359P EQUALIZER

DESCRIPTION

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1. GENERAL

1.01 This section describes the 359P equalizer, which is a plug-in apparatus unit designed for use in V4 telephone repeater applications (Fig. 1).

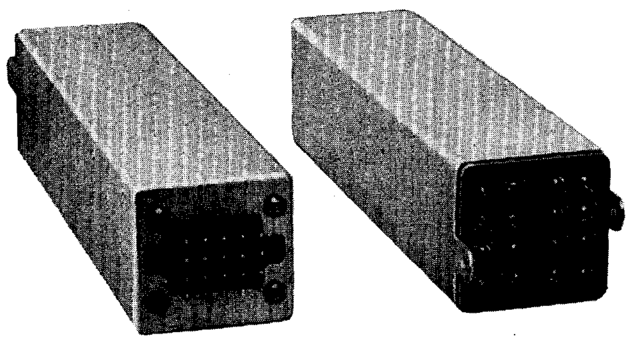

Fig. 1—359P Equalizer

1.02 The 359P equalizer is used in conjunction with a 227-type amplifier to provide equalization for 4-wire special service unigauge loops from 6 to 52 kft, with up to 6 kft of bridged tap at the customer location (Fig. 2).

1.03 Unigauge loops are:

(a) 26-gauge nonloaded cable in the range from 0 to 24 kft

(b) 26-gauge partially loaded cable in the range from 24 to 30 kft where 88-mH load coils are located at 15 and 21 kft

(c) 26-gauge nonloaded cable for the first 15 kft and 22-gauge, H88 loaded cable for the remaining distance when the length of the link is greater than 30 kft (Fig. 3).

1.04 The equalizer has independently adjustable low- and high-frequency sections that provide for the necessary equalization to obtain a substantially flat frequency response over the range from 300 to 3000 Hz.

2. EQUIPMENT DESCRIPTION

2.01 The 359P equalizer (Fig. 1) is a plug-in unit equipped with a 20-pin connector plug and is designed to be plugged directly into the equalizer connector socket of the repeater mounting shelf.

2.02 The 359P equalizer consists of 12 resistors, 8 capacitors, and 1 inductor mounted on a

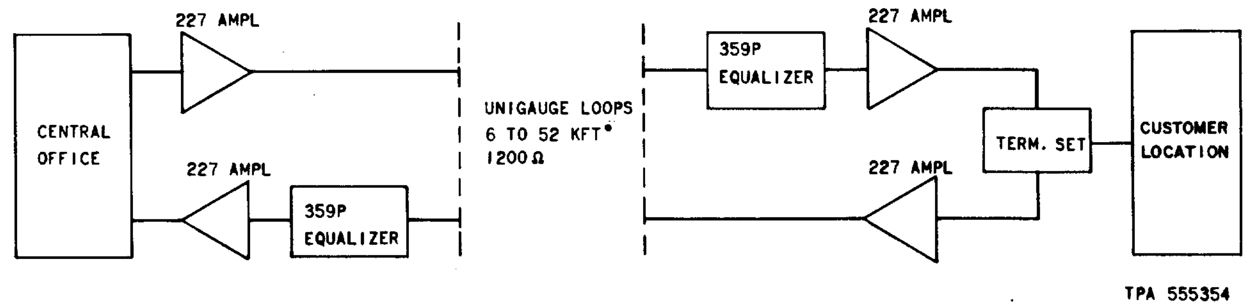

Fig. 2—359P Equalizer—4-Wire Unigauge Special Service Loops

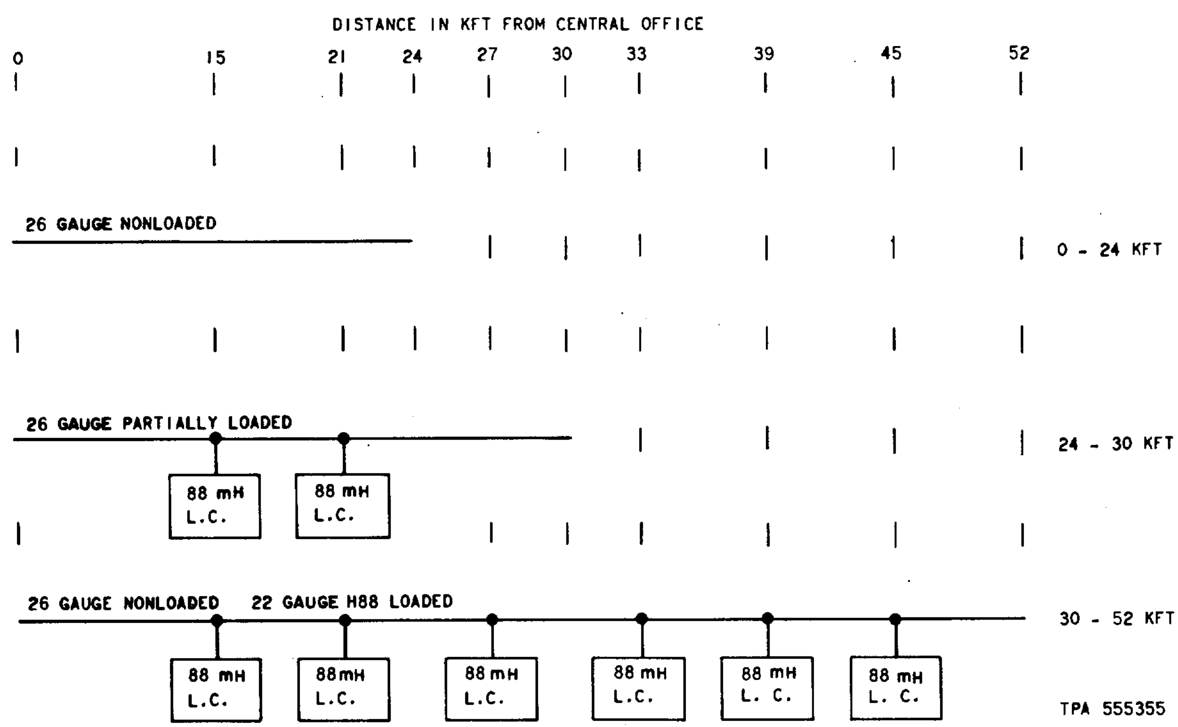

Fig. 3—Unigauge Design Outside Plant

printed wiring board and housed in a metal can approximately 1-3/4 inches high by 1-3/4 inches wide by 7 inches long. Tabs are provided on the front of the can to facilitate removal of the equalizer from the repeater mounting shelf with the use of a 602C or a 602D tool.

2.03 Sixteen screw-type switches are mounted on the equalizer faceplate. These switches permit the indicated component values to be added to or removed from the circuit, as required, when adjusting equalization.

3. CIRCUIT DESCRIPTION

3.01 The general circuit configuration of the 359P equalizer is illustrated in Fig. 4. Resistor R_{LF} and capacitor C_{LF} make up the series arm low-frequency equalizing section; inductor L1, capacitor C_{HF}, and resistor R_{HF} make up the shunt arm high-frequency section; and resistors R4, R5, and R6 make up a 6.2-dB pad that reduces interaction between the high- and low-frequency sections.

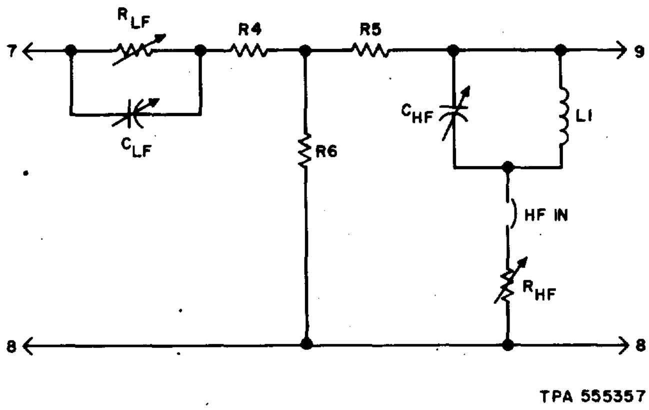

Fig. 4—359P Equalizer—General Circuit Configuration

3.02 Figure 5 is a schematic of the 359P equalizer that illustrates standard circuit connections when plugged into the equalizer socket of 24V4 or 44V4 repeaters. The transmitting side of the 359P equalizer provides no equalization, but does provide connections to the AMPL OUT and MON jacks, and thus connects the 1200-ohm transmitting amplifier output to the unigauge 4-wire line.

