

## PRIVATE LINE TELEPHONE SERVICE

### MULTISTATION SYSTEMS

Contents	Page
1. General .....	1
2. Definition of Terms .....	1
3. Responsibilities .....	2
4. Release of Circuits for Tests .....	2
5. Testing Equipment .....	3
6. Circuit Order Tests .....	3
(A) General .....	3
(B) Tests between STC's and Served Stations .....	3
(C) Over-all Tests .....	5
7. Routine Tests .....	6
(A) Tests of Sections between STC's and Served Stations .....	6
(B) Station Inspections .....	6
(C) Two-Tone Signaling Equipment... 6	
8. Trouble Investigation .....	6

#### 1. GENERAL

**1.01** This section covers the transmission tests and maintenance procedures to be followed at the subscriber's premises on multistation private line telephone circuits. Though applicable to all multistation private line circuits it is particularly applicable to those for the U.S. Armed Forces, Airline Companies, and Pipeline Companies. Circuits for the Federal Aeronautics Administration are covered in Section C71.834.2.

**1.02** This section replaces Section C71.834, Issue 2, "2-Wire and 4-Wire Private Line Station Circuit." The information formerly in that practice is included herein. This section is ex-

panded to include information and charts showing how to make the transmission tests required at the subscriber's premises. Additional station equipment information will be found in SD-69254-01 and its associated CD-69254-01. The schematic drawing is available in page size and should be filed with this section when the information is required.

**1.03** U.S. Armed Forces, Airline, and Pipeline circuits and similar circuits are established on a 24-hour-a-day basis. In view of the nature of the uses of these circuits, all possible precautions should be taken to prevent service interruptions and to restore service with a minimum of delay whenever interruptions occur. In view of this, **ANY WORK BY TELEPHONE COMPANY FORCES WHICH MIGHT INTERRUPT OR INTERFERE WITH THE PROPER OPERATION OF THESE CIRCUITS SHOULD BE CLOSELY SUPERVISED TO ASSURE THAT THESE SERVICES ARE ADEQUATELY PROTECTED.**

**1.04** The standard circuit order and maintenance instructions apply in all cases not covered by these procedures. The provisions of this section should be followed as closely as possible, and where exceptions must be made they should be reported promptly to higher offices via lines or organization.

#### 2. DEFINITION OF TERMS

**2.01** Certain terms are used frequently in this section to describe the tests and service operations. The more frequently used terms are defined below.

**2.02** A **Control Office** is an office designated as "control" on a circuit layout card or sketch for a specific private line telephone circuit.

## SECTION C71.834.1

**2.03** A **Subcontrol Office** is an office appointed by the control office to assist in carrying out control office functions in those sections where such assistance is required due to communication, circuit arrangement, or other reasons where it is impractical for the control office to handle all the details of service maintenance on a particular circuit. The subcontrol office has no line-up responsibilities unless such responsibilities are specifically assigned by the control office.

**2.04** A **Serving Test Center**, usually referred to as an STC, is an office that is designated as being responsible for all matters pertaining to the service received by the station or stations that the STC serves. Nearly always an STC will serve all of the stations that are multipled to the same loop. Usually the STC will be the toll office at which the subscriber's loop connects to the toll portion of the circuit or a bridging office at the end of a branch that includes both toll and loop facilities. In some few cases a private line circuit will not be routed through the office of the STC. In this case, the transmission tests to be made at the STC as prescribed by this section will be made by some other suitable office appointed by the STC.

**2.05** A **Bridging Office** is an office where the circuit is routed through a bridge, either 2-wire or 4-wire.

**2.06** A **Branch** is that portion of a private line circuit between a side of a bridge and a subscriber's station(s). A branch includes all equipment that is located at the subscriber's station such as pads, loop transformers, induction coil, instrument, etc. It also includes all equipment at the bridging office up to the bridge terminals.

**2.07** A **Loop** consists of all of the exchange facilities between a subscriber's station and the toll office from which the exchange facilities are fed. Loops are commonly referred to as "local channels." A loop can be either 2-wire or 4-wire. In the case of 4-wire loops, the loop that is used for transmission from the station is called a transmitting loop and the loop for transmission toward the station is called a receiving loop.

**2.08** A **Main-Line Circuit**, sometimes referred to as a backbone circuit, is that portion of a multistation private line telephone circuit that

extends from the control office to the most remote toll office. The main-line circuit will usually be routed through one or more intermediate bridging offices from which branches are fed. Where the circuit radiates from the control office in more than one direction, there will be more than one main-line circuit.

**2.09** A **Side-Leg Circuit** is that portion of a multistation private line circuit between the main-line circuit and a Serving Test Center (STC). Usually the main-line circuit will be routed through most of the STC's and therefore, in most cases, a circuit will not have a side-leg section.

### 3. RESPONSIBILITIES

**3.01** No work or testing of any kind, other than necessary to restore service in case it is interrupted, should be done on these circuits or the associated station equipment (excluding the routine tests on loudspeaker equipment and telephone repeaters as covered in Part 7), except at the direction of or upon the approval of the control office.

**3.02** In those cases where loudspeakers are connected to the circuit at customer locations, testing by telephone company forces should be so conducted that the testing does not interfere with normal business activities of the subscriber. The circuit should not be used as an order wire during trouble investigations. If it is necessary to go in on the circuit, the tester should identify himself. Only business pertinent to the trouble being investigated should be conducted on the circuit.

### 4. RELEASE OF CIRCUITS FOR TESTS

**4.01** Tests on all new circuits, sections added to existing circuits, and on rearranged sections should be completed prior to the scheduled start of service so as to preclude the necessity of obtaining releases once the circuit has been turned up for service to the customer.

**4.02** These circuits are not to be taken out of service for test or any other purpose without first obtaining a release from the customer's authorized contact. The release should be obtained via the control office.

## 5. TESTING EQUIPMENT

**5.01** The following equipment, or equivalents, may be required and should be available at the subscriber's location when testing on the sections between the STC and the associated stations.

### Notes

- (1) 600-Ohm, Variable Frequency Oscillator 1
- (1) 2B or 3A Noise Measuring Set
- (1) 600-Ohm Transmission Measuring Set 2
- (1) 178F or 181B Induction Coil
- (4) 1W13A Cords
- (8) KS-6278 Clips
- (1) Zero db 89-Type Resistor (89A)
- (1) 15 db 89-Type Resistor (89BL)
- (1) 110-Volt Extension Cord with Multiple Receptacle

**Note 1:** The oscillator should have a frequency range from 300 to 3000 cycles per second. Typical types of oscillators that might be used are the 200 CD Hewlett-Packard oscillator and the oscillator associated with a 21A TMS. Both of these oscillators are ac operated. The output level of the oscillator that is used should be adjusted by patching its output to the input of the calibrated TMS at the station.

**Note 2:** Typical types of transmission measuring sets that might be used are the 21A TMS (J94021A) and the 13A TMS, both of which are ac operated. The transmission measuring set should be calibrated at the central office using a standard milliwatt supply before it is taken to the subscriber's location. In locations where commercial 110-volt ac power is not available, it might be necessary to provide a portable 110-volt ac power supply, such as a gasoline motor-generator, for operation of the oscillator and TMS. A method of checking oscillator and TMS calibrations without returning them to the central office is given in Chart 1 in this practice. This method requires

a nonrepeated cable pair between the central office and the station. It is not a substitute for the calibration of the TMS prior to transportation to the station.

## 6. CIRCUIT ORDER TESTS

### (A) General

**6.01** The tests required on all new multistation private line telephone circuits, on sections changed by circuit order, on sections added to existing circuits, and on sections affected by additions and rearrangements are subdivided as follows in this Part of the practice:

(B) Tests between STC's and Served Stations

(C) Over-all Tests

### (B) Tests between STC's and Served Stations

**6.02** It should be kept in mind that in some few cases it will be necessary for some office other than the STC to make these tests. See Paragraph 2.05.

**6.03** While these tests are being made, continuity between the STC and the subscribers's location should be maintained by available local connections, special underlying physical circuits, where provided, or by message facilities obtained through traffic department to expedite tests. If none of the above facilities are available, the section under test, properly terminated may be used for communication.

**6.04** During the period of release for tests, the STC should keep 600-ohm terminating plugs in the bridge leg associated with the section under test in order to maintain proper impedance to the remainder of the circuit and to insure that no testing tone is transmitted into the circuit. In case the circuit is not routed through a bridge at the STC, the 600-ohm terminations should be connected at the carrier channel or repeater jacks associated with the incoming facility.

**6.05** A series of charts with associated sketches is included in this practice to facilitate the testing of the sections between STC's and their served stations. Each section should be measured

**SECTION C71.834.1**

in both the transmitting and receiving directions. On 4-wire sections the talk-back path should also be measured by sending on the transmit path at the station and measuring on the receive path at the station. Selection of the applicable charts can be made by referring to Table I. On several of the charts where a test oscillator is connected thru a coil to the transmitter terminals a test level of +4.7 dbm is specified as resulting in a +3.0 dbm line level. This value will be obtained only with the use of 181B coils and a 4 mfd capacitor. Other equipment will give approximately the following loss between these points:

TEST AND SUBSET COILS	CAPACITOR (MFD)	LOSS (DB)
181B — 181B	0	2.1
181B — 181B	2	2.6
181B — 181B	4	1.7
181B — 178F	0	2.5
181B — 178F	4	2.9
181B — 178F	8	1.7
178F — 178F	0	3.0
178F — 178F	2	3.1
178F — 178F	4	1.6

ments used. In addition to the detailed testing procedures for the most commonly used 4-wire station arrangements, charts also cover the less frequently encountered 2-wire station arrangements and PBX arrangements although in less detail.

**6.07** All of the 4-wire testing arrangements in this practice assume that the circuit has been engineered so that the bridging losses at the stations remain constant regardless of whether one or all of the station instruments are off-hook. Only in isolated cases will circuits be encountered where idle circuit terminations are not used in a manner that will provide constant station bridging losses. One of the few such cases are FAA circuit terminations per Drawing SD-69164-01 that terminate in 102A key equipment at Air Route Traffic Control Centers. A circuit whose levels are dependent upon having a specific number of off-hook stations (bridging loss at station dependent upon number of off-hook stations) will have a note on the circuit layout card or sketch to that effect.

**TABLE I**

Type of Station Termination	STC to Station	Station to STC	Talk-Back Path
4-wire termination per SD-69158-01, Fig. 1 or SD-69167-01, Fig. 61	Chart 2 (5 and 7)*	Chart 3 (6 and 8)*	Chart 4
4-wire termination per SD-69254-01	Chart 9 (12, 14, and 16)*	Chart 10 (13, 15 and 16)*	Chart 11
2-wire termination	Chart 17	Chart 17	
PBX termination—2-wire loop	Chart 18	Chart 18	
PBX termination—4-wire loop	Chart 19	Chart 19	

( ) \* Indicates numbers of test charts that can be used to sectionalize troubles when over-all tests are not within the specified limits.

**6.06** It would not be practicable to prepare a chart to cover the exact testing procedure for all of the various station arrangements that are likely to be encountered. Instead, the most frequently used arrangements have been covered and notes included on the charts so that the tester can apply them to the majority of the other arrange-

**6.08** The tester at the STC should thoroughly understand the station arrangement being tested before starting to test. It is sometimes helpful for the STC to keep on file copies of the SD drawings applicable to the station arrangements and equipment at the stations that they serve.

**6.09** Nearly all of the charts in this practice refer to the "level reference point" at the stations. This term along with other information on station levels is discussed in other Bell System Practices.

#### Talking and Signaling Tests

**6.10** Since over-all tests require close coordination between a number of offices and also require Telephone Company coverage at a number of private line stations, a trouble condition on a single section between an STC and its served station is likely to delay the over-all tests and to cause a great deal of inconvenience to personnel at other offices and stations. For this reason, it is desirable that the following talking and signaling tests be made between each STC and its served stations, and all trouble conditions corrected prior to the over-all tests.

**6.11 Talking Tests:** Check the talking transmission between the subscriber's main station and the connected telephone set at the STC. Also check transmission between each extension station and the STC and between each extension station and the main station. The personnel at the subscriber's location and also the tester at the STC should speak at a normal volume directly into the transmitter when making these tests. Satisfactory volume free of echo noise, crosstalk, clicks, hum, etc., should be obtained.

