

TOLL SYSTEMS
A2 (40.8-KILOBIT) DATA TRANSMISSION SYSTEM
TROUBLE LOCATION

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1. GENERAL

1.01 This section covers trouble-locating procedures for a 40.8-kilobit data transmission circuit. The procedures are essentially the same for different types of circuits including interexchange and switched circuits, and circuits which provide alternate use of 12 voice channels, or one wideband channel with an associated voice coordination channel.

1.02 Troubles that activate audible and visible station alarms are located and cleared by following regular office procedures and procedures covered in other Bell System Practices. Troubles that do not activate office alarms but are reported by the wideband data customer are located under the direction of the *wideband circuit control office and serving test centers*.

1.03 The trouble report might include information which proves helpful in locating the trouble, but in most cases, end-to-end tests and sectional tests are necessary in order to isolate the trouble.

1.04 The suggested general procedure for locating and clearing trouble is given below.

- (1) The wideband circuit control office verifies that the circuit is in trouble.
- (2) After verification that the circuit is in trouble, the wideband circuit control office directs the tests necessary to isolate the trouble to a particular section (or sections) of the circuit.

(3) After the trouble is isolated to a particular section, the section control office directs the tests to determine the cause of the trouble. Corrective procedures, also under the direction of the section control office, are then initiated as covered in the 314-605-500 through 314-605-507 series of practices.

(4) If, after all test procedures have been applied and the customer still reports trouble, engineering assistance should be requested through normal channels. At the time the request is made, all documented test information should be available for use by the engineer.

(5) After the trouble is cleared, the wideband circuit control office directs digital error-rate tests to check the overall circuit to verify that the trouble has been cleared.

(6) Prior to turning the circuit back to the customer, the wideband circuit control office requests the customer to check the overall operation.

1.05 The general procedures and references used to isolate and clear trouble in the wideband data circuit are shown in Fig. 1, 2, and 3. Trouble-locating procedures for the vf coordination circuit are prescribed in the BSP's covering private lines.

2. TROUBLE-LOCATING PROCEDURES

A. General

2.01 Typical facilities between customer locations are shown in Fig. 4. Both looping and one-way testing arrangements are shown. The arrangements are used, as required, to isolate a trouble to a particular section or portion of the circuit.

2.02 In general, a complete failure of the system can be located by net-gain tests at 30.6 kc on a looped-back basis between the serving central office and the customer's premises at each end of

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the system. If the local loops are not in trouble, one-way net gain tests are made between wideband service bays (WSB's), starting at the serving central office at one end of the system and continuing through to the other end until the section in trouble is located. The control office for that section directs the procedures for further isolation and clearing of the trouble. If no sections are in trouble, the data sets should be checked.

2.03 For troubles other than a complete failure, digital error-rate tests are made on a looped-back basis between the terminating offices and the customer's premises while one-way tests for each direction of transmission are conducted between each serving test center. This procedure either eliminates the customer loops as the source of trouble (while confining the trouble to some portion of the system between end-office WSB's), or it locates one of the two customer loops as the source of trouble. If loop trouble is indicated, the section control office for that loop directs the procedures for further testing using the 314-640-series of practices. If the wideband customer loops are trouble free, the wideband circuit control office directs procedures for further sectionalizing the trouble. In this case, digital error-rate tests are performed between WSB's at the end offices and an intermediate office. Further sectionalizing will isolate the section in trouble, and the control office for that section will direct further tests. If no sections are found to be in trouble, the data sets should be checked and replaced, if necessary.

B. Local Loop Tests

2.04 In the case of reported troubles, the general procedure is as follows:

- (1) The customer is requested to check his own equipment at both ends of the circuit excluding data set 301B.
- (2) If the customer's equipment is operating satisfactorily, the customer is requested to operate the LINE-TEST key on data auxiliary set 803A2 to the TEST position at both ends of the circuit. The customer then makes test transmissions through data set 301B connected on a back-to-back basis through the 803A().

Caution: *Make certain that the customer's loop is opened at the serving central office WSB before requesting the customer to operate the LINE-TEST key on DAS 803A() to the TEST position. If the loop is not opened at the WSB, a loop sing can occur.*

Note: Some business machines do not have the capability of sending to themselves. If further tests so indicate, it may be necessary to check the data set at the customer's premises.

- (3) If both the customer's equipment and the data set 301B are operating satisfactorily, the gain should be checked on a looped-back basis by applying a 30.6-kc tone to the receiving side of the customer's loop and measuring the signal power returned to the WSB over the transmitting side of the customer's loop. Since the signal powers are standardized at $-10.0 \text{ dbm} \pm 0.25 \text{ db}$ at the WSB, any deviation from normal indicates loop trouble.

