

V3 TELEPHONE REPEATER

TESTS AND ADJUSTMENTS ON V3 AMPLIFIER

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1. GENERAL

1.01 This section covers the method of testing and adjusting the V3 amplifier and includes the requirements and limits for each test.

1.02 This section is reissued to include information about the KS-21076 Hybrid Integrated Network (HIN), which replaces the 408A vacuum tube in the V3 repeater. To protect the HIN from transient voltages, an ED-7C057 Lightning Surge Protector must be installed. (Refer to Section 332-103-100.) This conversion will result in substantial savings of electrical power, reduce maintenance cost, increase system stability, and reduce repeater outages. Since this is a general revision, change arrows have been omitted.

1.03 The V3 amplifier (as shown in Fig. 1) has pin jacks that permit access to the monitoring windings. The single pin jack (P) permits a reading of the voltage drop across a resistor in the cathode circuit for use in amplifier testing.

1.04 Testing procedures for the V3 amplifier unit differ according to whether there is a repeater jack field associated with the amplifier or whether an auxiliary test panel must be used. Table A shows patching arrangements depending on jack field availability. Since the amplifier is a plug-in unit, it may be removed for test and replacement. The replacing amplifier unit, or a spare unit, may be tested and adjusted in the auxiliary test panel before it is inserted into a working socket regardless of which jack field is available.

1.05 The V3 repeater jack fields may be furnished with either 410-type or 482A jacks. Patch cords for the 482A-type jacks should be equipped with a 291B (single) or a 361A (double) type plug. Cords equipped with a 310 (single) or 338A (double) type plugs can be used, but since a momentary short (tip to ring) occurs on insertion into the jack, their use is to be avoided where working circuits are being patched.

1.06 Before any operations are performed, it is important to accurately identify the location of the V3 units (ODD or EVEN) before they are removed or reinserted to prevent error in circuit levels. Care should also be taken not to interfere with a working circuit.

1.07 When a tube amplifier unit is removed from its socket for more than the normal testing time interval, a substitute load should be inserted into the socket to avoid increasing heater current in tubes on the same supply. The 360D plug of the 4P22A cord is a substitute heater load. The V3 amplifier unit equipped with a HIN does not

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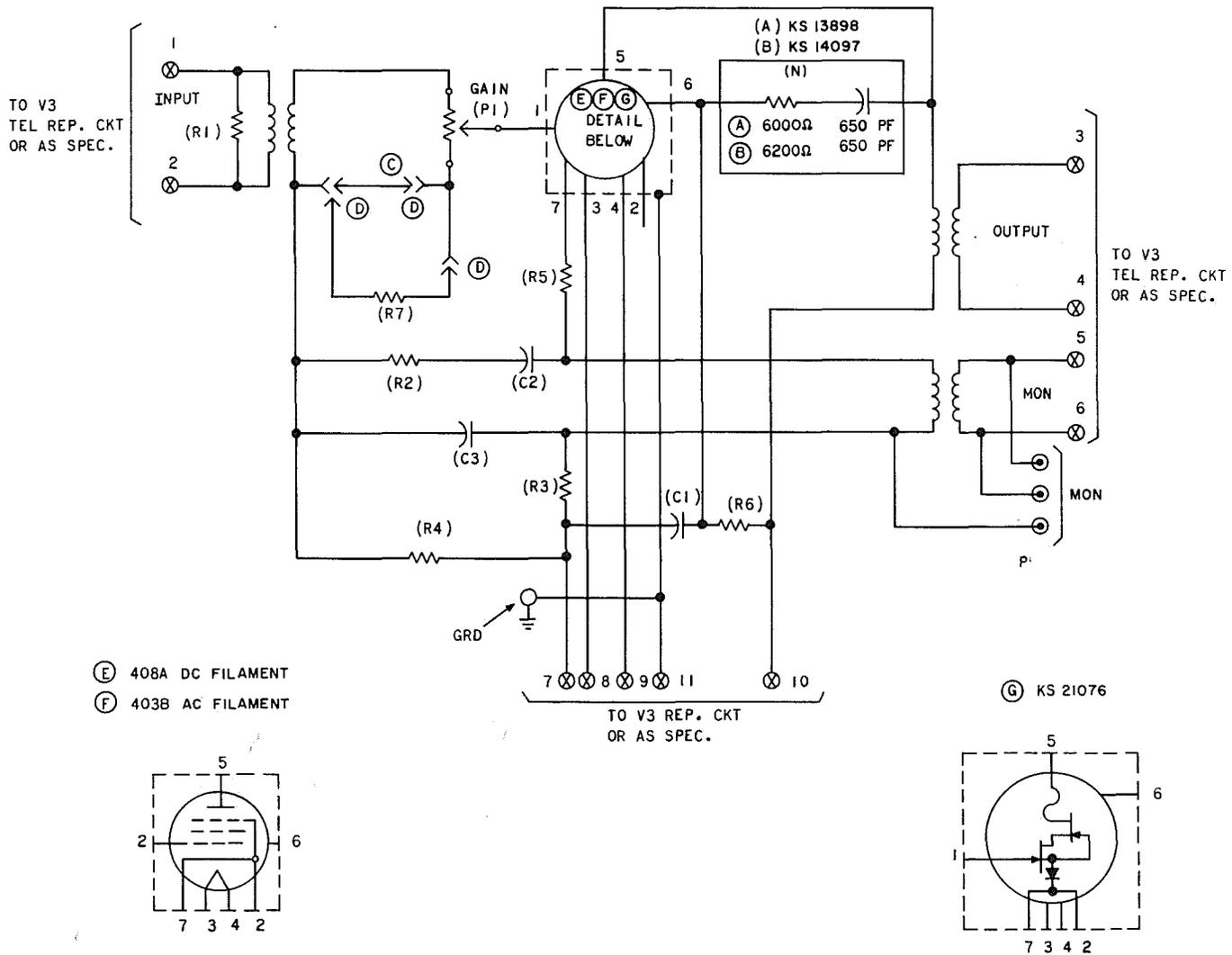


Fig. 1—V3 Amplifier Schematic

require the above substitution because there is no heater current involved.

