

TYPE N AND ON2 CARRIER TELEPHONE SYSTEMS
DEVIATION REGULATOR
MAINTENANCE TESTS AND ADJUSTMENTS
OUT-OF-SERVICE TESTS

The out-of-service tests described in this section require the use of a 2M switching set. The deviation regulator is switched from service and all measurements are made on the carriers received on the high-frequency line.

This series of tests should only be made if the in-service tests have not met the required limits, or if the deviation regulator has an actual case of trouble.

The test procedures for a switched deviation regulator which are covered in this section may be made consecutively or individually. In either case the test set preparation described below is necessary before any measurements or adjustments are made.

APPARATUS:

2M Switching Set
CFVM, with W20C Cord
VTVM, with W2DW Cord
3AF Test Set
SHORTING Cord

(A) PREPARATION FOR TESTS

STEP	PROCEDURE
1	Remove the deviation regulator from service with the 2M switching set as described in Section 362-504-501.
2	Insert the SHORTING plugs supplied with the deviation regulator into the TERM SL, TERM BU, TERM CU, and TERM QU jacks.
3	Insert the DUMMY plugs supplied with the deviation regulator into the SLOPE TST, BULGE TST, CUBIC TST, and QUARTIC TST jacks. <i>Note:</i> The deviation regulator is now switched from service as shown in Fig. 2. The output is terminated in 135 ohms and all networks are in their mean condition.

(B) CHECK AND ADJUSTMENT OF INDIVIDUAL CARRIER GAIN

The deviation regulator output characteristics are controlled by the twelve individual carrier frequencies on the high-frequency line. In this test the output of each of the twelve channel filters, which "pick off" the individual carriers, is checked and, if necessary, adjusted to provide the proper frequency characteristic in the regulator feed-back circuit.

PROCEDURE

There are two methods described for making this test. The method used will depend on the initial line-up procedure used for adjusting the pick-off filters in the deviation regulator. The Method A routine test procedure will be used on systems which have been aligned with the Method A line-up procedure. Likewise, the Method B test procedure will be used on systems which have been initially aligned according to Method B.

This test is also a check of the regulator single-frequency gain characteristic. The gain of the regulator at the carrier frequency of each channel is determined from twelve selective input and output measurements made with the regulator shape networks terminated and the regulating loops opened. When the shape networks are terminated and the regulating loops opened, the regulator is in its mean condition.

SYSTEMS LINED UP ACCORDING TO METHOD A

STEP	PROCEDURE
1	Energize the CFVM and allow 20 minutes for it to warm up. Calibrate the set according to Section A702.591, E40.666.
2	Prepare for the test according to (A) PREPARATION FOR TESTS.
3	Using the W20C cord, connect the CFVM to the TST jack of the 2M switching set.
4	Using a W2DW cord, or equivalent, connect the lower (ground) INPUT terminal of the VTVM to the chassis ground; and connect the upper (hot) INPUT terminal to terminal 3 of the channel 2 pick-off filter output potentiometer.
5	Rotate the CFVM selector switch to the GR OUT position (deviation regulator output) and tune for each of the twelve individual carrier frequencies. Record the CFVM readings. As each frequency is selected, the VTVM hot lead should be shifted to the terminal 3 of the potentiometer on the pick-off filter which is tuned to that frequency. Record the VTVM readings. The twelve individual carrier frequencies and the associated channel pick-off filters are listed in Table A.

TABLE A

CHANNEL	FREQUENCY	GAIN IN DB
2	176 Kc	+0.7
3	184 Kc	+0.8
4	192 Kc	+1.1
5	200 Kc	+1.4
6	208 Kc	+1.7
7	216 Kc	+1.7
8	224 Kc	+1.7
9	232 Kc	+1.4
10	240 Kc	+1.3
11	248 Kc	+0.9
12	256 Kc	+0.7
13	264 Kc	+0.2

STEP	PROCEDURE
6	<p>The difference between each individual carrier frequency level measured with a CFVM at the deviation regulator output, and the VTVM reading taken at terminal 3 of the potentiometer on the associated pick-off filter should be —</p> <p>Requirement: 20 ± 0.3 db</p>
7	<p>When the measurements on all of the channels are out of limits, it is an indication of a general trouble, such as a faulty pick-off amplifier. If the requirement is not met on a particular filter, readjust the OUTPUT potentiometer on the pick-off filter as follows:</p> <p>(a) Loosen the locknut on the OUTPUT potentiometer of the pick-off filter being checked.</p> <p>(b) Adjust the OUTPUT potentiometer for a meter reading on the VTVM that is 20 db lower than the reading on the CFVM meter for the individual carrier frequency.</p> <p>(c) Tighten the locknut on the pick-off filter OUTPUT potentiometer.</p>
8	<p>If no other tests are to be made, remove all of the SHORTING and DUMMY plugs. Disconnect the VTVM and the CFVM. Switch the deviation regulator back into service according to Section 362-504-501.</p>

