

## KS-16831, L1, L2, L3 AMPLIFIERS TESTS AND ADJUSTMENTS

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### 1. GENERAL

1.01 This section is reissued to revise information on test equipment arrangements.

1.02 This section outlines the tests to be performed on the KS-16831, L1, L2 and L3 Amplifiers. The List 1 Amplifier is designed for local program use. The List 2 and 3 Amplifiers are for use on facsimile and high-speed data circuits requiring bandwidths up to 100 KC and 552 KC, respectively.

1.03 The tests outlined in this section should be performed on the circuit order or the service order. They should also be used to locate trouble and should be performed in the amplifier when the trouble is cleared to make sure it meets requirements. It is not anticipated that routine transmission tests be performed on these units since they are expected to have long life as well as stable operation.

1.04 It is the intent of the tests outlined in this section to determine whether or not the amplifier is in trouble. It is not intended that these tests should "pin-point" the trouble. If trouble is found in the plug-in amplifier circuit board, IT SHOULD BE RETURNED TO A REPAIR CENTER for repair. If replacing the circuit board does not clear the trouble, THE ENTIRE AMPLIFIER SHOULD BE RETURNED TO THE REPAIR CENTER.

### 2. RECOMMENDED TEST EQUIPMENT

2.01 The following items of equipment are required for tests on L1 Amplifiers:

- 21A TMS or equivalent
- 3A NMS
- Resistor — 600Ω, 1/2W, 1%

2.02 The following items of equipment are required for tests on L2 Amplifiers:

- 200CD Oscillator or equivalent
- 400-Type VTVM (See 2.04)
- Oscilloscope
- Attenuator (600Ω) — Daven T693 or equivalent
- Resistor — 300Ω, 1W, 1%
- Resistor — 600Ω, 1/2W, 1%

2.03 The following items of equipment are required for tests on L3 Amplifiers:

- 200CD Oscillator or equivalent
- 400-Type VTVM (See 2.04)
- Oscilloscope
- Resistors (3) — 600Ω, 1/2W, 1%
- Resistor — 30,000Ω, 1/2W, 1%



2.04 Noise measurements cannot be made on L2 and L3 Amplifiers with the VTVM grounded in accordance with safety practices. In these situations, it is recommended that a transistorized, battery-operated VTVM be used.

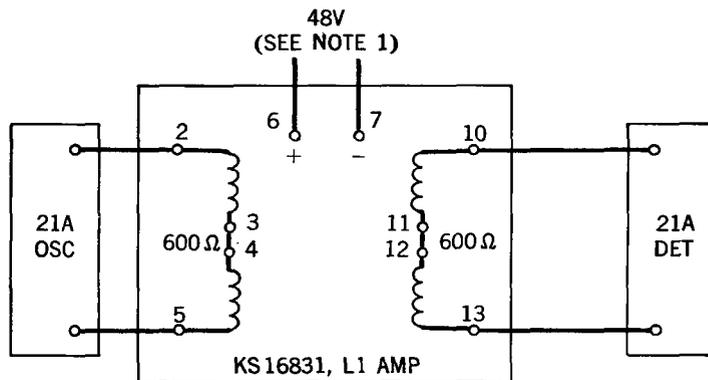
2.05 The amplifiers covered in this section are high quality amplifiers with broad frequency ranges. It is therefore necessary that good testing techniques be used in order to obtain a satisfactory result. Test equipment should be used which is known to be in good working condition and properly CALIBRATED. The standard 5A Attenuator, or equivalent, *should not* be used with the List 2 and 3 Amplifiers since it is not designed for use at frequencies above the audio range and will therefore cause errors in the test.

## 3. GAIN FREQUENCY TEST

3.01 The gain and frequency response of the KS-16831, L1 Amplifier should be measured in accordance with the simplified sketch shown in Fig. 1. The 21A OSC should be adjusted for an output of  $-25$  dbm at 1000 cycles. The "DB ATT" dial on the amplifier should be set at "0" and the amplifier "VERNIER GAIN" control turned to its maximum clockwise position. *The 21A DET should read  $+17.5$  dbm  $\pm 1.25$  db.* This is the DET input dial setting plus the meter indication. Sweep the 21A OSC from 35 cycles to 15,000 cycles. *The gain should*

*not change by more than  $\pm 0.5$  db* from the 1000-cycle gain over the band of frequencies.

3.02 Decrease the "VERNIER GAIN" control of the amplifier to minimum. This should lower the 21A DET reading *approximately 2.0 db*. Decrease the amplifier gain by rotating the "DB ATT" dial one step at a time in the counterclockwise direction. This should lower the 21A DET reading  $2 \pm 0.25$  db for each step. When the "DB ATT" is in the "OFF" position, there should be no signal output from the amplifier.



NOTE 1.-IF AMPLIFIER IS TESTED AT A POLE OR IN A MANHOLE AND BATTERY IS FED FROM A CABLE PAIR, VOLTAGE SHOULD BE 55V AT TERMINALS 6 & 7 WITH THE AMPLIFIER OPERATING.

