as the minor gauge.
- (2) Obtain the constant from Table AL to convert the minor gauge to the major gauge.
- (3) Multiply the length of the minor gauge by the constant to obtain the equivalent length of major gauge.
- (4) Use the result of (3) to enter the appropriate single-gauge table to obtain BW, HT, SL, and EQL GN settings.
- (5) Determine cable loss (Figure 44 or Table AN).

Example: Given a cable facility composed of:

- (1) 11 kft of 22 gauge NL
- (2) 17 kft of 19 gauge NL
- (a) Major gauge is 19-gauge; minor gauge is 22-gauge.
- (b) From Table AL, the constant is 1.19.
- (c) Convert 22-gauge to 19-gauge:

11-kft length of minor gauge (361 ohms) x 1.19 constant = 13.09 kft of equivalent 19-gauge length.

17 kft 19-gauge (277 ohms) + 13.09 kft 19-gauge equivalent = 30.09 kft (round off to 30 kft).

- (d) From Table AO for 30 kft of 19-gauge,
 BW=14, HT=7, SL=5, and EQL GN = 2.8 dB.

- (e) Determine cable loss:

$$\text{Total length} = 11 + 17 = 28 \text{ kft}$$

$$\text{Total resistance} = 361 + 277 = 638 \text{ ohms.}$$

$$\text{Cable loss from Figure 44} = 6.6 \text{ dB.}$$

11.13 When the facility contains more than two gauges and the 19-gauge segment is a minor gauge, use the procedure for *Nonloaded Cable Applications - More Than Two Gauges*. If the 19-gauge segment comprises more than one-half of the total length, the facility should be reduced to a 19-gauge equivalent as described previously. If neither of these cases applies to the facility, consider the 19-gauge segment as a minor gauge and follow the procedure for *Nonloaded Cable Applications - More Than Two Gauges*.

Example: Given a cable facility composed of:

- (1) 8 kft of 24-gauge
 - (2) 4 kft of 22-gauge
 - (3) 6 kft of 19-gauge
- (a) Since the length of the 19-gauge segment is less than one-half of the total length, the major gauges are 24 and 22.
- (b) Convert 19-gauge to 22-gauge:

$$6 \text{ kft 19-gauge (minor gauge)} \times 0.87 \\ \text{(constant from Table AL)} = 5.22 \text{ kft of 22-gauge equivalent.}$$

- (c) Determine table entry points:

$$5.22 \text{ kft 22-gauge equivalent} + 4.0 \text{ kft 22-gauge} + 8.0 \text{ kft 24-gauge} = 17.22 \text{ kft.}$$

$$\text{Round off to WL} = 17 \text{ kft.}$$

$$8 \text{ kft of 24-gauge and } 9 \text{ kft of 22-gauge.}$$

- (d) From Table AT, 24- and 22-gauge:

$$\text{BW}=14, \text{HT}=6, \text{SL}=2, \text{and EQL GN} = 1.3 \text{ dB.}$$

- (e) Determine cable loss:

$$\text{Total length} = 8 + 4 + 6 = 18 \text{ kft}$$

$$\text{Total resistance} = 415 + 131 + 98 = 644 \text{ ohms.}$$

$$\text{Cable loss from Figure 44} = 5.2 \text{ dB.}$$

11.14 Loaded Cable Applications - Single- or 2-Gauge:

Prescription equalizer settings for single-gauge facilities of 19-, 22-, 24-, 25-gauge MAT cable, and 26-gauge loaded cable are found in Tables AW, AX, AY, AZ, and BA, respectively. Settings for facilities composed of two gauges, 24/22, 26/22, or 26/24, may be found in Tables BB, BC, and BD, respectively. Table selection depends on the gauge(s) of the facility. The following procedure is used to find the settings for single- or 2-gauge facilities:

- (1) Obtain BW, HT, SL settings, and EQL GN from the appropriate table for the entry nearest to the facility length.
- (2) The 1-kHz cable loss must be calculated using the loss constants in Table AN.

11.15 Table Entry Points for 2-Gauge H88 Facilities:

Table entry points should be determined using the following guidelines:

- (1) Choose the table entry nearest the actual cable segment lengths. For example, for a cable composed of 7 kft of 26-gauge H88 and 38 kft of 24-gauge H88 (a total of seven H88 loads), the table entry is 6 kft (26-gauge) and 36 kft (24-gauge).
- (2) If the length of a cable segment rounds off to a lower table entry length and the other segment is exactly midway between entry points, that segment should be rounded up to the higher entry point. For example, for a cable composed of 9 kft of 26-gauge H88 and 38 kft of 24-gauge H88, the table entry is 12 kft (26-gauge) and 36 kft (24-gauge).

- (3) If the length of a cable segment rounds off to a higher table entry length and the other segment is exactly midway between entry points, that segment should be rounded down to the lower entry point. For example, for a cable composed of 9 kft of 26-gauge H88 and 40 kft of 24-gauge H88, the table entry is 6 kft (26-gauge) and 42 kft (24-gauge).
- (4) If length of both segments of cable is exactly midway between entry points, round off the coarser gauge to the lower entry point and the finer gauge to the higher entry point. For example, for a cable composed of 9 kft of 26-gauge H88 and 39 kft of 24-gauge H88, the table entry is 12 kft (26-gauge) and 36 kft (24-gauge).

11.16 The following examples apply to single- and 2-gauge facilities.

Example 1: Given 31 kft of 24-gauge loaded cable with 3.5 kft end sections:

- (a) Obtain BW, HT, and SL settings, and EQL GN from Table AY (24-gauge, 30 kft):
 $BW=3, HT=4, SL=2,$ and $EQL\ GN = 2.6\ dB.$
- (b) Determine the cable loss:
 $31\ kft\ 24H88 \times 0.23\ loss\ constant\ from\ Table\ AN = 7.13\ dB\ cable\ loss.$

Example 2: Given a cable facility composed of:

- (1) 21 kft of 26-gauge loaded
- (2) 20 kft of 24-gauge loaded
- (3) 2.5 kft end sections
- (a) Obtain settings from Table BD (26/24 gauge):
 $Entry\ point = 24\ kft\ of\ 26-gauge\ and\ 18\ kft\ of\ 24-gauge:$
 $BW=5, HT=5, SL=11,$ and $EQL\ GN = 9.5\ dB.$

- (b) Determine the cable loss:

$21\ kft\ 26-gauge \times 0.34\ constant\ from\ Table\ AN = 7.14\ dB\ loss\ of\ 26-gauge\ segment.$

$20\ kft\ 24-gauge \times 0.23\ constant\ from\ Table\ AN = 4.60\ dB\ loss\ of\ 24-gauge\ segment.$

$7.14\ dB\ loss\ of\ 26-gauge + 4.60\ dB\ loss\ of\ 24-gauge = 11.74\ dB\ total\ cable\ loss.$

11.17 Loaded Cable Applications - More Than Two Gauges: When more than two gauges make up the facility, the facility must be converted to the 2-gauge equivalent. The 1-kHz insertion loss is used as the criteria for determining the two major gauge segments. The remaining segments are minor gauges. The length of the minor gauges is added to the length of the nearest gauge size of major gauge to determine the table entry points. The settings are then determined from the appropriate 2-gauge table.

Example: Given a cable facility composed of:

- (1) 3 kft of 19-gauge loaded
- (2) 18 kft of 22-gauge loaded
- (3) 21 kft of 24-gauge loaded
- (4) 6 kft of 26-gauge loaded
- (5) 3 kft end sections
- (a) Compute the 1-kHz insertion loss of each segment using the constants in Table AN:
 $3\ kft\ 19H88 \times 0.08\ constant = 0.24\ dB\ 1-kHz\ loss.$
 $18\ kft\ 22H88 \times 0.15\ constant = 2.7\ dB\ 1-kHz\ loss.$
 $21\ kft\ 24H88 \times 0.23\ constant = 4.83\ dB\ 1-kHz\ loss.$
 $6\ kft\ 26H88 \times 0.34\ constant = 2.04\ dB\ 1-kHz\ loss.$
 $0.24\ dB\ 19-gauge + 2.7\ dB\ 22-gauge + 4.83$

dB 24-gauge + 2.04 dB 26-gauge = 9.81 total 1-kHz insertion loss.

- (b) Select two major gauges as segments with greatest loss from (a) above:

22-gauge and 24-gauge.

- (c) Add length of 19-gauge to 22-gauge:

18 kft 22-gauge + 3 kft 19-gauge = 21 kft 22-gauge for table entry.

- (d) Add length of 26-gauge to 24-gauge:

21 kft 24-gauge + 6 kft 26-gauge = 27 kft 24-gauge for table entry.

- (e) Round off 21 kft of 22-gauge to 18 kft.
Round off 27 kft of 24-gauge to 30 kft.
(From guidelines for loaded cable, single- or 2-gauge.)

WL = 18 + 30 = 48 kft.

From Table BB:

BW=3, HT=5, SL=2, and EQL GN = 2.6 dB.

D. 150-Ohm Mismatch Equalization

11.18 This section explains when and how to use mismatch equalization by selecting 150 ohms impedance. With 4-wire Series 5 channel units, active equalization is available only in the transmit direction; this is called "post-equalization" because the signal is equalized by the channel unit after it comes off the cable. This means that the 4-wire repeater at the distant end of the cable must provide corresponding equalization in the opposite direction. Using 150-ohm mismatch equalization on both cable pairs, the Series 5 channel units provide passive pre- and post-equalization that meet the roll-off requirements of the circuit for a wide range of *nonloaded* cable facilities. For these facilities, the repeater (if any) at the distant end does not have to provide any equalization. This range of cable facilities can be substantially increased if the far end also provides 150-ohm mismatch equalization on both cable pairs.

11.19 Tables T through X show this range of facilities for single-gauge cable without bridged tap. The tables list the cable transducer loss for various cable lengths up to the maximum value which meets the roll-off requirements of the circuit. Four categories of roll-off are listed based on whether the circuit is a line or trunk and on the number of cable links in the circuit. Roll-off limits are taken from AT&T 851-300-100. For circuits that can be equalized from one end (no equalization at the customer end), maximum cable lengths range from 1 to 19 kft; for 26-gauge nonloaded cable, the maximum length ranges from 12 to 15 kft, depending on the roll-off requirements of the circuit.

11.20 If the cable is mixed-gauge without bridged tap, the tables can be used by interpolation. For facilities with more than two gauges, convert the mixed-gauge cable to the equivalent 2-gauge facility. (See paragraph on *Nonloaded Cable Applications - More Than Two Gauges*.) The following interpolation formula gives the loss values for mixed-gauge cable:

$$I_{l,h} = T_h + \frac{L_h}{L_l + L_h} \times (T_l - T_h)$$

where:

$I_{l,h}$ = interpolated value for mixed-gauge cable

T_h = table value for the higher gauge

L_h = length of the higher gauge.

L_l = length of the lower gauge

T_l = table value for the lower gauge

11.21 Using mismatch equalization produces mismatch loss; this loss is included in Tables T through X, and the values listed should be used directly to calculate the attenuation settings of the Series 5 channel unit. Using standard circuit design rules, first determine TLPs at the channel unit interface to the cable. Then use the formulas for attenuation without equalization (Section 10A.) to calculate attenuator settings. These settings will give the proper end-to-end loss (from NCTE to bit

stream or the reverse). However, if the circuit has to be sectionalized to locate a loss problem, the measured level at the cable interface will be offset several dB from the calculated TLP because although the mismatch loss is assigned to the cable, it actually takes place inside the 4-wire channel unit. Procedures for alignment of channel units and circuits that use 150-ohm mismatch are included in AT&T 363-205-402.

E. Attenuation (Gain) Calculation with Active Equalization

11.22 The equations in this section are used to determine the amount of attenuation for the transmit and receive paths of channel units that provide equalization. Equalizer settings must have been determined previously to provide 1 kHz equalizer gain values required for calculating attenuation. The equalizer gain values given in Tables AO through BD are used to determine the equalization. The customer equipment TLPs, cable loss, and channel unit gain values must be known for the attenuation equations. The equations are based on D4 standard level points. Cable loss is obtained from the tables or from cable loss calculations (Part 13).

11.23 Transmit Path Calculations:

$$ATTt = 8.5 + Gt + Ge + TLPt,r$$

where:

ATTt = required channel unit transmit attenuator setting

Gt = channel unit transmit insertion gain (Table AJ)

Ge = additional 1 kHz gain due to equalizer setting (from Tables AO - BD)

TLPt,r = TLP level at the tip and ring (T,R) of channel unit (within cross talk limits of +6 to -9 dB TLP).

The TLPt,r value depends on the cross talk limit and the cable loss or on the circuit objective and the cable loss. (Refer to 4-wire applications in Part 5.)

11.24 Receive Path Calculations:

$$ATTr = 4.0 + Gr - TLPt1,r1$$

where:

ATTr = required channel unit receive attenuator setting

Gr = channel unit receive insertion gain (Table AJ)

TLPt1,r1 = the TLP level at the tip and ring (T1, R1) of channel unit.

The TLPt1,r1 value depends on the cross talk limit and the cable loss or on the circuit objective and the cable loss. (Refer to 4-wire applications in Part 5.)

11.25 Listed below are the design rules for the signal levels in the circuit; cross talk is limited mainly by following these rules. These design rules assume that the channel unit is located in a CO and is working into a cable section going to a PBX or distant CO. For circuits with loaded cable connecting two COs, use the relaxed values given in parentheses in the following guidelines.

- (1) Generally, the input to the channel T and R leads must be -9 dB TLP or more, and the output from the channel must not exceed +6 dB TLP. For 150-ohm, nonloaded 4-wire cable, a -15 dB TLP input is allowed; for the 4ETO application, a +7 dB TLP is allowed.
- (2) The minimum input level from the cable section is: -9 dB for 600-ohm nonloaded cable; -15 dB TLP for 150-ohm nonloaded cable; and -6 dB TLP (or -9 dB TLP) for 1200-ohm loaded cable.
- (3) The maximum input to the cable from the customer equipment is: +6 dB for nonloaded cable and +3 dB TLP (or +6 dB TLP) for loaded cable.
- (4) The maximum allowable transducer loss at 1 kHz for a cable section is: 15 dB for nonloaded and 12 dB (or 15 dB) for H88 loaded.

- (5) A nominal 3-kft end section is assumed for loaded cables. For end sections from 1.5 to 4.5 kft, there is an additional roll-off of up to 0.8 dB at 3 kHz.

F. Example — 4-Wire Circuit Calculations

11.26 Consider the foreign exchange trunk of Figure 27C. The end-to-end trunk loss objective for this circuit is taken to be 3.5 dB. Assume that the loop to the customer location consists of 24 kft of 24-gauge H88 loaded cable without bridged taps and that the COT faces a D4 bank through 500 feet of 22-gauge office wiring. The circuit order calls for toll diversion with the simplex connection reversed at the AUA44 end of the 4-wire intra-office connection. The simplex connection of both the RT channel unit (AUA41/AUA141) and the NCTE can usually be set to normal. WORD entries are derived as follows.

11.27 RT Channel Unit (AUA41/AUA141): For the AUA41/AUA141 channel unit facing loaded cable, the metallic interface impedance should be 1200 ohms. From Table S the function code is FXT3. From Table AY, the equalization settings are BW=3, HT=4, SL=1. To calculate the setting for the transmit attenuator, use the following equation:

$$ATTt = 8.5 + Gt + Ge + TLPt,r$$

From Table AJ obtain Gt: 6.5 dB; from Table AY obtain Ge: 1.4 dB. From Table AN, obtain the cable loss: 24 kft x 0.23 dB per kft = 5.52 dB. From Figure 27C, the TLP at T,R, is $-1.5 - L/2$, where L is the cable loss; thus $TLPt,r = -1.5 - 2.76 = -4.26$ dB. Finally, $ATTt = 12.14$ dB, which yields a rounded-off setting of 12.1 dB.

11.28 To calculate the setting for the receive attenuator, use the following equation:

$$ATTr = 4.0 + Gr - TLPt1,r1$$

From Table AJ, obtain Gr: 2.0 dB. From Figure 27C, the TLP at T1, R1 is $-1.5 + L/2$; thus $TLPt1,r1 = -1.5 + 2.76 = 1.26$ dB. ATT_r then becomes 4.74

dB, which rounds off to 4.7 dB.

11.29 The settings derived above should be placed in the WORD in the following sequence: FC=FXT3, TRMT=12.1, RCV=4.7, L-N=L, SL=1, BW=3, HT=4, IMP=1200.

11.30 COT Channel Unit (AUA44): For an AUA44 channel unit facing a digital carrier terminal through office wiring, metallic interface impedance should be 600 ohms. The function code from Table S is FXP5. Consult office wiring records or interpolate from Table AP to find the office wiring loss: 0.1 dB. Equalization settings are all zero. To calculate the transmit attenuator setting, use the equation for $ATTt$, with $Ge = 0.0$ and $TLPt,r = -0.1$. The result is $ATTt,r = 14.9$ dB. In the receive direction, the TLP leaving the channel unit is 0.0, and $ATTt1,r1$ becomes 6.0. WORD entries for the AUA44 channel unit are: FC=FXP5, TRMT=14.9, RCV=6.0, L-N=N, SL=0, BW=0, HT=0, and IMP=600.

12. CSA Cable Guidelines

12.01 By limiting customer-RT separation, the CSA concept can provide ready access to carrier for digital services for every customer along a subscriber carrier route. Design of 2-wire channel units has been tailored to CSA applications and satisfactory performance when connected to non-CSA loops cannot be assured. To handle any special service customers outside a CSA, the Series 5 four-wire channel units should be used. The CSA design rules are detailed in AT&T RL82-02-207, IL83-09-095, and Bell Communications Research, Inc. AL-851-84/04-002. The maximum values for CSA cable at 68° F are 4.7 dB loss and 750 ohms resistance.

12.02 The CSA concept basically divides an entire route into discrete geographical units (CSAs) so that when digital subscriber carrier is fully deployed along the route, every customer will have access to 64 kb/s service. The CSAs use existing allocation areas where possible, and should require few, if any, changes to the present method of

sectionalizing the loop plant. Using this approach, the entire route from 12 kft beyond the CO is segmented into CSAs. Then, when relief is required, loop carrier can be established on the route with minimum additional planning and engineering.

12.03 CSA Cable Requirements:

- Nonloaded cable only.
- The length of 26-gauge cable (used alone or in combination with other gauge cables) should not exceed a total length of 9 kft including bridged tap.
- Total bridged tap length should not exceed 2.5 kft. No single tap should exceed 2.0 kft.
- Multigauge cable is restricted to 2 gauges (excluding short links for stubbing and fusing).
- For single or multigauge cable containing only 19-, 22-, or 24-gauge cable, the total length including bridged tap should not exceed 12 kft.
- Where an existing cable containing a 26-gauge segment has a total length including bridged tap that is longer than 9 kft (but less than 12 kft), that cable is considered to meet the CSA definition provided it satisfies the following restriction:

$$LTOT < 12 - (3) \times (L26) / (9 - LBTAP) \text{ kft}$$

where:

LTOT = the total length including bridged tap

L26 = the total length of 26-gauge sections of the cable (excluding any 26-gauge bridged tap)

LBTAP = the total length of bridged tap in the cable.

In the limiting case where the cable is entirely 26-gauge, total length is limited to 9 kft, including bridged tap.

13. Calculations for 1-kHz Cable Loss

A. Loaded Cable (No Bridged Taps)

13.01 The 1-kHz cable loss of loaded cable is determined by multiplying the length of each gauge by the loss constants in Table AN and adding for the total.

B. Nonloaded Cable

13.02 The 1-kHz loss of nonloaded cable may be determined from Tables AO through AS or from Tables T through X for single-gauge facilities, or from Figure 44 or 45. To use Figure 44 or 45, the facility length and DC resistance must be known. For nonloaded facilities terminated in 600 ohms on each end, use Figure 44. For a facility terminated in 900 ohms on one end and 600 ohms on the other end, use Figure 45.

13.03 The following method of using Figures 44 and 45 provides accurate results that are temperature-independent as long as the proper value of temperature-dependent cable resistance is used.

- (1) Determine the total length of the facility: channel unit to termination. Add the length of any bridged taps to the total.
- (2) Determine the total DC resistance using the constants in Table AK. Do not include bridged tap resistance in total.
- (3) Read across the appropriate figure to the total length value. Read up to the DC resistance value. The 1-kHz loss may be read at the intersecting point.

14. References

14.01 The following AT&T Practices give additional information on Series 5 equipment and related systems. Most of these practices are referred to elsewhere in this document. (Check appropriate numerical index for practice

availability.) Also listed are references that are not AT&T practices, but provide relevant information.

Document	Title
500-206	<i>Craft Interface Unit, User's Guide</i>
AT&T 363-005-101 through 363-005-310	SLC [®] <i>Series 5 Carrier System Data Sheets</i>
AT&T 363-205-010	SLC [®] <i>Series 5 Carrier System Application and Planning Guide</i>
AT&T 363-205-101	<i>Craft Interface Unit, Description</i>
AT&T 363-205-300	<i>Extended Test Controller, Description, Installation, and Maintenance</i>
AT&T 363-205-402	SLC [®] <i>Series 5 Channel Unit Installation (TOP)</i>
AT&T 851-300-100	<i>Transmission Design Considerations and Objectives, Switched Special Services and PBX Automatic Call Distribution (ACD)/ Centrex Station Services</i>
AT&T 880-420-102	<i>Private Line Data Circuits Standard Design of a 2-Point and Multipoint Circuits, Data Communications Engineering</i>
AT&T 880-601-115	<i>Engineering Guidelines, 4-Wire Local Loop</i>
AT&T 880-604-102	<i>Two-Point and Multipoint Private Line Design, Circuit Engineering</i>

Document	Title
AT&T 915-710-115	SLC [®] <i>Series 5 Carrier System Application Engineering</i>
ED-7C628-10	SLC <i>Series 5 Carrier System Ordering Guide</i>
AL-851-84/04-002	Bellcore Advisory Letter, Carrier Serving Area Guidelines
IL83-09-095	AT&T Information Letter, Carrier Serving Area (CSA) Design Procedures
RL82-02-207	AT&T Recommendation Letter, Introduces Fundamental Subscriber Carrier Planning to Insure New Services Capability in the Subscriber Network
TR-TSY-000030	Bellcore Technical Reference, SPCS Customer Premises Equipment Data Interface, Issue 1, November 1988
TR-TSY-000031	Bellcore Technical Reference, CLASS SM Feature: Calling Number Delivery, Issue 3, January 1990

Glossary

2RD	Point-to-Point Manual Ringdown
2WPLAR	2-Wire Private Line Auto Ring
4DX	4-Wire Duplex
4ETO	4-Wire Equalized Transmission Only
4FXO	4-Wire Foreign Exchange, Office end
4FXS	4-Wire Foreign Exchange, Station end
4TDM	4-Wire Tandem

4TO	4-Wire Transmission Only	DCU	Digital Connectivity Unit
ACD	Automatic Call Distribution	DCU-L	Digital Connectivity Unit - Left
ADU	Alarm Display Unit	DCU-R	Digital Connectivity Unit - Right
AMI	Alternate Mark Inversion	DDS	Digital Data System
ATT	Attenuation	DID	Direct Inward Dial
BAL	Balance	DPO	Dual Pulse Originating
BCU	Bank Control Unit	DPT	Dual Pulse Terminating
BRI	Basic Rate Interface	DS0	Digital Signal Zero
BRITE II	Basic Rate Interface Terminal Equipment (Universal <i>SLC</i> Carrier System)	DS0-DP	Digital Signal Zero - Dataport
BT	Bridged Tap	DSL	Digital Subscriber Loop
BW	Bandwidth	DX	Duplex
CC	Clear Channel	EEPROM	Electronically Erasable Programmable Read-Only Memory
CCITT	International Telephone and Telegraph Consultant Committee	EL	Equivalent Length
CFU	Combined Function Unit	EQLGN	Equalizer Gain
CIU	Craft Interface Unit	ETO	Equalized Transmission-Only
CO	Central Office	FXO	Foreign Exchange, Office End
COT	Central Office Terminal	FXO/GT	Foreign Exchange, Office End/Gain Transfer
CPE	Customer Premises Equipment	FXO/LS	Foreign Exchange, Office End/Loop Start
CPFT	Customer Premises Facility Terminal	FXS	Foreign Exchange, Station End
CPI	Calling Party Identification	FXS/GT	Foreign Exchange, Station End/Gain Transfer
CSA	Carrier Serving Area	FXS/LS	Foreign Exchange, Station End/Loop Start
CTS	Conventional Term Set	GA	Gauge
CTU	Channel Test Unit	GN	Gain
CU	Channel Unit	HT	Height
DACS	Digital Access Cross-Connect System	ID	Identification
DAT	Data Alignment Tone	INA	Integrated Network Access
DCS	Digital Cross-Connect System	INA-RT	Integrated Network Access - Remote Terminal

ISDN	Integrated Services Digital Network	RBOC/BOC	Regional Bell Operating Company/Bell Operating Company
LATA	Local Access and Transport Area	RBS	Robbed-Bit Signaling
LBRV	Low Bit-Rate Voice	RCV	Receive
LED	Light Emitting Diode	REN	Ringer Equivalence Number
LIU	Line Interface Unit	REV	Reverse
LS	Loop-Start	RT	Remote Terminal
LT-MODE	Line Terminating Mode	RZ	Return to Zero
LS/GS	Loop Start/Ground Start	SARTS	Switched Access Remote Testing System
MAT	Metropolitan Area Trunk	SCEC	Second Channel Error Correction
MFT	Metallic Facility Terminal	SMAS	Switched Maintenance Access System
MJU	Multipoint Junction Unit	SL	Slope
MLT	Multiloop Test	SRDM	Sub-Rate Data Multiplexer
MVEC	Majority Vote Error Correction	SSCU	Special Service Channel Unit
NCTE	Network Channel Terminating Equipment	SSP	Service Switching Point
NOR	Normal	T-BRITE	T-Interface Basic Rate Interface Terminal Equipment (Universal SLC Carrier System)
NRBS	No Robbed-Bit Signaling	TE1	Terminal Equipment 1
NT1	Network Terminating - Layer 1	TDM	Tandem
OCU	Office Channel Unit	TDO	Tandem Office End
OCU-DP	Office Channel Unit - Dataport	TE1	Terminal Equipment 1
OHT	On-Hook Transmission	TDS	Traffic Data System
OPS	Off-Premises Station	TLP	Transmission Level Point
OTU	Office Timing Unit	TO	Transmission-Only
PBX	Private Branch Exchange	TOP	Task Oriented Practice
PBX-CO	Private Branch Exchange - Central Office	T/R	Tip/Ring
PCM	Pulse Code Modulation	U-DSL	U-Interface Digital Subscriber Line
PGTC	Pair Gain Test Controller	VF	Voice Frequency
PLAR	Private Line Auto Ring		
PLR	Pulse Link Repeater		
POTS	Plain Old Telephone Service		

WATS	Wide Area Telephone Service
WL	Working Length
WORD	Work Order Record Detail
XMT	Transmit
XTC	Extended Test Controller
ZCS	Zero Code Suppression
ZRD	Point-to-Point Manual Ringdown

Table A. Series 5 Special Service and DCU Channel Units

<u>Apparatus Code</u>	<u>CLEI* Code</u>	<u>Type</u>	<u>Channel Unit Functions</u>	
AUA45B	5SCUUJ5	2-Wire	2RD	Point-to-Point Manual Ringdown
AUA75	5SC1FF2A	2-Wire	2WPLAR	Point-to-Point Automatic Ring
AUA43†	5SCU6A0A	2-Wire CF‡	FXS DPO TO	(Foreign Exchange, Station End) (Dial Pulse Originating) (Transmission Only)
AUA42†	5SCU690A	2-Wire CS‡	FXO DPT TO	(Foreign Exchange, Office End) (Dial Pulse Terminating) (Transmission Only)
AUA142†	5SCU69ZA	2-wire CS‡	FXO DPT TO	(Foreign Exchange, Office End) (Dial Pulse Terminating) (Transmission Only)
AUA54	5SCU7B0A	4W0 E&M	4E&M PLR	(4-Wire E&M Lead Signaling) (Pulse Link Repeater)
AUA41	5SCU7D0A	4W1 CF	4FXS 4TO 4ETO 4DX	(4-Wire Foreign Exchange, Station End) (4-Wire Transmission Only) (4-Wire Equalized TO) (4-Wire Duplex)
AUA141	5SCU7DZA	4W1 CF	4FXS 4TO 4ETO 4DX	(4-Wire Foreign Exchange, Station End) (4-Wire Transmission Only) (4-Wire Equalized TO) (4-Wire Duplex)

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† Functions listed are actually function codes for AUA42, AUA142 and AUA43 channel units.

‡ CF = current feed, CS = current sink.

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Table A. Series 5 Special Services and DCU Channel Units (Contd)

<u>Apparatus Code</u>	<u>CLEI Code</u>	<u>Type</u>	<u>Channel Unit Functions</u>
AUA44	5SCU7C0A	4W2 CS	4FXO (4-wire Foreign Exchange, Office End) 4TDM (4-Wire Tandem)
AUA52	5SCU480A	Dataport	OCU DP (Office Channel Unit Dataport at 2.4, 4.8, 9.6, 56 kb/s)
AUA152	5SCU48ZA §	Dataport	OCU DP (at 2.4, 4.8, 9.6, 56 kb/s)
AUA52B	5SC1430A §	Dataport	OCU DP (at 2.4, 4.8, 9.6, 19.2, 56, and 64 kb/s)
AUA34	5SCU380A	Dataport	DS0 DP (Digital Signal Zero Dataport)
AUA34B	5SC1330A ¶	Dataport	DS0 DP (Digital Signal Zero Dataport)
AUA90	5SC1EE0A	T-BRITE	ISDN BRI (2B+D)
AUA93	5SC1HE0A	BRITE II	ISDN BRI (B1+B2+D)
AUA16	5SCS400AA **	DCU-Left	VF Special Service and/or Data Services
AUA17	5SCS500A **	DCU-Right	VF Special Service and/or Data Services
AUA117	5SCS5C0A **	DCU-Right	VF Special Service and/or Data Services

§ For CIU purposes, use 5SCU48 for the AUA52, AUA152, and AUA52B **CLEI** code.

¶ For CIU purposes, use 5SCU38 for the AUA34 and AUA34B **CLEI** code.

** For CIU and WORD document purposes, use only 5SCS500A for the DCU **CLEI** code.

Table B. Series 5 Four-Wire Channel Unit Function Codes for Equivalent D4 Four-Wire Channel Units (Notes)

<u>D4 Channel Unit</u>	<u>Channel Unit Code J98726()</u>	<u>D4 CLEI* Code</u>	<u>Function</u>	<u>Function Code</u>
				<u>AUA41/</u> <u>AUA141</u>
4FXS	SB	D4CX5__	Current feed, LS, normal simplex	FXS1
4FXS	SB	D4CX5__	Current feed, LS, reverse simplex	FXS2
4FXS	SB	D4CX5__	Current feed, GS, normal simplex	FXS3
4FXS	SB	D4CX5__	Current feed, GS, reverse simplex	FXS5
4DX	SE	D4CE4__	Duplex signaling, normal simplex	DX4N
4DX	SE	D4CE4__	Duplex signaling, reverse simplex	DX4R
4ETO	SQ	D4C03__	Equalized transmission only	ETO4
4TO	SH	D4C01__	Transmission only	TO4
				<u>AUA44</u>
4FXO	SC	D4CX6__	Current sink, LS, normal simplex	FXO1
4FXO	SC	D4CX6__	Current sink, LS, reverse simplex	FXO2
4FXO	SC	D4CX6__	Current sink, GS, normal simplex	FXO3
4FXO	SC	D4CX6__	Current sink, GS, reverse simplex	FXO5
Tandem	SF	D4CE5__	4-state signaling, office beyond distant end of Series 5 carrier system, signaling leads looped	TDOA
Tandem	SF	D4CE5__	4-state, office, not looped	TDOB
Tandem	SF	D4CE5__	4-state, subscriber beyond distant end, signaling leads looped	TDSA
Tandem	SF	D4CE5__	4-state, subscriber, not looped	TDSB
Tandem	SF	D4CE5__	2-state, looped	TDOC
Tandem	SF	D4CE5__	2-state, not looped	TDOD
Tandem	SF	D4CE5__	2-state, looped	TDSC
Tandem	SF	D4CE5__	2-state, not looped	TDSD

See note and footnotes at the end of the table.

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Table B. Series 5 Four-Wire Channel Unit Function Codes for Equivalent D4 Four-Wire Channel Units
(Contd)

<u>D4 Channel Unit</u>	<u>Channel Unit Code J98726()</u>	<u>D4 CLEI Code</u>	<u>Function</u>	<u>Function Code</u>
				<u>AUA34</u>
DS0DP	AHG30	D4PQ122A	2.4, 4.8, 9.6 kb/s DS0 dataport	DS0A
DS0DP	AHG30	D4PQ122A	56 kb/s DS0 dataport	DS0B
				<u>AUA34B</u>
DS0DP	AHG30	D4PQ122A	2.4, 4.8, 9.6 kb/s DS0 dataport	DS0A
DS0DP	AHG30	D4PQ122A	19.2 kb/s DS0 dataport	DS0A
DS0DP	AHG30	D4PQ122A	56 kb/s DS0 dataport	DS0B
DS0DP	AHG30	D4PQ122A	64 kb/s DS0 dataport	DS0B
				<u>AUA52/</u> <u>AUA152</u>
OCUDP	AHG33	D4PQ128A	2.4, 4.8, 9.6, 56 kb/s OCU dataport	OCU
				<u>AUA52B</u>
OCUDP	AHG33	D4PQ128A	19.2, 64 kb/s OCU dataport	OCU

Notes:

1. AUA41/AUA141 and AUA44 can perform toll-diversion which D4 units cannot perform in FXS/FXO modes; refer to tables of channel unit options.
2. D4 E&M type channel units do not map as well as does the **SLC**[®] 96 Carrier System channel unit J98726CJ. See Table C for E&M equivalences.