**6.12 Signaling Tests:** The proper operation of signaling equipment should be checked by having the main and extension stations apply outward signals and listening at the STC to make sure the proper conversion is accomplished by the signaling equipment. The STC, if possible, should measure the 20-cycle signaling voltage from the subscriber to make sure that the voltage is sufficient to provide the proper margin of operation for the type of central office signaling equipment that is used. The STC should also apply a signal and check to make sure that the signal circuit at the station operates properly. All selective signaling features should be checked. Two-tone signals and 1000-cycle signals to the main-line circuit should be checked for proper levels. The volume indicator when connected can be used for this check. Loudspeaker operations should also be checked at this

time to ascertain that satisfactory volume is obtainable and to verify that the loudspeaker is disabled in the manner desired by the subscriber. Usually the loudspeaker will be disabled when an instrument is removed from its mounting or inserted in the station jack, although occasionally the customer will desire to have it operative at all times except when the push-to-talk button is operated.

#### (C) Over-all Tests

**6.13** After the central office tests and the tests between STC's and their served stations have been completed, the following over-all tests should be made on each multistation private line telephone circuit.

#### Transmission Tests

**6.14** The testing frequency for these tests is 1000 cycles and the testing level is the level shown on the circuit layout card or sketch for the point of application.

**6.15** Make 1000-cycle net loss measurements in each direction between the customer's main station and one or more of the remote stations. The procedures to be followed when sending and receiving at the stations including the sending and receiving levels are the same as the procedures used in making tests between the STC and station per Part 6(B) of this section.

**Requirements:** The transmission measuring sets at each measuring station should indicate level shown on the circuit layout card or sketch within the limits specified for facilities of corresponding length and make-up. Consult the control office for the requirements.

#### Signaling and Talking Tests

**6.16** Make talking tests between the customer's main station and all station drops to insure that satisfactory talking volume is obtained. The volume from all stations should be approximately the same. Check for noise, echo, and for the proper operation of echo suppressors where assigned.

## SECTION C71.834.1

**6.17** Check the operation of the signaling circuit between each combination of stations that has a signaling requirement. Two-tone signaling equipment should be checked in accordance with Section E37.255. All selective signaling features should be checked at this time. The control office should check that the signals applied to the private line circuit are at the correct level.

**6.18** Check operation of loudspeaker equipment, where provided, at each station drop to determine if volume and quality are satisfactory. If practicable, the volume check should be made during periods of high room noise. Also, check that lifting the hand set off the hook, plugging in the handset, or operating a push-to-talk button, as the case may be, silences the loudspeaker.

### Operation of Relay Switching Equipment

**6.19** Test the operation of relay switching equipment used to connect two circuits or sections of a circuit together where such equipment is provided. This check should be made by operating the dial or switching key equipment at the customer's location in order to check the control circuit as well as the switching relays.

**6.20** Where two circuits or sections are connected together by means of relay switching equipment, arrange for talking tests between the stations at the distant terminals of the circuits or sections involved to insure that satisfactory transmission is obtained. Observations should be made for noise, crosstalk and echo.

## 7. ROUTINE TESTS

### (A) Tests of Sections between STC's and Served Stations

**7.01** Tests of sections between STC's and served stations are only required if repeatered or carrier facilities are included in the section. These tests should be scheduled and coordinated by the STC. A release will be required and should be obtained by the STC from the control office as outlined in Part 4 of this section.

**7.02** The section should be measured following the procedure applicable to the type of facility involved. Nonrepeatered loop facilities need not be included in the measurements. The section should be tested every three months or at the interval specified for the type facility involved, whichever is the more frequent.

### (B) Station Inspections

**7.03** The STC should arrange with the local maintenance forces for an inspection of the station equipment every three months. Particular attention should be paid to loudspeaker operation, talking battery supply, and physical condition of equipment, such as wiring, protection, and designations. The inspections should be made in accordance with the information and instructions in the "C" Series of the Practices. Serving Test Centers should participate in these inspections where feasible. Loudspeakers can be routined without obtaining a release provided the customer monitors the circuit with an instrument while the loudspeaker is out of service.

**7.04** Where the talking battery is supplied by dry cells, their condition should be checked quarterly and their cells replaced if necessary.

### (C) Two-Tone Signaling Equipment

**7.05** Periodic tests on two-tone signaling equipment at stations should be made in accordance with instructions in the "C" Series of the Practices. Necessary releases should be obtained per Paragraph 4.02.

## 8. TROUBLE INVESTIGATION

**8.01** The charts in this section for circuit order tests between an STC and a station can sometimes be used to advantage in locating troubles between an STC and a station. If the trouble is of such a nature that the section is not totally inoperable, it should be located and cleared in short release periods only.

**8.02** At the termination of any release period, the following steps should be taken before restoration of service to the subscriber.

(a) At the subscriber's terminal, verify that all station equipment has been restored to its normal working condition.

(b) Make talking and signaling tests between the STC and the station and notify the subscriber that service has been restored to him.

(c) The STC should notify the control office that the service has been restored.

(d) The control office should make a continuity test of the circuit and then notify the customer's controlling station of the service restoration.

**Attached:**

**Charts 1 to 19, inclusive**

CHART 1  
FIG. 1

PURPOSE OF TEST

This chart outlines a method of checking the calibration of test equipment at a private line station without returning it to the central office. This test *is not a substitute for calibration of test equipment* (oscillator and TMS) *at the central office before it is taken to the private line station for use*. This test can only be made if a nonrepeated cable or open wire pair is available between the private line station and the central office. A local loop can normally be used. All testing frequencies are 1000 cycles.

TEST PROCEDURE

- | STEP |   |
|------|---|
| 1    | (Fig. A) At the private line station, connect the oscillator output to the TMS. Adjust the oscillator output until the TMS reads zero dbm. Do not change the oscillator output or TMS calibration during the remaining Steps.   |
| 2    | (Fig. B) At the central office, connect the output of an oscillator to a nonrepeated open wire or cable pair to the station. The output of the oscillator at the central office <i>must be zero dbm</i> . At the private line station, connect the TMS to the cable pair. Read the TMS and record. Positive readings should be given positive signs and negative readings should be given negative signs. <i>This is reading B.</i> |
| 3    | (Fig. C) At the private line station, connect the OSC to the cable or open wire pair. At the central office, connect the TMS to the pair. <i>The TMS must be accurate</i> . At the central office, read and record the TMS indication. Observe positive and negative signs as outlined in Step 2. <i>This is reading C.</i>   |
| 4    | Compute the error of the output of the oscillator at the private line station as follows:<br>Station Oscillator Output Error = $\frac{C-B}{2}$ (A positive answer means the output of the oscillator is high)   |
| 5    | Compute the expected error of the private line station TMS as follows:<br>Station TMS Error = $\frac{B-C}{2}$ (A positive answer means the TMS will read high)  |

EXAMPLE

Assume the following readings were obtained. B = -11.0 dbm      C = -9.0 dbm

Oscillator Error =  $\frac{(-9.0) - (-11.0)}{2} = \frac{-9.0 + 11.0}{2} = +1.0$  (Oscillator output 1.0 db too high)

TMS Error =  $\frac{(-11.0) - (-9.0)}{2} = \frac{-11.0 + 9.0}{2} = -1.0$  (TMS reads 1.0 db low)

CENTRAL OFFICE

SUBSCRIBER'S LOCATION

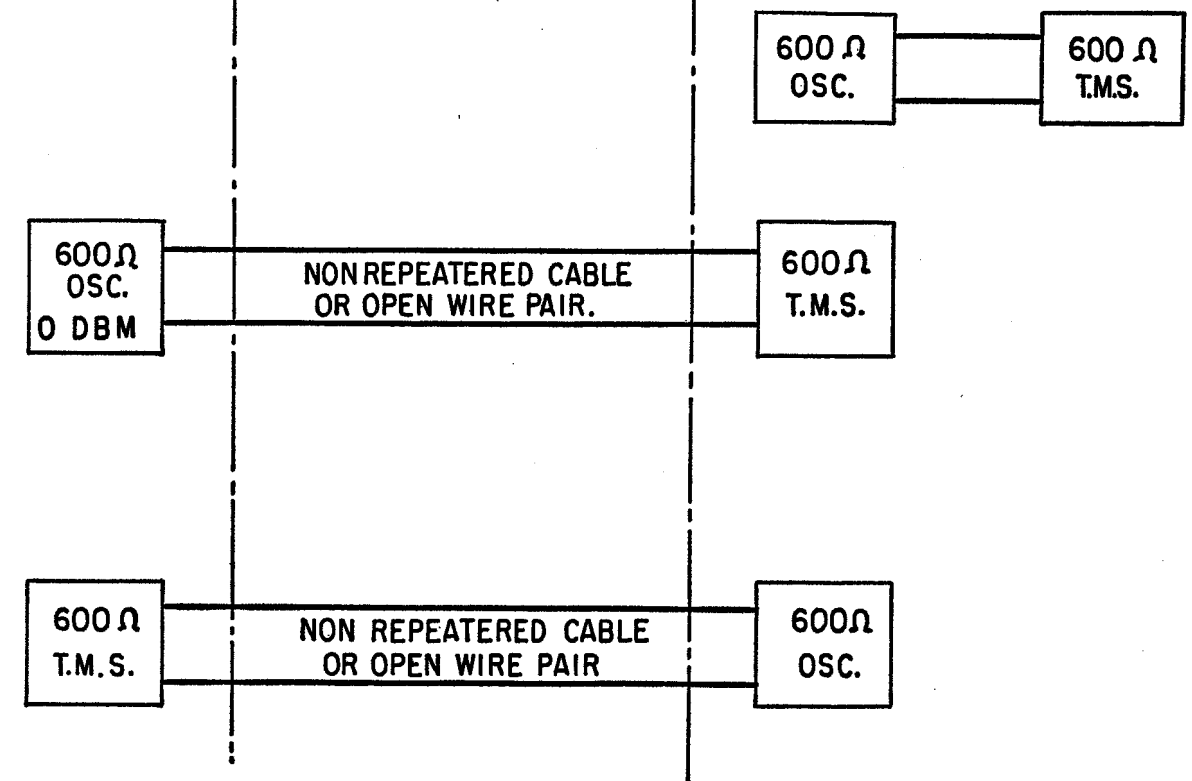




CHART 2  
FIG. 2

## PURPOSE OF TEST

This chart and associated figure outline the procedure to be followed when measuring the net loss of the receiving 4-wire path from an STC to a served private line station where loop terminating arrangements per SD-69167-01, Fig. 61 or SD-69158-01, Fig. 1 or equivalent are used.

## TEST PROCEDURE

## STEP

- 1 At the STC, adjust the OSC for a frequency of 1000 cycles. Adjust the output of the OSC so that it is the same level as that shown on the circuit layout card or sketch for the receiving loop REP IN. *Do not substitute any other level* or erroneous readings may result at the subscriber's terminal due to varistor action. Patch OSC output to REP IN jack.
- 2 At the STC, measure at the REP OUT jack with a 600<sup>w</sup> TMS. If this measurement does not agree with the level shown on the circuit layout card or sketch, calibrate the repeater. When the REP OUT level is correct, remove the TMS patch and leave the OSC patched to the REP IN jack.
- 3 At the subscriber's location, select one station of the group of multipled stations for test. Do not test from an off-premises extension.
- 4 At the subscriber's terminal, remove the receiver unit from the handset and connect the 600<sup>w</sup> TMS to the handset receiver contact springs. Remove the handset from its mounting and read the power received on the TMS. Report this reading to the STC.  
*Requirement:* The TMS reading should be the same as the level shown on the circuit layout card or sketch.  
*Limits:* Loop facilities only included in section measured —  $\pm 1.0$  db.  
Loop and toll facilities included in section measured —  $\pm 2.0$  db.  
If limits are not met, make tests per Chart 5.
- 5 Repeat Steps 1 through 4 using 300- and 3000-cycle test frequencies.  
*Limits:* Should not deviate from 1000-cycle measurement by more than -10 db.

## TEST PROCEDURE NOTES

## NOTE

- 1 In case key equipment is used to connect the station instrument to the private line termination, operate the associated line key when making measurements.
- 2 No correction is required for the TMS readings if the impedance of the removed receiver unit is 600 ohms (HA3, HC4, HC6, or U2 units). For 300-ohm receiver units (HA2, HC1, HC3, or HC5 units), correct the TMS reading 0.5 db. For 150-ohm receiver units (HA1, HA6, HC1, or U1 units), correct the reading of the TMS by 2.0 db, or use a 4:1 transformer and correct for the loss of the transformer. In nearly all cases, 600-ohm receiver units will be used at 4-wire stations.
- 3 If the station termination is a jack for a plug-ended instrument, connect the TMS to the sleeves of a 289B-type plug. Insert the 289B-type plug in the station jack to make the measurements.
- 4 Multipled station phones may be either "on-hook" or "off-hook" without affecting the measurements.