1.08 A 602D tool is available to remove the amplifier unit, lightning surge protector, or the 360D plug from the mounting shelf. *

1.09 Prior to inserting an amplifier unit into a mounting shelf, it is important that the correct unit is inserted into the proper socket. When inserting an amplifier unit, surge protector, or a 360D plug into a socket, make sure the pins and guide key are properly aligned with the socket holes and that the unit is straight in line. Seat the unit by pushing with one thumb over the pin jacks and the other one over the potentiometer

lucite cover, making sure not to disturb the potentiometer setting.

1.10 In removing tubes or HINs from the socket of an amplifier unit, they should be pulled straight out to avoid breaking or misaligning the pins. Prior to reinserting the tube or HIN, the pins should be straightened in a pin straightener.

1.11 When using the 4P21A cord in testing an amplifier unit, it is important to make sure that the cord is poled properly to avoid shorting one amplifier (see Fig. 2). Inadvertently, the manufacturing specifications for this cord did not define the orientation of the plug designation with respect to the wiring. Future manufacturing is to

TABLE A

TEST OR OPERATION	AMP. UNITS IN SOCKETS	PATCH			FIG.
		FROM	CORD	TO	
Transfer to Test Panel	Test Panel	Test Panel Field ODD AMP Test Panel Field EVEN AMP	4P22A	Working Socket ODD Working Socket EVEN	4
Talking and Monitoring	Working	Test Panel TEL LINE	4P21A	Amp. Unit Mon pin jacks	3
	Working	Test Panel TEL LINE	3P14A/B	Repeater Field MON jacks	3
	Test Panel	Test Panel Field ODD AMP	4P22A	ODD Working Socket	4
		Test Panel Field EVEN AMP		EVEN Working Socket	
Test Panel TEL LINE	3P14A 4P21A	Test Panel Field MON or Amp. Unit MON pin jacks			
600Ω on Line Eq.	Out	Put 360C Plug In Working Socket (Terminate Both Ways)			
Line Eq. — Line Eq.	Out	Put 360B Plug In Working Socket			—
Patching To Terminate A Through Circuit at the Repeater Office	Working	ODD Spare AMP OUT EVEN Spare AMP IN	3P14A/B	Working EQ IN (O or E) Working EQ OUT (E or O)	6
		ODD Spare AMP IN EVEN Spare AMP OUT	3P14A/B	Spare Drop EQ OUT Spare Drop EQ IN	
	Test Panel	Spare Drop EQ OUT Spare Drop EQ IN	3P14A/B	EVEN AMP IN Test Panel ODD AMP OUT Field	
Patching To Change Thru Route	Working	Test Panel Field ODD AMP Test Panel Field EVEN AMP	4P22A	ODD Working Socket EVEN Working Socket	7
		ODD EQ IN Circuit A EVEN AMP IN	3P14A/B	ODD AMP OUT EVEN EQ OUT Ckt A	—
		EVEN EQ IN Circuit B ODD AMP IN	3P14A/B	EVEN AMP OUT ODD EQ OUT Ckt B	

TABLE A (Cont)

TEST OR OPERATION	AMP. UNITS IN SOCKETS	PATCH			FIG.
		FROM	CORD	TO	
Amplifier Gain	Working	600Ω Sending Source 600Ω Receiving T.M.S.	3P14A/B	Repeater Field AMP IN Repeater Field AMP OUT	— —
	Test Panel	600Ω Sending Source 600Ω Receiving T.M.S.	3P14A/B	Test Panel Field AMP IN Test Panel Field AMP OUT	—
600Ω AMP OUTPUT Thru MON Windings		Test Panel TEL LINE 600Ω Receiving T.M.S.	4P21A 3P14A/B	Amp. Unit MON pin jacks Test Panel Field Meas. ODD or EVEN	—
Space Current (Reading in Volts)	Working	KS14510 Meter (—) Pin Jack or equivalent	List 3	Amp. Unit Ear (Ground)	9
		KS14510 Meter (+) Pin Jack	List 2	Amp. Unit P pin jack	
Cathode Activity	Test Panel	Same As Space Current	"	Connections	9

be in accordance with the following usage, and existing cords should be checked to make sure that they agree. When the 241B plug knurling is left or upward, the 354A and 354B plugs should be placed in the ODD and EVEN amplifier MON jacks, respectively, so that the ODD and EVEN designations are on top.

2. AUXILIARY TEST PANEL

2.01 This panel is described in Section 332-103-101.

Drawings SD-95116-01 and ED-63407-01 give the circuit and equipment information for the J68649C auxiliary test panel used with the V3 amplifier. Drawings SD-55537-01 and ED-63406-01 show the circuits of the telephone set and the jack field associated with the test panel, respectively. None of these drawings are attached.

2.02 The auxiliary test panel and its associated jack field are used for testing repeaters when a repeater jack field is not available. The various applications are covered in the succeeding paragraphs and in Table A. There is no means of signaling on the circuit at the test panel; therefore, signaling must be obtained through the

local test board or other locations where signaling facilities are available.

2.03 The TALK key on the auxiliary test panel, see Fig. 3, is a locking key. The tester should make sure the TALK key is not operated when the telephone set is connected to a working circuit for the purpose of monitoring, and that the key is restored to normal following its use. These measures are necessary to avoid introduction of undesirable loss and noise into the overall transmission path of circuits to which the telephone set may be connected and to prevent current drain.

2.04 The transmission loss caused by the telephone set during any of the monitoring conditions is approximately 0.03 dB. The balance between the line and balancing network of the repeater is not disturbed appreciably by the bridging path between the two monitoring windings.

2.05 The overall transmission loss is approximately 2.5-dB maximum when the telephone set is in any talking condition. The telephone set is connected as a hybrid arrangement, and it reduces the echo effect between the two directions of transmission of the V3 repeater.

