

PRESERVICE AND MAINTENANCE TESTS FOR ALL TYPES OF MESSAGE TRUNKS

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A. General	4	1.01 This section provides information on the preservice and maintenance tests required for message trunks in the message telecommunications service (MTS) network. The message trunks consid- ered in this section have the following traffic use codes: CA, DD, DT, IE, IT, LW, MN, MT, OA, OJ, OO, RC, SP, TC, TE, TG, TM,, TO, TS, and TT. These traf- fic use codes are defined in Table L and in Section 795-400-100. This section does not include operator service trunks (TSPS and ACD) which are covered in Section 660-450-303*. It also does not cover interna- tional trunks which are covered in Section 660-630- 350.	
B. Summary of Preliminary Tests	4	1.02 This section is reissued to consolidate the test requirements for preservice and maintenance tests into a single section to enable a more uniform and complete updating of requirements when neces- sary. In general, the following changes have been made as a result of this reissue:	
4. TESTING OF TRUNKS THAT REQUIRE SPECIAL CONSIDERATIONS	4	• Requirements for 1004-Hz loss and gain- slope have been updated.	
A. Trunks Containing E-Type SF Signaling Circuits With Built-In 4-Wire Terminat- ing Circuits	4	• Requirements have been added for 1004-Hz loss and gain-slope tests on multimode trunks.	
B. Trunks Containing T1 Carrier Channels With D1 Channel Units	5	• Requirements for C-message and C-notched noise have been added.	
5. OVERALL TESTS REQUIRED BETWEEN TRUNK TERMINALS	5	• Impedance balance requirements have been added.	
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* To be issued.

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SECTION 660-450-301

- Information concerning routine maintenance of message trunks as well as routine maintenance test requirements have been added
- The section title has been changed to reflect the addition of the routine maintenance information.
- The terms “trunk order” and “circuit order tests” have been replaced with the equivalent term “preservice tests.”
- Information has been added concerning signaling tests.
- Tables A through N have been updated.
- The discussions of expected measured loss (EML), compensation for test access loss, “record only” changes, and setting of carrier group alarm (CGA) options have been clarified.

Since this is a general revision, change arrows have not been used. The transmission parameters monitored by routine maintenance have been expanded to include five parameters: 1004-Hz loss, gain-slope, C-message noise, C-notched noise, and terminal balance. Where Centralized Automatic Reporting on Trunks (CAROT) is available, these parameters may be measured by CAROT demand tests. The Trunk Integrated Record Keeping System (TIRKS) is being modified to record the expanded maintenance parameters. The requirements in this section are compatible with TIRKS.

1.03 The term circuit records will be used throughout this section to denote the trunk or circuit order records such as the Work Order Record and Details (WORD) document from the Trunks Integrated Details document from TIRKS, and the Circuit Layout Record (CLR), or equivalent.

1.04 *The tests outlined in this section require that testing personnel be thoroughly familiar with Section 660-450-300, which gives the following information:*

- (a) Importance of making the tests and of meeting the test requirements,
- (b) Explanation of the terms used in the tests,
- (c) The three basic segments of a trunk,

- (d) Testing arrangements provided at testboards and at other locations.

1.05 *The testing personnel should also be thoroughly familiar with sections in the following categories:*

- (a) All sections defining the codes and abbreviations used on trunk records
- (b) All sections giving methods and procedures for tests and adjustments at the specific test location
- (c) All sections giving methods and procedures for reporting completion.

1.06 The circuit records and the appropriate testing procedures must be understood and followed exactly when trunks are measured to ensure that:

- (a) The correct levels of test signal are used when connecting test equipment to a trunk,
- (b) Equipment having the proper impedance is used,
- (c) Allowance is made for test pads as specified on the circuit records.

1.07 All test equipment (meters, tone supplies, etc), test access, test lines, and other related equipment should be checked to ensure proper operation.

1.08 Tables A through N list sections giving information on trunk records, testing methods and procedures, test requirements, and references for information or requirements. Table L lists the definitions of the common language codes used in Tables O through Y. Table M is a summary of the preliminary tests to be performed on trunk components. Table N is a summary of the preservice tests required before a trunk is placed in service. Tables O through Y list the applicable test requirements for message trunks.

1.09 Standard test frequencies are 1004 Hz for loss measurements and 404 Hz, 1004 Hz, and 2804 Hz for gain-slope frequency response measurements. The 71G tone generator as well as the 52- and 56-type responders used in the Automatic Transmission Measuring System (ATMS) and CAROT systems provide these frequencies. The 4 Hz offset from 400 Hz,

1000 Hz, and 2800 Hz prevents slow gain variations (± 0.25 dB at 1000 Hz) which occur in T-carrier, No. 4 ESS, and other digital systems on test tones which are harmonically related to the 8 kHz sampling rate.

2. APPLICATION OF PRESERVICE TESTS

2.01 Preservice tests are based on the objective of providing good service to all customers and to assure the capability of the network to support both voice and voice-grade data transmission. Meeting this objective depends upon the ability to provide a high quality of transmission on every message trunk. From a transmission viewpoint, there is no longer any distinction between toll- and exchange-type trunks.

2.02 The term preservice test is used in this section to indicate the transmission and operational tests required on all types of message trunks when trunk or circuit orders authorize a new trunk group or an addition to an existing trunk group or when circuit or trunk orders authorize rearrangements of equipment or facilities, assigned to existing trunk groups. This includes all trunks affected by the cut-over of new switching systems. Preservice tests include both tests on individual components performed during installation work in individual offices and end-to-end tests performed prior to turning up the circuit for service.

2.03 Record changes which involve no changes or adjustments in facilities, equipment components, or EML values (eg, change in control office) require no testing other than routine tests. In No. 4 ESS offices, this may be accomplished by use of the Circuit Maintenance System (CMS) "Record Change Only" feature.

2.04 When CAROT is used for routine testing or for preservice testing, processor controlled interrogator tests or manually controlled interrogator tests can be performed. The values obtained for 1 KHz loss, C-message noise, C-notched noise, terminal balance, and gain-slope should be used in preference to manual test results for satisfying these test requirements. Trunk and Facilities Maintenance System/Outgoing Trunk Testing System (TFMS/OTTS) test results may also be used instead of manual test results. Manual tests will still be required for pulsing and alternate mode transmission tests which CAROT does not make.

2.05 Two components of access loss must be considered when loss measurements are made.

(a) Access loss at the originating end is the loss between the actual point of measurement and the outgoing switch appearance. This appearance is the near-end signal reference point for the trunk under test. In some cases, particularly in No. 5 crossbar offices, the EML listed in the trunk records (WORD document or CLR card) has included this access loss.

(b) Access loss at the terminating end is the loss between the completing side of the switch in the far-end office (the far-end signal reference point) and the milliwatt supply or equivalent.

- The terminating end access loss is normally compensated for by adjusting the milliwatt supply to provide a milliwatt at the completing side of the switch. Responders operating as a test signal source, as well as milliwatt test lines, are adjusted to provide a milliwatt at this reference point. Terminating end access loss is then considered to be zero and can be ignored.

2.06 CAROT and TFMS use gain to compensate for the originating end access loss. For manual testing, the originating end access loss may be compensated for if a test pad is present which can be adjusted to the nominal value minus the test access loss to provide the proper test levels. In the case of manual testing where test pads are not present, the originating end access loss is not compensated for and must be measured and posted in a conspicuous place at the manual test facilities. All the manual measurements should be adjusted to reflect the values at the reference point. Manual measurements, adjusted by the posted originating end access loss factor, should equal the CAROT or TFMS measurements within the accuracies of the various measuring systems. **However, if manual measurements differ from CAROT or TFMS measurements, the CAROT or TFMS test results should agree with the defined EML.** Typical methods of compensating for originating and terminating end access loss are shown in Fig. 1.

2.07 Note that the EML is defined as the loss between the outgoing switch appearance at the originating end and the completing side of the switch at the far-end office (between the near-end and far-end reference points) plus the test pads (if present) in both offices. In the past, the EML listed in the trunk records was allowed to include the originating end access loss, if not compensated for, and therefore represented the levels at the actual measuring point

rather than the levels at the defined reference point. However, since the automated testing systems such as CAROT and TFMS reflect the EML as defined, the listed EML should be changed to reflect the defined EML values nominally measured by the automated systems.

3. PRELIMINARY TESTS REQUIRED ON EQUIPMENT COMPONENTS AND FACILITIES

A. General

3.01 Before any tests are made between trunk terminals, it must be verified that suitable service and acceptance tests have been made on the appropriate trunk elements, such as cable or open-wire facilities and line and office equipment, including telephone repeaters, signaling equipment, carrier telephone systems, etc.

3.02 Any trunk components which are being put into service, rearranged, or which are to have options changed must pass all applicable tests given in Table M. If cable pairs are changed, associated 4-wire terminating sets should be rebalanced. These preliminary tests and adjustment are not required on equipment components in a given central office if the equipment has been in service immediately before installation in the present layout and the circuit or trunk order does not affect the layout in the central office.

3.03 When multi-terminal repeating coils, such as the 120G or the 120P, are specified, they should be checked to verify that they are strapped to the ratio specified on the circuit or trunk order and that they are properly connected in the circuit. Build-out networks, impedance compensators, pads, or low-frequency correctors, if used, must be correctly installed and adjusted according to the circuit or trunk order.

3.04 Repeaters of any type, if used, must be connected and adjusted to the required gain and all options selected as indicated on the circuit records before overall transmission measurements are made. The repeaters should meet all installation, acceptance, and pre-service tests as specified in the appropriate sections listed in Table C.

3.05 Carrier group alarm (CGA) options on carrier systems and single-frequency (SF) signaling systems must be selected and checked during instal-

lation. ESS scan points for CGA must be connected and checked.

3.06 Signaling units must be checked for proper options, operation, and loss according to the appropriate sections listed in Table E.

3.07 Common Channel Interoffice Signaling (CCIS) voice frequency links (VFL) must be checked for proper operation according to the procedures of Section 660-450-507. Further information on CCIS testing is given in the sections listed in Table E. Tests listed in Parts 5 and 6 and in Table N do not apply to CCIS voice frequency links.

3.08 Office wiring and equipment losses must be measured and adjusted to meet the transmission requirements for each trunk. The testing procedures are given in the appropriate sections listed in Table G.

B. Summary of Preliminary Tests

3.09 Table M lists the preliminary tests required for equipment components and facilities assigned to new installations and for current installations involving rearrangements or additions to existing trunk groups.

4. TESTING OF TRUNKS THAT REQUIRE SPECIAL CONSIDERATIONS

A. Trunks Containing E-Type SF Signaling Circuits With Built-In 4-Wire Terminating Circuits

4.01 When transmission measurements are made on trunks containing some types of E-type SF signaling circuits with built-in 4-wire terminating circuits, the loss to the input of the carrier channel is approximately -16 dB and is *not* adjustable. If these trunks are tested with a test pad (TP2), investigating transmission troubles requires extra alertness for the following reasons:

- When signals are being sent through the 2 dB test pad, the input level to the carrier is approximately -18 dBm instead of -16 dBm and the output level from the carrier at the distant end is approximately +5 dBm instead of +7 dBm.
- During initial alignment or trouble investigation, the carrier channel itself is always

measured with -16 dBm test signal at the voice-frequency (VF) patching bay in order to obtain $+7$ dBm at the distant terminal.

B. Trunks Containing T1 Carrier Channels With D1 Channel Units

4.02 The 2-wire D1 channel unit for D1 channel banks contains a built-in, unadjustable, 4-wire terminating circuit. When a transmission measurement is made, 0 dBm is applied in a TPO office at a 0 test level point (TLP) the input power to the carrier is nominally -9.25 dBm measured at the channel jack through J98711M matching network. The output power of the carrier in the distant office is nominally $+2.5$ dBm for D1D and $+2.25$ dBm for D1A and D1B channel banks.

4.03 If trunks assigned to D1 channel units are measured with a test pad, (TP2) investigating transmission troubles require extra alertness. When signals are being sent through a 2 -dB test pad (ie, a 0 dBm signal applied at 0 TLP in a TP2 office), the input power to the carrier is approximately -11.25 dBm instead of -9.25 dBm and the output power from the carrier channel at the distant end is approximately $+0.5$ dBm for D1D and $+0.25$ dBm for D1A and D1B instead of $+2.5$ dBm and 2.25 dBm.

4.04 The 4-wire E and M D1 channel unit for D1 channel banks permits the establishment of the proper transmitting level with or without a test pad (TP2) at the 4-wire switching office. But the introduction of the required loss at the distant 2-wire switching office to permit use of a TP2 pad is not provided for. Therefore, in arrangements involving a 2-wire D1 channel unit at one end and a 4-wire D1 channel unit at the other, the considerations of paragraph 4.03 apply at the 2-wire end. Arrangements involving 4-wire units at both ends will result in standard levels being measured.

4.05 Toll connecting trunks assigned to 2-wire D1D channel units are measured with a 3 -dB test pad (TP3) at a No. 4 ESS office. The required additional loss at the distant 2-wire switching office to establish proper transmitting levels is possible only with new or modified channel units and the considerations in paragraph 4.03 are not required.

5. OVERALL TESTS REQUIRED BETWEEN TRUNK TERMINALS

A. General

5.01 Since most trunks are selected by automatic switching systems, overall tests between trunk terminals *must* be performed before trunks are placed in service to ensure that any message trunk likely to be switched into service in the MTS or other networks meets the overall service objectives.

