VOICEBAND MULTIPORT SPLIT BRIDGE WITH GAIN, EQUALIZATION, AND TEST ACCESS INSTALLATION AND MAINTENANCE TEST PROCEDURES

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1. GENERAL

1.01 This section describes installation and maintenance test procedures for the Voiceband Multiport Split Bridge With Gain, Equalization, and Test Access (ED-2C029-30), more commonly known as the data bridge.

1.02 The data bridge is used for 4-wire voicegrade private line data transmission service between one main station, such as a computer location, and multiple remote stations. The data bridge interfaces with cable and/or carrier transmission facilities and has constant loss characteristics which are unaffected by the actual number of ports in service. The basic configuration, as described in Section 314-815-100, consists of either a dual 6-port bridge or a single 12-port bridge. Subscriber circuit growth beyond the capacity of a single data bridge can be accomodated by cascading between data bridge assemblies without rearranging circuits. Each bridge has three cascade ports for this purpose, accessible at the distribution frame.

1.03 Both in-service and out-of-service test capabilities are provided, including interlocked control of dc loop-back for stations having data auxiliary set (DAS) 828A or equivalent. Electrically independent (split) distribution and collection networks are used. The loss of the resistive networks used for each bridge assembly is 23 dB. Standard transmission levels of +7 TLP and −16 TLP (−6 dBm and −29 dBm data levels) are maintained at the input and output of the resistance networks, regardless of the number of ports in actual service.

2. TEST EQUIPMENT

2.01 A complete list of test equipment required for installation and maintenance tests on voiceband private lines is given in Section 314-410-500. The following patch cords and plugs are also required:

- Two 2P4B patch cords (No. 310 plugs on both ends)
- Two 2P3A patch cords (No. 309 plugs on both ends)
- Twenty 258-type nonconductive (dummy) plugs.

2.02 Prior to starting the tests, calibrate the test equipment to ensure the accuracy of the measurements.

3. INSTALLATION AND MAINTENANCE TEST PROCEDURES

3.01 The following procedures should be followed in sequence when initially setting up and checking out the bridge assembly. Details on how to perform the various tests are given in Parts 4 through 7.

(1) Verify that the data bridge is powered and cabled to the distribution frame.

(2) Select and install the 227-type amplifiers (or 849-type networks) and 359-type equalizers. Do not attempt to make circuit order adjustments at this time.

Note: Review the special operating considerations in Part 9 related to use of amplifiers and equalizers.

(3) If it is necessary to install F-58122 amplifiers (option Y), refer to 4.02.

(4) Terminate the unused bridge ports by inserting 258-type (dummy) nonconductive plugs into the transmit amplifier (AMPL IN) and receive amplifier (AMPL OUT) jacks of these ports.

(5) The bridge is shipped in a dual 6-port configuration. If a single 12-port configuration is required, remove the graphics panel, rotate the three key switches clockwise, and reverse and replace the panel.

(6) Assign circuit and leg identification, and label the bridge assembly.

(7) Perform the resistive bridge loss and port termination tests as described in Part 4.

(8) Perform the transmit and receive transmission path verification tests as described in Part 5.

(9) Cross-connect the bridge assembly port interfaces to the facility line appearances at the distribution frame as indicated on the circuit layout record card (CLRC).

(10) Perform the circuit order transmission tests as described in Part 6.

(11) Establish loop-back "benchmarks" as described in Part 7.

4. RESISTIVE BRIDGE LOSS AND PORT TERMINATION TESTS

4.01 The objective of this series of tests is to measure the loss of the resistive networks of the distribution and collection bridges, which are designed for a constant 22.5- to 23.5-dB loss.

4.02 Review the circuit order information to determine if the layout requires the installation of F-58122 AGC amplifiers. The bridge is shipped in option X configuration (which ***does not*** permit use of the F-58122 amplifiers), and the tests described herein must be made in option X configuration. After the tests, the bridge should be rewired to the option Y configuration if the F-58122 amplifiers are to be used. For information on converting to option Y, see Section 314-815-100.

4.03 To test the resistive bridge loss and port terminations, adjust the transmission measuring set (TMS) to transmit 1000-Hz at 0-dBm signal level into 600-ohm impedance. Figure 1 is a functional diagram which can be used to locate test access points shown in Table A. Table A covers the test requirements for distribution and collection bridges in a dual 6-port configuration and for distribution and collection bridges in a single 12-port configuration. In every case, the detector should measure between −22 and −23 dBm.

5. TRANSMIT AND RECEIVE TRANSMISSION PATH VERIFICATION TESTS

5.01 After the bridge assembly has been equipped with amplifiers and equalizers as specified in the circuit order information, the internal wiring of the bridge (including the plug-in units) should be verified. The verification tests consist of connecting the distribution and collection bridges in series, and measuring the amplification and attenuation at various points in the circuit. (See Fig. 2 for location of test points.)

