

HALF-GROUPBAND DATA SYSTEMS
2-POINT PRIVATE LINE
MAINTENANCE TEST PROCEDURES

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A. Wideband Data Channels	6	1. GENERAL	
B. Voice Frequency Coordination Channels	6	1.01 This section describes preservice and maintenance tests for use on half-groupband data circuits employing 303-type data station equipment.	
C. PBX Private Line Channels	7	1.02 This section is reissued:	
D. Circuit Arrangements	8	(a) To provide current transmission objectives and maintenance test procedures for half-groupband data systems.	
4. PRECAUTIONS	8	(b) To provide test procedures previously contained in Section 314-608-503.	
5. TEST ACCESS ARRANGEMENTS	8	Since this reissue constitutes a complete revision, arrows normally used to show changes are not used.	
6. GAIN FREQUENCY MEASUREMENTS	12	1.03 This issue affects equipment test lists.	
DETERMINATION OF RELATIVE GAIN SLOPE, SAG, AND PEAK VALUES	16	1.04 This section deals primarily with maintenance tests of half-groupband data circuits. The maintenance of voice frequency circuits is discussed only as they relate to the wideband data circuits.	
7. RELATIVE ENVELOPE DELAY	18	1.05 For tests of interarea half-group channels which necessarily involve facilities such as wideband loop repeaters, N carrier, T carrier, or L-type multiplex, the test procedures given in sections covering that particular facility should be followed when testing and adjusting the equipment or carrier facility. The following sections contain test procedures for equipment that may appear in the wideband circuit.	
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SECTION 314-608-500

SECTION	TITLE
314-602-501	915 Wideband Data Test Bay— Test Procedures for 303-Type Data Station—Restored Polar Line Signal Operation
314-641-500	50-Kilobit Wideband Loop—1 to 50 KC-WLR-3 Repeater— Maintenance
314-643-500	50-Kilobit Wideband Loop—1 to 50 kHz—WLR-5 Repeater— Maintenance
314-644-500	Data Systems—Central Office Wideband Regenerative Repeater— WRR-1, J70174 Test Procedures
356-400-500	40-KC Wideband Transmission System—Signal Level Tests and Alignment
356-401-500	L-Type Multiplex—36 KC Wideband Transmission System—Signal Level Tests and Alignment
356-410-500	L-Type Multiplex 16 KC Wideband Transmission System—Signal Level Tests and Alignment
362-811-502	N2 Carrier Telephone System— N2WM-1 Wideband Modem (10-51 KC)—Maintenance Tests
362-812-502	N2 Carrier Telephone System— N2WT-1 Wideband Terminal— N2WM-1 Wideband Modem (10-51 kHz) Maintenance Tests
362-812-504	N2 Carrier Telephone System— N2-WT-1 Wideband Terminal— N2WM-2 Wideband Modem (0.1 to 37.5 kHz) Maintenance Tests
365-118-501	Digital Transmission Systems— T1WB-1 and T1WB-2 Wideband Banks—Lineup and Adjustments
365-119-501	Digital Transmission System— T1WM-2 Wideband Modem—Lineup and Adjustments

SECTION	TITLE
365-120-501	T1WB-3 Wideband Bank—Lineup and Adjustments
593-800-500	Wideband Data Station Using Data Set 303—4-Wire Point-to-Point Private Line (Commercial Service)—Test Procedures

1.06 The tests listed below are to be performed during maintenance periods or when directed by the circuit control office (CCO). The results of these tests should be recorded on a permanent record for use as reference material. An example of a suitable record form is shown in Fig. 1.

- (a) Gain at 36 kHz (Passband) -9.6 kHz (Baseband)
- (b) Gain Frequency
- (c) Noise Measurements
- (d) Relative Envelope Delay
- (e) Digital Error Rate

All transmission tests are performed on an out-of-service basis under the direction and supervision of the CCO or wideband data test center.

1.07 Test Equipment: The following test equipment, or its equivalent, is required for preservice tests or maintenance tests on a half-group data circuit. This equipment may be provided as part of the wideband service bay (WSB) or 915A wideband data test bay (WDTB), or it may be furnished from another office for use in testing. 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 WSB) consisting of HP 204B oscillator, 353 patch panel, and 3400A voltmeter; or the Hewlett-Packard 3550A test set (portable) consisting of HP 204B oscillator, 353A patch panel, and 403B voltmeter.

Note: The HP E18-204B or E60-204B test set has greater accuracy than the HP 3550A, and its voltmeter gives a true rms indication which allows its use in random noise and data

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

TEST	DIR	SECTION	RESULT		REQT	SECTION	RESULT		REQT	REMARKS	
GAIN AT 36 KHZ	INC										
	OG										
GAIN AT 9.6 KHZ	INC										
	OG										
			GAIN	DELAY	GAIN	DELAY	GAIN	DELAY	GAIN	DELAY	
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										
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20 KHZ	INC										
	OG										
28 KHZ	INC										
	OG										
30 KHZ	INC										
	OG										
32 KHZ	INC										
	OG										
34 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
NOISE	RMS	INC										
		OG										
	IMP	INC										
		OG										
SF INT	FREQ	INC										
		OG										
	FREQ	IN										
		OG										
	FREQ	INC										
		OG										
CROSSTALK	INC											
	OG											
DIGITAL ERROR RATE	INC											
	OG											
RELATIVE ENVELOPE DELAY			SA	SL	P	SA	SL	P	SA	SL	P	
	INC											
RELATIVE GAIN	OG											
	OG											

Fig. 1—Transmission Measurements Form

power measurements. For this reason, these test sets are preferred over the portable HP 3550A test set. The 403B voltmeter does not give a true rms indication; therefore, measurements of nonsinusoidal waveforms such as noise or data should not be made with this meter.

- Hewlett-Packard 11035A cables (furnished with the HP 3550A test set).
- 6G wideband noise measuring set (J94006G) equipped with the 10 to 50-kHz weighting network.
- KS-15538-L5A carrier frequency voltmeter (CFVM) (Sierra).
- 26A wideband gain and delay measuring set (J94026A). This single test set replaces the X75947A and X75947B gain and delay measuring sets. Refer to Section 103-115-105 for description and operation.
- Hewlett-Packard 5233L frequency counter.
- 912 data test set.
- Tektronix oscilloscope RM561A equipped with either one 2B67 time base unit and one 2A63 amplifier or two 2A63 amplifier units.
- 368B terminating plugs (135 ohms).

1.09 In addition to the equipment listed, there are other oscillators and voltmeters which can be used when connected through a suitable impedance matching device. These include the HP 200CD oscillator and HP 400L, HP 403B-DB, or HP 3400A voltmeters. The use of this equipment requires the use of a 4142A network for impedance matching and circuit termination.

1.10 Use of the HP E18-204B, HP E60-204B, or HP 3550A test set is recommended for gain measurements, since these sets contain the patch panel which provides impedance matching, attenuation, and calibrate-measure features.

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

1.12 A record of delay versus frequency or received level versus frequency can be obtained using a single pen recorder such as the Moseley, model H14-7035A, X-Y recorder or equivalent. The Tektronix oscilloscope RM 561A when supplied with the two 2A63 amplifier units is also acceptable for use with the 26A wideband gain and delay measuring set when a visual presentation of gain or delay is required.

2. TEST CONSIDERATIONS AND OBJECTIVES

2.01 Where requirements or limits are not met during maintenance tests of half-group data facilities, or in facilities which are common to both data and other customer services, the serving and circuit control offices should be notified.

2.02 Before making tests on a 2-point private line, the circuit control office should verify that release of the wideband channel has been obtained from the customer.

2.03 One-way measurements in each direction should be made for lineup purposes or to determine which direction of a circuit is at fault. For trouble location on station lines, a looped-line measurement should be made first to determine whether one-way measurements between the WSB and the wideband data station will be required. It should be noted that measurement of different characteristics of noise is affected in different ways when looped-circuit measurements are made. The power of Gaussian noise generated within the facilities tends to be additive, and since the equipment used in a looped-circuit measurement is doubled, the measured level could be as much as 3 dB higher than the one-way objective. Where single-frequency tones control the continuous noise measurement, the measured level could reach as high as 6 dB above the one-way measurement. Noise impulses are difficult to interpret on a looped circuit, but generally, the impulse count at a given threshold should double. The amplitude of single-frequency tones on a looped circuit may be additive or may tend to cancel out, depending on the phase relationship of the tones. The phase relationship may vary slowly, resulting in an indication which varies from maximum (in-phase condition) to minimum (out-of-phase condition). The readings resulting from a looped measurement are sometimes difficult to interpret, but generally, if a looped facility meets its one-way objectives, it is satisfactory. If measurements are greater

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than 6 dB above the one-way objective, either or both straightaway measurements will exceed the objective.

2.04 Designation of testing jacks at WSBs is not standardized. For this reason, a theoretical east-west wideband channel is used for describing test procedures, and arbitrary jack designations are assigned. The illustrations in this section identify the equivalent jacks in the WSB at a particular location.

2.05 All measurement results should be recorded on a transmission measurements form as previously mentioned in 1.06. Notes or other pertinent information regarding maintenance of data transmission circuits should also be entered on the form used.

3. 2-POINT CONSIDERATIONS

A. Wideband Data Channels

3.01 No switching, other than providing alternate use, is involved in the private line for half-groupband data transmission. The wideband service bay (WSB) test jacks in the wideband data channel permit the direct patching of test equipment to the data channel in either direction. A typical testing arrangement in simplified form is shown in Fig. 2. The wideband data test bay (WDTB) is either adjacent to or close by the WSB; so that test equipment in either bay may be connected to the test jacks. If circuit tests indicate that additional tests must be made on specific equipment such as wideband loop repeaters, wideband modems, or data terminals, refer to the sections covering that equipment. The test arrangements for this equipment are shown in the sections covering the equipment and are not shown in this section.

3.02 Some offices may provide test access to the WDTB at the wideband access line jack as shown in Fig. 2. This access point may be used for testing a section of the wideband line such as an N-carrier link, but is *not* used for lineup purposes. Lineup tests on wideband lines are always performed at the wideband access line jacks at the WSB.

3.03 A loop-back feature may be used to loop the wideband subscriber line or the wideband line and data set at the wideband data station. When only the wideband line is looped, transmission

tests of the wideband line may be performed from the serving test center. When the wideband line and data set are included in the loop, the data set acts as a regenerative repeater, and its operating characteristics may be checked from the data test center. These tests may be made without assistance at the data station. The procedure for establishing the loop-back feature from the serving test center is given in 5.04.

