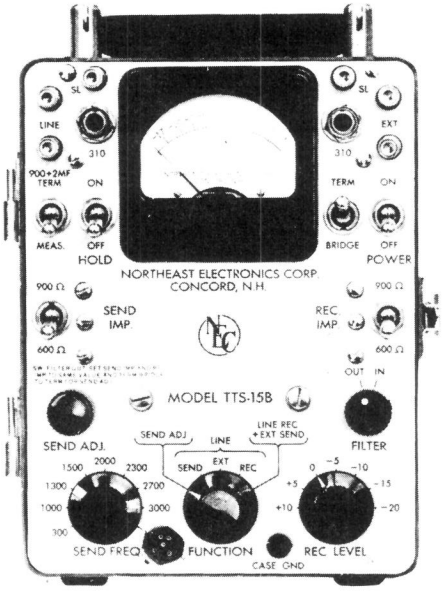
MODEL 15B AND 15C TRANSMISSION TEST SETS (NORTHEAST ELECTRONICS CORPORATION)

OPERATING PROCEDURES



TTS 15B

TTS 15C

1. GENERAL

1.01 This section provides the operating procedures for Northeast Electronics Corporation Model 15B and 15C transmission test sets.

1.02 The section is reissued to add procedures for the 15C transmission test set, and to make extensive changes in the practice format. Arrows have been omitted.

1.03 In general use, the test sets require no routine maintenance other than the periodic replacement of batteries and the occasional calibration of the mechanical meter "zero". Should problems develop that indicate that the test set is not functioning properly, accuracy checks and repair service are available at Western Electric service centers under the "Red Ball" program.

1.04 The Northeast Electronics Corporation Model TTS 15B is a portable test set that measures signal levels from +13 dBm to -37 dBm over a range of eight fixed frequencies. The send and receive test functions may be performed separately or simultaneously for either "end-to-end" or "loop" testing. Specifications for the TTS 15B and TTS 15C are shown in Table B.

1.05 The Model TTS 15C is identical to the TTS 15B, however, it provides for the following additional features:

(a) Output transformer.

(b) Battery test circuit. (Under control of the BATT TEST pushbutton.)

(c) Power may be supplied by an internal battery or the 48V central office battery.

2. FRONT PANEL CONTROLS

2.01 Table A indicates the functions of all of the front operating controls and indicators. The numbers on the photographs of the TTS 15B and TTS 15C, as shown in Fig. 2, relate to the index numbers provided in the index number column of Table A.

2.02 The TTS 15B and 15C may be operated in either the vertical or horizontal position. When the lid is closed on either the 15B or 15C, a projection inside the lid will automatically turn off the power switch, thus preventing the batteries from running down when the set is not in use.

Note: When the test set is not in use, the cover should be latched closed to protect the set from dust and damage. When the cover is to be left open, it may be removed from the base by sliding it upward.

2.03 CAUTION: When applying external power to the TTS 15C, the power supply cord should be jacked into the TTS 15C FIRST and then connected to the 48V central office battery. Conversely, for the REMOVAL of the external power, the power supply cord should be disconnected from the central office battery supply FIRST and then removed from the TTS 15C jack.

3. INTERNAL BATTERY TESTS

3.01 To prevent false and erroneous meter readings, the condition of the test set internal batteries should be checked prior to starting transmission tests. In addition, if the test set is employed for an extensive series of tests, the condition of the batteries should be checked periodically.

3.02 Exhausted batteries should be replaced as soon as possible, to prevent damage to the test set because of corrosion. In the event that the test set is to be held in storage, the batteries should be removed and the test set tagged accordingly.

3.03 To test the condition of the batteries in the TTS 15B, proceed as follows:

(1) Operate the SEND IMP and REC IMP switches to 600 ohms.

(2) Turn the FUNCTION switch to SEND ADJ.

(3) Operate the TERM/BRIDGE switch to the TERM position.

(4) Turn the FILTER switch to the OUT position.

(5) Turn the SEND ADJ control knob in a clockwise direction, as far as it will rotate.

(6) Operate the POWER switch to ON.

(7) Read the meter; it should read +1.5 or higher in the red portion of the scale. If the meter reading meets or exceeds the +1.5 requirement, the batteries are in satisfactory condition.

(8) In the event that the +1.5 requirement cannot be met, replace both internal batteries with new Eveready #2356 or equivalent batteries.

(9) To replace the batteries, remove the unit from the case and replace the batteries by removing the screw holding the battery clamp plate to the bottom of the case. When refastening the clamp plate, check to make certain that the battery leads are not short circuited.

