DATA AUXILIARY SET 828A

MAINTENANCE AND TEST PROCEDURES

CONTENTS PAGE

1. GENERAL

1.01 This section provides the tests to be made at the time of installation and during maintenance periods to determine the performance of data auxiliary set (DAS) 828A.

1.02 This section is reissued to add information pertaining to the hazardous voltage protection network and to DASs which have been modified for station bridging.

1.03 DAS 828A provides amplification or attenuation in transmit and receive pairs, slope equalization (in receive line), and equal-level loop-back for one 4-wire private line voiceband data channel. It also provides for voice operation and 20-Hz manual ringdown signaling when equipped with a 37A1 data unit and a 568HAA-3 telephone set. This arrangement is referred to as full data/alternate voice (FDA).

1.04 The test procedures given in this section are performed prior to transmission tests. DAS 828A is considered to be part of the private line channel, and transmission tests, such as slope, envelope delay, noise, etc, should be made through DAS 828A.

2. TEST EQUIPMENT

2.01 The test equipment required at the station and used in testing the DAS 828A is as follows:

1—Portable volt-ohm-milliammeter (VOM), KS-14510-L1 or equivalent

1—Voiceband transmission test set, TTS-4, TTS-15, or equivalent set with bridging measurement capability

2—2W6A patch cords (310 plug on one end and clip leads on the other end)

2—2P4B patch cord (310 plug on both ends).

3. INSTALLATION TESTS

3.01 The checkout and test of the operating performance of the installed DAS 828A can be made by performing the following tests:

A. Not-in-Data

B. Loop-Back Transmission Path

C. FDA—Ring, Talk, and Sidetone Circuits

D. Data Circuit Transmission

E. FDA—Voice Circuit Transmission.

3.02 These tests provide a checkout of the DAS 828A without the aid of a test center or distant station. The tests can be made whether or not DDD backup is provided with DAS 828C. If provided, connect the DAS 828A and 828C before starting the tests.

3.03 If DAS 828A is equipped for remote ac (tone) loop-back, the tone-detecting feature can be tested by the STC when benchmark channel measurements are being made.

3.04 Some of the tests apply only if the alternate voice arrangement is provided. These tests are prefixed by the letters FDA. For station arrangements without alternate voice, the FDA tests should be disregarded.

3.05 Verify that all V4 plug-in screw settings and gain adjustments are as specified on the service order or circuit layout record (CLR). If an F-58122 amplifier is used, the preliminary adjustments given in 3.06 through 3.10 are required. If the F-58122 amplifer is not used, proceed to 3.11.

3.06 The gain of the F-58122 amplifier is continuously adjustable from −10 dB to +25 dB. The clamped output power of the amplifier is adjustable from −20 dBm to 0 dBm. The amplifier is intended to be used in the TAMPL socket of the V4 repeater to provide transmit level limiting if required. For more descriptive information on the F-58122 amplifier, refer to the section entitled V4 Telephone Repeater—F-58122 AGC Amplifier—Description (332-104-103).

TLP-to-dBm Conversion

3.07 In adjusting the F-58122 amplifier, reference must be made to the CLR or equivalent to determine the required input and output levels in dBm. However, it may be found that the levels are not specified in dBm but rather in TLP. If this is the case, the conversion to dBm must be made.

3.08 Data circuits are to be lined up at normal data levels which are 13 dBm below the TLP. Thus, if the CLR specifies TLP, change to dBm by subtracting 13 dB. For example, suppose the CLR specifies that the amplifier input is −3 TLP and the output is +5 TLP. Using the 13-dB conversion factor, the resulting levels in dBm would be −16 dBm input and −8 dBm output.

Adjustments of F-58122 Amplifier

3.09 The LEV ADJ control and screw switch S1 provide a range of −10 to +25 dB gain. With S1 out, the LEV ADJ provides −10 to +10 dB of gain. With S1 in, the LEV ADJ provides +5 to +25 dB of gain. The setting of the AGC ADJ control determines the point at which clamping of the amplifier output begins. The range of the AGC ADJ control is from −20 to 0 dBm.

3.10 The following steps and a typical example describe the method that should be used to adjust the F-58122 amplifier:

STEP	PROCEDURE
1	Place the transmission test set (TTS) near DAS 828A and apply power.
2	Allow the TTS to warm up and stabilize, then calibrate using instructions printed on the instrument case.
3	Refer to the CLR or equivalent to determine the data levels at the input and output of the amplifier, converting from TLP to dBm if necessary.
4	Set the send level of the TTS to the specified input level, the send impedance to 600Ω, and send frequency to 1000 Hz.
5	Using a 2P4B patch cord, connect the TTS SEND 310 output to the AMPL IN jack associated with the amplifier.