5.02 The overall lineup tests listed in Table N are required between the originating and terminating terminals of all trunks. The tests are required to ensure that each complete trunk meets the requirements for which it was designed. Any trunk failing to meet its requirements should not be turned up for service. Any problems which cannot be resolved by field forces should be referred to the Field Assistance Bureau, the Circuit Provisioning Center, or local management per local practices.

B. Modes of Operation

5.03 One-way trunks are always used as outgoing trunks at one of their terminal offices and as incoming trunks at the other. These trunks are tested for operational performance (call set-up) in this direction. Two-way trunks are used as outgoing trunks at either of their terminal offices. When a 2-way trunk is first aligned to meet EML requirements, it is tested and measured as an outgoing trunk at the control office and as an incoming trunk at the noncontrol office. However, a 2-way trunk must also be tested for operational and transmission performance as an outgoing trunk from the non-control office as part of the preservice tests. Generally both 1-way and 2-way trunks must be tested for transmission performance in both directions; exceptions are covered in Parts 5E, 5F, and 5G.

C. Multiple Access Modes of Operation

5.04 Some trunk arrangements allow access or termination in two or more modes of operation. These modes may require different paths through the office, different wiring arrangements, and sometimes, different apparatus. Each mode of operation must be checked to determine whether the trunk meets all its requirements. If different apparatus is used or if there are significant differences in wiring loss, different EMLs and gain-slope limits may apply.

It is necessary, therefore, to test both 1004-Hz loss and gain-slope in each mode where there is a difference. Table O lists the required 1004-Hz loss and gain-slope tests by switching system and trunk type. The different modes of operation are:

- (a) **2-way trunks:** Different paths through the office and within the trunk equipment at each end depending on which end originates a call as discussed in paragraph 5.03.
- (b) **Trunks with switchboard and machine access:** Different paths and, sometimes, different EMLs for calls originated from the switchboard, or from the testboard manual or automatic testing arrangements. Some ESS trunk circuits switch an isolation transformer and loop impedance compensation network.
- (c) **Incoming or 2-way trunks to 2-train No. 4-type crossbar offices:** All incoming trunks can interconnect with outgoing trunks located on the intertoll or the toll-completing train. They should be able to complete to outgoing trunks located on either train.
- (d) **Incoming trunks to No. 5 crossbar, step-by-step, and No. 1 ESS offices:** Some trunks can complete to an intertoll, toll connecting or tandem trunk, or to a subscriber line. Different apparatus may be switched into the trunk circuit for each mode. Figure 2 shows a typical example of this mode of operation in a No. 5 crossbar office.
- (e) **Outgoing trunks from No. 5 crossbar and No. 1 ESS offices:** Some trunks can be accessed directly from a subscriber line, from an incoming tandem or toll connecting trunk, or from an incoming intertoll trunk. The EML is usually different for each mode. Figure 3 shows a typical example of this mode of operation in a No. 5 crossbar office.

D. Supervision

5.05 When transmission and noise measurements are being made on a trunk, the trunk must be in the off-hook condition at both terminals. This is done to remove SF signaling tone and disable the SF signaling unit filter where SF signaling is used, and to remove idle circuit terminations, and place the trunk in the talking state. All test lines used for transmission and noise

measuring (eg, 102-type milliwatt supply test line, the 100- and 105-type balance test lines, or the 101-type test line) should be checked to ensure that off-hook supervision is provided. This requirement does not apply to trunks incoming to switchboards where supervision is not normally passed through the switchboard.

E. CAROT Testing

5.06 CAROT should be utilized for preservice and maintenance testing wherever possible. The CAROT system provides features which allow demand (request) testing on trunks on a real time basis with rapid test analysis. Available CAROT controlled demand tests include 1004-Hz loss, gain-slope, C-message noise, C-notched noise, and terminal balance (echo return loss and singing return loss). Manual tests will still be required for pulsing and alternate-mode transmission tests which CAROT does not make.

5.07 CAROT 2 can make demand tests via the Remote User Terminal, the Remote Office Test Line (ROTL) test set, the Responder ROTL Control Unit (RRCU), or the Circuit Maintenance System (CMS 1) in No. 4 ESS offices. Use of the Remote User Terminal for demand testing is outlined in Section 190-102-305, Remote User Terminal Operation. The use of TFMS/OTTS (Outgoing Trunk Testing System), Processor Controlled Interrogator (PCI), Manually Controlled Interrogator (MCI) or RRCU is equivalent to CAROT.

F. 1004-Hz Loss Measurements

5.08 Measurement of 1004-Hz loss is made at a test level of 0 dBm0. A 1004-Hz measurement is also required at -16 dBm0 as part of the gain-slope test as covered in paragraph 5.11.

5.09 Preservice 1004-Hz loss tests should be made between all access points and in all operating modes as discussed in paragraph 5.04 and Table O. Because each direction of transmission is essentially independent of the other, each direction must be individually adjusted. Two-way measurements are required for the following:

- (a) On 2-wire voice frequency trunks equipped with hybrid-type repeaters (ie, Metallic Facility Terminal [MFT] repeaters)
- (b) On 4-wire voice frequency repeatered trunks

- (c) On trunks assigned to carrier channels
- (d) On all trunks terminated in 4-wire switching systems.

5.10 Two-way manual 1004-Hz loss measurements require the use of 101-type test lines, or equivalent jack-ended test lines, at distant testboards and maintenance centers. (See paragraphs 2.05 through 2.07 for information on access loss compensation.) The overall AML of any trunk should not differ from the EML by more than the permissible deviations listed in Table P. When an overall measurement indicates the need for corrective action, the trunk segments should be checked individually and corrected. **No change is to be made in any segment on the basis of an overall measurement and no segment is to be changed to compensate for deviations from requirements in any other segment.**

Note: Exceptions to the above include voice frequency repeatered trunks. The total gain of the repeaters can be adjusted a maximum of ± 1.0 dB to meet the overall EML requirements.

G. Gain-Slope Measurements

5.11 The procedures for gain-slope measurements are similar to those for 2-way manual 1004-Hz loss measurements except that the test frequencies and tone levels are different. The test frequencies used in gain-slope measurements are 404 Hz, 1004 Hz, and 2804 Hz. Gain-slope test signals are transmitted at -16 dBm0. Table Q shows the 404 Hz and 2804 Hz gain-slope requirements relative to 1004 Hz. Gain-slope measurements are required on all message trunks. The same requirements for testing in both directions of transmission apply to gain-slope tests as for 1004 Hz loss tests (see paragraph 5.09). Tests are required between all access points and in operational modes as discussed in paragraph 5.04 and shown in Table O.

5.12 Some trunks have alternate access and termination points and/or alternate operational modes. Gain-slope tests are required between all access points and in all operational modes as discussed in paragraph 5.04. Gain-slope tests are also required in both directions of transmission as discussed in paragraph 5.09 concerning 1004-Hz loss tests. Table O lists the gain-slope tests to be performed for each trunk type. Where adjustments in the EML are re-

quired for testing in alternate modes, these adjustments are given in Table O. Routine testing of the gain-slope of alternate modes is not required. Preservice gain-slope of alternate modes are required at 1004 and 2804 Hz; the 404 Hz test is not required in alternate modes.

5.13 When gain-slope measurements are made on a trunk equipped with SF signaling equipment, precautions should be taken to prevent false disconnects by avoiding frequencies from 100 Hz above to 100 Hz below the 2600-Hz signaling frequency (ie, between 2500 Hz and 2700 Hz).

H. Noise Measurements

5.14 *It is always desirable to make 1004-Hz loss measurements before noise measurements.* The value of the actual measured loss (AML) as well as the noise measurement should be recorded. The cause for any abnormal deviation between the AML and the EML should be determined and corrected before the reasons for excessive noise are investigated as low loss values can sometimes result in high noise readings.

5.15 Two types of noise measurements are specified for preservice and maintenance tests: C-message noise and C-notched noise. C-message noise is measured with a noise measuring set equipped with a C-weighting network to approximate the effect of noise on the human ear. C-notched noise measurements are required because of the widespread use of digital carrier and compandored analog carrier. To measure digital quantizing noise and to measure noise on compandored facilities without the noise masking effect of the compandor, a 1004-Hz tone is inserted on the facility and filtered out prior to measurement. Preservice and maintenance testing requires measuring both C-message and C-notched noise. The C-message noise levels are not to exceed the limits given in Tables R through W; C-notched noise limits are given in Table X.

5.16 Noise measurements should be made at both ends of all trunks. However, for 2-wire nongain or E-type repeatered trunks the noise at the distant end may be estimated by adding the AML to the noise measurement at the near end as discussed in Section 660-403-500. If the estimated noise exceeds the requirements, the actual noise at the distant end should be measured.

SECTION 660-450-301

I. Through and Terminal Balance Tests

5.17 In 2-wire offices of class 3 or higher rank, all new or rearranged intertoll trunks must meet through balance test requirements before they are placed in service. In 2- and 4-wire class 3 and higher offices, secondary intertoll trunks must meet through balance requirements. Through balance tests are given in the appropriate sections listed in Table G.

5.18 Terminal balance tests are required for all 2- and 4-wire offices of class 4 or higher rank performing toll switching functions, including decentralized toll offices (class 4P). In addition, individual echo return-loss tests are required for all 4-wire terminating sets associated with an intertoll or 4-wire toll connecting trunk in a 2-wire switching entity. Terminal balance tests are given in the appropriate sections listed in Table G.

5.19 It will be necessary to have completed all loss, noise, and gain-slope tests before balance testing is carried out. Balance tests and adjustments must be made on all new and rearranged trunks before they are placed in service if the connecting office is a class 4, or higher, office. If the balance measurement results meet or exceed the requirements given in Table Y, the measurements are recorded and no further action is necessary. Should the measurement results of any test fall below these requirements given in Table Y, the measurements are recorded, the transmission engineer notified, and the appropriate corrective action taken.

5.20 Any changes, such as circuit order and traffic load balancing rearrangements, which may affect balance make it necessary for new balance measurements to be made and recorded. In this category are:

- (a) Any wiring changes between hybrid and switch on an intertoll trunk.
- (b) Any wiring changes between a fixed impedance point (impedance compensation, 2-dB pad, or channel bank hybrid) and a switch on a toll connecting trunk.
- (c) Any facility changes on 2-wire toll connecting trunks.
- (d) Any wiring changes in the end office of a toll connecting trunk.

(e) A change in the office NBO value.

(f) Installation of Traffic Service Position System (TSPS) or Remote Trunking Arrangements (RTA).

(g) Removal of toll switchboards.

5.21 Table Y contains requirements for balance tests from office to office and from office to switchboard. Trunks with TSPS access require further tests which are covered in Section 660-450-303 and Section 660-463-301.

J. Automatic Test Frame Access Check Tests

5.22 In offices equipped with automatic trunk test frames, a check should be made to ensure that each test frame can obtain access to each new or rearranged trunk before the trunk is placed in service. The methods for making these checks are given in the sections on their specific test frames.

5.23 Overall pulsing tests are required only on trunks using dial pulse addressing. MF and CCIS require no pulsing tests (transmission tests verify MF addressing and CCIS addressing is verified by CCIS system tests). If a trunk has dial pulse (DP) signaling in one direction and MF in the other, pulsing tests are made only in the DP direction. Requirements for pulsing tests and test methods are given in Sections 332-123-500 and 332-124-500.

5.24 Signaling tests are made on all nonCCIS trunks to verify supervisory functions. These tests are made to synchronous, non-synchronous, or 103-type test lines. These tests are covered in Section 660-403-504 (although this section is written for trunks with SF signaling, the tests covered apply to all trunks).

5.25 Operational tests are required on all nonCCIS trunks to verify that the trunks can complete calls to the terminating switching machine (the Translation Integrity Check performs this function for CCIS trunks). Generally a call to a test line at the terminating office will verify proper operation. In order to test trunks that terminate on both the incoming intertoll and toll completing trains of a No. 4 crossbar switching system, a supplementary check should be made to test code 959 which appears on the toll completing train.

6. ROUTINE MAINTENANCE TESTS

6.01 The new routine maintenance testing plan includes testing of five transmission parameters: 1004-Hz loss, C-message noise, C-notched noise, gain-slope, and terminal balance. The purpose of these additional routine maintenance tests is to improve the performance of the message network and to further assure the capability of the network to support both voice and voice-grade data transmission. The necessary modifications will be made in the CAROT and TIRKS systems to provide automatic testing and recording of these parameters.

6.02 Any trunk which fails a maintenance limit will affect the maintenance index (TTMI or NTTMP). Such trunks should be considered for repair as needed to maintain objective index levels. A trunk which is at, or below, any immediate action limit must be removed from service until repaired. A repaired trunk must meet preservice limits before being restored to service.

6.03 Routine loss and gain-slope tests are not required for all operational modes of multimode trunks. For trunk circuits in No. 1 ESS, No. 2 ESS, and No. 5 crossbar offices used in both tandem and local modes, only one mode is used for routine testing.

The mode to be tested should be that for which the trunk was designed and aligned and/or that used for CAROT testing. In No. 4A crossbar offices, routine tests on incoming trunks are made either to the toll completing train or to the intertoll train depending on where the test line to be used is located.

