

**TYPE N AND ON CARRIER REPEATERS — REPEATERED HIGH-FREQUENCY LINE  
CARRIER LINE-UP — HIGH-FREQUENCY LINE MEASUREMENTS  
EQUALIZATION OF INDIVIDUAL CARRIERS AT THE OUTPUT OF THE REPEATER**

This section covers the procedure for placing plug-in equalizers in an N carrier system to improve the loss frequency characteristics of the high-frequency line.

The plug-in equalizers are of two basic types, designated high frequency and low frequency, for use at low-high repeaters and high-low repeaters. The characteristics of the units are shown in Fig. 1 along with simplified sketches which illustrate how they are constructed. The equalizers are wired into standard ED-92309-30, G1 connector plugs. The connector plug cases are colored red or blue to identify the high-frequency and low-frequency units, respectively. Each type equalizer is wired into two different plug-in units, stenciled E-W or W-E, so they can be used in either direction of transmission at a repeater. When correction is required in both directions, two equalizers are used (out west and out east).

Equalization proceeds from one terminal through the repeaters to the other terminal in each direction of transmission. The general procedure is as follows:

- (1) Bridged carrier frequency measurements are plotted at each locally powered repeater station; except where artificial lines or deviation equalizers are used at the repeater output, or where the central office shielded cable to the carrier cable terminal or central office main frame is more than about 50 feet in length. In these cases the repeater measurements should be made at the next locally powered point.
- (2) An ideal slope line is computed and plotted from the measurements.
- (3) Plug-in equalizers are inserted in preceding repeaters, as required, when a "tip-up" is indicated in a comparison of the ideal and measured slopes.

***Important: The equalizers should never be used indiscriminately. They should only be used as authorized by the Engineering Department.***

The suggested procedure is to have two men coordinate in the testing. One man can make the necessary measurements and computations at the locally powered repeater locations, while the other man provides the equalization required at the preceding repeaters.

Best results will be obtained if the tests are made when the temperature is about average for the locality. If trouble or traffic demands necessitate equalizing a system during extreme temperature conditions, the measurements should be rechecked when the temperature is average.

**APPARATUS:**

- 1 — KS-15538, L1 or L2 Carrier Frequency Voltmeter
- 1 — W20C Cord used with Carrier Frequency Voltmeter
- 1 — 2J Repeater Test Set (J94002J)

Determination of Individual Carrier Output Slope	
STEP	PROCEDURE
1	Energize the carrier frequency voltmeter and allow 20 minutes for it to stabilize.
2	Check that each J2 or J3 jack on the repeater under test contains either a connector plug or a plug-in equalizer unit. If equalization has been provided at the repeater in the direction of transmission being checked, remove that plug-in unit; otherwise, remove a connector plug. <i>Note:</i> A bridged measurement should not be made at a repeater which has an equalizer in the direction of transmission being checked.
3	Connect the carrier frequency voltmeter to the vacant J2 or J3 jack with a W20C cord as shown in Fig. 2.
4	Operate the voltmeter selector switch to the W-E OUT or E-W OUT position as required.
5	Measure the carrier level for each channel at the frequencies given in Table I. <i>Note:</i> As covered in the introduction, bridged measurements should not be made at repeaters with artificial lines or deviation equalizers at the output, or where the shielded office cable is more than about 50 feet in length.
6	Determine the repeater output slope. <i>Requirement:</i> Each of the plotted individual carrier levels should be within approximately $\pm 2$ db of the computed slope line ( $Y_0 - Y_{12}$ ).
7	If the measured slope shows a deviation (higher in level) at the high numbered carrier end (10, 11, 12, and 13), place a Red HF equalizer in one or more of the preceding low-high repeaters depending upon the amount of correction required. If the measured slope shows a deviation (higher in level) at the low numbered carrier end (1, 2, 3, and 4) place a Blue LF equalizer in one or more of the preceding high-low repeaters, depending upon the amount of correction required.
8	Allow a few minutes for the repeaters to stabilize after each equalizer is added to the line. Then remeasure and recompute the carrier slope to determine whether the correction brings the frequency characteristics of the line within the limits given in Step 6 above.
9	After the line has been equalized, the computed repeater output slope should be — <i>Requirements:</i> Within approximately $\pm 2$ db of the slope specified on the circuit order for the system. <i>Note:</i> Any slope setting adjustments to meet these requirements should be made and recorded under the direction of the person responsible for laying out the carrier system.
Method for Placing Plug-in Equalizers in the High-Frequency Line	
STEP	PROCEDURE
1	Check that the J2 and J3 jacks on the repeater requiring equalization contain either two connector plugs, or a connector plug and a plug-in equalizer in the direction of transmission <i>not</i> under test.

