

**GROUPBAND DATA SYSTEMS (RESTORED POLAR)  
SWITCHED NETWORK AND 2-POINT PRIVATE LINE  
LINE-UP PROCEDURES**

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**1. GENERAL**

**1.01** This section outlines the procedures and considerations necessary for the line-up of groupband data channels carrying the line signals of the 303-type data set. These channels may either be part of a switched network or may be 2-point private lines. The model network, described in Section 314-609-110, is used in this section as an example of a switched network.

**1.02** Since the voice frequency coordination channels may be used as order wires during the line-up of the wideband data channels, these channels should be lined up in advance of the line-up of the wideband data channels. The line-up of the voice frequency coordination channels uses the same procedures as those used in the line-up of a standard voice frequency message channel.

**1.03** In a switched network, it is important that one office be responsible for the coordination of the line-up and testing of the system. The toll office at the network hub has been given this responsibility and designated as the **network control office**. The toll offices to which the wideband subscribers are connected via wideband subscriber lines are designated as **area control offices**. The line-up of the wideband subscriber lines is accomplished

by the area control office and the line-up results are forwarded to the network control office. The line-up of the network trunks is accomplished under the direct control of the network control office. The coordination and control of system line-up and testing by a single office is intended to help provide the wideband subscribers with service of uniform quality and help keep outage times to a minimum.

**1.04** The groupband, 2-point private line consists of the same types of wideband transmission facilities as those used in the switched network. However, in the 2-point private line application, the wideband facilities are dedicated for use between two data stations. The 2-point private line may consist of several types of wideband facilities which pass through several offices. One of these offices is designated as the **circuit control office** for the entire private line. An office near each end of the 2-point private line, which has the responsibility for line-up and maintenance of the station line to the customer and the customer data station, is designated as the **serving test center**. Each serving test center assumes control over line-up, testing, and maintenance of a station line or interexchange facility as directed by the circuit control office.

**1.05** The line-up results are to be submitted to the network or circuit control office. This control office should verify that the results meet the requirements as given in Table A or Table B, as applicable. When the data system or channel has met the requirements, the recorded results should be filed for future reference in comparing subsequent test results. If, in subsequent measurements, the results obtained differ appreciably from those recorded during initial line-up, an investigation should be made to locate the cause of the difference. ***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 requirement is not met (even though it may seem to pass acceptable data) unless special permission is obtained from transmission engineering.*

**1.06** A transmission measurements form is provided for recording results of measurements. This form is shown in Fig. 1. The form lists the measurements to be made and provides spaces for recording results of measurements in each direction of transmission for each section of a circuit having a test appearance at the office where the tests are conducted. Identification of the circuit and sections tested should be entered in the designated spaces. Any additional information helpful in the maintenance of high-quality wideband data transmission should also be entered on the form.

## 2. TEST EQUIPMENT

**2.01** The following test equipment, or equivalent, is required for the initial line-up of a groupband data channel. This equipment may be provided as part of the WSB or 915A wideband data test bay, or it may be furnished from another office for use in initial line-up. The test equipment should be calibrated before use in accordance with the sections or manuals covering the individual sets.

- **Hewlett-Packard E18-204B or E60-204B Test Set** (rack-mounted in the wideband service bay), consisting of HP204B oscillator, 353 patch panel, and 3400-DB voltmeter or the **Hewlett-Packard 3550A Test Set** (portable) consisting of HP204B oscillator, 353A patch panel, and 430-DB voltmeter. (The 403-DB voltmeter does not give a true rms indication, therefore noise measurements should not be made with this test set.)
- **Hewlett-Packard 11035A Cables** (furnished with the HP3550A test set).
- **6G Wideband Noise Measuring Set** (J94006G), equipped with the 10-to-50-kHz weighting network.
- **KS-15538, L5 Carrier Frequency Voltmeter** (Sierra)
- **X75947A Gain and Delay Transmitter**

- **X75947B Gain and Delay Receiver**
- **Hewlett-Packard 5233L Frequency Counter**
- **Data Test Set 912A**
- **Tektronix Oscilloscope RM561A**, equipped with two 2A63 amplifier units.
- **368B Terminating Plugs** (135 ohms)

**2.02** The HP E18-204B or E60-204B test set which is rack-mounted in the wideband service bay is preferred over the portable HP 3550A test set. The HP E18-204B or E60-204B has greater accuracy and its voltmeter gives a true rms indication which allows its use in random noise measurements.