7. FORMS AND RECORDS

7.01 Form E-2545A, described in Section 660-450-010, or an equivalent form, is used to record trunk order or circuit order test results on all types of message trunks (except in No. 4 ESS offices). No. 4 ESS offices are to record test results on the appropriate E-600X, or equivalent, form. The form is always completed by the designated control office for each trunk or circuit order. The noncontrol office prepares the appropriate form for its own office, completing the items required for that office.

7.02 The WORD document from TIRKS may be used as a replacement for Form E-2545A. Companies using the WORD document should refer to Section 682-400-010 for the description and objectives of the document.

7.03 In No. 4 ESS offices, circuit layout cards and the form for recording trunk order or circuit order test results are provided on cathode ray tube (CRT) displays by the Circuit Maintenance System. These displays are described in Section 234-103-010.

TABLE A

INFORMATION ON TRUNK RECORDS—ABBREVIATIONS, CODES, AND COMMON LANGUAGE

SUBJECT	SECTION
Codes for Trunk Details	682-100-010
Codes for Trunk Details	682-100-011
Codes for Repeater Data	682-100-012
Codes for Line Assignment Entries	682-100-013
Codes for Line Equipment	682-100-014
Codes for Signaling Equipment	682-100-015
Codes for Other Equipment Entries	682-100-017
Trunk Numbering	682-100-018
Abbreviations and Symbols Used in Preparing Toll Message and Special Service Layout Record Cards	682-000-100
DC Signaling Paths Used With Toll Message Circuits	682-100-016
Word Document	682-400-010
<i>Plant Assignment—Circuit Layout Record</i>	
Description	682-000-011
<i>Common Language—Descriptive Information</i>	
Circuit Identification	795-400-100
Standard Coding Procedures—Equipment Identification	795-200-000
Central Office Equipment Configuration Identification	795-500-000
Facility Identification	795-450-100
Location Identification	795-100-100
Common Language Codes Used in Table M Through Y	Table L

TABLE B

INFORMATION ON TESTING CABLE AND OPEN-WIRE FACILITIES

SUBJECT	SECTION
<i>Cable and Open-Wire Testing</i>	
Voltmeter and Wheatstone Bridge Testing	660-807-500
<i>Exchange Area Cables</i>	
Completion Tests	330-300-500

TABLE C

**TRUNK RECORDS AND TESTING INFORMATION
VOICE-FREQUENCY TELEPHONE REPEATERS**

TYPE OF TELEPHONE REPEATER	SECTION	
	CIRCUIT RECORD CODES AND ABBREVIATIONS	INITIAL LINEUP AND CIRCUIT ORDER TEST INFORMATION
Codes for Repeater Data	682-100-012	
<i>Signaling and Transmission Systems Compatibility Information</i>		179-100-301
<i>Amplifier-Type Repeaters</i>		
MFT (Metallic Facility Terminal)		332-9XX-XXX
V3		332-103-300
V4		332-104-500
<i>E-Type (Negative Impedance) Repeaters</i>		332-200-XXX
<i>E-Type Repeaters</i>		
E6 Repeater Lineup on Nonloaded Cable		311-240-501
E7 Repeater Lineup		332-207-301
EML Calculations for E-Repeated and Nonrepeated 2-Wire Trunks		682-000-101
<i>Test Equipment*</i>		
4A Signaling Test Set		179-360-501
54C Return Loss Measuring Set (VF ckts)		103-106-110
2G Repeater Test Set (Measures gain of E1 rep.)		103-107-100
E Repeater Test Set (E1, E2, & E3)		103-107-105
KS-20501 Return Loss Measuring Set (ERL, SRL, SRL-HI)		103-106-115
J99343TN Facility Matching Test Set		332-910-103

* or equivalent

TABLE D
TRUNK RECORDS AND TESTING INFORMATION
ECHO CONTROL DEVICES

TYPE OF EQUIPMENT	SECTION	
	CIRCUIT RECORD CODES AND ABBREVIATIONS	TEST INFORMATION
Codes for Echo Suppressors	682-100-017	
<i>Echo Suppressors</i>		
1A and Disabler		332-410-500
1A and Disabler Equipped With 326-Type Mercury Relays		332-410-501
3A and Disabler		332-412-500
4A and J68914TA Test Extender		332-414-105
1A and Trouble Location		332-414-500
Echo Suppressor Terminal (EST)—No. 4 ESS*		234-151-025
Echo Suppressor Testing in No. 4 ESS*		234-150-001
(a) 108-Type Test Line Method		
(b) Local Access Method (if SMAS No. 3B is Available)		
<i>Echo Canceler</i>		
4A Echo Canceler		
(a) Description		332-414-101
(b) Tests		332-414-501
<i>Test Equipment**</i>		
58-Type Echo Suppressor Measuring System—Operation		103-105-310
Echo Suppressor Test From Trunk Terminals		332-410-301

* For trunks employing the EST, no Echo Suppressor Measuring System (ESMS) test is required. This applies to both full EST or two split ESTs. However, a split analog echo suppressor with a split EST requires an ESMS test of the analog echo suppressor.

** or equivalent

TABLE E

TRUNK RECORDS AND TESTING INFORMATION SIGNALING EQUIPMENT

TYPE OF EQUIPMENT	SECTION	
	CIRCUIT RECORD CODES AND ABBREVIATIONS	TEST INFORMATION
Codes for Signaling Equipment	682-100-015	
Signaling Equipment Losses at 1 kHz		304-207-100
<i>Signaling and Transmission Systems Compatibility Information</i>		
General		179-100-304
E-Type Signaling System		179-100-304
F-Type Signaling System		179-100-306
G-Type Signaling System		179-100-312
MFT Signaling Units		332-9XX-XXX
<i>Carrier Group Alarm Options—SF Signaling Systems</i>		
E-Type Signaling System		179-355-101
F-Type Signaling System		179-364-101
G-Type Signaling system		179-405-100
		179-406-100
<i>Overall Signaling Arrangements and Testing</i>		
Overall Dial Pulsing Tests—General		333-121-500
Dial Pulsing on Intertoll Trunks		333-123-500
Dial Pulsing on Local and Toll Connecting Trunks		333-124-500
Applications of the 2B or 2B-1 Test Sets and Pulse Repeating Adapter		333-122-501
Overall Dialing-Trunk Pulsing—Intertoll (from E and M Leads)		
Test Procedures Using SD-64540 Test Set		179-708-501
Test Procedures Using 2B Type Test Set		179-708-502
Overall Dialing-Trunk Pulsing—Intertoll (from Test Jack)		333-122-605
Test Procedures Using SD-64540 Test Set		179-708-504
Test Procedures Using 2B Type Test Set		179-708-505
Overall Dialing-Trunk Pulsing—Intertoll (from Testboard)		333-122-603
Test Procedures Using SD-64540 Test Set		178-708-507
Test Procedures Using 2B Type Test Set		178-708-508

TABLE E (Contd)

TRUNK RECORDS AND TESTING INFORMATION SIGNALING EQUIPMENT

TYPE OF EQUIPMENT	SECTION	
	CIRCUIT RECORD CODES AND ABBREVIATIONS	TEST INFORMATION
<i>CCIS—Common Channel Interoffice Signaling</i>		
Description, Maintenance, and Testing		660-450-507
CCIS Description—No. 4 ESS		234-110-070
CCIS—No. 4 ESS Test Operations Center (TOC)		234-150-001
VFL and Access Circuit Tests in No. 4 XB Using the IMTF		212-807-502
VFL Tests at a Signal Transfer Point Using the VFL Test Frame in No. 4A XB		212-807-503
CCIS Intraoffice Trunk Test Frame (CIOT)		212-514-105
CIOT Tests in a No. 4 XB		212-514-504
CIOT Trunk Tests and Methods		212-514-505
<i>Single Frequency Signaling System Signaling Tests</i>		
Types E and F, Using 4A Signaling Test Set (J94743)		179-302-502
<i>Test Extenders</i>		
E-Type Test Extender		179-313-101
Test Extender for Use With FWA, FWB, and FWC Units		179-362-101
Test Extender for Use With Metallic Terminal Units		234-111-020
Test Extender for Use With Metallic Facility Terminal		332-910-102
		332-610-500
<i>Overall Tests on Trunks Employing SF Signaling</i>		660-403-504

TABLE F
TRUNK RECORDS AND TESTING INFORMATION
CARRIER TELEPHONE SYSTEMS

TYPE OF SYSTEM	SECTION	
	CIRCUIT RECORD CODES AND ABBREVIATIONS	TEST INFORMATION
ON, O, N1 (Channel Noise Measurement)		362-305-510
ON, O, N1 (Channel Net Gain)		362-305-512
O	795-205-001	362-101-300
ON Carrier Units and Channel Groups	795-205-001	362-101-300
N1 Channel Bank	295-205-001	362-011-300
N2 Channel Bank	795-205-001	362-800-505 362-800-506
N3 Channel Bank	795-205-001	362-971-001
N4 Channel Bank	795-205-001	362-972-000
A5 Channel Bank	795-213-120	356-015-501
A6 Channel Bank	795-213-121	356-016-000 through 356-016-019
<i>T-Carrier</i>	795-209-001	365-100-300
D1 Signaling Compatibility (Including Carrier Group Alarm Settings)		179-100-302
D2 Signaling Compatibility		179-100-307
D3 Signaling Compatibility		179-100-310
D4 Signaling Compatibility		179-100-311
Carrier Group Alarm Options		
J98711P, L2 and Later (D1 Channel Banks)		365-108-102
D2 Channel Units		365-400-107
D3 Channel Units		365-150-503
D3 Channel Bank and Trunk Processing Unit		365-150-100
D4 Channel Units		365-170-101
<i>Adjustment of Transmission Levels on Multifacility Trunks—Intermediate Offices</i>		660-450-504
<i>Channel Net Gain Characteristics</i>		660-450-505
Multiplex Terminal Equipment—Group to Group Pilot—Frequency and Noise Out-of-Service Testing		356-020-507

TABLE G
INFORMATION ON BALANCE TESTING PROCEDURES

SUBJECT	SECTION
<i>Switching Systems</i>	
No. 1 ESS HILO	660-470-ZZZ
Crossbar Tandem Systems	660-471-ZZZ
No. 5 Crossbar Offices	660-472-ZZZ
No. 4 Crossbar Offices	660-473-ZZZ
Step-by-Step Offices	660-474-ZZZ
Decentralized Toll Offices (Switchboards)	660-475-ZZZ
No. 1 ESS	660-476-ZZZ
No. 4 ESS	660-460-ZZZ
TSPS/RTA	660-463-ZZZ
Each Layer Consists of:	
Administration and Records	660-4YY-010
General Information	660-4YY-100
Through Balance Requirements	660-4YY-300
Terminal Balance Requirements	660-4YY-301 Table Y
Office NBO Selection	660-4YY-500
Through Balance Build-Out Procedures and Verification Tests	660-4YY-501
Terminal Balance DBO and Verification Tests	660-4YY-502
Test Circuits and Terminations Used	660-4YY-504
Large Class 5 Office NBO Selection	660-4YY-520
<i>Hybrids and 4-Wire Terminating Circuits</i>	
Equipment Losses at 1 kHz	304-205-100
Composite Sets and Associated Hybrid Transformers	332-450-500
<i>4-Wire Terminating Sets</i>	
1A and 1K	332-800-101
1B and 1L	332-800-102
1C, 1F, and 1M	332-800-103
1D and 1N	332-800-104
1G	332-800-105
1P, 1R	332-800-108

TABLE H

INFORMATION ON MEASUREMENT OF OFFICE WIRING AND EQUIPMENT LOSSES

SUBJECT	SECTION
<i>Measurement of Office Wiring and Equipment Losses</i>	
2-Wire Switching Offices	660-450-502
4-Wire Switching Offices	660-450-503
4-Wire Switching Offices—No. 4 ESS—Metallic	234-150-006
4-Wire Switching Offices—No. 4 ESS—UTES	234-150-010

TABLE I

INFORMATION ON TEST POWER SOURCES AND TRANSMISSION MEASURING SETS

<p>Test equipment used must meet the requirements specified in Publication 41009 (Transmission Parameters Affecting Voiceband Data Transmission—Measuring Techniques).</p> <p>Product Evaluation Report (PER) No. 117 provides a summary of evaluations performed on test equipment comparing product specifications and performance with the requirements in Pub. 41009.</p> <p>Bell System Practices in the 103-series cover several types of test equipment.</p>

TABLE J

INFORMATION ON CIRCUIT NOISE MEASUREMENTS

SUBJECT	SECTION
<i>Circuit Noise</i>	
Message Circuit and C-Notched Noise-General Information	331-100-100
Message Circuit Noise Test Classifications and Intervals	660-403-300
Message Circuit Noise Methods and Requirements	660-403-500