5.02 Make the following preliminary adjustments:

(a) Distribution bridge

- Adjust the port 1 REC AMPL gain to +17 dB (includes the effect of the equalizer).
- Adjust the port 2 TRANS AMPL gain to +26 dB.

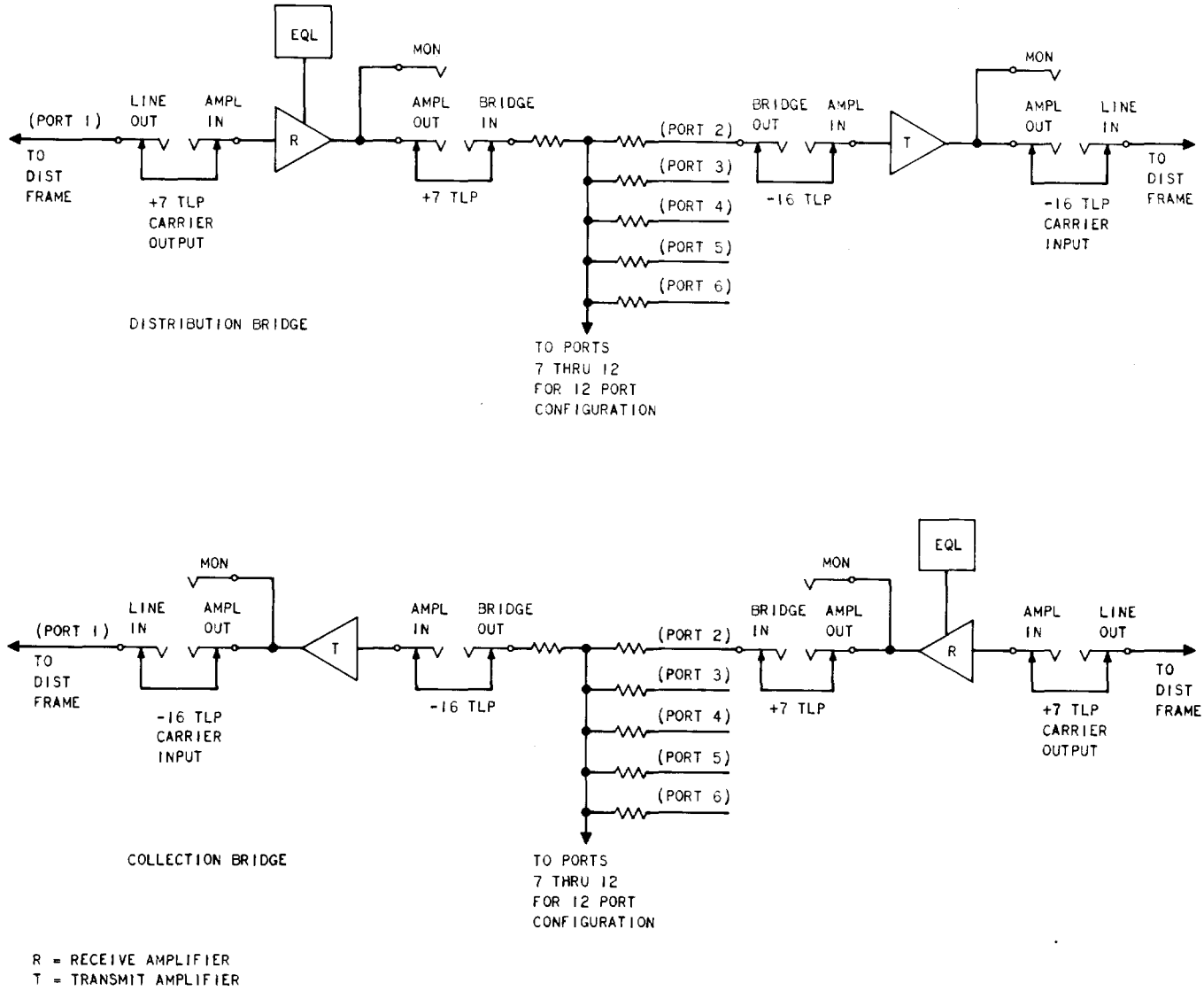

Fig. 1—Simplified Sketch Showing Test Access and Transmission Level Points of Multipoint Split Bridge

(b) Collection bridge

- Adjust the port 2 REC AMPL gain to +20 dB (includes the effect of the equalizer).
- Adjust the port 1 TRANS AMPL gain to +6 dB.

If the indicated amplification cannot be achieved at a test point (Fig. 2) via the amplifier gain control, minimize the insertion loss of the equalizer as described in 5.03.

