TL MICROWAVE RADIO
SYSTEM TESTS
TRANSMISSION MEASUREMENTS

The quality of the over-all TL system is checked by means of baseband gain-frequency and noise tests and net loss measurements described in this section. The transmission and net loss tests may be performed on a straight away basis over one or more hops of the system, or on a looped basis covering transmission in both directions throughout the entire system.

Measurements in the order-wire and alarm channel may be made in service, so the amplitude of the 2600-cps pilot tone may be monitored at any time at appropriate points in the system, as may the lower frequency interrogating tones. It is intended that these be the indicators of net loss stability in a working system. Steps 1 through 10 below show the way to relate tone measurements to net loss requirements.

In the event that measurement of looped transmission of pilot tone discloses that net loss is out of limits for the over-all system, a technique is offered in Steps 11 through 14 below which permits locating the hop or hops which are in trouble.

Measurement of transmission and noise in the high-frequency portion of the baseband can only be made out of service, since that is the portion normally occupied by the multiplex service in use. Gain-frequency and noise tests, Steps 19 through 35 below, should be performed under the following conditions:

(a) on initial installation, throughout the whole system

(b) routinely, as suggested in Section 409-302-330.

Except on initial installation, gain-frequency tests will normally be made on a hop-by-hop basis. On a diversity system these may be made at any time by locking multiplex service out of each parallel path in turn, and testing on the other.

Caution: Since making gain-frequency tests on a nondiversity system involves circuit outage time, this should only be done if there is good indication that high-frequency transmission is seriously impaired due to the TL system. Such indication would be a customer complaint of excessively noisy channels, or channel levels seriously out of limits.

In the event that serious impairment exists, and pilot transmission measurements offer no clue as to its whereabouts, there is then no recourse but to isolate the troubled hop by separately measuring transmission, out of service, at each repeater in turn until the trouble is located.

Tests to be performed are as follows:

(a) Net Loss Measurement and Adjustment in Order-wire Channel

  (1) Initial Calibration and Alignment — Diversity or Nondiversity System

  (2) Routine Measurement of Looped Pilot Transmission at the Alarm Center

(b) Trouble Location by Measurement of Interrogating Tones

  (1) Initial Calibration

  (2) Trouble Location

  (3) Isolation of Trouble to a Particular Repeater Bay or Cabinet

(c) Gain-frequency Measurements
  (1) Straight Away System Measurements — Nondiversity
  (2) Individual Hop Measurements — Nondiversity System
  (3) Individual Hop Measurements — Diversity System

(d) Noise Measurements
  (1) Noise on the Order Wire
  (2) Noise on the Multiplex Baseband

APPARATUS:

1 — KS-14510, List 1 Volt-ohm-milliammeter (VOM)
2 — J99262AA TL Portable Test Sets

NET LOSS MEASUREMENT AND ADJUSTMENT IN ORDER-WIRE CHANNEL

While the object of this measurement is to determine and control net loss variations in the TL system proper, account must be taken of variations in:

(a) 2600-cps oscillator output amplitude at the order-wire and alarm control panel

(b) voice-frequency line connecting the order-wire and alarm control panel to the near terminal radio station.

Variations in either of these, although they are not related to transmission performance of the TL radio path, affect the amplitude of tones measured at individual TL stations. It is, therefore, necessary to know the amplitude of pilot tone arriving at the first TL transmitter before proceeding further, and to relate subsequent measurements at later stations to that at the TL system input to determine variations attributable to the TL radio equipment.

Since net loss variations from station to station are expected to be random rather than systematic, allowance for random addition is incorporated in the accompanying table of net loss variation versus number of hops (see Table A). The table is designed for use in judging the quality of multihop systems between maintenance intervals, to be used in conjunction with looped measurement of pilot tone at the alarm center. (Thus for a 5-hop system the table should be read for ten hops to tell what looped transmission should result.) The table will also be used in conjunction with the high-frequency transmission measurements to show expected variations in frequency response as a function of the number of hops.

