MODEL TTS 4BNH TRANSMISSION TEST SET (NORTHEAST ELECTRONICS CORP.)

INSTRUCTION MANUAL

1. GENERAL

1.01 This section provides information in connection with the operation and maintenance of the Northeast Electronics Corporation Model TTS 4BNH Series of Transmission Test Sets.

1.02 The section consists of an instruction manual prepared by Northeast Electronics Corporation, Concord, New Hampshire. The instruction manual has been abridged to delete references to internal wiring diagrams and repair procedures. Accuracy checks and repair service for the TTS 4BNH Transmission Test Set is available at Western Electric Service Centers under the "Red Ball" program.

Attached:

Abridged Instruction Manual for the TTS 4BNH series of Transmission Test Sets.

FOREWORD

The information provided in Northeast Electronic Corporation's Instruction Manual has been included only to describe the operation of the TTS 4BNH Transmission Test Set. The information provided should not be construed as a substitute for the transmission procedures described in Bell System Practices.

General transmission requirements for Bell System equipment and facilities may be found in the 300 division series of Bell System Practices. Specific transmission parameters for a particular item of equipment will usually be found in the installation and maintenance practices associated with the equipment.

TTS 4BNH

INSTRUCTION MANUAL (ABRIDGED)

GENERAL DESCRIPTION

1.0 GENERAL INFORMATION

Overall Features

1.01 The TTS 4BNH portable Transmission Test Set and the rack mounted version, the TTS 4BNHR, were designed to operate in the audio-frequency range and to permit transmission measurements over a wide range of telephone circuits. The appearance and the operation of these sets is almost identical to that of the earlier TTS 4ANH series of test sets. The TTS 4BNH and TTS 4BNHR contain all the features provided in these earlier sets and provide a number of additional features, such as individually calibrated meter scales, a 20 dB increase in receive sensitivity, the ability to provide bridging measurements at full sensitivity and additional send frequencies.

1.02 The set may be used on local exchange or PBX circuits as well as on two-wire or four-wire toll circuits and program circuits. In addition to the transistorized transmission measuring circuits and their associated switching provisions, the set contains a built-in talk circuit as well as precision terminations of 600Ω +2 μF and 900Ω +2 μF. A 4 $\frac{1}{2}$"mirror-scale level meter, which is individually calibrated, is centrally located on the panel.

For operation on local circuits which carry DC, the set contains switchable low resistance holding coils. A self-contained talk circuit, equipped with jacks for a 52A or equivalent external headset, is provided. This circuit can be switched to the ON HOOK condition; in this case, a neon bulb indicates incoming ringing. The receiver of the headset can be switched to monitor the signals in the receive amplifier; this provision is also used in the "four-wire TALK" position. When equipped with an external 52A headset and an external dial, which can be inserted in the unused line jack, the set duplicates the functions of a subscriber dial set.

A connector is provided for connecting external frequency determining networks; these are located in accessory "slip-on" covers and provide networks for both switchable and continuously variable frequencies.

1.03 All connections to the test set are made through standard telephone type jacks or through universal binding posts; these are arranged along the lower edge of the front panel. The sleeve circuits of the SEND jacks are connected to a pin jack to provide for external sleeve connections and the sleeve circuits of the LINE, REC, DIRECT and NMS jacks are connected to another pin jack. The TTS 4BNH series of equipment provides a SEND 309-310, LINE 309-310, REC 310, REC DIR 310 and an NMS 310 jack. The REC DIR jack gives direct access to the amplifier-meter circuits, thereby eliminating the frequency response of the receive transformer. The NMS jack makes it possible to connect external devices, which do not provide a path for DC current, such as certain types of noise measuring equipment, to the line, while holding the external circuits through the DC path provided by the hold coil in the TTS 4BNH set. The LINE 310 jack and the REC 310 jack are located adjacent to each other and they are spaced to permit insertion of a twin plug. This arrangement facilitates testing of 4-wire systems; for these systems the LINE 310 jack provides the send functions and the REC jack provides the receive functions.