Fig. 1 - Setup for Gain Frequency Test for KS-16831, L1 Amplifier

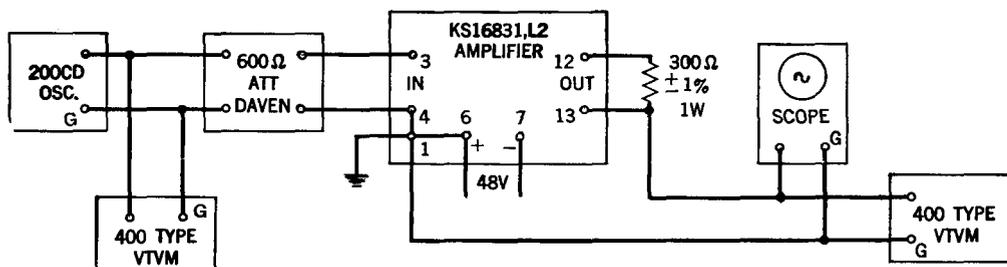


Fig. 2 - Setup for Gain Frequency Test for KS-16831, L2 Amplifier

**3.03** The gain and frequency response of the KS-16831, L2 Amplifier should be measured in accordance with the simplified sketch shown in Fig. 2.



**Note:** Mechanical grounds must be disconnected in the power cords of the test sets. The test sets may be grounded only through terminal 1 of the amplifier. For safety, the test lead grounds must be connected before connecting the power cords. Test sets must be arranged to eliminate accidental grounds.

Insert about 25 db of loss in the ATT. The 200CD OSC should be adjusted for a frequency of 1000 cycles and an output of 0.78 volts. The "DB ATT" dial of the amplifier should be set at "0" and the amplifier "VERNIER GAIN" control turned to its maximum clockwise position. The loss of the ATT should be increased until the output of the amplifier is 0.78 volts. The ATT setting for this condition should be  $41 \pm 1.5$  db. Sweep the OSC from 10 cycles to 50,000 cycles. The output of the amplifier should not change by more than  $\pm 0.05$  volts from the 1000-cycle value. Observe the amplifier output waveshape on the oscilloscope. The waveshape should be a clean sine wave throughout the frequency range. Meter values are given in volts rather than dbm since the List 2 Amplifier is designed to work into a 300-ohm load.

**3.04** Adjust the ATT to give an output of 1 volt at 1000 cycles. Decrease the "VERNIER GAIN" control of the amplifier to minimum. This should reduce the output voltage to between 0.75 and 0.84 volts. Return "VERNIER GAIN"

control to its maximum clockwise position. Rotate the "DB ATT" dial of the amplifier counterclockwise. The output of the amplifier should decrease  $2 \pm 0.25$  db for each step. When the "DB ATT" is in the "OFF" position, there should be no signal output from the amplifier.

**3.05** The gain and frequency response of the KS-16831, L3 Amplifier should be measured in accordance with the simplified sketch shown in Fig. 3.



**Note:** Mechanical grounds must be disconnected in the power cords of the test sets. The test sets may be grounded only to terminal 1 of the amplifier. For safety, the test lead grounds must be connected before connecting the power cords. Test sets must be arranged to eliminate accidental grounds.

The "DB ATT" dial on the amplifier should be set at "0" and the amplifier "VERNIER GAIN" control should be turned to its maximum clockwise position. With the VTVM connected to "B", adjust the 200CD OSC for  $-38$  dbm at 1000 cycles. The VTVM in the output circuit should read  $+1.5$  dbm  $\pm 2.0$  db. Connect the VTVM to "A" as shown in Fig. 3 and adjust the 200CD OSC until the VTVM in the output circuit reads 0 dbm at 1000 cycles. Sweep OSC frequency from 10 cycles to 500,000 cycles keeping OSC output constant. The VTVM in the output circuit should read  $0$  dbm  $\pm 1.5$  db at 10 cycles and 500,000 cycles. Observe the amplifier output waveshape on the oscilloscope. The waveshape should be a clean sine wave throughout the frequency range.