TABLE A

Variation in Net Loss and Frequency Characteristic as a Function of Number of Hops in Tandem.

NUMBER OF HOPS	REQUIREMENTS FOR NET LOSS OR GAIN-FREQUENCY CHARACTERISTIC
	db
1	±0.5
2	±0.75
3 - 4	±1.0
5 - 7	±1.25
8 - 10	±1.5
11 - 14	±1.75
15 - 20	±2.0

Before proceeding with the following measurements, it is assumed that each station has met its performance requirements as specified in Section AA636.774, Transmitter-Receiver Performance Requirements, particularly those concerned with the proper adjustment of transmitter deviation and receiver gain.

STEP	PROCEDURE
	INITIAL CALIBRATION AND ALIGNMENT — DIVERSITY OR NONDIVERSITY SYSTEM
1	Measure pilot tone amplitude at the OW OUT jacks of the J99262N order-wire and alarm panel located in the near terminal (NT) T/R bay or cabinet. This measurement should be made with the TL test set voltmeter, on a 600-ohm bridging basis. ***Requirement:*** The amplitude shall be between −33.75 and −33.25 dbm. If this requirement is not met, but is within normal limits for the type voice frequency (vf) facility used, adjust the OSC OUT control on the J99262M order-wire and alarm control panel at the alarm center to obtain −33.5 dbm (in accordance with Section 409-310-502). If the normal limit is exceeded, locate and correct trouble in the vf line in accordance with Section 409-310-502. ***Note:*** If the pilot tone is connected to the first TL repeater by means of an appreciable length of vf line (several miles), the amplitude received at the TL input can be expected to vary perceptibly over the duration of the testing interval of several hours. In such cases, take care that the received pilot level at the OW OUT jacks is proper before measuring and adjusting a level anywhere else in the system. (See Step 14.)
	NONDIVERSITY SYSTEM
2	Measure the pilot amplitude at each succeeding TL station. This measurement is made with the TL test set, on a 600-ohm bridging basis, at the OW IN jacks on the order-wire panel of the near repeater (NR) T/R bay or cabinet. ***Requirement:*** The amplitude shall be between −22.25 and −21.75 dbm. If the above requirement is not met, but is within 0.5 db of its nominal value of −22 dbm, adjust the RCVR GAIN control on the J99262G receiver IF and baseband panel of the channel under test to obtain this reading. This adjustment takes precedence over that made in the course of tests outlined in Section 409-306-501. If the value as found is more than 0.5 db from its nominal Section 409-306-501 value, refer to Section 409-302-501 for corrective action in the hop involved.
3	(a) Continue on to each succeeding repeater, repeating Step 2 in each case until the whole system is aligned. Radio spur sections and terminals, where present, should be treated in the same manner. (b) The return path must be similarly measured and adjusted, except that the order-wire panel involved is in the far repeater (FR) bay or cabinet instead of the NR bay or cabinet. During this adjustment of the return path, the tests of Section 409-310-501 should be performed to verify the alarm indications at the control center. (c) Perform steps described under Alignment of the Return VF Transmission Path in Section 409-310-502.