1.04 To facilitate measurements on 4-wire circuits, and to provide test terminations, special precision termination circuits have been added. Their purpose is as follows: assume that a 4-wire circuit is terminated at the distant end by a 4-wire termination set and that a test signal is applied to the 2-wire side of this termination set. Assume also that it is desired to measure the transmission loss from the 2-wire far end circuit to the receive leg of the near end 4-wire circuit. In this case it is necessary to make sure that no signals are applied to the near end send leg of the 4-wire circuit. If signals

should, by mistake, be applied to the near end send leg, part of their energy will normally be transmitted through the far end hybrid and be added to the far end test signal; the only occasion when this does not occur is when a "perfect" hybrid balance exists at the far end. This extra signal will result in erroneous transmission loss measurements. To insure that no signals can be applied by the TTS 4BNH set to the near end send leg, the line circuit of the TTS 4BNH is terminated in either 600Ω +2 μF or 900Ω +2 μF whenever the LINE switch is in the REC position while, simultaneously, the receive leg of the TTS 4BNH circuit is patched into the REC jack of the set. The position of the REC IMP switch determines whether a 600 Ω or 900Ω termination is used. As precision, non-inductive resistors are used, this circuit can also provide a test termination on the LINE jack for other measurements. Note, however, that a plug, perferably a dummy plug, must be inserted into the REC jack to complete the circuits which connect this test termination to the LINE jacks.

1.05 The TTS 4BNH and TTS 4BNHR provide maximum send levels of +11 dBm in a 600Ω or a 900Ω circuit. A special 600Ω output circuit can be selected for program circuits. These modes of operation are selected by the SEND IMP switch. The SEND LEVEL attenuator permits immediate selection of levels from +10 to -40 dBm. Intermediate send levels can be established by means of the CAL SEND control.

The receive section of these sets provides 0 dBm readings on the meter for levels from +10 to -60 dBm under the control of the REC LEVEL attenuator. As the meter scale is calibrated from +3.0 dBm to -15 dBm, levels from +13 dBm to -75 dBm can be measured. In addition to the dBm scales, voltmeter scales are provided permitting measurement of voltages from 1.0mV to 3.0V full scale. For voltage measurements the REC IMP switch must be in the 600Ω position.

When accessed through the LINE or REC jacks, the receive section can be used in the 900Ω terminated, the 600Ω terminated or the 600Ω bridging mode of operation under the control of the REC IMP switch. In the bridging mode of operation, the sensitivity is the same as in the terminated mode. When accessed through the REC DIR jack, the receive section is always operated in a bridging, DC blocked, mode; when used in this manner, the circuit can be switched for operation on 600 or 900Ω circuits by means of the REC IMP switch.

1.06 The TTS 4BNH series of sets are equipped with an internal regulated power supply circuit. This circuit can be supplied either from a number of self-contained D cells or from external central office batteries having any voltage between 20 and 70 volts. The condition of the self-contained batteries can be checked by depressing the button marked "BATT TEST". The source of power is selected by the POWER switch. In the center position of this switch, all power is turned off. When closing the cover, a bracket in the cover returns the POWER switch to the OFF position if it had been inadvertently left in the INT BATT position.

Batteries may be replaced by removing the set from the case.

CAUTION: The patch cord for the central office battery operation must be inserted in the "external power" jack on the test set BEFORE the other end is connected to any jack which is used to provide connections to the station battery. To disconnect power, remove connection from central office battery first.

1.07 The TTS 4BNH is contained in a gray finished aluminum case which is approximately 8 ½" wide x 12" long x 10" high. These demensions include the standard detachable hinged cover. The weight of the set is approximately 21 pounds. The eighteen "D-cells" required for the self-powered operation are contained within the case

1.08 This manual describes the TTS 4BNH in detail. Unless specific mention is made of differences, it also applies to the TTS 4BNHR.

Oscillator Section

1.09 The oscillator portion provides for sending individual tone frequencies of 300, 400, 500, 800, 1000, 1400, 1600, 2000, 2300, 2500, 2700, 2800, 3000, 3100, 3200, and 3400 Hz, selected by operation of the SEND FREQ switch. An additional position, marked EXT on the SEND FREQ switch, can be used to transfer the frequency determining circuits in the oscillator to a front panel connector socket marked EXT FREQ. Adapter units contained in special removable covers may be connected to this socket to provide additional fixed or variable frequencies for testing program circuits, FAA voice control circuits, etc. One switch position is vacant and is available to install an additional frequency.

Output levels of +10, +7, 0, -5, -10, -16, -20, -25, -30, -35 and -40 dBm can be selected by the SEND LEVEL attenuator, provided the CAL SEND control has been adjusted to provide the correct 0 dBm level. Output levels of +5 and -15 dBm can be substituted for the +7 and -16 attenuator positions on special order. By adjusting the CAL SEND control, intermediate levels may be obtained; in addition, the use of this control permits sending a maximum level of +11 dBm.

1.10 The maximum level variation when switching the self-contained send frequencies is less than 0.1 dB. In general, this permits a change of frequency without requiring a readjustment in the oscillator level for each new frequency. The output of the oscillator is available at jacks designated LINE and SEND and on binding posts.

