TRAFFIC SERVICE POSITION SYSTEM NO. 1 AND NO. 1B
TRANSMISSION PLAN AND
TRANSMISSION ENGINEERING CONSIDERATIONS

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1. GENERAL

1.01 The Traffic Service Position System (TSPS) No. 1 and No. 1B are stored-program controlled electronic switching systems. They are designed to extend the direct customer-dialed long distance service by providing certain customer-dialing features which previously required operator dialing. These types of calls are as follows:

(a) Person-to-person coin and noncoin calls

(b) Station-to-station coin calls

(c) Collect coin and noncoin calls

(d) Charge-to-third number coin and noncoin calls

(e) Credit card coin and noncoin calls.

A remote trunk arrangement (RTA) feature permits the extension of these features to areas served by small toll centers which cannot by themselves support a TSPS.

1.02 The reasons for reissuing this section are listed below. Since this reissue is a general revision, revision arrows have not been used to denote changes.

(a) To consolidate Sections 852-404-101 and 852-404-102 into this section. Sections 852-404-101 and 852-404-102 are to be canceled.

(b) To update the transmission engineering considerations and the transmission plan to be current through generic program 1BT1 with the exception that this section does ***not*** include the Rate Quote System feature introduced with generic program 1T10.2.

(c) To require impedance balance testing of the TSPS base unit in all configurations.

(d) To list TSPS transmission circuit changes which have become Bell System standard.

1.03 A detailed description of the system operation and circuit functions is covered in Section 984-100-100 for TSPS No. 1 and in Section 984-200-100 for TSPS No. 1B and other related sections and schematic drawings as referenced in Part 7. Design information for trunks associated with TSPS No. 1 will be found in the Standard Message Trunk Design System (SMETDS).

2. SYSTEM DESCRIPTION

A. General

2.01 Figure 43 is a block diagram of the TSPS No. 1 showing the various components of the system required to provide the features available with TSPS generic program 1BT1. The TSPS base unit provides the basic feature of the TSPS which is to provide direct customer-dialed long-distance service. This basic feature is briefly described in Part 2B. The operators associated with the TSPS initially interfaced with the base unit through the Position Subsystem (PSS) No. 1 which is briefly described in Part 2C. The PSS No. 1 has since been superseded by the Position Subsystem No. 2 for new installations. The PSS No. 2 is described in Part 2D. Additional features have been added to the TSPS No. 1 with the development of new generic programs. These features are described in Parts 2E through 2Q. In Parts 2R and 2S, the TSPS No. 1 maintenance features are discussed.

B. TSPS Basic Feature

2.02 A customer initiating a 1+, 0+, or 0 call is connected over a toll-connecting trunk through the TSPS trunk circuit and then through the TSPS base unit switching network. A dial pulse or multifrequency (MF) receiver is connected to the trunk link circuit to receive either dial or MF pulses. After the receipt of digits, an MF outpulser is connected through the TSPS trunk circuit to the toll-connecting trunk toward the toll office and outpulses the called number. After digit outpulsing has been completed, the transmission path through the TSPS trunk circuit is completed and the calling party can now hear ringing, busy tone, or called party answer. When the MF outpulser is disconnected and the transmission path is cut through the TSPS trunk circuit, an operator position is bridged onto the primary transmission path. This bridged connection provides the operator with a primary transmission path to both the calling and called customer. A detailed description of the TSPS No. 1 operation is contained in Section 984-100-100. Operation of the TSPS No. 1B is contained in Section 984-200-100.

2.03 The basic objective of the TSPS transmission plan is to bridge an operator onto the connection near the toll office end of a toll-connecting trunk in a manner that has negligible effect on the quality of the through-transmission path. When the operator function is completed, the bridge is removed and the connection is equivalent to that of a normal message telecommunication system (MTS) call.

C. Position Subsystem No. 1

2.04 The PSS No. 1 includes the TSPS operator positions (100B traffic service positions) in an operator service organization, the common control equipment to provide the data link between the operator position and the base unit, and the transmission facilities used to interconnect the operator position and the TSPS base unit. The PSS No. 1 may be configured in a local, semiremote, or a remote mode. In the local configuration, the operator positions are located in the same building as the TSPS base unit. In the semiremote configuration, the operator positions and associated equipment may be located up to 4 facility route miles from the TSPS base unit. Four-wire metallic facilities are used for both the voice and data paths between the base unit and the operator position. In the remote configuration, the operator positions may be located up to 50 airline miles from the base unit. The voice and data paths between the operator positions and the TSPS base unit are to be provided by a T1 carrier system using D1C channel banks. The voice and data path is provided by T1 carrier channels with the data being transmitted in the signaling bit position.

2.05 To agree with the standard transmission plan for TSPS, all PSS No. 1 operator position trunks must be retrofitted with 1R, or equivalent, 4-wire terminating sets as the TSPS bridging hybrid; and the 4251B network unified telephone circuit (UTC) must be used as the operator position circuit. The 4281 network is ***not*** to be used in place of the 4251B network UTC.

D. Position Subsystem No. 2

2.06 Like the PSS No. 1, the PSS No. 2 also provides an interface between an operator service organization and the TSPS base unit. The PSS No. 2 consists of a 4-wire voice-frequency transmission facility interconnecting the base unit position link circuit with a 100C traffic service console. The 2- to 4-wire conversion is accomplished at the position link circuit by use of a TSPS bridging hybrid. The necessary data communication between the base unit and the operator position is provided by the peripheral control link (PCL) (discussed in paragraphs 5.90 through 5.92). A detailed description of PSS No. 2 is contained in Section 984-100-102.

E. Remote Trunk Arrangement

2.07 The remote trunk arrangement (RTA) feature permits the extension of the features provided by the TSPS base unit to areas served by small toll centers which, by themselves, cannot support a TSPS base unit. The RTA consists of a RTA incoming trunk circuit, a RTA concentrator, two voice-frequency base-remote trunks, and a peripheral control link. The RTA incoming trunk circuit is bridged across the toll-connecting trunk at the toll office. Connections are made from the various incoming trunk circuits to the RTA concentrator to allow efficient use of the base-remote trunks. Two connections are made through the RTA concentrator to base-remote trunks. One connection is made from the incoming (local office) side of the RTA incoming trunk circuit for connections to the MF receiver at the base unit and, if required, to the TSPS operator. The second connection is made from the MF outpulser at the base unit to the outgoing (toll office) side of the RTA incoming trunk circuit. These connections are maintained only for the length of time required to perform their functions. The peripheral control link is the data communication link which allows the TSPS base unit processor to maintain control of the RTA functions. The peripheral control link is discussed further in paragraphs 5.90 through 5.92. A detailed description of the RTA is contained in Section 984-100-102.

F. Monitoring and Supervisor Assistance Features

2.08 If a TSPS operator requires a supervisor's assistance to handle a customer call, the operator is able to add a supervisor, from within the operator service organization, to the operator-customer connection. This results in a 3-way connection among the operator, customer, and supervisor.

2.09 An arrangement is also provided in each operator service organization to allow observation of an operator's actions at any operator position within the organization. This can be done from a supervisory console or a monitoring position within the operator service organization without alerting the operator.

G. Service Observing

2.10 The capability is provided in the TSPS base unit to permit a service observer to observe the TSPS operator's actions on selected connections. The service observer may select the class of calls and the operator service organization to be observed. When the service observing function is activated, the selected incoming call will be automatically routed through the base unit to include the service observer. On calls selected for observation, the service observing trunk access circuit is inserted into the overall connection through the base unit at the beginning of the call and remains in the connection until the operator releases from the call.

H. International Call Handling

2.11 The purpose of the TSPS international call handling feature is to extend improved service on international calls to all customers served by a TSPS. This feature allows the customer to dial most special toll, as well as all station-to-station, international calls to participating countries. On TSPS operator assisted calls, the TSPS operator will be able to complete the international calls without the assistance of an International Operating Center operator. The TSPS base unit will automatically perform the required two stages of MF outpulsing. The first stage of MF outpulsing occurs between the TSPS base unit and the toll office served by the TSPS system to establish a connection to the appropriate International Switching Center (ISC). The second stage of MF outpulsing occurs between the TSPS base unit and the ISC to establish a connection to the called party.

I. Delayed Call

2.12 When a call request handled by a TSPS operator cannot be completed on the first attempt, a subsequent attempt can be made at a later time by the TSPS operator using a delayed call trunk. The operator MF outpulses over the delayed call trunk to the serving toll office to connect the calling customer to the delayed call trunk. To connect the called customer, the operator MF outpulses in the other direction over the delayed call trunk to the serving toll office and the MTS network. The calling and the called customers are connected through the delayed call trunk with the operator bridged onto the connection. When the operator function is completed, the operator drops from connection.

J. CAMA Transfer

2.13 The recording of detailed toll call information for billing purposes is the function of centralized automatic message accounting (CAMA) equipment. In areas with CAMA equipment, automatic number identification (ANI) equipment is often provided at the originating local offices to automatically identify the number of the calling customer for proper billing. When the ANI equipment is not available, an equipment failure occurs, or operator number identification is required, the calling customer is connected to an operator who obtains the calling number from the customer and keys it into the CAMA equipment. The TSPS operator may function as a CAMA operator during certain traffic overflow situations in the CAMA office, during nonbusy hours when traffic is insufficient to justify the presence of regular CAMA operators, or on a fulltime basis. Connections to the TSPS operator from the CAMA offices are provided over special transfer trunks and circuits reserved specifically for the CAMA functions.

2.14 Two transmission paths are associated with CAMA transfer trunk arrangements. One of the paths is used to carry voice communications between the TSPS operator and the calling customer. The other path carries the MF key pulses corresponding to calling number information obtained by the operator and transmitted from the TSPS base unit to the CAMA office.

K. Directory Assistance Charge Recording

2.15 The directory assistance charge recording feature provides the TSPS with the capability for charge recording of local calls to directory assistance provided by Bell System operators at either a Phase I or Phase II No. 5 automatic call distributor (ACD) or a No. 23 ACD. Use of the TSPS for this function may be attractive in terms of cost, availability, and possibility of early widespread implementation of directory assistance charging in the Bell System.

L. Inward Call

2.16 This feature enables the TSPS operator to provide terminating operator services on inward calls received from an originating (non-TSPS) operator. These services include general assistance, busy line verification, time and charges call back, and hotel call back. An incoming inward call will be switched by the toll office which is served by a TSPS to an inward trunk onto which a TSPS operator will be bridged. After the appropriate actions are performed by the TSPS operator, the other end of the inward trunk will be switched by the toll office to a toll-connecting trunk to extend the inward call to the desired class 5 office. The operator will remain bridged on the inward trunk until the operator function has been completed, at which time the bridge will be removed.

M. Automated Coin Toll Service

2.17 The automated coin toll service (ACTS) feature further mechanizes the handling of coin toll calls in the TSPS. This mechanization is accomplished through the addition of a Station Signaling and Announcement Subsystem (SSAS) at the TSPS base unit to provide announcements to customers and to count coin deposits. With ACTS, the functions of quoting the charges on initial contact and charge-due phases of a call, verifying the amount deposited, collecting the coins, and notifying the customer at the end of the initial period are handled without operator intervention on most coin-paid calls. When operator assistance is needed, the SSAS detects and counts coin deposits, displays this information to the operator, and provides protection against coin deposit fraud. In addition, the announcement capabilities of the SSAS are used to automate noncoin notifications and time-and-charge quotations.

2.18 The type I and type II coin detection and announcement (CDA) circuits form a part of the SSAS. These circuits are similar in concept to, but different in function from, existing TSPS service circuits such as the dial pulse receiver, MF receiver, MF outpulser, and coin control and ringback (CCR) circuit. Unlike other service circuits, which are used to communicate with other switching offices, the CDA circuits communicate directly with the customer. In conjunction with the SSAS controller and announcement store, the CDA circuits provide announcements to the customer and count coin deposits made by the customer. Access to the customer is obtained through a standard TSPS/RTA connection. The CDA circuits interface with the customer either in place of or in conjunction with a TSPS operator. The call is ultimately completed through the toll office to an intertoll trunk.

N. Signaling Irregularity Detection

2.19 With the signaling irregularity detection (SIGIRR) feature, irregular changes in trunk supervision from toll offices can be detected. Irregular signals of this type may be caused by network problems (eg, equipment malfunctions or transmission impairments) or by a customer attempting to bypass the billing process for the purpose of making a free toll call (ie, "blue box" fraud). When irregular signals are detected, the TSPS records pertinent call information including any unauthorized multifrequency (MF) digits. This information is recorded on the automatic message accounting (AMA) billing tape and (optionally) a security teletypewriter for subsequent analysis.

2.20 The detection of unauthorized MF digits by the SIGIRR feature is accomplished by attaching a high impedance multifrequency receiver (HMFR) to the call. The HMFR is a TSPS service circuit located in the TSPS base unit and having a single appearance on the position link circuit.

O. Busy Line Verification

2.21 The busy line verification (BLV) feature will permit a TSPS operator to bridge onto a customer line through a network of dedicated trunks switched to the class 5 office serving the customer line. The TSPS operator can monitor the customer line to verify a busy condition and, if necessary, interrupt to relay an emergency message. To prevent the TSPS operator from overhearing conversations between customers while verifying a connection, a scrambler circuit is included in the verification circuit at the TSPS base unit. If the operator needs to interrupt an existing customer connection, the scrambler circuit will be bypassed and an alerting tone will be supplied to both the TSPS operator and the customers.

2.22 The facilities required to provide the BLV feature are divided into two segments. First, the TSPS BLV access trunk from a TSPS base unit to a nearby toll or tandem office with access to the BLV network. Second, the dedicated BLV network which parallels the MTS network or metropolitan tandem network.

P. Three-Way Operator Service Trunk Conferencing

2.23 Operator service trunks are provided at the TSPS base unit to allow the TSPS operator to access a second operator for assistance in serving certain type calls (eg, rate and route information). The TSPS operator can connect to a service assistance operator at a 3C or 3CL switchboard, a No. 23 operating room desk, a No. 23 ACD, or a Phase I, Extended Phase I, or Phase II No. 5 ACD. The 3-way operator service trunk conferencing feature permits the TSPS operator to establish either a 2-way connection between the TSPS operator and a service assistance operator or, a 3-way connection among the TSPS operator, a service assistance operator, and the calling customer.

Q. Calling Card Service

2.24 Calling card service (CCS) (formerly known as auto bill calling [ABC]) may be used as a replacement for credit card service and as an alternative to collect and bill-to-third number services. Calling card service allows a customer to charge a call to a number other than the calling number without operator assistance by dialing the necessary billing information into a TSPS using TOUCH-TONE® dialing. If the customer does not wish to dial the billing information, or TOUCH-TONE dialing is not available, the billing information may be given to a TSPS operator who keys the information into the TSPS and completes the call. The calling card service billing information is validated through a TSPS inquiry to a data base which contains all valid calling card service numbers.

2.25 The circuitry used to provide calling card service is similar to the ACTS circuitry. The major difference being that the CDA circuit is replaced with either a TOUCH-TONE dialing detection and announcement (TDA) circuit or a MF detection and announcement (MDA) circuit as determined by the type of signaling used to input the billing information.

R. Control, Display, and Test Frame

2.26 The maintenance center for the TSPS is the control, display, and test (CDT) frame, which is part of the master control center located in the TSPS base unit. Lamp displays and audible and visual alarms indicate the status of critical, major, and minor TSPS equipment units. Routine maintenance testing and transmission testing are performed at the CDT.

S. Test and Display Frame

2.27 The test and display (TSTD) frame provided at the remote location of the PSS No. 2 and RTA displays status information and provides control and test facilities including a maintenance teletypewriter (TTY).

3. TRANSMISSION OBJECTIVES

3.01 The transmission plan and specific requirements for TSPS No. 1 are formulated on the basis of overall transmission objectives for Bell System operator services. The application of these objectives to TSPS connections can be most easily understood if the standard arrangement of an incoming call served by an RTA shown in Fig. 1 is resolved into three 2-way calls: customer-to-customer, TSPS operator to calling customer, and TSPS operator to called customer. These general objectives remain unchanged when additional links are added for service observing, delayed calls, inward calls, etc.

3.02 ***Customer-to-Customer:*** The general transmission objective for this call is loss-noise-echo performance not significantly different from that of customer direct dialed toll calls of the same length without TSPS access. Therefore, the toll-connecting trunks permitting TSPS access should meet the usual transmission standard for toll-connecting trunks in both the 2-way and bridged modes. Also, severe transmission performance contrasts between TSPS-handled calls and direct-dialed calls, due to additional trunk facility lengths used to route the TSPS call, should be avoided.

3.03 ***TSPS Operator to Calling Customer:*** The transmission objective for this call is loss-noise-echo quality which is not significantly different from that of an average short toll call. In terms of the performance of the network today, the objective MTS call is between 100 and 150 miles in connection length.

3.04 ***TSPS Operator to Called Customer:*** The general transmission objective for this call is loss-noise-echo quality which is not significantly different from that of the calling customer connection to the called customer. Two different kinds of transmission degradation are encountered: (1) Customer and operator talker echo problems created by the extra switching point introduced by the RTA concentrator and by the additional delay introduced by long base-remote, incoming CAMA transfer, and operator position trunk facilities, and (2) high message noise levels in long lengths of base-remote, incoming CAMA transfer, and operator position trunk facilities.

3.05 ***Average Speech Volume:*** This is the average speech power at any given transmission level point (TLP). The reference point, or 0 TLP, for the MTS network is the outgoing switching appearance of a class 5 office. The average speech volume at the 0 TLP is assumed to be the speech power equivalent to a −21 dBm 1004-Hz tone. The TSPS bridging point is designed as a −3 TLP in both directions of transmission and is to have an average speech power of −24 dBm at the bridging point. The average speech power is not to exceed −16 dBm0 at any point within the TSPS.

3.06 ***Acoustic Signal-to-Noise Ratio:*** The circuit signal to noise ratio is defined as the ratio between the power of a 1004-Hz tone (inserted into the system to simulate a −21 dBm speech power at the 0 TLP) and the noise power measured in dBrnC at the same point. The noise power in dBrnC must be converted into dBm using a conversion factor of 90 dBrnC equals 0 dBm at 1004 Hz. To determine the overall acoustic noise power at the listeners ears, the acoustic room noise and side tone noise powers must be added to the circuit noise power. The overall acoustic signal-to-noise ratio at the listener's ear may be used as a substitute for subjective loss/noise transmission quality ratings when the overall acoustic signal-to-noise ratio is between 40 dB and 21 dB. The average overall acoustic signal-to-noise ratio objective is 29 dB or better and should not be allowed to fall below 21 dB on any connection to any listener.

3.07 ***Operator Position Circuit:*** The operator position circuit is used in connection with the operator position trunk to receive incoming calls. The following objectives are recommended for the operator position circuit when connected to a standard headset. (See paragraph 5.08 for a listing of standard headsets.)

Receive voice level −33 dBm = 84 dB sound pressure level (SPL) (sound pressure level relative to 20 micro-Pascal [μPa])

Transmit voice level −17 dBm = 87 dB SPL

Acoustic-to-acoustic sidetone loss = 12 dB ±4 dB

Automatic gain control (AGC) = 89 dB SPL ±2 dB

Voice switched attenuation (VSA) = 15 dB total at 88 dB SPL or above; initial activation point 78 dB SPL.

3.08 The AGC feature of the operator telephone circuit will limit received signals to 89 dB SPL ±2 dB output from a standard headset receiver (this corresponds to −28 dBm ±2 dBm at the input to the receiver). Click suppression and transient impulse protection is provided by a varistor in the position AGC unit as well as by a varistor in the receiver of the standard headset. The headset varistor must limit the maximum acoustical pressure developed in the ear by an on-the-ear operator headset to 115 dB(A) sound field equivalent. (The sound field equivalent is a sound field which, when a headset is placed in the same environment produces an equivalent acoustic frequency response at a designated point in the ear.)

3.09 ***Supervisor Position Circuit:*** The objectives for the supervisor position circuit are the same as those for the operator position circuit.

3.10 ***Operating Room Noise:*** Excessively high room noise levels will cause operator complaints because of noise interference with received signals. To avoid these problems in TSPS operator rooms, it is recommended that the following ambient room noise level objectives be observed: 55 dB(A) average and 62 dB(A) maximum referenced to 20 μPa with A-weighting and measured with the noise meter adjusted for slow response. See American National Standards Institute (ANSI) Volume S1.9, Issue 1971.

3.11 Soundproofing may be necessary to meet these objectives. Therefore, it is strongly recommended that the building engineering organization be contacted for assistance. If these room noise objectives are not met, additional operator work time will be required and operator noise complaints will increase. Problems are also to be expected with the voice-activated room noise suppressor in the 60-type headset or equivalent and with the voice switched attenuator in the 4251B network.

4. TRANSMISSION PLAN

A. Transmission Configuration

4.01 A functional block diagram of the voice transmission configuration of a TSPS is shown in Fig. 43. An operator position trunk may be connected, through the base unit switching network, to any trunk or service circuit with an appearance on the base unit trunk link circuit. On incoming calls served by an RTA, a base-remote trunk provides the voice path connection between the RTA and the service circuits (eg, MF receiver, MF outpulser, CDA, TDA, or

MDA circuits) or operator position trunks which terminate on the base unit position link circuit. A base-remote trunk may be connected to any trunk with an appearance on the trunk stage of the RTA concentrator.

4.02 On incoming calls to the TSPS base unit selected for service observing, the service observing trunk access circuit is inserted in the overall connection through the TSPS base unit to an operator position trunk or to a CDA, MDA, or TDA circuit at the beginning of the call and remains in the connection while the call is in the bridged mode (during that portion of the call requiring operator assistance).

4.03 On coin calls handled by ACTS, a CDA circuit will be connected to the TSPS bridging point in the following situations: when a coin call is initiated, when the called customer is disconnected with charges due, and when the calling customer is notified of the end of the initial charging period. If detection of coin deposit signals are required while the called customer is on the connection, the CDA circuit configuration depends on whether the TSPS or RTA incoming trunk circuit is 2- or 4-wire. When a 2-wire incoming trunk circuit is used, the toll-connecting trunk is opened within the incoming trunk circuit and the CDA circuit is inserted into the transmission path. (Two base-remote trunks will be used to insert the CDA circuit in an RTA configuration.) When a 4-wire incoming trunk circuit is used, the CDA circuit will be connected to the TSPS bridging points on the toll-connecting trunk.

4.04 The TSPS bridging access to toll-connecting and directory assistance charge recording trunks may be either 2- or 4-wire. To meet transmission requirements, the following trunks must use 4-wire facilities:

Base-remote trunks

Delayed call trunks

Inward trunks

Service observing trunks (one way transmission is provided, and the other direction is terminated at the trunk access circuit)

PSS No. 1 and PSS No. 2 operator position trunks

Incoming CAMA transfer trunks

Three-way operator service trunks

Busy line verification (BLV) access trunks.

4.05 The TSPS base unit switching network and the RTA concentrator are 2-wire switches,and a 4-wire term set is needed for the 2- to 4-wire conversion required to interface the 2-wire switches with 4-wire trunk facilities. The 1R (or equivalent) 4-wire term set is required to provide the interface between the TSPS position link circuit and operator position trunks, service observing trunks, and service circuits in order to meet transmission requirements. The 1R (or equivalent) 4-wire term set is also required between the RTA concentrator and base-remote trunks. A 900-ohm 4-wire term set such as the 1M (or equivalent) is to be used to provide the interface between the base unit trunk link circuit, (or RTA concentrator) and the 4-wire facilities of the various types of trunks shown in Fig. 43. The 4-wire bridging repeater includes a 900-ohm 4-wire term set, equivalent to the 1M term set, to interface with the 2-wire switching networks of the TSPS base unit and the RTA concentrator. The 4-wire bridging repeater is used to provide bridging access to 4-wire toll-connecting, inward, and delayed call trunks at the base unit, and to 4-wire toll-connecting and inward trunks at the RTA.

B. System Layout Requirements (Mileage Limitations)

4.06 In order to meet the transmission objectives, noise and/or round-trip delay contributions to the loss-noise-echo grade of service must be controlled. This can be accomplished in part by placing restrictions on the maximum facility route length of each trunk in the layout of any given TSPS. The resulting requirements on the maximum facility route lengths for the various types of trunks associated with the TSPS are summarized below and in Fig. 44.

(a) The TSPS base unit should be located within 50 facility route miles of the toll office which it serves to restrict the maximum facility route length of inward and delayed call trunks.

(b) An RTA installation should be located within 50 facility route miles of the toll office which it serves if inward trunks are provided. If inward trunks are not provided at the RTA, the distance between an RTA and the serving toll office may extend up to 200 facility route miles.

(c) The total combined route length of noncompandored analog carrier included in any PSS No. 2 operator position trunk and any base-remote trunk, incoming CAMA transfer trunk, or BLV access trunk should not exceed 400 facility route miles. If the sum of analog carrier facility route lengths in any pair of trunks is expected to exceed 400 miles, the use of companded L-multiplex carrier facilities will be required for the analog carrier facilities used in either trunk or in both trunks of the pair as necessary to meet noise requirements. If the only type of analog carrier facilities used in both trunks of a pair are companded L-multiplex carrier facilities, the sum of the analog carrier facility route mileage for both trunks may be increased to 1000 miles. The length of intertoll grade digital carrier facilities appearing in each pair of trunks can be ignored with respect to these facility route length restriction requirements provided that no more than one digital carrier system is associated with each of these trunks. It should be noted that the length of a PSS No. 2 position trunk or base-remote trunk may also be limited by the 8.8 ms 1-way propagation delay limit on the peripheral control link (see pargraph 5.91).

(d) For the proper operation of the peripheral control link an 8.8 ms maximum 1-way propagation delay requirement must be met by the end-to-end facilities of each of the three data links associated with each peripheral control link. The maximum differential delay between any two peripheral control links is to be 2.5 ms. The maximum permissible facility route length of each data link will depend upon the types of facilities and the number and types of terminals used to form each data link. Both this requirement and the requirement stated in item (c) above must be met when locations for an RTA concentrator or the consoles of a PSS No. 2 are selected.

(e) The total facility route length of noncompandered analog carrier facilities from the TSPS bridging access point to the most remotely located service assistance operator position (in a No. 23, extended Phase I No. 5, or Phase II No. 5 ACD system) should not exceed 400 facility route miles. To extend the maximum facility route length to 1000 miles, use of companded L-multiplex carrier facilities will be required in the applicable trunks associated with the TSPS and the ACD systems. Applicable trunks associated with the TSPS include the operator position trunk, the base-remote trunk, and the operator service trunk. Applicable trunks associated with the ACD include the nightclosing, overflow, and operator position trunks.

(f) The service assistance operator should not be located at a 3C-type switchboard, a No. 23 operating room desk, or a Phase I No. 5 ACD if an RTA installation is associated with the TSPS base unit. If no RTAs are associated with a TSPS base unit, the round-trip signal propagation delay should not exceed 1.4 milliseconds from the TSPS base unit switching network to a 3C or 3CL switchboard, or 2 milliseconds to the switching network of a No. 23 operating room desk or a Phase I No. 5 ACD. The maximum permissible facility route length of each type of operator service trunk will depend upon the types of facilities and the number and types of terminals used.

(g) The maximum total route length of the facilities in a directory assistance charge recording connection between the class 5 office serving the calling customer and a directory assistance operator located in a Phase II No. 5 or a No. 23 ACD should be limited as follows:

(1) Nonextended service area without nightclosing, 350 route miles

(2) Nonextended service area with nightclosing, 450 route miles

(3) Extended service area using L-multiplex carrier facilities equipped with N3 compandor appliques with or without nightclosing, 850 route miles.

C. Transmission Requirements on Connecting Networks and Systems

4.07 Some of the types of trunks associated with a TSPS will be connected to other trunk networks or systems in normal operations. The transmission requirements on connecting trunk networks and systems, imposed by connections to trunks associated with a TSPS, are summarized in this part. Also included are the impedance balance requirements on the interface between TSPS trunks and the various trunk networks and systems. These impedance balance requirements are frequently specified using the terms "terminal balance" and "through balance" which should be interpreted in the same manner as for existing terminal and through balance requirements on toll-connecting and intertoll trunks. The inserted connection loss (ICL), gain-slope, and noise requirements on trunks associated with a TSPS No. 1 are specified in Part 4E.

4.08 The toll-connecting trunks providing TSPS bridging access, inward trunks, delayed call trunks, and CAMA transfer trunks are ultimately connected to the existing MTS network through the toll offices served by a TSPS base unit or RTA. No changes are required in the transmission design of the existing MTS network to accomodate TSPS additions. The same terminal balance test requirments should be met at the serving toll office by toll-connecting trunks with, or without, TSPS bridging access. However, in order that the balance requirements on the TSPS base unit and RTA can be met, the additional balance test requirement on 4-wire toll-connecting trunks terminating on a 2-wire toll office illustrated in Table F should be met on all 4-wire toll-connecting trunks providing TSPS bridging access.

4.09 The TSPS bridging access to the toll-connecting trunks of the MTS network may be provided on a 2- or 4-wire basis. Figures 10 and 11 show the standard configurations for TSPS bridging access on 2- or 4-wire toll-connecting trunks. It should be noted that the standard method of obtaining bridging access on 4-wire toll-connecting trunks homing on 4-wire toll offices is by use of 4-wire TSPS bridging access. The use of 2-wire TSPS bridging access on 4-wire toll-connecting trunks which home on 4-wire toll offices will require a 4-wire to 2-wire and back to 4-wire conversion which would defeat many of the transmission and maintenance advantages of 4-wire facilities and 4-wire switching offices and is therefore discouraged.

4.10 The TSPS inward and delayed call trunks are analogous to secondary intertoll trunks and have the same balance requirements on connections through the serving toll office. Terminal balance requirements apply when a TSPS inward or delayed call trunk is connected to a toll-connecting trunk, and through balance requirements apply when a TSPS inward or delayed call trunk is connected to an intertoll trunk.

4.11 Terminal balance test requirements should be met at the incoming CAMA transfer trunk on connections through the CAMA office to a CAMA trunk.

4.12 A TSPS base unit or RTA may be used to provide charge recording of directory assistance calls to Bell System operators at either a Phase II No. 5 or a No. 23 ACD. No changes are required in the transmission designs of existing Phase II No. 5 or No. 23 ACD systems used to provide directory assistance. The directory assistance charge recording trunks terminating on an ACD are analogous to toll-connecting trunks providing TSPS bridging access. Toll office balance test requirements on toll-connecting trunks providing TSPS bridging access also apply for directory assistance charge recording trunks. When concentration is provided on the directory assistance charge recording trunks, terminal balance requirements should be met at the No. 1, or the No. 23, trunk concentrator to permit balance test requirements to be met at the TSPS base unit, the RTA, and the ACD. In the case of the No. 1 trunk concentrator, terminal balance requirements must be met after correction for any transmission gain transferred across the No. 1 trunk concentrator switch from the outgoing trunk to the incoming trunk.

4.13 Operator service trunks are provided at the TSPS base unit to provide the TSPS operator with access to a service assistance operator located at 3C-type switchboard, a No. 23 operating room desk, a No. 23 ACD, or a Phase I, Extended Phase I, or Phase II No. 5 ACD. The TSPS operator will be provided with the capability to establish either a 2-way connection with a service assistance operator or a 3-way connection with a service assistance operator plus a calling customer. No changes are required in the transmission designs of existing ACD systems for this application. However, it is recommended that a 4281-type network be used to provide the automatic gain control (AGC) feature needed to limit the maximum sound pressure level of the signals reaching the ear of a service assistance operator at operator positions of the 3C-type switchboard, the No. 23 operating room desk, and the Phase I No. 5 ACD. The AGC feature of the 4251-type network used as the operator telephone circuit in the consoles associated with No. 23, Extended Phase I No. 5, and Phase II No. 5 ACD will provide the necesssary disturbance protection for the service assistance operators of these types of ACD systems. It is also recommended that the operator service trunks not terminate in a 3C-type switchboard, a No. 23 operating room desk, or a Phase I No. 5 ACD if an RTA installation is associated with the TSPS base unit. No balance requirements have been imposed on connections through a 3C-type switchboard, a No. 23 operating room desk, or a Phase I No. 5 ACD involving a TSPS operator service trunk. However, when the service assistance operator is located at either a No. 23, and Extended Phase I No. 5, or a Phase II No. 5 ACD, through balance requirements should be met on connections between a TSPS operator service trunk and any type of trunk in the particular ACD system.

4.14 The busy line verification (BLV) feature allows a TSPS operator to bridge onto a busy customer line through a network of dedicated trunks switched by existing toll offices to the appropriate no-test vertical in the class 5 office serving the customer line. The BLV network access trunk terminates on the trunk link circuit of the TSPS base unit switching network at one end and on the switching network of a toll office with access to the dedicated BLV network at the other end.

4.15 The BLV network consists of dedicated trunks which parallel the existing MTS network and are switched by the MTS switching machines (Fig. 2). The BLV network is configured in a switching hierarchy which allows up to four trunks in tandem between the network accessing office (usually a toll office located near the TSPS base unit) and the class 5 office serving a particular subscriber. The maximum distance between the accessing toll office and the most distant class 5 office in the BLV network should not exceed 1000 airline miles. No echo suppressors should ever appear in a connection through the BLV network. If busy verification of a subscriber line outside the serving area of a given BLV network is required, the TSPS operator receiving the BLV request should transfer the request to an inward operator at a TSPS base unit with access to the BLV network serving the subscriber line to be busy verified.

4.16 An alternate transmission plan is for the BLV network to parallel an existing metropolitan tandem network and use that network's switching machines. In this configuration a maximum of three trunks may be connected in tandem and a maximum distance of 150 airline miles is allowed between the network accessing office and the most distant class 5 office served. The hierarchial network configuration used for the metropolitan tandem network also applies to this type of BLV network. The network accessing office may be either a sector tandem office or a directional tandem office as shown in Fig. 3.

4.17 In either configuration, the transmission requirements for the BLV network are the same as those of the parallel message network. In step-by-step, No. 1 crossbar, No. 5 crossbar, and No. 2 ESS class 5 offices a signal limiter circuit (SD-97761-01) must be installed at the class 5 office to protect the transmission facilities from overloading due to high signal levels, such as "receiver off-hook" signals, which may be encountered on a subscriber line.

4.18 The following impedance balance test requirements should be met on BLV network access trunks:

(a) Through balance requirements on connections through a toll office to trunks terminating at an intermediate switching point in the BLV network (Fig. 2).

(b) Terminal balance requirements on connections through a toll office to a trunk terminating at a class 5 office in the BLV network (Fig. 2).

(c) Terminal balance requirements on connections through a directional tandem office in a BLV tandem network (Fig. 3).

(d) Terminal balance requirements on connections through a sector tandem office to a trunk terminating at an intermediate switching point in a BLV tandem network if terminal balance requirements are normally met in this office. Otherwise, there are no balance requirements (Fig. 3).

(e) There are no balance requirements on connections through a sector tandem office to a trunk terminating in a class 5 office in a BLV tandem network (Fig. 3).

D. Transmission Circuit Change Requirements

4.19 The following changes will be required in some TSPS base unit and RTA installations to meet current transmission performance objectives for all the features available in the TSPS generic programs up to and including generic program 1BT1 with the exception of the Rate Quote System feature introduced with generic program 1T10.2. These changes are system standard.

4.20 Early TSPS base unit and RTA installations did not meet the current Bell System standard MF tone level requirement. The low-level signaling tones outpulsed by TSPS over toll connecting, inward, and delayed call trunks did not cause significant service deficiencies until the introduction of the

International Direct Distance Dialing (IDDD) feature. The following circuit changes are required to correct the IDDD signaling problems:

(a) Modification of the TSPS base unit incoming and inward trunk circuits to add an isolation network (ie, SD-1B006-01 Issue 8B - remove Option Z and add Option Y, and SD-1B007-01 Issue 9A - remove Option V and add Option W). This modification can be accomplished in the field on older circuits and will be provided in new trunk circuits currently being manufactured.

(b) Replacement of all delayed call trunk circuits SD-1B008-01 and SD-1B009-01 (J1B001AT List 1) with SD-1B009-01 Issue 8 BU (J1B001AT List 2) which is currently being manufactured.

(c) Modification of the MF tone supply (SD-95391-01) to reduce the MF tone levels to the current standard of −7 dBm0 ±1 dB per frequency.

Note 1: Regardless of which MF supply is used the Bell System standard MF tone level is −7 dBm0 ±1 dB per frequency.

Note 2: Modification of the MF tone supply should not be implemented until the changes described in (a) and (b) have been completed.

(d) Replacement of the 424V4-type 4-wire bridging repeater with the TSPS 4-wire bridging repeater (SD-7C022-01).

Note: The TSPS 4-wire bridging repeater (SD-7C022-01) is the preferred Bell System standard for all TSPS 4-wire bridging configurations. However, the 3-way, 4-wire bridging repeater (SD-99782-01) used in conjunction with the signaling converter (SD-1B145-01), externally provided 227-type amplifiers and externally provided drop buildout capacitors (DBOCs), if required, is an acceptable arrangement in existing TSPS base units and RTAs, but is rated Additions and Maintenance only (A&M only).

4.21 All TSPS operator and supervisor positions must be equipped with a 4251B network.The 4251B network (shown in Fig. 6) consists of an adjustable sidetone path which provides local operator sidetone, a voice switched attenuator (VSA) to suppress operator talker echo, frequency equalization and gain adjustments to enable coupling of the network to a 4-wire carrier or metallic facility, and AGC to limit the average energy of high-level signals arriving at the operator's headset receiver. A monitor port and an external port for connection to a supervisory position and a monitoring position circuit are provided.

4.22 All PSS No. 1 operator position circuits are to be retrofitted with 1R 4-wire terminating sets, or equivalent, as the TSPS bridging hybrids and 4251B networks as operator position circuits. The 4251B network is also to be used as the telephone circuit in the supervisory buffer circuit (SD-1B044-01). A 4281-type network is ***not*** to be substituted in place of the 4251B network.

4.23 Impedance balancing of the TSPS base unit, as well as the RTA, became a requirement with the introduction of the RTA feature and to a lesser extent the PSS No. 2 feature. The following additional circuit changes are also required in the TSPS base unit:

(a) Add the service observing trunk access circuit (SD-1B275-01) and modify the service evaluation and control interface circuit (SD-3B025-01, option Z) for connection to the service evaluation system.

(b) Modify incoming CAMA transfer trunk circuit (SD-1B016-01) to provide option A.

(c) Replace SD-1B022-01 and SD-1B017-01 incoming CAMA transfer trunk circuits with modified SD-1B016-01 trunk circuits.

(d) Add a drop build-out capacitor across the impedance interface network of the incoming CAMA transfer trunk circuit SD-1B016-01.

4.24 With the introduction of the ACTS and signaling irregularity detection (SIGIRR) features, impedance balancing of the TSPS base unit is required regardless of whether the RTA feature is provided. In order to realize the full capabilities of the ACTS feature, all RTA 4-wire incoming trunk circuits handling coin traffic must be equipped with the standard JW237 trunk circuit (SD-1B117-01). Use of the older RTA 4-wire incoming trunk circuits, JW217 (SD-1B117-01) and JW218 (SD-1B118-01), will cause a reduction in the reliability of coin deposit detection and the loss of protection against coin deposit fraud by the called party. The JW237 trunk circuit provides the required T2 port access capability and proper impedance matching for all connections to the T2 port.

4.25 With the introduction of busy line verification and the 3-way operator service trunk conferencing features, the 2-way operator service trunk circuit (SD-1B278-01) has been modified with the addition of a negative impedance converter (NIC). The purpose of the negative impedance converter is to provide the proper impedance to permit 3-way connections among the calling customer, the TSPS operator, and a service assistant. The modified SD-1B278-01 operator service trunk circuit is the Bell System standard and is required for use with generic program 1T10 and later generic programs. Any SD-1B010-01 or unmodified SD-1B278-01 operator service trunk circuits are to be replaced with modified SD-1B278-01 operator service trunk circuits.

E. Transmission Requirements

4.26 ***Transmission Loss:*** The inserted connection loss (ICL) requirements for the various types of trunks associated with the TSPS are summarized in Table A. The average speech power of a calling customer measured at the class 5 office is about −21 dBm and the average speech power of the calling customer at the originating toll office is expected to be about −24 dBm since the average ICL of toll-connecting trunks is 3 dB. To minimize the speech level contrasts perceived by the parties involved in a 3-way connection, both the TSPS base unit and the RTA concentrator are designed to operate at the same average speech power levels as the originating toll office (ie, −24 dBm). The ICL values for the various types of trunks presented in Table A were selected so that the average speech power arriving at the TSPS base unit or RTA concentrator will be nominally −24 dBm and the average speech power arriving at the opposite end of each type of trunk will be the nominal value required for proper operation of the circuit, network, or system connected to the trunk. For example, the PSS No. 2 operator position trunks are aligned to meet two general objectives; first, to deliver speech power of −24 dBm to the TSPS base unit from the TSPS operator; second, to deliver the proper level acoustic signal to the TSPS operator when an average customer speech power of −24 dBm is received at the base unit. In the case of CDA, TDA, and MDA circuits, the ICL of all possible voice transmission paths through these circuits will be 0 dB. The average power of the ACTS announcements reaching the TSPS base unit will be nominally −24 dBm.

4.27 ***Noise:*** The noise requirements for the TSPS are given in Table B. A transmission path through a TSPS in many cases is provided by two trunks in tandem (eg, a TSPS operator trunk and possibly a base-remote trunk). On connections to the TSPS operator, special consideration should be given in the operator receive direction. Particular attention is required if the operator position trunk, or the connecting trunk (eg, base-remote, incoming CAMA transfer or BLV access trunk), is over 200 facility route miles in length and the overall connection through the TSPS approaches the noise limit in Table B for 201 to 400 facility miles of noncompanded analog carrier facilities.

4.28 The overall noise requirement on a connection through a TSPS is: the sum of the noise contributions from the various trunks in the connection (from the point of bridging to the receive port of the TSPS operator telephone circuit) are to be within the limits listed in Table B for noncompanded analog carrier facilities. That is, the sum of noise from the trunks in any connection through a TSPS should be the same for circuit order and maintenance purposes as that of a single trunk having the same overall route mileage.

4.29 If system lengths longer than 400 miles are required, then special noise reduction techniques must be employed to meet the requirements of Table B. The recommended noise reduction techniques include use of compandors with analog carrier facilities (eg, the N3 Compandor Applique with L-multiplex carrier systems) to reduce the effective noise; and use of toll grade digital carrier facilities such as the T2 carrier system rather than analog carrier facilities. Some of the restrictions on the maximum facility route lengths of various types of trunks presented in Part 4B have been imposed as a direct consequence of the above noise requirements and noise reduction techniques.

4.30 The type I or type II CDA circuit or the TDA and MDA circuits will appear in some of the possible connections through a TSPS. In order to make their noise contribution to the overall connection through the TSPS negligible, the noise introduced in any of the possible transmission paths through these circuits must be less than 10 dBrnC.

4.31 The service observing trunk access circuit (SD-1B275-01) will be included in those connections through the TSPS to be service observed. In order to make its noise contribution to the overall connection through the TSPS negligible, the noise introduced by the service observing trunk access circuit must be less than 10 dBrnC.

4.32 Cable pairs used for transmitting data and those used for carrying TTY information between the TSPS base unit and operator service organizations located in other buildings may cause excessive interference if the cable pairs are located in the same cable with interoffice operator position trunks. Voice-frequency interference objectives for a "remote chance" of interference in toll circuits should be met. Noise interference values can be measured using a 3-type noise measuring set (NMS) connected to the disturbing circuit by means of a noise interference coupler as described in Section 103-642-100.

4.33 The overall noise requirement in each direction on a connection between a supervisory console and an operator position headset jack via supervisory trunks is 3 dBrnC and 12 dBrn measured at 3 kHz with flat weighting at the receive jack of the 4251B network. Transfer trunks are to meet the noise limits specified in Table B.

4.34 ***Gain-Slope Distortion:*** The trunks in a TSPS No. 1 or No. 1B may be grouped into three categories:

(a) Trunks that ***either*** originate or terminate on the base unit or RTA concentrator switching network (eg, operator position trunks, operator service trunks, incoming trunks, BLV trunks, inward trunks, delayed call trunks, CAMA transfer trunks, and base-remote trunks)

(b) Trunks that ***both*** originate and terminate on the base unit or RTA concentrator switching network (eg, service observing access trunks, CDA, MDA, and TDA circuits)

(c) Trunks that ***neither*** originate nor terminate on the base unit or RTA concentrator switching network (eg, supervisory trunks and transfer trunks).

4.35 The gain-slope requirements are expressed as the gain or loss at 404 Hz and 2804 Hz relative to the actual measured gain or loss at 1004 Hz. The gain-slope requirements for trunks listed in paragraph 4.34 (a) and (c) are the same as the requirements listed in Section 660-450-301. Exceptions to the requirements in Section 660-450-301 are permitted for 4-wire voice-frequency metallic extensions of carrier facilities on base-remote, incoming CAMA transfer, operator service, BLV access, delayed call, inward, and PSS No. 2 operator position trunks. For these exceptions the following additional gain-slope distortion is permitted on the metallic extension: 1.0 dB more loss to 0.5 dB less loss at 404 Hz and 2.5 dB more loss to 0.5 less loss at 2804 Hz relative to the gain or loss measured at 1004 Hz.

4.36 The gain-slope requirements for trunks listed in paragraph 4.34 (b) are: 0.5 dB more loss to 0.5 dB less loss at 404 Hz 0.5 dB more loss to 0.5 dB less loss at 2800 Hz relative to the gain or loss measured at 1004 Hz.

4.37 ***Impedance Balance:*** As indicated in paragraph 3.04, the effects of customer and/or TSPS operator talker echo can result in significant degradation in the quality of the transmission performance provided for the RTA, CAMA transfer, and BLV features. This possible degradation may be due to the additional 2-wire switching point introduced by the RTA concentrator, and the signal propagation delay of potentially long base-remote, incoming CAMA transfer, and BLV access trunks. Use of the 4251B network in all TSPS operator positions as indicated in Part 4D will help solve the TSPS operator talker-echo problem. Careful impedance balancing of the 2-wire TSPS base unit switching network and the 2-wire RTA concentrator will solve the customer talker echo problem.

4.38 Impedance balancing of the 2-wire TSPS base unit switching network and the 2-wire RTA concentrator is required. The impedance balance test requirements for a TSPS/RTA are presented in Section 660-463-301 for use by the craft personnel during balance testing and in Table F for use by the transmission engineer during evaluation of the balance test data. Restrictions on the use of service assistance operators at 3C-type switchboards, No. 23 operating room desks, and Phase I No. 5 ACDs have been imposed to help solve the potential service assistance operator talker-echo problem.

4.39 A general discussion of impedance balance testing for TSPS No. 1 is given in Section 660-463-100. Balancing the TSPS base unit, or the RTA concentrator requires the use of successive step techniques and intermediate evaluations. The successive step methods simplify the balancing process and specify that intermediate echo return loss (ERL) and singing return loss (SRL) evaluations be made to substantiate completed steps and verify portions of balance work before the total dynamic structure of switch balancing can become distorted by improper analyses of adjustments. Determining that a TSPS trunk group meets balance requirements is the responsibility of the transmission engineer. Detailed procedures for balancing a TSPS base unit and RTA are provided in Sections 250-103-506 and 250-145-503, respectively for TSPS No. 1 and in Sections 250-208-505 and 250-211-503, respectively, for TSPS No. 1B.

4.40 The ERL and SRL balance test requirements presented in Sections 660-463-301 are reference values. If the balance test results obtained by the craft personnel meet or exceed the requirements in Section 660-463-301, no further action is necessary. If the balance test results fail to meet these requirements, the results are to be reported to the transmission engineer. The transmission engineer will determine whether the results meet the ERL and SRL balance test requirements based on the median and minimum criteria for the base unit and the RTA impedance balance test requirements as presented in Table F.

4.41 Before the impedance balancing steps can be started at the TSPS base unit or RTA, the toll office associated with the TSPS base unit must be balanced and certified as being balanced. The TSPS base unit cannot be successfully balanced if the associated toll office is not properly balanced. Also, before balance procedures can begin;

(a) All trunks should meet ICL and noise requirements.

(b) All circuit changes specified in Part 4D should be made.

(c) The maximum cabling length restrictions specified in Part 4F for the 2-wire transmission paths through the TSPS base unit and the RTA should be met.

4.42 ***Impedance Balance Certification:*** The initial impedance balance certification and recertification requirements are covered in Section 852-400-010.

F. Two-Wire Path Cabling Length Restrictions

4.43 No resistance build-out capability is provided in the impedance balancing networks of the 1R 4-wire term set and the equivalent 900-ohm 4-wire term set used in 3-way 4-wire bridging repeaters for TSPS base unit and RTA applications. Therefore, it is necessary to limit the cabling resistance of the 2-wire path between the point of good impedance of each type of trunk through the TSPS base unit switching network, or RTA concentrator, and the 4-wire term set hybrid junction. In TSPS base units and RTAs, 26-gauge switchboard (26SB) cabling is used exclusively to allow reasonable control of the series resistance portion of the 2-wire impedance of a trunk to be obtained by limiting the length of 26SB cabling. Therefore, when equipment rearrangements, additions, deletions, and modifications are made which change the amounts of 26SB cabling in these 2-wire paths, the effect on the balance in the TSPS base unit, or RTA, should be investigated.

4.44 The restrictions on the maximum length of 26SB cable permitted in voice-transmission connections through the TSPS base unit and RTA are summarized in Tables C and D, respectively. These restrictions apply only if drop build-out capacitors (DBOC) are provided in the 2-wire paths where required and are properly set. These restrictions are sensitive to the value of the resistance portion of impedance matching networks and to the value of the resistance portion of the impedance balancing network of each 4-wire term set. Therefore, for the maximum cable length restrictions summarized in Tables C and D to apply, the circuit changes specified in Part 4D must be made.

4.45 The maximum cable length restriction requirements summarized in Tables C and D do not include requirements on the maximum length and gauge of office wiring to interconnect the TSPS 2-wire incoming trunk circuit (of either the TSPS base unit or an RTA), the toll office, and the point of good impedance of the toll-connecting trunk facilities. However, if terminal balance requirements can be met in the toll office on the toll-connecting trunk, it has been demonstrated that balance requirements can be met by such a toll-connecting trunk in a TSPS base unit or RTA provided that the network buildout capacitor of the 1R 4-wire term set associated with the balance test circuit in the TSPS base unit or RTA is properly adjusted.

4.46 There is no specific maximum permissible value for the capacitance in the 26SB cabling for any 2-wire connection through either the TSPS base unit or the RTA. Nor is there a specified maximum for the NBOC value selected for the impedance balancing network for the 1R 4-wire term set associated with either the balance test circuit of the CDT in the TSPS base unit or the TSTD frame in an RTA. Rather, the maximum value for the NBOC of the 1R 4-wire term sets is specified as that compromise value required to meet balance requirements on all possible 2-wire connections through either the RTA concentrator or the TSPS base unit switching network involving a 1R 4-wire term set and any toll connecting trunk providing TSPS 2-wire access. It should be noted that there is already a maximum value of capacitance in office cabling specified for 2-wire connections to a 4-wire term set in a toll office. This maximum permissible value is limited by gain-slope distortion characteristics such that the NBOC of the balancing networks of 4-wire term sets in the toll office should not exceed 0.080 μF. The maximum adjustment of the NBOC of the 1R 4-wire term sets is 0.063 μF. If the 2-wire toll office NBOC value is something greater than 0.063 μF it will not be possible to balance the TSPS base unit or RTA unless the NBOC value greater than 0.063 μF was caused by a switchboard which is intended to be removed. In which case the toll office NBOC will be reestablished.

4.47 The value of the NBOC of the balancing networks associated with the 1R 4-wire term sets in a given RTA or base unit is to be selected first. This effectively specifies the maximum permissible value for the capacitance in the 26SB cabling for any other connection in the RTA or base unit involving a 1R 4-wire term set. It should be remembered that the capacitance of the 26SB cabling between the 4-wire transmit and receive ports of a term set and the points of good impedance of the associated 4-wire facilities also contributes to the total capacitance of the connection to a 1R 4-wire term set. A point of good impedance on 4-wire facilities is provided by a 227-type amplifier, or equivalent. The effect of the 26SB cabling between the 4-wire transmit and receive ports of the 4-wire term set and the points of good impedance may be sufficiently masked by inserting 600-ohm pads between the 4-wire transmit and receive ports and the 26SB cabling. The minimum value for these pads depends upon the length and gauge of the 26SB cabling to be masked.

5. TRANSMISSION ENGINEERING CONSIDERATIONS

A. General

5.01 The following paragraphs (paragraphs 5.01 through 5.132) present the transmission engineering considerations for standard TSPS trunks and connections for features provided by TSPS generic programs through generic 1BT1 with the exception that the Rate Quote System feature introduced with generic program 1T10.2 is not covered in this section. The discussion considers typical arrangements in a TSPS installation equipped with generic program 1BT1 and the transmission circuit changes specified in Part 4D. Trunk design information is available in SMETDS. The following transmission engineering considerations (in Part 5A) are general in nature and apply to more than one type of TSPS trunk.

Compandor Use

5.02 In order to meet the noise requirements in Part 4E, use of companded L-multiplex (LMX) carrier facilities will be required in place of other types of analog carrier facilities in the facility design of PSS No. 2 operator position, base-remote, incoming CAMA transfer, BLV access, and operator service trunks under certain conditions as outlined in Part 4B. The N3 Compandor Applique (J99338E) described in Section 332-421-100, provides an economical means of companding L-multiplex facilities and permits companding on a single voice channel basis. This circuit was developed specifically for application in trunks used to provide operator services and is the recommended means for companding L-multiplex facilities in TSPS applications. Another means of obtaining the desired companding of voice channels for transmission over L-multiplex cable and radio carrier system facilities in TSPS applications is the type B N3-L Junction described in Section 855-335-108. The type B N3-L Junction permits either 12 or 24 channels to be transferred from voiceband to one or two L-multiplex groups.

Verification of the 4251B Network AGC Feature

5.03 The 4251B network provides the operator and supervisor positions (supervisory consoles and remote headset jacks) with an AGC feature to limit the received volume of loud tones. The AGC feature can be checked for proper operation at a supervisory position by establishing a connection using one of the supervisory trunks and transmitting a 1-kHz tone from the remote headset transmit jacks and measuring it at the receive jacks of the supervisory position. A 0 dBm, 1-kHz tone input into the 132A test set at the remote headset jack should be measured as a −26 dBm ±2 dB signal at the supervisory position if the

AGC circuit is functioning and if both positions are properly aligned. The operator AGC circuit can be similarly checked by transmitting the test tones from the supervisor position and measuring the response at the operator receive jacks.

B. PSS No. 1 and No. 2 Operator Position Trunks

5.04 Figures 4 and 5 show typical transmission layouts for a PSS No. 1 and a PSS No. 2 operator position trunk, respectively. The trunk equipment is for voice transmission, because the position information data is transmitted in PSS No. 2 by a separate common data channel. The position information data in a local or semi-remote PSS No. 1 is also transmitted by a separate common data channel. The signaling channel of the T1 carrier system is used to transmit position information for remote operation of PSS No. 1 operator positions.

5.05 The PSS No. 1 and No. 2 and operator position trunk designs are based on a 4-wire carrier system or 4-wire metallic cable pairs. The 4-wire facility is terminated in an external 24V4-type repeater at the base unit end and in the 4251-type network at the position end. In a PSS No. 1 the following equipment is to be used:

(a) A 4251B network must be used as the operator telephone circuit in the 100B console.

(b) On a local or semi-remote operator position trunk, 4-wire metallic facilities must be used with a 1R 4-wire term set used as the TSPS bridging hybrid in the 24V4 repeater.

(c) On a remote operator position trunk, a bridging end DIC channel unit, with a bridging hybrid equivalent to a 1R 4-wire term set, must be used with the T1 carrier system.

5.06 For PSS No. 1, the operator service organizations must be located within 50 airline miles of the TSPS base unit and a T1 carrier system with D1C channel banks must be used to provide the operator position trunk facilities for remote operation. In contrast, the PSS No. 2 operator service trunk facilities may be composed of any intertoll grade carrier system facilities for remote operation.

5.07 For PSS No. 2, the maximum permissible noncompanded analog carrier facility length between the most remote operator position and the most remote portion of the TSPS network (ie, the base unit, RTA, CAMA office, service assistance operator, or BLV network access office) is 400 route miles. This maximum distance can be increased up to 1000 route miles by using compandors to reduce noise (see paragraph 5.02), providing the absolute delay requirements on the peripheral control link associated with the RTA or PSS No. 2 are met (see paragraph 5.91).

5.08 To avoid maintenance confusion and unacceptable compromises in transmission performance, the lineup rules for TSPS operator position trunks are based upon the performance of 60A, 61A, KS-20778 List 16B, or equivalent headsets.

5.09 It is not possible to align operator position trunks for optimum transmission when headsets other than those listed above are used. The transmission alignment recommended for the PSS No. 1 and PSS No. 2 operator position trunks is specified in Fig. 4 and 5, respectively. The levels for the supervisory position and monitor position are the same as for the operator position. External headset amplifiers are to be used only in accordance with Section 024-108-105.

5.10 A plug-in 1R 4-wire term set is used in the 24V4-type repeater associated with a PSS No. 2, or a local or semi-remote PSS No. 1. An equivalent 1R 4-wire term set is provided in the bridging end D1C channel unit (SD-97068-02) used in a remote PSS No. 1. The 1R 4-wire term set is designed to be bridged across a 2-wire 900-ohm trunk or another circuit of similar impedance (nominally 450 ohms + 4.32 μF). It consists of a 2-transformer hybrid arrangement with a factory set build-out resistor in the 2-wire port. The balancing network is a compromise network (481 ohms + 4.32 μF) shunted by an adjustable NBOC. The resistance portion of this compromise network is greater than 450 ohms to allow for the series resistance introduced by the TSPS base unit switching network and the 26SB cabling in the 2-wire voice transmission path. The nominal impedance of the 2-wire port of the 1R 4-wire term set or equivalent is 11,550 ohms.

5.11 The 4251B network pictured in Fig. 6 contains a built-in frequency equalizer. However, on metallic PSS No. 1 operator position trunks the reference trunk circuit (SD-1B064-01) has access to the operator end of the position trunk before the equalization has been applied. Since a frequency equalizer is not provided in the reference trunk circuit, the necessary loss-frequency equalization at the operator end of PSS No. 1 operator trunk facilities should be provided between the facilities and the reference trunk circuit rather than by the 4251B network in the TSPS operator position.