STEP	PROCEDURE
	DIVERSITY SYSTEM
	At a diversity repeater, both receivers must be measured and adjusted for proper net loss.
4	(a) Determine which is the active channel; the procedure for this is given in Step 3 of the instructions (Fig. 1 in Section 409-303-500) for removing a section from service. On initial installation this may be done without fear of interrupting service, so omit precautions concerning verification of active channel.
	(b) Manually switch to the channel in use, following the procedure in the instructions in Fig. 1 of Section 409-303-500.
5	(a) Measure the pilot transmission on the channel in use, by connecting the TL test set voltmeter to the OW IN jacks on the order-wire panel for the diversity pair under test. This is a 600-ohm bridging measurement.
	Requirement: The pilot amplitude shall be between −22.25 and −21.75 dbm.
	(b) If the requirement is not met, but is within 0.5 db of its nominal value, adjust the RCVR GAIN control on the J99262G IF and baseband panel of the channel in use at the moment to obtain a reading of −22.0 dbm. This adjustment takes precedence over that made in the course of tests outlined in Section 409-306-501.
	(c) If the value is more than 0.5 db from its nominal value, refer to Sections 409-302-501 and 409-306-501 for corrective action in the hop involved.
6	Manually switch service to the other channel of the diversity pair as described in the instructions for Manual Switch Operation in Fig. 1 of Section 409-303-500. (On initial installation this may be done directly.)
7	Repeat Step 5 on the channel now in use.
8	Restore MAN switch to the AUTO position.
9	(a) Continue on to each succeeding repeater, repeating Steps 4 through 10, until the whole diversity system is measured and aligned. The return path must be similarly measured and adjusted, except that the order-wire panel involved is in the FR bay or cabinet instead of the NR bay or cabinet. During this adjustment of the return path, the tests of Section 409-310-501 should be performed to verify the alarm indications at the control center.
	(b) Perform steps described under Alignment of the Return VF Transmission Path in Section 409-310-502.
	ROUTINE MEASUREMENT OF LOOPED PILOT TRANSMISSION AT ALARM CENTER
	There are either one or two amplifiers in the voice-frequency line connecting the NT TL bay or cabinet to the alarm center, depending on line length. To make a looped measurement of pilot tone meaningful, therefore, it is necessary to isolate the contribution of the vf line, both sending and receiving, from that due to the TL system proper.
	It is also necessary that the frequency of the 2600-cps pilot be peaked according to the procedure specified in Section 409-310-502.

STEP	PROCEDURE
10	Measure the received amplitude of pilot tone at the REC AMPL OUT jack of the OW alarm and control panel, using the TL test set on a 600-ohm terminated basis. ***Requirement 1:*** See Table A. Since this is a looped measurement of pilot tone going through the system both ways, compute the allowable net loss variation on the basis of two hops for every air path in the system. ***Requirement 2:*** Add the allowable variation (either plus or minus) to the requirement at the REC AMPL OUT jack, which is within 3 db of 0 dbm. (See Notes below.) ***Note 1:*** The transmission equivalent from the last TL receiver in the loop (in this case the NT bay or cabinet), through the vf line, to the REC AMPL OUT jacks, must be known. The adjustment of receiver amplifier gain to 0-dbm output, called for in Section 409-310-502, should not be made unless it is known that the requirements on the adjustment of the V1 FIL ADJ control and the OSC LEVEL control as described in this section have been met. Pertinent details will be found under Control Panel Filament Voltage Adjustment and Oscillator Level Adjustment of the above mentioned section. ***Note 2:*** If the pilot level at the last TL receiver output is incorrect, then the level measured in this step should be incorrect by the same amount. In other words, it is not desirable to add the net loss variations in the wire line to those of the TL system. This is to make the measurement made at the alarm center indicative of the condition of the TL system. In most cases, where the vf line is quite short, this will not be a problem. Where the line is many miles long, however, and extremes of temperature cause considerable net loss variations in this line, such variations may be subtracted out by the procedure of Step 14 (see Step 14, especially Note 2). If the requirements of Step 10 are not met, proceed to Step 14. **TROUBLE LOCATION BY MEASUREMENT OF INTERROGATING TONES** If the requirements of Step 10 are not met, it is possible to localize the trouble to a particular hop by the following procedure. **INITIAL CALIBRATION** When Steps 3 (or 9) and 10 of this section have been completed on initial installation, Step 10 should show none of the allowable variation referred to in Table A which is reserved for degradation between maintenance intervals. This is the time, then, to calibrate transmission of interrogating tones around their several loops within the system.
11	At the alarm center, adjust the frequencies of the interrogating tones as described under Interrogation Frequency Adjustment in Section 409-310-502. Then connect the TL test set to the REC AMPL OUT jack of the control panel (a 600-ohm terminated measurement).
12	Depress the first station key on the control panel and read the TL test set voltmeter. ***Requirement:*** The amplitude shall be between −5 and −2 dbm. Record this reading for future reference whenever interrogating tones are being used in this way to help locate a troubled TL repeater.

