L4 CARRIER
OVERALL SYSTEM
TESTS
THERMAL AND INTERMODULATION NOISE

This section provides procedures for measuring the thermal and intermodulation noise in an L4 line section and for locating defective repeaters. ▶A ***line section*** for noise measurements may include one or two main sections. Noise loading test procedures are explained in Section 359-200-506.◀

This section is reissued to clarify the test procedures, to correct errors, and to expand the explanations. Arrows are used to indicate significant changes. ***Equipment Test Lists are not affected.***

Intermodulation noise in an L4 line depends on the number of repeaters in tandem. This intermodulation noise is measured by inserting two signals, 544 kHz apart, at the transmitting main station and measuring the 544-kHz noise at the receiving main station. When this noise exceeds the requirement, a second test is made using the monitoring oscillator signals as one of the two signals to locate a defective repeater.

Noise on L4 lines includes two major types: intermodulation and thermal noise. ***Intermodulation*** noise caused by amplifiers, transformers, and other frequency-sensitive units is predominant. When several signals are simultaneously applied to a nonlinear device, the output contains not only the input signals, but also undesired intermodulation noise: the sums and differences of the input frequencies, harmonics, and the sums and differences of the harmonics. Intermodulation noise varies with the loading and the nonlinearity of the line section. Loading is determined by the number of assigned channels and the types of signals present on these channels. ***Thermal*** noise is continuous broadband noise throughout the frequency band used by coaxial cable systems.

CHART **PAGE**

APPARATUS:

Transmission test equipment provided at the L4 main station is required

544-kHz bandpass filter.

Note: Main stations having a control center can use the 751M filter mounted in the bank of A equalizer test signal filters at the rear of the control center. When the line under test is selected, any 544-kHz signal on this line appears at the filter output.

▶CHART 1◀

PREPARING LINE SECTION FOR NOISE TESTS

STEP	PROCEDURE
	A. Disabling Line Switching
	Caution: Prior to beginning this procedure, the line equalization should be checked and adjusted as required. Equalizer test signals must not be on the line while noise measurements are being made.
	Note: When the ***standby*** line is under test, line switching for all regular lines is disabled (locked normal). When a regular line assigned to service is under test, service is switched to the standby line. When a regular line ***not*** assigned to service is under test, line switching for all other lines remains unaffected.
1	Proceed to Part B for a ***standby*** line, proceed to Part C for a regular line ***not*** assigned to service, or proceed to Part D for a regular line assigned to service.

CHART 1 (Cont)

STEP	PROCEDURE
	B. Preparing Standby Line
	At transmitting main station,
2	***At the standby line transmit bay,*** remove the patch plug between the BLK TRK OUT and BLK SIG IN jacks.
	Note: This patch plug is removed to prevent noise received from the preceding main section from entering the line section to be tested. At each main station, the standby line blocks the command carrier, line pilot, and line switching signals.
3	Perform the following procedure at ***each*** receiving main station if the line section to be tested includes two main sections.
4	***At receiving main station control connecting bay,*** depress the MSTR and LOCK NORM pushbuttons simultaneously.
	Note: The LOCK NORM lamp lights. The OUT SERV lamp lights in the line receiving bay for the ***standby*** line. The switching is disabled.
5	Check that the line terminate MODE switch, if provided, for the ***standby*** line is in the MAN position.
6	Proceed to Chart 2.
	C. Preparing Regular Line not Assigned to Service
	Note: This procedure applies ***only*** to a regular line not assigned to service. Proceed to Part D for a regular line assigned to service to switch service to the standby line.
7	***At receiving main station switch control bay,*** operate the receive line test switch (REC L SW), on the switch initiator panel for this regular line, to disconnect (DISC).
8	Operate the associated initiator (INIT) switch to TST.
9	***On switching signal filter panel,*** block the REG relay for this regular line in the operated position.
	Note: This relay is blocked operated to prevent any signals received on this line from entering the switching circuits.

▶CHART 1◀ (Cont)

STEP	PROCEDURE
10	***At line receiving bay,*** remove the patch plug between the BLK SIG OUT and BLK CKT IN jacks for the regular line to be tested.
	Note: The following step provides additional assurance that switching involving this regular line will not occur.
11	***At transmitting main station switch control bay on transmitting switch control panel for this regular line,*** operate the transmit switch disconnect switch (TRSG SW) to disconnect (DISC).
	Note: The adjacent TRSG SW DISC lamp lights. Switching is now disabled for this regular line.
12	***At line transmitting bay,*** remove the patch plug between the BLK TRK OUT and BLK SIG IN jacks for this regular line.
	Note: This patch plug is removed to prevent noise received from the preceding main section from entering the line section to be tested.
13	Proceed to Chart 2.

D. Preparing Regular Line Assigned to Service

Note: Service is switched to the standby line when a regular line assigned to service is to be tested.

At receiving main station,

14	Monitor the message signal at the RCVG TST jack in each receiving main station while performing the following steps.

At transmitting main station,

▶***Note:*** Do not perform the following step at the ***intermediate*** main station if the line section to be tested includes two main sections.◀

15	***At the standby line transmitting bay,*** remove the patch plug between the BLK TRK OUT and BLK SIG IN jacks.
	Note: This patch plug is removed to prevent noise received on the standby line from entering the regular line to be tested via the pilot signal path to be established in Part E.