3.04 Since transmission tests are made only on an out-of-service basis, connections should not be made or disturbed unless the data circuit has been released by the customer. Monitoring tests may be made on an in-service basis by connecting to the monitor jack at the WSB. The monitoring tests may include the oscilloscope tests and performance checks on an operating circuit, using a data set connected via a high-impedance bridging amplifier.

WRR-1 Wideband Regenerative Repeater

3.05 The WRR-1 is a 2-way wideband regenerative repeater used to reduce the effect of transmission impairments between two data sets. The WRR-1 is normally placed somewhere near the middle of the facilities and regenerates the synchronous data signals before impairment is sufficient to introduce excessive errors. The WRR-1 can also be used to convert a baseband signal out of T1WB- or T1WM-modems to a passband format for transmission over carrier facilities.

3.06 Transmission and noise tests cannot be made through the WRR-1 regenerative repeater. For this reason, maintenance tests can be made to each side of the WRR-1 only. Maintenance tests on the WRR-1 are given in Section 314-644-500.

B. Voice Frequency Coordination Channels

3.07 The voice frequency line sections of a 2-point private line provided for half-groupband service are served from private line testboards. The private line sections have test jacks at testboards in each toll office and have testing arrangements similar to those of a switched trunk. A simplified arrangement for testing voice frequency coordination channels is shown in Fig. 3.

3.08 In some instances, initial voice contact between a wideband data test center and a data station or between two data test centers is

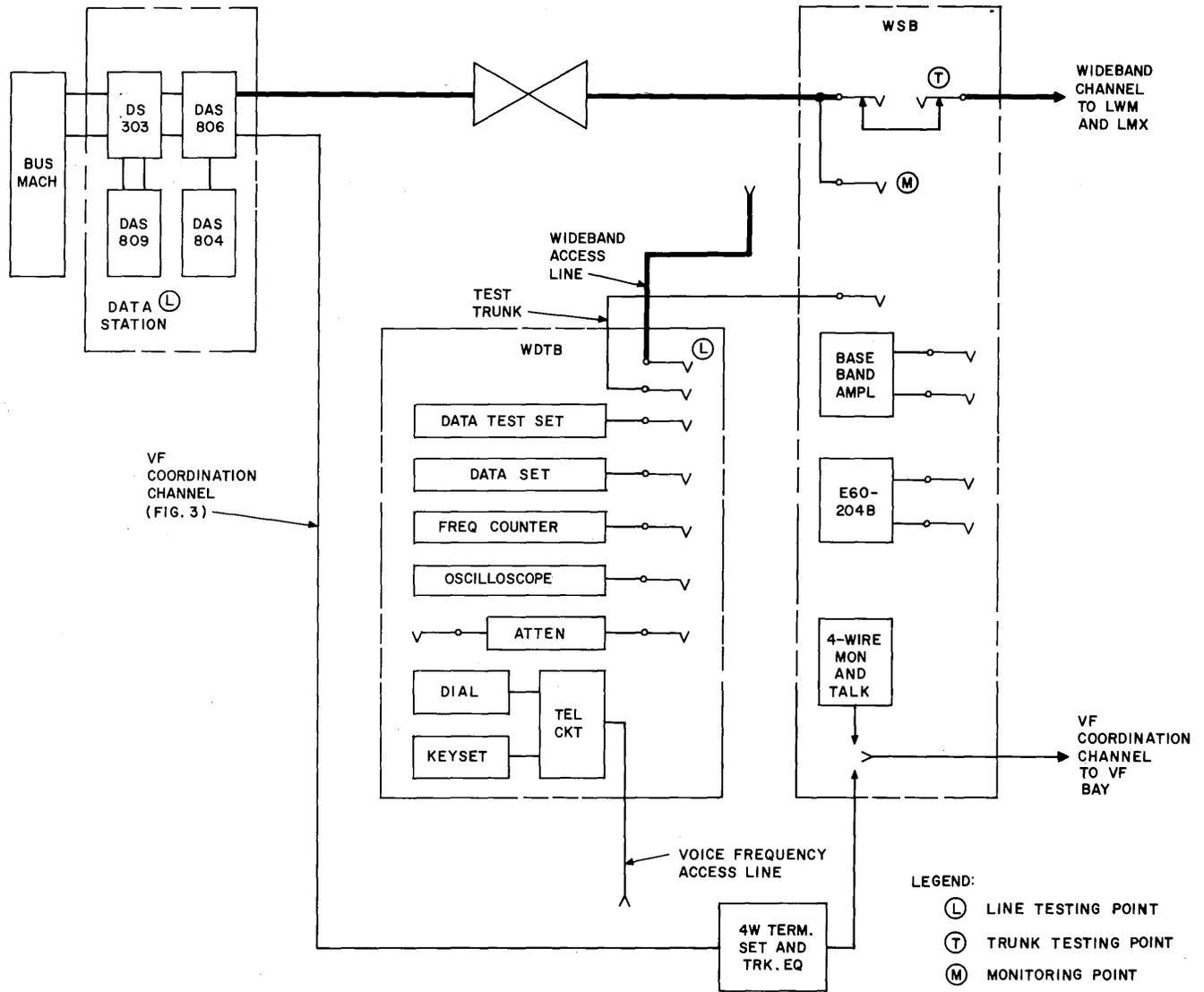


Fig. 2—Testing Arrangements, Wideband Data Channel

made over the DDD network. After contact is made, the voice frequency coordination channel is generally used as an order wire for test coordination, if required. Connection to the voice frequency coordination channel (or channels if two low-speed data circuits are employed) is made at the WSB through the 4-wire monitor and talk circuit.

C. PBX Private Line Channels

3.09 Testing arrangements for the PBX voice channels are shown in Fig. 3. Under this arrangement, the half-group service is comprised of one channel of high-speed data with its voice

coordination channel and six additional voice channels from the PBX facility. Arrangements for routine or general maintenance tests should be made with the customer by the control office. In order to minimize service interruptions, it may be necessary to make these tests after normal working hours.

3.10 The individual test procedures, equipment required, and additional connection arrangements are given in the 311-350-ZZZ series of sections. In addition, the overall measurement tests for 2-point private line telephone circuits are given in Section 310-300-500.

D. Circuit Arrangements

3.11 Examples of signal format and system arrangements for half-groupband service are shown in Fig. 4. The illustration shows examples of a standard all-passband arrangement, a mixed arrangement using both baseband and passband signal format, and an all-baseband arrangement. There can also be various combinations of these arrangements, including the use of the WRR-1 regenerative repeater in the all-baseband arrangement. Test access for maintenance purposes is as shown at the indicated levels found in either the WSB or station.

4. PRECAUTIONS

4.01 Typical half-group service uses the restored polar signal translated into the passband signal format at the station, using DAS 809B-type. This results in a frequency range of 28 to 44 kHz at the WSB. In this case, sine wave test tones transmitted over the passband channel must be power-limited to -20 dBm at the -10 SLP.

4.02 The integrity of tip-to-tip and ring-to-ring must be maintained throughout the wideband data channel. Proper care must be taken to prevent lead turnover when making patches or changing equipment. If the possibility exists that turnover may have occurred, a procedure for performing a polarity check is given in Section 314-643-300. The procedure is applicable to polarity tests made between wideband service bays as well as polarity tests made between a WSB and a data auxiliary set.

4.03 The baseband signal format is sometimes used in conjunction with T1 Carrier Systems. When T1 carrier is used as part of the wideband subscriber lines, tests using the sine wave test signals should not be made. The T1 Carrier System is a digital, regenerative system, and therefore most of the types of transmission tests used on analog transmission systems are not applicable. Refer to the 365-119-ZZZ series of sections for information pertaining to the T1 carrier terminals.

4.04 Prior to performing routine tests on equipment that is common to both the wideband data customer and other customers, all circuits providing

the other services should be patched out and made busy as they become free in order to prevent service interruption.

4.05 At no time should an N carrier line be left unterminated or the transmitted carriers be removed unless the repeaters have been deactivated. The N Carrier System can be terminated with an impedance of 135 ohms using span pads in the line terminating unit.

Note: In central office locations, the N2WT-1 terminal with an N2WM-1 or N2WM-2 modem, or an N2 terminal with an N2WM-1 modem normally terminates the N carrier line. In this case the above precaution does not apply.

4.06 Where spare LMX equipment is used when the normally used equipment is patched out for maintenance, equivalent equipment should be carefully selected and the following requirements should be observed:

- (a) The frogging rule concerning groups 2 and 4 within a supergroup must be observed.
- (b) Equalized connectors must be used at group connecting points.
- (c) The 104.08-kHz pilot should be used.
- (d) The 92-kHz band elimination filters must be removed.

5. TEST ACCESS ARRANGEMENTS

5.01 Maintenance tests of data station equipment are normally made by accessing the data station from a WSB or WDTB at the central office or serving test center. Remote tests can only be performed when the data station is equipped with data auxiliary set (DAS) 806B-type or DAS 806D1.

5.02 Two test conditions can be obtained by transmitting in sequence a 2800-Hz tone for 7+ seconds from a WDTB for each of the test conditions. Transmission of the test tone for a third time restores the station to normal.