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Table C. Series 5 AUA54 Channel Unit Function Codes for Equivalent SLC® 96 Carrier System J98726CJ RT Channel Unit

J98726CJ CLEI* Code	Function	AUA54 Function Code
D4CE8__	E&M interface, Type I	EM4C
	E&M interface, Type II	EM4H
	PLR interface, Type I	PLR1
	PLR interface, Type II	PLR2

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Table D. AUA42/AUA142 Channel Unit Options

<u>Function Code</u>	<u>Option Setting</u>	<u>Word Entry Example {Range}</u>
FXO	(Hybrid) Impedance *	IMP=600 {600 or 900}
	(Hybrid) Balance	BAL=0 {0 to 15}
	Transmit Gain	XMT(GN)=-1.0 {-1.0 to 6.75 in steps of 0.25}
	Receive Gain	RCV(GN)=-8.0 {-8.0 to 1.5 in steps of 0.25}
	Equalizer Slope †	SL=0 {0 to 7}
	Toll Diversion	TD=YES {YES or NO}
	Signaling Type	LS-GS=LS {LS or GS}
	On-Hook Transmission ‡	OHT=YES {YES or NO}
DPT, TO	(Hybrid) Impedance	IMP=600 {600 or 900}
	(Hybrid) Balance	BAL=0 {0 to 15}
	Transmit Gain	XMT(GN)=-1.0 {-1.0 to 6.75 in steps of 0.25}
	Receive Gain	RCV(GN)=-8.0 {-8.0 to 1.5 in steps of 0.25}
	Equalizer Slope †	SL=0 {0 to 7}

* When the channel unit interfaces outside plant cable, the impedance should be set to 600 ohms.

† The 1-kHz gain of the channel unit is independent of the equalizer setting.

‡ For ground-start services, the OHT option should always be set to NO.

Table E. AUA43 Channel Unit Options

<u>Function Code</u>	<u>Option Setting</u>	<u>Word Entry Example [Range]</u>
FXS	(Hybrid) Impedance *	IMP=600 {600 or 900}
	(Hybrid) Balance	BAL=0 {0 to 15}
	Transmit Gain	XMT(GN)=-1.0 {-1.0 to 6.75 in steps of 0.25}
	Receive Gain	RCV(GN)=-8.0 {-8.0 to 1.5 in steps of 0.25}
	Equalizer Slope †	SL=0 {0 to 7}
	On-Hook Transmission ‡	OHT=YES {YES or NO}
DPO, TO	(Hybrid) Impedance	IMP=600 {600 to 900}
	(Hybrid) Balance	BAL=0 {0 to 15}
	Transmit Gain	XMT(GN)=-1.0 {-1.0 to 6.75 in steps of 0.25}
	Receive Gain	RCV(GN)=-8.0 {-8.0 to 1.5 in steps of 0.25}
	Equalizer Slope †	SL=0 {0 to 7}

* When the channel unit interfaces outside plant cable, the impedance should be set to 600 ohms.

† The 1-kHz gain of the channel unit is independent of the equalizer setting.

‡ For ground-start services, the OHT option should always be set to NO.

Table F. AUA41/AUA141 Channel Unit Options

<u>Function Code</u>	<u>Option Setting</u>	<u>Word Entry Example {Range}</u>
FX[S or T][1, 2, 3, or 5]	Transmit Attenuator	TRMT=0 {0 to 16.5 in steps of 0.1}
	Receive Attenuator	RCV=0 {0 to 16.5 in steps of 0.1}
	Equalizer Nonloaded/ Loaded *	L-N= {L or N}
	Equalizer Slope *	SL=0 {0 to 15 steps of 1}
	Equalizer Bandwidth *	BW=0 {0 to 15 in steps of 1}
	Equalizer Height *	HT=0 {0 to 15 in steps of 1}
	Transmit and Receive Impedance	TRMT&RCV(IMP)=600 {150, 600, or 1200}
DX4[N or R]	Transmit Attenuator	TRMT=0 {0 to 16.5 in steps of 0.1}
	Receive Attenuator	RCV=0 {0 to 16.5 in steps of 0.1}
	Equalizer Nonloaded/ Loaded *	L-N= {L or N}
	Equalizer Slope *	SL=0 {0 to 15 steps of 1}
	Equalizer Bandwidth *	BW=0 {0 to 15 in steps of 1}
	Equalizer Height *	HT=0 {0 to 15 in steps of 1}
	Transmit and Receive Impedance	TRMT&RCV(IMP)=600 {150, 600, or 1200}

* Adjustable equalization is provided for the transmit direction only (for post-equalization of cable transmission characteristics).

See note and footnotes at the end of the table.

Continued on next page

Table F. AUA41/AUA141 Channel Unit Options (Contd)

<u>Function Code</u>	<u>Option Setting</u>	<u>Word Entry Example {Range}</u>
TO4	Transmit Attenuator	TRMT=0 {0 to 16.5 in steps of 0.1}
	Receive Attenuator	RCV=0 {0 to 16.5 in steps of 0.1}
	-7 dB Transmit †	-7DB TRMT=WH {WH or BK}
	-7 dB Receive †	-7DB RCV=WH {WH or BK}
ETO4	Transmit Attenuator	TRMT=0 {0 to 16.5 in steps of 0.1}
	Receive Attenuator	RCV=0 {0 to 16.5 in steps of 0.1}
	-7 dB (J3) ‡	-7DB(J3)=WH {WH or BK}
	Equalizer Nonloaded/Loaded	L-N=N {L or N}
	Equalizer Slope	SL=0 {0 to 15 in steps of 1}
	Equalizer Bandwidth	BW=0 {0 to 15 in steps of 1}
	Equalizer Height	HT=0 {0 to 15 in steps of 1}
	Transmit and Receive Impedance	TRMT&RCV(IMP)=600 {150, 600, or 1200}

† For the 4TO function of the channel unit, changing the setting from WH (white) to BK (black) increases the attenuation by 7 dB. The transmit and receive impedance is fixed at 600 ohms.

‡ For the 4ETO function of the channel unit, changing the setting from WH (white) to BK (black) **decreases** the attenuation by 7 dB.

Table G. AUA41/AUA141 Channel Unit Function Codes

<u>Function Code</u>	<u>CU Function</u>	<u>Signaling Mode</u>
FXS1	4FXS	Loop-Start Signaling Signaling Leads Normal * No Toll Diversion Capability
FXT1	4FXS	Loop-Start Signaling Signaling Leads Normal Toll Diversion Capability
FXS2	4FXS	Loop-Start Signaling Signaling Leads Reversed † No Toll Diversion Capability
FXT2	4FXS	Loop-Start Signaling Signaling Leads Reversed Toll Diversion Capability
FXS3	4FXS	Ground-Start Signaling Signaling Leads Normal No Toll Diversion Capability
FXT3	4FXS	Ground-Start Signaling Signaling Leads Normal Toll Diversion Capability
FXS5	4FXS	Ground-Start Signaling Signaling Leads Reversed No Toll Diversion Capability
FXT5	4FXS	Ground-Start Signaling Signaling Leads Reversed Toll Diversion Capability
DX4N	4DX	Duplex Signaling Signaling Leads Normal
DX4R	4DX	Duplex Signaling Signaling Leads Reversed
TO4	4TO	Transmission only No DC Signaling
ETO4	4ETO	Equalized Transmission Only No DC Signaling

* Tip signaling lead connected to T-R, ring signaling lead connected to T1-R1.

† Ring signaling lead connected to T-R, tip signaling lead connected to T1-R1.

Table H. AUA44 Channel Unit Options

<u>Function Code</u>	<u>Option Setting</u>	<u>Word Entry Example [Range]</u>
FX[O or P][1,2,3, or 5]	Transmit Attenuator	TRMT=0 {0 to 16.5 in steps of 0.1}
	Receive Attenuator	RCV=0 {0 to 16.5 in steps of 0.1}
	Equalizer Nonloaded/ Loaded *	L-N=N {L or N}
	Equalizer Slope *	SL=0 {0 to 15 in steps of 1}
	Equalizer Bandwidth *	BW=0 {0 to 15 in steps of 1}
	Equalizer Height *	HT=0 {0 to 15 in steps of 1}
	Transmit and Receive Impedance	TRMT&RCV(IMP)=600 {150, 600, or 1200}
TD[O or S][A, B, or D]	Transmit Attenuator †	TRMT=0 {0 to 11.6 in steps of 0.1}

* Adjustable equalization is provided for the transmit direction only (for post-equalization of cable transmission characteristics).

† For the tandem function, the receive TLP on T1/R1 is set to -2.1 dB, and the transmit and receive impedance is fixed at 600 ohms.

Table I. AUA44 Channel Unit Function Codes

<u>Function Code</u>	<u>CU Function</u>	<u>Signaling Mode</u>
FXO1	4FXO	Loop-Start Signaling Signaling Leads Normal * No Toll Diversion Capability
FXP1	4FXO	Loop-Start Signaling Signaling Leads Normal Toll Diversion Capability
FXO2	4FXO	Loop-Start Signaling Signaling Leads Reversed † No Toll Diversion Capability
FXP2	4FXO	Loop-Start Signaling Signaling Leads Reversed Toll Diversion Capability
FXO3	4FXO	Ground-Start Signaling Signaling Leads Normal No Toll Diversion Capability
FXP3	4FXO	Ground-Start Signaling Signaling Leads Normal Toll Diversion Capability
FXO5	4FXO	Ground-Start Signaling Signaling Leads Reversed No Toll Diversion Capability
FXP5	4FXO	Ground-Start Signaling Signaling Leads Reversed Toll Diversion Capability

* Tip signaling lead connected to T-R, ring signaling lead connected to T1-R1.

† Ring signaling lead connected to T-R, tip signaling lead connected to T1-R1.

Continued on next page

Table I. AUA42 Channel Unit Function Options (Contd)

<u>Function Code</u>	<u>CU Function</u>	<u>Signaling Mode</u>
TDOA	4TDM	4-State Signaling Signaling Leads Looped Through Carrier Toward Office
TDSA	4TDM	4-State Signaling Signaling Leads Looped Through Carrier Toward Subscriber
TDOB	4TDM	4-State Signaling Signaling Leads Nonlooped Through Carrier Toward Office
TDSB	4TDM	4-State Signaling Signaling Leads Nonlooped Through Carrier Toward Subscriber
TDOC	4TDM	2-State Signaling ‡ Signaling Leads Looped
TDSC	4TDM	2-State Signaling ‡ Signaling Leads Looped
TDOD	4TDM	2-State Signaling § Signaling Leads Nonlooped
TDSD	4TDM	2-State Signaling § Signaling Leads Nonlooped

‡ The choice of either TDOC or TDSC will result in the same signaling mode, 2-state signaling with looped signaling leads.

§ The choice of either TDOD or TDSD will result in the same signaling mode, 2-state signaling with nonlooped signaling leads.

Table J. AUA54 Channel Unit Options (Note)

<u>Function Code</u>	<u>Option Setting</u>	<u>Word Entry Example [Range]</u>
EM4[C or H] PLR[1 or 2]	Transmit Attenuator	TRMT=0 {0 to 16.5 in steps of 0.1}
	Receive Attenuator	RCV=0 {0 to 16.5 in steps of 0.1}

Note: The transmit and receive impedance of the channel unit is fixed at 600 ohms.

Table K. AUA54 Channel Unit Function Codes

<u>Function Code</u>	<u>CU Function</u>	<u>Signaling Mode</u>
EM4C	4E&M	E&M Signaling Type I
EM4H	4E&M	E&M Signaling Type II
PLR1	PLR	PLR Signaling Type I *
PLR2	PLR	PLR Signaling Type II *

* PLR signaling was developed to permit the back-to-back connection of two carriers with E&M signaling; it is the "complement" of E&M signaling.

Table L. Options and WORD Entries for AUA52, AUA152, and AUA52B * OCU Dataport

<u>Option (CIU Prompt)</u>	<u>Function Code</u>	<u>WORD Entry Example {Range}</u>
Subscriber data rate [†]	OCU	RATE=2.4 {2.4, 4.8, 9.6, or 56 kb/s}
Error correction [‡]	OCU	EC=MVEC [§] {MVEC, SCEC [¶] or NONE}
All-zero-code allowed	OCU	ZC=NO {NO or YES}
Secondary channel used? **	OCU	SCC=NO {NO or YES}

* AUA52B has the *CLEI* code 5SC1430A, but the *CLEI* code 5SCU48() () must be entered into the CIU.

† For AUA52B, CIU provisioning is combined with option switch settings for 19.2 and 64 kb/s clear channel service.

‡ For AUA52B, CIU provisioning is combined with an option switch setting to activate 19.2 error correction.

§ MVEC = Majority Vote Error Correction. MVEC is not an option if data rate is 56 kb/s.

¶ SCEC = Second Channel Error Correction.

** Secondary channel unavailable with 64 kb/s clear channel service (AUA52B only).

Table M. Options and WORD Entries for AUA34 and AUA34B * DS0 Dataport

<u>Option (CIU Prompt)</u>	<u>Function Code</u>	<u>WORD Entry Example {Range}</u>
Error correction †	DS0A	EC=MVEC ‡ {MVEC, SCEC §, or NONE}
	DS0B	EC=SCEC {SCEC or NONE}
All-zero-code allowed	DS0A	ZC=NO {NO or YES}
	DS0B	ZC=NO {NO or YES}

* AUA34B has the *CLEI* code 5SC1330A, but the *CLEI* code 5SCU38()() must be entered into the CIU.

† For AUA34B, CIU provision is combined with an option switch setting to activate 19.2 error correction.

‡ MVEC = Majority Vote Error Correction.

§ SCEC=Second Channel Error Correction.

Table N. Transmission Specifications VF Channel Units with Adjustable Settings

Parameter	2-Wire E SPOTS® Channel Units (AUA142, AUA43)	4-Wire Channel Units (AUA141, AUA44, AUA54) (Note)
Loop resistance (beyond RT, excluding telset)	CSA loops	0-2800 ohms (loop-start, ground-start, transmission only)* 0-5000 ohms (duplex)
Gain range (granularity)		
Metallic interface to digital line	-1.0 dB to 6.75 dB granularity = 0.25 dB	Range depends on function code
Digital Line to metallic interface	-8.0 dB to 1.5 dB granularity = 0.25 dB	Granularity = 0.1 dB
Gain tracking		
Input -37 to +3 dBm	±0.25 dB	±0.25 dB
Input -50 to -37 dBm	±0.5 dB	±0.5 dB
Equalization	(Slope type) Equalized CSA cable roll off at 0.4 kHz varies from 0.0 dB to 1.1 dB; at 2.8 kHz, roll off varies from 0.3 dB to 1.75 dB	Post-equalization of cable less than 15 dB (H88) or 18 kft (NL) is comparable to D4 4FXS CU (J98726SB). Pre-equalization and post-equalization available by emulating 150-ohm mismatch
Structural impedance	600 ohms + 2.16 µF or 875 ohms + 2.16 µF	600 ohms or 1200 ohms
ERL/SRL (2-wire return loss with 4-wire path broken)	28/20 dB	
RL (any frequency)		23 dB
RL (1 kHz)		28 dB
Balance capability, CSA loops	ERL better than 12 dB at digital line interface of channel unit facing loop	

Note:

For AUA54, and for AUA44 in tandem applications, the ED7C700-20 E&M harness must be added to each digroup affected.

* Range based on commercial power. On battery power, range may be reduced.

Continued on next page

Table N. Transmission Specifications VF Channel Units with Adjustable Settings *Contd*

Parameter	2-Wire E SPOTS Channel Units (AUA142, AUA43)		4-Wire Channel Units (AUA141, AUA44, AUA54)
	AUA42/ AUA142	AUA43	
Longitudinal balance (IEEE method)	AUA42/ AUA142	AUA43	
200 Hz	63 dB	58 dB	67 dB
500 Hz	63 dB	58 dB	67 dB
1000 Hz	63 dB	58 dB	67 dB
3000 Hz	58 dB	58 dB	62 dB
Equal-level cross talk, C-message weighted between 0.2 and 3.4 kHz	-65 dB		-65 dB (channel unit and interunit cross talk)
Idle-channel noise	23 dB _{rnc0} for AUA42(AUA142)/AUA43 pair		20 dB _{rnc0} per channel unit, each direction
Impulse noise at 59 dB _{rnc0}	≤ 15 counts in 15 minutes		≤ 15 counts in 15 minutes
Signal-to-distortion ratio (at -10 dBm)	> 33 dB		> 33 dB
Single-frequency distortion (0-12 kHz 0 dBm0)	< -28 dBm0 per AUA42 (AUA142)/AUA43 pair		< -28 dBm0 per channel unit
Intermodulation distortion (-13 dBm0 input) (IM products)	A-B (R2) < -43 dB 2A-B (R3) < -44 dB		R2 < -49 dB R3 < -51 dB
Pulse distortion (P/AR)	≥ 90		≥ 94

Table O. Transmission Specifications (Note) AUA45 and AUA45B Manual Dual Ringing Repeater Channel Unit

Parameter	Value
Loop Design	The unit is not limited to CSA design rules. Maximum cable loss should not exceed 9 dB, split in any proportion between the two end cable links. Total combined loop resistance (not including the terminating equipment) should not exceed 1500 ohms.
Structural impedance	900 ohms + 2.16 μ F
Balance impedance	900 ohms + 2.16 μ F
1000-Hz loss * \pm 0.5 dB typical, \pm 1.0 dB max)	0 dB or 3 dB (switch selectable)
Bandwidth (relative to the 1000-Hz loss; + is more loss)	+1 to -0.5 dB at 400 Hz and 2800 Hz
Return loss † end-to-end	ERL \geq 26 dB SRL \geq 20 dB
Idle channel noise ‡	\leq 20 dBmC maximum
Signal-to-distortion ratio (at -10 dBm0)	>33 dB
Data Pulse Distortion (PAR) at -13 dBm	>90
Gain tracking (1004 Hz) -37 dBm0 to +3 dBm0	\pm 0.5 dB maximum
-50 dBm0 to -37 dBm0	\pm 1.0 dB maximum
Intermodulation distortion (-13 dBm0 input)	A-B (R2) Product: >43 dB 2A-B (R3) Product: >44 dB
Single frequency distortion (0—12 kHz 0 dBm0)	<-28 dBm0
Impulse noise at 47 dBmC0	\leq 15 counts in 15 minutes
Overload at COT and RT	\geq +3 dBm0 with \leq 0.5 dB compression
Longitudinal balance §	200 Hz, 500 Hz, 1000 Hz: \geq 58 dB 3000 Hz: \geq 53 dB
Equal-level cross talk	Better than -65 dB (200 Hz to 3400 Hz)

Note: Measured at 25°C.

* Measured as insertion loss between 900-ohm terminations.

† Measured with respect to 900 ohms +2.16 μ F with the opposite end terminated in 900 ohms +2.16 μ F.

‡ Measured with 900-ohm terminations on both ends.

§ Measured by IEEE Method 455-1976.

Table P. Ringing Specifications AUA45 Manual Dual Ringing Repeater Channel Unit

<u>Parameter</u>	<u>Value</u>
Ringing delay	≤ 200 ms end-to-end
Ringing distortion	$\leq \pm 50$ ms
Ring trip delay	≤ 200 ms for $R_{dc} \leq 1930$ ohms.
Ring trip immunity	8 μ F in parallel with 10K ohms at T/R interface
Ringing range at COT*	40 Vrms across 3 REN
<u>Ringing Range at RT†</u>	<u>40 Vrms across 4 REN</u>

* COT Ringing 86 Vrms and 1500 ohms of cable.

† RT Ringing 100 Vrms and 1500 ohms of cable.

Table Q. Transmission Specifications (Note) AUA75 Private Line Auto Ring Channel Unit

Parameter	Value
Loop Design	The unit is not limited to CSA design rules. Maximum cable loss should not exceed 9 dB, split between the COT and RT. Total combined loop resistance (not including the terminating equipment) may not exceed 1500 ohms. No one loop may exceed 1300 ohms.
Structural impedance	900 Ohms \pm 2.16 μ F
Balance impedance	900 Ohms \pm 2.16 μ F
1000 Hz loss* (\pm 0.5 dB typical, \pm 1.0 dB max)	0 dB or 3 dB (switch selectable)
Bandwidth (relative to the 1000 Hz loss + is more loss)	+1 to -0.5 dB at 400 and 2800 Hz
Return loss [†] end-to-end	ERL \geq 23 dB SRL \geq 17 dB
Idle channel noise [‡]	\leq 20 dBmC maximum
Signal-to-distortion Ratio (at -10 dBm0)	>33 dB
Data pulse distortion (PAR) at -13 dBm	>90
Gain tracking (1004 Hz)	
-37 dBm0 to +3 dBm0	\leq \pm 0.5 dB maximum
-50 dBm0 to -37 dBm0	\leq \pm 1.0 dB maximum
Intermodulation distortion (-13 dBm0 input)	A-B (R2) Product > 43 dB 2A-B (R3) Product > 44 dB
Single frequency distortion (0-12 kHz 0 dBm0)	< -28 dBm0
Impulse noise at 47 dBmC0	\leq 15 counts in 15 minutes
Overload at COT and RT	\geq +3 dBm0 with \leq 0.5 dB compression
Longitudinal balance [§]	200 Hz, 500 Hz, 1000 Hz \geq 58 dB 3000 Hz \geq 53 dB
Equal level crosstalk	Better than -65 dB between 200 Hz and 3400 Hz

Note: Measured at 25°C

* Measured as insertion loss between 900-ohm terminations.

† Measured with respect to 900-ohms + 2.16 μ F with the opposite end termination in 900 ohms + 2.16 μ F.

‡ Measured with 900-ohm terminations on both ends.

§ Measured by IEEE Method 455-1976.

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Table Q. Transmission Specifications (Note) AUA75 Private Line Auto Ring Channel Unit *Contd*

Parameter	Value
Ringling Delay	≤200 ms
Ring trip delay	≤200 ms for $R_{dc} \leq 1800$ ohms
Ring trip immunity	8 μF in parallel with 10 k ohms at T/R
Ringling range at COT ¶	40 Vrms across 3 REN
Ringling range at RT ¶	40 Vrms across 4 REN
Ringling cycle	2 seconds on (100 ms) 4 seconds off (100 ms)
Audible ringling	440 Hz plus 480 Hz (1.6%)
Audible ringling level	-47 to -16 dBm0 (with no more than 5 dB between components)

¶ COT Ringling 86 Vrms and 1300 ohms of cable.
RT Ringling 100 Vrms and 1300 ohms of cable.

Table R. Ringling Specifications AUA75 Automatic Dual Ringling Repeater Channel Unit

Parameter	Value
Ringling delay	≤200 ms
Ring trip delay	≤200 ms for $R_{dc} \leq 1800$ ohms
Ring trip immunity	8 μF in parallel with 10K ohms at T/R interface
Ringling range at COT *	40 Vrms across 3 REN
Ringling range at RT †	40 Vrms across 4 REN
Ringling cycle	2 seconds on (±100 msec), 4 seconds off (±100 msec)
Audible Ringling	440 Hz plus 480 Hz (±1.6%)
Audible Ringling Level	-47 to -16 dBm0 (with no more than 5 dB between components)

* COT Ringling 86 Vrms and 1300 ohms of cable.

† RT Ringling 100 Vrms and 1300 ohms of cable.

Table S. Function Encoder for 4-Wire Channel Units

Channel Unit	Function	Function Code Character Position			
		1	2	3	4
AUA41/	FOREIGN EXCHANGE (STATION END)	F	X		
AUA141	No Toll Diversion			S	
	Toll Diversion			T	
	Loop Start: normal/reversed = NOR *				1
	normal/reversed = REV *				2
	Ground Start: normal/reversed = NOR *				3
	normal/reversed = REV *				5
	DUPLEX	D	X	4	
	normal/reversed = NOR *				N
	normal/reversed = REV *				R
	TRANSMISSION ONLY		T	O	4
	Equalized	E			
	FOREIGN EXCHANGE (OFFICE END)	F	X		
	No Toll Diversion			O	
	Toll Diversion			P	
	Loop Start: normal/reversed = NOR *				1
	normal/reversed = REV *				2
	Ground Start: normal/reversed = NOR *				3
	normal/reversed = REV *				5
AUA44	TANDEM	T	D		
	Office End			O	
	Station End			S	
	3-State: looped				A
	3-State: not looped				B
	2-State: looped			†	C
	2-State: not looped			†	D
	E&M	E	M	4	
	Type I				C
	Type II				H
AUA54	PULSE LINK REPEATER	P	L	R	
	Type I				1
	Type II				2
	DS0 DATAPORT	D	S	0	
AUA34/	2.4, 4.8, 9.6, 19.2 kb/s				A
AUA34B	56 and 64 kb/s				B
AUA52/	OCU DATAPORT	O	C	U	
AUA152/					
AUA52B					

* Simplex of T, R and T1, R1. See text for selection guidelines.

† The 3rd character is meaningless here: "O" or "S" can be used.

Table T. 4-Wire VF Channel Units — 19-Gauge Nonloaded Cable Pre- and Post-Equalization Using 150/600 Ohm Mismatch (Notes)

Cable Length (kft)	Effective Cable Transducer Loss, dB											
	Trunk Circuit						Line Circuit					
	3 Links			2 Links			3 Links			2 Links		
	No EQL	Series 5 Equal*	Both Ends†	No EQL	Series 5 Equal*	Both Ends†	No EQL	Series 5 Equal*	Both Ends†	No EQL	Series 5 Equal*	Both Ends†
1	0.1			0.1			0.1			0.1		
2	0.3			0.3			0.3			0.3		
4	0.5			0.5			0.5			0.5		
6	0.8			0.8			0.8			0.8		
8	1.2	4.0		1.2			1.2			1.2		
8.3	1.2											
10		4.3		1.5	4.3		1.5	4.3		1.5		
10.9				1.7								
12		4.7			4.7			4.7		1.9	4.7	
12.3										1.9		
14		5.0	7.2		5.0			5.0			5.0	
14.7		5.2										
16			7.6		5.5	7.6		5.5	7.6		5.5	
17.7								5.9	7.9			
17.8					5.9	7.9						
18			7.9			7.9			7.9		5.9	7.9
19.3											6.2	
20			8.3			8.3			8.3			8.3

Notes:

1. Disable channel unit equalization by selecting 0 for BW, HT, and SL options. Select N for the L-N option.
2. TRUNK connects two switches (CO-PBX, CO-ACD, or PBX-PBX). Line connects one end to a nonswitched termination (for example, station set, modem). 3 LINKS: COT and RT connect to cable; COT end of circuit extends beyond foreign CO (for example, foreign exchange trunk completed via an interLATA carrier). 2 LINKS: COT and RT connect to cable, and COT end of circuit does not extend beyond foreign CO (for example, local OPS circuit). 1 LINK: one cable segment (loop or COT metallic extension). Equalization is not required for one-link cable lengths shorter than 18 kft.

* Select 150 ohms impedance at the Series 5 end and 600 ohms impedance at the network channel terminating equipment (NCTE).

† Select 150 ohms impedance at both ends.

Table U. 4-Wire VF Channel Units — 22-Gauge Nonloaded Cable Pre- and Post-Equalization Using 150/600 Ohm Mismatch (Notes)

Cable Length (kft)	Effective Cable Transducer Loss, dB											
	Trunk Circuit						Line Circuit					
	3 Links			2 Links			3 Links			2 Links		
	No EQL	Series 5 Equal*	Both Endst†	No EQL	Series 5 Equal*	Both Endst†	No EQL	Series 5 Equal*	Both Endst†	No EQL	Series 5 Equal*	Both Endst†
1	0.2			0.2			0.2			0.2		
2	0.5			0.5			0.5			0.5		
4	1.0			1.0			1.0			1.0		
6	1.5			1.5			1.5			1.5		
8	2.0	4.8		2.0			2.0	4.8		2.0		
8.2	2.0											
9.9							2.5					
10		5.3		2.5	5.3			5.3		2.5		
10.5				2.7								
12		5.9			5.9			5.9		3.1	5.9	
14		6.5	9.1		6.5			6.5			6.5	
16			9.7		7.0	9.7		7.0	9.7		7.0	
16.3					7.1							
16.8								7.3				
18			10.3			10.3			10.3		7.7	10.3
18.2											7.7	
20			10.9			10.9			10.9			10.9

Notes:

1. Disable channel unit equalization by selecting 0 for BW, HT, and SL options. Select N for the L-N option.
2. TRUNK connects two switches (CO-PBX, CO-ACD, or PBX-PBX). LINE connects one end to a nonswitched termination (for example, station set, modem). 3 LINKS: COT and RT connect to cable; COT end of circuit extends beyond foreign CO (for example, foreign exchange trunk completed via an interLATA carrier). 2 LINKS: COT and RT connect to cable, and COT end of circuit does not extend beyond foreign CO (for example, local OPS circuit). 1 LINK: one cable segment (loop or COT metallic extension). Equalization is not required for line circuits with cable shorter than 18 kft. One-link trunk circuits with cable longer than 15.4 kft require Series 5 equalization; transducer loss is listed in the column under **LINE CIRCUIT — 2 LINKS**.

* Select 150 ohms impedance at the Series 5 end and 600 ohms impedance at the network channel terminating equipment (NCTE).

† Select 150 ohms impedance at both ends.

Table V. 4-Wire VF Channel Units — 24-Gauge Nonloaded Cable Pre- and Post-Equalization Using 150/600 Ohm Mismatch (Notes)

Cable Length (kft)	Effective Cable Transducer Loss, dB											
	Trunk Circuit						Line Circuit					
	3 Links			2 Links			3 Links			2 Links		
	No EQL	Series 5 Equal*	Both Endst†	No EQL	Series 5 Equal*	Both Endst†	No EQL	Series 5 Equal*	Both Endst†	No EQL	Series 5 Equal*	Both Endst†
1	0.4			0.4			0.4			0.4		
2	0.7			0.7			0.7			0.7		
4	1.5			1.5			1.5			1.5		
6	2.2	5.0		2.2			2.2			2.2		
7.7	2.8											
8		5.7		2.9			2.9	5.7		2.9		
9.1							3.3					
9.8		6.3		3.5	6.3							
10		6.4			6.4			6.4		3.6	6.4	
11										4.0		
12		7.2	10.2		7.2			7.2			7.2	
12.7		7.4										
14			11.0		7.9	11.0		7.9	11.0		7.9	
14.7					8.2							
15.3								8.4				
16			11.8			11.8			11.8		8.7	11.8
16.5											8.9	
18			12.5			12.5			12.5		9.5	12.5
18.1			12.6									
20						13.3			13.3			13.3

Notes:

1. Disable channel unit equalization by selecting 0 for BW, HT, and SL options. Select N for the L-N option.
2. TRUNK connects two switches (CO-PBX, CO-ACD, or PBX-PBX). LINE connects one end to a nonswitched termination (for example, station set, modem). 3 LINKS: COT and RT connect to cable; COT end of circuit extends beyond foreign CO (for example, foreign exchange trunk completed via an interLATA carrier). 2 LINKS: COT and RT connect to cable, and COT end of circuit does not extend beyond foreign CO (for example, local OPS circuit). 1 LINK: one cable segment (loop or COT metallic extension). Equalization is not required for line circuits with cable shorter than 18 kft. One-link trunk circuits with cable longer than 16 kft require Series 5 equalization; transducer loss is listed in the column under **LINE CIRCUIT — 2 LINKS**.

* Select 150 ohms impedance at the Series 5 end and 600 ohms impedance at the network channel terminating equipment (NCTE).

† Select 150 ohms impedance at both ends.

Table W. 4-Wire VF Channel Units — MAT 25-Gauge Nonloaded Cable Pre- and Post-Equalization Using 150/600 Ohm Mismatch (Notes)

Cable Length (kft)	Effective Cable Transducer Loss, dB											
	Trunk Circuit						Line Circuit					
	3 Links			2 Links			3 Links			2 Links		
	No EQL	Series 5 Equal*	Both Ends†	No EQL	Series 5 Equal*	Both Ends†	No EQL	Series 5 Equal*	Both Ends†	No EQL	Series 5 Equal*	Both Ends†
1	0.5			0.5			0.5			0.5		
2	0.9			0.9			0.9			0.9		
4	1.8			1.8			1.8			1.8		
6	2.6			2.6			2.6			2.6		
8	3.3	6.1		3.3			3.3			3.3		
9.4	3.9											
10		6.9		4.1			4.1	6.9		4.1		
11.2				4.5			4.5					
12		7.6		4.8	7.6			7.6		4.8	7.6	
13.5										5.4		
14		8.4	12.0		8.4			8.4			8.4	
15.2		8.8										
16			12.7		9.1	12.7		9.1			9.1	
17.5					9.7							
18			13.5			13.5		9.9	13.5		9.9	13.5
18.3								10.0				
19.6											10.5	
20			14.3			14.3			14.3			14.3

Notes:

1. Disable channel unit equalization by selecting 0 for BW, HT, and SL options. Select N for the L-N option.
2. TRUNK connects two switches (CO-PBX, CO-ACD, or PBX-PBX). Line connects one end to a nonswitched termination (for example, station set, modem). 3 LINKS: COT and RT connect to cable; COT end of circuit extends beyond foreign CO (for example, foreign exchange trunk completed via an interLATA carrier). 2 LINKS: COT and RT connect to cable, and COT end of circuit does not extend beyond foreign CO (for example, local OPS circuit). 1 LINK: one cable segment (loop or COT metallic extension). Equalization is not required for one-link cable lengths shorter than **18 kft**.

* Select 150 ohms impedance at the Series 5 end and 600 ohms impedance at the network channel terminating equipment (NCTE).

† Select 150 ohms impedance at both ends.