5.03 The only equalizers having the possibility of insertion losses too large to be compensated for by adjusting the amplifier gain are 359A- and 359P-types. In these cases, proceed as follows:

(1) For the 359A equalizer, close [turn clockwise (cw)] the screw-type switches 250, 500, 1000, and 2000 on the LF "R" portion of the faceplate. This will bypass the series low-frequency equalization circuit. On the HF portion of the faceplate, open [turn counter-clockwise (ccw)] the screw-type switch designated IN. This will open the shunt high-frequency equalization circuit. With the LF and HF portions deactivated, only

TABLE A

BRIDGING CONFIGURATIONS AND TMS TEST POINTS FOR RESISTIVE BRIDGE LOSS AND PORT TERMINATION TESTS

PROCEDURE	BRIDGE CONFIGURATION					
	DIST BRIDGE DUAL 6-PORT CONFIGURATION		COLLECTION BRIDGE DUAL 6-PORT CONFIGURATION		DIST BRIDGE SINGLE 12-PORT CONFIGURATION	COLLECTION BRIDGE SINGLE 12-PORT CONFIGURATION
Insert 258-type plugs into jacks *(Note)*	AMPL IN ports 2 thru 6	AMPL IN ports 8 thru 12	AMPL OUT ports 2 thru 6	AMPL OUT ports 8 thru 12	AMPL IN ports 2 thru 12	AMPL OUT ports 2 thru 12
Connect TMS OSC OUT to jacks	BRIDGE IN port 1 (leave TMS OSC OUT connected to port 1 until end of test)	BRIDGE IN port 7 (leave TMS OSC OUT connected to port 7 until end of test)	BRIDGE IN ports 2 thru 6, consecutively	BRIDGE IN ports 8 thru 12, consecutively	BRIDGE IN port 1 (leave TMS OSC OUT connected to port 1 until end of test)	BRIDGE IN ports 2 thru 12, consecutively
Connect TMS DET IN to jacks	BRIDGE OUT ports 2 thru 6, consecutively	BRIDGE OUT ports 8 thru 12, consecutively	BRIDGE OUT port 1 (leave TMS DET IN connected to port 1 until end of test)	BRIDGE OUT port 7 (leave TMS DET IN connected to port 7 until end of test)	BRIDGE OUT ports 2 thru 12, consecutively	BRIDGE OUT port 1 (leave TMS DET IN connected to port 1 until end of test)

Note: Remove 258-type plugs upon completion of test.

a 6-dB pad will be left in the circuit. For this test, the position of the remaining screws will have no effect on the equalizer.

(2) For the 359P equalizer, close (turn cw) the screw-type switches 500, 1000, and 2000 on the LF portion of the faceplate. This will bypass the series low-frequency equalization circuit. Open (turn ccw) the screw-type switch designated HF-IN on the upper right-hand portion of the faceplate. This will open the shunt high-frequency equalization circuit. With the LF and HF portions