- (a) RT1—Loops the wideband and voiceband lines at the data station towards the test

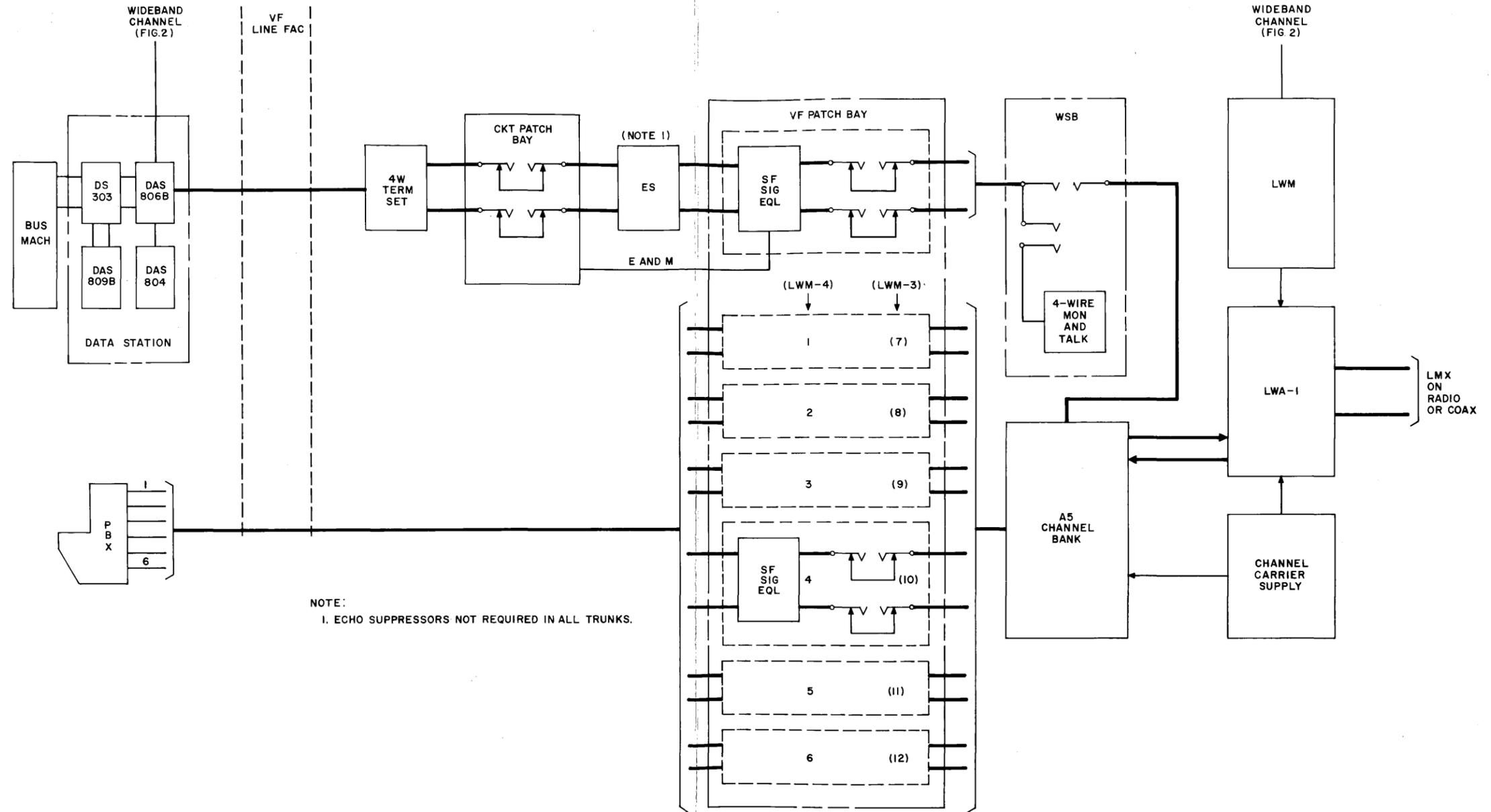


Fig. 3—Testing Arrangements, PBX and Voice Frequency Coordination Channel

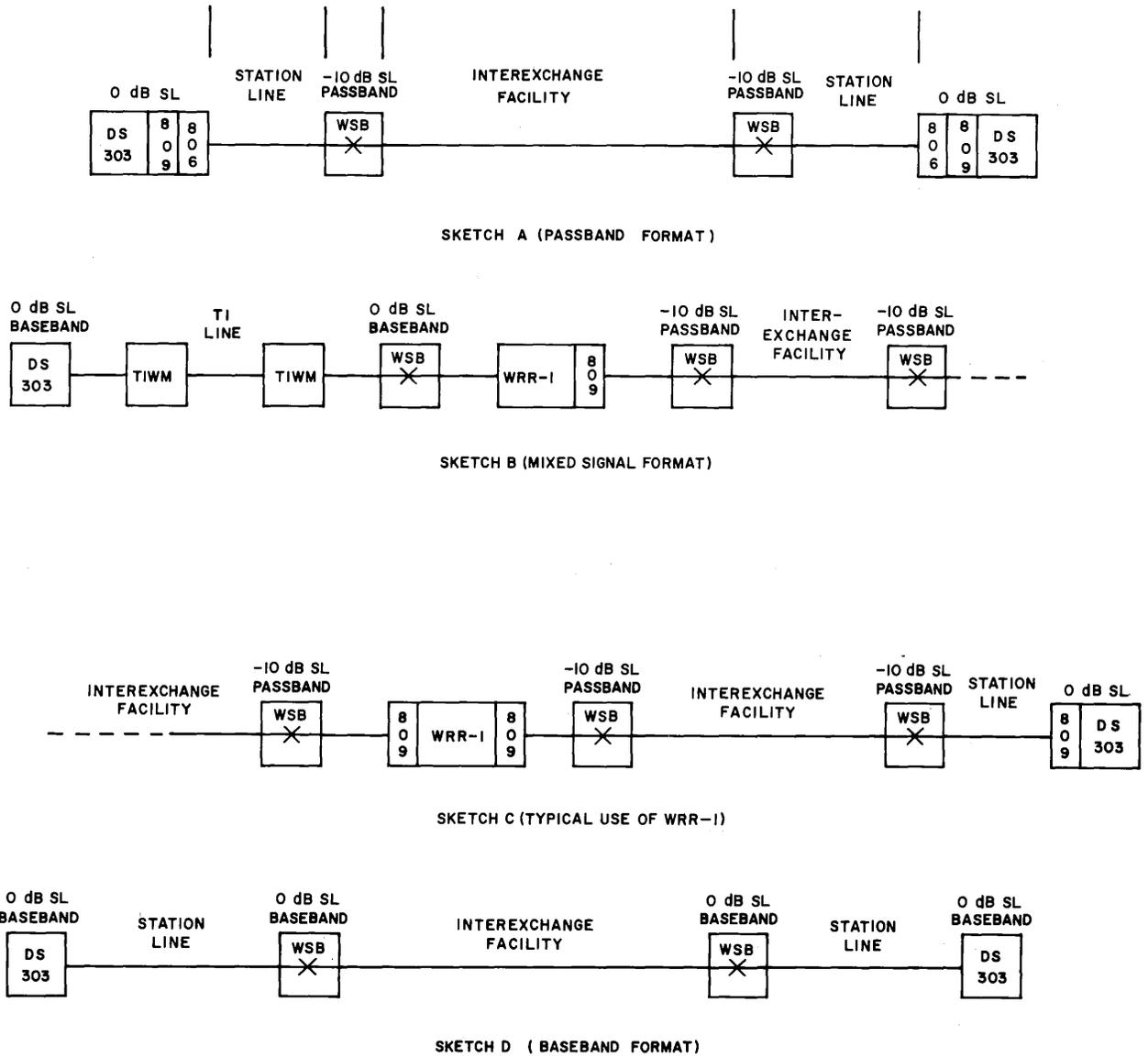


Fig. 4—Example of Signal Format and System Arrangements

center in order to test the transmission lines (first tone).

tone). For more detailed procedures refer to Part 6 of Section 314-602-100.

(b) RT2—Loops the data station back to the test center to test the data station (second

5.03 Access to the Data Station Under Test Gained Via WSB:

STEP	PROCEDURE
1	Establish voice communications with the WSB.

STEP	PROCEDURE
2	Request a wideband patch from the 915A appearance on the WSB to the desired data station appearance.
3	Request a patch from the voice frequency coordination channel appearance of the desired data station to the 915A appearance on the WSB.

5.04 Remote Test Mode:

STEP	PROCEDURE
1	Set the 2800 CPS power switch (located on the voiceband key panel) to the -10 DBM position.
2	<p>To establish RT1 mode, operate the appropriate 2800 CPS key to the 2800 CPS position and hold for 10 seconds. Release key and listen for answer-back tone.</p> <p>Note 1: The data station is now in the RT1 mode. It will remain in this mode until the RT2 mode is established.</p> <p>Note 2: If using the patch line circuit, the PATCH BAY LINE key must be in the TALK position to hear answer-back tone.</p>
3	To establish RT2 mode, operate the appropriate 2800 CPS key to the 2800 CPS position, and hold for approximately 10 seconds until the 2800-Hz tone stops. Release key. After a silent pause, the 2025 Hz answer-back tone becomes audible.
4	<p>Release the 2800 CPS key.</p> <p>Note: The data station is now in the RT2 mode. It will remain in this mode until returned to the normal mode.</p>
5	<p>To restore the line to normal, operate the 2800 CPS key to the 2800 CPS position for at least 10 seconds. Observe that the NO SYNC and NO DATA lamps on the 912A light when the data station returns to the normal mode.</p> <p>Note: The data station is now returned to the normal mode and normal operation may be resumed.</p>

6. GAIN-FREQUENCY MEASUREMENTS

6.01 Gain-frequency measurements are made at initial lineup and during maintenance of transmission facilities. During trouble location procedures, the factor of gain-frequency response may be in doubt. Symptoms of poor gain-frequency

response may be weak or erratic data signal level, low level of pilot tones, or no data signal.

6.02 Gain-frequency measurements are made on a 2-point private line when directed by the CCO.

- 6.03 When maintenance tests indicate that a gain adjustment of the wideband data channel is required, it is recommended that a measurement of noise be made first. The measurement of noise is necessary since a high noise can cause an improper gain adjustment, and conversely, an improper gain adjustment can cause the noise to be out of limits.
- 6.04 If any portion of the wideband data channel contains T1 carrier facilities, a gain-frequency measurement should not be made. These facilities are regenerative and would cause erroneous readings.
- 6.05 The wideband system is checked by making a gain measurement at the center frequency point of the baseband or passband frequency spectrum. Other gain-frequency measurements are made at specified frequencies in the overall frequency band to test for amplitude distortion in the channel over the band of frequencies in which the data signals are transmitted. Whether measuring the single-frequency gain at midfrequency or determining the overall amplitude response, the measurements are made in the same manner. The gain measurement

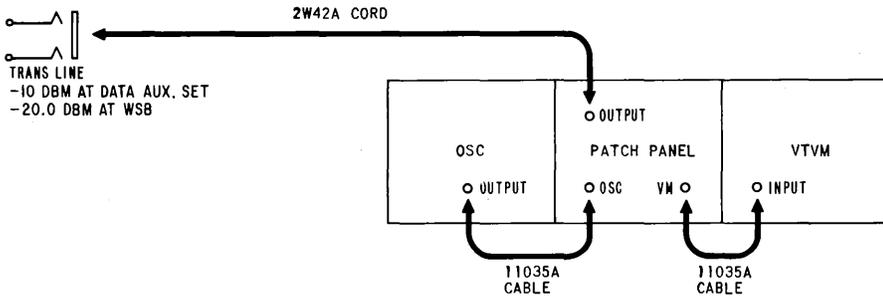
at midfrequency should precede other gain frequency measurements, since the gain at other frequencies is referenced to the gain at midfrequency. Procedures for obtaining test access to wideband channels are given in Section 314-602-100.