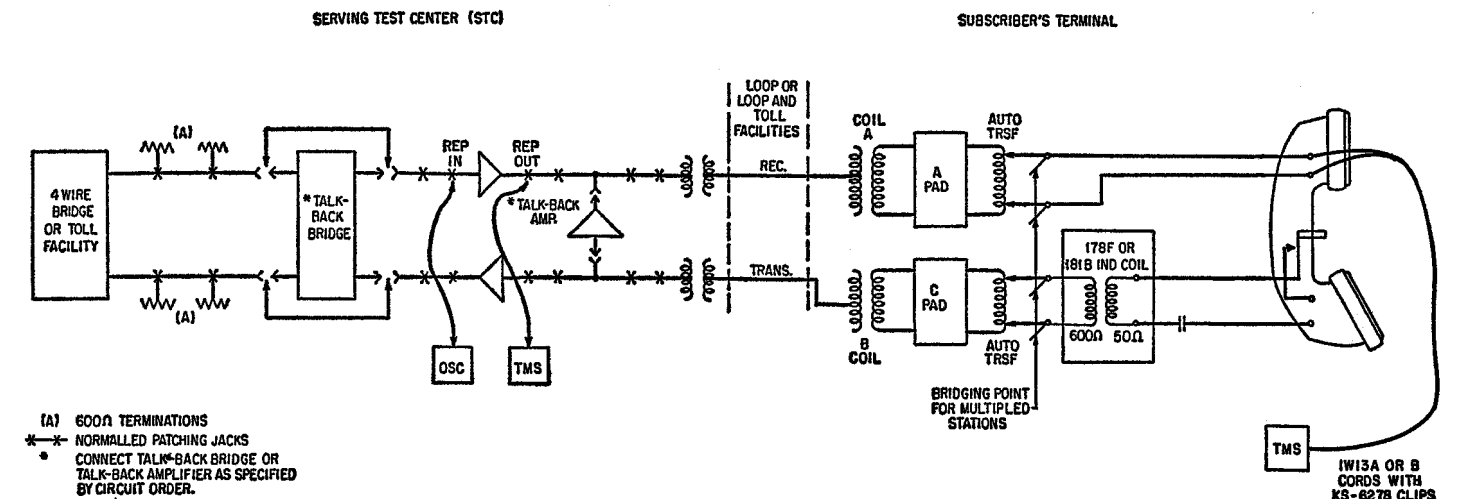


CHART 2  
FIG. 2

CHART 3  
FIG. 3

## PURPOSE OF TEST

This chart and associated figure outline the procedure to be followed when measuring the net loss of the transmitting 4-wire path from a private line station to its STC when loop terminating arrangements per SD-69167-01, Fig. 61, SD-69158-01, Fig. 1, or equivalent are used at the station location.

## TEST PROCEDURE

## STEP

- 1 At the subscriber's location, select one station of the group of multipled stations for test. Do not test from an off-premises extension.
- 2 At the subscriber's terminal, adjust output of OSC, set for 1000 cycles, to plus 4.7 dbm as read on a 600 $\Omega$  TMS. This assumes that a level of plus 3.0 dbm is shown on the circuit layout card or sketch as being the level at the transmitting level reference point.
- 3 At the subscriber's terminal, remove the transmitter unit from the handset. Connect the OSC output to Terminals 1 and 6 of the test 178F or 181B Induction Coil (600 ohms), strap Terminals 2 and 5 and connect Terminals 7 and 8 (50 ohms) to the handset transmitter springs.
- 4 At the STC, calibrate the transmitting loop repeater to the level shown on the circuit layout card or sketch by patching the OSC to REP IN and measuring at REP OUT.
- 5 At the STC, remove the OSC from the REP IN and leave the TMS patched to REP OUT.
- 6 At the subscriber's terminal, operate the handset "push-to-talk" button while the STC measures the 1000 cycles.
- 7 At the STC, read the level at REP OUT.  
**Requirement:** The TMS at the STC should read the same level as the level shown on the circuit layout card or sketch.  
**Limits:** Loop facilities only included in section measured —  $\pm 1.0$  db. Loop and toll facilities included in section measured —  $\pm 2.0$  db. If limits are not met, make tests per Chart 6.
- 8 Repeat Steps 1 through 7 using 300- and 3000-cycle test frequencies.  
**Limits:** Should not deviate from 1000-cycle measurement by more than -10 db.

## TEST PROCEDURE NOTES

## NOTE

- 1 In case key equipment is used to connect the station instrument to the private line termination, operate the associated line key when making measurements.
- 2 The test level of plus 4.7 dbm assumes a reference level of plus 3.0 dbm which is the reference level for an F1 transmitter unit when operated 4-wire. Should some other type transmitter unit be used, such as an N1 unit (52-type headset), the testing level must be corrected according to the level at the reference point as shown on the circuit layout card or sketch.
- 3 If the station termination is a jack for a plug-ended instrument, connect terminals 7 and 8 of the test induction coil to the tips of a 289B-type plug. Insert the plug in the station jack to make the measurements.
- 4 Multipled station phones may be either "on-hook" or "off-hook," push-to-talk buttons operated or nonoperated without affecting measurements.

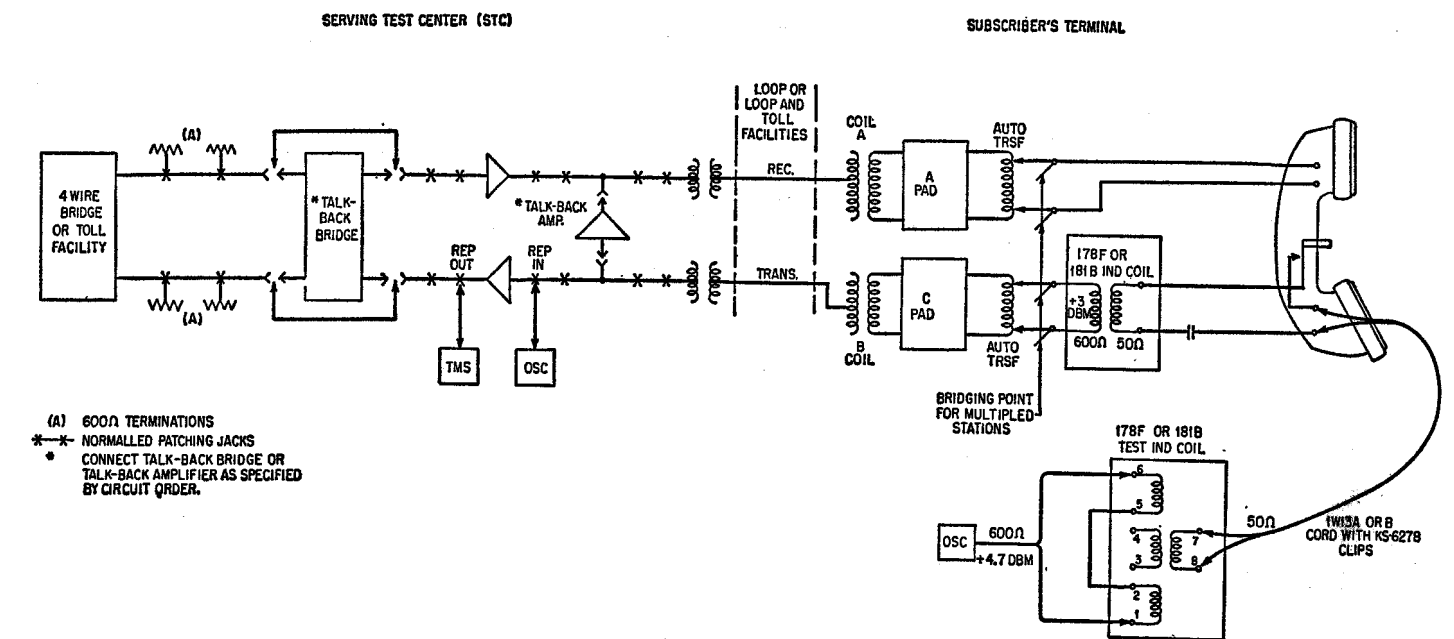
CHART 3  
FIG. 3

CHART 4  
FIG. 4

PURPOSE OF TEST

This chart and associated figure outline the procedure to be followed when measuring the talk-back path from a station transmitter to a station receiver. The procedure is applicable to stations with terminating arrangements per SD-69167-01, Fig. 61, SD-69158-01, Fig. 1, or equivalent.

TEST PROCEDURE

- | STEP |  |
|------|--|
| 1    | At the subscriber's location, select one station of the group of multipled stations for test. Do not test from an off-premises extension.  |
| 2    | At the STC, calibrate the talk-back amplifier if one is used.  |
| 3    | At the subscriber's terminal, adjust output of the OSC, set for 1000 cycles, to plus 4.7 dbm as read on a 600 <sup>w</sup> TMS.  |
| 4    | At the subscriber's terminal remove the transmitter unit from the handset. Connect the OSC output to Terminals 1 and 6 of the test 178F or 181B Induction Coil (600 ohms), strap Terminals 2 and 5 and connect Terminals 7 and 8 (50 ohms) to the handset transmitter springs. |
| 5    | At the subscriber's terminal, remove the receiver unit from the handset and connect the TMS to the handset receiver contact springs.   |
| 6    | At the subscriber's terminal, operate the "push-to-talk" button on the handset.  |
| 7    | At the subscriber's terminal, read the power received in the 600 <sup>w</sup> TMS and inform the STC of the reading.   |
- Requirement:** The TMS reading should be the same as the level at the receiving level reference point as shown on the circuit layout card or sketch.
- Limits:** Loop facilities only included between talk-back arrangement and station — ±2.0 db.  
Loop and toll facilities included between talk-back arrangement and station — ±4.0 db.

TEST PROCEDURE NOTES

- | NOTE |   |
|------|---|
| 1    | In case key equipment is used to connect the station instrument to the private line termination, operate the associated line key when making measurements.  |
| 2    | The test level of +4.7 dbm assumes a reference level of +3.0 dbm at the reference point. This is the reference level commonly used for F1 transmitter units when operated 4-wire. Should some reference level other than +3.0 dbm be shown on the circuit layout card or sketch, as would be the case if a different type of transmitter unit were used, the testing level must be corrected accordingly.   |
| 3    | If the station termination is a jack for a plug-ended instrument, connect Terminals 7 and 8 of the test induction coil to the tips of a 289B-type plug. Connect the TMS to the sleeves of the 289B-type plug. Insert the plug in the station jack to make the measurements.   |
| 4    | No correction is required for the TMS readings if the impedance of the removed receiver unit is 600 ohms (HA3, HC4, HC6, or U2 units). For 300-ohm receiver units (HA2, HC1, HC3, or HC5 units), correct the TMS reading 0.5 db. For 150-ohm receiver units (HA1, HA6, HC1, or U1 units), correct the reading of the TMS 2.0 db, or use a 4:1 transformer and correct for the loss of the transformer. In nearly all cases, 600-ohm receiver units will be used at 4-wire stations. |
| 5    | Multipled station phones may be either "on-hook" or "off-hook" and push-to-talk buttons may be either operated or nonoperated without affecting the measurements.   |

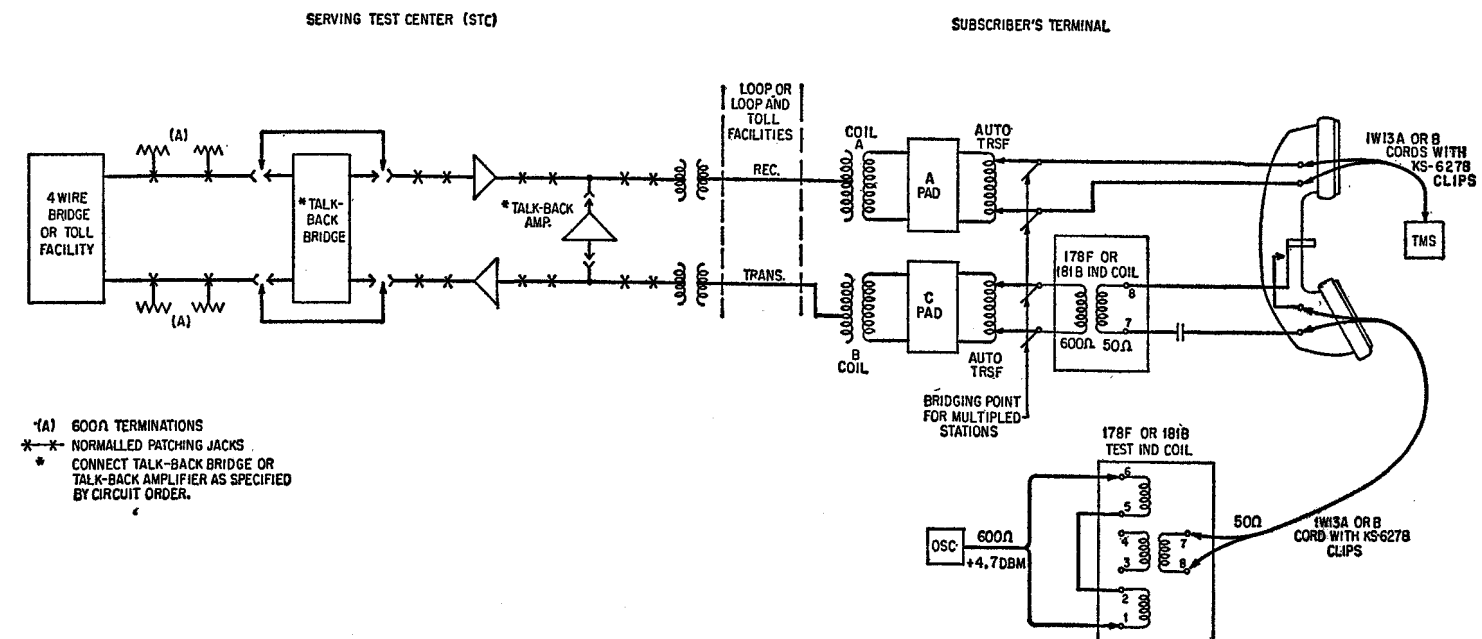


CHART 4  
FIG. 4

CHART 5  
FIG. 5

PURPOSE OF TEST

This chart and associated figure outline the procedure to be followed when making transmission tests on the receiving loop facilities that are used to feed stations with terminating arrangements per SD-69167-01, Fig. 61, SD-69158-01, Fig. 1, or equivalent. These tests are only necessary when the over-all receiving path tests from the STC to the station, per Chart 2, do not meet limits. Where both toll facilities and loop facilities were included in the tests per Chart 2, the toll and loop facilities should be measured separately when locating troubles.