▶CHART 1◀ (Cont)

STEP	PROCEDURE
16	Perform the following procedure at ***each*** receiving main station if the line section to be tested includes two main sections.
17	***At receiving main station control conecting bay,*** depress the SEL LINE MAN pushbutton for this regular line.
	Note: The associated SEL LINE MAN lamp lights.
18	Depress the MSTR and MAN pushbuttons simultaneously.
	Note: The appropriate OUT SERV MAN lamp lights for this regular line. The OUT SERV lamp lights in the line receiving bay for this regular line. Service has been transferred to the ***standby*** line.
19	Check that the line terminate MODE switch, if provided, for the ***standby*** line is in the MAN position.
20	Proceed to Part E.
	E. Completing Pilot Signal Path from Standby Line to Regular line
	Note: The following patching procedure is required for this ***regular*** line at the transmitting main station in the line section under test; ***not*** at the intermediate main station in a two-section control arrangement.
	At transmitting main station,
21	Proceed to Step 22 for a line with jack and hybrid panel ED-51423 provided in later L4 line transmitting bays and in L4S line bays; proceed to Step 27 for a line with jack and hybrid panel ED-50710, which is manufacture discontinued.
	Note: Take care that pilot signals are removed from the line to be tested for the minimum time possible while patching.
	Jack and Hybrid Panel ED-51423 (Fig. 1)
22	***At the standby line transmitting bay,*** remove the patch plug between the HYB OUT B and SW IN jacks for the ***standby*** line.
23	Connect one end of a patch cord to the HYB OUT B jack for the standby line.

CHART 1 (Cont)

STEP	PROCEDURE
24	***At the regular line transmitting bay, at regular line being tested,*** remove the patch plug between the HYB OUT A and LINE AMPL IN jacks, and ***immediately*** connect the other end of the patch cord to the LINE AMPL IN jack.
	Requirement: Pilots are supplied to the regular line to be tested.
25	Insert a terminating plug in the HYB OUT A jack for the regular line.
26	Proceed to Chart 2.
	Jack and Hybrid Panel ED-50710 (Fig. 2)
27	***At the standby line transmitting bay,*** remove the patch plug between the TRMTG HYB OUT B and SW IN jacks for the ***standby*** line.
28	Connect one end of a patch cord to the TRMTG HYB OUT B jack for the standby line.
	Note: In the following step, take care that the coaxial plug does not short the power terminals on the amplifier or the ADD SIG IN jack.
29	***At the regular line transmitting bay, at regular line,*** remove the plug from the IN jack on the line amplifier, and ***immediately*** connect the other end of the patch cord to the IN jack on the line amplifier.
	Note: The regular line amplifier is located inside at the rear of jack and hybrid panel ED-50710. The IN jack is located on the right side at the bottom of the amplifier when facing the rear of the bay.
	Requirement: Pilots are supplied to the regular line to be tested.
30	Terminate the cable plug removed from the line amplifier IN jack in 75 ohms.
31	Proceed to Chart 2.

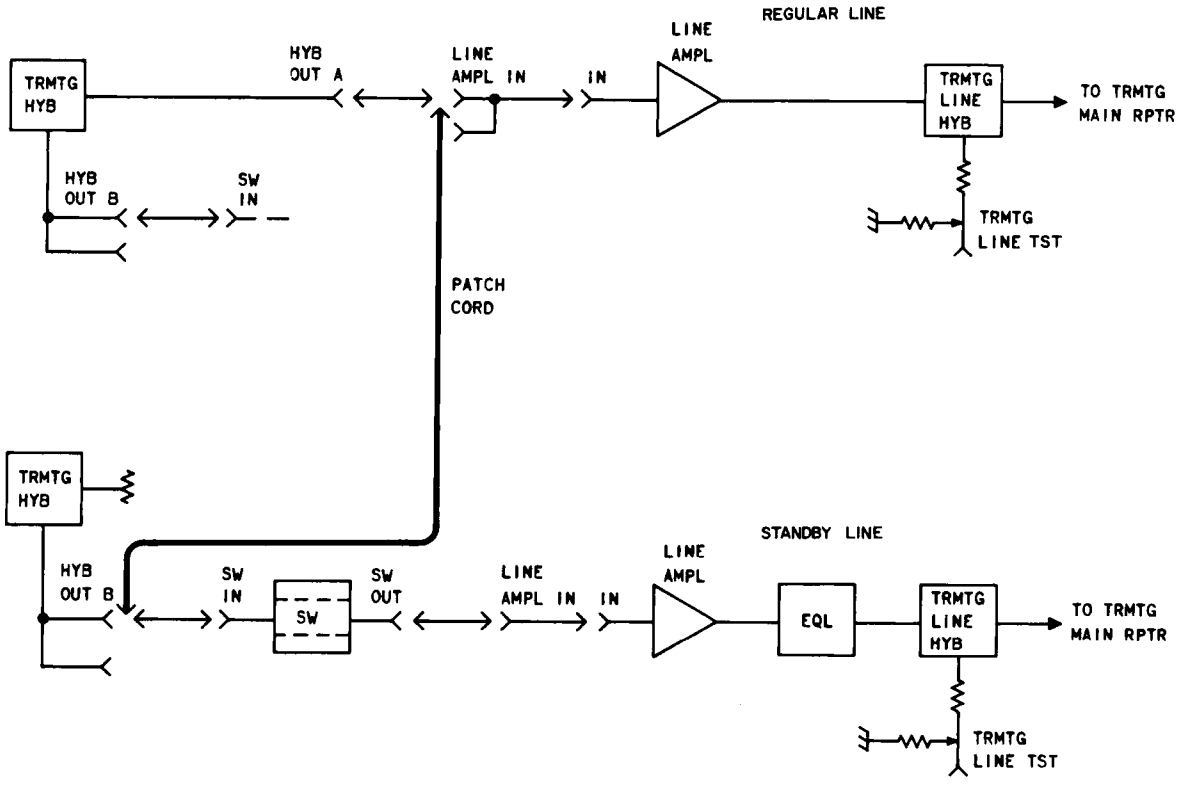

Fig. 1—Connections for Jack and Hybrid Panel ED-51423

CHART 2

MEASURING THERMAL NOISE

Thermal noise in the line section is measured to detect excessive noise that may affect the intermodulation noise measurements in Chart 3. The test arrangement is shown in Fig. 3.