6.06 Measurements are made at zero system level point (SLP) where the signal power of a random data pulse train test signal is normally 0 dBm. In the modified baseband of frequencies transmitted, however, this power cannot be transmitted as a single frequency in any part of the band. Test signals in procedures described in this section are transmitted at 10 dB below the data signal power.

6.07 If a gain adjustment is required, the adjustment is made at a wideband loop repeater or wideband modem, depending on the facilities used in the line section being tested. Refer to the applicable section covering the equipment for the proper test procedure as given in 1.05.

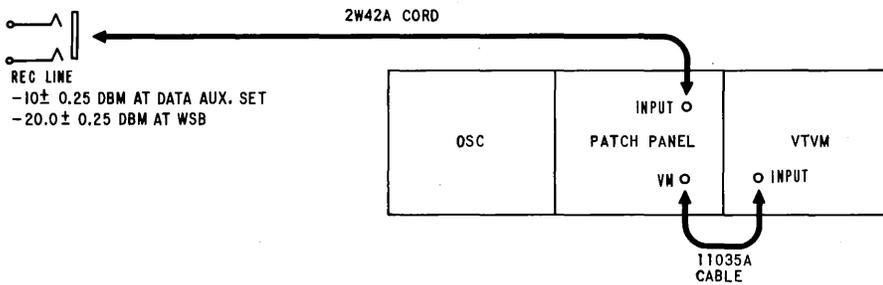
6.08 Gain-Frequency Test:

STEP	PROCEDURE
1	<p>At Transmitting End</p> <p>At the 3550A or E60-204B test set, operate controls as follows:</p> <p><i>Oscillator:</i> FREQ to 36 kHz RANGE to X1K AMPLITUDE to minimum (ccw)</p> <p><i>Patch Panel:</i> MEAS-CAL to CAL IMPEDANCE to 135 (OUTPUT) FREQ to > 5 KC DB to 10 (station), 20 (WSB)</p>
2	<p>At the 3550A or E60-204B test set, interconnect the oscillator, patch panel, and voltmeter as shown in Fig. 5. Connect the patch panel OUTPUT jack to the TRANSMITTING LINE WB jack (at DAS 806B or 806D1) or to appropriate XMT() jack (at WSB).</p> <p><i>Note:</i> If the transmitting end is located at a shop-wired WSB, Step 2 will not be necessary, as the test set will already be interconnected and have an output jack appearance on the WSB jack field. In this case it will be necessary to patch between the test set output jack appearance and the transmitting jack of the circuit to be tested.</p>



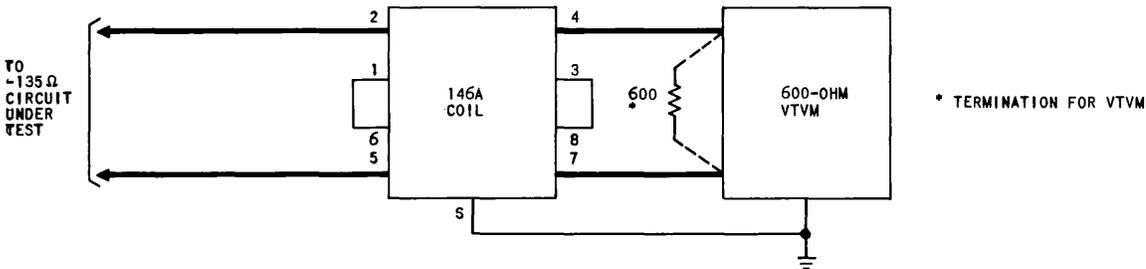
EQUIPMENT	CONTROL	SETTING
OSC	FREQ	36
	RANGE	X1K
	AMPLIFIER	MIN (CCW)
PATCH PANEL	MEAS-CAL	MEAS
	IMPEDANCE	135
	FREQ	>5KC
	DB	0
VTVM	FUNCTION	ON
	RANGE	-10 (DB) DAS -20 (DB) WSB

A. TRANSMITTING E18-204B OR 3550A TEST SET



EQUIPMENT	CONTROL	SETTING
PATCH PANEL	MEAS-CAL	MEAS
	IMPEDANCE	135
	FREQ	>5KC
	DB	0
VTVM	FUNCTION	ON
	RANGE	-10 (DB) DAS -20 (DB) WSB

B. RECEIVING E18-204B OR 3550A TEST SET



C. CONNECTION TO 600-OHM TEST SET

Fig. 5—Testing Arrangements, Gain-Frequency Measurements

STEP	PROCEDURE
3	<p>At Receiving End</p> <p>Operate test set controls as follows:</p> <p>Patch Panel: MEAS-CAL to MEAS IMPEDANCE to 135 (INPUT) FREQ to > 5 KC DB to 0</p> <p>Voltmeter: FUNCTION to ON RANGE to -10 dB (station), -20 dB (WSB)</p>
4	<p>At the 3550A or E60-204B test set, interconnect the patch panel and voltmeter as shown in Fig. 5. Connect the patch panel INPUT jack to the RECEIVING LINE WB jack (at DAS 806B) or to the appropriate REC() jack (at WSB).</p> <p>Note: If the receiving end is located at a shop-wired WSB, Step 4 will not be necessary as the test set will already be interconnected and have an input jack appearance on the WSB jack field. In this case it will be necessary to patch between the test set input jack appearance and the receiving jack of the circuit to be tested.</p>
	<p>At Transmitting End</p>
5	<p>Adjust the output of the oscillator to exactly -10 dBm (station) or -20 dBm (WSB), as indicated by the voltmeter.</p>
6	<p>Operate the patch panel MEAS-CAL switch to MEAS.</p>
	<p>At Receiving End</p>
7	<p>Read the indication on the voltmeter and record the reading on the Transmission Measurements Form.</p>
	<p>Requirement: -10.0 ±0.5 dB (station) or -20 ±0.5 dB (WSB).</p>
8	<p>For gain-frequency measurements, repeat the measurement at each frequency listed on the Transmission Measurements Form shown in Fig. 1.</p>
9	<p>At each frequency setting of the transmitting oscillator, return the MEAS-CAL switch to CAL, check the output of the oscillator for exactly -10 dBm (station) or -20 dBm (WSB), and return the MEAS-CAL switch to MEAS.</p>
10	<p>At frequency settings below 5 kHz, operate the patch panel FREQ control to ≤5 KC at each testing location.</p>
11	<p>Record the gain deviation at each frequency relative to the gain at midfrequency on the Transmission Measurements Form. A gain greater than the gain at mid-frequency will produce a plus (+) deviation. A gain less than the gain at midfrequency will produce a minus (-) deviation.</p>

STEP	PROCEDURE
12	Plot the gain deviation on a linear frequency-versus-deviation (dB) graph. Refer to 6.09 for instructions in interpreting the graph.
13	If the test objectives for gain-frequency are satisfied, remove the test equipment and looping arrangement, if used. Return the wideband channel to the customer. Release the make-busy condition, if used.

DETERMINATION OF RELATIVE GAIN SLOPE, SAG, AND PEAK VALUES

6.09 The relative gain requirements for the facilities which make up a wideband data system are given in terms of slope (SL), sag (SA), and peak (P) values. The following procedure

should be used to convert the results obtained in 6.08 to slope, sag, and peak values of relative gain. Before beginning this procedure, the results obtained in 6.08 should be recorded and plotted. This plotted curve is referred to in the following procedure as the characteristic curve. Refer to Fig. 6.

STEP	PROCEDURE
1	Draw a smooth curve through the characteristic curve averaging the peaks, trying to have as much area on one side of the smooth curve as on the other. This can be done by placing a mark at the estimated midpoint of the upper and lower excursions of each cycle of ripple and by drawing a smooth curve (with no reverse curves) using the marks as a guide.
2	Draw a straight line from the minimum frequency point on the smooth curve to the maximum frequency point on the smooth curve. The difference (in dB) between the minimum and maximum points is equal to the slope (SL).
3	At the midfrequency point (9.6 or 36 kHz), measure the vertical distance between the straight line and the smooth curve. This value (in dB) represents the sag (SA). A plus (+) sag value will result from a <i>concave up</i> smooth curve. A minus (–) sag value will result from a <i>concave down</i> smooth curve.
4	Measure the largest positive vertical distance (P ₁) from the smooth curve to the characteristic curve and the largest negative distance (P ₂). Add the P ₁ and P ₂ values. The sum of these values (P ₁ + P ₂) is equal to the peak (P) in dB.