Table X. 4-Wire VF Channel Units — 26-Gauge Nonloaded Cable Pre- and Post-Equalization Using 150/600 Ohm Mismatch (Notes)

Cable Length (kft)	Effective Cable Transducer Loss, dB											
	Trunk Circuit						Line Circuit					
	3 Links			2 Links			3 Links			2 Links		
	No EQL	Series 5 Equal*	Both Endst†	No EQL	Series 5 Equal*	Both Endst†	No EQL	Series 5 Equal*	Both Endst†	No EQL	Series 5 Equal*	Both Endst†
1	0.6			0.6			0.6			0.6		
2	1.2			1.2			1.2			1.2		
4	2.2			2.2			2.2			2.2		
6	3.2	6.0		3.2			3.2			3.2		
7.3	3.8											
8		7.0		4.2	7.0		4.2	7.0		4.2		
8.6							4.5					
9.1				4.7								
10		7.9	11.5		7.9			7.9		5.1	7.9	
10.1										5.2		
11.6		8.7										
12			12.5		8.9	12.5		8.9			8.9	
13.3					9.6							
14			13.5			13.5		9.9	13.5		9.9	
15											10.4	
15.4			14.2									
16								14.5		14.5		14.5
17.2								15.1				
17.8									15.4			15.5
19.2												16.1

Notes:

1. Disable channel unit equalization by selecting 0 for BW, HT, and SL options. Select N for the L-N option.
2. TRUNK connects two switches (CO-PBX, CO-ACD, or PBX-PBX). LINE connects one end to a nonswitched termination (for example, station set, modem). 3 LINKS: COT and RT connect to cable; COT end of circuit extends beyond foreign CO (for example, foreign exchange trunk completed via an interLATA carrier). 2 LINKS: COT and RT connect to cable, and COT end of circuit does not extend beyond foreign CO (for example, local OPS circuit). 1 LINK: one cable segment (loop or COT metallic extension). Equalization is not required for line circuits with cable shorter than **18 kft**. One-link trunk circuits with cable longer than **14.3 kft** require Series 5 equalization; transducer loss is listed in the column under **LINE CIRCUIT — 2 LINKS**.

* Select 150 ohms impedance at the Series 5 end and 600 ohms impedance at the network channel terminating equipment (NCTE).

† Select 150 ohms impedance at both ends.

Table Y. 2-Wire VF Provisioning Dialog

Channel Unit (CLEI*Code)	Prompt	Range of Response	Word Entry Example		
{Preliminary Dialog}	SYSTEM ID	0000† to 9999	0011-43-C (on SARTS line)		
	CHANNEL LOCATION	1 to 96 CO or RT			
	CLEI	5SCU690A‡ or 5SCU6A0A	5SCU690A		
	AUA42 (5SCU690A) AUA142 (5SCU69Z) DPT or TO Function Codes	FUNCTION CODE IMPEDANCE BALANCE TRANSMIT GAIN RECEIVE GAIN SLOPE	DPT or TO 600 or 900 0 to 15 in steps of 1 -1.0 to 6.75 in steps of 0.25 -8.0 to 1.5 in steps of 0.25 0 to 7 in steps of 1	FC=DPT IMP=600 BAL=3 XMT(GN)=0.5 RCV(GN)=-4.5 SL=3	
FXO Function Code	FUNCTION CODE IMPEDANCE BALANCE TRANSMIT GAIN RECEIVE GAIN SLOPE TOLL DIVERSION? SIGNALING ON-HOOK TRANSMISSION?	FXO 600 or 900 0 to 15 in steps of 1 -1.0 to 6.75 in steps of 0.25 -8.0 to 1.5 in steps of 0.25 0 to 7 in steps of 1 YES or NO LS or GS YES or NO	FCFXO IMP=600 BAL=3 XMT(GN)=0.5 RCV(GN)=-4.5 SL=3 RD=NO LS-G=LS OHT=YES		
	AUA43 (5SCU6A6A) DPO or TO Function Codes	FUNCTION CODE IMPEDANCE BALANCE TRANSMIT GAIN RECEIVE GAIN SLOPE	DPO or TO 600 or 900 0 to 15 in steps of 1 -1.0 to 6.75 in steps of 0.25 -8.0 to 1.5 in steps of 0.25 0 to 7 in steps of 1	FC=DPO IMP=900 BAL=2 XMT(GN)=-0.5 RV(GN)=0.0 SL=17	
		FXS Function Code	FUNCTION CODE IMPEDANCE BALANCE TRANSMIT GAIN RECEIVE GAIN SLOPE ON-HOOK TRANSMISSION?	FXS 600 or 900 0 to 15 in steps of 1 -1.0 to 6.75 in steps of 0.25 -8.0 to 1.5 in steps of 0.25 0 to 7 in steps of 1 YES or NO	FC=FXS IMP=900 BAL=2 XMT(GN)=-0.5 RCV(GN)=0.0 SL=7 OHT=NO

* COMMON LANGUAGE is a registered trademarks and CLEI, CLLI, CLCI, and CLFI are trademarks of Bell Communications Research, Inc.

† System ID number 0000 should not be assigned to an in-service system; it will preclude test access to that system by SARTS.

‡ The CIU recognizes only the first six characters of the CLEI code, thus, the AUA42 and AUA142 channel units are treated identically by the CIU.

Table Z. Series 5 AUA42, AUA142, and AUA43 Channel Unit Compatibility with Other Channel Units Beyond the DCU

<u>Channel Unit</u>	<u>Function Codes</u>	<u>D1D,D3, and D4 Channel Units</u>	<u>D5 Channel Units Function Codes</u>	<u>Series 5 Channel Units: Function Codes</u>
AUA42/ AUA142	FXO	2FXS, 2FXSLS, 2FXS/GT, 4FXS, 4TDM	AEK20: FC=FXS[A,B,C,D,6,7] AEK23: FC=FXS[1,2,3,5] AEK24: FC=TDO[A,B]	AUA43: FC=FXS AUA41: FC=FXS[1,2,3,5] AUA141: FC=FXS[1,2,3,5] AUA44: FC=TDO[A,B]
	DPT	DPO, DPMO, SDPO, 2DX/GT, 2E&M, 2E&M6, 4DX, 4E&M, 4E&MER, 4TDM	AEK20: FC=DPO[M,D,S] AEK22: FC=EM4[], PLR[1,2] AEK23: FC=DX4[N,R] AEK24: FC=TD[O,S][C,D] AEK25: FC=EM[6,9][]	AUA43: FC=DPO AUA41: FC=DX4[N,R] AUA141: FC=DX4[N,R] AUA44: FC=TD[O,S][C,D] AUA54: FC=EM4[C,H], PLR[1,2]
	TO	2TO, 4TO, 4ETO	AEK20: FC=TO2 AEK23: FC=TO4, ETO4	AUA42: FC=TO AUA142: FC=TO AUA43: FC=TO AUA41: FC=TO4, ETO4 AUA141: FC=TO4, ETO4
AUA43	FXS	2FXO, 2FXOLS, 2FXO/GT, 4FXO, 4TDM	AEK21: FC=FXO[A,B,C,D,6,7] AEK24: FC=FXO[1,2,3,5] AEK24: FC=TDS[A,B]	AUA42: FC=FXO AUA142: FC=FXO AUA44: FC=FXO[1,2,3,5], TDS[A,B]
	DPO	DPT, PLR, 2D/GT, 2E&M, 2E&M6, 4DX, 4E&M, 4E&MER, 4TDM	AEK21: FC=DPT[6,9] AEK22: FC=EM4[], PLR[1,2] AEK23: FC=DX4[N,R] AEK24: FC=TD[O,S][C,D] AEK25: FC=EM[6,9][]	AUA42: FC=DPT AUA142: FC=DPT AUA41: FC=DX4[N,R] AUA141: FC=DX4[N,R] AUA44: FC=TD[O,S][C,D] AUA54: FC=EM4[C,H], PLR[1,2]
	TO	2TO, 4TO 4ETO	AEK20: FC=TO2 AEK23: FC=TO4, ETO4	AUA42: FC=TO AUA142: FC=TO AUA43: FC=TO AUA41: FC=TO4, ETO4 AUA141: FC=TO4, ETO4

Table AA. Series 5 Four-Wire VF Channel Unit Compatibility with D1D, D3, D4, and D5 Channel Units Beyond the DCU

<u>Channel Unit</u>	<u>Function Codes</u>	<u>D1D, D3, and D4 Channel Units</u>	<u>D5 Channel Units Function Codes</u>
AUA41/ AUA141	FXS[1,2,3,5]	2FXO, 2FXOLS, 2FXO/GT, 4FXO, 4TDM	AEK21: FC=FXO[A,B,C,D,6,7] AEK24: FC=FXO[1,2,3,5]
	DX[N,R]	DPO,DPMO,DPT, PLR, SDPO, 2DX/GT, 2E&M, 2E&M6, 4DX, 4E&M, 4E&MER, 4TDM	AEK20: FC=DPO[M,D,S] AEK21: FC=DPT[6,9] AEK22: FC=EM4[], PLR[1,2] AEK23: FC=DX4[N,R] AEK24: FC=TD[O,S][C,D] AEK25: FC=EM[6,9][]
	TO4, ETO4	2TO, 4TO, 4ETO	AEK20: FC=TO2 AEK23: FC=TO4, ETO4
AUA44	FXO[1,2,3,5]	2FXS/GT, 2FXSLS, 2FXS/GT, 4FXS, 4TDM	AEK20: FC=FXS[A,B,C,D,6,7] AEK23: FC=FXS[1,2,3,5] AEK24: FC=TDO[A,B]
	TDO[A,B]	2FXO, 2FXOLS, 2FXO/GT, 4FXO, 4TDM	AEK21: FC=FXO[A,B,C,D,6,7] AEK24: FC=FXO[1,2,3,5] TDS[A,B]
	TDS[A,B]	2FXS, 2FXSLS, 2FXS/GT, 4FXS, 4TDM	AEK20: FC=FXS[A,B,C,D,6,7] AEK23: FC=FXS[1,2,3,5] AEK24:FC=TDO[A,B]
	TD[O,S][C,D]	DPT, DPO, DPMO, SDPO, PLR, 2DX/GT,, 2E&M, 2E&M6, 4DX, 4E&M, 2E&MER, 4TDM,	AEK20: FC=DPO[] AEK21: FC=DPT[] AEK22: FC=EM4[], PLR[1,2] AEK23: FC=DX4[] AEK24: FC=TD[][C,D] AEK25: FC=EM[][]
AUA54	EM4[C,H], PLR[1,2]	DPMO, DPO, SDPO, DPT, PLR, 2DX/GT, 2E&M, 2E&M6, 4DX 4E&M, 4E&MER, 4TDM,	AEK20: FC=DPO[] AEK21: FC=DPT [6,9] AEK22: FC=EM4[], PLR[] AEK23: FC=DX4[] AEK24: FC=TD[O,S][C,D] AEK25: FC=EM[6,9][]

Table AB. Series 5 Four-Wire VF Channel Unit Compatibility with Series 5 Channel Units Beyond the DCU

<u>Channel Unit</u>	<u>Function Codes</u>	<u>Series 5 Channel Units: Function Codes</u>
AUA41/ AUA141	FXS[1,2,2,5]	AUA42: FC=FXO AUA142: FC=FXO AUA44: FC=FXO[1,2,3,5]
	DX4[N,R]	AUA42: FC=DPT AUA142: FC=DPT AUA43: FC=DPO AUA41: FC=DX4[N,R] AUA141: FC=DX4[N,R] AUA44: FC=TD[O,S][C,D] AUA54: FC=EM4[C,H], PLR[1,2]
	TO4, ETO4	AUA42: FC=TO AUA142: FC=TO AUA43: FC=TO AUA41: FC=TO4, ETO4 AUA141: FC=TO4, ETO4
AUA44	FXO[1,2,3,5]	AUA43: FC=FXS AUA41: FC=FXS[] AUA141: FC=FXS[] AUA44: FC=TDO[A,B]
	TDO[A,B]	AUA42: FC=FXO AUA142: FC=FXO AUA44: FC=FXO[], TDS[A,B]
	TDS[A,B]	AUA43: FC=FXS AUA41: FC=FXS[] AUA141: FC=FXS[] AUA44: FC=TDO[A,B]
	TD[O,S][C,D]	AUA42: FC=DPT AUA142: FC=DPT AUA43: FC=DPO AUA41: FC=DX4[] AUA141: FC=DX4[] AUA44: FC=TD[O,S][C,D] AUA54: FC=EM[][], PLR[]
AUA54	EM4[C,H], PLR[1,2]	AUA42: FC=DPT AUA142: FC=DPT AUA43: FC=DPO AUA41: FC=DX4[] AUA141: FC=DX4[] AUA44: FC=TD[O,S][C,D] AUA54: FC=EM4[], PLR[]

Table AC. Hybrid Balance Settings for the AUA43 Channel Units with Structural Impedance of 600 Ohms

Major Gauge Equivalent Length (kft)	Cable Gauge and Far End Termination											
	26			24			22			19		
	600	Telset	900	600	Telset	900	600	Telset	900	600	Telset	900
0.0	3	4	0	3	4	0	3	4	0	3	4	0
0.5	3	4	2	3	4	2	3	4	1	3	4	1
1.0	3	4	2	3	4	2	3	4	2	3	4	2
1.5	3	4	2	3	4	2	3	4	2	3	4	2
2.0	7	11	15	7	11	15	7	11	15	7	4	15
2.5	7	11	15	7	11	15	7	11	15	7	11	15
3.0	15	11	15	7	11	15	7	11	15	7	11	15
3.5	15	11	15	7	11	15	7	11	15	7	11	10
4.0	15	11	15	7	11	10	7	11	10	7	11	10
4.5	15	11	15	7	11	10	7	11	10	7	11	10
5.0	15	15	14	7	11	10	7	11	10	7	11	8
5.5	15	15	14	8	15	10	7	11	10	8	11	8
6.0	10	15	14	8	12	10	8	12	10	8	12	8
6.5	10	14	14	8	12	10	8	12	10	6	12	9
7.0	10	14	14	8	12	10	8	12	8	6	12	9
7.5	10	14	14	8	12	10	8	12	13	6	12	9
8.0	10	14	14	8	12	13	8	12	9	6	12	9
8.5	10	14	10	8	12	13	9	12	9	6	12	6
9.0	10	14	10	8	12	13	9	12	9	6	13	6
9.5	10	14	10	8	12	13	9	13	9	6	13	6
10.0	10	14	10	9	13	13	9	13	9	5	13	6
10.5	NA	NA	NA	9	13	9	6	13	9	5	13	6
11.0	NA	NA	NA	9	13	9	6	13	6	5	13	5
11.5	NA	NA	NA	9	13	9	6	13	6	5	6	5
12.0	NA	NA	NA	9	13	9	6	13	6	5	6	5
12.5	NA	NA	NA	9	13	9	6	13	6	5	6	5

Table AD. Hybrid Balance Settings for the AUA42 and AUA142 Channel Units with Structural Impedance of 600 Ohms

Major Gauge Equivalent Length (kft)	Cable Gauge and Far End Termination							
	26		24		22		19	
	600	900	600	900	600	900	600	900
0.0	3	0	3	0	3	0	3	0
0.5	2	2	2	2	2	2	3	2
1.0	2	10	2	6	2	6	2	6
1.5	2	10	2	10	2	10	2	6
2.0	6	10	6	10	2	10	2	10
2.5	6	10	6	10	6	10	6	10
3.0	6	10	6	10	6	10	6	10
3.5	6	10	6	10	6	10	6	10
4.0	10	10	6	10	6	10	6	15
4.5	10	10	6	10	6	10	6	15
5.0	10	10	6	10	6	9	6	15
5.5	10	10	15	9	7	13	7	13
6.0	10	10	15	9	7	13	7	13
6.5	10	10	7	13	7	13	5	8
7.0	10	9	7	11	7	11	5	8
7.5	9	9	7	11	7	11	5	8
8.0	9	9	7	11	7	11	5	14
8.5	9	9	7	11	8	12	5	14
9.0	9	9	7	11	8	12	5	14
9.5	9	9	7	12	8	12	5	14
10.0	9	11	8	12	8	12	4	14
10.5	NA	NA	8	12	5	14	4	14
11.0	NA	NA	8	12	5	14	4	14
11.5	NA	NA	8	12	5	14	4	4
12.0	NA	NA	8	12	5	14	4	4
12.5	NA	NA	8	12	5	14	4	4

Table AE. Hybrid Balance Settings for the AUA42, AUA142 and AUA43 Channel Units (900 Ohms Structural Impedance) Facing Central Office Equipment

<u>Office Wire Length (kft)</u>	<u>Setting Number</u>
0.00	0
0.25	1
0.50	2
0.75	2
1.00	2

Table AF. Equalizer Prescription Settings (AUA42/AUA43) and (AUA142/AUA43) for Single-Gauge CSA Cable Without Bridged Taps (Note)

Cable Length (kft)	Cable Gauge and Termination									
	26-Gauge		25-Gauge		24-Gauge		22-Gauge		19-Gauge	
	Slope 600Ω	Slope 900Ω	Slope 600Ω	Slope 900Ω	Slope 600Ω	Slope 900Ω	Slope 600Ω	Slope 900Ω	Slope 600Ω	Slope 900Ω
0.3	0	0	0	0	0	0	0	0	0	0
3.5	0	0	0	0	0	0	0	0	0	0
4.0	0	1	0	0	0	0	0	0	0	0
4.5	0	1	0	0	0	1	0	1	0	1
5.0	1	1	0	0	1	1	0	1	0	1
5.5	1	1	0	1	1	1	1	1	1	1
6.0	1	1	0	1	1	1	1	1	1	1
6.5	1	2	1	1	1	1	1	1	1	1
7.0	1	2	1	1	1	2	1	2	1	1
7.5	2	2	1	1	1	2	1	2	1	2
8.0	2	3	1	1	2	3	1	2	1	2
8.5	2	3	1	2	2	3	2	3	2	2
9.0	3	4	1	2	2	3	2	3	2	3
9.5	3	4	1	2	3	4	2	3	2	3
10.0	4	5	2	3	3	4	3	4	2	3
10.5	4	5	2	3	3	5	3	4	3	4
11.0	NA	NA	2	3	4	5	3	4	3	4
11.5	NA	NA	3	4	4	5	4	5	3	4
12.0	NA	NA	3	4	5	6	4	5	4	5

Note: Structural impedance = 600 ohms,
cable termination = 600 or 900 ohms for telset, use 600 ohms.

Table AG. Constant for Conversion to Equivalent Gauge (600 to 600 Ohms)

Major Gauge	Minor Gauge			
	19	22	24	26
19	1.00	1.07	1.13	1.22
22	0.97	1.00	1.09	1.17
24	0.89	0.91	1.00	1.08
26	0.81	0.84	0.92	1.00

Table AH. Constant for Conversion to Equivalent Gauge (900 to 600 Ohms)

Major Gauge	Minor Gauge			
	19	22	24	26
19	1.00	1.01	1.10	1.11
22	0.99	1.00	1.09	1.10
24	0.91	0.92	1.00	1.05
26	0.90	0.91	0.95	1.00

Table AI. Equivalent Lengths (kft) for Bridged Taps, 2-Wire Designs

Bridged Tap Length (kft)	Gauge			
	26	24	22	19
0.5	0.3	0.4	0.5	0.5
1.0	0.7	0.8	0.9	1.0
1.5	1.1	1.3	1.4	1.5
2.0	1.6	1.7	1.9	2.0
2.5	2.1	2.2	2.4	2.5

Table AJ. D4 Equivalent Attenuation, Gain, and Loss Parameters for 4-Wire Series 5 Channel Units (Note)

Channel Unit	Transmit Path (T/R to -8.5 dB TLP Point)				Receive Path (+4.0 dB TLP Point to T1/R1)			
	Gt Insertion Gain (+) or Loss(-)	Attenuator Range (dB)	Input Level at T/R (dB)		Gr Insertion Gain (+) or Loss(-)	Attenuator Range (dB)	Output Level at T1/R1 (dB)	
			Min	Max			Min	Max
4FXS*	+6.5	0—16.5	-15.0*	+1.0	+2.0	0—16.5	-10.5	+6.0
4DX*	+6.5	0—16.5	-15.0*	0	+2.0	0—16.5	-9.0	+6.0
4TO	+7.5WH†(HI)	0—16.5	-16.0	+0.5	+3.0WH†(HI)	0—16.5	-9.5	+7.0
4TO	+0.5BK†(LO)		-9.0	+7.5	-4.0BK†(LO)		-16.5	0
4ETO*	+6.5BK†(HI)	0—16.5	-15.0*	+1.0	+3.0	0—16.5	-3.0	+7.0
4ETO*	-0.5WH†(LO)		-8.0*	+8.5				
4FXO*	+6.5	0—16.5	-15.0*	+1.0	+2.0	0—16.5	-10.5	+6.0
4TDM	-4.9	0—11.6‡	-3.6	-2.1	-6.1	(None)	-2.1	-2.1
4E&M	+9.0	0—25.5	-17.5	+8.0	+4.5	0—25.5	-17.0	+8.5
PLR	+9.0	0—25.5	-17.5	+8.0	-4.5	0—25.5	-17.0	+8.5

Note: Special service channel unit input and output levels are recommended values. In some cases, attenuator ranges cover a wider distribution of levels. It is recommended that circuit levels be constrained within the input and output levels specified in the table.

* Channel units with active post equalization only in the transmit direction.

† On WORD, use WH/BK instead of HI/LO; see AUA41, AUA141 and AUA44 channel unit options.

‡ The 4TDM attenuator should use only 0 to 1.5 dB.

Table AK. DC Resistance Constants for Nonloaded and Loaded Cable (Notes)

<u>Gauge</u>	<u>68°F</u>		<u>100°F</u>	
	<u>Nonloaded</u>	<u>H88 Loaded</u>	<u>Nonloaded</u>	<u>H88 Loaded</u>
19	16.3	17.8	17.4	19.1
22	32.8	34.3	35.1	36.7
24	51.9	53.4	55.6	57.2
25-gauge MAT cable	65.5	67.0	70.1	71.7
26	83.3	84.8	89.2	90.8

Notes:

1. Values shown are in ohms/kft.
2. For other temperatures, use the following:

$$R_T = R_{68} [1 + 0.0022(T-68)]$$

Table AL. Gauge Conversion Constants

<u>Major Gauge</u>	<u>Minor Gauge</u>			
	<u>19</u>	<u>22</u>	<u>24</u>	<u>26</u>
19	1	1.19	1.41	1.70
22	0.87	1	1.17	1.38
24	0.76	0.86	1	1.17
25	0.77	0.77	0.77	0.77
26	0.67	0.74	0.86	1

Table AM. Equivalent Lengths (kft) for Bridged Taps, 4-Wire Designs

Bridged Tap Length (kft)	Gauge			
	26	24	22	19
0.5	0.3	0.4	0.4	0.4
1.0	0.6	0.7	0.8	0.9
1.5	0.9	1.1	1.3	1.4
2.0	1.3	1.5	1.7	1.9
2.5	1.6	1.9	2.1	2.3
3.0	2.0	2.3	2.6	2.8
3.5	2.3	2.7	3.1	3.4
4.0	2.7	3.2	3.6	3.9
4.5	3.1	3.6	4.1	4.4
5.0	3.5	4.1	4.6	5.0
5.5	3.9	4.5	5.1	5.5
6.0	4.4	5.0	5.6	6.1

Table AN. H88 (Loaded) Cable Loss at 1 kHz at 68°F (Note)

Gauge	Loss/kft (dB)
26	0.34
25 (MAT Cable)	0.24
24	0.23
22	0.15
19	0.08

Note: For other temperatures, change cable loss by $\pm 1\%$ for each change in temperature of $\pm 5^\circ\text{F}$.

Table AO. 19-GA Nonloaded Cable Without Bridged Taps (Notes)

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL	Gain (dB)	
1	14	0	0	0.0	0.1
2	14	0	0	0.0	0.3
3	14	0	0	0.0	0.4
4	14	0	0	0.0	0.5
5	14	0	0	0.0	0.7
6	14	2	0	0.1	0.8
7	14	1	1	0.4	1.0
8	14	3	0	0.1	1.2
9	14	2	1	0.5	1.3
10	14	4	0	0.2	1.5
11	14	3	1	0.5	1.7
12	14	5	0	0.3	1.9
13	14	4	1	0.6	2.1
14	14	6	0	0.4	2.3
15	14	5	1	0.7	2.5
16	13	5	2	1.1	2.7
17	14	5	2	1.2	2.9
18	13	5	3	1.5	3.1
19	14	6	2	1.3	3.4
20	14	6	2	1.3	3.6
21	14	6	3	1.7	3.8
22	14	7	2	1.4	4.1
23	14	6	4	2.2	4.3
24	14	6	4	2.2	4.5
25	14	7	3	1.9	4.8

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AO. 19-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL		
26	14	6	5	2.7	5.0
27	14	7	4	2.4	5.3
28	14	7	4	2.4	5.5
29	14	7	5	2.8	5.8
30	14	7	5	2.8	6.0
31	14	7	6	3.3	6.3
32	14	7	6	3.3	6.5
33	14	7	6	3.3	6.8
34	14	7	7	3.9	7.0
35	14	7	8	4.2	7.3
36	14	7	8	4.2	7.6
37	14	7	9	4.7	7.8
38	14	7	10	5.1	8.1
39	14	7	11	5.5	8.3
40	14	7	11	5.5	8.6
41	14	8	8	4.4	8.8
42	14	8	9	4.9	9.1
43	14	8	9	4.9	9.3
44	14	8	10	5.3	9.6
45	14	8	11	5.7	9.8
46	14	8	12	6.1	10.1
47	14	8	13	6.5	10.3
48	14	8	14	6.9	10.6
49	14	9	12	6.1	10.8
50	14	9	13	6.6	11.1

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

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Table AO. 19-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL		
51	14	9	14	7.0	11.3
52	14	9	15	7.4	11.6
53	14	9	15	7.4	11.8
54	14	10	13	6.8	12.1
55	14	10	14	7.2	12.3
56	14	10	15	7.5	12.6
57	14	10	15	7.5	12.8
58	14	11	14	7.4	13.1
59	14	11	15	7.7	13.3
60	14	11	15	7.7	13.6
61	14	11	15	7.7	13.8
62	14	12	14	7.6	14.0
63	14	12	15	8.0	14.3
64	14	12	15	8.0	14.5
65	14	12	15	8.0	14.8
66	14	13	15	8.2	15.0

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Table AP. 22-GA Nonloaded Cable Without Bridged Taps (Notes)

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL		
1	14	0	0	0.0	0.2
2	14	0	0	0.0	0.5
3	14	0	0	0.0	0.7
4	14	0	0	0.0	1.0
5	14	0	0	0.0	1.2
6	14	1	1	0.4	1.5
7	14	2	0	0.1	1.7
8	14	3	0	0.1	2.0
9	13	2	1	0.5	2.2
10	14	4	0	0.2	2.5
11	14	5	0	0.3	2.8
12	14	4	1	0.6	3.1
13	14	6	0	0.4	3.4
14	14	5	1	0.7	3.6
15	13	5	2	1.1	3.9
16	14	6	1	0.8	4.2
17	13	5	3	1.5	4.6
18	14	6	2	1.3	4.9
19	13	6	3	1.6	5.2
20	14	7	2	1.4	5.5
21	14	6	4	2.2	5.8
22	14	7	3	1.9	6.1
23	14	6	5	2.7	6.5
24	14	7	4	2.4	6.8
25	14	7	5	2.8	7.1

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AP. 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL		
26	14	7	5	2.8	7.5
27	14	8	4	2.5	7.8
28	14	8	5	3.0	8.2
29	14	8	5	3.0	8.5
30	14	8	6	3.5	8.8
31	14	8	7	4.1	9.2
32	14	8	8	4.4	9.5
33	14	8	9	4.9	9.9
34	14	9	8	4.5	10.2
35	14	9	9	5.0	10.6
36	14	9	10	5.4	10.0
37	14	10	8	4.7	11.3
38	14	10	9	5.2	11.6
39	14	10	11	6.0	12.0
40	14	11	9	5.3	12.3
41	14	11	10	5.8	12.7
42	14	11	12	6.6	13.0
43	14	11	13	7.0	13.4
44	14	12	11	6.4	13.7
45	14	12	12	6.8	14.1
46	14	12	14	7.6	14.4
47	14	13	11	6.7	14.8
48	13	13	15	7.7	15.1

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Table AQ. 24-GA Nonloaded Cable Without Bridged Taps (Notes)

Cable Length (kft)	Equalizer Settings			Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL		
1	14	0	0	0.0	0.4
2	14	0	0	0.0	0.7
3	14	0	0	0.0	1.1
4	14	0	0	0.0	1.5
5	14	2	0	0.1	1.8
6	14	2	0	0.1	2.2
7	13	3	0	0.1	2.5
8	14	3	0	0.1	2.9
9	14	3	1	0.6	3.6
10	14	3	1	0.6	3.6
11	14	4	1	0.6	4.0
12	14	6	0	0.4	4.3
13	14	5	1	0.7	4.7
14	14	6	1	0.8	5.1
15	13	5	3	1.5	5.5
16	14	6	2	1.3	5.9
17	13	6	3	1.6	6.3
18	14	7	2	1.4	6.7
19	14	8	2	1.6	7.5
20	14	8	2	1.6	7.5
21	14	7	4	2.4	7.9
22	14	7	5	2.8	8.4
23	14	8	4	2.5	8.8
24	14	8	5	3.0	9.2
25	14	8	5	3.0	9.6

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AQ. 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL		
26	14	9	5	3.1	10.1
27	14	9	6	3.6	10.5
28	14	9	7	4.2	11.0
29	14	9	8	4.5	11.4
30	14	10	7	4.3	11.8
31	14	10	9	5.1	12.3
32	14	10	10	5.6	12.7
33	14	11	9	5.3	13.2
34	13	11	13	6.6	13.6
35	14	12	9	5.6	14.0
36	13	12	13	6.7	14.5
37	13	12	15	7.5	14.9
38	13	13	12	6.5	15.4

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Table AR. 25-GA (MAT) Nonloaded Cable Without Bridged Taps (Notes)

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL	Gain (dB)	
1	14	0	0	0.0	0.5
2	14	0	0	0.0	0.9
3	14	0	0	0.0	1.3
4	14	0	0	0.0	1.8
5	14	2	0	0.1	2.2
6	14	2	0	0.1	2.6
7	14	2	0	0.1	2.9
8	14	2	1	0.5	3.3
9	14	2	1	0.5	3.7
10	14	5	0	0.3	4.1
11	14	5	0	0.3	4.4
12	14	5	1	0.7	4.8
13	14	5	1	0.7	5.2
14	14	5	2	1.2	5.6
15	14	6	2	1.3	5.9
16	14	6	2	1.3	6.3
17	14	7	2	1.4	6.7
18	14	7	2	1.4	7.1
19	14	7	4	2.3	7.5
20	14	7	4	2.3	7.9
21	14	7	5	2.8	8.2
22	14	8	5	3.0	8.7
23	14	8	5	3.0	9.0
24	14	8	7	4.1	9.5
25	14	8	7	4.1	9.8

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AR. 25-GA (MAT) Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL		
26	14	9	7	4.2	10.3
27	14	9	7	4.2	10.6
28	14	10	8	4.7	11.0
29	14	10	8	4.7	11.4
30	14	11	8	4.9	11.8

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Table AS. 26-GA Nonloaded Cable Without Bridged Taps (Notes)

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	BW	HT	SL		
1	14	0	0	0.0	0.6
2	14	1	0	0.0	1.2
3	14	2	0	0.1	1.7
4	13	1	0	0.0	2.2
5	15	1	0	0.1	2.7
6	14	2	0	0.1	3.2
7	13	3	0	0.1	3.7
8	13	2	1	0.5	4.2
9	13	3	1	0.5	4.7
10	14	5	0	0.3	5.1
11	14	6	0	0.4	5.6
12	14	5	1	0.7	6.1
13	14	6	1	0.8	6.6
14	13	6	2	1.1	7.1
15	13	6	3	1.6	7.6
16	14	7	2	1.4	8.1
17	14	7	3	1.9	8.6
18	14	8	2	1.6	9.1
19	14	8	3	2.1	9.7
20	14	8	4	2.5	10.2
21	14	8	5	3.0	10.7
22	14	8	6	3.5	11.3
23	14	9	6	3.6	11.8
24	14	9	7	4.2	12.4
25	14	11	5	3.5	12.9

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

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Table AS. 26-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)	Equalizer Settings			1kHz Equalizer Gain (dB)	1 kHz Cable Transducer Loss (dB) (600 to 600 Ohms at 68°F)
	HT	BW	SL		
26	14	11	6	4.0	13.5
27	13	11	9	4.9	14.0
28	13	11	11	5.8	14.6
29	13	12	10	5.5	15.1

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Table AT. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Notes)

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	22-GA	BW	HT	SL	
WL = 9					
7	2	14	4	0	0.2
8	1	14	4	0	0.2
WL = 10					
5	5	13	3	1	0.5
6	4	13	3	1	0.5
7	3	13	3	1	0.5
8	2	13	3	1	0.5
9	1	14	3	1	0.6
WL = 11					
2	9	14	5	0	0.3
3	8	14	5	0	0.3
4	7	14	5	0	0.3
5	6	14	5	0	0.3
6	5	14	5	0	0.3
7	4	14	5	0	0.3
8	3	14	5	0	0.3
9	2	13	4	1	0.5
10	1	13	4	1	0.5
WL = 12					
1	11	14	4	1	0.6
2	10	14	4	1	0.6
3	9	14	4	1	0.6
4	8	14	4	1	0.6
5	7	14	4	1	0.6
6	6	14	4	1	0.6
7	5	14	4	1	0.6
8	4	14	4	1	0.6
9	3	14	4	1	0.6
10	2	14	6	0	0.4
11	1	14	6	0	0.4