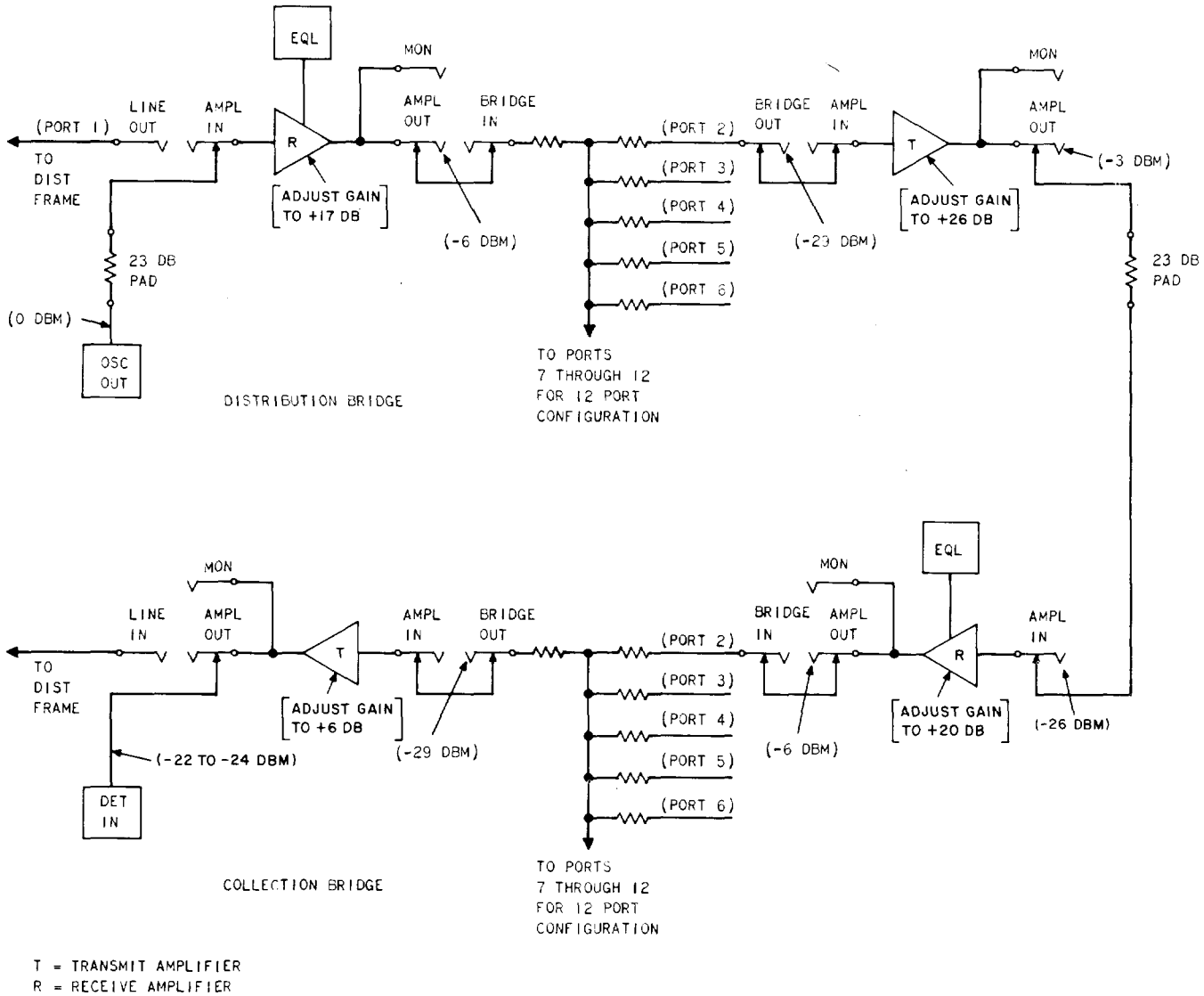

Fig. 2—Transmit and Receive Transmission Path Verification Tests—Schematic Representation of the Test Points and Anticipated Gains and Losses

deactivated, only a 6-dB pad will be left in the circuit. For this test, the position of the remaining screws will have no effect on the equalizer.

(3) Additional information concerning 359A and 359P equalizers can be found in Sections 332-116-101 and 332-116-114, respectively.

5.04 Adjust the TMS to transmit 1000-Hz at 0-dBm signal level into 600-ohm impedance. Connect the OSC OUT jack to a 23-dB pad (provided in the bridge assembly loop-back panel) and connect the pad into the distribution bridge port 1 receive AMPL IN jack. Connect another 23-dB pad between the distribution bridge port 2 transmit AMPL OUT jack and the collection bridge port 2 receive AMPL IN jack, as shown in Fig. 2. This will connect the distribution bridge in series with the collection bridge through the 23-dB pad, thus establishing a path for verification of the amplification and attenuation features (end-to-end) through the bridge.

5.05 Prior to starting the transmission measurements, refer to Fig. 2 for a schematic representation of the test points and anticipated gains and losses.

(a) Nonoperational ports should be equipped with plug-in units on a temporary basis and tested at this time for future application.

(b) Plug the TMS DET IN cord into the port 1 transmit AMPL OUT jack of the collection bridge. The detector should measure between −22 and −24 dBm. This tests the amplification, attenuation, and internal 23-dB pads of both the distribution and collection bridges.

(c) In the event that the measurement is out of tolerance, check the levels at the test points shown in Table B. If the outputs of the plug-in components fail to measure close to the anticipated values, replace them with equivalent units. Make the same preliminary gain adjustments as in 5.02.

5.06 In the case of a dual 6-port configuration, test ports 3 through 6 in the same manner as for port 2 in Table B. For ports 7 through 12, substitute "port 7" for "port 1" in Table B and test ports 8 through 12 in the same manner as for port 2. In the case of a single 12-port configuration, test ports 3 through 12 in the same manner as port 2 in Table B.

5.07 At the conclusion of the verification tests, remove all test connections. Place 248-type (dummy) nonconductive plugs into the transmit amplifier AMPL IN and receive amplifier AMPL OUT jacks of the nonoperational bridge assembly ports.

6. CIRCUIT ORDER TRANSMISSION TESTS

6.01 The requirements for circuit order transmission tests are contingent upon the specifications

TABLE B

TEST POINT LOCATIONS AND LEVELS FOR TRANSMISSION TESTS

TEST POINT LOCATION	DESIGNATION	MEASURE
Distribution Bridge	Port 1 REC AMPL, AMPL IN	−23 dBm
Distribution Bridge	Port 1 REC AMPL, AMPL OUT	−6 dBm
Distribution Bridge	Port 2 TRANS AMPL, BRIDGE OUT	−29 dBm
Distribution Bridge	Port 2 TRANS AMPL, AMPL OUT	−3 dBm
Collection Bridge	Port 2 REC AMPL, AMPL IN	−26 dBm
Collection Bridge	Port 2 REC AMPL, AMPL OUT	−6 dBm
Collection Bridge	Port 1 TRANS AMPL, BRIDGE OUT	−29 dBm

that apply to the facilities and facility conditioning necessary for the type of service ordered by the customer. The suggested transmission tests for multipoint data services are covered in Section 314-410-500. The recommended ac test access points, shown in Section 314-410-500, correspond to the data bridge receive amplifier AMPL OUT and the transmit amplifier AMPL IN jacks.