3.03 The receiving side of the equalizer contains the actual equalizing elements and selects the proper secondary tap of the receiving amplifier input transformer to make the primary side look like approximately 1200 ohms. Received transmission signals from the 4-wire line at terminals 2 and 4 are connected through to the 1200-ohm receiving amplifier input circuit at terminals 1 and 3. Terminals 7, 8, and 9 connect the high- and low-frequency equalizing sections into the receiving amplifier circuit.

3.04 The high- and low-frequency sections are adjusted by means of the faceplate screw-type switches. The capacitors in both the high- and low-freqency sections are added to the circuit when the associated screw-type switches are closed (turned in) and are removed when the switches are opened (turned out). The resistors in both the high- and low-frequency sections are bypassed when the associated screw-type switches are closed and are placed in the circuit when the switches are opened. The screw-type switch designated IN puts the high-frequency section in the circuit when closed and removes the high-frequency section when opened.

3.05 The series arm low-frequency component R_{LF} and C_{LF} provide compensation for amplitude distortion in the 4-wire line facilities at frequencies up to approximately 1000 Hz. Figures 6 through 9 illustrate typical equalization losses that may be obtained by various combinations of C_{LF} and R_{LF}. Figures 6 and 7 show the results of keeping R_{LF} constant at 1500 ohms and 3000 ohms, respectively, and varying C_{LF} with the HF section out of the circuit. Figures 8 and 9 show the results of keeping C_{LF} constant at 0.25 μF and 0.5 μF, respectively, and varying R_{LF} with the HF section out of the circuit.

3.06 The shunt arm high-frequency components provide amplitude equalization from 1 to 3 kHz. Figure 10 shows the results of keeping R_{HF} constant at 80 ohms and varying C_{HF} with the LF section out of the circuit. Figures 11 and 12 show the results of keeping C_{HF} constant at 0.1 μF and 0.3 μF, respectively, and varying R_{LF} with the LF section out of the circuit.

3.07 While the series arm low-frequency components R_{LF} and C_{LF} provide compensation for amplitude distortion, they introduce delay distortion at the same time. Figures 13 through 16 illustrate typical delay frequency characteristics by various combinations of C_{LF} and R_{LF}. Figures 13 and 14 show the results of keeping R_{LF} constant at 1500 ohms and 3000 ohms, respectively, and varying C_{LF} with the HF section out of the circuit. Figures 15 and 16 show the results of keeping C_{LF} constant at 0.25 μF and 0.5 μF, respectively, and varying R_{LF} with the HF section out of the circuit.

3.08 While the shunt arm high-frequency components provide compensation for amplitude distortion, they introduce delay distortion at the same time. Figure 17 shows the results of keeping R_{HF} constant at 80 ohms and varying C_{HF} with the LF section out of the circuit. Figures 18 and 19 show the results of keeping C_{HF} constant at 0.1 μF and 0.3 μF, respectively, and varying R_{HF} with the LF section of the circuit.