1.11 The CAL SEND potentiometer, which is used to adjust the send level to the desired value, can be locked in any position by means of a concentric ring on this control.

Precision Terminations

1.12 The set contains a precision 600Ω +2 μF and 900Ω +2 μF termination. These are available on the LINE terminals when the LINE switch is in the REC position and a plug or dummy plug is inserted in the REC jack. Selection of a 600Ω +2 μF or 900Ω +2 μF is done by the REC IMP switch.

Amplifier and Level Meter

1.13 The receive section of the test set provides a level meter which can be operated either on a bridging or a terminated basis. The receive sensitivity is controlled by an attenuator which provides a 0 dB reading on the meter scale for signal levels of +10 +7, 0, -5, -10, -16, -20, -25, -30, -35, -40, -45, -50, -55 and -60 dB. Attenuator steps providing 0 level reading at +5 and -15 can be substituted on special order. As the meter scale is calibrated from +3 to -15 dB, levels from +13 to -75 dBm may be measured. Scale divisions of 0.10 dB between +1.0 and -1.0 dBm and divisions of 0.20 dB for the range +3.0 to +1.0 and -1.0 to -3.0 dB permit accurate measurements over the range of +13 to -63 dB. Between -3.0 and -10.0 dB, sub-divisions of 0.50 dB are provided; below this point the divisions are 1.0 dB. Additional voltmeter scales have been provided on the meter and corresponding markings have been provided on the attenuator to permit use of the receive section to measure voltages from 0.10 mV to 3.0 V To use the voltmeter scales the REC IMP switch should be in the 600Ω terminated or 600Ω bridging position. Individually calibrated meters are used to increase the accuracy of the level measuring section. The meter is driven by a detector circuit which responds to the AVG. value of the applied signal.

Access to the receive portion is obtained either through the LINE jacks or LINE terminals when the LINE switch is in the REC position or through the REC jack or the REC terminals which are connected in parallel with the REC jack. When so accessed, the REC IMP switch permits selection of a 900Ω terminated, a 600Ω terminated or a 600Ω bridging mode of operation. In this mode of operation, a balanced, DC blocked, input transformer is inserted in the receive channel. The

"hold" circuit is available only when access is obtained through the LINE jacks or terminals. When accessed through the REC DIR jack, the input transformer is bypassed thereby extending the frequency response of the receive section. In this mode of operation, the receive section is always operated on a bridging basis; DC blocking is provided in this input circuit and the REC switch is used to select operation on 600 or 900Ω circuits. It should be noted that when external equipment is inserted in the NMS jack, the connection between the receive section and the LINE jacks and terminals is interrupted; in this case, it is still possible to access the receive section through the REC or REC DIR jacks, however, hold functions are not available in this mode of operation.

1.14 Highly stable circuits are used in the receive section of this test set. As a result, no front panel control is provided for the calibration of the receive sensitivity. Internal controls are provided for recalibration as described in the section on maintenance.

Talk, Monitor, Calibration and Power Circuits

1.15 The test set contains an induction coil and an internal "talk battery" supply. TEL SET jacks are provided for insertion of a 52A or equivalent headset, thus permitting test personnel to send, receive or talk on any line connected to the LINE jack by moving the LINE key to the desired position. A key designated LINE/MON, when in the OPEN (ON HK) position, opens the hold coil circuit, thus creating an on hook condition for the talk and the receive circuits. To create an on hook condition for the send circuits the SEND IMP key switch must be in the 600P position. In the on hook condition, the talk circuit remains operative and a neon bulb, in series with a capacitor, is connected across the line to indicate incoming ringing signals. In the center position of this switch, a hold coil is placed across the line to provide an off hook condition. The LINE/MON key has a third position marked MON AND 4W TALK which provides a transfer of the headset receiver to the amplifier output circuit. This provides monitoring of the signals which are being measured. Operation of this key will not affect the meter indication. Two series connected LINE jacks, marked 309 and 310, are provided. The line under test is connected to one of these. A dial may be plugged into the second, unused jack. As an alternative, the line under test may also be connected to the LINE terminals.

On 4-wire circuits, the headset transmitter is connected to the LINE circuit and thus to the send leg of the 4-wire system, provided the LINE switch is in the TALK position. When the LINE/MON switch is in the MON AND 4W TALK position, the headset receiver remains connected to the receive amplifier, which in turn is connected to the receive leg of the 4-wire system through the REC jack. This completes the 4-wire talk circuit. Acceptable receive levels in the headset are obtained by moving the REC LEVEL switch until the desired level is obtained.