STEP	PROCEDURE
	Note: ◗Prepare the line section per Chart 1 before starting this test.◖
	At receiving main station,
1	Prepare the receiving test equipment (RTE) for 75-ohm measurement of 544 kHz at powers between -99.0 and -120.0 dBm.
	Note: ◗Use the LOW NOISE mode.◖
2	Remove the patch plug between the PIL HYB OUT A and SW IN jacks.

CHART 2 (Cont)

STEP	PROCEDURE

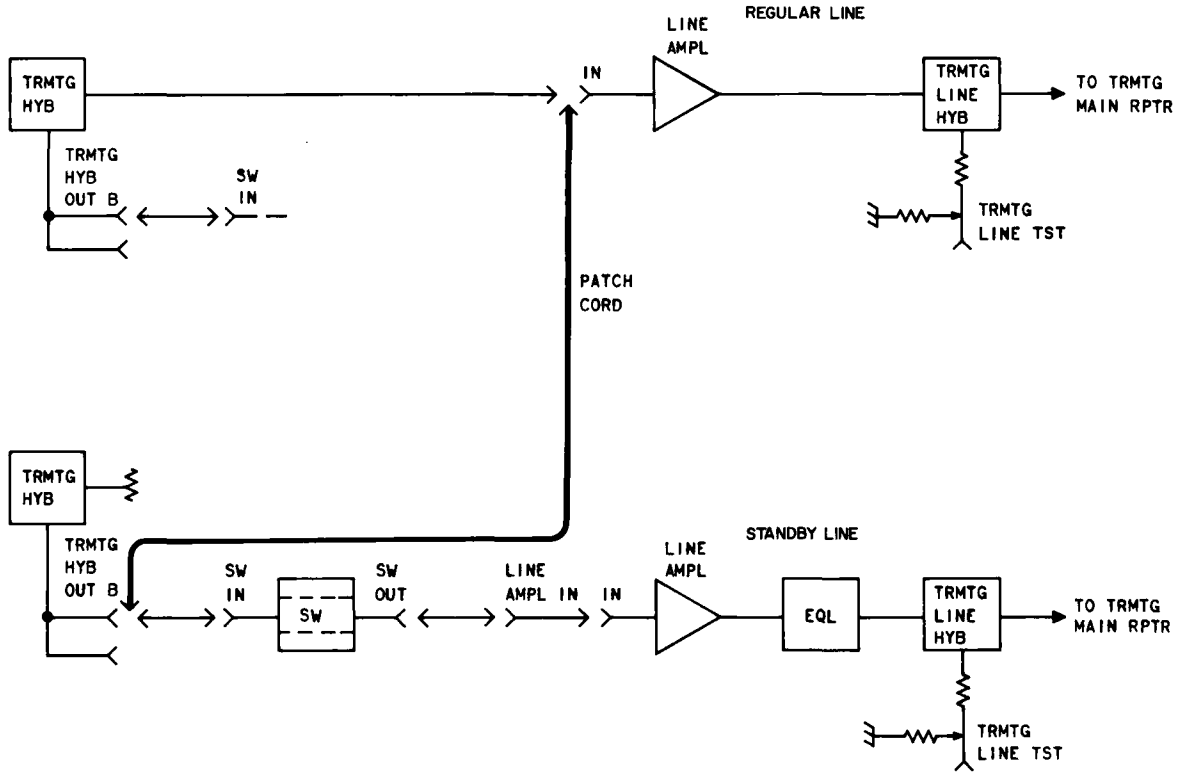

Fig. 2—Connections for Jack and Hybrid Panel ED-50710

3 Connect the PIL HYB OUT A jack through a 751M filter to the RTE [patches (1) and (2), Fig. 3].

4 Measure and record the thermal noise at 544 kHz.

Requirement: Thermal noise power within limits in Table A according to the number of repeaters in the line section under test, including the transmitting and receiving repeaters at the main stations.

Example: The thermal noise power requirement for a line section with 50 repeaters is -97.01 dBm or less. A power indication of -98.5 dBm is less and meets the requirement.

5 Leave test equipment connected, and proceed to Chart 3 if the requirement of Step 4 is met. Otherwise, the line contains noisy repeaters which can affect the intermodulation noise. These repeaters should be located and replaced before proceeding to Chart 3.

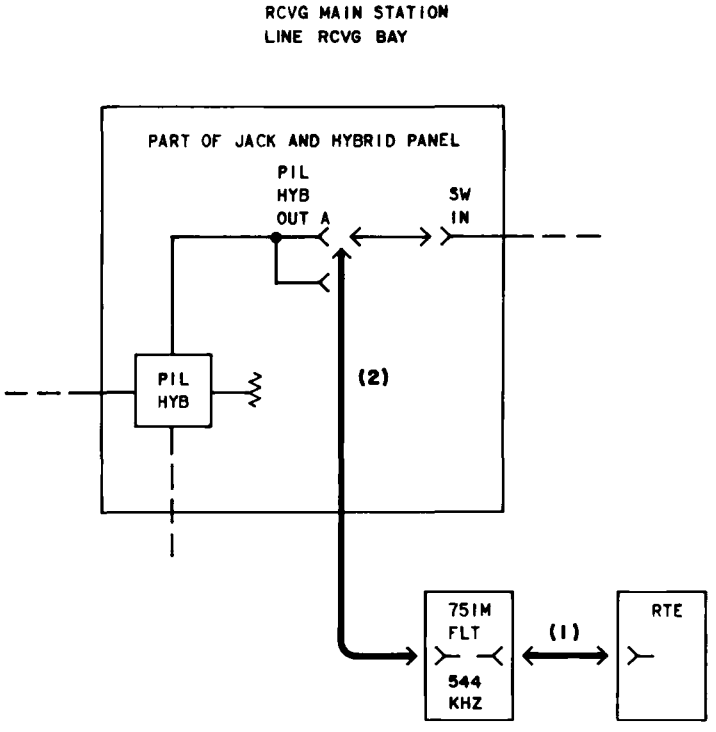

Fig. 3—Test Arrangement for Thermal Noise Measurement

CHART 3

MEASURING INTERMODULATION NOISE

Two signals, 17.544 and 17.000 MHz, are inserted at the transmitting main station. The 544-kHz intermodulation noise power is measured at the receiving main station. The test arrangement is shown in Fig. 4.