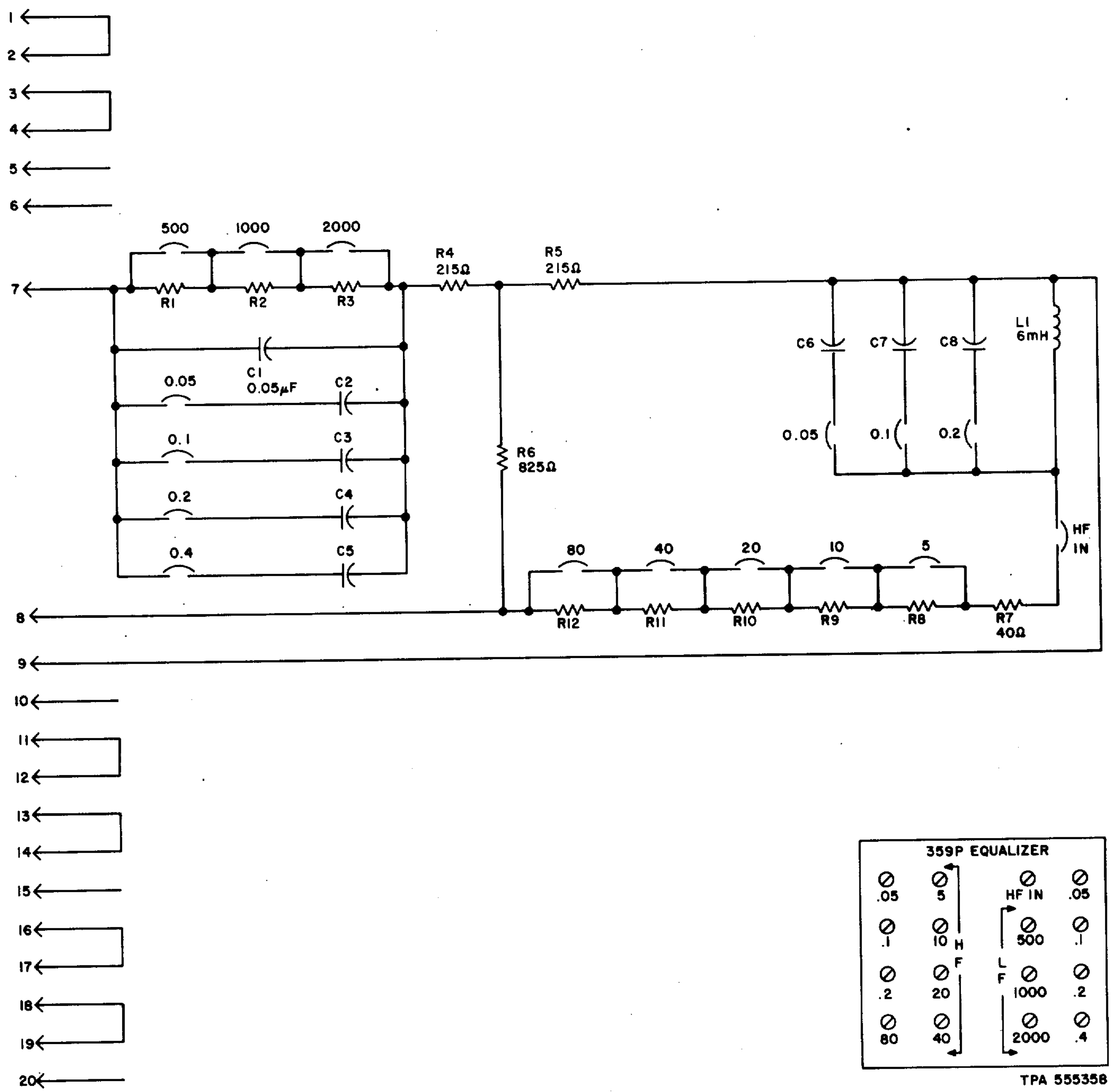

Fig. 5—359P Equalizer Schematic and Faceplate

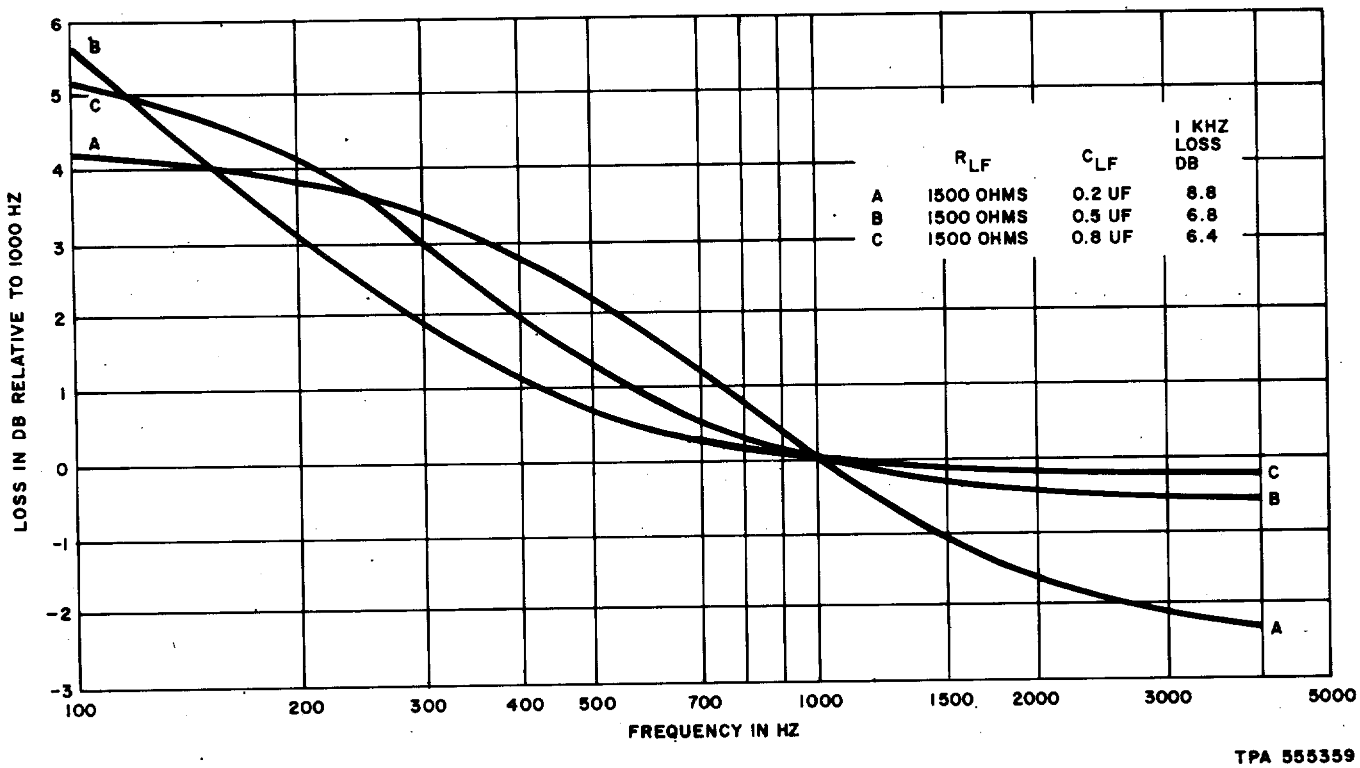

Fig. 6—359P Equalizer Low-Frequency Characteristics—Loss Between 600 Ohms, Varying C_{LF} for R_{LF} Constant at 1500 Ohms

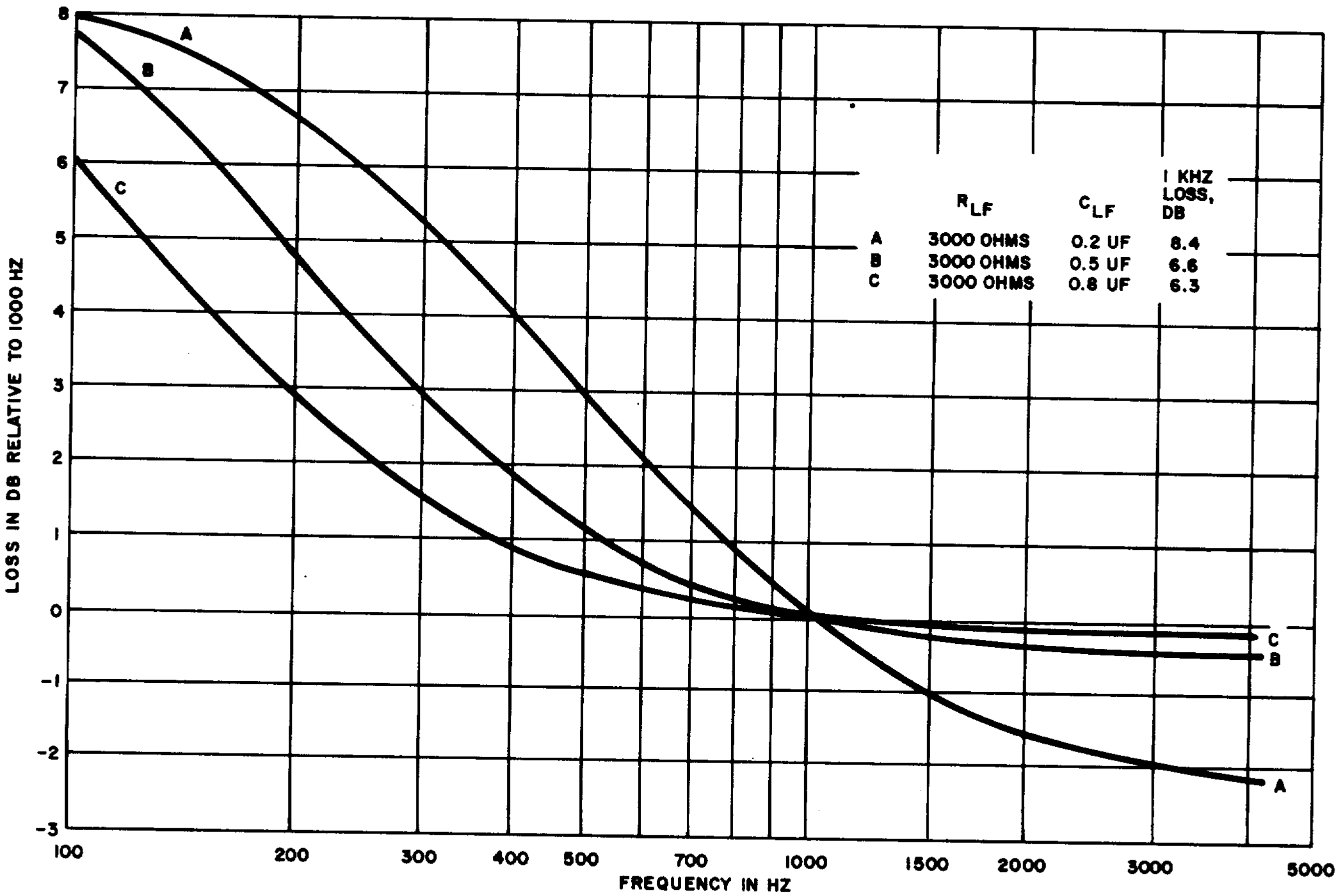

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Fig. 7—359P Equalizer Low-Frequency Characteristics—Loss Between 600 Ohms, Varying C_{LF} for R_{LF} Constant at 3000 Ohms

