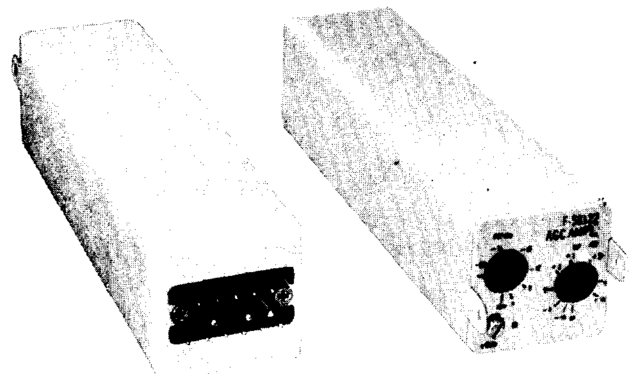
V4 TELEPHONE REPEATER
F58122 AMPLIFIER

1. GENERAL

1.01 The F58122 amplifier, which has automatic gain control (AGC), is for use in the transmitting leg between customer-provided facilities and Bell System facilities. It provides limiting capability to ensure compliance with standards for inband signals.

1.02 The F58122 amplifier (Fig. 1) is identical in size and connections to the 227-type amplifier. This amplifier is intended to be used in 24V4 and 44V4 repeaters for the purpose of limiting the inband signal power applied to Bell System facilities.



TPA 555377

Fig. 1—F58122 Amplifier

2. EQUIPMENT DESCRIPTION

2.01 The F58122 amplifier is a plug-in unit terminated in a 15-pin connector plug, designed to be mounted on a shelf per J98615 on 1-3/4 inch centers. Overall dimensions are approximately 1-3/4 inches square by 7-1/2 inches long.

2.02 This amplifier consists of circuit components mounted on a printed wiring board and assembled in an extruded aluminum can. The circuit is connected to the 15-pin connector plug on the rear of the can for use in plug-in mountings. A gray faceplate on the front of the unit completes the assembly. Two lugs are provided on the front of the can to facilitate removal from its mounting socket with a 602D tool.

2.03 Two control potentiometers and a screw-type switch are mounted on the faceplate. The LEV ADJ potentiometer provides an adjustment range of −10 dB to +10 dB. Screw switch S1, when closed (turned in), will add +15 dB gain to the level adjustment. The potentiometer designated AGC ADJ has a range of 0 to −20 dBm.

3. CIRCUIT DESCRIPTION

3.01 The circuit (see schematic drawing, Fig. 2) consists of input and output transformers, two operational amplifiers (integrated circuits), three transistors, one field effect transistor, two gain control potentiometers, a screw switch, resistors, inductor, capacitors, and diodes.

3.02 The input and output transformers are designed primarily to present either 600- or 1200-ohm impedance to the line circuits. Balanced center-tap connections on the transformers provide for simplex signaling or supervisory arrangements. By using a center tap for connection to one side of the line, additional input and output impedances of 150 and 300 ohms can be obtained for special applications. The simplex must be sacrificed in order to do this.

3.03 The input circuit consists of transformer T1 terminated by resistor R2 and a signal voltage divider circuit R3 and R4. The line winding of the input transformer is center-tapped for a simplex connection or balanced-to-ground operation. The secondary winding is tapped so that the amplifier may be connected to present a 600- or 1200-ohm port to the line. The secondary winding is brought out to terminals that permit connecting an equalizer for equalization of loss-frequency characteristics of cable facilities. (Equalization is in the receive direction.)