STEP	PROCEDURE
2	Remove a connector plug and connect the 2J test set in the vacant jack.
3	Set the 2J test set DBM toggle switch for the direction of transmission under test and measure the total power output at the repeater. <i>Record the reading.</i>
4	Disconnect the 2J test set.
5	Place the proper plug-in equalizer in the vacant jack. Fig. 3 indicates the equalizers required for each direction of transmission at low-high and high-low repeaters.
6	Remove the connector plug (or plug-in equalizer) from the second jack and connect the the 2J test set to the vacant jack.
7	Set the 2J test set DBM toggle switch for the direction of transmission under test and measure the total power output at the repeater.  <i>Requirement:</i> The power measured should be approximately the same as the power measured in Step 3 above. This is a check for trouble in the equalizer.
8	Disconnect the 2J test set.
9	Replace the connector plug (or proper plug-in equalizer) in the vacant jack.
10	Do not leave the repeater location until the effects of the equalizer have been checked by the person responsible for measuring and computing the carrier slope at the locally powered repeater point.

**TABLE I**  
**CHANNEL CARRIER FREQUENCIES AT REPEATER OUT IN KC**

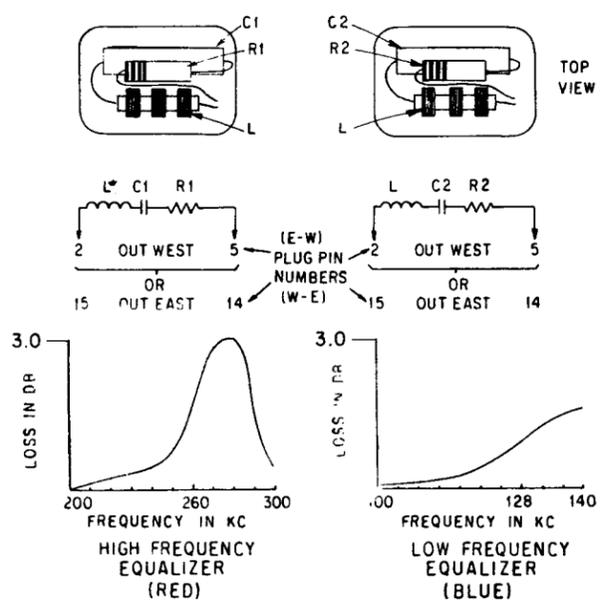
N CARRIER													
CHANNEL NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13
HIGH-LOW REPT. OUTPUT	136	128	120	112	104	96	88	80	72	64	56	48	40
LOW-HIGH REPT. OUTPUT	168	176	184	192	200	208	216	224	232	240	248	256	264

ON1 CARRIER											
LOW-LOW OR HIGH-LOW REPEATER											
CARRIER NO.	1	2	3	4	5	6	LCO	7	8	9	10
FREQUENCY — KC	132	124	112	104	92	84	76	72	64	52	44

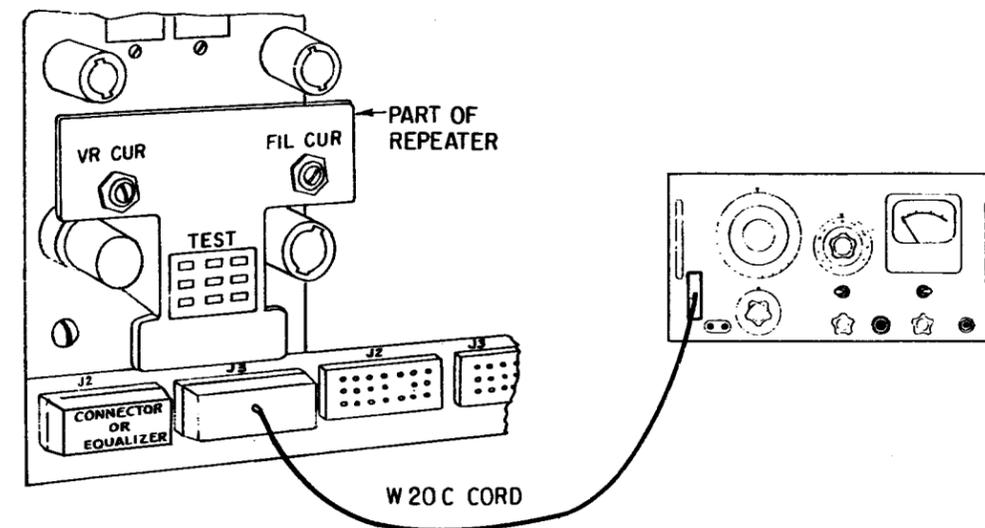
LOW-HIGH REPEATER											
CARRIER NO.	1	2	3	4	5	6	LCO	7	8	9	10
FREQUENCY — KC	172	180	192	200	212	220	228	232	240	252	260