STEP	PROCEDURE
6	Using a 2P4B patch cord, connect the REC 310 jack of the TTS to the AMPL OUT jack and set the receive impedance for 600Ω.
7	Turn the AGC ADJ control clockwise to the 0 dBm setting.
8	Adjust the LEV ADJ as required to provide the output level specified on the CLR.
9	Increase the TTS output by 4 to 6 dB and ***slowly*** adjust the AGC ADJ control counterclockwise until the meter reading is 0.5 dB greater than in Step 8. (The 0.5 dB is required to prevent the limiting circuit from affecting normal data level adjustment in Step 8.) The AGC amplifier is now adjusted. ***Note:*** Once the amplifier has been adjusted, no change can be made to the gain (LEV ADJ) without a corresponding change to the clamping level (AGC ADJ). Example: (a) Assume that the CLR shows an output level of −8 dBm and an input level of −16 dBm, which indicates an amplifier gain of 8 dB. (b) Open switch S1 on the F-58122 amplifier to the turned-out position. Turn the LEV ADJ control to the +8 dBm position and the AGC ADJ to the 0-dBm position. The AGC amplifier is now set for approximately 8 dB of gain. (c) Set the TTS-4B (or equivalent) SEND LEVEL control to −16 and the SEND IMP control to 600Ω. Set the TTS-4B REC LEVEL control to −5 and the REC IMP control to 600Ω. Set the SEND FREQ control to 1000. (d) Connect the TTS-4B SEND jack to the AMPL IN jack. Connect the TTS-4B REC 310 jack to the AMPL OUT jack. Adjust the LEV ADJ control on the AGC amplifier for a −8 dBm output level reading on the meter. (e) Increase the send level by rotating the SEND LEVEL control switch counterclockwise to −10. ***Slowly*** adjust the AGC ADJ control on the amplifier counterclockwise until the output level is −7.5 dBm (−8 dBm +0.5 dB). The amplifier is now adjusted to give −8 dB of gain and to go into limiting as the output exceeds −8 dBm. (f) As a check for proper clamping, decrease the send level of the TTS to −16. The output level should be −8 dBm. (g) Disconnect the TTS-4B from the amplifier and temporarily store the connector cables.

3.11 Perform the following tests in the order listed in 3.01.

A. Not-in-Data

3.12 This test verifies that the not-in-data circuits give the proper indication to the modem.

STEP	PROCEDURE

1 Verify that the modem is not connected.

2 Verify that the 4-wire private line metallic facilities are not connected.

3 Obtain and connect the KS-14510 VOM (or equivalent) to the terminals indicated below. The VOM readings should be as follows:

TB3 TERMINALS	READING
1 and 2	Infinity
1 and 4	Infinity
3 and 4	1900 to 2300 Ohms
5 and 6	0 Ohms

4 Operate the LB relay by the local key or by applying −24 volts and ground to terminals 11 and 12 of TB2, respectively.

Note: If station is FDA, take handset off-hook and depress the LB button.

Requirement: The LB lamp on the telephone set lights.

5 Repeat the VOM checks as follows:

TB3 TERMINALS	READING
1 and 2	0 Ohms
1 and 4	1900 to 2300 Ohms
5 and 6	Infinity

6 Release the LB relay. If the station is FDA, the LB lamp on the key telephone set is extinguished.

Note: Steps 7 through 9 apply only to DASs arranged for voice operation. If DAS is not FDA, proceed to Step 11.

7 Take the telephone handset off-hook and depress the PL TALK button on the key telephone set.

Requirement: The PL TALK lamp lights.

8 Repeat the VOM checks in Step 5.

Requirement: Readings are the same.

STEP	PROCEDURE
9	Place the telephone handset on-hook. ***Requirement:*** The PL TALK lamp extinguishes.
10	Depress the HOLD button to release the PL TALK button.
11	Remove the VOM leads from terminal points on TB3.

B. Loop-Back Transmission Path

3.13 This test provides a means for checking the transmission path switching that enables the receive line to be looped back to the transmit line. It also verifies that both drop pairs are properly terminated.

STEP	PROCEDURE
1	Turn off power.
2	Remove the TAMPL, RAMPL, TERM SET (if provided), T pad, and LB pad plug-ins. Turn on power.
3	Connect the VOM to the terminals indicated below. The resistance readings should be as follows: TB2 TERMINALS — READING 21 and 26 — 0 Ohms 22 and 25 — 0 Ohms 23 and 28 — 1000 to 1400 Ohms 24 and 27 — 1000 to 1400 Ohms 25 and 26 — →Approx 200 kohms*← 21 and 23 — Infinity 22 and 24 — Infinity 27 and 28 — →Approx 200 kohms*← *Measured using KS-14510 VOM, X10K multiplier. Other meters may read infinity.
4	Operate the LB relay by the local key or by applying −24 volts and ground to terminals 11 and 12 of TB2, respectively. ***Note:*** If station is FDA, take handset off-hook and depress the LB button. ***Requirement:*** The LB lamp lights.
5	Perform the following resistance checks. The readings should be as follows:

STEP	PROCEDURE

TB2 TERMINALS	READING
21 and 26	Infinity
22 and 25	Infinity
23 and 28	Infinity
24 and 27	Infinity
25 and 26	540 to 660 Ohms
21 and 23	0 Ohms
22 and 24	0 Ohms
28 and 27	2700 to 3300 Ohms

6 If all resistance requirements are met, the test is completed. If not, refer to Part 4 for information on trouble tests.

7 Release the LB relay.

Requirement: If station is FDA, the LB lamp extinguishes.

8 Turn off power and reinstall the plug-ins removed in Step 2. Remove the VOM leads from TB2.

9 Turn on power.

C. FDA—Ring, Talk, and Sidetone Circuits

3.14 This procedure tests the signaling operation and talk circuit of the alternate voice portion. The test uses only clip leads or jumper wires.

STEP	PROCEDURE

1 With the handset on-hook, momentarily depress the HOLD key in order to release all keys.

2 Obtain clip leads or jumpers and connect terminal 31 of TB4 to terminal 9 of TB2. Connect terminal 32 of TB4 to terminal 10 of TB2.

Requirement: The key set bell rings.

3 Disconnect the jumpers at TB4 terminals 31 and 32 and connect to terminals 39 and 40 on TB4.

4 Take the key set off-hook and depress the RING button.

STEP	PROCEDURE
	Requirement: The tel set bell does not ring.
5	Release the RING button and depress the PL TALK button.
	Requirement: The PL TALK lamp lights and sidetone is heard in the handset receiver.
6	Depress the RING button.
	Requirement: The tel set bell now rings.
7	Release the RING button.
	Requirement: The bell is silenced.
8	Place the telephone handset on-hook.
	Requirement: The PL TALK lamp extinguishes.
9	Release the PL TALK button and remove the jumper wires from terminals 9 and 10 on TB2 and 39 and 40 on TB4.

