

HALF-GROUPBAND DATA SYSTEMS

2-POINT PRIVATE LINE

LINEUP OBJECTIVES AND TROUBLE LOCATION

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Since this reissue constitutes a general revision, arrows normally used to show changes have been omitted.

1.03 The initial lineup of the wideband data channel will require use of the voice frequency coordination channel (VFCC) as order wires during the lineup procedure. It is necessary then to line up the VFCCs in advance of the wideband data channels. The lineup of the VFCC uses the same procedures as those used in the lineup of a standard voice frequency message channel or the PBX message lines provided as part of the half-group service. Private line sections cover the lineup procedures for the voice-frequency circuits.

1.04 The initial lineup of wideband customer loops using the WLR-5 repeaters is covered in Section 314-643-300. The initial adjustment and lineup procedures for L-type multiplex, L-type modems, N carrier, and T carrier equipment which may be employed in half-groupband data circuits are covered in the series of practices as follows:

1. GENERAL

1.01 This section provides the lineup objectives and trouble location information for half-groupband data systems carrying the line signals of data set 303B () or 303H () or from customer-owned and -maintained facsimile equipment. The transmission system described in Section 314-608-100 is used as an example of 2-point private line service.

1.02 This section is reissued:

- (a) To provide current transmission objectives for half-groupband data systems
- (b) To provide trouble location information previously contained in Section 314-608-301.

SECTION	TITLE
356-400-500	40-KC Wideband Transmission System—Level Tests and Alignment
356-410-500	L-Type Multiplex 16-kHz Wideband Transmission System—Signal Level Tests and Alignment
362-800-300	Type N2 Carrier Telephone System—Overall System—Initial Line-Up and Maintenance Tests
362-811-501	N2 Carrier Telephone System—N2WM-1 Wideband Modem (10 to 51 KC)—Initial Line-Up Procedure
365-100-300	T1 Carrier System Terminal (D1 Bank)—Initial Line-Up and Maintenance Tests

SECTION 314-608-300

SECTION	TITLE
365-104-500	Digital Transmission Systems—D1 Bank—Initial Line-Up and Adjustments
365-105-500	Digital Transmission Systems—D1 Bank—Overall System Line-Up
365-115-500	Digital Transmission Systems—Terminal (D1 Bank)—Channel Unit Test and Adjustments
365-118-501	Digital Transmission Systems—T1WB-1 and T1WB-2 Wideband Banks—Line-Up and Adjustments
365-119-501	Digital Transmission Systems—T1WM-1 Wideband Modem—Line-Up and Adjustments
365-200-300	T1 Carrier System—Repeatered Line—Initial Line-Up and Maintenance Tests

1.05 The half-groupband, 2-point private line wideband transmission service contains facilities which are dedicated for use between two data stations. This service may contain or consist of several types of wideband facilities which pass through several offices.

2. CONTROL OFFICE FUNCTIONS

2.01 One office through which the 2-point private line passes is designated the circuit control office (CCO) for the private line service. This office is responsible for coordination of all testing and maintenance activity on the private line. The office to which each station is connected is designated the serving test center (STC) for that data station. This office is responsible for tests of the station line and local and remote tests of the data station. Each STC assumes control over lineup, testing, and maintenance of a station line or interexchange facility as directed by the circuit control office.

2.02 The CCO verifies that the test requirements given in Section 314-608-500 are met at the time of initial lineup and during maintenance periods.

2.03 When the data system or channel has met all transmission requirements, the recorded results should be filed for future reference in

comparing subsequent test results. If in the subsequent measurements the results obtained differ appreciably from those recorded during initial testing, an investigation should be made to locate the cause of the difference.

Note: If any one or more of the requirements cannot be met, special considerations are necessary and the network or circuit control office should request assistance from transmission engineering personnel who engineered the circuit. The system should not be turned up for service if any objective is not met (even though it may seem to pass acceptable data) unless special permission is obtained from the transmission engineer.

2.04 A transmission measurements form should be provided for use in recording measurement results by the CCO and each STC. A typical form which can be used is shown in Fig. 1. This form will not be a standard stock item. Copies of this form can be obtained by reproducing locally as required. The form lists the various measurements to be made and provides blocks of spaces used for recording measurement results obtained for each direction of transmission. Any additional information which may be helpful in maintaining the wideband service should also be recorded on the form.