TEST PROCEDURE

STEP

- 1 If both toll facilities and loop facilities were included in the section measured per Chart 2, measure the toll facility portion between toll offices in the standard manner for the particular type of facility. The section should meet the limits given in Section E26.040. If limits are met, proceed with the following steps for measurement of the receiving loop.
- 2 At the subscriber's terminal, lift the straps from Coil A, Terminals 2 and 5, on the terminal strip stenciled "pad-coil." (On equipment not modified to include a terminal strip, unsolder wires from lugs 2 and 5 of Coil A.)
- 3 At the subscriber's terminal, connect a 600<sup>w</sup> TMS to Terminals 2 and 5 of Coil A.
- 4 At the test room, send 1000 cycles adjusted to zero dbm level into REC LP jack (drop of coil) on the receiving path.
- 5 At the subscriber's terminal, read the power received in the 600<sup>w</sup> TMS and inform the test room.

**Requirement:** The loss of the loop facilities plus the loss of the loop coils at each end should be as shown on the circuit layout card or sketch.

**Limits:** Plus or minus 1 db.

TEST PROCEDURE NOTES

NOTE

- 1 If the test requirements of this chart *are* met, make tests per Chart 7.
- 2 If the loss for the subscriber's loop coil is not known, use same value as shown on the circuit layout card or sketch for the test room loop coil.
- 3 If the transmitting and receiving loops have identical make-up and exceed requirements by the same amount, the STC should notify the office that issued the circuit order who will advise whether to change pad values at the subscriber's terminal or repeater levels at the test room to correct for the error in computation. A circuit order correction should be submitted in the manner prescribed by the Company that issued the circuit order.

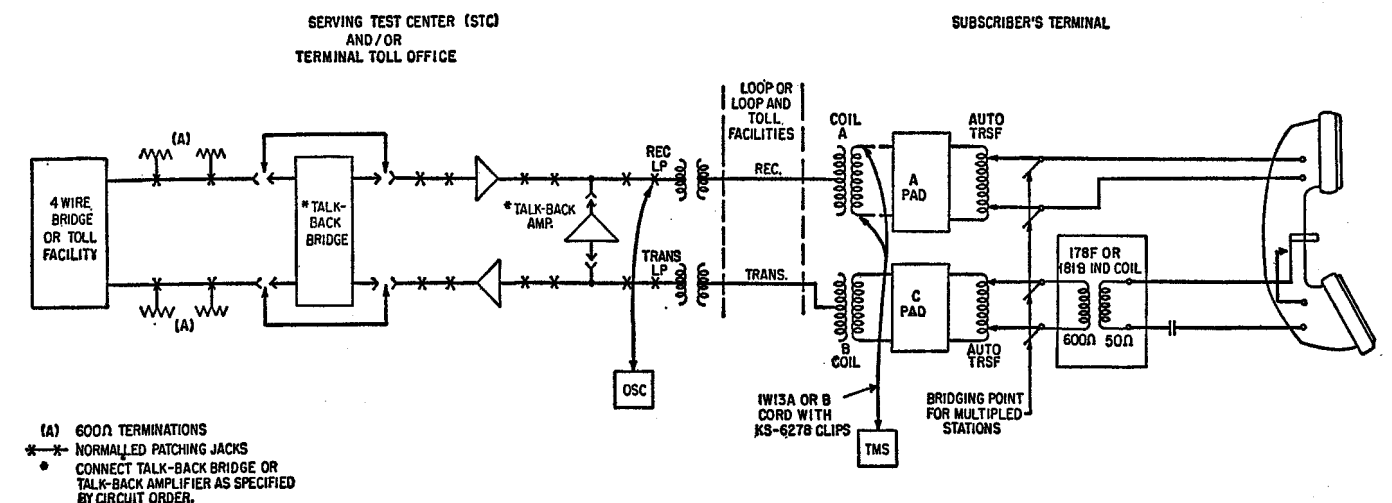


CHART 6  
FIG. 6

PURPOSE OF TEST

This chart and associated figure outline the procedure to be followed when making transmission tests on the transmitting loop facilities that are used to feed stations with terminating arrangements per SD-69167-01, Fig. 61, SD-69158-01, Fig. 1, or equivalent. These tests are only necessary when the over-all transmitting path tests from the station to the STC, per Chart 3, do not meet limits. Where both toll facilities and loop facilities were included in the tests per Chart 3, the toll and loop facilities should be measured separately when locating troubles.

TEST PROCEDURE

STEP

- 1 If both toll facilities and loop facilities were included in the section measured per Chart 3, measure the toll facility portion between toll offices in the standard manner for the particular type of facility. The section should meet the limits given in Section E26.040. If limits are met, proceed with the following steps for measurement of the transmitting loop.
- 2 At the subscriber's terminal, adjust output of the OSC set for 1000 cycles to zero dbm as read on a 600<sup>w</sup> TMS.
- 3 At the subscriber's terminal, lift the straps from Coil B, Terminals 2 and 5, on the terminal strip stenciled "pad-coil." (On equipment not modified to include a terminal strip, unsolder wires from lugs 2 and 5 of Coil B.)
- 4 At the subscriber's terminal, connect the OSC to Terminals 2 and 5 of Coil B.
- 5 At the test room, read the level at the TRANS LP jack (drop of coil) on the transmitting path.

**Requirement:** The loss of the loop facilities plus the loss of the loop coils at each end should be as shown on the circuit layout card or sketch.

**Limits:** Plus or minus 1 db.

TEST PROCEDURE NOTES

NOTE

- 1 If the test requirements of this chart *are* met, make tests per Chart 8.
- 2 If the loss for the subscriber's loop coil is not known, use same value as shown on the circuit layout card or sketch for the test room loop coil.
- 3 If the transmitting and receiving loops have identical make-up and exceed requirements by the same amount, the STC should notify the office that issued the circuit order who will advise whether to change pad values at the subscriber's terminal, or repeater levels at the test room to correct for the error in computation. A circuit order correction should be submitted in the manner prescribed by the Company that issued the circuit order.

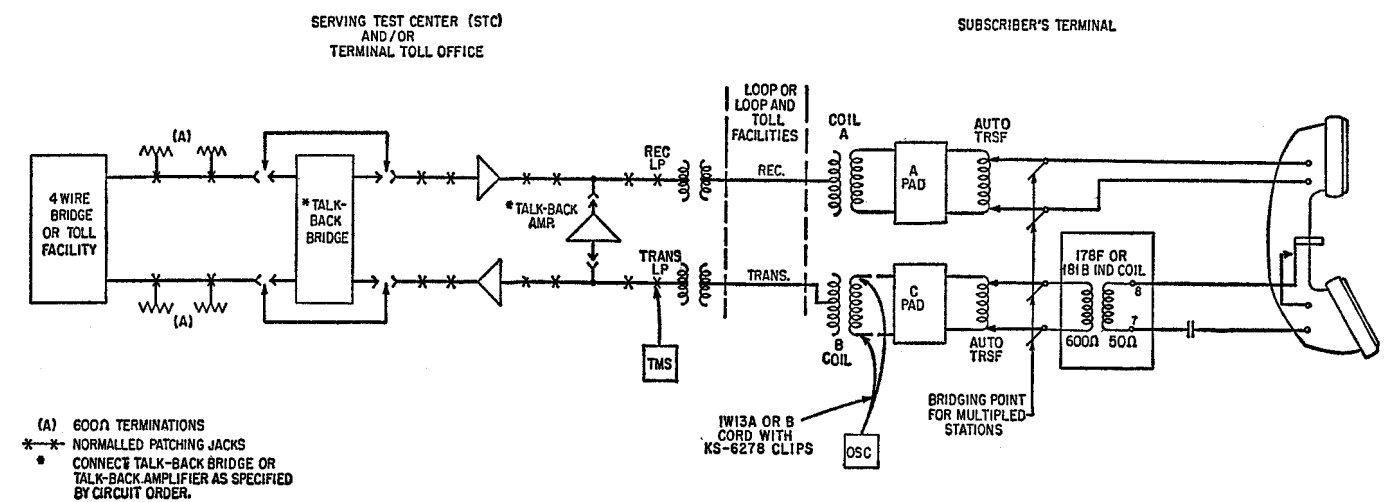


CHART 7  
FIG. 7

## PURPOSE OF TEST

This chart and associated figure outline the procedure to be followed when measuring the loss of the receiving station equipment. These tests should be made when the over-all test from the STC to a station (Chart 2) does not meet limits and after the facilities from the STC to a station meet the limits per Chart 5. The procedures outlined are applicable to private line station terminating arrangements per SD-69167-01, Fig. 61, SD-69158-01, Fig. 1, or equivalent.

## TEST PROCEDURE

## STEP

- 1 At the subscriber's terminal, adjust the output of the OSC set for 1000 cycles to zero dbm as read on a 600<sup>w</sup> TMS.
- 2 At the subscriber's terminal, lift the straps from pad A, Terminals 3 and 4, on the terminal strip stenciled "pad-coil." (On equipment not modified to include a terminal strip, unsolder wires from lugs 3 and 4 of pad A.)
- 3 At the subscriber's terminal, connect the OSC to Terminals 3 and 4 of pad A.
- 4 At the subscriber's terminal, replace pad A with a 15 db pad. Do not substitute any other value or erroneous readings may result due to varistor action.
- 5 At the subscriber's terminal, remove the receiver unit from the handset and connect the TMS to the handset receiver contact springs. Read the power received on the 600<sup>w</sup> TMS. Check idle circuit termination for all extension stations by momentarily lifting the handset off and replacing it on the switchhook at each extension station. The meter reading should remain the same during this operation.

## Requirements:

	No. of Stations	Loss (db)
See Note 1	1	15.3
	2	18.5
	3	20.1
	4	21.4

Limits: Plus or minus 0.5 db.

## TEST PROCEDURE NOTES

## NOTE

- 1 The values given are for equipment per SD-69167-01, Figs. 61 and 62. Occasionally similar equipment per other SD drawings and/or figures are used. The values will vary slightly (up to 0.5 db). Consult SD drawing when testing those other arrangements.
- 2 If requirements are not met, the equipment should be checked for trouble using appropriate drawings applicable to this equipment. First it should be determined that the terminal strip and the autotransformers are properly strapped for the number of stations at the location. In some cases a loudspeaker is disabled by the operation of a separate key or by push-to-talk button operation rather than switchhook operation. In this case, the loudspeaker is considered as being an additional receiving station when determining the equipment losses and autotransformer strapping.
- 3 In case key equipment is used to connect the station instrument to the private line termination, operate the associated line key when making measurements.
- 4 If the station termination is a jack for a plug-ended instrument, connect the TMS to the sleeves of a 289B-type plug. Insert the 289B-type plug in the station jack to make the measurements.