SYSTEMS LINED UP ACCORDING TO METHOD B

STEP	PROCEDURE																										
1	Energize the CFVM and allow 20 minutes for it to warm up. Calibrate the set according to Section A702.591, E40.666.																										
2	Prepare for the test according to (A) PREPARATION FOR TESTS.																										
3	Using the W20C Cord, connect the CFVM to the TST jack of the 2M switching set.																										
4	Using a W2DW cord, or equivalent, connect the lower (ground) INPUT terminal of the VTVM to the chassis ground; and connect the upper (hot) INPUT terminal to terminal 3 of each of the channel pick-off filter output potentiometers.																										
5	Adjust each pick-off filter potentiometer for the value given in Table B. If the individual carrier level varies during the test, adjust for the average of the variation.																										
TABLE B																											
	<table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>CHANNEL</th> <th>ADJUST FOR VTVM READING OF</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>-26.0 db</td> </tr> <tr> <td>3</td> <td>-25.3 db</td> </tr> <tr> <td>4</td> <td>-24.7 db</td> </tr> <tr> <td>5</td> <td>-24.1 db</td> </tr> <tr> <td>6</td> <td>-23.4 db</td> </tr> <tr> <td>7</td> <td>-22.8 db</td> </tr> <tr> <td>8</td> <td>-22.2 db</td> </tr> <tr> <td>9</td> <td>-21.5 db</td> </tr> <tr> <td>10</td> <td>-20.9 db</td> </tr> <tr> <td>11</td> <td>-20.3 db</td> </tr> <tr> <td>12</td> <td>-19.6 db</td> </tr> <tr> <td>13</td> <td>-19.0 db</td> </tr> </tbody> </table>	CHANNEL	ADJUST FOR VTVM READING OF	2	-26.0 db	3	-25.3 db	4	-24.7 db	5	-24.1 db	6	-23.4 db	7	-22.8 db	8	-22.2 db	9	-21.5 db	10	-20.9 db	11	-20.3 db	12	-19.6 db	13	-19.0 db
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6	If no other tests are to be made, remove all of the SHORTING and DUMMY plugs. Disconnect the VTVM and the CFVM. Switch the deviation regulator back into service according to Section 362-504-501.															
(C) CHECK OF SHAPE NETWORK REGULATING RANGE																
This test checks the regulating range of each of the four shape networks (SLOPE, BULGE, CUBIC, and QUARTIC).																
The measurements are made using the carrier frequencies being received from the high-frequency line. The procedure should be repeated for each shape network under test.																
STEP	PROCEDURE															
1	Prepare for the test according to (A) PREPARATION FOR TESTS.															
2	Using a W2DW cord, or equivalent, connect the lower (ground) INPUT terminal of the VTVM to the chassis ground and connect the upper (hot) INPUT terminal of the VTVM to terminal 3 (middle terminal) on the output potentiometer of the channel pick-off filter associated with the network under test as covered in Table D.															
<p>TABLE D</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>NETWORK</th> <th>CHANNEL FILTER</th> <th>FREQUENCY</th> </tr> </thead> <tbody> <tr> <td>Slope</td> <td>2</td> <td>176 Kc</td> </tr> <tr> <td>Bulge</td> <td>7</td> <td>216 Kc</td> </tr> <tr> <td>Cubic</td> <td>5</td> <td>200 Kc</td> </tr> <tr> <td>Quartic</td> <td>4</td> <td>192 Kc</td> </tr> </tbody> </table>		NETWORK	CHANNEL FILTER	FREQUENCY	Slope	2	176 Kc	Bulge	7	216 Kc	Cubic	5	200 Kc	Quartic	4	192 Kc
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Quartic	4	192 Kc														
3	<i>Record the VTVM reading</i> for the network under test. Call this reading R.															
4	Remove the SHORTING plug from the TERM jack of the network being tested and allow time for the thermistor to stabilize. The network is now in the position shown in Fig. 3(a).															
5	The VTVM meter reading should be within the limits shown in Table E for each network.															
<i>Note: R is the reading recorded for the network in Step 3 above.</i>																
<p>TABLE E</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>NETWORK</th> <th>READING IN DB</th> </tr> </thead> <tbody> <tr> <td>Slope</td> <td>R-5.3 ±1.5</td> </tr> <tr> <td>Bulge</td> <td>R+2.3 ±1.5</td> </tr> <tr> <td>Cubic</td> <td>R-3.7 ±1.5</td> </tr> <tr> <td>Quartic</td> <td>R-3.2 ±1.5</td> </tr> </tbody> </table>		NETWORK	READING IN DB	Slope	R-5.3 ±1.5	Bulge	R+2.3 ±1.5	Cubic	R-3.7 ±1.5	Quartic	R-3.2 ±1.5					
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Quartic	R-3.2 ±1.5															
6	If the requirement in Step 5 is met, prepare the 3AF test set as follows: (a) Set the toggle switch to the 40 MA position. (b) Set the rotary switch to the ALIGN position. (c) Insert the two-prong plug into the TST PWR jack located on the front of the deviation regulator filter and network panel.															