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AT. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>24-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 13					
1	12	14	6	0	0.4
2	11	14	6	0	0.4
3	10	14	6	0	0.4
4	9	14	5	1	0.7
5	8	14	5	1	0.7
6	7	14	5	1	0.7
7	6	14	5	1	0.7
8	5	14	5	1	0.7
9	4	14	5	1	0.7
10	3	14	5	1	0.7
11	2	14	5	1	0.7
12	1	14	5	1	0.7
WL = 14					
1	13	14	5	1	0.7
2	12	14	5	1	0.7
3	11	14	4	2	1.1
4	10	14	4	2	1.1
5	9	14	4	2	1.1
6	8	14	4	2	1.1
7	7	14	4	2	1.1
8	6	12	5	2	1.0
9	5	13	5	2	1.1
10	4	13	5	2	1.1
11	3	13	5	2	1.1
12	2	13	5	2	1.1
13	1	14	7	0	0.5
WL = 15					
1	14	13	5	2	1.1
2	13	14	6	1	0.8
3	12	14	6	1	0.8

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AT. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>24-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 15 (Contd)					
4	11	14	6	1	0.8
5	10	14	6	1	0.8
6	9	14	6	1	0.8
7	8	14	6	1	0.8
8	7	14	6	1	0.8
9	6	14	6	1	0.8
10	5	14	6	1	0.8
11	4	14	6	1	0.8
12	3	14	5	2	1.2
13	2	14	5	2	1.2
14	1	14	5	2	1.2
WL = 16					
1	15	14	5	2	1.2
2	14	14	5	2	1.2
3	13	14	5	2	1.2
4	12	13	5	3	1.5
5	11	13	5	3	1.5
6	10	13	5	3	1.5
7	9	13	5	3	1.5
8	8	13	5	3	1.5
9	7	13	5	3	1.5
10	6	13	5	3	1.5
11	5	13	6	2	1.1
12	4	13	6	2	1.1
13	3	14	6	2	1.3
14	2	14	6	2	1.3
15	1	14	6	2	1.3
WL = 17					
1	16	13	5	3	1.5
2	15	14	6	2	1.3
3	14	14	6	2	1.3

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

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Table AT. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>24-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 17 (Contd)					
4	13	14	6	2	1.3
5	12	14	6	2	1.3
6	11	14	6	2	1.3
7	10	14	6	2	1.3
8	9	14	6	2	1.3
9	8	14	6	2	1.3
10	7	14	6	2	1.3
11	6	14	6	2	1.3
12	5	14	6	2	1.3
13	4	14	6	2	1.3
14	3	14	6	2	1.3
15	2	13	6	3	1.6
16	1	13	6	3	1.6
WL = 18					
1	17	14	6	2	1.3
2	16	14	6	2	1.3
3	15	13	5	4	2.0
4	14	13	5	4	2.0
5	13	13	6	3	1.6
6	12	13	6	3	1.6
7	11	13	6	3	1.6
8	10	13	6	3	1.6
9	9	13	6	3	1.6
10	8	14	6	3	1.7
11	7	14	6	3	1.7
12	6	14	6	3	1.7
13	5	14	6	3	1.7
14	4	14	6	3	1.7
15	3	14	7	2	1.4
16	2	14	7	2	1.4
17	1	14	7	2	1.4

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AT. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>24-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 19					
1	18	14	6	3	1.7
2	17	14	6	3	1.7
3	16	14	6	3	1.7
4	15	14	6	3	1.7
5	14	14	7	2	1.4
6	13	14	7	2	1.4
7	12	14	7	2	1.4
8	11	14	7	2	1.4
9	10	14	7	2	1.4
10	9	14	7	2	1.4
11	8	14	7	2	1.4
12	7	14	7	2	1.4
13	6	14	7	2	1.4
14	5	13	6	4	2.1
15	4	13	6	4	2.1
16	3	14	6	4	2.2
17	2	14	6	4	2.2
18	1	14	6	4	2.2
WL = 20					
1	19	14	7	2	1.4
2	18	14	7	2	1.4
3	17	14	7	2	1.4
4	16	13	6	4	2.1
5	15	13	6	4	2.1
6	14	14	6	4	2.2
7	13	14	6	4	2.2
8	12	14	6	4	2.2
9	11	14	6	4	2.2
10	10	14	6	4	2.2
11	9	14	6	4	2.2
12	8	14	7	3	1.9

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

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Table AT. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>24-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 20 (Contd)					
13	7	14	7	3	1.9
14	6	14	7	3	1.9
15	5	14	7	3	1.9
16	4	14	7	3	1.9
17	3	14	7	3	1.9
18	2	14	7	3	1.9
19	1	14	8	2	1.6
WL = 21					
1	20	14	6	4	2.2
2	19	14	6	4	2.2
3	18	14	6	4	2.2
4	17	14	7	3	1.9
5	16	14	7	3	1.9
6	15	14	7	3	1.9
7	14	14	7	3	1.9
8	13	14	7	3	1.9
9	12	14	7	3	1.9
10	11	14	7	3	1.9
11	10	14	7	3	1.9
12	9	14	8	2	1.6
13	8	14	8	2	1.6
14	7	14	8	2	1.6
15	6	14	8	2	1.6
16	5	14	8	2	1.6
17	4	14	7	4	2.4
18	3	14	7	4	2.4
19	2	14	7	4	2.4
20	1	14	7	4	2.4
WL = 22					
1	21	14	7	3	1.9
2	20	14	7	3	1.9

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AT. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>24-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 22 (Contd)					
3	19	14	7	3	1.9
4	18	14	7	3	1.9
5	17	14	6	5	2.7
6	16	14	6	5	2.7
7	15	14	6	5	2.7
8	14	14	7	4	2.4
9	13	14	7	4	2.4
10	12	14	7	4	2.4
11	11	14	7	4	2.4
12	10	14	7	4	2.4
13	9	14	7	4	2.4
14	8	14	7	4	2.4
15	7	14	7	4	2.4
16	6	14	7	4	2.4
17	5	14	8	3	2.1
18	4	14	8	3	2.1
19	3	14	8	3	2.1
20	2	14	8	3	2.1
21	1	14	8	3	2.1
WL = 23					
1	22	14	7	4	2.4
2	21	14	7	4	2.4
3	20	14	7	4	2.4
4	19	14	7	4	2.4
5	18	14	7	4	2.4
6	17	14	7	4	2.4
7	16	14	7	4	2.4
8	15	14	7	4	2.4
9	14	14	7	4	2.4
10	13	14	7	4	2.4

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AT. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>24-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 23 (Contd)					
11	12	14	8	3	2.1
12	11	14	8	3	2.1
13	10	14	8	3	2.1
14	9	14	8	3	2.1
15	8	14	7	5	2.8
16	7	14	7	5	2.8
17	6	14	7	5	2.8
18	5	14	7	5	2.8
19	4	14	7	5	2.8
20	3	14	7	5	2.8
21	2	14	8	4	2.5
22	1	14	8	4	2.5
WL = 24					
1	23	14	7	4	2.4
2	22	14	7	4	2.4
3	21	14	7	4	2.4
4	20	14	8	3	2.1
5	19	14	7	5	2.8
6	18	14	7	5	2.8
7	17	14	7	5	2.8
8	16	14	7	5	2.8
9	15	14	7	5	2.8
10	14	14	7	5	2.8
11	13	14	7	5	2.8
12	12	14	7	5	2.8
13	11	14	7	5	2.8
14	10	14	7	6	3.3
15	9	14	8	4	2.5
16	8	14	8	4	2.5
17	7	14	8	4	2.5

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AT. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	22-GA	BW	HT	SL	
WL = 24 (Contd)					
18	6	14	8	4	2.5
19	5	14	8	4	2.5
20	4	14	8	4	2.5
21	3	14	8	4	2.5
22	2	14	8	4	2.5
23	1	14	8	4	2.5
WL = 25					
1	24	14	7	5	2.8
2	23	14	7	5	2.8
3	22	14	7	5	2.8
4	21	14	7	5	2.8
5	20	14	7	5	2.8
6	19	14	7	5	2.8
7	18	14	7	6	3.3
8	17	14	7	6	3.3
9	16	14	7	6	3.3
10	15	14	8	4	2.5
11	14	14	8	4	2.5
12	13	14	8	4	2.5
13	12	14	8	4	2.5
14	11	14	8	4	2.5
15	10	14	8	4	2.5
16	9	14	8	4	2.5
17	8	14	8	5	3.0
18	7	14	8	5	3.0
19	6	14	8	5	3.0
20	5	14	8	5	3.0
21	4	14	8	5	3.0
22	3	14	8	5	3.0
23	2	14	8	5	3.0
24	1	14	8	5	3.0

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AT. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>24-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 26					
1	25	14	7	6	3.3
2	24	14	7	6	3.3
3	23	14	7	6	3.3
4	22	14	7	6	3.3
5	21	14	8	4	2.5
6	20	14	8	4	2.5
7	19	14	8	4	2.5
8	18	14	8	4	2.5
9	17	14	8	4	2.5
10	16	14	7	7	3.9
11	15	14	7	7	3.9
12	14	14	8	5	3.0
13	13	14	8	5	3.0
14	12	14	8	5	3.0
15	11	14	8	5	3.0
16	10	14	8	5	3.0
17	9	14	8	5	3.0
18	8	14	8	5	3.0
19	7	14	8	6	3.5
20	6	14	8	6	3.5
21	5	14	8	6	3.5
22	4	14	8	6	3.5
23	3	14	8	6	3.5
24	2	14	9	5	3.1
25	1	14	9	5	3.1
WL = 27					
1	26	14	8	4	2.5
2	25	14	7	6	3.3
3	24	14	7	7	3.9
4	23	14	7	7	3.9

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AT. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	22-GA	BW	HT	SL	
WL = 27 (Contd)					
5	22	14	7	7	3.9
6	21	14	7	7	3.9
7	20	14	8	5	3.0
8	19	14	8	5	3.0
9	18	14	8	5	3.0
10	17	14	8	5	3.0
11	16	14	8	5	3.0
12	15	14	8	5	3.0
13	14	14	8	5	3.0
14	13	14	8	6	3.5
15	12	14	8	6	3.5
16	11	14	8	6	3.5
17	10	14	8	6	3.5
18	9	14	9	5	3.1
19	8	14	9	5	3.1
20	7	14	9	5	3.1
21	6	14	9	5	3.1
22	5	14	9	5	3.1
23	4	14	8	7	4.1
24	3	14	8	7	4.1
25	2	14	9	6	3.6
26	1	14	9	6	3.6
WL = 28					
1	27	14	8	5	3.0
2	26	14	8	5	3.0
3	25	14	8	5	3.0
4	24	14	8	5	3.0
5	23	14	8	5	3.0
6	22	14	8	5	3.0
7	21	14	8	5	3.0
8	20	14	8	6	3.5

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AT. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	22-GA	BW	HT	SL	
WL = 28 (Contd)					
9	19	14	8	6	3.5
10	18	14	8	6	3.5
11	17	14	8	6	3.5
12	16	14	8	6	3.5
13	15	14	8	6	3.5
14	14	14	9	5	3.1
15	13	14	9	5	3.1
16	12	14	8	7	4.1
17	11	14	8	7	4.1
18	10	14	8	7	4.1
19	9	14	9	6	3.6
20	8	14	9	6	3.6
21	7	14	9	6	3.6
22	6	14	9	6	3.5
23	5	14	9	6	3.6
24	4	14	9	6	3.6
25	3	14	10	5	3.3
26	2	14	10	5	3.3
27	1	14	9	7	4.2
WL = 29					
1	28	14	8	5	3.0
2	27	14	8	6	3.5
3	26	14	8	6	3.5
4	25	14	8	6	3.5
5	14	14	8	6	3.5
6	23	14	8	6	3.5
7	22	14	8	6	3.5
8	21	14	8	6	3.5
9	20	14	8	6	3.5
10	19	14	8	6	3.5
11	18	14	8	7	4.1

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AT. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>24-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 29 (Contd)					
12	17	14	8	7	4.1
13	16	14	8	7	4.1
14	15	14	9	6	3.6
15	14	14	9	6	3.6
16	13	14	9	6	3.6
17	12	14	9	6	3.6
18	11	14	9	6	3.6
19	10	14	10	5	3.3
20	9	14	9	7	4.2
21	8	14	9	7	4.2
22	7	14	9	7	4.2
23	6	14	9	7	4.2
24	5	14	9	7	4.2
25	4	14	9	7	4.2
26	3	14	10	6	3.8
27	2	14	10	6	3.8
28	1	14	10	6	3.8
WL = 30					
1	29	14	8	6	3.5
2	28	14	8	6	3.5
3	27	14	8	6	3.5
4	26	14	8	6	3.5
5	25	14	8	7	4.1
6	24	14	8	7	4.1
7	23	14	8	7	4.1
8	22	14	8	7	4.1
9	21	14	8	7	4.1
10	20	14	8	7	4.1
11	19	14	9	6	3.6
12	18	14	9	6	3.6

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AT. Mixed 24- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>24-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 30 (Contd)					
13	17	14	9	6	3.6
14	16	14	8	8	4.4
15	15	14	9	7	4.2
16	14	14	9	7	4.2
17	13	14	9	7	4.2
18	12	14	9	7	4.2
19	11	14	9	7	4.2
20	10	14	10	6	3.8
21	9	14	10	6	3.8
22	8	14	10	6	3.8
23	7	14	10	6	3.8
24	6	14	10	6	3.8
25	5	14	9	9	5.0
26	4	14	9	9	5.0
27	3	14	10	7	4.3
28	2	14	10	7	4.3
29	1	14	10	7	4.3

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Table AU. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Notes)

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	22-GA	BW	HT	SL	
WL = 7					
5	2	13	3	0	0.1
6	1	13	3	0	0.1
WL = 8					
4	4	14	3	0	0.1
5	3	14	3	0	0.1
6	2	14	3	0	0.1
7	1	12	2	1	0.5
WL = 9					
3	6	14	4	0	0.2
4	5	14	4	0	0.2
5	4	14	4	0	0.2
6	3	14	4	0	0.2
7	2	14	4	0	0.2
8	1	14	4	0	0.2
WL = 10					
2	8	13	3	1	0.5
3	7	14	3	1	0.6
4	6	14	3	1	0.6
5	5	14	3	1	0.6
6	4	14	3	1	0.6
7	3	14	3	1	0.6
8	2	14	5	0	0.3
9	1	14	5	0	0.3
WL = 11					
1	10	14	5	0	0.3
2	9	14	5	0	0.3
3	8	13	4	1	0.5
4	7	13	4	1	0.5
5	6	13	4	1	0.5
6	5	14	4	1	0.6

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AU. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 11 (Contd)					
7	4	14	4	1	0.6
8	3	14	4	1	0.6
9	2	14	4	1	0.6
10	1	14	4	1	0.6
WL = 12					
1	11	14	4	1	0.6
2	10	14	4	1	0.6
3	9	14	4	1	0.6
4	8	14	6	0	0.4
5	7	14	6	0	0.4
6	6	14	6	0	0.4
7	5	14	6	0	0.4
8	4	14	6	0	0.4
9	3	14	6	0	0.4
10	2	14	5	1	0.7
11	1	14	5	1	0.7
WL = 13					
1	12	14	6	0	0.4
2	11	14	5	1	0.7
3	10	14	5	1	0.7
4	9	14	5	1	0.7
5	8	14	5	1	0.7
6	7	14	5	1	0.7
7	6	14	5	1	0.7
8	5	14	5	1	0.7
9	4	14	4	2	1.1
10	3	12	5	2	1.0
11	2	13	5	2	1.1
12	1	14	7	0	0.5

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AU. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	22-GA	BW	HT	SL	Gain (dB)
WL = 14					
1	13	14	4	2	1.1
2	12	12	4	3	1.4
3	11	13	5	2	1.1
4	10	13	5	2	1.1
5	9	14	7	0	0.5
6	8	14	7	0	0.5
7	7	14	6	1	0.8
8	6	14	6	1	0.8
9	5	14	6	1	0.8
10	4	14	6	1	0.8
11	3	14	6	1	0.8
12	2	14	5	2	1.2
13	1	13	5	3	1.5
WL = 15					
1	14	14	6	1	0.8
2	13	14	6	1	0.8
3	12	14	6	1	0.8
4	11	14	5	2	1.2
5	10	14	5	2	1.2
6	9	14	5	2	1.2
7	8	13	5	3	1.5
8	7	13	5	3	1.5
9	6	13	5	3	1.5
10	5	13	6	2	1.1
11	4	13	6	2	1.1
12	3	14	7	1	0.9
13	2	14	7	1	0.9
14	1	14	7	1	0.9

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AU. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 16					
1	15	14	5	2	1.2
2	14	13	5	3	1.5
3	13	13	5	3	1.5
4	12	13	6	2	1.1
5	11	14	6	2	1.3
6	10	14	6	2	1.3
7	9	14	6	2	1.3
8	8	14	7	1	0.9
9	7	14	7	1	0.9
10	6	14	7	1	0.9
11	5	14	6	2	1.3
12	4	13	6	3	1.6
13	3	13	6	3	1.6
14	2	13	6	3	1.6
15	1	14	7	2	1.4
WL = 17					
1	16	14	6	2	1.3
2	15	14	6	2	1.3
3	14	14	6	2	1.3
4	13	14	6	2	1.3
5	12	14	6	2	1.3
6	11	13	6	3	1.6
7	10	13	6	3	1.6
8	9	13	6	3	1.6
9	8	13	6	3	1.6
10	7	14	6	3	1.7
11	6	14	7	2	1.4
12	5	14	7	2	1.4
13	4	14	7	2	1.4
14	3	14	8	1	1.1

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AU. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	22-GA	BW	HT	SL	
WL = 17 (Contd)					
15	2	14	8	1	1.1
16	1	13	7	3	1.7
WL = 18					
1	17	13	5	4	2.0
2	16	13	6	3	1.6
3	15	14	6	3	1.7
4	14	14	6	3	1.7
5	13	14	6	3	1.7
6	12	14	7	2	1.4
7	11	14	7	2	1.4
8	10	14	7	2	1.4
9	9	14	7	2	1.4
10	8	14	7	2	1.4
11	7	13	6	4	2.1
12	6	13	7	3	1.7
13	5	13	7	3	1.7
14	4	14	7	3	1.9
15	3	14	7	3	1.9
16	2	14	7	3	1.9
17	1	14	8	2	1.6
WL = 19					
1	18	14	6	3	1.7
2	17	14	7	2	1.4
3	16	14	7	2	1.4
4	15	14	7	2	1.4
5	14	13	6	4	2.1
6	13	14	6	4	2.2
7	12	14	6	4	2.2
8	11	14	6	4	2.2
9	10	14	7	3	1.9

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AU. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)		Equalizer Settings			1 KHZ Equalizer Gain (dB)
26-GA	22-GA	BW	HT	SL	
WL = 19 (Contd)					
10	9	14	7	3	1.9
11	8	14	7	3	1.9
12	7	14	7	3	1.9
13	6	14	8	2	1.6
14	5	14	8	2	1.6
15	4	14	8	2	1.6
16	3	14	7	4	2.4
17	2	14	7	4	2.4
18	1	14	9	2	1.7
WL = 20					
1	19	14	7	2	1.4
2	18	14	6	4	2.2
3	17	14	6	4	2.2
4	16	14	6	4	2.2
5	15	14	7	3	1.9
6	14	14	7	3	1.9
7	13	14	7	3	1.9
8	12	14	7	3	1.9
9	11	14	8	2	1.6
10	10	14	8	2	1.6
11	9	14	7	4	2.4
12	8	14	7	4	2.4
13	7	14	7	4	2.4
14	6	14	7	4	2.4
15	5	14	9	2	1.7
16	4	14	8	3	2.1
17	3	14	8	3	2.1
18	2	14	8	3	2.1
19	1	13	8	4	2.3

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AU. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	22-GA	BW	HT	SL	
WL = 21					
1	20	14	6	4	2.2
2	19	14	7	3	1.9
3	18	14	7	3	1.9
4	17	14	7	3	1.9
5	16	14	6	5	2.7
6	15	14	6	5	2.7
7	14	14	7	4	2.4
8	13	14	7	4	2.4
9	12	14	7	4	2.4
10	11	14	7	4	2.4
11	10	14	8	3	2.1
12	9	14	8	3	2.1
13	8	14	8	3	2.1
14	7	14	8	3	2.1
15	6	14	8	3	2.1
16	5	13	8	4	2.3
17	4	14	8	4	2.5
18	3	14	8	4	2.5
19	2	14	8	4	2.5
20	1	13	8	5	2.8
WL = 22					
1	21	14	7	3	1.9
2	20	14	6	5	2.7
3	19	14	7	4	2.4
4	18	14	7	4	2.4
5	17	14	7	4	2.4
6	16	14	7	4	2.4
7	15	14	7	4	2.4
8	14	14	8	3	2.1
9	13	14	8	3	2.1

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AU. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 22 (Contd)					
10	12	14	7	5	2.8
11	11	14	7	5	2.8
12	10	14	7	5	2.8
13	9	14	8	4	2.5
14	8	14	8	4	2.5
15	7	14	8	4	2.5
16	6	14	8	4	2.5
17	5	13	8	5	2.8
18	4	14	8	5	3.0
19	3	14	9	4	2.7
20	2	14	9	4	2.7
21	1	14	9	4	2.7
WL = 23					
1	22	14	7	4	2.4
2	21	14	7	4	2.4
3	20	14	7	4	2.4
4	19	14	7	4	2.4
5	18	14	7	5	2.8
6	17	14	7	5	2.8
7	16	14	7	5	2.8
8	15	14	7	5	2.8
9	14	14	7	5	2.8
10	13	14	8	4	2.5
11	12	14	8	4	2.5
12	11	14	8	4	2.5
13	10	14	8	4	2.5
14	9	14	8	5	3.0
15	8	14	8	5	3.0
16	7	14	9	4	2.7

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

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Table AU. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 23 (Contd)					
17	6	14	9	4	2.7
18	5	14	9	4	2.7
19	4	14	8	6	3.5
20	3	14	9	5	3.1
21	2	14	9	5	3.1
22	1	14	10	4	2.8
WL = 24					
1	23	14	7	4	2.4
2	22	14	7	5	2.8
3	21	14	7	5	2.8
4	20	14	7	5	2.8
5	19	14	7	5	2.8
6	18	14	7	6	3.3
7	17	14	7	6	3.3
8	16	14	8	4	2.5
9	15	14	8	4	2.5
10	14	14	8	4	2.5
11	13	14	8	5	3.0
12	12	14	8	5	3.0
13	11	14	9	4	2.7
14	10	14	9	4	2.7
15	9	14	8	6	3.5
16	8	14	9	5	3.1
17	7	14	9	5	3.1
18	6	14	10	4	2.8
19	5	14	10	4	2.8
20	4	14	9	6	3.6
21	3	14	9	6	3.6
22	2	14	10	5	3.3
23	1	14	10	5	3.3

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AU. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 25					
1	24	14	7	5	2.8
2	23	14	7	5	2.8
3	22	14	7	6	3.3
4	21	14	7	6	3.3
5	20	14	7	6	3.3
6	19	14	7	6	3.3
7	18	14	7	7	3.9
8	17	14	7	7	3.9
9	16	14	8	5	3.0
10	15	14	8	5	3.0
11	14	14	8	5	3.0
12	13	14	8	6	3.5
13	12	14	8	6	3.5
14	11	14	9	5	3.1
15	10	14	10	4	2.8
16	9	14	10	4	2.8
17	8	14	9	6	3.6
18	7	14	9	6	3.6
19	6	14	10	5	3.3
20	5	14	10	5	3.3
21	4	14	10	5	3.3
22	3	14	10	6	3.8
23	2	14	10	6	3.8
24	1	14	10	6	3.8
WL = 26					
1	25	14	7	6	3.3
2	24	14	7	6	3.3
3	23	14	7	6	3.3
4	22	14	7	7	3.9
5	21	14	7	7	3.9

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AU. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	22-GA	BW	HT	SL	Gain (dB)
WL = 26 (Contd)					
6	20	14	8	5	3.0
7	19	14	8	5	3.0
8	18	14	8	5	3.0
9	17	14	8	6	3.5
10	16	14	8	6	3.5
11	15	14	9	5	3.1
12	14	14	9	5	3.1
13	13	14	8	7	4.1
14	12	14	9	6	3.6
15	11	14	9	6	3.6
16	10	14	10	5	3.3
17	9	14	10	5	3.3
18	8	14	9	7	4.2
19	7	14	10	6	3.8
20	6	14	10	6	3.8
21	5	14	11	5	3.5
22	4	14	11	5	3.5
23	3	13	10	8	4.3
24	2	14	10	7	4.3
25	1	14	11	6	4.0
WL = 27					
1	26	14	7	7	3.9
2	25	14	7	7	3.9
3	24	14	8	5	3.0
4	23	14	8	5	3.0
5	22	14	8	5	3.0
6	21	14	8	5	3.0
7	20	14	8	6	3.5
8	19	14	8	6	3.5
9	18	14	8	6	3.5

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AU. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 27 (Contd)					
10	17	14	9	5	3.1
11	16	14	8	7	4.1
12	15	14	9	6	3.6
13	14	14	9	6	3.6
14	13	14	10	5	3.3
15	12	14	9	7	4.2
16	11	14	10	6	3.8
17	10	14	10	6	3.8
18	9	14	11	5	3.5
19	8	14	11	5	3.5
20	7	14	10	7	4.3
21	6	13	10	9	4.8
22	5	14	11	6	4.0
23	4	14	11	6	4.0
24	3	14	11	6	4.0
25	2	13	11	8	4.5
26	1	14	11	7	4.5
WL = 28					
1	27	14	8	5	3.0
2	26	14	8	5	3.0
3	25	14	8	6	3.5
4	24	14	8	6	3.5
5	23	14	8	6	3.5
6	22	14	8	6	3.5
7	21	14	8	6	3.5
8	20	14	8	7	4.1
9	19	14	8	7	4.1
10	18	14	9	6	3.6
11	17	14	9	6	3.6
12	16	14	9	7	4.2

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AU. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 28 (Contd)					
13	15	14	9	7	4.2
14	14	14	10	6	3.8
15	13	14	10	6	3.8
16	12	14	11	5	3.5
17	11	14	10	7	4.3
18	10	13	10	9	4.8
19	9	14	11	6	4.0
20	8	14	11	6	4.0
21	7	13	11	8	4.5
22	6	13	11	8	4.5
23	5	14	11	7	4.5
24	4	13	11	9	4.9
25	3	13	11	9	4.9
26	2	13	11	10	5.3
27	1	13	11	10	5.3
WL = 29					
1	28	14	8	6	3.5
2	27	14	8	6	3.5
3	26	14	8	6	3.5
4	25	14	8	6	3.5
5	24	14	8	7	4.1
6	23	14	8	7	4.1
7	22	14	8	7	4.1
8	21	14	8	8	4.4
9	20	14	8	8	4.4
10	19	14	9	7	4.2
11	18	14	9	7	4.2
12	17	14	10	6	3.8
13	16	14	10	6	3.8
14	15	14	10	7	4.3

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AU. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	22-GA	BW	HT	SL	
WL = 29 (Contd)					
15	14	14	10	7	4.3
16	13	14	11	6	4.0
17	12	14	11	6	4.0
18	11	13	10	10	5.2
19	10	14	11	7	4.5
20	9	14	11	7	4.5
21	8	13	11	9	4.9
22	7	13	11	10	5.3
23	6	13	11	10	5.3
24	5	13	11	11	5.8
25	4	13	11	11	5.8
26	3	14	12	7	4.7
27	2	14	12	7	4.7
28	1	13	12	9	5.1
WL = 30					
1	29	14	8	6	3.5
2	28	14	8	7	4.1
3	27	14	8	7	4.1
4	26	14	8	7	4.1
5	25	14	8	8	4.4
6	24	14	8	8	4.4
7	23	14	8	8	4.4
8	22	14	8	9	4.9
9	21	14	9	7	4.2
10	20	14	9	7	4.2
11	19	14	9	8	4.5
12	18	14	9	9	5.0
13	17	14	10	7	4.3
14	16	14	10	7	4.3
15	15	14	10	8	4.7

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AU. Mixed 26- and 22-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 30 (Contd)					
16	14	14	10	9	5.1
17	13	14	11	7	4.5
18	12	13	11	9	4.9
19	11	14	12	6	4.2
20	10	13	11	10	5.3
21	9	13	11	11	5.8
22	8	13	12	8	4.6
23	7	13	12	9	5.1
24	6	13	12	9	5.1
25	5	13	12	9	5.1
26	4	13	12	10	5.5
27	3	13	12	10	5.5
28	2	13	12	11	5.9

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Table AV. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Notes)

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	24-GA	BW	HT	SL	
WL = 6					
5	1	14	2	0	0.1
WL = 7					
3	4	13	3	0	0.1
4	3	13	3	0	0.1
5	2	13	3	0	0.1
6	1	13	3	0	0.1
WL = 8					
1	7	14	3	0	0.1
2	6	12	2	1	0.5
3	5	12	2	1	0.5
4	4	12	2	1	0.5
5	3	12	2	1	0.5
6	2	12	2	1	0.5
7	1	12	2	1	0.5
WL = 9					
1	8	14	4	0	0.2
2	7	14	4	0	0.2
3	6	14	4	0	0.2
4	5	14	4	0	0.2
5	4	14	4	0	0.2
6	3	14	4	0	0.2
7	2	14	4	0	0.2
8	1	13	3	1	0.5
WL = 10					
1	9	14	3	1	0.6
2	8	14	5	0	0.3
3	7	14	5	0	0.3
4	6	14	5	0	0.3
5	5	14	5	0	0.3
6	4	14	5	0	0.3

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

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Table AV. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	24-GA	BW	HT	SL	
WL = 10 (Contd)					
7	3	14	5	0	0.3
8	2	14	5	0	0.3
9	1	14	5	0	0.3
WL = 11					
1	10	14	4	1	0.6
2	9	14	4	1	0.6
3	8	14	4	1	0.6
4	7	14	4	1	0.6
5	6	14	4	1	0.6
6	5	14	4	1	0.6
7	4	14	4	1	0.6
8	3	14	4	1	0.6
9	2	14	4	1	0.6
10	1	14	4	1	0.6
WL = 12					
1	11	14	6	0	0.4
2	10	14	6	0	0.4
3	9	14	5	1	0.7
4	8	14	5	1	0.7
5	7	14	5	1	0.7
6	6	14	5	1	0.7
7	5	14	5	1	0.7
8	4	14	5	1	0.7
9	3	14	5	1	0.7
10	2	14	5	1	0.7
11	1	14	5	1	0.7
WL = 13					
1	12	14	4	2	1.1
2	11	14	4	2	1.1
3	10	12	5	2	1.0

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

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Table AV. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>24-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 13 (Contd)					
4	9	13	5	2	1.1
5	8	13	5	2	1.1
6	7	13	5	2	1.1
7	6	13	5	2	1.1
8	5	13	5	2	1.1
9	4	13	5	2	1.1
10	3	14	7	0	0.5
11	2	14	7	0	0.5
12	1	14	6	1	0.8
WL = 14					
1	13	14	6	1	0.8
2	12	14	6	1	0.8
3	11	14	6	1	0.8
4	10	14	6	1	0.8
5	9	14	6	1	0.8
6	8	14	6	1	0.8
7	7	15	5	2	1.2
8	6	14	5	2	1.2
9	5	14	5	2	1.2
10	4	12	5	3	1.5
11	3	13	5	3	1.5
12	2	13	5	3	1.5
13	1	13	5	3	1.5
WL = 15					
1	14	13	5	3	1.5
2	13	13	5	3	1.5
3	12	13	6	2	1.1
4	11	13	6	2	1.1
5	10	14	6	2	1.3
6	9	14	6	2	1.3

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

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Table AV. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>24-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 15 (Contd)					
7	8	14	6	2	1.3
8	7	14	6	2	1.3
9	6	14	7	1	0.9
10	5	14	7	1	0.9
11	4	14	7	1	0.9
12	3	14	7	1	0.9
13	2	14	7	1	0.9
14	1	14	6	2	1.3
WL = 16					
1	15	14	6	2	1.3
2	14	14	6	2	1.3
3	13	14	6	2	1.3
4	12	14	6	2	1.3
5	11	13	6	3	1.6
6	10	13	6	3	1.6
7	9	13	6	3	1.6
8	8	13	6	3	1.6
9	7	13	6	3	1.6
10	6	13	6	3	1.6
11	5	13	6	3	1.6
12	4	14	6	3	1.7
13	3	14	6	3	1.7
14	2	14	7	2	1.4
15	1	14	7	2	1.4
WL = 17					
1	16	14	6	3	1.7
2	15	14	6	3	1.7
3	14	14	6	3	1.7
4	13	14	7	2	1.4
5	12	14	7	2	1.4

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

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Table AV. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	24-GA	BW	HT	SL	
WL = 17 (Contd)					
6	11	14	7	2	1.4
7	10	14	7	2	1.4
8	9	14	7	2	1.4
9	8	14	7	2	1.4
10	7	14	7	2	1.4
11	6	14	8	1	1.1
12	5	14	8	1	1.1
13	4	14	8	1	1.1
14	3	13	7	3	1.7
15	2	13	7	3	1.7
16	1	13	7	3	1.7
WL = 18					
1	17	14	7	2	1.4
2	16	13	6	4	2.1
3	15	14	6	4	2.2
4	14	14	6	4	2.2
5	13	14	6	4	2.2
6	12	14	6	4	2.2
7	11	14	6	4	2.2
8	10	14	7	3	1.9
9	9	14	7	3	1.9
10	8	14	7	3	1.9
11	7	14	7	3	1.9
12	6	14	7	3	1.9
13	5	14	7	3	1.9
14	4	14	7	3	1.9
15	3	14	8	2	1.6
16	2	14	8	2	1.6
17	1	14	8	2	1.6