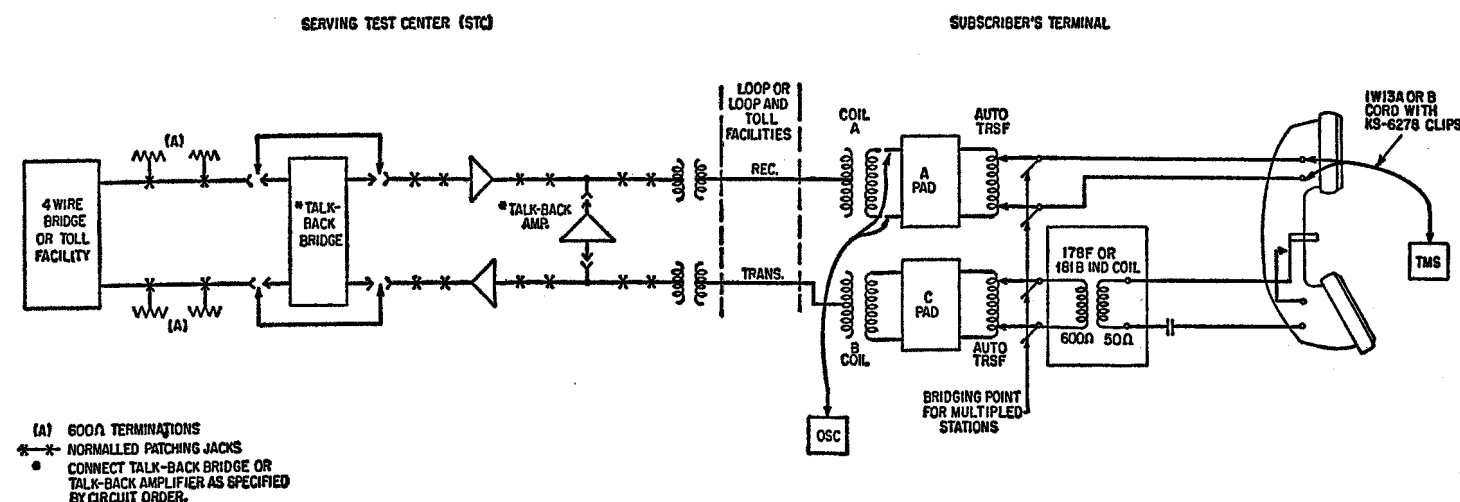








CHART 10  
FIG. 10

PURPOSE OF TEST

This chart and associated figure outline the procedure to be followed when measuring the net loss of the transmitting 4-wire path from a private line station to its STC. The procedure that follows assumes that loop terminating arrangements per SD-69254-01, Fig. 2 are used at the subscriber's location.

TEST PROCEDURE

STEP

- 1 At the subscriber's location, select one station of the group of multipled stations for test. Do not test from an off-premises extension.
- 2 At the subscriber's terminal, adjust output of OSC, set for 1000 cycles, to a level 1.7 db higher than the level at the transmitting level reference point (line terminals of the station induction coil) as shown on the circuit layout card or sketch. For example, if the station instrument is an F-type handset, the reference level in most cases will be +3.0 dbm. In this case the OSC would be connected to the TMS and its output adjusted until a level of +4.7 dbm was read on the TMS.
- 3 At the subscriber's terminal, remove the transmitter unit from the handset. Connect the OSC output to Terminals 1 and 6 of the test 178F or 181B Induction Coil (600 ohms), strap Terminals 2 and 5 and connect Terminals 7 and 8 (50 ohms) to the handset transmitter springs.
- 4 At the STC, calibrate the transmitting loop repeater to the level shown on the circuit layout card or sketch by patching the OSC to REP IN and measuring at REP OUT.
- 5 At the STC, remove the OSC from the REP IN and leave the TMS patched to REP OUT.
- 6 At the subscriber's terminal, operate the handset "push-to-talk" button while the STC measures the 1000-cycle level.
- 7 At the STC, read the level at REP OUT.
 

**Requirement:** The TMS at the STC should read the same level as the level shown on the circuit layout card or sketch.

**Limits:** Loop facilities only included in section measured —  $\pm 1.0$  db.  
Loop and toll facilities included in section measured —  $\pm 2.0$  db.  
If limits are not met, make tests per Chart 13.
- 8 Repeat Steps 1 through 7 using 300- and 3000-cycle test frequencies.
 

**Limits:** Should not deviate from 1000-cycle measurement by more than -10 db.

TEST PROCEDURE NOTES

NOTE

- 1 If the station termination is a jack for a plug-ended instrument, connect Terminals 7 and 8 of the test induction coil to the tips of a 289B-type plug. Insert the plug in the station jack to make the measurements.
- 2 Multipled station phones may be either "on-hook" or "off-hook," but "push-to-talk" buttons should not be operated except at the station from which the test frequencies are sent.
- 3 F-type handsets, G-type handsets, or 52-type headsets are used with loop terminations per SD-69254-01. Each of the above instruments will have a different transmitting reference level.

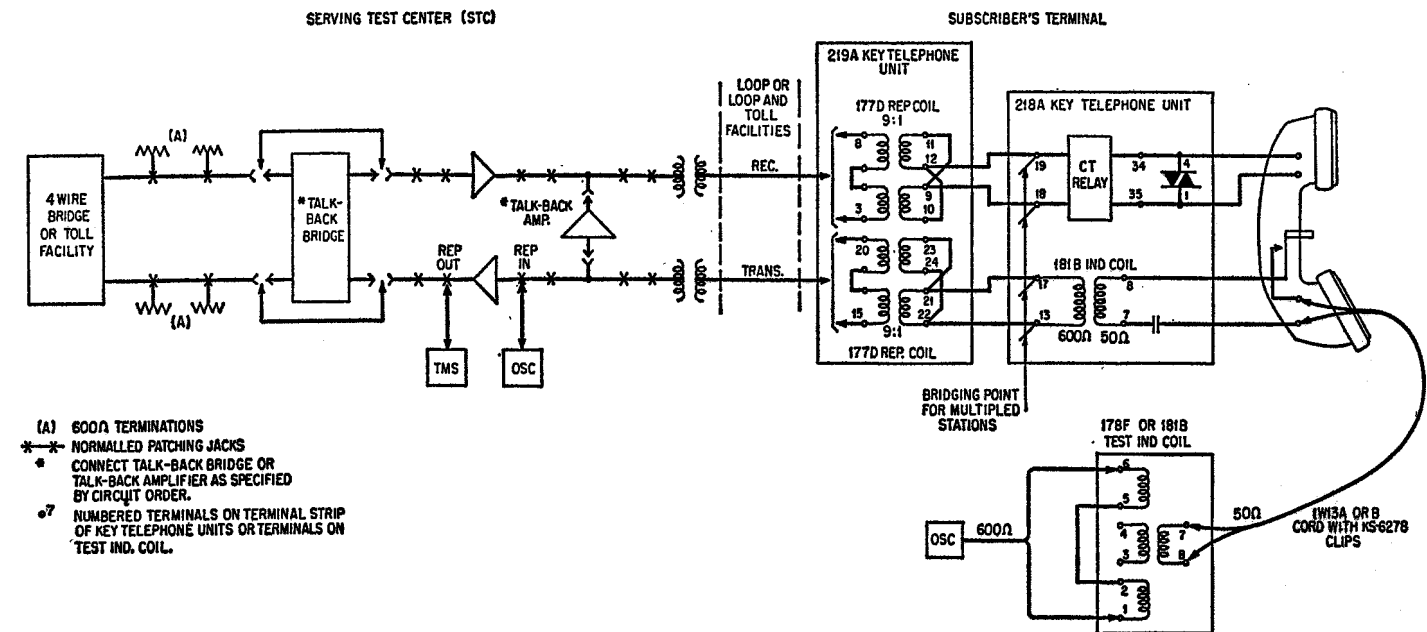


CHART 10  
FIG. 10

CHART 11  
FIG. 11

PURPOSE OF TEST

This chart and associated figure outline the procedure to be followed when measuring the talk-back path from a station transmitter to a station receiver. The procedure is applicable to stations with terminating arrangements per SD-69254-01, Fig. 2.

TEST PROCEDURE

STEP

- 1 At the subscriber's location, select one station of the group of multipled stations for test. Do not test from an off-premises extension.
- 2 At the STC, calibrate the talk-back amplifier if one is used.
- 3 At the subscriber's terminal, adjust output of OSC, set for 1000 cycles, to a level 1.7 db higher than the level at the transmitting level reference point (line terminals of the station induction coil) as shown on the circuit layout card or sketch. For example, if the station instrument is an F-type handset, the reference level in most cases will be +3.0 dbm. In this case the OSC would be connected to the TMS and its output adjusted until a level of +4.7 dbm was read.
- 4 At the subscriber's terminal, remove the transmitter unit from the handset. Connect the OSC output to Terminals 1 and 6 of the test 178F or 181B Induction Coil (600 ohms), strap Terminals 2 and 5 and connect Terminals 7 and 8 (50 ohms) to the handset transmitter springs.
- 5 At the subscriber's terminal, remove the receiver unit from the handset and connect the TMS to the handset receiver contact springs.
- 6 At the subscriber's terminal, operate the "push-to-talk" button on the handset.
- 7 At the subscriber's terminal, read the power received in the 600<sup>m</sup> TMS and inform the STC of the reading.

**Requirement:** The TMS reading should be the same as the level at the receiving level reference point as shown on the circuit layout card or sketch.

**Limits:** Loop facilities only included between talk-back arrangement and station —  $\pm 2.0$  db.  
Loop and toll facilities included between talk-back arrangement and station —  $\pm 4.0$  db.

TEST PROCEDURE NOTES

NOTE

- 1 If the station termination is a jack for a plug-ended instrument, connect Terminals 7 and 8 of the test induction coil to the tips of a 289B-type plug. Connect the TMS to the sleeves of the 289B-type plug. Insert the plug in the station jack to make the measurements.
- 2 Multipled station phones may be either "on-hook" or "off-hook," but "push-to-talk" buttons should not be operated except at the station from which the test frequencies are set.

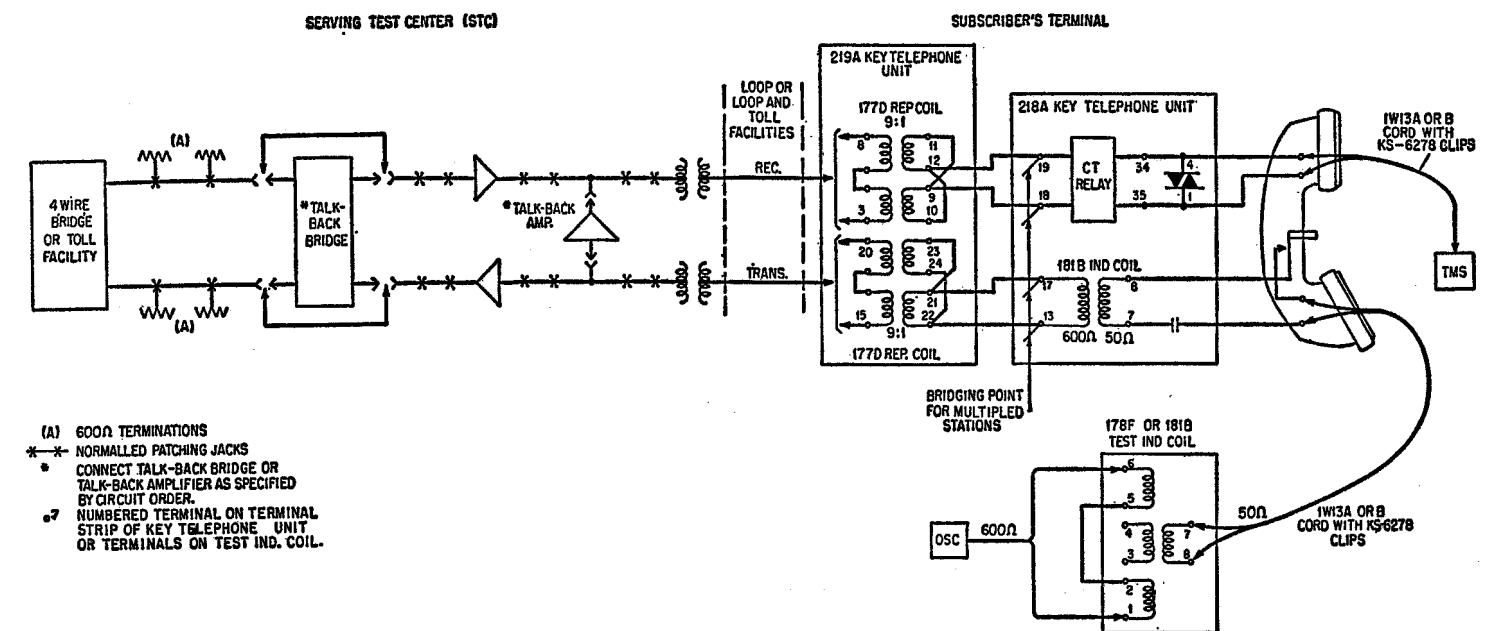


CHART 11  
FIG. 11

CHART 12  
FIG. 12

PURPOSE OF TEST

This chart and associated figure outline the procedure to be followed when making transmission tests on the receiving loop facilities that are used to feed stations with terminating arrangements per SD-69254-01, Fig. 2. These tests are only necessary when the over-all receiving path tests from the STC to the station, per Chart 9, do not meet limits. Where both toll facilities and loop facilities were included in the tests per Chart 8, the toll and loop facilities would be measured separately when locating troubles.

