PRIVATE LINE TELEPHONE SYSTEMS
FOUR-WIRE CHANNELS FOR POLLING TELEVISION RECEIVERS
TROUBLE AND OVER-ALL TRANSMISSION TESTS

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1. GENERAL

1.01 This practice outlines the circuit order and routine tests to be made on circuits used to poll television receivers. The backbone route is made up of four-wire facilities and the subscriber loop is made up of two-wire facilities. These circuits are used by the American Research Bureau to obtain an index of television programs.

1.02 These circuits are in use almost continuously. For this reason it is important that they not only be put in properly but that routine tests be coordinated with the customer. When clearing trouble, tests should be made by the control office to isolate the trouble as quickly as possible. As much of the circuit as possible should be kept working so as not to disrupt service any more than is necessary.

2. TESTING EQUIPMENT

2.01 One of the most important aspects of good measurements is good testing equipment. ***YOU CAN'T MAKE GOOD TESTS WITH POOR EQUIPMENT.*** Before making the tests covered in this practice, then, check the equipment and make sure it's working properly. Ample warmup time is also important since this has a bearing on the stability of the equipment in its operation.

2.02 The following test apparatus is recommended for these tests:

13A TMS 21A TMS	Wheatstone Bridge or Rheostat on Local Test Desk
40B Transmission System (TMS only)	200 CD Oscillator or Equivalent and Isolating Coil
2B Noise Measuring Set	Transistorized OSC or TMS
400-Type VTVM and Isolating Coil	Telephone Test Set, Type 107A or B or equivalent

2.03 In some Companies, battery-operated transistorized test sets may be available which are suitable for testing at the customer's premises. Two such instruments are the Northern Electric R18568B Volume Indicator and the Northeast Electronics Corporation Model 4 Transmission Test Set. If such test sets are available, it will simplify the testing procedure at the customer's premises. This is true since power is not required to operate these sets and, hence, it is not necessary to disturb the customer.

2.04 It is possible to permanently damage the 13A and 21A sets by the presence of dc. In some instances sealing current may be used to minimize the noise on the backbone route. In these instances, the current should be removed before the test.

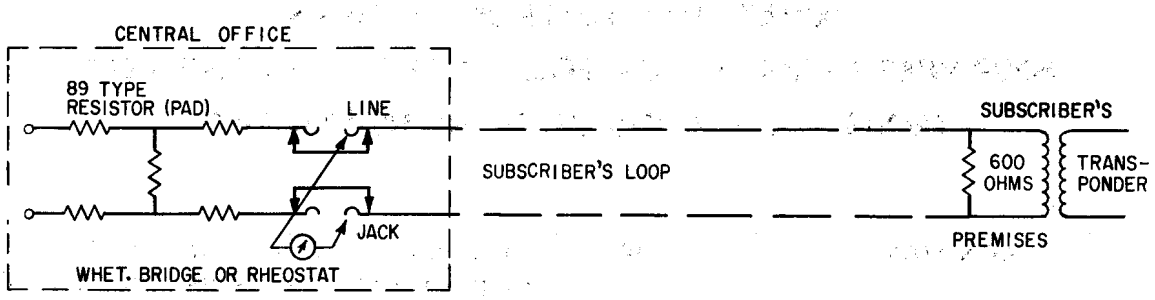

Fig. 1 — Measurement of Loop DC Resistance

3. DC RESISTANCE MEASUREMENTS

3.01 The resistance of each loop should be measured from its LINE jack at the central office with a Wheatstone Bridge or rheostat on the local test desk as shown in Fig. 1. The resistance should include the 600-ohm termination placed by the Telephone Company and located at the subscriber's premises. *IF* the transponder is installed by ARB, its resistance of about 540 ohms will be in parallel with the Telephone Company termination and this should not be overlooked. The resulting resistance of each loop measured on the circuit order test should be filed with the circuit order card or sketch for future reference.

3.02 The continuity of the backbone route trunk pairs should be checked and verified to the control office. Any interoffice trunks used to inter-connect subscriber loops to the 44-type bridge or hybrid should also be checked.

3.03 The dc subscriber loop resistance should measure within ±10% of the loop resistance at 68°F. This limit is for a temperature range of from −10°F to +110°F.

4. AMPLIFIER GAIN ADJUSTMENT

4.01 The gain of each amplifier should be adjusted to the value indicated on the circuit order card or sketch. The adjustments should be made in accordance with the Bell System Practices covering the amplifier.