5.12 The test and display (TSTD) frame (SD-1B123-01) located in each PSS No. 2 operator service organization has access to the operator end of the position trunk facilities by means of the voice path control circuit (SD-1B078-01) as shown in Fig. 5. A 24V4-type repeater is included at the input of the TSTD frame to provide the interface between the test equipment of the TSTD frame and the position trunk facilities. If all PSS No. 2 operator position trunks to an operator service organization have the same facility makeup, the loss-frequency equalization of the position trunk facilities can be provided by the 4251B network. However, since the 359-type equalizer associated with this 24V4-type repeater cannot be easily adjusted, loss-frequency equalization position trunks which consist of varying facility make-ups should be provided by equalizers located between the facilities and the voice path control circuit.

5.13 The transmission requirements for PSS No. 1 and No. 2 operator position trunks can be found in the following places:

Loss — Paragraph 4.26 and Table A

Noise — Paragraphs 4.27 through 4.33 and Table B

Gain-Slope — Paragraphs 4.34 through 4.36

Balance — Paragraphs 4.37 through 4.42 and Table F.

C. Supervisory and Monitor Positions

5.14 A supervisor associated with a PSS No. 1 or PSS No. 2 operator service organization is provided with the capabilities to perform the following functions:

(a) Answer calls from TSPS operators in the operator service organization or calls from customers transferred by TSPS operators.

(b) Establish talking or monitoring connections to any TSPS operator position in the operator service organization (maximum of 62 operator positions).

(c) Originate calls to a local or toll office in the MTS network.

5.15 A supervisory console is a desk mounted CALL DIRECTOR® telephone set equipped with nonlocking keys and signaling lamps. In addition to the supervisory position, one of the TSPS operator positions in a operator service organization is designated as the monitor position. Connections to any TSPS operator position in the operator service organization can be monitored from the bi-modal operator/monitor position.

5.16 The transmission requirements for supervisory and monitoring position can be found in the following locations:

Loss — Paragraph 4.26 and Table A

Noise — Paragraphs 4.27 through 4.33 and Table B

Gain-Slope — Paragraphs 4.34 through 4.36

Balance — Paragraphs 4.37 through 4.42 and Table F.

Supervisor Positions and Circuits

5.17 A supervisory position connects directly to the supervisory buffer circuit (SD-1B044-01) as shown in Fig. 45 and 46. Most of the transmission circuits required to support the supervisory position are contained in the supervisory buffer circuit. The supervisory buffer circuit is capable of supporting two positions allowing two supervisors to work together in the same operator service organization. In addition to the supervisory headset jacks provided at the supervisory consoles, a maximum of four remote supervisory jacks may be located at different TSPS operator positions in the operator service organization. Use of any remote supervisory jack will permit a supervisor at a location other than a supervisory console to answer a supervisory request call from an operator in the operator service organization or transferred by an operator in that operator service organization.

5.18 The supervisory trunks in the supervisory buffer circuits are used for all communications between a TSPS operator within an operator service organization and a supervisor. Three supervisory trunks are provided. One preference trunk is associated with each supervisory position. Only the preference supervisory trunk for a given supervisory position can be used at the console for calling or monitoring TSPS operator positions. However, each supervisory position can receive calls from TSPS operators over its preference trunk or over the third supervisory trunk.

5.19 Incoming calls to a TSPS operator position from a customer may be transferred from the TSPS operator position to a supervisory position by means of a transfer trunk. There are two types of transfer trunks which can be supplied: trunks to the supervisory buffer circuit from a toll office, or local subscriber lines from a local office terminating on the supervisory buffer circuit. A total of three transfer trunks, all of which must be of the same type, may be provided with each supervisory buffer circuit.

5.20 A 3 by 4 four-wire switching matrix is provided to connect the three supervisory trunks to the four remote supervisory jacks. Another 3 by 4 four-wire switching matrix is provided to connect the three transfer trunks to the remote supervisory jacks. A connection from any remote supervisory jack to a supervisory trunk or transfer trunk is permitted. However, connections from more than one remote supervisory jack to the same supervisory trunk or transfer trunk are not permitted. When a supervisor is called on a supervisory trunk or a transfer trunk, the call can be answered by a supervisor from either supervisory position or from any of the remote supervisory jacks.

5.21 The supervisory position is capable of providing access to two types of lines to allow a supervisor to initiate outgoing calls. A toll subscriber line allows the supervisor to place calls through a toll operator. A subscriber line to a local office allows the supervisor to dial calls using the TOUCH-TONE dialing pad provided in the supervisory position in the same manner as a customer with a TOUCH-TONE* telephone set.

5.22 The supervisory buffer circuit provides the telephone circuits (6 maximum) used by two supervisory consoles and by four remote supervisory jacks as shown in Fig. 46 to handle all calls except outgoing calls over a subscriber line to a local office (discussed in paragraph 5.21). The telephone circuits provided in the supervisory buffer circuit associated with a PSS No. 2 or a PSS No. 1 operator service organization should be the 4251B network. The wiring distance between a 4251B network and an associated supervisory position or remote supervisory jack should not exceed either 100 feet or dc loop resistance of 5 ohms. Otherwise, a headset transmitter extension circuit must be used. The headset transmitter extension circuit is available as an option on the SD-1B030-01 and SD-1B075-01 operator position circuits.

*Trademark

5.23 A supervisory trunk consists of a 4-wire voice connection between the EXT port of the operator position 4251B network and the EXT port of the supervisors 4251B network as shown in Fig. 46. A connection from the EXT port of the 4251B network in each of the TSPS operator positions in an operator service organization is multipled through the contacts of the supervisory (SR__) relays in the voice path control circuit (SD-1B078-01) for connection to the supervisory trunks in the supervisory buffer circuit. In contrast, the selected transfer trunk is connected to the supervisor through the LINE port of the 4251B networks in the supervisory buffer circuit as also shown in Fig. 46.

5.24 Supervisory trunks utilize 4-wire, 600-ohm facilities while transfer trunks use 900-ohm, 2-wire facilities. Included in the supervisory buffer circuit are five 1M 4-wire term sets to provide the interface between the 4-wire LINE port of the 4251B networks and the 2-wire transfer trunk faclities. Loop supervision signaling for the transfer trunks from a toll or a local office is also provided in the supervisory buffer circuit. The ICL requirements for the transfer trunks are given in Table A. The transmission alignment recommended for the supervisory and transfer trunks and for the 4251B networks in the supervisory buffer circuit is specified in Fig. 45.

5.25 The toll subscriber line to a toll operator and the subscriber line to a local office interface with the supervisory buffer circuit on a 2-wire basis. When a supervisor wishes to initiate an outgoing call over a toll subscriber line (if the toll subscriber line option is implemented), the 4-wire LINE port of the 4251B network in the supervisory buffer circuit will be connected to the 2-wire toll subscriber line through the 1M 4-wire term set used to interface with the 2-wire transfer trunk facilities. Since the 4-wire LINE port of this 4251B network is aligned for connection to a transfer trunk, the recommended ICL of the toll subscriber line will depend on the ICL of the transfer trunk. Loop signaling and a hold capability for the toll subscriber line is provided by circuitry in the supervisory buffer circuit. The impedance presented to the 2-wire interface with the toll subscriber line by the supervisory buffer circuit is nominally 900 ohms + 2.16 μF.

5.26 When a supervisor wishes to initiate an outgoing call over the local subscriber line, the telephone circuit and TOUCH-TONE dialing pad provided in the supervisory position will be connected through the supervisory buffer circuit to the 2-wire subscriber line facilities to a local office. A hold circuit for the subscriber line will be provided in the supervisory buffer circuit. Since the telephone circuit plus supervisor headset or handset and the average subscriber telephone set are expected to provide equivalent performance, the transmission design of the subscriber line to a local office should be the same as for lines provided to normal customers in the MTS network.

Monitor Position

5.27 One TSPS operator position in a operator service organization is designated as the monitor position and that position is equipped with a MON switch. This monitor position may be used by a TSPS operator to handle normal TSPS traffic in the same manner as any other operator position in the operator service organization. However, when an operator inserts a key and operates the MON switch, the stored program control is informed that a monitoring session is to begin. An operator occupying this position may be connected to any other TSPS operator position in the operator service organization through the voice path control circuit (SD-1B078-01) for listening only as shown in Fig. 45.

D. TSPS Bridging Arrangement

5.28 Figures 7, 8, and 9 show simplified block diagrams of the TSPS 2-wire and 4-wire trunk bridging arrangements used in the TSPS base unit and the RTA and their respective connections to the trunk link circuit of the TSPS base unit switching network or the trunk stage of the RTA concentrator.

Two-Wire Bridging

5.29 The 2-wire bridging arrangement is used to provide TSPS access to 2-wire toll-connecting trunks and is essentially the same for both TSPS base unit and RTA applications as indicated in Fig. 7. A simple 2-wire metallic bridging connection to the toll-connecting trunk facilities is provided within the TSPS or RTA 2-wire incoming trunk circuit. Slight differences in these 2-wire incoming trunk circuits do occur as a consequence of the type of signaling (ie, loop or E & M) used between the local office and the TSPS base unit or RTA. In addition, a termination is required in the RTA 2-wire incoming trunk circuits as indicated in Fig. 7 to provide the necessary impedance matching required when a base-remote trunk is connected to the T2 port of this trunk circuit.

5.30 The structural return loss of the exchange cable must be 30 dB or greater in order to meet the return loss requirements on 2-wire incoming trunks to the TSPS or RTA. This permits insertion of the TSPS or RTA 2-wire incoming trunk circuit into a 2-wire toll-connecting trunk without significantly lowering the terminal balance at the toll office. However, the cabling runs on either side of the TSPS or RTA incoming trunk circuit can affect the terminal balance and must be controlled. The insertion loss of the TSPS 2-wire incoming trunk circuit is 0.1 dB during normal conversation (without the operator bridged on). When the TSPS operator is connected to the T1 port of any of these trunk circuits, the insertion loss is increased to 0.4 dB. Because the impedance presented to either side of the bridging point is nominally 900 ohms + 2.16 μF, the impedance presented to the T1 port appearance on the base unit trunk link circuit or on the trunk stage of the RTA concentrator will nominally be 450 ohms +4.32 μF.

5.31 The standard applications of 2-wire bridging arrangements are shown in Fig. 10 and 11 for toll-connecting trunks. It should be noted that use of 2-wire bridging arrangements on 4-wire toll-connecting trunks to 4-wire toll offices is nonstandard and is discouraged as discussed in paragraph 4.09.

Four-Wire Bridging

5.32 The 4-wire bridging arrangement is used to provide TSPS access to 4-wire toll-connecting, inward and delayed call trunks at the TSPS base unit or RTA. Different bridging arrangements are used for TSPS base unit and RTA applications as illustrated in Fig. 8 and 9, respectively. Another variation of the 4-wire bridging arrangement is used in the service observing trunk access circuit (SD-1B275-01) to provide a service observer with access to connections through the TSPS base unit switching network as discussed in Part 5I.

5.33 Four-wire bridging access to toll-connecting, inward, and delayed call trunks is provided by the TSPS 4-wire bridging repeater (SD-7C022-01) in conjunction with the appropriate TSPS or RTA trunk circuit. However, as indicated in Fig. 8, the configuration of the TSPS 4-wire bridging repeater used at a base unit will be different from one used in a RTA (Fig. 9) due to the differences in the base unit and RTA 4-wire incoming and inward trunk circuits. The TSPS/RTA 4-wire bridging access is a consolidated equipment arrangement introducing negligible transmission degradation in the trunks to which it is added. Complete incoming and outgoing level control on all ports as well as level control for MF tones transmitted from the trunk circuit T2 port is available. The E & M or simplex loop signaling interface to the 4-wire toll-connecting, inward or delayed call trunks is provided by optional plug-in units (ie, 849H or 849J networks or a 333B relay).

5.34 The TSPS 4-wire bridging repeater mounting shelf also accepts the SD-99782-01 3-way, 4-wire bridging repeater, two 227F amplifiers (or 849-type networks when no gain is required), and two optional signaling plug-ins (either the 849H or 849J network or the 333B relay). The shelf contains a jack panel with five pairs of splitting jacks to provide test equipment access for maintenance and initial lineup. An adjustable drop build-out capacitor (DBOC) is also included to build out office cabling capacitance on the 2-wire T1 port. The nominal impedance of the T1 port is 450 ohms + 4.32 μF.

> ***Note:*** Although the TSPS 4-wire bridging repeater (SD-7C022-01) is the preferred Bell System standard for all TSPS and RTA 4-wire bridging arrangements, the 3-way, 4-wire bridging repeater (SD-99782-01) used with the signaling converter (SD-1B145-01), externally provided 227-type amplifiers, and externally provided DBOC when required, is an acceptable arrangement in existing TSPS base units and RTAs.

5.35 The standard applications of 4-wire bridging arrangements are shown in Fig. 10 and 11 for toll-connecting trunks. It should be noted that the use of 2-wire bridging arrangements on 4-wire trunks to a 4-wire toll office is nonstandard and is discouraged as discussed in paragraph 4.09.

5.36 The transmission requirements for TSPS or RTA bridging arrangements can be found in the following locations:

Loss — Paragraph 4.26 and Table A

Noise — Paragraphs 4.27 through 4.33 and Table B

Gain-Slope — Paragraphs 4.34 through 4.36

Balance — Paragraphs 4.37 through 4.42 and Table F.

E. Toll-Connecting Trunks

5.37 A variety of toll-connecting trunks will be found at each TSPS No. 1 installation as shown in Fig. 10 and 11. The toll-connecting trunk design is dictated by circuit length, available facilities, and types of offices at each end of the trunk. The TSPS incoming trunk circuit as well as the bridging arrangement is inserted into the toll-connecting trunks as shown in Fig. 7 and 8. An operator position trunk will be connected to the T1 port of the TSPS incoming trunk circuit through the TSPS base unit when operator assistance is required. An MF outpulser will be connected to the T2 port of the TSPS incoming trunk circuit in the base unit during call connection setup. The impedance of the T1 port presented to the trunk link circuit of the TSPS base unit switching network will be nominally 450-ohms +4.32 μF. The nominal impedance at the T2 port of the base unit incoming trunks is 900-ohm +2.16 μF for TSPS 2-wire incoming trunk circuits and 600-ohms +2.16 μF for TSPS 4-wire incoming trunk circuits.

5.38 The RTA incoming trunk circuit and bridging arrangement is inserted into the toll-connecting trunk as shown in Fig. 9. A base-remote trunk is connected to the T1 port of an RTA incoming trunk circuit through the RTA concentrator. The MF outpulser, located at the base unit, will be connected through a second base-remote trunk, through the RTA concentrator, to the T2 port of the RTA incoming trunk circuit. The nominal impedance presented to the RTA concentrator by the T1 and T2 ports of the incoming trunk circuit, is 450 ohms + 4.32 μF.

5.39 The ICL of the toll-connecting trunk between the TSPS or RTA trunk circuit and the toll office should be nominally 0 dB with a maximum of loss 0.5 dB. Regardless of how the various sections of the toll-connecting trunks are designed, the overall ICL must meet the requirements specified in Table A. The transmission alignment recommended for the various types of toll-connecting trunks providing TSPS or RTA access are specified in Fig. 12 through 16. Figure 12 specifies the transmission alignment recommended for toll-connecting trunks providing TSPS or RTA 2-wire bridging access. Figures 13 and 14 cover the transmission alignment for 4-wire toll-connecting trunks providing TSPS base unit bridging access with a TSPS 4-wire bridging repeater (SD-7C0022-01), or a 3-way, 4-wire bridging repeater (SD-99782-01), respectively. Figures 15 and 16 cover the transmission alignment of 4-wire toll-connecting trunks providing RTA 4-wire bridging access.

5.40 Appropriate TSPS and RTA incoming trunk circuits are available to accept any combination of 2-wire or 4-wire facilities, loop or E & M lead supervision signaling, and dial pulse or MF address signaling from the originating local office. The incoming pulsing information received by the TSPS No. 1 is processed as required and transmitted to the toll-switching office by an MF outpulser in the base unit. The supervision signaling used between the TSPS base unit, or RTA, and the toll-switching office must be loop signaling when TSPS or RTA 2-wire trunk circuits are used and either simplex loop or E & M lead signaling when 4-wire trunk circuits are used.

TSPS Base Unit or RTA Located at the Toll Office

5.41 Figure 10 shows various facility arrangements with the TSPS or RTA incoming trunk circuit located at the toll office. If a 4-wire toll-connecting trunk is provided to a 4-wire toll office, a 4-wire bridging repeater must be used along with a 4-wire TSPS or RTA incoming trunk circuit as discussed in paragraph 4.09. Otherwise, the TSPS or RTA 2-wire incoming trunk circuit can be used as shown in Fig. 10, provided the 2-wire cabling runs between the toll office and the base unit or RTA are controlled to ensure that terminal balance requirements are met.

5.42 When the section of the toll-connecting trunk between the local office and the TSPS or RTA incoming trunk circuit has less than 3 kilofeet of nonloaded cable, a 2-dB 900-ohm pad is added to the circuit as shown in Fig. 10. Although not shown in Fig. 10, a 1613A inductor should be used in conjunction with the 2-dB pad for nonloaded 22- and 24-gauge cable lengths between 2 and 5 kilofeet and in some cases (ie, 3 to 5 kilofeet of nonloaded 24-gauge cable) should be used instead of the 2-dB pad (see SMETDS).

5.43 If the 2-wire portion of the toll-connecting trunk between the local office and the TSPS base unit or RTA is composed of loaded cable, an 837-type impedance compensator is used to present a 900-ohm impedance toward the TSPS or RTA 2-wire incoming trunk circuit as shown in Fig. 10. Use of a precision network on a 900-ohm 4-wire term set which interfaces between a 2-wire toll-connecting trunk and a 4-wire toll office is not allowed because the possible deviation from 900 ohm +2.16 μF may prevent the TSPS base unit or RTA from meeting balance requirements.

TSPS Base Unit or RTA Remotely Located From the Toll Office

5.44 The TSPS or RTA incoming trunk circuit may be remotely located from the toll office if the facility length restrictions of paragraph 4.06 are met and the section of the toll-connecting trunk between the TSPS or RTA incoming trunk circuit and the toll office is derived on 4-wire cable or carrier facilities as shown in Fig. 11. Using the TSPS or RTA 2-wire incoming trunk circuit with 4-wire facilities and a 4-wire toll office is not recommended as discussed in paragraph 4.09. Through balance requirements would apply to both hybrids facing the TSPS base unit or RTA. This would have the same affect as an additional 2-wire toll office in every connection involving the TSPS.

5.45 The transmission engineering considerations for the portion of the toll-connecting trunk between the local office and the TSPS base unit or RTA when the TSPS base unit or RTA are located at the toll office (paragraphs 5.41 to 5.43) also apply when they are remotely located.

5.46 The transmission requirements for toll-connecting trunks providing TSPS or RTA bridging access can be found in the following locations:

Loss — Paragraph 4.26 and Table A

Noise — Paragraphs 4.27 through 4.33 and Table B

Gain-Slope — Paragraphs 4.34 through 4.36

Balance — Paragraphs 4.37 through 4.42 and Table F.

F. Delayed Call Trunks

5.47 When a call cannot be completed on the first attempt a subsequent attempt to complete the call may be made using a delayed call trunk. Delayed call trunks are provided only at the TSPS base unit. The delayed call trunk has two incoming intertoll trunk appearances in the toll office serving the TSPS. Figure 17 shows a facility arrangement for delayed call trunks. The TSPS operator performs the necessary operations to connect one end of the 4-wire delayed call trunk through the MTS network to the calling customer and connect the other end of the trunk to the called customer. The two customers are then connected through the delayed call trunk.

5.48 The delayed call trunk is essentially two secondary intertoll trunks in tandem with 4-wire TSPS bridging access at the interface between the secondary intertoll trunks. Thus, the transmission performance requirements on the delayed call trunk are the same as those on secondary intertoll trunks. Each of the two halves of a delayed call trunk should be composed of low-noise 4-wire facilities such as T-carrier or metallic facilities. To limit the degradation of the echo grade of service provided to the calling and called customers the maximum route length of the facilities composing each of the two halves of a delayed call trunk must be restricted as follows:

(a) Metallic facilities: 9 route miles

(b) T-carrier facilities: 50 route miles

(c) T-carrier facilities with metallic extensions: the length of the T-carrier facilities plus 10 times the length of the metallic extensions must not exceed 50 route miles.

5.49 The ICL requirement for a delayed call trunk is given in Table A. The delayed call trunk must meet balance requirements in the toll office; through balance when connected to an intertoll trunk and terminal balance when connected to a toll-connecting trunk. In order to meet the transmission requirements, the delayed call trunk must be 4-wire and the 4-wire delayed call trunk circuit (SD-1B009-01) with the TSPS 4-wire bridging repeater should be used. The transmission alignment recommended for delayed call trunks is specified in Fig. 18 or 19 depending upon the 4-wire bridging arrangement used.

Note: Although the TSPS 4-wire bridging repeater (SD-7C022-01) is the preferred Bell System standard for TSPS 4-wire bridging arrangments, the 3-way, 4-wire bridging repeater (SD-99782-01) used in conjunction with the signaling converter (SD-1B145-01), externally provided 227-type amplifier, and externally provided DBOCs when required, is an acceptable arrangement.

5.50 An operator position trunk will be connected to the T1 port of the delayed call trunk circuit in the TSPS base unit until the calling and called customers are connected. An MF outpulser will be connected to the T2 port of the delayed call trunk circuit during call connection setup. The impedance of the T1 and T2 ports of the TSPS base unit switching network is nominally 450 ohms +4.32 μF and 600 ohms +2.16 μF, respectively.

5.51 The TSPS 4-wire delayed call trunk circuit will provide the capability for either simplex loop or E & M lead supervision signaling. Only MF address signaling will be used by the TSPS base unit on delayed call trunks.

5.52 The transmission requirements for delayed call trunks can be found in the following locations:

Loss — Paragraph 4.26 and Table A

Noise — Paragraphs 4.27 through 4.33 and Table B

Gain-Slope — Paragraphs 4.34 through 4.36

Balance — Paragraphs 4.37 through 4.42 and Table F.

G. Inward Trunks

5.53 The TSPS is capable of performing some of the traditional inward operator functions such as general assistance, time and charges call back, and hotel call back. A special 4-wire inward trunk must be used to handle inward calls to a TSPS base unit or RTA. This inward trunk is composed of a toll office outgoing trunk circuit, a TSPS or RTA 4-wire inward trunk circuit, a 4-wire TSPS bridging arrangement, and a toll office incoming trunk circuit (Fig. 20 and 21). These three circuits are interconnected by 4-wire facilities. An incoming inward call will be connected through the toll office to the toll office outgoing trunk circuit associated with an inward trunk, and a TSPS operator will be added through the TSPS base unit or RTA 4-wire bridging arrangement. After the appropriate actions are performed by the TSPS operator, the toll office incoming trunk circuit associated with the inward trunk will be connected through the toll office to the appropriate toll-connecting trunk, thereby extending the inward call to the desired end office. Figure 20 shows the typical facility arrangement for inward trunks to a TSPS base unit. Figure 21 shows the typical facility arrangement for inward trunks to an RTA.

> ***Note:*** Although the TSPS 4-wire bridging repeater (SD-7C022-01) is the preferred Bell System standard for this application, the 3-way, 4-wire bridging repeater (SD-99782-01) used in conjunction with the signaling converter (SD-1B145-01), externally provided 227-type amplifier, and externally provided DBOC when required, is an acceptable arrangement.

5.54 The inward trunk is in effect, two secondary intertoll trunks connected in tandem with TSPS base unit or RTA access provided at the interface of the two trunks. Thus, the transmission performance requirements on both halves of an inward trunk are the same as those on secondary intertoll trunks. Each of the two halves of an inward trunk should be composed of low-noise 4-wire facilities such as T-carrier or metallic facilities and the facility route length must be limited as follows:

(a) Metallic facilities: 9 route miles

(b) T-carrier facilities: 50 route miles

(c) T-carrier facilities with metallic extension: determined by the relationship that the length of the T-carrier facilities plus 10 times the length of the metallic extensions must not exceed 50 route miles.

5.55 The ICL requirements for inward trunks are given in Table A. The transmission alignment recommended for inward trunks at a TSPS base unit are specified in Fig. 18 and 19 and for inward trunks at an RTA in Fig. 22 and 23. The inward trunk must meet through-balance requirements in the toll office when the inward trunk is connected to an intertoll trunk, and terminal balance requirements when the inward trunk is connected to a toll-connecting trunk. The impedance balance requirements pertaining to the TSPS base unit and RTA are in paragraphs 4.37 through 4.42 and Table F. Gain-slope requirements are discussed in paragraphs 4.34 through 4.36.

5.56 An operator position trunk will be connected through the TSPS base unit to the T1 port of the TSPS 4-wire inward trunk circuit or a base-remote trunk to the T1 port of an RTA 4-wire inward trunk circuit until operator assistance is no longer required. During call connection setup, an MF outpulser will be connected to the T2 port of the TSPS 4-wire inward trunk circuit in the TSPS base unit or through a base-remote trunk to the T2 port of an RTA 4-wire inward trunk circuit. The impedance of the T1 port of the TSPS base unit switching network or the trunk stage of the RTA concentrator is nominally 450 ohms +4.32 μF. The impedance of the T2 port of the TSPS base unit switching network is nominally 600 ohms +2.15 μF and 450 ohms +4.32 μF for RTA incoming trunks.

5.57 Appropriate TSPS and RTA 4-wire inward trunk circuits are available to accept E & M lead supervision signaling and MF address pulsing from the toll office on the incoming half of an inward trunk and will provide the capability for either simplex loop or E & M lead supervision signaling and MF address signaling on the outgoing half of an inward trunk.

H. Directory Assistance Charge Recording Trunks

5.58 The TSPS may be used to provide charge recording of directory assistance (DA) calls to Bell System operators at either a Phase II No. 5 ACD or a No. 23 ACD. Figures 24 and 25 show the trunking arrangements used for TSPS charge recording of local and intra-numbering plan area (intra-NPA) directory assistance traffic. These trunking arrangements include dedicated direct trunking from each originating class 5 office to a TSPS base unit or RTA and from the TSPS base unit to the ACD.

5.59 The same TSPS and RTA incoming trunk circuits and bridging arrangements used to provide TSPS access to toll-connecting trunks will be used to provide TSPS access to directory asistance charge recording trunks. Therefore, the supervision and address signaling capabilities and impedances presented to the trunk link circuit of the TSPS base unit or the trunk stage of an RTA concentrator by the T1 and T2 ports of the TSPS or RTA incoming trunk circuits will be the same for directory assistance charge recording and toll-connecting trunks (see Part 5E).

5.60 For TSPS charge recording of toll directory assistance calls or intra-NPA directory assistance calls routed through the MTS network, the call will be routed over a regular toll-connecting trunk providing TSPS or RTA access. The transmission design of toll-connecting trunks used for this application is the same as that discussed in Part 5E for toll-connecting trunks providing TSPS or RTA bridging access.

5.61 The transmission requirements for directory assistance charge recording trunks routed to a TSPS or RTA can be found in the following locations:

Loss — Paragraph 4.26 and Table A

Noise — Paragraphs 4.27 through 4.33 and Table B

Gain-Slope — Paragraphs 4.34 through 4.36

Balance — Paragraphs 4.37 through 4.42 and Table F.

Directory Assistance Charge Recording Trunks Without Trunk Concentration

5.62 For TSPS charge recording on calls using dedicated direct trunking without trunk concentration (Fig. 24), the charge recording trunk may be considered as two separate trunks which are permanently interconnected; (a) a trunk between the originating class 5 office and the TSPS or RTA bridging access point and (b) a trunk extending from and including the TSPS or RTA bridging access point to either a Phase II No. 5 ACD or No. 23 ACD. The trunk between the originating class 5 office and the TSPS or RTA bridging point should be designed as if it were a toll-connecting trunk so that the balance requirements on the TSPS base unit or RTA and the ACD system can be met. The trunk between the TSPS or RTA bridging access point and the Phase II No. 5 ACD or the No. 23 ACD should use only 4-wire metallic or carrier facilities. If the facilities used for the trunk between the originating class 5 office and the TSPS or RTA bridging access point are 4-wire, then 4-wire bridging access must be provided. However, if the facilities used for the trunk between the originating class 5 office and the TSPS or RTA bridging access point are 2-wire, either 2-wire or 4-wire bridging access may be provided. The transmission alignment recommended for directory assistance charge recording trunks without trunk concentration is specified in Fig. 24.

Directory Assistance Charge Recording Trunks With Trunk Concentration

5.63 For TSPS charge recording on local or intra-NPA directory assistance calls using dedicated direct trunking with trunk concentration, the trunks between the originating class 5 office and the Phase II No. 5 ACD or the No. 23 ACD (Fig. 25) may be considered as three permanently interconnected trunks; (a) a trunk between the originating class 5 office and the No. 1 or No. 23 trunk concentrator, (b) a trunk between the trunk concentrator and the TSPS or RTA bridging access point, and (c) a trunk extending from and including the TSPS or RTA bridging access point to the ACD.

5.64 The incoming trunks to the No. 1 or No. 23 trunk concentrator from the class 5 office may be engineered using either 2- or 4-wire facilities. The outgoing trunks from the trunk concentrator to the TSPS or RTA bridging access point must use 4-wire facilities. If a No. 1 trunk concentrator is used, the incoming trunk to the concentrator is to be designed with an ICL of 10 dB and the outgoing trunk from the concentrator to the TSPS or RTA incoming trunk circuit should be designed with an ICL of −7 dB (7 dB of gain). If a No. 23 trunk concentrator is used, the incoming trunk to the concentrator is to be designed with an ICL of 3 dB and the outgoing trunk to the TSPS or RTA incoming trunk circuit is to have an ICL of 0.0 dB. In order that the balance requirements on the TSPS base unit or RTA and the ACD can be met, terminal balance requirements must be met at the trunk concentrator. In the case of the No. 1 trunk concentrator, terminal balance requirements on the incoming trunk should be met after correction for any transmission gain transferred across the No. 1 trunk concentrator switching network from the outgoing trunk to the incoming trunk.

5.65 The trunk between the TSPS or RTA, bridging access point and the Phase II No. 5 or No. 23 ACD should use only 4-wire metallic or carrier facilities. A TSPS or RTA 4-wire incoming trunk circuit in conjunction with a TSPS 4-wire bridging repeater (SD-7C022-01) should be used to provide TSPS or

RTA bridging access. The transmission alignment recommended for directory assistance change recording trunks concentration is specified in Fig. 25.

> ***Note:*** Although the TSPS 4-wire bridging repeater (SD-7C022-01) is the preferred Bell System standard for this application, the 3-way, 4-wire bridging repeater (SD-99782-01) used in conjunction with the signaling converter (SD-1B145-01), externally provided 227-type amplifiers, and externally provided DBOCs when required, is an acceptable 4-wire bridging arrangement.

I. Service Observing Trunks

5.66 On incoming calls selected for service observing, a service observing trunk access circuit (SD-1B275-01), will be inserted in tandem with the overall connection through the TSPS base unit to a TSPS operator position trunk. For service observing incoming ACTS calls, the service observing access trunk is in tandem with a CDA circuit (see Part 5Q). In the case of a customer-dialed calling card call, the service observing access circuit is in tandem with a TDA circuit. A typical transmission layout for a service observing trunk is shown in Fig. 26.

5.67 The service observing access trunk circuit (SD-1B275-01) will provide a monitoring bridge connection from the service evaluation control and interface circuit (SD-3B025-01) to the service observing access trunk circuit appearances on the trunk link and position link circuits of the TSPS base unit switching network. A service observing position will be connected by appropriate facilities to the service observing monitor circuit. The service observing access trunk circuit, contains a 24V4-type repeater with a 1R 4-wire term set and a 3-way, 4-wire bridging repeater with the transmitting pair of the 4-wire P1 port providing the monitoring access for the service observer. The 24V4-type repeater in the service observing access trunk circuit interfaces with the 4-wire port 2 of the 3-way, 4-wire bridging repeater. The 2-wire port of this 24V4-type repeater has an appearance on the position link circuit of the TSPS base unit switching network and may be connected to a toll-connecting or base-remote trunk or to a CDA or TDA circuit. The 2-wire port 3 of the 3-way, 4-wire bridging repeater in the service observing access trunk circuit has an appearance on the trunk link circuit of the TSPS base unit switching network and may be connected to a TSPS operator position trunk or a CDA or TDA circuit. The transmission alignment recommended for the service observing trunk is specified in Fig. 26.

5.68 The transmission requirements for service observing access trunks may be found in the following locations:

Loss — Paragraph 4.26 and Table A

Noise — Paragraphs 4.27 through 4.33 and Table B

Gain-Slope — Paragraphs 4.34 through 4.36

Balance — Paragraphs 4.37 through 4.42 and Table F.

J. Incoming CAMA Transfer Trunks

5.69 The TSPS operator may function as a CAMA operator in place of a regular CAMA, operator in a CAMA office during certain traffic overflow situations, on a regular programmed basis during nonbusy hours, or on a permanent basis. Incoming CAMA transfer trunks are provided for this purpose which extend from the CAMA office to the TSPS base unit. The function of the TSPS operator when serving a CAMA call is the same as that of the regular CAMA operator; to orally obtain the directory number of the calling customer and to key it into the CAMA system to be recorded. The information keyed into the CAMA system on these calls by the TSPS operator is transmitted back to the CAMA office for recording on its automatic message accounting (AMA) equipment. Two transmission paths are associated with these incoming CAMA transfer trunks: a voice path to carry voice communications between the TSPS operator and the calling customer, and a keypulsing path to carry MF outpulser signals corresponding to the information keyed in by the TSPS operator. Thus, the TSPS incoming CAMA transfer trunk circuits have two appearances on the trunk link circuit of the TSPS base unit switching network: one reserved for attachment of the TSPS operator and the second reserved for attachment of an MF outpulser.

5.70 The object of the standard transmission plan for CAMA transfer trunks is to provide voice-transmission performance equivalent to that provided on an average short (100 to 150 airline miles) toll call in the MTS network and MF pulse transmission equivalent to that provided over the MF signaling path from the TSPS base unit to a toll office served by an RTA. Step-by-step, most crossbar tandem, and 4A/4M crossbar CAMA offices may experience difficulty in meeting the overall transmission requirements of this transmission plan due to deficiencies in the CAMA office transmission design which are beyond the control of operating company personnel. However, adhering to the requirements of this transmission plan as close as possible using currently available CAMA office equipment is expected to result in acceptable performance of the CAMA transfer feature.

5.71 The standard CAMA trunk circuits, transmission levels, and facility impedances to interface with the TSPS incoming CAMA transfer trunk circuit (SD-1B016-01) are shown in Fig. 27 and 28. The incoming CAMA transfer trunk circuit presents a 450-ohm +4.32 μF impedance to the base unit switching network for the voice communication path and a 900-ohm +2.16 μF impedance for the keypulsing path. Figure 27 shows the circuit design using type II and type III E & M signaling for No. 5 crossbar, No. 4A/4M crossbar, crossbar tandem, No. 1/1A ESS (2-wire), No. 1/1A ESS (with HILO) and No. 4 ESS CAMA offices. The only CAMA offices on which the transmission plan allows loop supervision are No. 5 crossbar and 2-wire No. 1/1A ESS offices. The circuit design for these two offices using loop supervision is shown in Fig. 28. Whichever type of supervision is used (E & M or loop), it will be necessary that both the voice and keypulsing paths use 4-wire facilities and the same type of signaling. The voice path is to be designed for a 0 dB ICL while the keypulsing path is to be designed for a −3 dB ICL.

5.72 Use of compandored LMX analog carrier facilities on the voice path may be required as discussed in paragraph 5.02 in order to meet overall noise requirements on the connection from the CAMA office to the most remote TSPS operator positions as discussed in Part 5B. The use of compandors are not required on the keypulsing path.

5.73 Impedance balance requirements for the voice-transmission path are contained in Table F. There are no impedance balance requirements on the keypulsing path, but to ensure that the keypulsing path is stable and does not approach a singing condition, the keypulsing path NBOC is to be set equal to the value of the voice path NBOC minus the setting of the DBOC in the incoming CAMA transfer trunk circuit.

5.74 The transmission requirements for CAMA transfer trunks are listed in the following locations:

Loss — Paragraph 4.26 and Table A

Noise — Paragraphs 4.27 through 4.33 and Table B

Gain-Slope — Paragraphs 4.34 through 4.36

Balance — Paragraphs 4.37 through 4.42 and Table F.

K. Base-Remote Trunks

5.75 Access to TSPS operators and service circuits is centralized at the TSPS base unit. Base-remote trunks are provided to permit voice-frequency connections from the RTA to TSPS operator position trunks or service circuits at the TSPS base unit. A base-remote trunk has an appearance on the trunk link circuit of the TSPS base unit switching network and an appearance on the base-remote stage of the RTA concentrator. All supervisory signaling functions required between the RTA and TSPS base unit will be provided by a peripheral control link.

5.76 When a particular base-remote trunk is not in use a 2600-Hz, −24 dBm0 signal is applied at the −4 dB TLP at the remote end of the trunk. The 942-ohm +2.15 μF termination for the 1M term set in the base-remote trunk circuit is switched out while the base-remote trunk is in the idle condition which will allow the 2600-Hz signal to be reflected back to the remote end of the trunk where the returning signal is detected as shown in Fig. 29. This serves as continuity check and allows the RTA software to verify the trunks availability for use.

5.77 Figure 29 shows the recommended transmission design for a base-remote trunk. The base-remote trunk facilities should be 4-wire and be provided by intertoll grade carrier system facilities. Carrier transfer circuits (see Part 5L) in conjunction with spare carrier facilities are provided to increase the reliability of the base-remote trunks. Each carrier channel used to provide a base-remote trunk is terminated at the RTA concentrator end in an external 24V4-type repeater and at the TSPS base unit end in an external 24V4-type repeater or metallic facility terminal (MFT) unit. A 1R 4-wire term set is used in the 24V4-type repeater at the RTA to present a high impedance (nominally 11,550 ohms) to the base-remote stage of the RTA concentrator suitable for bridging a toll-connecting trunk or inward trunk at the T1 and T2 ports of an RTA incoming or inward trunk circuit. A 900-ohm hybrid circuit (ie, 1M 4-wire term set, or equivalent) is provided in the 24V4-type repeater or MFT at the TSPS base unit. During talking states, the base-remote trunk circuit (SD-1B135-01), 900-ohm hybrid circuit will be terminated in an impedance matching network and DBOC. When the base unit end base-remote trunk circuit is connected to a service circuit, the impedance matching network and DBOC will be removed from the transmission path. Thus, the impedance of the base-remote is nominally 450 ohms +4.32 μF when the base unit end base remote trunk circuit (SD-1B135-01) is configured for voice communications and 900 ohms +2.16 μF when configured for connection to a service circuit.

5.78 The transmission alignment recommended for base-remote trunks is specified in Fig. 29. In order to eliminate contrast in speech power level received by the customers and TSPS operators on calls served by an RTA and those served by a TSPS base unit, an ICL of 0 dB was established for base-remote trunks. Use of companded LMX analog carrier facilities (see paragraph 5.02) or intertoll grade digital carrier facilities may be required in order to meet noise requirements on the overall connection from the RTA to the most remote TSPS operator position as discussed in Part 5B or from the RTA to the most remote service assistance operator in a No. 23, an extended Phase I No. 5, or a Phase II No. 5 ACD as discussed in Part 5S.

5.79 The transmission requirements for base-remote trunks can be found in the following locations:

Loss — Paragraph 4.26 and Table A

Noise — Paragraphs 4.27 through 4.33 and Table B

Gain-Slope — Paragraphs 4.34 through 4.36

Balance — Paragraphs 4.37 through 4.42 and Table F.

L. Carrier Transfer Circuit

5.80 The T1 carrier transfer circuits (SD-1B024-01) are provided for remote PSS No. 1 operator position trunks and SD-1B124-01 carrier transfer circuits are provided in remote PSS No. 2 operator position trunks and base-remote trunks to be used in conjunction with spare carrier facilities for increased reliability.

Remote PSS No. 1 Operator Position Trunks

5.81 The T1 carrier transfer circuits (SD-1B024-01) provide the means by which the stored program control in the TSPS base unit can determine when trouble has occurred on the T1 carrier facilities used to provide PSS No. 1 operator position trunks to remote operator service organizations. The carrier transfer circuit can switch the voice channels from the D1C channel bank of the faulty T1 carrier system to the D1C channel banks of a spare T1 carrier system. There will be one spare set of D1C channel banks with a connecting T1 digital line for up to three sets of operating D1C channel banks. The T1 carrier transfer circuit also provides the means for the stored program control to localize the trouble in a failed T1 carrier system to the receive or transmit side of the T1 digital line or to the receive or transmit side of either D1C channel bank.

Base-Remote and Remote PSS No. 2 Operator Position Trunks

5.82 The carrier transfer circuits (SD-1B124-01) included in remote PSS No. 2 operator position trunks and base-remote trunks will determine when a trouble has occurred on the trunk carrier facilities and will switch the voice channels to spare carrier facilities if a failure has been detected. For remote PSS No. 2 operator position trunks, use of the carrier transfer circuits are optional, although strongly recommended to maintain an acceptable quality of service. Carrier transfer circuits are required on base-remote trunks. Exceptions to the group transfer are channels used by the peripheral control links. Peripheral control links use the same carrier facilities and channel banks used by the voice circuits but are not switched to spare facilities by the carrier transfer circuit.

5.83 Each carrier group alarm (CGA) and each carrier failure detection circuit (see Part 5M) is monitored by the carrier transfer circuit (SD-1B124-01). Upon detecting a CGA or a failure of the alarm channel in any of the active groups the carrier transfer circuit assumes that the entire group has malfunctioned and automatically switches in the spare channel group. The carrier transfer circuit can switch in only one spare channel group, either 12 or 24 channels (two 12 channel groups may be treated as a single 24 channel group).

M. Carrier Failure Detection Circuits

5.84 Use of the carrier failure detection circuits (SD-1B119-01) in conjunction with the carrier transfer circuit (SD-1B124-01) is required for certain carrier facility arrangements used to provide base-remote or remote PSS No. 2 trunks. If the associated carrier system does not provide carrier failure alarm indications which are compatible with the carrier transfer circuit (SD-1B124-01), or if more than two carrier terminals are in cascade, the carrier failure detection circuit must be provided. The carrier failure detection circuit, when used, will occupy one carrier channel and should be assigned to channel 12 in a 12- or 24-channel terminal group. The carrier failure detection circuit will alert the carrier transfer circuit if there is a carrier alarm channel failure. The carrier failure detection circuit is located on the remote carrier transfer and miscellaneous units (RCTM) frame in the PSS No. 2 operator service organization or in an RTA. The transmission circuit design and alignment recommended for the carrier alarm channel and the carrier failure detection circuit is specified in Fig. 30.

5.85 The carrier failure detection circuit constantly monitors the continuity of the associated carrier failure alarm channel by inserting a 2600-Hz single frequency tone onto the channel at the PSS No. 2 operator service organization or at the RTA location. The tone is transmitted over the channel to the TSPS base unit where it is looped back through an unterminated hybrid in the 24V4-type repeater. The tone is then returned over the channel to the remote end where it is monitored by the carrier failure detection circuit.

5.86 Failure of the associated carrier system in either direction causes the carrier alarm channel loop to be broken. Loss of 2600-Hz tone for a period exceeding 2 seconds is detected by the carrier failure detection circuit, which sends a failure indication to the carrier transfer circuit at the PSS No. 2 operator service organization or RTA which relays the failure indiction through the peripheral control link to the base unit stored program control. The stored program control, in turn, provides the control to switch out the failed carrier group and replace it with the spare group. When the failed carrier group is repaired and the carrier alarm channel loop is restored, 2600-Hz tone is returned over the loop to the circuit failure detection circuit. When presence of tone is detected for a period exceeding 10 seconds, a restoral indication is sent to the carrier transfer circuit which relays the indication to the base unit stored program control. The stored program control provides the control signals to restore the previously failed (switched-out) carrier group to service and to return the replacement group to spare.

> ***Note:*** The carrier alarm channel associated with a carrier group will not be switched when the carrier transfer circuit switches out a failed carrier group.

N. Carrier Channel Requirements For PSS No. 2 and RTA

5.87 The number of carrier channels that must be furnished is largely a function of the number of PSS No. 2 operator positions and base-remote trunks to be provided. The channel quantity can be determined as follows:

- 3 per peripheral control link
- 1 per teletypewriter
- 1 per carrier group for carrier alarm
- 1 per operator position
- 12 or 24 for spare group switching
- 1 per base-remote trunk.

If the carrier type selected has its own carrier group alarm, then the carrier group alarm may be used rather than a carrier failure detection circuit and a carrier alarm channel, provided that only one or two carrier systems in tandem are used between the TSPS base unit and the remote site.

Diversified Routing

5.88 For reliability, the carrier groups should be split over diverse routes. This is particularly important in the case of a peripheral control link. The data links providing the two active channels of the peripheral control link should be in different carrier groups and transmitted over separate facilities. If extra channels in a carrier group are used for other purposes independent of TSPS applications, they must not be connected to the carrier transfer circuit.

> ***Note:*** The channels used to provide the peripheral control link also should not be connected to the carrier transfer circuit.

Carrier Channel Assignments For PSS No. 2 and RTA

5.89 Table E provides recommended channel assignments for the following functions: voice, peripheral control link, carrier alarm, teletypewriter, etc. By following these assignment recommendations, the impact of carrier group failure can be minimized and the job of splitting the functions over diverse routes is made easier.

O. Peripheral Control Link

5.90 Remote control of the equipment at a PSS No. 2 operator service organization or at the RTA by the stored program control in the TSPS base unit is provided by a group of elements known collectively as the peripheral control link. A block diagram of the peripherial control link is shown in Fig. 31. As indicated in Fig. 31, data links are an integral part of the peripheral control link. The peripheral control link data circuits operate at 2400 bits per second over 3002-type data facilities. The peripheral control data links are to be composed of SD-1B071-01 group gate circuits at the TSPS base unit, 3002-type data facilities with DAS 829-type channel interface units, and SD-1B072-01 remote data circuits at the RTA or PSS No. 2 positions. Three data links are required for each peripherial control link (ie, two active links and one spare). The two active data links will work in a matching mode and should use geographically diverse routes. If feasible, it is recommended for added reliability that at least one of the three data links be routed to avoid being transmitted via radio carrier systems.

5.91 In order for the peripheral control link to operate as required, certain delay requirements on the three data links must be met. The 1-way propagation delay (as measured from the output of one data modem to the data modem at the distant end) must not exceed 8.8 msec for any of the three data links. The differential propagation delay measured between any two of the three data links must not exceed 2.5 msec. This requirement can be met by using delay equalizers in the faster routes if necessary.

5.92 The permissible length of the data transmission facility will depend on the type of facility used and the number and type of terminals required. The use of fast carrier systems (such as L-carrier) with a minimum number of terminals will allow a 1000-mile facility route length to be used. However, appending short lengths of slower systems (such as N-carrier) could result in a limit lower than the 1000 facility route miles set by voice-transmission considerations. The peripheral control links are to be maintained by the serving test center if the standard 3002-type facilities are used. If other types of facilities are used, maintenance responsibility will be retained by the TSPS personnel.

P. Automated Coin Toll Service

5.93 The automated coin toll service (ACTS) features automate most of the TSPS operator tasks required to handle station paid coin toll calls such as transmission of deposit requests to the coin station customer and registration of coin deposits made at the coin station. However, TSPS operator assistance can be provided on a coin toll call being handled by ACTS if necessary. The Station Signaling and Announcement Subsystem (SSAS) is a peripheral subsystem of TSPS No. 1 and is capable of synthesizing announcements for distribution to TSPS coin station customers and processing received coin deposit data. The SSAS includes a microprocessor, an announcement source and distribution circuit, and coin detection and announcement (CDA) circuits. The CDA circuit includes:

(a) Coin-tone receivers (CTRs) for detection of coin deposit signals from the coin station

(b) Service circuit module (SCM) containing the digital-to-analog converter for converting the stored digital announcements for transmission to coin station customers

(c) Transmission and switching equipment elements required to interface the CTRs and the service circuit module with TSPS trunks and the MTS network.

5.94 The SSAS announcement source and distribution circuit plus the service circuit module combine to form the CDA circuit. The CDA circuits must provide accurate and reliable registration of legitimate dual-frequency coin deposit signals in the presence of speech and/or other interfering signals, while providing protection against coin deposit fraud. It should be noted that a CDA circuit will be added to a coin toll call only when an announcement is to be made or coin deposits are to be registered and collected.

5.95 There are two types of CDA circuits located in the TSPS base unit which can service coin toll calls handled by either a TSPS base unit or an RTA; the type I CDA circuit, and the type II CDA circuit. The type I CDA circuit, which is the simpler circuit, is used on those phases of an ACTS call which do not require coin deposit detection while the called customer is present as illustrated in Fig. 32. These include initial and end-of-call charge announcement and collection (during which the called party is disconnected) and notification at the end of the initial charging period. The type I CDA circuit also may be utilized to provide non-coin notifications and time-and-charge quotations. The type II CDA circuit is used for phases of ACTS calls which require the detection of coin deposit signals with the called customer present which may include the following charge announcements and collections: interim charge-due announcements (typically occurring every ten overtime intervals), initial announcements for postpay coin stations, and initial announcements where the required charges could exceed the hopper capacity of the coin station ("large-charge calls").

5.96 The type II CDA circuit can be switched by stored program control into the appropriate one of three different configurations as required to handle the following three situations illustrated in Fig. 33, 34, and 35, respectively:

(a) Coin deposit announcement and detection during the calling/called customer talking state when the TSPS or RTA 2-wire bridging arrangement is used to provide access to the coin toll-connecting trunk (2-wire mode)

(b) Coin deposit announcement and detection during the calling/called customer talking state when the TSPS or RTA 4-wire bridging arrangement is used to provide access to the coin toll-connecting trunk (4-wire mode)

(c) Coin deposit detection during initial deposit for large-charge coin toll calls when the size of the coin station hopper is too small to permit the customer to deposit the entire amount requested without multiple collections (type I mode).

5.97 Both the type I and type II CDA circuits have an appearance on the position link circuit (P1 port) of the base unit switching network for connection to the T1 port of the TSPS or RTA 2- or 4-wire bridging arrangement. Both types of CDA circuits also have an appearance on the trunk link circuit (T1 port) for connection to a TSPS operator, if required. The type II CDA circuit has a second appearance on the position link circuit (P2 port) for connection for the T2 port of a TSPS or RTA 2- or 4-wire bridging arrangement.

5.98 The T1 port of the type I and type II CDA circuits has a nominal impedance of 450 ohms + 4.32 μF. The P1 port has a nominal impedance of 11,500 ohms. The P2 port of the type II CDA circuit has a nominal impedance of 900 ohms +2.16 μF when interfacing 2-wire TSPS and 2- or 4-wire RTA bridging arrangements. The P2 port also has a 50,000-ohm impedance for use with 4-wire TSPS bridging arrangements. For impedance balancing reasons, a DBOC will be associated with the T1 port of the type I and type II CDA circuits in all configurations and with the P2 port of type II CDA circuits when a base-remote trunk is connected to the P2 port.

5.99 The average speech power of the ACTS announcements presented to the T1 and P1 appearances on the TSPS base unit switching network is to be −24 dBm. The transmission requirements for the ACTS feature can be found in the following locations:

Loss — Paragraph 4.26

Noise — Paragraph 4.31

Gain-Slope — Paragraphs 4.34 through 4.36

Balance — Paragraphs 4.37 through 4.42 and Table F.

Type I CDA Circuit

5.100 A typical connection involving a type I CDA circuit is illustrated in Fig. 32 which also specifies the transmission alignment recommended for the type I CDA circuit. The P1 port of the type I CDA will be connected to the T1 port of the incoming trunk circuit, either directly (for a call served by the TSPS base unit) or through a base-remote trunk and concentrator connection (for a call served by an RTA). On those seizures of the type I CDA circuit requiring announcements or a coin deposit detection, the TSPS or RTA trunk circuit will be placed in the "split" state with the called customer disconnected. Customer announcements will be generated by the CDA announcement (ANN) circuit and are inserted into the connection at the T1 port of the CDA circuit. If assistance by a TSPS operator is requested or required, a TSPS operator position trunk will be connected to the T1 port of the type I CDA circuit. There is nominally 0 dB of loss between the CDA announcement circuit and the T1 port of the trunk circuit.

5.101 When required, detection of coin deposit signals will be performed by the CDA coin tone receiver (CTR) which is located at a −3 TLP. Protection against announcement interference with coin deposit detection is achieved by isolating the CTR through the use of 4-wire transmission within the type I CDA circuit.

Type II CDA Circuit (2-Wire Mode)

5.102 Figure 33 shows a typical type II CDA circuit configuration utilized for coin toll call situations requiring an announcement or detection of coin deposit signals from a coin station when the called customer is present and a TSPS or RTA 2-wire bridging arrangement is provided on the coin toll-connecting trunk. The transmission alignment recommended for this configuration of the type II CDA circuit is also specified in Fig. 33. This configuration of the type II CDA circuit provides protection against both unintentional speech interference with coin deposit detection, and attempted coin deposit fraud by the called customer. This is accomplished by routing the calling-called customer connection through the type II CDA circuit via the T1 and T2 ports of the TSPS or RTA 2-wire incoming trunk circuit.

5.103 The type II CDA circuit will be placed in the "2-wire mode" under program control. In this configuration, three simultaneous 0-dB connections will be established between the following ports: P1 to T1, P2 to T2, and P1 to P2. The connections to the T1 and P1 ports and the CTR1 and ANN circuits of the type II CDA circuit are analogous to the respective connections in a type I CDA circuit. The one difference being that the hybrid interfacing with the ANN circuit and the T1 port of a type I CDA circuit has been incorporated into the 3-way bridging repeater of the type II CDA circuit. In the type II CDA circuit the called customer is connected to the P2 port through the T2 port of the TSPS or RTA incoming trunk circuit. The calling to called customer path is maintained by the P1 and P2 connection within the type II CDA circuit.

5.104 The ACTS announcements are directed to the calling and called customers through the CDA P1 and P2 ports, respectively. The clipper/filter (C/F) contains a signal power limiter and band elimination filter to block any fraudulant coin deposit signals generated by the called customer which could ultimately be received by the CTR1 circuit because of an impedance imbalance of the hybrid circuit associated with the P1 port of the type II CDA circuit or signal reflections from impedance irregularities external to the type II CDA circuit returning to the P1 port of the type II CDA circuit. The CTR 2 is connected at a $-P_4$ TLP, where P_4 is the toll office test pad value of 0, 2, or 3 dB, and is arranged to detect any coin deposit fraud attempts by the called customer.

Type II CDA Circuit (4-Wire Mode)

5.105 Figure 34 shows a typical connection of the type II CDA circuit in its "4-wire mode" which is utilized to handle the same coin toll situations as handled by the type II CDA circuit in the 2-wire mode as discussed in paragraphs 5.102 to 5.104, except that the TSPS or RTA incoming trunk circuit involved will be 4-wire instead of 2-wire. This configuration of the type II CDA circuit is compatible with the JW237 RTA 4-wire incoming trunk circuit and all TSPS base unit 4-wire incoming trunk circuits. It provides protection against both unintentional speech interference with coin deposit detection and attempted coin deposit fraud by the called customer. In this configuration of the type II CDA circuit the calling-called customer connection is maintained directly through the TSPS or RTA 4-wire incoming trunk circuit.

5.106 The type II CDA circuit is placed in its "4-wire mode" under program control. In this configuration, the connections between the P1 and T1 ports and the CTR 1 and announcement circuits of the type II CDA circuit and their connecting circuits are analogous to respective connections involving the type I CDA circuit. The ACTS announcements are directed to both the calling and called customers through the T1 port of the TSPS or RTA 4-wire incoming trunk circuit and its associated bridging repeater. Protection against speech interference and attempted fraud by the called customer is achieved by monitoring the T2 port of the TSPS or RTA 4-wire trunk circuit for coin deposit signals with CTR 2 (through the P2 port of the type II CDA circuit). The levels of coin deposit signals received by CTR 1 and CTR 2 are compared, and a determination made as to whether the received coin deposit signal is legitimate or fraudulent. Because of this signal comparison, strict adherence is required to the recommended transmission alignment for the coin toll-connecting trunks (Part 4E) and the type II CDA circuit (Fig. 34).

Type II CDA Circuit (Type I Mode)

5.107 The typical connection with the type II CDA circuit in the "type I mode," shown in Fig. 35, is used to handle large-charge coin toll calls and those ACTS call situations normally requiring a type II CDA circuit because of the presence of the called customer, but in which the called customer hangs up. In this configuration, the type II CDA circuit is used in the same manner as the type I CDA circuit.

Service Observed ACTS Call

5.108 Due to the circumstances of a particular coin toll call, TSPS operator assistance may be required in any of the possible ACTS call situations. In addition, each of these calls may be service-observed. A typical connection for a service observed and TSPS operator assisted coin toll call is shown in Fig. 36 for the type I CDA circuit. As indicated in Fig. 36, the 0-dB service-observing trunk access circuit is inserted between the T1 port of the incoming trunk circuit and the P1 port of the CDA circuit. The operator is connected to the T1 port of the CDA circuit, and is therefore indirectly connected to the T1 port of the incoming trunk circuit through the CDA and service-observing circuits (a nominal 0-dB path).

Coin Station Test Call

5.109 The type I CDA circuit may be used to facilitate testing of the signaling capability of coin stations equipped with dual-frequency signal generators. The CDA circuit configuration is analogous to that described in paragraph 5.100 except 3 dB of additional loss is inserted ahead of the CTR, thereby reducing the transmission level at that point to a −6 TLP. This arrangement provides a stringent test environment in which the craftsperson located at the coin station can verify the ability of the ACTS to detect coin deposit signals from the coin station using the procedures in Section 506-900-503.

Q. Calling Card Service

5.110 Calling card service (CCS) is an alternative to credit card, collect, and bill-to-third-number calls. Calling card service allows a customer to charge a call to a number other than the calling number by inputting required billing information directly into the TSPS using TOUCH-TONE dialing or by relaying the necessary information to a remote (non-TSPS) operator or to a TSPS operator. The billing information is verified using the common channel interoffice signaling direct signaling (CCIS/DS) feature to access a data base containing a listing of all valid calling card numbers.