1.16 A three-position FUNCTION switch is provided. In the CAL SEND position, this switch establishes a direct connection between the send and the receive section of the test set for the purpose of setting up the desired send level. This connection is independent of any connection which may have been made to the set through the jack strip or the binding posts. The CAL SEND level control is adjusted to obtain the desired send level; normally, this send level is adjusted to provide a 0 dBm reading at 1000 Hz. To set up this adjustment both SEND and REC IMP switches should be set to the desired send impedance and the SEND LEVEL and REC LEVEL controls should be set to the 0 dBm positions. After adjustment, the CAL SEND control may be mechanically locked by means of the concentric ring which is provided for this purpose.

In the center position of the switch the SEND, REC and TALK functions can be selected under the control of the LINE switch. In the REC +TALK position the SEND circuits are disabled and the REC and TALK functions can be selected by the

LINE switch; this eliminates any interference from the SEND circuit when extremely low send signals are to be measured and reduces battery drain.

1.17 A three-position POWER switch is provided. In the center position, the set is turned off. When this switch is moved to the INT BATT position, the set is operated from self-contained D-cells. A bracket in the cover operates the switch to the OFF position when the cover is closed if the switch had been inadvertently left in the INT BATT position. The CO BATT position connects the power from the CO battery to the set. Power from any central office battery having a voltage between 20 and 70 volts may be supplied to the test set through this jack.

CAUTION:
The patch cord for the central office battery operation must be inserted in the CO BATT jack on the test set BEFORE the other end is connected to any jack which is used to provide connections to the station battery. To disconnect power, remove connection from station battery first.

Jack Connections and Terminals

1.18 A number of jacks and two pairs of universal binding posts are located at the bottom of the front panel. A jack marked CO BATT is located near the POWER switch and a connector for external frequency determining networks near the CAL SEND control. The following describes these in more detail.

SL (left) This pin jack located to to the left of the jack strip provides a connection to the sleeves of both SEND jacks.

TEL SET A twin jack to accept a 52A or equivalent headset connects to the talk circuits in the set.

SEND Two cut-off type jacks in tandem, one accepting a 309 and the other a 310 plug, provide direct access to the LINE side of the balanced, DC blocked, output transformer. A low resistance hold coil is connected across the SEND jacks for the 600 and 900Ω positions of the SEND IMP key switch. In the 600P position on this key switch, the hold coil is removed to provide extended low frequency response for measurements on program lines.

LINE Two jacks connected in series; one accepting a 309 and and the other a 310 plug and connected in parallel to the LINE binding posts provide access to the LINE switch in the test set. The LINE switch connects the LINE jacks to either the SEND, TALK or REC circuits of the test set. In the SEND and REC positions of the LINE switch, impedances of 600 or 900Ω are selected by the operation of the SEND IMP or REC IMP keys; in the REC position of the LINE switch, an additional bridging input is available at full sensitivity. In the TALK and REC positions of the LINE switches, a hold coil may be connected across or removed from the line circuit under the control of the LINE/MON key. In the SEND position of the LINE switch a hold coil is connected across the LINE circuit at all times. A telephone dial may be connected to the unused LINE jack to permit dialing test calls through the set.

CALL A recessed neon bulb serves as an incoming ringing indicator when the LINE/MON key is in the LINE OPEN position.

PRECISION
TERMINATION The set contains a precision 600Ω +2 μF and 900Ω +2 μF termination. These are available on the LINE jacks when the LINE switch is in the REC position and a plug or dummy plug is inserted in the REC jacks. The impedance of this termination is determined by the position of the REC IMP switch.

REC A jack to accept a 310 plug provides direct access to the LINE side of the balanced DC blocked, input transformer. A pair of universal binding posts is connected across this circuit. No hold circuit is available in this mode of operation.

REC DIR A jack to accept a 310 plug provides direct, DC blocked, access to the high impedance amplifier input attenuator. Using this jack, the input transformer is by-passed to take advantage of the full frequency response of the REC circuits. To avoid the need for recalibration, a pad equivalent to the transformer insertion loss is automatically inserted in the REC circuits when this jack is used. In this mode of operation, theREC IMP switch is used to select operation from 600 or 900Ω circuits. DC voltages in excess of 100 V must not be applied to this section.

NMS A jack to accept a 310 plug provides a direct connection to the LINE jack when the LINE switch is in the REC position. A low resistance hold coil can be bridged across this jack under the control of the LINE/MON key. The amplifier input transformer and the amplifier circuits are disconnected from the LINE circuit when a plug has been inserted in this jack.