STEP	PROCEDURE
13	Depress each station key in turn, reading and recording the resulting amplitude as in Step 12. This completes the initial calibration.
	TROUBLE LOCATION
	This test is to be performed whenever the requirements of Step 10 are not met.
14	Repeat Steps 12 and 13, until that station is found in which the net loss error explains the failure to meet the requirement of Step 10.
	Example: Suppose the measurement of Step 10 reveals the net loss to be 5 db excessive, (so that the voltmeter reads 5 db low instead of 2 db or less depending on the number of hops involved). Suppose, further, that in depressing the first and second interrogation keys each yields reasonable results (see Note 1 below and the accompanying Fig. 1), but measurements with the third and following keys depressed each show several db more loss than would be expected for their number of hops. Then it follows that the transmission impairment is located in station 2 or station 3 (station A or B in Fig. 1). That is, it may be in any of the four components starred in the accompanying figure, located at either station A or station B.
	Note 1: It is expected that between maintenance intervals the net loss measurement of Steps 12 and 13 will show increasing departure from the values found on initial calibration. This gradual departure should tend to track with that of Step 10 measurement of looped pilot transmission; together they provide a measure of the operating stability of the whole system. Table A should be used as a guide in judging the performance in Step 14, just as it was in Step 10. Remember that in this case, however, the effective system length varies with the station key depressed. That is, depressing the first key measures no hops at all (only the connecting line facility and passive filters in the near terminal order-wire panel), while the second key effectively yields a 2-hop system, so far as the interrogating path is concerned, the third key a 4-hop system, etc.
	Note 2: Since depressing the first station key provides transmission around the vf line only, it affords a ready means of isolating the connecting line contribution to the over-all net loss variations.
	A comparison of the level at any time with the level obtained on initial calibration (Step 12) directly gives the effect due to the connecting line. This difference should be applied to the over-all difference found in the current measurement of Step 10 to obtain the component due to the TL system proper.
	ISOLATION OF TROUBLE TO A PARTICULAR REPEATER BAY OR CABINET
	Isolation of trouble to a particular repeater bay or cabinet consists of measuring pilot amplitude at the appropriate radio stations, in the manner given in Steps 2 and 3 (nondiversity) or 4 through 8 (diversity). The limits of initial installation no longer apply, but rather those in Table A plus an allowance for connecting line variations. If the connecting line is long enough to contribute variation that is appreciable compared to the allowance in Table A, it would be advisable to repeat Step 1 to ensure proper sending level at the near terminal before proceeding with Step 15 or 16 (nondiversity) or 17 and 18 (diversity).

