

**ON/RADIO — RADIO MULTIPLEX POINTS**  
**CARRIER LINE-UP — 48-CHANNEL COMBINING UNITS**  
**PREPARATORY PROCEDURE — DC RESISTANCE MEASUREMENTS**

In the 48-channel combining unit, L and H groupings of ON1 or ON2 carrier received from terminals, junctions or "N"-equipped cable pairs, are adjusted in level and slope and combined through filters for application directly to the radio transmitter or for application to the 96-channel multiplexing equipment. Combined L and H groupings received from the radio are separated by filters and adjusted in level and pre-equalized for application to the Type N cable pairs, terminals, or junctions. At radio repeater sites where groupings are dropped, this unit may operate back-to-back with another unit like it, or back-to-back with a 96-channel multiplex equipment, or the unit may operate directly between two radio equipments. This flexibility calls for a large number of optional arrangements of span pads, slope networks, transformers and filters. Each installation should be checked visually to make certain that these components are provided in accordance with office records and correctly located. For impedance-matching reasons, it is important that the orientation of the slope networks be correct with regard to how ends A and B are connected.

The purpose of these tests is to measure resistance in each branch of the 48-channel combining unit with an ohmmeter to verify that the branch is electrically correct. Where a transmission branch can be isolated from other circuits at one end, an ohmmeter measurement can usually be made of the loop resistance between T & R leads at the terminal strips to verify that the branch is electrically correct. Such a measurement determines the total series resistance of pads, slope networks and transformer windings, and should be compared with the total obtained by computation, i.e., by numerical addition of the appropriate values given in Table I of this section.

In two cases, namely where the +7 db high group slope network or -7 db low group slope network is included in a branch, the dc shunt path of the network complicates the problem so that a simple addition of series components will not provide the correct answer. In these cases, longitudinal resistance is measured, and the measured value is compared with total series resistance divided by 4.

At radio repeater points where some ON groupings are dropped, two branches of the 48-channel combining unit may be permanently cabled, through TB1, to two branches of another such unit or to TB1 of a 96-channel multiplex mounting. In such cases of back-to-back operation, these branches will include no span pads or slope networks and need not be measured for resistance.

This section is reissued to include procedures and Figures which are used solely for ON/Radio on TL Radio.

**APPARATUS:**

- 1 — KS-14510, L1 or L5 Volt-Ohm-Milliammeter, Triplett Model 630, or equivalent
- 2 — Clip leads, 6-in., alligator clip on each end
- 1 — ED-92309-30 G8 Connector (for TL applications only)

