TRUNK TRANSMISSION TESTING USING THE LOOP-AROUND METHOD

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1. GENERAL

1.01 This section describes the loop-around method of making one-man 2-way 1000 cps transmission tests on 4-wire repeatered voice-frequency trunks, trunks on carrier channels, or 2-wire voice-frequency trunks equipped with hybrid-type (e.g. V3) repeaters. Only general concepts are discussed in this section. Other sections cover the detailed methods of setting up the test connections in the various switching systems.

1.02 2-way transmission tests are necessary on 4-wire repeatered voice-frequency trunks, trunks on carrier channels, and 2-wire voice-frequency trunks equipped with hybrid-type repeaters because each direction of transmission has its own active (or gain) devices. The two directions of transmission are essentially independent of each other and do not necessarily have the same losses and gains. Furthermore, repeaters and carrier channels are subject to variations in gain because of the number of components that can age or become defective. Thus one-way transmission tests are not sufficient — both directions of transmission must be measured.

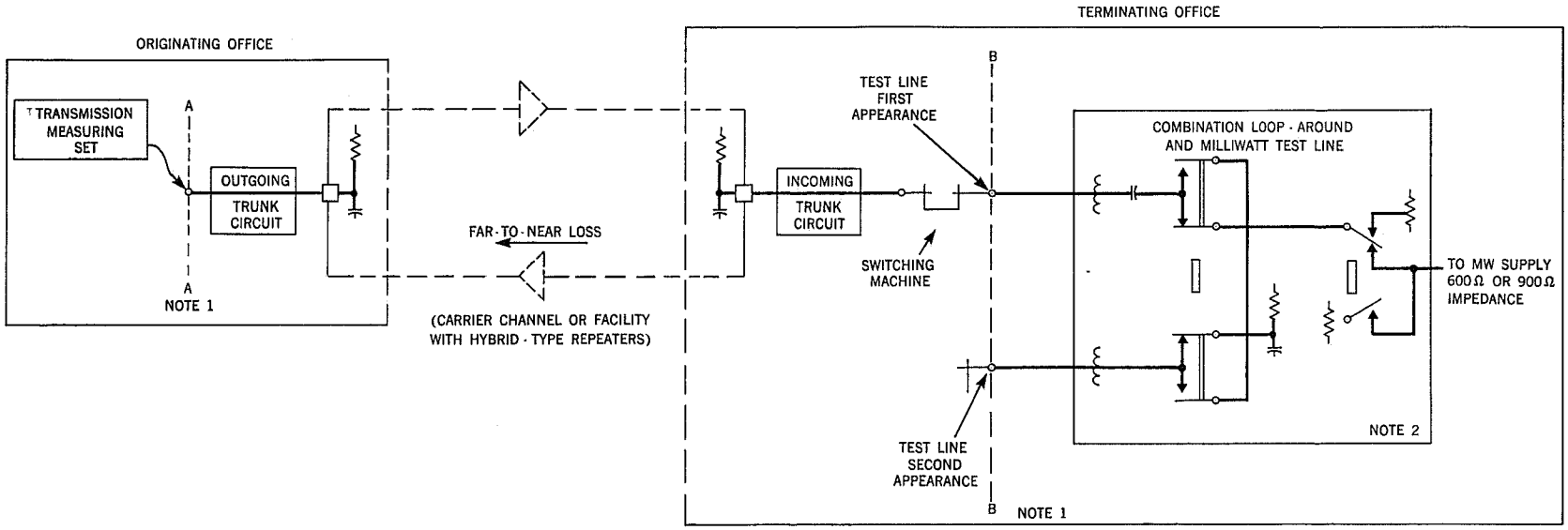
2. TEST EQUIPMENT

2.01 Recommended test equipment is given in the sections covering detailed methods of making the tests. However, a few general comments on this subject should be made.

2.02 All transmission measuring sets (TMS) *must* be properly calibrated before they are used in the tests. Sluggishness, instability, lack of smoothness in potentiometer adjustments, or failure to meet any calibration requirement indicates that the set needs repair. *No* allowance is made in trunk design or trunk test requirements for improperly operating or improperly calibrated test equipment. Along this same line, central office 1000 cps 1MW supplies must be accurately adjusted and must be of the proper impedance (see Paragraph 2.03). Section A204.474.00/E30.223.00 covers the adjusting procedures and requirements for the 1MW test lines.