6.02 Prior to starting the transmission tests, verify that all V4 plug-in screw settings and gain adjustments are as specified on the service order or CLRC. For V4 initial line-up procedures, refer to Section 332-104-500. If F-58122 AGC amplifiers are used in ports 1 and 7, refer to Section 332-104-503 for adjustment procedures.

6.03 Midlink transmission requirements are covered in Section 314-410-500. When a midlink is used to cascade two data bridges in two separate central offices, it will be necessary to have TMS equipment at both data bridge assemblies. The test points indicated in Table C should be used.

6.04 Midlink loop-back "benchmarks" should be established and recorded on the data transmission history cards (Form E-5596) by looping through the served bridge assembly and performing applicable transmission tests from the serving bridge assembly on a loop-back basis. (See Fig. 3.) (Form E-5596 is illustrated in Section 314-410-500.) For the served bridge loop-back test, connect a 23-dB pad (provided in the bridge assembly loop-back panel) from the port 1 (or port 7 if applicable) receive AMPL OUT jack of the distribution bridge to the port 1 transmit AMPL IN jack of the collection bridge, and proceed with tests from the serving bridge.

6.05 For stations equipped with DAS 828A or equivalent DASs, point-to-point tests should be made between the assigned bridge leg and the station interface. The distribution bridge test point is the transmit amplifier AMPL IN jack. The collection bridge test point is the receive amplifier AMPL OUT jack.

6.06 The recommended level for data circuits provides for transmission level points of −16 TLP at all transmit amplifier inputs and +7 TLP at all receive amplifier outputs (Fig. 1). When tests are made at data level, the corresponding power at the above test points for a −13 dBm0 level should be −29 dBm at the transmit AMPL IN jacks and −6 dBm at the receive AMPL OUT jacks.

7. LOOP-BACK TESTS

7.01 Loop-back tests from the bridge location to the station may be conducted in any one of

TABLE C

TEST POINTS FOR CIRCUIT ORDER TRANSMISSION TESTS

PROCEDURE	TEST	
	TEST FROM THE SERVING DISTRIBUTION BRIDGE TO THE SERVED DISTRIBUTION BRIDGE	TEST FROM THE SERVED COLLECTION BRIDGE TOWARD THE SERVING COLLECTION BRIDGE
Connect TMS OSC OUT to	Assigned leg transmit AMPL IN jack	Transmit AMPL IN jack (port 1 or 7)
Connect TMS DET IN to	Receive AMPL OUT jack (port 1 or 7)	Assigned leg receive AMPL OUT jack