STEP	PROCEDURE										
	<p data-bbox="397 304 795 331"><b>ON/Radio — Other Than TL Radio</b></p> <p data-bbox="397 361 1550 485"><i>Note:</i> For greatest accuracy, each ohmmeter reading, where possible, should be taken using the scale switch setting which gives a meter deflection between 5 and 50. When the correct switch setting has been found, recheck the zero setting with the test leads shorted, before making the measurement.</p> <p data-bbox="284 520 1550 674">1 Determine, from office records, the types of pads and slope network and transformer provided in each transmission branch of the 48-channel combining unit to be tested, and tabulate on Data Sheet 1, in the appropriate space in the row designated "Pad Loss, Net or Transf." If a pad, net, or transformer is not required, record "None." If a transformer is used, record "Yes."</p> <p data-bbox="284 709 1550 800">2 Obtain from Table I the value of series resistance corresponding to each pad and network required, and tabulate on Data Sheet 1, in the appropriate space in the row designated "Series Resistance." Record the transformer resistance in the space furnished.</p> <p data-bbox="284 835 1550 959">3 Add the resistance values tabulated in each "Series Resistance" row, and record this sum in the space in the column headed "Total Series Resis." If any branch contains a -7LG or +7HG slope net, divide its sum by 4 and record dividend in the column headed "Longitud. Resis."</p> <p data-bbox="284 995 1550 1085">4 If the branch whose resistance to be measured connects to the input or output of an "N" or "ON" repeater, remove the repeater switching plugs to open the dc circuit which the repeater presents to this branch.</p> <p data-bbox="284 1121 1550 1211">5 If the branch to be measured does <i>not</i> include a +7 db High Group (J98706N) or -7 db Low Group (J98706L) slope network, but it <i>does</i> include a transformer (T1, T2, T3 or T4):</p> <p data-bbox="430 1247 1550 1310">(a) As shown in the example of Fig. 1, measure the resistance between TB1 terminals as follows:</p> <table data-bbox="698 1344 1144 1554" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">BRANCH</th> <th style="text-align: center;">TB1 TERMINALS</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">HG IN</td> <td style="text-align: center;">1-2</td> </tr> <tr> <td style="text-align: center;">LG OUT</td> <td style="text-align: center;">9-10</td> </tr> <tr> <td style="text-align: center;">LG IN</td> <td style="text-align: center;">21-22</td> </tr> <tr> <td style="text-align: center;">HG OUT</td> <td style="text-align: center;">29-30</td> </tr> </tbody> </table> <p data-bbox="430 1583 1550 1646">(b) Record the reading in ohms on Data Sheet 1 in the space designated "Meas. Resis." for the branch being tested.</p> <p data-bbox="397 1673 1247 1701"><b>Requirement:</b> MEAS. RESIS. = TOTAL SERIES RESIS. <math>\pm 6\%</math></p> <p data-bbox="284 1730 1550 1793">6 If the branch to be measured does <i>not</i> include a +7 db High Group or -7 db Low Group slope network and does <i>not</i> include a transformer (T1, T2, T3 or T4):</p> <p data-bbox="430 1820 1550 1883">(a) As shown in the example of Fig. 2, connect a 6-inch clip lead between TB2 terminals 1 and 2, or 29 and 30, whichever this branch connects to (see Step 5).</p>	BRANCH	TB1 TERMINALS	HG IN	1-2	LG OUT	9-10	LG IN	21-22	HG OUT	29-30
BRANCH	TB1 TERMINALS										
HG IN	1-2										
LG OUT	9-10										
LG IN	21-22										
HG OUT	29-30										

STEP	PROCEDURE															
7	<p>(b) Measure the resistance between the pairs of TB1 terminals 1-2, 9-10, 21-22 or 29-30 (whichever applies for the branch under test).</p> <p>(c) Record the reading in ohms on Data Sheet 1 in the space designated "Meas. Resis." for the branch being tested.</p> <p><b>Requirement:</b> MEAS. RESIS. = TOTAL SERIES RESIS. <math>\pm 6\%</math></p> <p>If the branch to be measured <i>includes</i> a +7 db High Group (J98706N) or -7 db Low Group (J98706L) slope network, and it <i>also</i> includes a transformer (T1, T2, T3 or T4):</p> <p>(a) As shown in the example of Fig. 3, connect a 6-inch clip lead between the TB1 terminals of the branch and measure the resistance between this connection and the transformer center tap as follows:</p> <table border="1" data-bbox="683 772 1222 982"> <thead> <tr> <th>BRANCH</th> <th>TB1 TERMS.</th> <th>TRANSFORMER</th> </tr> </thead> <tbody> <tr> <td>HG IN</td> <td>1-2</td> <td>T1</td> </tr> <tr> <td>LG OUT</td> <td>9-10</td> <td>T2</td> </tr> <tr> <td>LG IN</td> <td>21-22</td> <td>T3</td> </tr> <tr> <td>HG OUT</td> <td>29-30</td> <td>T4</td> </tr> </tbody> </table> <p>(b) Record the reading in ohms on Data Sheet 1 under "Meas. Resis." for the branch being tested.</p> <p><b>Requirement:</b> MEAS. RESIS. = LONGITUD. RESIS. <math>\pm 6\%</math></p>	BRANCH	TB1 TERMS.	TRANSFORMER	HG IN	1-2	T1	LG OUT	9-10	T2	LG IN	21-22	T3	HG OUT	29-30	T4
BRANCH	TB1 TERMS.	TRANSFORMER														
HG IN	1-2	T1														
LG OUT	9-10	T2														
LG IN	21-22	T3														
HG OUT	29-30	T4														
8	<p>If the branch to be measured <i>includes</i> a +7 db High Group (J98706N) or -7 db Low Group (J98706L) slope network, but does <i>not</i> include a transformer:</p> <p>(a) As shown in the example of Fig. 4, connect a 6-inch clip lead between the TB1 terminals of this branch and another between TB2 terminals as follows:</p> <table border="1" data-bbox="716 1339 1263 1591"> <thead> <tr> <th>BRANCH DESIG. AT TB1</th> <th>SHORT CIRCUIT TB1 TERMS.</th> <th>SHORT CIRCUIT TB2 TERMS.</th> </tr> </thead> <tbody> <tr> <td>HG IN</td> <td>1-2</td> <td>1-2</td> </tr> <tr> <td>LG OUT</td> <td>9-10</td> <td>29-30</td> </tr> <tr> <td>LG IN</td> <td>21-22</td> <td>1-2</td> </tr> <tr> <td>HG OUT</td> <td>29-30</td> <td>29-30</td> </tr> </tbody> </table> <p>(b) Measure the resistance between the clip lead connection on TB1 and that on TB2 and record the reading in ohms on Data Sheet 1 under "Meas. Resis." in the space provided for this branch.</p> <p><b>Requirement:</b> MEAS. RESIS. = LONGITUD. RESIS. <math>\pm 6\%</math></p>	BRANCH DESIG. AT TB1	SHORT CIRCUIT TB1 TERMS.	SHORT CIRCUIT TB2 TERMS.	HG IN	1-2	1-2	LG OUT	9-10	29-30	LG IN	21-22	1-2	HG OUT	29-30	29-30
BRANCH DESIG. AT TB1	SHORT CIRCUIT TB1 TERMS.	SHORT CIRCUIT TB2 TERMS.														
HG IN	1-2	1-2														
LG OUT	9-10	29-30														
LG IN	21-22	1-2														
HG OUT	29-30	29-30														
9	<p>Remove any clip leads and ohmmeter connections applied during the tests and replace the switching plugs which were removed from the repeater switching jacks in Step 4.</p>															