2.03 The impedance of the TMS and of the MW supply must be of the same nominal value as the impedance of the office at which the test is made. Where this is not the case, an actual measured trunk loss will differ from the Expected Measured Loss by an amount depending upon the deviation of the TMS or MW impedance from the nominal office impedance. The nominal (or usually accepted) switching impedance value for *all* local (class 5) and tandem offices is 900 ohms. Toll offices are 600 ohms with the exception of crossbar tandem switching machines which are 900 ohms. Toll switchboards are considered to be 600 ohms. Thus in a crossbar tandem office we have a 900-ohm switching machine and a 600-ohm toll switchboard. In No. 5 crossbar offices the same switching machine serves toll and local and, in some cases, tandem connections, and has a 600-ohm impedance for toll and a 900-ohm impedance for local and tandem. The test procedures covered in other sections take into account these different nominal impedances and specify the proper test sets and impedance matching methods to be used.

2.04 Consideration must also be given to the general maintenance of test equipment plugs, jacks, and cords. Cords should be in good condition and should be checked for loose or



NOTE 1 – THE FAR-TO-NEAR LOSS INCLUDES ALL EQUIPMENT LOSSES, OFFICE WIRING AND SWITCHING LOSSES, FACILITY LOSSES, AND AMPLIFIER (CARRIER) GAINS FROM THE 'OUTGOING SWITCH' (B-B) IN THE TERMINATING OFFICE TO THE TESTING POINT (A-A) IN THE ORIGINATING OFFICE.

NOTE 2 – THE 1000 CPS 1MW TEST LINE MUST BE ADJUSTED TO DELIVER THE PROPER LEVEL AT THE 'OUT GOING SWITCH' (B-B) IN THE TERMINATING OFFICE. PROCEDURES ARE COVERED IN SECTION A 204.474.00/ E 30.223.00.

Fig. 1 – Measuring Far-To-Near Losses

broken internal connections. Plugs should be properly polished and should seat properly in the jacks. These checks are necessary to eliminate high resistance connections that may result in erroneous measurements.

3. TESTING ARRANGEMENTS

3.01 The loop-around technique requires that two trunks be looped (connected together) at the distant or terminating office. The Transmission Test Line Circuit (SD-98100-01) provides the equipment necessary for this interconnection. Generally, the combination loop-around and milliwatt test line will be provided. Two locally assigned test codes are required for connection to the loop-around equipment.

3.02 Loop-around testing necessarily requires that means be available at the test location in the originating office for originating and holding two connections simultaneously. The sections covering detailed loop-around testing show procedures for doing this in each of the various types of switching systems.

4. LOOP-AROUND TESTING METHOD

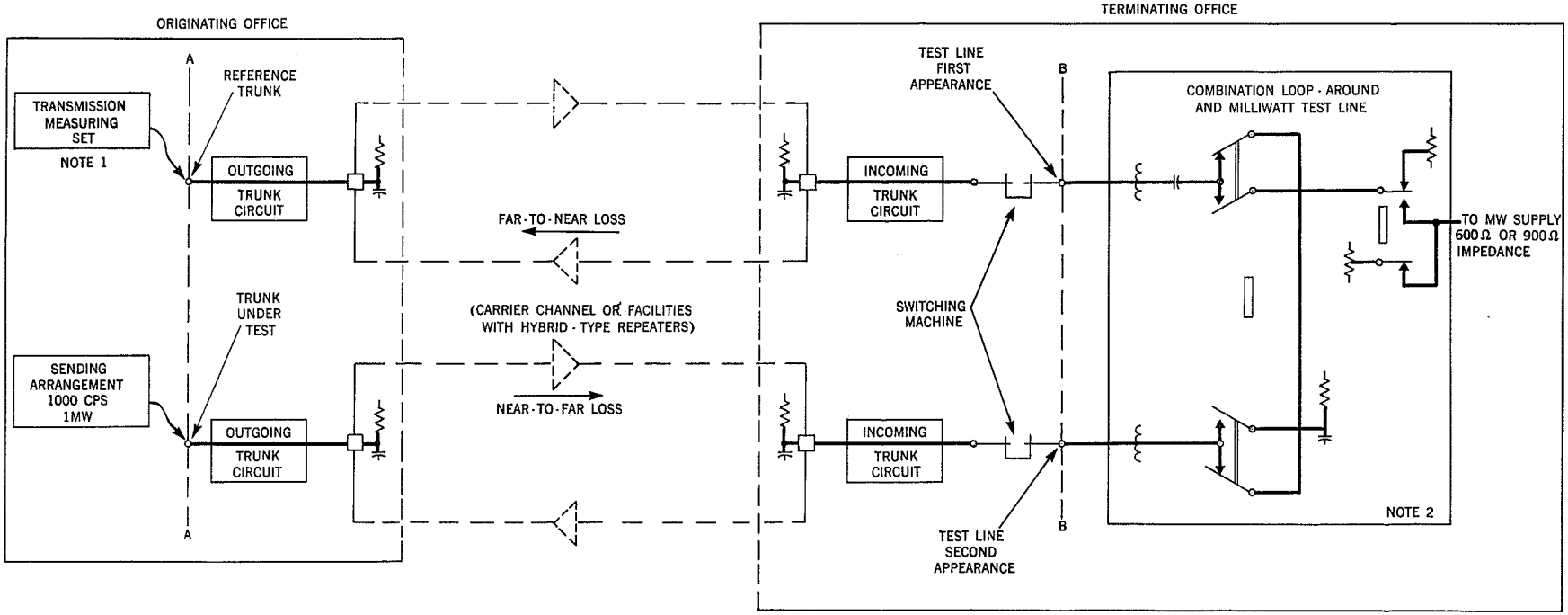
4.01 In loop-around testing, the 1000 cps net loss is first measured in the direction from the terminating office to the originating office (far-to-near loss). This is done on all the trunks to be tested by connecting each trunk in turn to the 1000 cps 1MW test line in the terminating office. A measurement of this type is shown in Fig. 1. As can be seen in Fig. 1, the loss measured at the originating office includes all the losses (minus all the gains) between A-A and B-B in the far-to-near direction.

