

KS-16508, L1 AND L2 AMPLIFIERS — DESCRIPTION

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1. GENERAL

1.01 This practice provides descriptive information on the KS-16508, L1 and L2 Amplifiers. These amplifiers have a nominal output of 8 watts. The amplifier is designed for general use with announcement systems using a magnetic rubber recording medium such as the KS-12055 and KS-12068 Recorder-Reproducers. It will feed as many as 1100 lines simultaneously at a level of -8VU. The amplifier is used in the 5A, 6A, 8A, 9A Announcement Systems.

1.02 The KS-16508, L1 Amplifier is "Manufacture Discontinued" and is directly replaced by the KS-16508, L2 Amplifier. The replacement has several mechanical changes and improvements, but they do not affect the physical appearance or the mounting and wiring of the unit. For equipment design purposes, all comments on the L1 Amplifier apply directly to the L2 Amplifier. The L2 Amplifier is electrically identical to the L1 Amplifier. For transmission design purposes, all comments in the practice also apply to the replacement amplifier.

1.03 The application and circuit schematic, SD-95256-01 includes connecting information. The drawing is not attached to this practice. The detailed description of the amplifier is included in CD-95256-01 which also is not attached.

1.04 Fig. 1 shows a photograph of the front view of the amplifier with the front cover (cover mat) assembled. Fig. 2 shows a rear view

photograph of the amplifier with the tubes removed. The tubes are not furnished with the amplifier and should be ordered separately.

1.05 The amplifier has a record channel, a reproduce channel and a transfer relay for switching from the reproduce to the record condition. It also has a high frequency oscillator for supplying bias and erase current to the magnetic heads and a voice-operated relay for operating alarm circuits in case of amplifier failure. A self-contained power supply is also provided.

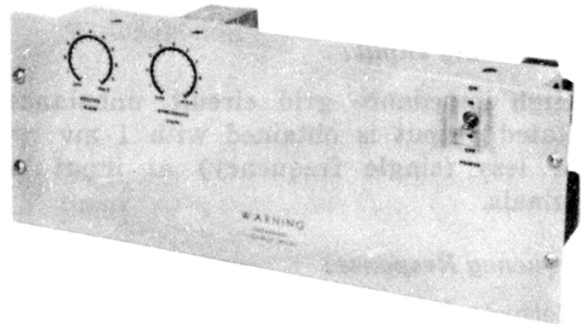


Fig. 1 — Front View

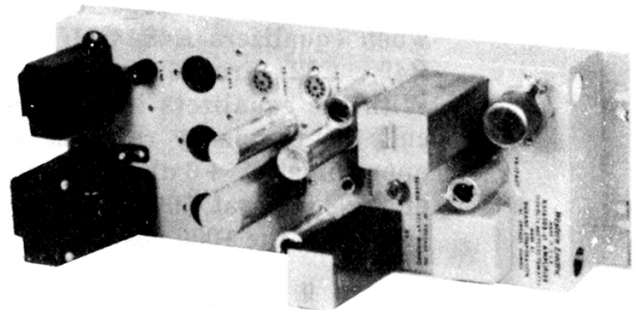


Fig. 2 — Rear View

2. ELECTRICAL CHARACTERISTICS

2.01 The typical electrical characteristics of the amplifier are as follows:

Power Supply:

110 to 130 volts, 60 cps ac, 80 watts. Fused with 2-amp fuse. An external source of 48 volts dc is also required to operate the record-reproduce switching relay K1.

Power Output:

4 watts into 4 ohms resistive load with less than 5% harmonic distortion, 100 to 5000 cps. 8 watts with less than 10% harmonic distortion.

Load Impedance:

Nominal rated load, 4 ohms. Internal output impedance less than 1 ohm.

Recording Input:

600 ohms nominal balanced source impedance. Rated output is obtained with 40 mv rms, or less (single frequency) at input terminals. Approximately 68 db gain at 1000 cps between rated impedances.

Reproducing Input:

High impedance grid circuit, unbalanced. Rated output is obtained with 1 mv rms, or less (single frequency) at input terminals.

Frequency Response:

Record: 200 to 4000 cps: 0 to -2 db with respect to 1000 cycles.

Reproduce: 100 to 5000 cps; 0 to -2.5 db with respect to 1000 cycles when equalizers R48, C31 and R49, C32 are disconnected. With the equalizers in the circuit the frequency response is approximately +6 db at 200 cps and -3.5 db at 5000 cps with respect to the 1000 cps value.