SL (right) A pin jack to the right of the jack strip provides a connection to the sleeves of the LINE, REC, REC DIR and NMS jacks.

CO BATT This jack, located near the POWER switch, accepts a 310 plug and provides an input connection to the internal regulated power supply for any central office station battery having a voltage between 20 and 70 volts. See the CAUTION note for the use of this jack under Section 1.06.

EXT FREQ This is a multi-connector which serves to connect external frequency determining circuits to the send section of the test set.

TRANSMISSION PERFORMANCE

2.0 TRANSMISSION PERFORMANCE

Design objective Specifications

SEND SECTION

2.01 General

After a warm-up period of two minutes the output level of the oscillator will hold ±0.1 dB for an ambient temperature of 10° to 40°C when changing to any of the self-contained SEND frequencies. If the test set is used in an area which the temperature varies from the above range, the SEND LEVEL may need to be recalibrated when changing frequencies by means of the CAL SEND control. In temperatures approaching freezing, the efficiency of the batteries drops rapidly and frequent check of the battery condition is recommended.

2.02 Oscillator Performance

Data are for room temperature unless otherwise stated and for battery test readings within the green arc.

Frequency: Controlled by multi-position switch-- 300, 400, 500, 800, 1000, 1400, 1600, 2000, 2300, 2500, 2700, 2800, 3000, 3100, 3200, and 3400Hz. Different frequencies or one extra frequency can be supplied on special order.

External Frequency Plug: An extra position, marked EXT is provided on the SEND FREQ switch and a connector is provided on the panel for connecting external frequency determining networks.

Frequency Stability: Better than 1% from 10°to 40°C (factory adjustment ½% for 1000 Hz).

Distortion: Less than 1% at any harmonic component.

Output Levels: After initial 0 dBm calibration, using the CAL SEND position of the FUNCTION switch with the attenuator in the CAL positions, TTS 4BNH fixed send levels are +10, +7, 0, -5, -10, -16, -20, -25, -30, -35, and -40. Levels of +5 and -15 can be provided on special order. Other send levels can be obtained by adjusting the CAL SEND control using the CAL SEND position of the FUNCTION switch.

Attenuator Accuracy: Better than 0.10 dB.

Level Variation with Frequency: Less than 0.10 dB for 10° to 40°C.

Output Impedance: Balanced output transformer with DC blocking; impedance selected by switch:
1-600Ω ±5%, ±5° from 300 to 3500 Hz
2-900Ω ±5%, ±5° from 300 to 3500 Hz
3-600P position: 600Ω ±5%, ±5° from 75 to 3500 Hz

Hold Coil: A low resistance hold coil similar to a 274J coil, is provided on the 600 and 900Ω positions of the SEND IMP switch; there is no hold coil in the 600P position.

Output Connections: On either 309 or 310 LINE jacks or LINE terminals when LINE switch is in SEND position. On either 309 or 310 SEND jack irrespective of LINE switch position.

RECEIVE SECTION

2.03 General

The amplifier level meter combination permits reading of signals from +13 dBm to -63 dBm in -0.2 dB divisions by using the attenuator and the scale markings between -3.0 and +3.0 dB. The range from -1.0 to +1.0 dBm is provided with 0.10 dB

markings. The meter is individually calibrated. Markings in 0.50 dB from -3 to -10 dBm and 1.0 dB markings from -10 to -15 dBm make it possible to measure signal levels down to -75 dBm. With a 52A headset plugged into the jacks marked TEL SET, operation of the LINE/MON key to the MON position makes it possible to monitor the amplifier output without affecting the meter reading.

2.04 Performance

Data are for room temperature unless otherwise stated and for battery test readings within the green arc.

Input Connections:

1. On either 309 or 310 LINE jack when the the LINE switch is in the REC position. In this circuit a DC blocked, balanced transformer is provided and a low resistance hold coil can be switched in under the control of the LINE/MON switch.

2. On the 310 REC jack; no hold coil is provided in this connection; however, a DC blocked, balanced transformer is provided.

3. On the 310 REC DIR jack, a DC blocked direct access to the amplifier input attenuator is provided and a fixed pad matching the input transformer insertion loss is inserted.

CAUTION

The REC DIR input has DC blocking; however, to prevent internal damage, this input must NOT be used in circuits carrying DC voltages in excess of 100 volts.

NOTE

On the 310 NMS jack, a direct connection to the LINE jack is provided. When the LINE key is in the REC position a low resistance hold coil is provided on this circuit under the control of the LINE/MON switch.