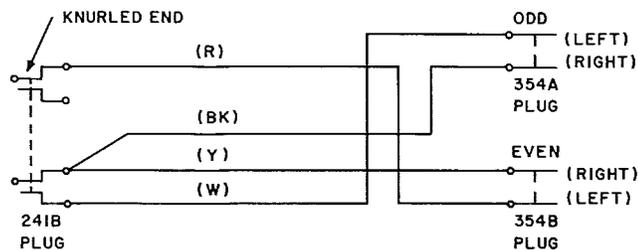


Fig. 2—4P21A Cord

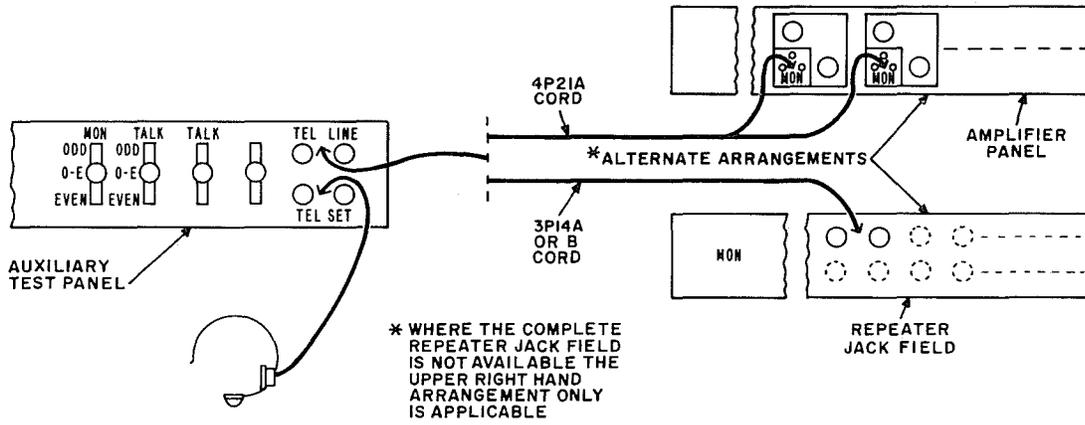


Fig. 3—Amplifier Units in Working Sockets

A. Monitoring or Talking on the Repeater or Order Wire

1 Operators Telephone Set
1 3P14A or 3P14B Cord or equivalent

2.06 The following apparatus is needed for monitoring or talking functions:

- MON pin jacks on amplifier unit
1 Operators Telephone Set
1 4P21A Cord or equivalent
- MON jacks on repeater jack field or auxiliary test panel

- Talking on the order wire
1 Operators Telephone Set
1 3P14A Cord or equivalent.

2.07 The following procedure is used for monitoring or talking on the repeater or order wire.

CHART 1

MONITORING OR TALKING ON THE REPEATER OR ORDER WIRE

STEP	PROCEDURE
1	Operate all keys to normal on the auxiliary test panel.
2	Establish patches shown in either Fig. 3 or 4, whichever is applicable. The telephone set is now arranged to monitor in both directions.
	Monitoring on the Repeater
3	To monitor on output of the ODD amplifier, operate MON ODD key.
4	To monitor on output of the EVEN amplifier, operate MON EVEN key.
5	When monitoring is complete, return all keys to normal.
	Talking on the Repeater
6	Repeat Steps 1 and 2.
7	To talk in both directions, operate TALK key.
8	To talk on output of the ODD amplifier, operate TALK and TALK ODD keys.
9	To talk on output of the EVEN amplifier, operate TALK and TALK EVEN keys.
10	When talking is completed, return all keys to normal.
	Talking on the Order Wire
11	Repeat Step 1.
12	Establish patches shown in Fig. 5. The telephone set is now arranged to monitor on the order wire.

CHART 1 (Cont)

STEP	PROCEDURE
13	To talk on the order wire, operate TALK and MON keys.
14	When talking is completed, return all keys to normal.

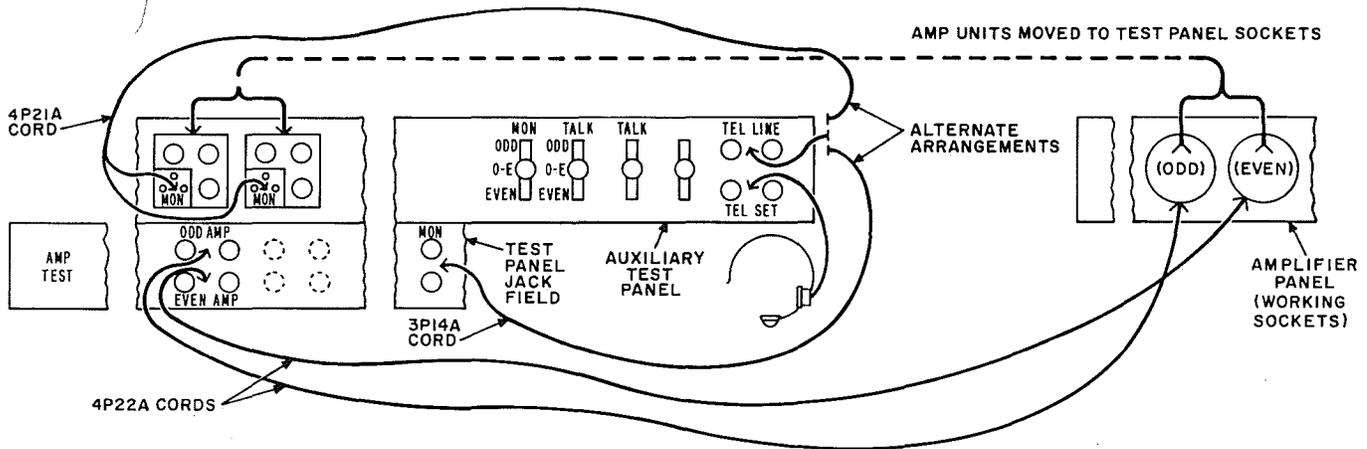


Fig. 4—Amplifier Units in Auxiliary Test Panel Sockets

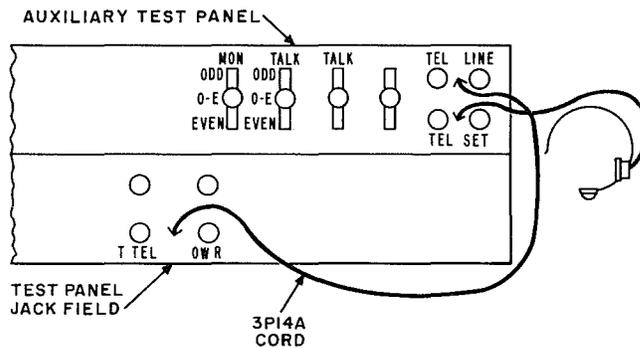


Fig. 5—Talking on the Order Wire

B. Testing Arrangements

2.08 Pulsing may be obtained by means of a key as shown in SD-64413-01, Fig. 11 (not attached), which may be associated with the order wire jack fields.

