

UG-231  
FM STEREO  
SIGNAL GENERATOR  
SERVICE MANUAL

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### NOTE

These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing other than that contained in the service manual unless you are qualified to do so.

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## 1. Test Equipment Required

The following test equipment is required for calibration and servicing of the Model LSG-231. The suggested specifications are the minimum necessary for proper calibration of this instrument.

TEST EQUIPMENT	MINIMUM SPEC.
o Multimeter	Accuracy $< \pm 1\%$
o Oscilloscope	5mV sensitivity 20MHz band width
o Sine Wave Generator	50Hz-60kHz
o AC Millivoltmeter	3mV-1V
o Frequency Counter	100MHz band width
o Distortion Meter	0.3% full scale at 1kHz
o RF Millivoltmeter	10mV sensitivity 100MHz band width
o FM Linear Detector	100MHz 75kHz deviation

## 2. Calibration Procedure

\* Calibration should be performed after a 30 minute warm-up period. It should also be confirmed that the unit is connected to the rated power line voltage.

\* All adjustment should be completed in the given order, because some adjustments interact with others.

\* During the adjustment procedure, remove the case only when necessary and replace immediately after making an adjustment. This will maintain all circuit at constant operating temperature.

### 1) Initial Control Settings

The initial control settings to be used for each check and adjustment are listed below. Any variations from these settings are stated in the applicable procedure.

FUNCTION	EXT. MOD.
EXT. MOD.	OFF
PILOT MODULATION	OFF
COMPOSITE LEVEL	MAX.
RF	Push ON
RF FREQUENCY SET	Center
RF LEVEL	HIGH

### 2) Power Supply

a) Connect the DC voltmeter between test point and chassis.

b) Adjust as required, using the adjustment shown in Table-1.

Voltage	Test point	Adjustment	Ripple
18V	TP1	VR001	<10mVp-p
5V	TP2	VR201	<10mVp-p

Table-1

### 3) 1kHz Oscillator Adjustment

- a) Connect the oscilloscope to TP4.
- b) Connect the AC millivoltmeter and the frequency counter to 1kHz OUTPUT jack on the rear panel.
- c) Adjust GAIN ADJ (VR301) for a reading of 150mVp-p on the oscilloscope.
- d) Adjust 1kHz OUTPUT LEVEL (VR302) for a reading of 1Vrms on the AC millivoltmeter.
- e) Repeat c) and d) if necessary.
- f) Check the frequency reading should be 1kHz within  $\pm 1\%$  (990Hz-1010Hz).
- g) Connect the distortion meter to the 1kHz OUTPUT jack.
- h) Check the distortion should be 0.5% or less.

### 4) 228kHz X'TAL Oscillator Adjustment

- a) Connect the frequency counter to TP3.
- b) Confirm that frequency is 228kHz within  $\pm 20$ Hz (227.080kHz-228.020kHz).

### 5) L.P.F.-1 Adjustment

- a) Connect the oscilloscope to 19kHz OUTPUT jack.
- b) Disconnect pin connector of L.P.F.-1 input.
- c) Connect the sine wave generator, frequency of which is monitored by frequency counter, to the L.P.F.-1 input.

Then set the frequency to 19kHz and output level for a reading of 3Vp-p on the oscilloscope.

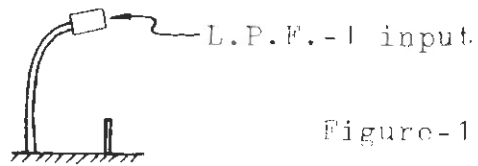


Figure-1

- d) Change the frequency to 57kHz.
  - e) Adjust 3rd HARMONIC TRAP(L201) for a minimum output level.
  - f) Change the frequency to 38kHz.
  - g) Adjust 2nd HARMONIC TRAP(L202) for a minimum output level.
  - h) Remove the sine wave generator and insert the pin connector.
  - i) Check the 19kHz pilot signal has no significant distortion.
- 6) Balanced Modulator Adjustment (Carrier Suppression Adjustment)
- a) Set PILOT MODULATION switch to OFF.
  - b) Connect the oscilloscope to COMPOSITE OUTPUT jack.
  - c) Adjust CARRIER SUPPRESSION (VR401, 402) alternately to obtain a maximum carrier suppression. (38kHz leakage should be less than 10mVp-p.)