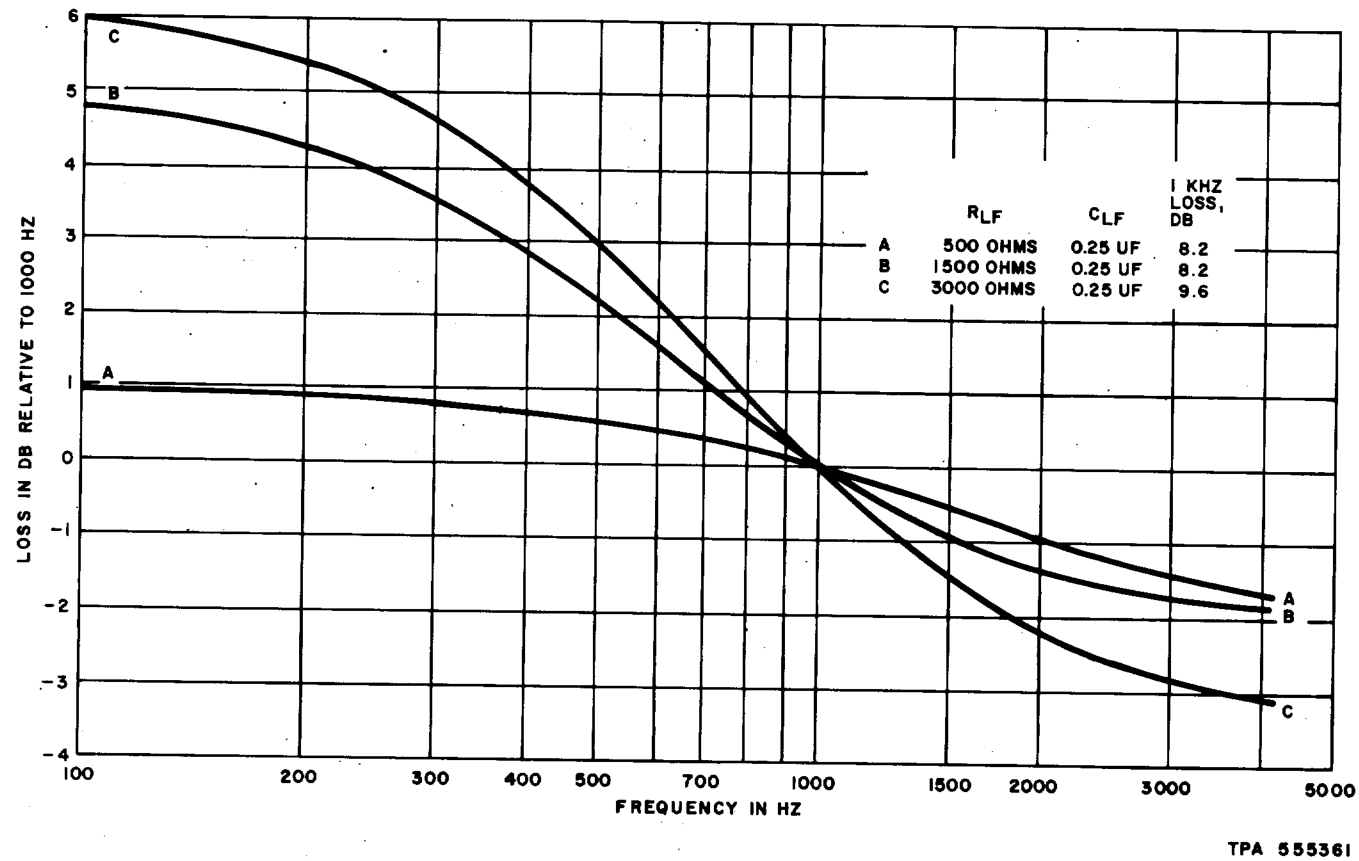

Fig. 8—359P Equalizer Low-Frequency Characteristics—Loss Between 600 Ohms, Varying RLF for CLF Constant at 0.25 μF

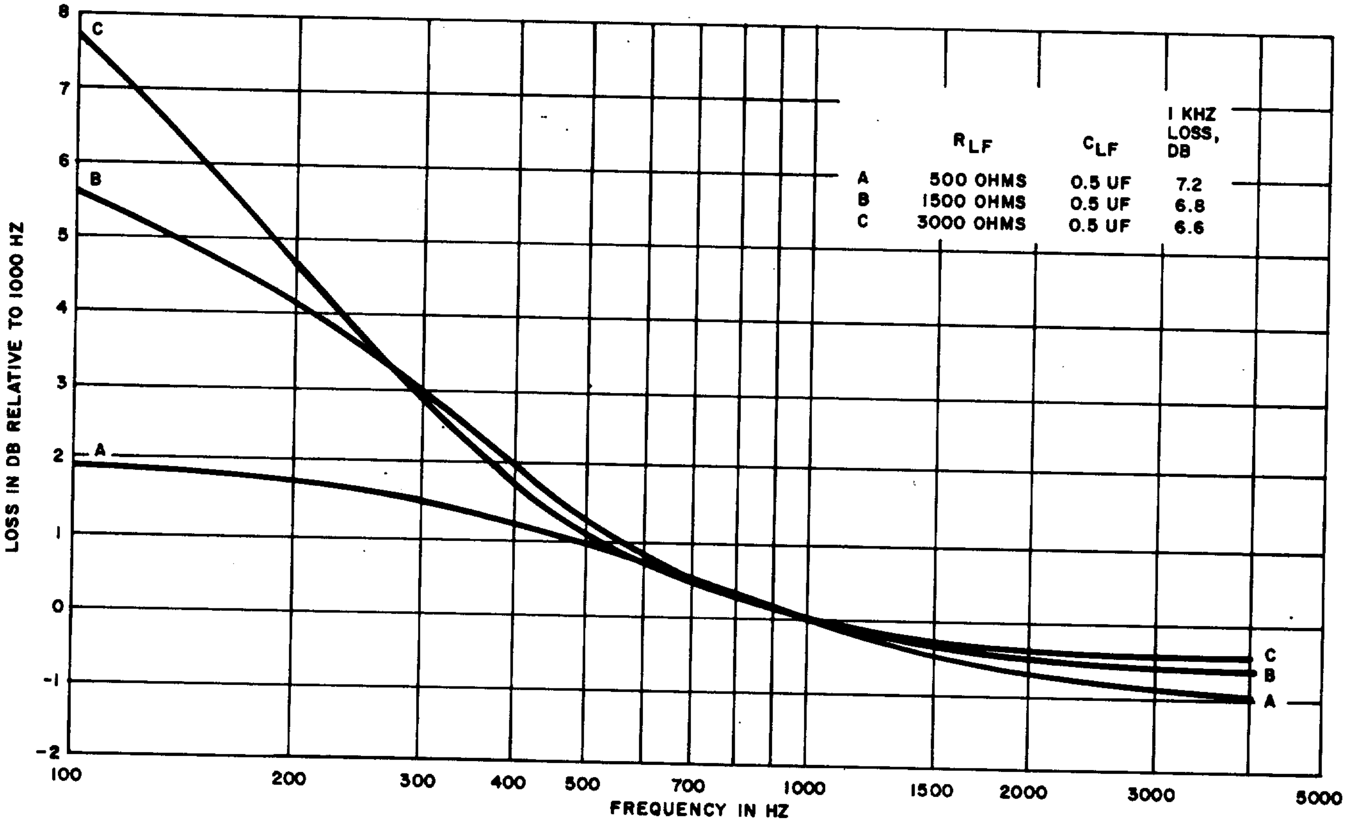

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Fig. 9—359P Equalizer Low-Frequency Characteristics—Loss Between 600 Ohms, Varying R_{LF} for C_{LF} Constant at 0.5 μF