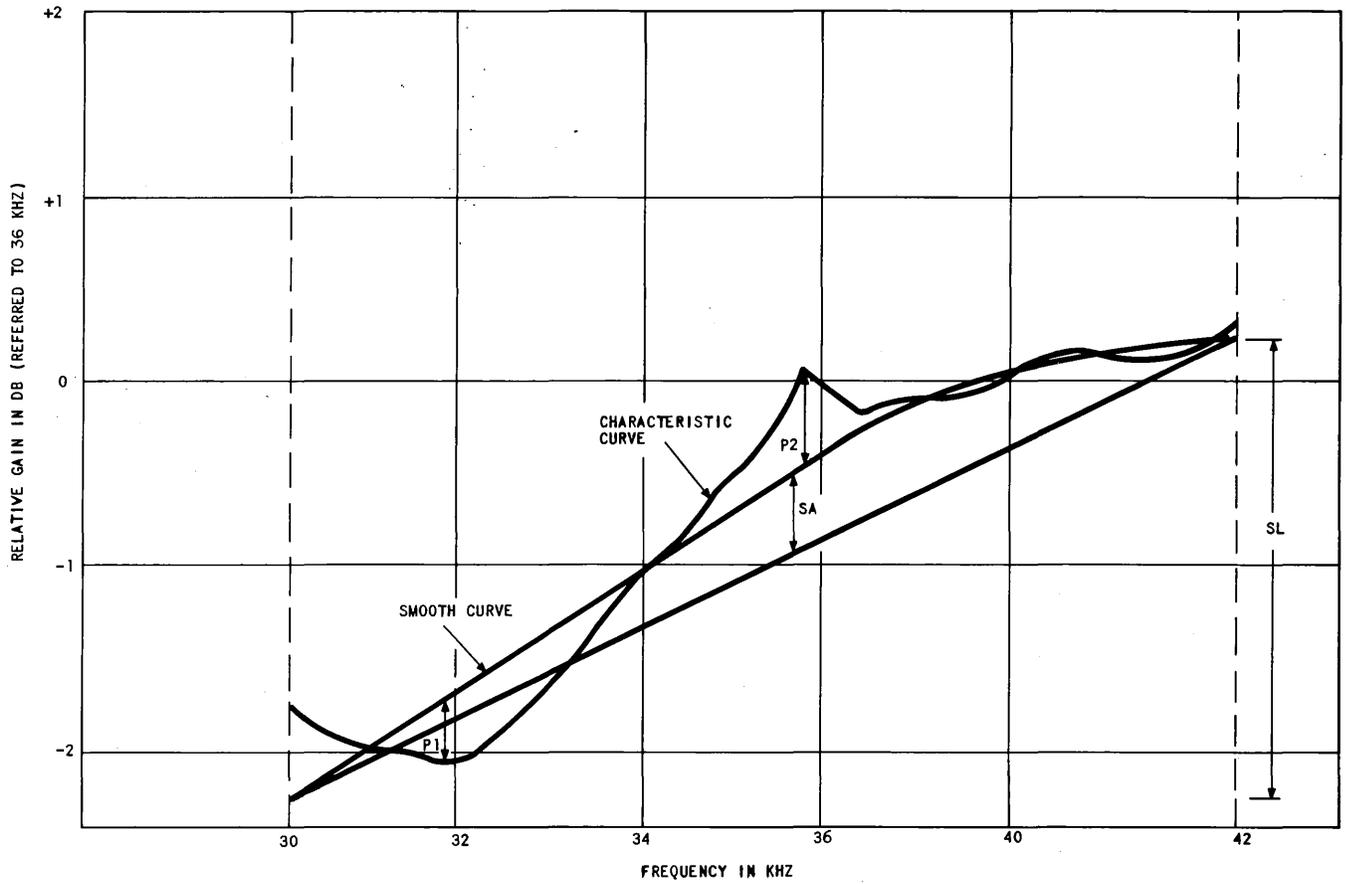


Fig. 6—Theoretical Relative Gain Curve Showing SL, SA, and P Values

STEP	PROCEDURE								
5	<p>Compare the SL, SA, and P values obtained with the SL, SA, and P requirements for the facility being tested. These requirements are given below.</p> <table border="0" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">INTEREXCHANGE FACILITY</th> <th style="text-align: center;">EACH STATION LINE</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">SL 3.5 dB</td> <td style="text-align: center;">SL 0.5 dB</td> </tr> <tr> <td style="text-align: center;">SA 1.0 dB</td> <td style="text-align: center;">SA 0.5 dB</td> </tr> <tr> <td style="text-align: center;">P 3.0 dB</td> <td style="text-align: center;">P 2.0 dB</td> </tr> </tbody> </table>	INTEREXCHANGE FACILITY	EACH STATION LINE	SL 3.5 dB	SL 0.5 dB	SA 1.0 dB	SA 0.5 dB	P 3.0 dB	P 2.0 dB
INTEREXCHANGE FACILITY	EACH STATION LINE								
SL 3.5 dB	SL 0.5 dB								
SA 1.0 dB	SA 0.5 dB								
P 3.0 dB	P 2.0 dB								

7. RELATIVE ENVELOPE DELAY

7.01 Delay measurements are also made during maintenance periods and may be a part of trouble location procedures. Delay distortion in data transmission facilities is characterized by erratic data and high data error rates. These same characteristics are also those of poor gain-frequency response or distortion. Therefore, before performing this measurement test, verify that gain-frequency objectives have been met.

7.02 The delay measurement of a wideband data system is generally made on a looped basis but may also be made end-to-end.

Note: These measurements *cannot* be made on channels that include T carrier facilities or wideband regenerative repeaters.

7.03 The apparatus used for looped envelope delay measurements is also suitable for end-to-end tests. However, this type of test requires a 26A wideband gain and delay set at both ends of the circuit. This type of measurement provides only the delay of the transmit path and not of both directions.

7.04 Measurements using swept carrier signals require the use of an X-Y recorder or oscilloscope and can be either end-to-end or on a looped basis.

7.05 Prior to making envelope delay measurements, calibrate the 26A wideband gain and delay set according to the procedures in Section 103-115-105. This procedure checks the overall calibration of the test set. If any particular part of the procedure cannot be met, it will be necessary to perform the complete calibration using internal adjustments as outlined in Part 6 of Section 103-115-105.

7.06 If a sweep-frequency measurement will be made using the X-Y recorder or an oscilloscope, refer to the alignment procedures in Part 4 of Section 103-115-105.

A. Looped Measurement

7.07 These measurements are normally made in the band of 30 to 42 kHz, and results are relative to the delay measured at the frequency of 36 kHz.

7.08 Variations in the output level of the 26A test set and variations in the loss of the circuit under test as the frequency of the test set is changed are not critical. The measurements results will be within the stated accuracy of the test set as long as the RCVD LEVEL meter reading remains on scale.

7.09 After looping the far end of the testing section, perform the following test procedures.

STEP	PROCEDURE
1	<p><i>Note:</i> The calibration procedure referred to in 7.05 should be performed before beginning this procedure. If an oscilloscope or an X-Y recorder is to be used, the alignment procedure referred to in 7.06 should be completed.</p> <p>At the 26A gain and delay set, set the controls as follows:</p> <p style="padding-left: 40px;">FREQUENCY RANGE to the 5-60 kHz position</p> <p style="padding-left: 40px;">RECEIVER MODE to NORMAL</p> <p style="padding-left: 40px;">TRMTR OUTPUT DBM to -10</p> <p style="padding-left: 40px;">RCVR INPUT to -35</p> <p style="padding-left: 40px;">ADD-MICROSECONDS to 0</p>

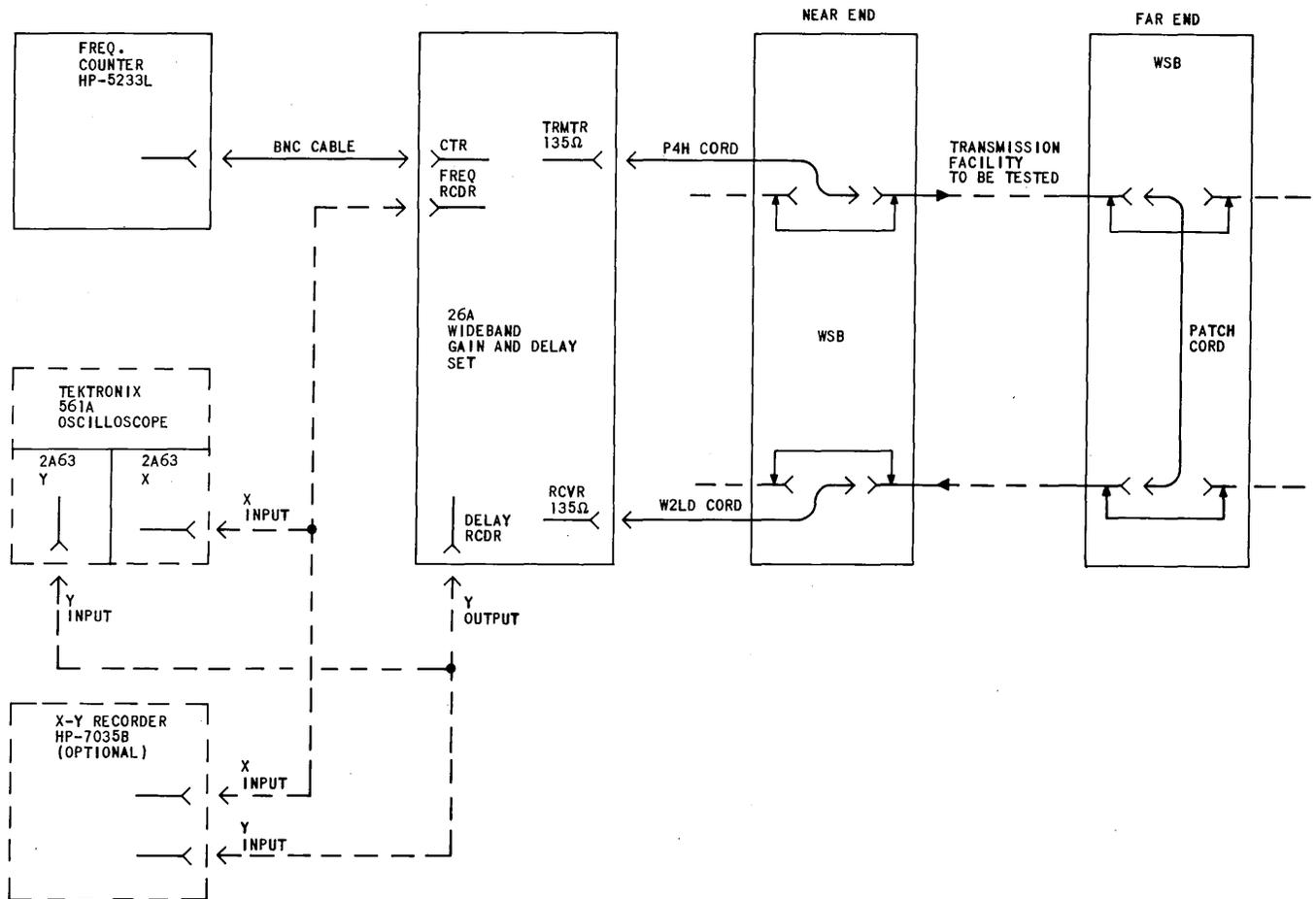


Fig. 7—Wideband Data Channel—Relative Envelope Delay Measurements (WSB to WSB)

STEP	PROCEDURE
2	Interconnect 26A gain and delay set, frequency counter, and oscilloscope, if used, as shown in Fig. 7 or 8. Connect the test equipment to the looped data facility as shown. Use the connecting cords indicated. <i>Caution: When adjusting the transmitter frequency controls, take care not to move the controls so that frequencies outside the assigned band are transmitted, since this may cause interference on other operating channels.</i>
3	Using the transmitter FREQUENCY and RANGE controls, adjust to obtain the reference frequency of 36 kHz as indicated by the FREQUENCY meter or the frequency counter, if used.
4	Adjust the RCVR INPUT control for an onscale reading on the RCVD LEVEL meter.