7) Separation Adjustment

The channel separation is determined by the amplitude ratio of composite signal (A) and base line (B) as shown in Figure-2.

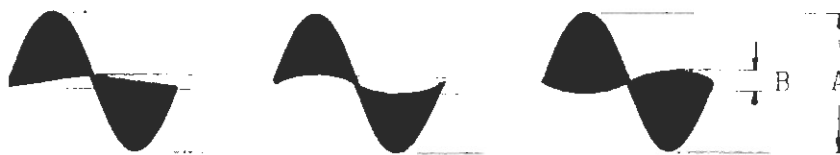
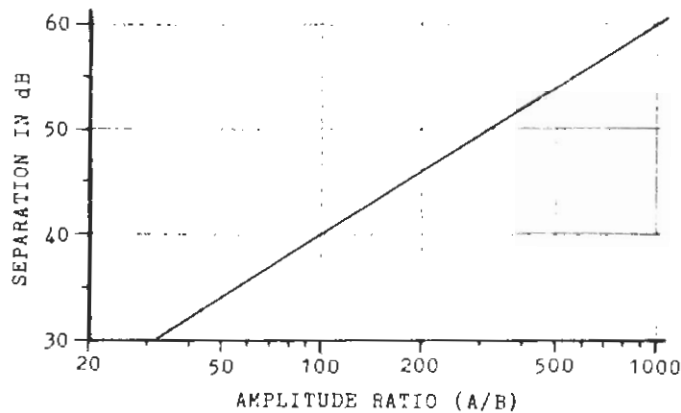


Figure-2

The separation is given by following equation or graph.

$$\text{Separation in dB} = 20 \log \frac{A}{B}$$



- a) set FUNCTION switch to EXT. MOD..
- b) Connect the oscilloscope to COMPOSITE OUTPUT jack.  
(Oscilloscope must be completely phase compensated.)
- c) Connect the sine wave generator to EXT. MOD. L INPUT jack and set frequency to 1kHz, output level to 3Vp-p.
- d) Adjust SEPARATION ADJ (L401, 402 and VR404) so that the base line becomes as flat as possible.
- e) Set the frequency to 15kHz.
- f) Adjust VR404 so that the base line becomes as flat as possible.
- g) Repeat d) and f) to obtain the best channel separation.
- h) Check the separation by Table-2

Freq. range	Separation	A/B
1kHz	50dB	320
100Hz-3kHz	45dB	180
50Hz-15kHz	35dB	56

Table-2

8) Composite Signal Output Level Adjustment

- a) Set FUNCTION switch to L+R.
- b) Connect the AC millivoltmeter to COMPOSITE OUTPUT jack.
- c) Adjust COMPOSITE OUTPUT (VR407) for a reading of 1Vrms.
- d) Check the output level is 0.9Vrms when COMPOSITE LEVEL control is at "3 o'clock" position.

9) Pilot Signal Adjustment

- a) Set: PILOT MODULATION            ON  
COMPOSITE LEVEL            MIN
- b) Connect the AC millivoltmeter to COMPOSITE OUTPUT jack.
- c) Adjust PILOT MOD. LEVEL (VR202), on the rear panel, for a reading of 100mVrms.
- d) Set the oscilloscope for X-Y mode to display a lissajous pattern. Then connect Y-INPUT to COMPOSITE OUTPUT and X-INPUT to 19kHz OUTPUT jack.
- e) Adjust PILOT SCOPE PHASE (VR204) on the rear panel to obtain the single slanted line.