**2.03** There are oscillators and voltmeters, other than those listed, which may be used when connected to the circuit through a suitable impedance matching device. These include the HP 200CD oscillator and HP 400L, HP 403B-DB, or HP 3400A-DB voltmeters. The use of these instruments will require the use of a 4142A network for proper impedance matching and circuit termination.

**2.04** The use of the E18-204B, E60-204B, or 3550A test set is recommended for gain measurements, because these sets include the patch panel providing impedance matching, attenuation, and a calibrate-measure feature.

**2.05** The calibration of the HP 5233L frequency counter may be quickly checked by measuring a known frequency, available in the office, such as the output of a pilot supply used in LMX facilities.

**2.06** The Tektronix oscilloscope with the two 2A63 amplifier units is required for use with the X75947A and X75947B gain and delay measuring equipment when a visual presentation of gain or delay is required. When a permanent record of the scope display is desired, a POLAROID® camera with oscilloscope attachment should also be provided. A suitable X-Y plotter may be used instead of the oscilloscope.

## 3. LINE-UP PROCEDURES AND OBJECTIVES

### A. General

**3.01** Line-up procedures are accomplished on an out-of-service basis. General information pertaining to tests of the Groupband Data System

is given in Section 314-609-510. Trouble locating and routine maintenance procedures are covered in Sections 314-609-311 and 314-609-312, respectively. Detailed testing procedures are described in the following sections:

SECTION	TITLE
314-609-511	Gain-Frequency Measurements
314-609-512	Noise Measurements
314-609-513	Relative Envelope Delay Measurements
314-609-514	Oscilloscope Tests

**3.02** For descriptive, line-up, and testing information on equipment used in the Groupband Data System, refer to the series of Bell System Practices listed below:

SECTION	TITLE
314-601-XXX	Wideband Service Bay
314-602-XXX	915A Wideband Data Test Bay
314-641-XXX	WLR-3 Wideband Loop Repeater
314-643-XXX	WLR-5 Wideband Loop Repeater
356-401-XXX	LWM-5 Wideband Modem
356-402-XXX	LWM-6 Wideband Modem
362-812-XXX	N2WT-1 Wideband Data Terminal and N2WM-2 Wideband Modem
365-119-XXX	T1WM-1 Wideband Data Terminal
593-012-XXX	303C Data Stations
593-800-XXX	303-Type Data Station Equipment

**3.09** The line-up of any wideband facility should begin with gain measurements. Subsequent measurements such as noise measurements, envelope delay measurements, etc., may be performed in any order. However, if these measurements require that the facility be modified in any way in order to meet a requirement, the gain measurements and all other measurements performed prior to

the measurement that necessitated the modification should be performed again.

#### B. Switched Network (Fig. 2)

**3.04** Line-up of the network trunks and line-up of the wideband subscriber lines are made separately. Ordinarily, no overall end-to-end line-up is performed, since in the switched network the facilities which make up a completed connection will vary. It is therefore important that each trunk and each wideband subscriber line meet its individual line-up requirements as given in Table A. The line-up of the network trunks is accomplished by the network control office with help from the area control offices. The line-up of the wideband subscriber lines is accomplished by the area control offices.