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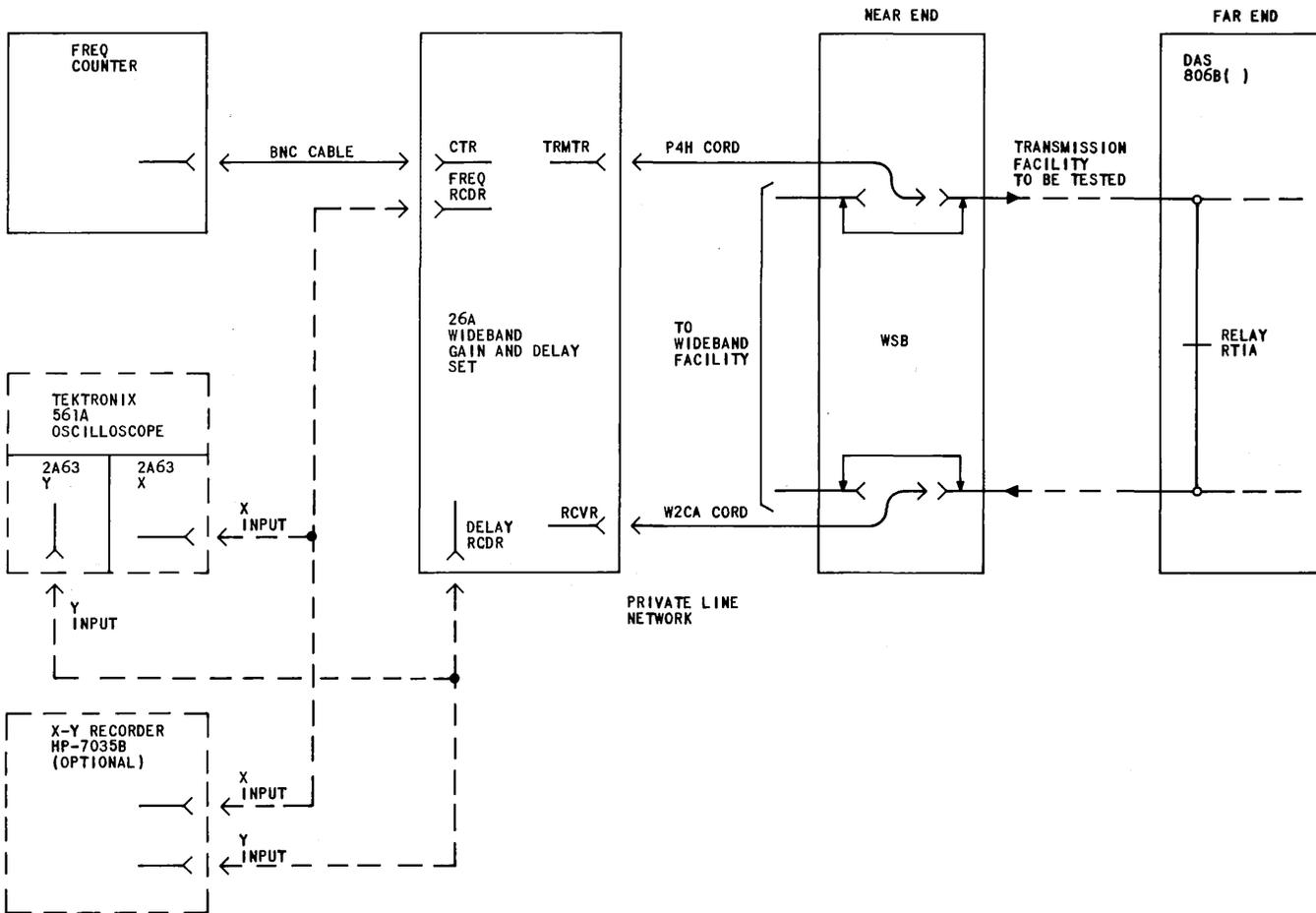


Fig. 8—Wideband Data Channel—Relative Envelope Delay Measurements (WSB to DAS)

STEP	PROCEDURE
5	<p>Note: The level meter reading should be maintained onscale during the point-by-point measurements.</p> <p>Adjust the DELAY ZERO control at the reference (midfrequency) frequency for a 0 indication on the DELAY meter.</p> <p>Note: If point-by-point measurements are being made, continue with Steps 6 through 10. If a sweep-frequency measurement is being made, continue with Steps 11 through 15.</p> <p>Point-by-Point Measurement</p>
6	<p>Using the transmitter FREQUENCY and RANGE controls, adjust the output frequency to 30 kHz.</p>

STEP	PROCEDURE
7	Read the DELAY meter, using the ADD-MICROSECONDS dial if necessary. <i>Do not readjust the DELAY ZERO control.</i>
8	Using the FREQUENCY control, adjust the transmitter frequency <i>slowly</i> through the frequency range. Observing the delay meter, note points at which peak/valley reversals occur, indicating extremities of delay in particular areas. Record these settings of the control.
9	Since this is a loop measurement, the differences found in Step 8 should be divided by 2 and the results plotted. The half-and-half allotment of delay to the two directions of the circuit is arbitrary and may not be correct. This should be kept in mind when test results approach the limits of the objective.
10	Refer to 7.10, which gives procedures for interpreting the results. Sweep-Frequency Measurement
11	Connect the frequency output at the FREQ RCDR jack on the 26A set to the X input on the oscilloscope or on the X-Y recorder.
12	Connect the delay output at the DELAY RCDR jack on the 26A set to the Y input on the oscilloscope or on the X-Y recorder.
13	Measure the delay-frequency characteristics of the circuit under test by <i>slowly turning</i> the FREQUENCY control over the range of the frequency band. <i>Note:</i> If the test frequency is changed too rapidly, some measurement error will result. This error will be distinguished by vertical displacements between plots of increasing and decreasing frequencies.
14	Observe the vertical deflection of the spot on the oscilloscope, or the vertical displacement of the pen on the X-Y recorder above and below the center reference lines as the transmitter frequency is varied. Instantaneous indications of relative delay in the circuit, on a looped basis, are indicated by deflections of the beam trace or vertical pen. Since this is a loop measurement, however, consider the overall amplitude of the deflection as twice the actual delay in one direction.
15	Obtain a plot of the oscilloscope presentation, either by manually plotting or by means of a photograph taken with the camera attachment. If an X-Y recorder is used, the plot made during the measurement test will provide a permanent record.

B. Determination of Slope, Sag, and Peak Values

7.10 The relative envelope delay objectives for the facilities which make up a Wideband Data System are given in terms of slope (SL), sag (SA), and peak (P) values. The following procedure

should be used to convert the results obtained in 7.09 to slope, sag, and peak values of envelope delay. Before beginning this procedure, the results obtained in 7.09 should be plotted. This plotted curve is referred to in the following procedure as the characteristic curve. Refer to Fig. 9.

STEP	PROCEDURE								
1	Draw a <i>smooth</i> curve through the characteristic curve averaging the peaks, trying to have as much area on one side of the smooth curve as on the other. This can be done by placing a mark at the estimated midpoint of the upper and lower excursions of each cycle of ripple and by drawing a <i>smooth</i> curve (with no reversals) using the marks as a guide.								
2	Draw a straight line from the minimum frequency point on the smooth curve to the maximum frequency point on the smooth curve. The difference (in microseconds) between the minimum and maximum points is equal to the slope (SL).								
3	At the midfrequency point, measure the vertical distance between the straight line and the smooth curve. This value (in microseconds) represents the sag (SA).								
4	Measure the largest positive vertical distance (P_1) from the smooth curve to the characteristic curve and the largest negative distance (P_2). Add the P_1 and P_2 values. The sum of these values ($P_1 + P_2$) is equal to the P in microseconds.								
5	<p>Compare the SL, SA, and P values obtained with the SL, SA, and P objectives for the facility being tested. These objectives are as follows:</p> <table border="0" data-bbox="527 919 974 1108"> <thead> <tr> <th data-bbox="527 940 722 993">INTEREXCHANGE FACILITY</th> <th data-bbox="857 919 966 993">EACH STATION LINE</th> </tr> </thead> <tbody> <tr> <td data-bbox="557 1014 693 1045">SL 18.0 μs</td> <td data-bbox="846 1014 971 1045">SL 2.0 μs</td> </tr> <tr> <td data-bbox="557 1045 693 1077">SA 18.0 μs</td> <td data-bbox="846 1045 971 1077">SA 4.0 μs</td> </tr> <tr> <td data-bbox="557 1077 693 1108">P 25.0 μs</td> <td data-bbox="846 1077 971 1108">P 6.0 μs</td> </tr> </tbody> </table>	INTEREXCHANGE FACILITY	EACH STATION LINE	SL 18.0 μs	SL 2.0 μs	SA 18.0 μs	SA 4.0 μs	P 25.0 μs	P 6.0 μs
INTEREXCHANGE FACILITY	EACH STATION LINE								
SL 18.0 μs	SL 2.0 μs								
SA 18.0 μs	SA 4.0 μs								
P 25.0 μs	P 6.0 μs								

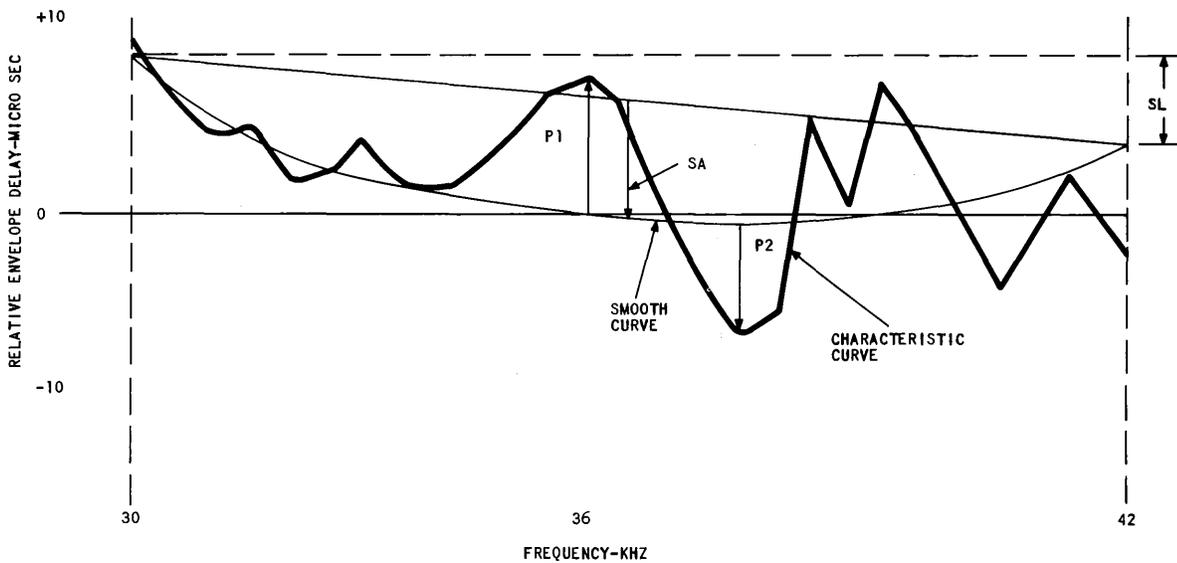


Fig. 9—Theoretical Relative Envelope Delay Curve Showing SL, SA, and P Values

8. NOISE MEASUREMENTS

8.01 Noise measurements are made during maintenance periods and usually as part of trouble location procedures. Noise in data transmission facilities is characterized by high data error rates or data dropouts caused by poor signal-to-noise ratio.