STEP	PROCEDURE
	Note: ▶Prepare the line section per Chart 1, and perform the thermal noise measurements per Chart 2 before starting this test.◀
	At transmitting main station,
1	Prepare one sending test equipment (STE) to send 17.544 MHz at -12.0 dBm and another to send 17.000 MHz at -12.0 dBm.
2	Remove the patch plugs between the MON OSC OUT and MON SIG IN jacks and between the LOOP BACK OUT and LOOP SIG IN jacks for the line under test.

TABLE A

THERMAL NOISE REQUIREMENTS

NO. OF RPTRS*	THERMAL NOISE MUST BE LESS THAN (DBM)	NO. OF RPTRS*	THERMAL NOISE MUST BE LESS THAN (DBM)	NO. OF RPTRS*	THERMAL NOISE MUST BE LESS THAN (DBM)	NO. OF RPTRS*	THERMAL NOISE MUST BE LESS THAN (DBM)
1	−114.00	21	−100.78	41	−97.87	61	−96.15
2	−110.99	22	−100.58	42	−97.77	62	−96.08
3	−109.23	23	−100.38	43	−97.67	63	−96.01
4	−107.98	24	−100.20	44	−97.57	64	−95.94
5	−107.01	25	−100.02	45	−97.47	65	−95.87
6	−106.22	26	−99.85	46	−97.37	66	−95.80
7	−105.55	27	−99.69	47	−97.28	67	−95.73
8	−104.97	28	−99.53	48	−97.19	68	−95.68
9	−104.46	29	−99.38	49	−97.10	69	−95.61
10	−104.00	30	−99.23	50	−97.01	70	−95.55
11	−103.59	31	−99.09	51	−96.92	71	−95.49
12	−103.21	32	−98.95	52	−96.84	72	−95.43
13	−102.86	33	−98.81	53	−96.76	73	−95.37
14	−102.54	34	−98.69	54	−96.68	74	−95.31
15	−102.24	35	−98.56	55	−96.60	75	−95.25
16	−101.96	36	−98.44	56	−96.52	76	−95.19
17	−101.70	37	−98.32	57	−96.44	77	−95.13
18	−101.45	38	−98.20	58	−96.37	78	−95.07
19	−101.21	39	−98.09	59	−96.29	79	−95.02
20	−100.99	40	−97.98	60	−96.22	80	−94.97

* Include main station transmitting and receiving repeaters

CHART 3 (Cont)

STEP	PROCEDURE
3	Connect the STE output signals to the MON SIG IN and LOOP SIG IN jacks [patches (1) and (2), Fig. 4].
4	Measure the power of the 17.544-MHz and 17.000-MHz test signals at the TRMTG LINE TST jack [patch (3), Fig. 4]. ***Requirement:*** Each test signal: -31.5 dBm. ***Note:*** These test signals are 10 dB above transmission level.
5	Adjust the output of the appropriate STE, if required, to meet the requirement. ***Note:*** Steps 6, 7, and 8 may have been completed in Chart 2.