D. Data Circuit Transmission

3.15 This procedure checks out the data transmission circuits by using a transmission test set (TTS) at the station. A Northeast Electronics TTS-4B is used for this test; however, an equivalent type capable of bridging measurements could be used. A typical connection arrangement is shown in Fig. 1.

3.16 For this test, the 24V4B repeater is looped back on the line side with the 4-wire telephone line disconnected. The test does not replace the station-to-station, end-to-end, or station-to-serving test center (STC) lineup procedures. The test serves to assure the installer that the station is operational.

3.17 Readings within $\pm$2 dB of the expected value are acceptable.

3.18 The procedures are as follows:

STEP	PROCEDURE
1	Connect DAS 828A for a back-to-back condition by making the following temporary connection at terminal block TB2: (a) Connect 13 to 15. (b) Connect 14 to 16.
2	Place the TTS-4B in close proximity to the 828A and apply power.

STEP	PROCEDURE

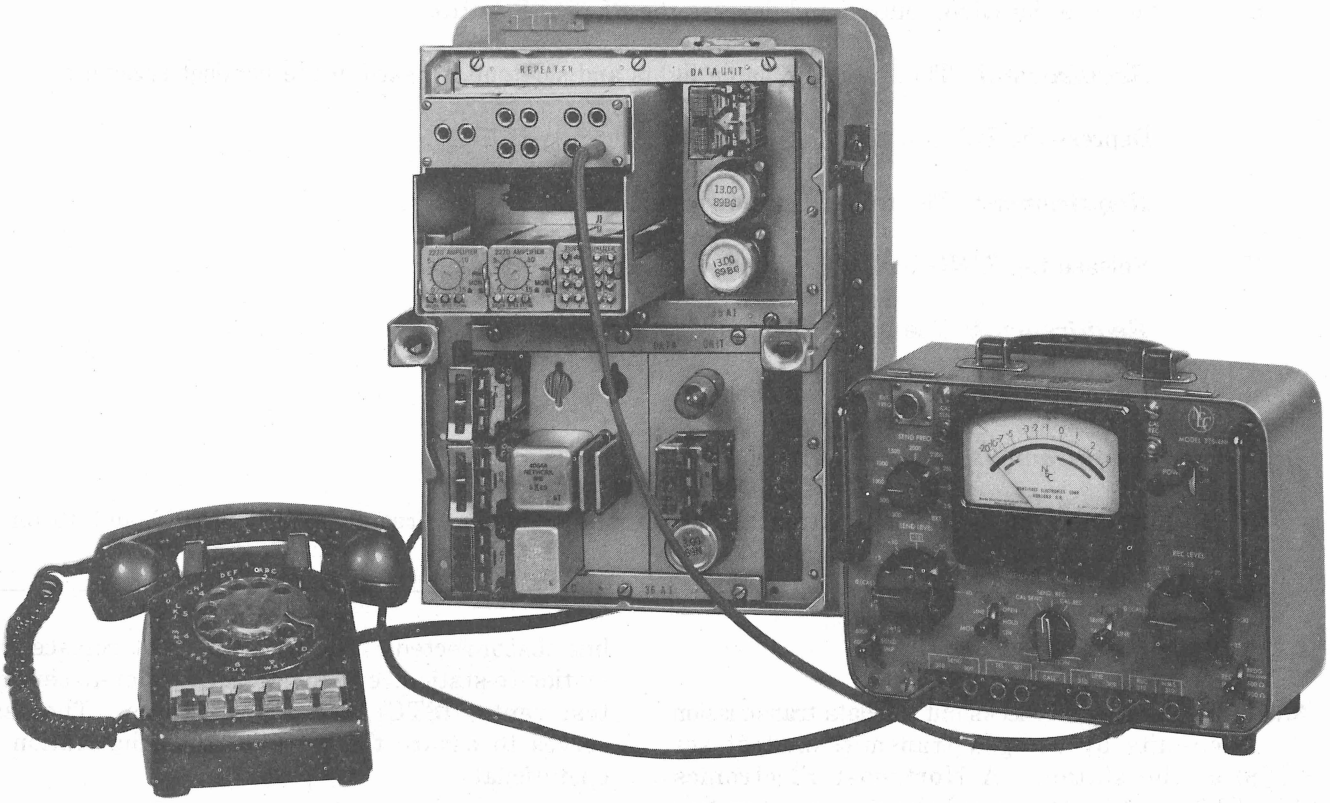

Fig. 1—Typical Test Connection—Transmission Level Tests

3 Allow the TTS-4B to warm up and stabilize, then calibrate using instructions printed on the instrument case.

4 Set the controls on the TTS-4B to the following positions:

SEND FREQ to 1000
SEND LEVEL to 0
SEND IMP to 600Ω
FUNCTION to SEND + TALK + REC
REC IMP to BRDG.

STEP	PROCEDURE

5 Verify that installed plug-ins are as specified on the service order or CLR and that the modem is not connected.

4-Wire Modem Interface (Proceed to Step 12 for 2-Wire Modem.)

6 Connect the TTS-4B SEND 310 jack to terminals 7 and 8 of TB3 using a 2W6A patch cord with a 310 plug on one end and clip leads on the other.

7 Connect the REC 310 jack on the TTS-4B to the TAMPL input MON jack on the 24V4B repeater using a 2P4B patch cord.

Requirement: The level reading on the TTS-4B is the sum loss of the T and LB pad plug-ins.