Output Noise:

Record: The following values are for normal operating conditions with maximum gain: Signal-to-noise ratio, 60 db (applies only to audible noise). During recording, a component of oscillator frequency (23 kc) about 35 db below maximum signal is also present in the output.

Reproduce: Signal-to-noise ratio, 44 db (with low-frequency equalizers disconnected).

Oscillator Output:

Frequency: 23KC \pm 3KC.

Recording Bias: 0.7 to 1 ma.

Erase Current: 6 to 9 ma.

3. MECHANICAL CHARACTERISTICS

3.01 The mechanical characteristics of the amplifier are as follows:

Mechanical:

Width: 19"

Height: 6-31/32"

Depth: 7-15/32" (6-3/4" behind mounting flange)

Mounting: Held in place by four No. 12-24 screws on 19" relay rack

Weight: 17 pounds

Finish: Light gray enamel

Electron Tubes:

The following electron tubes are required and are not supplied with the amplifier:

TUBE DESIG- NATION	CODE	FUNCTION
V1	12AY7	Pre-Amplifier
V2	12AU7	Voltage Amplifier
V3	12AU7	Phase Inverter
V4	6V6	Output)) Push-Pull
V5	6V6	Output)
V6	5Y3	Rectifier
V7	12AT7	Controls Voice-Operated Relay
V8	12AU7	Oscillator

4. MOUNTING AND MECHANICAL ARRANGEMENTS

4.01 The KS-16508, L1 and L2 Amplifiers are designed to mount on a standard 19" relay rack or cabinet. It is held in place by four No. 12-24 screws inserted through holes in the mounting flanges.

4.02 The amplifier is equipped with a removable front cover. When the cover is removed, the wiring side of the chassis is exposed making the input, output and power supply ter-

minals readily accessible. All external connections are made to terminal boards TB1, TB2 and TB3.

4.03 The record and reproduce gain controls are accessible through holes in the front panel and are adjusted by means of a screwdriver. The power switch is accessible from the front also and is protected by a guard to prevent accidental operation.

4.04 The gain controls on the front panel are protected from accidental adjustment by means of snap buttons which fit over the holes providing access to the controls. These buttons should be "in place" when adjustments are not being made.

4.05 The OPERATE and RELEASE adjustments for the voice-operated relay are mounted on the rear of the chassis. Both of these controls are equipped with a locking nut arrangement.

4.06 Two 3/4" holes are provided on the left end of the chassis and one on the right end for external connections. These holes are equipped with spun eyelets. In addition to these, one 7/8" hole is provided on the right end of the chassis for the ac power connections.

4.07 The amplifier will operate satisfactorily in normal ambient room temperatures. However, if the ambient is above 100° F, trouble may be experienced if the amplifier is operated continuously.

4.08 The amplifiers should be mounted so that the tubes are toward the rear of the frame (normally the "wiring side" of the frame or rack). The cover mat and front gain controls will then be on the "apparatus side" of the frame or rack.

5. OPERATION OF CIRCUIT

5.01 The amplifier provides two channels of amplification — one for recording and one for reproducing. These channels share a common amplifier which is switched by means of relay K1. Also included is an oscillator for supplying bias and erase current, a voice-operated relay K2 and a power supply. An external source of 48V is required to operate relay K1.

5.02 During the reproduce cycle, as shown in Fig. 3, relay K1 is released. The input signal "A" is fed through the relay contacts to the preamplifier. The output of the preamp is connected to the common amplifier through contacts of the K1 relay. During the reproduce cycle, the K1 relay also provides grounds to the record channel to prevent interaction between it and the reproduce channel. The relay also disables the oscillator by opening the cathode circuit of the electron tube.

5.03 An equalizing network consisting of resistors and capacitors (not shown in Fig. 3), is provided in the plate circuit of the preamplifier to boost the low frequency response and compensate for the recording characteristic. These components are connected to terminals No. 1 and 5 of terminal board TB6. The amplifier is normally provided with the equalizer in the circuit.

5.04 High frequency equalization is provided to resonate the reproduce head. The equalization is obtained by means of capacitors wired to terminal board TB4. These capacitors are associated with the preamp. The amplifier is normally provided with C4 in the circuit. The equalization capacitors for various announcement systems are selected in accordance with Note 101 of SD-95256-011.

