Installation Engineering Handbook 50
Western Electric Company, Incorporated
Kearny Works

Section 909
7-31-69
Replaces Section 909 dated 4-21-66 previously located in Handbook 59.

24B AND 24C LOOP CHECKER GENERATORS - TEST

CONTENTS

1. GENERAL INFORMATION

1.1 Description

1.11 Tests: This section describes the tests to be applied to the 24B or 24C Loop Checker Generator. This section contains all installation tests to be applied to the Checker. They will consist of checking levels as well as common tests such as continuity and fusing.

1.12 The tests also cover operation and transmission requirements of the associated Transmission Test Line Circuit SD-96100 Figures 1, 9, 45, 55 or 56, and 29, 30, 31, 33 or 34.

1.13 Drawings

SD-99707-01 Transmission Measuring, 24B Loop Checker Generator Circuit
SD-99709-01 Transmission Measuring, 24C Loop Checker Generator Circuit
SD-98100-01 Transmission Test Line Circuit

1.14 Equipment

J94024B 24B Loop Checker Generator
J94024C 24C Loop Checker Generator
J94004N Transmission Test Line

1.2 Sequence of Tests: The tests outlined in this section must be performed in the order in which they appear.

1.3 Precautions

1.31 This equipment contains transistors and several varieties of diodes. It is therefore essential that the precautions outlined in Section 0.3 of this handbook be observed during test.

1.32 If the requirements of this section cannot be met, do not attempt to repair the generator. Obtain a new unit.

1.4 Central Office Equipment Required

1.41 The installer will require the use of 20 spare subscriber lines (appearing on various line link or line finder frames).

1.42 Advise the Telephone Company that adjustments of the Loop Checker Generator will be based on readings from the office milliwatt supply. If the milliwatt supply is not properly calibrated, the Loop Checker Generator adjustment will be wrong.

1.5 References

1.51 Use of 21A Transmission Measuring Set Section 124 Handbook 81.

2. RECORDS AND REQUIREMENTS

2.1 Records: Record the results of these tests on the following forms:

SD-4-1313 Test Trouble Record
SD-4-1315 Summary of Tests Other Than General and Routine

2.2 Requirements: The requirements in this section are based upon BSP A702.691 (Preliminary).

3. TEST EQUIPMENT

3.1 Test Sets

Amt.	Code	Description	Notes
1	ITE-4208 or 2580B	Hand telephone set with dial	
1	ITE-4442	Volt-Ohmmeter	
1	ITE-4002	Tone Buzzer Set	
1	ITE-4089	21A Transmission Measuring Set	B,C
1	J94002AB	2AB Auxiliary Transmission Test Set	A,C
1	J94023A	23A Transmission Measuring Set	C

3.2 Cords

As Req'd: Patch cords not furnished with the test sets, are available as telephone company maintenance equipment.

3.3 Notes

A - Telephone company maintenance test equipment.

B - To be requisitioned; if equivalent items are not available from telephone company maintenance test equipment.

C - If a 23A Transmission Measuring Set J94023A is available, it can be used in place of the 21A TMS and the 2AB Auxiliary Set.

4. CONTINUITY AND GROUND TESTS

4.1 Before starting any tests, locate the Transmission Measuring Set near the office milliwatt supply, connect it to a source of 115V 60 cycle power and operate power switch to ON. Let it warm up in preparation for Paragraph 6.2.

4.2 Use only the ITE-4002 tone buzzer or the RX1000 scale on ITE-4442 for all continuity tests.

4.3 Check for continuity of all wiring connected by the installer.

4.4 Using the ITE-4442, Volt-Ohmmeter, check for the presence of ground on: punching 21 of the unit terminal strip or terminal 1 of the P3 connector, whichever is provided.

4.5 The following applies to the 24B generator only: Depending on the number of Test Line Circuits connected to the 24B Generator remove strapping from load resistors. See Table A and Note 104 on SD-99707-01.

5. FUSING

5.1 Using the ITE-4442, check for the absence of direct ground on the load and alarm contacts of the fuse associated with this circuit. (See CIRCUIT NOTE 101 on SD-99707-01 or SD-99707-01.)