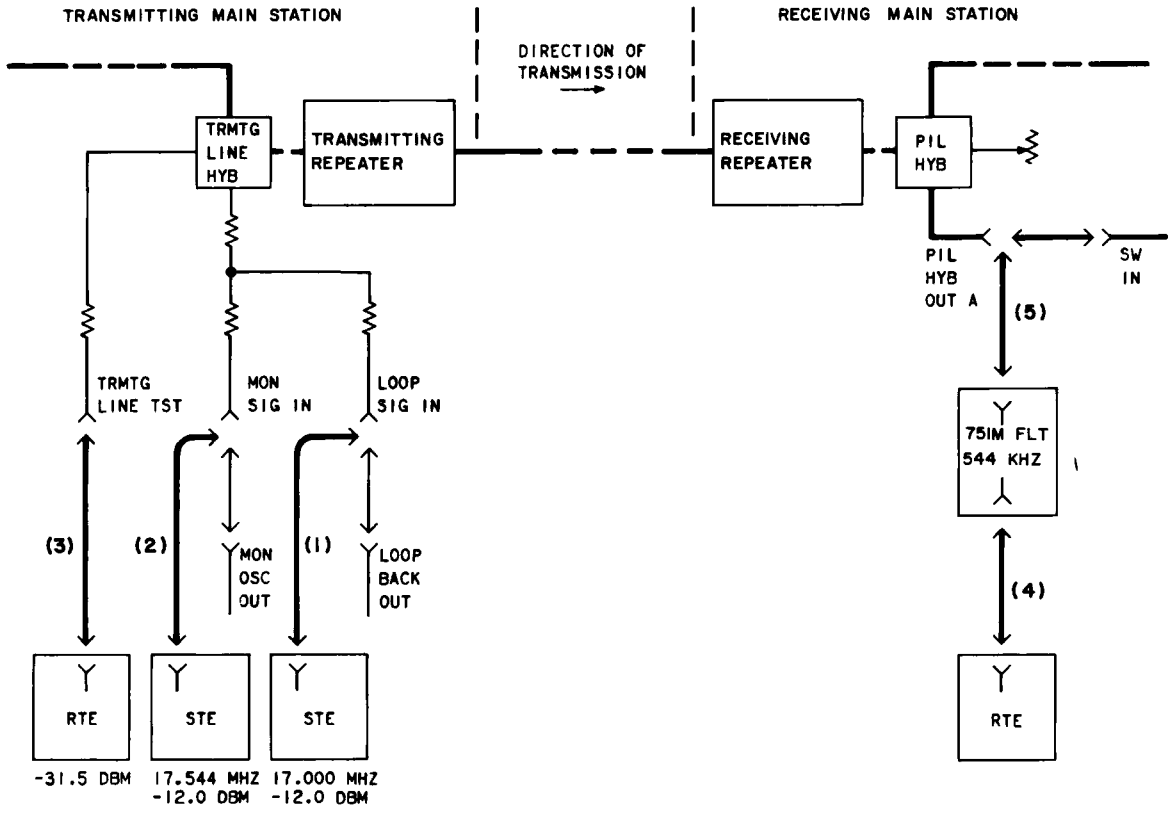

Fig. 4—Test Arrangement for Intermodulation Noise Measurement

CHART 3 (Cont)

STEP	PROCEDURE
	At receiving main station,
6	Prepare the RTE for 75-ohm measurement of 544 kHz at powers between -74.0 and -94.0 dBm.
	Note: ▶Use the LOW NOISE mode.◀
7	Remove the patch plug between the PIL HYB OUT A and SW IN jacks for the line under test.
8	Connect the PIL HYB OUT A jack to the 751M filter input, and connect the filter output to the RTE input [patches (4) and (5), Fig. 4].
9	Measure and record the power of the 544-kHz intermodulation noise.
	Requirement: Intermodulation noise power within limits in Table B according to the number of repeaters in the line section under test, including the transmitting and receiving repeaters at the main stations.
	Example: The intermodulation noise power for a line section with 50 repeaters is -72.01 dBm or less. A power indication of -72.2 dBm is less and meets the requirement.
10	Perform Steps 11 and 12, and proceed to Chart 5 if the requirement of Step 9 is met. Otherwise, proceed to Chart 4 to locate defective repeaters.
	At transmitting main station,
11	Disconnect the STE, and replace the patch plugs between the MON OSC OUT and MON SIG IN jacks and between the LOOP BACK OUT and LOOP SIG IN jacks.
	At receiving main station,
12	Disconnect the RTE, and replace the patch plug between the PIL HYB OUT A and SW IN jacks.

CHART 4

LOCATING DEFECTIVE REPEATERS

To locate a defective repeater producing excessive intermodulation noise, a two-signal test is used. Test signals in the range of 19.044 to 19.104 MHz are inserted at +15 dBm0 at the transmitting main station. The monitoring oscillator groups are turned on, in turn, and the intermodulation noise at 544 kHz is measured at the receiving main station.

TABLE B

INTERMODULATION NOISE REQUIREMENTS

NO. OF RPTRS*	INTERMOD NOISE MUST BE LESS THAT (DBM)	NO. OF RPTRS*	INTERMOD NOISE MUST BE LESS THAN (DBM)	NO. OF RPTRS*	INTERMOD NOISE MUST BE LESS THAN (DBM)	NO. OF RPTRS*	INTERMOD NOISE MUST BE LESS THAN (DBM)
1	−89.00	21	−75.78	41	−72.87	61	−71.15
2	−85.99	22	−75.58	42	−72.77	62	−71.08
3	−84.23	23	−75.38	43	−72.67	63	−71.01
4	−82.98	24	−75.20	44	−72.57	64	−70.94
5	−82.01	25	−75.02	45	−72.47	65	−70.87
6	−81.22	26	−74.85	46	−72.37	66	−70.80
7	−80.55	27	−74.69	47	−72.28	67	−70.73
8	−79.97	28	−74.53	48	−72.19	68	−70.68
9	−79.46	29	−74.38	49	−72.10	69	−70.61
10	−79.00	30	−74.23	50	−72.01	70	−70.55
11	−78.59	31	−74.09	51	−71.92	71	−70.49
12	−78.21	32	−73.95	52	−71.84	72	−70.43
13	−77.86	33	−73.81	53	−71.76	73	−70.37
14	−77.54	34	−73.69	54	−71.68	74	−70.31
15	−77.24	35	−73.56	55	−71.60	75	−70.25
16	−76.96	36	−73.44	56	−71.52	76	−70.19
17	−76.70	37	−73.32	57	−71.44	77	−70.13
18	−76.45	38	−73.20	58	−71.37	78	−70.08
19	−76.21	39	−73.09	59	−71.29	79	−70.02
20	−75.99	40	−72.98	60	−71.22	80	−69.97

* Include main station transmitting and receiving repeaters

CHART 4 (Cont)

The monitoring oscillators must be aligned to the proper power per Section 359-200-503; otherwise, a high or low monitoring oscillator signal may give a false indication.

STEP	PROCEDURE

Note: Prepare the line section per Chart 1 before starting this test.

1 Set up a test record, as shown in Fig. 5 for 4-kHz or Fig. 6 for 3-kHz monitoring oscillator spacing, and fill in the repeater station numbers for the line section under test.

Note: See office records for monitoring oscillator assignments.