5.111 The equipment required to provide calling card service consists of a TOUCH-TONE dialing tone detection and announcement (TDA) circuit to provide announcements and alerting tones to the customer, or a remote (non-TSPS) operator and to receive TOUCH-TONE dialing tones from the customer or remote operator. A multifrequency signaling tone detection and announcement (MDA) circuit is also provided to allow the remote operator to use MF signaling to input the customer billing information to the TSPS. The TDA and MDA circuitry is similar to the circuitry in the CDA type I circuit except that the coin tone receiver (CTR) is replaced either with a TOUCH-TONE receiver (TTR) or MF receiver (MFR).

5.112 When a 0+ call is made, the customer will receive an announcement explaining the calling card service procedure followed by an alerting tone. The customer may the use TOUCH-TONE dialing to enter the billing information directly to the TSPS to be verified. If the customer does not have TOUCH-TONE dialing capability or does not enter the billing information within the allotted time, a TSPS operator will be connected and will handle the call as an operator assisted call. If the customer connection is not made directly to a TSPS base unit or RTA but rather to a remote operator (ie, in areas where TSPS service is not available), the remote operator can obtain the calling card number from the customer and input the information to the TSPS.

5.113 The remote operator access to the TSPS is provided over inward trunks from the remote operator location to the TSPS base unit or to an RTA. The remote operator can provide the billing information to the TSPS by use of TOUCH-TONE dialing, MF signaling, or relay the information verbally to a TSPS operator. Three unique inward codes are utilized on the inward trunks from remote operators to the TSPS to enable the TSPS program control to provide the proper terminating circuitry: a TDA circuit to receive TOUCH-TONE dialing, an MDA circuit to receive MF signaling, or a TSPS operator position for a verbal transfer of information. Customer direct access to the TSPS is shown in Fig. 37. Access to the TSPS by the remote operator is shown in Fig. 38.

5.114 The transmission requirements for calling card service are the same as the requirements for ACTS and are found in the following locations:

Loss — Paragraph 4.26

Noise — Paragraph 4.31

Gain-Slope — Paragraphs 4.34 through 4.36

Balance — Paragraphs 4.37 through 4.42 and Table F.

R. High-Impedance Multifrequency Receiver

5.115 The detection of unauthorized MF pulsing digits by the signaling irregularities (SIGIRR) detection feature is accomplished by bridging a high-impedance multifrequency receiver (HMFR) on the connection via the T1 port of the TSPS or RTA incoming trunk circuit. The HMFR is a service circuit which consists of a conventional MF receiver, a 24V4-type repeater with a 1R 4-wire term set, and a 227-type amplifier which provides the required high impedance (ie, 11,500 ohms) interface with the position link circuit of the TSPS base unit switching network as shown in Fig. 39.

S. Operator Service Trunks

5.116 Operator service trunks are included in TSPS base unit installations to provide the TSPS operator with access to operators at a 3C-type switchboard, a No. 23 operating room desk, or one of the following ACD systems: No. 23, a Phase I No. 5, an extended Phase I No. 5, or a Phase II No. 5. This access is provided in order to obtain assistance in serving certain types of calls (ie, obtaining rate and route information).

5.117 The recommended transmission circuit design for TSPS operator service trunks is shown in Fig. 40. The modified operator service trunk circuit, SD-1B278-01, is the standard operator service trunk circuit for use with the TSPS and is required to permit an operator service trunk to be involved in a 3-way connection. The modified SD-1B278-01 operator service trunk circuit has been designed to:

(a) Operate in either 2-way or a 3-way connection mode

(b) Interface with the 4-wire operator service trunk facilities through a 24V4-type repeater equipped with a 1M, 4-wire term set, or equivalent, and 227-type amplifiers

(c) Use type II or type III E&M lead supervision signaling.

5.118 The operator service trunk has an appearance on the trunk link circuit of the TSPS base unit switching network. The nominal impedance of the operator service trunk is 450 ohms +4.32 μF. The standard SD-1B278-01 trunk circuit contains an impedance matching network including a DBOC and a negative impedance converter (NIC). In the 2-wire configuration, the impedance matching network is switched into the circuit for optimum balance. In the 3-way configuration, the impedance matching network is switched out and replaced by the NIC to provide the proper transmission loss, impedance, and balance. The ICL of the operator service trunk is determined by the type of equipment at the service assistance operator end of the trunk as shown in Fig. 40 and Table A. The transmission alignment recommended for TSPS operator service trunks is specified in Fig. 40.

5.119 Use of companded LMX carrier facilities (see paragraph 5.02) in place of other intertoll grade analog carrier facilities in the TSPS operator service trunk may be required if the total length of analog carrier facilities appearing in the connection from the TSPS or RTA access point to the most remotely located service assistance operator position in the ACD system exceeds 400 facility route miles. Use of companded LMX carrier facilities may also be required in base-remote trunks and in the night closing and operator position trunks associated with any of the ACD systems which may become involved in a 3-way operator service connection in order to meet noise requirements on the overall connection (see paragraphs 4.27 through 4.29).

5.120 In order to meet echo grade of service objectives, it is recommended that the service assistance operator ***not*** be located at either a 3C-type switchboard, a No. 23 operating room desk, or a nonextended Phase I No. 5 ACD system if an RTA is associated with the TSPS base unit. If an RTA is not associated with the TSPS base unit, the round-trip signal propagation delay of the TSPS operator service facilities should not exceed 1.4 milliseconds (eg, about 50 facility route miles of T1 carrier system facilities using D1 channel banks) from the TSPS base unit to a 3C-type switchboard, or exceed 2 milliseconds to the switching network of a No. 23 operating room desk or a Phase I No. 5 ACD. If the service assistance operator is served by either a No. 23, an extended Phase I No. 5, or a Phase II No. 5 ACD, the maximum length of companded LMX carrier facilities allowed in the overall connection between the TSPS or RTA access point on any toll-connecting trunk and the most remotely located service assistance operator should not exceed 1000 facility route miles.

5.121 The transmission requirements on the interface between the TSPS operator service trunk and a 3C-type switchboard, a No. 23 operating room desk, or a No. 23, a Phase I No. 5, and extended Phase I No. 5, or a Phase II No. 5 ACD are discussed in paragraph 4.13. The transmission requirements associated with the operator service trunk can be found in the following locations:

Loss — Paragraph 4.26 and Table A

Noise — Paragraphs 4.27 through 4.33 and Table B

Gain-Slope — Paragraphs 4.34 through 4.36

Balance — Paragraphs 4.37 through 4.42 and Table F.

T. Busy Line Verification

5.122 The busy-line-verification (BLV) network allows the TSPS operator to be bridged onto a customer line to verify whether the line is busy or not. Access to the BLV network is provided through a BLV access trunk as shown in Fig. 41. The BLV network will parallel either the MTS or a metropolitan tandem network and will be switched by the switching offices of that network. However, the BLV network is to be considered a separate and independent network from the MTS or metropolitan tandem networks. Trunks in a BLV network will have security features to prevent trunks outside the BLV network from connecting to a BLV network trunk. The BLV network trunks are to be equivalent to the trunks in the applicable parallel network and that network's requirements also apply to the BLV network trunks.

5.123 The TSPS verification trunk circuit (SD-1B308-01) used in conjunction with the TSPS verification circuit (SD-1B306-01) and the TSPS 4-wire bridging repeater (SD-7C022-01) provides a means by which the TSPS base unit program control can carry out the BLV functions required to respond to BLV requests (ie, privacy, seize forward, supervision and address signaling, monitor, interrupt, disconnect, etc). The TSPS verification trunk circuit (SD-1B308-01) used in conjunction with the TSPS 4-wire bridging repeater provides:

(a) The means by which a TSPS operator may be connected to a BLV access trunk

(b) Access for an MF outpulser to transmit the directory number of the line to be verified to the BLV network

(c) Either loop simplex or E&M lead supervision signaling for the BLV access trunk.

The BLV access trunk will have two appearances (T1 and T2 ports) on the trunk link circuit of the TSPS base unit switching network. An operator position trunk will be connected to the T1 port appearance during the verification call and an MF outpulser will be connected to the T2 port appearance during BLV call connection set up. The impedance of the T1 port is nominally 450 ohms +4.32 μF. A DBOC is provided in the T1 port for impedance balancing purposes. The impedance of the T2 port is nominally 600 ohms +2.16 μF.

5.124 The verification circuit (SD-1B306-01) provides the privacy and security functions for the TSPS verification trunk circuit which includes:

(a) A scrambler circuit which distorts the conversation on the customer line being monitored to render the speech unintelligible

(b) An alert tone generator which generates a 440-Hz tone which is used to alert the customer that an emergency operator is bridged on the connection in the unscrambled mode of operation

(c) A loop around circuit and tone detector which tests the scrambler and alert tone generator operation before each verification call is cut through.

5.125 The verification circuit will function so that either the scrambler circuit or the alert tone generator will be connected in the BLV access trunk whenever the operator is cut through towards the customer line being verified. The alert tone generator must be cut through whenever the scrambler circuit is bypassed which will occur when the TSPS operator elects to break in on the customer connection to relay an emergency message. The alerting tone will be perceived by both the verified customer and the TSPS operator. This is achieved by using the TSPS 4-wire bridging repeater (SD-7C022-01) to insert the alerting tone into the connection between the TSPS operator and the verified customer. The power level of the 440-Hz alerting tone is −13 dBm at 0 TLP.

5.126 The BLV access trunk facilities are to be composed of 4-wire metallic and/or carrier facilities, exclusively. Use of companded LMX analog carrier facilities (see paragraph 5.02) or intertoll grade digital carrier facilities may be required in order to meet noise requirements on the overall connection from the toll or tandem office providing access to a BLV network to the most remote TSPS operator position as discussed in Part 5B. The various possible BLV network configurations are illustrated in Fig. 2 and 3 and the transmission alignment recommended for the BLV access trunk, is specified in Fig. 42. The loss of the BLV access trunk should be nominally 0 dB with a maximum loss of 0.5 dB. The transmission requirements on the interface between the BLV access trunk and BLV network trunk at the toll, or tandem, office providing access to a BLV network are discussed in paragraph 4.18.

5.127 The BLV network may be designed in one of two configurations, it may parallel either the MTS network or the metropolitan tandem network. In either configuration a signal power limiter must be used in step-by-step, No. 1 crossbar, No. 5 crossbar, and No. 2 ESS, class 5, offices to protect the transmission facilities from overloading due to high-level signals which may be present on customer lines to be verified. Another restriction is that echo suppressors are never to be used in a BLV network.

5.128 When the BLV network parallels the MTS network, as illustrated in Fig. 2, a maximum configuration of four trunks in tandem are allowed between the toll office providing TSPS access to the network and the class 5 office serving the customer line to be verified. In addition to the BLV network access trunk, there are two types of trunks in a BLV network which parallels the MTS network. The final BLV trunk which extends from a toll office to the class 5 office serving the customer line to be verified, and trunks between two toll offices in the BLV network (a maximum of three such trunks in tandem are allowed in a BLV connection).

5.129 The maximum distance permitted from the toll office providing the TSPS access to the BLV network and the most distant class 5 office is 1000 airline miles. The trunks in a BLV network which parallels the MTS network are to be MTS equivalent trunks and are to meet the MTS network transmission requirements. The necessary trunk switching required by the BLV network is to be provided by the MTS network switch machines.

5.130 When the BLV network parallels the metropolitan tandem network, as illustrated in Fig. 3, a maximum configuration of three trunks in tandem are allowed between the sectional tandem or directional tandem office providing TSPS access to the network and the class 5 office serving the customer line to be verified. In addition to the BLV network access trunk, there are two types of trunks in a BLV network which parallels the metropolitan tandem network. The final BLV trunk which extends from a tandem office to the class 5 office serving the customer line to be verified, and trunks between two tandem offices in the BLV network (a maximum of two such trunks in tandem are allowed in a BLV connection).

5.131 The maximum distance permitted from the office providing the TSPS access to the BLV network and the most distant class 5 office is 150 airline miles. The trunks in a BLV network which parallels the metropolitan tandem network are to be metropolitan tandem equivalent trunks and are to meet the metropolitan network transmission requirements. The necessary trunk switching required by the BLV network is to be provided by the metropolitan tandem network switch machines.

6. TRANSMISSION MAINTENANCE

A. Control, Display, and Test Frame

6.01 The transmission maintenance center for the TSPS is the control, display, and test (CDT) frame which is part of the master control center located in the TSPS base unit. Lamp displays and audible and visual alarms indicate the status of most major TSPS equipment units. Routine maintenance testing and transmission trouble identification and location are coordinated at the CDT frame. The CDT frame is used to perform transmission tests on all trunks having an appearance on the base unit trunk link circuit. The CDT is also used to perform transmission tests on operator position trunks, service observing trunks, and service circuits having an appearance on the position link circuit. Additional capabilities in the CDT frame include the measurement of voltages and resistances of trunks and TSPS circuits.

6.02 The CDT frame permits two-person manual transmission testing of all trunks having an appearance on the trunk link circuit and one-person manual transmission testing of base-remote trunks and operator position trunks. Two-person tests will be required for initial line-up and some routine checks of operator position trunks. Transmission tests of service circuits such as the CDA, TDA, and MDA circuits, and MF receivers and outpulsers can also be performed on a one-person basis. The Master Test Line (MTL) included in the CDT frame permits voice-frequency communication within the TSPS to trunks under test, central office lines, tie lines, and intercommunication lines. Test equipment associated with a CDT frame includes a transmission measuring set (TMS), a noise measurements set (NMS), a 1 milliwatt 1004-Hz tone generator and associated pads, quiet terminations, balance terminations, and impedance matching resistors.

6.03 Access trunk 0 provides access for test equipment connections to the position link circuit for transmission testing of delayed call, inward, base-remote, CAMA transfer, toll connecting and BLV access trunks. A trunk access circuit (TAC), is provided to interface the transmission test equipment with access trunk 0. The TAC is similar to the circuit present when an operator position trunk is connected to a trunk on a normal call except that the amplifier gains may be different. Balance testing is accomplished using an externally provided return loss measuring set, hybrid, the TAC, and the quiet and balance termination. Access trunk 1 also provides access for test equipment connections to the trunk link circuit for transmission testing of operator position trunks, service observing trunks, CDA, TDA, and MDA circuits, and other service circuits.

6.04 The 900-ohm terminals of the transmission measuring set and the 600-ohm terminals of the noise measuring set are used when the sets are connected to access trunk 1. The transmission and noise measuring sets are shunted by resistors to make the impedance of the test sets presented to access trunk 1 equal to 450 ohms, thereby simulating a bridging connection on a 900-ohm trunk. With this arrangement, the meters indicate the power that would have been delivered in each direction on a trunk if the connection had been made directly to a TSPS trunk circuit rather than to test equipment. When the transmission measuring set is used to measure the output of the MF outpulser, the shunt resistor is omitted because the outpulser operates on a terminating rather than a bridging basis. The 600-ohm terminals of either the transmission or the noise measuring set are used when the sets are connected to the test access circuit associated with access trunk 0.

6.05 The capability for one-person manual transmission testing of PSS No. 2 operator position trunks or base-remote trunks is provided by the TSTD and CDT frames. The test data obtained by the TSTD frame in a PSS No. 2 or an RTA will be printed out on the maintenance TTY in the TSPS base unit.

6.06 The capability for one-person transmission testing of PSS No. 1 operator position trunks is provided through use of a reference trunk circuit (SD-1B064-01). The reference trunk is used to provide a loop-around arrangement on PSS No. 1 operator position trunks so that transmission tests can be made at the CDT without assistance at the operator service organization. Key operations at the CDT frame causes the stored program control to select the specific operator position trunk to be tested and to set up the proper transmission test configuration for the type of transmission test to be conducted. The reference trunk can also be used to provide test access for transmission testing on PSS No. 1 from the operator end of the position trunk to the CDT.

6.07 The reference trunk facility can be any voice-frequency facility with 600-ohm terminating impedances at both ends. The reference trunk facility is to be capable of maintaining 1.0 dB ± 0.5 dB loss between the reference trunk circuit in a PSS No. 1 operator service organization and the CDT frame in the TSPS base unit. The reference trunk circuit is provided on a one per PSS No. 1 basis and is located at the PSS No. 1 as shown in Fig. 4. The following functions are provided by the reference trunk circuit under control of test personnel at the CDT frame as required for one-person transmission testing of PSS No. 1 operator position trunks:

(a) Connection of a 1-kHz milliwatt tone through a 10-dB resistance pad to the operator transmit pair of the selected operator position trunk

(b) Connection of the operator receive pair of the selected PSS No. 1 operator position trunk through a 3-dB amplifier to the reference trunk facilities

(c) Connection of the operator receive pair of the selected operator position trunk directly to the reference trunk facilities

(d) Connection of a quiet termination to the operator transmit pair of the selected operator position trunk.

When any of these connections are made, the TSPS operator position will be disconnected from the selected PSS No. 1 operator position trunk. At the CDT frame, the 600-ohm terminals of either the transmission or noise measuring set are used when the test sets are connected to the reference trunk facilities.

6.08 The master test line (MTL) of the CDT frame provides the major voice-frequency communication link between the CDT frame and the TSPS system, and between the CDT frame and other offices. Access to both the position link and trunk link circuits of the TSPS base unit switching network is provided by the MTL. The trunk link circuit appearance is used to send keyed instructions, using MF tones, to the stored program control for establishing test conditions. The position link appearance is used to terminate incoming test calls on TSPS trunks and to establish a 2-way connection between the CDT frame and the craft person at the distant office.

B. Test and Display Frame

6.09 A test and display (TSTD) frame will be provided in each PSS No. 2 operator service organization and RTA. The TSTD frame at the RTA and operator service organization is designed to work in conjunction with the CDT frame in the associated TSPS base unit through a peripheral control link. The system and circuit status displays of the TSTD frame are provided to alert maintenance personnel of possible critical conditions in the associated operator service organization or RTA. The TSTD frame also permits maintenance personnel to request diagnostics and make transmission tests and voltage and resistance measurements on selected trunks from the CDT frame at the TSPS base unit or from the TSTD frame. The TSTD frame is designed to enable loss, noise, and gain-slope measurements to be made on toll-connecting, inward, and base-remote trunks in an RTA and on the voice path of PSS No. 2 operator position trunks. The TSTD frame also provides access for impedance balance testing on toll-connecting, inward, and base-remote trunks in an RTA. The TSTD frame will permit both manual and stored program controlled transmission testing.

6.10 The TSTD frame in a PSS No. 2 operator service organization provides test access to the various PSS No. 2 operator position trunks in the operator service organization through the voice-path control circuit (SD-1B078-01). The TSTD frame in an RTA provides test access to toll-connecting, inward, and base-remote trunks by means of access trunks 0 and 1 which have appearances on the base-remote and trunk stage of the RTA concentrator, respectively. The transmission test measurement circuitry of the TSTD frame is designed to receive and transmit 404-, 1004-, or 2804-Hz tones at various test tone levels, depending upon the type of trunk being tested, and to measure noise on the trunk being tested. When a toll-connecting, inward, base-remote, or PSS No. 2 operator position trunk is connected to the TSTD frame, the impedance presented to the trunk will be nominally the same as that provided to that trunk by the connecting circuits during normal operation.

6.11 Balance testing on trunks in an RTA is accomplished with an externally provided return loss measuring set using the balance test circuit of access trunk 0 and the quiet termination of access trunk 1 of the TSTD frame. The balance test circuit is composed of a 24V4-type repeater with a 1R 4-wire term set and is similar to the circuit present in the base-remote trunk when a base-remote trunk is connected. The quiet termination associated with access trunk 1 of the TSTD frame is used when checking the balance of base-remote trunks in an RTA.

6.12 The master test line (MTL) is included as part of the TSTD frame in each RTA and provides the major voice-frequency communications link between the TSTD frame and either the stored program control, the test facilities, or other offices. With the MTL, talking circuits can be established to trunks under test, central office lines, tie lines, and intercommunication lines. A monitoring capability is provided by the MTL in addition to the talking capability. Access to the MTL circuitry in the TSTD frame is provided from either the trunk or base-remote stage of the RTA concentrator. The base-remote stage of the concentrator is used to connect incoming test calls to the MTL. The trunk stage is used to connect the MTL with the TSPS base unit through a base-remote trunk.

C. Dial Access Test Lines

6.13 Dial access test lines (DATL) are provided in both the TSPS base unit and RTA. The DATL is part of the TSTD frame in an RTA but is a separate and distinct circuit in the TSPS base unit. Each DATL has two ports, with each port having an appearance on the base-remote stage of the RTA concentrator, or on the position link circuit of the TSPS base unit switching network. Each of the two ports of a DATL provides access to the following:

(a) 1004-Hz tone at a level equal to that supplied by the toll office

(b) Quiet termination

(c) Equal level loop around if accessed simultaneously by two trunks in the same trunk group.

7. REFERENCES

A. Schematic Drawings

7.01 The following is a partial listing of schematic drawings for the TSPS transmission equipment.

TSPS Base Unit Trunk Circuits and Repeaters

DRAWING	TITLE
SD-1B002-01	2-Wire Incoming Trunk Circuit; Loop Signaling, Dial Pulsing
SD-1B003-01	2-Wire Incoming Trunk Circuit; Loop Signaling, MF Pulsing
SD-1B004-01	2-Wire Incoming Trunk Circuit; E&M Signaling, Dial Pulsing
SD-1B005-01	2-Wire Incoming Trunk Circuit; E&M Signaling, MF Pulsing
SD-1B006-01	4-Wire Incoming and Inward Trunk Circuit; E&M Signaling, MF Pulsing
SD-1B007-01	4-Wire Incoming Trunk Circuit; E&M Signaling, Dial Pulsing
SD-1B009-01	4-Wire Delayed Call Trunk Circuit
SD-1B016-01	Incoming CAMA, Transfer Trunk Circuit
SD-1B020-01	Operator Cut-Through Circuit
SD-7C022-01	4-Wire Bridging Repeater
SD-97047-01	V4 Telephone Repeater
SD-99782-01	3-Way, 4-Wire Bridging Repeater
SD-1B278-01	Operator Service Trunk
SD-3B025-01	Service Evaluation System No. 1A Control and Interface Circuit

TSPS Base Unit and PSS No. 1 Equipment Circuits

DRAWING	TITLE
SD-1B011-01	High Impedance Multifrequency Receiver Circuit
SD-1B018-01	Trunk Link Circuit
SD-1B019-01	Position Link Circuit
SD-1B023-01	Control, Display, and Test Circuit
SD-1B024-01	T1 Carrier Transfer Circuit
SD-1B025-01	Position Group Gate Circuit
SD-1B027-01	Position Signal Distributor Circuit
SD-1B028-01	Position Buffer Circuit
SD-1B030-01	100B Console Circuit
SD-1B031-01	Position Scanner and Gate Circuit
SD-1B038-01	Communication Bus Translator Circuit
SD-1B044-01	Supervisory Buffer Circuit
SD-1B064-01	Reference Trunk Circuit
SD-1B135-01	Base Trunk, Base-Remote Trunk Circuit
SD-1B277-01	Dial Access Test Line Circuit
SD-1B275-01	Service Observing Trunk Access Circuit
SD-1B305-01	Supervisory Console Circuit
SD-97068-02	D1C Channel Unit Circuit, Bridging End
SD-97069-01	D1C Channel Unit Circuit, Operator Position End

RTA Trunk Circuits

DRAWING	TITLE
SD-1B115-01	2-Wire Incoming Trunk Circuit; Loop Signaling, MF or Dial Pulsing
SD-1B116-01	2-Wire Incoming Trunk Circuit; E&M Signaling, MF or Dial Pulsing
SD-1B117-01	4-Wire Incoming and Inward Trunk Circuit; E&M Signaling, MF or Dial Pulsing
SD-1B118-01	4-Wire Incoming and Inward Trunk Circuit; E&M Signaling, MF or Dial Pulsing
SD-1B120-01	Remote Trunk, Base-Remote Trunk Circuit

PSS No. 2 and RTA Equipment Circuits

DRAWING	TITLE
SD-1B075-01	100C Position Circuit
SD-1B078-01	Voice Path Control Circuit
SD-1B119-01	Carrier Failure Detection Circuit
SD-1B123-01	Test and Display Circuit
SD-1B124-01	Carrier Transfer Circuit
SD-1B125-01	RTA No. 1 Concentrator Circuit
SD-1B074-01	Scanner Circuit
SD-1B079-01	Trunk Buffer Circuit
SD-1B134-01	RTA No. 1 Trunk Frame Circuit
SD-1B035-01	TSPS No. 1 Miscellaneous Circuit

ACTS and Calling Card Service Circuits

DRAWING	TITLE
SD-7C038-01	Coin Detection and Announcement Circuit
SD-1B302-01	Station Signaling and Announcement Subsystem
SD-1C598-01	Coin Tone Receiver

BLV Trunk Circuits

DRAWING	TITLE
SD-1B306-01	Verification Circuit
SD-1B308-01	Verification Trunk Circuit

B. Bell System Practices

7.02 Descriptive and procedural information concerning the operation of the TSPS is contained in the 250 division series of sections for TSPS hardware and in the 254 division series of sections for TSPS No. 1 stored program control. Overall descriptive information may also be found in the following sections:

SECTION	TITLE
250-000-000	Numerical Index, Division 250, Traffic Service Systems
250-200-100	TSPS No. 1B General Description
250-202-100	Stored Program Control No. 1B, General Description
250-210-100	RTA Description and Method of Operation, TSPS No. 1B
250-212-100	PSS No. 2 Description and Method of Operation, TSPS No. 1B
254-000-000	Numerical Index, Division 254, Stored Program Control
955-351-101	Carrier Engineering System Application T1 Digital Line, Transmission and Outside Plant Design Procedures
951-600-100	Stored Program Control No. 1A, General Description
984-100-100	TSPS No. 1 General Description
984-10-102	RTA/PSS No. 2 Feature Description

TABLE A

TSPS NO. 1 TRUNK INSERTED CONNECTION LOSS

TRUNK TYPE	ICL (dB)	REMARKS
Supervisory Trunk - measured between bridges and operator position of the associated supervisor 4251B network	0	
Monitor Trunk - measured between bridges (-26 dB) of the associated monitor and operator position 4251 network	0	Supervisory position disconnected
Local Subscriber Line-measured between local office and input to supervisory console		Local design
Toll-Connecting Trunk or Directory Assistance Charging Trunk (VNL design) from a class 5 office less than 200 miles to the TSPS bridging point (or to a No. 23 trunk concentrator in a directory assistance charging trunk)	2.0 to 4.0	Without gain
	3.0	Fixed loss and with gain
Toll-Connecting Trunk or Directory Assistance Charging Trunk from a class 5 office over 200 miles to the TSPS bridging point (or to a No. 23 trunk concentrator in a directory assistance charging trunk)	VNL + 2.5	
Toll-Connecting Trunk or Directory Assistance Charging Trunk between the TSPS trunk circuit and toll office or ACD	0 (max 0.5)	
Directory Assistance Charging Trunk from No. 23 trunk concentrator to TSPS bridging point	0	
Directory Assistance Charging Trunk between a class 5 office and a No. 1 trunk concentrator	10	

TABLE A (Contd)

TSPS NO. 1 TRUNK INSERTED CONNECTION LOSS

TRUNK TYPE	ICL (dB)	REMARKS
Directory Assistance Charging Trunk between a No. 1 trunk concentrator and the TSPS bridging point	−7 (gain)	
Delayed Call Trunk	0	
Inward Trunk	0	
Operator Service Trunk terminating at a 3C or 3CL switchboard or nonextended Phase I No. 5 ACD	0 (max 0.5)	
Operator Service Trunk terminating at a No. 23 operating room desk	3	
Operator Service Trunk terminating at a No. 23 ACD, Phase II, or extended Phase I, No. 5 ACD	4	
Incoming CAMA Transfer Trunk	0	
Busy Line Verification Network Access Trunk	0 (max 0.5)	
Position Trunk — PSS No. 2, or retrofitted PSS No. 1, and 60A operator headset, or equivalent	7	Operator transmit direction
	9	Operator receive direction

TABLE B

NOISE LIMITS FOR TSPS NO.1 TRUNKS
LIMITS SHOWN IN DBRNCO
(NOTES 1, 2, 3, AND 4)

FACILITY TYPE	FACILITY ROUTE MILES				
	0 TO 50	51 TO 100	101 TO 200	201 TO 400	401 TO 1000
Analog Carrier noncompandored	31 / 40	33 / 40	35 / 40	37 / 42	NA
Analog Carrier compandored *	26 / 34	28 / 34	30 / 34	32 / 36	35 / 38
LMX Carrier with N3 compandor applique	21 / 26	22 / 27	22 / 27	23 / 28	24 / 29
Digital	28 / 34	28 / 34	28 / 34	28 / 34	NA
VF Metallic	25 / 36	NA	NA	NA	NA

Note 1: Table designed as follows:

B
A

A = Circuit order and maintenance limit
B = Immediate action limit
NA = Not applicable

Note 2: When the TSPS trunk is routed over multiple facility types, select the requirement with the highest dBrnC0 value applicable to mileage.

Note 3: For TSPS trunks composed of a combination of noncompandored analog and digital carriers with a total length exceeding 400 miles, the noise limit should be obtained from the noncompandored 201 to 400 mile category.

Note 4: Noise limits are to be adjusted to the EML of the point of measurement by subtracting the EML from the limit in the table.

Example:		
	Noise limit from table	37 dBrnC0
	-9 EML	-9
	Measured noise limit	28 dBrnC0

*For carrier facilities with built-in syllabic compandors such as N-type carrier.

TABLE C

MAXIMUM LENGTH OF 26-GAUGE SWITCHBOARD CABLE IN 2-WIRE VOICE CONNECTIONS THROUGH A TSPS BASE UNIT

CIRCUIT	CONNECTING CIRCUIT	MAX LENGTH (FEET)
24V4A repeater or D1C bridging end channel unit associated with operator position trunk	PLN	100
2-wire incoming trunk circuit associated with a 2-wire toll connecting trunk	TLN	150
3-way, 4-wire bridging repeater associated with a 4-wire toll connecting trunk	TLN	250
3-way, 4-wire bridging repeater associated with inward and delayed call trunks	TLN	250
Base unit, base-remote trunk circuit (SD-1B135-01)	TLN	150
	Repeater	150
3-way operator service trunk circuit (SD-1B278-01)	TLN	150
	Repeater	150
	NIC	150
Incoming CAMA transfer trunk circuit (SD-1B016-01)	TLN	150
	Repeater	300
3-way, 4-wire bridging repeater associated with service observing access trunk circuit (SD-1B275-01)	TLN	250
	PLN	100
Type I and type II CDA, MDA and (SD-7C038-01)	SSAS	100
	TLN	250
	PLN	100
3-way, 4-wire bridging repeater associated with the BLV network access trunk	TLN	250
High-impedance multifrequency receiver (HMFR)	PLN	100
Balance test termination (SD-1B023-01)	TLN	100
TSPS switching network*	TLN to PLN	100

* The maximun resistance from PLN to TLN is not to exceed 10 ohms.

TABLE D

MAXIMUM LENGTH OF 26-GAUGE SWITCHBOARD CABLE IN VOICE CONNECTIONS THROUGH 1 TSPS RTA

CIRCUIT	CONNECTING CIRCUIT	MAX LENGTH (FEET)
2-wire incoming toll-connecting trunk circuit	Trunk stage of RTA concentrator	150
24V4A repeater associated with a base-remote trunk	Base-remote stage of RTA concentrator (through the remote, base-remote trunk circuit, SD-1B120-01)	100
3-way, 4-wire bridging repeater	Trunk stage of RTA concentrator	250
Balance test termination (SD-1B123-01)	Trunk stage of RTA concentrator	100
RTA concentrator*	Trunk stage to base-remote stage	50

* The maximum resistance from trunk stage to base-remote stage is not to exceed 6 ohms

TABLE E

TYPICAL CARRIER CHANNEL ALLOCATIONS FOR PSS NO. 2 AND RTA (SEE SD-1B124-01 BEFORE ACTUAL CHANNEL ASSIGNMENT)

TERMINAL	ROUTE	CHANNEL	CHANNEL ASSIGNMENTS IN VARIOUS GROWTH SITUATIONS						
			1	2, 2′	3, 3′	4, 4′	5, 5′	6, 6′	7, 7′
A	0	1-8	Voice	Voice	Voice	Voice	Voice	Voice	Voice
		9	TTY	TTY	TTY	TTY	TTY	TTY	TTY
		10	Data Line Spare	Voice	Voice	Voice	Voice	Voice	Voice
		11	Data Line 0	Data Line 0	Data Line 0	Data Line 0	Data Line 0	Data Line 0	Data Line 0
		12	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm
AA	0	1-10		Voice	Voice	Voice	Voice	Voice	Voice
		11		Data Line Spare	Unused	Unused	Voice	Voice	Voice
		12		Alarm	Alarm	Alarm	Alarm	Alarm	Alarm
C	1	1-10			Voice	Voice	Voice	Voice	Voice
		11			Data Line Spare	Data Line Spare	Data Line 1	Data Line 1	Data Line 1
		12			Alarm	Alarm	Alarm	Alarm	Alarm
CC	1	1-10				Voice	Voice	Voice	Voice
		1				Unused	Voice	Voice	Voice
		12				Alarm	Alarm	Alarm	Alarm
D	0	1-10					Voice	Voice	Voice
		11					Data Line Spare	Data Line Spare	Data Line Spare
		12					Alarm	Alarm	Alarm
DD	0	1-11						Voice	Voice
		12						Alarm	Alarm
E	1	1-11							Voice
		12							Alarm
B	1	1-10	SW Spare	SW Spare	SW Spare	SW Spare	SW Spare	SW Spare	SW Spare
		11	Data Line 1	Data Line 1	Data Line 1	Data Line 1	SW Spare	SW Spare	SW Spare
		12	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm
BB*	1	1-11		SW Spare	SW Spare	SW Spare	SW Spare	SW Spare	SW Spare
		12		Alarm	Alarm	Alarm	Alarm	Alarm	Alarm
Possible Range of Available Voice Channels			8-9	19-21	29-33	39-45	51-56	62-68	73-80

* Used with the prime situations (2′, 3′, etc) where channel terminal groups apply rather than 12 channel terminal groups. Data lines are not replaced by switched channels.

TABLE F
TSPS No. 1/1B
BALANCE TEST REQUIREMENTS
(INDEX)

TEST NO.	CIRCUIT TESTED
1	Preliminary Tests on 2W Toll Offices
2 and 3	Verification of CDT balance test circuit
4	2-wire toll-connecting trunks (not RTA)
5 through 7	4-wire toll-connecting trunks (not RTA)
8	Operator position trunks
9 and 10	CAMA transfer trunks
11 through 15	Operator service trunks
16 through 18	Inward and delayed call trunks
19 through 23	Service observing trunk access circuits
24 through 28	Type I CDA circuit
29 through 33	TDA circuit
34 through 38	MDA circuit
39 through 50	Type II CDA circuit
51 through 53	Busy line verification access trunk
54 and 55	Transfer trunks
56 and 57	Verification of TSTD balance test circuit
58	RTA – 2-wire toll-connecting trunks
59 through 61	RTA – 4-wire toll-connecting trunks
62 through 66	Base-remote trunks
67 through 69	RTA – Inward trunks
70	Verification of DATL0 and DATL1
71	Verification of 1M term sets in CDT or TSTD

TABLE F (CONT)
BALANCE TEST REQUIREMENTS

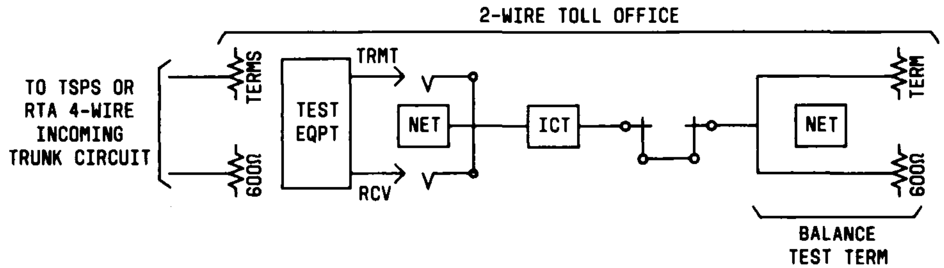
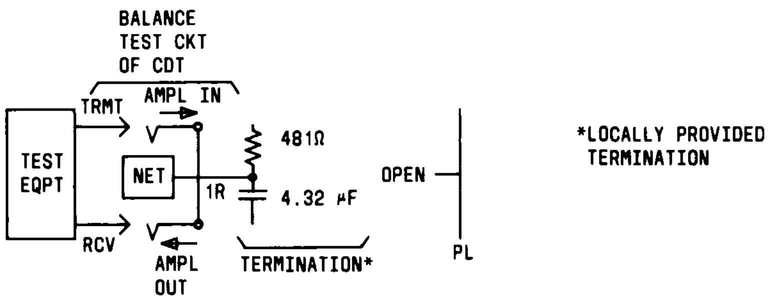
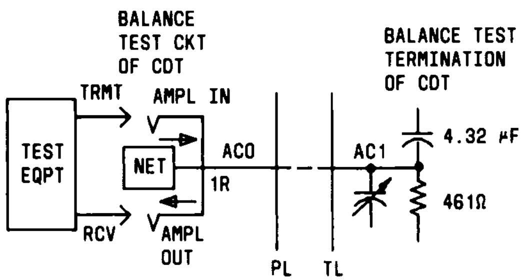
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB) ERL MED	ERL MIN	ERL TURN DOWN	SRL MED	SRL MIN	SRL TURN DOWN
1	PRELIMINARY TEST REQUIRED AT 2-WIRE TOLL OFFICES 4WTS NBOC VERIFICATION		20	16	10.5	15	11	4
2	VERIFICATION OF BALANCE TEST CIRCUIT OF CDT		–	32	–	–	32	–
3	VERIFICATION OF CDT ACCESS CIRCUIT AC1		–	29	–	–	29	–

TABLE F (CONT)

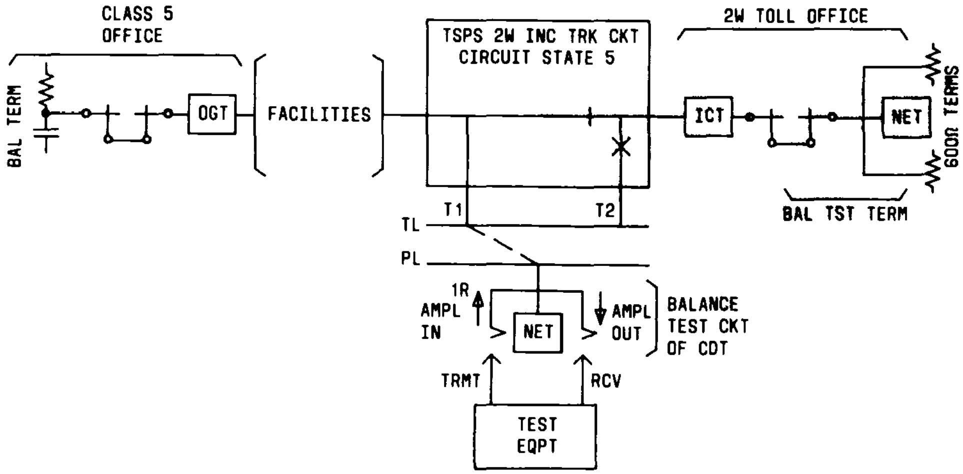
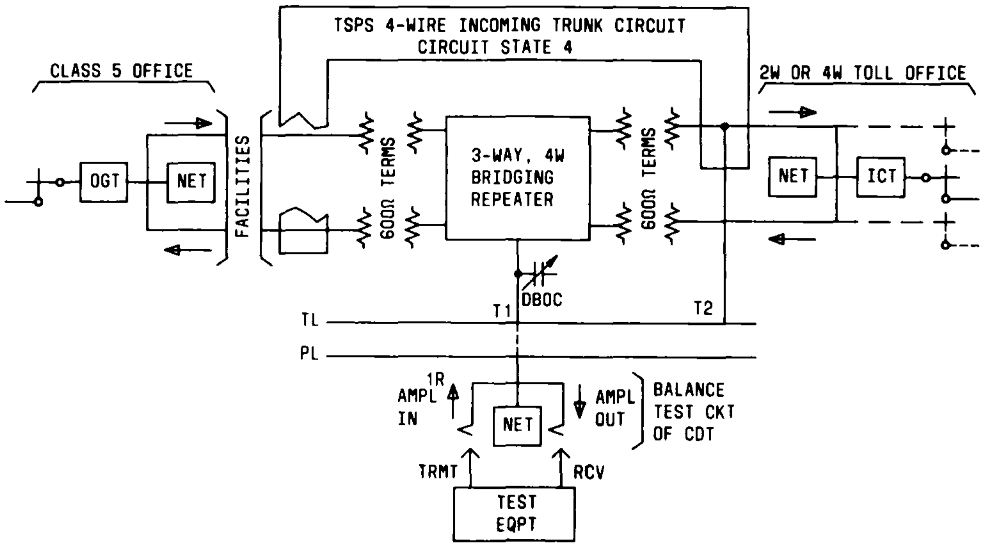
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB) ERL MED	ERL MIN	ERL TURN DOWN	SRL MED	SRL MIN	SRL TURN DOWN
4	OVERALL VERIFICATION (AFTER NBOC SELECTION) OF 2-WIRE TOLL-CONNECTING TRUNK		15	13	11	–	6	4
5	DBOC SELECTION AND VERIFICATION ON 4-WIRE TOLL-CONNECTING TRUNKS		24	21	18	19	16	13

TABLE F (CONT)

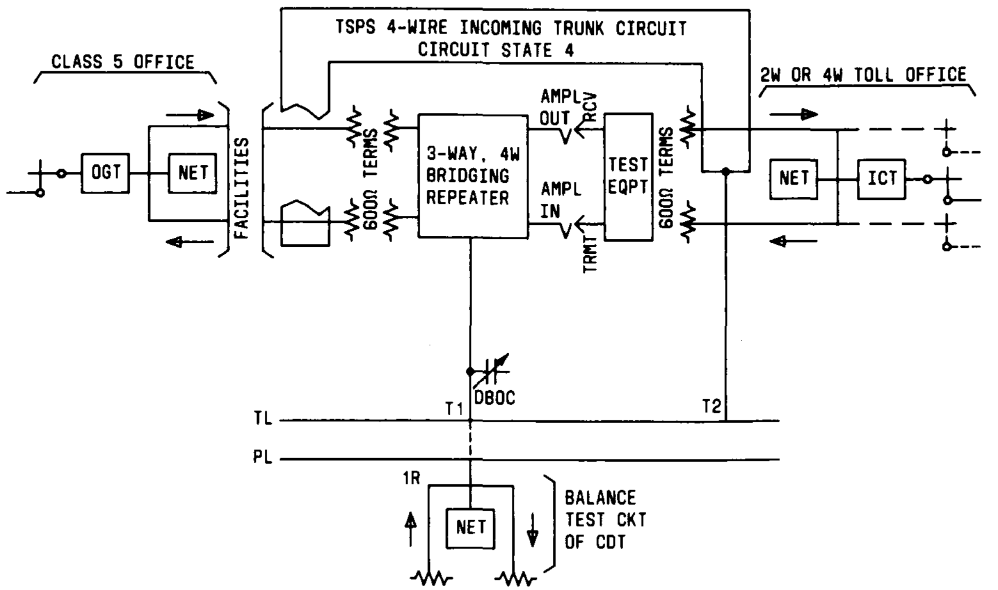
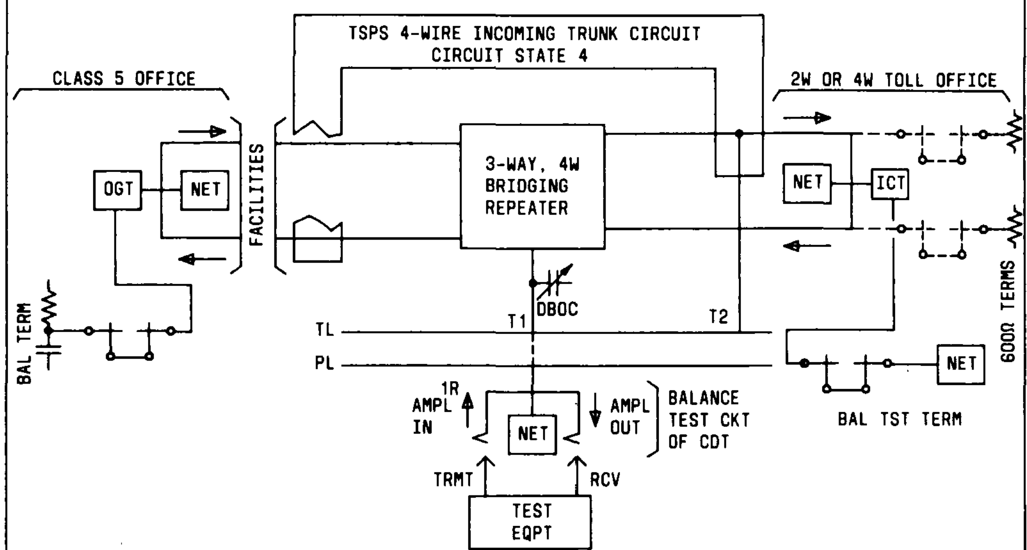
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB) ERL MED	ERL MIN	ERL TURN DOWN	SRL MED	SRL MIN	SRL TURN DOWN
6	NBOC SELECTION AND VERIFICATION ON 4-WIRE TOLL-CONNECTING TRUNKS		–	26	18	–	19	11
7	OVERALL VERIFICATION (AFTER NBOC SELECTION) OF 4-WIRE TOLL-CONNECTING TRUNK		–	19	12	–	15	8

TABLE F (CONT)

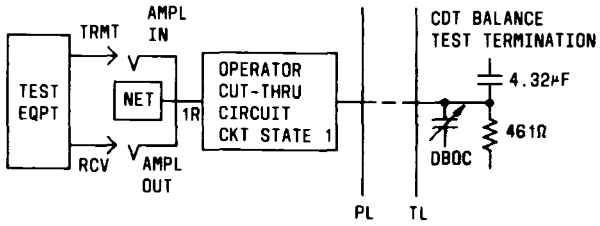
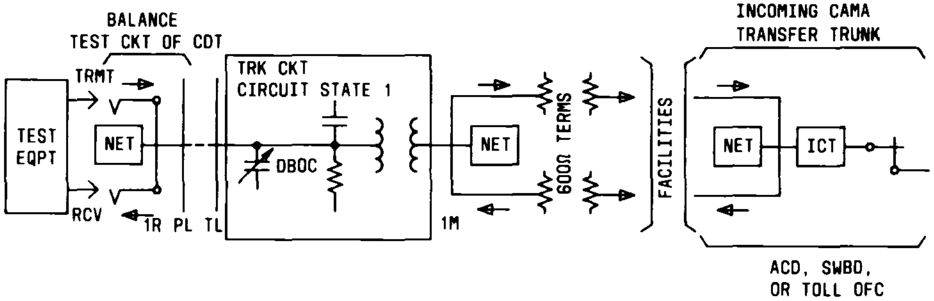
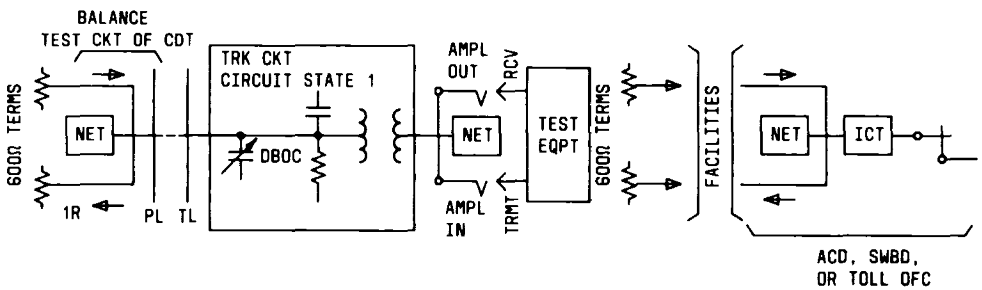
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB) ERL MED	ERL MIN	ERL TURN DOWN	SRL MED	SRL MIN	SRL TURN DOWN
8	OVERALL VERIFICATION OF OPERATOR POSITION TRUNKS (AFTER NBOC SELECTION)		-	27	-	-	27	-
9	DBOC SELECTION AND OVERALL VERIFICATION OF CAMA TRANSFER TRUNKS		–	21	18	–	16	13
10	NBOC SELECTION AND OVERALL VERIFICATION OF CAMA TRANSFER TRUNKS		–	26	18	–	19	11

TABLE F (CONT)

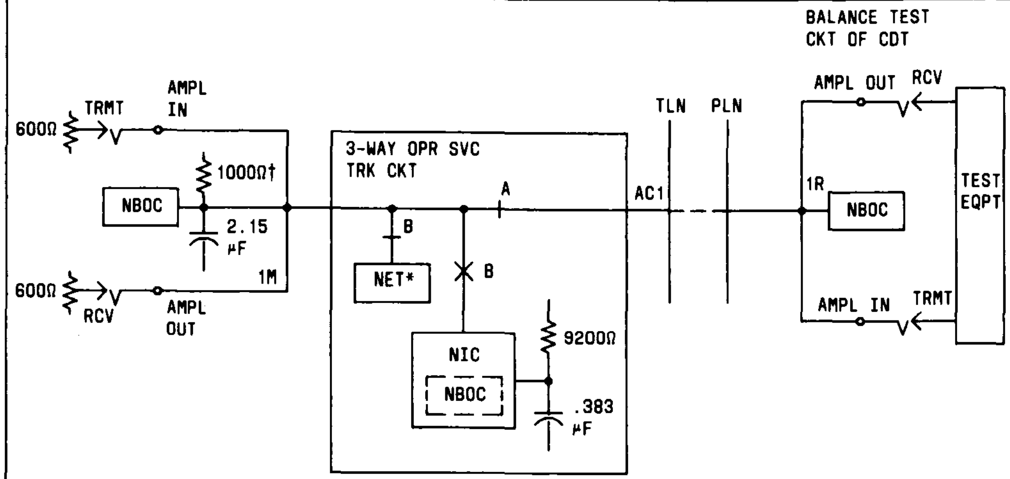
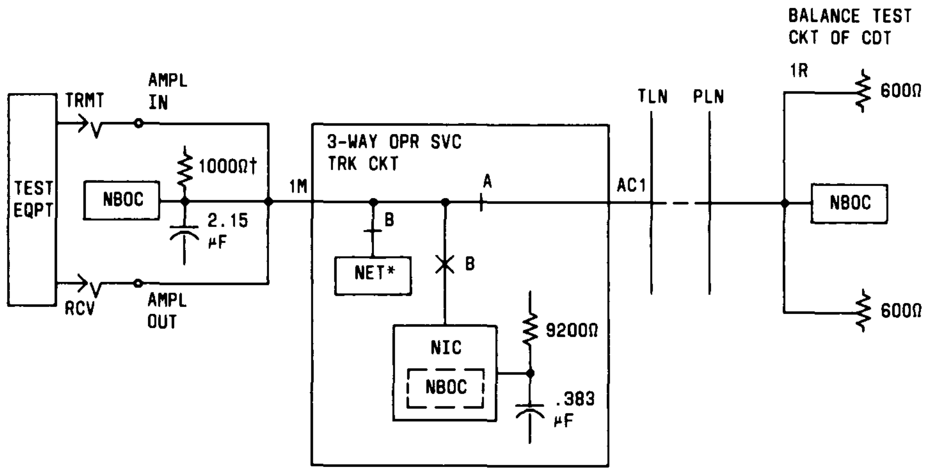
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB)					
			ERL			SRL		
			MED	MIN	TURN DOWN	MED	MIN	TURN DOWN
11	DBOC SELECTION AND VERIFICATION 3-WAY OPERATOR SERVICE TRUNK (2-WAY MODE)	 * NET=DBOC PLUS 1020Ω + 2.15 μF † LOCALLY PROVIDED TERMINATION	24	21	18	19	16	13
12	4-WIRE TERM SET NBOC SELECTION AND VERIFICATION 3-WAY OPERATOR SERVICE TRUNK (2-WAY MODE)	 * NET=DBOC PLUS 1020Ω + 2.15 μF † LOCALLY PROVIDED TERMINATION	-	26	18	-	19	11

TABLE F (CONT)

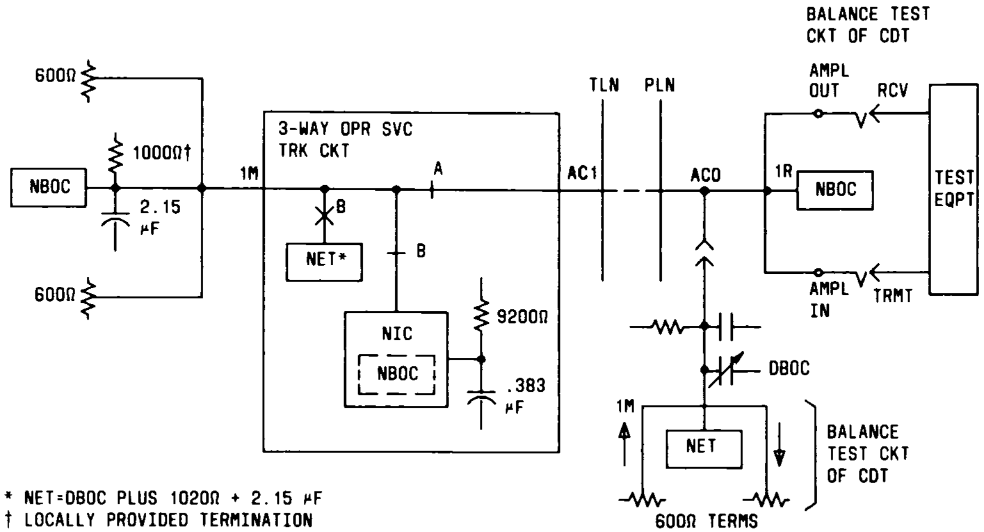
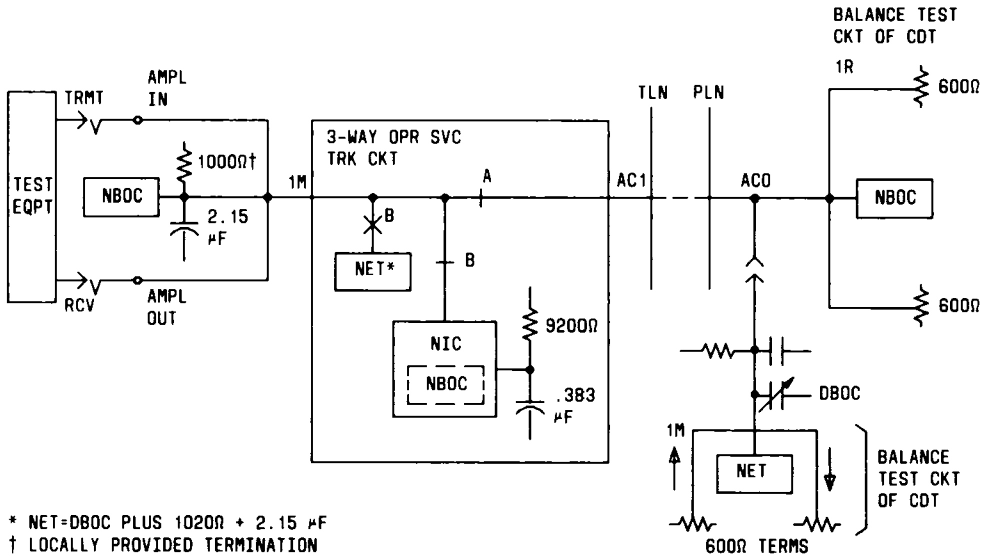
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB)					
			ERL			SRL		
			MED	MIN	TURN DOWN	MED	MIN	TURN DOWN
13	OVERALL VERIFICATION 3-WAY OPERATOR SERVICE TRUNK (3-WAY MODE)	 * NET=DBOC PLUS 1020Ω + 2.15 μF † LOCALLY PROVIDED TERMINATION	24	18	15	18	15	11
14	OVERALL VERIFICATION 3-WAY OPERATOR SERVICE TRUNK (3-WAY MODE)	 * NET=DBOC PLUS 1020Ω + 2.15 μF † LOCALLY PROVIDED TERMINATION	26	23	15	18	15	11

TABLE F (CONT)

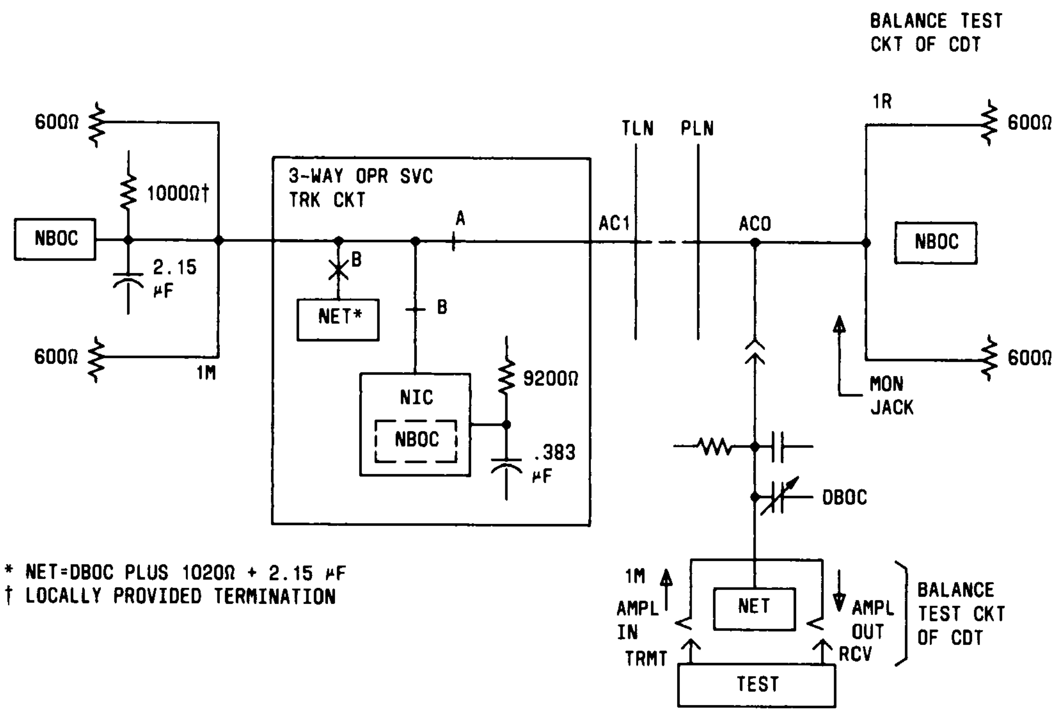
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB) ERL MED	ERL MIN	ERL TURN DOWN	SRL MED	SRL MIN	SRL TURN DOWN
15	OVERALL VERIFICATION 3-WAY OPERATOR SERVICE TRUNK (3-WAY MODE)	 * NET=DBOC PLUS 1020Ω + 2.15 μF † LOCALLY PROVIDED TERMINATION	26	23	15	18	15	11