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

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Table AV. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	24-GA	BW	HT	SL	Gain (dB)
WL = 19					
1	18	14	7	3	1.9
2	17	14	7	3	1.9
3	16	14	7	3	1.9
4	15	14	7	3	1.9
5	14	14	7	3	1.9
6	13	14	8	2	1.6
7	12	14	8	2	1.6
8	11	14	8	2	1.6
9	10	14	8	2	1.6
10	9	14	8	2	1.6
11	8	14	7	4	2.4
12	7	14	7	4	2.4
13	6	14	7	4	2.4
14	5	14	7	4	2.4
15	4	14	7	4	2.4
16	3	14	7	4	2.4
17	2	14	9	2	1.7
18	1	14	8	3	2.1
WL = 20					
1	19	14	8	2	1.6
2	18	14	7	4	2.4
3	17	14	7	4	2.4
4	16	14	7	4	2.4
5	15	14	7	4	2.4
6	14	14	7	4	2.4
7	13	14	7	4	2.4
8	12	14	7	4	2.4
9	11	14	7	4	2.4
10	10	14	8	3	2.1
11	9	14	8	3	2.1

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

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Table AV. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>24-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 20 (Contd)					
12	8	14	8	3	2.1
13	7	14	8	3	2.1
14	6	14	8	3	2.1
15	5	14	8	3	2.1
16	4	14	8	3	2.1
17	3	14	8	3	2.1
18	2	13	8	4	2.3
19	1	14	8	4	2.5
WL = 21					
1	20	14	7	4	2.4
2	19	14	8	3	2.1
3	18	14	8	3	2.1
4	17	14	8	3	2.1
5	16	14	8	3	2.1
6	15	14	7	5	2.8
7	14	14	7	5	2.8
8	13	14	7	5	2.8
9	12	14	7	5	2.8
10	11	14	7	5	2.8
11	10	14	8	4	2.5
12	9	14	8	4	2.5
13	8	14	8	4	2.5
14	7	14	8	4	2.5
15	6	14	8	4	2.5
16	5	14	8	4	2.5
17	4	14	8	4	2.5
18	3	14	8	4	2.5
19	2	13	8	5	2.8
20	1	14	8	5	3.0

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

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Table AV. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>24-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 22					
1	21	14	7	5	2.8
2	20	14	7	5	2.8
3	19	14	7	5	2.8
4	18	14	7	6	3.3
5	17	14	8	4	2.5
6	16	14	8	4	2.5
7	15	14	8	4	2.5
8	14	14	8	4	2.5
9	13	14	8	4	2.5
10	12	14	8	4	2.5
11	11	14	8	4	2.5
12	10	14	8	4	2.5
13	9	14	8	5	3.0
14	8	14	8	5	3.0
15	7	14	8	5	3.0
16	6	14	9	4	2.7
17	5	14	9	4	2.7
18	4	14	9	4	2.7
19	3	14	9	4	2.7
20	2	14	9	4	2.7
21	1	14	8	6	3.5
WL = 23					
1	22	14	8	4	2.5
2	21	14	8	4	2.5
3	20	14	8	4	2.5
4	19	14	8	4	2.5
5	18	14	8	4	2.5
6	17	14	8	5	3.0
7	16	14	8	5	3.0
8	15	14	8	5	3.0

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

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Table AV. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>24-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 23 (Contd)					
9	14	14	8	5	3.0
10	13	14	8	5	3.0
11	12	14	9	4	2.7
12	11	14	9	4	2.7
13	10	14	9	4	2.7
14	9	14	8	6	3.5
15	8	14	8	6	3.5
16	7	14	9	5	3.1
17	6	14	9	5	3.1
18	5	14	9	5	3.1
19	4	14	9	5	3.1
20	3	14	10	4	2.8
21	2	14	10	4	2.8
22	1	14	10	4	2.8
WL = 24					
1	23	14	8	5	3.0
2	22	14	8	5	3.0
3	21	14	8	5	3.0
4	20	14	8	5	3.0
5	19	14	8	5	3.0
6	18	14	8	5	3.0
7	17	14	8	6	3.5
8	16	14	8	6	3.5
9	15	14	8	6	3.5
10	14	14	8	6	3.5
11	13	14	9	5	3.1
12	12	14	9	5	3.1
13	11	14	9	5	3.1
14	10	14	10	4	2.8
15	9	14	10	4	2.8

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

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Table AV. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>24-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 24 (Contd)					
16	8	14	9	6	3.6
17	7	14	9	6	3.6
18	6	14	9	6	3.6
19	5	14	9	6	3.6
20	4	14	10	5	3.3
21	3	14	10	5	3.3
22	2	14	10	5	3.3
23	1	14	10	5	3.3
WL = 25					
1	24	14	8	6	3.5
2	23	14	8	6	3.5
3	22	14	8	6	3.5
4	21	14	8	6	3.5
5	20	14	9	5	3.1
6	19	14	9	5	3.1
7	18	14	9	5	3.1
8	17	14	9	5	3.1
9	16	14	8	7	4.1
10	15	14	8	7	4.1
11	14	14	9	6	3.6
12	13	14	9	6	3.6
13	12	14	9	6	3.6
14	11	14	10	5	3.3
15	10	14	10	5	3.3
16	9	14	10	5	3.3
17	8	14	10	5	3.3
18	7	14	9	7	4.2
19	6	14	10	6	3.8
20	5	14	10	6	3.8
21	4	14	10	6	3.8

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

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Table AV. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>24-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 25 (Contd)					
22	3	14	10	6	3.8
23	2	14	10	6	3.8
24	1	14	10	6	2.8
WL = 26					
1	25	14	9	5	3.1
2	24	14	8	7	4.1
3	23	14	8	7	4.1
4	22	14	8	7	4.1
5	21	14	9	6	3.6
6	20	14	9	6	3.6
7	19	14	9	6	3.6
8	18	14	9	6	3.6
9	17	14	9	6	3.6
10	16	14	10	5	3.3
11	15	14	9	7	4.2
12	14	14	9	7	4.2
13	13	14	9	7	4.2
14	12	14	10	6	3.8
15	11	14	10	6	3.8
16	10	14	10	6	3.8
17	9	14	11	5	3.5
18	8	14	11	5	3.5
19	7	14	11	5	3.5
20	6	14	10	7	4.3
21	5	14	10	7	4.3
22	4	14	10	7	4.3
23	3	13	10	9	4.8
24	2	14	11	6	4.0
25	1	14	11	6	4.0

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

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Table AV. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>24-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 27					
1	26	14	9	6	3.6
2	25	14	9	6	3.6
3	24	14	9	6	3.6
4	23	14	9	7	4.2
5	22	14	9	7	4.2
6	21	14	9	7	4.2
7	20	14	9	7	4.2
8	19	14	9	7	4.2
9	18	14	9	7	4.2
10	17	14	10	6	3.8
11	16	14	10	6	3.8
12	15	14	10	6	3.8
13	14	14	9	9	5.0
14	13	14	10	7	4.3
15	12	14	10	7	4.3
16	11	14	10	7	4.3
17	10	14	11	6	4.0
18	9	14	11	6	4.0
19	8	14	11	6	4.0
20	7	14	11	6	4.0
21	6	13	10	10	5.2
22	5	13	11	8	4.5
23	4	13	11	8	4.5
24	3	14	11	7	4.5
25	2	14	11	7	4.5
26	1	14	11	7	4.5
WL = 28					
1	27	14	9	7	4.2
2	26	14	9	7	4.2
3	25	14	9	8	4.5

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

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Table AV. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>24-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 28 (Contd)					
4	24	14	9	8	4.5
5	23	14	9	8	4.5
6	22	14	9	8	4.5
7	21	14	9	8	4.5
8	20	14	9	9	5.0
9	19	14	9	9	5.0
10	18	14	10	7	4.3
11	17	14	10	7	4.3
12	16	14	10	7	4.3
13	15	14	10	8	4.7
14	14	14	10	8	4.7
15	13	13	10	10	5.2
16	12	14	10	9	5.1
17	11	14	11	7	4.5
18	10	14	11	7	4.5
19	9	14	11	7	4.5
20	8	13	11	9	4.9
21	7	13	11	9	4.9
22	6	13	11	9	4.9
23	5	13	11	10	5.3
24	4	13	11	10	5.3
25	3	13	11	10	5.3
26	2	13	11	10	5.3
27	1	13	11	11	5.8
WL = 29					
1	28	14	9	8	4.5
2	27	14	9	9	5.0
3	26	14	10	7	4.3
4	25	14	10	7	4.3
5	24	14	10	7	4.3

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

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Table AV. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	24-GA	BW	HT	SL	
WL = 29 (Contd)					
6	23	14	10	7	4.3
7	22	14	10	7	4.3
8	21	14	10	8	4.7
9	20	14	10	8	4.7
10	19	14	10	8	4.7
11	18	14	10	8	4.7
12	17	14	10	9	5.1
13	16	14	11	7	4.5
14	15	14	11	7	4.5
15	14	14	11	7	4.5
16	13	14	11	8	4.9
17	12	14	11	8	4.9
18	11	13	11	10	5.3
19	10	13	11	10	5.3
20	9	13	11	11	5.8
21	8	13	11	11	5.8
22	7	13	11	12	6.2
23	6	14	12	7	4.7
24	5	14	12	7	4.7
25	4	13	12	9	5.1
26	3	13	12	9	5.1
27	2	13	12	9	5.1
28	1	14	12	8	5.1
WL = 30					
1	29	14	10	7	4.3
2	28	14	10	8	4.7
3	27	14	10	8	4.7
4	26	14	10	8	4.7
5	25	14	10	8	4.7
6	24	14	10	8	4.7

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table AV. Mixed 26- and 24-GA Nonloaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>24-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
<u>Gain (dB)</u>					
WL = 30 (Contd)					
7	23	14	10	9	5.1
8	22	14	10	9	5.1
9	21	14	10	9	5.1
10	20	14	11	7	4.5
11	19	14	11	7	4.5
12	18	14	11	8	4.9
13	17	14	11	8	4.9
14	16	14	11	8	4.9
15	15	13	11	10	5.3
16	14	13	11	11	5.8
17	13	13	11	12	6.2
18	12	14	12	7	4.7
19	11	13	12	9	5.1
20	10	13	12	9	5.1
21	9	13	12	10	5.5
22	8	13	12	10	5.5
23	7	13	12	10	5.5
24	6	13	12	10	5.5
25	5	13	12	11	5.9
26	4	13	12	11	5.9
27	3	13	12	11	5.9
28	2	13	12	12	6.3

Notes:

1. Select 600 for TRMT and RCV IMP options. Select N for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Table AW. 19-GA H88 Loaded Cable Without Bridged Taps (Notes)

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)
	BW	HT	SL	
18	1	3	0	0.0
24	5	2	0	0.0
30	5	3	0	0.0
36	5	4	0	0.0
42	5	4	0	0.0
48	5	4	0	0.0
54	4	5	0	0.0
60	6	4	0	0.0
66	5	5	0	0.0
72	6	5	0	0.0
78	6	5	0	0.0
84	6	5	0	0.0
90	5	6	0	0.0
96	6	6	0	0.0
102	6	6	0	0.0
108	6	6	0	0.0
114	5	7	0	0.0
120	5	7	0	0.0
126	5	7	0	0.0
132	6	7	0	0.0
138	6	7	0	0.0
144	6	7	0	0.0
150	5	8	0	0.0
156	5	8	0	0.0
162	5	9	0	0.0
168	5	9	0	0.0
174	5	9	0	0.0
180	5	9	0	0.0
186	5	10	0	0.0
192	5	10	0	0.0

Notes:

1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Table AX. 22-GA H88 Loaded Cable Without Bridged Taps (Notes)

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)
	BW	HT	SL	
18	3	3	0	0.0
24	6	2	0	0.0
30	4	4	0	0.0
36	3	4	1	1.4
42	4	4	1	1.4
48	4	4	1	1.4
54	3	5	1	1.4
60	4	5	1	1.4
66	4	5	1	1.4
72	3	6	1	1.4
78	4	6	1	1.4
84	4	6	1	1.4
90	3	7	1	1.4
96	3	7	1	1.4
102	4	7	1	1.4

Notes:

1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Table AY. 24-GA H88 Loaded Cable Without Bridged Taps (Notes)

Cable Length (kft)	Equalizer Settings			1kHz Equalizer Gain (dB)
	BW	HT	SL	
18	3	4	1	1.4
24	3	4	1	1.4
30	3	4	2	2.6
36	3	5	2	2.6
42	4	5	2	2.6
48	3	6	3	3.7
54	3	6	3	3.7
60	2	7	4	4.7
66	3	7	5	5.6

Notes:

1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
 2. Equalizer gain affects only the channel unit transmit path.
-

Table AZ. 25-GA (MAT) H88 Loaded Cable Without Bridged Taps (Notes)

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)
	BW	HT	SL	
12	15	1	0	0.1
18	15	1	0	0.1
24	15	0	2	2.6
30	15	0	3	3.7
36	15	0	3	3.7
42	15	0	4	4.7
48	15	0	5	5.5
54	15	0	7	7.2
60	15	0	10	9.0

Notes:

1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Table BA. 26-GA H88 Loaded Cable Without Bridged Taps (Notes)

Cable Length (kft)	Equalizer Settings			1 kHz Equalizer Gain (dB)
	BW	HT	SL	
12	8	3	1	1.4
18	5	4	4	3.7
24	5	4	7	7.2
30	6	4	12	10.0
36	5	5	12	10.0
42	6	5	12	10.0
48	6	6	12	10.0

Notes:

1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Table BB. Mixed 24- and 22-GA H88 Loaded Cable Without Bridged Taps (Notes)

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
24-GA	22-GA	BW	HT	SL	
WL = 18					
6	12	4	3	0	0.0
12	6	4	3	1	1.4
WL = 24					
6	18	5	3	0	0.0
12	12	4	3	1	1.4
18	6	5	3	1	1.4
WL = 30					
6	24	2	4	1	1.4
12	18	3	4	1	1.4
18	12	3	4	1	1.4
24	6	3	4	2	2.6
WL = 36					
6	30	4	4	1	1.4
12	24	5	4	1	1.4
18	18	3	5	1	1.4
24	12	1	5	2	2.6
30	6	3	5	2	2.6
WL = 42					
6	36	5	4	1	1.4
12	30	5	4	1	1.4
18	24	4	5	1	1.4
24	18	3	5	2	2.6
30	12	3	5	2	2.6
36	6	4	5	2	2.6
WL = 48					
6	42	5	4	1	1.4
12	36	4	5	1	1.4
18	30	4	5	1	1.4
24	24	4	5	2	2.6
30	18	3	5	2	2.6

Notes:

1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table BB. Mixed 24- and 22-GA H88 Loaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>24-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 48 (Contd)					
36	12	3	5	2	2.6
42	6	2	6	3	3.7
WL = 54					
6	48	4	5	1	1.4
12	42	4	5	1	1.4
18	36	5	5	1	1.4
24	30	4	5	2	2.6
30	24	2	6	2	2.6
36	18	3	6	2	2.6
42	12	2	6	3	3.7
48	6	3	6	3	3.7
WL = 60					
6	54	4	5	1	1.4
12	48	5	5	1	1.4
18	42	3	6	1	1.4
24	36	3	6	2	2.6
30	30	3	6	2	2.6
36	24	3	6	2	2.6
42	18	3	6	3	3.7
48	12	3	6	3	3.7
54	6	2	7	4	4.7
WL = 66					
6	60	5	5	1	1.4
12	54	4	6	1	1.4
18	48	4	6	1	1.4
24	42	3	6	2	2.6
30	36	4	6	2	2.6
36	30	4	6	2	2.6
42	24	2	7	3	3.7
48	18	2	7	3	3.7

Notes:

1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table BB. Mixed 24- and 22-GA H88 Loaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>24-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 66 (Contd)					
54	12	2	7	4	4.7
60	6	3	7	4	4.7
WL = 72					
6	66	4	6	1	1.4
12	60	4	6	1	1.4
18	54	4	6	2	2.6
24	48	4	6	2	2.6
30	42	4	6	2	2.6
36	36	3	7	2	2.6
42	30	3	7	3	3.7
48	24	3	7	3	3.7
54	18	2	7	4	4.7
60	12	2	7	5	5.5
WL = 78					
6	72	4	6	1	1.4
12	66	5	6	1	1.4
18	60	4	6	2	2.6
24	54	3	7	2	2.6
30	48	3	7	2	2.6
36	42	3	7	3	3.7
42	36	3	7	3	3.7
48	30	3	7	3	3.7
WL = 84					
6	78	4	6	1	1.4
12	72	5	6	1	1.4
18	66	3	7	2	2.6
24	60	3	7	2	2.6
30	54	3	7	2	2.6
36	48	3	7	3	3.7
42	42	3	7	3	3.7

Notes:

1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table BB. Mixed 24- and 22-GA H88 Loaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>24-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 90					
6	84	3	7	1	1.4
12	78	3	7	2	2.6
18	72	3	7	2	2.6
24	66	3	7	2	2.6
30	60	3	7	3	3.7
WL = 96					
6	90	4	7	1	1.4
12	84	4	7	2	2.6
18	78	4	7	2	2.6
WL = 102					
6	96	3	7	2	2.6

Notes:

1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Table BC. Mixed 26- and 22-GA H88 Loaded Cable Without Bridged Taps (Notes)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 18					
6	12	2	3	1	1.4
12	6	6	3	2	2.6
WL = 24					
6	18	4	2	1	1.4
12	12	5	3	2	2.6
18	6	5	4	5	5.5
WL = 30					
6	24	4	3	1	1.4
12	18	5	4	2	2.6
18	12	4	4	4	4.7
24	6	4	5	9	8.4
WL = 36					
6	30	4	4	1	1.4
12	24	6	4	1	1.4
18	18	4	5	3	3.7
24	12	3	5	7	7.2
30	6	5	5	12	10.0
WL = 42					
6	36	5	4	1	1.4
12	30	7	4	1	1.4
18	24	5	5	3	3.7
24	18	4	5	6	6.3
30	12	4	5	12	10.0
36	6	6	5	12	10.0
WL = 48					
6	42	5	4	1	1.4
12	36	7	4	1	1.4
18	30	6	5	2	2.6
24	24	5	5	5	5.6
30	18	5	5	11	9.5
36	12	4	6	12	10.0

Notes:

1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table BC. Mixed 26- and 22-GA H88 Loaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	22-GA	BW	HT	SL	
WL = 54					
6	48	4	5	1	1.4
12	42	5	5	2	2.6
18	36	6	5	3	3.7
24	30	4	6	6	6.3
30	24	4	6	11	9.5
36	18	4	6	12	10.0
WL = 60					
6	54	4	5	1	1.4
12	48	5	5	2	2.6
18	42	4	6	4	4.7
24	36	4	6	7	7.2
30	30	5	6	9	8.4
WL = 66					
6	60	5	5	1	1.4
12	54	6	5	2	2.6
18	48	5	6	3	3.7
24	42	5	6	6	6.4
30	36	5	6	12	10.0
WL = 72					
6	66	4	6	1	1.4
12	60	5	6	2	2.6
18	54	5	6	4	4.7
24	48	5	6	7	7.2
WL = 78					
6	72	4	6	1	1.4
12	66	5	6	2	2.6
18	60	5	6	5	5.6

Notes:

1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table BC. Mixed 26- and 22-GA H88 Loaded Cable Without Bridged Taps (Notes) (Contd)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>22-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 84					
6	78	5	6	1	1.4
12	72	5	6	3	3.7
18	66	4	7	5	5.6
WL = 90					
6	84	5	6	1	1.4
12	78	4	7	3	3.7
WL = 96					
6	90	3	7	2	2.6

Notes:

1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Table BD. Mixed 26- and 24-GA H88 Loaded Cable Without Bridged Taps (Notes)

<u>Cable Length (kft)</u>		<u>Equalizer Settings</u>			<u>1 kHz</u>
<u>26-GA</u>	<u>24-GA</u>	<u>BW</u>	<u>HT</u>	<u>SL</u>	<u>Equalizer</u>
					<u>Gain (dB)</u>
WL = 12					
6	6	7	3	1	1.4
WL = 18					
6	12	4	3	2	2.6
12	6	6	3	3	3.7
WL = 24					
6	18	4	3	2	2.6
12	12	4	4	3	3.7
18	6	5	4	6	6.3
WL = 30					
6	24	4	4	2	2.6
12	18	5	4	3	3.7
18	12	3	5	6	6.3
24	6	4	5	12	10.0
WL = 36					
6	30	4	5	2	2.6
12	24	5	5	3	3.7
18	18	4	5	6	6.3
24	12	4	5	12	10.0
30	6	5	5	12	10.0
WL = 42					
6	36	4	5	3	3.7
12	30	5	5	4	4.7
18	24	5	5	6	6.3
24	18	5	5	11	9.5
30	12	4	6	12	10.0
36	6	6	5	12	10.0
WL = 48					
6	42	3	6	3	3.7
12	36	4	6	5	5.6
18	30	4	6	8	7.8

Notes:

1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

Continued on next page

Table BD. Mixed 26- and 24-GA H88 Loaded Cable Without Bridged Taps (Notes) (Contd)

Cable Length (kft)		Equalizer Settings			1 kHz Equalizer Gain (dB)
26-GA	24-GA	BW	HT	SL	
WL = 48 (Contd)					
24	24	4	6	12	10.0
30	18	4	6	12	10.0
36	12	5	6	12	10.0
WL = 54					
6	48	3	6	4	4.7
12	42	4	6	6	6.3
18	36	5	6	7	7.2
24	30	5	6	12	10.0
30	24	5	6	12	10.0
WL = 60					
6	54	3	7	4	4.7
12	48	3	7	7	7.2
18	42	3	7	12	10.0
WL = 66					
6	60	3	7	5	5.6

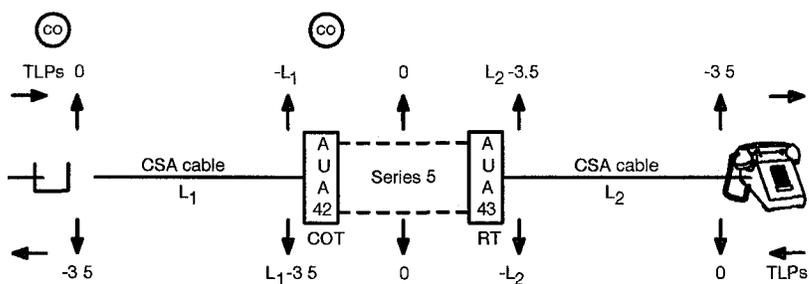
Notes:

1. Select 1200 for TRMT and RCV IMP options. Select L for the L-N option.
2. Equalizer gain affects only the channel unit transmit path.

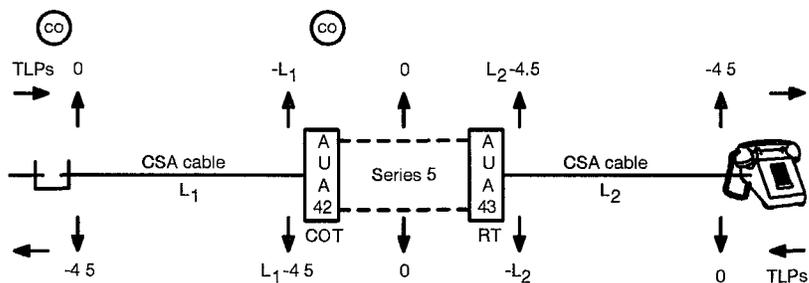
NOTE:

The following circuit applications show typical end-to-end trunk or line loss objectives for each circuit application (for example, 1.1 shows a line loss objective of 3.5 dB).

1 1 FX line, WATS line (to class 5 CO) with trunk cable interface



1 2 WATS line (to class 4 CO) with trunk cable interface



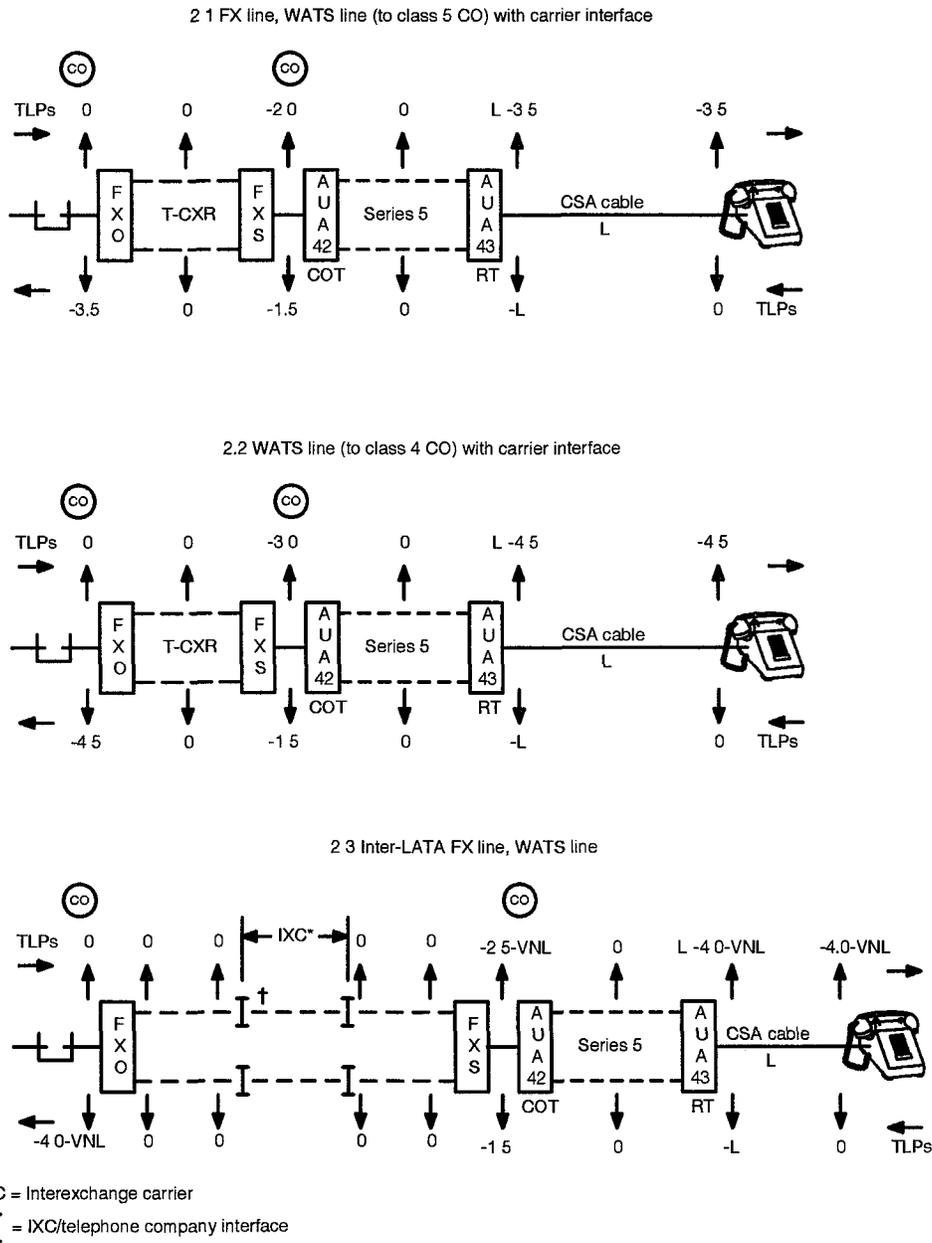
Channel unit functions and options*

	AUA42	AUA43
Function	FXO	FXS
IMP	600	600
SIG option	LS	

* Other settings, BAL, XMT(GN), RCV(GN), and SL, depend on cable makeup
L₁ and L₂ are cable loss

tpa 744448/01

Figure 1. 2-Wire Foreign Exchange or WATS Lines — Application 1



tpa 744449/01

Figure 2. Foreign Exchange or WATS Lines — Application 2

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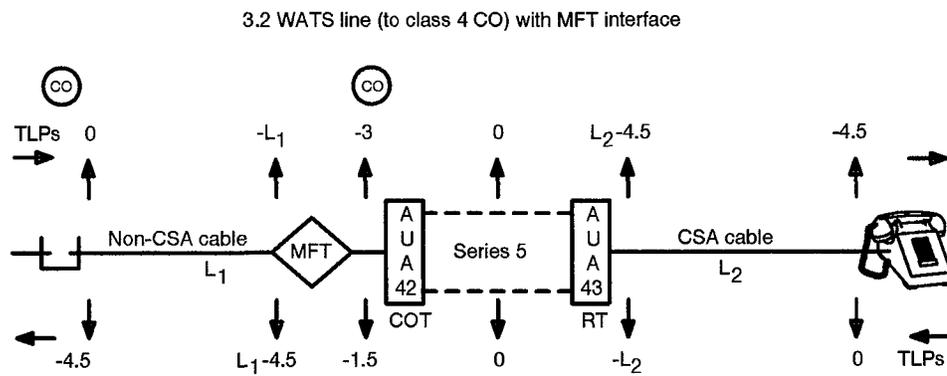
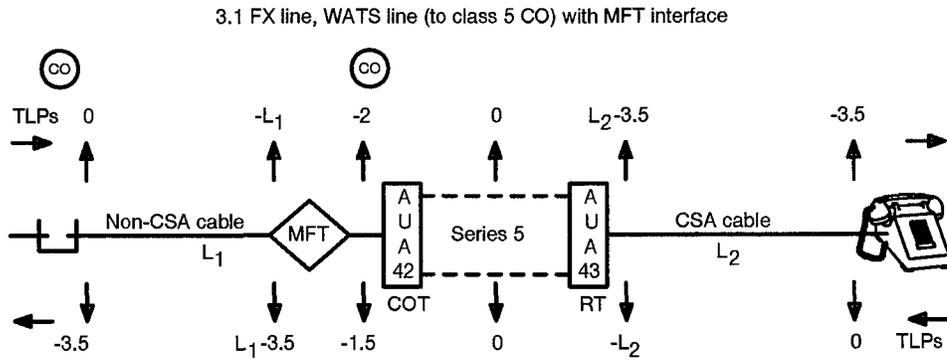
Channel unit functions and options

	<u>AUA42</u>	<u>AUA43</u>
Function	FXO	FXS
IMP	900	600
RCV(GN)	-1.5	*
SL	0	*
SIG option	LS	

* In AUA42, BAL=0, 1, or 2 depending on the length of office wiring, XMT(GN)=2.0 for application 2.1, 3.0 for application 2.2 and 2.5 + VNL (assume the long haul circuit) for application 2.3. In AUA43, settings depend on cable makeup. L₁ and L₂ are cable loss.

tpa 744449/02

Figure 2. Foreign Exchange or WATS Lines — Application 2



Channel unit functions and options

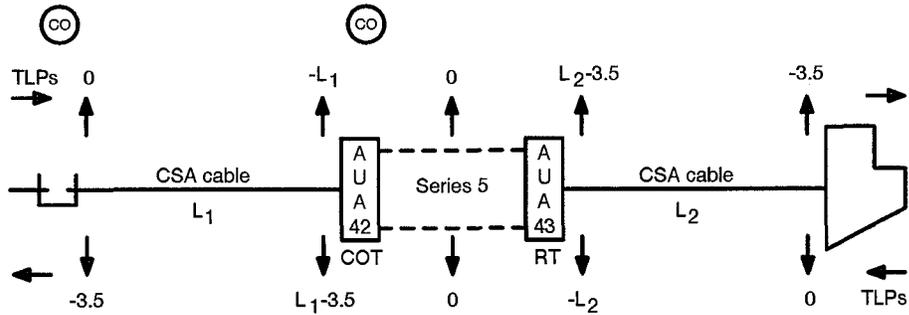
	AUA42	AUA43
Function	FXO	FXS
IMP	900	600
RCV(GN)	-1.5	*
SL	0	*
SIG option	LS	

* In AUA42, BAL=0, 1, or 2 depending on the length of office wiring, XMT(GN)=2.0 for application 3.1, 3.0 for application 3.2. In AUA43, settings depend on cable makeup. L₁ and L₂ are cable loss.