ON2 CARRIER													
LOW-LOW OR HIGH-LOW REPEATER													
CARRIER NO.	1	2	3	4	5	6	7	LCO	8	9	10	11	12
FREQUENCY — KC	128	120	112	104	96	88	80	76	72	64	56	48	40

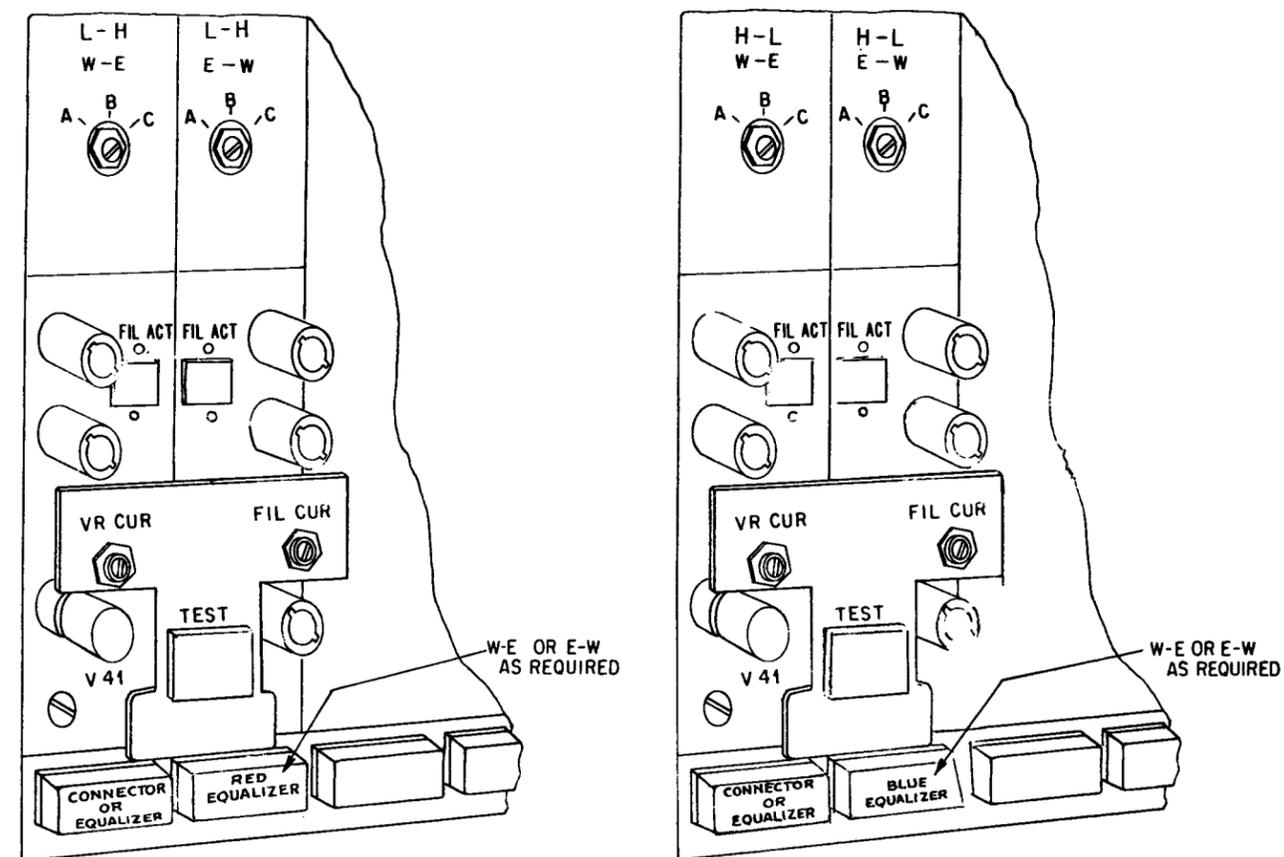
LOW-HIGH REPEATER													
CARRIER NO.	1	2	3	4	5	6	7	LCO	8	9	10	11	12
FREQUENCY — KC	176	184	192	200	208	216	224	228	232	240	248	256	264



**Fig. 1 — The Plug-in Equalizer**



**Fig. 2 — Test Setup for Bridged Measurements**



**Fig. 3 — Method for Placing Plug-in Equalizers**

**Fig. 1, 2 and 3**