2.09 The amplifier unit or units may be transferred to the sockets of the auxiliary test panel. These sockets supply the amplifier with battery, and as mentioned in 1.04, make available the amplifier input, output, and the monitoring winding for that unit or those units through jacks associated with the test panel. Cathode activity tests may be made on the tube type unit in either socket of the test panel without any patches to the working socket.

2.10 By use of 4P22A cords between the working sockets (the unit having been removed) and the ODD and the EVEN AMP jacks in the jack field associated with the test panel (1.04), the EQ IN and the EQ OUT jacks of this same jack field allow access to the line equipment (in and out) of circuits connected to the working sockets.

2.11 The TEL LINE jacks of the auxiliary test panel permit connecting the telephone set through proper cords to the monitoring windings of the amplifier units whether in the working socket or in the sockets of the test panel. These jacks are patched either to the MON pin jacks of the amplifier unit with a 4P21A cord or to the corresponding MON jacks in the repeater jack field with a 3P14A or 3P14B cord. With the same patches, the TEL LINE jacks also may be used for making 600-ohm measurements of the output of amplifier units through their monitoring windings. Then the 600-ohm transmission measuring set is patched to MEAS ODD or MEAS EVEN jacks on the auxiliary panel. In other words, the MEAS ODD and MEAS EVEN jacks permit access to any circuit connected to the TEL LINE jacks. The tips of the MEAS EVEN jacks connect directly to the tips of the TEL LINE jacks; and the tips of the MEAS ODD jacks connect directly to the tip and sleeve of the TEL LINE jacks.

3. REMOVING THE AMPLIFIER UNIT

3.01 Before removing an amplifier unit or a pair of amplifier units from their sockets, positive

identification of the units wanted is very important (1.06). Care should be taken not to interfere with a working circuit especially in case of circuits employing single-frequency signaling. Obtain a release or turn down the circuit prior to removal of a unit or units.

3.02 As mentioned in 1.07, it is desirable to place some form of suitable load on the heater supply when the tube amplifier is to be out of its socket for more than its normal testing interval. The V3 amplifier equipped with a HIN does not require the above substitute load as there is no heater current involved.

4. PATCHING

Note: It is recommended that no intermixing of tube, solid state, and HIN amplifiers be allowed on heater circuitry associated with any specific fuse panel.

4.01 Removing a defective amplifier unit and replacing it with a good unit and changing the line equipment associated with a particular circuit usually necessitates a major patching replacement of the entire phantom group equipment at the primary board. Because of this, patching of V3 repeaters is usually limited to a relatively small group of operations. In fact, it normally will be limited to cutting a through circuit at the repeater point in order to provide a terminal circuit to one or both terminals of a through circuit or to change the routing of a through circuit.

4.02 Patches at the V3 amplifier require:

- (a) that circuits appear as 4-wire facilities.
- (b) that the necessary line equipment, eg, hybrid coils, equalizers, regulating networks, filters, ringing equipment, be associated with the line facilities.

Accordingly, the usual patching arrangements are between circuits or parts of circuits employing V-type amplifiers, or between circuits arranged for that type amplifier or to carrier channels. The following four patches are required for each complete circuit:

SECTION 332-103-500

FROM	TO
ODD EQ IN (Terminal A)	ODD AMP OUT (Spare)
EVEN AMP IN (Spare)	EVEN EQ OUT (Terminal A)
EVEN EQ IN (Terminal B)	EVEN AMP OUT (Spare)
ODD AMP IN (Spare)	ODD EQ OUT (Terminal B)

through circuit. The choice between the two figures is dependent upon whether the particular amplifiers have an associated jack field or if it is necessary to set up the patching arrangement through the use of the auxiliary test panel and its associated jacks. Figure 6 applies where the complete repeater jack field is available, and Fig. 7 applies where the patch is made through the auxiliary test panel and its jack field.

Where carrier facilities are involved instead of EQ IN and EQ OUT, it is MOD IN and DEMOD OUT, respectively, through any necessary pads.

4.03 Figures 6 and 7 illustrate how to derive one or two terminating circuits from one

4.04 Where 482A jacks are furnished in the repeater jack field shown in Fig. 6, the patch cords used are to be 3P14A or 3P14B (P3E cords equipped with 291B type plugs) or equivalent.