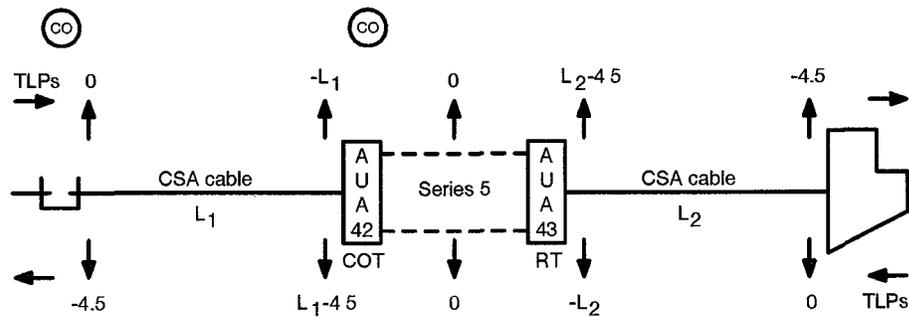
tpa 744450/01

Figure 3. Foreign Exchange or WATS Lines — Application 3

4.1 FX trunk, WATS trunk (to class 5 CO) with trunk cable interface



4.2 WATS trunk (to class 4 CO) with trunk cable interface



Channel unit functions and options*

	AUA42	AUA43
Function	FXO	FXS
IMP	600	600
SIG option	GS	

*Other settings, BAL, XMT(GN), RCV(GN), and SL, depend on cable makeup.
L₁ and L₂ are cable loss.

tpa 744451/01

Figure 4. Foreign Exchange or WATS Trunks — Application 4

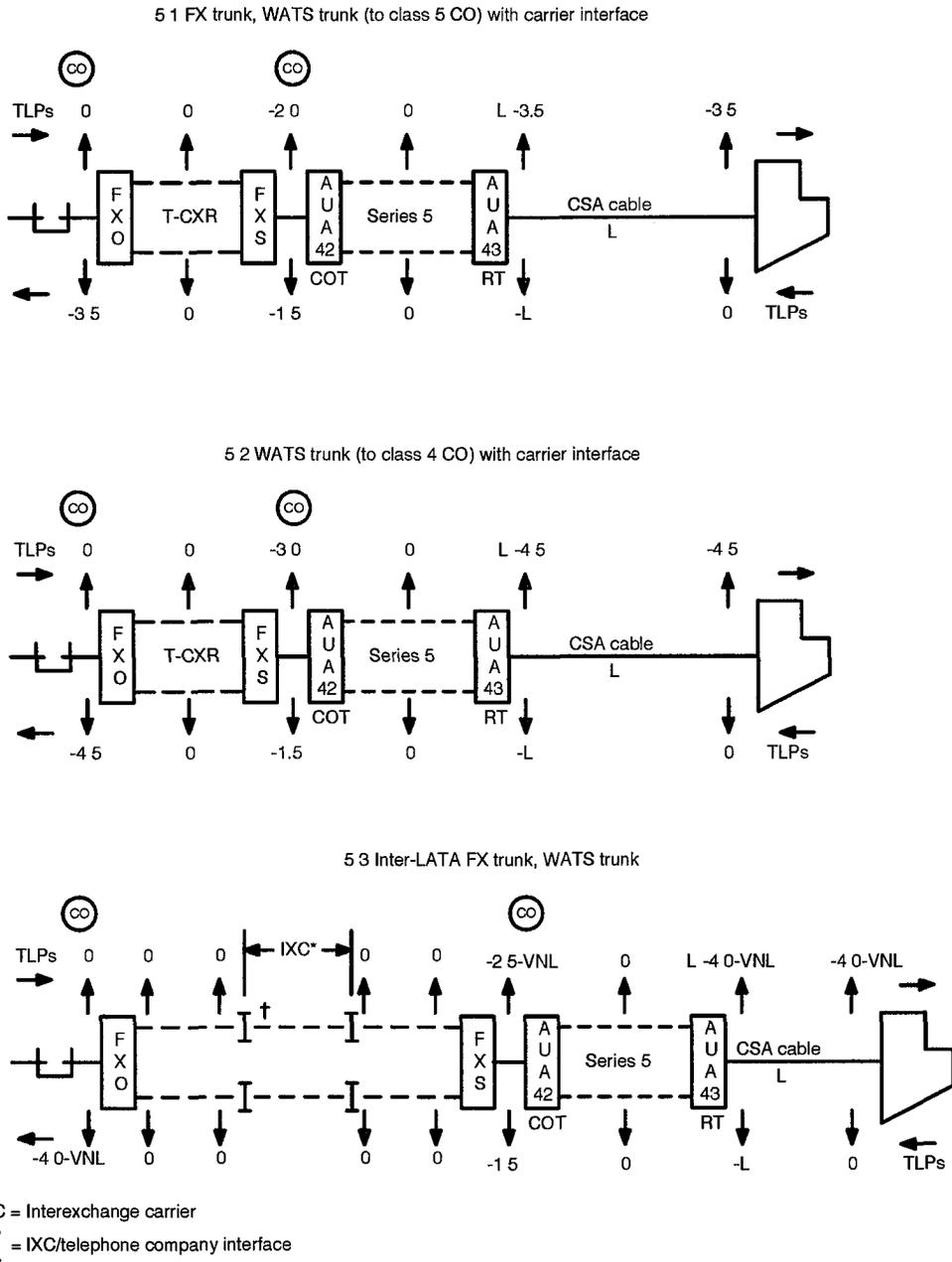


Figure 5. Foreign Exchange or WATS Trunks — Application 5

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Continued

Channel unit functions and options

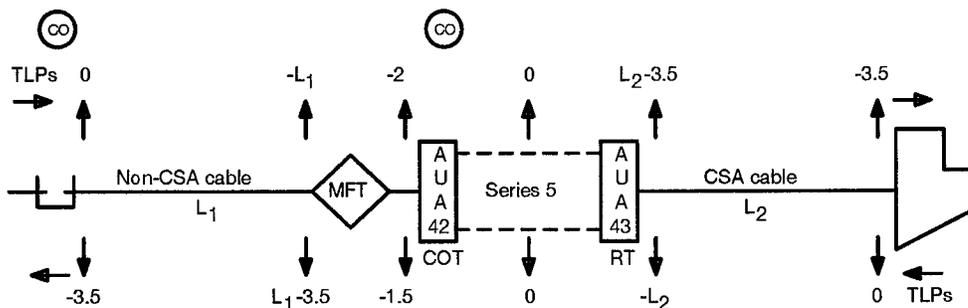
	<u>AUA42</u>	<u>AUA43</u>
Function	FXO	FXS
IMP	900	600
RCV(GN)	-1.5	*
SL	0	*
SIG option	GS	

*In AUA42, BAL=0, 1, or 2 depending on the length of office wiring,
XMT(GN)=2.0 for APP.(5.1), 3.0 for APP.(5.2) and 2.5 + VNL (assume the
long haul circuit) for APP. (5.3). In AUA43, settings depend on cable makeup
L₁ and L₂ are cable loss.

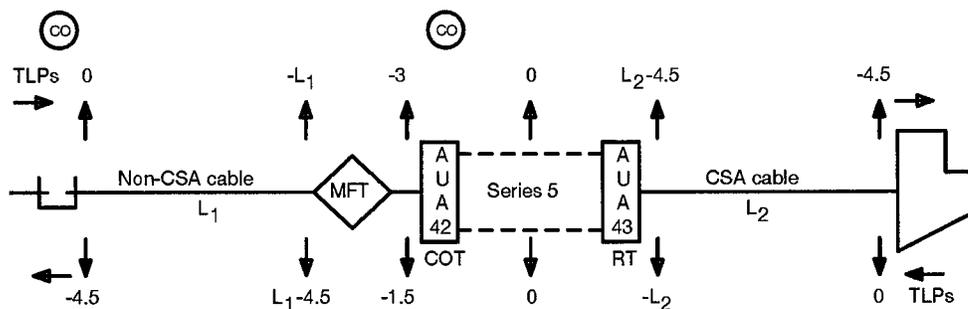
tpa 744452/02

Figure 5. Foreign Exchange or WATS Trunks — Application 5

6.1 FX trunk, WATS trunk (to class 5 CO) with MFT interface



6.2 WATS trunk (to class 4 CO) with MFT interface



Channel unit functions and options

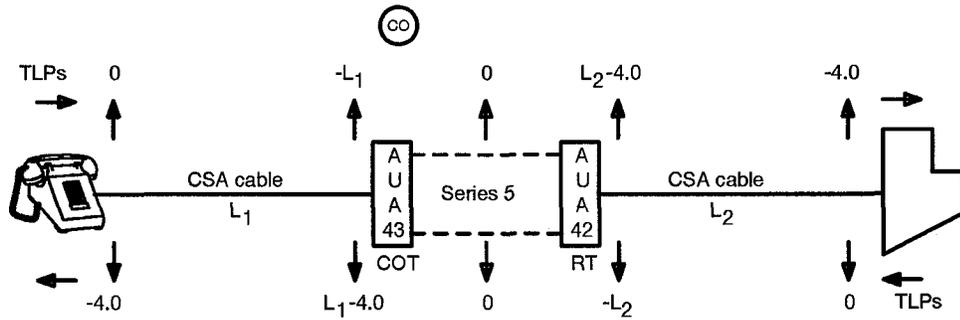
	AUA42	AUA43
Function	FXO	FXS
IMP	900	600
RCV(GN)	-1.5	*
SL	0	*
SIG option	GS	

* In AUA42, BAL=0, 1 or 2 depending on the length of office wiring, XMT(GN)=2.0 for application 6.1, 3.0 for application 6.2 in AUA43, settings depend on cable makeup. L₁ and L₂ are cable loss.

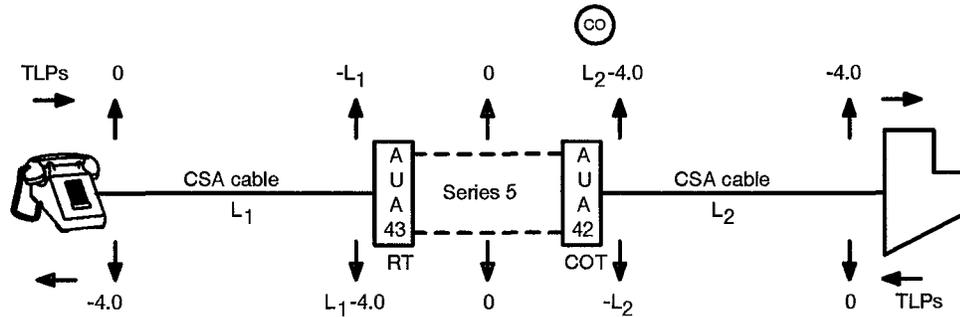
tpa 744453/01

Figure 6. Foreign Exchange or WATS Trunks — Application 6

7.1 Intraoffice OPS line



7.2 Intra-office OPS line



*Channel unit functions and options

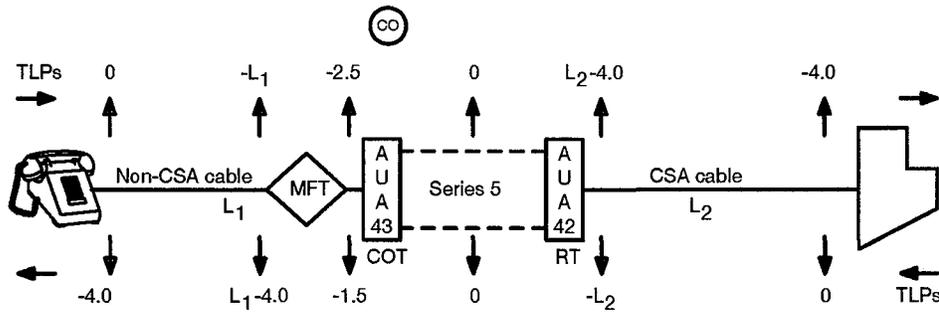
	AUA42	AUA43
Function	FXO	FXS
IMP	600	600
SIG option	LS	

* Other settings, BAL, XMT(GN), RCV(GN), and SL, depend on cable makeup. L₁ and L₂ are cable loss.

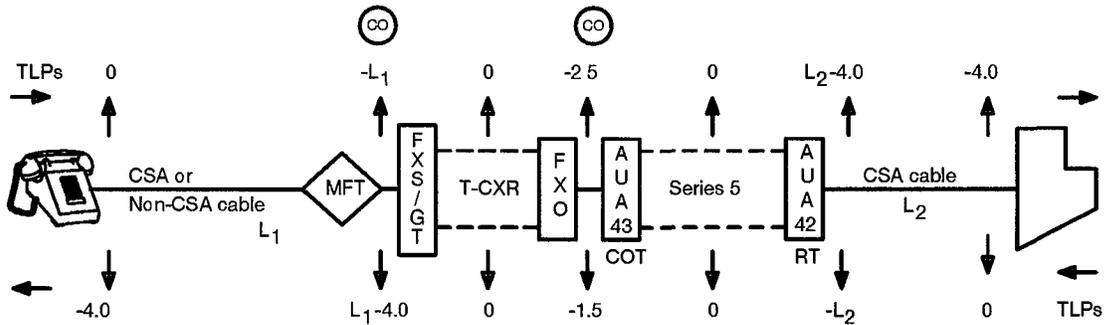
tpa 744454/01

Figure 7. Off-Premises Station Lines — Application 7

8.1 Intra-office OPS line with MFT interface



8.2 Intra-office OPS line with carrier interface



Channel unit functions and options

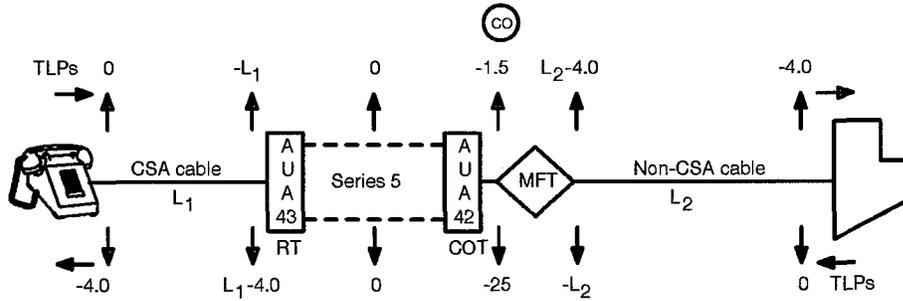
	AUA42	AUA43
Function	FXO	FXS
IMP	600	900
XMT(GN)	*	2.5
RCV(GN)	*	-1.5
SL	*	0
SIG option	LS	

* In AUA43, BAL=0, 1, or 2 depending on the length of office wiring. Other settings in AUA42 depend on cable makeup. L₁ and L₂ are cable loss.

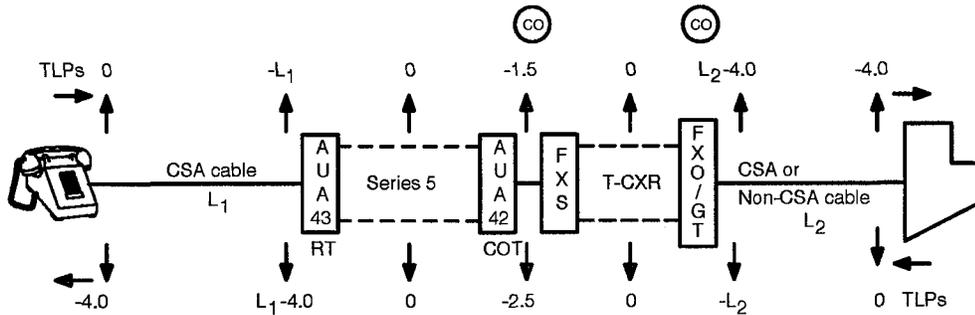
tpa 744455/01

Figure 8. Off-Premises Station Lines — Application 8

9.1 Intra-office OPS line with MFT interface



9.2 Interoffice OPS line with carrier interface



Channel unit functions and options

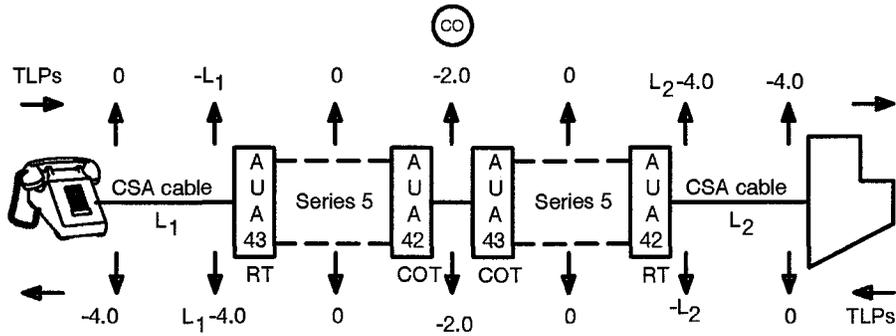
	AUA43	AUA42
Function	FXS	FXO
IMP	600	900
XMT(GN)	*	2.5
RCV(GN)	*	-1.5
SL	*	0
SIG option		LS

* Settings in AUA43 depend on cable makeup. In AUA42, BAL=0, 1, or 2 depending on the length of office wiring. L₁ and L₂ are cable loss.

tpa 744456/01

Figure 9. Off-Premises Station Lines — Application 9

10. Interoffice OPS line with Series 5 back-to-back



Channel unit functions and options

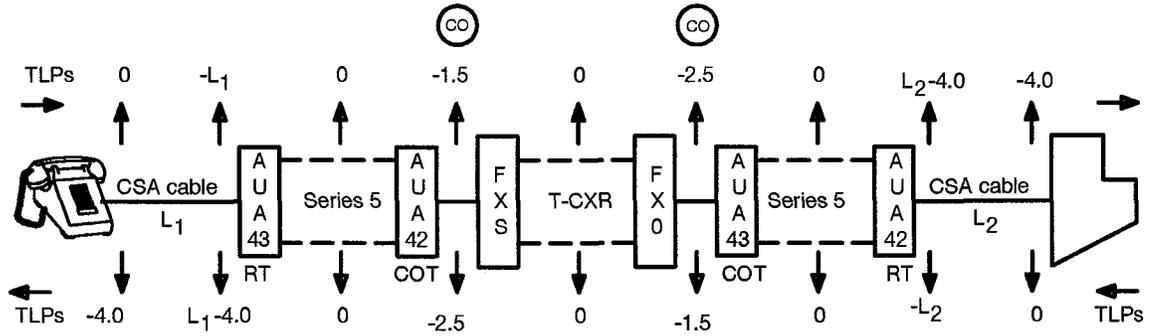
	RT AUA43	COT AUA42	COT AUA43	RT AUA42
Function	FXS	FX0	FXS	FX0
IMP	600	900	900	600
XMT(GN)	*	2.0	2.0	*
RCV(GN)	*	-2.0	-2.0	*
SL	*	0	0	*
SIG option		LS		LS

* Other settings depend on cable makeup or length of office wiring.
L₁ and L₂ are cable loss.

tpa 744457/01

Figure 10. Off-Premises Station Lines — Application 10

11. Interoffice OPS line with carrier interface



Channel unit functions and options

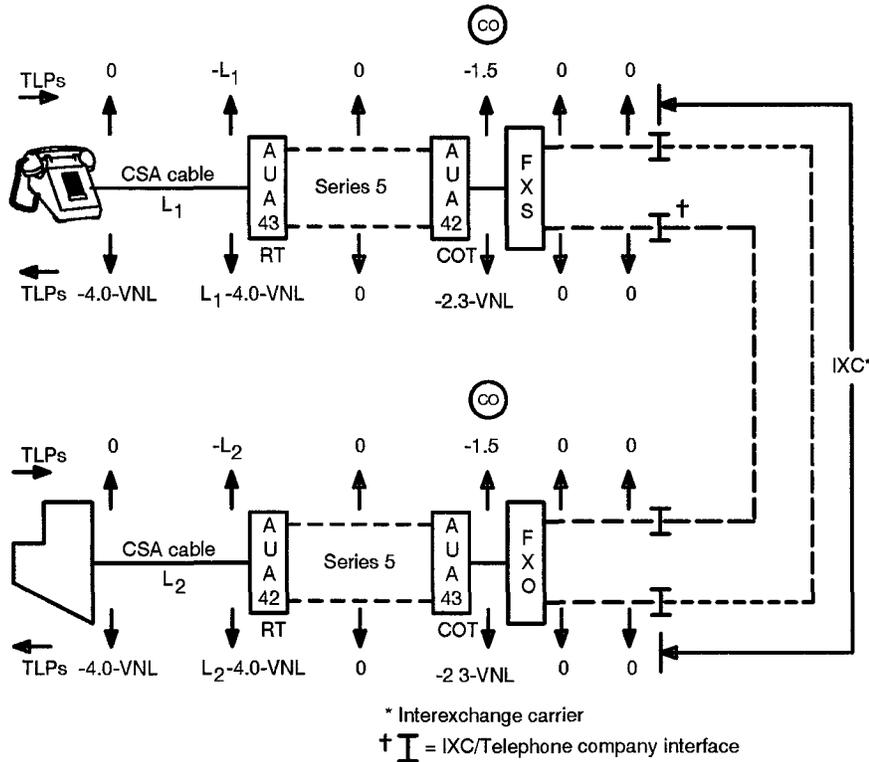
	RT AUA43	COT AUA42	COT AUA43	RT AUA42
Function	FXS	FX0	FXS	FX0
IMP	600	900	900	600
XMT(GN)	*	2.5	2.5	*
RCV(GN)	*	-1.5	-1.5	*
SL	*	0	0	*
SIG option		LS		LS

* Other settings depend on cable makeup or length of office wiring.
L₁ and L₂ are cable loss.

tpa 744458/01

Figure 11. Off-Premises Station Lines — Application 11

12. Inter-LATA OPS line



Channel unit functions and options

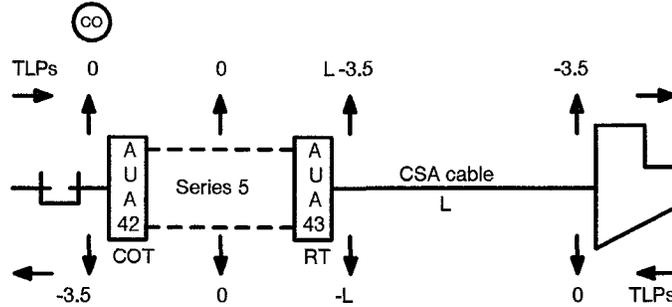
	RT AUA43	COT AUA42	COT AUA43	RT AUA42
Function	FXS	FX0	FXS	FX0
IMP	600	900	900	600
XMT(GN)	*	2.5+VNL	2.5+VNL	*
RCV(GN)	*	-1.5	-1.5	*
SL	*	0	0	*
SIG option		LS		LS

* Other settings depend on cable makeup or length of office wiring
 It is assumed that the circuit is a long haul circuit.
 L₁ and L₂ are cable loss.

tpa 744459/01

Figure 12. Off-Premises Station Lines — Application 12

13. PBX-CO trunk with toll diversion



Channel unit functions and options

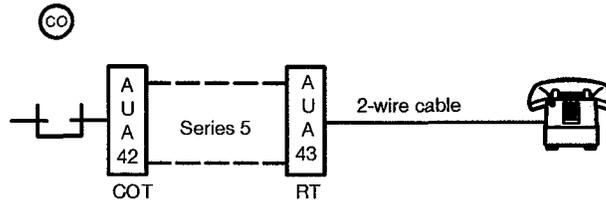
	AUA42	AUA43
Function	FXO	FXS
IMP	900	600
XMT(GN)	0	*
RCV(GN)	-3.5	*
SL	0	*
TD	YES	
SIG option	GS	

* In AUA42, BAL = 0, 1, or 2 depending on the length of the office wiring. Settings in AUA43 depend on cable makeup. L = cable loss. If locally-switched special service circuit design is desired, select balance settings BAL = 0 for AUA42 and 15 for AUA43, and slope settings XMT(GN) = 0, RCV(GN) = 0, and SL = 7 for both units.

tpa 744460/01

Figure 13. PBX-CO Trunks with Toll Diversion — Application 13

14. POTS line with on-hook transmission

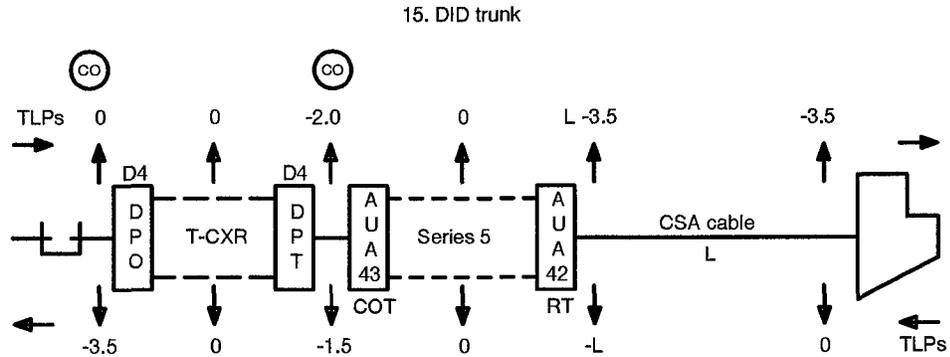


Channel unit functions and options

	AUA42	AUA43
Function	FX0	FXS
IMP	900	600
BAL	0	15
XMT(GN)	0	0
RCV(GN)	0	0
SL	0	0
OHT	YES	YES
SIG option	LS	

tpa 744461/01

Figure 14. POTS Lines — Application 14



Channel unit functions and options

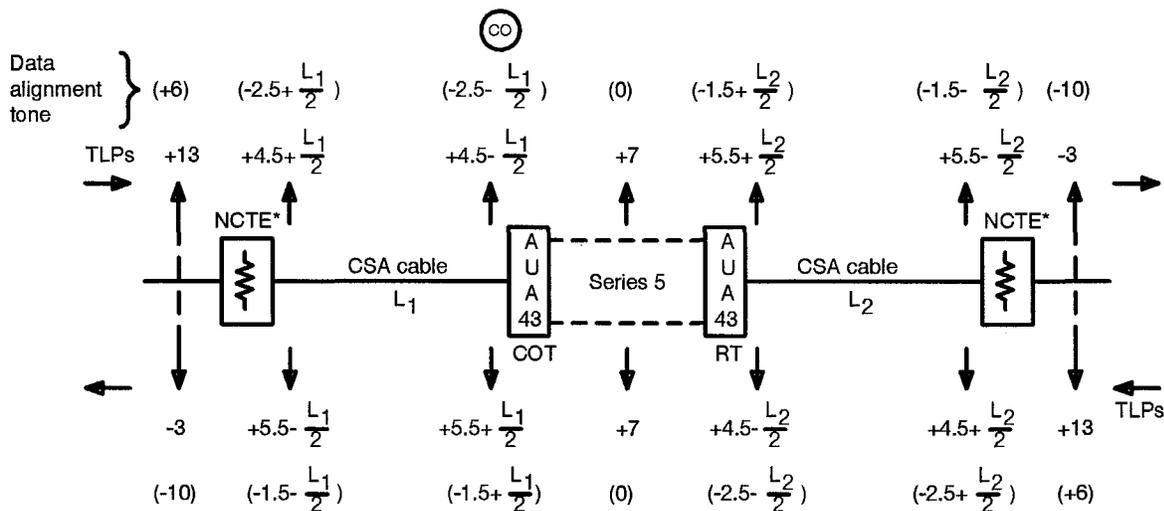
	AUA43	AUA42
Function	DPO	DPT
IMP	900	600
XMT(GN)	2.0	*
RCV(GN)	-1.5	*
SL	0	*

* In AUA43, BAL = 0, 1, or 2 depending on the length of office wiring, settings in AUA42 depend on cable makeup. L = cable loss. If locally-switched special service circuit design is desired, use AUA36 and AUA56 DID channel units. Signaling is the same on either circuit.

tpa 744462/01

Figure 15. DID Trunks — Application 15

16. Intra-office 2W voiceband alarm or private line data



*Network channel terminating equipment

Channel unit functions and options†

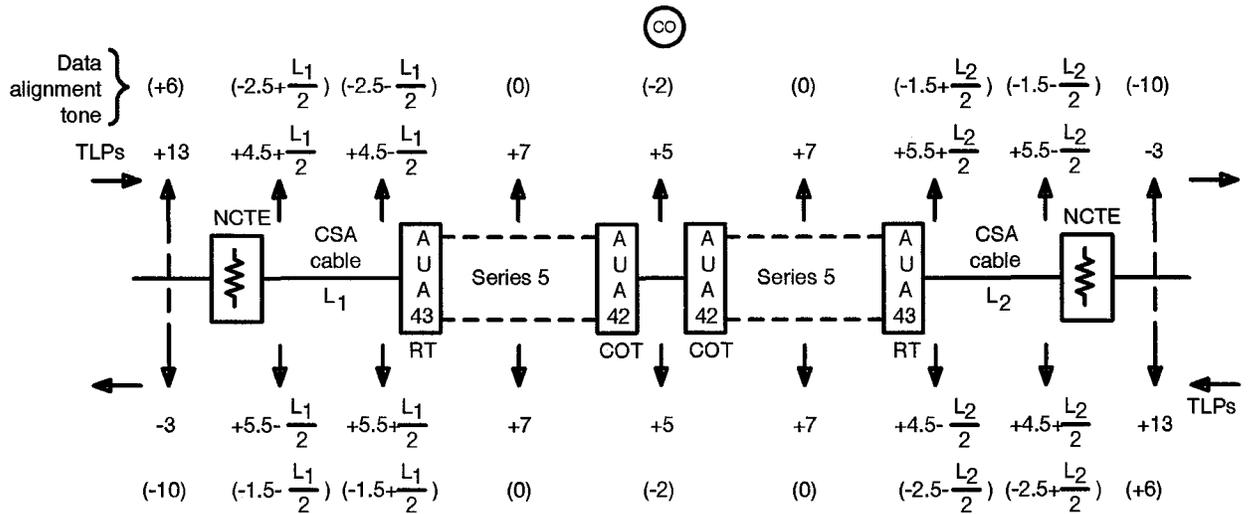
	AUA43	AUA43
Function	TO	TO
IMP	600	600

† Other settings, BAL, XMT(GN), RCV(GN), and SL, depend on cable makeup. AUA43 channel units are used in both COT and RT to provide sealing current. L_1 and L_2 are cable loss.

tpa 744463/01

Figure 16. 2-Wire Voiceband Alarm or Private Line Data — Application 16

17. Intraoffice 2W voiceband alarm or private line data with Series 5 back-to-back



Channel unit functions and options

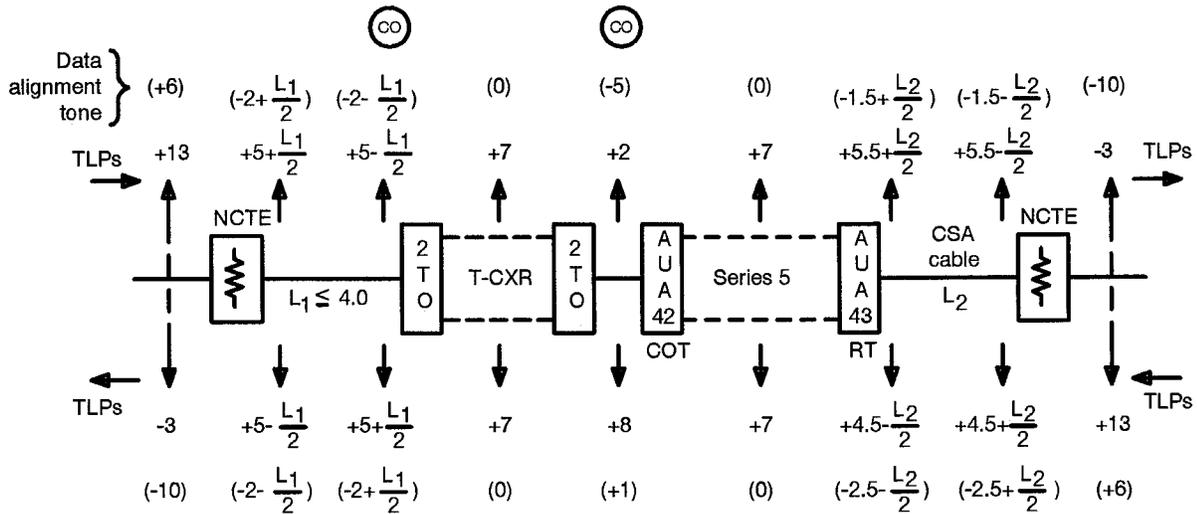
	RT	COT	RT	COT
	AUA43	AUA42	AUA42	AUA43
Function	TO	TO	TO	TO
IMP	600	900	900	600
XMT(GN)	*	2.0	2.0	*
RCV(GN)	*	-2.0	-2.0	*
SL	*	0	0	*

* In both AUA42 units, BAL = 0, 1, or 2 depending on the length of office wiring. Settings in AUA43 units depend on cable makeup. L₁ and L₂ are cable loss.

tpa 74464/01

Figure 17. 2-Wire Voiceband Alarm or Private Line Data — Application 17

18. Interoffice 2W voiceband alarm or private line data with carrier interface



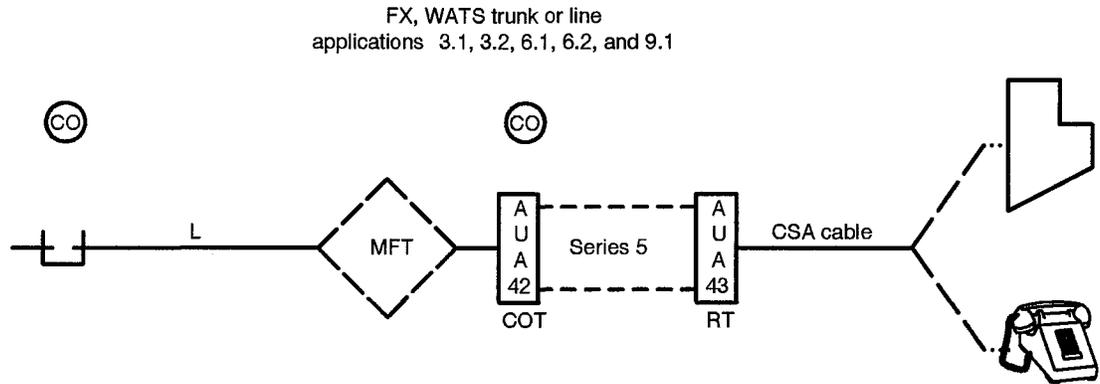
Channel unit functions and options

	AUA42	AUA43
Function	TO	TO
IMP	900	600
XMT(GN)	5.0	*
RCV(GN)	1.0	*
SL	0	*

* In the AUA42 unit, BAL = 0, 1, or 2 depending on the length of office wiring. Settings in AUA43 units depend on cable makeup. L_1 and L_2 are cable loss. Note that L_1 is restricted to no more than 4.0 dB for D4 2TO unit. If D3 2TO is used, L_1 is limited to 2.5 dB of loss.

tpa 744465/01

Figure 18. 2-Wire Voiceband Alarm or Private Line Data — Application 18



DC Resistance	Required MFT Unit	
	2-2 Terminal Repeater	Signaling Unit
L ≤ 750	None	None
L > 750	PA/PB/PG*	LSR/LSO†
	Or Combined Function Unit GG/GH/GK/GL‡	

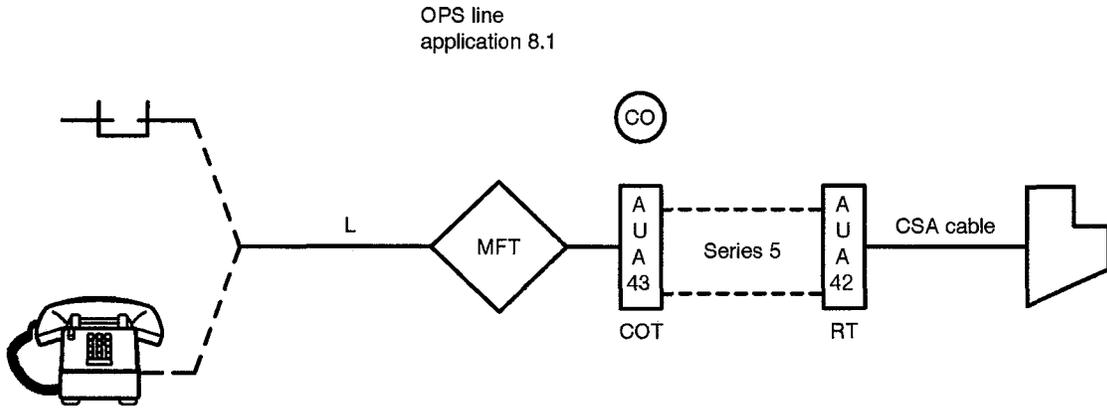
* The A side (with compromise balance network) should face the AUA42 unit, and the B side should face the interoffice cable. The "REVERSED" signaling mode should be selected, that is, RV = RV and RV/T = RV/T.