Note: Where loop trouble is indicated, refer to Section 314-640-500.

- (4) If the gain of the loop appears normal, the error rate should be measured with the circuit still looped at the 803A2. Data set 301B and the 900-series data test sets are employed. The signal can also be observed on an oscilloscope connected at the monitor jacks at the WSB, and the waveforms compared with photographs of normal signal waveforms. See Section 314-605-507.
- (5) If the error rate is excessive, localization of the trouble in the customer's loop is accomplished by looping the intermediate repeaters as described in Section 314-640-500. The digital error rate for each portion of the loop is checked using previously determined error rate as an index of performance as covered in Section 314-605-300.
- (6) If the error rate of the wideband customer's loop is acceptable, both the section and the wideband circuit control office are notified.

C. Sectional Tests

2.05 Sectional testing is performed under the direction of the wideband circuit control office until the section in trouble is located. The control office for that section then directs the procedures for locating and clearing trouble in that section.

2.06 Sectional tests may be made while similar tests are being made on local loops. Such tests include gain tests and digital error-rate tests between end offices, between each end office and an intermediate office, and between intermediate offices.

2.07 Tests are coordinated so that tests of any section can be discontinued as soon as a trouble is isolated to a particular section.

2.08 One-way digital error-rate tests for each direction of transmission are performed first to locate the trouble. Noise, gain-frequency, cross-talk, and delay-distortion tests are then made, as required, to further isolate the trouble and to determine the cause of the trouble. The actual tests, and the order in which the tests are made will be directed by the section control office.

2.09 When the trouble is located and cleared, the wideband circuit control office then directs the procedure for testing the complete circuit by making digital error-rate measurements before turning the circuit back to the customer.

2.10 The customer is then requested to check the overall system operation.

3. PRECAUTIONS

3.01 Absence of signal power in local loops can cause the wideband loop repeaters (which regulate on a total-power basis) to increase gain. When the overall gain exceeds the near-end cross-talk coupling loss, the circuit will oscillate at a discrete frequency and the repeaters will regulate on the power of this singing frequency. Care must be taken when performing tests on local loops to prevent this condition in order to avoid interference or service interruption to other services.

3.02 Trouble can occur in equipment which is common to both the wideband data customer and other customer services. Certain troubles, such as loss of pilot, or changes in pilot signal level in L-type multiplex systems, or complete or partial failure in certain units of both N and L carrier facilities, can affect the overall system gain and result in interference with other services. All precautions should be taken to avoid loss hits or disruption of service to other customers. When such troubles are encountered, the restoration procedures are to be performed only under the direction of the wideband circuit control office.