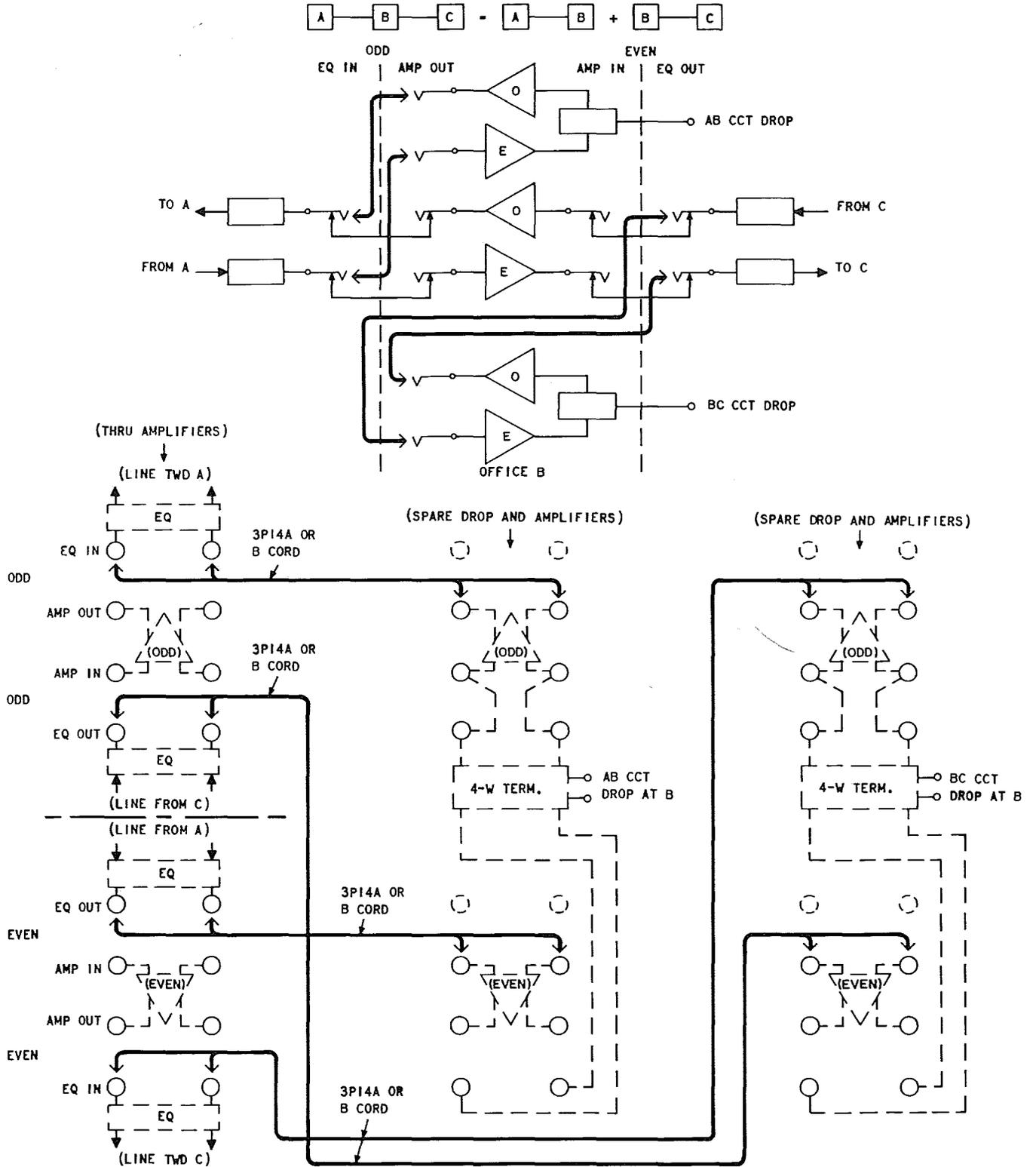


Fig. 6—Patching at Office B to Provide Two Terminating Circuits From One Through Circuit—Complete Repeater Jack Field

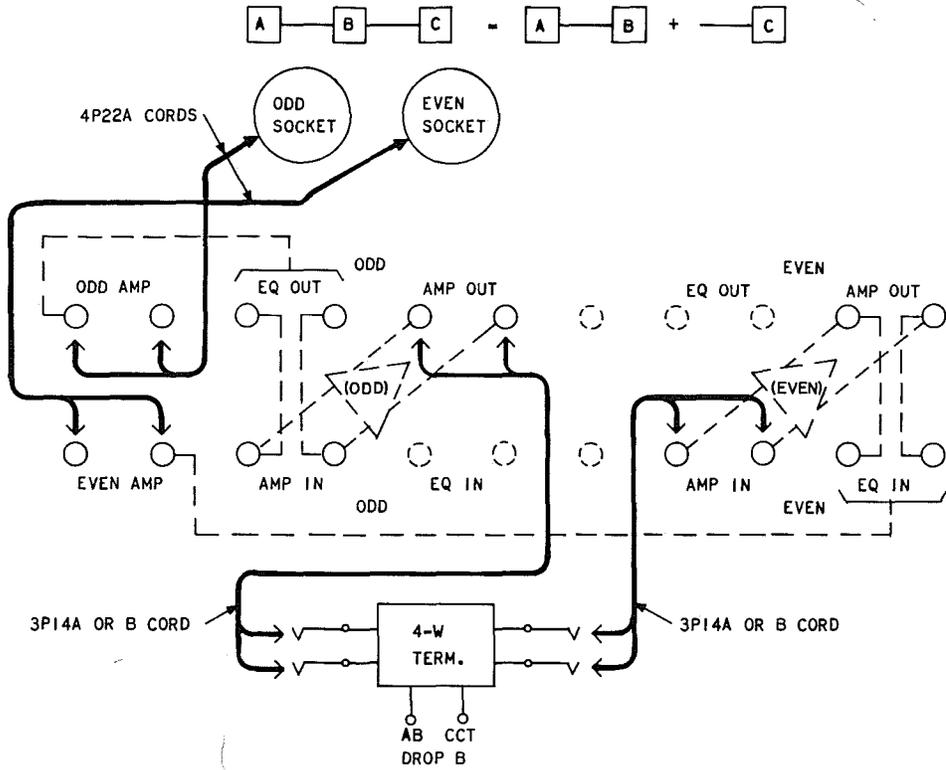


Fig. 7—Patching at Office B to Provide One Terminating Circuit From One Through Circuit—Using Auxiliary Test Panel and Associated Jacks

4.05 At times it may be necessary, on an emergency basis, to "make good" a circuit by patching out both ODD and EVEN amplifiers. Before this is done, the spare amplifiers used to replace the

defective amplifiers must be adjusted to the proper gain for that circuit. Charts 2 and 3 contain the procedures for adjusting repeater gain and patching the repeaters, respectively.

CHART 2

ADJUSTING AMPLIFIER GAIN

STEP	PROCEDURE
1	Select spare ODD and EVEN amplifiers known to be good.
2	Obtain specified gains of the defective amplifiers from the Circuit Layout Record (CLR), if available.
3	Calibrate a 21A TMS, or equivalent, for proper output at 1000 Hz and 600 ohms.
4	Connect oscillator output to detector input.
5	From Step 2, call the specified gain "G." Adjust oscillator output level for a reading of -G on the detector. Example: Suppose the specified gain of the amplifier is 10 dB. The oscillator output level would then be adjusted for a reading of -10 dBm on the detector.
6	Disconnect oscillator from detector.
7	Connect detector input to spare ODD amplifier AMP OUT jack.
8	Connect oscillator output to spare ODD amplifier AMP IN jack.
9	Adjust gain control potentiometer of the spare ODD amplifier for a reading of 0 dBm on the detector. Requirement: The gain of the spare ODD amplifier should not differ from the specified gain by more than 0.3 dB. Note: It is desirable to adjust the gain within 0.1 dB.
10	Repeat these procedures for the EVEN amplifier.
11	Remove oscillator and detector connections.