5. FREQUENCY RESPONSE MEASUREMENTS

5.01 Frequency response measurements should be made on the backbone route from 300 to 1300 cycles while watching for peaks and valleys. These should be made from the most remote central office on the backbone route to

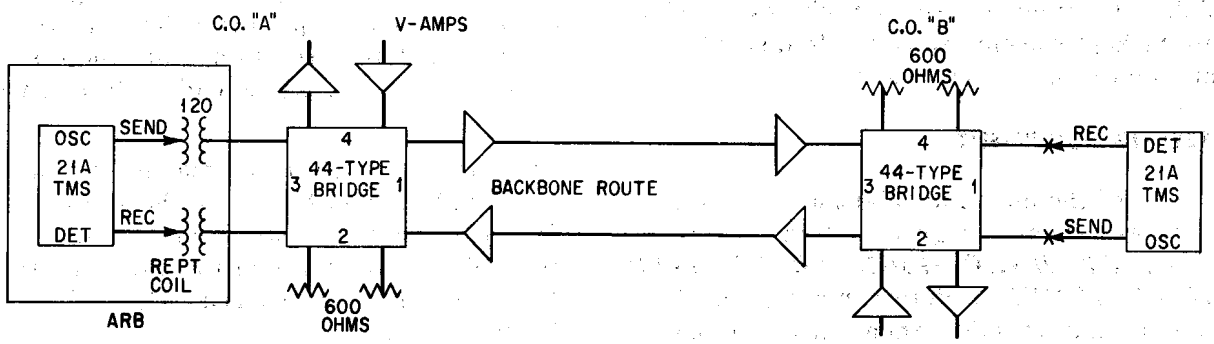

Fig. 2 — Testing Arrangement for Response of Backbone Route

ARB headquarters. If the route is split, measurements should also be made from the most remote central office on the branch. Measurements should be made in accordance with Fig. 2 which is a typical testing arrangement. ***ALL BRIDGING CIRCUITS AND LOOPS SHOULD BE CONNECTED NORMAL BEFORE MAKING THE TEST.***

5.02 Chart I outlines the procedure for making frequency response measurements on the backbone route. While Fig. 2 shows a 21A TMS, other sets recommended in Part 2 may also be used. This means that the procedure set forth in Chart I may have to be revised slightly depending on the test sets used.

CHART I

STEP	PROCEDURE	REMARKS
1	Connect 21A TMS to ac power.	Allow ample warmup time.
2	Calibrate test set.	
3	Adjust oscillator output at ARB for 0 dbm.	
4a	Connect DET IN terminals of 21A TMS to REC jack of 44-type bridge at C.O.	
4b	Connect DET IN terminals of 21A TMS to REC coil at ARB.	
5a	Connect OSC OUT terminals of 21A TMS to SEND jack of 44-type bridge at C.O.	
5b	Connect OSC OUT terminals of 21A TMS to SEND coil at ARB.	
6	Measure the 1000-cycle loss and check the circuit order card or sketch for the backbone route requirement.	Requirement: Measured loss should agree within ±1.0 db.
7	Send from ARB by sweeping the OSC from 300 to 1300 cycles.	Record the values of the peaks and valleys. Requirements: 0±1.5 db of 600-cycle loss for circuit order test and ±2.5 db for routine test.
8	Reverse procedure and send from central office and receive at ARB.	Repeat Steps 6 and 7.
9	If requirements are met, restore circuit to normal.	
10	If requirements are not met clear trouble before restoring circuit to normal.	