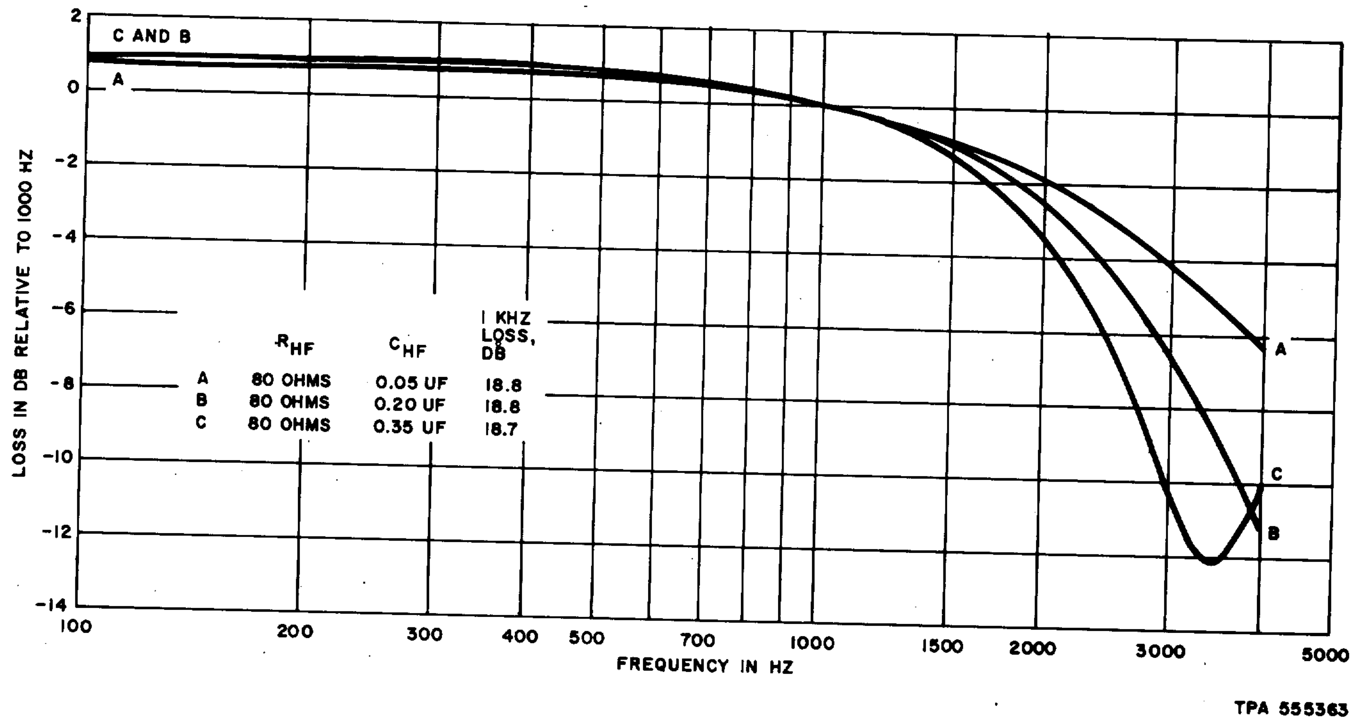

Fig. 10—359P Equalizer High-Frequency Characteristics—Loss Between 600 Ohms, Varying CHF for RHF Constant at 80 Ohms

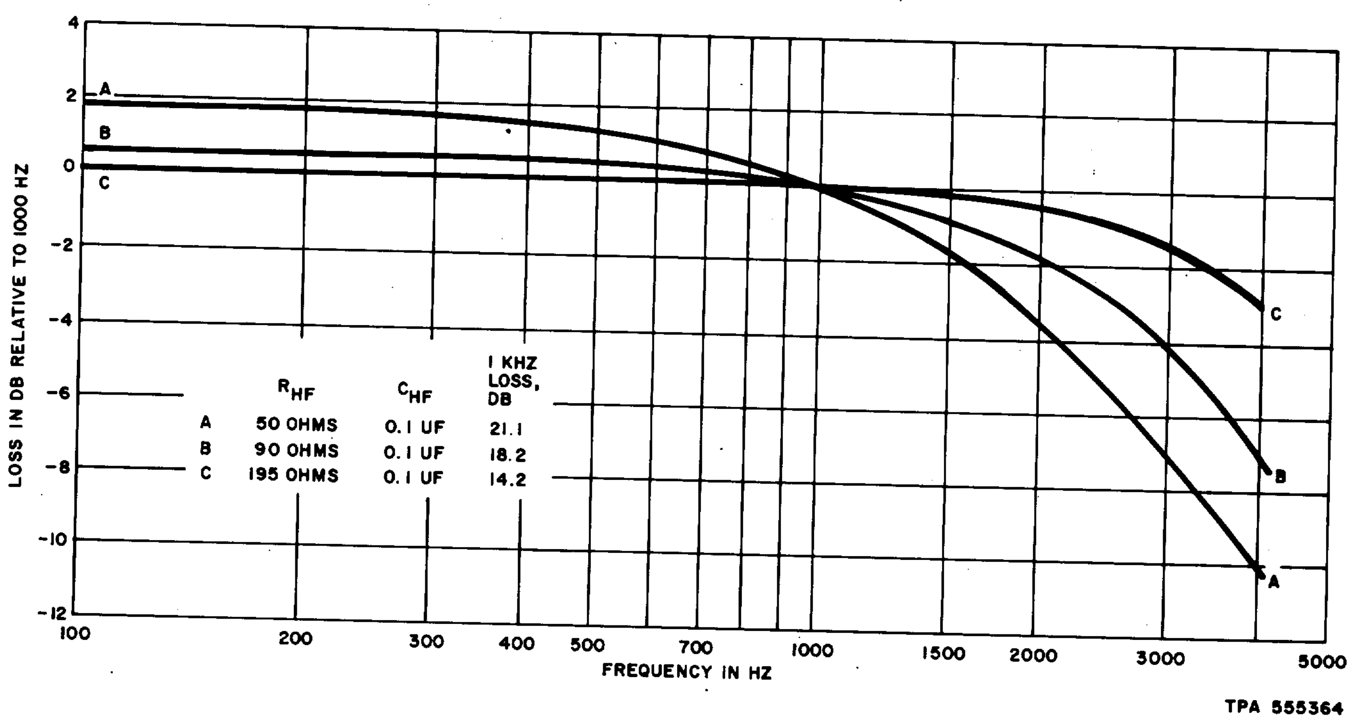

Fig. 11—359P Equalizer High-Frequency Characteristics—Loss Between 600 Ohms, Varying RHF for CHF Constant at 0.1 μF

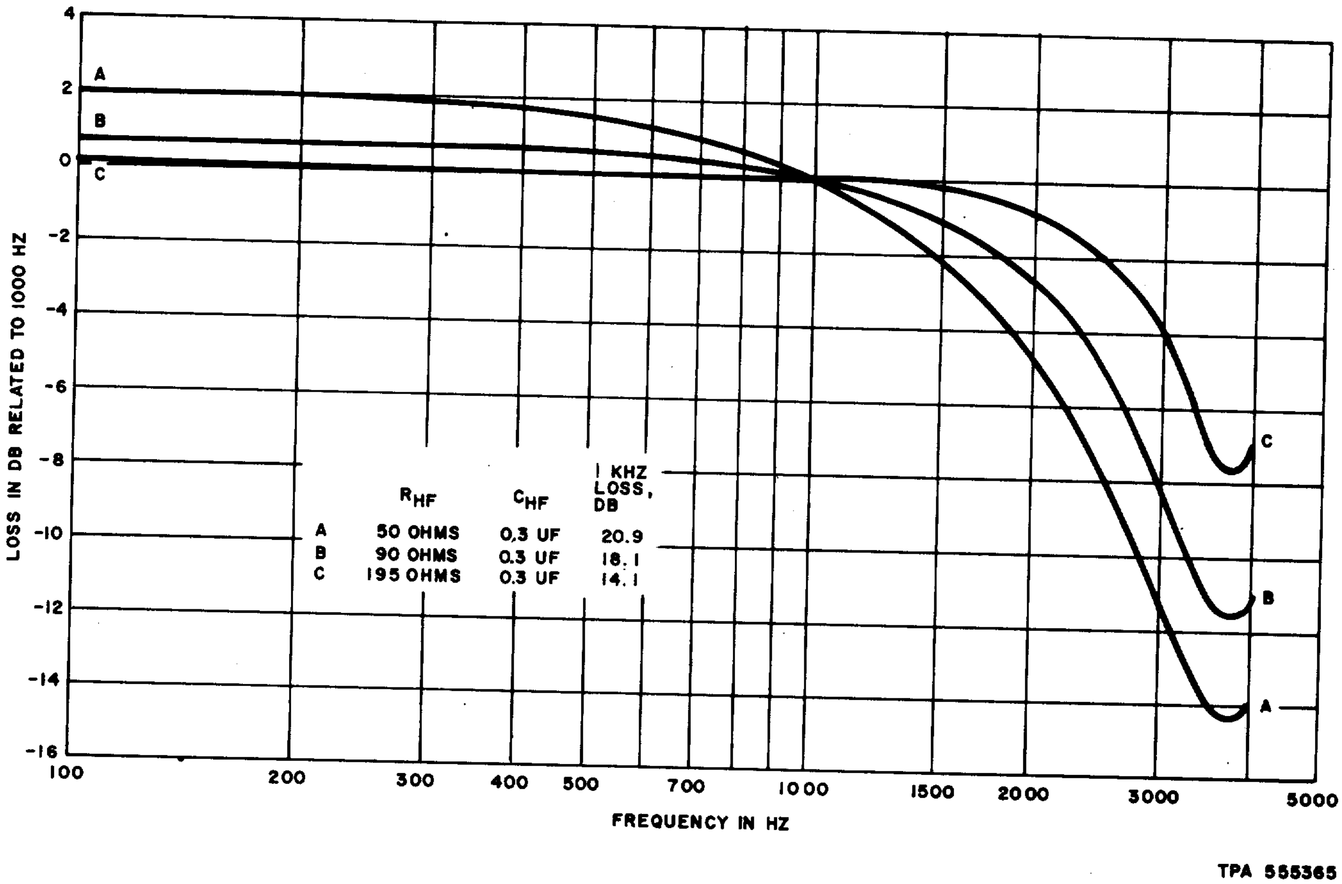

Fig. 12—359P Equalizer High-Frequency Characteristics—Loss Between 600 Ohms, Varying R_{HF} for C_{HF} at 0.3 µF