TABLE K
INFORMATION ON TRANSMISSION TESTING

SUBJECT	SECTION
<i>No. 4A and 4M Toll Switching Systems</i>	
Incoming Toll Connecting Trunks—Transmission and Pad Tests Using Test Trunk Circuit—SD-68359-01	212-534-501
Outgoing Toll Connecting Trunks—Overall 1 kHz Transmission Tests	212-565-501
17C Testboard—Transmission and Noise Measuring Circuits—SD-95900-01	664-500-500
Manual Test Frame (MTF)	212-517-501
Intertoll or Integrated Manual Test Frame (IMTF)	212-570-501
<i>Panel and Panel Tandem Office</i>	
Trunk Transmission Tests—Offices Provided With Outgoing Trunk Test Frame or Testboard	215-722-501
<i>No. 1 Crossbar Offices</i>	
Trunk Transmission Tests—Offices Provided With Manual Outgoing Test Frame SD-25177-01	216-769-501
<i>Crossbar Tandem Offices</i>	
Trunk Transmission Tests—Offices Provided With Manual Outgoing Trunk Test Frame SD-25177-01 or SD-95476-01	220-409-501
17B Testboard—Transmission and Noise Measuring Circuits—SD-95900-01	664-400-500
<i>No. 5 Crossbar Offices</i>	
Trunk Transmission Tests Using Master Test Frame	218-246-501
Trunk Transmission Tests Using Office Test Frame Test Circuit SD-27633-01 (H595-950)	218-546-501
Trunk Transmission Tests Using Office Test Frame Test Circuit SD-27633-01 (J23260)	218-549-501
17B Testboard—Transmission and Noise Measuring Circuits—SD-59500-01	664-300-500
<i>Step-by-Step Offices</i>	
Trunk Transmission Tests—Offices Not Provided With Manual Trunk Test Frame	226-588-500
Trunk Transmission Tests—Offices Provided With Manual Outgoing Trunk Test Frame	226-590-500
<i>No. 1 and No. 3 Switchboards</i>	
Transmission Loss and Noise Tests	211-120-501
17B Testboard—Transmission and Noise Measuring Circuits—SD-64355-01 or SD-95135-01	664-100-500

TABLE K (Contd)

INFORMATION ON TRANSMISSION TESTING

SUBJECT	SECTION
Operating Room and Information Desks	
2, 3, 4, 6, 7, 19, and 23 Types—Transmission Tests	210-310-502
No. 1 Electronic Switching System (ESS)	
Trunk Transmission Tests Using Master Control Center Line and Trunk Test Panel and Supplementary Trunk Test Panel	231-131-501
Manual Trunk Test Position (MTTP)	231-130-320
Transmission Tests Using the MTTP (2-wire and HILO)	231-131-520
Remote Office Test Line (ROTL) and Processor Controlled Interrogator (PCI)	231-133-301
Digital Carrier Trunk Tests	231-050-015
No. 2 Electronic Switching System (ESS)	
Trunk Test Panel	232-130-301
No. 3 Electronic Switching System (ESS)	
Trunk and Line Test Panel	233-135-105
No. 4 Electronic Switching System (ESS)	
Trunk Transmission Tests (Automatic) Using CAROT 2	234-150-001
Trunk Transmission Tests (Manual) Using 51A Test Position	234-150-001
Traffic Service Position No. 1 (TSPS No. 1)	
Control Display and Test (CDT) Frame	250-106-303
Test and Display Circuit (TDC) Frame	250-144-301
CAROT	
CAROT 2	190-102-XXX
Manually Controlled Interrogator (MCI)	103-251-110
Processor Controlled Interrogator (PCI)	103-251-105
92A Control Unit	103-251-112
No. 1 Crossbar ROTL	216-780-XXX
No. 5 Crossbar ROTL	218-743-XXX
Crossbar Tandem ROTL	220-462-XXX
Step-by-Step ROTL	226-831-XXX
Step-by-Step Mini ROTL	226-834-300
No. 1 ESS ROTL	231-119-333
	231-161-000
	231-133-XXX

TABLE K (Contd)

INFORMATION ON TRANSMISSION TESTING

SUBJECT	SECTION
No.2 ESS ROTL	232-132-XXX
No. 3 ESS ROTL	233-135-110
No. 4 ESS ROTL	234-150-005 234-110-080 234-110-081
No. 4 Crossbar ROTL (OTTS ROTL)	103-261-XXX
56A Responder and 105 Test Line	103-252-104
TFMS	103-260-XXX
<i>Trunk Maintenance Position (TMP)</i>	
Used with ESS Offices	190-130-200
Used with NonESS Offices	190-130-300

TABLE I
COMMON LANGUAGE CODES USED IN TABLES O THROUGH Z

COMMON LANGUAGE FACILITY CODES		COMMON LANGUAGE TRAFFIC USE CODES		COMMON LANGUAGE SWITCHING SYSTEM CODES	
CLFI CODE	DESCRIPTION	CLCI CODE	DESCRIPTION	SWITCHING SYSTEM CODE	DESCRIPTION
O	Analog channel group, O carrier	CA	Tandem access — CAMA	4A	No. 4A Crossbar toll switching system
ON	Analog channel group, ON carrier	DD	Tandem access — LAMA	4M	No. 4M Crossbar toll switching system
N	Analog channel group, N carrier	DT	Tandem connecting — Toll	4E	No. 4 ESS
T1	Digital systems, DS1 bit rate (1.544 Mb/s)	IE	Interend office — Local	SWB	Switchboard
A	All other analog channel group types	IT	Intertandem — Toll	MAN	Manual operator boards
AT	Combination analog and digital channel (LT-1/1B† connector in trunk)	LW	Operator access — Call back	3CL	Manual operator boards
AST*	Analog channel group routed via satellite half-hop	MN	Manual — Toll connecting	SXS	Step-by-Step
ATS*	Analog channel group routed via satellite half-hop	MT	Intertandem local	XBT	Crossbar Tandem
ATST*	Combination analog and digital channel group (with remotely located LT-1/1B† connector) routed via satellite half-hop	OA	Operator access — Inward operator	5XB	No. 5 Crossbar
ATTS*	Combination analog and digital channel group (with remotely located LT-1/1B† connector) routed via satellite half-hop	OJ	Tandem access — Operator junctor	25X	2-wire, No. 5 Crossbar
AT1ST*	Combination analog and digital channel group (with collocated LT-1/1B† connector) routed via satellite half-hop	OO	Operator connecting — Two-way	25P	2-Wire, paired No. 5 Crossbar
AT1TS*	Combination analog and digital channel group (with collocated LT-1/1B† connector) routed via satellite half-hop	RC	Operator access — Recording completing	SET	No. 5 Crossbar with Electronic Translator System (ETS)
AT1TTS*	Combination analog and digital channel group (with collocated LT-1/1B† connector) routed via satellite half-hop	SP	Tandem access — Service position	1E	No. 1 ESS
		TC	Tandem completing — Toll	2ES	No. 1 ESS — 2-wire
		TE	Interend office — Toll	HLE	No. 1 ESS with HILO
		TG	Tandem completing — Local	1AE	No. 1A ESS
		TM	Tandem completing — Multiplied	C2A	Manual and Step-by-Step combined system
		TO	Tandem access — Local	C2D	Manual and 2-wire No. 5 Crossbar combined system
		TS	Operator completing	C2M	Manual and Crossbar Tandem combined system
		TT	Tandem access — Operator switched	C21	Manual and No. 1 ESS combined system
				C3C	Manual, Step-by-Step, and 2-wire No. 5 Crossbar combined system

* The first two (2) alpha's in the CLFI codes are temporary coding to allow use of one-way satellite legs (half-hop), until technology solves the echo problem. The S being before the T implies the satellite leg is in the "A" to "Z" direction only. The T being before the S implies the satellite leg is in the "Z" to "A" direction.

† The LT-1 connector is used to interface analog carrier trunks directly to a digroup terminal (DT) or digital interface frame (DIF) of a No. 4 ESS office. The LT-1B Connector is used to interface analog trunks directly to digital (T-carrier) trunks using a DS-1 format.

TABLE M

SUMMARY OF PRELIMINARY TESTS REQUIRED TO BE MADE ON EQUIPMENT COMPONENTS AND FACILITIES
(See Paragraph 2.02.)

TYPE OF TEST	PROCEDURE	REFERENCES	INFORMATION ON REQUIREMENTS TO BE MET
1. DC Tests on Cable or Open-Wire Pairs, or Both	Verify that required tests for opens, shorts, grounds, and leakage have been made.	TABLE B	Normal requirements for type of facility.
2. Repeater Tests and Repeater Gains	Verify that required tests have been made and that each repeater gain and options has been adjusted to its required value.	TABLE C	Where repeater gains are adjusted to compensate for office wiring and equipment losses as covered in Test 7, the maximum allowable deviation in repeater gain from that originally indicated on CLR cards shall not exceed ± 1.0 dB. Adjusted value of repeater gain should be recorded on CLR cards and other locally prepared records in the office making the change.
3. Return Loss Tests	Verify that return loss tests have been made on cable.		As specified in local company practices.
4. Echo Suppressor, Echo Canceler and Disabler Unit Tests (if applicable)	When echo suppressors (or cancelers) are provided, verify that the applicable suppressor, canceler, and disabler tests have been made.	TABLE D	As covered in sections containing testing methods.
5. SF Signaling Circuits	(1) Verify that "out-of-service" tests have been made. (2) Verify that compromise networks have been correctly wired and adjusted. (See Test 3.) (3) Verify that CGA options have been selected	TABLE E TABLE C AND TABLE G	As covered in sections containing testing methods.
6. Carrier Telephone System Tests	Verify that the following tests have been made on the system. Where appropriate: (1) Initial Lineup (2) Overall channel noise measurements (3) Channel net gain measurements (4) When multifacility trunks are involved, adjustment of transmission levels at intermediate offices (5) CGA or CGC action and indications on LMX in DUIT 4A and T carriers (6) Recording of CTMS bench marks in No. 4 ESS offices.	TABLE F	As covered in sections containing testing methods.

TABLE M (Contd)

SUMMARY OF PRELIMINARY TESTS REQUIRED TO BE MADE ON EQUIPMENT COMPONENTS AND FACILITIES

(See Paragraph 2.02.)

TYPE OF TEST	PROCEDURE	REFERENCES	INFORMATION ON REQUIREMENTS TO BE MET
7. Measurement of Office Wiring and Equipment Losses—2-Wire and 4-Wire Switching Systems	<p style="text-align: center;">2-WIRE SWITCHING OFFICES</p> <p>For outgoing trunks—Measure office wiring losses between testboard multiple jack, master test frame, or maintenance center test jack appearance and the VF patch, repeater bay, or carrier terminal appearance.</p> <p>For incoming trunks—Measure office wiring losses between VF patch bay, repeater bay, or carrier terminal appearance, and testboard 101-type test line or maintenance center 101-type appearance. <i>See Note 3.</i></p> <p style="text-align: center;">NO. 4 XBAR SWITCHING OFFICES</p> <p>For outgoing trunks—Measure office wiring losses between testboard TST multiple jack (or equivalent access jack in AOOT, AOTT, AOCT, ATCT, IMTF, or manual test frame) appearance and VF patch, repeater bay, or carrier terminal appearance.</p> <p>For incoming trunks—Measure office wiring losses between VF patch, repeater bay, or carrier terminal appearance and testboard 101-type test line (or equivalent 101-type test line in AOOT, AOTT, ATCT, IMTF, or manual test frame) appearance. <i>See Note 3.</i></p> <p style="text-align: center;">NO. 4 ESS OFFICES</p> <p>See sections referenced in Table H.</p>	TABLE H	<p style="text-align: center;">2-WIRE SWITCHING OFFICES</p> <p>Transmission levels in each direction of transmission should be adjusted to within ± 0.13 dB by changing the T and R pads in external 4-wire terminating sets or by repeater gain adjustments. On trunks equipped with D-type channel banks or F- or G-type signaling circuits, the transmission levels in each direction of transmission should be adjusted to within ± 0.10 dB by adjusting the T and R pad values in the associated attenuators. <i>See Notes 1 and 2.</i></p> <p style="text-align: center;">NO. 4 XBAR SWITCHING OFFICES</p> <p>Transmission levels in each direction of transmission should be adjusted to within ± 0.13 dB by changing P_T and P_R pads or by repeater gain adjustments. wire F-type signaling circuits, the transmission levels in each direction of transmission should be adjusted to within ± 0.10 dB by adjusting the T and R pad values in the associated attenuators. <i>See Note 1.</i></p> <p style="text-align: center;">NO. 4 ESS OFFICES</p> <p>See sections referenced in Table H.</p>

Note 1: The maximum allowable deviation in the adjusted value of plug-in pads (89-type resistors), repeater gains, or attenuator values (D-type channel banks and SF signaling circuits) from that originally indicated on the circuit or trunk layout record cards must not exceed ± 1.0 dB. The adjusted values should be recorded in ink on the layout record cards and on locally prepared records in each office making the change. These values are then treated as new specified values.

Note 2: On trunks that use early types of E-type signaling circuits with built-in 4-wire terminating circuits, the loss in the transmitting direction of transmission is approximately 16.0 dB and is *not* adjustable. In the receiving direction of transmission, the level adjustment is made on a VF amplifier contained in the signaling circuit.

Note 3: Check operation of lockout and release of status display system in No. 4 Crossbar DUIT offices; also SMAS access and lockout feature where provided.