† The LSR signaling unit is needed for dial pulse correction. An LSO unit can also be used if the circuit requires loop-start only. L must be less than or equal to the signaling range of the LSR/LSO.

‡ The choice of a combined function unit depends on LS/GS signaling and loaded/nonloading cable. In these applications, the A side should face the interoffice cable, and the B side should face the AUA42. The signaling switch NOR/RV should be set to NOR.

tpa 744466/01

Figure 19. Metallic Facility Terminal Interface: FX or WATS Trunk or Line



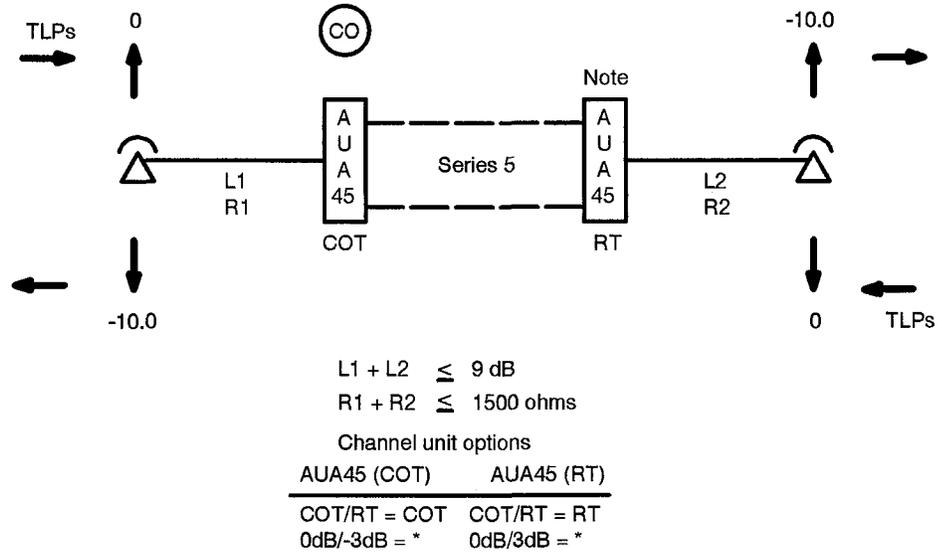
DC Resistance	Required MFT Unit	
	2-2 Terminal Repeater	Signaling Unit
L (ohms) (Note)		
$L \leq 750$	None	None
$750 < L \leq 750$	PA/PB/PG*	None

Note: L must include the DC resistance of the terminal repeater, if used.

* The A side (with compromise balance network) should face the AUA43 unit and the B side should face the loop or interoffice cable. The "through" signaling mode should be selected, that is, RV = NOR and RV/T = RV/T.

tpa 744467/01

Figure 20. Metallic Facility Terminal Interface: OPS Line

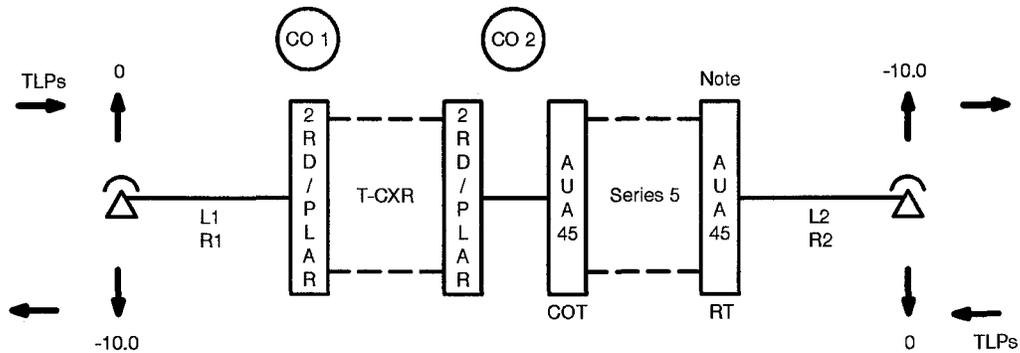


Note: When only one of the channels on the AUA45 is placed in service, the loss switches for the unterminated channel on both the COT and RT units must be set to the -3 dB position (that is, 6 dB end-to-end loss). This will prevent the other channel from singing. All unterminated AUA45 channels must be set for an end-to-end loss of 6 dB.

* Set the 0dB/-3dB switch on the COT and RT AUA45 channel units so that the sum of L1 + L2 + (COT channel unit loss) + (RT channel unit loss) is as close to the circuit design loss objective (10) as possible.

tpa 776562/01

Figure 21. 2-Wire Point-to-Point Manual Ringdown Application



$$L1 + L2 \leq 9 \text{ dB}$$

$$R1 + R2 \leq 1500 \text{ ohms}$$

Channel unit options

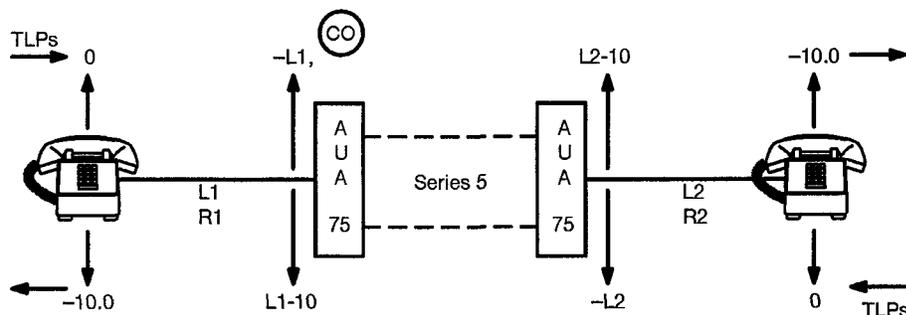
D4 2RD/PLAR (CO 1)	D4 2RD/PLAR (CO 1)	AUA45 (COT)	AUA45 (RT)
J2, J3, J4, J6, J8, J9 = WH exposed S6 M1 & M2 = BLK exposed S7 & S8 = All WH NUM covered TRMT ATTN = * RCV ATTN = *	J2, J3, J4, J6, J8, J9 = WH exposed S6 M1 & M2 = BLK exposed S7 & S8 = All WH NUM covered TRMT ATTN = * RCV ATTN = *	COT/RT = COT 0dB/-3dB = 0dB	COT/RT = RT 0dB/3dB = 0dB

Note: When only one of the channels on the AUA45 is placed in service, the loss switches for the unterminated channel on both the COT and RT units must be set to the -3 dB position (that is, 6 dB end-to-end loss). This will prevent the other channel from singing. All unterminated AUA45 channels must be set for an end-to-end loss of 6 dB.

* The levels for the TRMT and RCV attenuators for the D4 units should be set according to the cable loss at each end of the circuit as if the Series 5 system were not in the circuit.

tpa 776563/01

Figure 22. 2-Wire Point-to-Point Manual Ringdown — Tandem Application



$$\begin{aligned}
 L1 + L2 &\leq 9 \text{ dB} \\
 R1 &\leq 1300 \text{ ohms} \\
 R2 &\leq 1300 \text{ ohms}
 \end{aligned}$$

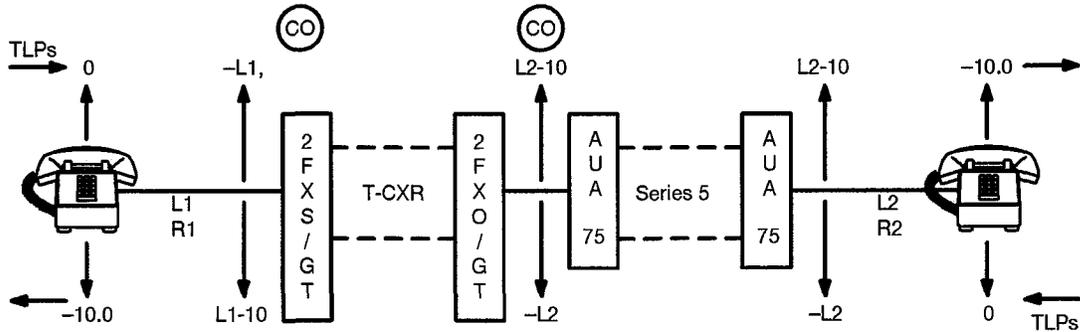
Channel unit options

AUA75 (COT)	AUA75 (RT)
COT/RT = COT	COT/RT = RT
D3/D4 = D4	D3/D4 = D4
0dB/-3dB = *	0dB/-3dB = *

* Set the 0 dB/-3 dB switches on the AUA75 channel units so that the sum of L1 + L2 + (COT channel units loss) + (RT channel units loss) is as close to the design loss objective (10 dB) as possible. Do not exceed 10 dB of loss.

tpa 783991/01

Figure 23. 2-Wire Point-to-Point Automatic Ringdown Application



$$L1 + L2 \leq 9 \text{ dB}$$

$$R1 \leq 1300 \text{ ohms}$$

$$R2 \leq 1300 \text{ ohms}$$

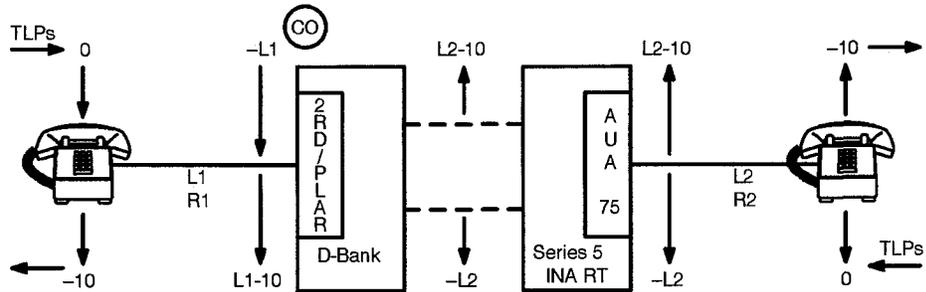
Channel unit options

D4 2FXS/GT	D4 2FXO/GT	AUA 75 (COT)	AUA 75 (RT)
S1 (LBOC) = as needed	S1 (LBOC) = as needed	COT/RT = COT	COT/RT = RT
S2 (SLOPE) = as needed	S2 (SLOPE) = as needed	D3/D4 = D4	D3/D4 = D4
J2, J3, J6 = loop dependent	J2 (LX), J6 = loop dependent	0dB/-3dB = 0dB	0dB/-3dB = 0dB
S6 (R/R1) = loop dependent	S6 (R/R1) = loop dependent		
S5 (R2) = loop dependent	R2, Z, L/NL = loop dependent		
S3 (Z) = loop dependent	J3 (LS) = white		
S4 (L/NL) = loop dependent	J4 (GS), RS/RG = black		
	G = cut		
TRMT ATTEN = 9-L1*	TRMT ATTEN = 9-L2*		
RCV ATTEN = 16-L1*	RCV ATTEN = 16-L2*		

* The levels for the TRMT and RCV attenuators for the D4 channel units are set according to the cable loss at each end of the circuit as if the Series 5 channel were not in the circuit. The overall loss (loop loss plus D4 channel loss) is to be as close to the design loss objective (10 dB) as possible. Do not exceed 10 dB of loss. The "as needed" and "loop dependent" options are selected based on the loop gauge, cable type, and loop length as specified in existing procedures.

tpa 783993/01

Figure 24. 2-Wire Point-to-Point Automatic Ringdown with Carrier Interface



$$L1 + L2 \leq 9 \text{ dB}$$

$$R1 \leq 1300 \text{ ohms}$$

$$R2 \leq 1300 \text{ ohms}$$

Channel unit options (Note)

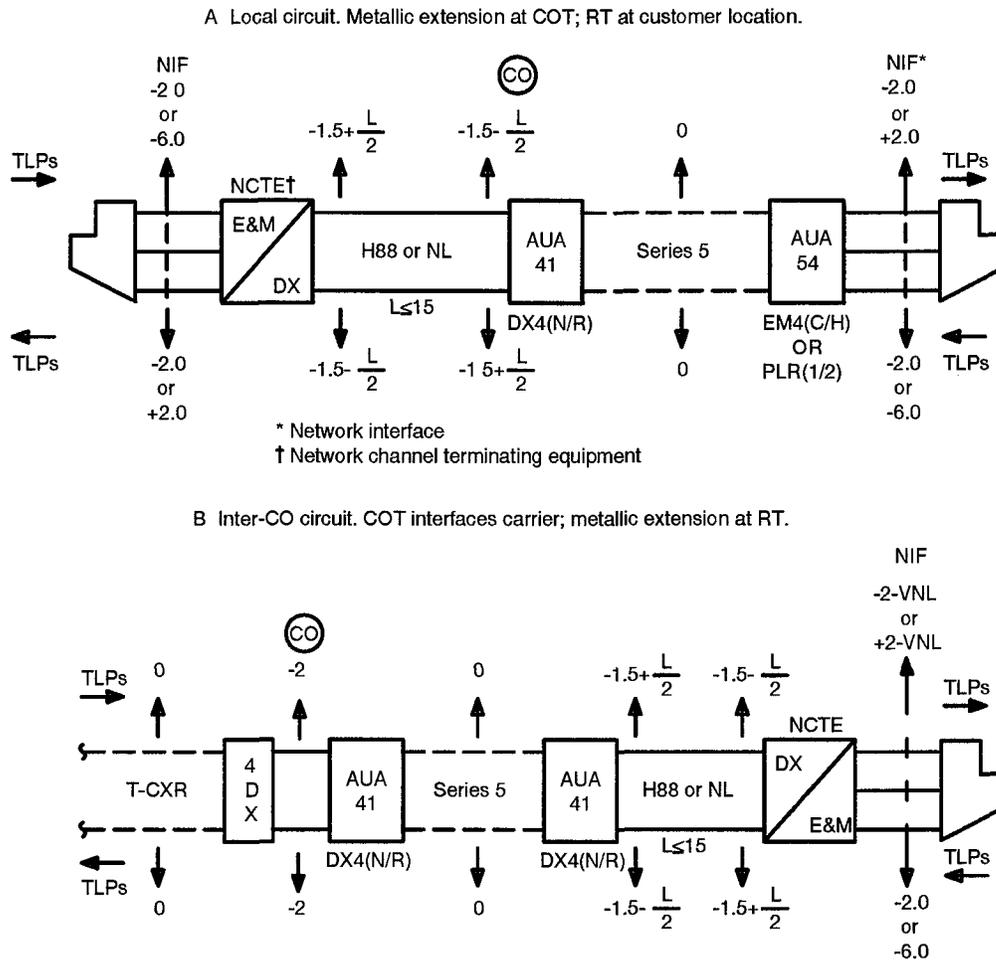
D4 2RD/PLAR	AUA75 (RT)
M(1,2) = white/white	COT/RT = RT
S7,S8 = all white	D3/D4 = D4
J2(AC/DC) = white	0dB/-3dB = 0dB
J3,J4,J8,J9 = black	
J6(F) = as needed	
J2(S) = white	
TRMT ATTEN = 19-(L1 + L2)*	
RCV ATTEN = 10-(L1 + L2)*	

Note: If a D3 bank is used instead of a D4 bank, the AUA75 is bit stream compatible with the D3 2WPLAR CU when D3 compatibility is selected on an AUA75. Circuit design will be very similar to the above example. If only one of the channels on the AUA75 is in service, a D3 2WPLAR CU MUST be plugged into the empty slot of the D3 bank corresponding to the channel not in service. This will prevent the unterminated AUA75 channel from *ringing falsely*. There is no need to connect a phone to the unused AUA75 channel or to the unused D3 PLAR CU. Also, if a D3 bank is used, it is advisable to have the circuits go through a DACS to sort out channel numbering differences between the SLC Series 5 Carrier System and the D3 banks.

* The levels for the TRMT and RCV attenuators for the D4 channel unit should be set according to the combined cable loss at both ends of the circuit with the understanding that there is 0 dB loss through the AUA75. The overall loss (loop loss plus D4 channel loss) is to be as close to the design loss objective (10 dB) as possible. Do not exceed 10 dB of loss.

tpa 783992/01

Figure 25. 2-Wire Point-to-Point Automatic Ringdown with Bit stream Interface



tpa 744468/01

Figure 26. 4-Wire VF Applications — Tie Trunk Arrangements

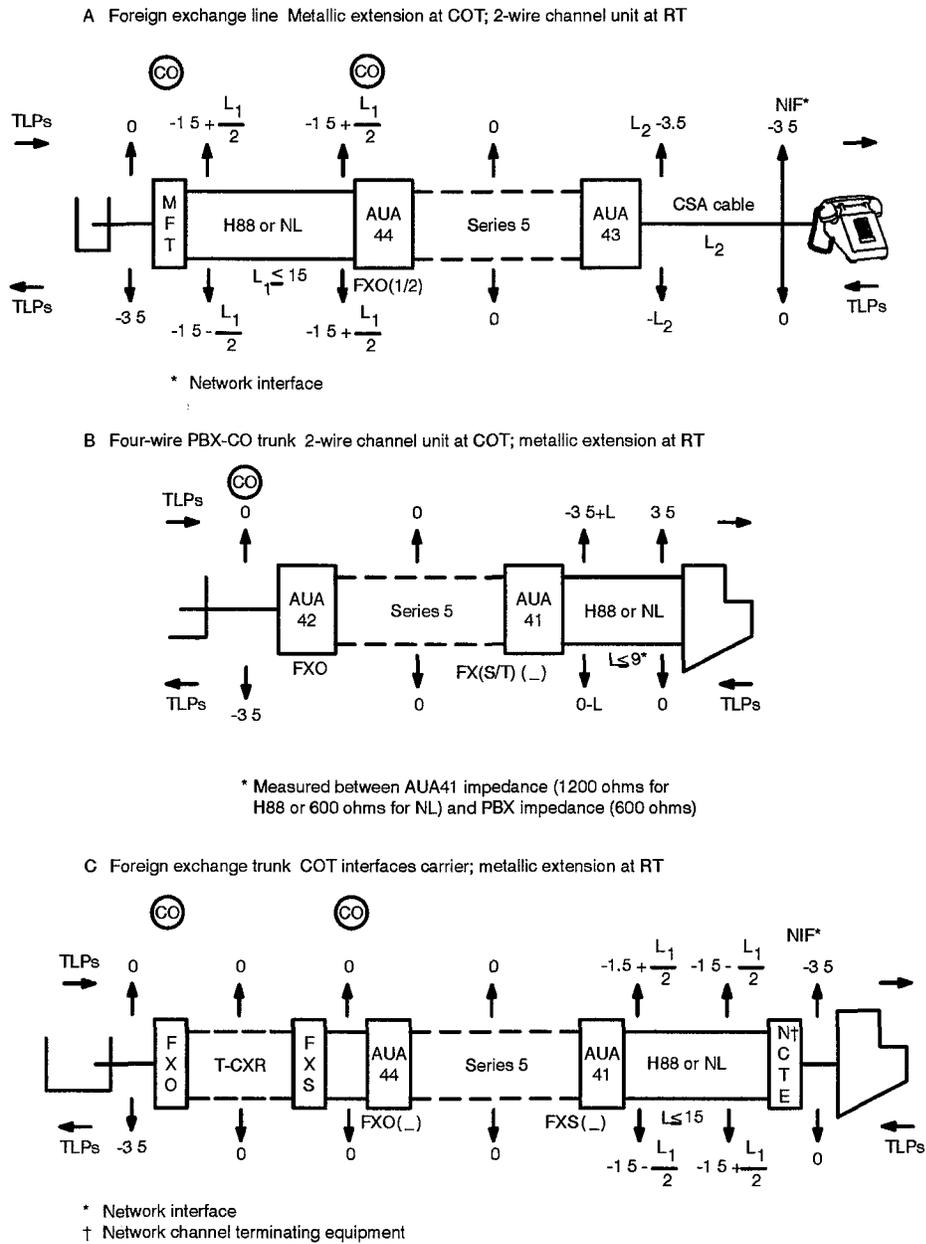
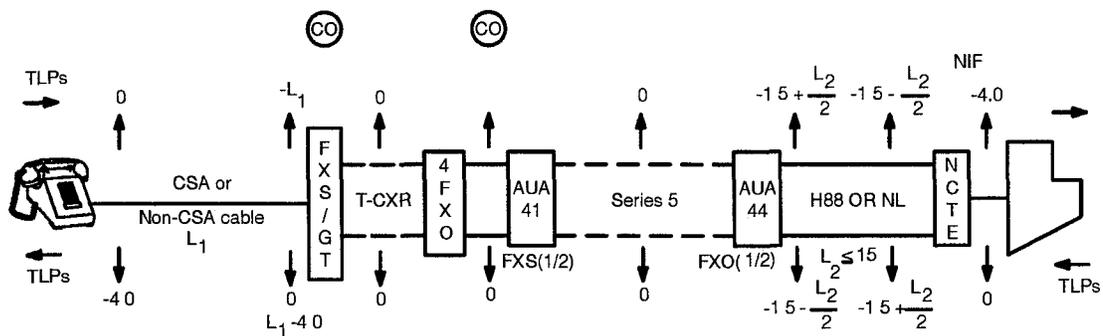


Figure 27. Loop-Start/Ground-Start Arrangements

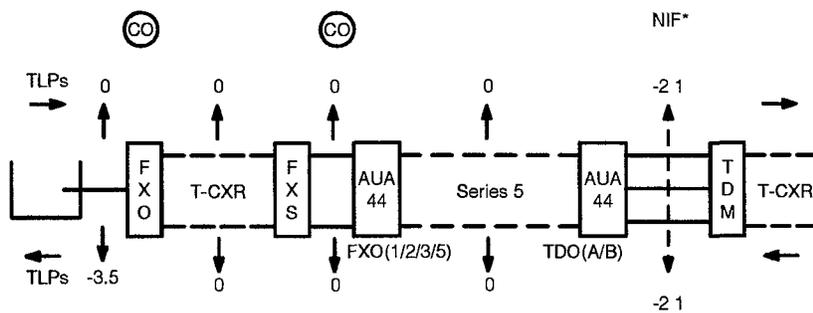
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Continued

D Off premises station COT interfaces carrier; metallic extension at RT.



E Foreign exchange trunk or line to interexchange carrier
COT interfaces carrier; RT interfaces IXC using tandem interface



* Network interface

tpa 744469/02

Figure 27. Loop-Start/Ground-Start Arrangements

Inter-CO circuit. COT interfaces carrier; metallic extension at RT.

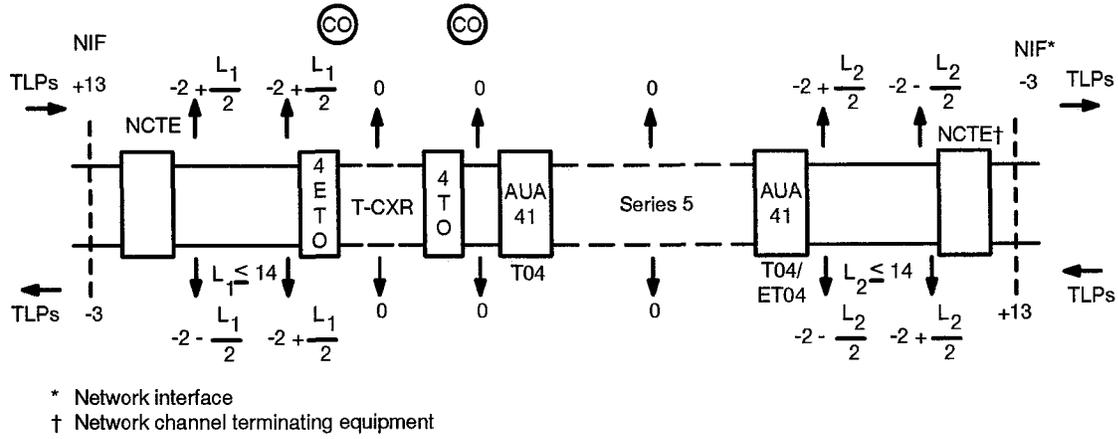
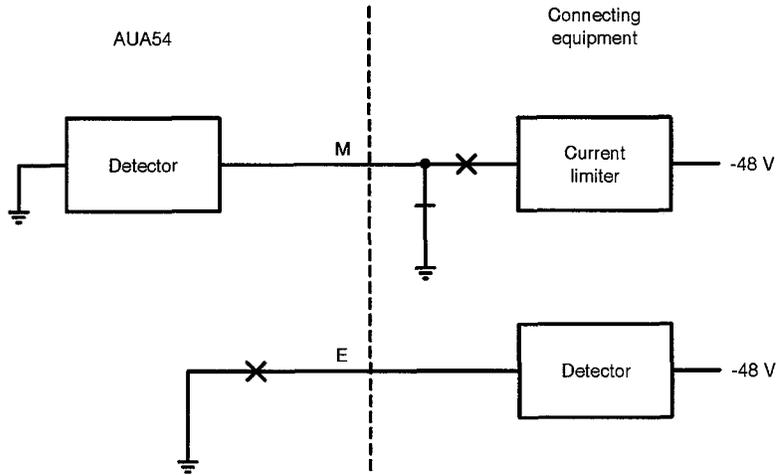


Figure 28. Private Line Data Arrangements

A Type I E&M interface, EM4C function code
(Connecting equipment originates on M lead)



B Type II E&M interface, EM4H function code
(Connecting equipment originates on M lead)

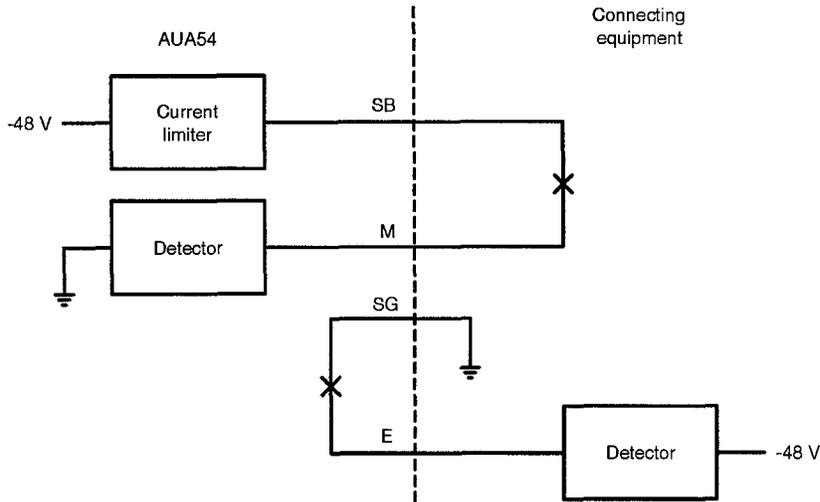
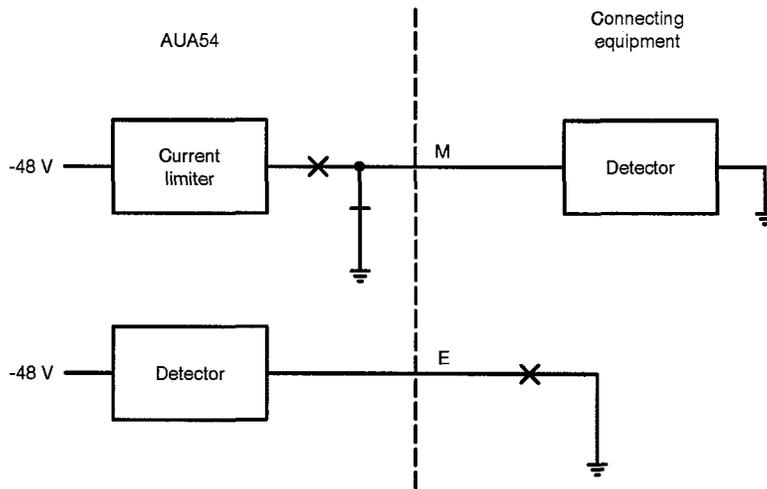


Figure 29. E&M Interface

Continued on next page

Continued

C Type I E&M interface, PLR1 function code
(Connecting equipment originates on E lead)



D Type II E&M interface, PLR2 function code
(Connecting equipment originates on E lead)

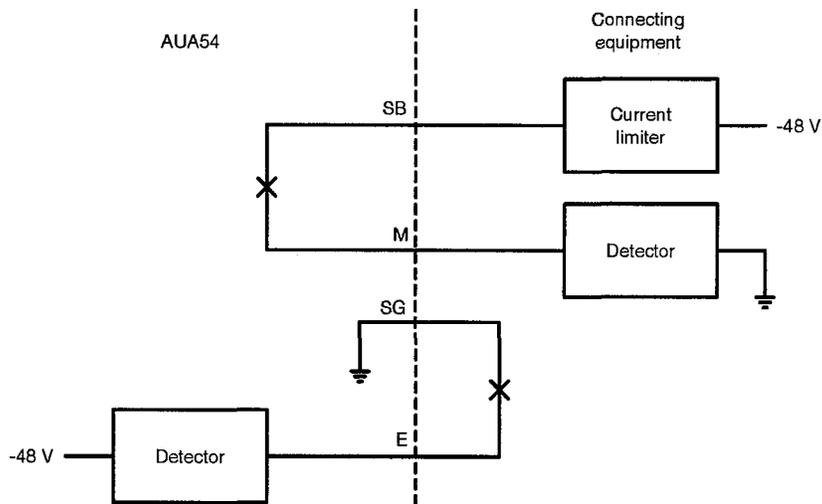
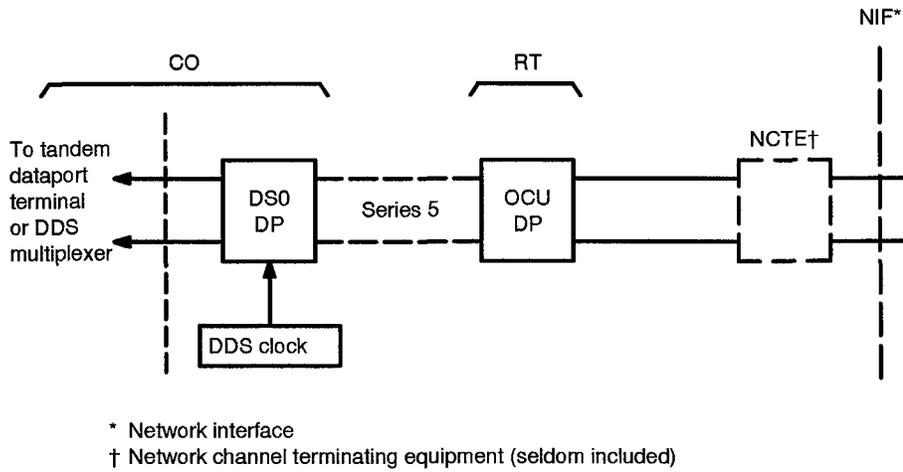
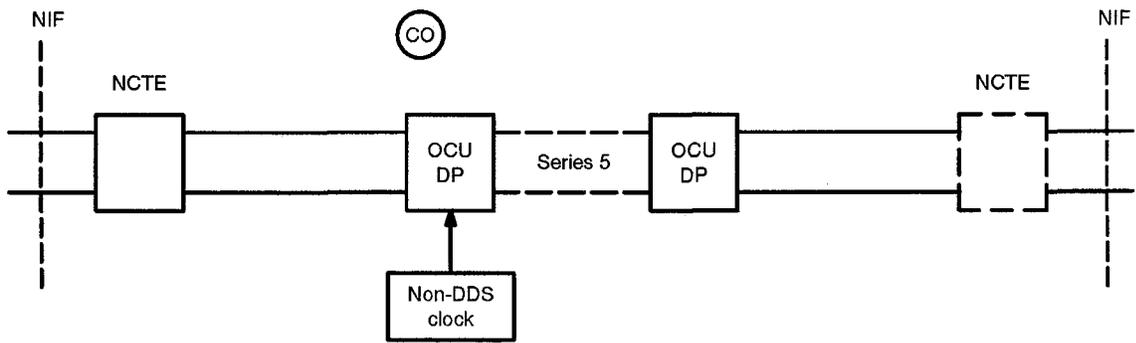