STEP	PROCEDURE										
	<p><b>ON/Radio — TL Radio</b></p> <p>1 Determine from office records, the types of pads, slope networks, BEF's and transformers provided in each transmission branch of the 48-channel combining unit to be tested and tabulate on Data Sheet 1 in the appropriate spaces provided.</p> <p>2 Obtain from Table I the value of series resistance corresponding to each pad and network required and tabulate this information on Data Sheet 1. Also record the transformer resistance.</p> <p>3 Add the resistance values tabulated in each "Series Resistance" row and record this sum in the space in the column headed "Total Series Resis." If any branch contains a -7 LG or +7 HG slope net, divide its sum by 4 and record dividend in the column headed "Longitud. Resis."</p> <p>4 If the branch whose resistance to be measured connects to the input or output of an N or ON repeater, remove the repeater switching plugs to open the dc circuit which the repeater presents to this branch.</p> <p>5 If the branch to be measured includes a 228 KC or 76 KC Band Elimination Filter, disengage the filter and connect an ED-92309-30 G8 connector.</p> <p>6 If the branch to be measured does <i>not</i> include a +7 db High Group or -7 db Low Group slope network, but it does include a transformer:</p> <p>(a) As shown on Fig. 5, measure the resistance between TB1 terminals as follows:</p> <table data-bbox="743 1163 1273 1373"> <thead> <tr> <th>BRANCH</th> <th>TB1 TERMINALS</th> </tr> </thead> <tbody> <tr> <td>HG Trsg.</td> <td>1-2</td> </tr> <tr> <td>LG Rec.</td> <td>5-6</td> </tr> <tr> <td>LG Trsg.</td> <td>1-2</td> </tr> <tr> <td>HG Rec.</td> <td>5-6</td> </tr> </tbody> </table> <p>(b) Record the reading in ohms on Data Sheet 1 in the space designated "MEAS. RESIS." for the branch being tested.</p> <p><b>Requirement:</b> MEAS. RESIS. = TOTAL SERIES RESIS. <math>\pm 6\%</math></p>	BRANCH	TB1 TERMINALS	HG Trsg.	1-2	LG Rec.	5-6	LG Trsg.	1-2	HG Rec.	5-6
BRANCH	TB1 TERMINALS										
HG Trsg.	1-2										
LG Rec.	5-6										
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HG Rec.	5-6										
7	<p>If the branch to be measured does <i>not</i> include a +7 db High Group or -7 db Low Group slope network and does <i>not</i> include a transformer:</p> <p>(a) As shown on Fig. 5 clip a 6-inch clip lead between TB2 terminals 1-2, 5-6, 13-14 or 17-18.</p> <p>(b) Measure the resistance between the pairs of TB1 terminals 1-2 or 5-6 (whichever applies for the branch under test).</p>										