TABLE F (CONT)

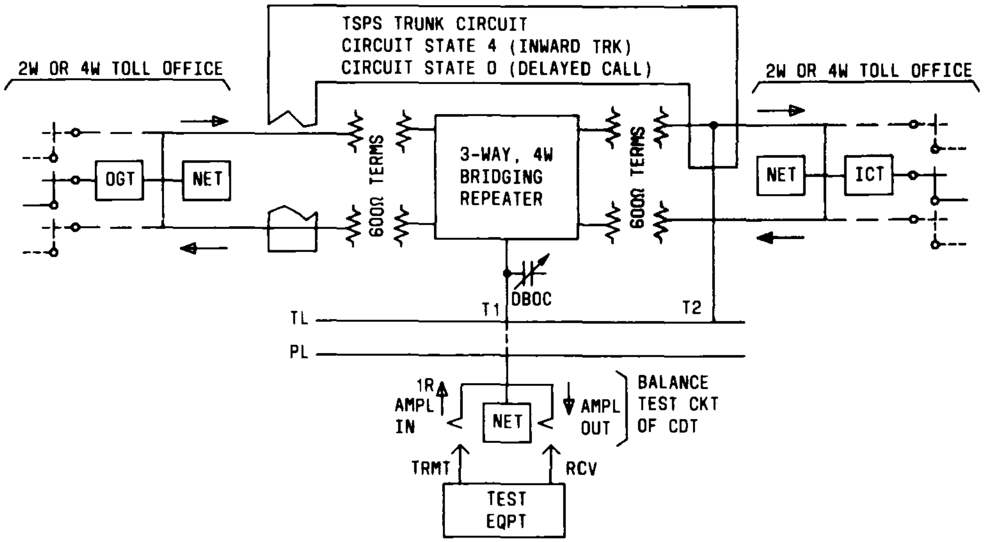
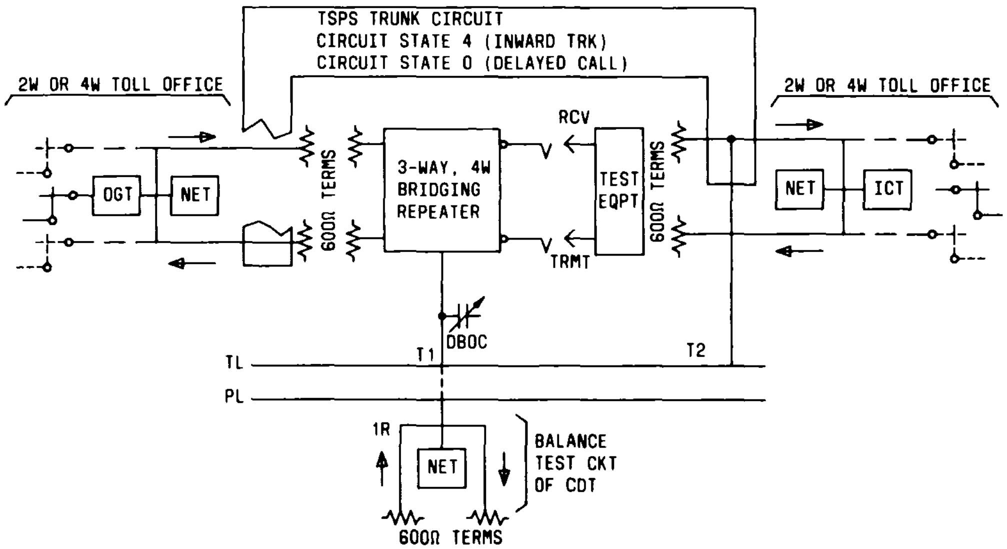
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB)					
			ERL			SRL		
			MED	MIN	TURN DOWN	MED	MIN	TURN DOWN
16	DBOC SELECTION AND VERIFICATION ON INWARD OR DELAYED CALL TRUNKS		24	21	18	19	16	13
17	NBOC SELECTION AND VERIFICATION ON INWARD OR DELAYED CALL TRUNKS		–	26	18	–	19	11

TABLE F (CONT)

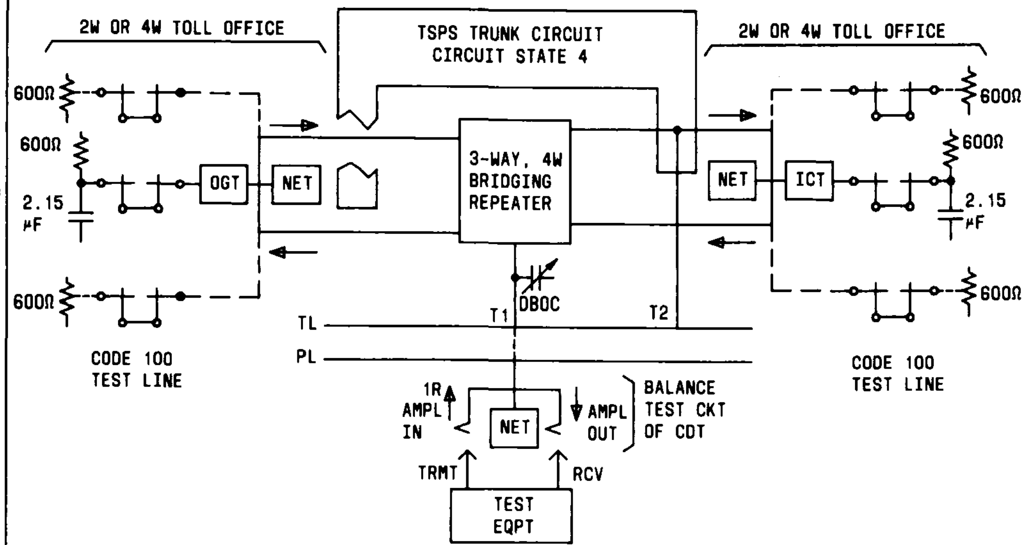
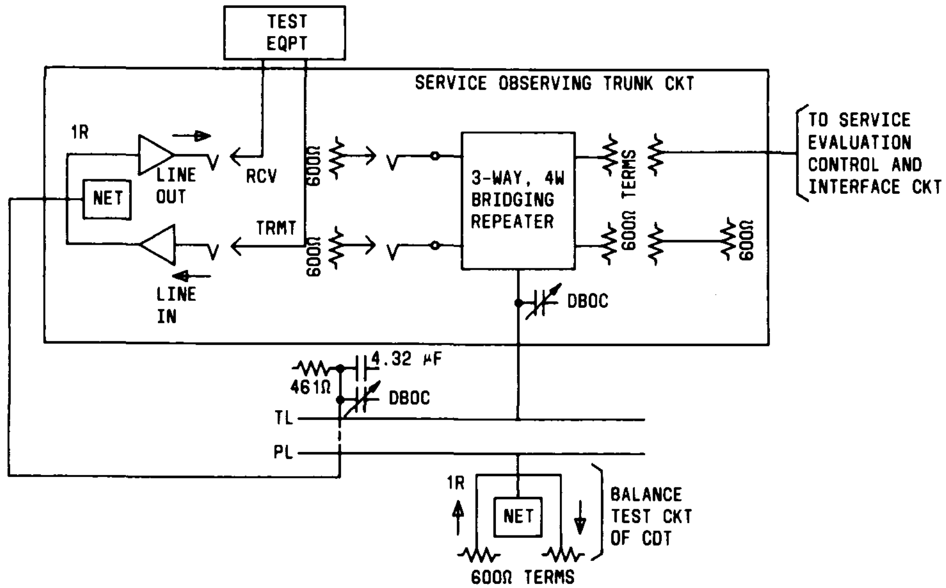
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB)					
			ERL			SRL		
			MED	MIN	TURN DOWN	MED	MIN	TURN DOWN
18	OVERALL VERIFICATION OF INWARD TRUNKS		24	21	18	19	16	13
19	1R 4WTS NBOC VERIFICATION ON SERVICE OBSERVING TRUNK ACCESS CIRCUIT		24	21	18	19	16	13

TABLE F (CONT)

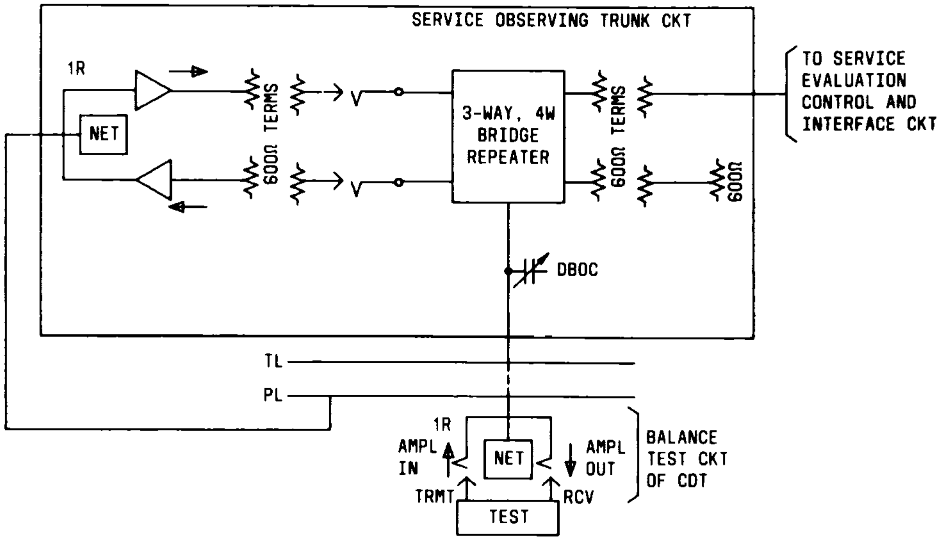
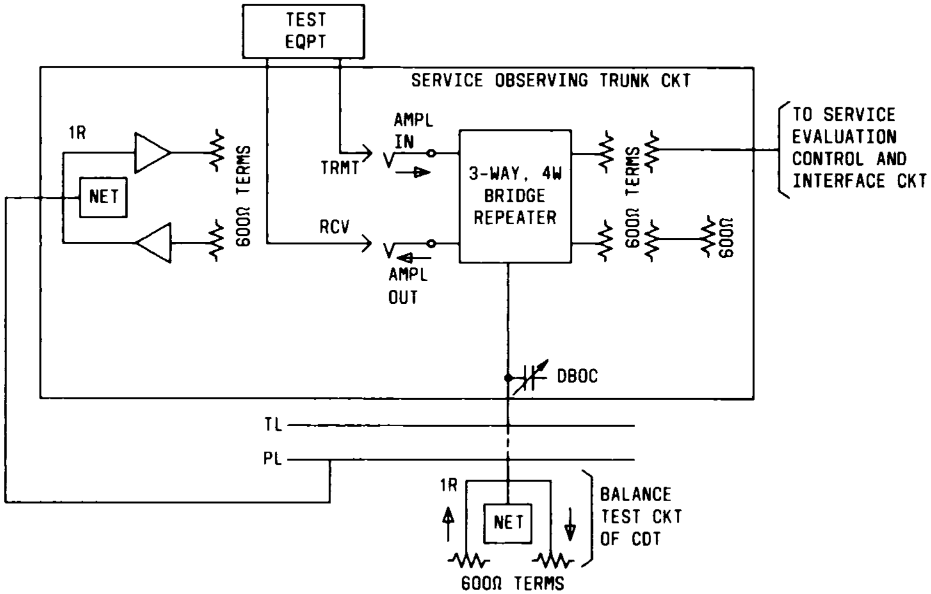
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB)					
			ERL			SRL		
			MED	MIN	TURN DOWN	MED	MIN	TURN DOWN
20	DBOC SELECTION AND VERIFICATION ON SERVICE OBSERVING TRUNK ACCESS CIRCUIT		24	21	18	19	16	13
21	NBOC SELECTION AND VERIFICATION OF SERVICE OBSERVING TRUNK ACCESS CIRCUIT		–	26	18	–	19	11

TABLE F (CONT)

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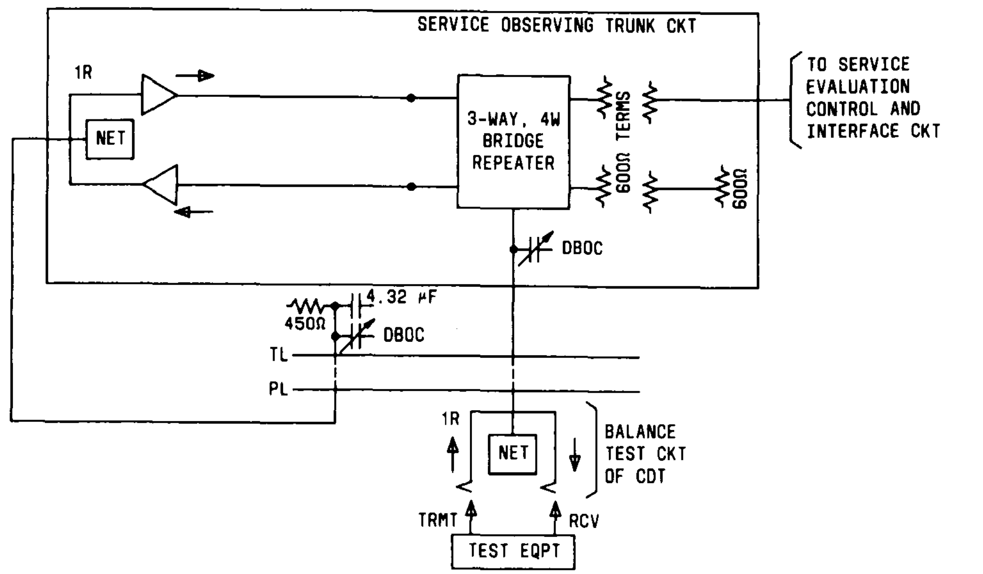
<tr><th rowspan="3">TEST NO</th><th rowspan="3">TEST</th><th rowspan="3">TEST CONNECTION</th><th colspan="6">REQUIREMENTS (dB)</th></tr>
<tr><th colspan="3">ERL</th><th colspan="3">SRL</th></tr>
<tr><th>MED</th><th>MIN</th><th>TURN DOWN</th><th>MED</th><th>MIN</th><th>TURN DOWN</th></tr>
<tr><td>22</td><td>OVERALL VERIFICATION ON SERVICE OBSERVING TRUNK ACCESS CIRCUIT</td><td>
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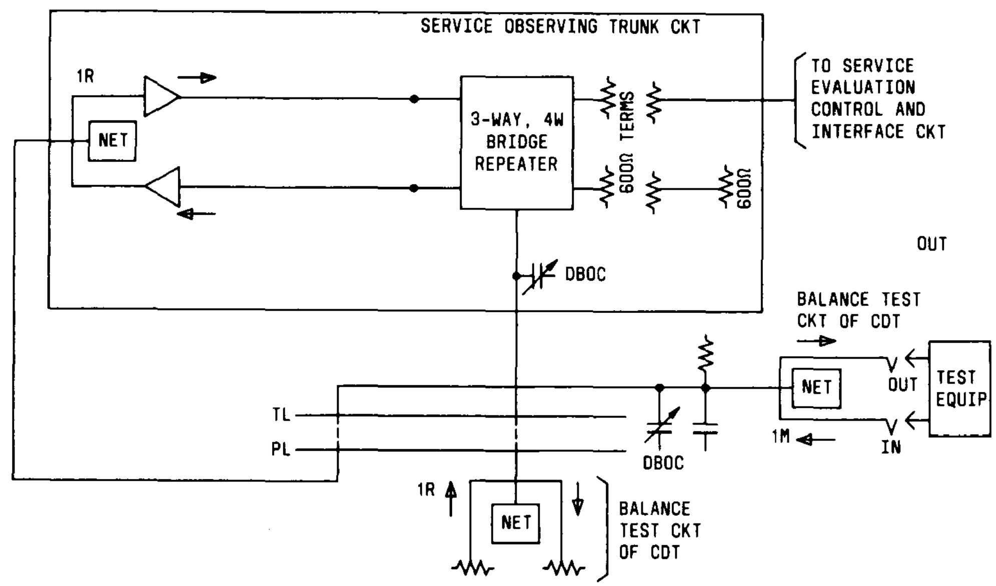
<tr><td>23</td><td>OVERALL VERIFICATION ON SERVICE OBSERVING TRUNK ACCESS CIRCUIT</td><td>
</td><td>26</td><td>23</td><td>15</td><td>18</td><td>15</td><td>11</td></tr>
</table>

TABLE F (CONT)

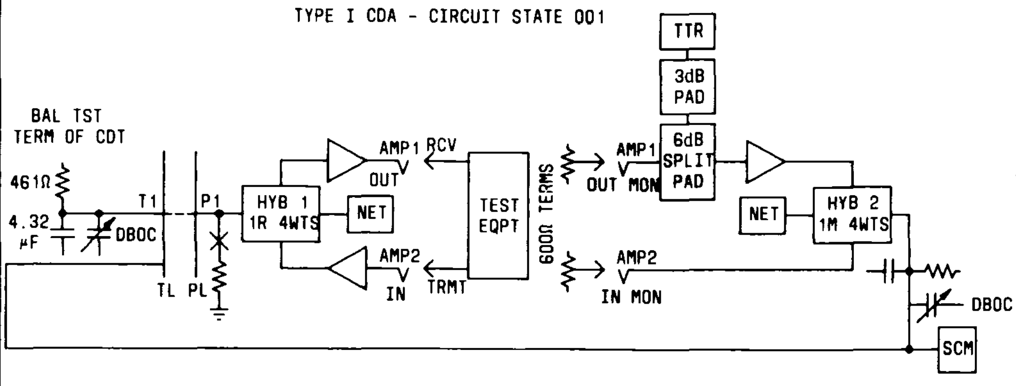
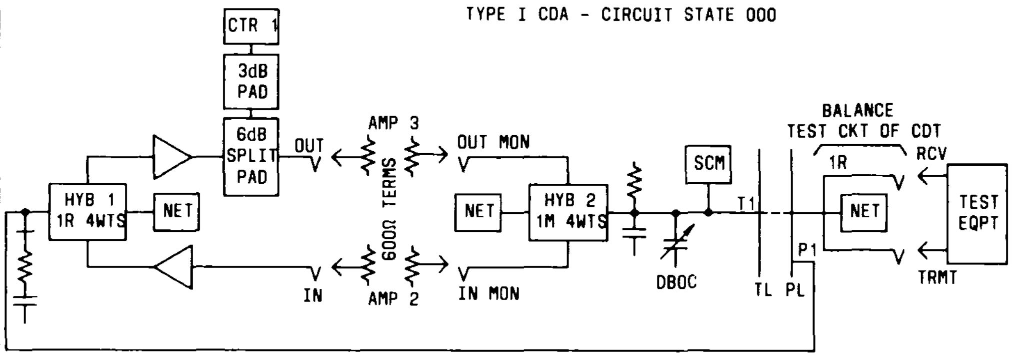
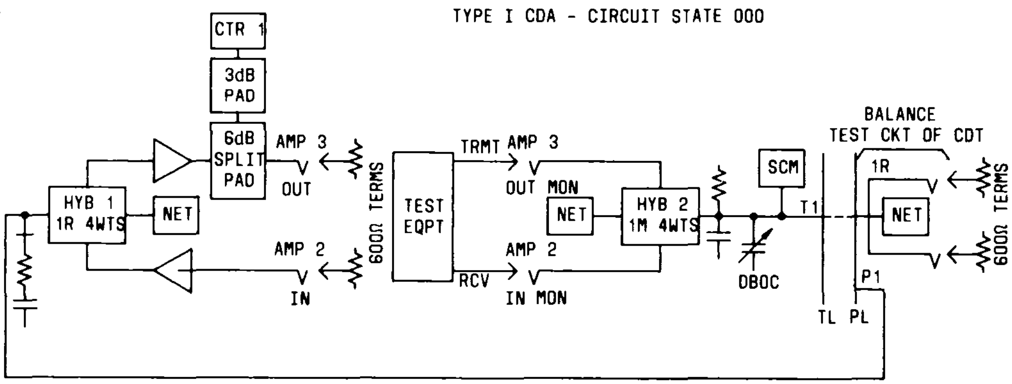
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB)					
			ERL			SRL		
			MED	MIN	TURN DOWN	MED	MIN	TURN DOWN
24	HYB1 (1R 4WTS) NBOC VERIFICATION TYPE I CDA		–	27	–	–	27	–
25	HYB 2 PORT DBOC SELECTION AND VERIFICATION TYPE I CDA		–	24	21	–	19	16
26	HYB 2 PORT 4WTS NBOC SELECTION AND VERIFICATION TYPE I CDA		–	25	22	–	20	17

TABLE F (CONT)

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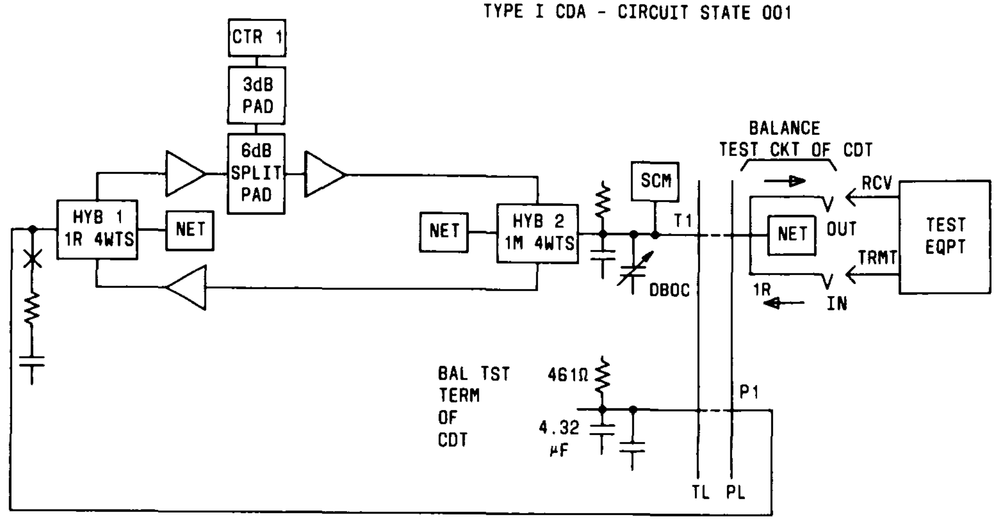
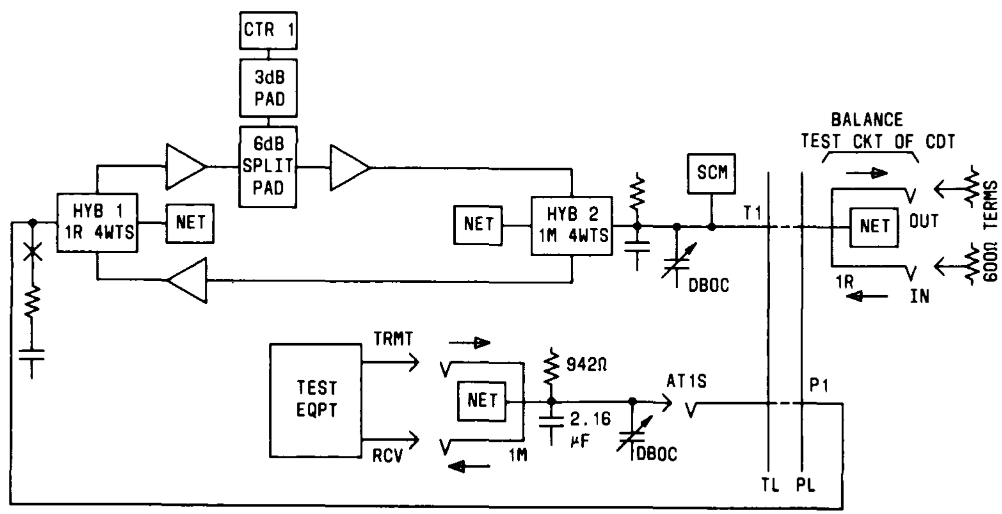
<tr><th colspan="3">ERL</th><th colspan="3">SRL</th></tr>
<tr><th>MED</th><th>MIN</th><th>TURN DOWN</th><th>MED</th><th>MIN</th><th>TURN DOWN</th></tr>
<tr><td>27</td><td>OVERALL VERIFICATION TYPE I CDA</td><td>TYPE I CDA - CIRCUIT STATE 001

</td><td>–</td><td>24</td><td>21</td><td>–</td><td>19</td><td>16</td></tr>
<tr><td>28</td><td>OVERALL VERIFICATION TYPE I CDA</td><td>TYPE I CDA - CIRCUIT STATE 001

</td><td>–</td><td>25</td><td>22</td><td>–</td><td>20</td><td>17</td></tr>
</table>

TABLE F (CONT)

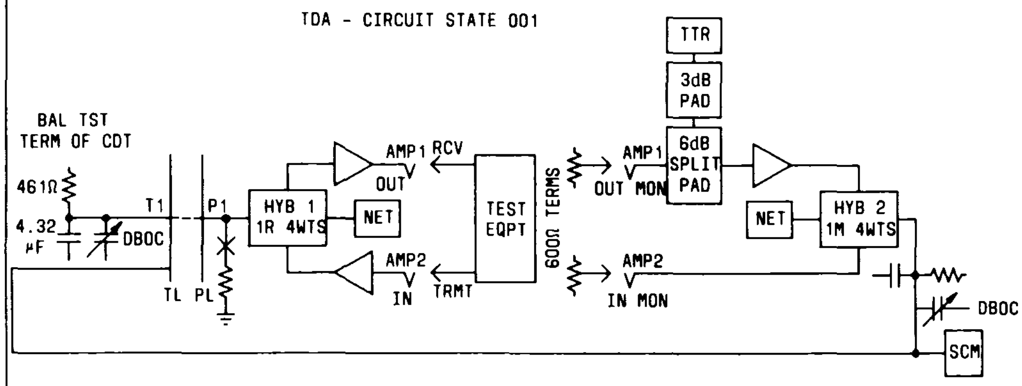
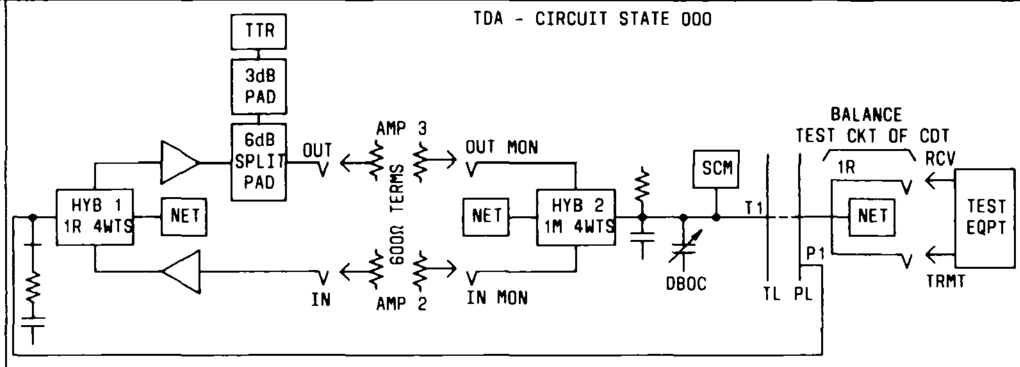
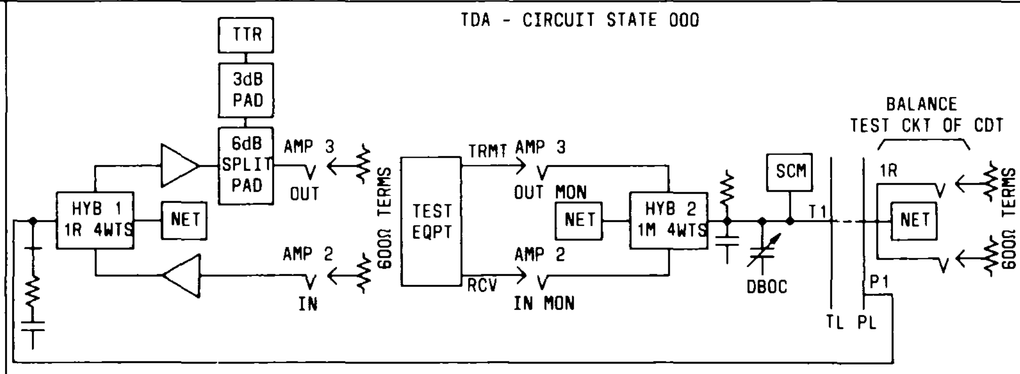
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB) ERL MED	ERL MIN	ERL TURN DOWN	SRL MED	SRL MIN	SRL TURN DOWN
29	HYB1 (1R 4WTS) NBOC VERIFICATION OF TDA CIRCUITS		–	27	–	–	27	–
30	HYB 2 PORT DBOC SELECTION AND VERIFICATION OF TDA CIRCUITS		–	24	21	–	19	16
31	HYB 2 PORT 4WTS NBOC SELECTION AND VERIFICATION OF TDA CIRCUITS		–	25	22	–	20	17

TABLE F (CONT)

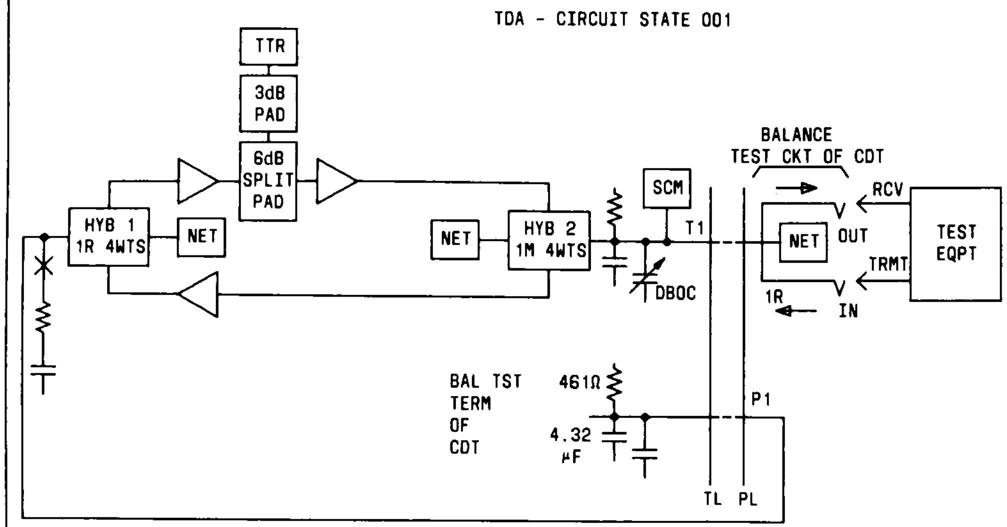
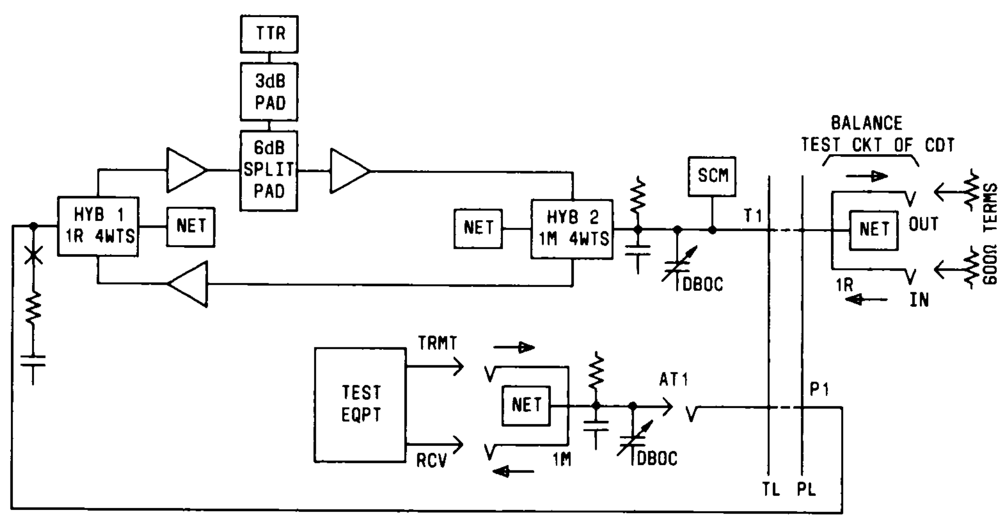
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB) ERL MED	ERL MIN	ERL TURN DOWN	SRL MED	SRL MIN	SRL TURN DOWN
32	OVERALL VERIFICATION OF TDA CIRCUITS	TDA - CIRCUIT STATE 001 	–	24	21	–	19	16
33	OVERALL VERIFICATION OF TDA CIRCUITS	TDA - CIRCUIT STATE 001 	–	25	22	–	20	17

TABLE F (CONT)

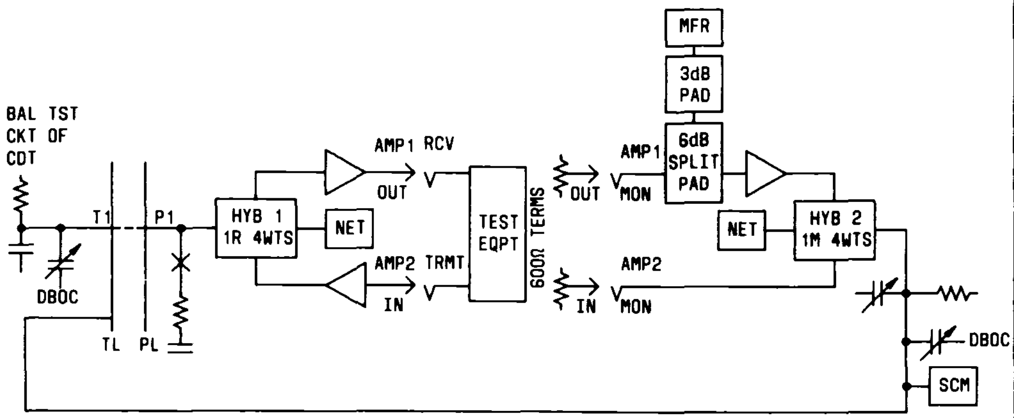
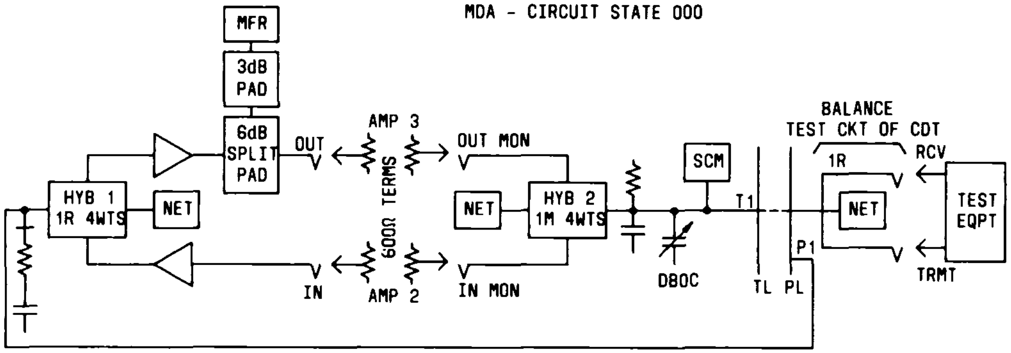
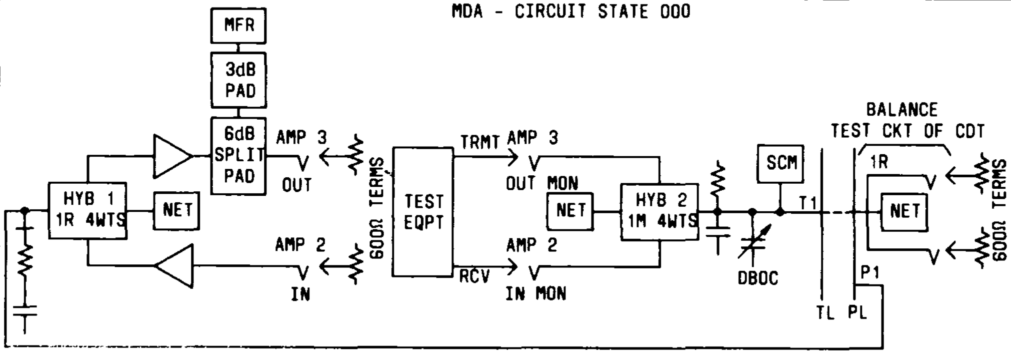
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB) ERL MED	ERL MIN	ERL TURN DOWN	SRL MED	SRL MIN	SRL TURN DOWN
34	HYB1 (1R 4WTS) NBOC VERIFICATION OF MDA CIRCUITS	MDA - CIRCUIT STATE 001 	–	27	–	–	27	–
35	HYB 2 PORT DBOC SELECTION AND VERIFICATION OF MDA CIRCUITS	MDA - CIRCUIT STATE 000 	–	24	21	–	19	16
36	HYB 2 PORT 4WTS NBOC SELECTION AND VERIFICATION OF MDA CIRCUITS	MDA - CIRCUIT STATE 000 	–	25	22	–	20	17

TABLE F (CONT)

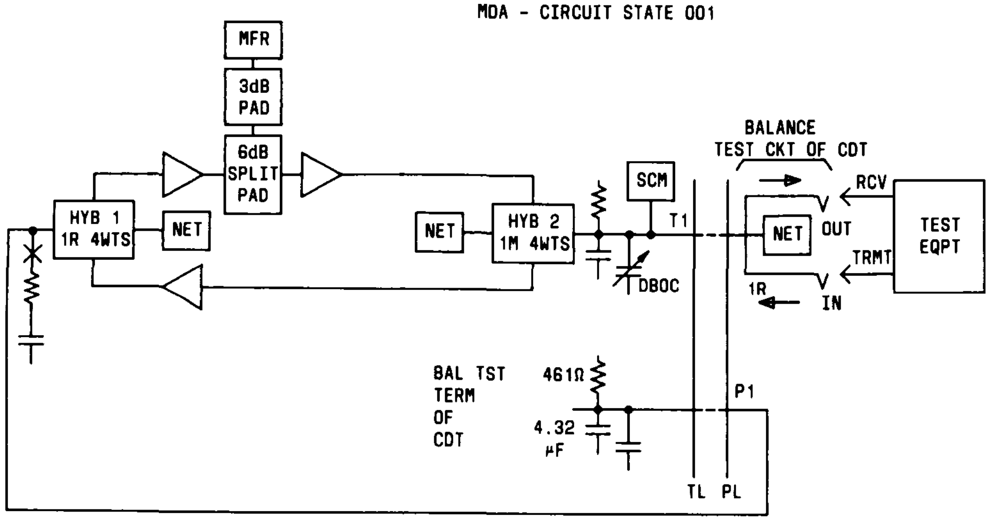
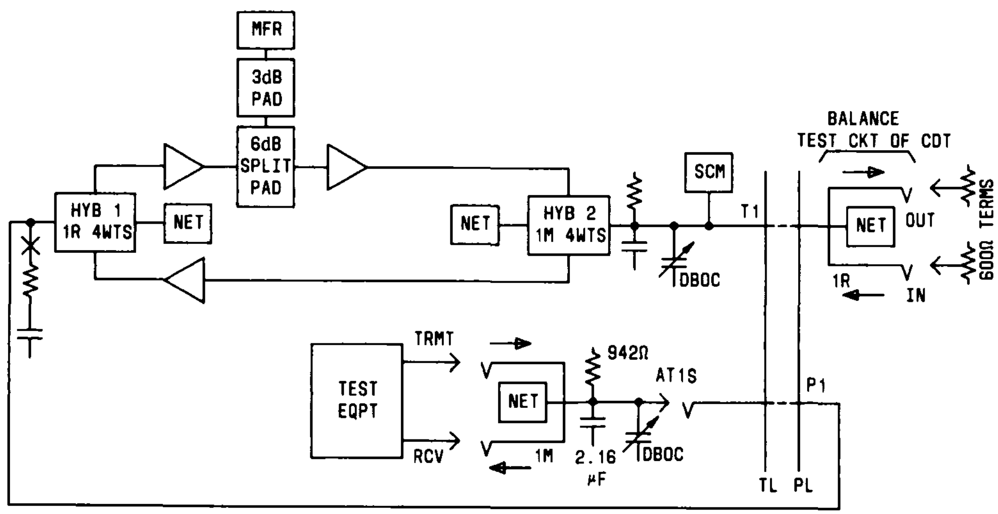
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB)					
			ERL			SRL		
			MED	MIN	TURN DOWN	MED	MIN	TURN DOWN
37	OVERALL VERIFICATION OF MDA CIRCUITS	MDA - CIRCUIT STATE 001 	–	24	21	–	19	16
38	OVERALL VERIFICATION OF MDA CIRCUITS	MDA - CIRCUIT STATE 001 	–	25	22	–	20	17

TABLE F (CONT)

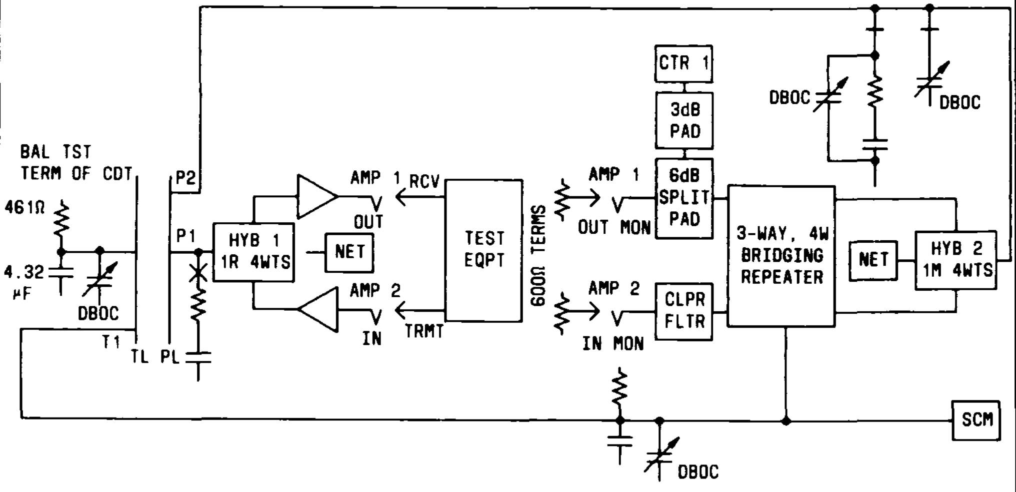
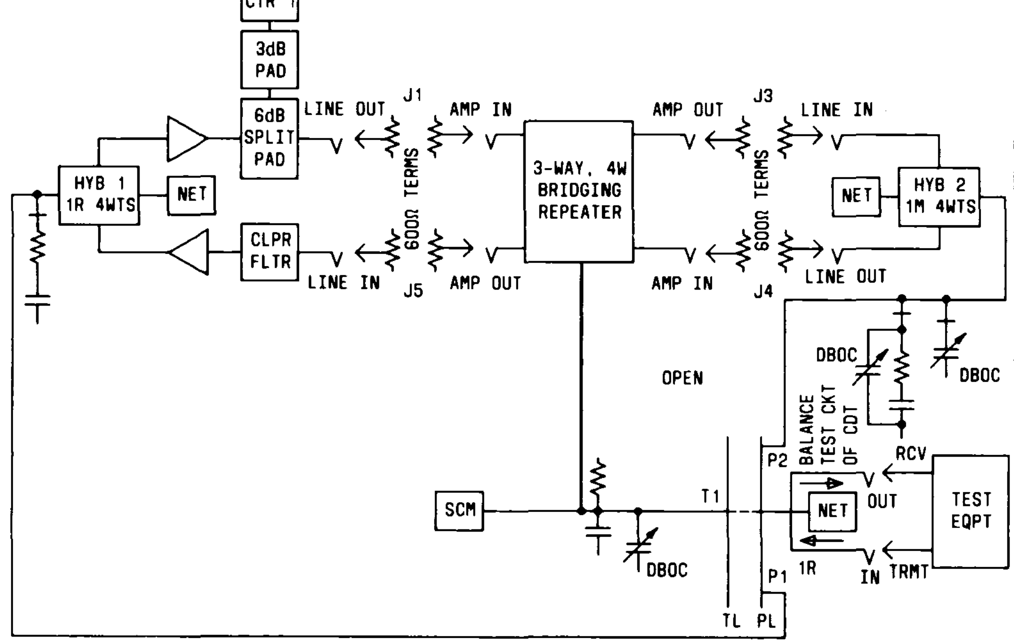
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB) ERL MED	ERL MIN	ERL TURN DOWN	SRL MED	SRL MIN	SRL TURN DOWN
39	1R 4WTS NBOC VERIFICATION TYPE II CDA	TYPE II CDA - CIRCUIT STATE 001 	–	27	–	–	27	–
40	T1 PORT DBOC SELECTION AND VERIFICATION TYPE II CDA	TYPE II CDA - CIRCUIT STATE 000 	–	24	21	–	19	16

TABLE F (CONT)

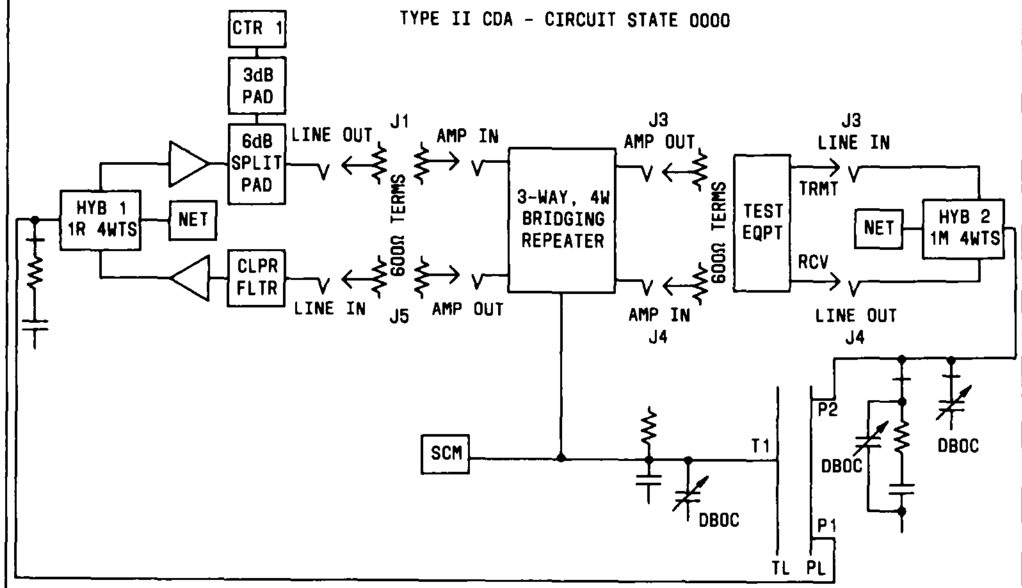
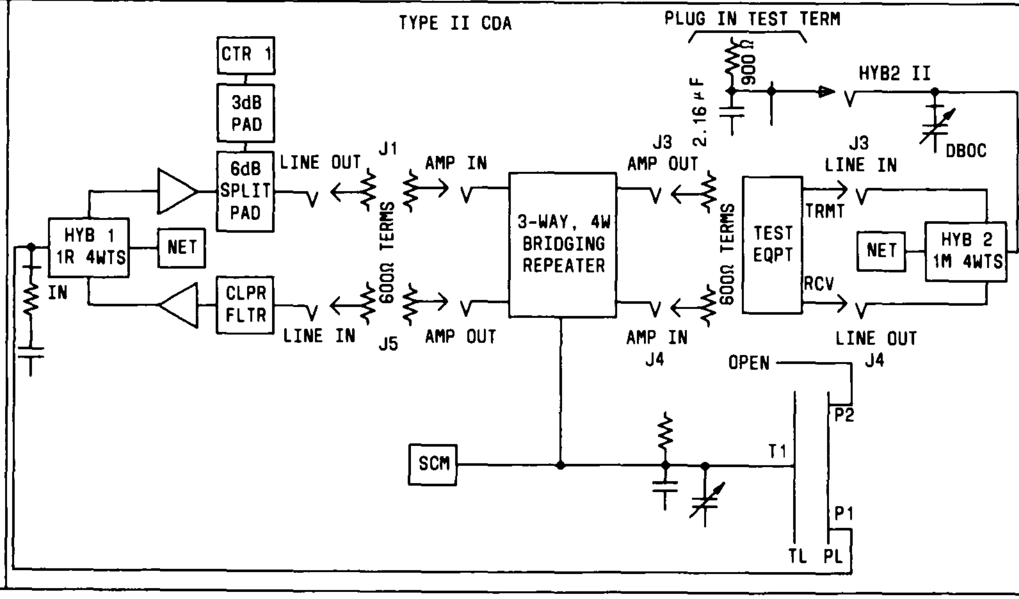
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB)					
			ERL			SRL		
			MED	MIN	TURN DOWN	MED	MIN	TURN DOWN
41	P2 PORT ICT DBOC SELECTION AND VERIFICATION TYPE II CDA		–	33	–	–	33	–
42	P2 PORT SWITCHABLE DBOC SELECTION AND VERIFICATION TYPE II CDA		–	33	–	–	33	–

TABLE F (CONT)

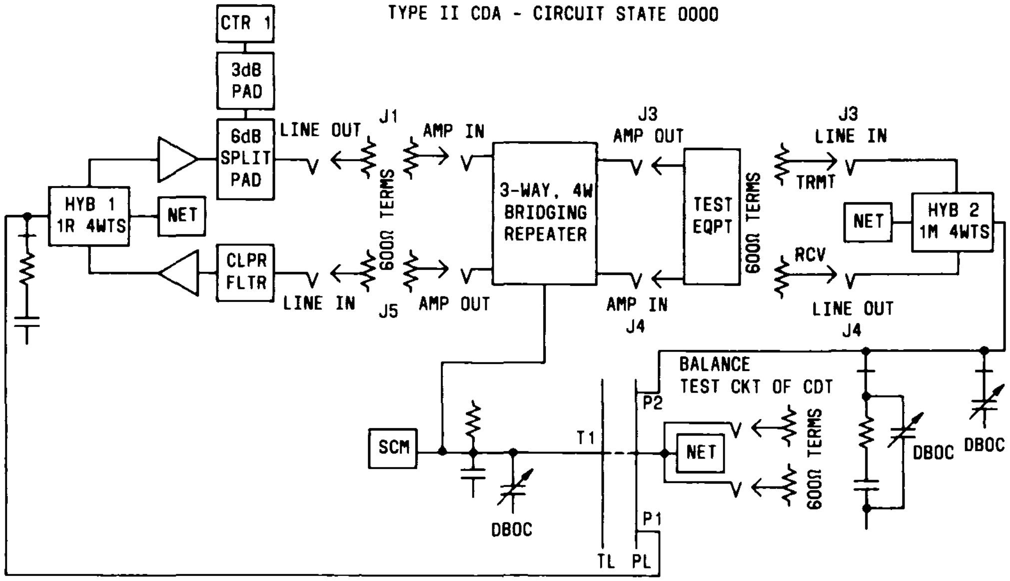
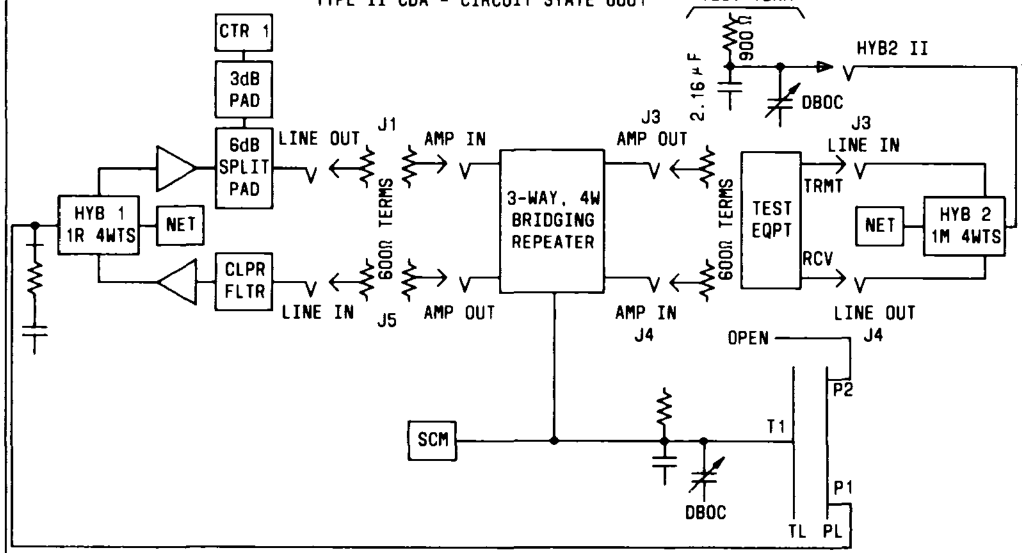
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB)					
			ERL			SRL		
			MED	MIN	TURN DOWN	MED	MIN	TURN DOWN
43	T1 PORT 4WTS NBOC SELECTION AND VERIFICATION TYPE II CDA	TYPE II CDA - CIRCUIT STATE 0000 	–	25	22	–	20	17
44	P2 PORT HYB2 NBOC VERIFICATION TYPE II CDA	TYPE II CDA - CIRCUIT STATE 0001 	–	33	–	–	33	–

TABLE F (CONT)

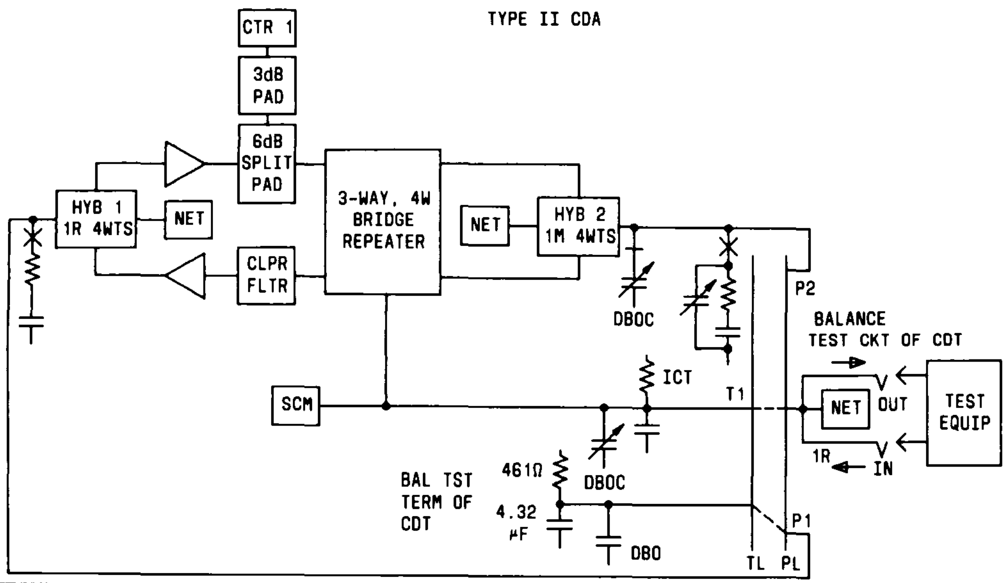
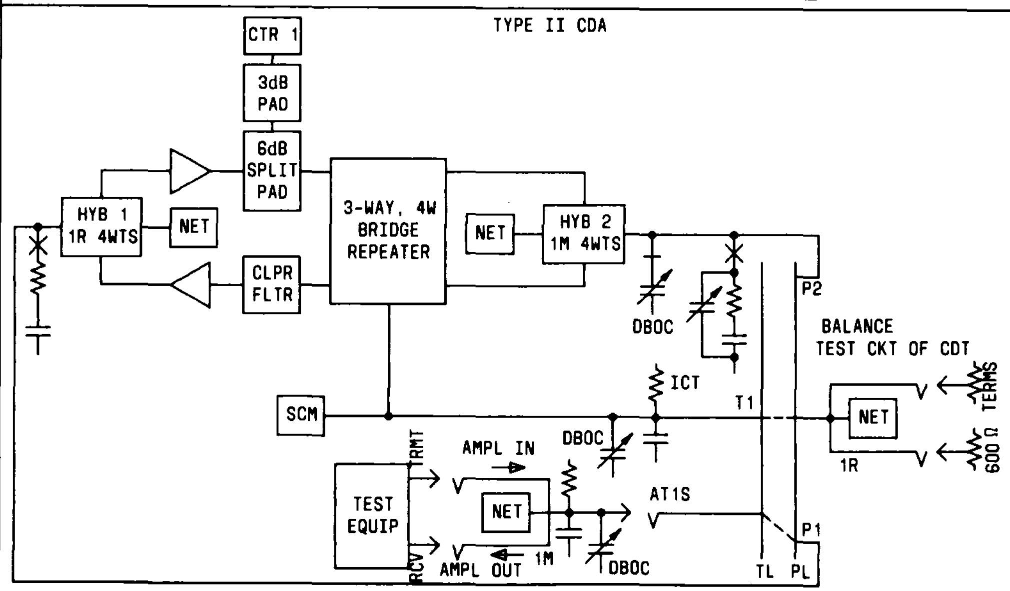
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB) ERL MED	ERL MIN	ERL TURN DOWN	SRL MED	SRL MIN	SRL TURN DOWN
45	OVERALL VERIFICATION TYPE II CDA T1-P1		–	24	21	–	19	16
46	OVERALL VERIFICATION TYPE II CDA P1-T1		–	25	22	–	20	17

TABLE F (CONT)