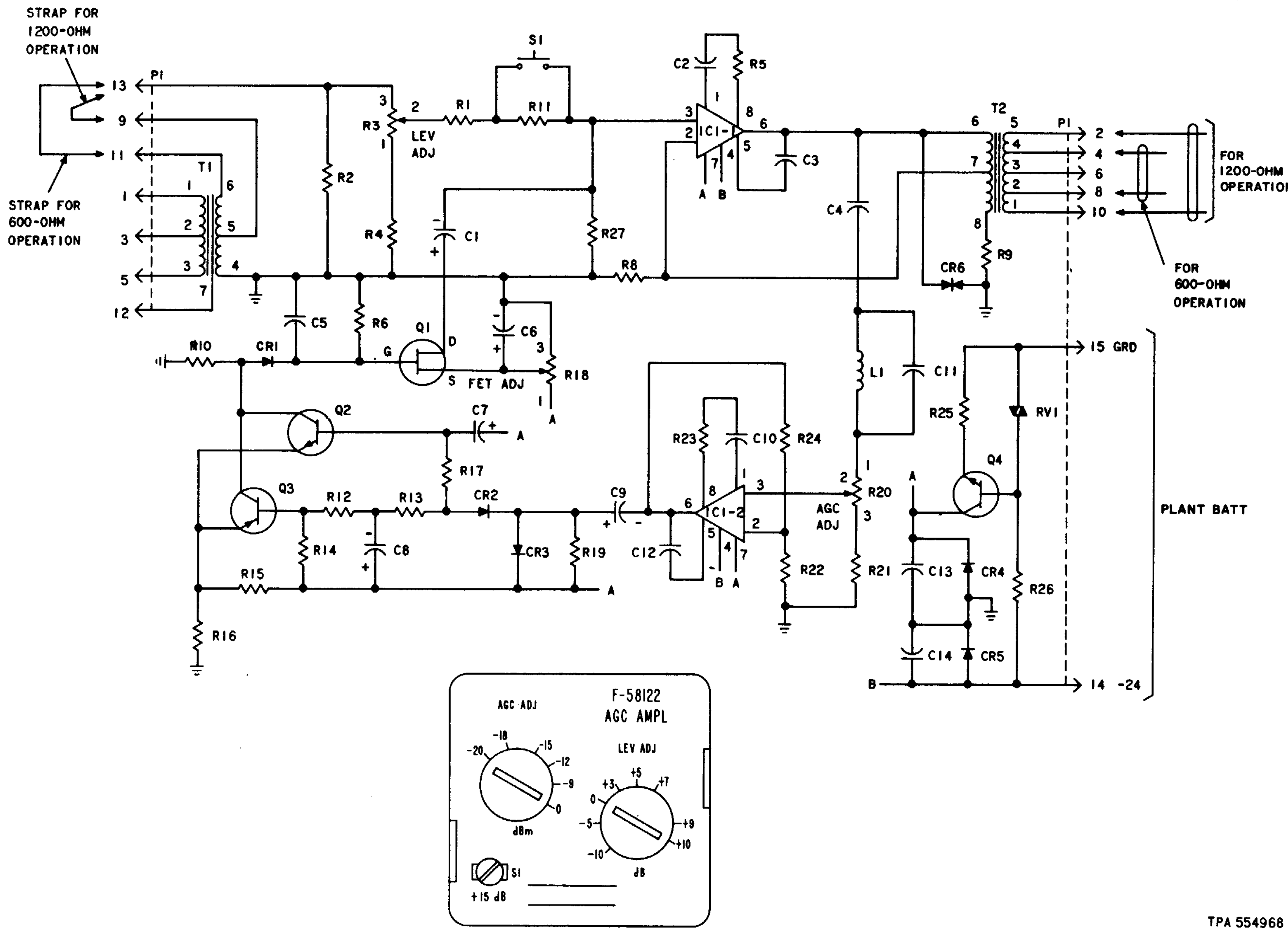


Fig. 2—F58122 Amplifier—Schematic Drawing and Face Plate Arrangement

3.04 Potentiometer R3 and screw-type switch S1 control the level of the input signal to the operational amplifier IC1-1. The output of amplifier IC1-1 feeds to output transformer T2 and to dc blocking capacitor C4. The secondary winding of transformer T2 is tapped so that output impedances of 600 or 1200 ohms are provided. The output impedance is generated by feedback action which avoids a power loss in a terminating resistor R9. Diode CR6 provides lightning protection for the amplifier output. Stability for amplifier IC1-1 is provided by a frequency compensation network C3, C2, and R5.

3.05 A 2600-Hz notch filter consisting of inductor L1 and capacitor C11 is provided to allow for adequate signaling level without operating the AGC circuit. From the notch filter, the input signal is fed to AGC ADJ potentiometer R20 and then to control amplifier IC1-2. Potentiometer R20 is the AGC level adjustment. Stability for amplifier IC1-2 is provided by a frequency compensation network C12, C10, and R23.

3.06 The output of amplifier IC1-2 is fed into a power detector circuit, then to a pair of dc amplifier transistors Q2 and Q3. The threshold is determined by resistors R15 and R16. Transistor Q3 will turn on in 25 milliseconds upon receiving signals +6 dB over the AGC level adjustment, whereas transistor Q2 will turn on in up to 3 seconds on signals greater than AGC level adjustment.

3.07 The output of transistors Q2 and Q3 is fed through diode CR1, resistor R6, and capacitor C5, a time-constant network to prevent clipping of voice frequencies, and then to the field effect transistor Q1. When transistor Q1 conducts, it forms a loss network with resistors R1 and R11 at the input of amplifier IC1-1 and thereby controls the maximum level of the signal to the output transformer. Potentiometer FET ADJ R18 is a factory adjustment made at the time of assembly and testing.

3.08 The power supply for the F58122 amplifier is a constant current drain type. Transistor Q4, resistors R25 and R26, with diode RV1, provide an 18-mA constant current drain on the input battery. Diodes CR4 and CR5 with bypass capacitors C13 and C14 provide regulated voltages for the amplifier circuits.

4. TRANSMISSION CHARACTERISTICS

4.01 Signals greater than the AGC ADJ level are clamped to the AGC ADJ level after an interval varying from 1 to 3 seconds (see Fig. 3).

4.02 Signals 6 dB or more above the AGC ADJ level are clamped to 6 dB above the AGC level after 25 milliseconds and then to the AGC level after an interval varying from approximately 1 to 1.5 seconds, depending on the level of the signal.

4.03 A 2600-Hz notch filter reduces the sensitivity of the AGC circuit to signals generated by the single frequency (SF) signaling unit.

4.04 The level-adjusting capabilities of the AGC amplifier are continuous from a loss of 10 dB to a gain of 25 dB. See Section 332-104-503 for making adjustments. The clamped output power of the AGC amplifier is adjustable from 0 dBm to −20 dBm.

> ***Note:*** In some applications, a pad will be necessary to reduce the output power to a value below −20 dBm. For example, when the amplifier is used to limit data signals into a carrier system, the amplifier output power must be padded down to −29 dBm.

A. Impedance

4.05 This amplifier presents a nominal input and output impedance of either 600 or 1200 ohms, and it may present 600 ohms to the input equipment and 1200 ohms to H88-loaded exchange cable pairs. The reverse may be to present 1200 ohms to the input circuit and 600 ohms to the output circuit. The input and output impedance (600- or 1200-ohm termination) at various frequencies is shown in Fig. 4, 5, 6, and 7.