3. LINEUP CONSIDERATIONS AND OBJECTIVES

A. General

3.01 Lineup and maintenance tests are always made on an out-of-service basis. The lineup of any wideband facility should begin with gain measurements. Subsequent measurements such as noise, envelope delay, etc, may be performed in any order. However, if as a result of these subsequent tests the facility must be modified in any way in order to meet a requirement, the gain measurements and all other prior measurements should be performed again.

3.02 There may be some wideband subscriber lines consisting of T1 carrier facilities. When this condition exists, only noise measurements may be made on the facility. Level measurements are to be made on the T1 carrier facility using the procedures described in the 365-YYY-ZZZ series of practices.

B. Transmission Objectives

3.03 Transmission objectives for interexchange facilities and station lines for 2-point private line half-group data service are given in Table A. These objectives represent the criteria needed to insure that the overall transmission circuit parameters are satisfactory for data transmission. The objectives listed in Table A are those which most trouble-free facilities will pass and are not intended to be absolute requirements. In addition, the values in Table A show the case in which passband frequencies are tested at the wideband service bay (WSB). In some instances, baseband frequencies may be tested at the WSB in which case the same value of objectives will apply but the gain-frequency measurement will be made at 9.6 kHz.

C. 2-Point Private Line

3.04 The half-groupband, 2-point private line can be composed of several types of wideband facilities as shown in the block diagram of Fig. 2. This figure shows one direction of transmission of a typical half-group data circuit consisting of wideband loops, N carrier, and L-type multiplex facilities connected together at wideband service bays. The transmission circuit is connected to data sets 303B() through data auxiliary sets 806B(). This figure also shows the division into the station line and interexchange facilities.

3.05 Although not shown in Fig. 2, the half-group data service can be furnished on an alternate use basis where L-multiplex is involved. This provides the customer, at his option, the use of the entire groupband circuit as two half-group wideband data channels, or one half-group wideband data channel and six voice frequency channels, or twelve voice frequency circuits with no wideband data channel. In all cases a voice frequency coordination channel is provided for each half-group wideband data channel in addition to the normal voice circuits. Six voice frequency channels may be used alternately in place of a half-group wideband data channel. Tests on the wideband data channel must necessarily be made in the data mode while tests on the voice frequency circuits must be made in the voice mode.

3.06 For lineup purposes, the 2-point private line is divided at the serving test centers. The wideband line between the serving test center and the data station is called the station line and should

meet the test objectives for a station line given in Table A. The wideband line between serving test centers is called an interexchange facility and should meet the test objectives for an interexchange facility given in the same table.

3.07 The general procedure used in initial lineup is given in (a) through (g). The results of all tests and measurements, both one-way and looped, should be recorded after each step of alignment is completed. As the lineup proceeds, any refinements which result in different measurement values should be noted and the new measurement value recorded. It is important that the wideband circuit control office be supplied a reference copy of the final results of all tests and measurements.

- (a) Perform gain adjustments for each individual section of the circuit (between WSBs) and also the wideband loop between each serving test center and data auxiliary set 806B().
- (b) Perform the transmission measurement tests on each individual section, including the wideband loops.
- (c) Perform the gain adjustment for the overall circuit between serving test centers.
- (d) Perform the gain adjustment for the overall circuit between data sets 303B().
- (e) Perform the transmission measurement tests on the overall circuit between data sets 303B().
- (f) If all gain and measurement test objectives have been met, turn the circuit up for service and turn the wideband circuit over to the customer for system tests.
- (g) If any gain or measurement objective is not met, refer the problem to the transmission engineer.

4. TROUBLE LOCATION

A. General

4.01 The instructions given in this part are used to locate a trouble condition by sectionalizing the data and voice circuits into the wideband subscriber or station lines, the data sets, and the wideband trunks or interexchange facility. The

TABLE A
TRANSMISSION OBJECTIVES
HALF-GROUP BANDWIDTH DATA CIRCUIT
2-POINT PRIVATE LINE (NOTE 1)

MEASUREMENT		INTEREXCHANGE FACILITY	EACH STATION LINE
Relative envelope delay (Note 2)		SL 18.0 μ s SA 18.0 μ s P 25.0 μ s	SL 2.0 μ s SA 4.0 μ s P 6.0 μ s
Gain deviation (Note 2)		SL 3.5 dB SA 1.0 dB P 3.0 dB	SL 0.5 dB SA 0.5 dB P 2.0 dB
Standard measurement (6G with 10 to 51 kHz WTG)	Gaussian	54 dBm or less	46 dBm or less
	Impulse	6 counts/30 min	130 counts/30 min
Single-Frequency Interference (at -10 dB SL)		-37 dBm or less	-37 dBm or less
Digital error rate		6 errors/5 min	3 errors/5 min
Gain at 36 kHz		0 \pm 0.5 dB	(Note 3)