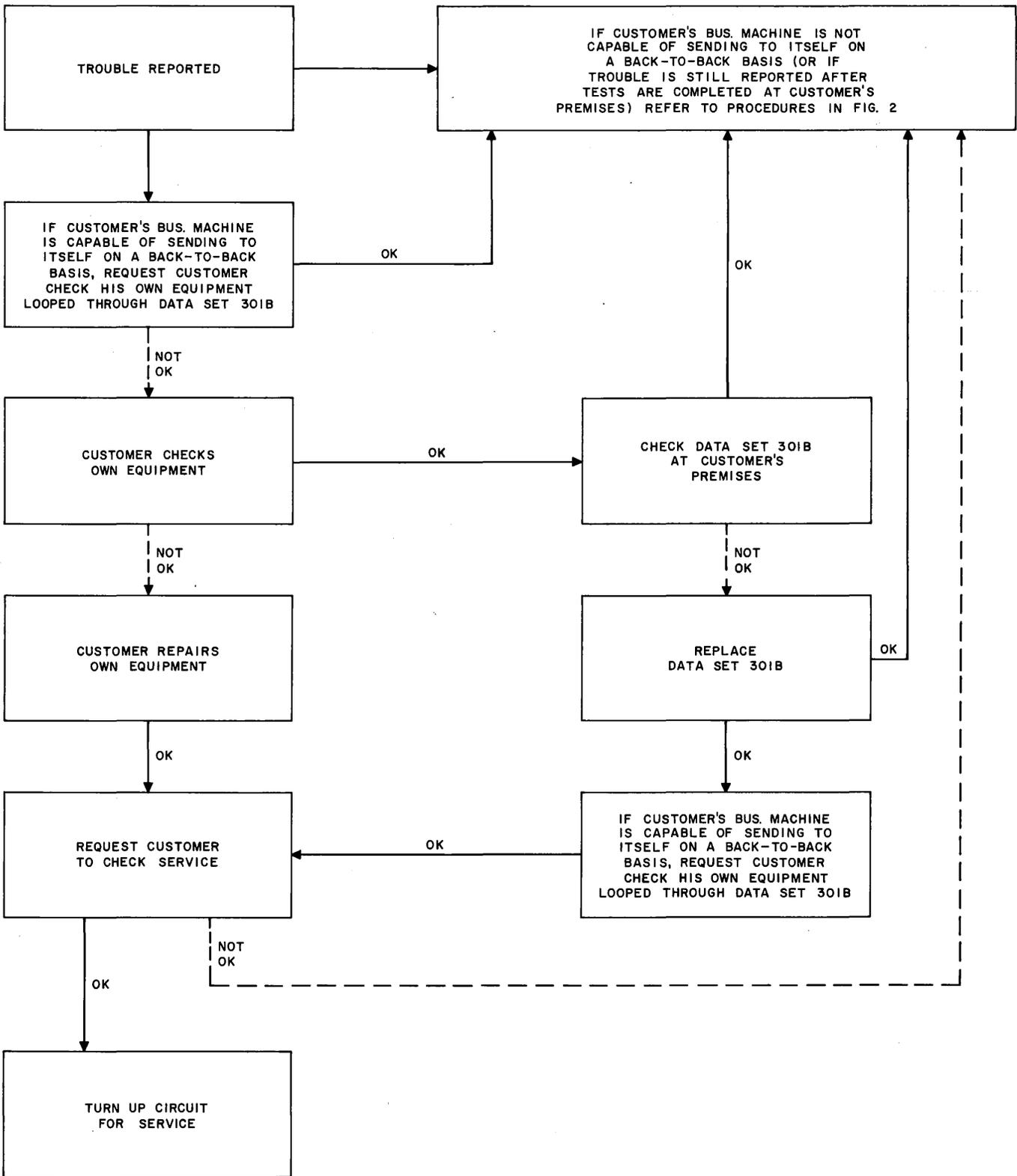


Fig. 1 — Preliminary Trouble-Location Procedure

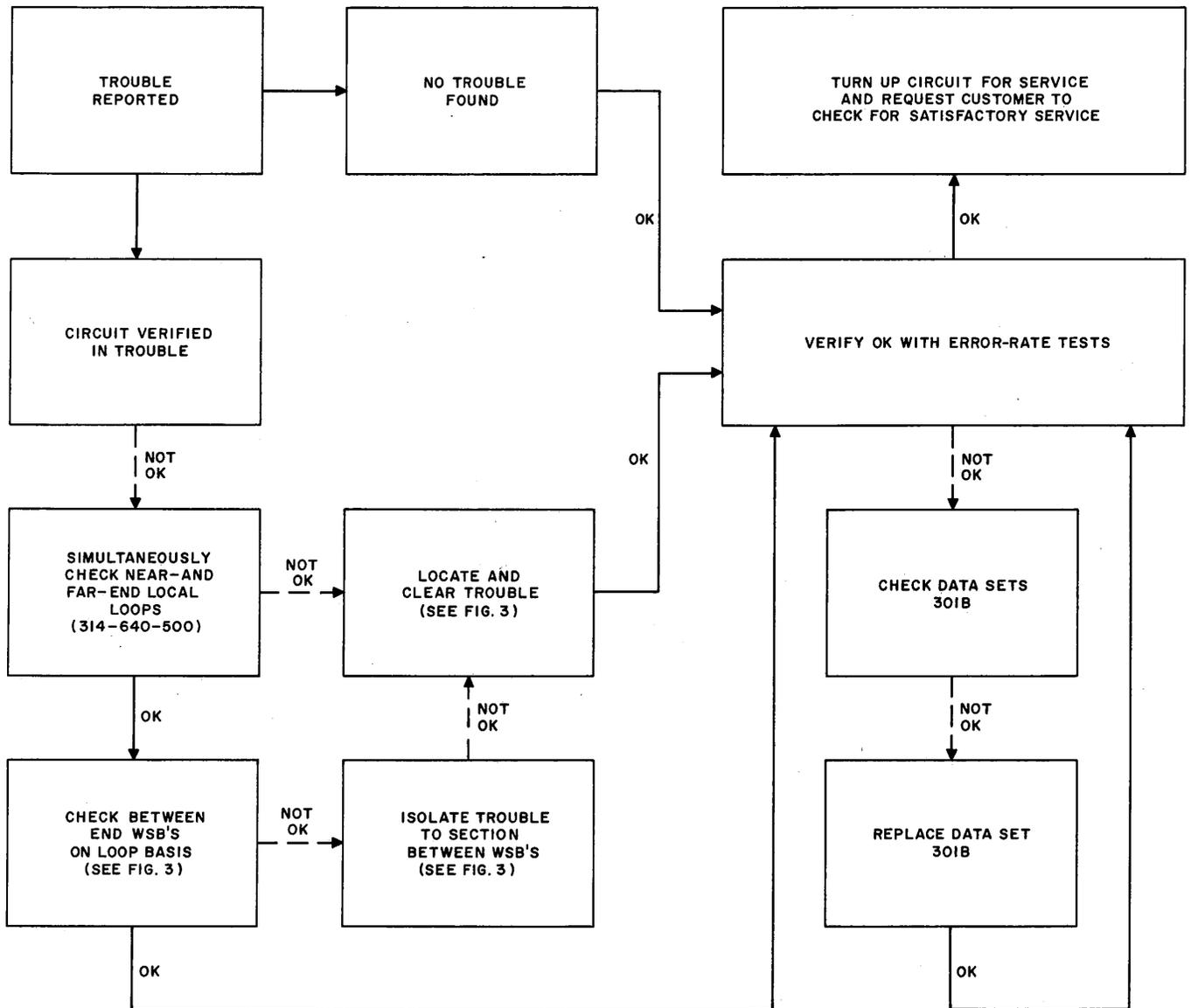


Fig. 2 — General Trouble-Location Procedure

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