4.06 Chart 3 contains procedures for making good a circuit by patching spare good amplifiers in place of defective amplifiers. If spare amplifiers

are not available, remove the defective amplifiers and replace with a type 360 (THRU) plug.

CHART 3

PATCHING SPARE AMPLIFIERS

STEP	PROCEDURE
1	Using patch cord 3P14A or B, patch ODD EQ OUT jack of the defective circuit to the spare ODD AMP IN jack.
2	Patch spare ODD AMP OUT jack to ODD EQ IN jack of the defective circuit.
3	Patch EVEN EQ OUT jack of the defective circuit to spare EVEN AMP IN jack.
4	Patch spare EVEN AMP OUT jack to EVEN EQ IN jack of the defective circuit.

5. HEATER SUPPLY

5.01 The method of adjusting the heater supply for the V3 tube amplifier is covered in the 024 division. However, if the amplifier is HIN equipped, the heater voltage adjustment can be disregarded since the HIN requires no heater current.

6. TUBE TESTS

6.01 The 408A tube in the V3 amplifier unit may be maintained by one of the following methods:

- (a) The space current history method can be performed with the amplifier unit in the repeater mounting.
- (b) For the cathode activity test, the amplifier unit must be inserted or plugged into the auxiliary test panel.
- (c) For the transconductance test, the tube is removed from the amplifier unit and tested in a suitable tube tester.

6.02 The space current history method of tube testing is used for in-service testing. It is based on the fact that after an initial period of stabilization, the space current in the tube decreases gradually over a long period of time, and then falls more rapidly to a point at which the tube has

reached the end of its useful life. The purpose of the test is to guard against failure of the tube while in service by discarding the tube just before the space current begins the more rapid fall. Whenever it is practicable, the in-service test should be used rather than the out-of-service test since the in-service test is more reliable and avoids hazards to the tube and its socket. The in-service test also will not interrupt service in any way.

6.03 Cathode activity tests are performed usually when an operating adjustment or test limit cannot be met and a tube is particularly suspected of causing a trouble condition. The amplifier unit or units are removed from the bay shelf and inserted into the auxiliary test panel for analysis.

6.04 For the transconductance test, the tube is removed from the amplifier unit and tested in a suitable tube tester.

6.05 The following apparatus is required for testing a 408A tube using the space current history method:

KS-14510 volt-ohm-milliammeter (VOM) with one list 2 lead and one list 3 lead (alligator clip). The KS-14510 VOM or equivalent is recommended for general application to tube tests on V3 repeaters (Fig. 8).

6.06 Space Current History Method

CHART 4

STEP	PROCEDURE
1	Operate meter range selector of KS-14510 VOM to 3 volts dc.
2	Using test leads as shown in Fig. 8, establish connections to the (P) pin jack of the amplifier unit and one to the ear (ground).
3	Obtain voltage reading on the 300 scale of the meter (300 = 3V) to the nearest whole or half scale division. This reading is used as a measure of the space current through the resistor in the cathode circuit.

"Initial" Test Requirement: The "initial" reading should be greater than or equal to 0.9 volt.

CHART 4 (Cont)

STEP	PROCEDURE
4	The discard value should be obtained to the nearest hundredth of a volt from Fig. 9 or from Table B (ie, the 80 percent value) using the "initial" reading obtained in Step 3. With a pencil, record discard value on the roughened surface on the upper right hand corner of the amplifier.
5	For subsequent tests, the voltmeter reading obtained in Step 3 is compared directly with the discard value recorded on the unit.

Requirement: The tube should be discarded when the reading obtained on the meter reaches or falls below the discard value recorded on the amplifier unit.