Notes:

1. This table applies only to signals in the 28- to 44-kHz passband which appear at the WSB at -10 dBm. The threshold setting for measurement of impulse noise is 5 dB below the signal level or 75 dBm in this case. Gain and delay objectives for half-group station lines correspond to those for group service. Station lines may also be engineered to appear at the WSB at 0 dBm in the 0- to 20-kHz baseband. In these cases, use the noise objectives for group station lines given in Section 314-609-310. Measurement of gain, delay, and noise are not applicable to T carrier baseband signals.
2. Values for SL, SA and P are obtained from results of transmission tests given in section 314-608-500.
3. Signals appear at 0 dBm at the data station and at -10 dBm at the WSB; thus there is a gain or loss of 10 dB in the station line depending upon the direction of transmission.

wideband subscriber lines or station lines are checked on a remote basis by following the procedures given in Section 314-608-500.

4.02 Transmission faults that activate office alarms which are both audible and visual are easily located and cleared by following established office procedures and procedures covered by other Bell System Practices. Faults that do not activate office alarms, but are reported by the data customer, require coordinated efforts of repair forces to ensure

that the trouble can be located and cleared in the most efficient manner.

4.03 The trouble report received from the customer or the report used during troubleshooting can be useful in determining what initial procedures are necessary to locate the trouble. Forms E4225 and E2545, titled Trouble Reports and Circuit Order Tests, respectively, are used for trouble calls on voice frequency channels. These trouble reports will generally relate to trouble that will usually fall into one of two categories: no data or voice

being received; or data being received but containing error rates or other impairments. Each category of trouble will require different steps in the initial fault-locating procedures. All details of the trouble report or reports should be documented and given equal consideration, even though some of the details may seem to be insignificant at the time of the trouble report. The trouble must be well defined before it can be located.

4.04 If the trouble still exists after all transmission objectives have been met and all dynamic tests are within limits, engineering assistance or the aid of an engineering data specialist should be requested. When the request is made, the documented trouble report or reports and all test information should be available for use by the engineer or data specialist.

4.05 When trouble in a particular section or portion of the data circuit has been isolated, additional tests are performed on that portion to determine the exact cause of the trouble condition.

4.06 When the exact cause of trouble has been located and appropriate corrective action taken, digital error rate tests are then made to verify that the trouble has been cleared on the wideband data channel. The customer or customers involved in the original trouble report should then be notified that the trouble has been cleared.

4.07 The following instructions are not intended to be directive, rather, they should provide examples of the general steps necessary for locating transmission circuit faults or deficiencies. The actual steps used should be those which can quickly locate and correct the trouble with a minimum of labor involved. It is possible that the trouble may exist in the customer business machine. However, it must be assumed that the customer has verified that his business machine is operating satisfactorily before initiating the trouble report.

B. Voice Channels

4.08 Voice circuit trouble should, in general, require that the circuit be released by the customer and removed from service. If the voice channel is distant but usable to one or more points, the 1000-Hz net loss tests described in Section 310-405-500 should be made. If the circuit fails but cannot be released, the following procedure may be used.

(a) Select an office to send 1000 cycles at the proper power level in the direction of the trouble. This office will generally be at one end of the main line circuit. Request other offices on the line to arrange their transmission measuring sets for gain level measurements on the line in trouble.

(b) The test tone should not be sent for more than 1 minute. The sending office should monitor the circuit during the test.

4.09 At the end of the release from service period, perform the following steps before restoring service to the customer.

(a) At the customer station, verify that all equipment is restored to its working condition.

(b) At the STC, verify that all test equipment, talking sets, and test terminations have been removed from all jacks.

(c) The STC should then notify the circuit control office that service is restored.

(d) The circuit control office then performs a continuity test of the circuit verifying restoration of service. Notify the customer control station that the circuit is now in service.

(e) The customer control station then notifies the customer that the trouble has been cleared.

C. Data Channels

4.10 Two possible circuit arrangements for a 2-point private line are shown in Fig. 3 and 4. Figure 3 shows a relatively simple 2-point private line with one STC which is also the circuit control office (CCO). Figure 4 shows a 2-point private line circuit with two STCs, one of which is the CCO.