**3.05 Network Trunks:** Each network trunk is lined up to present a zero net loss at 25 kHz between wideband service bay jack appearances on the trunk side of the wideband switches in each toll office. After the zero net loss has been established, the other measurements are made and their results recorded. When making the gain-frequency measurements on the network trunks, a test power no greater than -10 dBm should be used. Also, when the gain-frequency measurements or the single-frequency noise measurements are made, certain frequencies should be checked to ensure that 92-kHz band elimination filters have been removed and that the 96-kHz carrier leak is not excessive. When measuring the baseband signal at the wideband service bay, the readings at 26 kHz or 8 kHz should *not* reflect a dip in power or display a signal-free slot. Meeting this requirement verifies that the 92-kHz band elimination filters have been removed. The readings at 4 kHz or 30 kHz should *not* exceed the limits for single-frequency noise. Meeting this requirement verifies that the 96-kHz carrier leak is not excessive.

**3.06 Wideband Subscriber Lines:** Each wideband subscriber line is lined up to present a zero net loss at 25 kHz between the data auxiliary set 806 (DAS) at the data station and the wideband access trunk jack appearance at the wideband service bay. In order to line up the wideband subscriber line, a connection must be established from the wideband data test bay wideband access trunk through the wideband switch, to the data station associated with the wideband subscriber line to be lined up. Some offices may have wideband subscriber

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line jack appearances on the line side of the wideband switches but these appearances are *not* to be used to establish the zero net loss requirement. All wideband subscriber line line-up measurements include the wideband subscriber line *and* the wideband switch. The jacks which may appear on the line side of the wideband switches should be used only for troubleshooting or for testing the facilities which make up the wideband subscriber line.

**3.07** It should be noted that when the wideband subscriber line is lined up to the wideband access trunk jack appearance, a zero net loss figure will not be reflected at the wideband subscriber line jacks (if provided) on the line side of the wideband switch. Levels measured at these jacks will reflect a power slightly greater than the system level when measuring the level received from the data station and slightly less than system level when measuring the level transmitted to the data station. These deviations (a fraction of a dB) from the zero net loss figure are a result of the loss of the intraoffice wiring and the wideband switches and are to be expected. This fact should be posted in the area of these jacks so that when the wideband subscriber line facility is routined on an individual basis, the system level will not be disturbed.

**3.08** Some wideband subscriber lines may consist of T carrier facilities. When this condition exists, only noise measurements may be made on the facility when using test procedures in the 314-609-51X sections. Level measurements are to be made on the T carrier facility using the procedures described in the 365-119-XXX series of practices.

### C. Two-Point Private Line (Fig. 3)

**3.09** The groupband, 2-point private line is composed of the same types of wideband

transmission facilities as those used in the switched network and, therefore, should be capable of meeting the same end-to-end requirements as those for the switched network. It is important that the individual requirements be met, even though the line may pass acceptable signals.

**3.10** For line-up purposes, the 2-point private line is divided at the serving test centers. The wideband line between a serving test center and a data station is called a station line and should meet the requirements for a station line given in Table B. The wideband line between serving test centers is called an interexchange facility and should meet the requirements for an interexchange facility given in Table B. Figure 3 shows a typical 2-point private line that has been divided into the station line and interexchange facilities.

**3.11** In the 2-point private line application, the DAS (806B) and all wideband service bays are considered as 0-dB wideband system level points, *i.e.*, there is a zero net loss facility between wideband service bays or between a wideband service bay and a DAS. The line-up procedures and considerations for interexchange facilities containing L-type multiplex channels in the 2-point private line are the same as those for the network trunks of the switched network discussed in 3.05. The values shown in Table B for the interexchange facilities are equivalent to those for two network trunks of Table A added together.

**3.12** Each station line may consist of N-carrier, a WLR-3 or WLR-5 repeatered loop, or a combination of these facilities. T-carrier may also be used in the station line. The considerations given in 3.08 for the line-up and testing of T-carrier facilities in the switched network also apply to the 2-point private line application.