B. Gain-Delay Frequency Characteristics

4.06 The gain frequency and envelope delay frequency characteristics are shown in Fig. 8. The gain frequency is essentially flat over the voice range. The envelope delay distortion is less than 50 μ seconds distortion over the voice range.

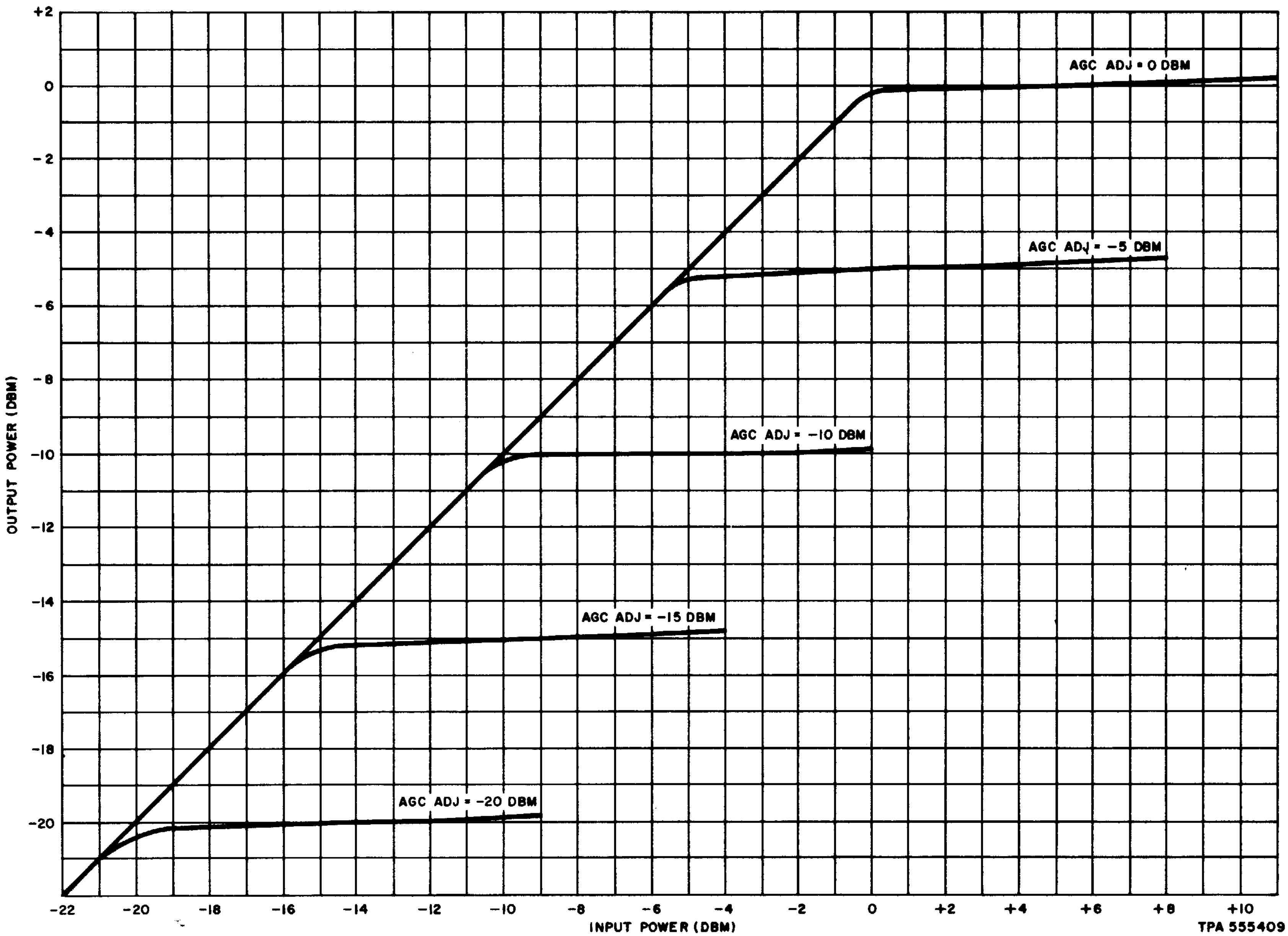


Fig. 3—F58122 Amplifier—Output Versus Input Power

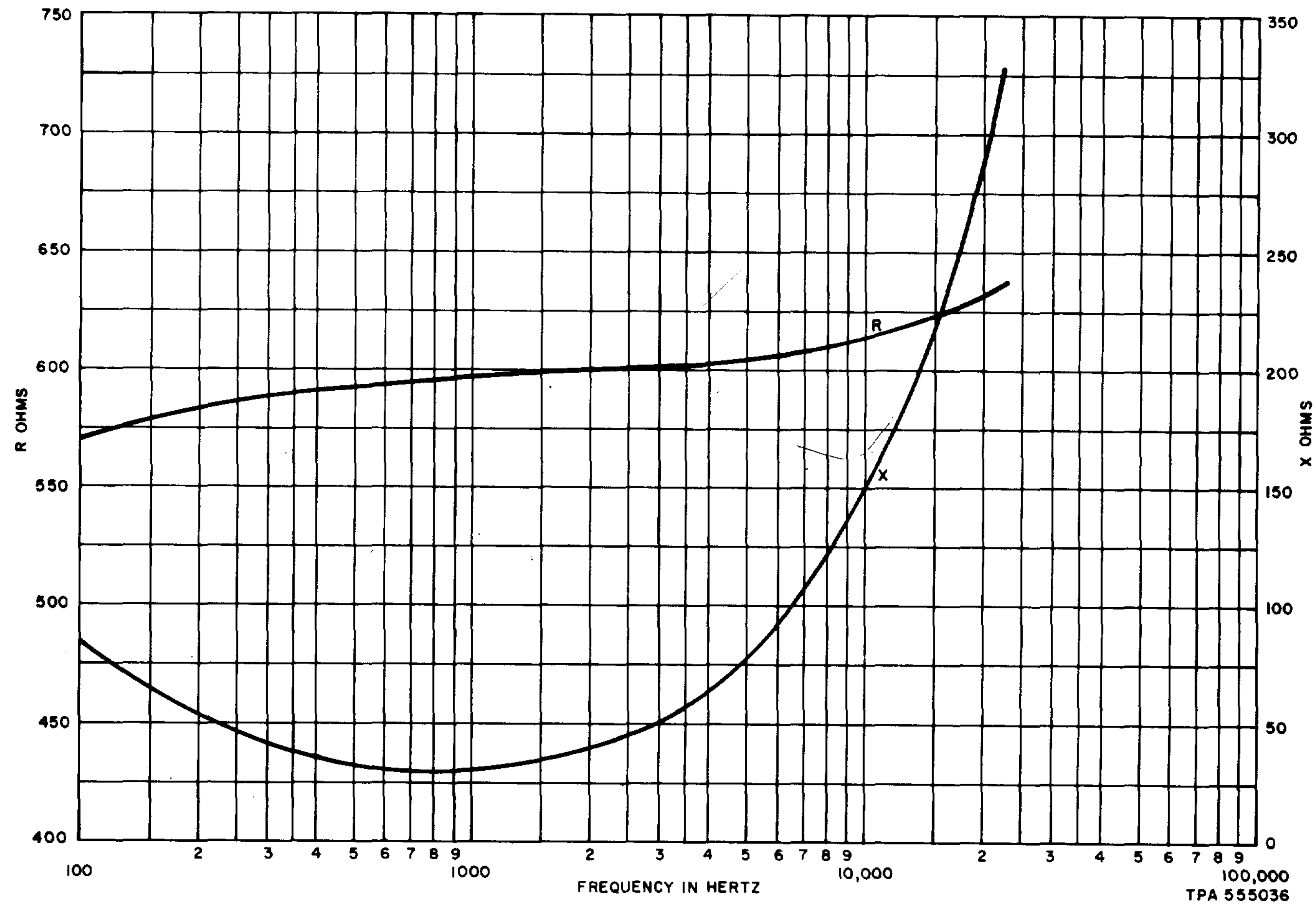


Fig. 4—F58122 Amplifier—Input Impedance—600-Ohm Termination

C. Harmonic Distortion

4.07 The second harmonic distortion increases with increased input level. As shown in Fig. 9, the harmonic distortion is for four different settings of the LEV ADJ and AGC ADJ potentiometers. The third-order harmonic distortion (not shown in Fig. 9) is down more than 60 dB from the input signal in the voice-frequency band at levels up to +10 dBm.

D. Reverse Transmission Loss

4.08 The curves of Fig. 10 show a typical insertion loss when transmitting through the F58122 amplifier in the reverse direction. The same loss is obtained when the amplifier is connected for either 600- or 1200-ohm input and output impedances.