DESIGNATION OF BRANCH AT TB1		DATA SHEET 1						
HIGH GROUP IN	PAD A	SLOPE NET A	PAD E	PAD J	T1 TRANSF	TOTAL SERIES RESIS	LONGITUD RESIS (1)	MEAS RESIS
Pad Loss, Net Type or Transf								
Series Resistance								
LOW GROUP OUT	PAD B	SLOPE NET B	PAD F		T2 TRANSF	TOTAL SERIES RESIS	LONGITUD RESIS (1)	MEAS RESIS
Pad Loss, Net Type or Transf								
Series Resistance								
LOW GROUP IN	PAD C	SLOPE NET C	PAD G	PAD K	T3 TRANSF	TOTAL SERIES RESIS	LONGITUD RESIS (1)	MEAS RESIS
Pad Loss, Net Type or Transf								
Series Resistance								
HIGH GROUP OUT	PAD D	SLOPE NET D	PAD H		T4 TRANSF	TOTAL SERIES RESIS	LONGITUD RESIS (1)	MEAS RESIS
Pad Loss, Net Type or Transf								
Series Resistance								

Note: (1) This space used only when branch being tested includes +7 high group or -7 low group slope net, longitud. resis. = total series resis. ÷ 4.

TABLE I  
SERIES RESISTANCE OF SPAN PADS, SLOPE NETS AND 2507S TRANSFORMERS

SPAN PAD DB	2	4	6	8	10	12	14	16	18	20	22	24
SERIES RESIS. OHMS	31.1	61.6	89.2	116.5	141	163	181	195	209	222	230	239

SLOPE NET TYPE	-7 Low Group*	+7 Low Group	+7 High Group*	-7 High Group
SERIES RESIS. OHMS	400	14.4	540	7.5