8.02 The three characteristic noise types that are measured are as follows:

(a) **Single Frequency:** Measurement of rms noise or tones at selected frequencies in the specified frequency band is made between WSBs or between a WSB and a wideband data station. These measurements can be performed using a looped circuit and/or a one-way circuit arrangement. The frequency slots are selected by tuning the frequency selective voltmeter through the band and observing maximum readings.

(b) **Gaussian:** Measurement of rms noise is made in the applicable frequency band between WSBs or between a WSB and a wideband data station. Circuit arrangements for this test can be either looped or one-way.

(c) **Impulse:** Measurement of impulse noise is made by counts of noise impulses above an established threshold level and within a predetermined time in the half-group band of

frequencies. This measurement can be made between WSBs or between a WSB and a wideband data station on a looped or one-way circuit arrangement.

Objectives

8.03 Noise objectives are based on impairments expected in a wideband data channel. Allocations of noise objectives are made to trunk and line sections which might be combined into an overall wideband data channel.

8.04 Objectives for interexchange facilities and station line sections are shown in Table A. When making a looped circuit measurement, refer to 2.03 for special considerations. If a particular objective cannot be met, a request for engineering assistance should be made.

Test Access to Wideband Channels

8.05 Procedures for obtaining test access to wideband channels are described in Section 314-602-100.

Caution: Before connecting a measuring set to make any kind of noise measurement, verify that the transmitting end of the circuit has been terminated. This must be done to prevent possible damage to the measuring set. Use a low meter sensitivity (high voltage scale setting) until all connections and control settings are made. Then, increase the sensitivity (lower scale setting) until an appropriate meter deflection is obtained.

TABLE A

MEASUREMENT		INTEREXCHANGE FACILITY	EACH STATION LINE
Standard measurement (6G with 10 to 51 kHz WTG)	Gaussian	54 dBrn or less	46 dBrn or less
	Impulse	6 counts/30 min	130 counts/30 min
Single frequency interference		-37 dBm or less	-37 dBm or less

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8.06 Typical test circuit arrangements for making one-way and looped circuit measurements of noise are shown in Fig. 10. The types of connections for making various noise tests are as follows:

- (1) One-way measurement from a DAS to a WSB.
- (1A) One-way measurement from a WSB to a DAS.
- (2) Looped line measurement from a WSB.
- (3) Looped trunk measurement from a WSB.
- (4) One-way measurement from a WSB at the

far end to a WSB at the near end.

- (4A) One-way measurement from a WSB at the near end to a WSB at the far end.

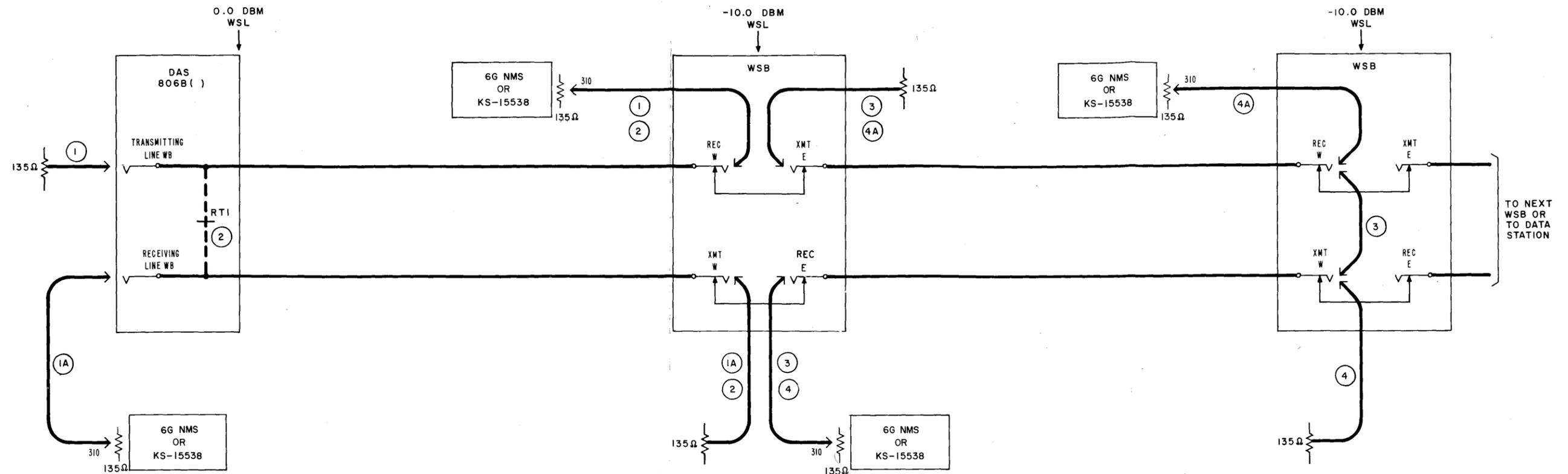
A. Single-Frequency Noise

8.07 Procedures for making single-frequency noise measurements are given in 8.08.

Note: The terminal connecting link on the KS-15538 CFVM INPUT jack should be disconnected from the ground terminal to make measurements on balanced circuits.

8.08 Single-Frequency Noise Measurement:

STEP	PROCEDURE
	<p>At Transmitting End</p>
1	Insert a 135-ohm termination (equipped with a 310 plug) in the appropriate transmitting jack as shown in Fig. 10.
2	For a one-way measurement, proceed to Step 4. For a looped line measurement, perform the procedure for looping the line at the DAS 806B-type or 806D1 as given in 5.04.
3	For a looped trunk measurement, have the trunk looped with a patching cord at the far-end WSB.
	<p>At Receiving End</p>
4	Connect a 135-ohm termination resistor across the input of the KS-15538-L5A CFVM.
5	<p>Set the controls of the CFVM as follows:</p> <p style="padding-left: 40px;">ATTENUATOR to -30</p> <p style="padding-left: 40px;">FUNCTION to 135Ω</p> <p style="padding-left: 40px;">SELECTOR to INPUT</p> <p style="padding-left: 40px;">FINE to minimum (counterclockwise).</p>
6	Connect the INPUT terminals of the CFVM, using a 2W4A test cord, to the appropriate jack as shown in Fig. 10. The connections correspond to the measurements listed in 8.06.
7	Calibrate the voltmeter.



- ① ONE-WAY MEASUREMENT, DAS TO WSB
- ①A ONE-WAY MEASUREMENT, WSB TO DAS
- ② LOOPED-LINE MEASUREMENT FROM WSB
- ③ LOOPED-TRUNK MEASUREMENT FROM WSB
- ④ ONE-WAY MEASUREMENT, WSB (FAR END) TO WSB (NEAR END)
- ④A ONE-WAY MEASUREMENT, WSB (NEAR END) TO WSB (FAR END)

Fig. 10—Noise Measurements and Noise Counts—Wideband Data Circuit

STEP	PROCEDURE
8	<p>Turn the voltmeter MAIN TUNING control <i>very slowly</i> through the frequency range of 2 to 20 kHz or 28 to 44 kHz. Observe and record any frequency settings at which the meter reading approaches or exceeds -37 dBm when testing a station line (2-point private line). Use the FINE tuning control to obtain maximum deflections. The level of any tone measured is the algebraic sum of the ATTENUATOR setting and the DBM meter reading.</p> <p>Note: Interfering signals are not necessarily of constant amplitude. It is recommended that more than one frequency run be made to note maximum readings.</p> <p>Requirement: -37 dBm or less</p>
9	<p>If a one-way measurement was made, switch testing locations and make a measurement in the opposite direction.</p>
10	<p>If a looped circuit measurement was made, refer to 2.03. Record the results on the Transmission Measurement Form as shown in Fig. 1.</p>
11	<p>Remove the test equipment and looping arrangement, if used. Return the wideband data channel to the customer. Release the make-busy condition, if used.</p>

B. Gaussian Noise

8.09 Typical testing arrangements for making one-way and looped circuit measurements of Gaussian noise are shown in Fig. 10.