STEP	PROCEDURE										
7	Remove the DUMMY plug from the TST jack of the shape network being tested and replace it with the 310 plug of the 3AF test set. The network is now in the condition shown in Fig. 3(b).										
8	<p>Adjust the 3AF test set CAL potentiometer for a reading of 27 ma. Wait for the thermistor in the network to stabilize and, if necessary, readjust the CAL potentiometer for 27 ma. The VTVM meter should now indicate a reading for the network that is within the limits shown in Table F.</p> <p><i>Note: R is the reading recorded for the network in Step 3 above.</i></p> <p style="text-align: center;">TABLE F</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>NETWORK</th> <th>READING IN DB</th> </tr> </thead> <tbody> <tr> <td>Slope</td> <td>$R + 4.8 \pm 1.3$</td> </tr> <tr> <td>Bulge</td> <td>$R - 2.0 \pm 1.0$</td> </tr> <tr> <td>Cubic</td> <td>$R + 3.1 \pm 1.0$</td> </tr> <tr> <td>Quartic</td> <td>$R + 3.0 \pm 1.0$</td> </tr> </tbody> </table> <p>(a) If the limits are exceeded on any measurement, check for trouble in one of the networks. A method for locating trouble in the shape networks is described in this series of sections. The entire sequence of tests must be repeated after any network is replaced.</p> <p>(b) If the requirements are met, proceed with Step 9.</p>	NETWORK	READING IN DB	Slope	$R + 4.8 \pm 1.3$	Bulge	$R - 2.0 \pm 1.0$	Cubic	$R + 3.1 \pm 1.0$	Quartic	$R + 3.0 \pm 1.0$
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9	Remove the 310 plug of the 3AF test set from the TST jack of the network and replace it with the DUMMY plug.										
10	Repeat Steps 1 through 9 on all networks to be tested.										
11	If no other tests are to be made, remove all of the SHORTING and DUMMY plugs. Disconnect the VTVM. Switch the deviation regulator back into service according to Section 362-504-501.										

(D) CHECK OF CONTROL CIRCUIT UNIT OUTPUT

In this test the four control amplifiers are checked with the deviation regulator in the mean, or terminated, condition. If the requirements are met, the regulator will give an output that approximates the nominal 7 db slope.

STEP	PROCEDURE
1	Prepare for the test according to (A) PREPARATION FOR TESTS.
2	Short the IN jacks of the network associated with the amplifier being adjusted. The IN jacks are located on the deviation regulator filter and network panel. They are designated SL, BU, CU, and QU.

STEP	PROCEDURE
3	Set the 3AF test set as follows: (a) Operate the CAL potentiometer to OFF. (b) Set the toggle switch to the 10 MA position. (c) Set the rotary switch to ALIGN. (d) Insert two-prong plug into TST PWR jack.
4	Remove the DUMMY plug from the TST jack of the control circuit unit being tested and insert the 310 plug of the 3AF test set.
5	Press the ADJ button on the 3AF test set. The network is now in the condition shown in Fig. 3(c). The test set meter should indicate a current reading of — Requirement: 7.0 ± 1.0 ma If the current reading exceeds the limits, proceed as follows: (a) Operate the 3AF test set toggle switch to the 40 MA position, and vary the ADJ potentiometer on the control amplifier from the extreme counterclockwise to the extreme clockwise position. The range between the lowest current reading and the highest current reading should be — Requirement: 20.0 ma (b) When the range limits cannot be met, check the control amplifier for trouble. If the range limits are met, readjust the ADJ potentiometer on the control amplifier for a reading of — Requirement: 7.0 ± 0.5 ma
6	Remove the 3AF test set. Replace the DUMMY plug in the TST jack.
7	Repeat Steps 1 through 6 on all of the control circuit units to be tested.
8	If no other tests are to be made, remove all of the SHORTING and DUMMY plugs. Switch the deviation regulator back into service according to Section 362-504-501.