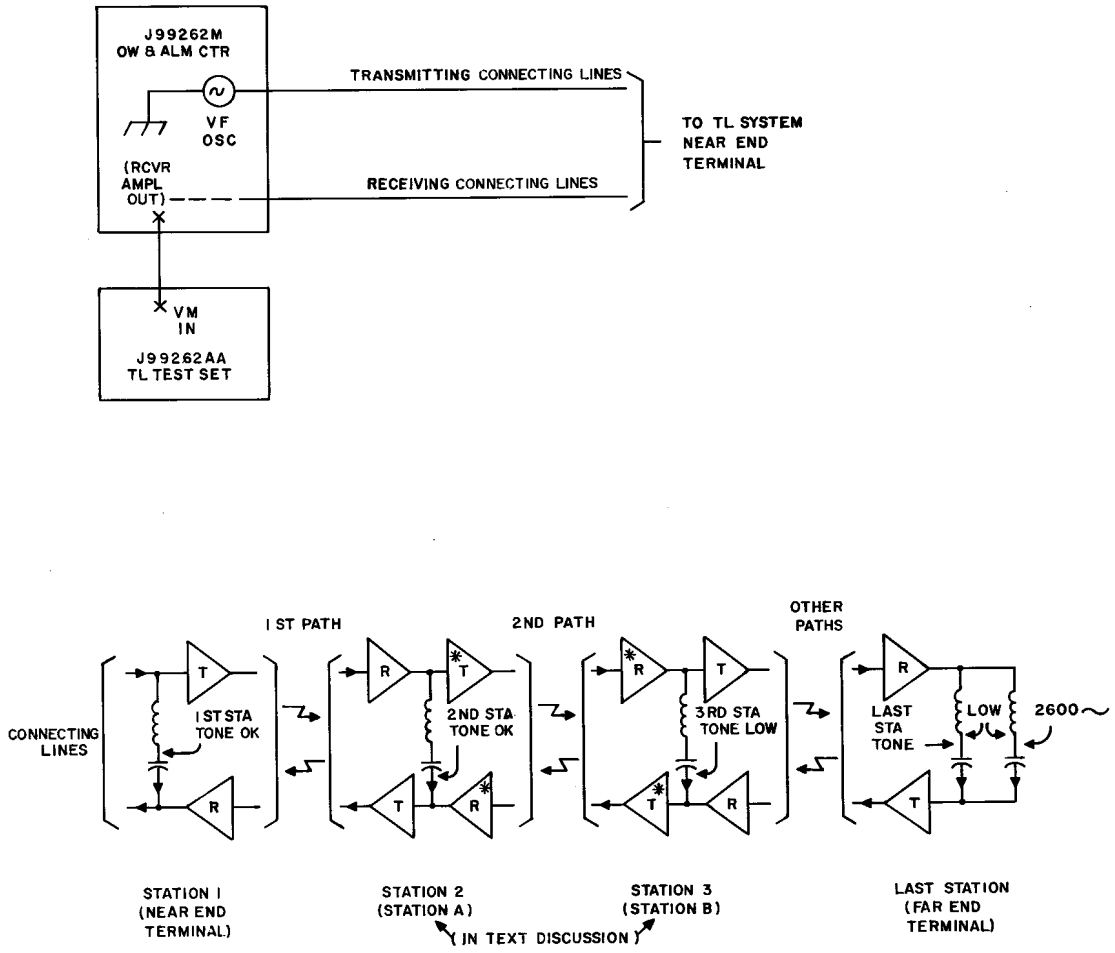

Fig. 1 – Block Schematic of TL Order Wire Route

STEP	PROCEDURE
	NONDIVERSITY
	If the trouble in question is merely a slight excess loss (as opposed to a complete outage), it is desirable to avoid disrupting service until the troubled hop has been definitely isolated. In this case, testing at the radio stations will at first be limited to in-service checks of pilot amplitude to determine which hop is in trouble (Step 15 below). Only when this has been accomplished will service be interrupted to determine whether the transmitter or receiver is at fault (Step 16). If the trouble is a complete outage, service is effectively removed by the trouble, and the precautionary Step 15 is both unnecessary and time consuming. Proceed immediately to Step 16 for out-of-service checks of transmitter and receiver at each of the two stations involved.
15	Step 14 isolated the trouble to either of two stations. (In the example given, these were stations 2 and 3, called stations A and B, respectively, in this discussion.) If convenient, go first to station B, the station farthest from the near terminal. (a) Measure the pilot amplitude as in Step 2 at the NR bay or cabinet.