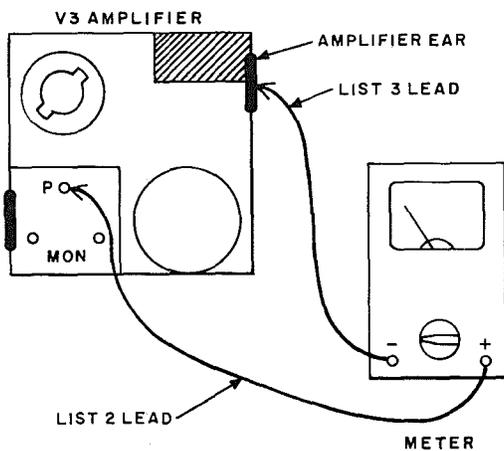


Fig. 8—Cathode Activity Test

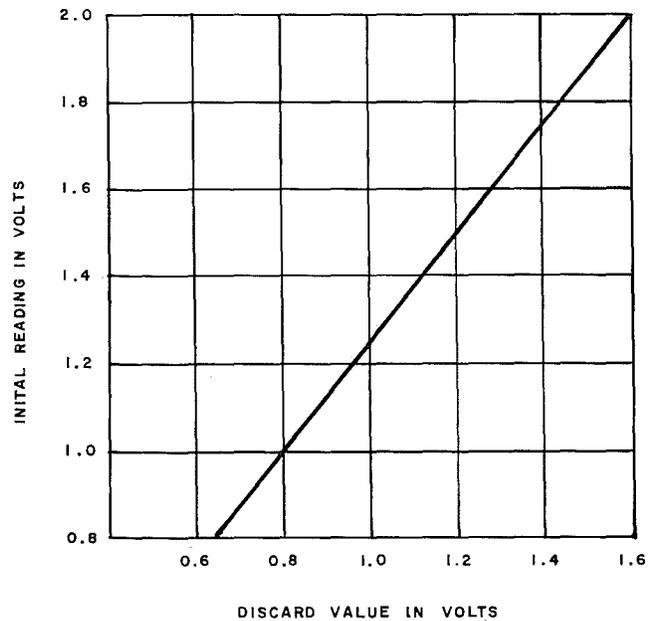


Fig. 9—Graph for Space Current History Method of Tube Testing

TABLE B

SPACE CURRENT HISTORY TUBE TESTS

(METER READING IS IN VOLTS)			
"INITIAL" READING	CORRESPONDING DISCARD RDG.	"INITIAL" READING	CORRESPONDING DISCARD RDG.
0.90	0.72	1.46	1.17
0.92	0.74	1.48	1.18
0.94	0.75	1.50	1.20
0.96	0.77	1.52	1.22
0.98	0.78	1.54	1.23
1.00	0.80	1.56	1.25
1.02	0.82	1.58	1.26
1.04	0.83	1.60	1.28
1.06	0.85	1.62	1.30
1.08	0.86	1.64	1.31
1.10	0.88	1.66	1.33
1.12	0.90	1.68	1.34
1.14	0.91	1.70	1.36
1.16	0.93	1.72	1.38
1.18	0.94	1.74	1.39
1.20	0.96	1.76	1.41
1.22	0.98	1.78	1.42
1.24	0.99	1.80	1.44
1.26	1.01	1.82	1.46
1.28	1.02	1.84	1.47
1.30	1.04	1.86	1.49
1.32	1.06	1.88	1.50
1.34	1.07	1.90	1.52
1.36	1.09	1.92	1.54
1.38	1.10	1.94	1.55
1.40	1.12	1.96	1.57
1.42	1.14	1.98	1.58
1.44	1.15	2.00	1.60

6.07 When a tube has been discarded for failure to meet the requirements of the space current history method of testing (with the exception of those which fail to meet the "initial" minimum requirement), a cathode activity test described in 6.08 may be made. If the tube meets the cathode activity requirements, it may be used until it is

discarded under subsequent cathode activity test requirements. This is a means of securing some additional hours of tube life and is not expected to be of material importance in tube maintenance.

6.08 Cathode Activity Test

CHART 5

STEP	PROCEDURE
1	Observing precautions given in 3.01 and 3.02, remove amplifier unit from its working socket and insert into the ODD or EVEN socket of the auxiliary test panel with all keys normal.
2	Operate range selector on the KS-14510 VOM to 3-volt dc position.
3	Using test leads as shown in Fig. 8, establish connections to the (P) pin jack of the amplifier and one to the amplifier ear (ground).
4	Allow 1-1/2 minutes for cathode current to stabilize. Obtain voltage reading of the meter on the 300 scale (300 = 3V) to the nearest whole or half scale division on the meter. This voltage reading is used as a measure of the space current flowing through the resistor in the cathode circuit. <i>Requirement:</i> The reading should be greater than or equal to 0.85 volts.
5	Operate CATH ACT key on the auxiliary panel to ODD or EVEN depending upon which amplifier unit has been inserted and again obtain the reading on the 300 scale to the nearest whole or half scale on the meter. <i>Requirement:</i> If the difference between the reading of Step 4 and Step 5 is greater than 20 percent of Step 4, the tube should be discarded. Instead of computing the percentages, Table C may be used. Opposite each value of the meter reading for the normal position of the CATH ACT key are given minimum permissible meter readings for the operated position of the CATH ACT key.

TABLE C

CATHODE ACTIVITY TESTS IN THE AUXILIARY TEST PANEL

(20 PERCENT DISCARD VALUES)			
VOLTAGE READING CATH ACT	MINIMUM VOLTAGE READING CATH ACT	VOLTAGE READING CATH ACT	MINIMUM VOLTAGE READING CATH ACT
KEY NORMAL	KEY OPERATED	KEY NORMAL	KEY OPERATED
0.85	0.68	1.42	1.14
0.86	0.69	1.44	1.15
0.88	0.70	1.46	1.17
0.90	0.72	1.48	1.18
0.92	0.74	1.50	1.20
0.94	0.75	1.52	1.22
0.96	0.77	1.54	1.23
0.98	0.78	1.56	1.25
1.00	0.80	1.58	1.26
1.02	0.82	1.60	1.28
1.04	0.83	1.62	1.30
1.06	0.85	1.64	1.31
1.08	0.86	1.66	1.33
1.10	0.88	1.68	1.34
1.12	0.90	1.70	1.36
1.14	0.91	1.72	1.38
1.16	0.93	1.74	1.39
1.18	0.94	1.76	1.41
1.20	0.96	1.78	1.42
1.22	0.98	1.80	1.44
1.24	0.99	1.82	1.46
1.26	1.01	1.84	1.47
1.28	1.02	1.86	1.49
1.30	1.04	1.88	1.50
1.32	1.06	1.90	1.52
1.34	1.07	1.92	1.54
1.36	1.09	1.94	1.55
1.38	1.10	1.96	1.57
1.40	1.12	1.98	1.58
		2.00	1.60

SECTION 332-103-500

6.09 Transconductance Test

Warning: Do not test HINs on a KS-type tube tester. The reverse voltage, plate to ground, will damage the HIN.

CHART 6

STEP	PROCEDURE
1	Remove tube from socket in amplifier unit and insert into a 7-pin miniature socket of a suitable tube tester.
2	Operation of tube tester and requirements to be met can be found in Section 100-63Y-ZZZ.

7. GAIN MEASUREMENTS AND ADJUSTMENTS

7.01 Unless otherwise specified, gain measurements of the amplifier units should be made between 600-ohm test equipment terminations. Where a full complement of jacks is associated with the amplifier unit, they may be tested in their working sockets. Otherwise, the test should be made in the auxiliary test panel. To avoid service interruption, the precautions given in 3.01 and 3.02 should be observed.

7.02 For gain measurements and adjustments, refer to Chart 2 in 4.05.

8. NOISE AND CROSSTALK

8.01 Battery Noise: Noise at the amplifier output due to plate battery noise is from 40 to 50 dB below the plate battery noise measured between the plate battery terminal of the amplifier and ground, depending on the frequency content of the latter. The noise at the amplifier output due to the heater supply noise should be negligible with any type of heater supply. Since HIN-equipped amplifiers do not require a heater supply, heater supply noise is not a factor. Total noise greater than 29 dBrnc at the amplifier output usually would indicate trouble.