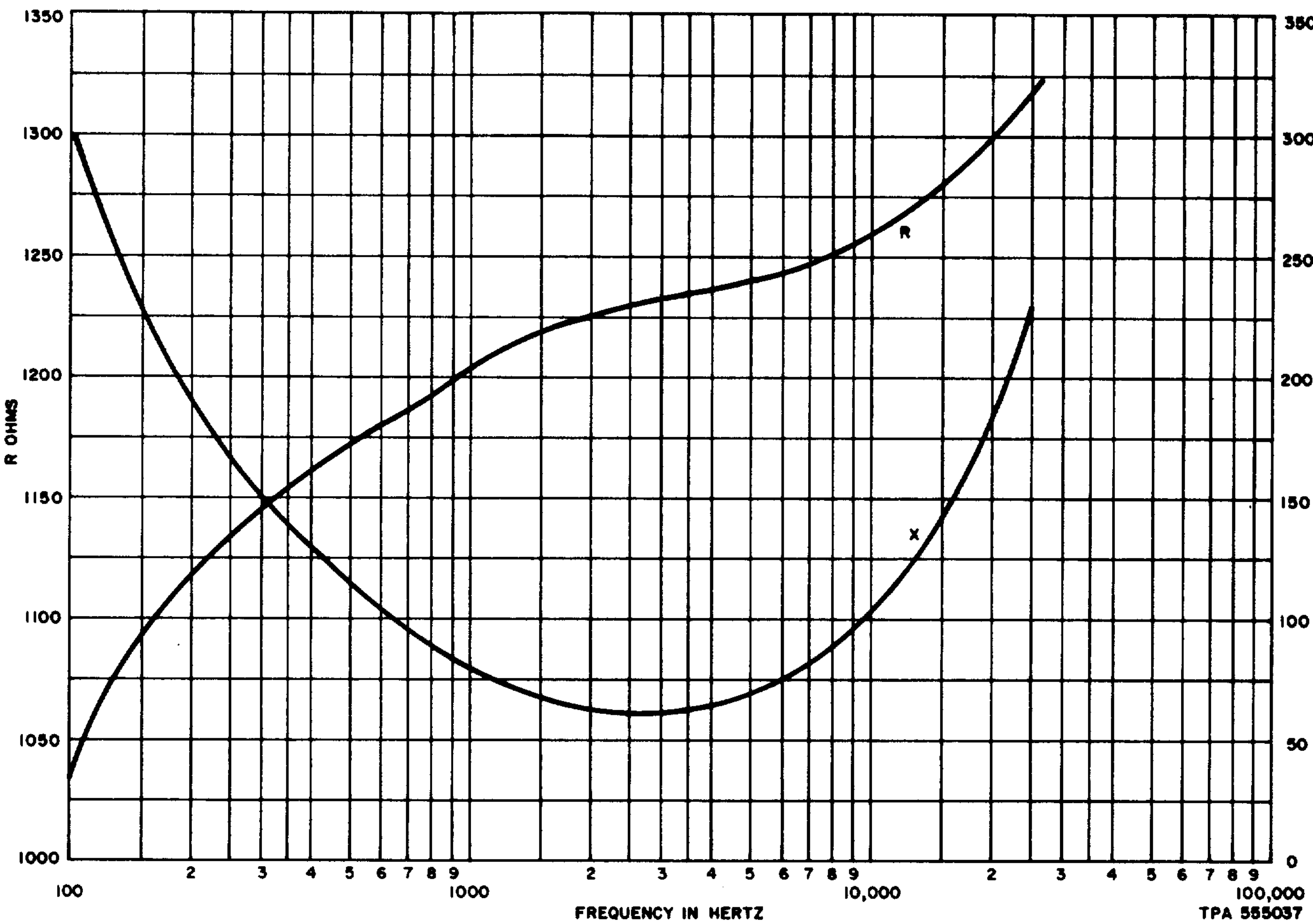


Fig. 5—F58122 Amplifier—Input Impedance—1200-Ohm Termination

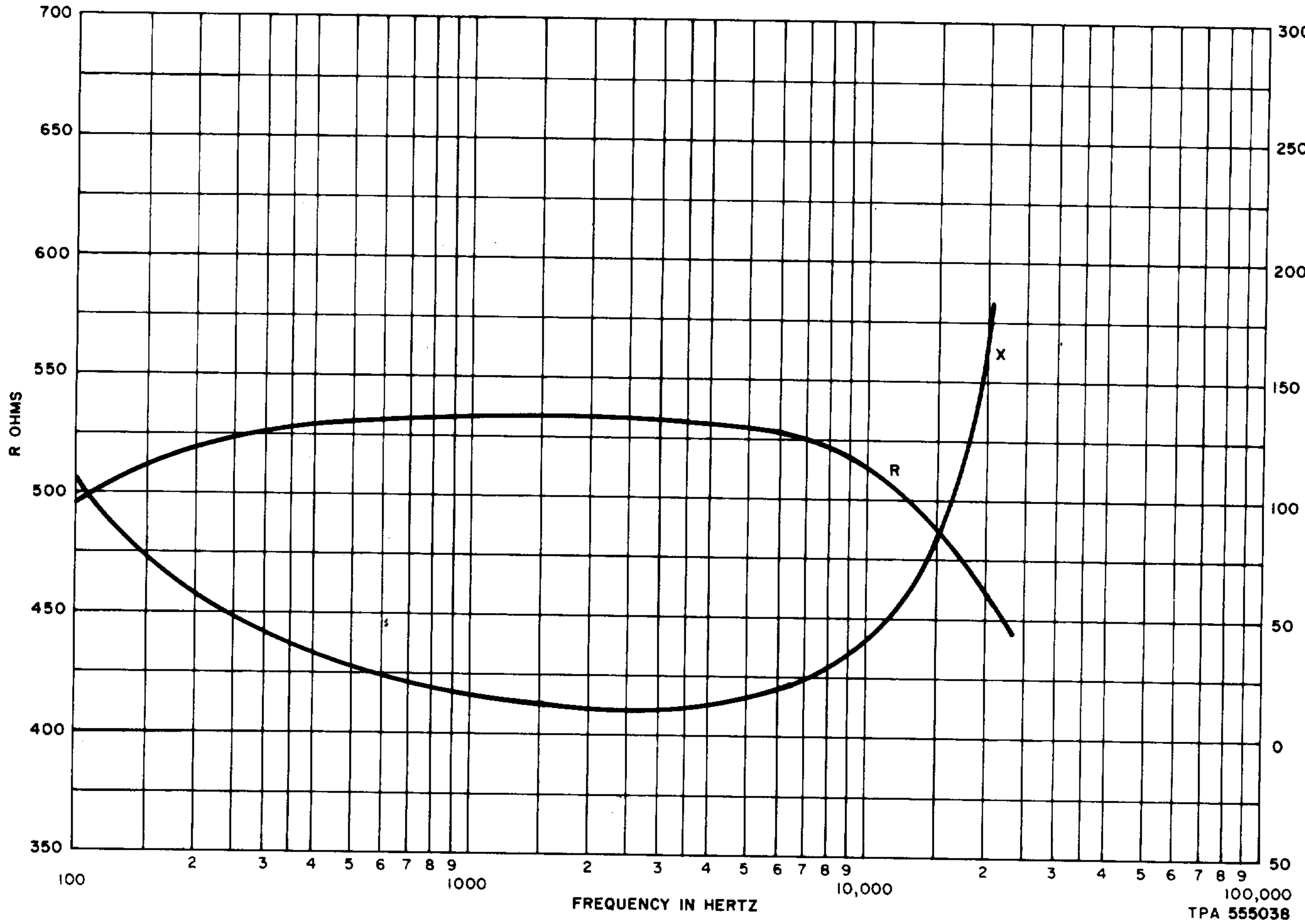