3.04 To test the condition of the batteries in the TTS 15C, proceed as follows:

(1) Operate the POWER switch to ON.

(2) Depress the BATT TEST pushbutton.

(3) The meter needle should read in the GREEN sector or beyond (toward the right hand portion of the meter).

(4) In the event that this requirement cannot be met, replace all (10) D type battery cells. The replacement may be accomplished by removing the battery cover on the back of the case without removing the unit from the case.

4. THE FUNCTION OF THE HOLD CIRCUIT AND THE FILTER CIRCUIT

4.01 Hold Circuit: Facilities connected to the line jack or test set binding posts may be held regardless of any other switch position by operating the HOLD switch to the ON position.

4.02 Filter Circuit: The high pass filter minimizes the affects of power line related interference at the input of the test set. Signals appearing at the input of the receive circuitry will be processed by the high pass filter regardless of any other switch position, by operating the FILTER switch to the ON position.

5. "DATA-PHONE" OR DIAL TELEPHONE FACILITIES - TELEPHONE TEST SET CONNECTIONS

5.01 To arrange to dial, talk or monitor on a dial-up type telephone (DATA-PHONE) facility in conjunction with a TTS 15 type test set proceed as follows:

(1) Operate the POWER switch to ON.

(2) Operate the HOLD switch to OFF.

(3) Set REC IMP at 900 ohms.

(4) Connect the telephone test set to the EXT jack or binding posts.

(5) Turn the FUNCTION switch to the LINE-EXT position.

(6) Connect the circuit to the LINE jack.

(7) Dial test number(s).

(8) To hold the circuit for transmission measurements, operate the HOLD switch to the ON position before changing the position of the FUNCTION switch.

6. CALIBRATION OF METER ZERO AND SEND LEVEL

6.01 The mechanical meter zero is adjusted at the factory, however, it may require periodic minor adjustment. The adjustment screw is located on the front of the meter. The zero calibration should always be checked prior to starting transmission tests and readjusted if necessary.

6.02 The calibration of the send level is usually made at 1000 Hz. When it is necessary to make tests at frequencies other than 1000 Hz, the level variation from a calibration at 1000 Hz is less than 0.2 dB for the fixed step frequencies. In

most instances, a variation of less than 0.2 dB allows for a change in testing frequency without recalibration at each frequency.

6.03 The send level may be calibrated to any required value between 0 dB and -37 dBm. While it is possible to set it for values above 0 dBm, this is likely to introduce distortion and is not recommended. To calibrate the send level, proceed as follows:

(1) Turn POWER switch ON.

(2) Test the condition of the batteries.

(3) Set the MEAS/900 OHM TERM switch to MEAS.

(4) HOLD switch OFF.

(5) TERM/BRIDGE switch at TERM.

(6) SEND IMP switch at 600 or 900 ohms.

(7) REC IMP switch at same impedance as SEND IMP switch.

(8) FILTER switch at OUT.

(9) SEND FREQ switch at 1000 Hz or as required.

(10) REC LEVEL switch at nearest value to desired sending level.

(11) FUNCTION switch at SEND ADJ.

(12) Adjust SEND ADJ control.

Note: For 0 dBm obtain 0 on the meter. For other levels, adjust so the algebraic sum of the REC LEVEL switching setting and the meter reading equals the required value.

(13) This completes the calibration of the send level. As long as the SEND ADJ control is not changed, resetting the REC LEVEL switch for subsequent tests has no effect upon the send level.

7. TRANSMIT TEST SIGNAL

7.01 To transmit a test signal "On-Line", proceed as follows:

(1) Turn POWER switch ON.

(2) Test the condition of the batteries, if it has not been done previously.

(3) Set the MEAS/900 OHM TERM switch at MEAS.

(4) HOLD switch OFF.

(5) TERM/BRIDGE switch (not involved).

(6) SEND IMP switch at circuit impedance.

(7) REC IMP switch (not involved).

(8) FILTER switch (not involved).

(9) FREQ switch at required frequency.

(10) REC LEVEL switch at correct level.

(11) FUNCTION switch at SEND ADJ.

(12) Adjust the SEND ADJ potentiometer for desired send level on meter.

(13) FUNCTION switch at LINE - SEND.

(14) Patch the circuit under test into the LINE jack or binding posts. At this point, the TTS 15 is transmitting a tone at the desired frequency and level into the circuit.

8. RECEIVE TEST SIGNAL

8.01 To arrange for the test set to receive "On-Line" test signals from a distant end oscillator, on a private line basis, proceed as follows:

(1) Turn POWER switch ON.