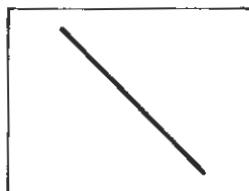


Figure-3



## 10) Pilot Signal and Subcarrier Phase Adjustment

- a) Set: FUNCTION L-R  
PILOT MODULATION OFF  
COMPOSITE LEVEL MAX
- b) Set the oscilloscope to X-Y mode. Then connect Y-INPUT to COMPOSITE OUTPUT and X-INPUT to 19kHz OUTPUT jack.
- c) Adjust PILOT MOD. PHASE (VR203) on the rear panel to obtain the lissajous pattern as shown in Figure-4.



Figure-4

## 11) Pilot Signal Phase Checking

- a) Set: FUNCTION L  
PILOT MODULATION ON
- b) Connect the oscilloscope to COMPOSITE OUTPUT jack.
- c) Confirm the waveform shown in Figure-5 (L).
- d) Set FUNCTION switch to R.
- e) Confirm the waveform shown in Figure-5 (R).

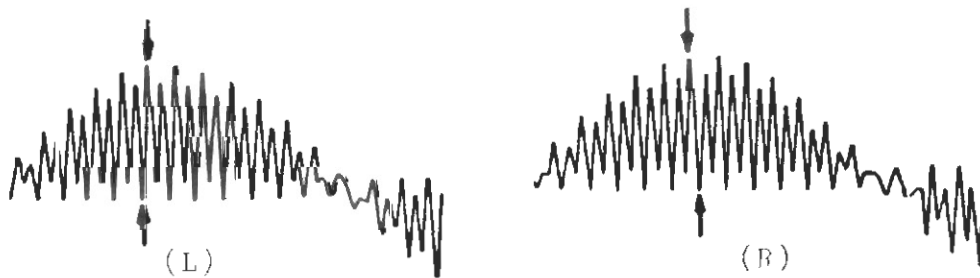


Figure-5

12) SCA Adjustment

- a) Set: FUNCTION                      67kHz  
          PILOT MODULATION            OFF
- b) Connect the frequency counter and AC millivoltmeter to COMPOSITE OUTPUT jack.
- c) Adjust 67kHz FREQ. (L101) for a reading of 67kHz within ±500Hz.
- d) Adjust 67kHz OUTPUT LEVEL (VR101) for a reading of 200mVrms.

13) Adjustment of RF Section

a) Frequency Adjustment

- o Set: FUNCTION                      EXT. MOD.  
          RF                            Push ON  
          COMPOSITE LEVEL            MIN
- o Connect the frequency counter to RF OUTPUT connector.
- o Adjust RF FREQ. ADJ (L702) for a reading of 100MHz.