Fig. 6—F58122 Amplifier—Output Impedance—600-Ohm Termination

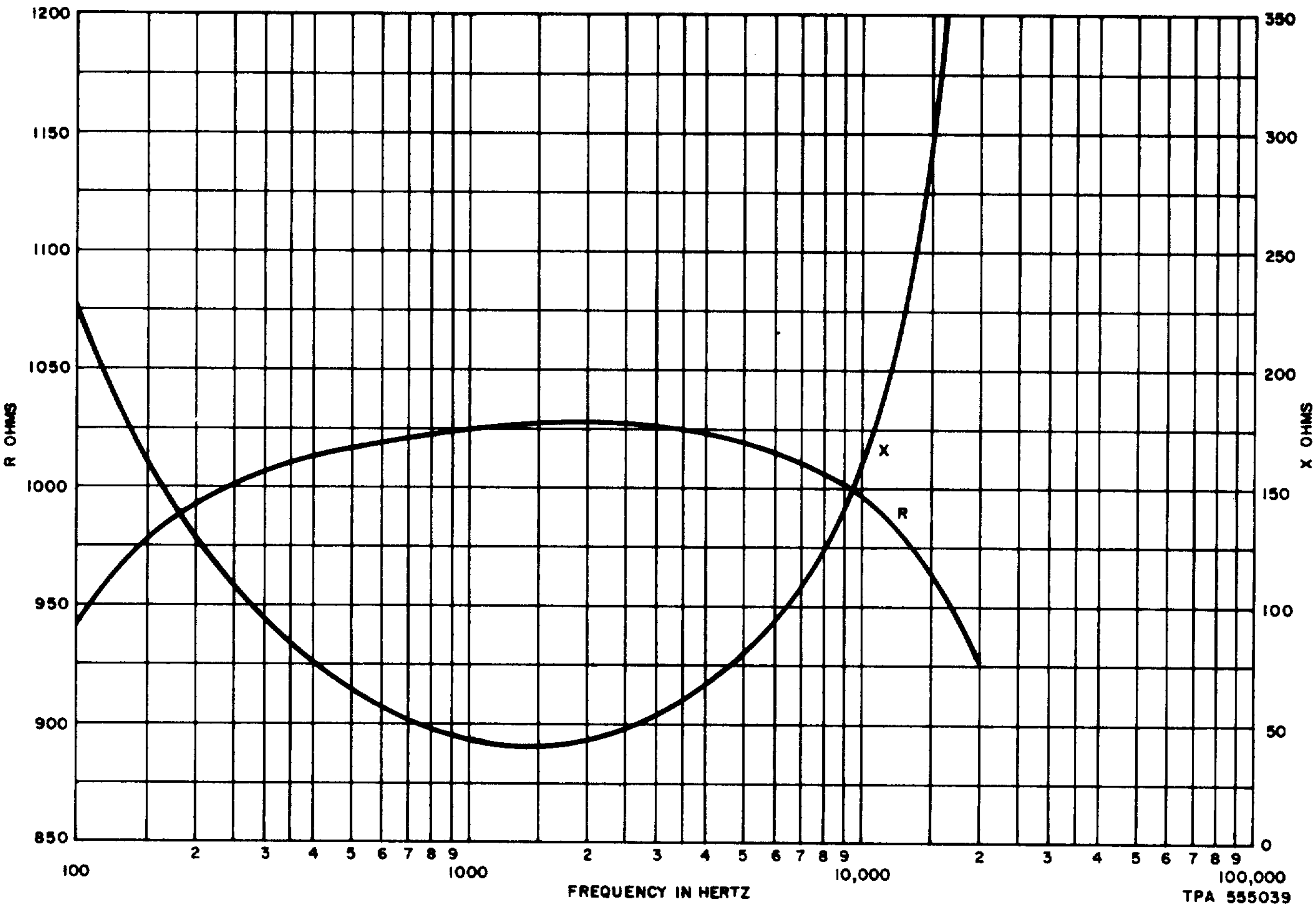


Fig. 7—F58122 Amplifier—Output Impedance—1200-Ohm Termination