5.05 During the record cycle, relay K1 is operated by means of an external 48V supply applied to the relay winding. This completes the path for the recording signal "B" to the common amplifier. The output of the amplifier is combined with the bias current and is fed to the record head for recording. Operation of the relay removes the grounds from the record channel and places grounds on the input and output of the preamp. It also energizes the oscillator circuit by completing the cathode circuit to ground.

5.06 The oscillator circuit generates a frequency of $23 \pm 3\text{kc}$ and is energized only during the record cycle. The output of the oscillator is used to supply recording bias and may also be used to supply current to a high frequency erase head.

5.07 The output transformer of the common amplifier has two secondary windings. One winding supplies negative feedback and also

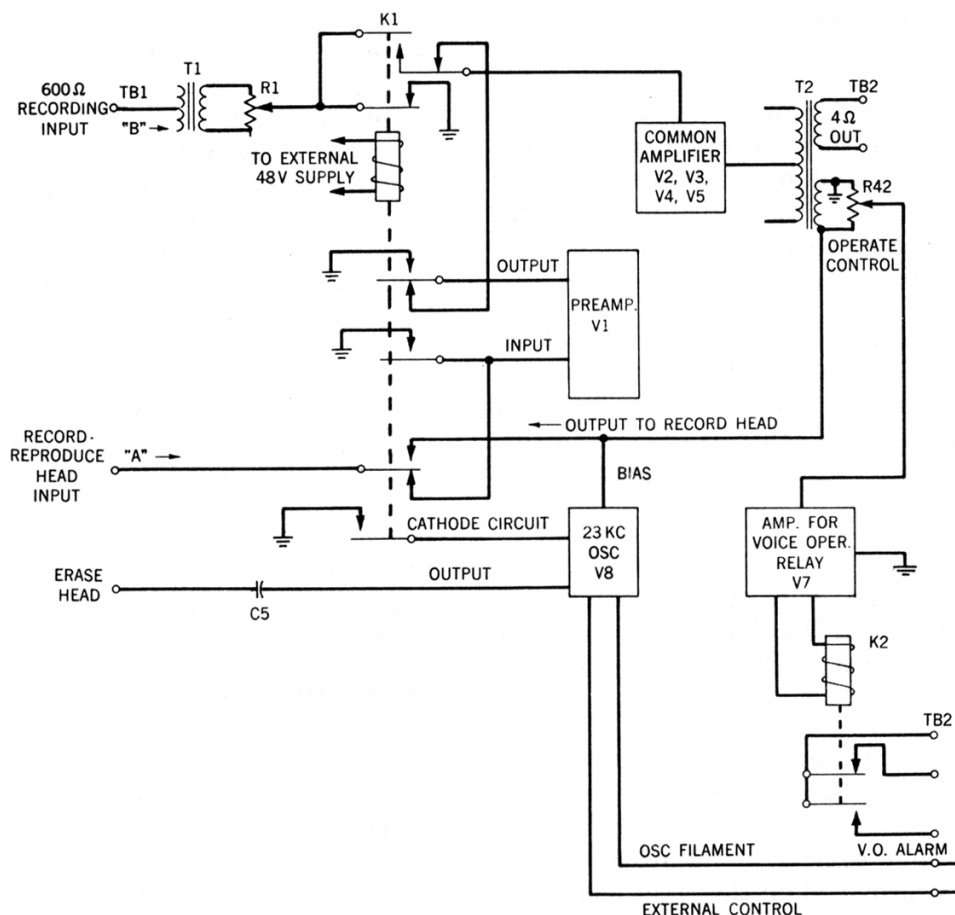


Fig. 3 – Simplified Schematic of Amplifier

provides the signal to the record head and to the voice-operated relay K2. The other winding is the output of the amplifier. The internal impedance of the common amplifier is such that the load impedance can be varied from 4 ohms to open circuit without changing the output voltage more than about 2 db. Half the output winding should be used when operating into impedances as low as one ohm.

5.08 In recorder-reproducer machines which use high frequency erase, the record-reproduce head is arranged on the machine to follow the erase head. Simultaneous erasing of the previous message and recording of the new message is accomplished by feeding erase current to the erase head which is connected to the oscillator output. To obtain sufficient output for

this condition, resistors R2 and R3 are connected in parallel in the oscillator cathode circuit by strapping terminals 2 and 3 of TB5 as shown on SD-95256-01. The amplifier is normally supplied with this connection made.