b) Output Level Adjustment

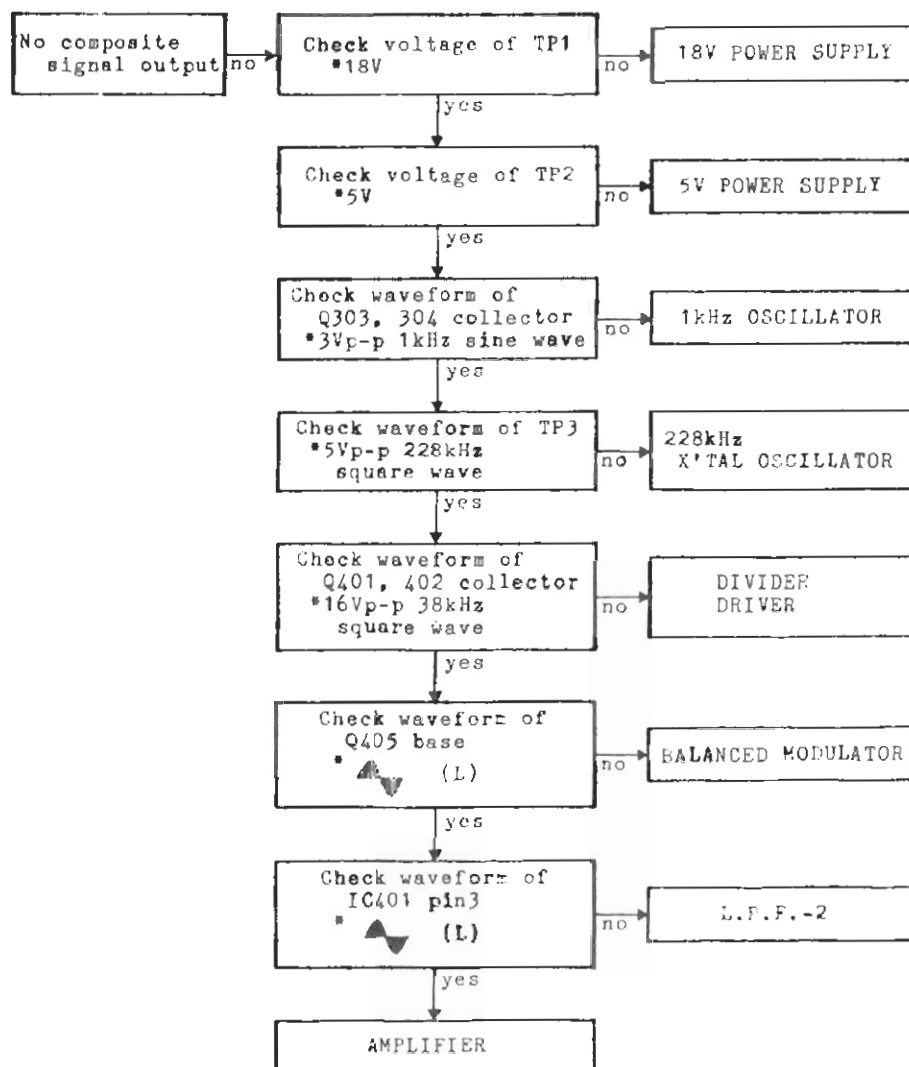
- o Connect the RF millivoltmeter to RF OUTPUT connector via 75 ohm termination.
- o Adjust RF OUTPUT LEVEL (VR701) for a reading of approximately 10mV.