TEST PROCEDURE

STEP

- 1 If both toll facilities and loop facilities were included in the section measured per Chart 9, measure the toll facility portion between toll offices in the standard manner for the particular type of facility. The section should meet the limits given in Section E26.040. If limits are met, proceed with the following steps for measurement of the receiving loop.
- 2 On the terminal strip of the 219A Key Telephone Unit at the subscriber's station, remove the leads from Terminals 3 and 8. (At the rear of the Key Telephone Unit.)
- 3 At the subscriber's terminal, connect a 600<sup>w</sup> TMS to the leads disconnected from Terminals 3 and 8 in Step 2.
- 4 At the test room, send 1000 cycles adjusted to zero dbm level into the REC LP jack (drop of coil) on the receiving path.
- 5 At the subscriber's terminal, read the power received in the 600<sup>w</sup> TMS and inform the test room.

**Requirement:** The measured loss should equal the sum of the loss of the loop coil at the test room, the loss of the loop facility, and the reflection loss due to connecting the 600-ohm TMS to the loop facility without using an impedance matching device. The first two losses can be determined by referring to the circuit layout card or sketch. To determine the reflection loss, find the basic make-up of the loop from the circuit layout card or sketch and then refer to the following table.

TYPE OF FACILITY	APPROXIMATE REFLECTION LOSS
19 gauge N.L.	0 db
16 & 19 gauge H-44-S	0 db
16 & 19 gauge H-31-S	0 db
16 gauge N.L.	0.4 db
16 & 19 gauge H-88-S	0.5 db
16 & 19 gauge H-172-S	0.9 db
16 & 19 gauge H-174-S	0.9 db
16 & 19 gauge B-88-S	0.9 db

**Limits:** Plus or minus 1 db.

TEST PROCEDURE NOTES

NOTE

- 1 If the test requirements of this chart are met, make tests per Chart 14.
- 2 If the transmitting and receiving loops have identical make-up and exceed requirements by the same amount, the STC should notify the office that issued the circuit order who will advise whether to change pad values or repeater levels at the test room to correct for the error in computation. A circuit order correction should be submitted in the manner prescribed by the Company that issued the circuit order.
- 3 The loop coil at the subscriber's station is not included in the measurements since its 9:1 impedance ratio would cause too great an error due to reflection loss.

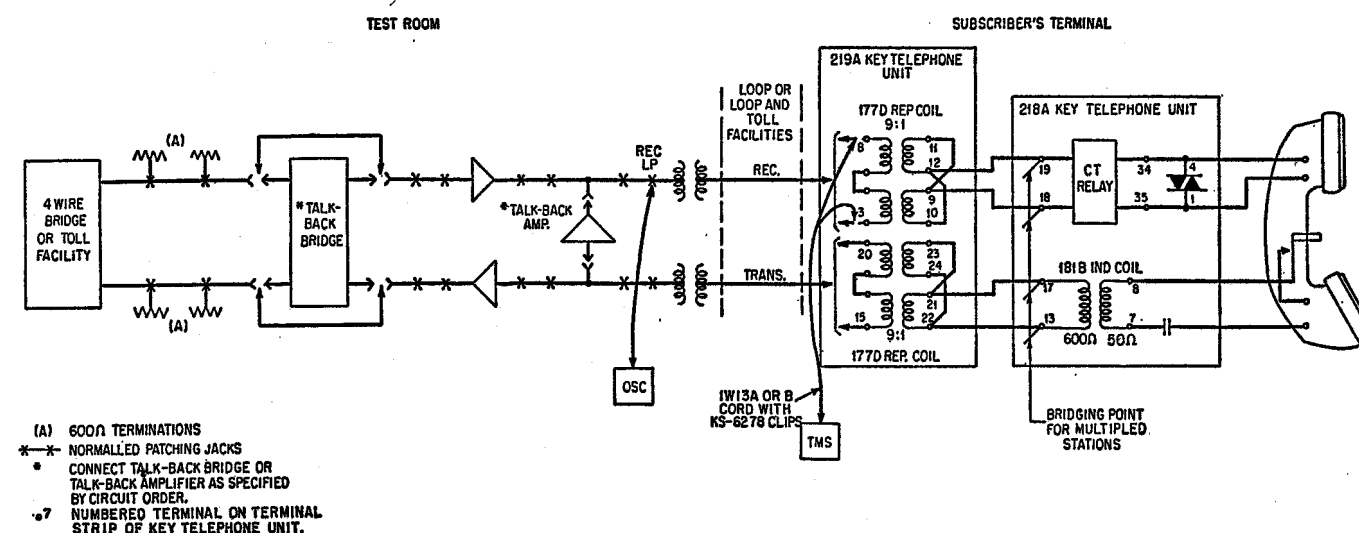


CHART 12  
FIG. 12

CHART 13  
FIG. 13

**PURPOSE OF TEST**

This chart and associated figure outline the procedure to be followed when making transmission tests on the transmitting loop facilities that are used to feed stations with terminating arrangements per SD-69254-01, Fig. 2. These tests are only necessary when the over-all transmitting path tests from the station to the STC, per Chart 10, do not meet limits. Where both toll facilities and loop facilities were included in the tests per Chart 10, they should be measured separately when locating troubles.

**TEST PROCEDURE**

**STEP**

- 1 If both toll facilities and loop facilities were included in the section measured per Chart 10, measure the toll facility portion between toll offices in the standard manner for the particular type of facility. The section should meet the limits given in Section E26.040. If limits are met, proceed with the following steps for measurement of the transmitting loop.
- 2 At the subscriber's terminal, adjust output of the OSC set for 1000 cycles to zero dbm as read on a 600<sup>w</sup> TMS.
- 3 At the subscriber's terminal, remove the leads from Terminals 15 and 20 of the 219A Key Telephone Unit terminal strip. (At the rear of the Key Telephone Unit.)
- 4 At the subscriber's terminal, connect the OSC to the leads disconnected from Terminals 15 and 20 in Step 3.
- 5 At the test room, read the level at the TRANS LP jack (drop of coil) on the transmitting path.

**Requirement:** The measured loss should equal the sum of the loss of the loop coil at the test room, the loss of the loop facility, and the reflection loss due to connecting the 600-ohm OSC to the loop facility without using an impedance matching device. The first two losses can be determined by referring to the circuit layout card or sketch. To determine the reflection loss, find the basic make-up of the loop from the circuit layout card or sketch and then refer to the following table.

TYPE OF FACILITY	APPROXIMATE REFLECTION LOSS
19 gauge N.L.	0 db
16 & 19 gauge H-44-S	0 db
16 & 19 gauge H-31-S	0 db
16 gauge N.L.	0.4 db
16 & 19 gauge H-88-S	0.5 db
16 & 19 gauge H-172-S	0.9 db
16 & 19 gauge H-174-S	0.9 db
16 & 19 gauge B-88-S	0.9 db

**Limits:** Plus or minus 1 db.

**TEST PROCEDURE NOTES**

**NOTE**

- 1 If the test requirements of this chart are met, make tests per Chart 15.
- 2 If the transmitting and receiving loops have identical make-up and exceed requirements by the same amount, the STC should notify the office that issued the circuit order who will advise whether to change pad values or repeater levels at the test room to correct for the error in computation. A circuit order correction should be submitted in the manner prescribed by the Company that issued the circuit order.
- 3 The loop coil at the subscriber's station is not included in the measurements since its 9:1 impedance ratio would cause too great an error due to reflection loss.

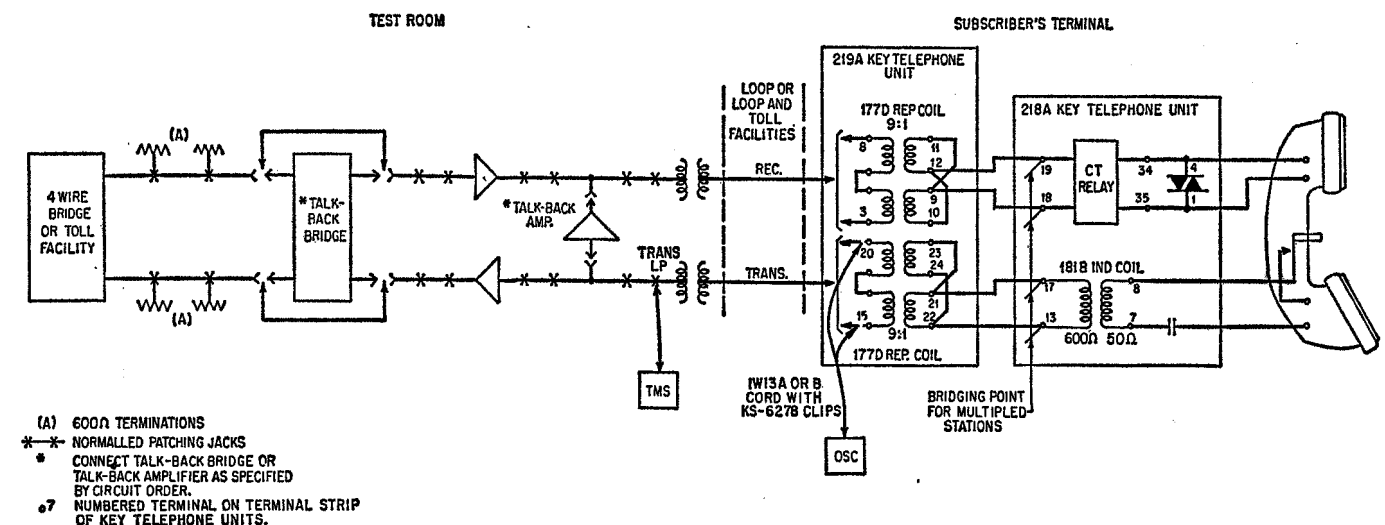


CHART 14  
FIG. 14

PURPOSE OF TEST

This chart and associated figure outline the procedure to be followed when measuring the loss of receiving station equipment at locations that have terminating arrangements per SD-69254-01, Fig. 2. These tests should be made when the over-all test from the STC to a station (Chart 9) does not meet limits and after the facilities from the STC to the station have been found to be satisfactory per Chart 12 tests.

TEST PROCEDURE

STEP

- At the subscriber's terminal, adjust the output of the OSC set for 1000 cycles to  $-7.0$  dbm as read on a  $600\omega$  TMS. *Do not substitute any other level* or erroneous readings may result due to varistor action.
- At the subscriber's terminal, disconnect the leads from Terminals 3 and 8 on the back side of the 219A Key Telephone Unit terminal strip.
- At the subscriber's terminal, connect the OSC to Terminals 3 and 8 on the 219A Key Telephone Unit terminal strip.
- At the subscriber's terminal, remove the receiver unit from the handset and connect the TMS to the handset receiver contact springs. Read the power received on the  $600\omega$  TMS. Check idle circuit termination for all extension stations by momentarily lifting the handset off and replacing it on the switchhook at each extension station. The meter reading should remain the same during this operation.

Requirements:

No. of Stations	TMS Reading
1	$-11.9$ dbm
2	$-12.7$ dbm
3	$-13.5$ dbm
4	$-14.2$ dbm
5	$-14.8$ dbm
6	$-15.4$ dbm

Limits: Plus or minus 0.5 db.

TEST PROCEDURE NOTES

NOTE

- If requirements are not met, the equipment should be checked for trouble using appropriate drawings applicable to the equipment. One possible cause of trouble would be incorrect strapping of the 177D Repeat Coil. Chart 16 gives the transmission requirements for the coil when strapped for a 9:1 impedance ratio. In some cases a loudspeaker is disabled by the operation of a separate key or by push-to-talk button operation rather than switchhook operation. In this case, the loudspeaker is considered as being an additional receiving station when determining the equipment losses.
- If the station termination is a jack for a plug-ended instrument, connect the TMS to the sleeves of a 289B-type plug. Insert the 289B-type plug in the station jack to make the measurements.
- The required losses as given above will not agree exactly with those shown on the circuit layout card due to connecting a 600-ohm oscillator in place of the cable pair.