TABLE N

SUMMARY OF OVERALL LINEUP TESTS REQUIRED TO BE MADE BETWEEN TRUNK TERMINALS

	TYPE OF TEST	PROCEDURE	REFERENCES	INFORMATION ON TEST REQUIREMENTS
1.	Signaling Tests (non-CCIS only)	Intertoll trunks equipped with rering or ring forward features should be tested to 103-type test line. Make overall signaling tests on all other trunks to "synchronous" or "nonsynchronous" test line.	TABLE K	BSP 660-403-504 — Tests on trunks employing SF signaling (the description of test lines and tests also applies to non-SF trunks).
2.	Overall Pulsing Tests	Make overall pulsing tests on dial pulsing trunks. Note: Does not apply to No. 4 ESS Trunks in DT or DIF.		BSP 333-123-500 Intertoll BSP 333-124-500 Local
3.	Operational Tests	Verify that operational tests have been made. When trunk orders involve new or rearranged trunks which are measured with automatic test frames, ensure that test frame access changes have been made.	TABLE K	Test requirements depend upon the specific location and type of office in which the trunks terminate. Use test methods specified in sections listed in the following Plant Series Indexes and Equipment Test Lists (ETLs): Manual Toll Offices and Toll Switchboards 212-000-000 No. 4A and 4M Toll Switching Offices 212-001-017 Panel Offices 215-001-026 No. 1 Crossbar Offices 216-001-025 No. 5 Crossbar—Master Test Frame Offices 218-001-017 No. 5 Crossbar—Office Test Frame Offices 218-002-015 Crossbar Tandem Offices 220-001-014 Step-by-Step and Community Dial Offices— Testing Information Applying to Specific Offices 225-000-000 Equipment Common to More Than One Type Office— Trunks and Trunk Circuits 226-001-016 General Testing Information—Common Control Equipment 227-000-000 No. 1 ESS 231-000-000 No. 2 ESS 232-002-511 No. 3 ESS 233-142-100 No. 4 ESS 234-150-001
4.	Operational and Transmission Tests—All Trunks With More Than One Mode of Operation	(1) Verify that operational and 1 kHz loss measurements have been made at all originating and terminating access locations.	TABLE I TABLE K TABLE O TABLE P	Refer to Part 5 and to Fig. 2 and 3 for examples of an intertoll trunk with two or more access modes of operation. Refer to Table O for applicable access locations. Refer to Table P for permissible deviation from EML.
5.	Overall 1 kHz Loss and Gain-Slope Measurements	Make measurements in both directions of transmission between trunk terminals, using frequencies of 0.4, 1, and 2.8 kHz. Measurements should be made from each end of 2-way trunks. Measurements should also be made for each mode of operation. (See Test 9 and paragraph 5.04.)	TABLE I TABLE K TABLE O TABLE P TABLE Q	1 kHz measurements should be as close as possible to the EML shown on circuit or trunk layout record, and should not exceed requirements shown in Table P. (See paragraph 5.10). Gain-slope measurements at .4 and 2.8 kHz should be compared with the 1 kHz loss and be within the requirement of Table Q.

TABLE N (Contd)

SUMMARY OF OVERALL LINEUP TESTS REQUIRED TO BE MADE BETWEEN TRUNK TERMINALS

	TYPE OF TEST	PROCEDURE	REFERENCES	INFORMATION ON TEST REQUIREMENTS
5-A.	Test of "A" Pad Operation and "A" Pad Control Signals—No. 4 XB Switching Systems	<p>At 17C Testboard Locations—When making 1 kHz measurements (Test 1), test the operation and control of switchable "A" pads associated with the transmitting and receiving branches of all trunks measured at the test-board.</p> <p>At AOOT, AOTT, AOCT, ATCT, IMTF, or Manual Test Frame Locations — When making 1 kHz measurements (Test 1), test the operation and control of switchable "A" pads, if any, and the "A" pad control signals associated with outgoing and incoming toll connecting trunks.</p>		At 17C Testboard Locations —Requirements ± 0.1 dB
6.	Circuit Noise Tests	Make C-message and C-notched noise measurements from both ends of the trunks.	TABLE J TABLE R-W	As covered in sections containing test methods.
7.	Through Balance Tests—Class 3 and Higher Ranking Offices	Intertoll trunks —Make through balance tests and record results.	TABLE G	Section 660-4YY-300 and Table Y.
8.	Terminal Balance Tests—Class 4 and Higher Ranking Offices	<p>Toll connecting trunks—Make terminal balance tests and record results. (See Note.)</p> <p>Intertoll trunks—At 2-wire class 4 offices, 4-wire terminating sets should be tested and should meet echo return-loss requirements.</p>	TABLE G	Refer to Table Y for requirements. See Table G for documentation on testing procedures and recording. Trunks with TSPS access require other tests which are covered in BSP 660-450-303. Note: The toll office has responsibility for balance records on outgoing and incoming toll connect trunks.
9.	Overall Echo Suppressor and Disabler or Echo Canceler Operation	When trunks are equipped with echo suppressors, make overall tests to verify actual operation of disablers and suppressors, or cancelers.	TABLE D AND TABLE K	As covered in sections containing test methods.
10.	Talk and Listen Test	Signal, talk, and listen		Every trunk must be tested.
11.	Carrier Group Alarm	Verify that carrier group alarm options are selected as specified on the circuit order.	TABLE F TABLE E	Carrier group alarm options desired depends on type of office and type of carrier or SF unit used. ESS scan points for CGA must be verified.
12.	Trunk Placed in Service		TABLE K	It is the responsibility of the control office to place the trunk in service.

TABLE O
LOSS AND GAIN-SLOPE TESTS
REQUIRED ON MESSAGE TRUNKS

TYPE OF SWITCHING OFFICE	TRAFFIC USE CODE (NOTE 1)	OFFICE	CLASS OF OFFICE	1004Hz LOSS AND GAIN-SLOPE TESTS REQUIRED (NOTES 2,3,4,5 and 6)
No. 1 ESS, and No. 5 crossbar	SP	A	5	TSPS—A
	SP	Z	1,2,3, or 4	TSPS—Z, A—Z (Tandem Mode), A—Z (Local Mode)* †
	IT	A, Z	1,2,3, or 4	A—Z (Tandem Mode), A—Z (Local Mode)* †
	CA, DD	Z	1,2,3, or 4	A—Z (Tandem Mode), A—Z (Local Mode) † ‡
	TC	A	1,2,3, or 4	A—Z (Tandem Mode), A—Z (Local Mode) † ‡
	MT, TG, TO	A, Z	4	A—Z (Tandem Mode), A—Z (Local Mode) † ‡
	OO	Z	1,2,3, or 4	A—Z (Tandem Mode), A—Z (Local Mode) † ‡ A—Switchboard † ‡
	OO, TM TSPS Delayed Call or Inward Trunks ALL Others	A, Z	1,2,3, or 4	A—Z, Switchboard—Z † ‡ A—Z, TSPS—A, TSPS—Z
No. 4A Crossbar	SP	Z	1,2,3, or 4	A—Z (TC), A—Z (IT), TSPS —Z
	OO	Z	1,2,3, or 4	A—Z, A—Switchboard
	OO, TM	A	1,2,3, or 4	A—Z Switchboard—Z
	TPS Delayed Call or Inward Trunks	A, Z	1,2,3 or 4	A—Z (TC), A—Z(IT), TSPS—A, TSPS—Z
	Others: Outgoing Others: Incoming or 2-Way Trunks	A A, Z	1,2,3, or 4 1,2,3, or 4	A—Z A—Z (IT), A—Z (TC)
Other Switching Systems	SP	A	5	TSPS—A
	SP	Z	1,2,3, or 4	A—Z, TSPS—Z
	OO	Z	1,2,3, or 4	A—Z, A—Switchboard
	OO, TM	A	1,2,3, or 4	A—Z, Switchboard—Z
	TSPS Delayed Call or Inward Trunks All Others	A, Z A, Z	1,2,3 or 4 1,2,3,4, or 5	A—Z, TSPS—A, TSPS—Z A—Z

Note 1: The definitions of the traffic use Codes may be found in Table L and Section 795-400-100.

Note 2: “Tandem” and “Local” refer to the tandem and local states of No. 1 ESS and No. 5 crossbar trunk circuits at either end of the trunk as applicable. “TC” and “IT” refer to terminating connections to test lines located on the toll completing and the intertoll switching trains of a No. 4A crossbar switch.

Note 3: Look up tests for both ends of the trunk as specified by switching system and trunk type. Measurements must be made in both directions of transmission between the switching entities indicated in the table. Some tests specified for one end of a trunk may duplicate tests specified for the other end; any duplications may be disregarded. Trunks interfacing No. 1 ESS and No. 5 crossbar offices which must be tested in local and tandem modes at both ends, as indicated in Table O, should be tested first with one end in the tandem mode and the other end in the local mode and then tested again with the modes reversed at each end.

Note 4: For preservice testing, make loss and gain-slope tests for all specified connections except it is not required to make 404-Hz gain-slope measurements in the alternate modes of operation.

For maintenance testing, neither loss nor gain-slope tests are required in the alternate modes of operation.

The primary mode of operation for test purposes should be the mode used for trunk design and alignment and/or which is used for CAROT testing.

Note 5: The 1004-Hz loss requirement is EML plus or minus, the preservice or maintenance limits given Table P (see[*] and [‡] for exceptions).

Note 6: The gain-slope requirement is the 1004-Hz AML plus or minus, the allowable deviations given in Table Q (see [†] for exceptions).

* **LOSS TESTS:** Add 2.5 dB to the EML and increase the preservice limits of Table P by an additional 0.5 dB. This assumes that the trunk was designed in the tandem mode. If the trunk was designed and aligned in the local mode, use the limits in Table P for testing in the local mode; for the associated tandem mode, decrease the EML by 2.5 dB and increase the preservice limits in Table P by an additional 0.5 dB.

† **GAIN-SLOPE TESTS:** Increase the 404-Hz “more loss” and “less loss” deviations by 0.5 dB; increase the 2804-Hz “more loss” deviation by 1.5 dB.

‡ **LOSS TESTS:** Add 0.5 dB to the EML and increase the perservice limits in Table P by and additional 0.5 dB. This assumes that the trunk was designed in the tandem mode. If the trunk was designed and aligned in the local mode, use the limits in Table P for testing in the local mode; for the associated tandem mode, decrease the EML by 0.5 dB and increase the preservice limits in Table P by an additional 0.5 dB.

TABLE P

1004 HZ PESERVICE, MAINTENANCE AND IMMEDIATE ACTION
TEST LIMITS DEVIATION FROM EML (NOTES 1 AND 2)

		NONREPEATERED CABLE OR OPEN WIRE (INTERBUILDING)	INTRABUILDING TRUNKS	MULTI-FACILITY TRUNKS	OTHER TYPES OF FACILITIES
AML must be within this range of EML	Preservice Limits	±1.0 dB	±0.5 dB	±0.5 dB	±0.5 dB
	Maintenance Limits	±1.0 dB	±1.0 dB	±1.5 dB	±1.0 dB
	Immediate Action Limits	±3.7 dB	±3.7 dB	±3.7 dB	±3.7 dB

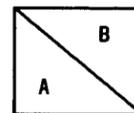
Note 1: Some trunks have alternate access/termination points and/or alternate operational modes. Table O lists all tests that must be performed for each trunk type and, where required, gives changes to the above limits.

Note 2: No change is to be made in any segment on the basis of an overall measurement. When an overall measurement indicates the need for corrective action, the trunk segments should be checked and corrected individually.

TABLE Q
 404-HZ AND 2804-HZ
 PRESERVICE AND MAINTENANCE TEST
 DEVIATION FROM 1004 HZ AML (-16 dBm)
 (NOTES 1, 2, AND 3)

		TYPE OF FACILITY (CLFI)												
		O	ON	N			T1				A	AT	NON REPEATERED CABLE	REPEATERED CABLE
TYPE OF CARRIER CHANNEL BANK		OA OB OC OD	1G1 1G2 1G3 1G4 1G5 2G1 2G2 2G3 2G4 2G5 2G6	N1	N2 N3 N4 3G1 3G2 4G1 4G2 EAU N3LA N3LB N3LC	D1A D1B D1C	D1D D2 D3A D3B D4A D4B DCT DT D1U SLC96 SLC40T SLC40R DACS D4A1 D4A2 D4A3 D4A4 D4B1 D4B2 D4B3 D4B4	A1 A2 A3 A4 A5 A6 A7 EAT EAM						
404 HZ	LESS LOSS THAN 1004-Hz AML	2.0 / 1.0	2.0 / 1.0	2.0 / 1.0	2.0 / 1.0	2.0 / 1.0	2.0 / 1.0	2.0 / 1.0	3.0 / 1.5	2.0 / 1.0	2.0 / 1.0	2.0	2.0	
	MORE LOSS THAN 1004-Hz AML	4.0 / 2.5	4.0 / 2.5	4.0 / 2.5	3.0 / 1.5	4.0 / 2.5	3.0 / 1.0	3.0 / 1.5	5.0 / 3.0	3.5 / 2.0	4.5 / 3.0	*	*	
2804 HZ	LESS LOSS THAN 1004-Hz AML	2.0 / 1.0	2.0 / 1.0	2.0 / 1.0	2.0 / 1.0	2.0 / 1.0	2.0 / 1.0	2.0 / 1.0	3.0 / 1.5	2.0 / 1.0	2.0 / 1.0	2.0	2.0	
	MORE LOSS THAN 1004-Hz AML	4.0 / 3.0	4.0 / 3.0	4.0 / 2.5	3.0 / 2.0	4.0 / 3.0	3.0 / 1.0	3.0 / 2.0	5.0 / 3.0	4.0 / 3.0	5.5 / 4.5	*	*	

NOTE 1: DEVIATION LIMITS ARE PRESENTED IN THE FORMAT SHOWN BELOW:



WHERE A IS THE PRESERVICE AND MAINTENANCE LIMIT AND B IS THE IMMEDIATE ACTION LIMIT.