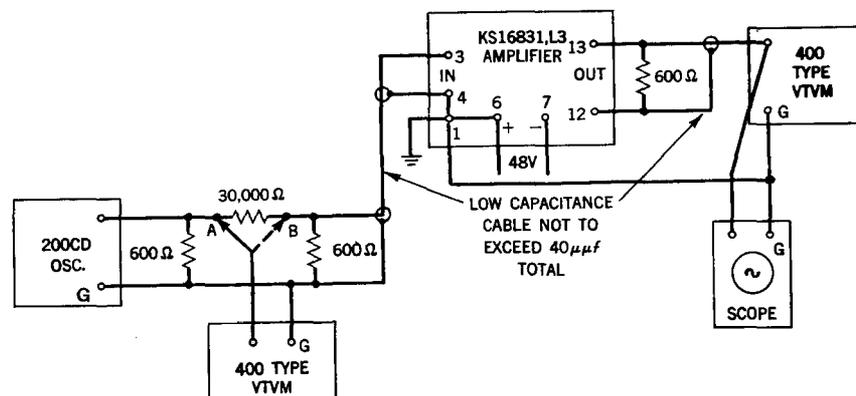


Fig. 3 – Setup for Gain Frequency Test for KS-16831, L3 Amplifier

#### 4. NOISE TEST

4.01 The noise of the KS-16831, L1 Amplifier should be measured in accordance with the simplified diagram shown in Fig. 4. The amplifier "DB ATT" dial should be set on "0" and the "VERNIER GAIN" should be in the maximum clockwise position. It is important that the grounded side of the battery be connected to terminal 1 of the amplifier. *The noise measuring set should read 30 dbm or less with 15 KC Flat Weighting.*

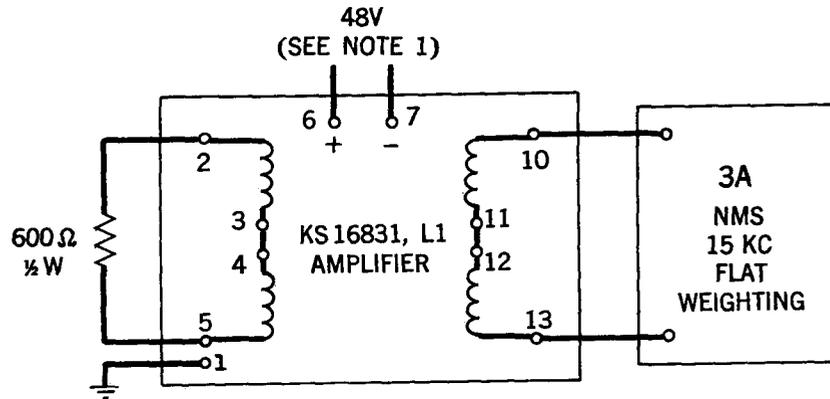
4.02 When measuring the noise on the L2 and L3 Amplifiers, a VTVM should be used since it will measure all frequencies within the desired band. Care should be exercised in making this measurement. If rf fields exist, they may interfere with the measurements. All leads inter-

connecting the equipment should be as short as possible. The amplifier should be connected to a good ground by means of a short lead. The output of the amplifier should not be grounded.

4.03 The noise of the KS-16831, L2 and L3 Amplifiers should be measured in accordance with Fig. 5. The amplifier "DB ATT" dial should be set on "0" and the "VERNIER GAIN" should be in its maximum clockwise position. *The VTVM should read no more than -60 dbm for the L2 Amplifier and -55 dbm for the L3 Amplifier.*

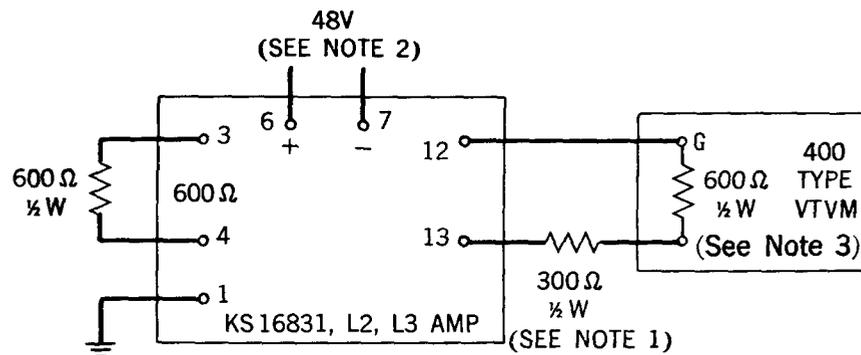
#### 5. REQUIREMENTS

5.01 The gain frequency tests should be made on circuit order and at intervals of six months.



NOTE 1.—IF AMPLIFIER IS MOUNTED AT A POLE OR IN A MANHOLE AND BATTERY IS FED FROM A CABLE PAIR, VOLTAGE SHOULD BE 55V AT TERMINALS 6 & 7 WHEN THE AMPLIFIER IS OPERATING.

Fig. 4 — Setup for Measuring Noise of KS-16831, L1 Amplifier



NOTE 1.—USE THE 300 OHM RESISTOR WITH THE L2 AMPLIFIER ONLY.

- 2.—48V FOR L2 AMPLIFIER. IF L3 AMPLIFIER IS MOUNTED IN C.O. USE 48V. IF MOUNTED ON POLE OR IN MANHOLE THE VOLTAGE SHOULD BE 50V AT AMPLIFIER TERMINALS 6 & 7 WITH THE AMPLIFIER OPERATING.
- 3.—VTVM MUST NOT BE GROUND (SEE 2.04)

Fig. 5 — Setup for Measuring Noise of KS-16831, L2 and L3 Amplifiers