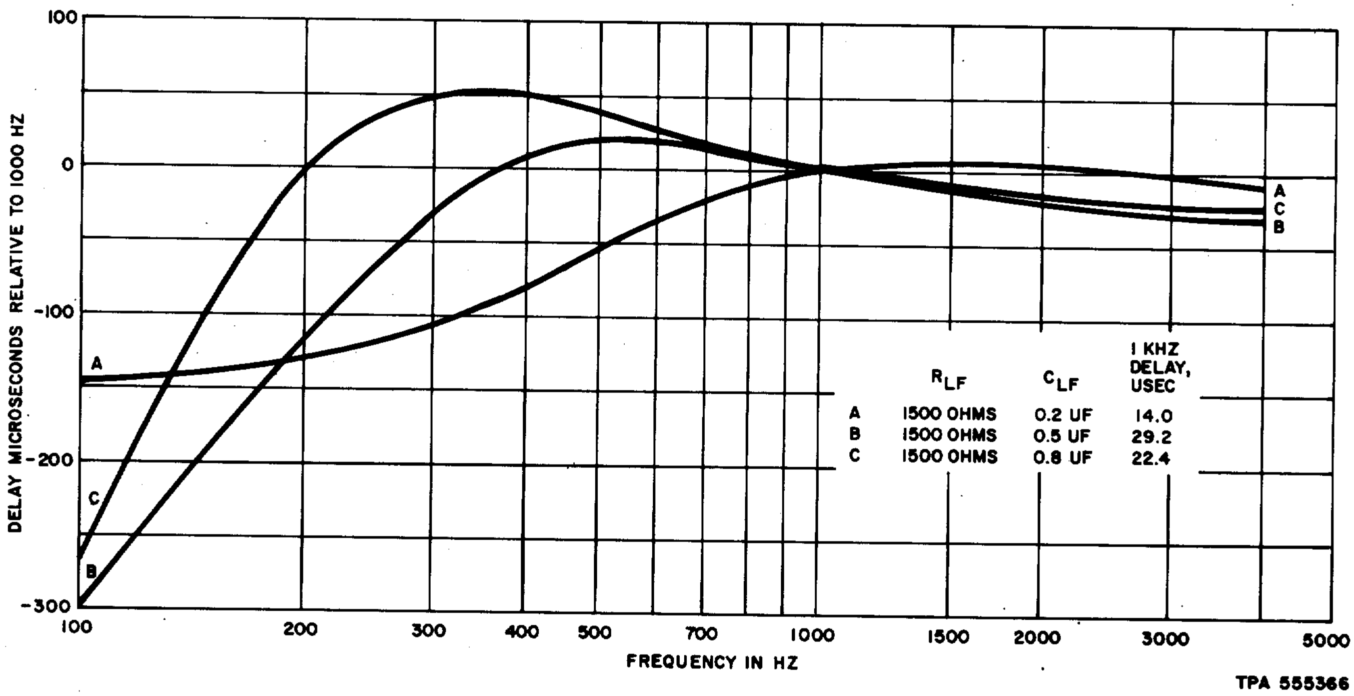

Fig. 13—359P Equalizer Low-Frequency Characteristics—Delay Between 600 Ohms, Varying CLF for RLF Constant at 1500 Ohms

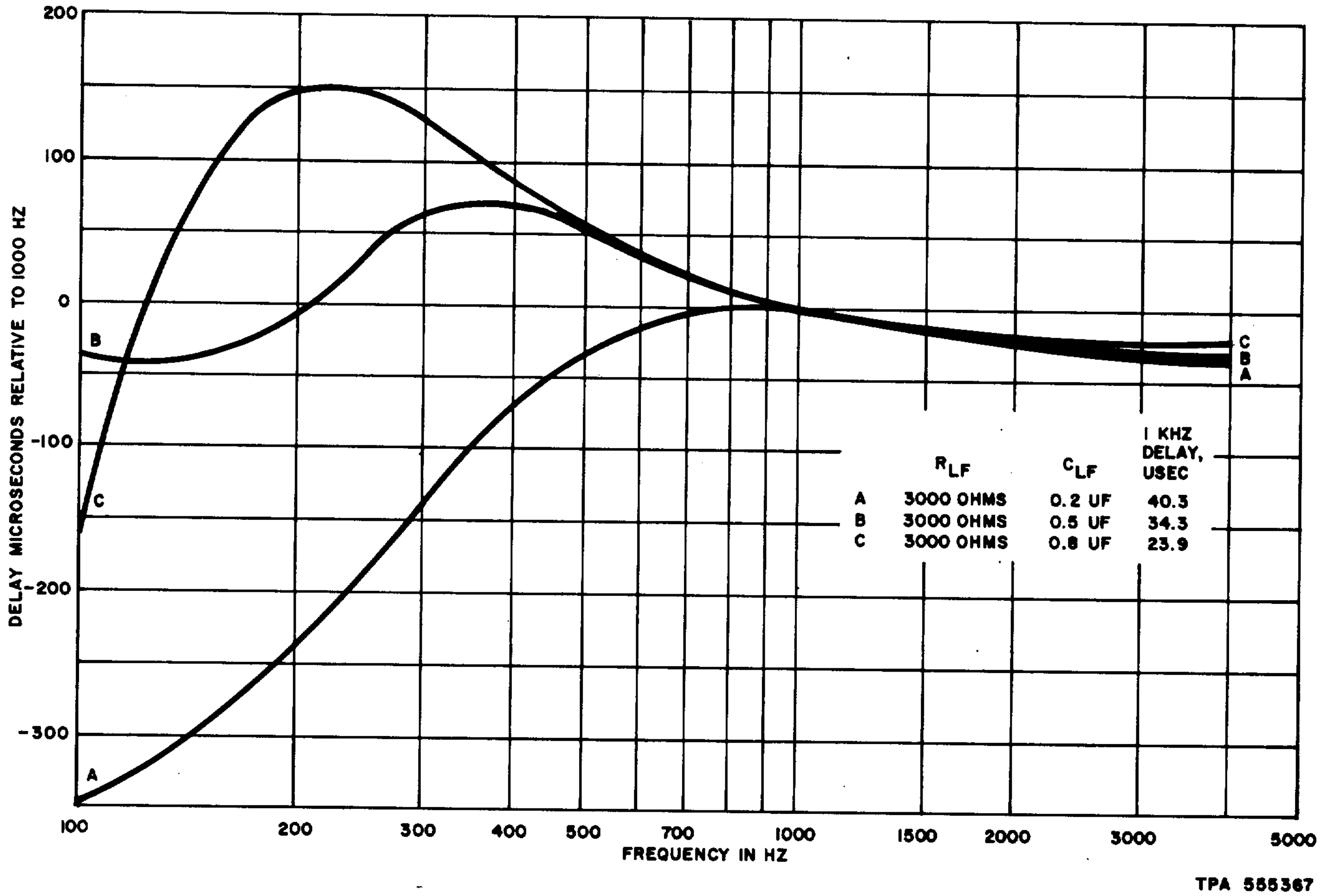

Fig. 14—359P Equalizer Low-Frequency Characteristics—Delay Between 600 Ohms, Varying CLF for RLF Constant at 3000 Ohms