\* Has dc shunt path

TRANSFORMER	2507S
SERIES RESIS. OHMS	4.4

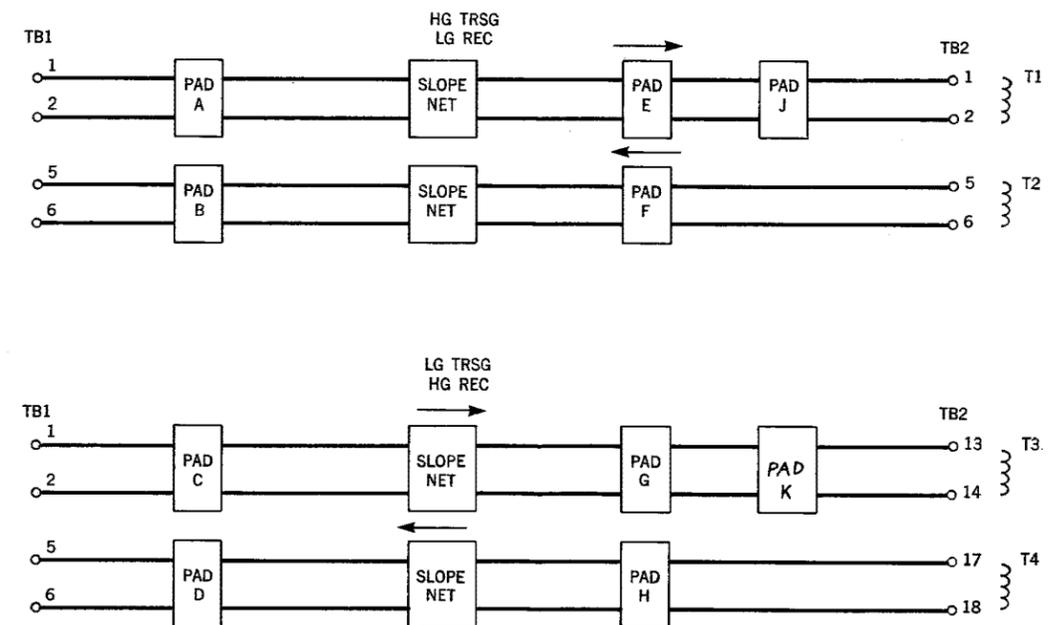
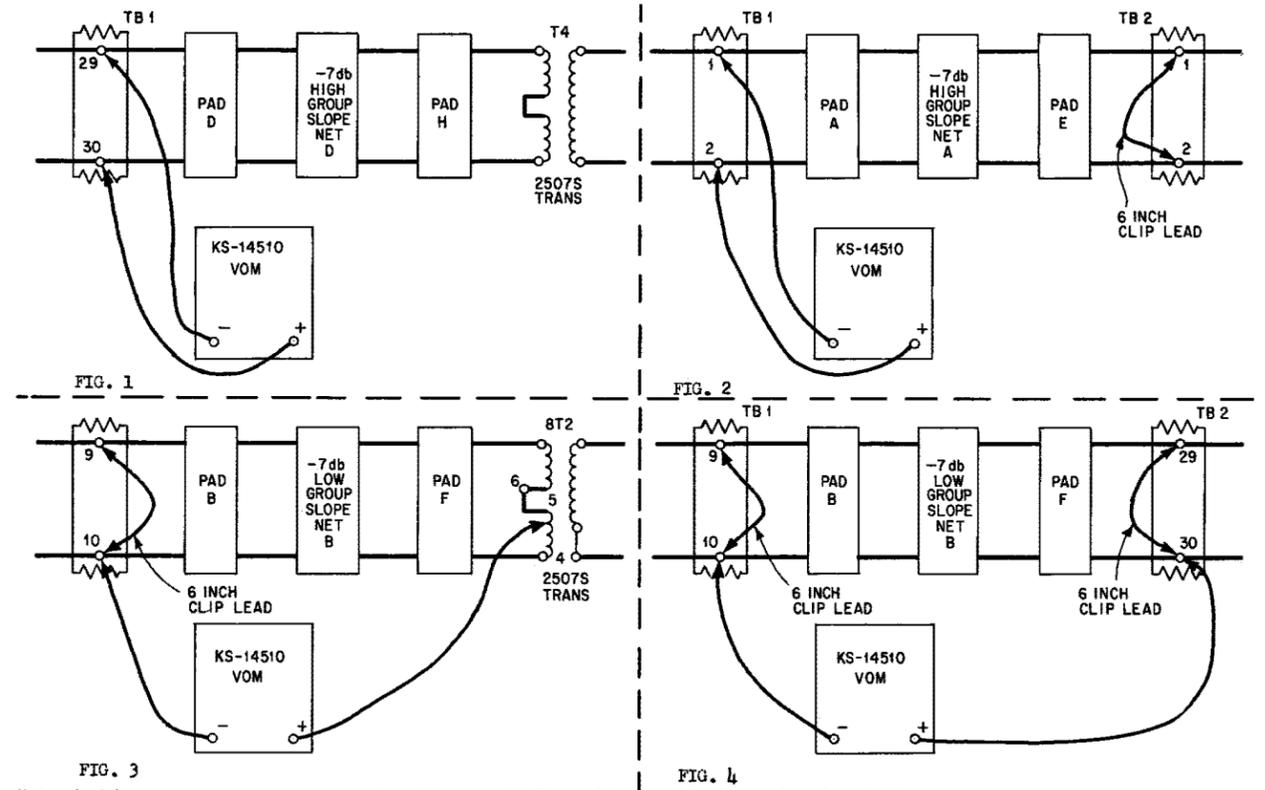