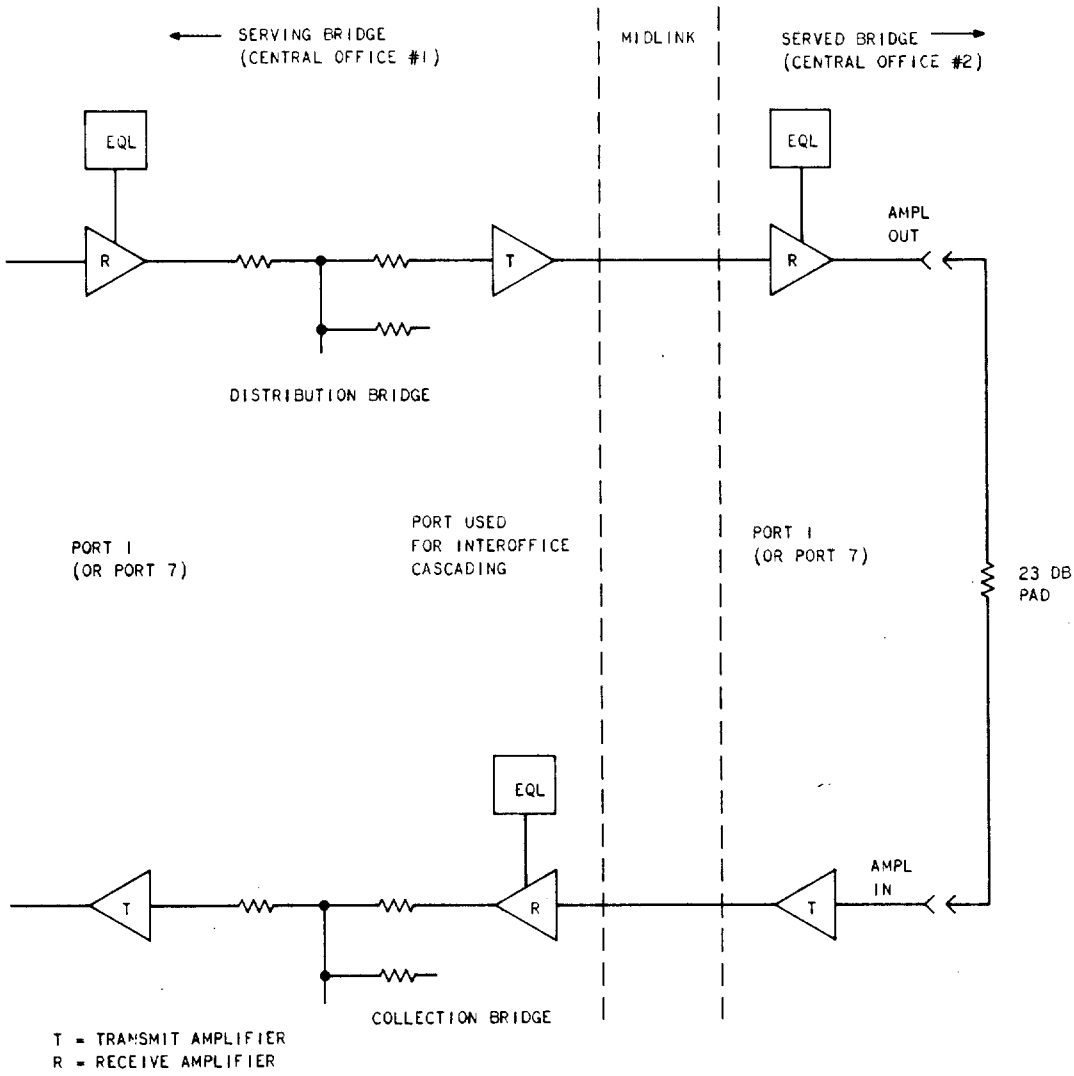

Fig. 3—Loop-Back Test Configuration for Inter-Office Cascading

three modes of operation, depending upon the features provided at the station DAS:

(a) ***Locally Operated Loop-Back***—If remote dc access is not practicable or local manual operation is desired, a local manual loop-back key may be provided at the customer location.

(b) ***Remote DC Loop-Back***—If remote dc loop-back is provided, the loop-back relay at the station DAS is operated via a 48-Vdc simplex circuit activated by the dc loop-back control button on the bridge assembly.

(c) ***Remote AC Loop-Back***—If the station DAS is equipped with ac loop-back capability, application of an ac loop-back command tone at data level at the distribution bridge transmit amplifier AMPL IN jack will activate the loop-back relay.

7.02 Before starting the loop-back tests, the circuits to the station locations (ports 2 through 6 and/or ports 8 through 12) must be isolated from the bridge assembly. Isolation is necessary on ac loop-back to prevent command tone from feeding back to distant end stations. Isolation of the bridge ports is accomplished by placing 600-ohm (262B) plugs in both the BRIDGE OUT

jack and the BRIDGE IN jack of the ports under test. This will complete the dc interlock circuits for these ports, and will enable the dc loop-back control switches.

7.03 Operation of the loop-back relay in the DAS will permit the performance of loop-back tests. Establish loop "benchmarks" as required and record on Form E-5596. All transmission measurements should be made at data level in accordance with 6.06. Refer to Section 314-410-500 for further information.

8. MAINTENANCE PROCEDURES

8.01 The maintenance responsibility and procedures for special services locations are described in Section 660-005-011. Under the control office plan (COP), the special services location responsible for the data bridge shall assume the plant control office (PCO) and/or network control office (NCO) functions.

8.02 The suggested transmission tests and test intervals for maintenance procedures are shown in Section 314-410-500.

9. SPECIAL OPERATING CONSIDERATIONS

9.01 Operating experience has revealed some precautions that should be observed in use of the bridge to protect the plug-in 227-type amplifiers and 359-type equalizers when using dc loop-back.

(a) The originally specified 5-amp loop-back supply fuse (Section 314-815-100) should be replaced with a 1-1/3 amp fuse. This will provide more protection for amplifier and equalizer transformer coils in the event of a line malfunction, such as a heat coil short to ground, without restricting the use of dc loop-back. If there is concern that the current rating of a transformer may be exceeded, the line to be tested should be checked for shorts to ground prior to pushing the loop-back button. The dc resistance measurements to ground should be made at the transmit AMPL OUT jack, as shown in Fig. 4, if the line under test is equipped with an equalizer with a transformer (359B-, F-, M-, and N-types). The dc resistance measurements to ground should be made at the transmit LINE IN jack, as shown in Fig. 5, if the line is equipped with any other type of equalizer. If no short or low-resistance path to ground is found, the loop-back button may then be pushed.