4.02 After all the trunk far-to-near losses have been measured and recorded, one trunk should be selected as a reference trunk. The reference trunk will be used in measuring the loss of all the other trunks in the direction from the originating office to the terminating office (near-to-far loss). The reference trunk should be stable and its measured far-to-near loss within ± 0.5 db of the Expected Measured Loss. Where the combination loop-around and milliwatt test line (SD-98100-01) is used, the far-to-near loss of the reference trunk may be rechecked after each loop-around measurement because the milliwatt supply is reconnected to the reference trunk each time the trunk connected to the second appearance of the loop-around test line is released. Where separate milliwatt and loop-around test lines are used, more care is required in choosing the reference trunk. Records of past trunk performance should be used where available. The reference trunk far-to-near loss should be remeasured before a cycle of tests is completed. If the reference trunk loss has changed, the preceding tests should, of course, be remade.

4.03 Having chosen a reference trunk, this trunk is now connected to the first appearance of the loop-around test line in the terminating office. (With the combination MW and loop-around equipment, this will be the MW side of the equipment.) One of the other trunks to be tested is then connected to the second appearance of the loop-around test line. Fig. 2 shows this connection. With the two trunks looped in this manner, 1000 cps (1MW) tone is sent into the trunk under test and measured on the reference trunk. The measured loss includes the near-to-far loss of the trunk under test and the far-to-near loss of the reference trunk. As the far-to-near loss of the reference trunk is known, this loss is subtracted from the measured loss to determine the near-to-far loss of the trunk under test. The loss of the loop-around equipment and the associated wiring in the terminating office should be less than 0.1 db and may be neglected. The reference trunk is held connected to the first appearance of the loop-around test line and each of the other trunks is connected in turn to the second appearance of the loop-around test line and measured in a like manner.

4.04 The near-to-far loss of the reference trunk may be obtained by selecting a second reference trunk and looping it with the original reference trunk.

4.05 All loop-around test measurements and computations should be recorded for analysis. Chart A is a suggested work sheet showing typical entries. Chart B is a blank work sheet that may, if desired, be reproduced locally. The trunk deviations, columns 4 and 8, Chart A, should be used for trouble analysis and for the computations of the distribution grade and bias for the office. All losses are recorded as positive values — gains are assumed to be negative losses. A plus deviation indicates that a trunk



NOTE 1 – THE MEASURED LOSS EQUALS THE NEAR-TO-FAR LOSS OF THE TRUNK UNDER TEST (A-A TO B-B) PLUS THE FAR-TO-NEAR LOSS OF THE REFERENCE TRUNK (B-B TO A-A).

NOTE 2 – THE 1000 CPS LOSS OF THE LOOP-AROUND EQUIPMENT (SD-98100-01) AND ITS ASSOCIATED WIRING (TO B-B) SHOULD BE LESS THAN 0.1 DB AND HENCE MAY BE NEGLECTED.

Fig. 2 – Measuring Near-To-Far Losses

has too much loss while a negative deviation indicates not enough trunk loss.

4.06 Summary of loop-around testing:

Step 1: Record the identifying numbers of the trunks to be tested (column 1, Chart A).

Step 2: Record the Expected Measured Loss of each trunk (column 2, Chart A).

Step 3: Check the calibration of all test equipment to be used in the tests.