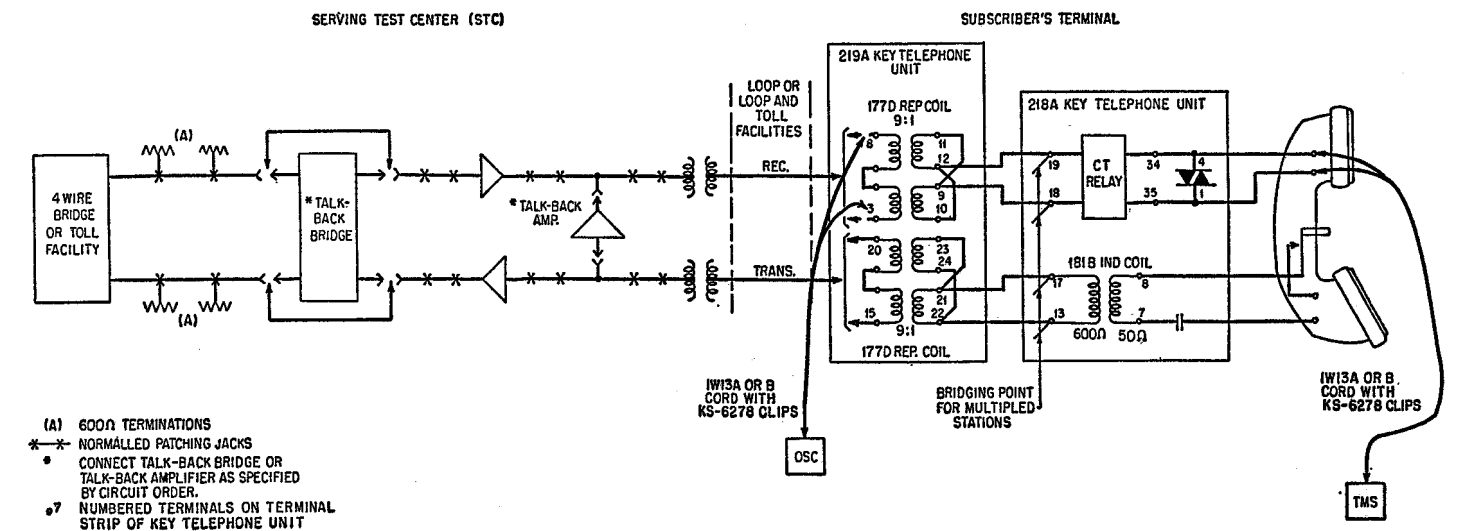


CHART 14  
FIG. 14

CHART 15  
FIG. 15

PURPOSE OF TEST

This chart and associated figure outline the procedure to be followed when measuring the loss of transmitting station equipment at locations that have terminating arrangements per SD-69254-01, Fig. 2. These tests should be made when the over-all test from a station to its STC (Chart 10) does not meet limits and after the facilities from the station to the STC have been found to be satisfactory per Chart 13 tests.

TEST PROCEDURE

- STEP**
- At the subscriber's terminal, adjust the output of the OSC set for 1000 cycles to +4.7 dbm as read on a 600<sup>Ω</sup> TMS.
  - At the subscriber's terminal, remove the transmitter unit from the handset. Connect the OSC to Terminals 1 and 6 of the 178F or 181B Test Induction Coil (600 ohms), strap Terminals 2 and 5 and connect Terminals 7 and 8 (50 ohms) to the handset transmitter springs.
  - At the subscriber's terminal, disconnect the leads from Terminals 15 and 20 on the back side of the 219A Key Telephone Unit terminal strip.
  - At the subscriber's terminal, connect the TMS to Terminals 15 and 20 on the 219A Key Telephone Unit terminal strip.
  - At the subscriber's terminal, operate the "push-to-talk" button on the handset and read the level on the TMS. Check idle circuit terminations for all extension stations by momentarily lifting the handset off and replacing it on the switchhook at each extension station. The meter reading should remain the same when the "push-to-talk" button is nonoperated and should not change more than 0.5 db when the "push-to-talk" button is operated.
- Requirements:**
- | No. of Stations | TMS Reading |
|-----------------|-------------|
| 1               | -2.0 dbm    |
| 2               | -2.7 dbm    |
| 3               | -3.2 dbm    |
| 4               | -3.7 dbm    |
| 5               | -4.3 dbm    |
| 6               | -4.8 dbm    |
- Limits:** Plus or minus 0.5 db.

TEST PROCEDURE NOTES

- NOTE**
- If requirements are not met, the equipment should be checked for trouble, using appropriate drawings applicable to the equipment. One possible cause of trouble would be incorrect strapping of the 177D Repeat Coil. Chart 16 gives the transmission requirements for the coil when strapped for a 9:1 impedance ratio.
  - If the station termination is a jack for a plug-ended instrument, connect Terminals 7 and 8 of the test induction coil to the tips of a 289B-type plug. Insert the plug in the station jack to make the measurements.

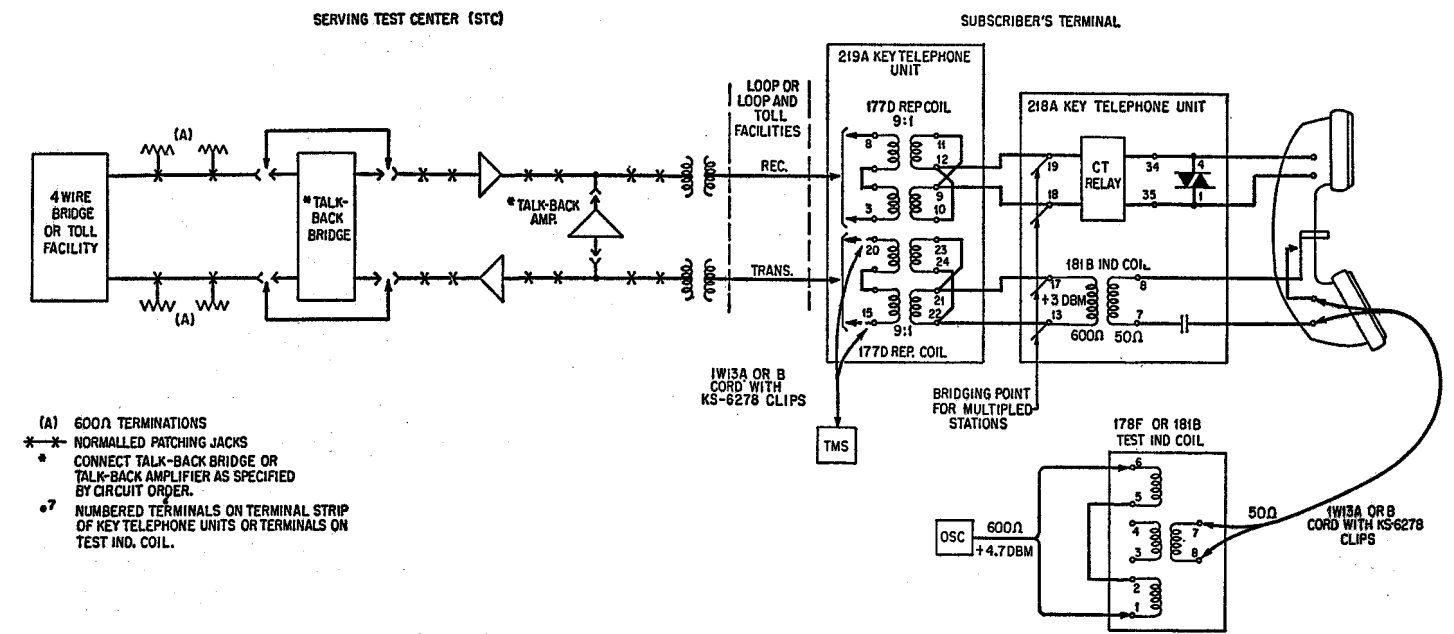


CHART 15  
FIG. 15

CHART 16  
FIG. 16

**PURPOSE OF TEST**

This chart and associated figure outline the procedure to follow when checking the loss of the transmitting and receiving 177D-type Repeat Coils that are used at 4-wire private line stations with equipment per SD-69254-01, Fig. 2. It is intended that these tests be made only when investigating troubles. The 177D Repeat Coils are strapped so that they have a 9:1 impedance ratio. These tests will check for correct strapping of the coil and also for the coil loss. The requirements allow for a loss of 4.4 db due to impedance mismatch and for 0.5 db coil loss.

**TEST PROCEDURE — TRANSMITTING COIL**

**STEP**

- 1 At the subscriber's terminal, disconnect the leads from Terminals 15 and 20 on the back side of the 219A Key Telephone Unit terminal strip.
- 2 At the subscriber's terminal, adjust the output of the OSC set for 1000 cycles to zero dbm as read on a 600<sup>w</sup> TMS.
- 3 At the subscriber's terminal, connect the TMS to Terminals 15 and 20 on the 219A Key Telephone Unit terminal strip.
- 4 At the subscriber's terminal, disconnect all leads from Terminals 21 and 22 on the back side of the 219A Key Telephone Unit terminal strip except the straps between Terminals 21 and 23 and between Terminals 22 and 24.
- 5 At the subscriber's terminal, connect the OSC to Terminals 21 and 22 on the 219A Key Telephone Unit terminal strip.
- 6 At the subscriber's terminal, read the TMS level.

**Requirement:** The TMS reading should be -4.9 dbm.

**Limits:** Plus or minus 0.5 db.

**TEST PROCEDURE — RECEIVING COIL**

**STEP**

- 1 At the subscriber's terminal, disconnect the leads from Terminals 3 and 8 on the back side of the 219A Key Telephone Unit terminal strip.
- 2 At the subscriber's terminal, adjust the output of the OSC set for 1000 cycles to zero dbm as read on a 600<sup>w</sup> TMS.
- 3 At the subscriber's terminal, connect the TMS to Terminals 3 and 8 on the 219A Key Telephone Unit terminal strip.
- 4 At the subscriber's terminal, disconnect all leads from Terminals 9 and 12 on the back side of the 219A Key Telephone Unit terminal strip except the straps between Terminals 9 and 11 and between Terminals 10 and 12.
- 5 At the subscriber's terminal, connect the OSC to Terminals 9 and 12 on the 219A Key Telephone Unit terminal strip.
- 6 At the subscriber's terminal, read the TMS level.

**Requirement:** The TMS reading should be -4.9 dbm.

**Limits:** Plus or minus 0.5 db.

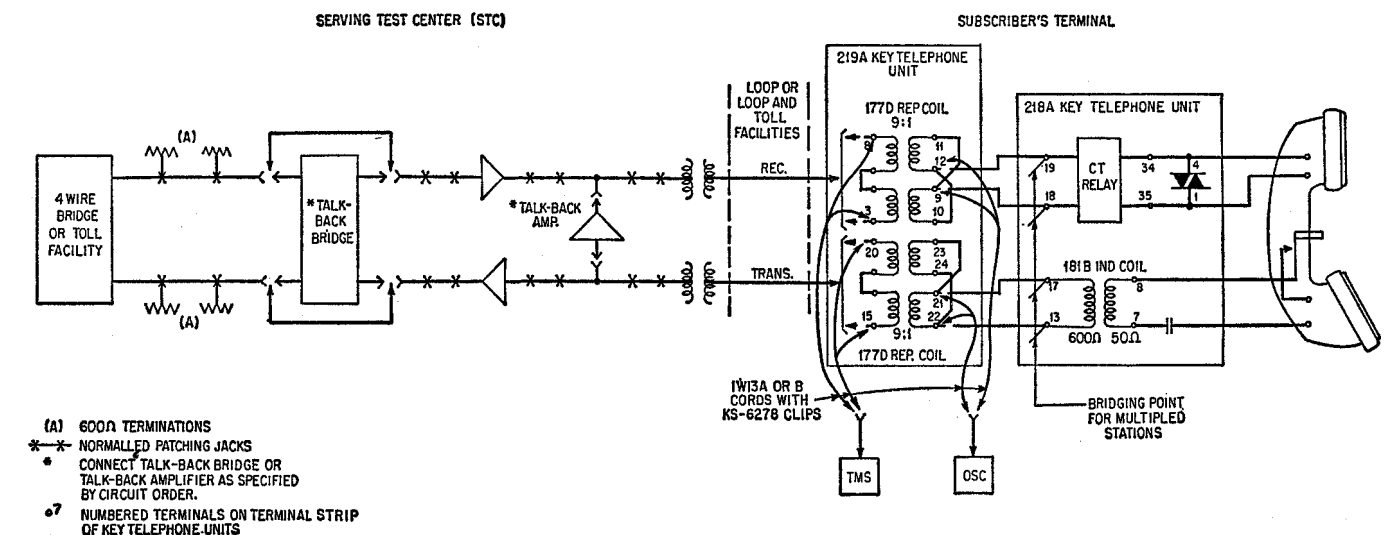


CHART 17  
FIG. 17**PURPOSE OF TEST**

This chart and associated figure outline the procedure to be followed when measuring the net loss of a 2-wire section from an STC to a served private line station with 2-wire station equipment.