STEP	PROCEDURE
	Requirement: −22.0 dbm ± allowance from Table A for the number of hops to the station under test. (Note earlier remarks about allowance for connecting line.) If this requirement is met, the trouble is not in the station A to station B path, so must be in the station B to station A path. If this requirement is not met, the trouble is in the A to B path. (The reason for going first to station B is so this distinction can be made; at station A the pilot in the return path would have to read low, yielding no additional information beyond that already derived at the alarm center.) Proceed to Step 16. (b) If it is inconvenient to go first to station B, some information can be gathered at station A by making the in-service checks on the FR transmitter-receiver bay or cabinet indicated in Section 409-302-501. If the trouble is located in either of these units by means of these tests, the system can be removed from service and repaired. If not, it is still necessary to go to station B, performing there Step 15 (a), then 16.
16	If the trouble is a complete outage, or if Step 15 has isolated a lesser trouble to a particular transmitter-air path-receiver, remove the system from service, using the instructions in Fig. 1 of Section 409-303-500. (a) Perform such tests as are indicated in Section 409-302-501 on the appropriate transmitter or receiver, until the trouble is located and cleared. If at station A, the appropriate bay or cabinet is FR; if at station B, NR. (b) Restore service, as indicated in Fig. 1 of Section 409-303-500.
	DIVERSITY In a diversity system it is possible to isolate the troubled diversity pair by manual switch operation at either station. Isolating the particular troubled transmitter-air path-receiver, however, may require going to both stations (if the trouble is not in a pair terminating in the station under test).
17	Verify with the alarm center that the trouble is still apparent (an automatic switch may have "cleared" the trouble by transferring the signal to unimpaired equipment). If it is, measure the pilot amplitude as in Step 5, but with the requirement relaxed as below; do this in the FR bay or cabinet if at station B, on each channel of the diversity pair in turn; in the NR bay or cabinet if at station A. ***Requirement:*** −22.0 dbm ± allowance from Table A for the number of hops to the station under test. Note the earlier remarks about allowance for vf line. ***Note:*** One of the following three sets of conditions will obtain: (a) Requirement met on both channels of the diversity pair under test (see Fig. 1 Section 409-303-500 for manual switch instructions); this can happen only at station B, and the trouble is in the B to A path. (b) Requirement met on neither channel of the pair under test; this can happen only at station A, and the trouble is in the A to B path. (c) Requirement met on one but not both channels. This can happen at either station, depending on where the trouble is. If at station A, the trouble is in the B to A path in the channel not meeting requirement; if at station B, the trouble is in the A to B path in the channel not meeting requirement. When the trouble is isolated to a particular channel of a particular diversity pair, proceed to Step 18.

STEP	PROCEDURE
18	(a) With the trouble located to a particular channel of a particular diversity pair, manually switch service to the good channel of the troubled pair, using the instructions in Fig. 1 of Section 409-303-500. Note that this must be done at the receiving station for the pair involved. (b) Take the receiver out of service and check it in accordance with the trouble location tests of Section 409-302-501. If the trouble proves to be in that receiver, replace it and restore service, as indicated in the instructions in Fig. 1 Section 409-303-500. (c) If no trouble can be located in that receiver, the trouble must be in the distant transmitter. If so, leave service manually switched to the unimpaired channel while the distant transmitter is checked in accordance with the trouble location procedures of Section 409-302-501. (d) When the transmitter is repaired or replaced, restore service at the receiving end of the hop, as described in the instructions in Fig. 1 of Section 409-303-500. **GAIN FREQUENCY MEASUREMENTS** Straight away transmission checks can be performed on a nondiversity system not involving carrier or radio spurs on an out-of-service basis by injecting test signals into the near-end transmitter and measuring their level at the output jack of the far-end receiver. Such a measurement should be made as part of the initial line-up procedure. If these measurements indicate that the frequency characteristic is out of limits, similar measurements must be made on individual hops to localize the trouble to a particular hop. On systems which include radio or carrier spurs this type of measurement probably cannot be made on an over-all basis. At some spur points the filters which separate the multiplex channels to be dropped (or added) from those to be transmitted to the receiving terminal equipment may block some or all of the test frequencies available from the TL test set. In view of this fact, the initial line-up transmission tests on such systems should be made in blocks which include the radio and baseband circuits up to the RCVR OUT jack on the radio receiver at the spur point, and from the IN jack of the transmitter at that point to the end of the system. Radio spurs should be measured separately in the same manner as the main transmission paths. Over-all transmission measurements on a diversity system, to have the same value as those made on a nondiversity system, would require manual operation of all the diversity switches. Consequently, on initial line-up each hop should be checked by itself. After this has been done, an over-all measurement should be made to make sure that there are no wiring or equipment errors in the common parts of the diversity system. This measurement uses the same procedure as is used for a nondiversity system and should meet the requirements for a nondiversity system of the same number of hops in tandem, even though the side of a particular diversity link which is in use is unknown. If transmission conditions are such that fading may be expected, it would be well to repeat the measurements to obtain assurance that a diversity switch had not operated during the course of the measurements. A diversity system can be measured hop by hop in service since it is possible to maintain service over one side of the diversity pair while checking the other side. As a precaution against breaking into a working line, the procedures detailed in Fig. 1 of Section 409-303-500 must be scrupulously followed.