Step 4: Measure the far-to-near loss of each trunk by connecting each trunk to the 1MW test line at the terminating office (see Fig. 1). Record the measurements (column 3, Chart A).

Step 5: Compute the far-to-near deviation of each trunk (column 3 minus column 2, Chart A). Record the deviations (column 4, Chart A).

Step 6: Select a reference trunk (see Paragraph 4.02) and record the measured far-to-near loss of this trunk (column 6, Chart A for all trunks except the reference trunk itself).

Step 7: Connect the reference trunk to the first appearance of the loop-around test line at the terminating office (see Fig. 2).

Step 8: Connect the trunk to be tested to the second appearance of the loop-around test line at the terminating office (see Fig. 2).

Step 9: Send 1000 cps (1MW) on the trunk under test and measure the loss on the reference trunk (see Fig. 2). Record this loop-around loss (column 5, Chart A).

Step 10: Repeat Steps 8 and 9 on the other trunks to be tested.

Step 11: Recheck periodically the far-to-near loss of the reference trunk (see Paragraph 4.02).

Step 12: Compute the near-to-far loss (column 7, Chart A) and the deviation (column 8, Chart A) for each trunk.

Step 13: Select a second reference trunk and connect it and the original reference trunk to the loop-around equipment.

Step 14: Send 1000 cps (1MW) on the original reference trunk and measure the loop-around loss on the second reference trunk. Record this loss.

Step 15: Compute the near-to-far loss and the deviation of the original reference trunk.

SHEET__ OF__

LOOP-AROUND TRANSMISSION TESTS

ORIGINATING (NEAR) OFFICE: Alpha
TERMINATING (FAR) OFFICE: Beta
TYPE OF TRUNK: Toll Switch

DATE:_____
TIME:_____
TESTER:_____

TRUNK NUMBER	EXPECTED MEASURED LOSS DB	FAR-TO-NEAR DIRECTION		MEASURED LOOP-AROUND LOSS DB	MEASURED FAR-TO-NEAR LOSS OF REFERENCE TRUNK DB	NEAR-TO-FAR DIRECTION	
		ACTUAL MEASURED LOSS DB	DEVIATION (3)-(2)=(4) DB			ACTUAL MEASURED LOSS (5)-(6)=(7) DB	DEVIATION (7)-(2)=(8) DB
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	3.0	2.9	−0.1	7.4	3.3	4.1	+1.1
2	3.0	2.6	−0.4	7.1	3.3	3.8	+0.8
3	3.0	2.5	−0.5	6.3	3.3	3.0	+0.3
4	3.0	2.6**	−0.4	6.8	3.3	3.5	+0.5
5	3.0	2.7	−0.3	7.5	3.3	4.2	+1.2
6	3.0	4.0	+1.0	6.1	3.3	2.8	−0.2
7	3.0	4.9	+1.9	7.0	3.3	3.7	+0.7
8	3.0	3.3*	+0.3	6.4	2.6	3.8	+0.8
9	3.0	6.3	+3.3	6.0	3.3	2.7	−0.3
10	3.0	2.7	−0.3	9.2	3.3	5.9	+2.9
11	3.0	2.8	−0.2	6.3	3.3	3.0	0.0
12	3.0	1.4	−1.6	5.1	3.3	1.8	−1.2

* USED AS REFERENCE TRUNK FOR NEAR-TO-FAR MEASUREMENTS.

** USED AS REFERENCE TRUNK FOR NEAR-TO-FAR MEASUREMENT OF ORIGINAL REFERENCE TRUNK.

LOOP-AROUND TRANSMISSION TESTS

ORIGINATING (NEAR) OFFICE:_____ DATE:_____
TERMINATING (FAR) OFFICE:_____ TIME:_____
TYPE OF TRUNK:_____ TESTER:_____

TRUNK NUMBER	EXPECTED MEASURED LOSS DB	FAR-TO-NEAR DIRECTION		MEASURED LOOP-AROUND LOSS DB	MEASURED FAR-TO-NEAR LOSS OF REFERENCE TRUNK DB	NEAR-TO-FAR DIRECTION	
		ACTUAL MEASURED LOSS DB	DEVIATION (3)-(2)=(4) DB			ACTUAL MEASURED LOSS (5)-(6)=(7) DB	DEVIATION (7)-(2)=(8) DB
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

* USED AS REFERENCE TRUNK FOR NEAR-TO-FAR MEASUREMENTS.

** USED AS REFERENCE TRUNK FOR NEAR-TO-FAR MEASUREMENT OF ORIGINAL REFERENCE TRUNK.