5.2 Insert the 48V SIG, A fuse associated with this circuit, in its mounting.

5.3 Using the 60 volt dc scale on ITE-4442, check for the presence of -48 volts on punching 23 of the unit terminal strip or terminal 9 of the P3 connector, whichever is provided.

6. CHECK OF TEST EQUIPMENT

6.1 Proper calibration of the Loop Checker Generator requires that the office milliwatt supply and the 21A or 23A Transmission Measuring Set (TMS) each be accurate within ± 0.1 db.

6.2 Check the TMS and milliwatt supply against each other. The TMS should have been warming up for at least an hour, from Paragraph 4.1.

6.3 Be sure the TMS impedance matches the milliwatt outlet impedance.

6.4 If the reading at the TMS is 0 ± 0.1 dbm, (or -0.5 dbm if 2AB set is used) start tests per Paragraph 7. If the reading is outside these limits, proceed as follows:

6.41 If the TMS is Western Electric property, calibrate it against the milliwatt supply per Handbook 81, Section 124, Paragraph 3.3. (If TMS is 23A, operate INPUT switch to 600Ω position).

6.42 If the TMS is Telephone Company property, inform them of the measurement just made and with their permission, adjust the TMS per Handbook 81, Section 124, Paragraph 3.3.

7. DETERMINATION OF OFFICE TRANSMISSION LOSS

NOTE 1: See Figure 1. The Loop Checker Generator is supposed to deliver a specified amount of db power, through the dial switching office, to an average subscriber line. In order to adjust the Loop Checker Generator for the correct amount of output db power, the db power loss through the switching office to an average subscriber line must be measured. Paragraph 7 tells how to make the measurement, using the office milliwatt supply.

7.1 Selection of Subscriber Lines for Test

7.11 Select 20 spare subscriber lines to be used for determination of office loss. Make the selection from lines appearing on various line link or line finder frames.

7.2 Test Setup

7.21 Locate a 21A TMS and 2AB Auxiliary Set, or a 23A TMS at the HMDF.

7.22 If 21A TMS is used, connect its power cord to 115V, 60 cycle power. Operate the ON-OFF switch to ON. Allow the set to warm up for at least 5 minutes. Patch the 21A set DET IN 600Ω jack to the 2AB Auxiliary set TMS jack. On the 2AB set: Set 2DB PAD switch to OUT position. Set TEST switch to REC 900Ω position. DIAL-SLV switch should be on DIAL position. Set DET INPUT SWITCH to +10.

7.23 If 23A TMS is used, set INPUT switch to 900Ω and DIAL-MEAS-SLV switch on DIAL. Set ADD DBM to +10.

7.3 Loss Measurement

7.31 Operate the key on the hand telephone set to MON. Connect the handset to the 2AB or 23A DIAL jack. Connect the HMDF appearance of the tip and ring of one of the subscriber lines to the 2AB or 23A MEAS jack or T-R binding posts.

7.32 Obtain from the telephone company the AB+5 code used to dial into the milliwatt supply. Operate the handset key to TALK and dial this number. As soon as 1000 cycle tone is heard, operate 2AB or 23A DIAL-SLV key to center, or MEAS position.

NOTE: When reading levels at the TMS, do not view the meter from either side. View it from directly