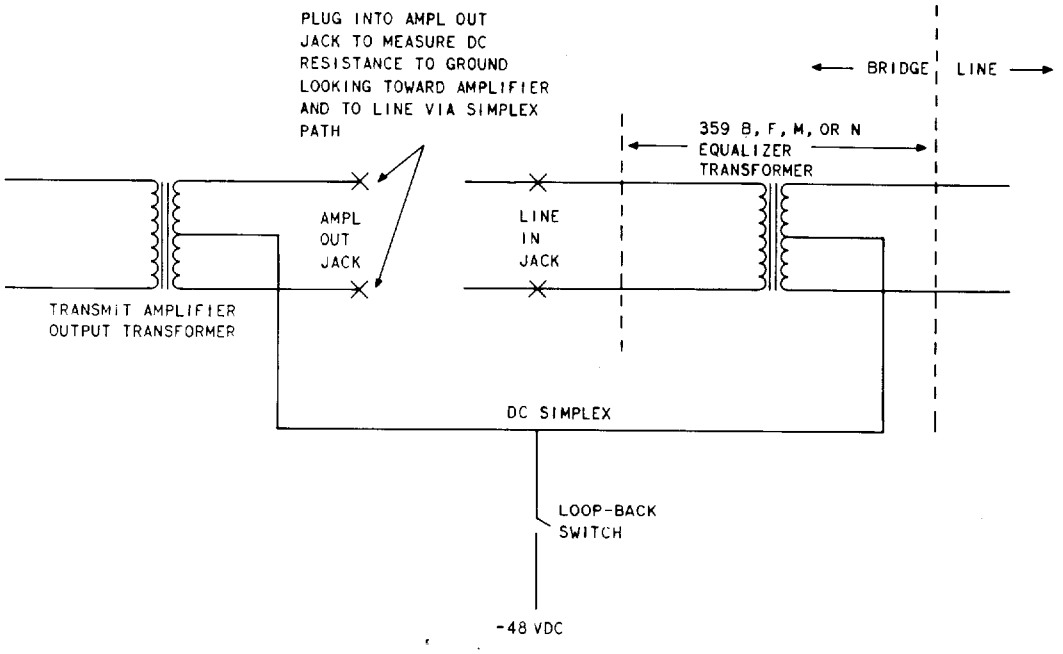

Fig. 4—DC Resistance to Ground Measurement From Transmit AMPL OUT Jack

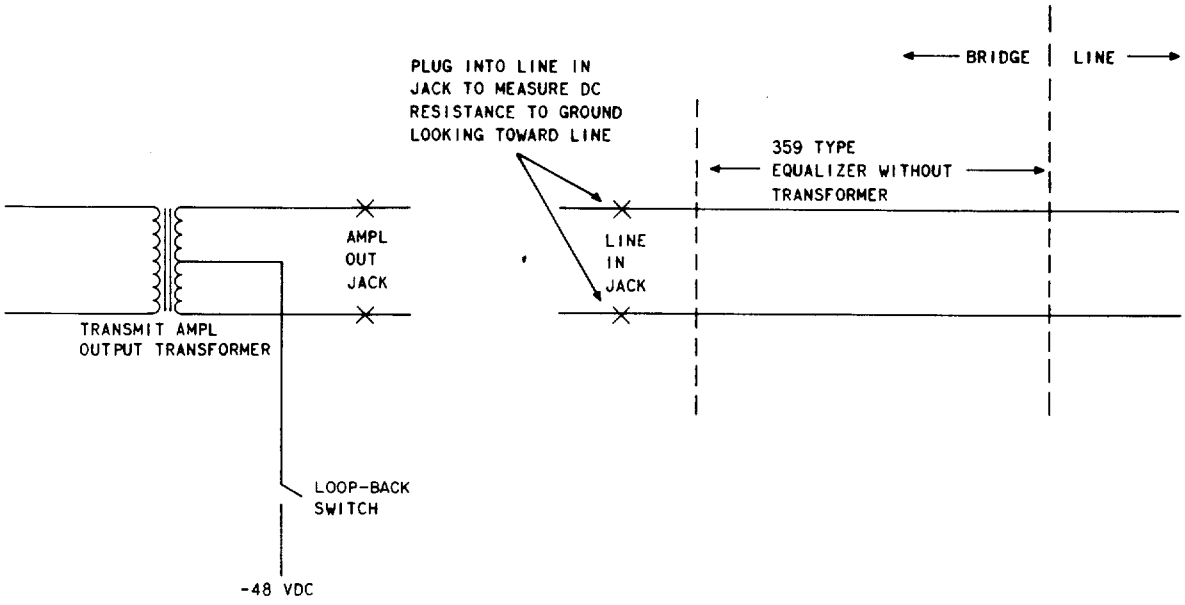

Fig. 5—DC Resistance to Ground Measurement From LINE IN Jack

(b) 359B-type equalizers are not recommended for bridge use with dc loop-back, as the loop-back current could exceed the 50-mA current rating of the transformer coils in this type of equalizer, even in the absence of a line malfunction. The 359M equalizer, rated at 350 mA, is recommended in place of the 359B.

(c) When using 359M and 359N equalizers, the two screws on the faceplate must always be ***out*** (fully ccw). If these are turned ***in*** (in violation of the instructions for V4 repeater applications contained in Sections 332-116-112 and 332-117-113), an unintended path is established that can burn out amplifier and/or equalizer coils upon application of dc loop-back voltage. Use of felt washers underneath these screws is recommended.

9.02 Operating experience has also revealed two test procedures that could provide undesired results.

(a) If equalizers with transformers are in use (359B-, F-, M-, and N-types), accessing the LINE IN and LINE OUT jacks will appear to the user to be looking into the transformer primary, as shown in Fig. 6. To make dc measurements on the line, substitute a dummy equalizer (359C, E, or J), as shown in Fig. 7. Reinstall the operational equalizer upon completion of the dc tests and prior to the ac tests.