8.10 *Gaussian Noise Measurement:*

STEP	PROCEDURE
	<p>At Transmitting End</p>
1	<p>Insert a 135-ohm termination (equipped with a 310 plug) into the transmitting jack as indicated in Fig. 10.</p>
2	<p>For a one-way measurement, proceed to Step 5.</p>
3	<p>For a looped line measurement, perform the procedure for looping the line at the DAS 806-type or DAS 806D1 as given in 5.04.</p>
4	<p>For a looped trunk measurement, have the trunk looped with a patching cord at the far-end WSB.</p>

STEP	PROCEDURE
5	<p>At Receiving End</p> <p>Set the controls of the 6G wideband noise measuring set (NMS) as follows:</p> <p>TIMER MINUTES to HOLD</p> <p>DBRN DIAL to 50 (network trunk, interexchange facility) or 40 (wideband subscriber line, station line)</p> <p>FUNCTION to ON LINE</p> <p>WTG—Use 10-50 kHz network</p>
6	<p>Patch the 310 input jack of the 6G NMS to the receiving jack shown in Fig. 10. The connections correspond to the measurements listed in 8.06. Use a 3P7B patching cord.</p>
7	<p>The measured noise is the sum of the DBRN DIAL setting and the meter reading. If necessary, readjust the DBRN DIAL setting to obtain a meter reading in the upper two-thirds of the meter.</p>
	<p>Requirement: 54 dBrn or less for interexchange facility, 46 dBrn or less for each station line.</p>
	<p>Note: If the objectives for Gaussian noise are exceeded by more than 6 dB, remove the trunk or line for trouble investigation. If the objectives are exceeded, but by 6 dB or less, repeat the measurement three times at 1-hour intervals. If more than one of these three subsequent measurements exceed the objective, remove the trunk or line for trouble investigation.</p>
7a	<p>If loop measurement exceeds one-way objectives, make one-way measurements in each direction.</p>
8	<p>If a one-way measurement was made, switch testing locations and make a measurement in the opposite direction. The same test objectives apply for both directions.</p>
9	<p>If a looped circuit measurement was made, refer to 2.03. Record test results on an appropriate Transmission Measurements Form as shown in Fig. 1.</p>
10	<p>Remove test equipment and looping arrangement, if used. Return the wideband data channel to the customer. Release the make-busy condition, if used.</p>

C. Impulse Noise Counts

8.11 Typical testing arrangements for making one-way and looped circuit measurements of noise impulses are shown in Fig. 10.

8.12 Impulse Noise Measurement:

STEP	PROCEDURE
	<p>At Transmitting End</p> <p>1 Insert a 135-ohm termination (equipped with a 310 plug) into the transmitting jack as indicated in Fig. 10.</p> <p>2 For a one-way measurement, proceed to Step 5.</p> <p>3 For a loop line measurement, perform the procedure for looping the line at the DAS 806B-type or DAS 806D1 as given in 5.04.</p> <p>4 For a looped trunk measurement, have the trunk looped with a patching cord at the far-end WSB.</p> <p>At Receiving End</p> <p>5 Set the controls of the 6G noise measuring set (NMS) as follows:</p> <p style="padding-left: 40px;">WTG—Use 10-50 kHz network</p> <p style="padding-left: 40px;">DBRN DIAL to 45 at WSB (75 dBrn); to 55 at station (85 dBrn)</p> <p style="padding-left: 40px;">FUNCTION to ON LINE</p> <p style="padding-left: 40px;">TIMER MINUTES to OFF</p> <p>6 Connect the INPUT jack of the 6G NMS to the receiving jacks shown in Fig. 10. The connections correspond to the measurements listed in 8.06. Use a 3P7B patching cord.</p> <p>7 If necessary, pull the measuring set RESET control to return the register to zero (000).</p> <p>8 Move the TIMER MINUTES control to 30 and allow the timing circuit to time out after 30 minutes. When setting the timing control, move the pointer about 5 minutes above the desired setting, then move downward to the desired setting.</p> <p>9 Read the number of noise impulse counts on the register. the register indicates the number of noise impulses (above the 75 or 85 dBrn threshold) counted during the test interval.</p> <p>Note: When it is necessary to repeat the test, return the TIMER MINUTES control to OFF, reset the register to 0, and return the TIMER MINUTES control to the proper setting for the test interval.</p> <p>Requirement: 6 counts/30 minutes for interexchange facility; 130 counts/30 minutes for each station line.</p>
10	If a one-way measurement was made, switch testing points and make a measurement in the opposite direction.

STEP	PROCEDURE
11	If a looped measurement was made, refer to 2.03. Record results of test on a suitable Transmission Measurements Form as shown in Fig. 1.
12	If test objectives for impulse noise are met, remove test equipment and looping arrangement, if used. Return the wideband circuit to the customer.
13	<p>If test objectives for impulse noise are not met, notify CCO and begin trouble location procedures.</p> <p><i>Note:</i> The data station is now returned to the normal mode and normal operation may be resumed.</p>

9. DIGITAL ERROR RATE TESTS

9.01 Digital error rate tests are performed to verify dynamic performance of both the transmission facilities and data sets. Testing between WSBs over an interexchange facility determines the ability of the facility to adequately transmit data and provides a convenient way of sectionalizing troubles.

9.02 Remote tests can be used to check the looped back facilities between the WSB and the customer (RT-1) or the combination of the facilities and the data station with the data test signal looped at the customer interface (RT-2). A local test at the data station provides a means of checking the operation of the data set alone. This type of test is given in Section 593-800-500.

9.03 The digital error rate tests described in this section use the 912A data test set (DTS). Description of the use and operation of the test set is found in Section 107-400-100. Use of the 915 WDTB rack-mounted version of this test set is covered in Section 314-602-100.

9.04 The test arrangement for making remote error rate tests is shown in Fig. 11. The 912A DTS is rack-mounted and is equipped with a special interface unit J79912AB, which connects the DTS to the wideband control panel. Digital error rate tests of the wideband service are generally made at the 915 WDTB by calling the data station and remotely putting DAS 806B or 806D-type in remote test 1 (RT1) or remote test 2 (RT2). Brief procedures for performing the remote test operation are given in 5.04. More complete procedures are given in Section 314-602-100.

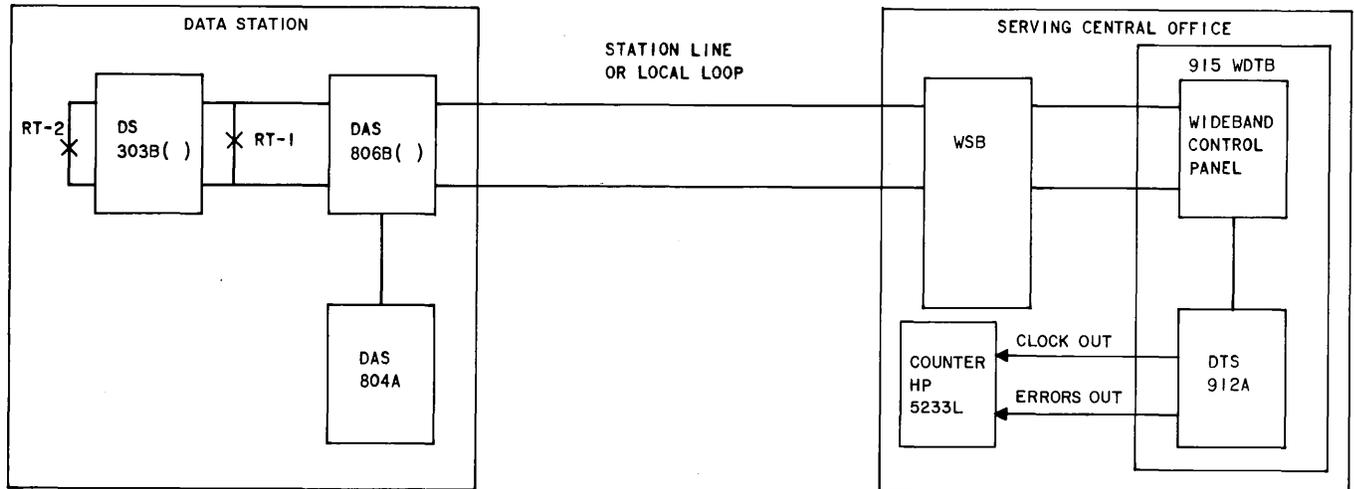


Fig. 11—Test Arrangement for Remote Error Rate Test

A. WSB-to-WSB

9.05 Perform the digital error rate test between WSBs as follows:

STEP	PROCEDURE
1	<p>On the INTERFACE panel of the 912A DTS at each WSB, set the switches as follows:</p> <p>SEND REQ to ON</p> <p>DATA SET to the applicable data set number for the data service under test</p> <p>TEST MODE to OPERATE</p>
2	<p>On the RECEIVE panel of the DTS at each WSB, set the switches as follows:</p> <p>BIT RATE to EXT</p> <p>INPUT to NORMAL</p> <p>TRIGGER to +</p> <p>WORD SYNC to AUTO</p> <p>TEST SIGNAL to 2087</p> <p>TIMING to 0-PERCENT-OF-BIT INTERVAL</p> <p>COUNTER to OFF</p>

STEP	PROCEDURE
3	On the TRANSMIT panel of the DTS at each WSB, set the switches as follows: BIT RATE to EXT TEST SIGNAL to 2087 OUTPUT to NORMAL
4	At each WDTB, patch into the DATA IN and DATA OUT jacks on the wideband control panel and connect to the 912 DTS.
5	On the wideband control panel, select the proper data set [303-B()] by setting the DATA SET control switch.
6	Set COUNTER switch to ON and run the test for a period of 5 minutes.
7	After this period of time, read the number of error counts on the DTS. <i>Requirement:</i> For interexchange facility, 6 errors/5 minutes.
8	Notify CCO of test results.

B. WSB-to-Station or Station-to-WSB

9.06 For this test a 912A DTS is required at both the data station and the WSB (WDTB) area. Perform the procedures given in 5.03 to gain access between the two points. Set the controls on the 912A DTS at both locations to the positions given in 9.05, Steps 1 through 3.

9.07 The test is run for a period of 5 minutes. The requirement is 3 errors in 5 minutes for each direction of transmission.

C. Remote Tests 1 and 2

9.08 These remote tests are used to sectionalize trouble to transmission facilities or the data stations. Remote test 1 (RT-1) loops the facilities between the WSB and the data station. Remote test 2 (RT-2) loops the facilities plus the data station. The detailed procedures for these tests are given in Section 314-602-100. The test requirements to be met are given in Section 314-602-501.

10. REFERENCES

10.01 Further information on equipment and systems involved with half-group data are contained in the following sections:

SECTION	TITLE		
		107-400-100	912A Wideband Data Test Set—Description and Operation
		310-300-500	Two-Point Private Line Telephone Circuits—Overall Measurements
		311-350-ZZZ	Balance Test Procedures For PBX—Switched 4-Wire Tie Trunks—And Access Lines
103-115-105	26A Wideband Gain and Delay Set — (J94026A) — Description, Operation and Maintenance	314-602-100	Data Systems Central Office—915A and 915B Wideband Data Test Bays
103-400-105	KS-15538, List 5 Carrier Frequency Voltmeter—(Range: 2 to 350 Kilocycles)—Description—(Sierra Electronic Corporation)	314-643-300	50-Kilobit Wideband Loop—1 to 50 kHz—WLR-5 Repeater—Initial Line-up