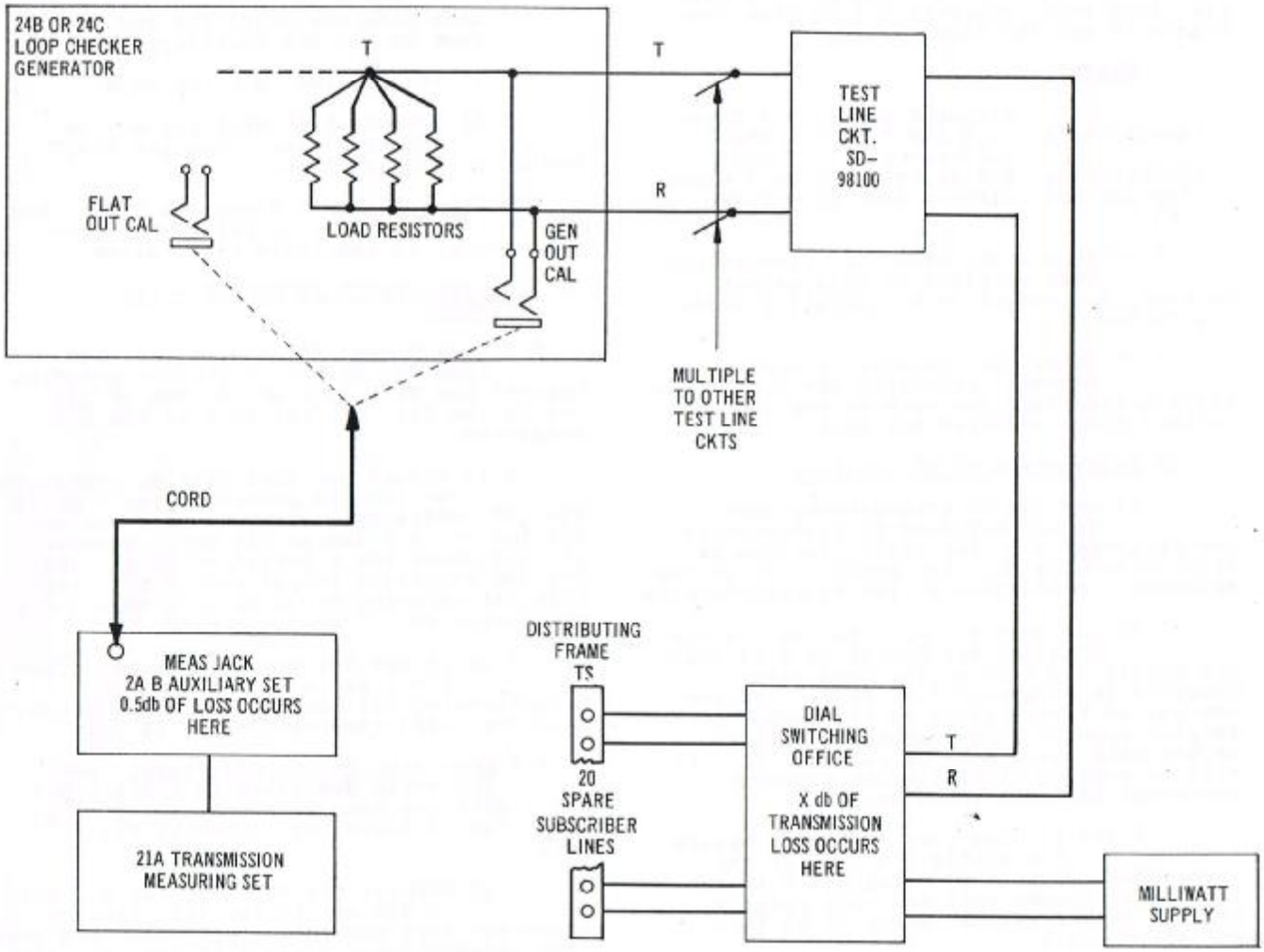

FIG. 1 TEST SETUP FOR OFFICE TRANSMISSION LOSS

in front to prevent a false reading due to parallax. Care must also be taken not to overload the meter movement. For every measurement, start with DET INPUT or ADD DBM at +10 position. If needle movement is small, turn switch clockwise one step at a time, stopping when needle movement can be seen easily.

7.33 Note the level of tone at the TMS. The office loss is 0 dbm (milliwatt supply level) minus the level read at the TMS. If the 21A and 2AB sets are being used, subtract 0.5 db from this figure to get the final answer.

EXAMPLE:

(Subtracting) Measured level = -1.2 dbm
-1.2 dbm from 0.0 dbm = difference of 1.2 db.
(Subtracting for 2AB set only) 0.5 db from 1.2 db = transmission loss of 0.7 db.

7.34 Record the value of transmission loss obtained in this manner. Release the connection by operating handset key to MON.

7.35 Using the foregoing procedure measure, calculate and record the transmission loss for each of the 20 subscriber lines selected for test.

7.4 Calculation of Office Loss

7.41 Add the 20 transmission loss values obtained in measurements per Paragraph 7.34 and divide the sum of these values by 20. The result will be the arithmetic mean value of the 20 measurements.