(b) If equalizers without transformers are in use (all 359-types except B, F, M, and N), do not attempt to access the LINE IN and LINE OUT jacks while in the dc loop-back mode. This will break the loop-back circuit and cause the far-end loop-back relay to drop out (Fig. 5). To place a signal on the line, apply it through the AMPL IN jack. To measure a signal coming back from the line, measure it at the AMPL OUT jack. In both cases, the amplifier gain must be verified to determine the signal levels on the line side of the amplifiers.

10. REFERENCES

10.01 The following documents provide additional information on equipment that may be associated with the data bridge assembly.

SECTION	TITLE
314-410-500	Voice Bandwidth Private Line Data Circuits—Test and Requirements

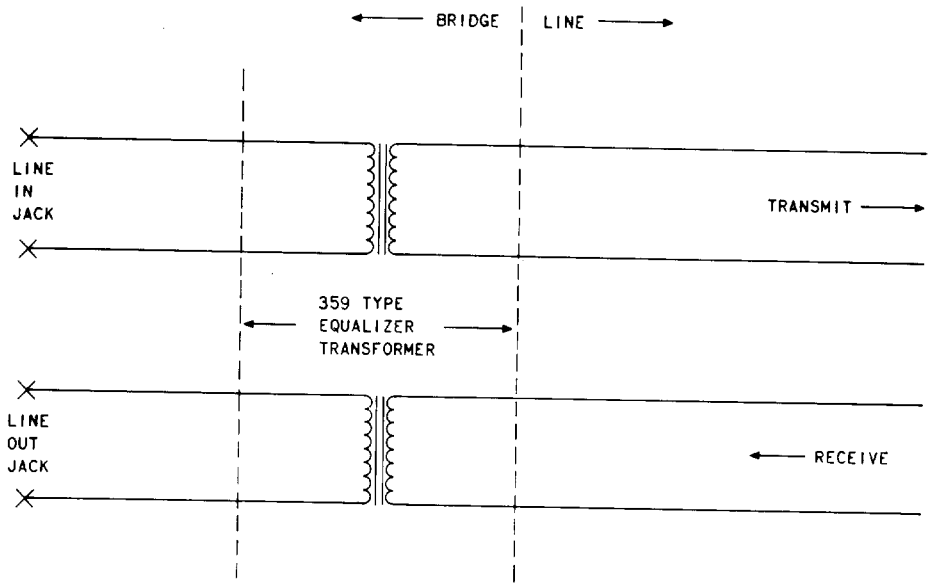

Fig. 6—AC Test Configuration With Equalizer Containing Transformer

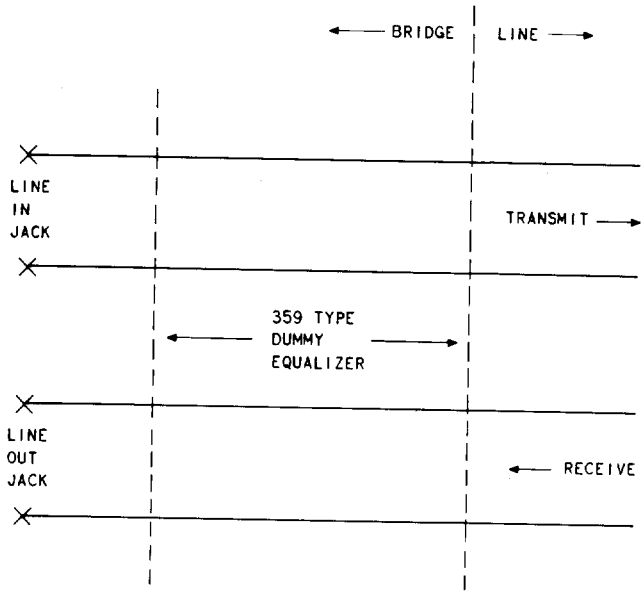

Fig. 7—DC Test Configuration Showing Replacement by Dummy Equalizer

314-815-100	Voiceband Multiport Split Bridge With Gain, Equalization, and Test Access—Description
332-104-100	V-Type Repeaters—V4 Telephone Repeater
332-104-103	V4 Telephone Repeater—F-58122 Amplifier
332-104-500	V4 Telephone Repeaters—Initial Line-Up
332-104-501	V4 Telephone Repeater—227-Type Amplifier—Tests and Adjustments
332-104-503	V4 Telephone Repeater—F-58122 Amplifier—Tests and Adjustments
332-116-101	359A Equalizer—Description
332-116-112	359M Equalizer—Description
332-116-113	359N Equalizer—Description
332-116-114	359P Equalizer—Description
660-005-011	Office Responsibilities, Special Services—Control Office Plan
SD- & CD-99565-01	Common Systems Voiceband Multiport Bridge With Gain, Equalization, and Test Access