Figure 29. E&M Interface



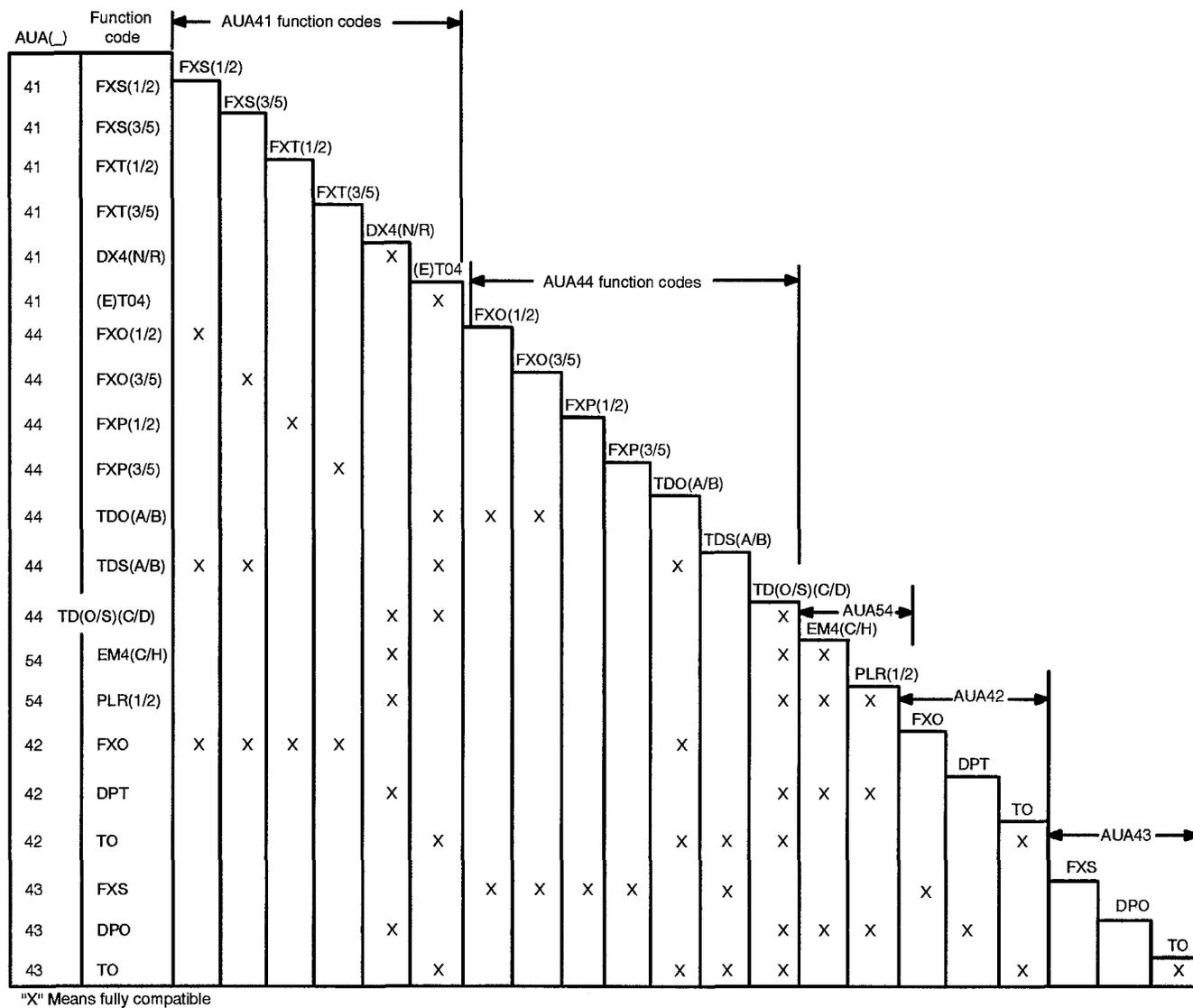
tpa 744471/01

Figure 30. Typical DDS Application



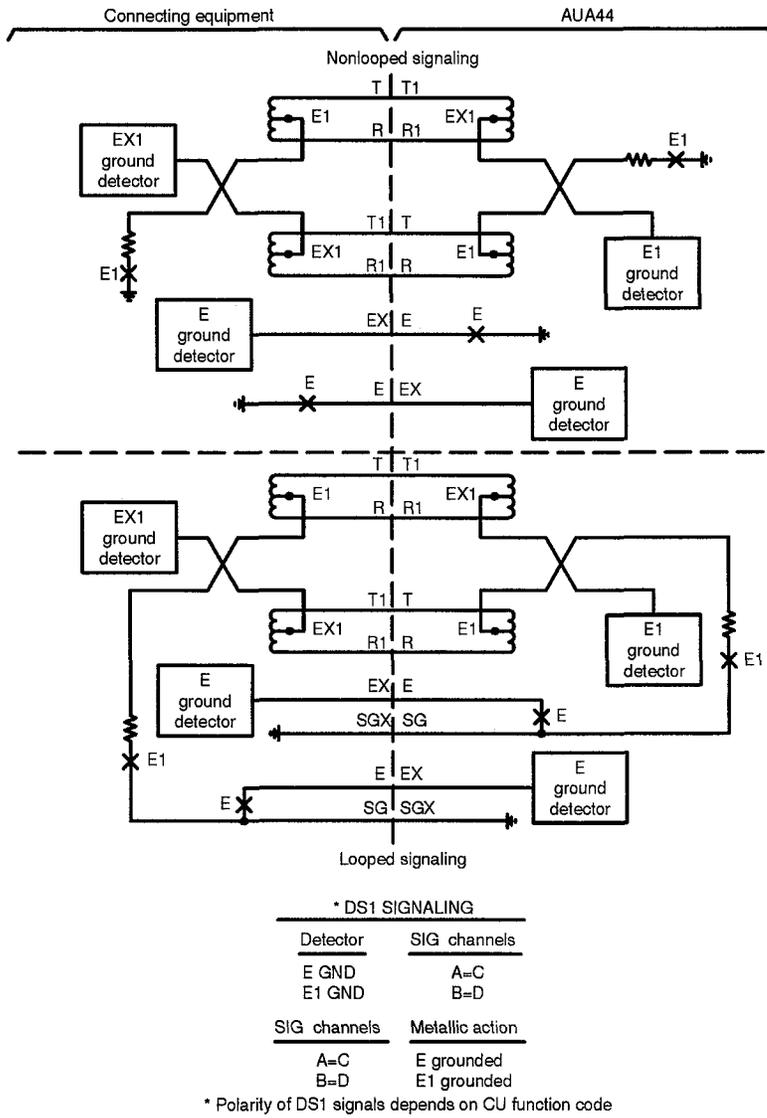
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Figure 31. Local Digital Circuit Application (OCU-DP)



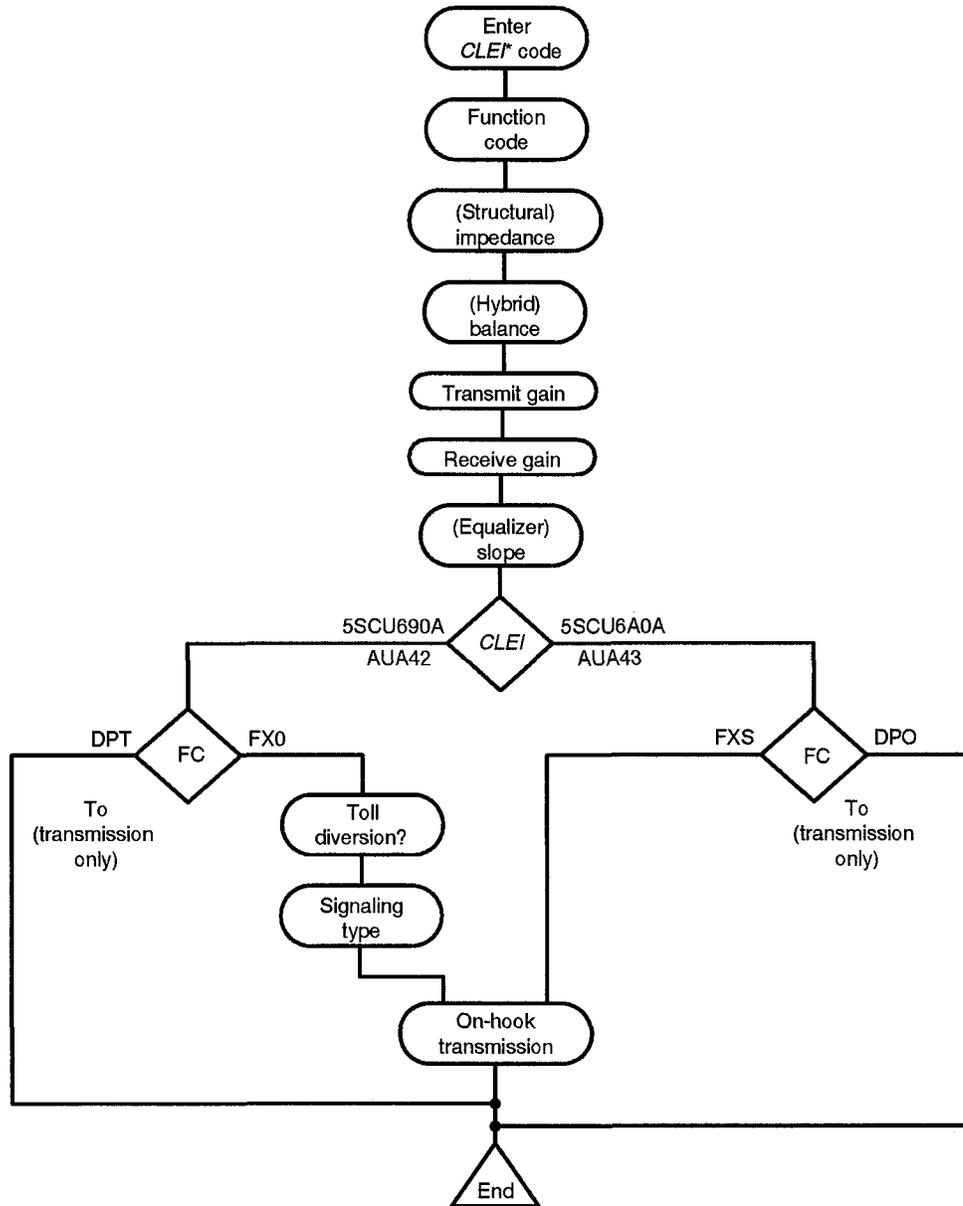
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Figure 32. End-to-End Compatibility of Series 5 VF Channel Units



tpa 814136/01

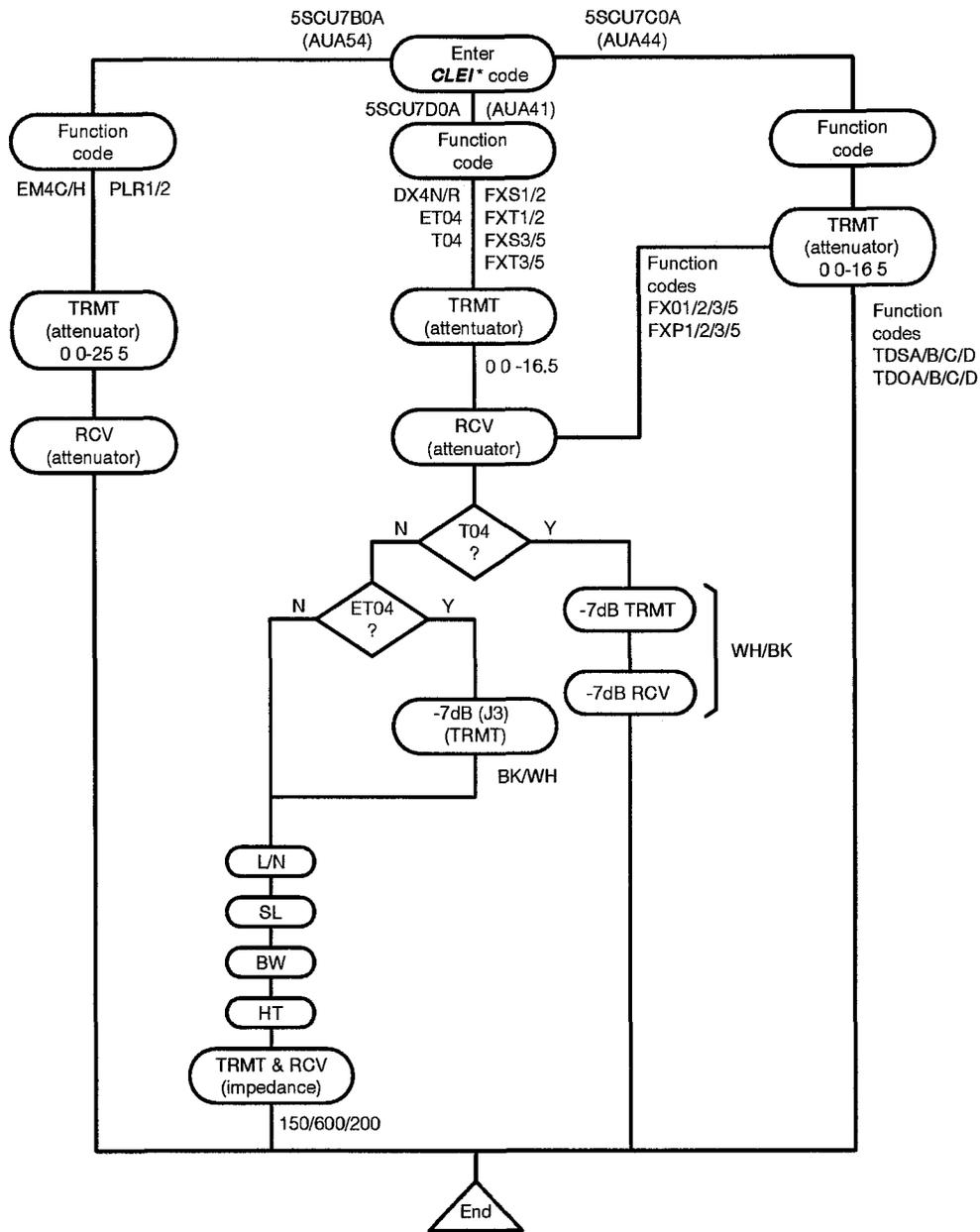
Figure 33. Signaling Paths Implemented with a Tandem Interface



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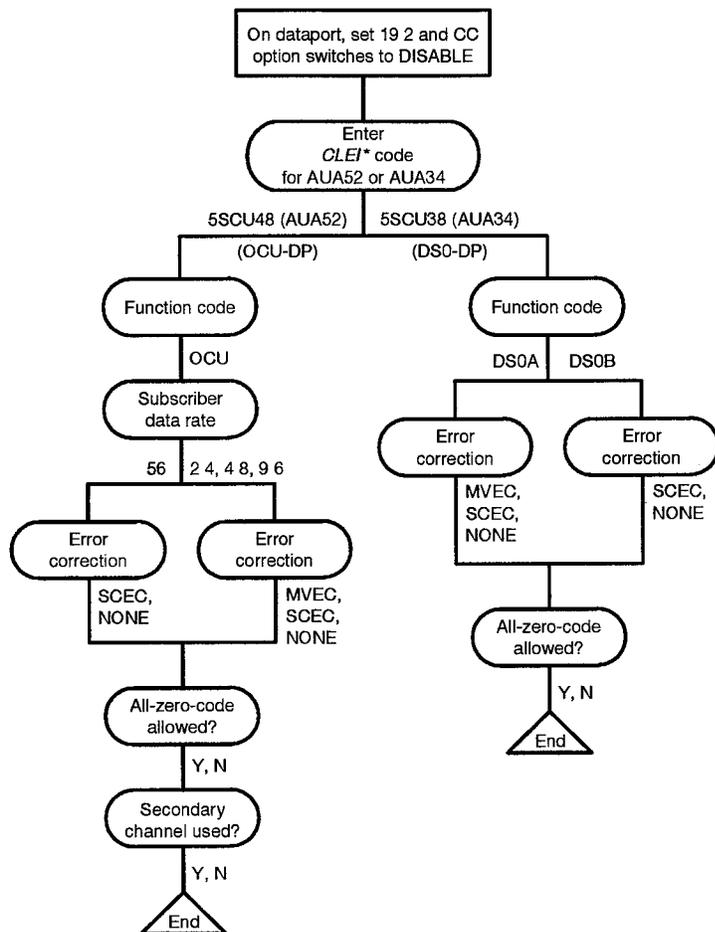
Figure 34. 2-Wire VF Provisioning Flow



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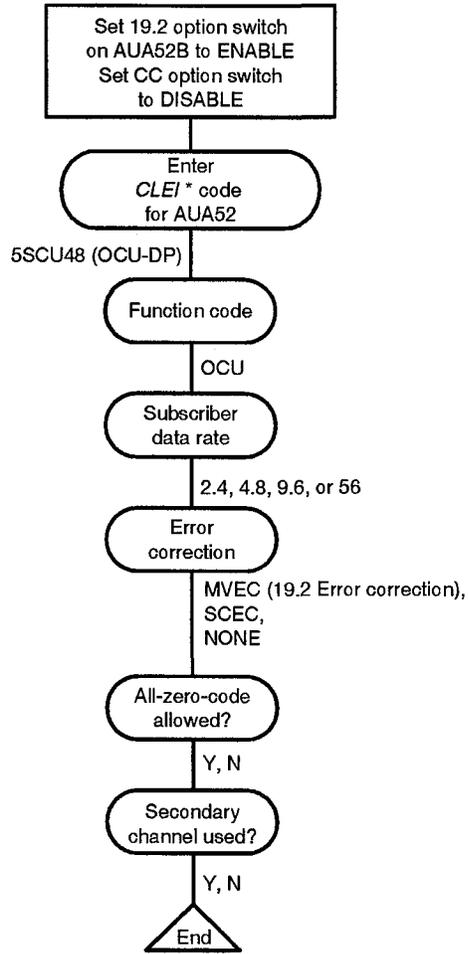
Figure 35. 4-Wire VF Provisioning Flow



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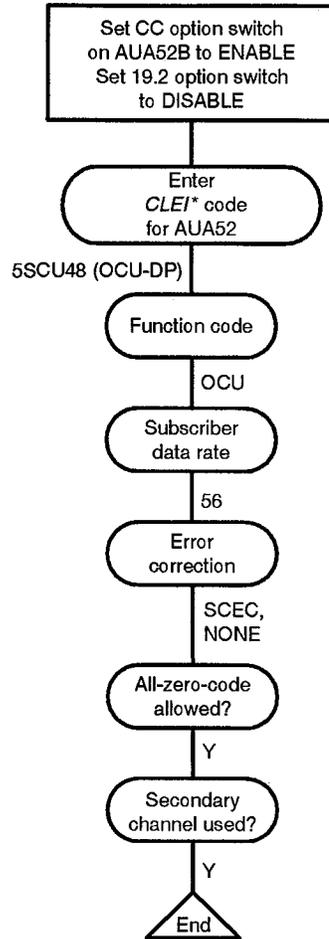
Figure 36. Dataport (AUA34, AUA34B, AUA52, AUA52B, AUA152) Provisioning Flow for 2.4, 4.8, 9.6, and 56 kb/s Service



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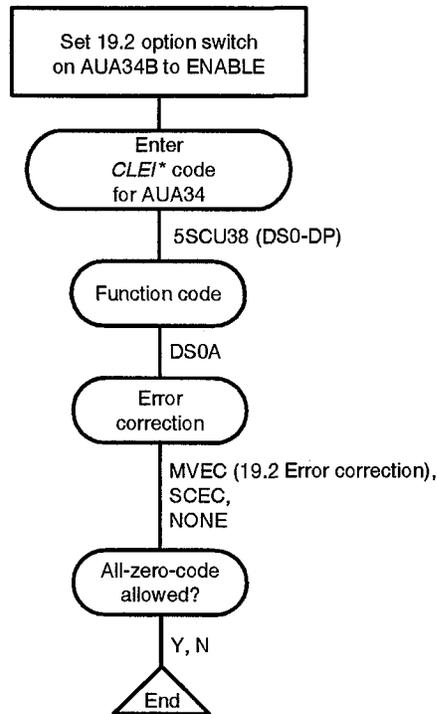
Figure 37. Provisioning AUA52B for 19.2 kb/s Service



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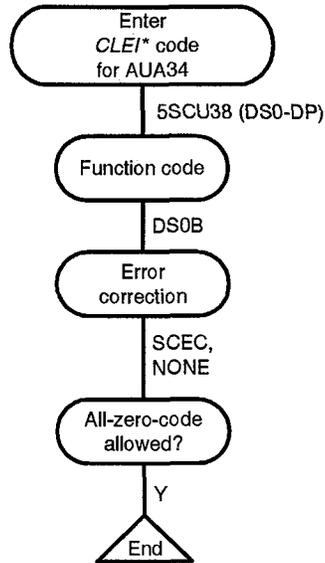
Figure 38. Provisioning AUA52B for 64 kb/s Clear Channel Service



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Figure 39. Provisioning AUA34B for 19.2 kb/s Service



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tpa 813921/01

Figure 40. Provisioning AUA34B for 64 kb/s Clear Channel Service

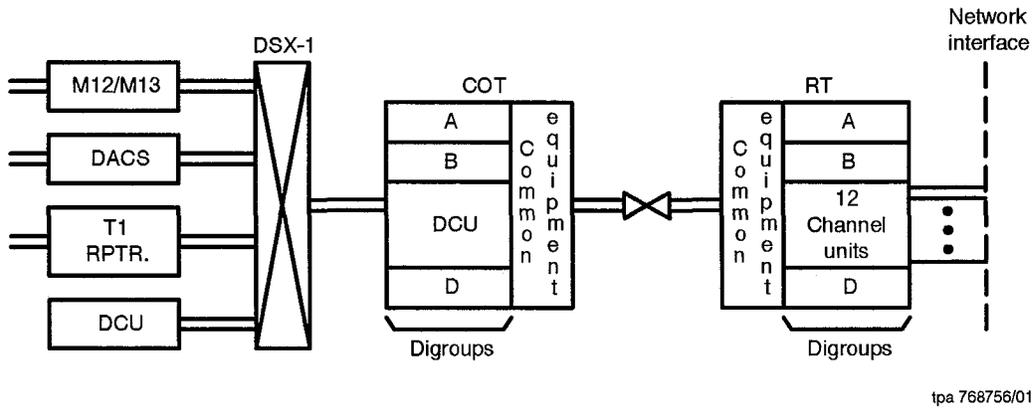


Figure 41. DCU at the COT, Channel Units at the RT

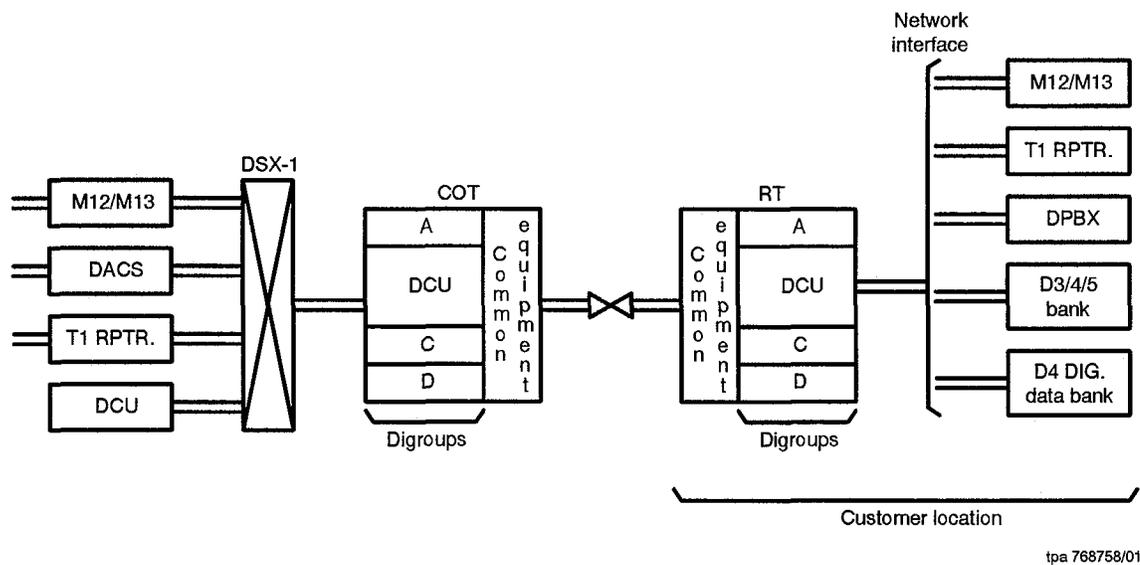
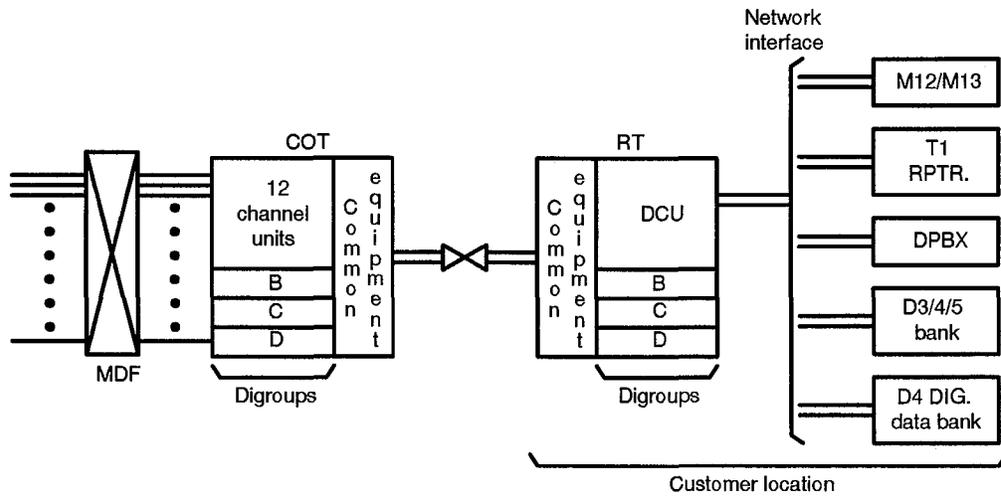


Figure 42. DCU at the COT and RT



tpa 768757/01

Figure 43. Channel Units at the COT, DCU at the RT

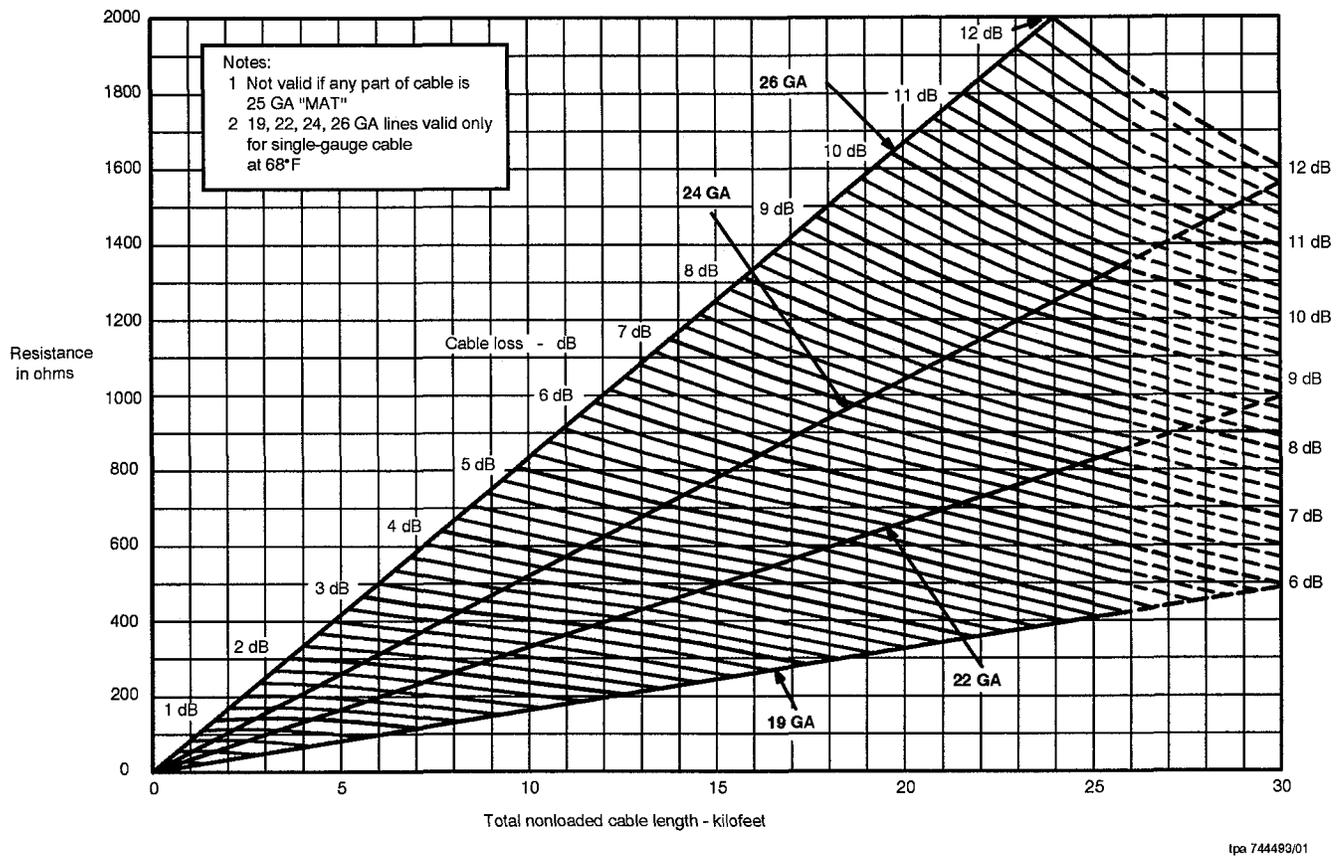


Figure 44. 1-kHz Cable Loss, Nonloaded Cable, Between 600-Ohm and 600-Ohm Terminations

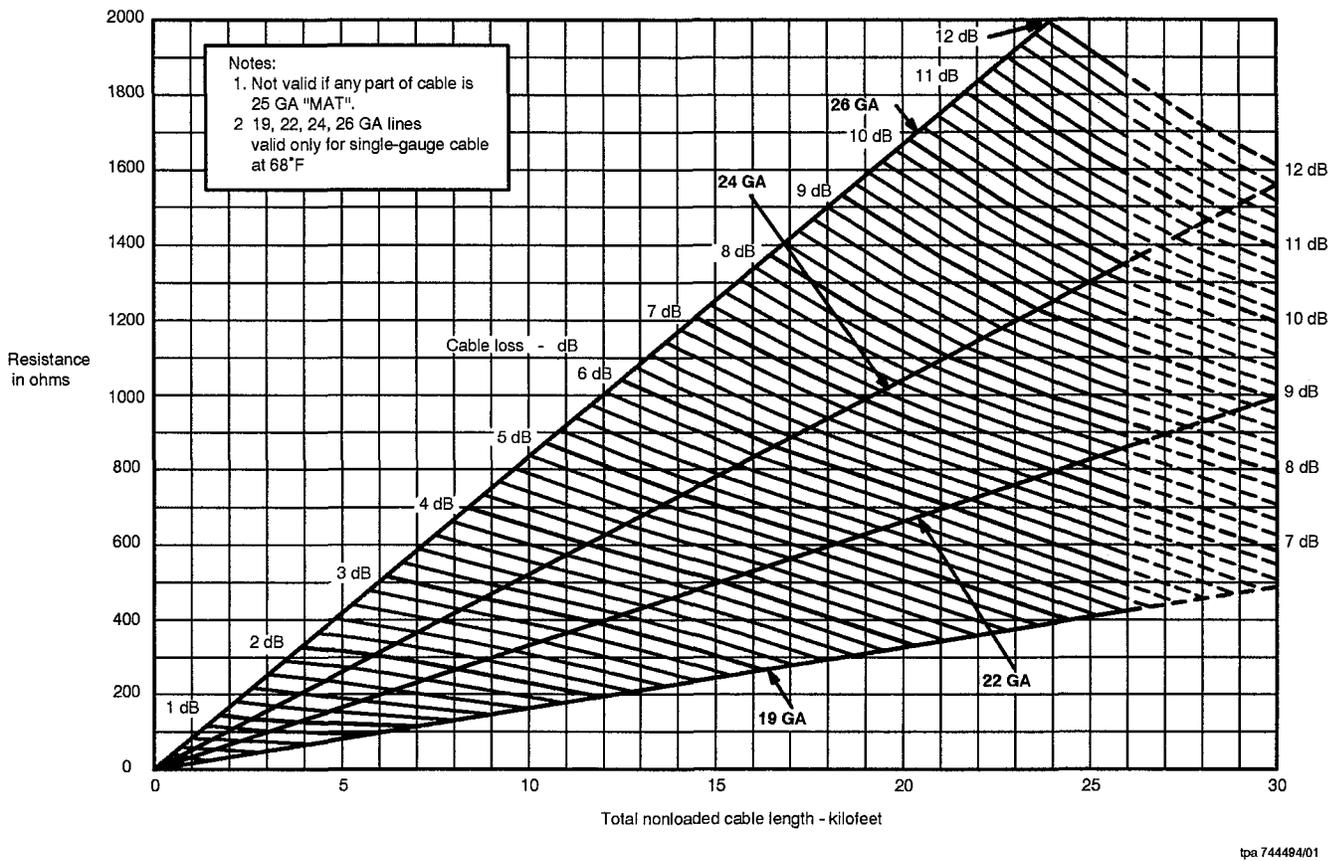


Figure 45. 1-kHz Cable Loss, Nonloaded Cable, Between 900-Ohm and 600-Ohm Terminations

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Completeness					////////////////////
Accuracy					////////////////////
Organization					////////////////////
Appearance					////////////////////
Examples					
Illustrations					
Overall Satisfaction					////////////////////

2. Please check the ways you feel we could improve this document:

- Improve the overview/introduction
- Improve the table of contents
- Improve the organization
- Include more figures
- Add more examples
- Add more detail
- Make it more concise/brief
- Add more step-by-step procedures/tutorials
- Add more troubleshooting information
- Make it less technical
- Add more/better quick reference aids
- Improve the index

Please provide details for the suggested improvement. _____

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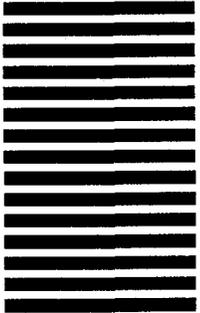
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