An example of this test is shown in Fig. 2. In this example, the sum of (−13 dB) + (−3 dB) = −16 dB for a level of −16 dBm.

8 Remove the patch cord from the TAMPL input MON jack and the TTS-4B REC 310 jack. Remove the patch cord from between the TTS-4B SEND 310 jack and terminals 7 and 8 of TB3. Connect the REC 310 jack of TTS-4B to terminals 9 and 10 of TB3 using a patch cord with a 310 plug on one end and clip leads on the other.

9 On the TTS-4B, set the REC IMP switch to 600Ω. Set the SEND LEVEL control to −16.

10 Using a 2P4B patch cord, connect between the SEND 310 jack on the TTS-4B and the TAMPL IN jack on the 24V4B repeater.

Requirement: The level reading on the TTS-4B equals the sum of the −16 dBm send level and loss or gain of the TAMPL + EQL + RAMPL plug-ins. Refer to Table A for

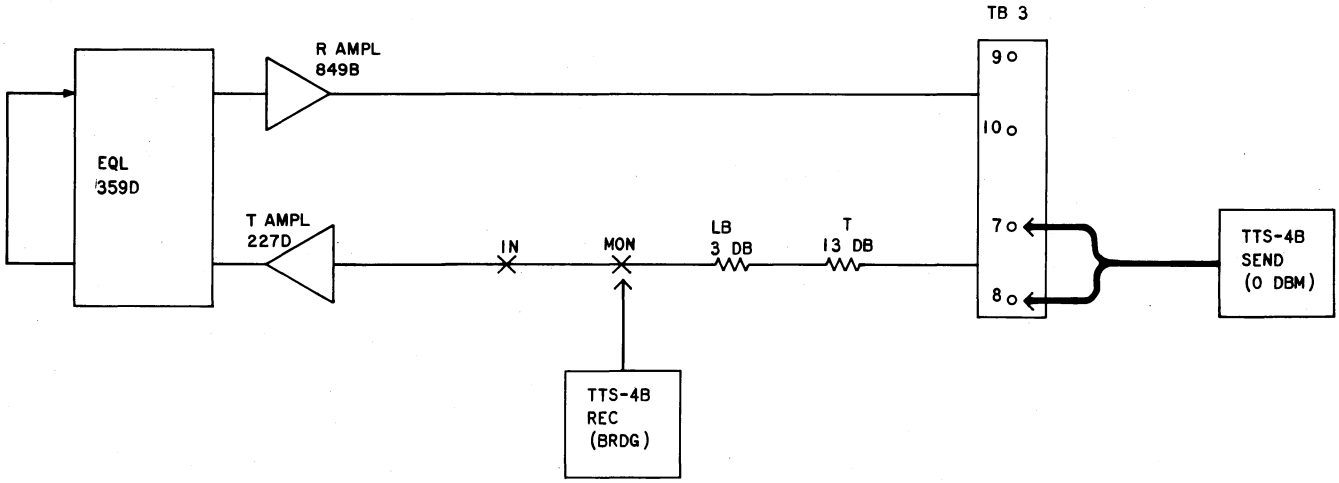

Fig. 2—Example of Test for Measuring Resistor Pad Loss—4-Wire

STEP	PROCEDURE

value of plug-in losses. An example of this test is shown in Fig. 3. In this example, the component gain or loss is as follows:

TAMPL	227D	8-dB Gain
EQL	359D	1-dB Loss (Assumed)
RAMPL	849B	6.9-dB Loss

The TTS-4B indicates −15.9 dBm for this example.

▶***Note:*** The hazardous voltage protection resistors in the transmit and receive paths add approximately 0.3 dB of loss. This loss may be disregarded.◀