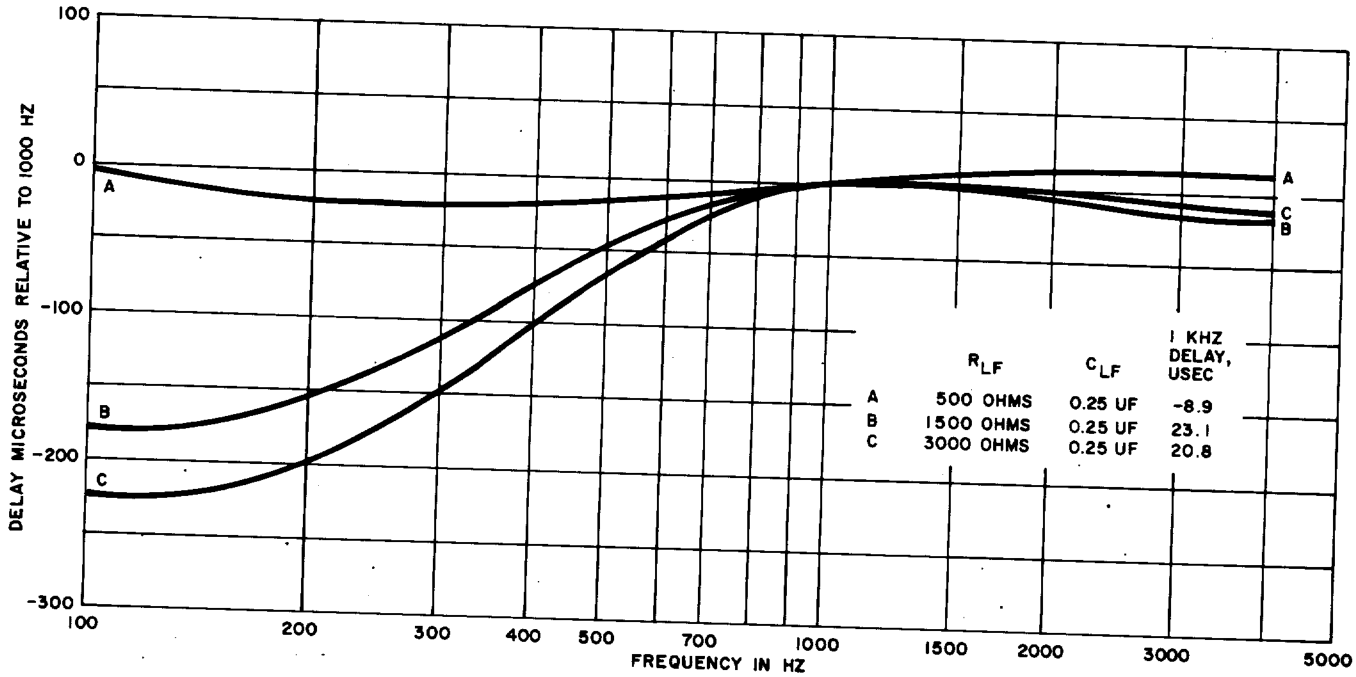

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Fig. 15—359P Equalizer Low-Frequency Characteristics—Delay Between 600 Ohms, Varying RLF for CLF Constant at 0.25 μF

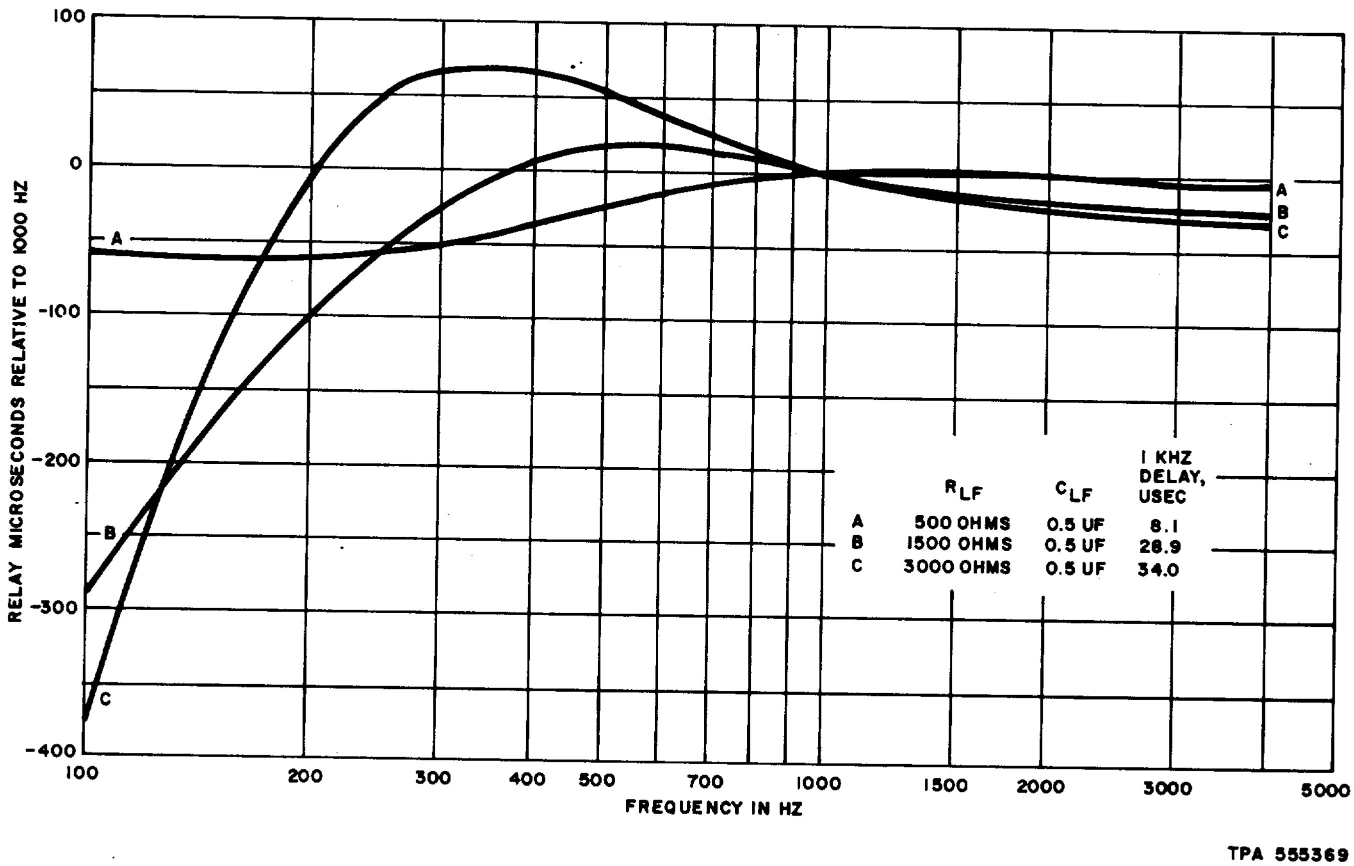

Fig. 16—359P Equalizer Low-Frequency Characteristics—Delay Between 600 Ohms, Varying R_{LF} for C_{LF} Constant at 0.5 μF