Input Impedance: Balanced input transformer with DC blocking. Impedance selected by switch, 600Ω terminated, 900Ω terminated and bridging 600Ω. "Terminated" impedance is 600 or 900Ω, ±5%, ±5° over the frequency range from 100 to 5000 Hz, except for the LINE input, where the hold coil causes a 7° phase angle at 300 Hz.

Frequency Response: The following data are referred to the response at 1000 Hz at 25°C.

1. Through balanced transformer:
   a) LINE jack
      With hold coil, 600 or 900Ω
      Variation: Less than 0.1 dB from 300 to 8000 Hz
      Less than 0.2 dB from 200 to 10,000 Hz

   b) REC jack
      1- Without hold coil, terminated, 600 or 900 Ω
      Variation: Less than 0.1 dB from 100 to 8000 Hz
      Less than 0.2 dB from 75 to 15,000 Hz

      2 - Bridging, (in excess of 15,000Ω)
      Variation: Less than 0.1 dB from 150 to 5,000 Hz
      Less than 0.2 dB from 75 to 10,000 Hz

   c) REC DIR jack
      Bridging (in excess of 50,000Ω) 600Ω or 900Ω circuit selected by REC IMP switch
      Variation: Less than 0.2 dB from 50 to 20,000 Hz

d). Temperature Effect
Frequency response changes are negligible over the range 0° to 50°C.

Receive Levels: Receive levels of +10, +7, 0, -5, -10, -16, -20, -25, -30 -35, -40, -45, -50, -55 and -60 dB will produce a 0 dBm reading on the meter scale for either 600 or 900Ω input impedance, provided the attenuator has been moved to the corresponding position. Levels of +5 and -15 can be provided on special order. By using the meter scale, levels from +13.0 to -63.0 dBm may be read in 0.20 dB increments; readings to -75 dBm can be read at reduced accuracy.

Basic Accuracy: A- ±0.1 dB, 1000 Hz, 600Ω; 25°C to ±10°C.
B- ±0.2 dB, 1000 Hz, 0 dBm, 600Ω; 0°C to 50°C.

Attenuator Accuracy: Better than 0.10 dB.

Meter: A- Range: -15 to +3 dB.
B - Scale: Mirror scale, marked in 0.10 dB steps from -1.0 to +1.0 dB; 0.20 dB steps from +1.0 to +3.0 and -1.0 to -3.0; 0.50 dB steps from -3.0 to -10.0 and 1.0 dB steps below -10.0 dB.
Meter is individually calibrated.

Batteries

2.05 The set uses 18 type "D" flashlight cells for self-powered operation. Battery life is in excess of 200 hours for normal usage.

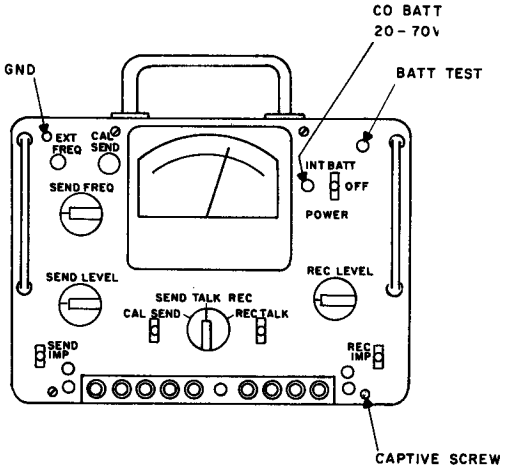
Battery Replacement

To replace batteries, remove the set from the case by loosening the four captive screws marked ➤ Disconnect the battery cable and remove the four screws which hold the battery protective plate. After replacing batteries, reassemble the set using the reverse order of the above steps.

NOTES

TTS 4BNH

MODEL TTS 4BNH TRANSMISSION
TEST SET OPERATION - GENERAL

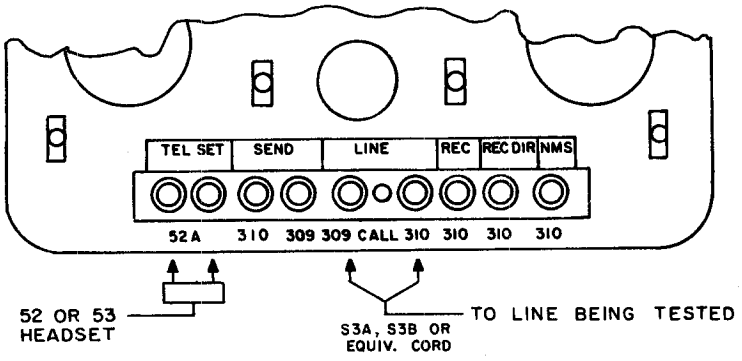


NOTE

The portable version of this instrument has been calibrated with the meter in the horizontal position and the rack-mounted version with the meter in the vertical position. To obtain the specified accuracy, the instrument must be operated in the same position in which it was calibrated. If it is desired to operate the instrument in another position, the instrument must be recalibrated while the meter is in the desired position.