c) FM Deviation Adjustment

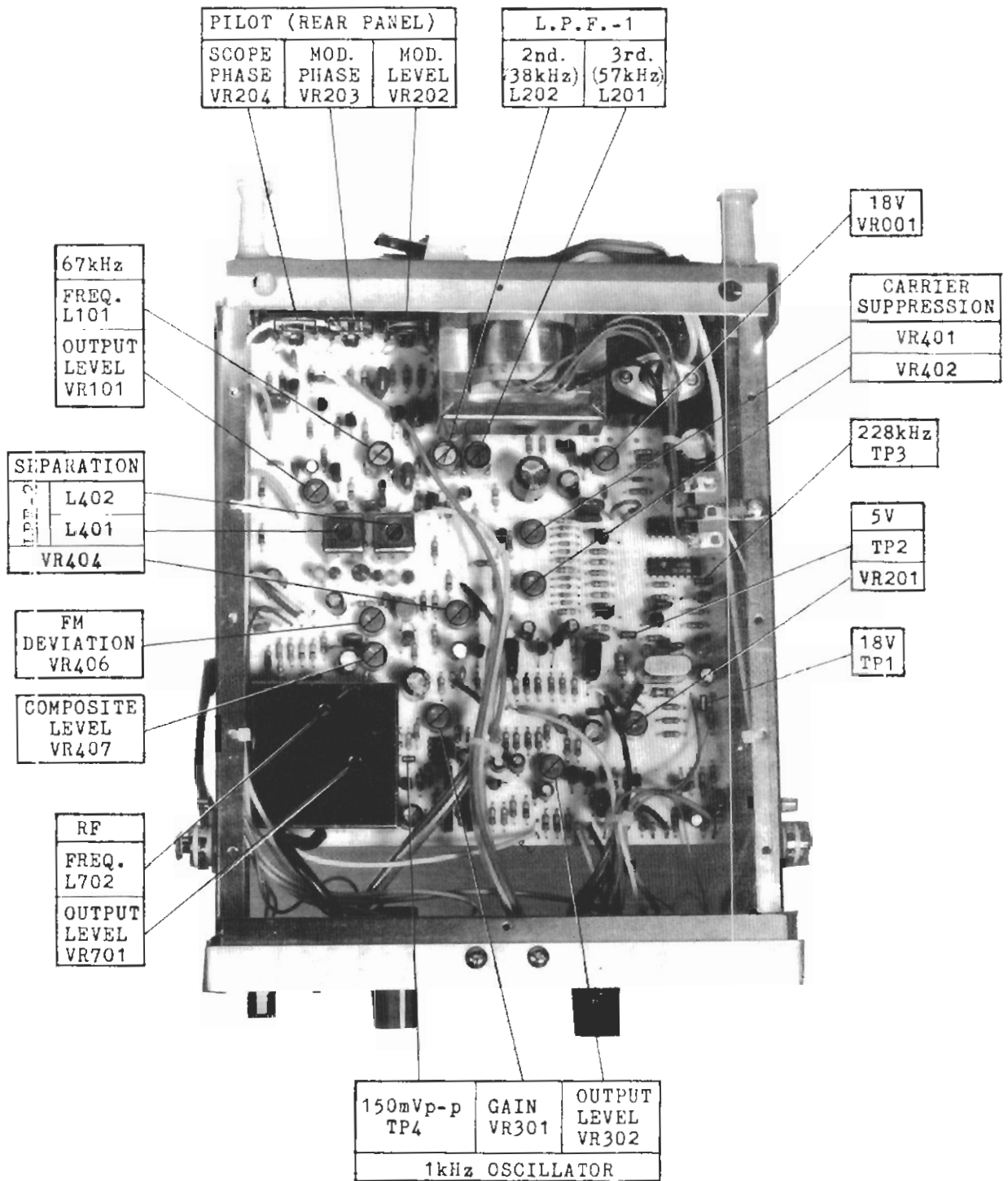
- o Set: FUNCTION                      L+R  
          COMPOSITE LEVEL            MAX
- o Connect the FM linear detector to RF OUTPUT connector via 75 ohm termination and amplifier if necessary.
- o Adjust FM DEVIATION (VR406) for a frequency deviation of 75kHz

### 3. Troubleshooting Procedure

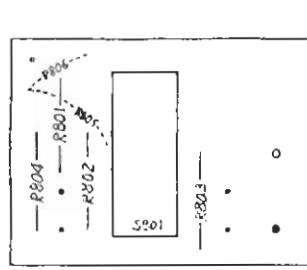
- 1) Check all control settings, because an incorrect setting can make a good unit appear defective.
- 2) Some trouble can be solved with proper adjustment.
- 3) Check the DC voltage and waveform as shown on the schematic diagram to locate the defective circuit. Start with the power supply.
- 4) Check all circuit for visual defects such as broken components, loose connections and poor soldering which could be a cause of trouble.
- 5) Troubleshooting Chart