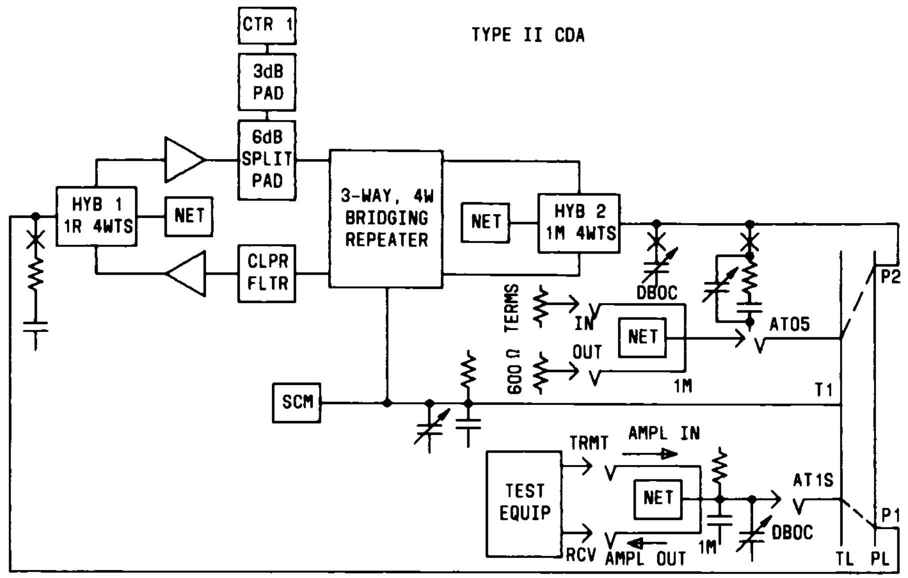
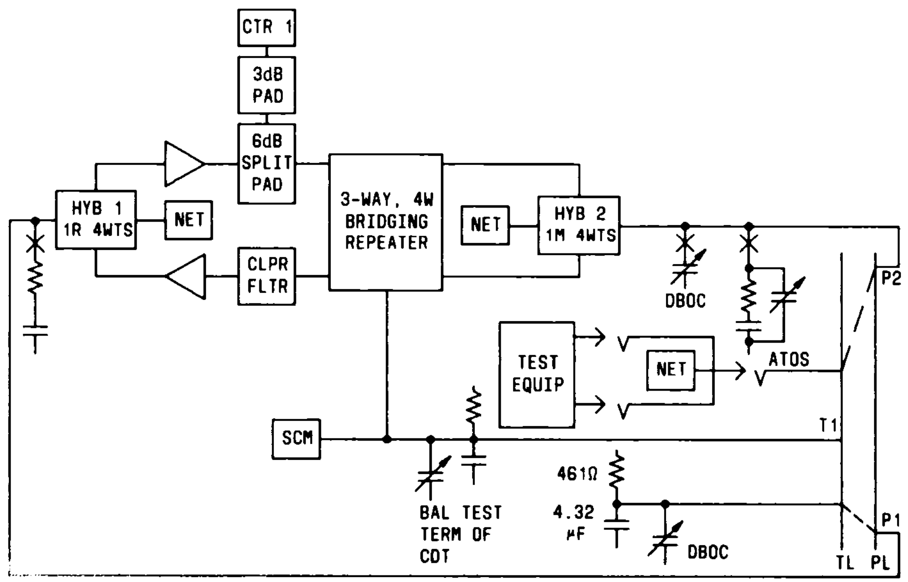
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB) ERL MED	ERL MIN	ERL TURN DOWN	SRL MED	SRL MIN	SRL TURN DOWN
47	OVERALL VERIFICATION TYPE II CDA P1-P2		–	26	18	–	19	11
48	OVERALL VERIFICATION TYPE II CDA P2-P1		–	26	18	–	19	11

TABLE F (CONT)

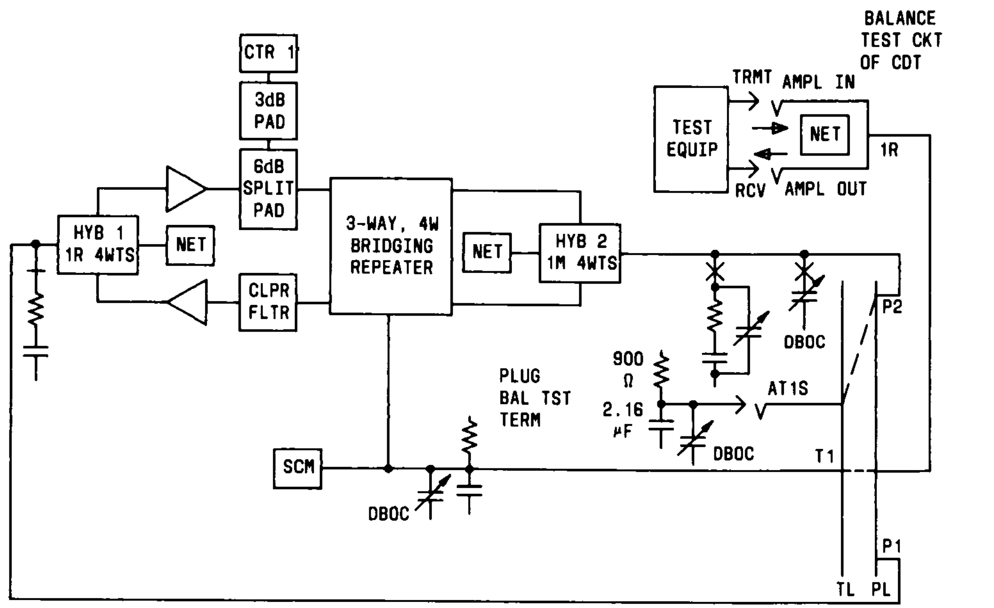
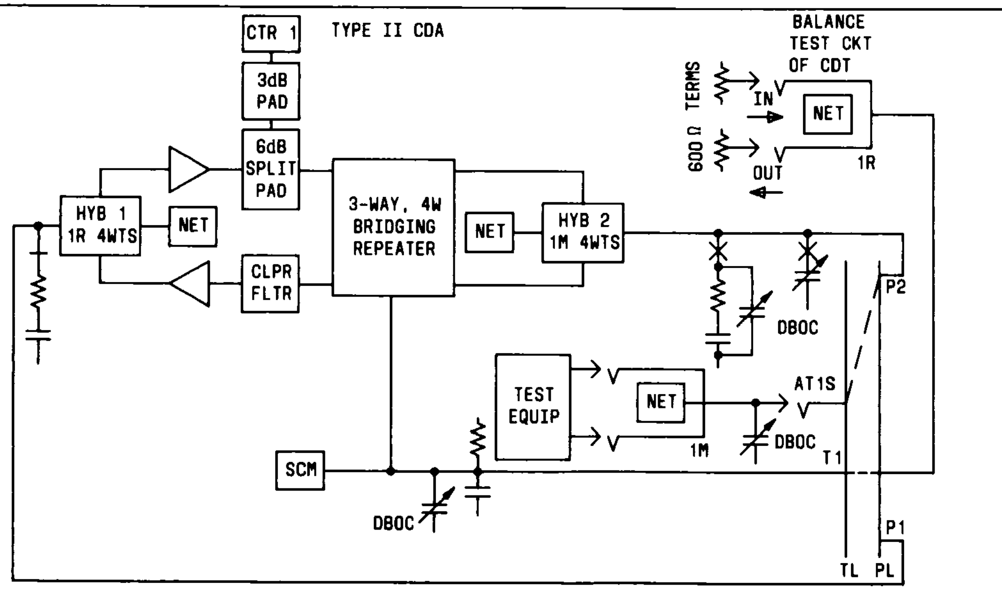
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB)					
			ERL			SRL		
			MED	MIN	TURN DOWN	MED	MIN	TURN DOWN
49	OVERALL VERIFICATION TYPE II CDA T1-P2		–	24	21	–	19	16
50	OVERALL VERIFICATION TYPE II CDA P2-T1		–	25	22	–	20	17

TABLE F (CONT)

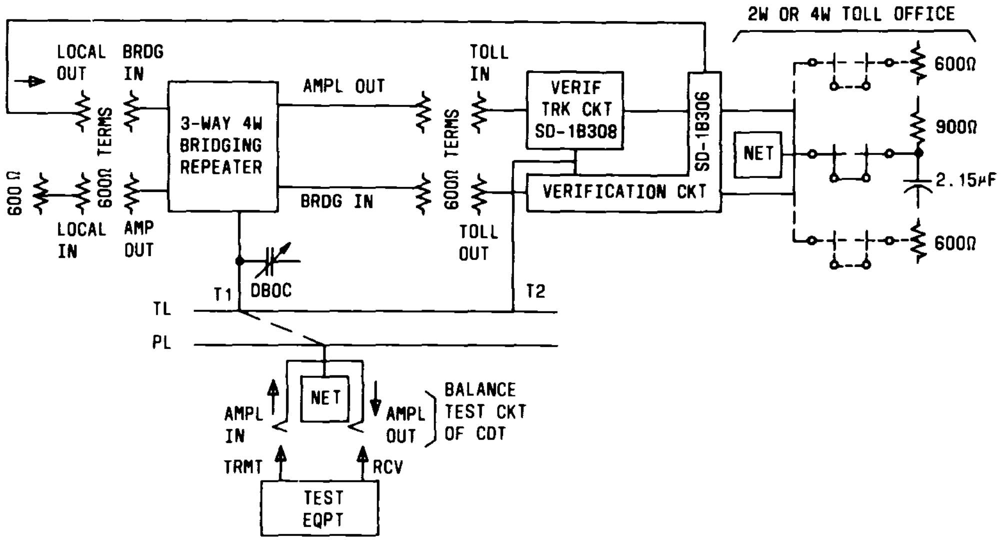
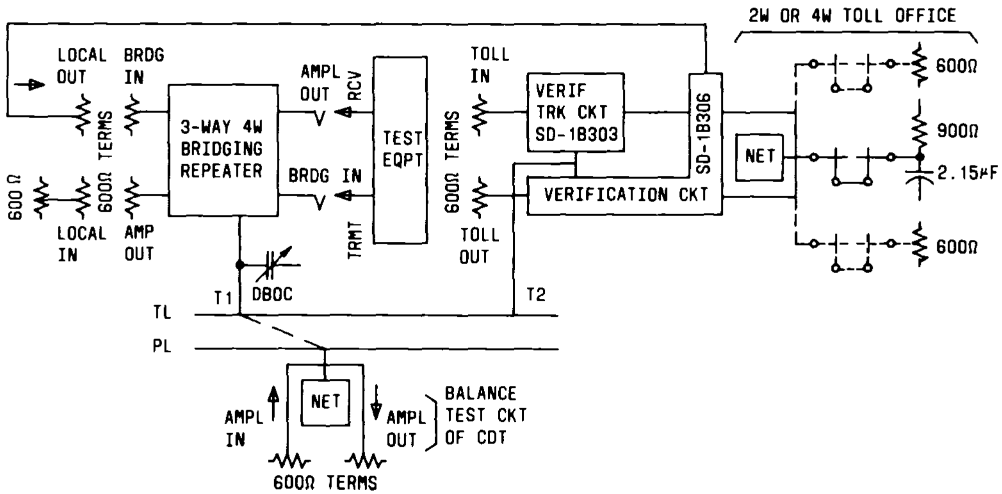
TEST NO	CIRCUIT	TEST CONNECTIONS	REQUIREMENTS (dB)					
			ERL			SRL		
			MED	MIN	TURN DOWN	MED	MIN	TURN DOWN
51	DBOC SELECTION AND VERIFICATION ON BUSY LINE VERIFICATION ACCESS TRUNK		24	21	18	19	16	13
52	NBOC SELECTION AND VERIFICATION OF BUSY LINE VERIFICATION ACCESS TRUNK		-	26	18	-	19	11

TABLE F (CONT)

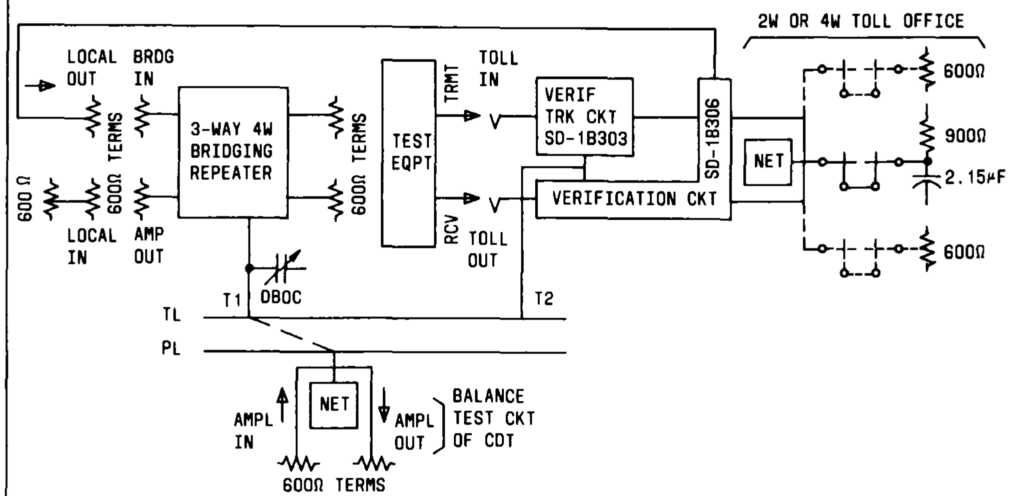
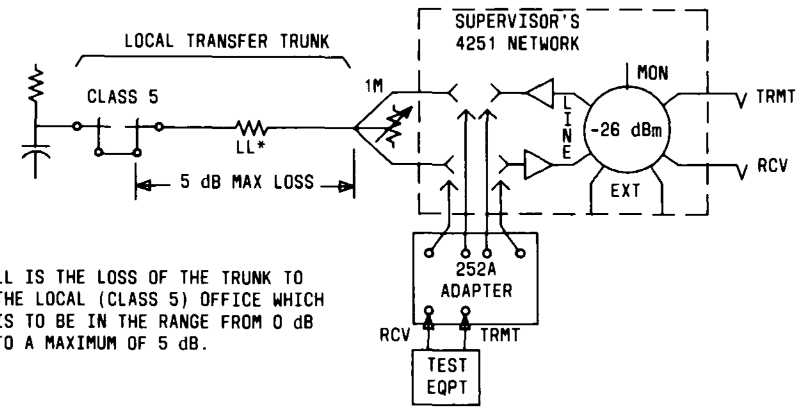
TEST NO	CIRCUIT	TEST CONNECTIONS	REQUIREMENTS (dB)					
			ERL			SRL		
			MED	MIN	TURN DOWN	MED	MIN	TURN DOWN
53	OVERALL VERIFICATION OF BUSY LINE VERIFICATION ACCESS TRUNK		-	26	18	-	19	11
54	OVERALL VERIFICATION OF TRANSFER TRUNK TO LOCAL (CLASS 5) OFFICE	 * LL IS THE LOSS OF THE TRUNK TO THE LOCAL (CLASS 5) OFFICE WHICH IS TO BE IN THE RANGE FROM 0 dB TO A MAXIMUM OF 5 dB.	22+ 2(LL)	19+ 2(LL)	16+ 2(LL)	14+ 2(LL)	12+ 2(LL)	10+ 2(LL)

TABLE F (CONT)

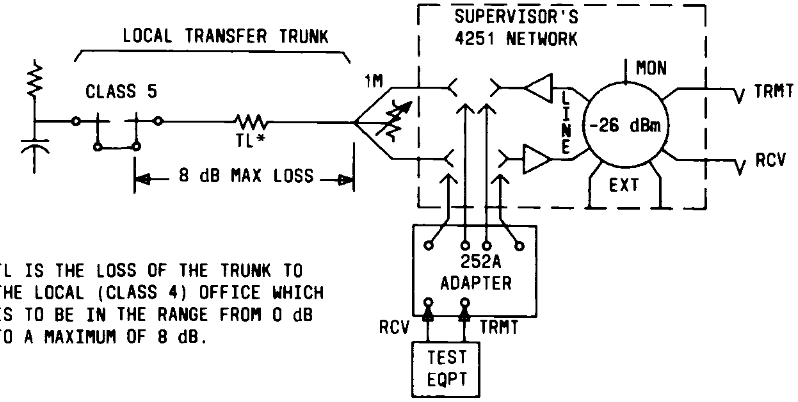
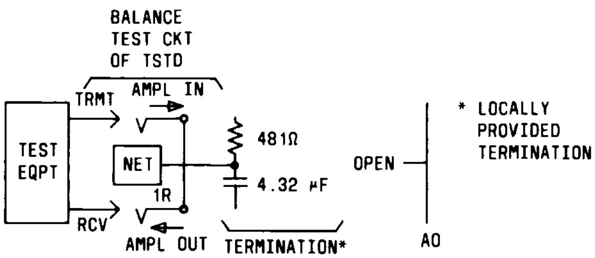
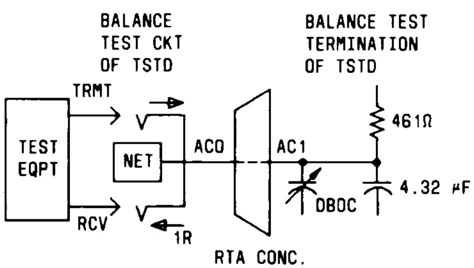
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB)					
			ERL			SRL		
			MED	MIN	TURN DOWN	MED	MIN	TURN DOWN
55	OVERALL VERIFICATION OF TRANSFER TRUNK TO LOCAL (CLASS 4) OFFICE	 * TL IS THE LOSS OF THE TRUNK TO THE LOCAL (CLASS 4) OFFICE WHICH IS TO BE IN THE RANGE FROM 0 dB TO A MAXIMUM OF 8 dB.	16+ 2(TL)	13+ 2(TL)	10+ 2(TL)	–	8+ 2(TL)	–
56	VERIFICATION BALANCE TEST CIRCUIT OF TSTD		–	32	–	–	32	–
57	VERIFICATION BALANCE TEST TERMINATION OF TSTD		–	29	–	–	29	–

TABLE F (CONT)

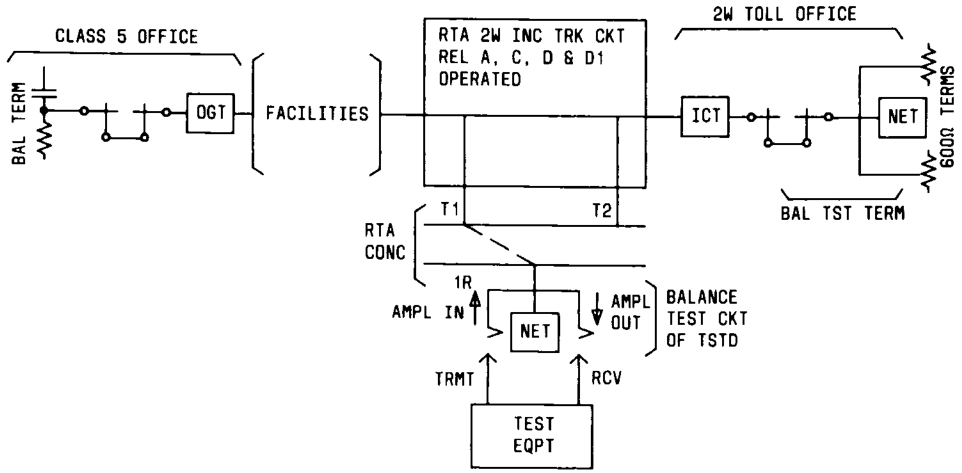
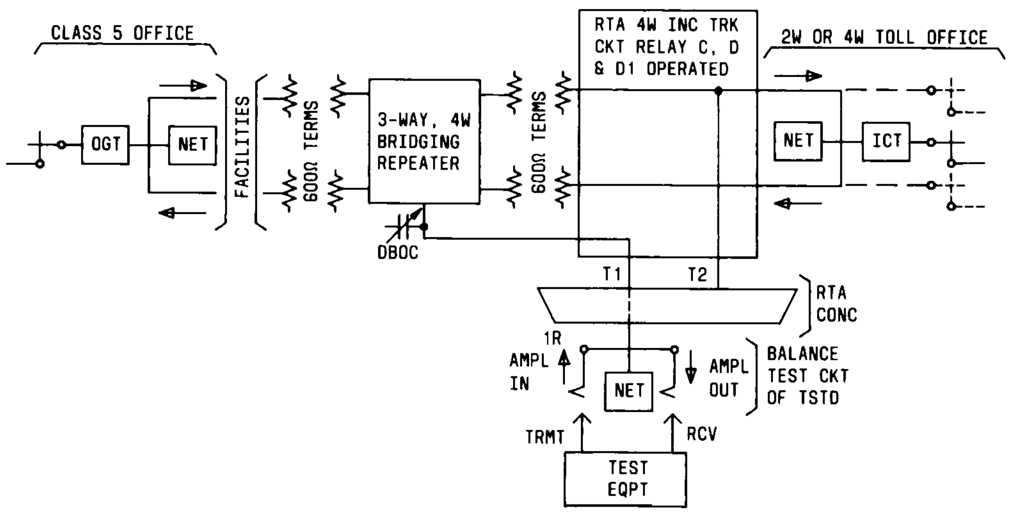
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB) ERL MED	ERL MIN	ERL TURN DOWN	SRL MED	SRL MIN	SRL TURN DOWN
58	OVERALL VERIFICATION 2-WIRE TOLL-CONNECTING TRUNK WITH RTA		15	13	11	–	6	4
59	DBOC SELECTION AND VERIFICATION ON 4-WIRE TOLL-CONNECTING TRUNK		24	21	18	19	16	13

TABLE F (CONT)

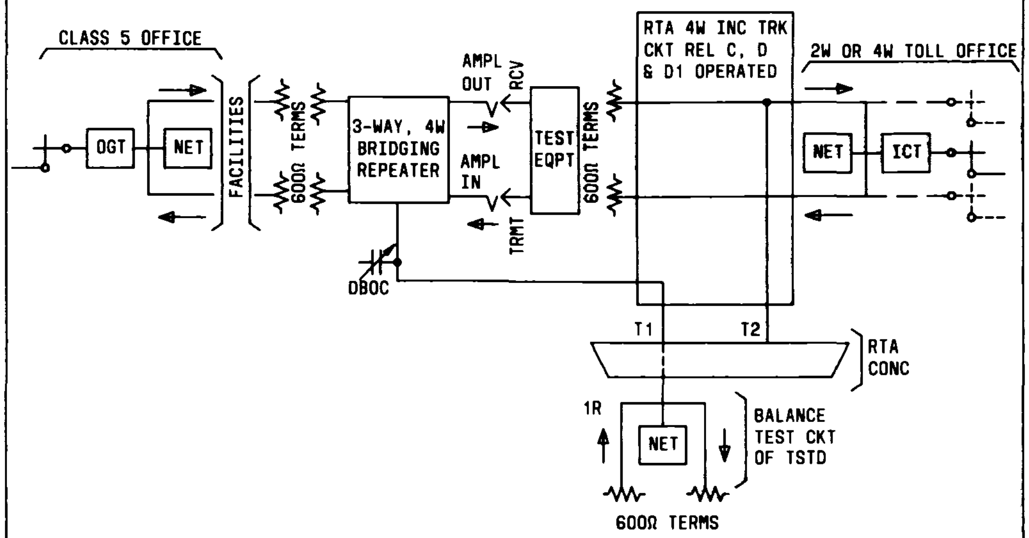
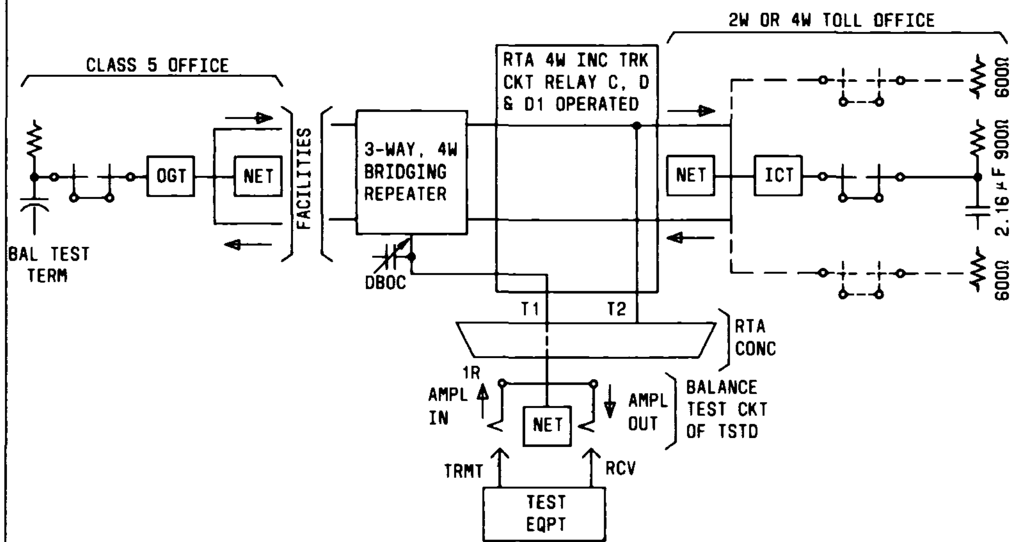
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB)					
			ERL			SRL		
			MED	MIN	TURN DOWN	MED	MIN	TURN DOWN
60	NBOC SELECTION AND VERIFICATION ON 4-WIRE TOLL-CONNECTING TRUNK		–	26	18	–	19	11
61	OVERALL VERIFICATION (AFTER NBOC SELECTION) ON 4-WIRE TOLL-CONNECTING TRUNK		-	19	12	-	15	8

TABLE F (CONT)

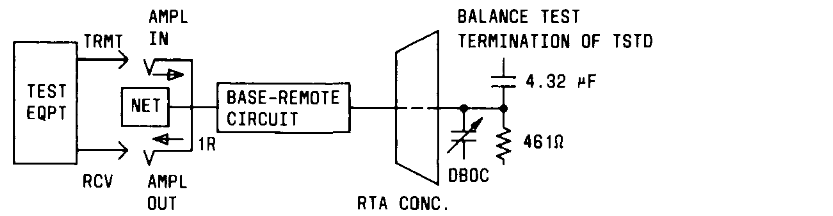
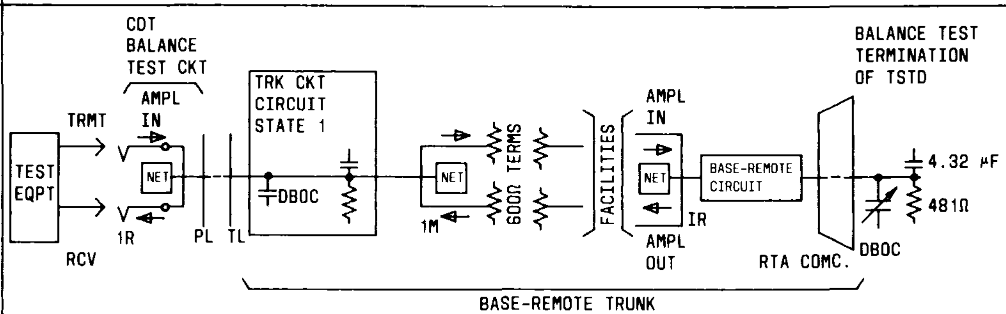
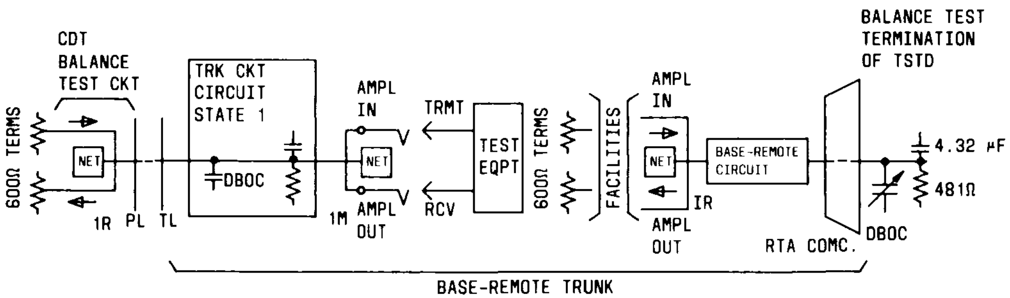
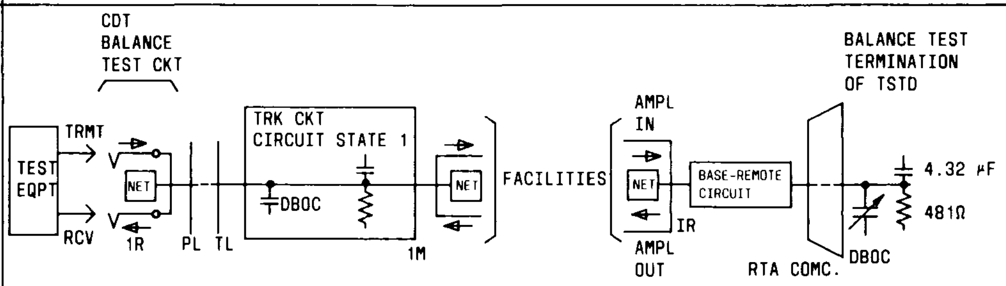
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB)					
			ERL			SRL		
			MED	MIN	TURN DOWN	MED	MIN	TURN DOWN
62	NBOC VERIFICATION OF REMOTE BASE REMOTE TRUNKS		-	27	-	-	27	-
63	DBOC SELECTION AND VERIFICATION OF BASE BASE-REMOTE TRUNKS		24	21	18	19	16	13
64	NBOC SELECTION AND VERIFICATION ON BASE BASE-REMOTE TRUNKS		-	26	18	-	19	11
65	OVERALL VERIFICATION BASE-REMOTE TRUNKS FROM TSPS BASE UNIT		24	18	15	18	13	11

TABLE F (CONT)

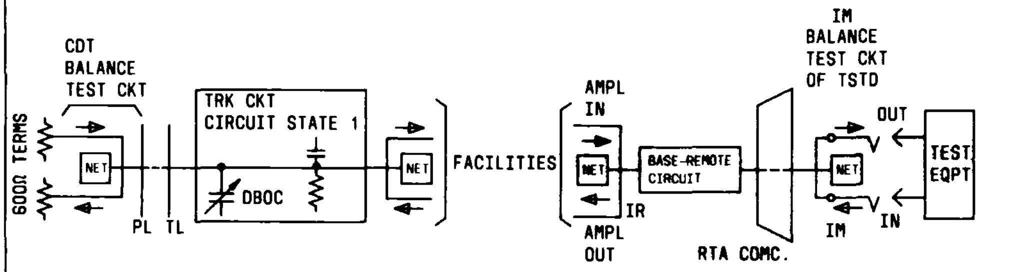
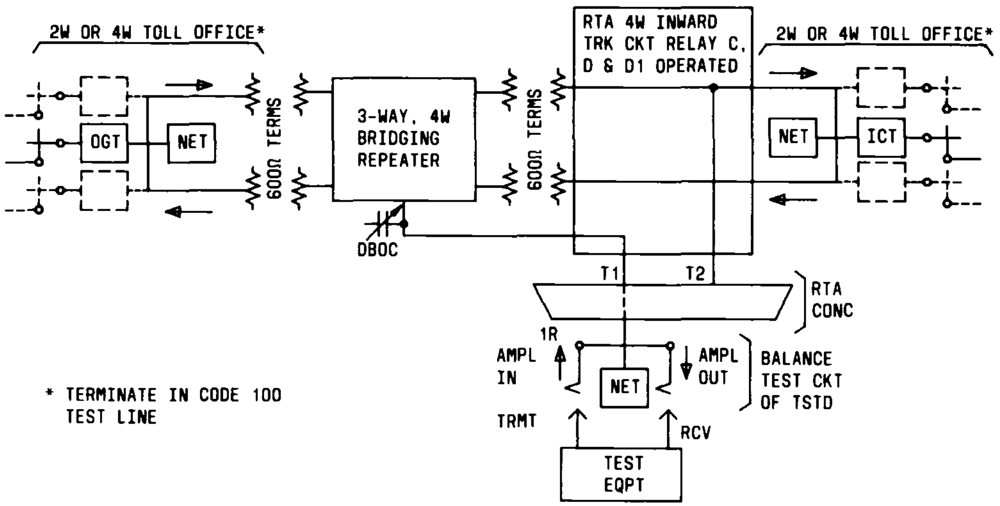
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB)					
			ERL			SRL		
			MED	MIN	TURN DOWN	MED	MIN	TURN DOWN
66	OVERALL VERIFICATION BASE-REMOTE TRUNKS FROM RTA		26	23	15	18	13	11
67	DBOC SELECTION AND VERIFICATION ON INWARD TRUNKS		24	21	18	19	16	13

TABLE F (CONT)

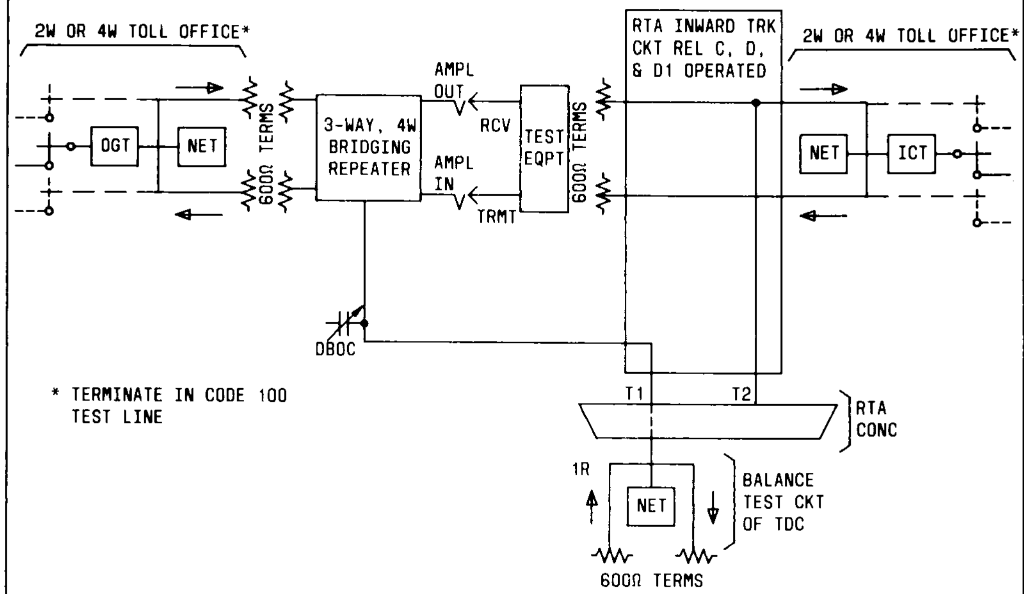
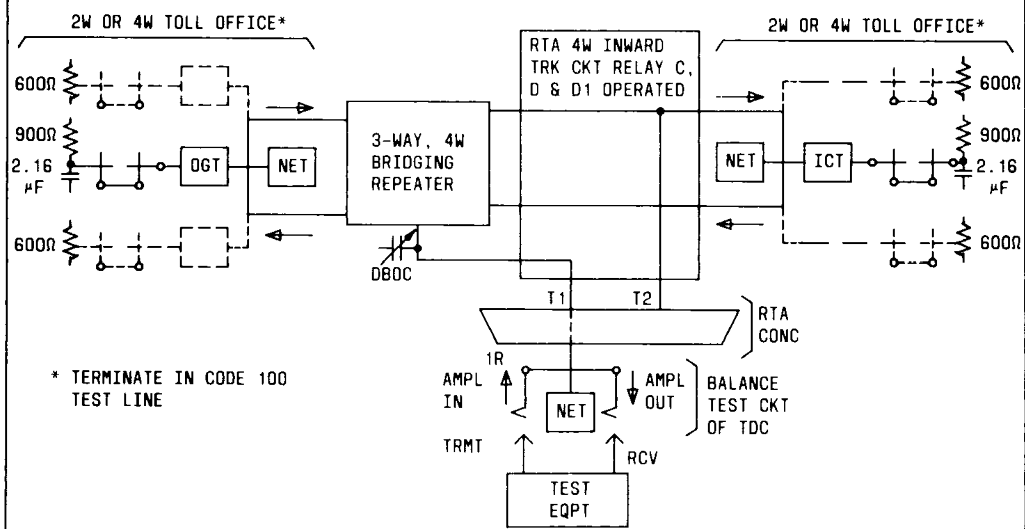
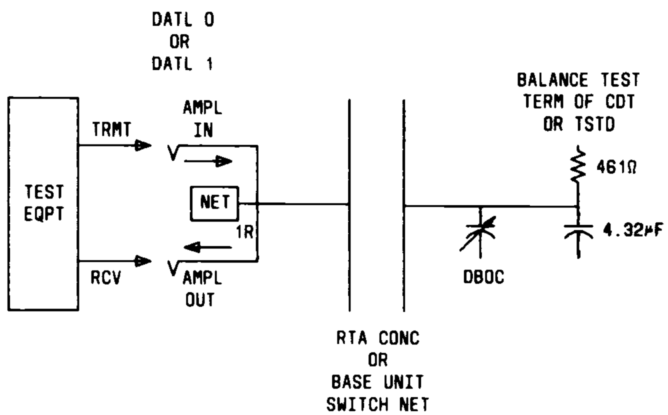
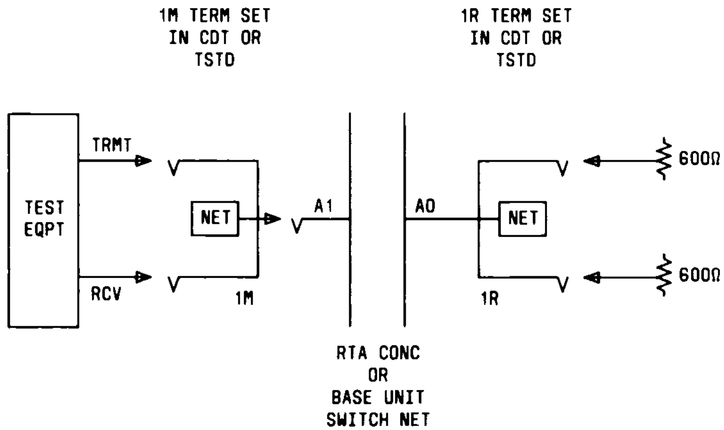
TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB)					
			ERL			SRL		
			MED	MIN	TURN DOWN	MED	MIN	TURN DOWN
68	NBOC SELECTION AND VERIFICATION ON INWARD TRUNKS		–	26	18	–	19	11
69	OVERALL VERIFICATION ON INWARD TRUNKS		24	21	18	19	16	13

TABLE F (CONT)

TEST NO	TEST	TEST CONNECTION	REQUIREMENTS (dB)					
			ERL			SRL		
			MED	MIN	TURN DOWN	MED	MIN	TURN DOWN
70	VERIFICATION OF DATL 0 AND DATL1 TEST LINES AT BASE UNIT OR RTA		–	27	–	–	27	–
71	VERIFICATION OF 1M TERM SETS IN CDT OR TSTD		–	30	–	–	30	–

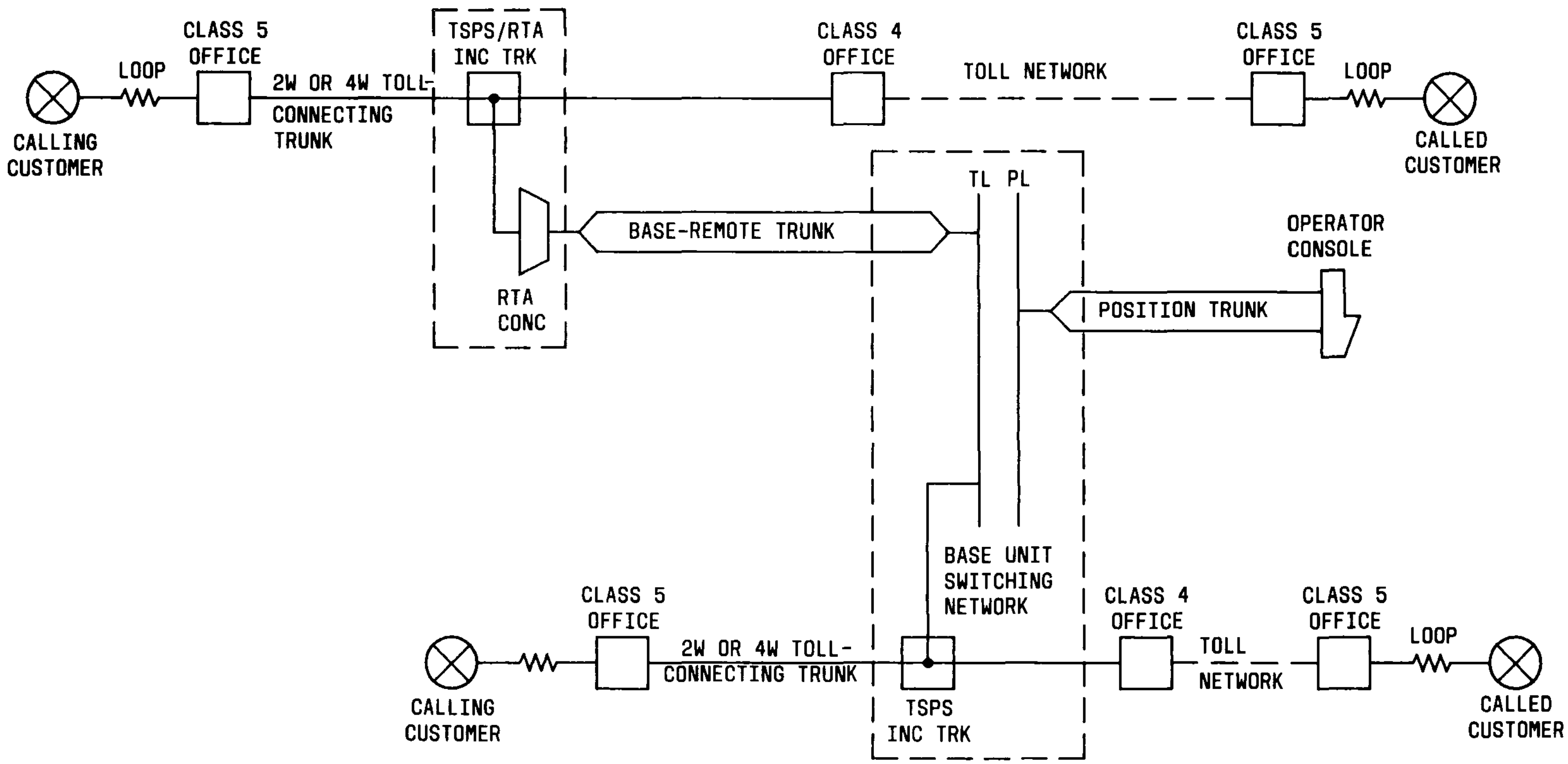
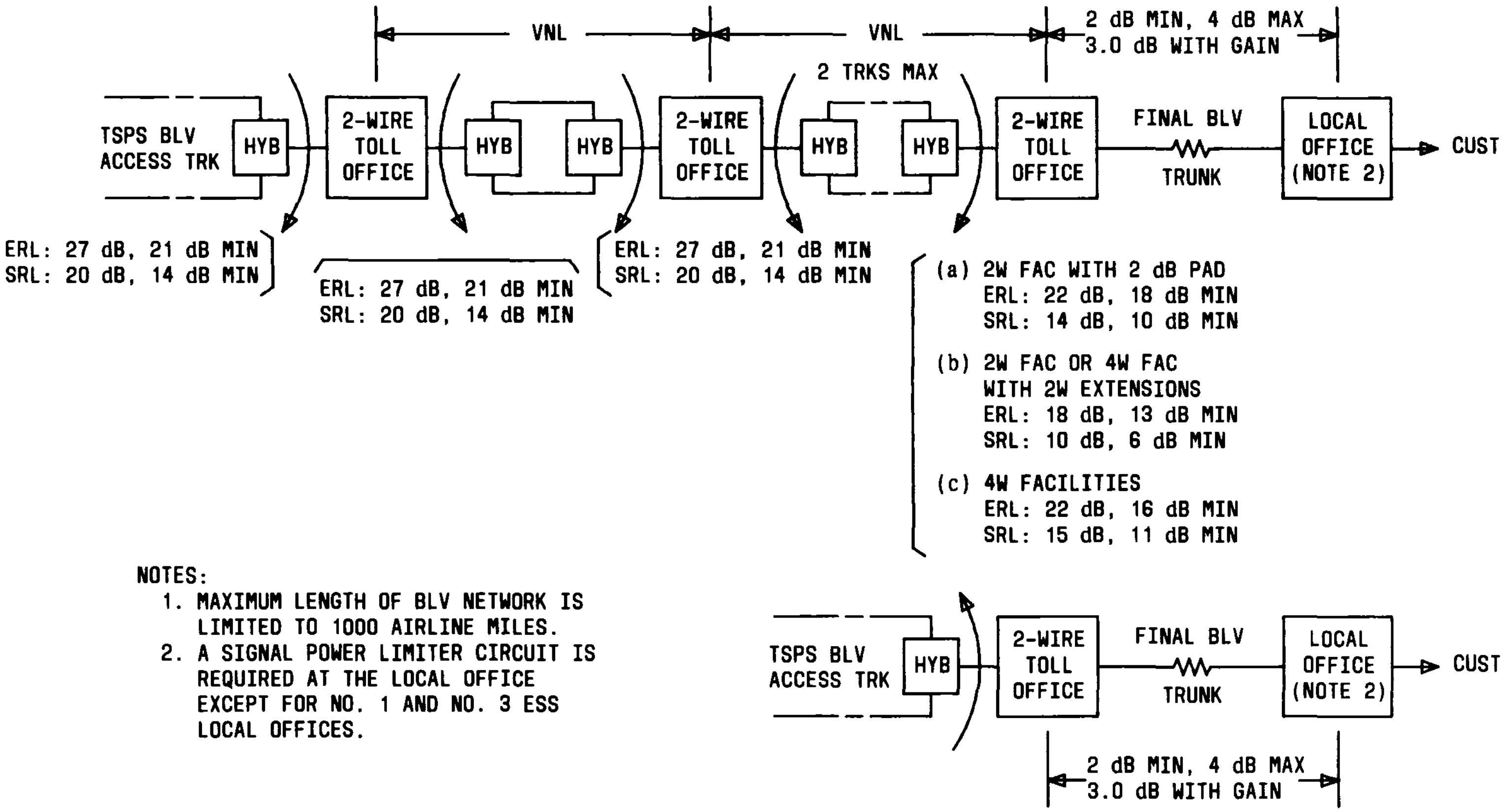
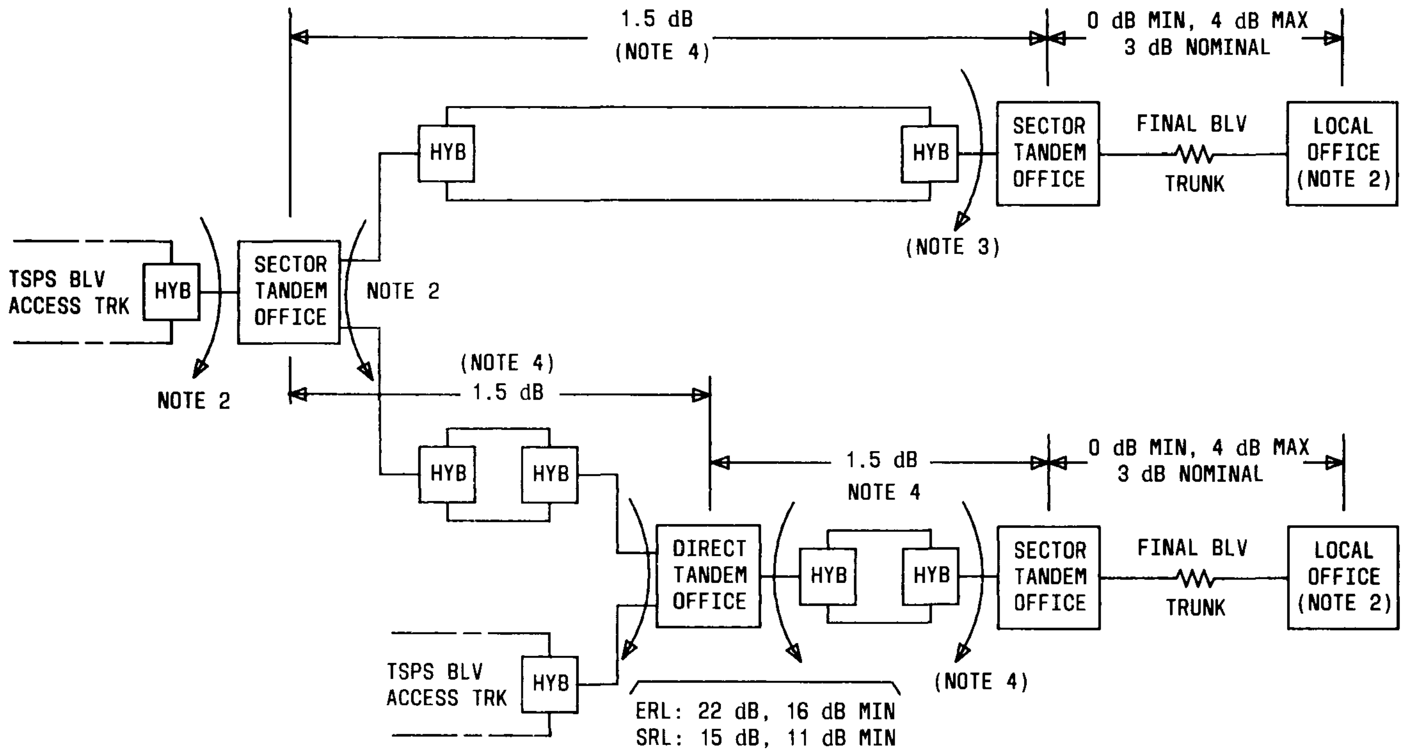


Fig. 1—Typical TSPS—Customer Connection



NOTES:
1. MAXIMUM LENGTH OF BLV NETWORK IS LIMITED TO 1000 AIRLINE MILES.
2. A SIGNAL POWER LIMITER CIRCUIT IS REQUIRED AT THE LOCAL OFFICE EXCEPT FOR NO. 1 AND NO. 3 ESS LOCAL OFFICES.

Fig. 2—Busy Line Verification Network Parallel to MTS Network (See Note 1)



NOTES:

1. MAXIMUM BLV NETWORK LENGTH IS LIMITED TO 150 AIRLINE MILES.
2. A SIGNAL POWER LIMITER CIRCUIT IS REQUIRED AT THE LOCAL OFFICE EXCEPT FOR NO. 1 AND NO. 3 ESS LOCAL OFFICES.
3. TERMINAL BALANCE REQUIREMENTS SHOULD BE MET IF TERMINAL BALANCE REQUIREMENTS ARE MET IN THIS OFFICE IN ITS NORMAL METROPOLITAN NETWORK SECTOR TANDEM OFFICE FUNCTION.
4. ICL SHOULD BE 0.5 dB MAXIMUM IF TERMINAL BALANCE REQUIREMENTS ARE MET IN ONE SECTOR TANDEM OFFICE.

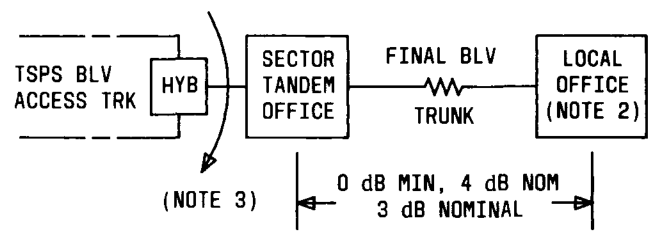
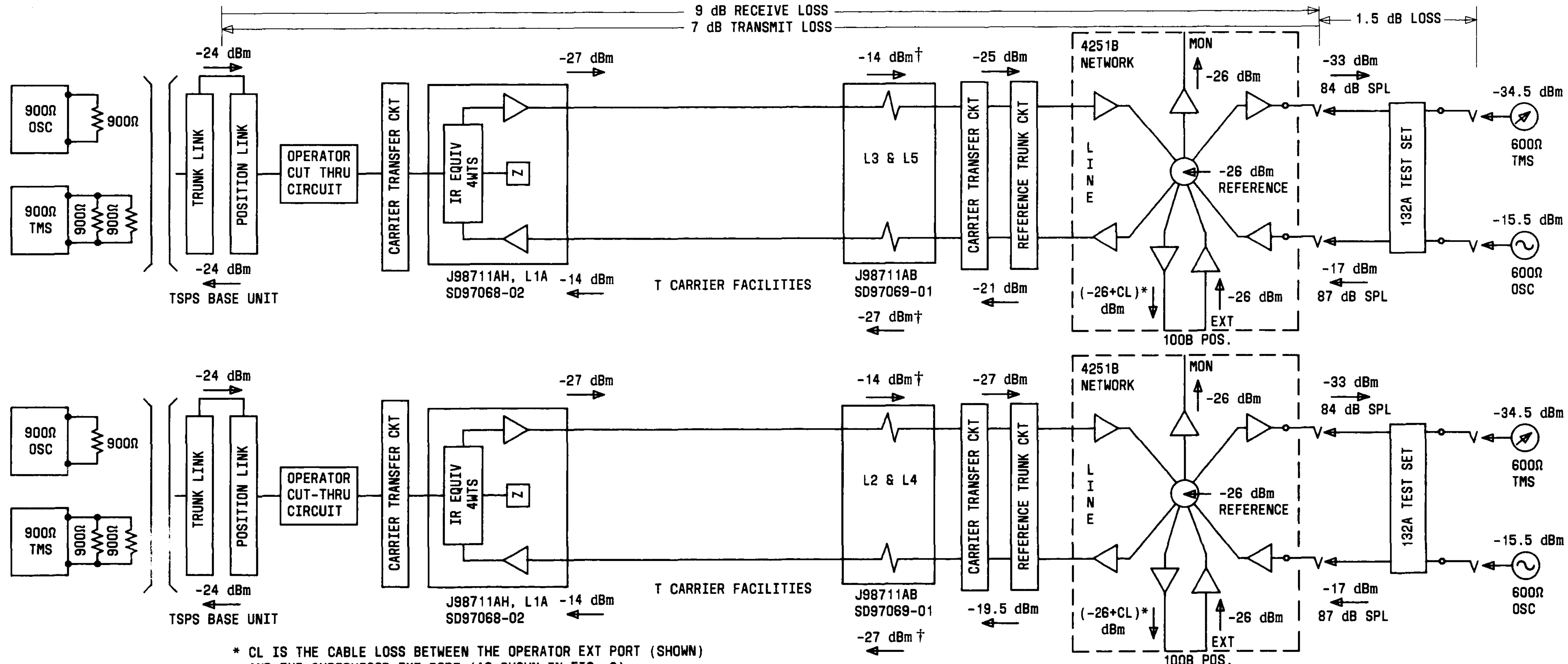


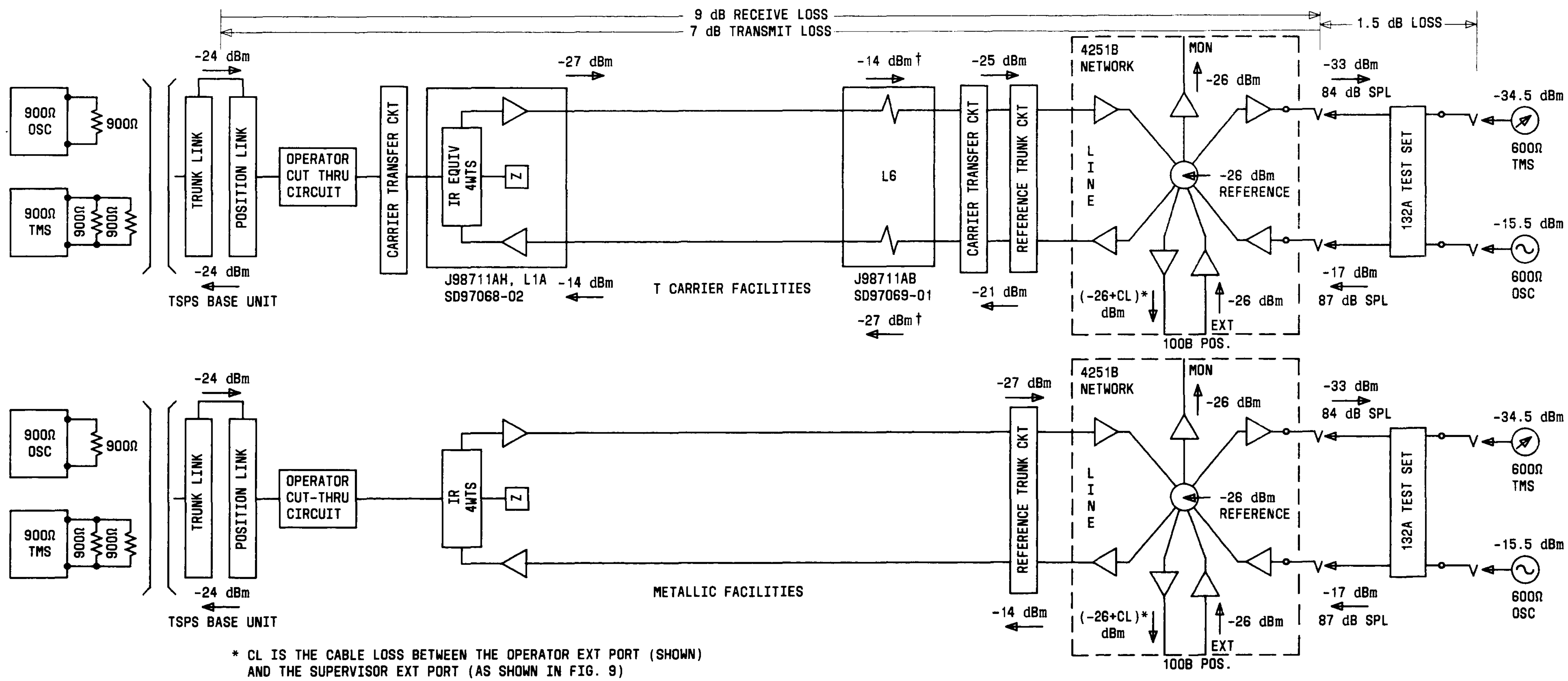
Fig. 3—Busy Line Verification Network Parallel to Metropolitan Tandem Network (See Note 1)



* CL IS THE CABLE LOSS BETWEEN THE OPERATOR EXT PORT (SHOWN) AND THE SUPERVISOR EXT PORT (AS SHOWN IN FIG. 9)

† THESE ARE APPROXIMATE SIGNAL LEVELS MEASURED USING THE J98711M MATCHING NETWORK. A 1 dB ERROR CORRECTION HAS BEEN INCLUDED.