STEP	PROCEDURE
	STRAIGHT AWAY SYSTEM MEASUREMENTS — NONDIVERSITY
	Note: These are out-of-service 2-station measurements requiring a TL test set at both stations. Preliminary to the measurements described below, the zero settings of both test sets should be adjusted in accordance with Section 104-440-300.
19	On the TL test set at the transmitting end of the hop or hops to be measured, arrange the controls to send a 100-kc signal at −14 dbm into the transmitter IN jack.
20	At the receiving end set up the test set to measure receiver output on a 75-ohm terminated basis. With the test set connected to the REC OUT jack, observe and record the reading obtained. (A level of about +6.5 dbm should be expected.)
21	Repeat Steps 19 and 20 at frequencies of 2600 cps, 1 mc, and 4.5 mc. Check that the sending level from the test set remains the same for each frequency.
22	The variation in received level at 100 kc, 1 mc, and 4.5 mc from that at 2600 cps shall meet the following requirement.
	Requirement: This variation shall be no greater than the values given in Table A for the number of hops being measured.
23	After transmission has been measured in one direction, similar measurements may be made in the opposite direction. If these requirements are not met where more than one hop is involved, it becomes necessary to measure transmission hop-by-hop to locate the troubled unit.
	INDIVIDUAL HOP MEASUREMENTS — NONDIVERSITY SYSTEM
	Individual hop measurements should cover the passive elements associated with the order wire and alarm circuits as well as the radio equipment. Such a hop is illustrated in Fig. 2. If a hop fails to meet its transmission requirements, the trouble may be in either part. It then becomes necessary to measure each separately to locate the trouble. The measuring procedure is as follows:
24	Send a 100-kc signal at −14 dbm from the test set into the radio transmitter.