7.42 Add together all the loss values obtained per Paragraph 7.34 that lie within ± 0.7 db of the mean value computed in Paragraph 7.41 above. Divide the sum of these values by the number of samples used in this computation. This second mean value will be called X db. It will be used in the adjusting procedure described in Paragraph 9 or 10.

7.421 If less than 17 sample values lie within ± 0.7 db of the mean value computed in Paragraph 7.41 the individual losses vary over too great a range. Select another group of 20 lines and start again.

7.422 If the mean value of loss computed in Paragraph 7.42 is greater than 1.5 db the apparent office loss is too large and should be referred to the telephone company for investigation.

NOTE: Where the office loss appears excessive a possible source of trouble could be due to incorrect adjustment of the milliwatt supply network.

8. TEST SETUP

8.1 Locate the transmission measuring equipment near the Loop Checker Generator panel.

8.2 If 21A TMS and 2AB Auxiliary Set are being used:

8.21 Connect the 21A set to 115 VAC, operate power switch to ON and wait 5 minutes before making first measurement. Patch the 21A set DET IN 600Ω jack to the 2AB set TMS jack. On the 2AB set, operate DIAL-SLV key to midposition, 2DB PAD key to OUT position, and TEST switch to REC 900Ω position.

NOTE: Level measurements and requirements in this handbook section have been corrected for the 0.5 db loss in the 2AB Auxiliary Set.

8.3 If the 23A TMS is being used:

8.31 Operate DIAL-MEAS-SLV key to MEAS position. Operate INPUT switch to 900Ω position.

8.4 See note under Paragraph 7.32. Use the procedure described for each measurement in the tests that follow.

9. TEST AND ADJUST PROCEDURE - 24B GENERATOR

9.1 Flat Output Adjustment: Set 24B FREQ CHK switch to its OPR position. Connect the MEAS jack of the 2AB or 23A set to the FLAT OUT CAL jack of the 24B generator.

9.11 Adjust the FLAT GAIN potentiometer on the 24B generator panel until the TMS indicates a level of -8.9 dbm on 21A TMS or -8.4 dbm on 23A TMS. Observe the TMS meter for a period of 10 seconds. The 24B generator output should not vary from the adjusted value by more than ± 0.1 dbm during the 10 second period.

9.12 If the deviation is greater than ± 0.1 dbm alternately adjust potentiometer R52 and the FLAT GAIN potentiometer until the requirement is met.

9.2 Generator Output Adjustment: Retain the setup described in Paragraph 8 but locate the test sets near the line link frame (No. 5 X-bar) or connector frame (SXS).

9.21 Connect the MEAS jack of the 2AB or 23A set to the line link or connector bank multiple appearance of a test line (SD-98100-01) associated with the 24B generator. Test connections between test set and line link or connector appearance of test line shall not exceed 10 feet in length.

9.22 Block the test line circuit OS relay operated. Operate the LEV CHK switch on the 24B generator. Adjust the OUT GAIN potentiometer on the 24B generator until the level indicated by the TMS is as follows:

9.221 When 2AB and 21A TMS are used: Set level to -1.0 + X dbm where X is the office loss computed in Paragraph 7.42. For example: If X = 0.7 db then 21A set should read -1.0 + 0.7 = -0.3 dbm. Another example: X = 1.2 db then 21A should read -1.0 + 1.2 = +0.2 dbm.

9.222 When 23A TMS is used: Set level to -0.5 + X dbm where X is the value of office loss computed in Paragraph 7.42. For example: If X = 0.3 db then 23A set should read -0.5 + 0.3 = -0.2 dbm. Another example: X = 1.2 db. Then 23A should read -0.5 + 1.2 = +0.7 dbm.

9.23 Record this value to which the generator has just been adjusted. Release (OS) relay.

9.3 Check of Wiring Loss: Using the same test setup described in Paragraph 8 connect the MEAS jack to the GEN OUT CAL jack of the 24B generator, and operate the LEV CHK switch. The level measured at the TMS should be within 0.5 db of the measurement made at the line link or connector frame (Paragraph 9.22). Record the measurement.