(A) PREPARATION

STEP	PROCEDURE
1	Open lid. (May be removed by moving cover to the right.)
2	Set POWER switch to INT BATT or CO BATT
3	Set SEND FREQ for desired frequency.
4	Wait 90 seconds for warm up.
5	Set SEND LEVEL and REC LEVEL to 0 (CAL).
6	Set FUNCTION to CAL SEND.
7	Set the SEND IMP to 600 P.
8	Adjust CAL SEND for 0 dBm on meter.
9	Set FUNCTION to SEND + TALK + REC



(B) GENERAL OPERATION USING LINE JACK

STEP	PROCEDURE
1	Complete all steps under (A) PREPARATION

(a) TO TALK

STEP	PROCEDURE
2	Connect line to be tested to LINE 310, LINE 309 jack, or LINE terminals depending on type of plug available.
3	Connect 52 or 53 type telephone set to TEL SET jack.
4	Operate LINE key to TALK. This connects the telephone set to line.

(b) TO SEND TONE

STEP	PROCEDURE
1	Set SEND FREQ to desired frequency.
2	Set SEND LEVEL to desired level.
3	Set SEND IMP to desired sending impedance.
4	Operate LINE key to SEND. This connects the output of the oscillator to the line.
5	After a predetermined length of time, restore the LINE key to TALK.

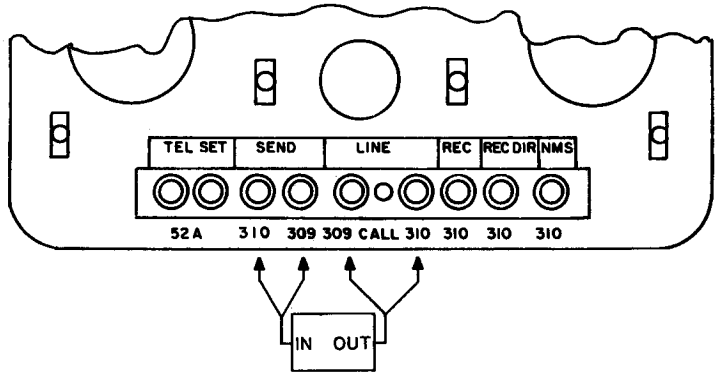
(c) TO MEASURE TONE

1	Set REC IMP to desired impedance.
2	Request tone to be sent.
3	When tone is heard in the telephone set, operate LINE key to REC.
4	Turn REC LEVEL switch to obtain a conventient reading on the meter (between the -3 and +3 marks, if possible) The level is the algebraic sum of the REC LEVEL switch and the meter ading.

Examples:

REC LEVEL	METER READING	LEVEL
+ 7	+2	+ 9
+10	-1	+ 9
0	-1.6	- 1.6
-10	+2.4	- 7.6
-16	-0.6	-16.6

STEP	PROCEDURE
5	To monitor the tone being measured, turn MONITOR key to ON.
6	When tone is removed, operate LINE/MON key to HOLD and LINE key to TALK.



(C) TO MAKE GAIN OR LOSS MEASUREMENTS

STEP	PROCEDURE
1	Complete all steps under (A) PREPARATION.
2	Set SEND FREQ, SEND LEVEL and SEND IMP switches as required.
3	Connect input of equipment to be measured to SEND 310 or SEND 309.
4	Connect output of equipment to be measured to LINE 310 or LINE 309.
5	Operate LINE key to REC.
6	Turn REC LEVEL switch to obtain convenient reading on meter.
7	Gain or loss is the difference between sending level and receiving level.

Example:

SEND LEVEL	REC LEVEL	METER READING	GAIN(+) or LOSS (-)
0	-5	-1.2	- 6.2
0	+7	-0.3	+ 6.7
-20	+10	-2.0	+28.0

(D) TO OPERATE SET FROM CENTRAL OFFICE BATT.

STEP	PROCEDURE
1	Open lid. (May be removed by moving cover to the right.)
2	Insert cord in jack marked CO BATT 20-70V in transmission test set.
3	Insert jack in CO station appearance.

CAUTION: Do not reverse steps 2 and 3. The set is now ready for use.