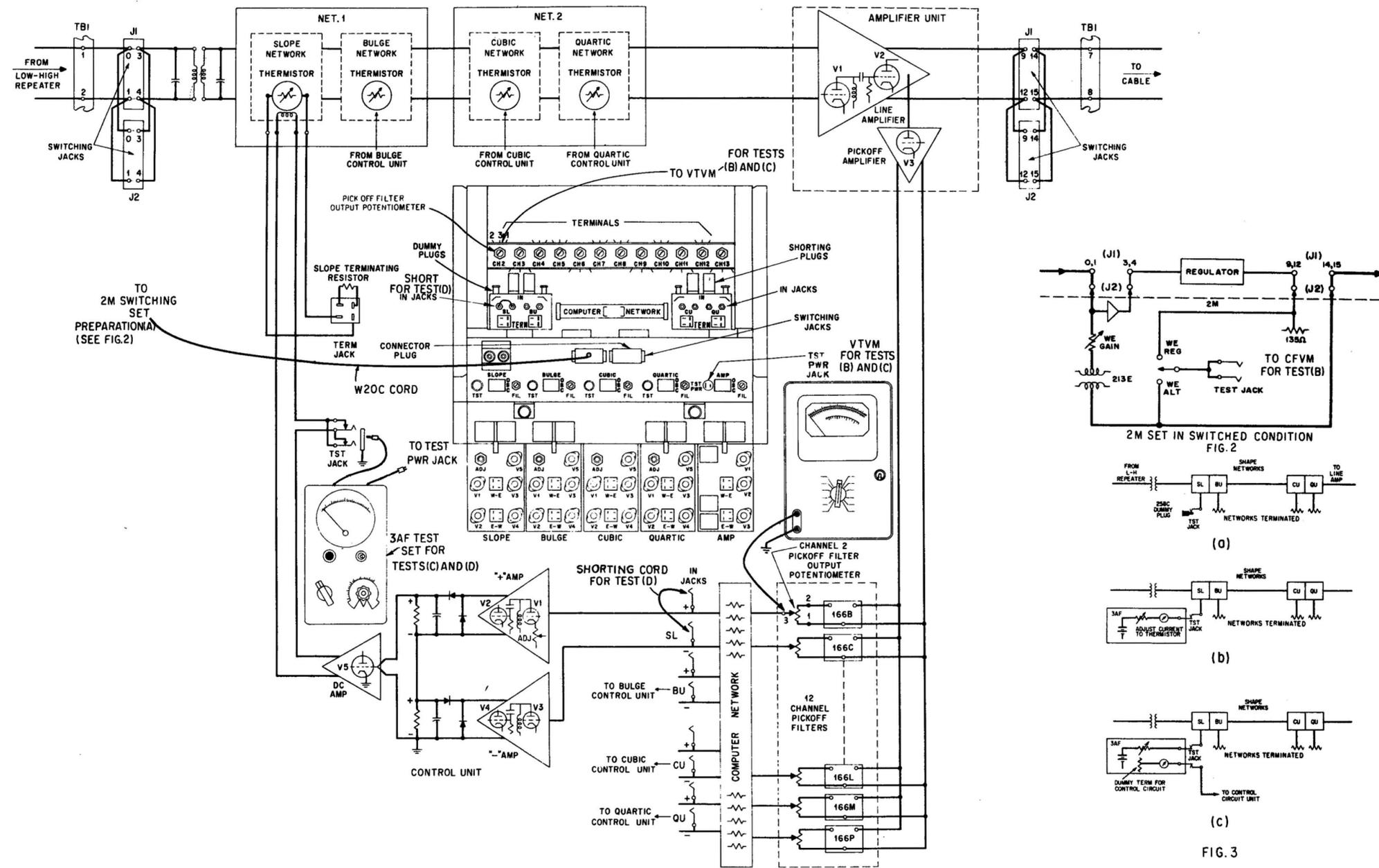


FIG. 1 - PREPARATION FOR TEST WHEN TESTING THE DEVIATION REGULATOR IN SWITCHED CONDITION

FIG. 3