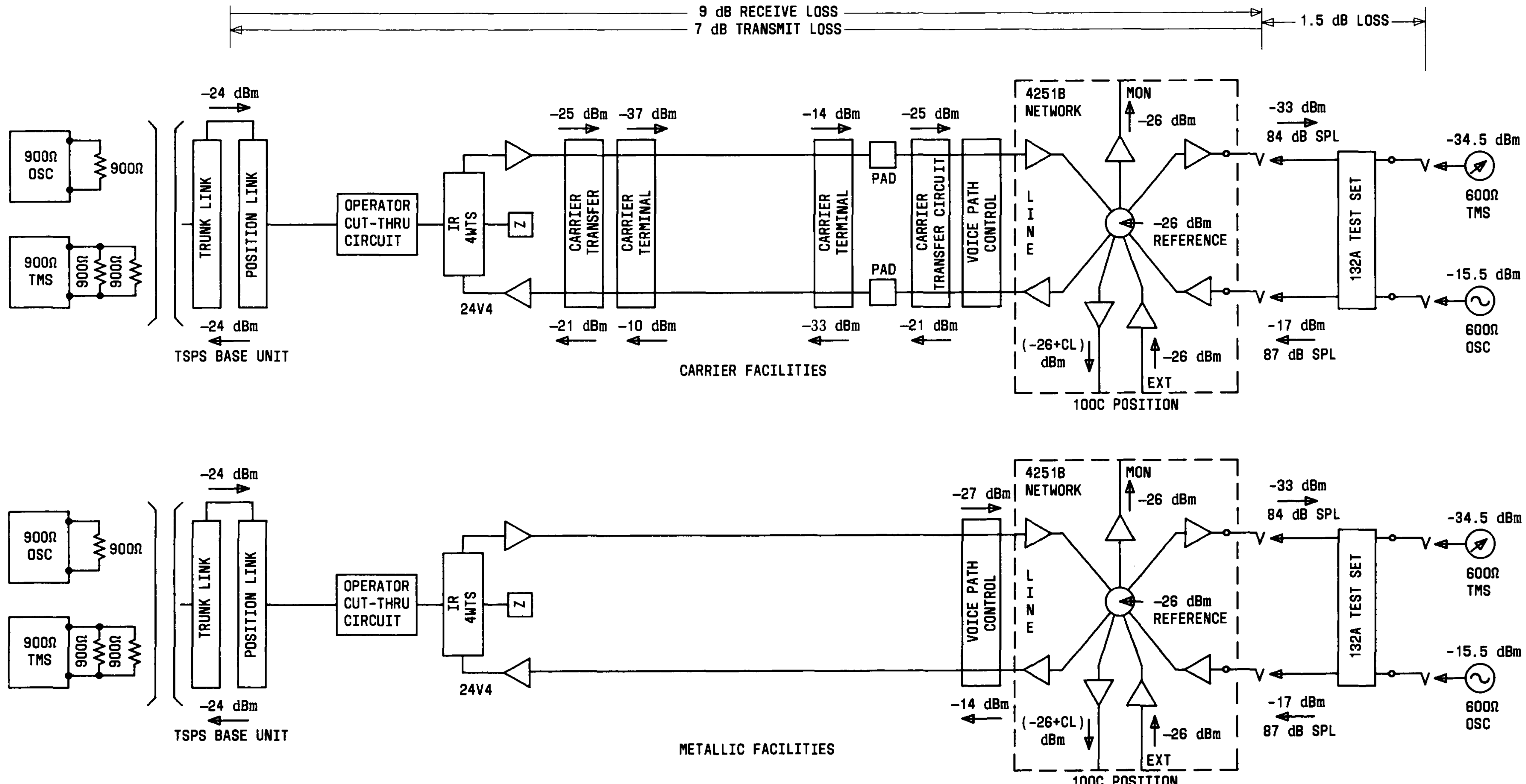
Fig. 4—Position Subsystem No. 1 Operator Position Trunks (Sheet 1 of 2)



* CL IS THE CABLE LOSS BETWEEN THE OPERATOR EXT PORT (SHOWN) AND THE SUPERVISOR EXT PORT (AS SHOWN IN FIG. 9)

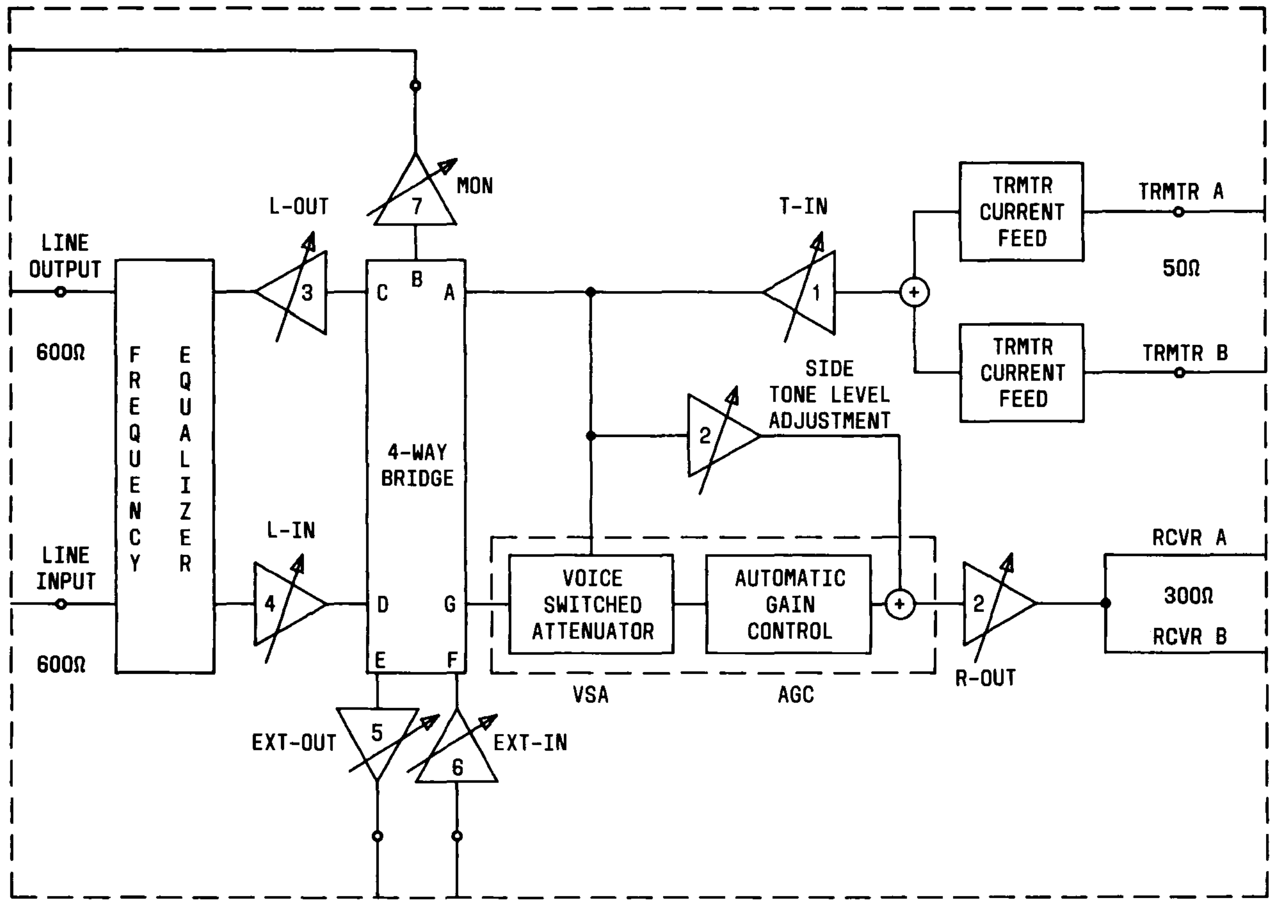
† THESE ARE APPROXIMATE SIGNAL LEVELS MEASURED USING THE J98711M MATCHING NETWORK. A 1 dB ERROR CORRECTION HAS BEEN INCLUDED.

Fig. 4—Position Subsystem No. 1 Operator Position Trunks (Sheet 2 of 2)



* CL IS THE CABLE LOSS BETWEEN THE OPERATOR EXT PORT (SHOWN) AND THE SUPERVISOR EXT PORT (AS SHOWN IN FIG. 9)

Fig. 5—Position Subsystem No. 2 Operator Position Trunks



FUNCTIONAL BLOCK DIAGRAM OF A

Fig. 6—Functional Block Diagram of 4251-Type Network

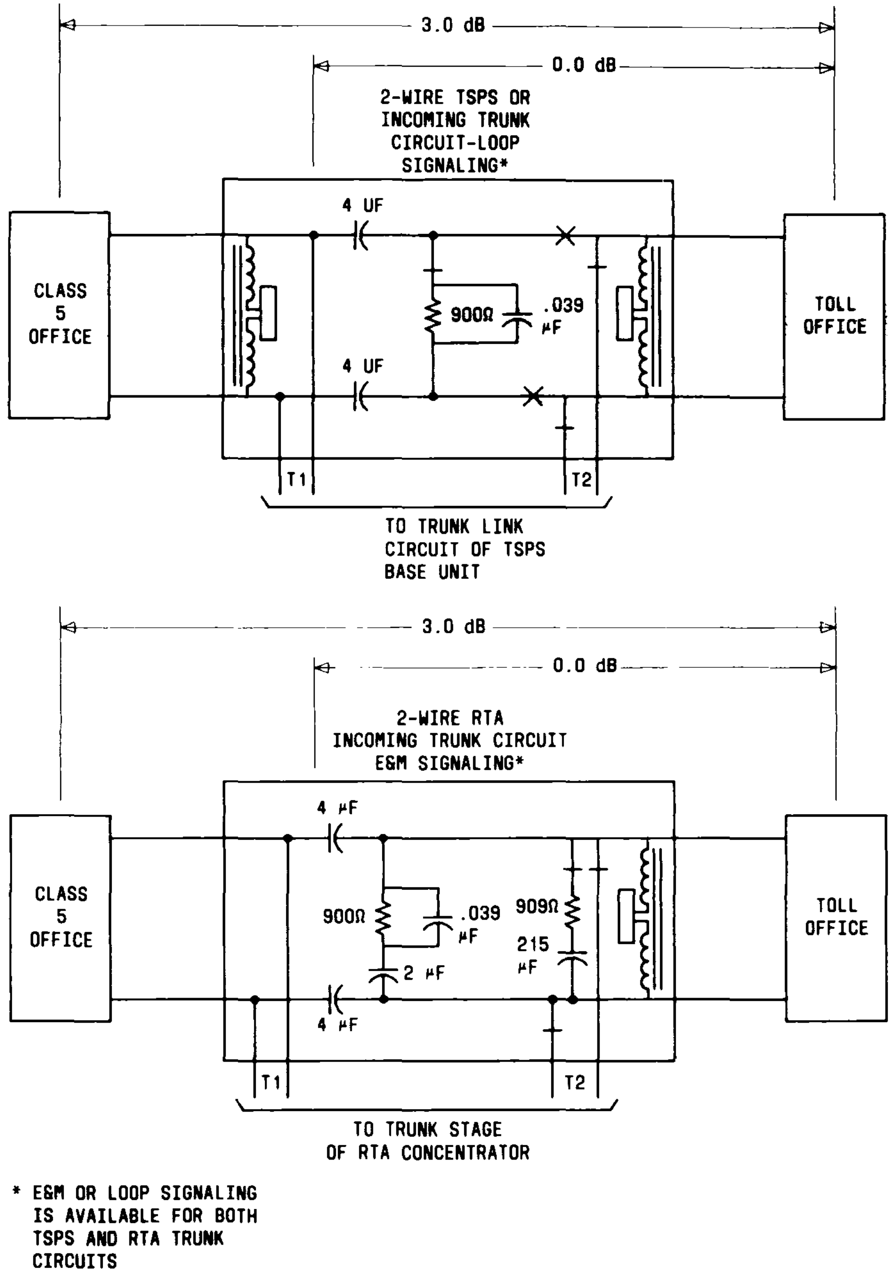


Fig. 7—Typical TSPS 2-Wire Bridging Arrangement

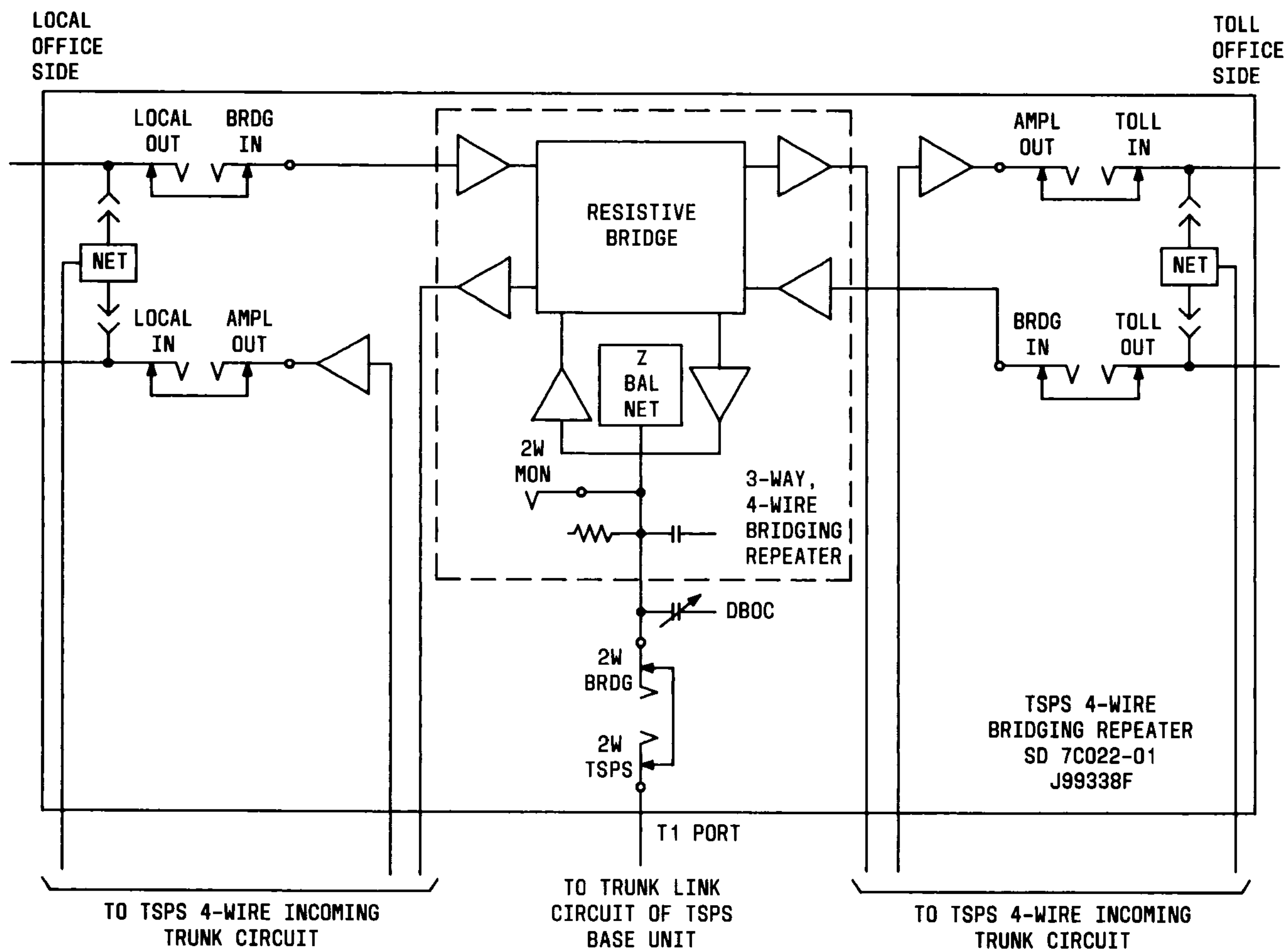


Fig. 8—Typical TSPS Base Unit 4-Wire Bridging Arrangement

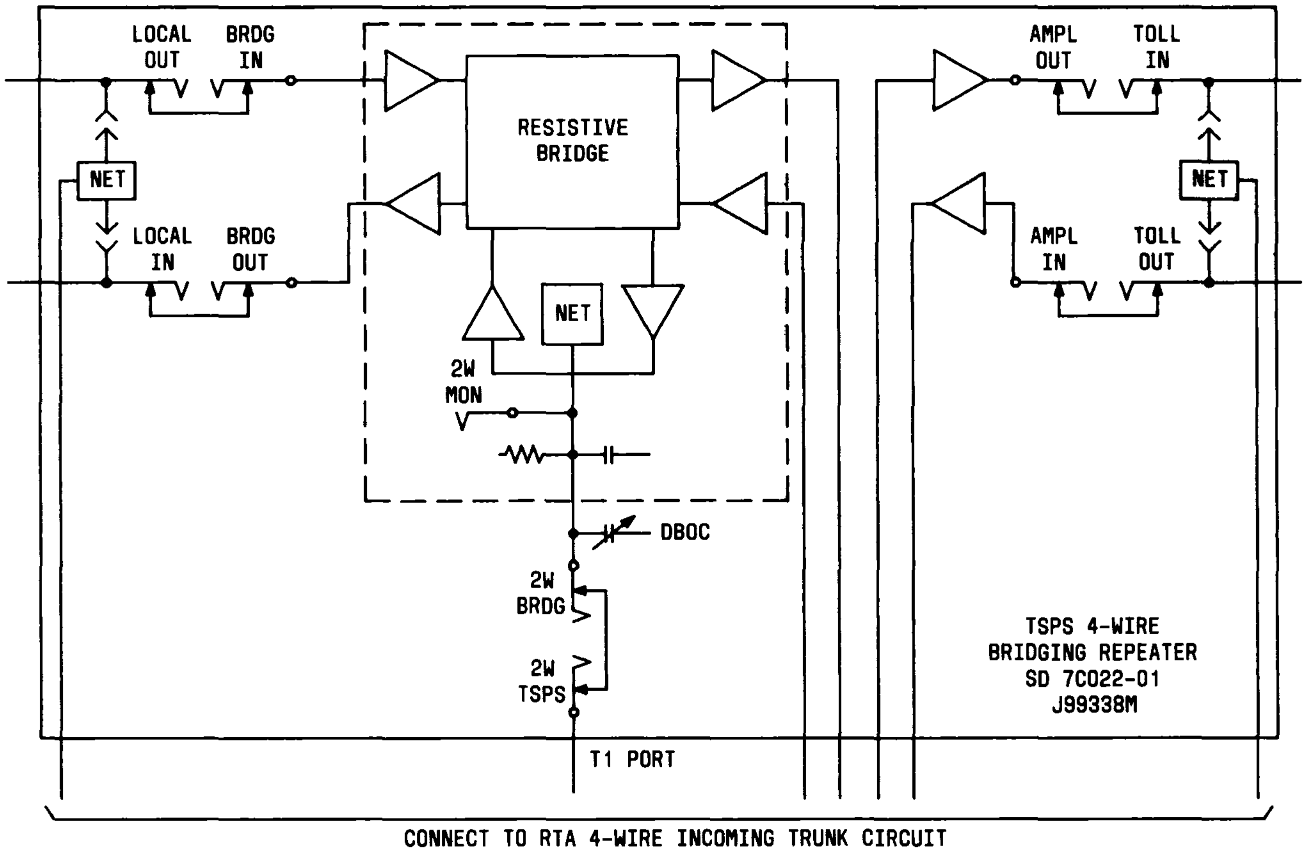


Fig. 9—Typical RTA 4-Wire Bridging Arrangement

TSPS OR RTA COLLOCATED WITH TOLL OFFICE

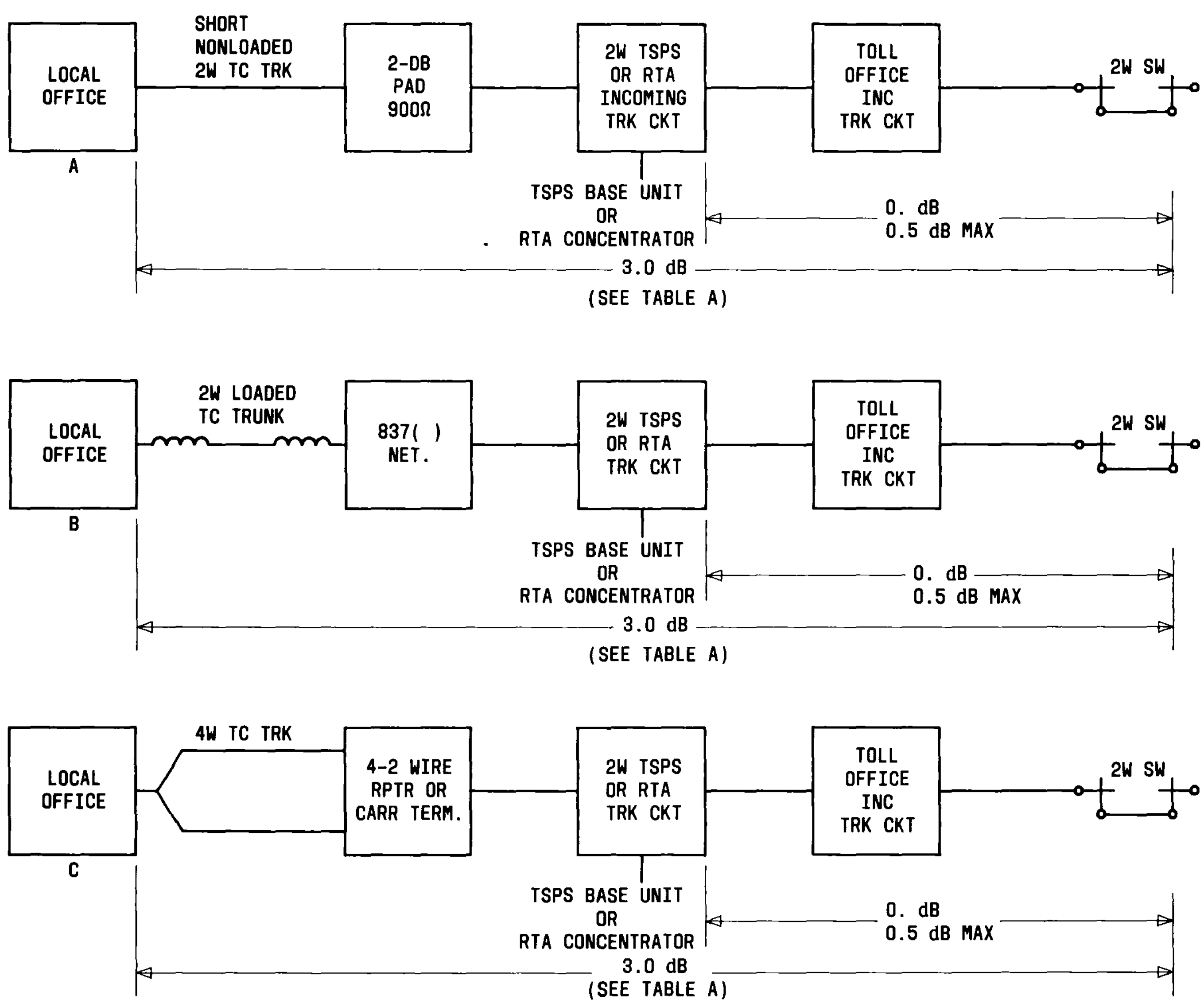


Fig. 10—Typical Arrangements for Toll-Connecting Trunks When the Toll Office is Located at the TSPS Base Unit or RTA (Sheet 1 of 2)

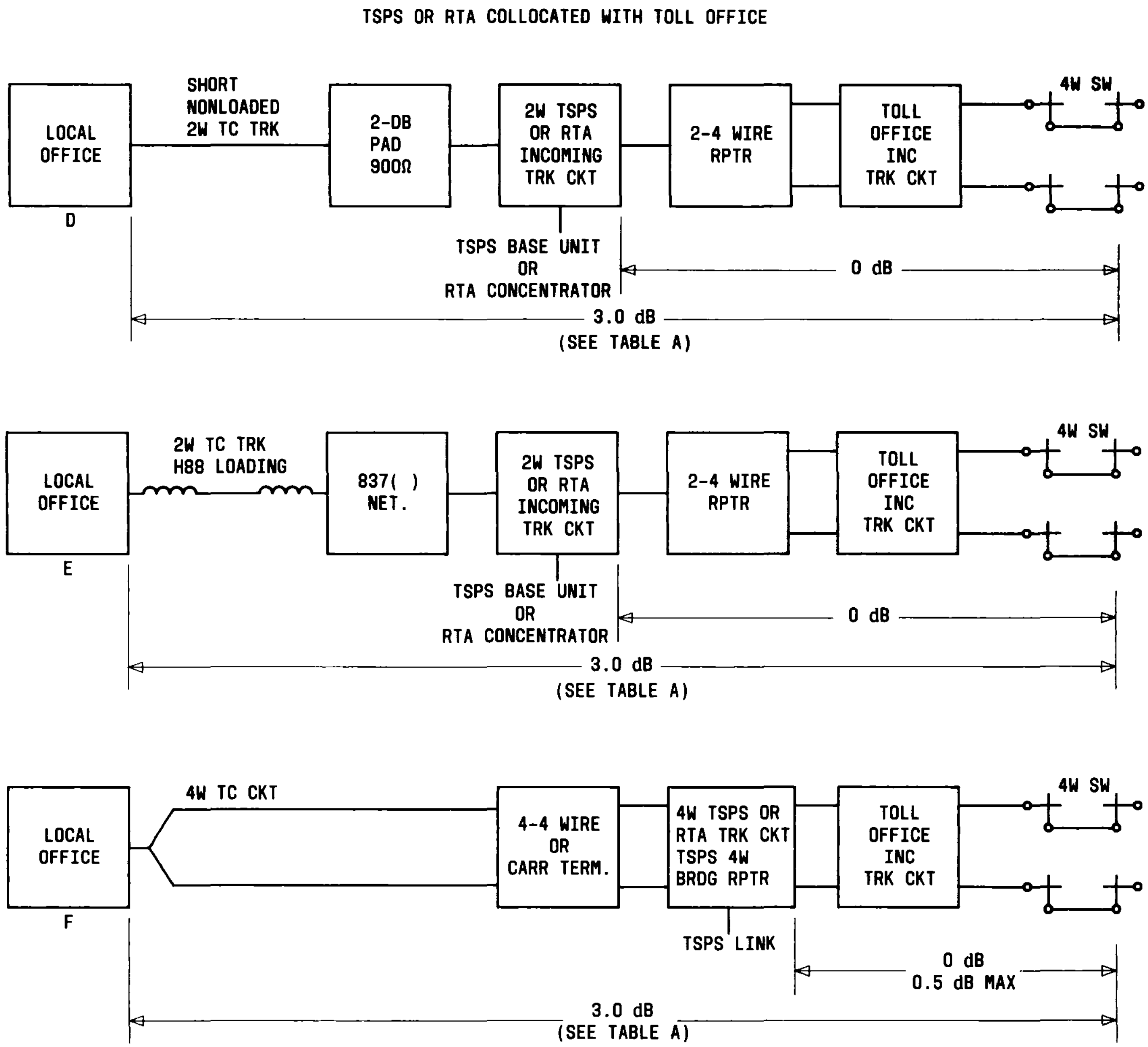


Fig. 10—Typical Arrangements for Toll-Connecting Trunks When the Toll Office is Located at the TSPS Base Unit or RTA (Sheet 2 of 2)

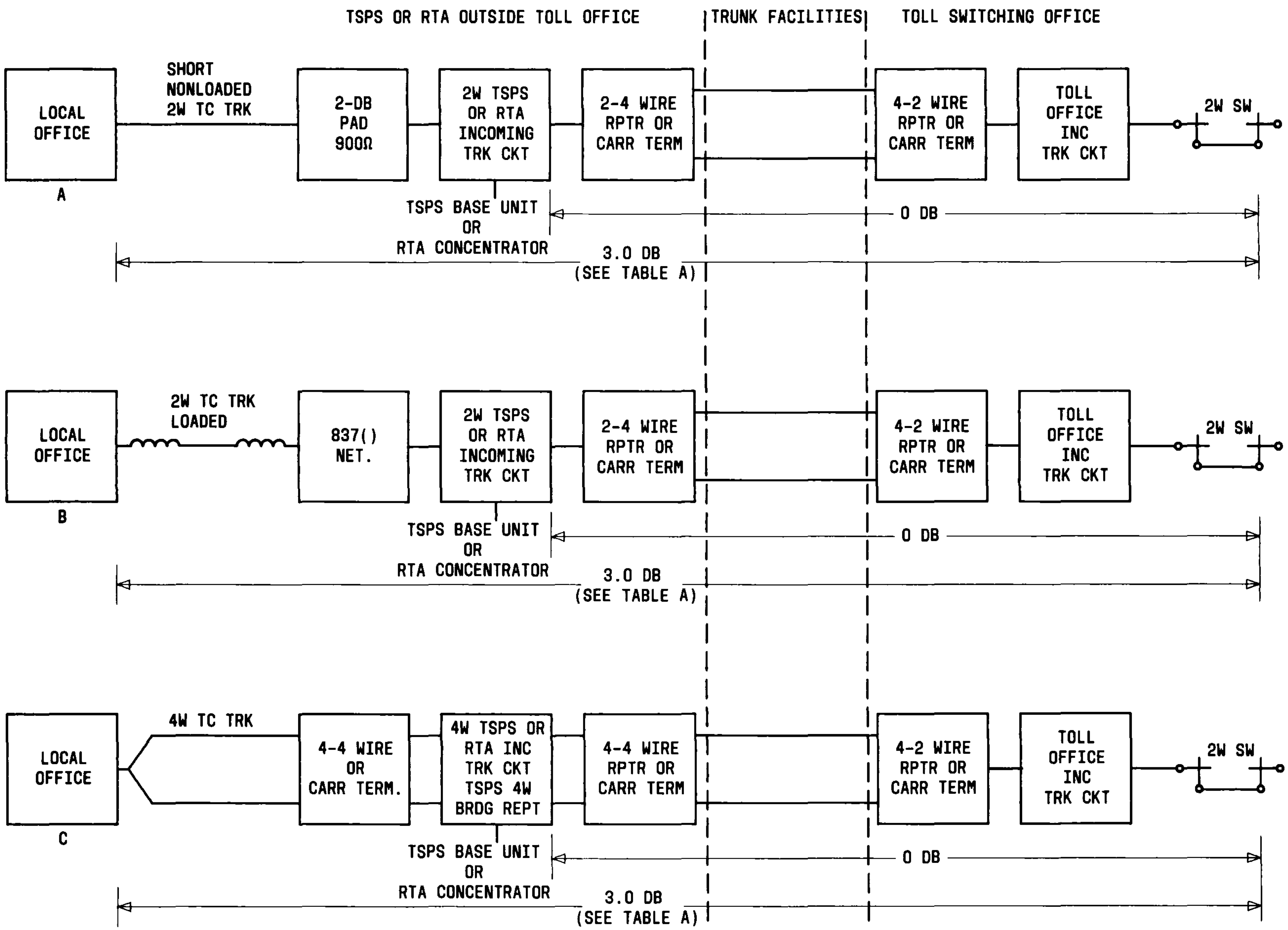


Fig. 11—Typical Arrangement for Toll-Connecting Trunks When the Toll Office is Remotely Located From the TSPS Base Unit or RTA (Sheet 1 of 2)

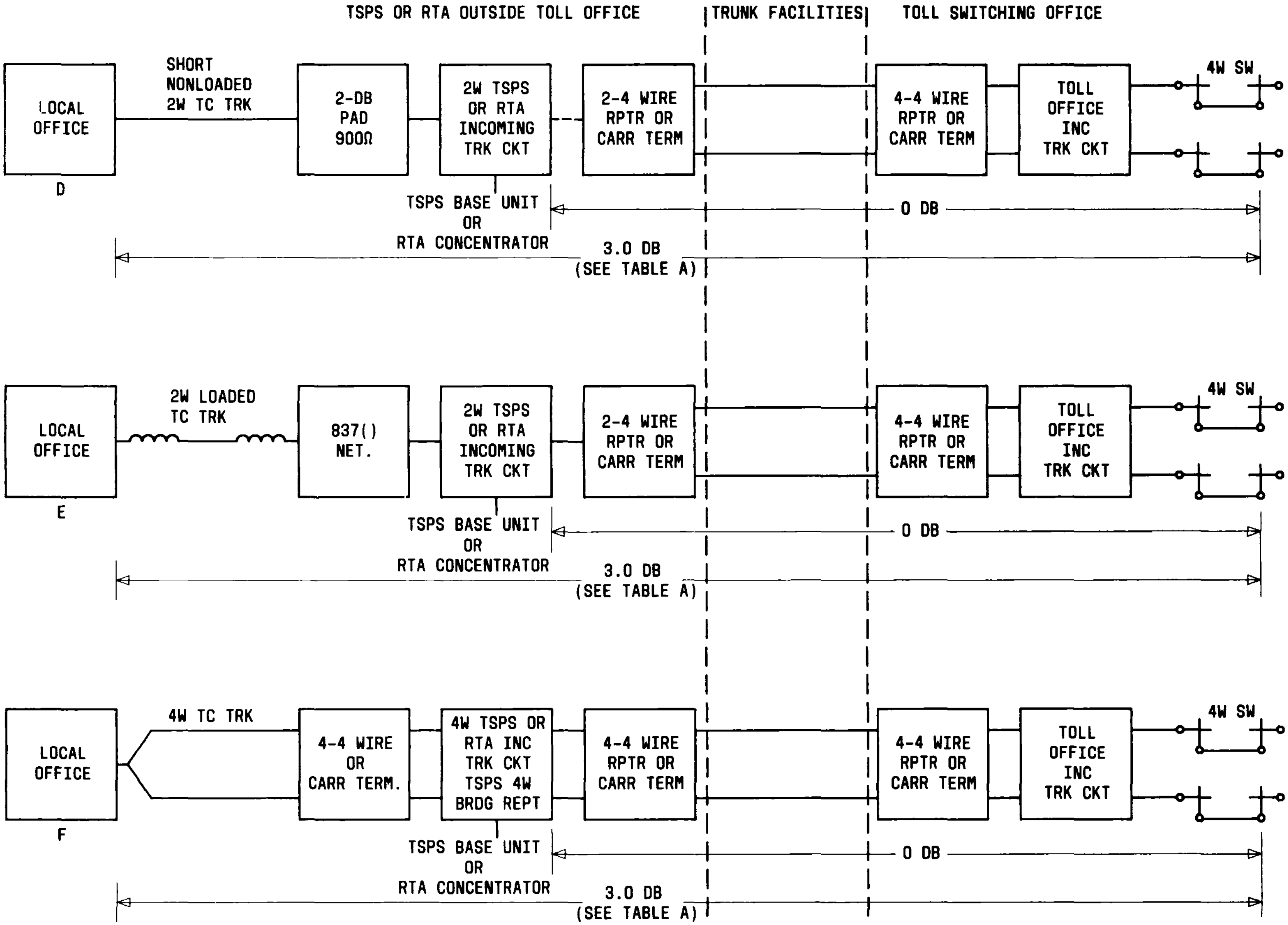
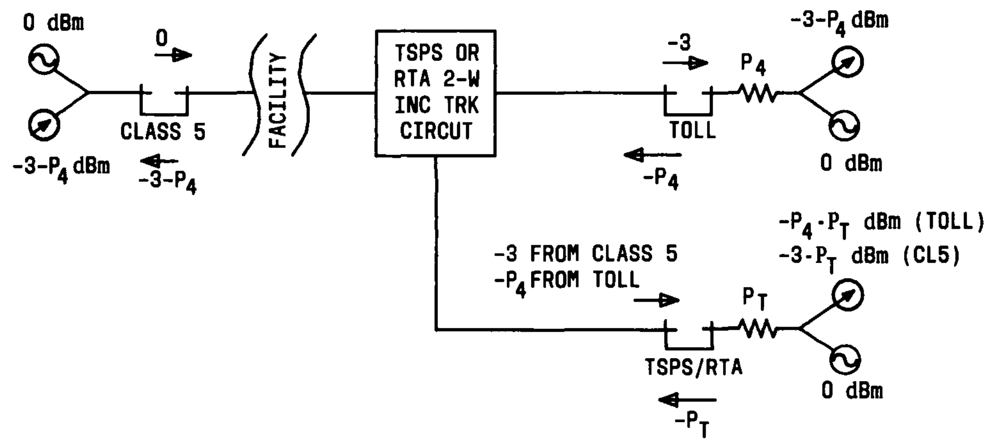


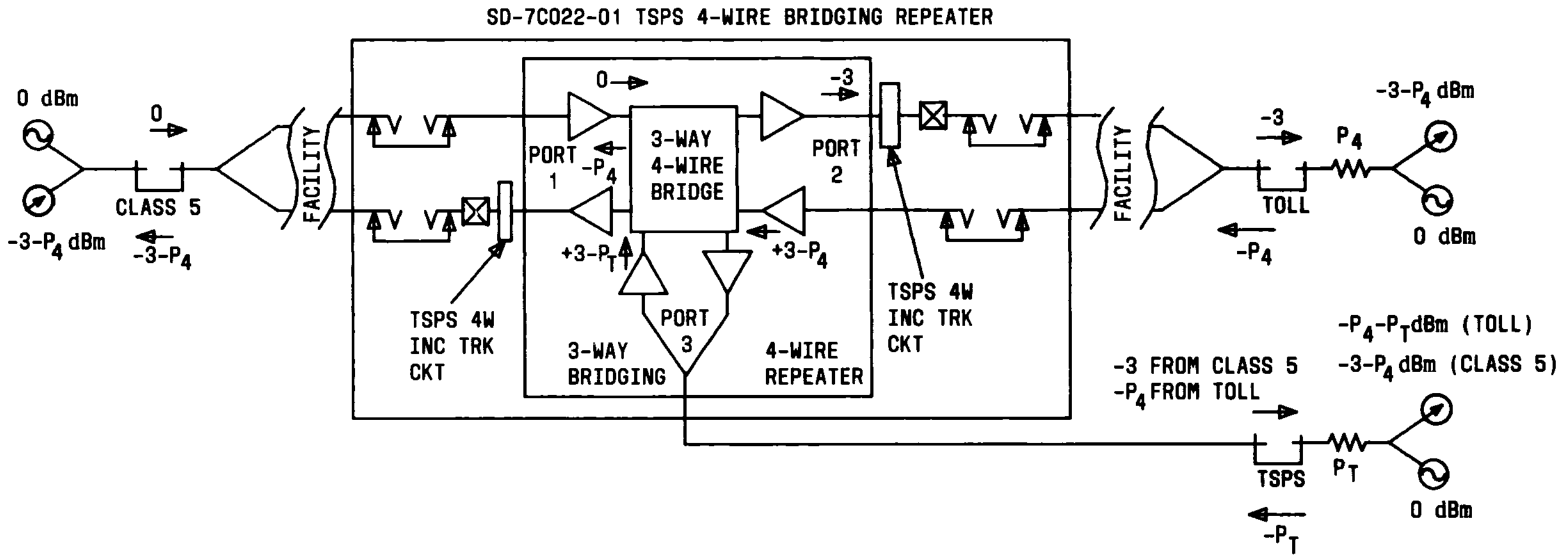
Fig. 11—Typical Arrangement for Toll-Connecting Trunks When the Toll Office is Remotely Located From the TSPS Base Unit or RTA (Sheet 2 of 2)



NOTES:

1. P_4 IS THE TOLL OFFICE TEST PAD VALUE OF 0, 2 OR 3 dB
2. P_T IS THE TSPS BASE UNIT OR RTA TEST PAD. IT IS P_4 WHEN TESTING WITH HE CL5 OFFICE AND 3 dB WHEN TESTING WITH THE TOLL OFICE
3. NORMAL CIRCUIT AND MAINTENANCE LIMITS BETWEEN CLASS 5 AND TOLL OFFICES
4. AN ADDITIONAL ±0.5 dB DEVIATION IS ALLOWED BETWEEN TSPS AND THE CLASS 5 OR TOLL OFFICE BECAUSE OF CABLING LOSSES
5. THE EXAMPLE ASSUMES ICL = 3.0dB. THE ICL MAY VARY FROM 2.0 TO 4.0 dB
6. (TMS symbol) IS A TRANSMISSION MEASURING SET (TMS). (oscillator symbol) IS A REFERENCE OSCILLATOR
7. ◄— DENOTES TRANSMISSION LEVEL POINT (TLP)

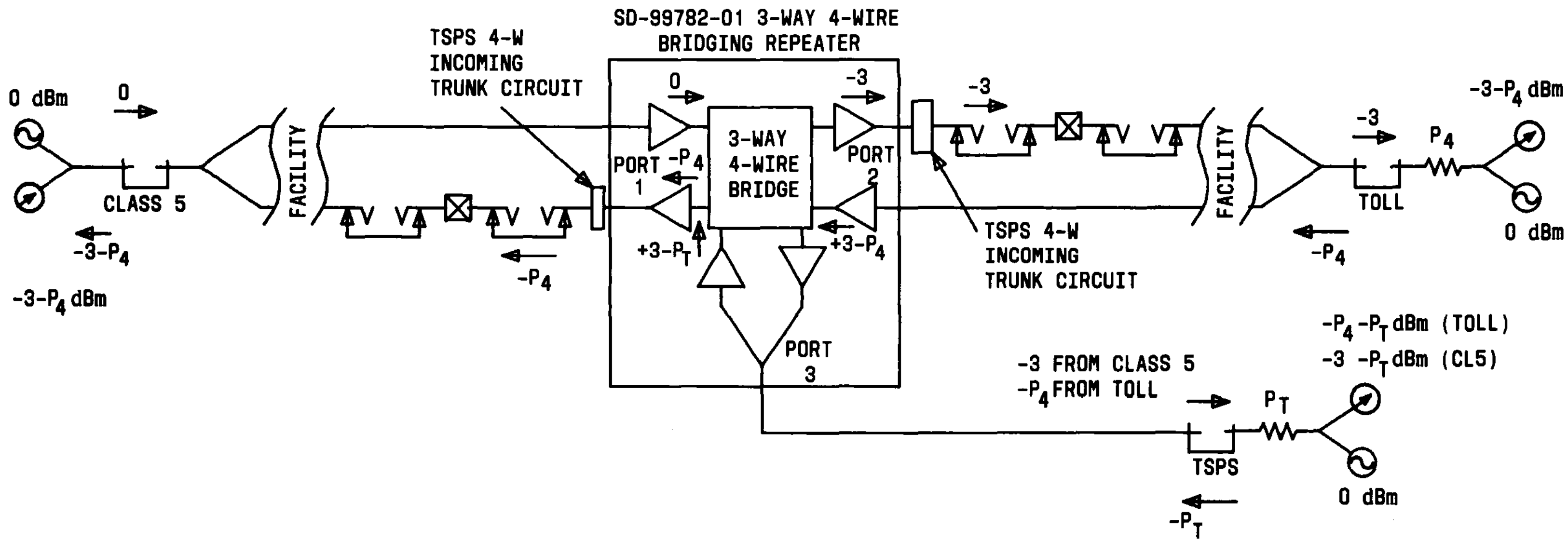
Fig. 12—TSPS Base Unit or RTA Lineup of 2-Wire Toll-Connecting Trunks



NOTES:

1. P_4 IS THE TOLL OFFICE TEST PAD VALUE OF 0, 2, OR 3DB
2. P_T IS THE TSPS BASE UNIT TEST PAD. IT IS P_4 WHEN TESTING WITH THE CLASS 5 OFFICE AND 3DB WHEN TESTING WITH THE TOLL OFFICE.
3. ⊠ IS EITHER A 1C PAD, AN 849C NETWORK EQUIPPED WITH A 89 TYPE RESISTOR, OR 227 AMPLIFIER.
4. (TMS symbol) IS A TRANSMISSION MEASURING SET (TMS). (oscillator symbol) IS A REFERENCE OSCILLATOR.
5. ➝ DENOTES TRANSMISSION LEVEL POINT (TLP)

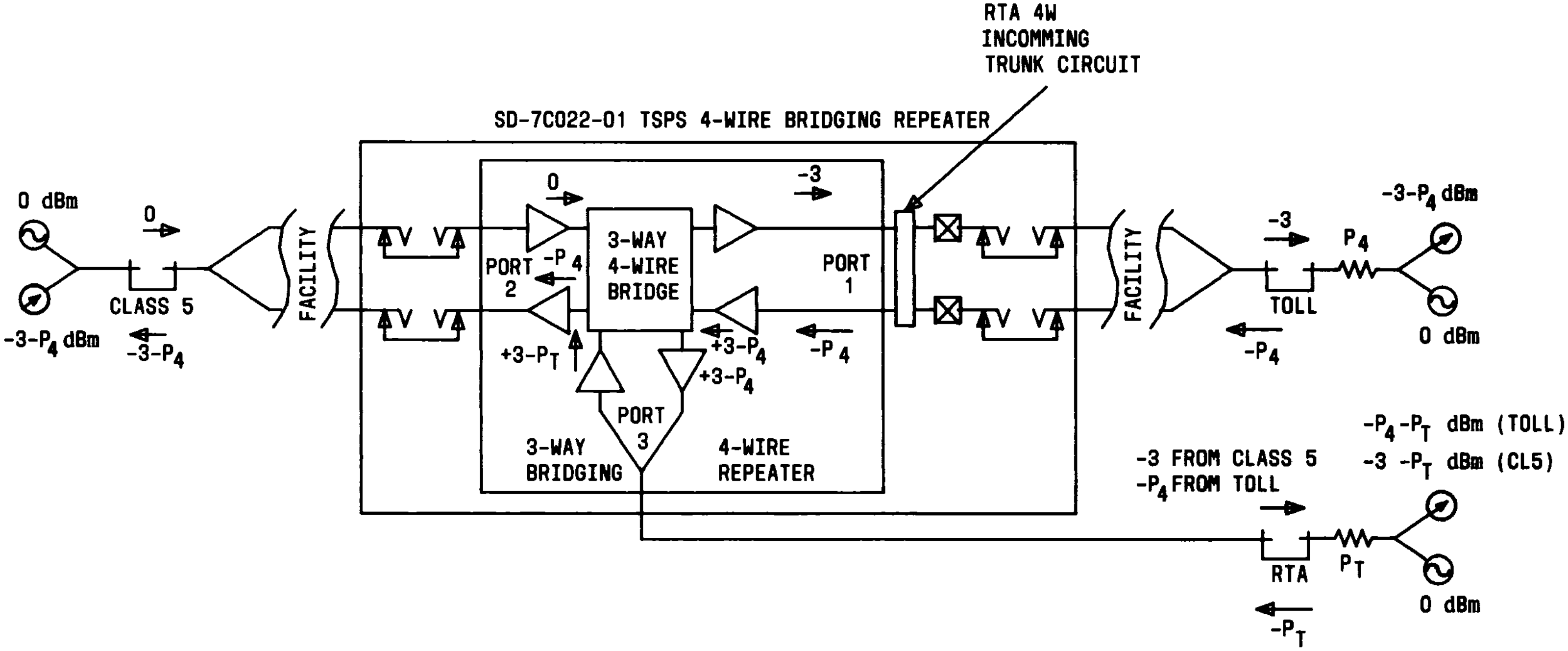
Fig. 13—TSPS Base Unit Lineup of 4-Wire Toll-Connecting Trunks Using the 4-Wire Bridging Repeater (SD-7C022-01)



NOTES:

1. P_4 IS THE TOLL OFFICE TEST PAD VALUE OF 0, 2, OR 3dB.
2. P_T IS THE TSPS BASE UNIT TEST PAD. IT IS P_4 WHEN TESTING WITH THE CLASS 5 OFFICE AND 3dB WHEN TESTING WITH THE TOLL OFFICE.
3. ⊠ IS EITHER A 1C PAD, AND 849C NETWORK EQUIPPED WITH A 89 TYPE RESISTOR, OR 227 AMPLIFIER.
4. (TMS symbol) IS A TRANSMISSION MEASURING SET (TMS). (oscillator symbol) IS A REFERENCE OSCILLATOR.
5. → DENOTES TRANSMISSION LEVEL POINT (TLP).

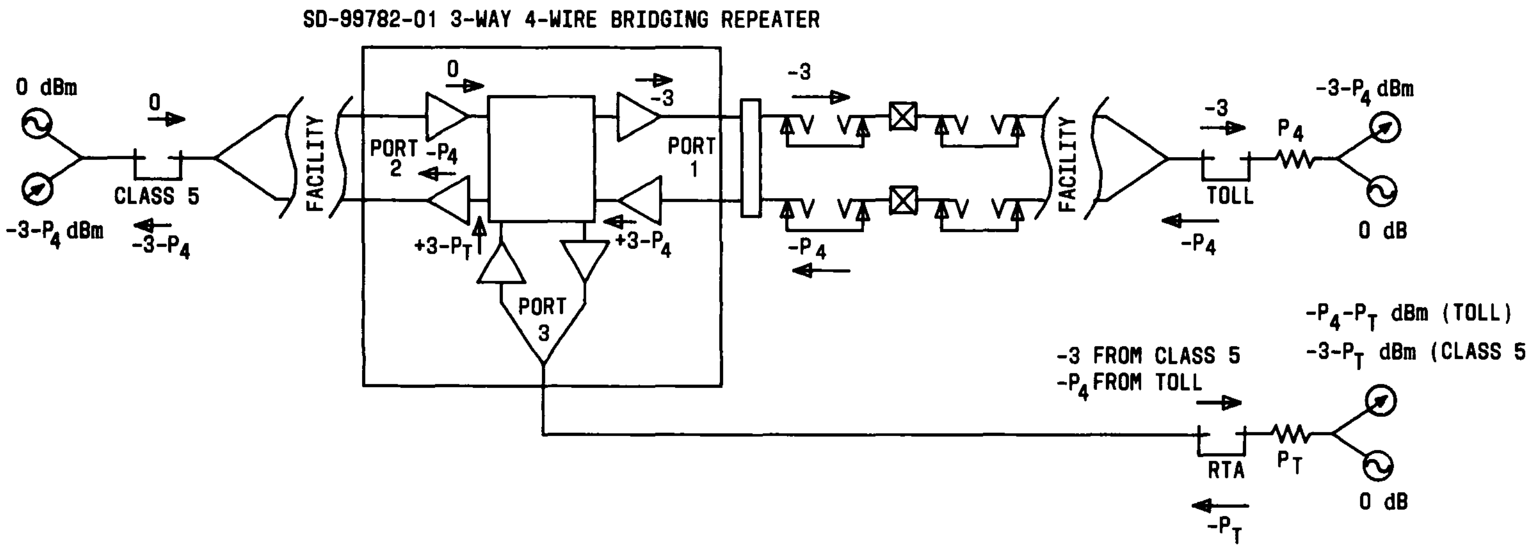
Fig. 14—TSPS Base Unit Lineup of 4-Wire Toll-Connecting Trunks Using the 3-Way, 4-Wire Bridging Repeater (SD-99782-01)



NOTES:

1. P_4 IS THE TOLL OFFICE TEST PAD VALUE OF 0, 2, OR 3dB
2. P_T IS THE TSPS TEST PAD. IT IS P_4 WHEN TESTING WITH THE CLASS 5 OFFICE AND 3dB WHEN TESTING WITH THE TOLL OFFICE
3. ⊠ IS EITHER A 1C PAD, AND 849C NETWORK EQUIPPED WITH A 89 TYPE RESISTOR, OR 227 AMPLIFIER
4. ⊘ IS A TRANSMISSION MEASURING SET (TMS). ⊙ IS A REFERENCE OSCILLATOR
5. → DENOTES TRANSMISSION LEVEL POINT (TLP)

Fig. 15—RTA Lineup of 4-Wire Toll-Connecting Trunks Using the 4-Wire Bridging Repeater (SD-7C022-01)



NOTES:

1. P_4 IS THE TOLL OFFICE TEST PAD VALUE OF 0, 2, OR 3dB
2. P_T IS THE RTA TEST PAD. IT IS P_4 WHEN TESTING WITH THE CLASS 5 OFFICE AND 3DB WHEN TESTING WITH THE TOLL OFFICE.
3. ⊠ IS EITHER A 1C PAD, AND 849C NETWORK EQUIPPED WITH A 89 TYPE RESISTOR, OR 227 AMPLIFIER
4. (TMS symbol) IS A TRANSMISSION MEASURING SET (TMS). (oscillator symbol) IS A REFERENCE OSCILLATOR
5. —▶ DENOTES TRANSMISSION LEVEL POINT (TLP)

Fig. 16—RTA Lineup of 4-Wire Toll-Connecting Trunks Using the 3-Way, 4-Wire Bridging Repeater (SD-99782-01)

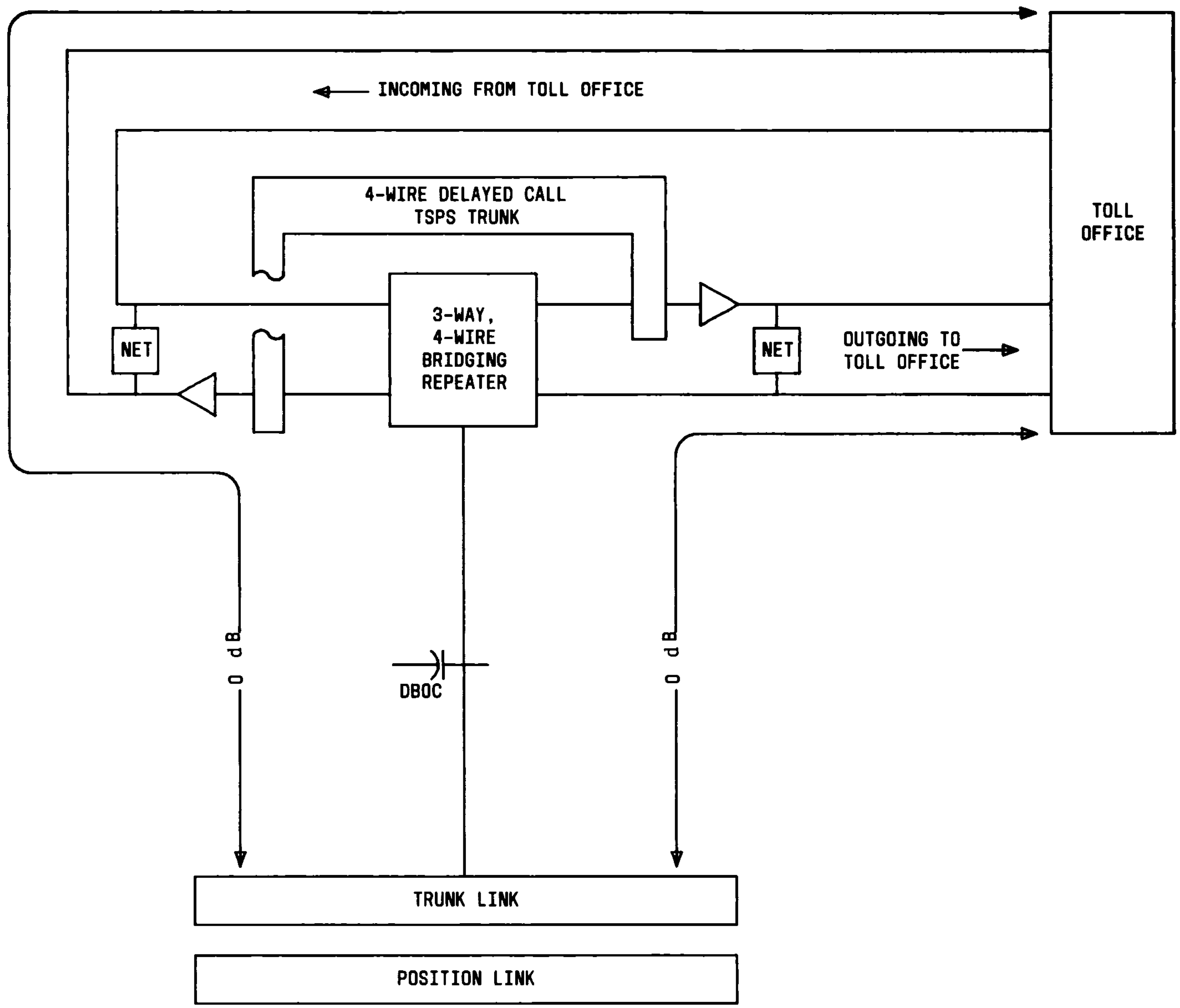
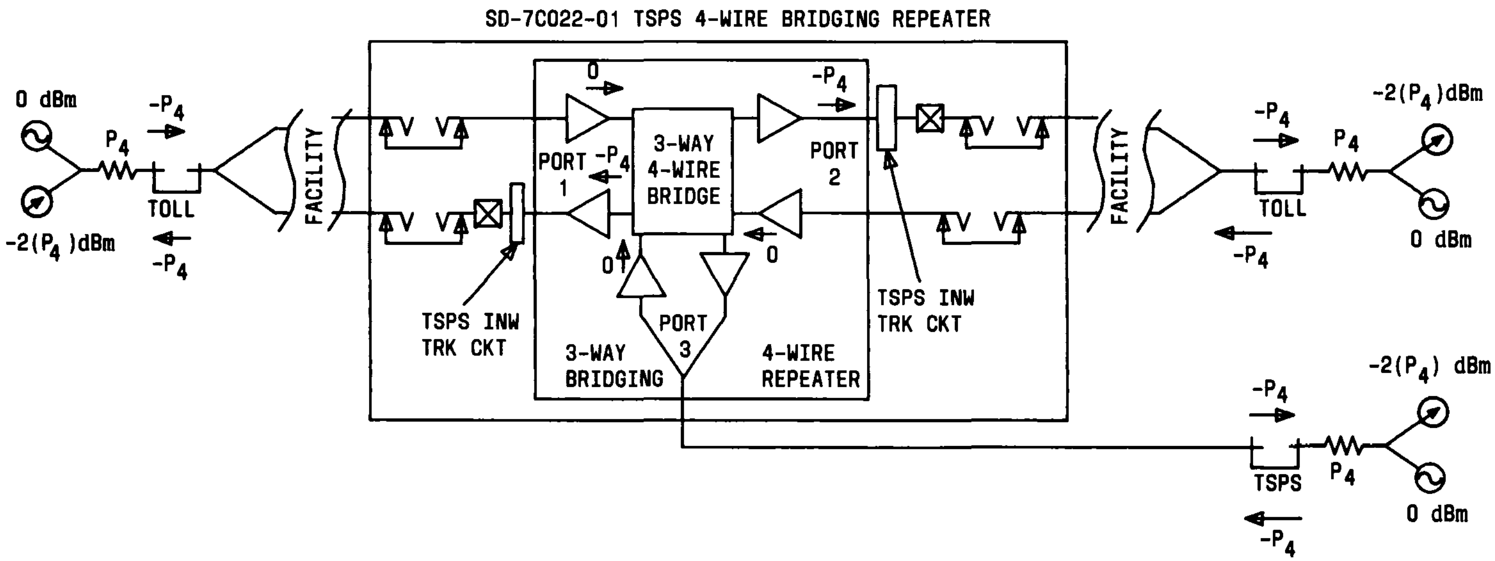


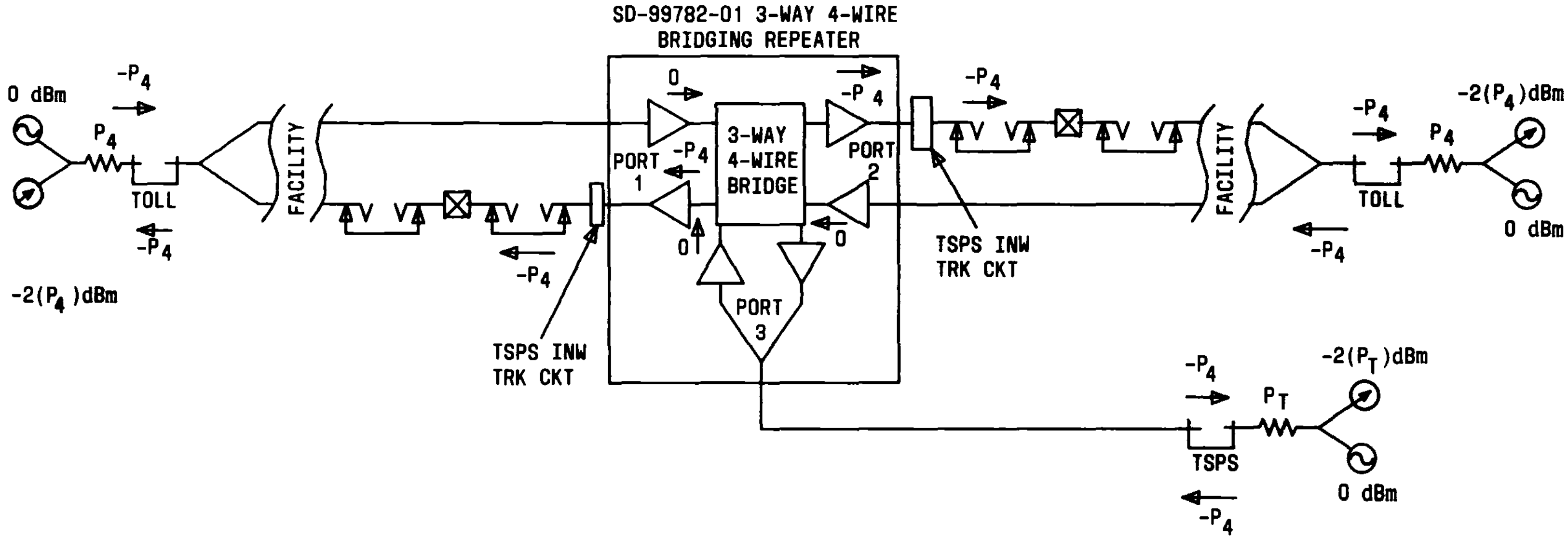
Fig. 17—Typical Facility Arrangement for a Delayed Call Trunk



NOTES:

1. P_4 IS THE TOLL OFFICE TEST PAD VALUE OF 0, 2, OR 3DB
2. ⊠ IS EITHER A 1C PAD, AN 849C NETWORK EQUIPPED WITH A 89 TYPE RESISTOR, OR 227 AMPLIFIER.
3. (TMS symbol) IS A TRANSMISSION MEASURING SET (TMS). (oscillator symbol) IS A REFERENCE OSCILLATOR.
4. → DENOTES TRANSMISSION LEVEL POINT (TLP)

Fig. 18—TSPS Base Unit Lineup of Inward and Delayed Call Trunks Using the 4-Wire Bridging Repeater (SD-7C022-01)



NOTES:

1. P_4 IS THE TOLL OFFICE TEST PAD VALUE OF 0, 2, OR 3dB.
2. ⊠ IS EITHER A 1C PAD, AND 849C NETWORK EQUIPPED WITH A 89 TYPE RESISTOR, OR 227 AMPLIFIER.
3. (TMS symbol) IS A TRANSMISSION MEASURING SET (TMS). (oscillator symbol) IS A REFERENCE OSCILLATOR.
4. → DENOTES TRANSMISSION LEVEL POINT (TLP).