FIG. 5

STEP	PROCEDURE															
8	<p>(c) Record the reading in ohms on Data Sheet 1 in the space designated "MEAS. RESIS." for the branch being tested.</p> <p><b>Requirement:</b> MEAS. RESIS. = TOTAL SERIES RESIS. <math>\pm 6\%</math></p> <p>If the branch to be measured <i>includes</i> a +7 db High Group or -7 db Low Group slope network, and it <i>also</i> includes a transformer:</p> <p>(a) As shown on Fig. 5, connect a 6-inch clip lead between the TB1 terminals of the branch under test and measure the resistance between this connection and the transformer center top as follows:</p> <table border="1"> <thead> <tr> <th>BRANCH</th> <th>TB1 TERMS.</th> <th>TRANSFORMER</th> </tr> </thead> <tbody> <tr> <td>HG Trsg.</td> <td>1-2</td> <td>T1</td> </tr> <tr> <td>LG Rec.</td> <td>5-6</td> <td>T2</td> </tr> <tr> <td>LG Trsg.</td> <td>1-2</td> <td>T3</td> </tr> <tr> <td>HG Rec.</td> <td>5-6</td> <td>T4</td> </tr> </tbody> </table> <p>(b) Record the reading in ohms on Data Sheet 1 under "Meas. Resis." for the branch being tested.</p> <p><b>Requirement:</b> MEAS. RESIS. = LONGITUD. RESIS. <math>\pm 6\%</math></p>	BRANCH	TB1 TERMS.	TRANSFORMER	HG Trsg.	1-2	T1	LG Rec.	5-6	T2	LG Trsg.	1-2	T3	HG Rec.	5-6	T4
BRANCH	TB1 TERMS.	TRANSFORMER														
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9	<p>If the branch to be measured <i>includes</i> a +7 db High Group or -7 db Low Group slope network, but does <i>not</i> include a transformer:</p> <p>(a) As shown on Fig. 5, connect a 6-inch clip lead between the TB1 terminals of this branch and another between TB2 terminals as follows:</p> <table border="1"> <thead> <tr> <th>BRANCH</th> <th>SHORT CIRCUIT TB1 TERMS.</th> <th>SHORT CIRCUIT TB2 TERMS.</th> </tr> </thead> <tbody> <tr> <td>HG Trsg.</td> <td>1-2</td> <td>1-2</td> </tr> <tr> <td>LG Rec.</td> <td>5-6</td> <td>5-6</td> </tr> <tr> <td>LG Trsg.</td> <td>1-2</td> <td>13-14</td> </tr> <tr> <td>HG Rec.</td> <td>5-6</td> <td>17-18</td> </tr> </tbody> </table> <p>(b) Measure the resistance between the clip lead connection on TB1 and that on TB2 and record the reading in ohms on Data Sheet 1 under "Meas. Resis." in the space provided for this branch.</p> <p><b>Requirement:</b> MEAS. RESIS. = LONGITUD. RESIS. <math>\pm 6\%</math></p>	BRANCH	SHORT CIRCUIT TB1 TERMS.	SHORT CIRCUIT TB2 TERMS.	HG Trsg.	1-2	1-2	LG Rec.	5-6	5-6	LG Trsg.	1-2	13-14	HG Rec.	5-6	17-18
BRANCH	SHORT CIRCUIT TB1 TERMS.	SHORT CIRCUIT TB2 TERMS.														
HG Trsg.	1-2	1-2														
LG Rec.	5-6	5-6														
LG Trsg.	1-2	13-14														
HG Rec.	5-6	17-18														
10	Disconnect the ED-92309-30 G8 connector and connect the band elimination filter.															
11	Remove any clip leads and ohmmeter connections applied during the tests and replace the switching plugs which were removed from the repeater jacks.															

DESIGNATION OF BRANCH AT TB1	DATA SHEET 1							
	PAD A	SLOPE NET A	PAD E	PAD J	T1 TRANSF	TOTAL SERIES RESIS	LONGITUD RESIS (1)	MEAS RESIS
HIGH GROUP IN								
Pad Loss, Net Type or Transf								
Series Resistance								
LOW GROUP OUT								
Pad Loss, Net Type or Transf								
Series Resistance								
LOW GROUP IN								
Pad Loss, Net Type or Transf								
Series Resistance								
HIGH GROUP OUT								
Pad Loss, Net Type or Transf								
Series Resistance								

**Note: (1)** This space used only when branch being tested includes +7 high group or -7 low group slope net, longitud. resis. = total series resis.  $\div 4$ .

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