4.11 The data transmission lines connecting the STC to the served wideband data station are called station lines. The data transmission channel which interconnects the two STCs is called an interexchange facility.

Note: Trouble can occur in equipment common to both the wideband data channel and the voice frequency channels. Certain troubles,

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such as loss of pilot or end-of-range in the automatic regulator circuit in the L-type multiplex systems, or complete or partial failure in certain units of N or L carrier facilities, can affect the overall system gain and result in voice or data channel failures. All precautions should be taken to avoid 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 or network control office.

4.12 For a 2-point private line, the customer will normally report trouble to personnel at his serving test center or private line testboard. If the 2-point private line has only one STC as shown in Fig. 3, the STC will test both station lines. However, if the 2-point private line contains two STCs, as shown in Fig. 4, the STC receiving the trouble report will notify the CCO so that this office can coordinate the work effort of the two WSBs at the STCs.

4.13 If a trouble is reported on a 2-point private line containing only one serving test center as shown in Fig. 3, the procedures in (a) through (e) should be followed.

(a) Perform the procedures given in Section 314-602-501 in order to associate the trouble with the data set or the station line. The procedures check the station line by making digital error rate tests over the line with the data set operating in the remote test 1 (RT 1) condition. If the station line passes this test, the data set is checked by placing the data set in the remote test 2 (RT 2) condition and making digital error rate tests over the line using the data set as a regenerative repeater. These tests should be relatively short go/no-go tests at first, intended for isolating trouble sources as rapidly as possible.

(b) If the data set is found to be the source of trouble, repair or replace the data set.

(c) If the station line is found to be the source of trouble, additional tests are performed as covered in Section 314-608-500 to determine the cause of trouble. These tests should be

performed in the following sequence until the cause of the trouble is found.

(1) Net Loss (36 kHz Passband or 9.6 kHz Baseband)

(2) Noise

(3) Gain Frequency

(4) Envelope Delay

(d) When the cause of trouble has been found and corrected, digital error rate tests should be performed to verify that the trouble has been cleared and that the data circuit is functioning normally.

(e) The circuit should then be restored to the data station and the customer or customers notified that the trouble has been cleared.

4.14 If the trouble is reported on a 2-point private line containing two STCs as shown in Fig. 4, the following procedures should be followed.

(a) Personnel at the STC receiving the trouble report will notify personnel at the CCO.

(b) Personnel at the CCO will direct craft employees at each STC and data station to perform the procedures in 4.13 in order to check the two station lines and data sets.

(c) If the trouble is not found in the station lines, the interexchange facility between the two STCs must be checked. The following tests should be performed in the sequence given until the cause of trouble in the interexchange facility is found.

(1) Net Loss at 36 kHz

(2) Noise

(3) Gain Frequency

(4) Envelope Delay

(d) When the cause of trouble has been found and corrected, digital error rate tests should be performed to verify that the trouble has been cleared and that the data circuit is functioning normally.

(e) The circuit should then be restored to the data station and the customer or customers should be notified that the trouble has been cleared.

CIRCUIT NO. _____ FROM _____ TO _____
 CONTROL OFFICE _____
 TEST CENTER _____ DATE _____ INITIALS _____

TEST	DIR	SECTION	RESULT		REQT		SECTION	RESULT		REQT		REMARKS
			GAIN	DELAY	GAIN	DELAY		GAIN	DELAY	GAIN	DELAY	
GAIN AT 36 KHZ	INC											
	OG											
9.6 KHZ	INC											
	OG											
4 KHZ	INC											
	OG											
6 KHZ	INC											
	OG											
8 KHZ	INC											
	OG											
12 KHZ	INC											
	OG											
14 KHZ	INC											
	OG											
16 KHZ	INC											
	OG											
18 KHZ	INC											
	OG											
20 KHZ	INC											
	OG											
28 KHZ	INC											
	OG											
30 KHZ	INC											
	OG											
32 KHZ	INC											
	OG											
34 KHZ	INC											
	OG											
36 KHZ	INC											
	OG											
38 KHZ	INC											
	OG											
40 KHZ	INC											
	OG											
42 KHZ	INC											
	OG											
44 KHZ	INC											
	OG											