Fig. 19—TSPS Base Unit Lineup of Inward and Delayed Call Trunks Using a 3-Way, 4-Wire Bridging Repeater (SD-99782-01)

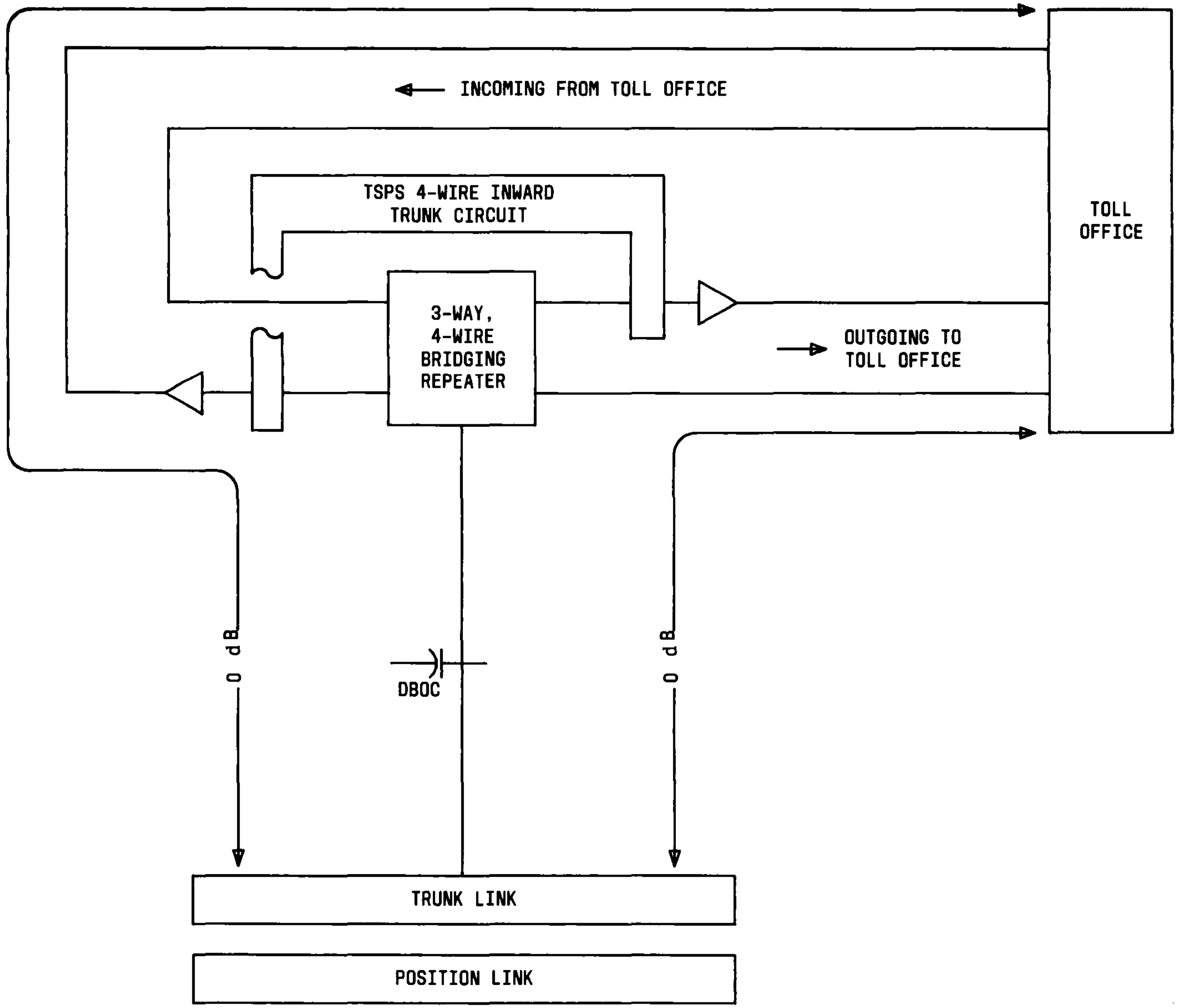


Fig. 20—Typical Facility Arrangement for Inward Trunks at the TSPS Base Unit

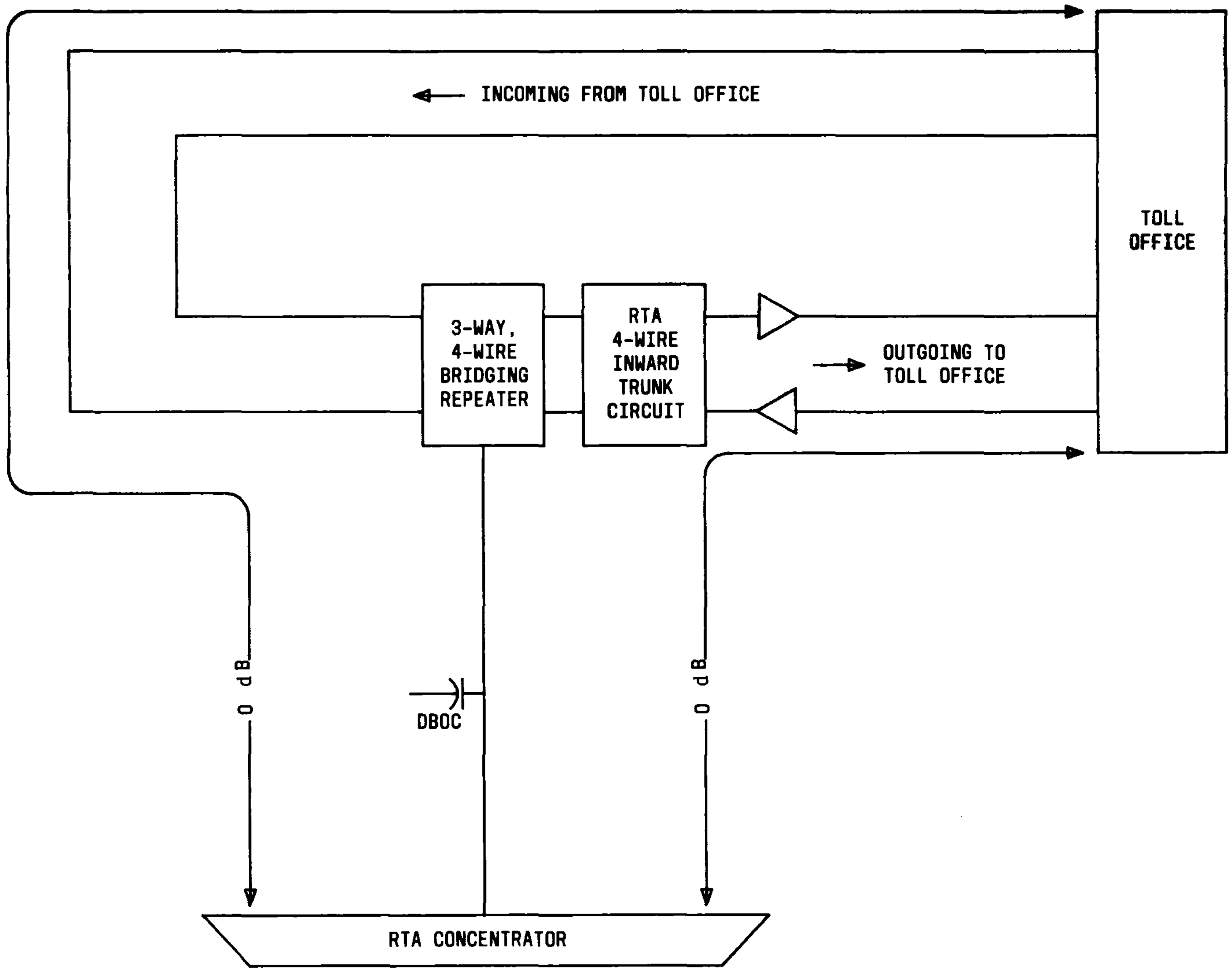
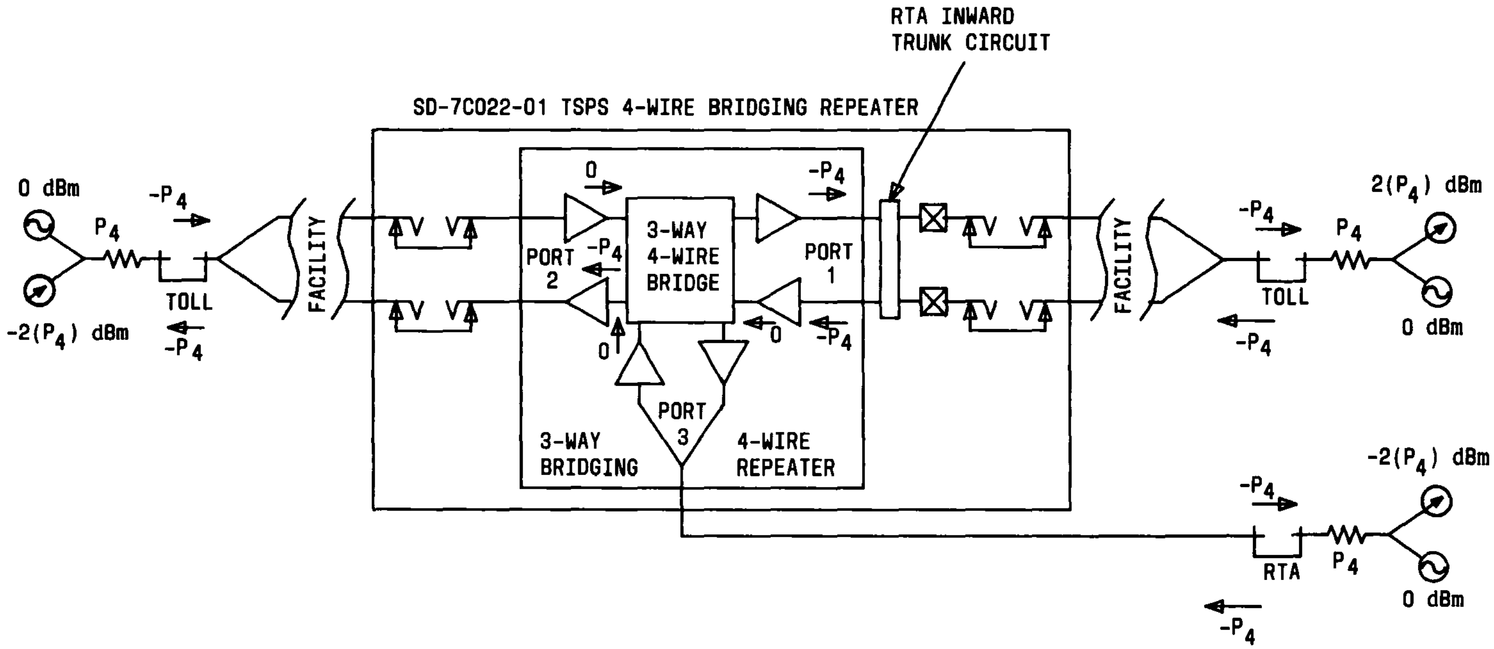


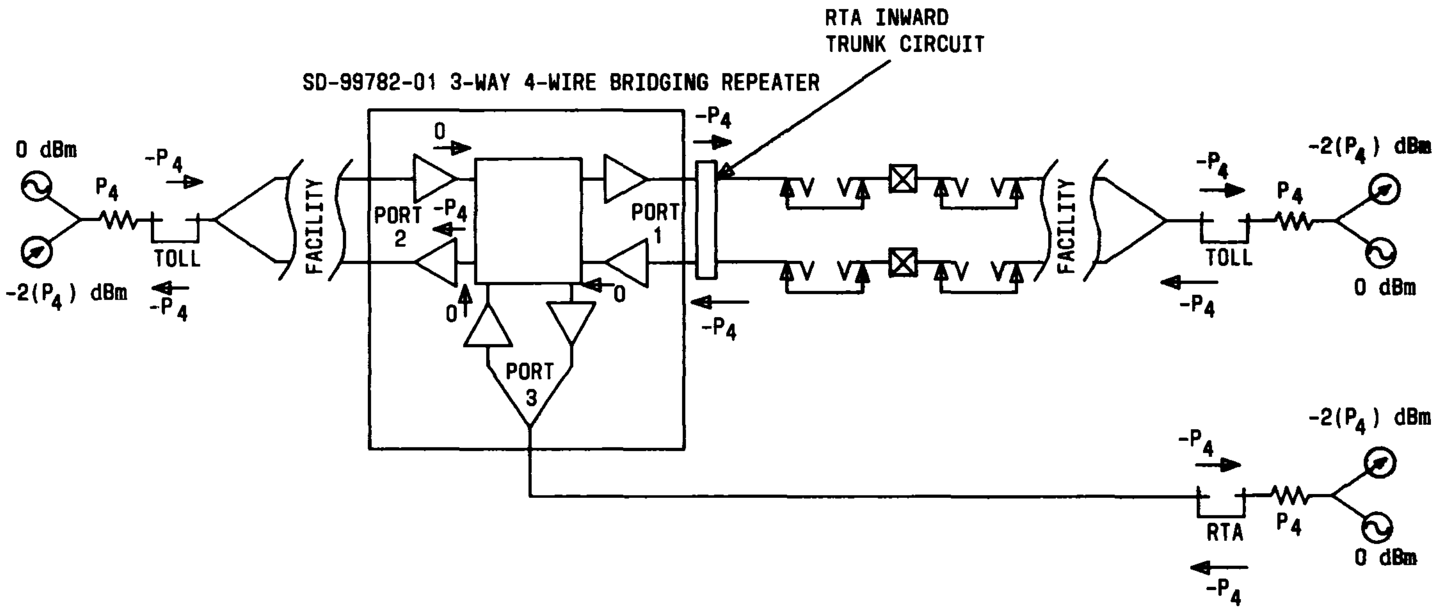
Fig. 21—Typical Facility Arrangement for Inward Trunks at an RTA



NOTES:

1. P_4 IS THE TOLL OFFICE TEST PAD VALUE OF 0, 2, OR 3dB
2. ☒ IS EITHER A 1C PAD, A 849C NETWORK EQUIPPED WITH A 89 THPE RESISTOR, OR A 227 AMPLIFIER
3. (TMS symbol) IS A TRANSMISSION MEASURING SET (TMS). (oscillator symbol) IS A REFERENCE OSCILLATOR.
4. ◄— DENOTES TRANSMISSION LEVEL POINT (TLP)

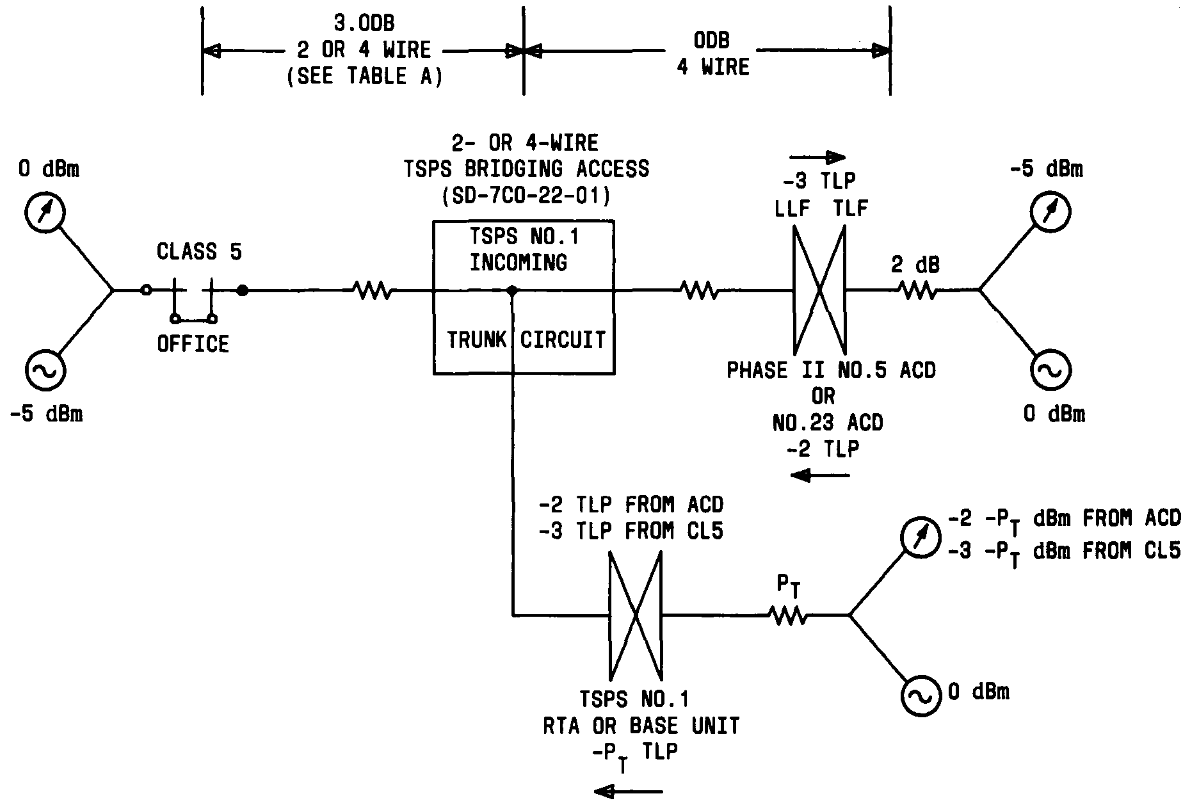
Fig. 22—RTA Lineup of Inward Trunks Using a 4-Wire Bridging Repeater (SD-7C022-01)



NOTES:

1. P_4 IS THE TOLL OFFICE TEST PAD VALUE OF 0, 2, OR 3dB
2. ⊠ IS EITHER A 1C PAD, AND 849C NETWORK EQUIPPED WITH A 89 TYPE RESISTOR, OR 227 AMPLIFIER
3. ⊘ IS A TRANSMISSION MEASURING SET (TMS). ⊙ IS A REFERENCE OSCILLATOR.
4. ——► DENOTES TRANSMISSION LEVEL POINT (TLF)

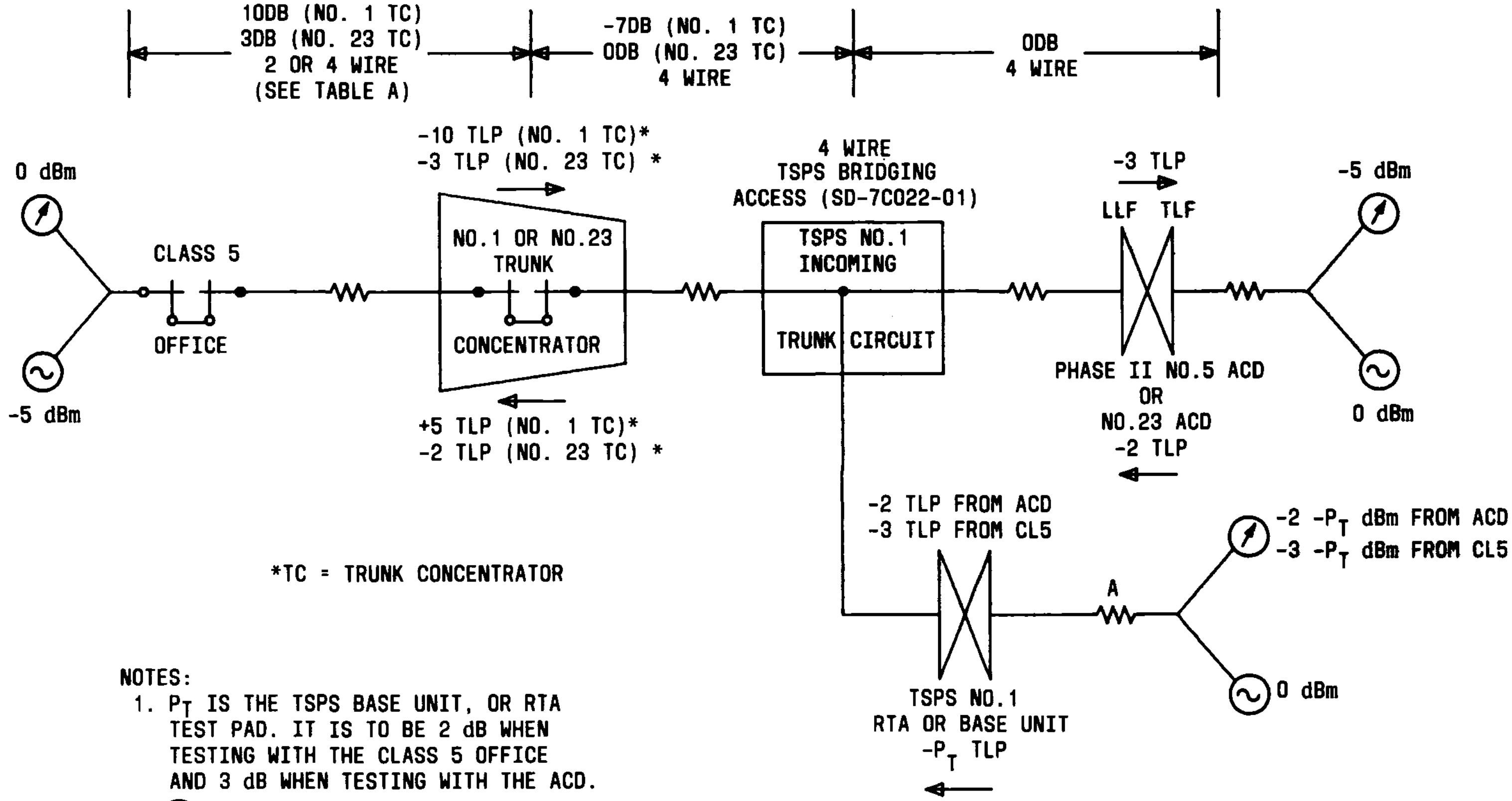
Fig. 23—RTA Lineup of Inward Trunks Using a 3-Way, 4-Wire Bridging Repeater (SD-99782-01)



NOTES:

1. P_T IS THE TSPS BASE UNIT, OR RTA TEST PAD. IT IS TO BE 2 dB WHEN TESTING WITH THE CLASS 5 OFFICE AND 3 dB WHEN TESTING WITH THE ACD.
2. (meter symbol) IS A TRANSMISSION MEASURING SET (TMS). (oscillator symbol) IS A REFERENCE OSCILLATOR.
3. → REPRESENTS A TRANSMISSION LEVEL POINT (TLP).
4. THE EXAMPLE ASSUMES AN ICL OF 3 dB BETWEEN THE CL5 OFFICE AND THE TSPS BRIDGING POINT. THE ICL MAY VARY FROM 2.0 dB TO 4.0 dB AS INDICATED IN TABLE A.

Fig. 24—Directory Assistance Charge Recording Trunks—Without Trunk Concentration



NOTES:
1. P_T IS THE TSPS BASE UNIT, OR RTA TEST PAD. IT IS TO BE 2 dB WHEN TESTING WITH THE CLASS 5 OFFICE AND 3 dB WHEN TESTING WITH THE ACD.
2. (TMS symbol) IS A TRANSMISSION MEASURING SET (TMS). (oscillator symbol) IS A REFERENCE OSCILLATOR.
3. ——▶ REPRESENTS A TRANSMISSION LEVEL POINT (TLP).
4. THE EXAMPLE ASSUMES AN ICL OF 3 dB BETWEEN THE CL5 OFFICE AND THE TSPS BRIDGING POINT. THE ICL MAY VARY FROM 20 dB TO 4.0 dB AS INDICATED IN TABLE A.

Fig. 25—Directory Assistance Charge Recording Trunks—With Trunk Concentration

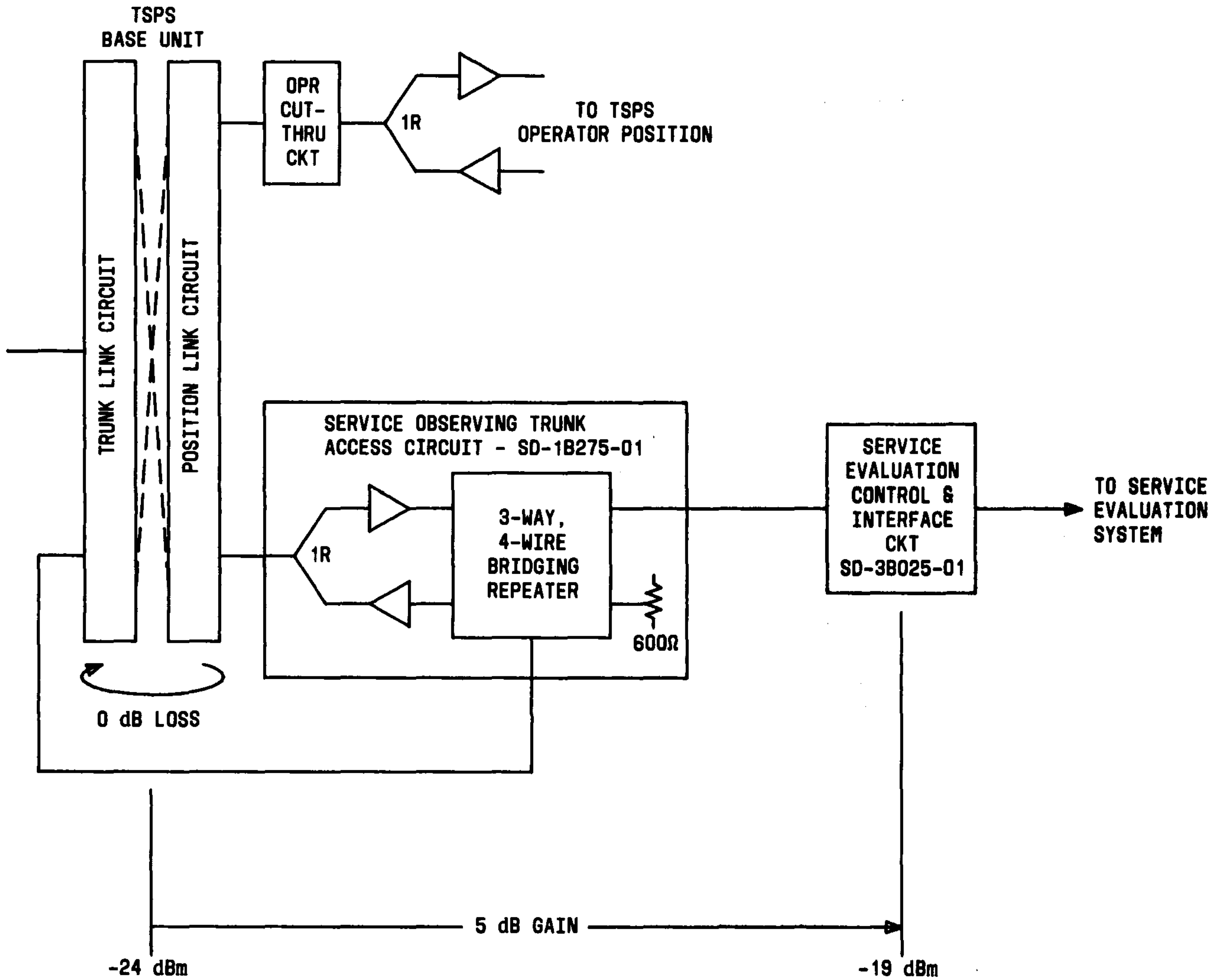


Fig. 26—Service Observing Trunk Access Circuit

NOTES: 1. ——▶ DENOTES TRANSMISSION LEVEL POINT
2. P_T REPRESENTS THE TSPS BASE UNIT TEST PAD. P_T IS EQUAL TO THE VALUE OF THE CAMA OFFICE TEST PAD, WHICH IS 2 dB FOR ALL CAMA OFFICES EXCEPT THE NO. 4 ESS WHERE P_T = 3 dB

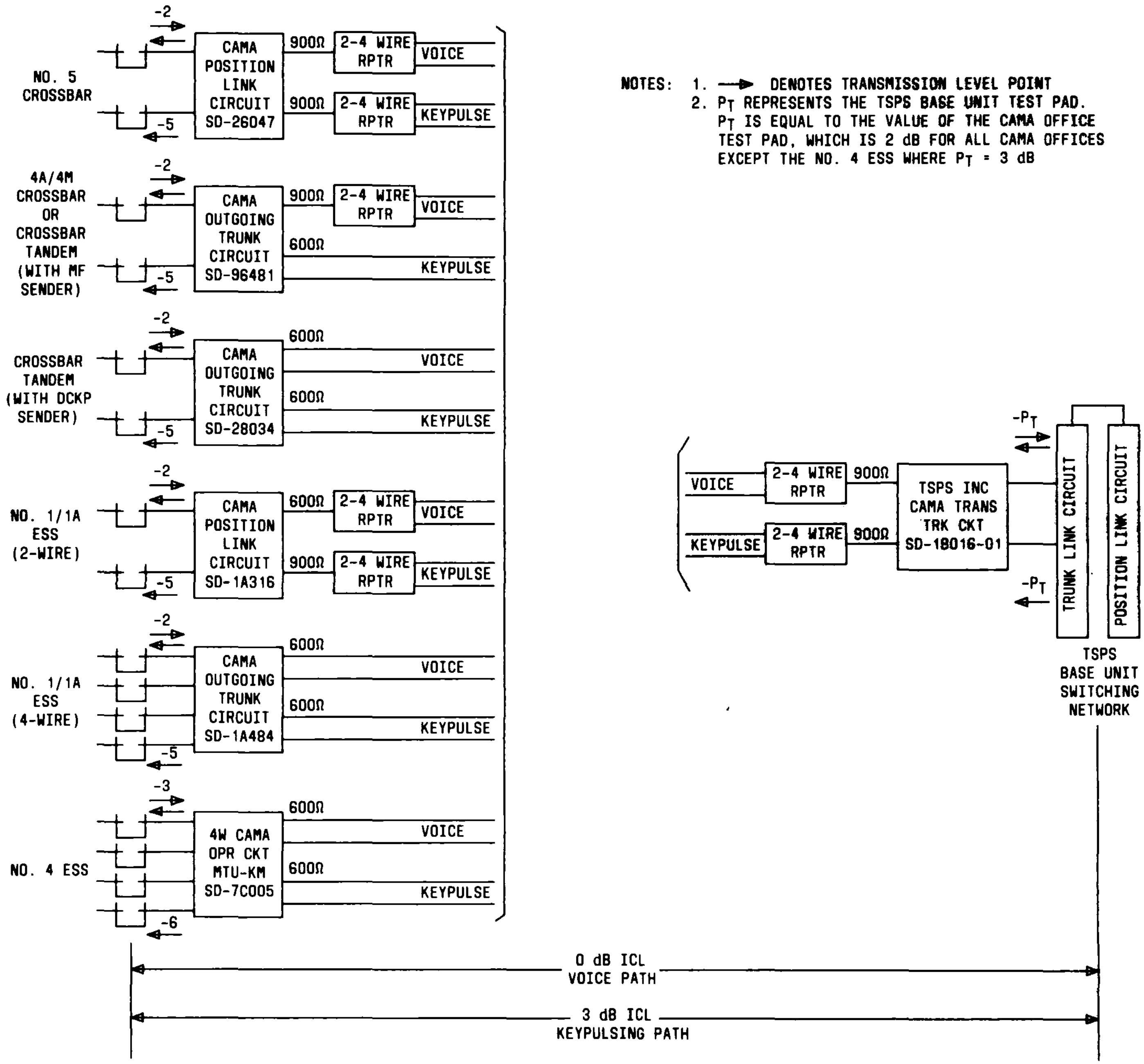
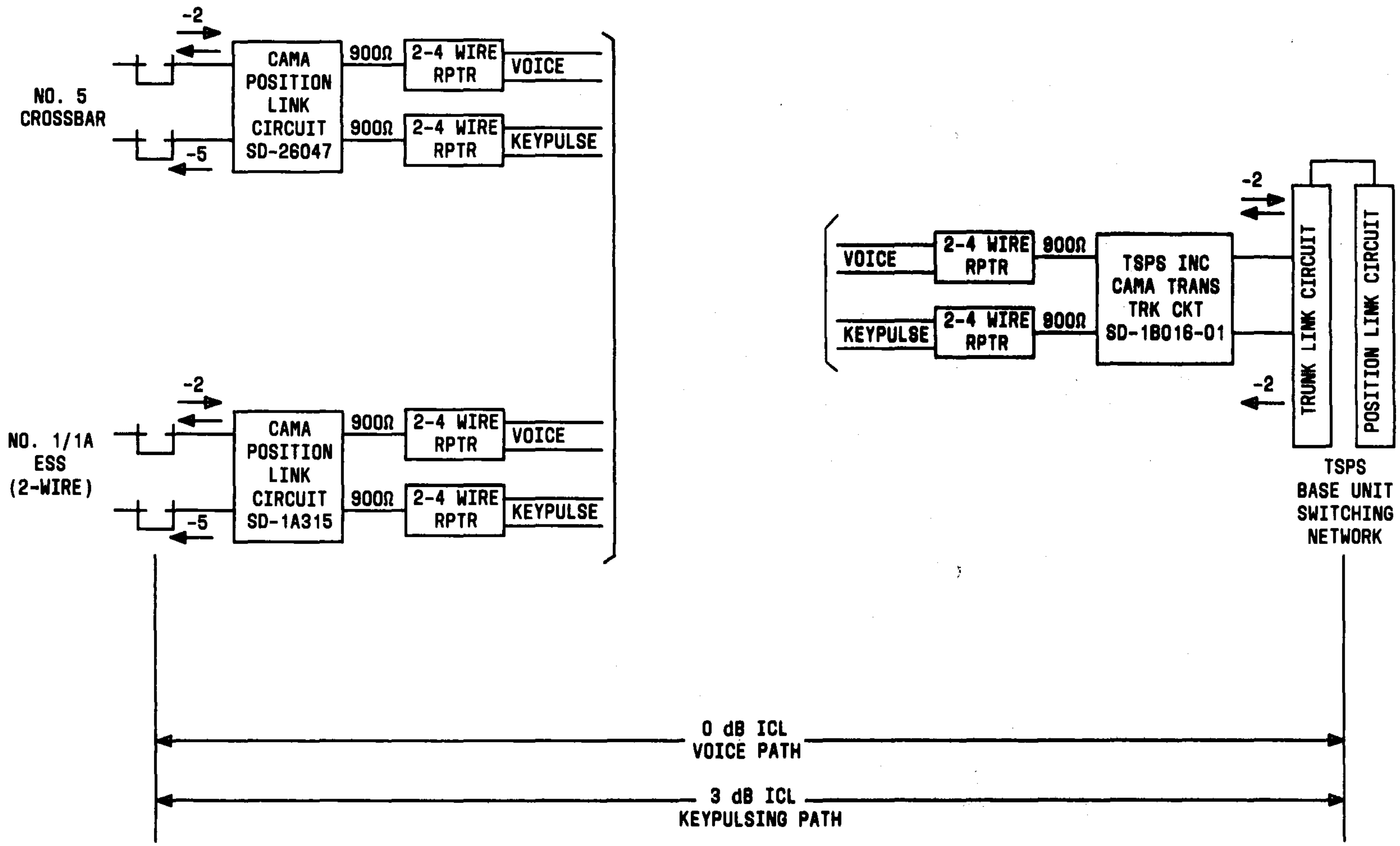


Fig. 27—CAMA Transfer Trunks With E&M Lead Signaling



NOTES: 1. ⟶ DENOTES TRANSMISSION LEVEL POINT

Fig. 28—CAMA Transfer Trunks With Loop Signaling

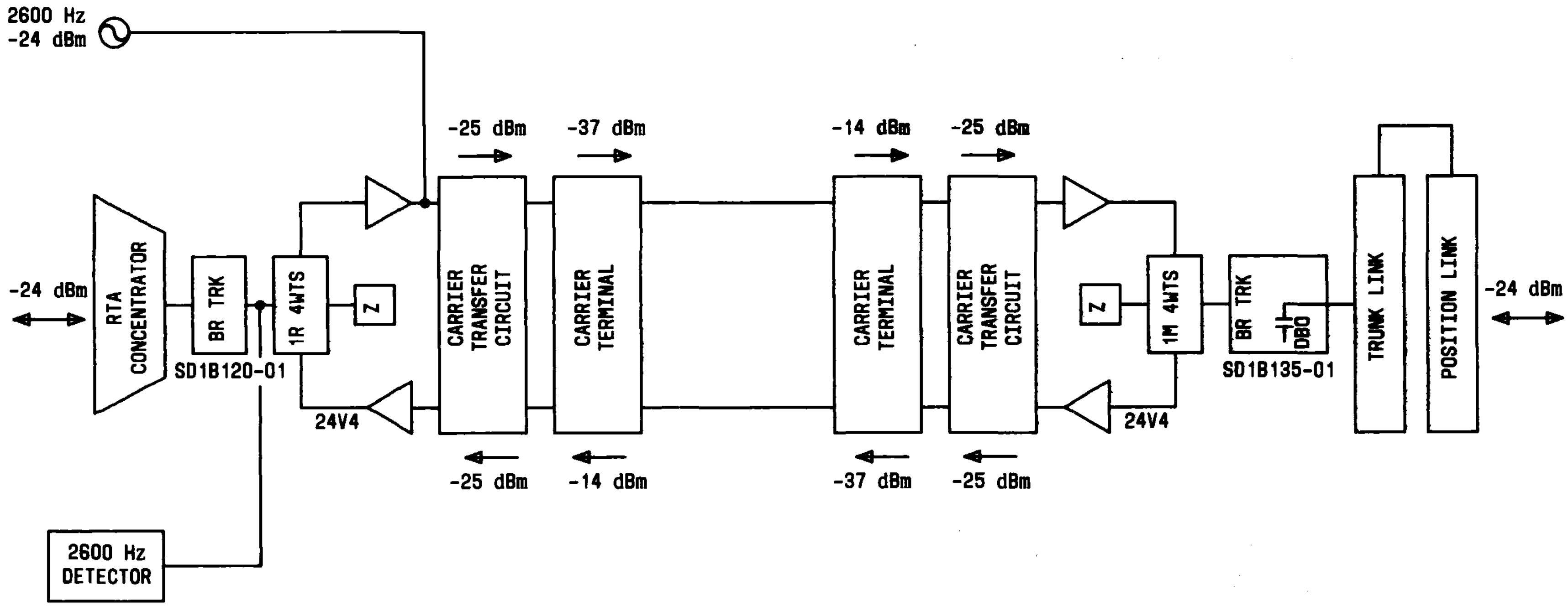


Fig. 29—Typical Facility Arrangement and Lineup of Base-Remote Trunk

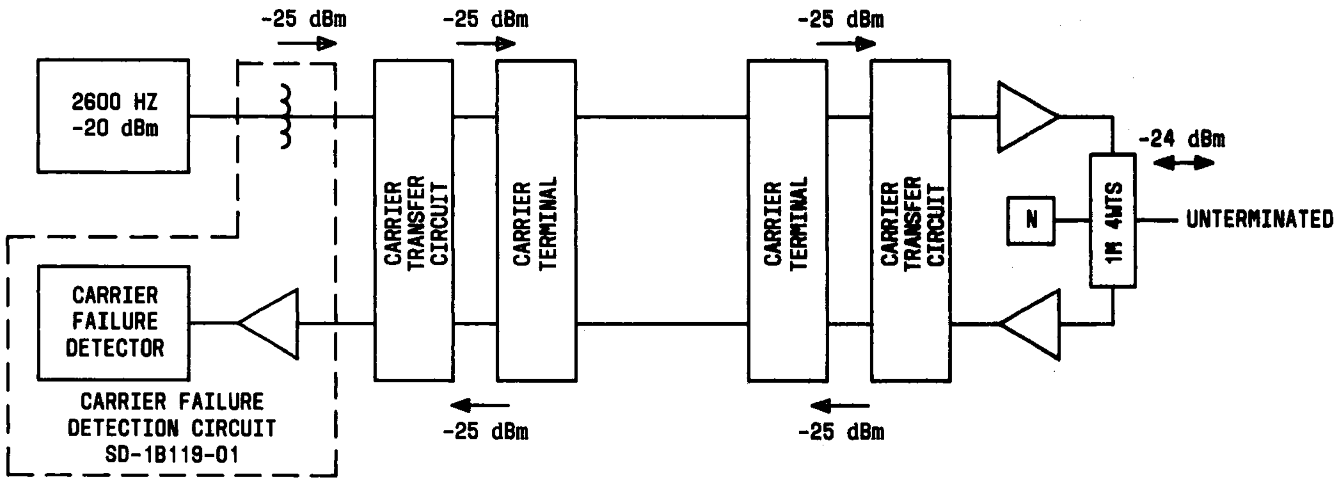
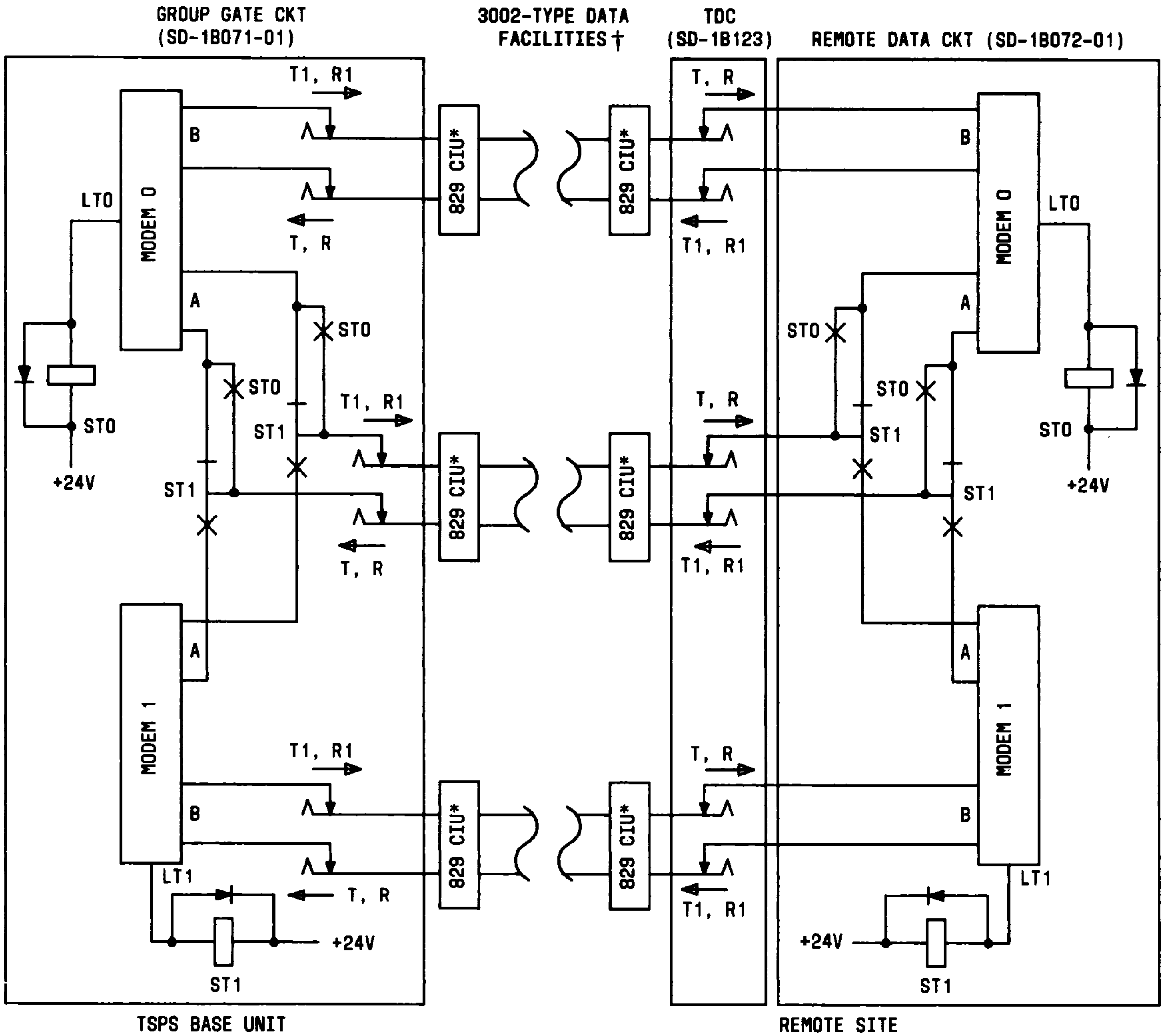


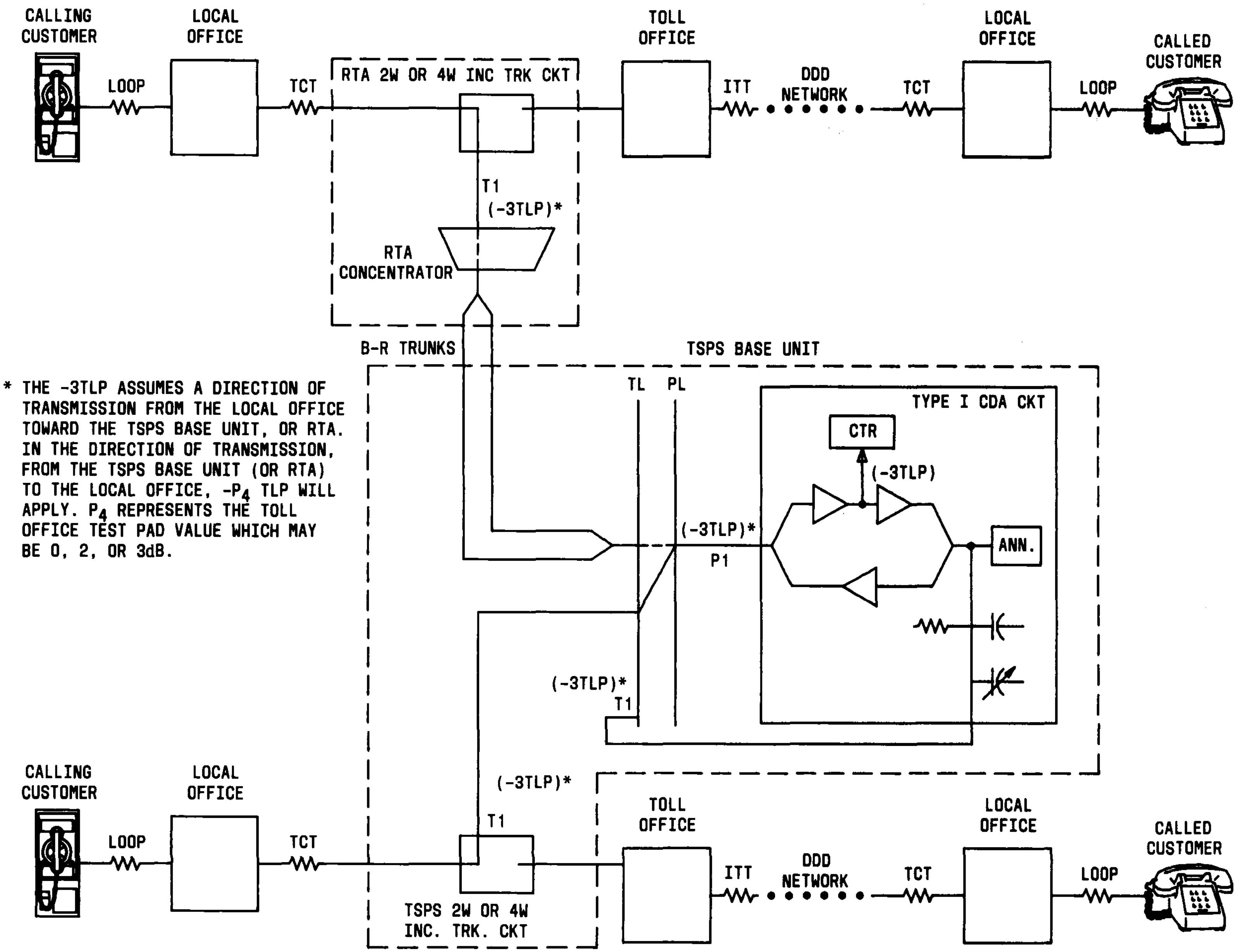
Fig. 30—Carrier Alarm Channel With Carrier Failure Detection Circuit on Base-Remote Trunks and PSS No. 2



* THE 829-CHANNEL INTERFACE UNITS (CIU)

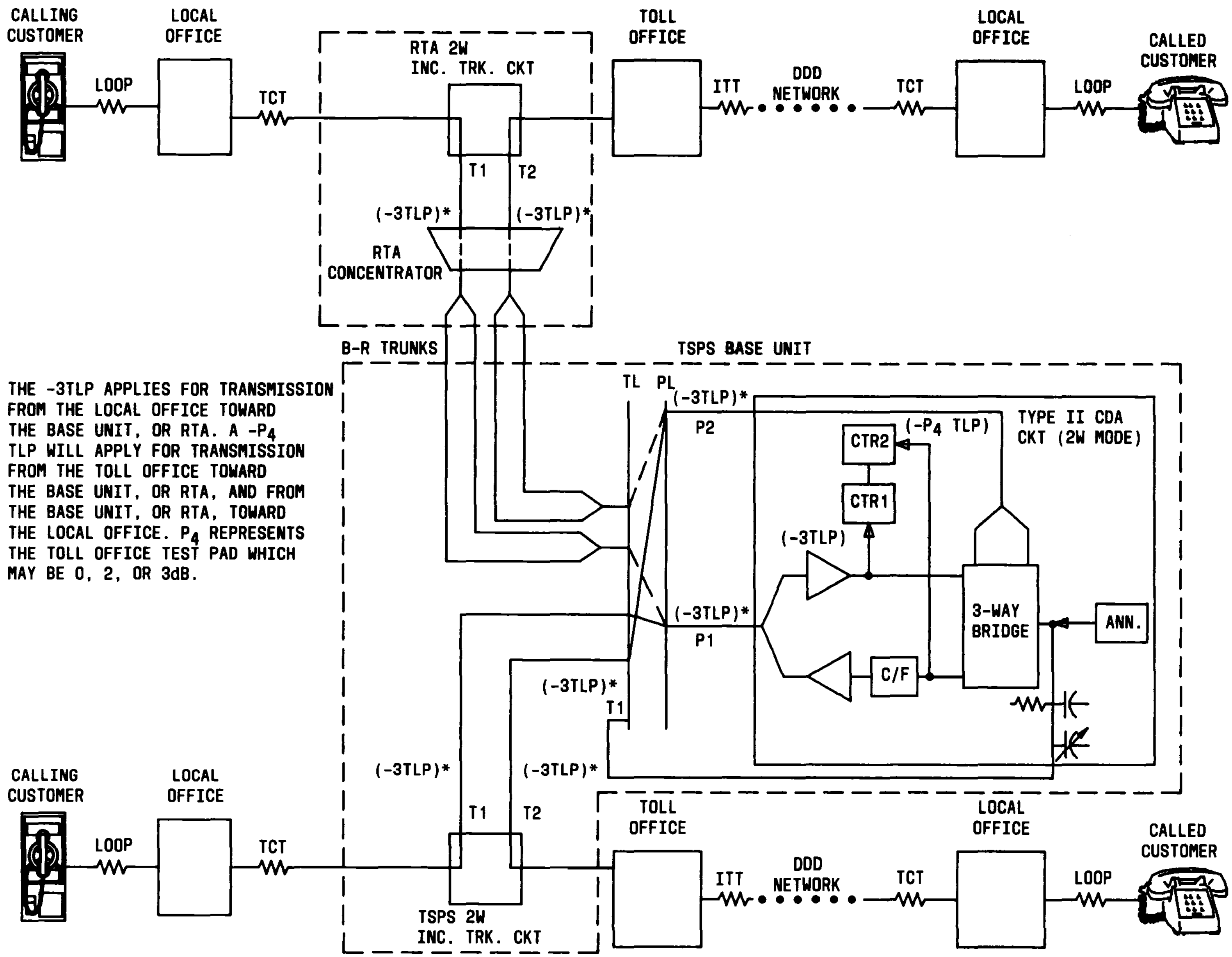
† THE ONE-WAY PROPAGATION DELAY OF THE 3002-TYPE DATA FACILITIES MUST BE NO GREATER THAN 8.8 ms AND THE DIFFERENTIAL DELAY BETWEEN THE THREE 3002-TYPE DATA FACILITIES MUST BE NO GREATER THAN 2.5 ms

Fig. 31—Peripheral Control Link, Block Diagram



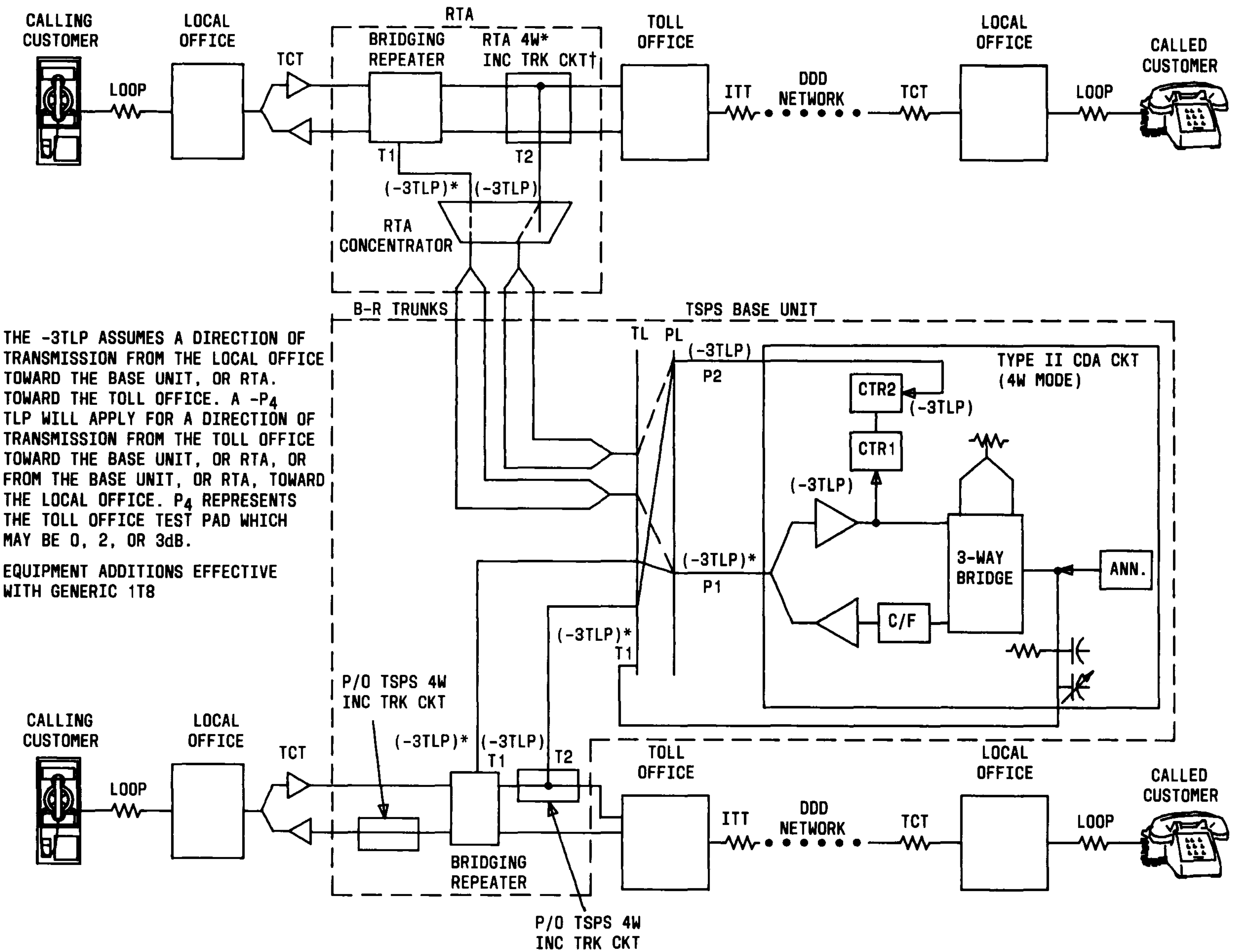
* THE -3TLP ASSUMES A DIRECTION OF TRANSMISSION FROM THE LOCAL OFFICE TOWARD THE TSPS BASE UNIT, OR RTA. IN THE DIRECTION OF TRANSMISSION, FROM THE TSPS BASE UNIT (OR RTA) TO THE LOCAL OFFICE, $-P_4$ TLP WILL APPLY. P_4 REPRESENTS THE TOLL OFFICE TEST PAD VALUE WHICH MAY BE 0, 2, OR 3dB.