11 If all readings meet the requirements, the test of the data portion is complete. Proceed to Step 15.

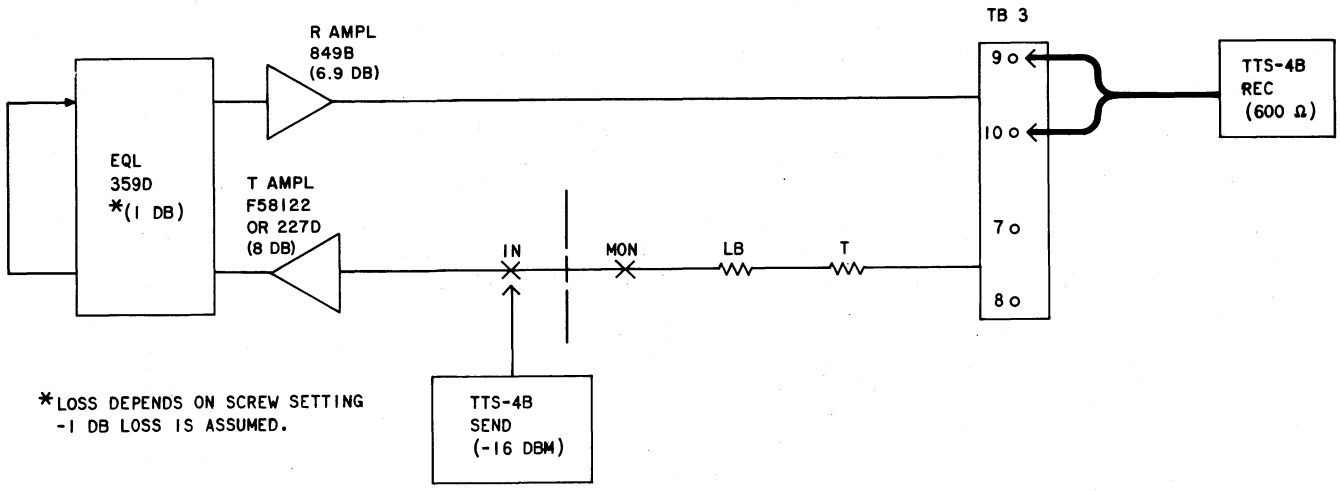

Fig. 3—Example of Test for Measuring Plug-in Loss—4-Wire

STEP	PROCEDURE

TABLE A

CIRCUIT LOSS OF REPEATER PLUG-IN UNITS

PLUG-IN UNIT	LOSS IN DB (AT 1000 HZ)
Term Sets	
Type 1A	3.5-4.0 (Typically 4.0)*
Type 1B	3.7-4.5 (Typically 4.5)*
Type 1C	4.0
Type 1D	4.5
Type 1G	4.0
849 Network	
Type A	0.4 + PAD
Type B	0.4 + PAD
Type C†	PAD
Type D	0.5 + PAD
Type E	0.5 + PAD
359 Equalizer	
Type A	6.2 to 9.2
Type B	0.5
Type C	0.0
Type D	0 to 3.0
Type E	0.0
Type F	0.5
Type J	0.0
Type M	0.5
Type N	0.5

* Loss is dependent on screw settings.

† To be used only with 359B, F, M or N.

2-Wire Modem Interface

12 Using the 2W6A cord, connect the TTS-4B SEND 310 jack to the data set 2-wire connect point on TB3 as follows:

STEP	PROCEDURE

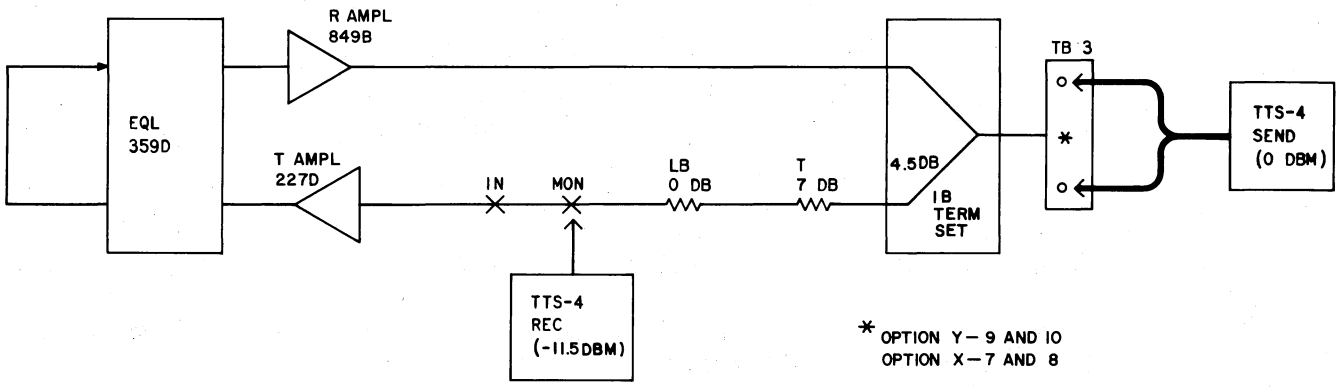

Fig. 4—Example of Test for Measuring Resistor Pad Loss—2-Wire

13 Using a 2P4B patch cord, connect the TTS-4B REC 310 jack to the TAMPL MON input jack on the 24V4B repeater.

Requirement: The level reading on the TTS-4B is the sum of the T and LB pad plug-ins plus the TERM SET loss. An example of this test is shown in Fig. 4. In this example, with T = 7 dB and LB = 0 dB, the total loss is (−7.0) + 0 + (−4.5) = −11.5 dB and the level should be −11.5 dBm. Refer to Table A for value of plug-in losses. Disconnect patch cords after test.

2-WIRE OPTION	CONNECT SEND TO
Option Y	TB3—9 and 10
Option X	TB3—7 and 8

14 On the TTS-4B, set the REC IMP switch to 600Ω. Set the TTS-4B SEND LEVEL to the expected value in Step 13 above. For example, set the SEND LEVEL to −11.5 dBm by setting the SEND LEVEL and REC LEVEL controls to −10, setting the FUNCTION switch to CAL SEND, and adjusting the CAL SEND control for a meter reading of −1.5 dBm. Return the FUNCTION switch to SEND + TALK + REC. Using the 2P4B cord, connect the TTS-4B SEND 310 jack to the TAMPL IN jack. Using the 2W6A cord, connect the TTS-4B REC 310 jack to the data set 2-wire connect point given in Step 12.

Requirement: The level on the TTS-4B is the sum of the SEND LEVEL setting and the loss or gain of the TAMPL, EQL, RAMPL, and TERM SET plug-ins. An example of this test circuit is shown in Fig. 5. In this example, the component gain or loss is as follows:

STEP	PROCEDURE

TAMPL	227D	8-dB Gain
EQL	359D	1-dB Loss (Assumed)
RAMPL	849B	6.9-dB Loss (Includes 6.5-dB Pad)
TERM SET	1B	4.5-dB Loss

The received level should be −15.9 dBm for this example.

15 If the F-58122 amplifier is used in the TAMPL socket, proceed to Step 16. If the F-58122 amplifier is not used, proceed to Step 17.

16 Increase the TTS-4B SEND LEVEL to the next higher step (counterclockwise) position.

Requirement: The TTS-4B indicates a change of no more than 1 dB.

17 If DAS 828A is arranged for data-only service, the test is complete. Proceed to Step 18. If DAS 828A is arranged for alternate-voice service, proceed to Part E.

18 Disconnect the jumper connections on TB2-13, -14, -15, and -16. Connect the receive line pair to terminals 13 and 14 on TB2 and the transmit line pair to terminals 15 and 16 on TB2.