5.09 Machines which make use of the bulk erase method do not require the oscillator for erase current. Hence, a lower output from the oscillator is frequently desirable. In these situations the strap between terminals No. 2 and 3 of TB5 should be removed. This disconnects R3 from the circuit (not shown in Fig. 3).

5.10 The oscillator heater circuit is completed through a strap between terminals No. 19 and 20 of TB2. This feature is provided as a safety precaution against erasing a recorded

message by operating the RECORD key accidentally. In those situations where it is desirable to control the oscillator externally, this strap should be removed. The heater circuit should then be completed through an external control circuit.

5.11 The voice-operated relay circuit consists of relay K2, electron tube V7 and associated components. One section of V7 is connected as an amplifier with the relay connected in its plate circuit. When no signal is delivered by the common amplifier, the plate current of V7 is adjusted to a value less than the operate point of the relay by the release control R43 (not shown in Fig. 3). During recording and reproducing, a signal from the feedback winding of the output transformer is applied through the operate control R42 to the grid of V7. The second section of V7 rectifies the output of the first section of V7 and develops a dc potential of the proper polarity to drive the amplifier grid in a positive direction. This increases the plate current and causes the relay to operate. When the signal is reduced 4 db, the relay will release in about 11 seconds.

6. EXTERNAL CONNECTIONS

6.01 The ac power connections should be brought into the amplifier through the lower right-hand entrance hole adjacent to TB3. This wiring should be in accordance with the local electrical wiring code. The ground side of the ac circuit should be connected in accordance with the average line voltage to be expected, as shown in Table 1. The ungrounded side of the ac power circuit should be connected to terminal 21 of TB3. Amplifiers manufactured before June, 1958 have terminals designated 115V, 125V and common.

TABLE I

AC VOLTAGE	TERMINAL DESIGNATION
Ungrounded side	21 or common
110 to 120	22 or 115V
120 to 130	23 or 125V

6.02 The input and output connections, as well as 48V battery connections for relay K1 are shown in Table II.

TABLE II

TERM. STRIP	TERM. NO.	EXTERNAL CONNECTION
TB1	1	-48
TB1	2	+48V (GRD)
TB1	3 and 4	Shielded twisted pair cable to record-reproduce head with shield connected to terminal 4.
TB1	5 and 6	600-ohm record input.
TB1	7	Ground
TB1	8	Not used
TB1	9 and 10	Shielded twisted pair cable to erase head with shield connected to terminal 10.
TB2	11, 12 & 15	Voice-Operated Relay Contacts.
TB2	13	Ground
TB2	14	Output transformer center tap.
TB2	16 and 17	Amplifier Output.
TB2	18	Not used
TB2	19 and 20	Strap to control oscillator heater circuit — normally strapped.

6.03 The external connections to TB1 should be brought in through the entrance holes at the left end of the chassis and to TB2 through the upper right entrance hole.

6.04 Low capacity shielded twisted pair cable should be used for magnetic head and erase head connections. The total capacity of the cable to the head should not exceed about 500 mmf.

6.05 The following internal connections in the amplifier should be checked in order to assure that the amplifier will operate properly:

- (1) When low frequency boost is not desired, remove the low frequency equalizer from the preamplifier by removing the connections to terminals 1 and 5 of TB6 located on the wiring side of the chassis.

(2) The amplifier is normally supplied with the 4700 mmf capacitor C4 connected for resonating the reproduce head. Check SD-95256-011, Note 101 for the strapping to be used for a specific system.

(3) For use with record-reproduce machines employing high frequency erase heads terminals 2 and 3 on TB5 should be strapped, connecting resistors R2 and R3 in parallel in the cathode circuit of the oscillator. The amplifier is normally supplied with this strap connected. When lower output levels are required from the oscillator, this strap should be removed leaving only R2 in the cathode circuit.

7. TRANSMISSION INFORMATION

7.01 Fig. 4 shows the frequency response of the reproduce and record channels. The middle curve in the figure shows the effects of low frequency equalization on the reproduce channel. This equalization is normally provided.