Fig. 32—Typical ACTS Connection—Type I CDA Circuit



* THE -3TLP APPLIES FOR TRANSMISSION FROM THE LOCAL OFFICE TOWARD THE BASE UNIT, OR RTA. A $-P_4$ TLP WILL APPLY FOR TRANSMISSION FROM THE TOLL OFFICE TOWARD THE BASE UNIT, OR RTA, AND FROM THE BASE UNIT, OR RTA, TOWARD THE LOCAL OFFICE. P_4 REPRESENTS THE TOLL OFFICE TEST PAD WHICH MAY BE 0, 2, OR 3dB.

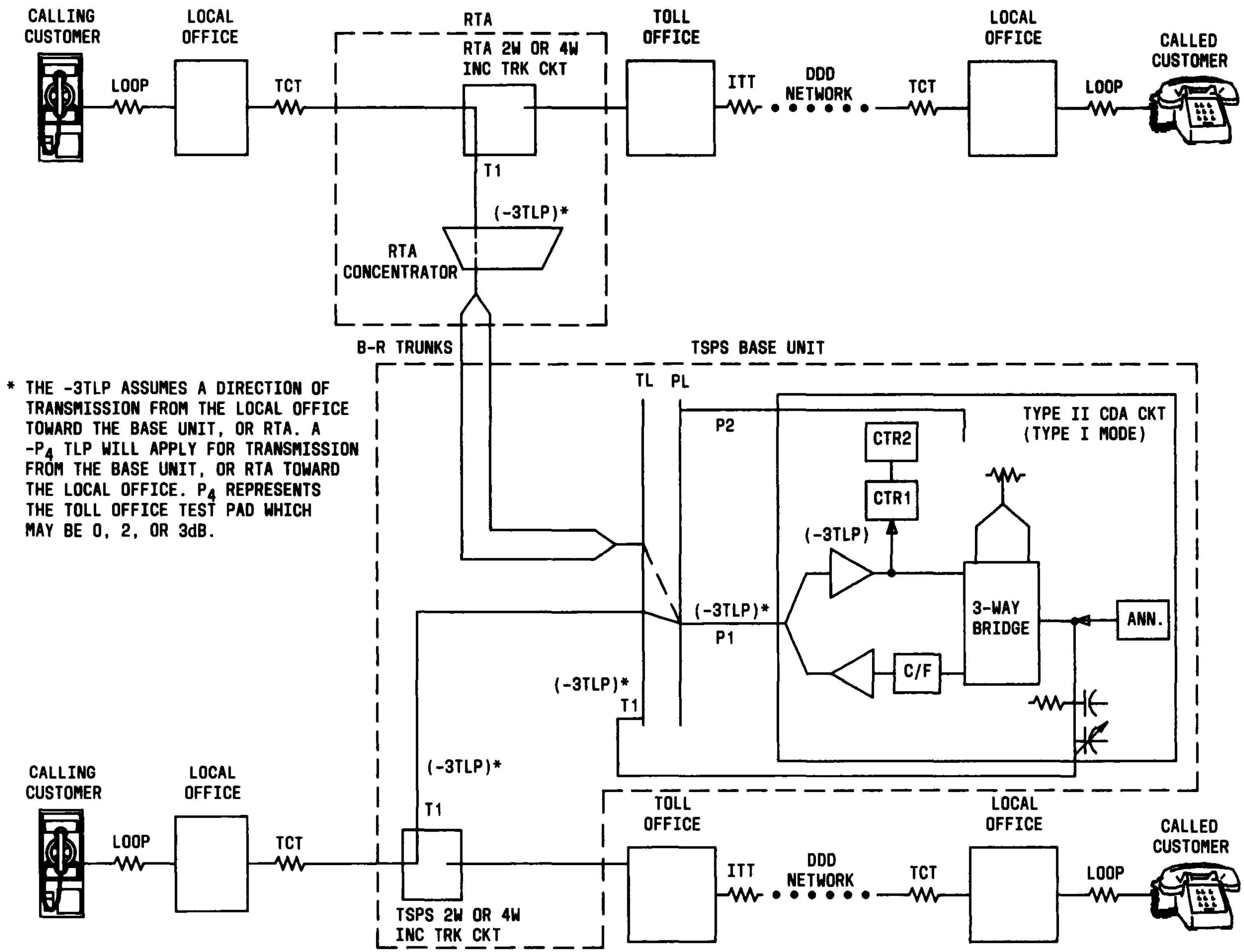
Fig. 33—Typical ACTS Connection—Type II CDA Circuit (2-Wire Mode)



* THE -3TLP ASSUMES A DIRECTION OF TRANSMISSION FROM THE LOCAL OFFICE TOWARD THE BASE UNIT, OR RTA. TOWARD THE TOLL OFFICE. A $-P_4$ TLP WILL APPLY FOR A DIRECTION OF TRANSMISSION FROM THE TOLL OFFICE TOWARD THE BASE UNIT, OR RTA, OR FROM THE BASE UNIT, OR RTA, TOWARD THE LOCAL OFFICE. P_4 REPRESENTS THE TOLL OFFICE TEST PAD WHICH MAY BE 0, 2, OR 3dB.

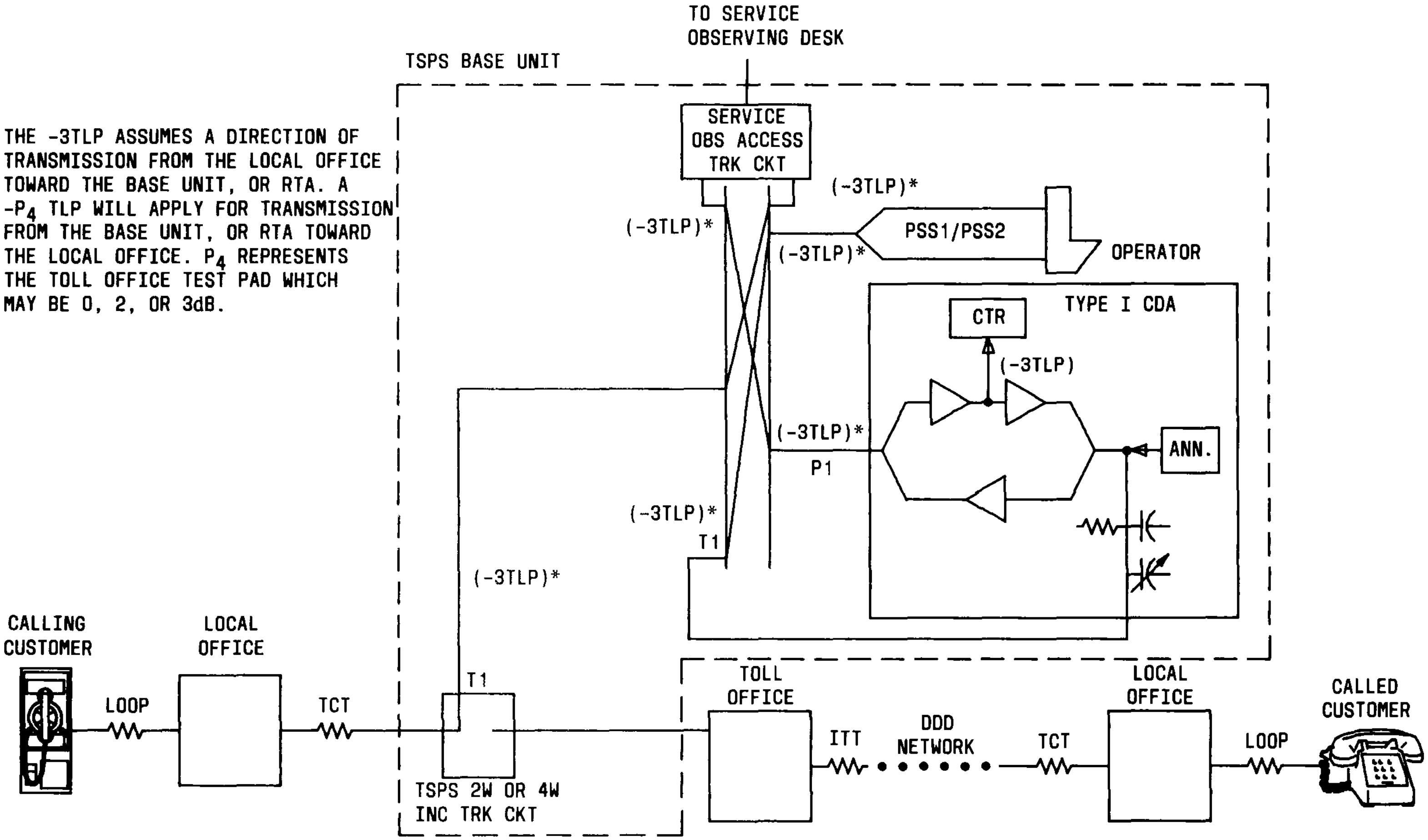
† EQUIPMENT ADDITIONS EFFECTIVE WITH GENERIC 1T8

Fig. 34—Typical ACTS Connection—Type II CDA Circuit (4-Wire Mode)



* THE -3TLP ASSUMES A DIRECTION OF TRANSMISSION FROM THE LOCAL OFFICE TOWARD THE BASE UNIT, OR RTA. A $-P_4$ TLP WILL APPLY FOR TRANSMISSION FROM THE BASE UNIT, OR RTA TOWARD THE LOCAL OFFICE. P_4 REPRESENTS THE TOLL OFFICE TEST PAD WHICH MAY BE 0, 2, OR 3dB.

Fig. 35—Typical ACTS Connection—Type II CDA Circuit (Type I Mode)



* THE -3TLP ASSUMES A DIRECTION OF TRANSMISSION FROM THE LOCAL OFFICE TOWARD THE BASE UNIT, OR RTA. A $-P_4$ TLP WILL APPLY FOR TRANSMISSION FROM THE BASE UNIT, OR RTA TOWARD THE LOCAL OFFICE. P_4 REPRESENTS THE TOLL OFFICE TEST PAD WHICH MAY BE 0, 2, OR 3dB.

Fig. 36—Typical ACTS Connection—Service Observed and Operator Assisted ACTS Call

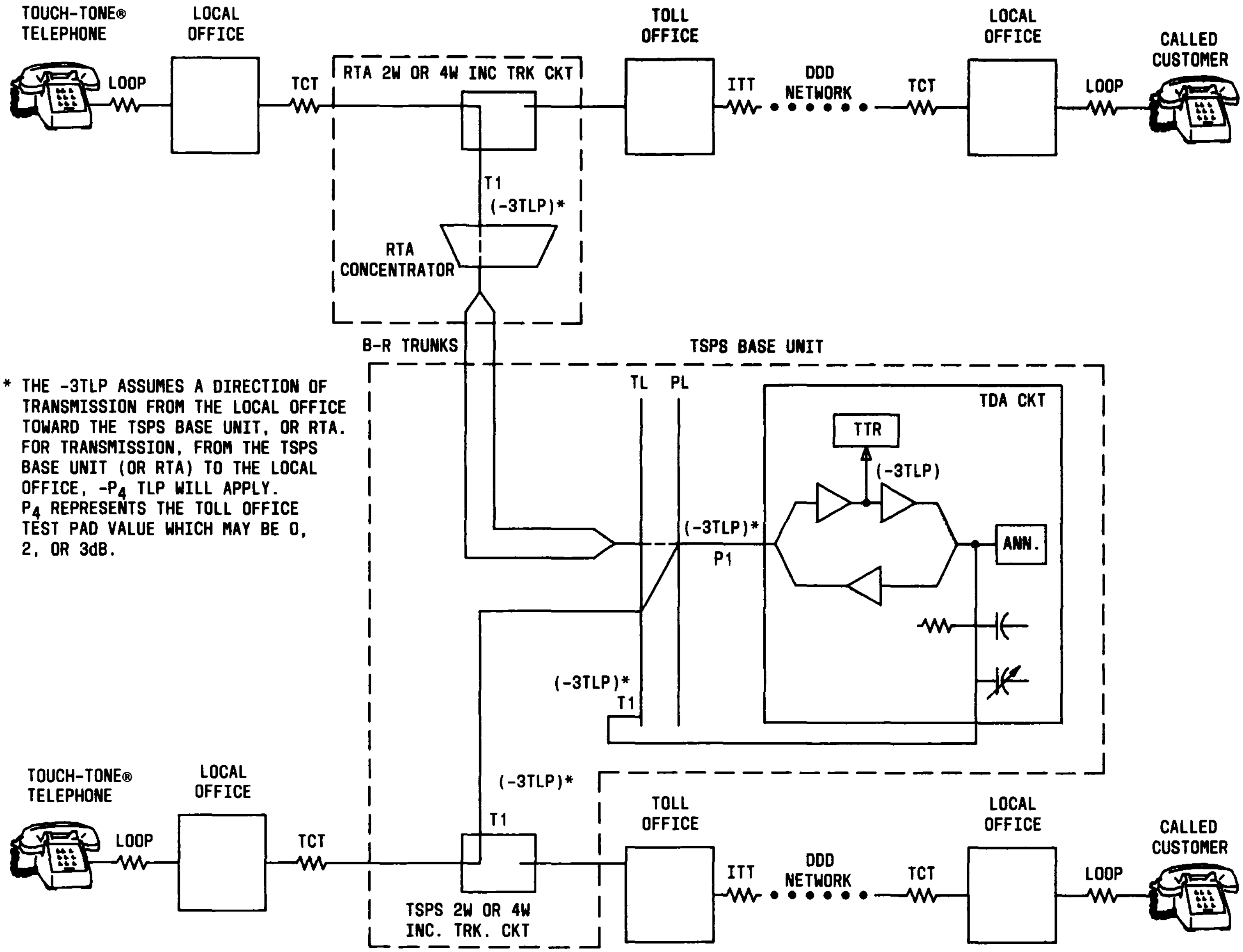
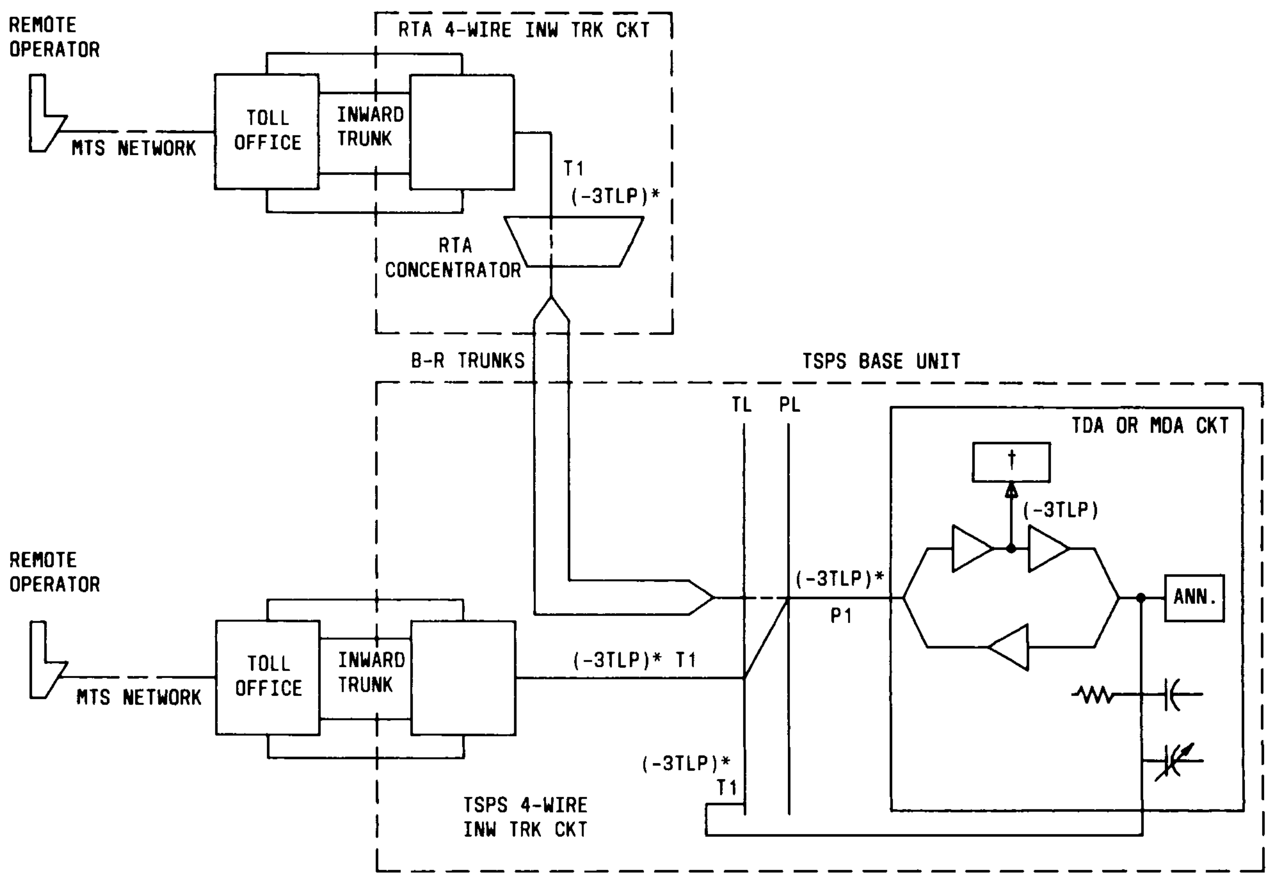


Fig. 37—Typical Calling Card Service Conection in Which the Customer Inputs the Billing Information



* THE -3TLP ASSUMES A DIRECTION OF TRANSMISSION FROM THE LOCAL OFFICE TOWARD THE TSPS BASE UNIT, OR RTA. FOR TRANSMISSION, FROM THE TSPS BASE UNIT (OR RTA) TO THE LOCAL OFFICE, $-P_4$ TLP WILL APPLY. P_4 REPRESENTS THE TOLL OFFICE TEST PAD VALUE WHICH MAY BE 0, 2, OR 3dB.

† IF THE REMOTE OPERATOR USED TOUCH-TONE® SIGNALING TO INPUT THE BILLING INFORMATION, A TDA CIRCUIT IS ATTACHED AT THE BASE UNIT AND A TTR IS USED. IF MF SIGNALING IS USED, A MDA CIRCUIT IS ATTACHED AND A MFR IS USED.

Fig. 38—Typical Calling Card Service Connection in Which a Remote Operator Inputs the Billing Information

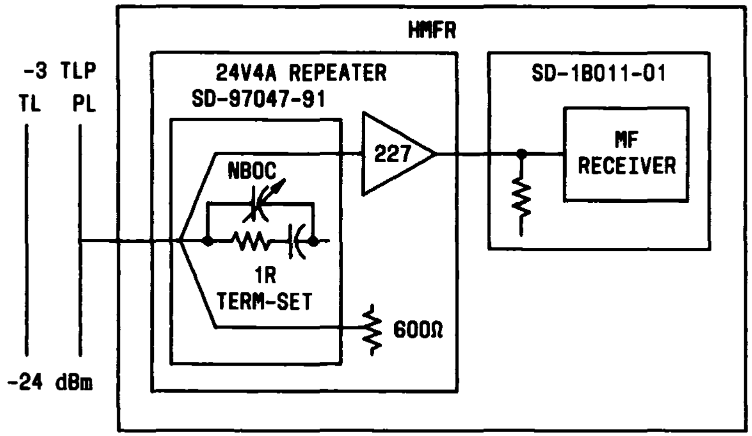
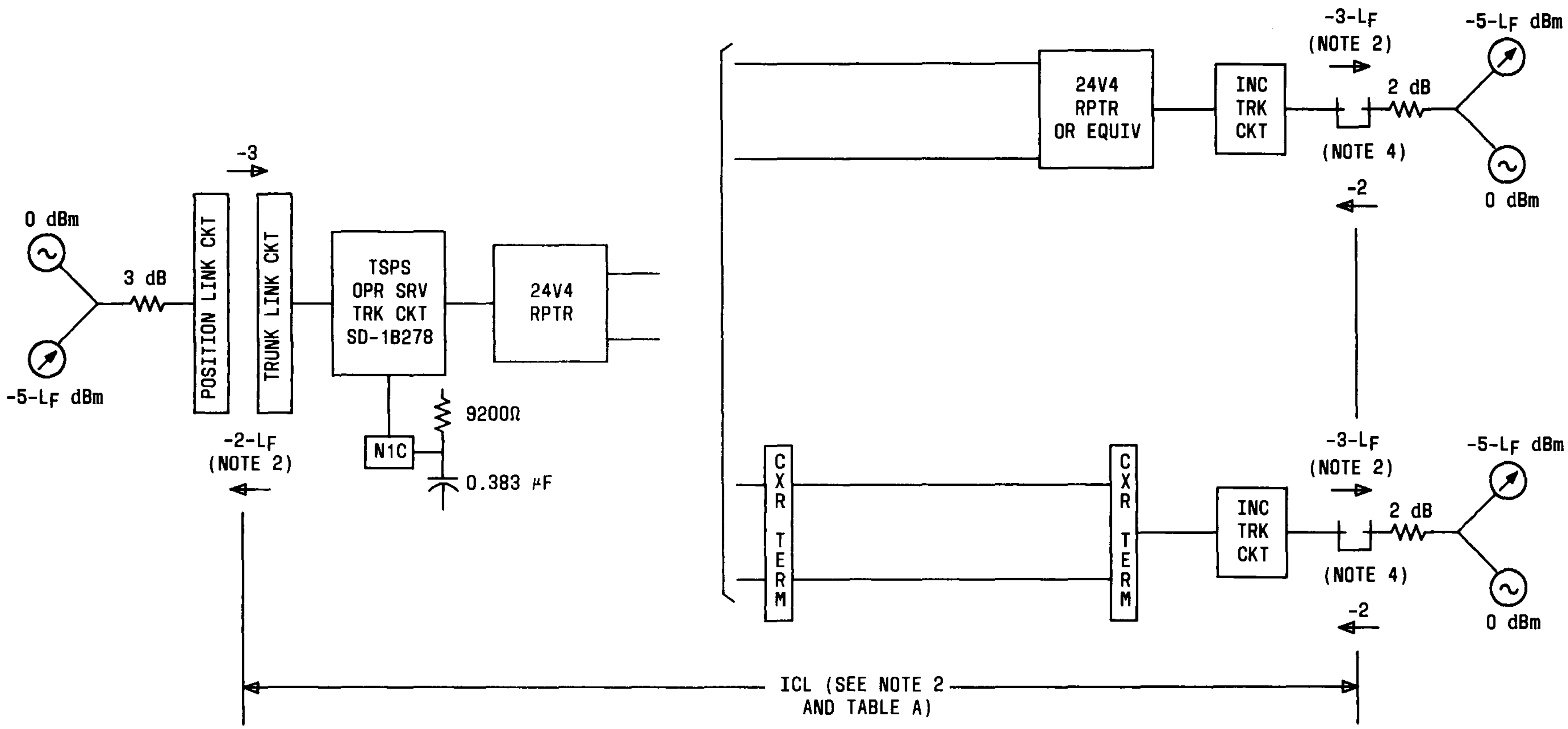


Fig. 39—Block Diagram of High-Impedance Multifrequency Receiver



NOTES: 1. [TMS symbol] IS A TRANSMISSION MEASURING SET (TMS), [oscillator symbol] IS A REFERENCE OSCILLATOR.

2. L_F REPRESENTS THE ICL OF THE OPERATOR SERVICE TRUNK. REFER TO TABLE A FOR SPECIFIC ICL VALUES AS DETERMINED BY THE EQUIPMENT USED.

3. ⟶ DENOTES A TRANSMISSION LEVEL POINT (TLP).

4. THE IMPEDANCE OF THE VARIOUS OPERATOR SERVICE SWITCHING EQUIPMENT IS AS FOLLOWS:

3C OR 3CL SWITCHBOARD - 600Ω
NO. 23 OPERATING ROOM DESK (ORD) - 900Ω
NO. 23 ACD - 900Ω
PHASE I NO. 5 ACD - 900Ω
EXTENDED PHASE I NO. 5 ACD - 900Ω
PHASE II NO. 5 ACD - 900Ω

Fig. 40—Facility Arrangement and Lineup for Operator Service Trunks

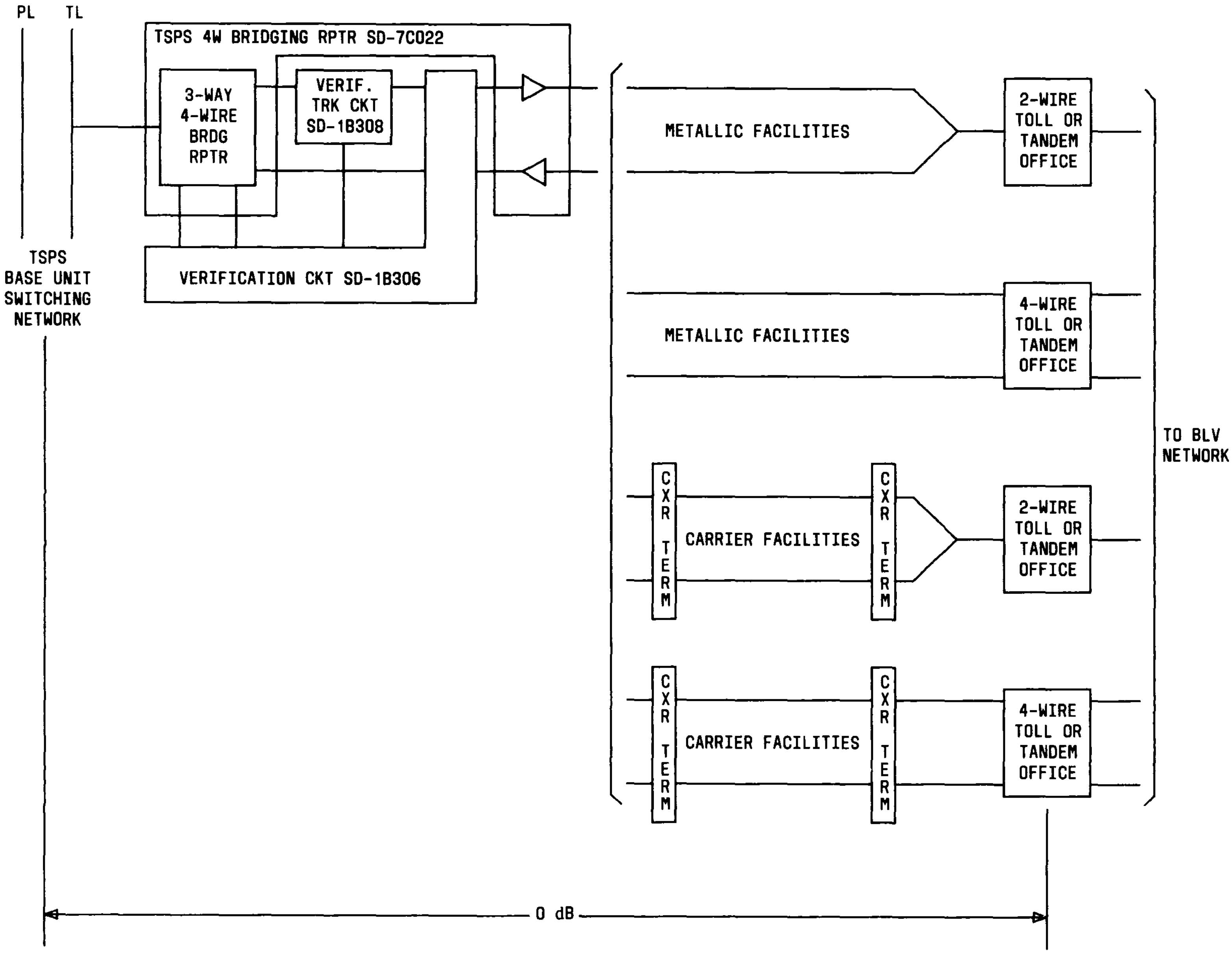
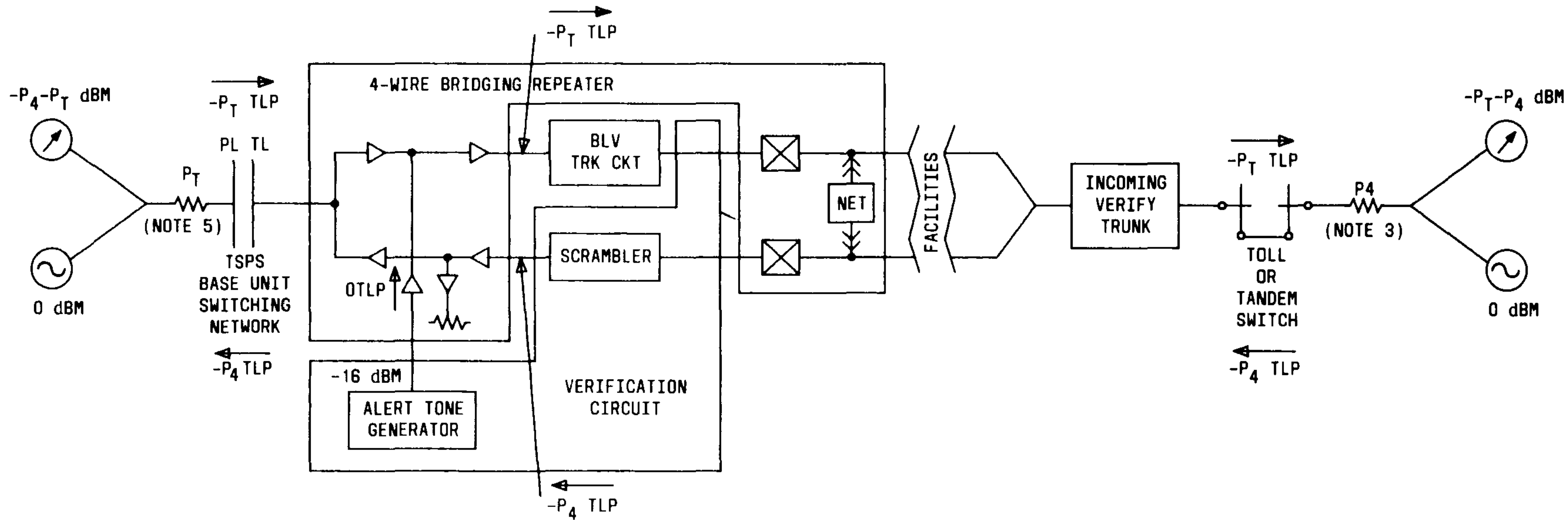


Fig. 41—Facility Arrangement for Busy Line Verification Network Access Trunks



NOTES:

1. INSERTED CONNECTION LOSS (ICL) IS 0.0 DB MINIMUM AND 0.5 DB MAXIMUM IN BOTH DIRECTIONS BETWEEN THE TOLL OFFICE AND THE T1 AND T2 PORTS OF THE TLN.
2. ⊠ IS EITHER A 1C PAD, AN 849C NETWORK EQUIPPED WITH A 89-TYPE RESISTOR, OR A 227-TYPE AMPLIFIER.
3. P4 EQUATES TO TOLL OFFICE TEST PAD VALUE OF 0.0, 2.0, OR 3.0 DB.
4. THE BLV TRUNK CIRCUIT AND VERIFICATION CIRCUIT ARE PLACED IN THE TRANSMISSION TEST STATE WHEN OUTPULSING IS COMPLETED.
5. PT DENOTES THE TSPS TEST PAD WHICH WILL BE EQUAL TO P_4 ($P_T = P_4$)
6. (TMS symbol) REPRESENTS A TRANSMISSION MEASURING SET (TMS).
7. (oscillator symbol) REPRESENTS A REFERENCE OSCILLATOR.

Fig. 42—BLV Network Access Trunk Lineup

This Figure is available from the Indiana Distribution Center (IDC) as a 19" X 36" wallchart. Specify as follows: TSPS No. 1/1B Voice Transmission Configuration - Select Code 425-070.

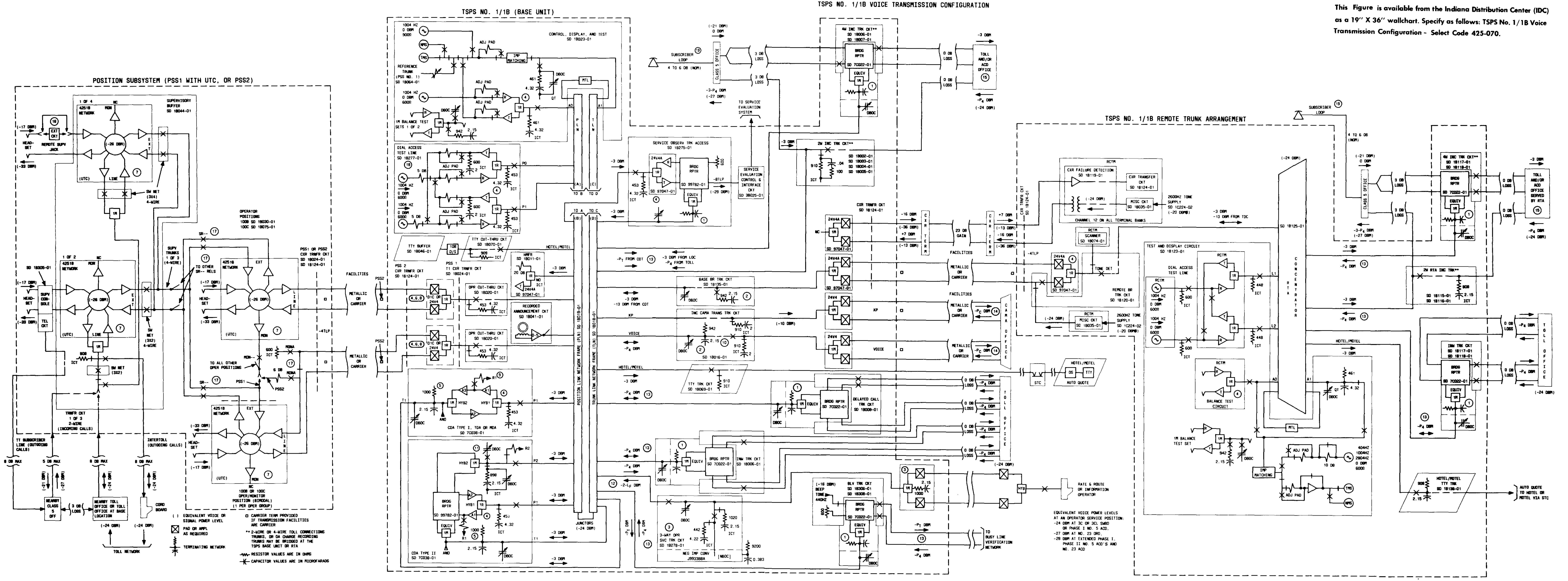


Fig. 43—TSPS No. 1/1B Voice-Transmission Configuration (See Notes on Sheet 2) (Sheet 1 of 2)

TSPS TRANSMISSION DIAGRAM

-2-

(1) THE 1M EQUIVALENT HYBRID IN THE 3 WAY-4 WIRE BRIDGING REPEATER (J99338CA, SD99782-01) SHOULD HAVE THE RECOMMENDED 942 OHM RESISTOR AND 2.15 MICROFARAD CAPACITOR TERMINATING NETWORK (R99, C28). HYBRIDS EQUIPPED WITH A 942 OHM AND 1.93 MICROFARAD NETWORKS ARE ACCEPTABLE.

(2) EXCEPT FOR THE CDA, MDA, TDA, CAMA/KP, AND THE OPERATOR SERVICE TRUNK CIRCUIT, ALL 1M TERMINATING SETS WILL HAVE A TERMINATING NETWORK OF 942 OHMS AND 2.15 MICROFARAD. (THE BASE/REMOTE TRUNK'S TERMINATION IS APPLIED ONLY WHEN THE B/R TRUNK IS SEIZED.)

(3) THE OPERATOR SERVICE TRUNK CIRCUIT ASSOCIATED 1M TERMINATING SET MUST BE EQUIPPED WITH A 1020 OHM RESISTOR AND 2.15 MICROFARAD CAPACITOR TERMINATING NETWORK. THE CIRCUIT IS ALSO EQUIPPED WITH A 1000 OHM RESISTOR AND 2.15 MICROFARAD CAPACITOR (RXT, CXT) "COMPROMISE NETWORK" IN PLACE OF THE BUILT-IN NETWORK. CAPACITOR CXT IS CONNECTED BETWEEN TERMINALS 10 AND 18 AND RESISTOR RXT CONNECTED BETWEEN TERMINALS 11 AND 18 OF THE MATING CONNECTOR. (TERMINAL 18 IS USED AS A TIE POINT).

THE ASSOCIATED NEGATIVE IMPEDANCE CONVERTER (NIC) SHALL HAVE AN EXTERNAL TERMINATION (CXN, RXN) OF 0.383 MICROFARAD CAPACITOR AND 9200 OHM RESISTOR ACROSS TERMINALS 9 AND 10 OF THE NIC. THE NIC ALSO HAS AN IDLE CIRCUIT TERMINATION (ICT) OF 442 OHM RESISTOR AND 4.32 MICROFARAD CAPACITOR (R4, C2) SUPPLIED BY THE TRUNK CIRCUIT. (SD1B278-01).

(4) THERE ARE TWO TYPES OF 1R TERMINATING SETS. ONE IS A FIELD MODIFICATION OF THE 1P TERMINATING SET, AND THE OTHER IS A NEW FACTORY PRODUCT. THE OPERATING COMPANIES CAN ELECT TO FIELD MODIFY THEIR EXISTING 1P TERMINATING SETS TO 1R TERMINATING SETS BY CHANGING THE "COMPROMISE NETWORK" RESISTOR R3 FROM 448 OHMS TO 481 OHMS (1%).

(5) THE 1M TERMINATING SET OR THE EQUIVALENT HYBRID IN THE CDA TYPE I, CDA TYPE II, MDA AND TDA CIRCUITS MUST BE EQUIPPED WITH TERMINATING NETWORK OF 1000 OHM RESISTOR AND 2.15 MICROFARAD CAPACITOR.

(6) FOR REMOTE PSS1, THE T1 CARRIER D1C CHANNEL UNIT (J98711AH1, LIST 1) AT THE BRIDGING END (BASE UNIT) MUST HAVE A 481 OHM RESISTOR, R2, INSTEAD OF 450 OHMS. MODIFIED CHANNEL UNITS ARE IDENTIFIED AS J98711AH1, LIST 1, A.

(7) LEVELS SHOWN ARE ONLY FOR INDICATED POINTS OF METALLIC FACILITY. INTERMEDIATE POINTS OF THE TRANSMISSION PATH CAN VARY DEPENDING UPON FACILITIES USED.

(8) PSS1/LOCAL -- 24V4 OR EQUIVALENT WITH 1R TERMINATING SET.

PSS1/SEMI-REMOTE -- 24V4 OR EQUIVALENT WITH 1R TERMINATING SET.

PSS1/REMOTE -- T1 CARRIER, D1C CHANNEL UNIT J98711AH1, LIST 1, A.

PSS2/LOCAL OR REMOTE -- 24V4A OR EQUIVALENT WITH 1R TERMINATING SET.

(9) PAD OUTPUT CONNECTS TO TONE DETECTOR. TDAs AND MDAs WERE ADDED ON GENERIC 1T10. MDAs ARE ALIGNED THE SAME AS FOR THE CDA TYPE I. FOR TDAs, AMPLIFIER A1 MUST BE ADJUSTED FOR 7dB ADDITIONAL GAIN AND AMPLIFIER A3 MUST BE ADJUSTED FOR 7dB LESS GAIN TO PROVIDE A PAD OUTPUT LEVEL 7dB HIGHER THAN FOR CDA TYPE I AND MDAs.

(10) TRANSMISSION LEVELS DEPEND ON THE TYPE CAMA OFFICE.

(11) THE CDA TYPE II CIRCUIT 1M TERMINATING SET (HYB2) HAS AN 898 OHM RESISTOR AND 2.15 MICROFARAD CAPACITOR IDLE CIRCUIT TERMINATION (ICT).

(12) 600 OHM OR 900 OHM TERMINATING SET IS DETERMINED BY THE OPERATOR SERVICES FACILITY IMPEDANCE. L_F REPRESENTS THE INSERTED CONNECTION LOSS (ICL) OF THE OPERATOR SERVICE TRUNK AND IS VARIABLE (MAXIMUM LOSS IS 5dB). SEE TABLE A.

(13) P_4 = dB LOSS OF TEST PAD AT TOLL OFFICE. IT MAY BE 0, 2, OR 3dB.

P_T = TEST PAD VALUE IN BASE UNIT CDT OR RTA TDC. 3dB WHEN TESTING WITH THE TOLL OFFICE, OR P_4 WHEN TESTING WITH THE LOCAL OFFICE.

(14) P_C IS A LEVEL EQUAL TO THE VALUE OF THE CAMA OFFICE TEST PAD. 2dB FOR ALL CAMA OFFICES EXCEPT 4E OFFICES WHICH ARE 3dB.

(15) DIRECTORY CHARGE RECORDING TRUNKS ONLY GO TO THE ACD.

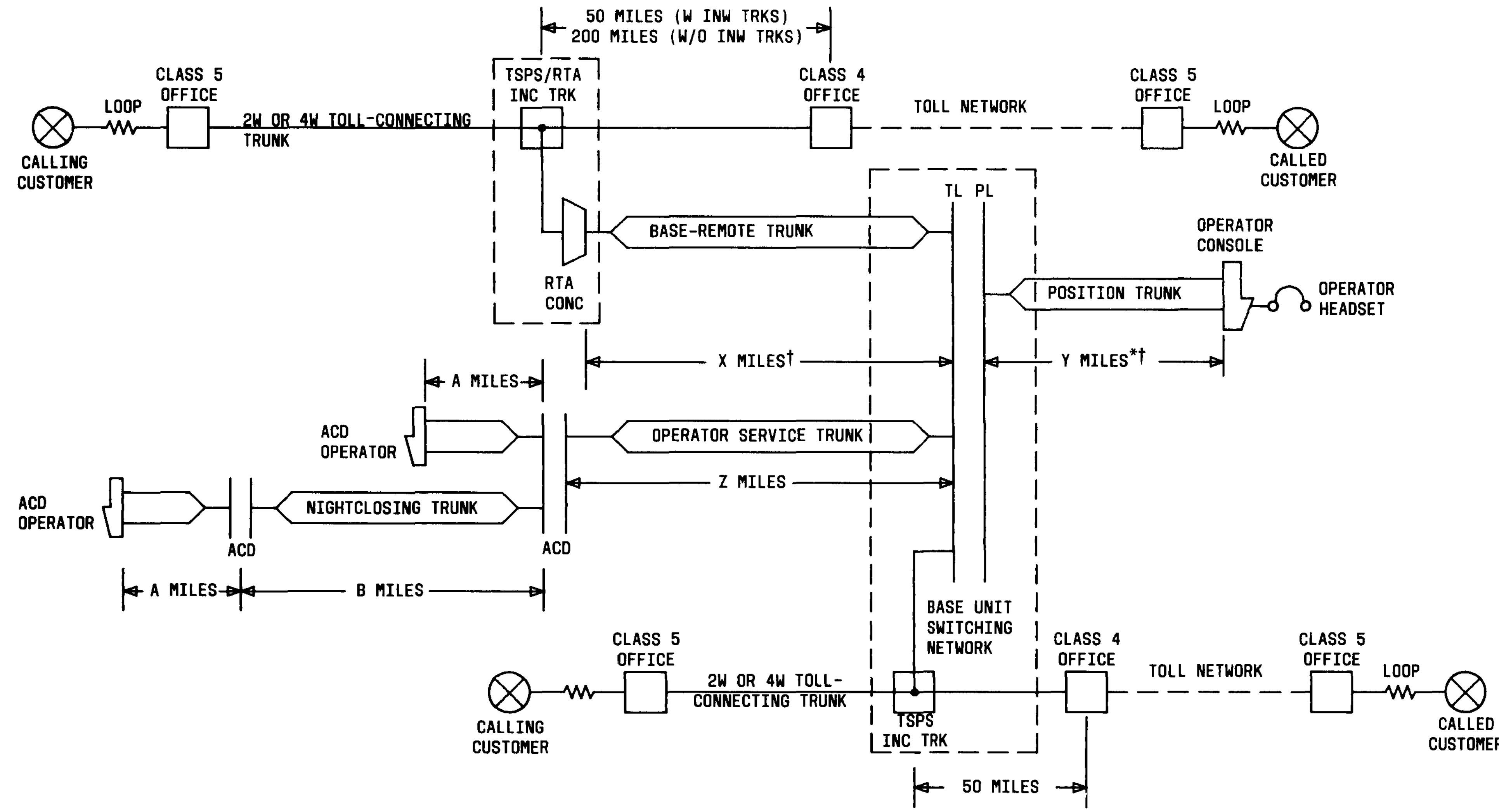
(16) HEADSET TRANSMITTER EXTENSION CIRCUIT (300 OHMS) IS TO BE USED WHEN THE CABLE DISTANCE FROM THE SUPERVISOR'S REMOTE HEADSET JACK EXCEEDS 100 FEET OR THE LOOP RESISTANCE IS GREATER THAN 5 OHMS. (SD 1B030-01 OR SD 1B075-01)

(17) SR -- RELAY CONTACTS SHOWN ARE PART OF SD1B028-01, POSTIION BUFFER CIRCUIT FOR PSS1; AND PART OF SD1B078-01, VOICE PATH CONTROL CIRCUIT FOR PSS2.

(18) THE D AND E RELAYS ADDED ON SD1B277-01, ISSUE 3B (FS2) ARE REQUIRED AT ALL BASE UNIT LOCATIONS, EFFECTIVE WITH TSPS GENERIC 1T10, ISSUE 2.

(19) SUBCRIBER LINES WARE TO HAVE A NOMINAL INSERTED CONNECTION LOSS OF 4 TO 6 dB WITH A MAXIMUM LOSS OF 7.9 dB.

Fig. 43—TSPS No. 1/1B Voice-Transmission Configuration (Notes) (Sheet 2 of 2)



NOTE 1: MILEAGE LIMITS WITHOUT COMPANDORS
$X+Y \le 400$ MILES - TSPS ONLY
$X+Y+Z+A \le 350$ MILES - TSPS/DA CHARGING, NO NIGHTCLOSING TRUNKS
$X+Y+Z+A+B \le 400$ MILES - TSPS/DA CHARGING OR SERVICE ASSISTANCE VIA NIGHTCLOSING TRUNKS

NOTE 2: MILEAGE LIMITS WITH COMPANDORED L-CARRIER
$X+Y \le 1000$ MILES - TSPS ONLY
$X+Y+Z+A+B \le 850$ MILES - TSPS/DA CHARGING WITH, OR WITHOUT NIGHTCLOSING TRUNKS
$X+Y+Z+A+B \le 1000$ MILES - SERVICE ASSISTANCE WITH, OR WITHOUT NIGHTCLOSING TRUNKS

* PSS NO. 1 POSITION TRUNKS (Y) ARE LIMITED TO 50 FACILITY ROUTE MILES OR LESS

† BASE-REMOTE TRUNKS (X) AND PSS NO. 2 POSITION TRUNKS (Y) MAY BE LIMITED BY THE 8.8 ms ONE-WAY PROPAGATION DELAY LIMIT ON PCL

Fig. 44—TSPS Facility Route Mileage Limitations (See Notes)

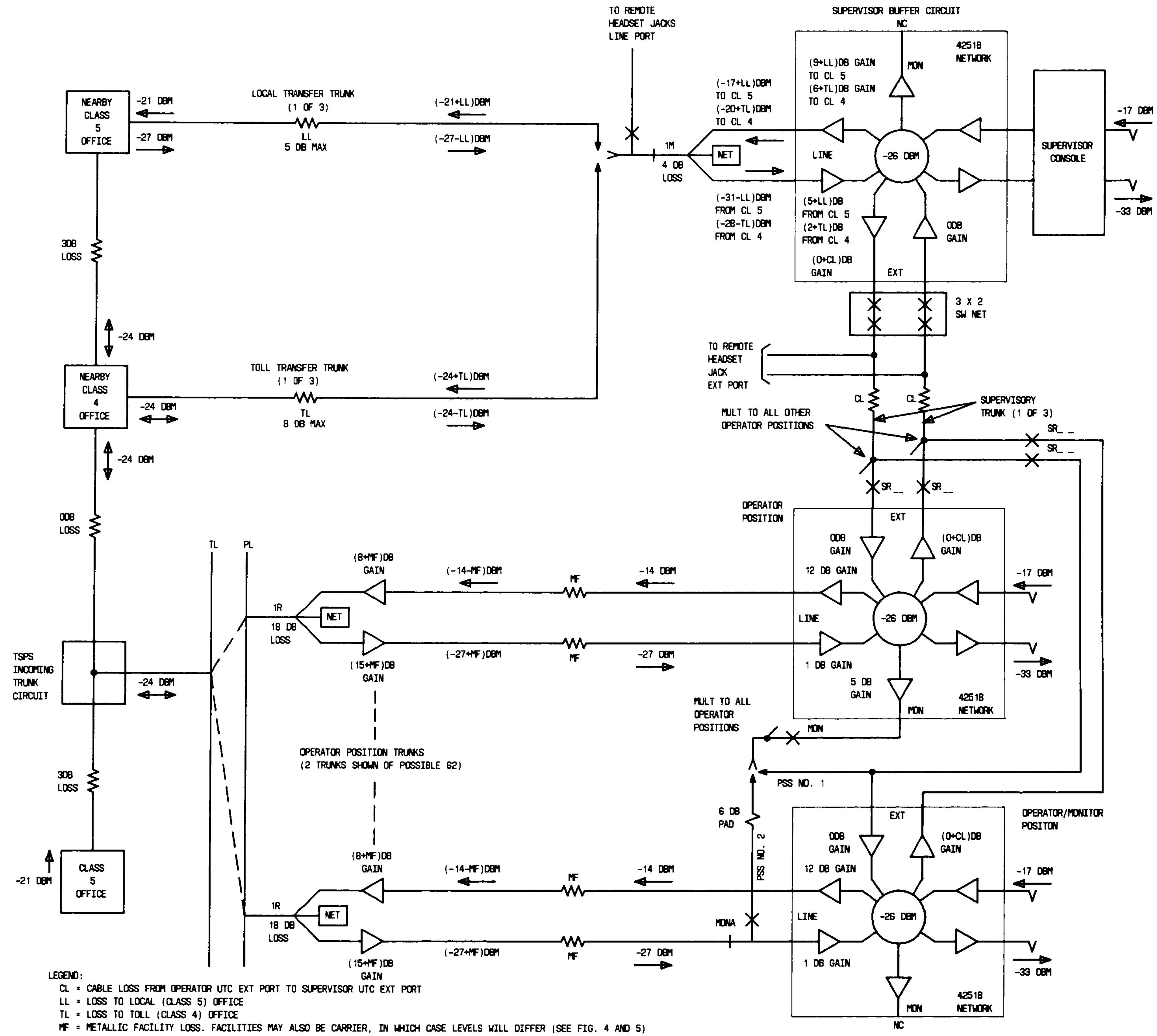
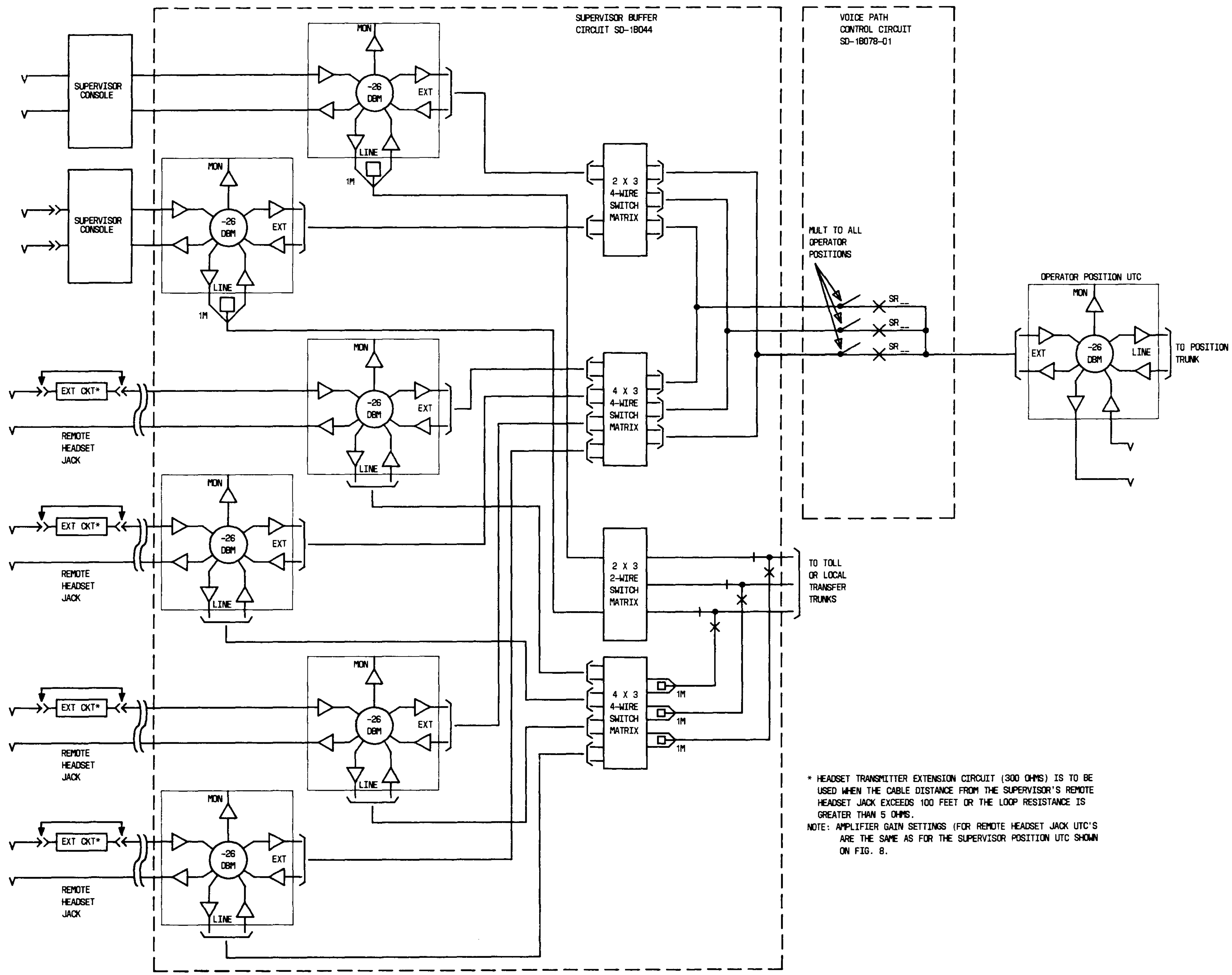


Fig. 45—Alignment Levels for Transfer Trunks



* HEADSET TRANSMITTER EXTENSION CIRCUIT (300 OHMS) IS TO BE USED WHEN THE CABLE DISTANCE FROM THE SUPERVISOR'S REMOTE HEADSET JACK EXCEEDS 100 FEET OR THE LOOP RESISTANCE IS GREATER THAN 5 OHMS.

NOTE: AMPLIFIER GAIN SETTINGS (FOR REMOTE HEADSET JACK UTC'S ARE THE SAME AS FOR THE SUPERVISOR POSITION UTC SHOWN ON FIG. 8.

Fig. 46—Supervisory Buffer Circuit (See Note)