19 Connect the modem using the plug-in cable. Refer to Section 598-080-200 for connecting information.

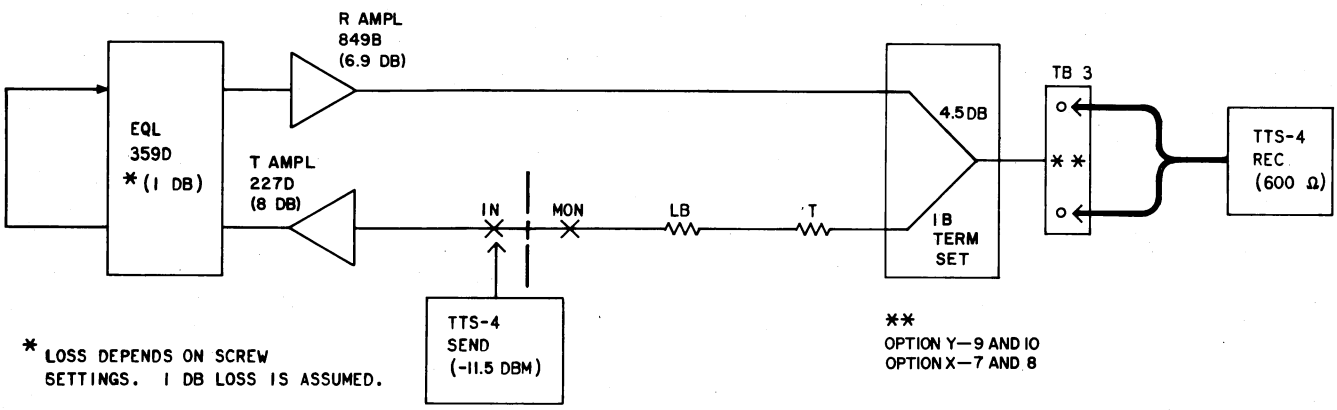

Fig. 5—Example of Test for Measuring Plug-in Loss—2-Wire

E. FDA—Voice Circuit Transmission

3.19 This procedure is a continuation of data transmission path tests in Part 3D for stations that include the voice circuit arrangement.

STEP	PROCEDURE
1	Calibrate and set the controls on the TTS-4B to the following positions: SEND FREQ to 1000 SEND LEVEL to 0 SEND IMP to 600Ω FUNCTION to SEND + TALK + REC REC IMP to BRDG. Take the tel set off-hook by lifting the handset and depressing the PL TALK button. ***Requirement:*** The PL TALK lamp lights.
2	Connect the TTS-4B SEND 310 jack to terminals 19 and 20 of TB4 using a 2W6A patch cord with a 310 plug on one end and clip leads on the other end. Connect the REC 310 jack on the TTS-4B to the TAMPL input MON jack on the 24V4B repeater with a 2P4B patch cord. ***Requirement:*** The level is the sum of the loss of the LB pad plus a loss of 3 dB to allow for the effect caused by the key telephone set bridging the TTS-4 output. An example of this test is shown in Fig. 6. In this example, with a 3-dB loss pad in the LB socket the level reading is −6 dBm.

STEP	PROCEDURE

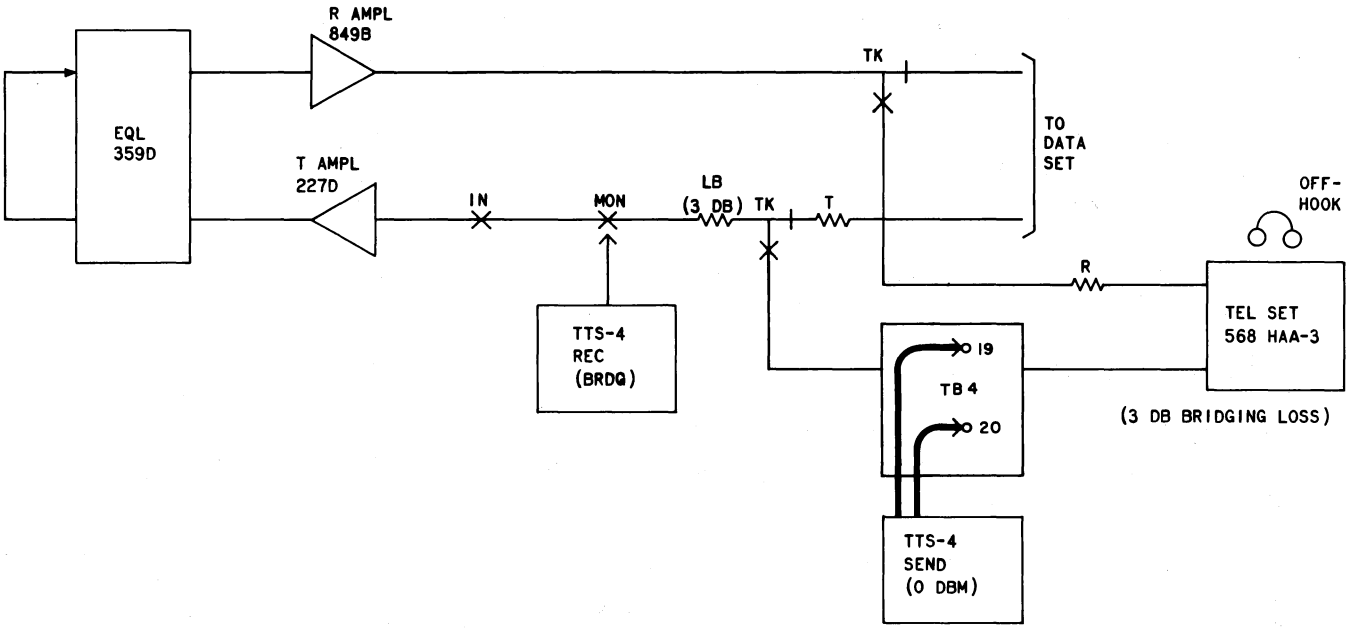

Fig. 6—Example of Test for Measuring LB Pad and Telephone Set Loss

3 Verify that DAS 828A is connected for a back-to-back condition by checking the following connections at terminal block TB2.