**TABLE A**  
**TRANSMISSION REQUIREMENTS GROUPBAND DATA CIRCUIT SWITCHED NETWORK**

MEASUREMENTS		NETWORK TRUNK	WIDEBAND SUBSCRIBER LINE	REMARKS
RELATIVE ENVELOPE DELAY		SL 4.5 $\mu$ s SA 6.0 $\mu$ s P 7.0 $\mu$ s	SL 0.5 $\mu$ s SA 3.5 $\mu$ s P 6.5 $\mu$ s	Interpretation of SL, SA, and P delay values is found in Section 314-609-513.
GAIN DEVIATION		SL 2.5 dB SA 0.5 dB P 1.5 dB	SL 0.5 dB SA 0.5 dB P 2.0 dB	Interpretation of SL, SA, and P gain values is found in Section 314-609-511.
NOISE	GAUSSIAN	61 dBrn or LESS	54 dBrn or LESS	See note on measurements of Gaussian noise. Impulse count is taken at reference setting of 85 dBrn. Noise measured at WSB.
	IMPULSE	30 COUNTS/ 30 MIN.	110 COUNTS/ 30 MIN.	
	SF INT	-36 dBm or LESS	-30 dBm or LESS	
DIGITAL ERROR RATE		3 ERRORS/ 5 MIN.	3 ERRORS/ 5 MIN.	
GAIN AT 25 KHZ		0 $\pm$ 0.5 dB	0 $\pm$ 1.0 dB	

**Note:** If the requirement for Gaussian noise is exceeded by more than 6 dB, remove the trunk or line immediately for trouble investigation. If the requirement is exceeded, but by 6 dB or less, repeat the measurement three times at 1-hour intervals. If more than one of the three subsequent measurements exceed the requirement, remove the trunk or line for trouble investigation.

TABLE B

## TRANSMISSION REQUIREMENTS GROUPBAND DATA CIRCUIT TWO-POINT PRIVATE LINE

MEASUREMENTS		INTEREXCHANGE FACILITY	EACH STATION LINE	REMARKS
RELATIVE ENVELOPE DELAY		SL 9.0 $\mu$ S SA 12.0 $\mu$ S P 10.0 $\mu$ S	SL 0.5 $\mu$ S SA 3.5 $\mu$ S P 6.5 $\mu$ S	Interpretation of SL, SA, and P delay values is found in Section 314-609-513.
GAIN DEVIATION		SL 3.5 dB SA 1.0 dB P 2.0 dB	SL 0.5 dB SA 0.5 dB P 2.0 dB	Interpretation of SL, SA, and P gain values is found in Section 314-609-511.
NOISE	GAUSSIAN	64 dBrn or LESS	54 dBrn or LESS	See note on measurements of Gaussian noise. Impulse count is taken at reference setting of 85 dBrn. Noise measured at WSB.
	IMPULSE	60 COUNTS/ 30 MIN.	110 COUNTS/ 30 MIN.	
	SF INT	-30 dBm or LESS	-30 dBm or LESS	
DIGITAL ERROR RATE		6 ERRORS/ 5 MIN.	3 ERRORS/ 5 MIN.	
GAIN AT 25 KHZ		0 $\pm$ 0.5 dB	0 $\pm$ 1.0 dB	