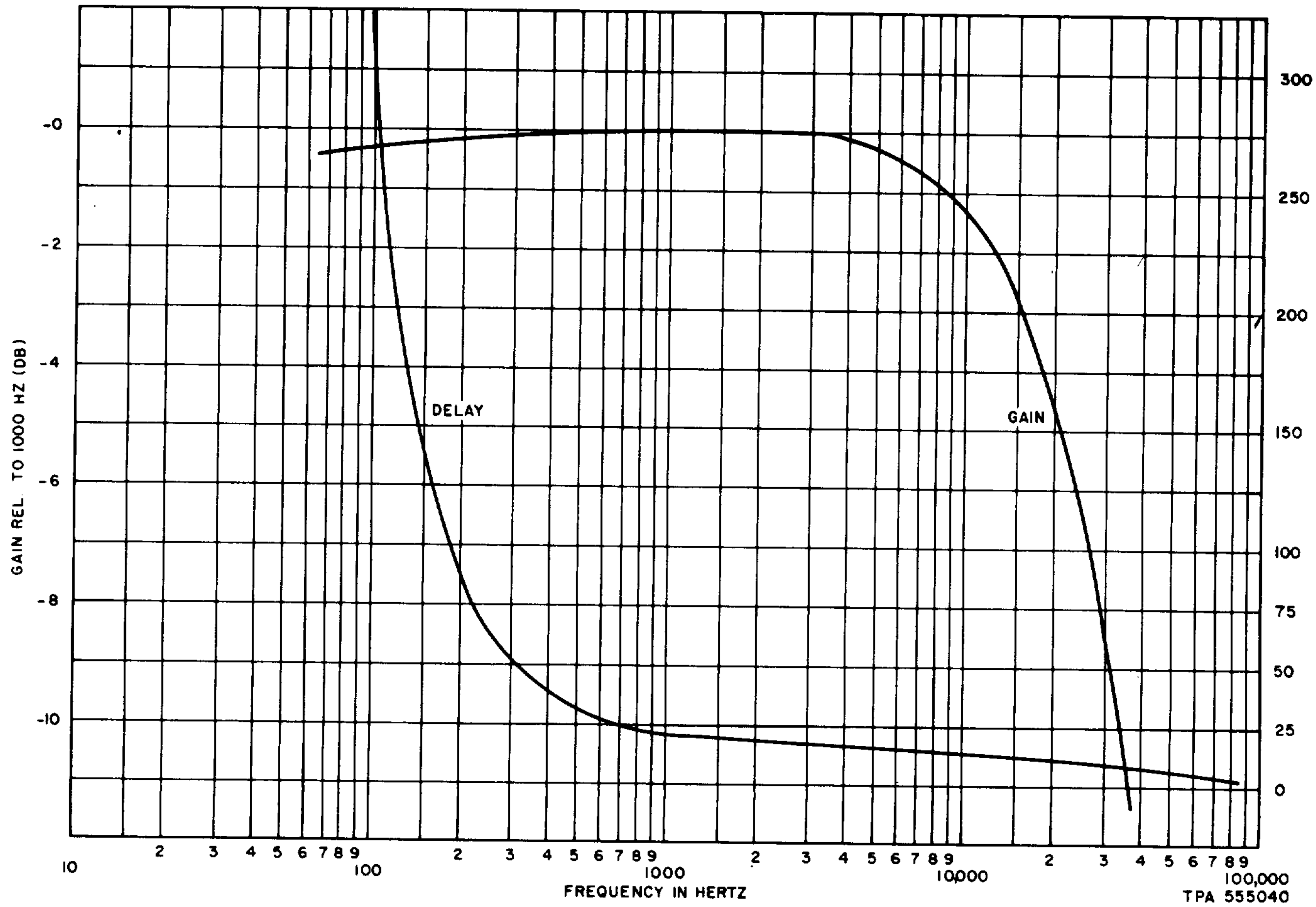


Fig. 8—F58122 Amplifier—Gain-Delay Frequency Characteristics

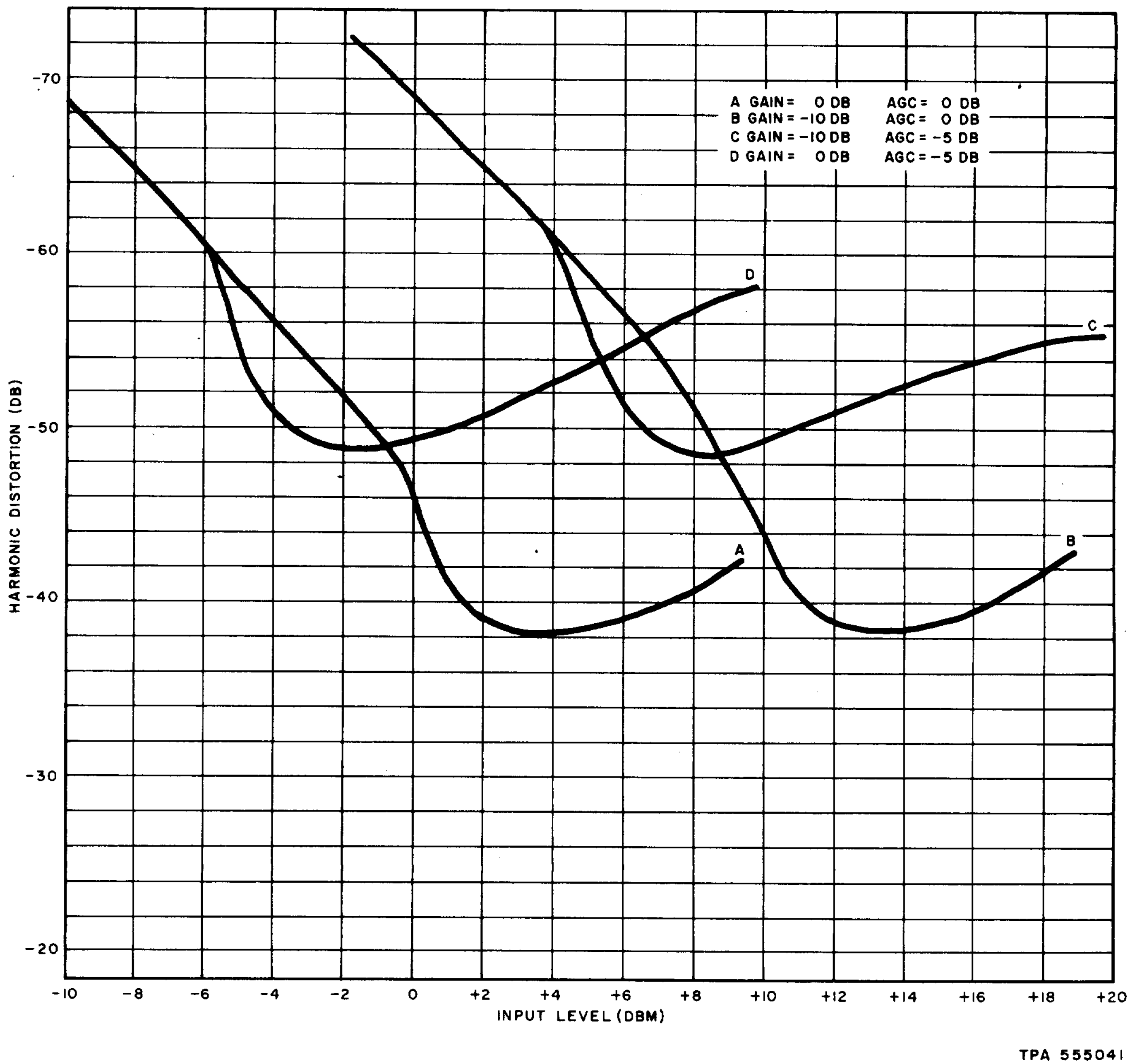