LINE _____ THERMAL NOISE _____ DBM DATE _____

INTERMODULATION NOISE _____ DBM BY _____

MON OSC FREQ	TEST SIGNAL FREQ	RPTR STA	PWR AT 544 KHZ	RPTR STA	PWR AT 544 KHZ	RPTR STA	PWR AT 544 KHZ	RPTR STA	PWR AT 544 KHZ	RPTR STA	PWR AT 544 KHZ	RPTR STA	PWR AT 544 KHZ
18.500	19.044												
18.504	19.048												
18.508	19.052												
18.512	19.056												
18.516	19.060												
18.520	19.064												
18.524	19.068												
18.528	19.072												
18.532	19.076												
18.536	19.080												
18.540	19.084												
18.544	19.088												
18.548	19.092												
18.552	19.096												
18.556	19.100												
18.560	19.104												

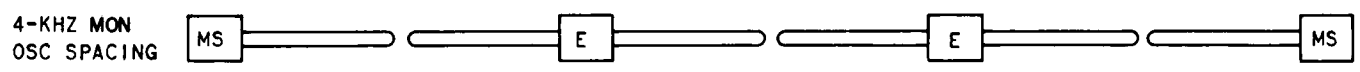

Fig. 5—Test Record for Monitoring Oscillators with 4-kHz Spacing

CHART 4 (Cont)

STEP	PROCEDURE
	At transmitting main station,
2	Remove the patch plug between the MON OSC OUT and MON SIG IN jacks.
3	Connect the 19.044-MHz signal at -7 dBm to the MON SIG IN jack (Fig. 7).

MON OSC FREQ	TEST SIGNAL FREQ	RPTR STA	PWR AT 544 KHZ	RPTR STA	PWR AT 544 KHZ
18.500	19.044				
18.503	19.047				
18.506	19.050				
18.509	19.053				
18.512	19.056				
18.515	19.059				
18.518	19.062				
18.521	19.065				
18.524	19.068				
18.527	19.071				
18.530	19.074				
18.533	19.077				
18.536	19.080				
18.539	19.083				
18.542	19.086				
18.545	19.089				
18.548	19.092				
18.551	19.095				
18.554	19.098				
18.557	19.101				
18.560	19.104				

LINE _____ DATE _____

BY _____

THERMAL NOISE _____ DBM

INTERMODULATION NOISE _____ DBM

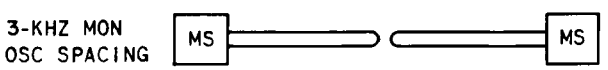

Fig. 6—Test Record for Monitoring Oscillators with 3-kHz Spacing

CHART 4 (Cont)

STEP	PROCEDURE

Note: Use a higher test frequency, if required, that will produce 544 kHz with the lowest monitoring oscillator frequency. When checking the transmitting repeater at this main station, connect the test signal to the LOOP SIG IN jack, and replace the patch plug between the MON OSC OUT and MON SIG IN jacks.

4 Measure the 19.044-MHz signal at the TRMTG LINE TST jack.

Requirement: -26.5 dBm.

5 Readjust the output of the STE, if required, to meet the requirement.

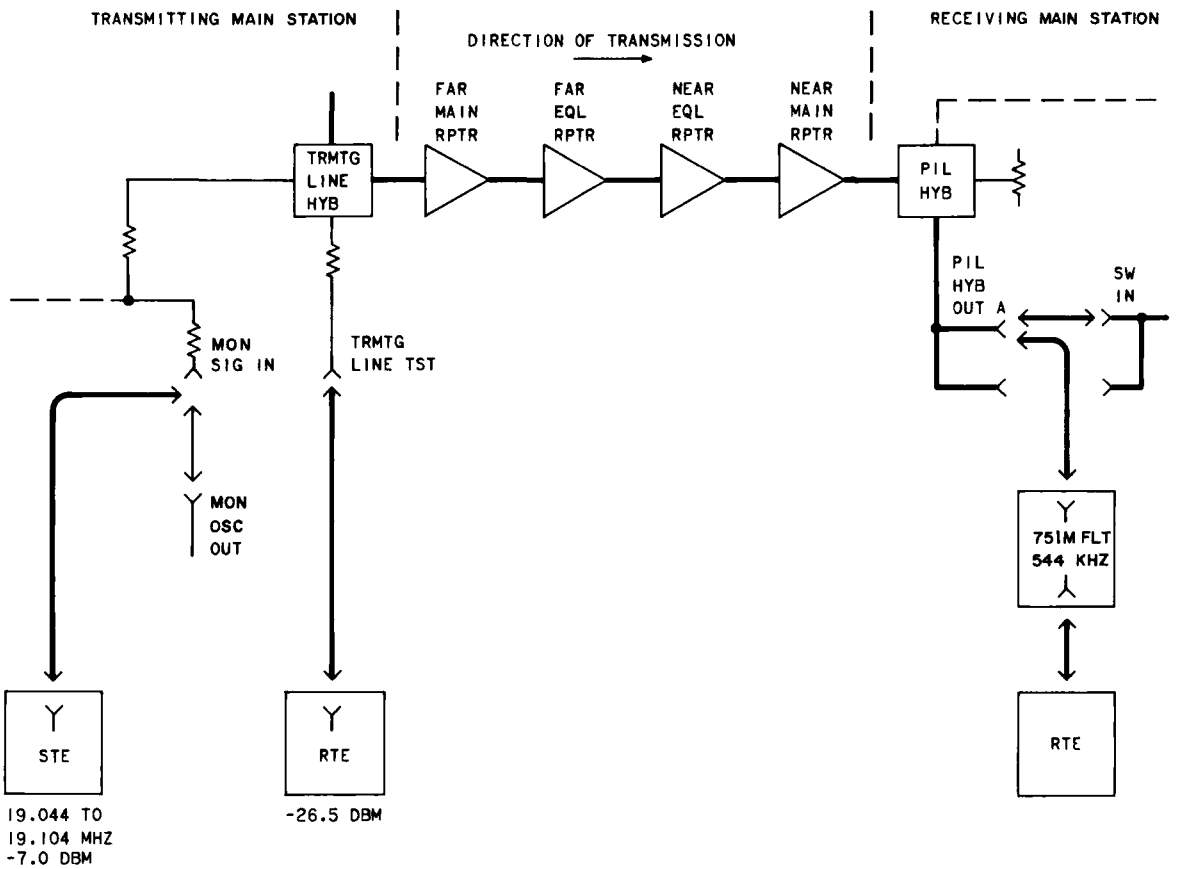

Fig. 7—Test Arrangement for Identification of Defective Repeaters

CHART 4 (Cont)