NOTE 2: TABLE Q LISTS THE GAIN-SLOPE TESTS REQUIRED FOR THE PRIMARY AND ALTERNATE MODES (IF APPLICABLE) OF THE VARIOUS TYPES OF MESSAGE TRUNKS. WHERE THE GAIN-SLOPE REQUIREMENTS IN THE ALTERNATE MODE IS DIFFERENT FROM THE PRIMARY MODE REQUIREMENT, CORRECTION FACTORS ARE GIVEN IN TABLE Q.

NOTE 3: 1004 HZ AND 2804-Hz GAIN-SLOPE TESTS ARE REQUIRED ON ALTERNATE MODES FOR PRESERVICE TESTS ONLY (NOT REQUIRED FOR ROUTINE MAINTENANCE). 404-Hz TESTS ARE NOT REQUIRED ON ALTERNATE MODES.

NOTE 4: MULTIFACILITY IS DEFINED AS MULTIPLE CARRIER SYSTEMS LINKED AT VOICE-FREQUENCY, OR CARRIER SYSTEMS WITH METALLIC EXTENSIONS. METALLIC FACILITIES CONNECTED IN TANDEM ARE TREATED AS A SINGLE CABLE FACILITY.

* FOR MULTIPLE FACILITY TYPES, THE "MORE LOSS" DEVIATION LIMIT IS DETERMINED BY SQUARING THE APPLICABLE LIMIT FOR EACH FACILITY TYPE AND TAKING THE SQUARE ROOT OF THE SUM OF THOSE NUMBERS UP TO 4.5dB FOR THE PRESERVICE AND MAINTENANCE LIMIT AND UP TO 5.5dB FOR THE IMMEDIATE ACTION LIMIT.

TABLE R
INDEX TO C-MESSAGE
NOISE LIMIT TABLES
(NOTE)

FACILITY TYPE	CLFI	TABLE
Metallic Facilities (Interbuilding) Repeatered Intrabuilding Cable		S
Analog Carrier Noncompandored Non-Satellite	A	T
Analog Carrier Compandored Non-Satellite	N ON N3L	U
Digital Carrier Non-Satellite	T1	V
Carrier Routed Via Satellite*	AST ATS ATST ATTS AT1ST AT1TS	W

* The last two (2) alpha's in the CLFI codes are temporary coding to allow use of one-way satellite legs, until the echo problem is resolved.

The S being before the T implies the satellite leg is from the "A" terminal to the "Z" terminal only.

The T being before the S implies the satellite leg is from the "Z" terminal to the "A" terminal only.

Note: For trunks composed of two facility types, obtain the limit for each link (by facility type and mileage), take the difference between the two limits and combine as shown below:

- difference is 0 dB — add 3 dB to the limit,
- difference is 1 to 3 dB — add 2 dB to the greater limit,
- difference is 4 to 8 dB — add 1 dB to the greater limit,
- difference is 9 dB, or greater. — Use the greater limit

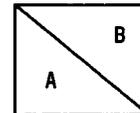
The resulting number is the limit for the combined facilities. For three facility types, combine two facilities as above and combine the result with the remaining facility in the same manner.

Metallic facilities connected in tandem are treated as a single cable facility.

TABLE S
C-MESSAGE NOISE LIMITS (IN DBRNC)
FOR VOICE FREQUENCY METALLIC FACILITIES
AND REPEATERED INTRABUILDING CABLE (NOTE)

HIGH LOSS TOLL CONNECTING TRUNKS TO A 4A CROSSBAR SWITCH	30 20
ALL OTHERS	36 25

NOTE: LIMITS ARE PRESENTED IN THE FORMAT SHOWN BELOW:



WHERE A IS THE PRESERVICE AND MAINTENANCE LIMIT AND B IS THE IMMEDIATE ACTION LIMIT.

TABLE T
 C-MESSAGE NOISE LIMITS (IN DBRNC)
 ANALOG CARRIER
 (NONCOMPANDORED, NONSATELLITE)

EXPECTED MEASURED LOSS (EML)	MILEAGE							
	0 - 50	51 - 100	101 - 200	201 - 400	401 - 1000	1001 - 1500	1501 - 2500	2501 - 4000
0.0-0.5	40 31	40 33	40 35	42 37	44 40	46 42	48 43	50 45
0.6-1.5	38 30	38 32	38 34	40 36	44 39	46 41	46 42	48 44
1.6-2.5	38 29	38 31	38 33	40 35	42 38	44 40	46 41	48 43
2.6-3.5	36 28	36 30	36 32	38 34	42 37	44 39	44 40	46 42
3.6-4.5	36 27	36 29	36 31	38 33	40 36	42 38	44 39	46 41
4.6-5.5	34 26	34 28	34 30	36 32	40 35	42 37	42 38	44 40
5.6-6.5	34 25	34 27	34 29	36 31	38 34	40 36	42 37	44 39
6.6-7.5	32 24	32 26	32 28	34 30	38 33	40 35	40 36	42 38
7.6-8.5	32 23	32 25	32 27	34 29	36 32	38 34	40 35	42 37
8.6-9.5	30 22	30 24	30 26	32 28	36 31	38 33	38 34	40 36

TABLE U
 C-MESSAGE NOISE LIMITS (IN DBRNC)
 ANALOG CARRIER
 (COMPANDORED, NONSATELLITE)

EXPECTED MEASURED LOSS (EML)	MILEAGE							
	0 - 50	51 - 100	101 - 200	201 - 400	401 - 1000	1001 - 1500	1501 - 2500	2501 - 4000
0.0-0.5	34 26	34 28	34 30	36 32	38 35	40 37	42 38	44 40
0.6-1.5	32 25	32 27	34 29	36 31	38 34	40 36	40 37	42 39
1.6-2.5	32 24	32 26	32 28	34 30	36 33	38 35	40 36	42 38
2.6-3.5	30 23	30 25	32 27	34 29	36 32	38 34	38 35	40 37
3.6-4.5	30 22	30 24	30 26	32 28	34 31	36 33	38 34	40 36
4.6-5.5	28 21	28 23	30 25	32 27	34 30	36 32	36 33	38 35
5.6-6.5	28 20	28 22	28 24	30 26	32 29	34 31	36 32	38 34
6.6-7.5	26 19	26 21	28 23	30 25	32 28	34 30	34 31	36 33
7.6-8.5	26 18	26 20	26 22	28 24	30 27	32 29	34 30	36 32
8.6-9.5	24 17	24 19	26 21	28 23	30 26	32 28	32 29	34 31

SECTION 660-450-301

TABLE V

C-MESSAGE NOISE
LIMITS (IN DBRNC)
DIGITAL CARRIER
(NONSATELLITE)

EXPECTED MEASURED LOSS (EML)	
0.0-0.5	34 28
0.6-1.5	32 27
1.6-2.5	32 26
2.6-3.5	30 25
3.6-4.5	30 24
4.6-5.5	28 23
5.6-6.5	28 22
6.6-7.5	26 21
7.6-8.5	26 20
8.6-9.5	24 19

TABLE W

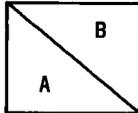
C-MESSAGE NOISE
LIMITS (IN DBRNC)
CARRIER ROUTED
VIA SATELLITE

EXPECTED MEASURED LOSS (EML)	
0.0-0.5	46 42
0.6-1.5	46 41
1.6-2.5	44 40
2.6-3.5	44 39
3.6-4.5	42 38
4.6-5.5	42 37
5.6-6.5	40 36
6.6-7.5	40 35
7.6-8.5	38 34
8.6-9.5	38 33

TABLE X
C-NOTCH NOISE LIMITS
(IN DBRNC0)
(NOTES 1, 2, AND 3)

CLFI	CHANNEL BANKS	HOLDING TONE LEVEL IN DBMO	CIRCUIT LENGTH (MILES)						
			0-100	101-200	201-400	401-1000	1001-1500	1501-2500	2501-4000
A, REPEATERED, OR NON-REPEATERED CABLE	ALL *	-16	38	38	42	42	42	46	48
			32	34	35	38	39	41	43
ON, O	ALL	-16	48	48	48	48	48	48	49
N	N1		45	45	45	45	45	45	47
	ALL OTHER	-16	41	42	42	43	43	44	45
T1	D1A D1B D1C	-16	47	47	47	47	47	47	48
	ALL OTHER	-16	45	45	45	45	45	45	47
AT	ALL		39	40	40	42	42	43	43
		38	39	39	40	40	42	42	

NOTE 1: NOISE LIMITS ARE PRESENTED IN THE FORMAT SHOWN BELOW:



WHERE A IS THE PRESERVICE AND MAINTENANCE LIMIT AND B IS THE IMMEDIATE ACTION LIMIT.

NOTE 2: THESE VALUES ARE GIVEN IN dB_{rnc0}. TO OBTAIN THE LIMIT FOR A PARTICULAR TRUNK, SUBTRACT THE 1004-Hz EML FROM THE REQUIREMENT LISTED IN THE TABLE.

NOTE 3: FOR TRUNKS COMPOSED OF TWO FACILITY TYPES, OBTAIN THE LIMIT FOR EACH LINK (BY FACILITY TYPE AND MILEAGE), TAKE THE DIFFERENCE BETWEEN THE TWO LIMITS AND COMBINE AS SHOWN BELOW:

DIFFERENCE IS 0 dB - ADD 3 dB TO THE LIMIT,

DIFFERENCE IS 1 TO 3 dB - ADD 2 dB TO THE GREATER LIMIT,

DIFFERENCE IS 4 TO 8 dB - ADD 1 dB TO THE GREATER LIMIT,

DIFFERENCE IS 9 dB OR GREATER. - USE GREATER LIMIT.

THE RESULTING NUMBER IS THE LIMIT FOR THE COMBINED FACILITIES. FOR THREE FACILITY TYPES, COMBINE TWO FACILITIES AS ABOVE AND COMBINE THE RESULT WITH THE REMAINING FACILITY IN THE SAME MANNER.

METALLIC FACILITIES CONNECTED IN TANDEM ARE TREATED AS A SINGLE CABLE FACILITY.

* C-NOTCHED NOISE MEASUREMENTS ON NON-COMPANDORED FACILTIES (CABLE AND A-CARRIER) SHOULD BE MADE ONLY IN AUTOMATED (IE, CAROT) ENVIRONMENTS; MANUAL TESTS ARE NOT REQUIRED ON THESE FACILTIES.

TABLE Y
BALANCE TESTS AND REQUIREMENT

SWITCH TYPE (NOTES 1 AND 2)	TRAFFIC USE CODE	OFFICE CLASS	BALANCE TEST DESCRIPTION	FACILITY TYPE	PRESERVICE AND MAINTENANCE REQUIREMENTS (NOTE 3)		IMMEDIATE ACTION REQUIREMENTS (NOTE 3)	
					ERL (dB)	SRL (dB)	ERL (dB)	SRL (dB)
STEP-BY-STEP (Reference Section 660-474-301)	IT (Intertoll)	4	SWBD access to outgoing IT trunks	Any	27	20	21	14
		4	Machine paths to incoming and outgoing IT trunks	Any	22	14	16	8
	LW, OA (Incoming Sec. Intertoll)	4	Operator assistance trunks	Any	22	14	16	8
	IT	4	2-Wire Tandem to outgoing IT trunks	2-Wire	22	14	16	8
	TC, TM 00 (Intertoll To Toll Connecting Via Machine)	4	Intertoll to toll connecting machine paths	Intrabldg	22	14	16	10
				2w Interbldg	18	10	13	6
				4w Interbldg	22	15	16	11
	4WTS of outgoing toll connecting trunk	4	4-Wire	14	6	13	5	
		TM, TS (Intertoll To Toll Connecting Via SWBD)	4	Intertoll to toll connecting paths via SWBD	Intrabldg	22	14	15
	2w Interbldg				18	10	13	6
	4w Interbldg				22	15	16	11
	4WTS of incoming or outgoing toll connecting trunks	4	4-wire	14	6	13	5	
		CA (Toll Connecting To Intertoll Via Machine)	4	Toll connecting to intertoll machine path (CAMA)	Intrabldg	22	14	16
2w Interbldg	18				10	13	6	
4w Interbldg	22				15	16	11	
4WTS of incoming toll connecting trunks	4	4-wire	14	6	13	5		
	RC, 00 (Toll Connecting To Intertoll Via SWBD)	4	Toll connecting to intertoll via SWBD	Intrabldg	22	14	16	10
2w Interbldg				18	10	13	6	
4w Interbldg				22	15	16	11	
4WTS of incoming or outgoing toll connecting trunks	4	4-wire	14	6	13	5		
	Misc. Manual Services	4	Incoming or outgoing toll connecting paths via SWBD	Any	15	10	9	6

TABLE Y (Contd)