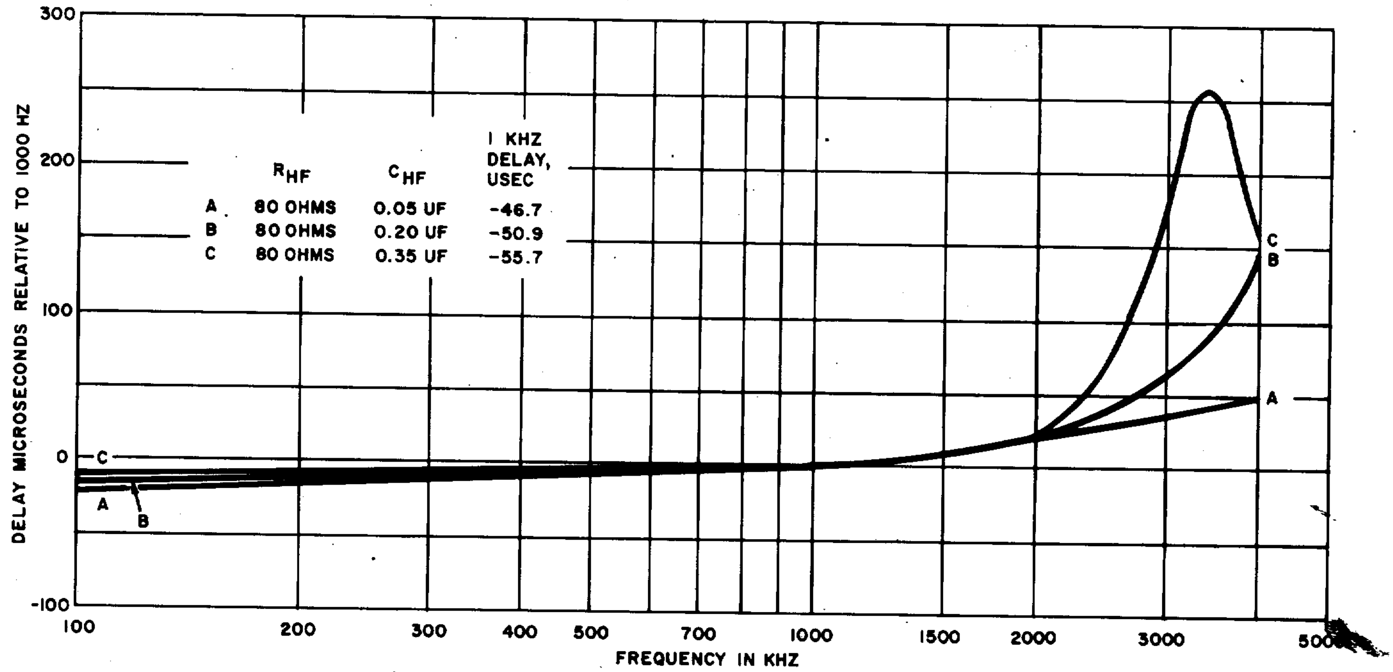

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Fig. 17—359P Equalizer High-Frequency Characteristics—Delay Between 600 Ohms, Varying CHF for RHF Constant at 80 Ohms

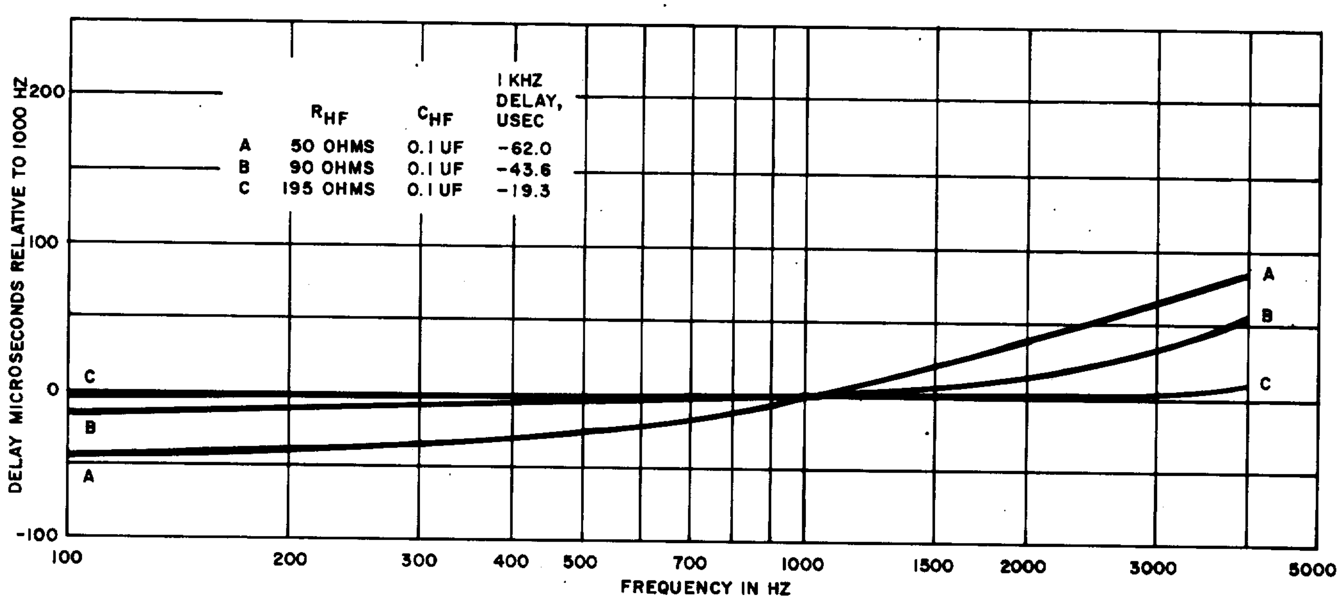

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Fig. 18—359P Equalizer High-Frequency Characteristics—Delay Between 600 Ohms, Varying RHF for CHF Constant at 0.1 μF

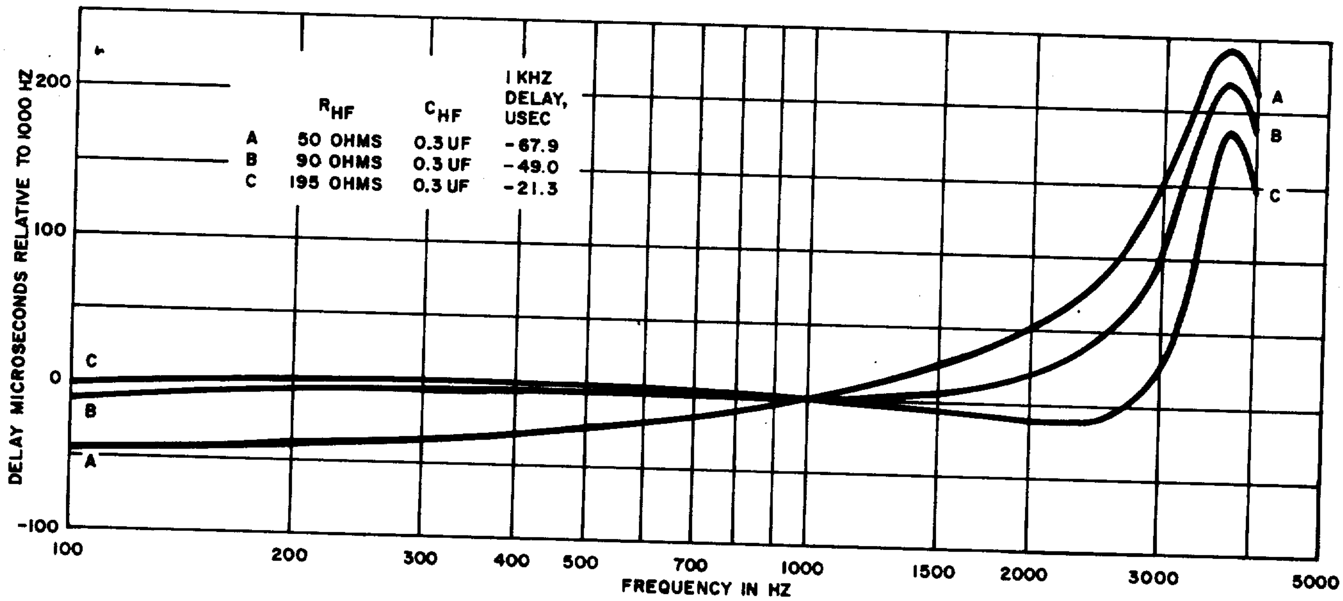

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Fig. 19—359P Equalizer High-Frequency Characteristics—Delay Between 600 Ohms, Varying R_{HF} for C_{HF} Constant at 0.3 μF