9.31 If more than one Test Line Circuit is associated with the 24B generator, the line link or connector bank appearances must be measured (not adjusted), as in Paragraphs 9.21 and 9.22. If any of these measurements are different by more than 0.5 db than the measurement at the GEN OUT CAL jack, there is excessive loss in the wiring between units.

9.4 Frequency Check

9.41 Release the LEV CHK switch and turn the FREQ CHK switch to its 3000 position. Adjust the 3KC CHK ADJ potentiometer R75 until the TMS indicates a maximum. It is normal for the reading to drop off sharply just after the maximum is reached. It is not necessary to maintain the setting at maximum, but only to record the highest possible reading. This should be between 2.1 and 3.5 db greater than the measurement obtained in Paragraph 9.3.

9.411 If the maximum is outside these limits, carefully adjust potentiometer R72 and repeat Paragraph 9.41.

9.42 Turn the FREQ CHK switch to the 1000 position. The TMS should indicate a level between 5.7 and 6.3 db lower than the measurement made in Paragraph 9.3. Record this measurement.

9.421 If the reading is outside those limits carefully adjust potentiometer R71.

9.43 If potentiometers R71 or R72 have been adjusted, keep repeating Paragraphs 9.41 through 9.421 in order, until no more adjustment is necessary to get the correct readings at the 3000Ω and 1000Ω positions of FREQ CHK switch. Then repeat all tests starting with Paragraph 9.1.

9.5 Turn the FREQ CHK to OPR position.

10. TEST AND ADJUST PROCEDURE - 24C GENERATOR

10.1 Crystal Oven Thermostat: Within the first 20 minutes after fusing, lamp DS1 on the 24C panel should have lit. After this, it may be lit or out at any time, but verify that it does not remain either way for more than 5 minutes.

10.2 Flat Output Adjustment

10.21 Connect the 2AB or 23A MEAS jack to the 24C Generator FLAT OUT CAL jack.

10.22 The 24C FLAT GAIN potentiometer R80 must be adjusted to give readings on the TMS as follows. But the reading may change on its own over a 10 second period. Therefore adjust the FLAT GAIN so that over a 10 second period the reading stays within these limits:

10.221 If 2AB and 21A TMS are used reading must stay between -0.1 and -8.8 dbm.

10.222 If 23A TMS is used reading must stay between -8.5 and -8.3 dbm.

10.3 Frequency Check

10.31 Connect the 2AB or 23A MEAS jack to the 24C GEN OUT CAL jack. Hold the (S1) switch to its LEV CHK position. Adjust the OUT GAIN potentiometer R50 for a reading of 0.0 dbm at the TMS.

10.32 3KC Level: Hold switch (S1) to its FREQ CHK position. Turn the FREQ CHK potentiometer R34 fully clockwise and then slowly counterclockwise. The reading at the TMS will increase as the potentiometer is turned counterclockwise. and then suddenly it will drop. Note the maximum value on the meter just before the reading drops. This maximum value must be between 2.1 and 3.5 dbm.

10.321 If the maximum value is not within limits, adjust FREQ ADJ 2 COARSE potentiometer R31 (then FREQ ADJ 2 FINE potentiometer R29) and repeat Paragraph 10.32 until the requirement is met. Further adjustment will be needed later on.

10.33 1KC Level: Still holding switch (S1) to its FREQ CHK position. turn FREQ CHK pot R34 fully counterclockwise. then slowly clockwise. The reading at the TMS should decrease and then suddenly rise. Note the minimum reading on the TMS. It must be between -5.7 and -6.3 dbm.

10.331 If the minimum value is outside these limits, adjust FREQ ADJ1 potentiometer R22 and repeat Paragraph 10.33 until the limits are met.

10.34 Alignment: If it has been necessary to adjust potentiometers according to Paragraphs 10.321 or 10.331. then Paragraphs 10.32 through 10.331 must be repeated in order over and over again until the limits can be met without adjusting any of the FREQ ADJ potentiometers R31. R29, or R22.