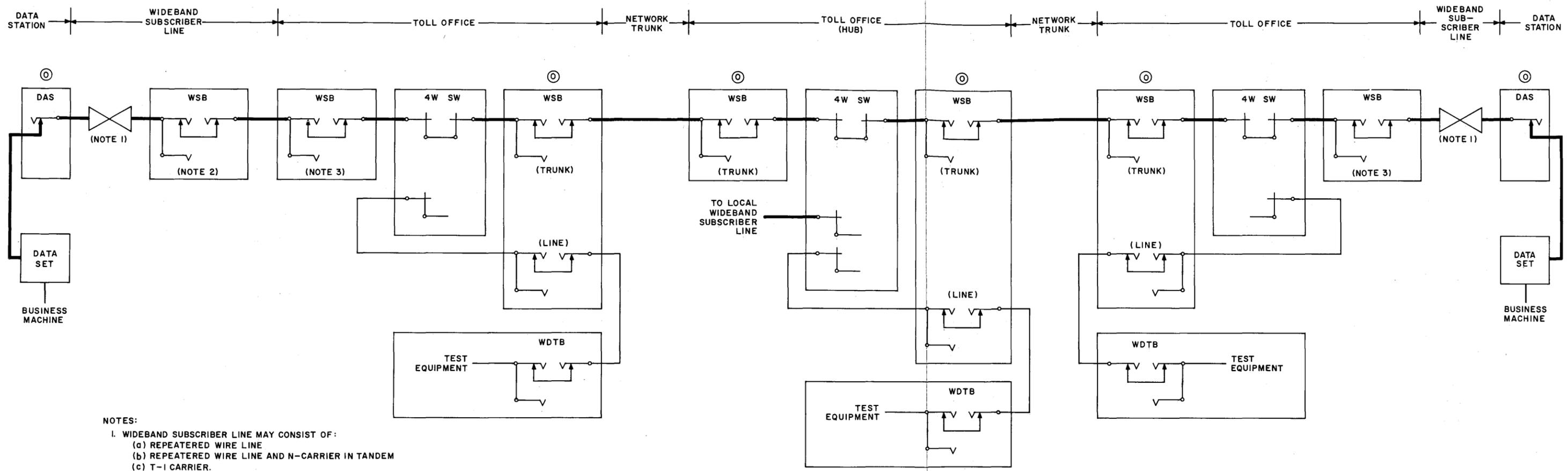
**Note:** If the requirement for Gaussian noise is exceeded by more than 6 dB, remove the trunk or line immediately for trouble investigation. If the requirement is exceeded, but by 6 dB or less, repeat the measurement three times at 1-hour intervals. If more than one of the three subsequent measurements exceed the requirement, remove the trunk or line for trouble investigation.

CIRCUIT NO. \_\_\_\_\_ FROM \_\_\_\_\_ TO \_\_\_\_\_  
 CONTROL OFFICE \_\_\_\_\_ DATE \_\_\_\_\_ INITIALS \_\_\_\_\_  
 TEST CENTER \_\_\_\_\_

TEST	DIR	SECTION	RESULT		REQT		SECTION	RESULT		REQT		REMARKS
			GAIN	DELAY	GAIN	DELAY		GAIN	DELAY	GAIN	DELAY	
GAIN AT 25 KHZ	INC											
	OG											
25 KHZ	INC											
	OG											
2 KHZ	INC			/	/			/	/			
	OG			/	/			/	/			
4 KHZ	INC			/	/			/	/			
	OG			/	/			/	/			
6 KHZ	INC											
	OG											
8 KHZ	INC											
	OG											
10 KHZ	INC											
	OG											
12 KHZ	INC											
	OG											
14 KHZ	INC											
	OG											
16 KHZ	INC											
	OG											
20 KHZ	INC											
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22 KHZ	INC											
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24 KHZ	INC											
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26 KHZ	INC											
	OG											
28 KHZ	INC											
	OG											
30 KHZ	INC											
	OG											
32 KHZ	INC											
	OG											
34 KHZ	INC											
	OG											
36 KHZ	INC											
	OG											