Fig. 9—F58122 Amplifier—Second Harmonic Distortion

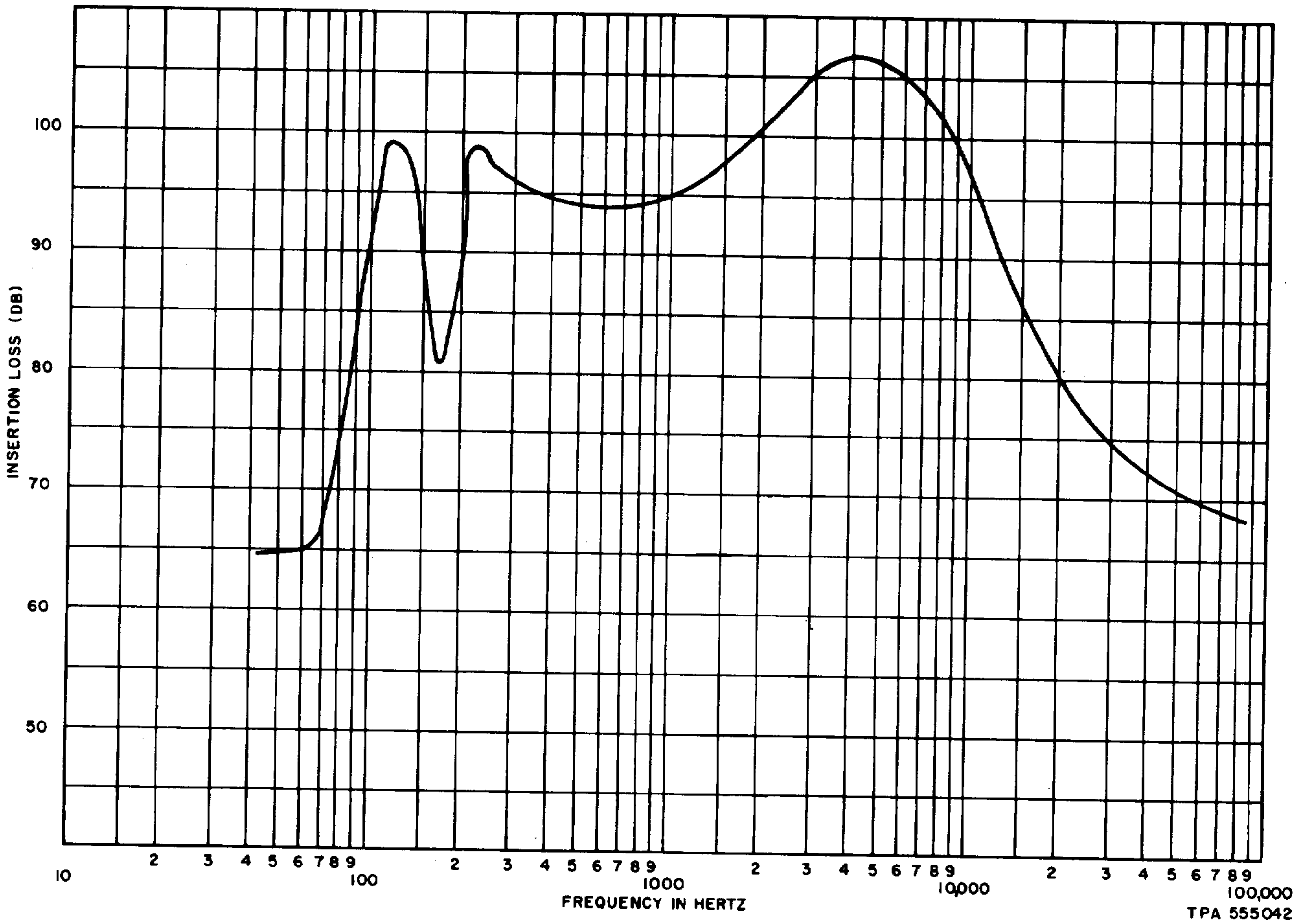


Fig. 10—F58122 Amplifier—Reverse Transmission Loss