10.4 OUT GAIN Adjustment

10.41 Retain the same test setup but locate the test sets near the line link frame (X-bar) or connector frame (SXS). Connect the MEAS jack of the 2AB or 23A TMS to the line link or connector bank multiple appearance of the test line

(SD-98100) associated with the 24C generator. Make this connection less than 10 feet long. At the test line circuit (J94004N) block (OS) relay operated.

10.411 If a permanent signal holding tone is initiated while performing this test, insulate the T and R from the line link frame (X-bar) on connector frame (SXS) to the test line.

10.42 Check the wiring loss between the test set location by holding the 24C (S1) switch on its LEV CHK position. Verify that the TMS reads between 0.0 and -0.5 dbm.

10.421 If more than one test line circuit is associated with the 24C generator, repeat Paragraphs 10.41 and 10.42 at each line link or connector bank appearance of the test lines.

10.43 In the next step, the generator will be set for an output of -0.5 + X dbm, where X is the value of office loss (Paragraph 7.42). The test sets are set up as in Paragraph 10.41 at any one of the test line circuit appearances.

10.431 If the 2AB and 21A sets are used, a correction of 0.5 db must be applied. Therefore, the level must be set to -1.0 + X dbm.

Example 1: If X = 0.7 db loss
Then -1.0 + 0.7 = -0.3 dbm

The 24C generator would be adjusted to indicate -0.3 dbm at the 21A set.

Example 2: If X = 1.2 db loss
Then -1.0 + 1.2 = +0.2 dbm

The 24C generator would be adjusted to indicate +0.2 dbm at the 21A set.

10.432 If the 23A set is used: The level must be set to -0.5 + X dbm.

Example 1: If X = 0.3 db loss
Then -0.5 + 0.3 = -0.2 dbm

The 24C generator would be adjusted to indicate -0.2 dbm at the 23A set.

Example 2: If X = 0.6 db loss
Then -0.5 + 0.6 = +0.1 dbm

The 24C generator would be adjusted to indicate +0.1 dbm at the 23A set.

10.44 Now knowing the level desired, record it and adjust as follows: Hold the 24C (S1) switch to its LEV CHK position. Adjust the 24C OUT GAIN potentiometer R50 so that the TMS indicates the desired level.

10.441 As before when making the flat gain adjustment, there will be some variation in the reading at the TMS over a 10 second period. This variation should not carry the reading more than 0.2 db above or below the desired level.

10.45 Release (OS) relay and remove test connections.

11. CHECK OF ADJUSTMENTS AND OF TIMEOUT - 24B AND 24C GENERATORS

11.1 Check of Alignment Procedure

11.11 Select 3 spare subscriber lines for test, and locate the test sets near the distributing frame appearance of the lines. Connect the 2AB or 23A MEAS jack to one of the lines. Plug handset into DIAL jack.

11.12 Follow the procedure of Paragraphs 7.31 and 7.32 but dial the AB+5 code that will cause connection to the Loop Checker Generator. When connection is made, release the 2AB or 23A DIAL-SLV key. Operate LEV CHK on 24B, or set (S1) to LEV CHK on 24C.

11.13 At the 21A set the reading should be between -1.7 and -0.3 dbm. If 23A set is being used, the reading should be between -1.2 and +0.2 dbm.

11.14 Repeat Paragraphs 11.11 through 11.13 for the other two subscriber lines. When finished, do not move test sets.

11.2 Check of Test Line Circuit Timeout

11.21 As before, dial the AB+5 code to make connection to the Loop Checker Generator.

11.22 If Figure 56 is provided on SD-98100: After about 1 minute (LO) operates, releasing (OS), which cuts off tone, as indicated by the meter on the TMS dropping all the way to the left. The cycle does not repeat, and it is necessary to redial the connection to get a tone from the generator.

11.23 If Figure 55 is provided on SD-98100: After about two minutes relay (LO) should operate, releasing (OS) and cutting off tone from the generator as indicated by the meter on the TMS dropping all the way to the left. (LO) releases and (OS) operates again and the cycle repeats until the circuit is released.

11.3 Repeat all of Paragraphs 11.1 through 11.2 for each test line circuit associated with the Loop Checker Generator.

→ Arrowed lines indicate new or changed information.

Manager, Product Engineering

Reason for Reissue:
To move section to Handbook 50