(2) Test the condition of the batteries, if it has not been done previously.

(3) Set the MEAS/900 OHM TERM switch at MEAS.

(4) HOLD switch OFF.

(5) TERM/BRIDGE switch as required.

(6) SEND IMP switch (not involved).

(7) REC IMP switch at circuit impedance.

(8) FILTER switch as required.

(9) FREQ switch (not involved).

(10) REC LEVEL switch at +10.

(11) FUNCTION switch at LINE REC.

(12) SEND ADJ control (not involved).

(13) If it is necessary to monitor the incoming signal, connect a (1011) telephone test set to the extension jack or binding post.

(14) Patch the circuit under test (tip & ring) into the LINE jack or binding posts of the TTS 15B or 15C test set.

(15) Adjust the REC LEVEL switch setting to obtain a meter reading between +3 and -3 if practicable, otherwise as close to this range as the set will permit. The transmission measurement in the algebraic sum of the REC LEVEL switch setting and the meter reading as long as the send level corresponds to the design level of the circuit at the point of application.

9. LOCAL LOOP MEASUREMENTS - SENDING AND RECEIVING SIMULTANEOUSLY

9.01 The loss of a circuit or portion of a circuit (measured in dBs) is the output power of the oscillator minus the power read on the measuring set (in dBm) provided the test sets have purely resistive impedances and are matched to the circuit. Example: 600:600, 900:900 ohms.

9.02 Impedance mismatches between the circuit and the test sets cause the circuit under test to measure more loss than is actually present in the circuit. If impedance mismatches cannot be avoided, the error caused by commonly encountered mismatches should be subtracted from the measured circuit loss.

IMPEDANCE MISMATCH	CORRECTION (For each mismatch)
600 : 1200	0.5 dB
600 : 900	0.2 dB
900 : 600	0.2 dB
900 : 1200	0.2 dB

9.03 The TTS 15B and 15C test sets may be used for local measurements requiring the test set to send and receive simultaneously. It is possible to make repeater gain tests (maximum of 13 dB when sending at zero level), and test for insertion gain or loss on four-wire facilities, etc. To arrange the TTS 15B or 15C for simultaneous operation, proceed as follows:

(1) Turn POWER switch ON.

(2) Test the condition of the batteries, if it has not been done previously.

(3) Set the SEND IMP and REC IMP switches to correspond to the input impedance of the facility or equipment to be tested. Calibrate the send level (as described in 6.02). For the balance of this test, do not change the setting of the SEND IMP switch.

(4) Set the MEAS/900 OHM TERM switch at MEAS.

(5) TERM/BRIDGE switch at TERM.

(6) SEND IMP switch, as described in step 3 above. (Do not change setting during subsequent steps.)

(7) REC IMP switch at the setting of the output impedance of the line or equipment to be tested.

(8) FILTER switch - as required.

(9) FREQ switch at the desired frequency setting. For a test at a frequency other than 1000 Hz, a variation of up to 0.2 dB may be encountered as described in 6.02. If recalibration is required, steps 3 through 7 above, should be checked.

(10) REC LEVEL switch at +10.

(11) FUNCTION switch at LINE REC + EXT SEND.

(12) SEND ADJ unchanged from calibration sequence.

(13) Patch the input of the circuit or equipment to be tested into the EXT jack or binding posts.

(14) Patch the output of the line or equipment under test to the LINE jack or binding posts. The test set is now sending into the input of the line or equipment to be tested and receiving from the output.

(15) Adjust the REC LEVEL switch setting to obtain a meter reading between +3 and -3 if practicable, otherwise as close to this range as the set will permit. The transmission measurement is the algebraic sum of the REC LEVEL switch setting and the meter reading.

10. SUMMARY OF PROCEDURES

10.01 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.

10.02 For the end-to-end transmission measurements on DDD and private line facilities, there are four basic steps that should be applied to obtain accurate results:

(1) Calculate the desired oscillator output contingent upon the test level for the type of circuit involved.

(2) Calibrate and adjust the oscillator to the desired output.

(3) Read and record the transmission measurement.

(4) Correct the reading for impedance mismatches and verify test level.

10.03 A transmission level point (TLP) is a point in a circuit at which the transmission level (expressed in dB) is defined as the nominal or design gain (or loss) at 1000 Hz referenced to an arbitrary point in the system called the zero transmission level point or 0 TLP. The use of a standard reference point in Bell System channels makes it possible to compare the signal power at two or more points in the channel even though the points are many miles apart.