7.02 Fig. 5 shows the output power versus frequency characteristics of the reproduce channel for 1% and 5% distortion.

7.03 Fig. 6 shows the output power versus frequency characteristics of the record channel for 1% and 5% distortion.

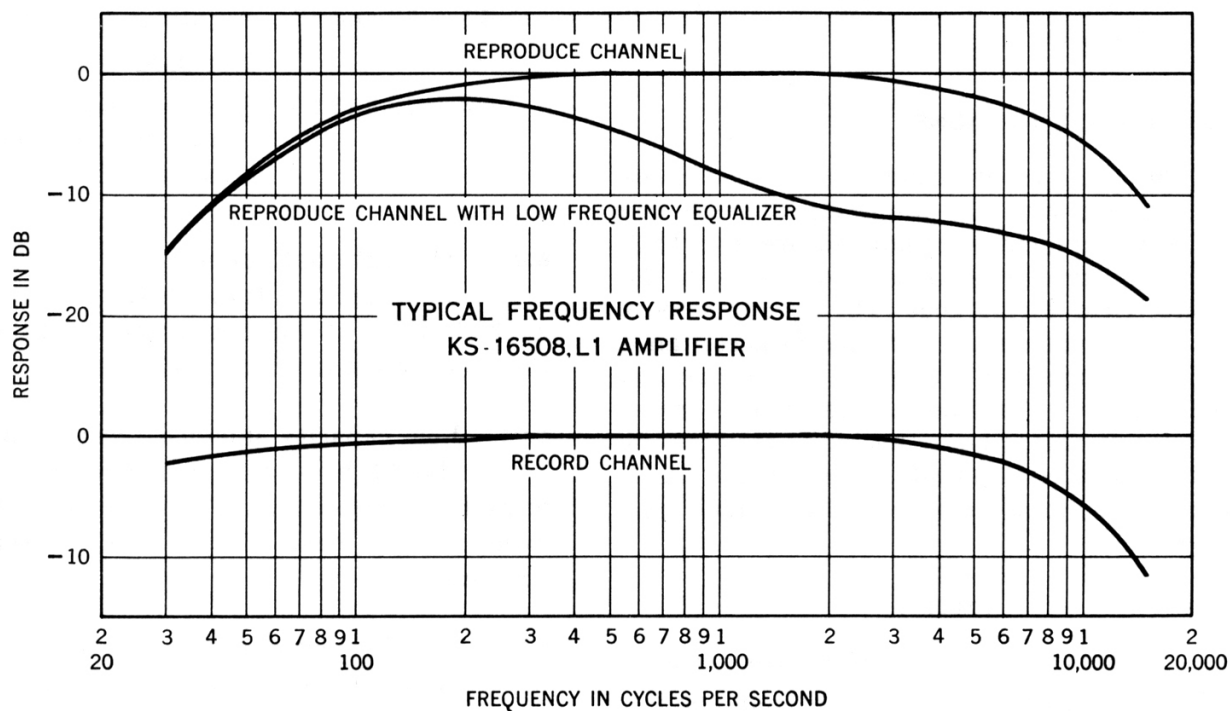


Fig. 4 – Frequency Response

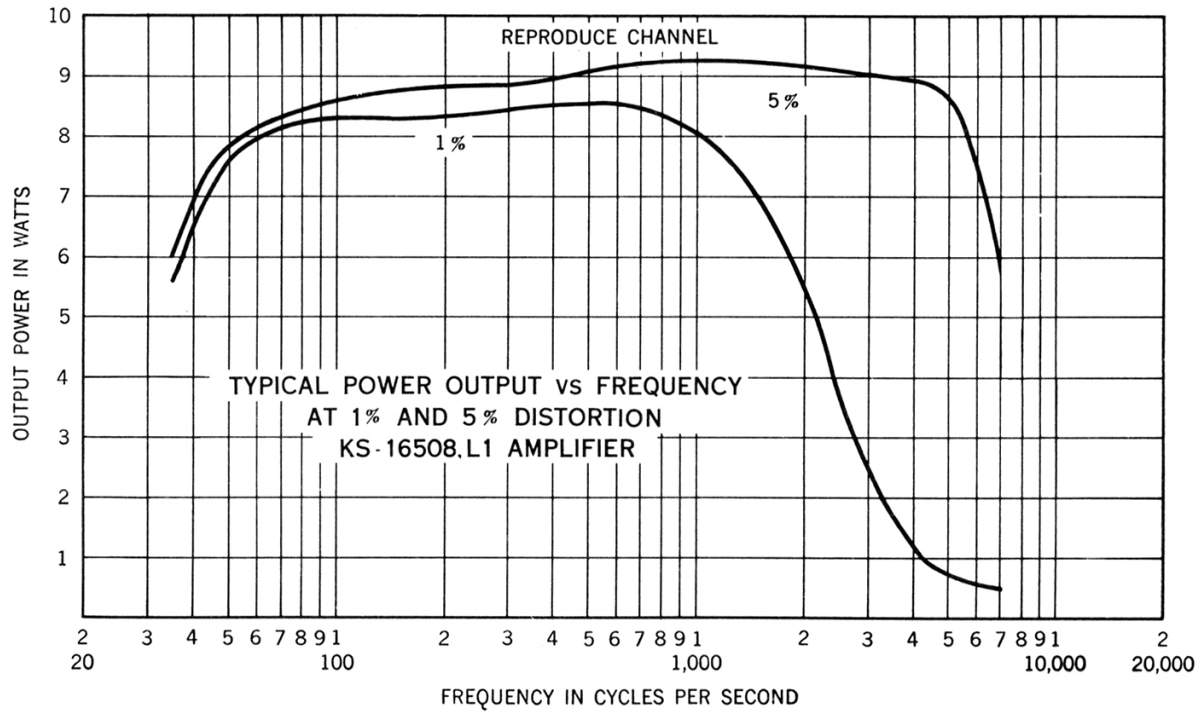


Fig. 5 – Output Power vs. Frequency

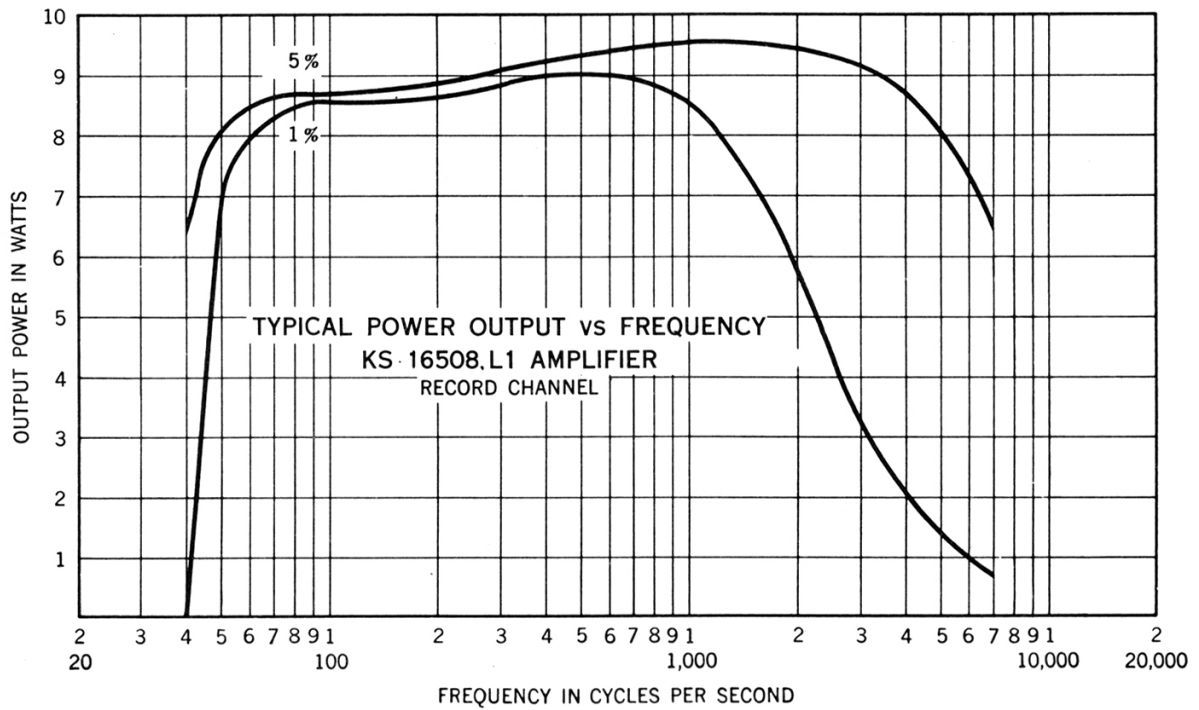


Fig. 6 – Output Power vs. Frequency