(a) Connect 13 to 15.

(b) Connect 14 to 16.

4 Connect the TTS-4B REC 310 jack to terminals 37 and 38 of TB4. Connect the SEND 310 jack to the TAMPL IN jack of the 24V4B repeater. Set the SEND LEVEL to −16.

Requirement: The level is the sum of −16 dB and the gain or loss of TAMPL + EQL + RAMPL + R pad plug-ins plus −6 dB bridging loss caused by the key telephone set receiver.

An example of this test is shown in Fig. 7. In this example, the component gain or loss is as follows:

STEP	PROCEDURE

TAMPL	227D	8-dB Gain
EQL	359D	1-dB Loss (Assumed)
RAMPL	849B	6.9-dB Loss (Includes 6.5-dB Pad)
R	89BG	13-dB Loss

Meter reading should indicate −34.9 dBm.

5 If all readings meet the requirements, the test of DAS 828A is complete. Place the handset on-hook. Disconnect and remove the TTS-4B and all jumper connections. Connect the 4-wire line by connecting the receive pair to TB2-13 and −14, and the transmit pair to TB2-15 and −16. Connect the DAS to the data set. Refer to Section 598-080-200 for further tests (transmission, loop-back, end-to-end, etc).

4. ▶TESTING OF DAS 828A MODIFIED FOR STATION BRIDGING◀

4.01 A DAS 828A that has been modified to provide station bridging must be tested and adjusted to ensure that the signal levels meet transmission requirements.