10.04 With the establishment of the 0 TLP concept, the power present in a channel is described by stating what the power would be if it were accurately measured at the 0 TLP. The standard notation used to describe the power in this instance is dBm0. As an example, the term -13 dBm0 means that the power at the

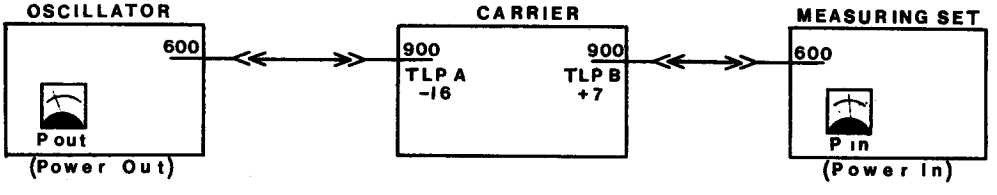
0 TLP is -13dBm; if a -13 dBm0 signal were measured at the 0 TLP, the meter of the test set would indicate -13 dBm.

TEST FOR	TEST LEVEL (In dB0)
DATA	-13
SF SIGNALING	-20
VOICE	0 (Zero)

10.05 The TLPs and the test level of the circuit provide the information needed to set the oscillator output and to interpret the reading on the transmission measuring set. The test level of a circuit, expressed in dB0, is the level at which the circuit should be tested relative to the TLPs. Common test levels are as follows:

10.06 The test level must be added to each TLP pertinent to a test. For example, for the circuit diagram, Fig. 1 (assuming the test level to be -13 dB0) the test level added to TLP "A" indicates the oscillator (power) setting at "P" out. The test level added to TLP "B" minus any impedance mismatch corrections indicates the expected measuring set reading at "P" in.

FIGURE 1
(TEST LEVEL -13dBO)



A. P out is set to: -13, -16 = -29dBm
B. The reading on the transmission measuring set is expected to be: +7 -13 -0.2 -0.2 = -6.4dBm, taking the two impedance mismatches into account.
C. If "P" in were to read -8 dBm, the facility would be 1.6dB too long.
D. If "P" in were to read -4 dBm, the facility would be 2.4dB too hot.

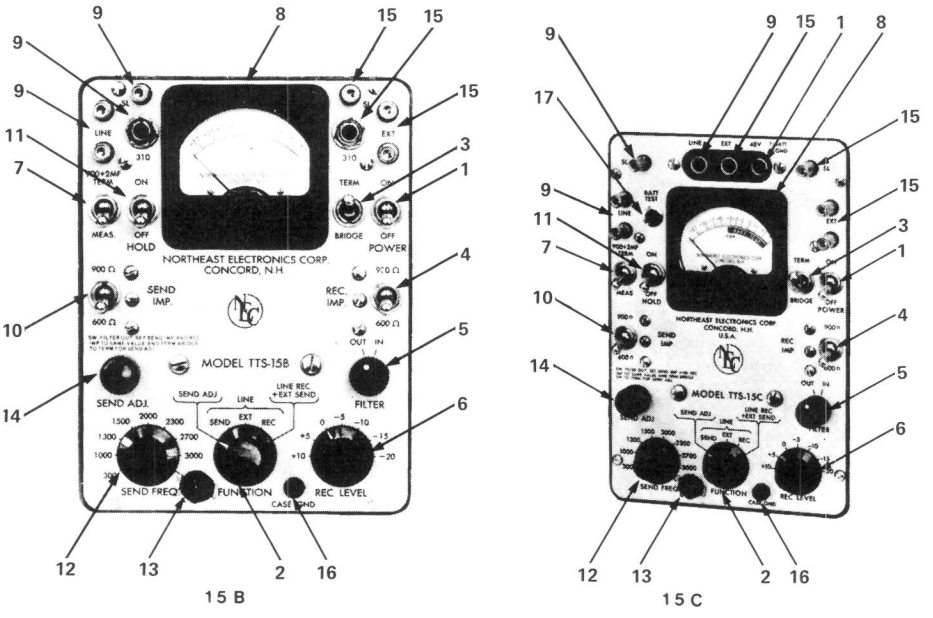


Fig. 2

FRONT PANEL CONTROLS

TABLE A

TTS 15B & 15C FRONT PANEL CONTROLS

Photo Index No.	CONTROL or INDICATOR	Type of Test Set	DESCRIPTION
(1)	POWER ON/OFF switch:	TTS 15B	Applies internal battery power to the circuitry within the set.
	POWER ON/OFF switch and 48V jack:	TTS 15C	Provides power switching and input connections.
(2)	FUNCTION switch:	TTS 15B & C	Determines one of the following five modes of operation: (1) SEND ADJ - connects SEND SECTION to the level measuring section to permit calibration of the SEND level. (2) LINE/SEND - connects the SEND SECTION to the LINE jack. (3) LINE/EXT - connects the LINE jack directly to the EXT jack.