4	Turn POWER switch to CO BATT position.
5	Wait 90 seconds for warm up.
6	Set SEND LEVEL and REC LEVEL to 0 (CAL)
7	Set FUNCTION to CAL SEND.
8	Adjust CAL SEND for 0 dBm on meter.
9	Set FUNCTION to SEND+ TALK +REC
10	To disconnect test set from station battery, first turn power switch to OFF, next remove cord from CO station appearance, finally remove cord from transmission test set.

CAUTION: Do not change the sequence of steps described here.

(E) TO USE HOLDING FEATURES OF TTS 4BNH IN CONNECTION WITH NOISE MEAS. EQUIP.

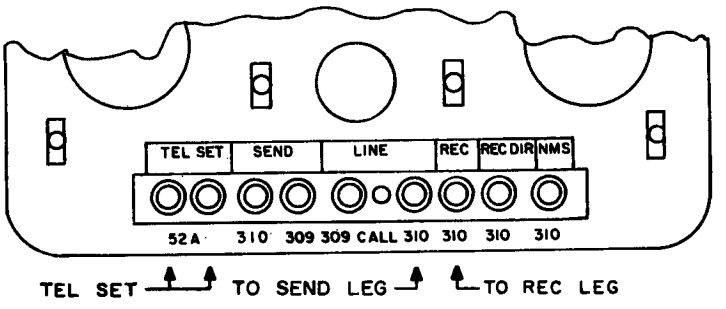
STEP	PROCEDURE
1	Connect the noise measuring set to a cord terminated in a type 310 plug.
2	Insert the cord from the noise measuring set in the jack marked NMS.

NOTE: This disconnects the RECEIVE circuit of the transmission measuring set.

3	At the completion of the noise measuring test, remove the cord from the NMS jack.

NOTE: This restores the RECEIVE section of the transmission measuring set to its normal operation.

TTS 4BNH



(F) TESTING 4-WIRE CIRCUITS

F.1 4-WIRE CIRCUITS IN GENERAL

STEP	PROCEDURE
1	Complete all steps under (A) PREPARATION.
2	Set SEND and RECEIVE impedance switches to the desired value.
3	Connect headset cord to TEL SET jack.
4	Set LINE/MON switch to MON AND 4W TALK position.
5	SET LINE switch to TALK position.
6	Insert a 4-wire cord into the LINE and REC jacks which are marked 4-W SND and 4-W REC.
7	Insert the other end of the 4-wire cord into the twin LINE jacks of the 4-wire telephone set.

F.2 DIALING ON 4-WIRE CIRCUITS

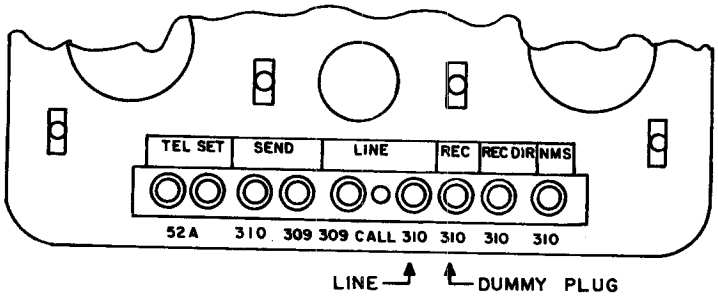
Multi-Frequency Dialing

Some 4-wire systems are equipped with multi-frequency tone dialing generated in the subscriber set. If the TTS 4BNH Unit is to be used in such a circuit and it is desired to establish connection, complete all the steps 1-7 listed above and thereafter proceed as follows:

STEP	PROCEDURE
8	Insert a 2-wire cord into the EQUIP-SEND jack of the telephone set and remove its hand set.
9	Insert the other end of the 2-wire cord into the NMS jack of the TTS 4BNH.
10	Move the LINE switch in the TTS 4BNH set to the REC position.
11	Establish the desired connection by dialing the desired number in the 4-wire telephone set.
12	Move the LINE switch to the TALK position and check that

F.2 DIALING ON 4-WIRE CIRCUITS

STEP	PROCEDURE
12	the desired number has been reached.
13	Return the hand set of the 4-wire telephone set to the ON HOOK condition.
14	The TTS 4BNH is now ready to make transmission measurements.
15	Upon completion of measurements; move the LINE switch to TALK and the LINE/MON switch to LINE OPEN. This releases the circuit.



(G) TO USE PRECISION TERMINATION

STEP	PROCEDURE
1	Select desired terminating impedance on REC IMP key.
2	Connect circuit to be terminated to LINE 310 jack.
3	Insert a "dummy" plug in the REC 310 jack.
4	Move the LINE key to the REC position. The circuit under test is now terminated in either 600Ω+2μF or 900Ω+2μF.