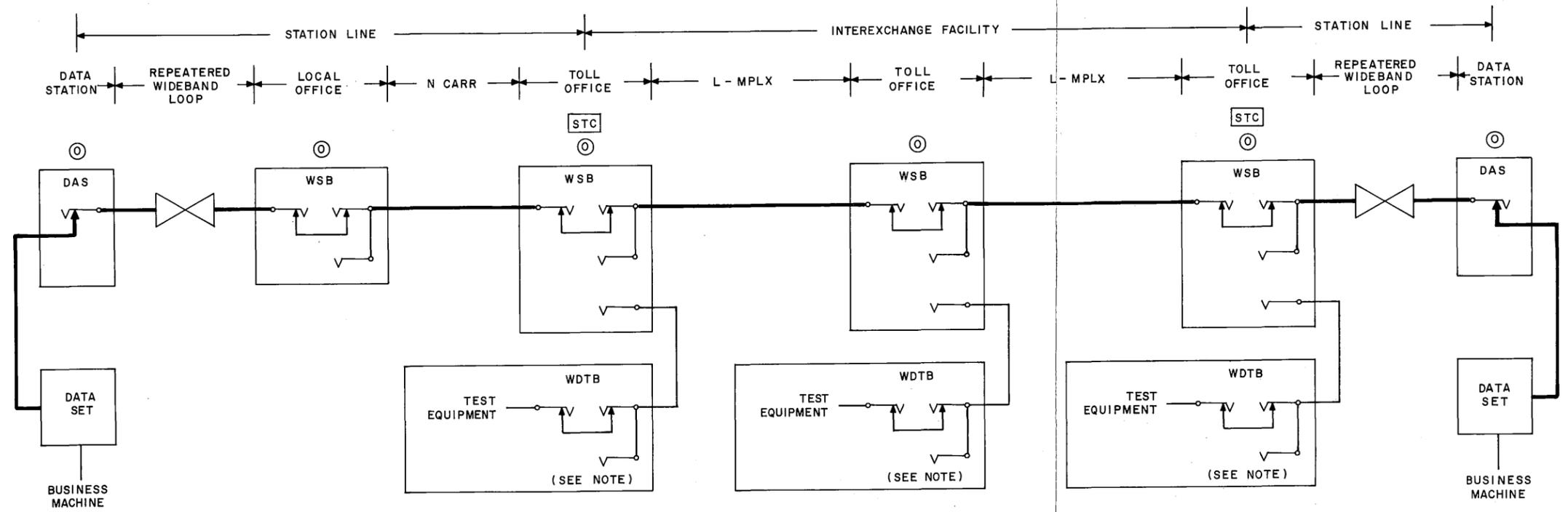
TEST	DIR	SECTION	RESULT			REQT			SECTION	RESULT			REQT			REMARKS
			SA	SL	P	SA	SL	P		SA	SL	P	SA	SL	P	
NOISE	RMS	INC														
		OG														
	IMP	INC														
		OG														
SF INT	FREQ	INC														
		OG														
	FREQ	IN														
		OG														
	FREQ	INC									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

Fig. 1—Transmission Measurements Form



- NOTES:
1. WIDEBAND SUBSCRIBER LINE MAY CONSIST OF:
    - (a) REPEATERED WIRE LINE
    - (b) REPEATERED WIRE LINE AND N-CARRIER IN TANDEM
    - (c) T-1 CARRIER.
  2. WIDEBAND SUBSCRIBER LINE MAY OR MAY NOT PASS THROUGH AN INTERMEDIATE OFFICE.
  3. WSB JACKS ON LINE SIDE OF 4W SWITCHES ARE OPTIONAL, NOT USED FOR LINE-UP.
- LEGEND:
- ⊙ WIDEBAND SYSTEM LEVEL POINT.
  - ( ) WIDEBAND SYSTEM LEVEL MEASURING POINT FOR LINE OR TRUNK, AS INDICATED.

Fig. 2—Simplified Groupband Data System—  
Switched Network, Wideband Channel



NOTE:  
WIDEBAND DATA TEST BAYS MAY NOT BE PROVIDED  
IN ALL CASES.

LEGEND:  
 (O) WIDEBAND SYSTEM LEVEL POINT.  
 [STC] SERVING TEST CENTER (MAY BE LOCATED AT LOCAL  
OFFICE INSTEAD OF TOLL OFFICE AS SHOWN.)

Fig. 3—Simplified Groupband Data System—2-Point  
Private Line, Wideband Channel