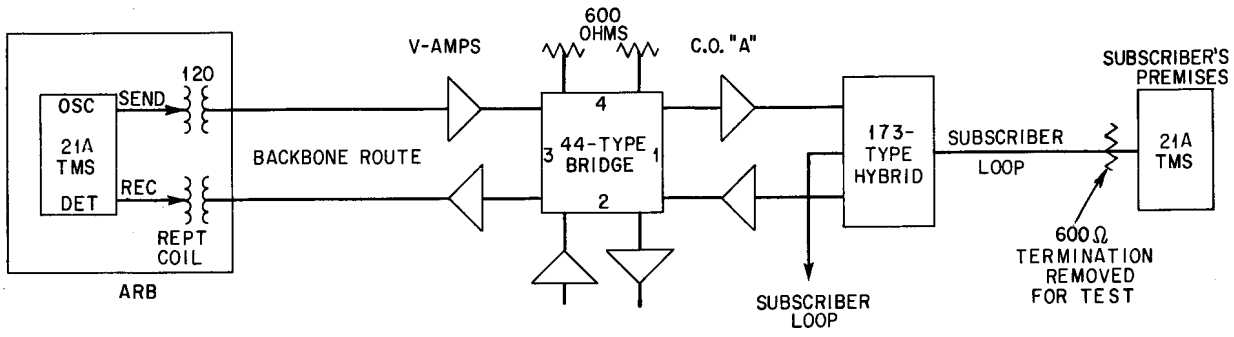

Fig. 3 — Frequency Response Measurement from Subscriber Loops

5.03 The frequency response from 300 to 1300 cycles should also be measured from the subscriber's premises on each subscriber loop to ARB headquarters. The test setup for this is shown in Fig. 3. Chart II outlines the procedure for making the measurements.

5.04 If battery-operated test sets are available, they should be used in preference to testing from the subscriber's premises. This is good public relations! The use of these sets also makes it possible to test from the cable terminal serving the customer.

5.05 If tests are made from the cable terminal, two temporary jumpers should be run from the terminal to the test location — one pair for talking and one for testing. If the drop wire has been connected, it should be removed before the test is started and reconnected after the test. Make sure the test equipment is connected to the pair to be used for the circuit.

5.06 If tests are to be made from a cable terminal, arrangements should be made with the Plant Assignment people for a talking pair. This pair should be temporarily wired to the outgoing trunk test frame (OGT) or some other convenient test location. A temporary tel set should also be installed at ARB headquarters to facilitate testing. This will minimize the amount of inconvenience to the customer.

5.07 The two talking pairs should be bridged at the office. If necessary, a loudspeaker should be connected to the talking circuit at the central office. This will provide a means for either tester to call the central office in on the test in case their assistance is needed.

5.08 When testing from a cable terminal, a telephone test set such as the 107A or B or equivalent should be used.

5.09 ***IF POSSIBLE,*** the test equipment used at ARB should be calibrated with test equipment used throughout the circuit. This will minimize errors due to differences in the test equipment.

6. NOISE MEASUREMENTS

6.01 Measurements of the over-all steady noise should be made at ARB headquarters using the 2B Noise Measuring Set in accordance with practices covering the use of the set. The over-all circuit should be in the normal operating condition. Fig. 4 shows the test set up for a typical circuit. The drop side of the repeat coil at ARB headquarters should be connected to the LINE jacks or terminals of the 2B set with the switch on FIA weighting. The circuit should be monitored for crosstalk during the measurement. The presence of intelligible crosstalk is an indication of trouble. The steady noise measured at ARB should not exceed 35 dba, FIA weighting.

7. INTERVALS

7.01 The routine tests outlined in this practice should be performed quarterly. They are in addition to the routine tests performed on the repeaters. The asterisk (*) in Table I indicates the tests to be performed on a circuit order or routine basis. ***ROUTINE TESTS SHOULD BE COORDINATED WITH THE CUSTOMER (ARB).***

CHART II

STEP	PROCEDURE	REMARKS
1a	If test is made from cable terminal, disconnect drop wire at terminal.	This is drop for ARB circuit.
1b	If test is made from subscriber's premises, remove 600-ohm resistor on 11C connector.	The 600-ohm TMS acts as the termination.
2	If testing from a cable terminal, run two jumpers from the terminal to the test location.	One pair is for talking and one is for testing.
3	Connect test equipment to ac power.	Allow ample warmup time.
4	Calibrate test equipment.	
5	Connect test equipment as shown in Fig. 3.	
6	Measure the 1000-cycle loss and compare with circuit order card or sketch.	Requirement: Measured loss should agree within ±1.5 db.
7	Send from ARB headquarters sweeping OSC from 300 to 1300 cycles.	Record the peaks and valleys. Requirement: —25 dbm ±4.0 db of 600-cycle loss for circuit order test and ±5.0 db for trouble hunting test.
8	If requirements are met, reverse direction of test and receive at ARB headquarters.	Same as Step 6.
9	Disconnect test equipment.	
10	Reconnect drop wire or 600-ohm resistor.	
11	If requirements are not met check repeaters, cable pairs, etc., and clear trouble before restoring circuit to normal.	