**TEST PROCEDURE — RECEIVING DIRECTION**

- | STEP |  |
|------|--|
| 1    | At the STC, adjust the OSC for a frequency of 1000 cycles and an output level that is the same as the level shown on the circuit layout card or sketch for the REP IN. Patch the OSC output to the REP IN jack.  |
| 2    | At the subscriber's terminal, disconnect the induction coil of one station from the loop transformer. Care should be taken so that the extension station's induction coil (where provided) remains connected.  |
| 3    | At the subscriber's terminal, connect the TMS to the station side of the loop transformer (repeat coil) and record the level indicated by the TMS. Notify the STC of this reading.<br><br><b>Requirement:</b> The level indicated by the TMS should be the same as the receiving level at the level reference point (line terminals of station induction coil) as shown on the circuit layout card or sketch.<br><br><b>Limits:</b> Loop facilities only — Plus or minus 1.0 db.<br>Loop and toll facilities — Plus or minus 2.0 db. |
| 4    | Repeat Steps 1 through 3 using 300- and 3000-cycle test frequencies.<br><br><b>Limits:</b> Should not deviate from 1000-cycle measurement by more than -10 db.   |

**TEST PROCEDURE — TRANSMITTING DIRECTION**

- | STEP |   |
|------|---|
| 5    | At the subscriber's terminal, adjust the OSC for a frequency of 1000 cycles and connect its output to the input of the TMS. By referring to the circuit layout card or sketch, determine the transmitting level at the level reference point (line terminals of the station induction coil). Adjust the output of the OSC until the TMS indicates the level just determined. For a handset with an F-type transmitter, the level will usually be 0 dbm. |
| 6    | Repeat Step 2.  |
| 7    | At the subscriber's terminal, connect the OSC to the station side of the loop transformer.  |
| 8    | At the STC, patch the TMS to the REP OUT jack and read the indicated level.<br><br><b>Requirement:</b> The level indicated by the TMS should be the same as that shown on the circuit layout card or sketch for the REP OUT.<br><br><b>Limits:</b> Loop facilities only — Plus or minus 1.0 db.<br>Loop and toll facilities — Plus or minus 2.0 db.   |
| 9    | Repeat Steps 5 through 8 using 300- and 3000-cycle test frequencies.<br><br><b>Limits:</b> Should not deviate from 1000-cycle measurement by more than -10 db.  |

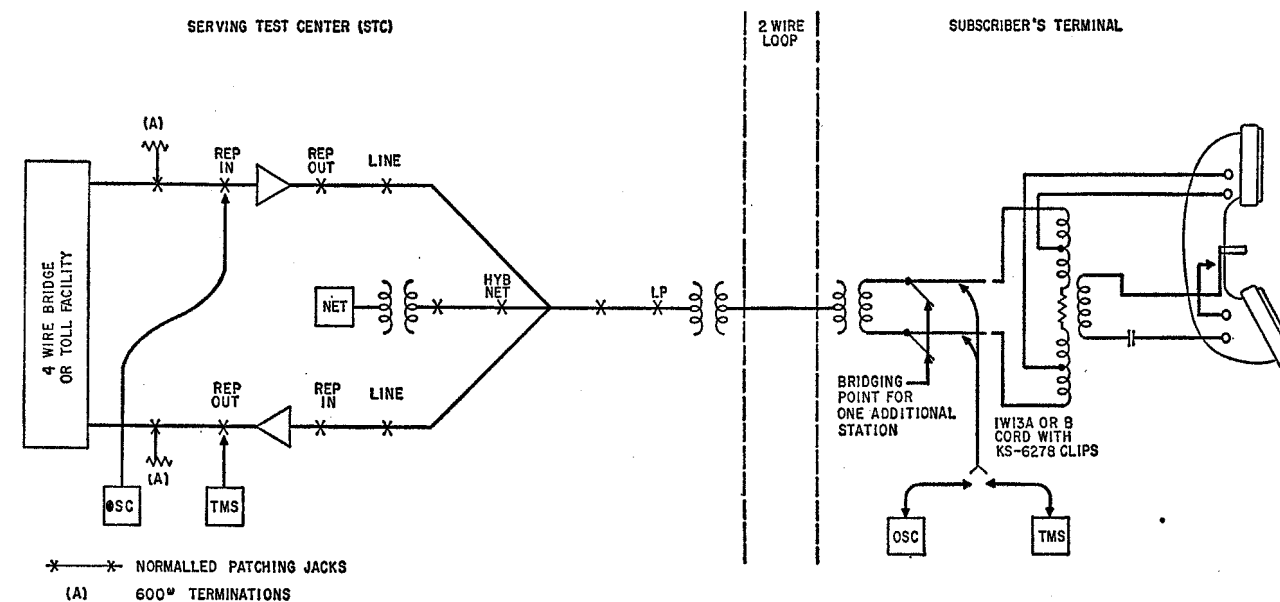
CHART 17  
FIG. 17



CHART 18  
FIG. 18

**PURPOSE OF TEST**

This chart and associated figure outline the procedure to be followed when measuring the net loss of a 2-wire section from an STC to a served private line PBX station.

**TEST PROCEDURE — RECEIVING DIRECTION**

- | STEP |  |
|------|--|
| 1    | At the STC, adjust the OSC for a frequency of 1000 cycles and an output level that is the same as the level shown on the circuit layout card or sketch for the REP IN. Patch the OSC output to the REP IN jack.  |
| 2    | At the subscriber's terminal, patch the TMS to the PBX jack.   |
| 3    | At the subscriber's terminal, read the level indicated by the TMS and pass the reading to the STC.<br><b>Requirement:</b> The level read on the TMS should be the same as the level shown on the circuit layout card or sketch for the receiving direction at the PBX jack.<br><b>Limits:</b> Loop facilities only — Plus or minus 1.0 db.<br>Loop and toll facilities — Plus or minus 2.0 db. |
| 4    | Repeat Steps 1 through 3 using 300- and 3000-cycle test frequencies.<br><b>Limits:</b> Should not deviate from 1000-cycle measurement by more than -10 db.   |

**TEST PROCEDURE — TRANSMITTING DIRECTION**

- | STEP |  |
|------|--|
| 5    | At the subscriber's terminal, adjust the OSC for a frequency of 1000 cycles and connect its output to the input of the TMS. By referring to the circuit layout card or sketch, determine the transmitting level at the PBX jack (usually 0 dbm) and then adjust the output of the OSC until the TMS indicates the same level.                          |
| 6    | At the subscriber's terminal, patch the OSC to the PBX jack.   |
| 7    | At the STC, patch the TMS to the REP OUT jack and read the level indicated by the TMS.<br><b>Requirement:</b> The level read on the TMS should be the same as the level shown on the circuit layout card or sketch for the REP OUT.<br><b>Limits:</b> Loop facilities only — Plus or minus 1.0 db.<br>Loop and toll facilities — Plus or minus 2.0 db. |
| 8    | Repeat Steps 5 through 7 using 300- and 3000-cycle test frequencies.<br><b>Limits:</b> Should not deviate from 1000-cycle measurement by more than -10 db.   |

**TEST PROCEDURE NOTES**

- | NOTE |   |
|------|---|
| 1    | No loop transformer (repeat coil) is normally used since one is usually included as part of the PBX tie trunk circuit.  |
| 2    | The loss of the PBX tie trunk circuit can be measured in case the above limits are not met. The expected loss can be determined from the circuit layout card or sketch or by referring to the applicable SD drawing.                    |
| 3    | If limits are not met, the repeaters should be calibrated and the loss of the 4-wire terminating set checked. Replace the network with a 600 $\omega$ termination connected at the HYB NET jack when checking the terminating set loss. |

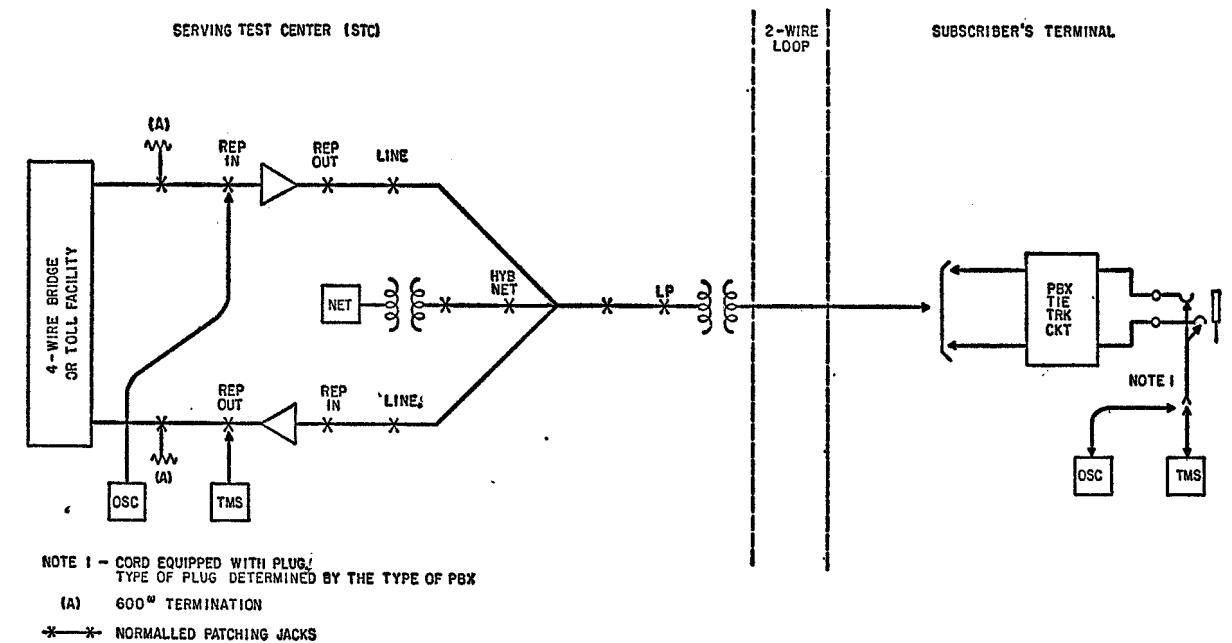


CHART 19  
FIG. 19

PURPOSE OF TEST

This chart and associated figure outline the procedure to be followed when measuring the net loss of a 4-wire section from an STC, to a served private line PBX station. This procedure assumes that a 4-wire to 2-wire terminating set per SD-66679-01, Fig. 1 is used at the subscriber's terminal.

TEST PROCEDURE — RECEIVING DIRECTION

- STEP 1** At the STC, adjust the OSC for a frequency of 1000 cycles and an output level that is the same as the level shown on the circuit layout card or sketch for the REP IN. Patch the OSC output to the REP IN jack.
- STEP 2** At the subscriber's terminal, patch the TMS to the PBX jack.
- STEP 3** At the subscriber's terminal, read the level indicated by the TMS and pass the reading to the STC.
- Requirement:** The level read on the TMS should be the same as the level shown on the circuit layout card or sketch for the receiving direction at the PBX jack.
- Limits:** Loop facilities only — Plus or minus 1.0 db.  
Loop and toll facilities — Plus or minus 2.0 db.
- STEP 4** Repeat Steps 1 through 3 using 300- and 3000-cycle test frequencies.
- Limits:** Should not deviate from 1000-cycle measurement by more than -10 db.

TEST PROCEDURE — TRANSMITTING DIRECTION

- STEP 5** At the subscriber's terminal, adjust the OSC for a frequency of 1000 cycles and connect its output to the input of the TMS. By referring to the circuit layout card or sketch, determine the transmitting level at the PBX jack (usually 0 dbm) and then adjust the output of the OSC until the TMS indicates the same level.
- STEP 6** At the subscriber's terminal, patch the OSC to the PBX jack.
- STEP 7** At the STC, patch the TMS to the REP OUT jack and read the level indicated by the TMS.
- Requirement:** The level read on the TMS should be the same as the level shown on the circuit layout card or sketch for the REP OUT.
- Limits:** Loop facilities only — Plus or minus 1.0 db.  
Loop and toll facilities — Plus or minus 2.0 db.
- STEP 8** Repeat Steps 5 through 7 using 300- and 3000-cycle test frequencies.
- Limits:** Should not deviate from 1000-cycle measurement by more than -10 db.

TEST PROCEDURE NOTES

- NOTE 1** If limits are not met, the following should be checked in the order named until the trouble has been located.
- (a) Calibrate the repeaters at the central office.
  - (b) Measure the loss of all transmission paths at the central office.
  - (c) Measure the loss of the loops including the loop transformers at both the central office and the station.
  - (d) Measure the loss of the station equipment between the PBX jack and the loop transformers at the station. It will be necessary to disconnect the loop transformer from the terminating set when making these measurements at the station. The transmit and receive A and C pads should be of zero db value when making the measurements.

