

GENERAL TESTING METHODS

1. GENERAL

- 1.01 This section describes the general methods which are used in making transmission tests on the exchange area circuits and equipment associated with local and toll offices in manual, step-by-step and panel areas.
- 1.02 The following general information refers to the application of the detailed testing methods which are specified in Division K2 covering the circuits and equipment associated with local and toll offices in manual and dial areas:
- 1.03 The tests specified are to be made on the circuits in the normal talking conditions. On circuits designed for more than one arrangement of the apparatus in the talking condition, tests are specified for each arrangement.
- 1.04 Whenever it is necessary to make repairs or replacements in connection with the testing work, the tests should be repeated after the repairs or replacements have been made to be sure that the circuits contain no other troubles which would manifest themselves only after certain troubles have been cleared.
- 1.05 The testers should be familiar with any arrangements which should be made with the Wire Chief in regard to the clearing of trouble.
- 1.06 Testers should also be familiar with the transmission loss information for the circuits being tested.
- 1.07 The testers should be familiar with the operation of the central office circuits and also the testing apparatus which should always be kept in good condition.
- 1.08 Testers should be familiar with any arrangements which should be made with the traffic people as to the light load periods of certain circuits which should only be tested at these times.
- 1.09 In order to facilitate the testing work some of the prescribed methods involve the use of certain circuits other than the particular ones to be tested, for example, in some loop tests switchboard cord circuits are used for looping while in testing certain step-by-step trunks, local connector circuits are involved as the method specifies connecting the testing apparatus to vacant connector terminals. Since more than one connector has access

to the assigned vacant connector terminals, it is suggested that all of the connectors in the office be tested before proceeding with tests of the trunk circuits.

- 1.10 Where these other circuits are used in the testing work as outlined in paragraph 1.09 proper allowance should be made for the additional transmission loss which they introduce.
- 1.11 In connection with the use of vacant selector terminals in the testing work as mentioned in paragraph 1.09, it is advisable that, if possible, selector terminals be used that have been out of service for some time. It is suggested, therefore, that in selecting these terminals a check be made with the assignment clerk to determine which vacant connector terminals have been on intercept for some time.

2. TRANSMISSION TEST METHODS

- 2.01 Overall measurements of trunks and lines are generally made from office to office either on a loop or straightaway basis, as discussed in later paragraphs.
- 2.02 Where the measuring sets provide various impedance terminations, care should be taken to see that the proper termination is used to correspond with the impedance conditions at the terminals of the circuit being measured. Corrections to measurements should be applied in accordance with the instructions pertaining to the transmission measuring sets used.
- 2.03 Where the measuring conditions are such as to allow either straightaway or loop measuring, the one should be used which permits the work to be done most efficiently. For example, where groups of trunks or lines are involved between manual offices or between a manual and a dial office, loop measurements can probably be made to the best advantage since the operator at the distant office can be employed to loop the circuits. Where less than three trunks or lines are involved between these offices, straightaway measurements will be required unless some other circuits can be made available to permit the tests being made on a loop basis.

(a) Loop Transmission Measurements

- 2.04 This method of measuring requires two circuits which are looped together at the distant end. The measurement thus made

SECTION K20.01

includes the transmission loss of the two circuits and that of the looping circuit.

- 2.05 The transmission loss of one of these circuits should be determined so that the remaining circuits of the group under test may be looped with this circuit. This circuit will be referred to as the standard or test circuit and its transmission loss determined as outlined below under (a₁).
- 2.06 Where loops are established for trunk testing, it will facilitate the computation work if trunks of similar makeup are used wherever this is practicable. Otherwise, proper allowance should be made for any reflection losses or gains, as the case may be.
- 2.07 When circuits are looped with the standard or test circuit at the distant end, the looping should be done at a position of the switchboard that will include any multiples of the circuit under test.
- 2.08 The looping of circuits may be done with either a double-ended (patching) cord, the sleeves of which should be equipped in the same manner as the sleeves of the cord circuits normally used with the circuits under test, or a regular switchboard cord circuit which should be known to be in good condition and proper allowance made for its loss.
- 2.09 To facilitate the work when testing trunks or lines, both ends of which are not available at the testing point, such as interoffice trunks, it will often be necessary to establish a talking circuit between the tester and an assistant at the distant end by using nearby telephones or, where facilities are available, a trunk connection to the (TEL jack) auxiliary test unit.
- 2.10 It is more convenient to hold the standard or test circuit after making a loop test, so that succeeding circuits to be tested may be readily looped with the standard or test circuit. In some cases it is not practicable to hold the standard or test circuit, due to the design of the particular circuit under test, or the testing method. In these cases it will be necessary to release the standard or test circuit after each test and reestablish it for succeeding tests. This matter is covered in detail throughout the various sections.
- 2.11 In order to facilitate the testing work, an arrangement of keys, jacks and coils is necessary and is referred to throughout this division as an auxiliary test unit. The holding coils of this unit remain connected to the transmission measuring set while the circuit is being tested and as the transmis-

sion loss of the coils is very small, it may be disregarded.

- 2.12 Loop measurements are usually made at a frequency of 1,000 cycles. The methods of making the measurements, however, would be the same in case it is desired, for special investigation, to make measurements at other frequencies.

(a₁) Triangulation Measurements

- 2.13 Where circuits are looped in measurement work, it is necessary to know the transmission loss of the circuit which is used as a standard in order to determine the loss of the circuit under test, since the measurement includes the combined losses of the two circuits which are looped together at the distant end.
- 2.14 To determine the loss of the circuit used as standard, it is necessary that two other circuits be employed and that loop measurements between the three circuits be made and equations set up for these loop values.
- 2.15 The following method may be used to calculate the loss of any one circuit, A, B and C being used to designate the circuits involved.
- (1) Measure the loop loss of circuits A and B, of circuits B and C, and of circuits A and C.
 - (2) Add together the sum of the three loop losses.
 - (3) Divide this sum by two to obtain the sum of the individual losses of the three circuits.
 - (4) Subtract from this sum the measurement taken under (a) which does not include the circuit whose loss is desired.
 - (5) Thus, if it is desired to find the loss of circuit A, the following equation may be used.

$$A = \frac{(A + B) + (B + C) + (A + C)}{2} - (B + C)$$

or

$$A = (A + B + C) - (B + C)$$

- (6) Similarly, the values of B and C can be determined using the value of A as follows:

$$B = (A + B) - A$$

and

$$C = (A + C) - A$$

(b) Straightaway Transmission Measurements

- 2.16 Straightaway transmission measuring is the method of determining the loss of a circuit

by means of applying standard testing power at one end of a circuit and measuring the received testing power at the other end of the circuit.

- 2.17 The straightaway method requires two testers, each equipped with an oscillator and a "meter" type transmission measuring set.
- 2.18 In making straightaway measurements it is very important that the testing power and frequency at each end of the circuit be exactly the same otherwise errors will be introduced into the results obtained.

2.19 The measurements are usually made at a frequency of 1,000 cycles. The methods of making the measurements, however, would be the same in cases where it is desired for special investigations to make measurements at other frequencies.

2.20 In order to facilitate these measurements it may be desirable to establish a communication circuit between the sending and receiving terminals of the circuit under test. It may be convenient, however, to use the circuits being measured as the means for communication.