STEP	PROCEDURE
	At receiving main station,
6	Prepare the RTE to measure 544 kHz at approximately -100 dBm. ***Note:*** ◗Use the LOW NOISE mode.◖
7	Connect the PIL HYB OUT A jack to the 751M filter input, and connect the filter output to the RTE input (Fig. 7).
8	Request the control center attendant to turn on the monitoring oscillator group adjacent to the receiving main station. ***Note:*** For an L4S system, the monitoring oscillators are controlled by means of pushbuttons in the control connecting bay.
9	Measure and record on the test record (Fig. 5 or 6) the power at 544 kHz. ***Note:*** For odd-numbered lines (S to N or W to E), the indication is for the first repeater in the group nearest the measuring point. For even-numbered lines, the indication is for the repeater farthest away from the measuring point.
10	Turn on each of the monitoring oscillator groups, in turn, proceeding toward the transmitting main station; measure and record on the test record the power at 544 kHz.
11	Examine the measured 544-kHz power values in each power loop for a step change of 10 dB or more. ***Note:*** Begin at the receiving end. A step change of 10 dB or more between adjacent monitoring oscillator groups indicates a defective repeater exists, either the first repeater or a repeater in the group toward the receiving main station.
	Identification of Defective Repeater
12	Turn on the monitoring oscillator group on the downstream side of the step change.
	At transmitting main station,
13	Increase the frequency of the input test signal by 4 kHz to 19.048 MHz, or by 3 kHz to 19.047 MHz, when 3-kHz monitoring oscillator spacing is used.
	At receiving main station,
14	Measure and record in the test record the 544-kHz power produced by the 18.504-MHz or 18.503-MHz monitoring oscillator signal and the 19.048-MHz or 19.047-MHz test signal.

CHART 4 (Cont)

STEP	PROCEDURE
	At transmitting main station,
15	Increase the input test signal frequency in 4-kHz or 3-kHz steps; at the receiving main station, measure and record 544-kHz power for each frequency.
	Note: To obtain complete data on the line section, repeat Steps 12 through 15 to obtain the 544-kHz values for each monitoring oscillator group.
16	Disconnect the STE, and replace the patch plug between the MON OSC OUT and MON SIG IN jacks.
	At receiving main station,
17	Disconnect the RTE, and replace the patch plug between the PIL HYB OUT A and SW IN jacks.
18	Examine the data for a step change in the power at 544 kHz.
	Note 1: When evaluating a group, it may be necessary to take into account variations in the power of the monitoring oscillator signals.
	Note 2: Do not replace a repeater causing an increase in the 544-kHz power when the 544-kHz power drops to average power at the next repeater away from the receiving station, as at repeater C in Figure 8. The increase in 544-kHz power is probably due to a higher than nominal monitoring oscillator power.

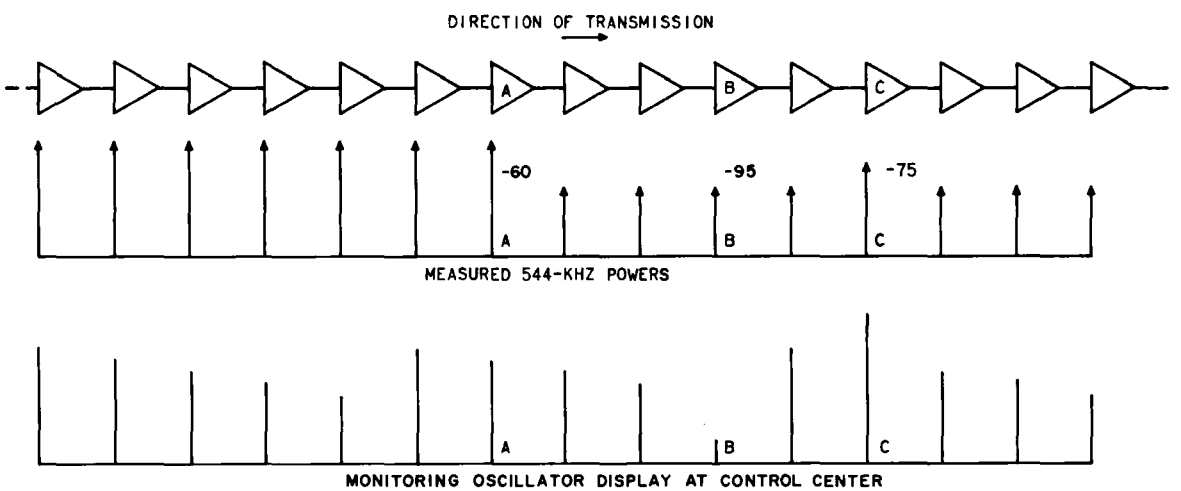

Fig. 8—Analysis of Test Results

CHART 4 (Cont)

STEP	PROCEDURE
	Note 3: A defective repeater may not cause an increase in the measured 544-kHz power as at repeater B in Fig. 8. This occurs when the monitoring oscillator power is below nominal. A repeater with a monitoring oscillator signal 5 dB below nominal power ***not*** resulting in a lower than average 544-kHz power is probably defective and should be replaced.
	Note 4: Expected powers of the 544-kHz noise produced by the test signals and the monitoring oscillator signals are included in Table C for reference, not as an absolute requirement.
19	Replace the repeater indicating a step change increase of 5 dB or more in the noise power at 544 kHz.
	Note: See repeater A in Fig. 8.
20	Repeat the noise power measurements to determine if replacing the repeater clears the trouble.
21	Proceed to Chart 5 to restore the line to service.