8.02 Chart 7 contains procedures for measuring noise on the V3 repeater.

CHART 7**MEASUREMENT OF AMPLIFIER NOISE**

STEP	PROCEDURE
1	Calibrate 3-type noise measuring set (NMS) as described in Section 103-611-100.
2	Set FUNCTION switch to 600 ohms.
3	Set DBRN dial to 85.
4	Plug in network to "C" message weighting.
5	Terminate AMP IN jack with a 600-ohm terminating plug.
6	Connect 3-type NMS to AMP OUT jack.
7	Connect monitoring receiver to 3-type NMS.
8	Rotate DBRN knob in a counterclockwise direction and obtain a reading between +2 and +9 (disregard occasional high peaks).
9	Record measured noise (the sum of the meter reading and the DBRN switch setting). Also record the character of noise heard in the monitoring receiver, eg, "frying", "hissing", "static", etc.
	Requirement: The noise should not exceed 29 dBrnc at the amplifier output.
10	Leave terminating plug in the AMP IN jack; terminate AMP OUT jack with a 600-ohm terminating plug.
11	Set FUNCTION switch of 3-type NMS to BRDG.

CHART 7 (Cont)

STEP	PROCEDURE
12	Connect a 4-MF capacitor in series from each of the IN binding posts of the NMS to the plate supply (terminal 11) and to ground (terminal 10) of the V3 repeater. <i>Caution: +130 volts dc is present on terminal 11. Connections to the NMS should be made before connecting to the V3 repeater battery supply terminals.</i>
13	Record measured noise (the sum of meter reading and DBRN switch setting). Also record the character of noise heard in the monitoring receiver.
14	Subtract reading obtained in Step 9 from reading obtained in Step 13. <i>Requirement: 40 dB or greater</i>
15	Disconnect 3-type NMS and remove all terminating plugs. Return circuit to normal.

8.03 Crosstalk: The controlling crosstalk paths between V3 amplifiers are those via the battery supply circuits. The relative location of one amplifier with respect to another is of minor importance in influencing the coupling between the two. Crosstalk measurements between V3 tube-type amplifiers are made with both amplifiers at top gain with the "disturbing" amplifier energized with 1000-Hz testing power sufficient to produce

an output close to, but not exceeding +10 dBm. For the HIN-equipped amplifier, the maximum gain is 35 dB. Table D indicates the connections to be made and the reading to be noted during crosstalk tests between any two amplifiers A and B. These tests should be repeated with A and B interchanged.

8.04 Chart 8 contains the procedures for measuring crosstalk.

CHART 8

MEASURING CROSSTALK

STEP	PROCEDURE
1	Calibrate 3-type NMS as described in Section 103-611-100.
2	Connect filter network on NMS for "C" message weighting.
3	Set DAMP-NORMAL switch to NORMAL.
4	Set DBRN dial to 85.
5	Calibrate 21A TMS output for a level of -35 dBm at 1000 Hz and 600 ohms.
6	If the V3 repeaters are equipped with HINs, proceed to Step 7. If the V3 repeaters are tube type, go to Step 11.
7	Connect 21A TMS to AMP IN jack of amplifier A.
8	Connect NMS to AMP OUT jack of amplifier A.
9	Adjust gain control on amplifier A for a reading of 90 dBrc. The HIN-equipped amplifier is now adjusted for 35-dB gain.
10	Repeat Steps 5 through 9 for amplifier B.
11	For tube type V3 repeaters, adjust gain control maximum clockwise on both amplifiers A and B.
12	Connect 21A TMS output to AMP IN jack of amplifier A.
13	Adjust output level of 21A TMS for -28 dBm at 1000 Hz and 600 ohms.
14	Terminate AMP IN and AMP OUT of amplifier B with 600-ohm plugs.
15	Connect NMS to AMP OUT jack of amplifier A and record "disturbing power" as measurement #1.

CHART 8 (Cont)

STEP	PROCEDURE
16	Remove NMS from AMP OUT jack of amplifier A and terminate AMP OUT jack with a 600-ohm plug.
17	Remove 600-ohm plug from AMP OUT jack of amplifier B and connect NMS to AMP OUT jack. Record "crosstalk + noise" as measurement #2.
18	Remove 21A TMS from AMP IN jack of amplifier A and terminate AMP IN jack with a 600-ohm plug. Record "noise alone" reading as measurement #3.
19	Repeat Steps 1 through 18 with amplifiers A and B interchanged.
20	Table E shows the amplifier corrections for crosstalk measurements just completed.
21	Compute crosstalk coupling loss as shown in the following example: Requirement: Crosstalk coupling loss shall not be less than 74 dB. Example: Computing crosstalk loss: (1) Assume that "disturbing power" measurement #1 in Step 15 was 95 dBrnc. (2) Assume that "crosstalk + noise" measurement #2 in Step 17 was 20 dBrnc. (3) Assume that "noise alone" measurement #3 in Step 18 was 18 dBrnc. (4) Subtract measurement #3 from measurement #2: $20 - 18 = 2$ dB. (5) From Table E apply correction factor to measurement #2 to find crosstalk alone: $20 - 4 = 16$ dBrnc. (6) Crosstalk coupling loss is measurement #1 minus corrected measurement #2 found in previous steps: $95 - 16 = 79$ dB.

TABLE D

MEASUREMENT	AMPLIFIER A		AMPLIFIER B	
	INPUT	OUTPUT	INPUT	OUTPUT
(1) Disturbing Power	Test Power	NMS*	TERM.	TERM.
(2) Crosstalk & Noise	Test Power	TERM.	TERM.	NMS*
(3) Noise Alone	TERM.	TERM.	TERM.	NMS*

* NMS = 3A Noise Measuring Set, C Message Weighting

TERM = 217D Plug (or 600 ± 6 ohm) Termination.

TABLE E

MEASUREMENT (2) MINUS MEASUREMENT (3) dB	CORRECTION TO BE SUBTRACTED FROM MEASUREMENT (2) dB
1	7
2	4
3	3
4, 5	2
6, 7, 8	1
Greater than 8	0