BALANCE TESTS AND REQUIREMENT

SWITCH TYPE (NOTES 1 AND 2)	TRAFFIC USE CODE	OFFICE CLASS	BALANCE TEST DESCRIPTION	FACILITY TYPE	PRESERVICE AND MAINTENANCE REQUIREMENTS (NOTE 3)		IMMEDIATE ACTION REQUIREMENTS (NOTE 3)	
					ERL (dB)	SRL (dB)	ERL (dB)	SRL (dB)
No. 5 CROSSBAR (Reference Sections 660-472-300 and 660-472-301)	IT (Incoming Intertoll)	4	Incoming machine paths: Using Code 100 test line, Using 900Ω + 2.16μF termination	Any	27	20	21	14
				Any	22	14	16	10
		1,2,3	Incoming machine paths: Through balance, 900Ω + 2.16μF termination	Any	27	20	21	14
				Any	22	14	16	10
	IT (Outgoing Intertoll)	4	Outgoing machine paths: 900Ω + 2.16μF termination, 600Ω termination	Any	22	14	16	10
				Any	27	20	21	14
		1,2,3,4	SWBD access to outgoing trunk	Any	22	14	16	8
		1,2,3	Outgoing machine paths: 900Ω + 2.16μF termination, Through balance	Any	22	14	16	10
				Any	27	20	21	14
		1,2,3	Outgoing trunk with SWBD access (through balance)	Any	27	20	21	14
	LW, AO (Incoming Secondary Intertoll)	4	Operator assistance trunks	Any	22	14	16	8
		1,2,3	Operator assistance trunks incoming to SWBD (121 trunks) (through balance)	Any	27	20	21	14
		1,2,3	Performance verification of operator assistance connection (through balance)	Any	27	20	21	14
	OJ, TT (Outgoing Secondary Intertoll)	4	Operator toll junctor	Any	22	14	16	8
		1,2,3	Operator junctor outgoing from SWBD (through balance)	Any	27	20	21	14
1,2,3		Performance verification of operator assistance connector (through balance)	Any	27	20	21	14	
TC, TM, OO (Intertoll To Toll Connecting Via Machine)	1,2,3,4	Incoming intertoll machine paths	Intrabldg	22	14	16	10	
			2w Interbldg	18	10	13	6	
			4w Interbldg	22	15	16	11	
	1,2,3,4	4WRS of outgoing toll connecting machine paths	4-wire	14	6	13	5	

TABLE Y (Contd)

BALANCE TESTS AND REQUIREMENT

SWITCH TYPE (NOTES 1 AND 2)	TRAFFIC USE CODE	OFFICE CLASS	BALANCE TEST DESCRIPTION	FACILITY TYPE	PRESERVICE AND MAINTENANCE REQUIREMENTS (NOTE 3)		IMMEDIATE ACTION REQUIREMENTS (NOTE 3)	
					ERL (dB)	SRL (dB)	ERL (dB)	SRL (dB)
No. 5 CROSSBAR (Contd)	TM, TS (Intertoll To Toll Connecting Via SWBD)	1,2,3,4	Incoming intertoll via SWBD	Intrabldg	22	14	16	10
				2w Interbldg	18	10	13	6
				4w Interbldg	22	15	16	11
		1,2,3,4	4WTS of incoming or outgoing SWBD Paths	4-wire	14	6	13	5
	SP*, DD, CA (Toll Connecting To Intertoll Via Machine)	1,2,3,4	Outgoing intertoll machine paths: (AMA, CAMA, LAMA, TSPS, intermarker group)	Intrabldg	22	14	16	10
				2w Interbldg	18	10	13	6
				4w Interbldg	22	15	16	11
		1,2,3,4	4WTS of incoming toll connecting paths (AMA, CAMA, LAMA, TSPS)	4-wire	14	6	13	5
	RC, OO (Toll Connecting To Intertoll Via SWBD)	1,2,3,4	Outgoing intertoll via toll SWBD	Intrabldg	22	14	16	10
				2w Interbldg	18	10	18	6
			4w Interbldg	22	15	16	11	
1,2,3,4		4WTS of incoming or outgoing SWBD paths	4-wire	14	6	13	5	
MISC. Manual Services	1,2,3,4	Incoming or outgoing toll completing trunks via machine or toll SWBD	Any	15	10	9	6	
Conference Bridge	1,2,3	Multiport conference bridge test (through balance)	Any	27	20	21	14	
No. 4A CROSSBAR (Reference Sections 660-473-300 and 660-473-301)	Emergency Access Trunks	1,2,3	Intertoll to emergency access trunks (through balance)	Any	27	20	21	14
	LW, OA (Incoming Sec. Intertoll)	4	Incoming Sec. Intertoll paths	Any	27	20	21	14
		1,2,3	Intertoll to intertoll; OA to Tandem (through balance)	Any	27	20	21	14
	TT (Outgoing Sec. Intertoll)	4	Outgoing Sec. intertoll paths	Any	27	20	21	14
1,2,3		Intertoll to intertoll; Tandem to OA (through balance)	Any	27	20	21	14	

TABLE Y (Contd)

BALANCE TESTS AND REQUIREMENT

SWITCH TYPE (NOTES 1 AND 2)	TRAFFIC USE CODE	OFFICE CLASS	BALANCE TEST DESCRIPTION	FACILITY TYPE	PRESERVICE AND MAINTENANCE REQUIREMENTS (NOTE 3)		IMMEDIATE ACTION REQUIREMENTS (NOTE 3)	
					ERL (dB)	SRL (dB)	ERL (dB)	SRL (dB)
No. 4A CROSSBAR (Contd)	TC, TS (Toll Completing)	1,2,3,4	Outgoing toll connecting trunks	Intrabldg	22	14	16	10
				2w Interbldg	18	10	13	6
				4w Interbldg	22	15	16	11
		1,2,3,4	4WTS of incoming or outgoing toll connecting trunks terminating on a SWBD	4-wire	14	6	13	5
	CA, DD, OO SP*, RC (Toll Originating)	1,2,3,4	Incoming toll connecting trunks	Intrabldg	22	14	16	10
				2w Interbldg	18	10	13	6
				4w Interbldg	22	15	16	11
		1,2,3,4	4WTS of incoming or outgoing toll connecting trunks terminating on a SWBD	4-wire	14	6	13	5
	MISC. Manual Service	1,2,3,4	Special Services, mobile radio, toll Subscriber lines, etc.	Any	15	10	9	6
	Conference Service	1,2,3,4	Multipoint conference bridge	Any	27	20	21	14
CROSSBAR TANDEM (Reference Sections 660-471-300 and 660-471-301)	IT (Incoming Intertoll)	4	Incoming machine paths	Any	27	20	21	14
		1,2,3	Incoming to machine (through balance)	Any	27	20	21	14
	IT (Outgoing Intertoll)	4	Outgoing machine paths	Any	27	20	21	14
		4	SWBD access to outgoing intertoll trunks	Any	22	14	16	8
		1,2,3	Outgoing intertoll from machine (through balance)	Any	27	20	21	14
		1,2,3	Outgoing intertoll from SWBD (through balance)	Any	27	20	21	14
	LW, OA (Incoming Sec. Intertoll)	4	Operator assistance trunks	Any	22	14	16	8
		1,2,3	Operator assistance trunks: 121 trunks only (through balance)	Any	27	20	21	14

TABLE Y (Contd)

BALANCE TESTS AND REQUIREMENT

SWITCH TYPE (NOTES 1 AND 2)	TRAFFIC USE CODE	OFFICE CLASS	BALANCE TEST DESCRIPTION	FACILITY TYPE	PRESERVICE AND MAINTENANCE REQUIREMENTS (NOTE 3)		IMMEDIATE ACTION REQUIREMENTS (NOTE 3)		
					ERL (dB)	SRL (dB)	ERL (dB)	SRL (dB)	
CROSSBAR TANDEM (Contd)	TT (Outgoing Sec. Intertoll)	1,2,3,4	Tandem trunks to outgoing inter-Toll	2-wire	22	14	16	8	
		1,2,3	Tandem trunk outgoing from SWBD (through balance)	4-wire	27	20	21	14	
		1,2,3	NBO Verification of Tandem trunk; SWBD end (through balance)	4-wire	27	20	21	14	
		1,2,3	NBO Verification of Tandem trunks machine end (through balance)	4-wire	27	20	21	14	
	TC, TM, OO (Intertoll To Toll Connecting Via Machine)	1,2,3,4		Incoming intertoll machine paths	Intrabldg	22	14	16	10
					2w Interbldg	18	10	13	6
					4w Interbldg	22	15	16	11
		1,2,3,4	4WTS of outgoing toll connecting Trunks	4-wire	14	6	13	5	
	TM, TS (Intertoll To Toll Connecting Via SWBD)	1,2,3,4		Incoming intertoll via toll SWBD	Intrabldg	22	14	16	10
					2w Interbldg	18	10	13	6
					4w Interbldg	22	15	16	11
		1,2,3,4	4WTS of incoming or outgoing SWBD paths	4-wire	14	6	13	5	
	CA, DD, SP* (Toll Connecting To Intertoll via machine)	1,2,3,4		Outgoing intertoll machine paths	Intrabldg	22	14	16	10
					2w Interbldg	18	10	13	6
4w Interbldg					22	15	16	11	
1,2,3,4		4WTS of incoming toll connecting machine paths	4-wire	14	6	13	5		
RC, OO (Toll Connecting To Intertoll Via SWBD)	1,2,3,4		Outgoing intertoll via toll SWBD	Intrabldg	22	14	16	10	
				2w Interbldg	18	10	13	6	
				4w Interbldg	22	15	16	11	
	1,2,3,4	4WTS of incoming or outgoing SWBD paths	4-wire	14	6	13	5		
MISC. Manual Services	1,2,3,4		Incoming or outgoing toll Completing trunks via machine or SWBD	Any	15	10	9	6	
Conference Service	1,2,3		Multipoint conference bridge	Any	27	20	21	14	

TABLE Y (Contd)

BALANCE TESTS AND REQUIREMENT

SWITCH TYPE (NOTES 1 AND 2)	TRAFFIC USE CODE	OFFICE CLASS	BALANCE TEST DESCRIPTION	FACILITY TYPE	PRESERVICE AND MAINTENANCE REQUIREMENTS (NOTE 3)		IMMEDIATE ACTION REQUIREMENTS (NOTE 3)	
					ERL (dB)	SRL (dB)	ERL (dB)	SRL (dB)
No. 1/1A ESS (Reference Sections 660-476-300 and 660-476-301)	IT	4	Intertoll, Sec. Intertoll, or 4-wire toll connecting trunks	4-Wire	40	35	39	34
		4	Intertoll trunks; Outgoing, Incom- ing or 2-way-Tandem mode	Any	27	20	21	14
		1,2,3,4	Intertoll trunks; Incoming, Out- going local mode	Any	22	14	16	10
		1,2,3	Intertoll, Sec. Intertoll, or 4-wire toll connecting trunk (through balance)	4-wire	40	35	39	34
		1,2,3	Intertoll trunks; Incoming, Out- going or 2-way-tandem mode (through balance)	Any	27	20	21	14
	LW, OA, TT (Sec. Intertoll)	4	Intertoll, Sec. Intertoll, or 4-wire Toll connecting trunks	4-wire	40	35	39	34
		4	Incoming from intertoll or outgoing to intertoll	Any	27	20	21	14
		1,2,3	Intertoll, Sec. Intertoll, or 4-wire toll connecting trunks (through balance)	4-wire	40	35	39	34
		1,2,3	Incoming from intertoll or outgoing to intertoll (through balance)	Any	27	20	21	14
		1,2,3	Sec. intertoll to Sec. intertoll via Toll SWBD (through balance)	Any	27	20	21	14
	OO, TC, TM DT (Toll Completing Via Machine)	1,2,3,4	Intertoll to toll connecting via machine	Intrabldg	22	14	16	10
				2w Interbldg	18	10	13	6
				4w Interbldg	22	15	16	11
		1,2,3,4	4WTS of toll connecting trunks	4-wire	14	6	13	5
	TM, TS (Toll Completing Via SWBD)	1,2,3,4	Intertoll to toll connecting SWBD	Intrabldg	22	14	16	10
2w Interbldg				18	10	13	6	
4w Interbldg				22	15	16	11	
1,2,3,4		4WTS of toll connecting trunk	4-wire	14	6	13	5	

TABLE Y (Contd)

BALANCE TESTS AND REQUIREMENT

SWITCH TYPE (NOTES 1 AND 2)	TRAFFIC USE CODE	OFFICE CLASS	BALANCE TEST DESCRIPTION	FACILITY TYPE	PRESERVICE AND MAINTENANCE REQUIREMENTS (NOTE 3)		IMMEDIATE ACTION REQUIREMENTS (NOTE 3)			
					ERL (dB)	SRL (dB)	ERL (dB)	SRL (dB)		
No. 1/1A ESS (Contd)	CA, DD, SP* (Toll Originating Via Machine)	1,2,3,4	Toll connecting to intertoll via machine (AMA, CAMA, TSPS/RTA)	Intrabldg	22	14	16	10		
				2w Interbldg	18	10	13	6		
				4w Interbldg	22	15	16	11		
		1,2,3,4	4WTS of AMA or CAMA trunk	4-wire	14	16	13	5		
				1,2,3,4	Intrabuilding toll connecting/TSPS	Any	22	14	16	10
						RC, OO (Toll Originating Via SWBD)	1,2,3,4	Toll connecting to intertoll via toll SWBD	Intrabldg	22
	2w Interbldg	18	10	13	6					
	4w Interbldg	22	15	16	11					
	1,2,3,4	4WTS of toll connecting trunk	4-wire	14	6		13	5		
			1,2,3,4	CAMA junctor	Any		15	10	9	6
					1,2,3,4		Mobile radio, coastal harbor, special service, WATTS, LD	Any	15	10
	1,2,3,4	Intrabuilding Toll connecting/TSPS	Any	22		14		16	8	
No. 1 ESS With HILO (Reference Sections 660-470-300 and 660-470-301)			LW, OA (Incoming Sec. Intertoll)	4	Incoming from intertoll or outgoing to intertoll	Any	27	20	21	14
	1,2,3,4	Incoming from intertoll or outgoing to intertoll (through balance)		Any	27	20	21	14		
				1,2,3,4	Incoming sec. intertoll to outgoing sec. intertoll via toll SWBD (through balance)	Any	27	20	21	14
	TT (Outgoing Sec. Intertoll)	4	Incoming from intertoll or outgoing to intertoll	Any	27	20	21	14		
		1,2,3,4	Incoming from intertoll or outgoing to intertoll (through balance)	Any	27	20	21	14		
				1,2,3,4	Outgoing sec. intertoll to incoming sec. intertoll via toll SWBD (through balance)	Any	27	20	21	14