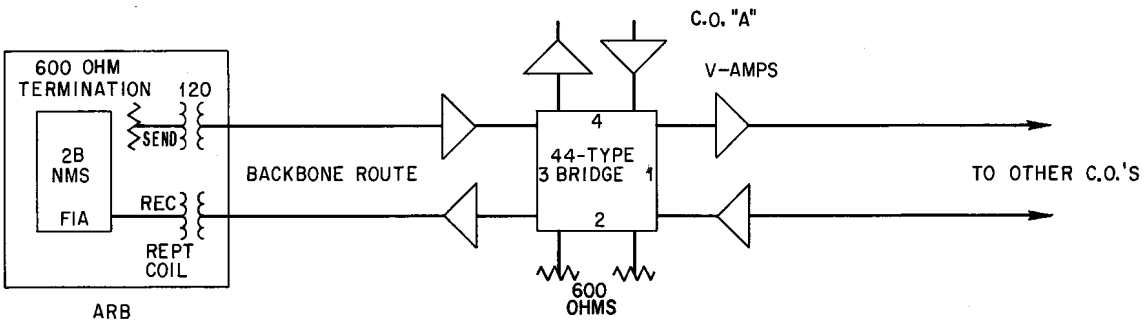

Fig. 4 — Test Set Up for Measuring Noise

TABLE I

TEST	CIRCUIT ORDER	QUARTERLY
Frequency Response of Backbone Route	*	*
Frequency Response of Loops to ARB	*	—
DC Resistance of Loops	*	—
Noise	*	*

8. TROUBLE HUNTING

8.01 The television polling circuit is in use almost continuously during the television broadcasting hours. For this reason the trouble hunting procedures should be such as to isolate the trouble quickly. It is also important that as much of the circuit as possible be kept working.

8.02 A good clear story from the customer (ARB) as to what the trouble is will help considerably in isolating the trouble. For instance, are all stations in trouble or just certain ones? The trouble hints outlined below cover some of the more common troubles which may be encountered. Other possibilities should not be overlooked.

8.03 Case No. 1—Customer complains circuit causes errors in data. This may be caused by noise.

Trouble Hints

(1) Sectionalize the trouble.

(2) Check the tip and ring conductors of the backbone route for ground.

(3) If carrier is used between offices, check the terminals for noise in accordance with practices covering the carrier.

(4) Check amplifiers in accordance with appropriate practices.

(5) Check 44-type bridge to make sure that 600-ohm terminations have not been removed by mistake. Check the circuit order card or sketch for the location of these terminations.

(6) If possible, isolate the trouble to a specific office.

(7) Monitor the loops at the LINE jacks for excessive noise. If a 2B Set is available, measure the noise at the same jack. The noise should not exceed 35 dba.

(8) Check the subscriber loop for a ground.

(9) If all loops are noisy, check central office for recent rearrangements in central office power plant.

(10) Measure loop resistance as shown in Fig. 1.

(11) Remove connections to transponder on 11C connector at customer's premises.

Remedial Measures

(1) Change trunk pair.

(2) Change carrier channel assignment.

(3) Change amplifier.

(4) Change subscriber loop pair.

(5) Customer's equipment may be in trouble.

(6) Bay filtering may be required if central office battery filtering is inadequate.

8.04 Case No. 2—Customer complains that the received levels are too low.

Trouble Hints

(1) Measure the 1000-cycle net loss of the backbone route.

(2) If no signal is received, check trunk cable pairs for an open.

(3) Measure the loss of the 44-type bridge, hybrids, resistance bridges, amplifiers, etc. Check the circuit order card or sketch for these losses.

(4) Measure the dc resistance of the subscriber loop or loops which appear to be in trouble.

Remedial Measures

(1) Replace repeater or carrier terminals or defective tubes.

(2) Change cable pairs.

(3) Readjust carrier or amplifier. Note: Don't cover up trouble by adjusting the gain. The trouble will reappear if you do.

(4) Output of transponder at subscriber's premises may be too low.

(5) ARB central station equipment may be in trouble.

8.05 Case No. 3—ARB complains that specific subscribers on a backbone route do not respond to interrogating frequencies.

Trouble Hints

(1) Request the location of subscriber or subscribers which do not respond to ARB signals.

(2) Measure the dc loop resistance of cable pair in accordance with Fig. 1. Compare reading with circuit order value.

Remedial Measures

(1) If loop resistance is satisfactory, ***HAVE ARB CHECK TRANSPONDER*** on TV sets.