▶CHART 5◀

RESTORING LINE SECTION TO NORMAL

STEP	PROCEDURE
1	Proceed to Part A for a ***standby*** line, proceed to Part B for a regular line ***not*** assigned to service, or proceed to Part C for a regular line assigned to service.
	A. Restoring Standby Line
	At transmitting main station,
2	Replace the patch plug between the BLK TRK OUT and BLK SIG IN jacks for the ***standby*** line.
3	Perform the following procedure at ***each*** receiving main station if the line section under test includes two main sections.
	At receiving main station,
4	Operate the line terminate MODE switch, if provided, to the AUTO position.

TABLE C

EXPECTED 544-KHZ INTERMODULATION NOISE POWER
USING MONITORING OSCILLATOR SIGNALS

RPTR NO.	544-KHZ POWER (DBM)	RPTR NO.	544-KHZ POWER (DBM)	RPTR NO.	544-KHZ POWER (DBM)	RPTR NO.	544-KHZ POWER (DBM)
1	−114.00	21	−100.78	41	−97.87	61	−96.15
2	−110.99	22	−100.58	42	−97.77	62	−96.08
3	−109.23	23	−100.38	43	−97.67	63	−96.01
4	−107.98	24	−100.20	44	−97.57	64	−95.94
5	−107.01	25	−100.02	45	−97.47	65	−95.87
6	−106.22	26	−99.85	46	−97.37	66	−95.80
7	−105.55	27	−99.69	47	−97.28	67	−95.73
8	−104.97	28	−99.53	48	−97.19	68	−95.68
9	−104.46	29	−99.38	49	−97.10	69	−95.61
10	−104.00	30	−99.23	50	−97.01	70	−95.55
11	−103.59	31	−99.09	51	−96.92	71	−95.49
12	−103.21	32	−98.95	52	−96.84	72	−95.43
13	−102.86	33	−98.81	53	−96.76	73	−95.37
14	−102.54	34	−98.69	54	−96.68	74	−95.31
15	−102.24	35	−98.56	55	−96.60	75	−95.25
16	−101.96	36	−98.44	56	−96.52	76	−95.19
17	−101.70	37	−98.32	57	−96.44	77	−95.13
18	−101.45	38	−98.20	58	−96.37	78	−95.08
19	−101.21	39	−98.09	59	−96.29	79	−95.02
20	−100.99	40	−97.98	60	−96.22	80	−94.97

Note: This data is provided for reference only, *not* to be used as a requirement.

▶CHART 5◀ (Cont)

STEP	PROCEDURE
5	Depress, in the control connecting bay jack field, the MSTR and RLS pushbuttons simultaneously.
	Note: This completes the procedure for a standby line.
	B. Restoring Regular Line not Assigned to Service
	Note: This procedure applies ***only*** to a regular line not assigned to service. Proceed to Part C for a regular line assigned to service to switch service from the standby line.
	At transmitting main station switch control bay,
6	Restore the transmit switch disconnect switch (TRSG SW), on transmitting switch control panel for this regular line, from DISC to normal.
	At transmitting main station line transmitting bay,
7	Replace the patch plug between the BLK TRK OUT and BLK SIG IN jacks for the regular line under test.
	At receiving main station switch control bay,
	On switching signal filter panel,
8	Remove the block from the REG relay for this regular line.
	On switch initiator panel,
9	Restore the receive line test switch (REC L SW) for this regular line from DISC to normal.
10	Restore the associated initiator (INIT) switch from TST to normal.
	At receiving main station line receiving bay,
11	Replace the patch plug between the BLK SIG OUT and BLK CKT IN jacks for the regular line under test.
	Note: This completes the procedure for a regular line ***not*** assigned to service.

▶CHART 5◀ (Cont)

STEP	PROCEDURE
	C. Restoring Regular Line Assigned to Service
12	Monitor the message signal at each main station while performing the following steps.
	At transmitting main station,
13	Proceed to Step 14 for a line with jack and hybrid panel ED-51423; proceed to Step 18 for a line with jack and hybrid panel ED-50710.
	Jack and Hybrid Panel ED-51423 (Fig. 1)
14	Remove the terminating plug from the HYB OUT A jack for the regular line under test.
15	Remove the patch cord from the LINE AMPL IN jack for the ***regular*** line and ***immediately*** insert a patch plug between the HYB OUT A and LINE AMPL IN jacks.
16	Remove the patch cord from the HYB OUT B jack for the ***standby*** line.
17	Insert a patch plug between the HYB OUT B and SW IN jacks for the ***standby*** line.
	Jack and Hybrid Panel ED-50710 (Fig. 2)
18	Remove the patch cord from the line amplifier IN jack for the ***regular*** line, and ***immediately*** reconnect the coaxial connector to the line amplifier IN jack.
19	Remove the patch cord from the TRMTG HYB OUT B jack for the ***standby*** line.
20	Replace the patch plug between the TRMTG HYB OUT B and SW IN jacks for the ***standby*** line.
	At transmitting main station,
21	Replace the patch plug between the BLK TRK OUT and BLK SIG IN jacks in the line transmitting bay for the ***standby*** line.
22	Perform the following procedure at ***each*** receiving main station if the line section under test includes two main sections.
	At receiving main station control connecting bay,
23	Operate the line terminate MODE switch, if provided, for the ***standby*** line to the AUTO position.
24	Depress the MSTR and RLS pushbuttons simultaneously.
	Note: This completes the procedure for a regular line assigned to service.