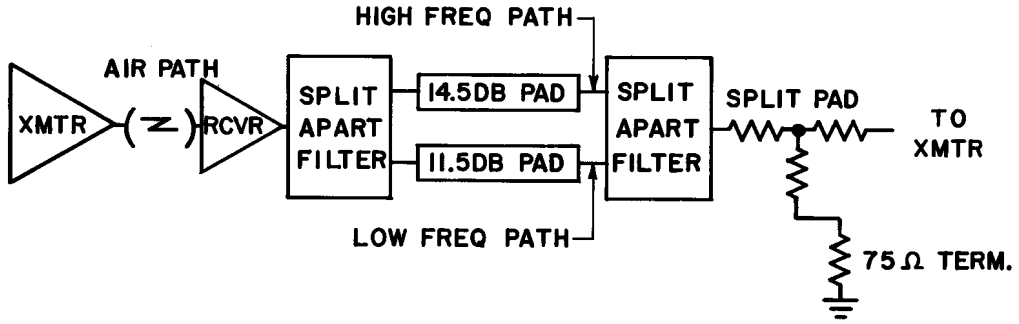

Fig. 2 – Typical Individual Link Nondiversity

STEP	PROCEDURE
25	At the receiving end of the hop break the coaxial connection feeding the transmitter following the receiver under test and connect this coaxial lead to the test set voltmeter at this location. Arrange the test set to receive on a 75-ohm terminated basis. Observe and record the reading of the test set voltmeter.
26	Repeat this measurement at 2600 cps, 1 mc, and 4.5 mc with the sending level maintained constant. (A received signal level of −14 dbm can be expected.)
27	The variation of level over this band of frequencies should meet the following requirement. ***Requirement:*** The variation shall be no greater than the single hop requirement given in Table A. If this requirement is not met, the radio hop alone should be measured. It should meet the above requirement. If it does not, refer to Section 409-302-501 for correction of trouble. If the radio hop meets its requirements, check transmission through the passive section of the hop as follows.
28	Calibrate the test set voltmeter against its oscillator per Section 104-440-300.
29	With the voltmeter in the test set connected as in Step 25, remove the coaxial patch cord from the radio receiver output jack, RCVR OUT, and connect it to the test set oscillator.
30	Send a 0-dbm signal from the test set at 2600 cps, 100 kc, 1 mc, and 4.5 mc into the circuit under test, and observe and record the readings of the test set voltmeter. These readings should meet the following requirement. ***Requirement:*** −20.5 ±0.25 dbm at each frequency. If this requirement is not met, check for defective elements in the passive portion of the circuit.
	INDIVIDUAL HOP MEASUREMENTS — DIVERSITY SYSTEM These measurements are identical to those in Steps 19 through 22 above, except that each path of a diversity pair must be measured at each hop. Refer to Fig. 1 Section 409-303-500 for instructions for removing and restoring service over this path.
	NOISE MEASUREMENTS Noise checks on both the order wire and multiplex baseband should be made at the time of initial installation and when required thereafter. A meaningful measurement of noise in the multiplex baseband can only be made on an out-of-service basis. Order-wire noise checks, however, can be made without disrupting service. Both measurements are made with the TL test set and are not intended to be precise. The same limits apply regardless of the number of hops included in the test. Their chief value lies in pointing out any serious noise troubles in a system. The multiplex baseband noise on a nondiversity system is measured on the complete system at the receiving terminals. On a diversity system the measurement should be made on each hop of the system. The order wire is measured at the end of the system only, whether nondiversity or diversity.

STEP	PROCEDURE
	NOISE ON THE ORDER WIRE
	Note: When making this test the 2600-cycle pilot tone should be present at its normal level (−33.5 dbm at OW OUT).
31	On the order-wire and alarm panel in the NT or FT bay (depending on the direction of transmission being checked) open the hinged subpanel exposing the terminals of the "B" amplifier.
32	Connect the VOLTMETER of the TL test set, VM IN jack, between the output terminal W and the ground terminal L of the "B" amplifier.
33	Plug in the head set and with the INPUT switch on the TL test set on BRDG (600Ω) measure the noise. ***Requirement:*** The indicated noise reading shall not exceed − 40 dbm. ***Note:*** If a high noise reading is obtained, check that the order-wire extension at the other end of the system is not contributing by removing the 89-type pad from the order wire and alarm panel in the NT or FT bay at the other end of the system and connecting terminals 4 and 5 together with a clip lead. This terminates the extension and prevents transmission into the radio order-wire.
	NOISE ON THE MULTIPLEX BASEBAND
	This measurement does not include the low-frequency noise measured in Steps 31 through 33, as the measurement is made on the drop side of the split-apart filter in the order-wire and alarm panel. A convenient point of measurement is the MX IN jack. The multiplex equipment should not be connected. The measurement is made at the receiving terminals of a nondiversity system and at the MX IN jack of the order-wire and alarm panel of each bay for a diversity system. The multiplex signals must not be applied; if not already removed, grounding the MX OUT jack at the NT or FT (or FR bay at a spur point) bay at the far end of the system will remove them.
34	Connect the TL test set VOLTMETER to the MX IN jack on the order-wire and alarm panel.
35	With the INPUT switch on RCVR GAIN observe the VOLTMETER reading. ***Requirement:*** Less than −45 dbm for 1 hop Less than −40 dbm for 2 to 8 hops Less than −39 dbm for 9 or 10 hops.