4.02 The following procedure assumes that the plug-ins of DAS 828A have been installed and adjusted as required.

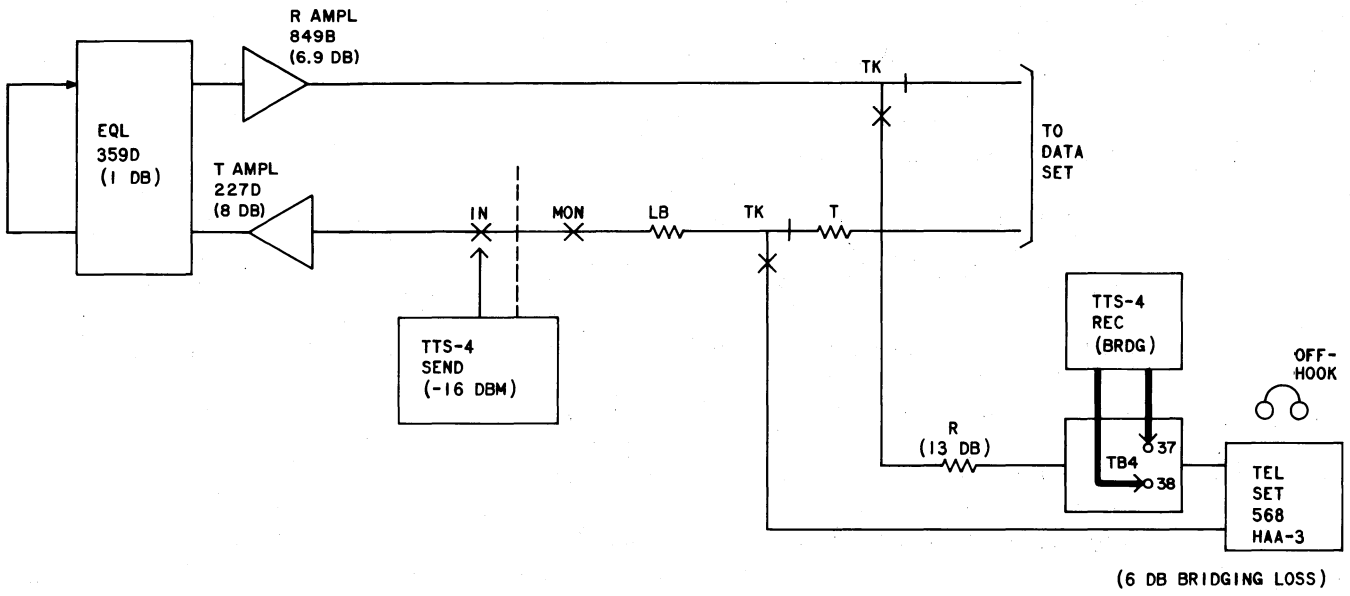

Fig. 7—▶Example of Test for Measuring Voice Transmission Path Loss◀

STEP	PROCEDURE
1	Verify that the DAS 828A equalizer and amplifier screw-down terminals are as specified in the service order and that all required adjustments have been made.
2	Terminate all receive ports (terminals 2-7, 3-8, 4-9, 5-10) of the 228A KTU with 600Ω, 1/4 watt 1% resistors (KS-20616-L1A or equivalent).
3a	If an F-58122 amplifier is used, perform the preliminary adjustments given in 3.06 through 3.10.
4	Connect TB2 terminal 2 to TB2 terminal 7. ***Requirement:*** TK relay operates.
5	Set the TTS receive line impedance to bridge 600 ohms and the REC LEVEL to −10.
6	Set the SEND LEVEL of the TTS to −20, the SEND IMP to 600Ω, and the SEND FREQ to 1000.
7	Connect the TTS SEND 310 output jack to terminals 25 and 26 of TB2 using a 2W6A patch cord.
8	Connect the TTS REC 310 input jack to terminals 1 and 6 of the 228A KTU using a 2W6A patch cord.
9	Adjust the 227D amplifier mounted external to the DAS 828A until the meter indicates +2 dBm. This sets the amplifier gain to 12 dB.
10	Set TTS REC LEVEL to −20.
11	At the 228A KTU, disconnect clip leads from terminals 1 and 6 and connect to terminals 2 and 7. ***Requirement:*** Meter indicates −.5 to +.5 dBm.
12	Disconnect clip leads from terminals 2 and 7 and connect to terminals 3 and 8. ***Requirement:*** Meter indicates −.5 to +.5 dBm.
13	Disconnect clip leads from terminals 3 and 8 and connect to terminals 4 and 9. ***Requirement:*** Meter indicates −.5 to +.5 dBm.
14	Disconnect clip leads from terminals 4 and 9 and connect to terminals 5 and 10. ***Requirement:*** Meter indicates −.5 to +.5 dBm.
15	Disconnect clip leads from terminals 5 and 10.
16	Disconnect the clip leads from terminals 25 and 26 of TB2.

STEP	PROCEDURE
17	Disconnect strap from TB2 terminal 2 to TB2 terminal 7.
18	Disconnect 600Ω terminations from receive ports and connect to transmit ports (terminals 23-28, 24-29, and 25-30) of the 228A KTU.
19	Set the TTS SEND LEVEL to −10. Connect the TTS SEND 310 output jack to terminals 22 and 27 of the 228A KTU.
20	Set the TTS REC IMP switch to 600Ω.
21	Set the TTS REC LEVEL to −20. Connect the TTS REC 310 input jack to terminals 21 and 26 of the 228A KTU. ***Requirement:*** Meter indicates −2.5 to −1.5 dBm.
22	Disconnect the clip leads from terminals 22 and 27 of the 228A KTU.
23	Disconnect the 600Ω terminating resistor from terminals 23 and 28 and connect it between terminals 22 and 27.
24	Connect the TTS SEND 310 output jack to terminals 23 and 28 of the 228A KTU. ***Requirement:*** Meter indicates −2.5 to −1.5 dBm.
25	Disconnect the clip leads from terminals 23 and 28 of the 228A KTU.
26	Disconnect the 600Ω terminating resistor from terminals 24 and 29 and connect it between terminals 23 and 28.
27	Connect the TTS SEND 310 output jack to terminals 24 and 29 of the 228A KTU. ***Requirement:*** Meter indicates −2.5 to −1.5 dBm.
28	Disconnect the clip leads from terminals 24 and 29 of the 228A KTU.
29	Disconnect the 600Ω terminating resistor from terminals 25 and 30 and connect it between terminals 24 and 29.
30	Connect the TTS SEND 310 output jack to terminals 25 and 30 of the 228A KTU. ***Requirement:*** Meter indicates between −2.5 and −1.5 dBm.
31	Disconnect test equipment and terminating resistors. Connect modems as required. Terminate unused ports in 600Ω.

5. TROUBLE ISOLATION TESTS

5.01 The loop-back circuit and monitor jacks of the 24V4B repeater provide access for maintenance of DAS 828A and should be used for isolating trouble at the station end.

5.02 The first test to be performed is the loop-back test to the STC. This enables the STC personnel to compare actual measurement results against the bench mark tests. Local policy should dictate what tests are to be performed prior to dispatching personnel to the station.

5.03 When station trouble is traced to DAS 828A, the levels of normal data signals or test signals should be monitored at the 24V4B repeater jacks and compared with those previously recorded. Substitution may be made on suspected plug-ins.

5.04 Depending on trouble symptoms, the cause may be due to lack of battery voltage or signaling voltage. For this reason, the telephone company employee should first verify that DAS 828A has the required voltages applied by performing the following steps.

(a) Using a KS-14510 VOM or equivalent, measure for −24 volt signaling voltage by connecting the meter between terminals 3 (−24V) and 4 (ground B) of TB2.

(b) Measure for −24 volt talk voltage by connecting the meter between terminals 1 (−24V) and 2 (ground A) of TB2.

(c) If either voltage is not present or not −24 volts, check the power supply for proper output voltage.

Note: Where voltage is not present, verify that it is required. Not all stations require talk and signaling voltages.

(d) If ringdown signaling is used at DAS 828A, check for 105 Vac power at terminals 31 and 32 of TB4. This must be supplied by a 20-Hz power supply, not a 30-Hz power supply.

5.05 If all primary voltages required are present at DAS 828A, disconnect the 4-wire priviate line (TB2: terminals 13, 14, 15, and 16) and perform the installation tests outlined in 3.01. If any test fails its requirement, the cause can be located using the test equipment listed in 2.01 and by referring to SD-1D225-01, sheets B1 and B2.

5.06 In cases where the DAS is equipped with an F-58122 amplifier installed in the TAMPL socket and the AGC action of this plug-in is suspected of causing the trouble, perform the following steps.

(1) Patch around the F-58122 amplifier using a 2P4B patch cord inserted in the TAMPL IN MON and OUT MON jacks. Remove the amplifier plug-in.

(2) Repeat the Data Circuit Transmission Test in Part 3D, allowing for loss of the TAMPL gain.

(3) If transmission path now checks satisfactorily, substitute another F-58122 amplifier and remove the 2P4B patch cord.

5.07 Other troubles involving internal wiring of DAS 828A should be cleared by replacing the DAS. Field repair of KTUs, relays, and ringers is not recommended.