TABLE A (Continued)

Photo Index No.	CONTROL or INDICATOR	Type of Test Set	DESCRIPTION
(2) (Cont.)	FUNCTION switch (Cont.)	TTS 15B & C	(4) LINE/REC - connects the level measuring section to the LINE jack and connects the EXT jack to the receiver output for monitoring. (5) LINE REC/EXT SEND - connects the level measuring section to the LINE jack and simultaneously connects the SEND SECTION to the EXT jack.
(3)	BRIDGE/TERM switch:	TTS 15B & C	Enables maintenance personnel to bridge or terminate the connections appearing at the LINE jack or binding posts.
(4)	REC IMP switch:	TTS 15B & C	Selects the terminating impedance of the receiving circuitry within the set (600 or 900 ohms)
(5)	FILTER IN/OUT switch:	TTS 15B & C	Switches the high pass filter into or out of the receive circuitry.
(6)	REC LEVEL rotary Attenuator switch:	TTS 15B & C	Adjusts the sensitivity of the receive circuitry over a range of 30 dB in steps of 5 dB
(7)	MEAS/900 Ohm TERM switch:	TTS 15B & C	Switches the receive circuitry or the 900 ohm termination across the LINE jack or binding posts.
(8)	METER:	TTS 15B	Provides a visual indication of received levels and instrument calibration.
		TTS 15C	Provides visual indication of receive levels, instrument calibration and condition of the power source.
(9)	LINE jack and binding posts:	TTS 15B & C	Provides for access to the SEND or RECEIVE circuitry within the test set.
(10)	SEND IMP switch:	TTS 15B & C	Selects the output impedance for the send circuitry within the set.

TABLE A (Continued)

Photo Index No.	CONTROL or INDICATOR	Type of Test Set	DESCRIPTION
(11)	HOLD ON/OFF switch:	TTS 15B & C	Switches a hold coil across the LINE jack or binding posts.
(12)	SEND FREQ rotary switch:	TTS 15B & C	Selects either one of eight internal fixed frequencies or the external frequency determining network accessory. *
(13)	External Frequency Network Connector (*Optional Equipment):	TTS 15B & C	Provides for the insertion of an external frequency determining network.
(14)	SEND ADJ potentiometer:	TTS 15B & C	Provides an adjustment of output level.
(15)	EXT jack and binding posts:	TTS 15B & C	Provides access to the send or receive circuitry within the test set.
(16)	CASE GND jack:	TTS 15B & C	Provides access to the case ground of the test set.
(17)	BATT TEST pushbutton:	TTS 15C	Provides a means of checking the condition of the test set's power source.

TABLE B

TTS 15B & 15C SPECIFICATIONS

RECEIVING SECTION	Specifications
Input Impedance:	600 Ohms and 900 Ohms ±5% at 1000 Hz.
Bridging Impedance:	Filter OUT = 15,000 Ohms Minimum. Filter IN = 8,000 Ohms Minimum.
Frequency Response: (Filter Out)	±0.25 dB from 200 to 15,000 Hz. ±0.50 dB from 100 to 20,000 Hz.
Frequency Response: (Filter In)	±0.25 dB from 500 to 15,000 Hz. 60 Hz attenuated at least 30 dB.
Range of Measurements:	+13 dBm to -37 dBm.
Division of Meter Scale:	0.2 dB divisions from +3 dB to -3 dB. 0.5 dB divisions from -3 dB to -7 dB. 1.0 dB divisions from -7 dB to -17 dB.
Stability of Calibration:	±A maximum of 0.1 dB from 50° to 120° F using 70° F as a reference. ±A maximum of 0.1 dB with a supply voltage change ranging from 18V dc to 12V dc.

SENDING SECTION	
Output Impedance:	600 Ohms and 900 Ohms ±5% at 1000 Hz.
Output Frequencies:	300, 1000, 1300, 1500, 2000, 2300, 2700 and 3000 Hz. All frequencies ±2% from 50° F to 100° F.
Distortion:	Less than 1% at any harmonic.
Level Variation with Frequency:	Less than ±0.2 dB.
Output Level:	Variable from 0 dB to -37 dBm.

NOTES