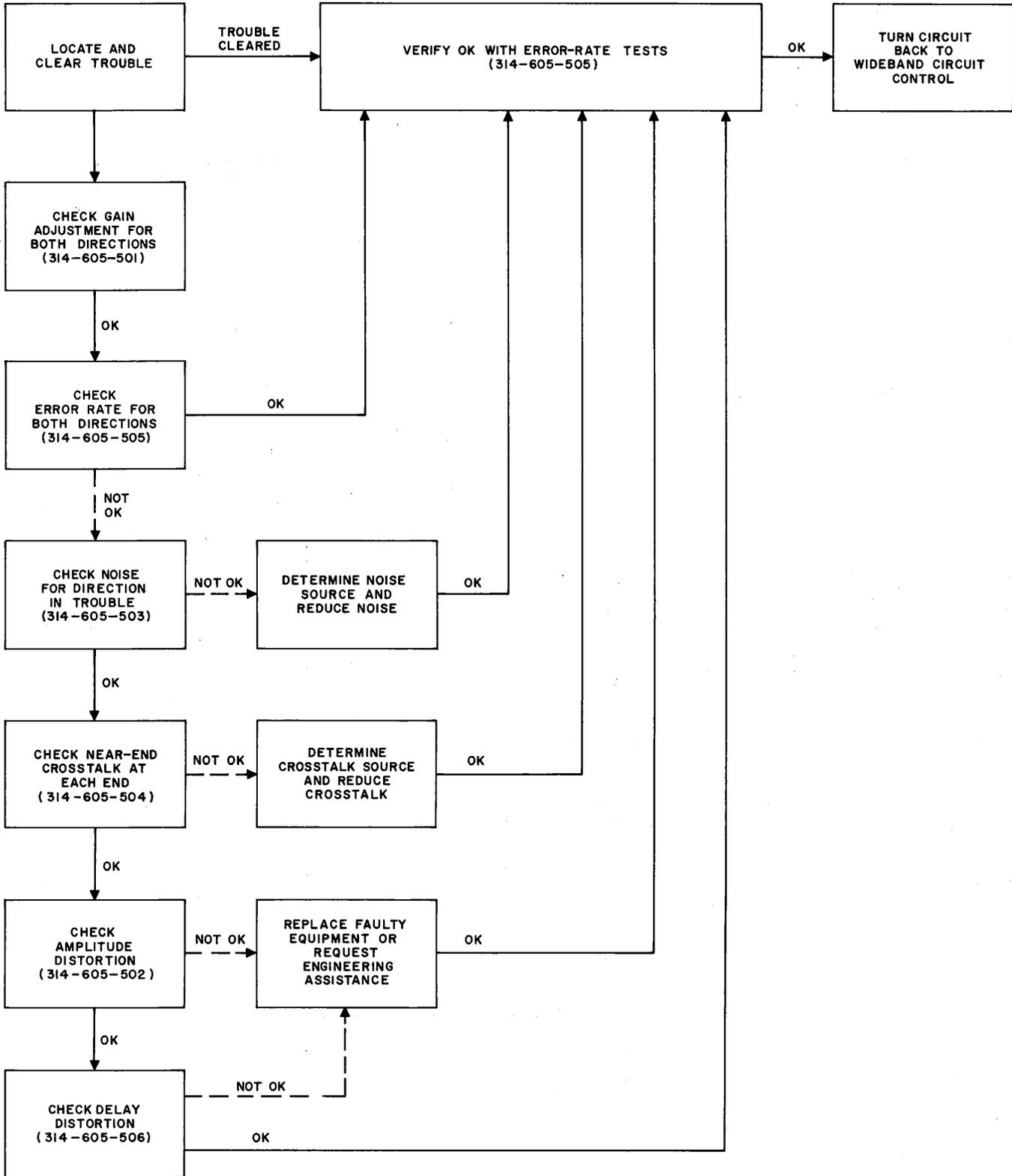
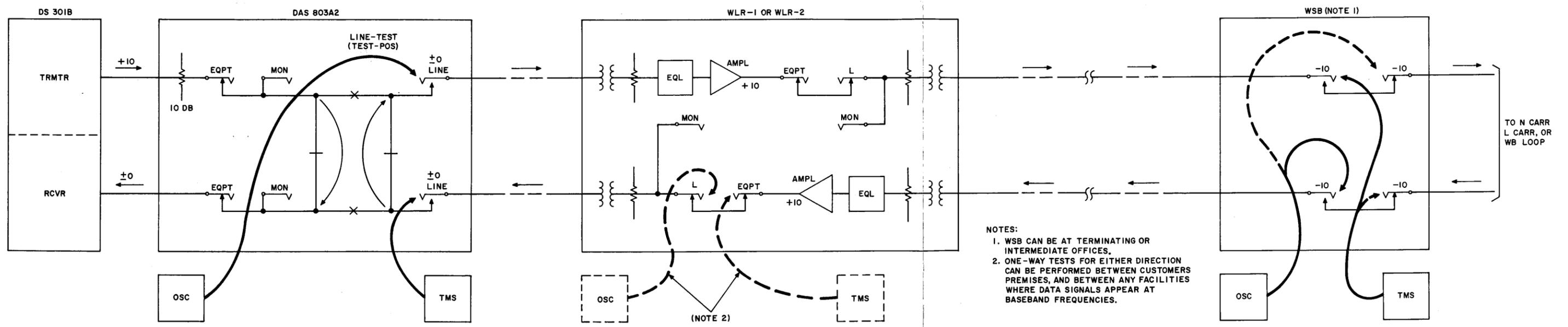
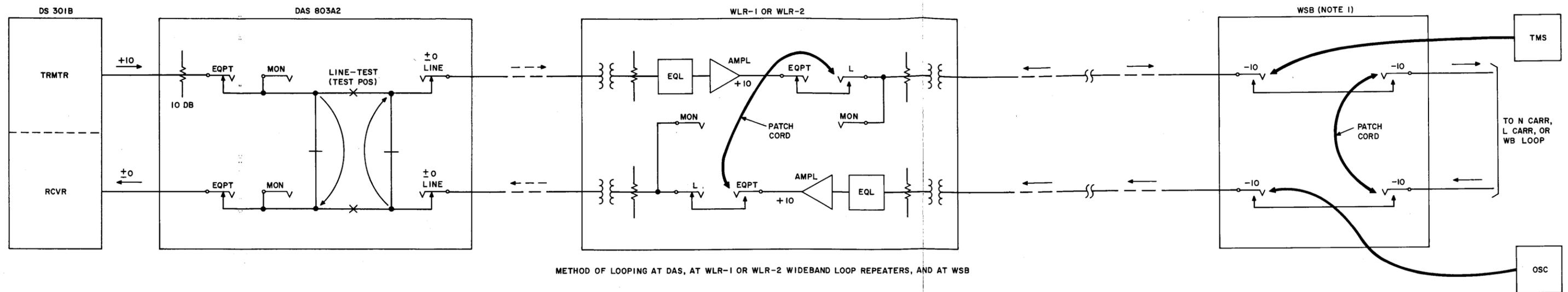


Fig. 3 — Detailed Trouble-Location Procedure



- NOTES:
1. WSB CAN BE AT TERMINATING OR INTERMEDIATE OFFICES.
 2. ONE-WAY TESTS FOR EITHER DIRECTION CAN BE PERFORMED BETWEEN CUSTOMERS PREMISES, AND BETWEEN ANY FACILITIES WHERE DATA SIGNALS APPEAR AT BASEBAND FREQUENCIES.

Fig. 4—Typical Looping and One-Way Testing Arrangements