TEST	DIR	SECTION	RESULT		REQT		SECTION	RESULT		REQT		REMARKS
			SA	SL	P	SA		SL	SA	SL	P	
NOISE	RMS	INC										
		OG										
	IMP	INC										
		OG										
SF INT	FREQ	INC										
		OG										
	FREQ	INC										
		OG										
CROSSTALK	INC											
	OG											
DIGITAL ERROR RATE	INC											
	OG											
RELATIVE ENVELOPE DELAY	INC											
	OG											
RELATIVE GAIN	INC											
	OG											

Fig. 1—Transmission Measurements Form

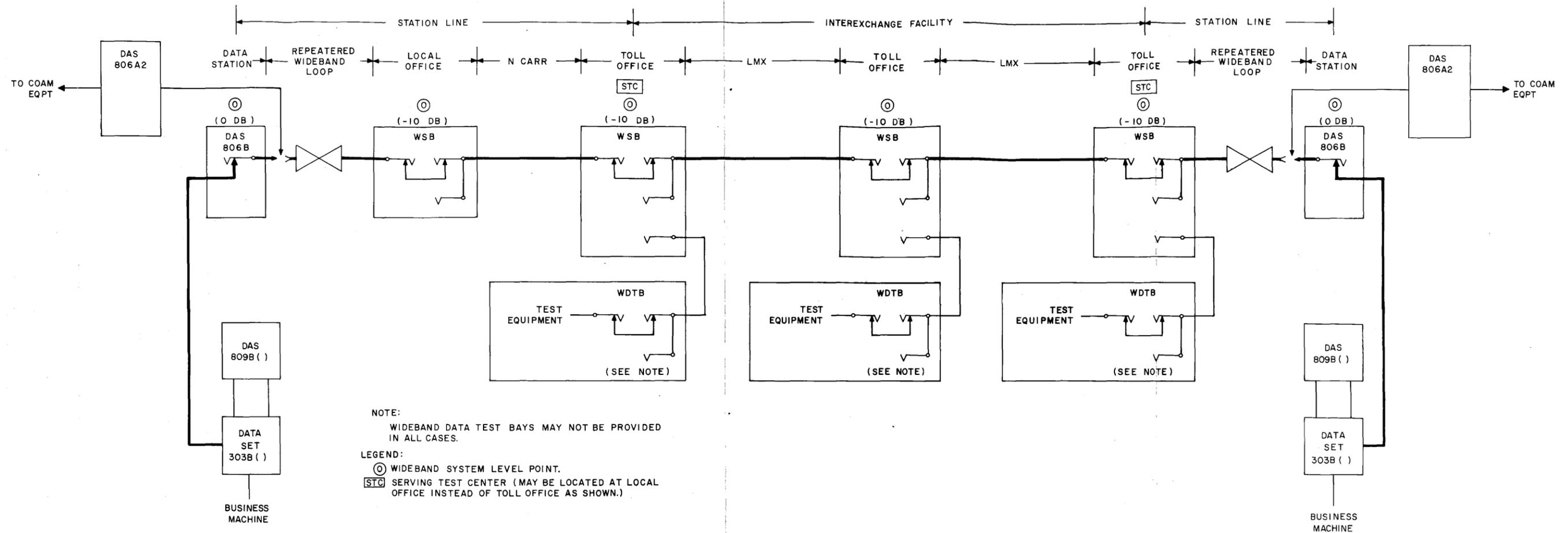


Fig. 2—Simplified Half-Groupband Data System—2-Point Private Line, Wideband Channel

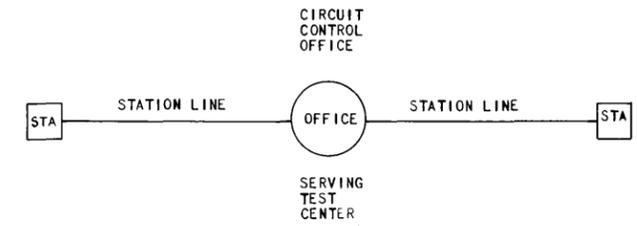


Fig. 3—Half-Groupband Service, No Interexchange Facility

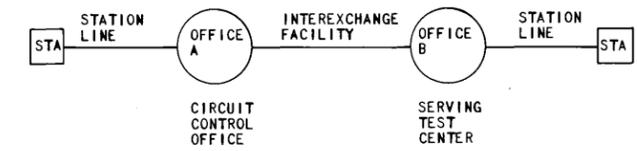


Fig. 4—Half-Groupband Service With Interexchange Facility