TABLE Y (Contd)

BALANCE TESTS AND REQUIREMENT

SWITCH TYPE (NOTES 1 AND 2)	TRAFFIC USE CODE	OFFICE CLASS	BALANCE TEST DESCRIPTION	FACILITY TYPE	PRESERVICE AND MAINTENANCE REQUIREMENTS (NOTE 3)		IMMEDIATE ACTION REQUIREMENTS (NOTE 3)			
					ERL (dB)	SRL (dB)	ERL (dB)	SRL (dB)		
No. 1 ESS With HILO (Contd)	OO, TC, TM (toll Connecting Via Machine)	1,2,3,4	Intertoll to toll connecting via machine paths	Intrabldg	22	14	16	10		
				2w Interbldg	18	10	13	6		
				4w Interbldg	22	15	16	11		
		1,2,3,4	4WTS of toll connecting trunks	4-wire	14	6	13	5		
				1,2,3,4	Intertoll to toll connecting via SWBD	Intrabldg	22	14	16	10
						2w Interbldg	18	10	13	6
	4w Interbldg	22	15			16	11			
	1,2,3,4	4WTS of toll connecting trunks	4-wire	14	6	13	5			
			CA, DD, SP* (Toll Orginating Via Machine)	1,2,3,4	Toll connecting to intertoll via machine paths	Intrabldg	22	14	16	10
						2w Interbldg	18	10	13	6
	4w Interbldg	22				15	16	11		
	1,2,3,4	4WTS of toll connecting trunks		4-wire	14	6	13	5		
RC, OO (Toll Originating Via SWBD)				1,2,3,4	Toll connecting to intertoll via SWBD	Intrabldg	22	14	16	10
						2w Interbldg	18	10	13	6
	4w Interbldg	22	15			16	11			
	1,2,3,4	4WTS of toll connecting trunk	4-wire	14	6	13	5			
			1,2,3,4	Mobile radio special service	Any	15	10	9	6	
					1,2,3	Mulitport Conference bridge (through balance)	Any	27	20	21
No. 4 ESS (Reference Section 660-460-301)	Trunks Selected Via Machine	1,2,3,4	Toll orginating and toll completing	Intrabldg			22	15	16	11
				2w Interbldg	18	13	16	11		
				4w Interbldg	22	15	16	11		
	SWBD Trunks	1,2,3,4	SWBD trunks	Any	Use same tests and requirements as No. 4A Cross bar					

TABLE Y (Contd)

BALANCE TESTS AND REQUIREMENT

Note 1: The Switching Systems listed (ie, No. 5 crossbar) are intended to include all forms of that switch (ie, codes 25A, 25P, etc) as well as switchboard combinations (ie, code C2D).

Note 2: Reference Sections 660-4XX-300 and 600-47X-301 contain through and terminal balance test information respectively. The tests listed in the Test Description column of this table are assumed to be terminal balance tests and refer to the applicable 660-47X-301 section unless otherwise indicated. (Through balance test refer to the appropriate 660-4XX-300 section.)

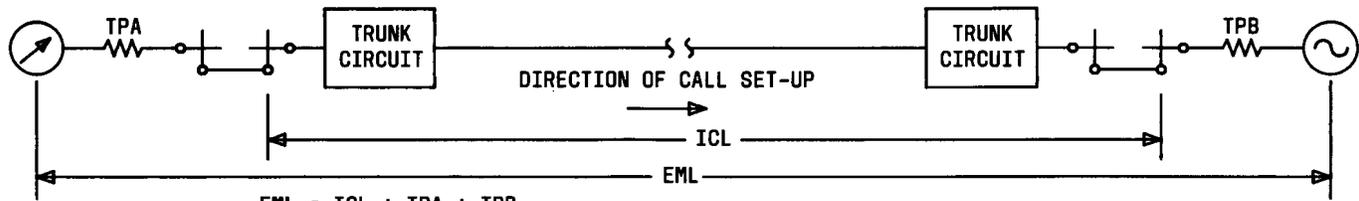
Note 3: The values given for Preservice, Maintenance, and Immeditate Action requirements are based on TPO testing. Other test pad (TP) values will require the following correction factors:

TP2 — add 4 dB to the requirments listed in the table

TP3 — add 6 dB to the requirements listed in the table

High loss trunks (No. 4A crossbar offices only) add 14 dB (in addition to the 4 dB TP2 correction, if applicable) to the requirements listed in the table

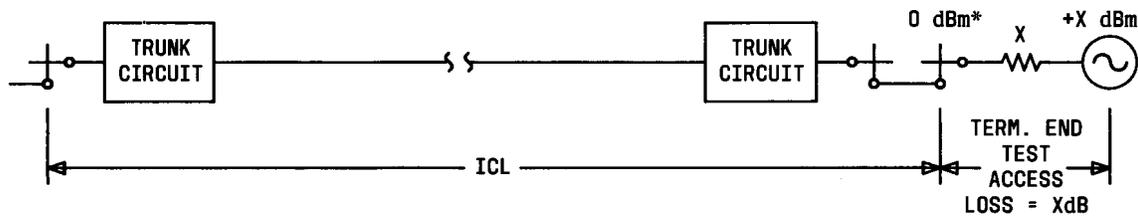
*Test requirements shown for SP trunks apply only to the Class 5 to toll office portion of the trunk. Balance requirements for the Class 5 to TSPS portion of the trunk, and the base-remote trunks, (also coded SP) are in Section 660-450-303 (to be issued).



$EML = ICL + TPA + TPB$

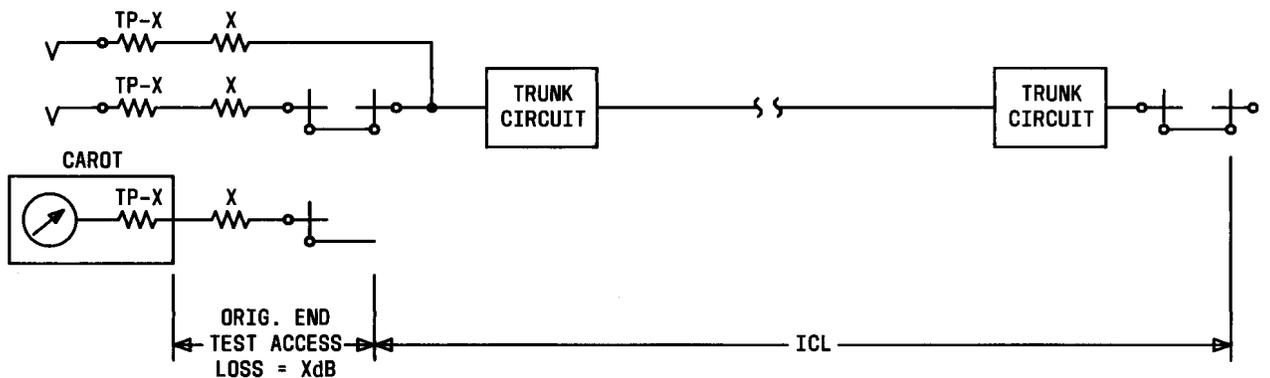
TPA AND TPB MAY BE 0-, 2-, OR 3-dB TEST PADS (NOMINAL VALUE)

(A) DEFINITION OF EML

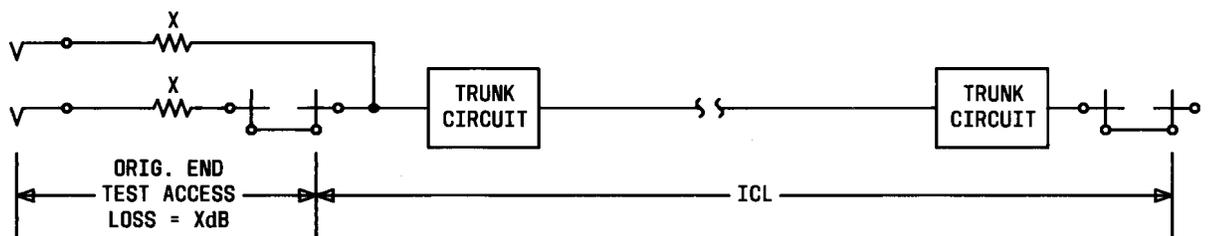


* 0 dBm IN TP0 OFFICES, -2 dBm IN TP2 OFFICES, OR -3 dBm IN TP3 OFFICES

(B) TERMINATING END ACCESS LOSS COMPENSATED FOR BY INCREASING LEVEL OF TEST SIGNAL BY VALUE OF TEST ACCESS LOSS

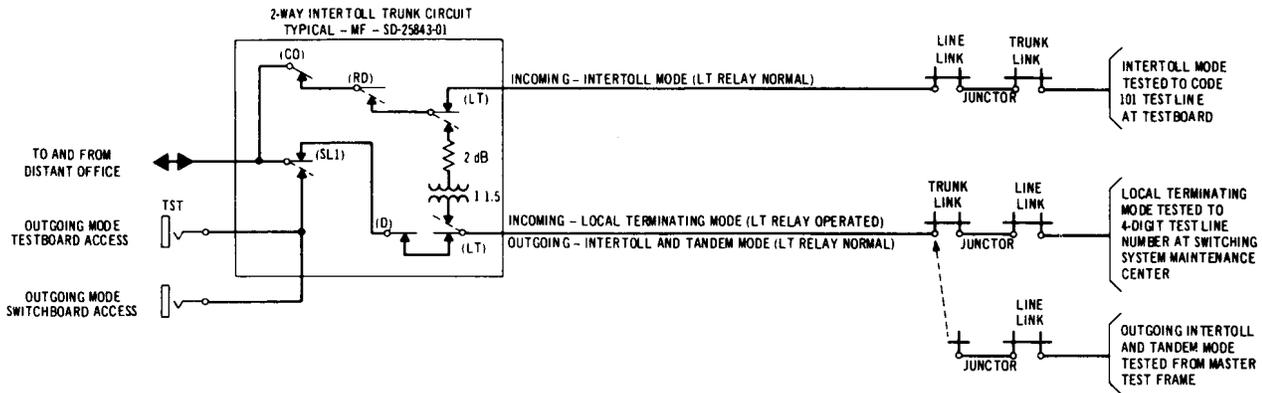


(C) ORIGINATING END TEST ACCESS LOSS COMPENSATED FOR BY REDUCING TEST PAD (TP) VALUE BY THE VALUE OF THE TEST ACCESS LOSS

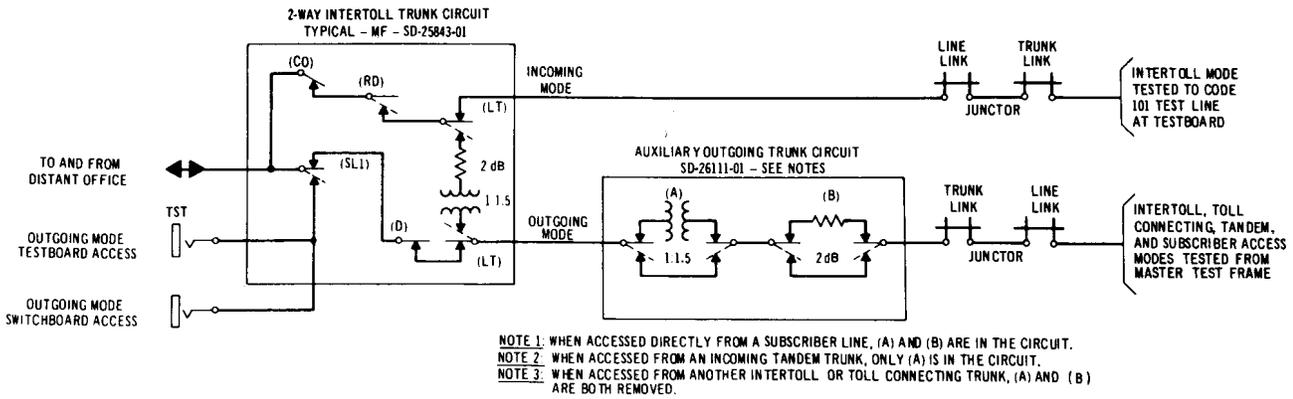


(D) ORIGINATING END TEST ACCESS LOSS NOT COMPENSATED FOR. ACCESS LOSS MUST BE MEASURED AND SUBTRACTED FROM THE AML FOR COMPARISON WITH THE DEFINED EML

Fig. 1—EML and Compensation for Test Access Loss



**Fig. 2—Schematic Showing Modes of Operation—2-Way Intertoll Trunk Circuit—
No. 3 Crossbar Offices**



**Fig. 3—Schematic Showing Modes of Operation—2-Way Intertoll Trunk Circuit and
Auxiliary Outgoing Trunk Circuit—No. 5 Crossbar Offices**