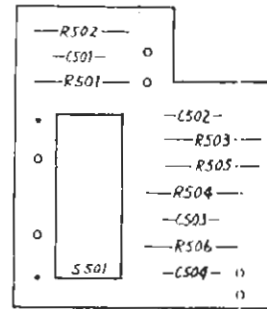
#### 4. Location of Adjustment



# 5. Printed Circuit Board

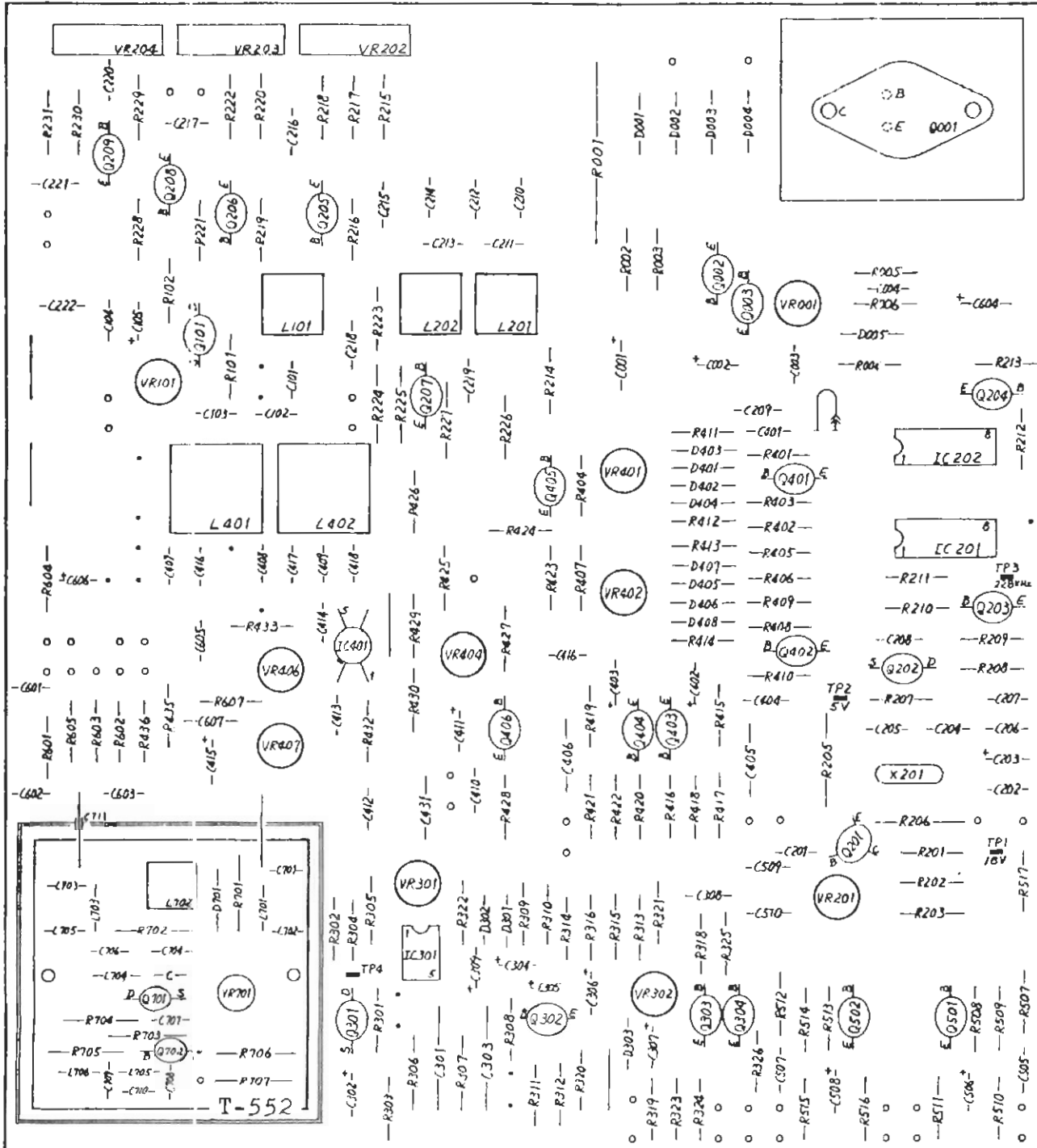


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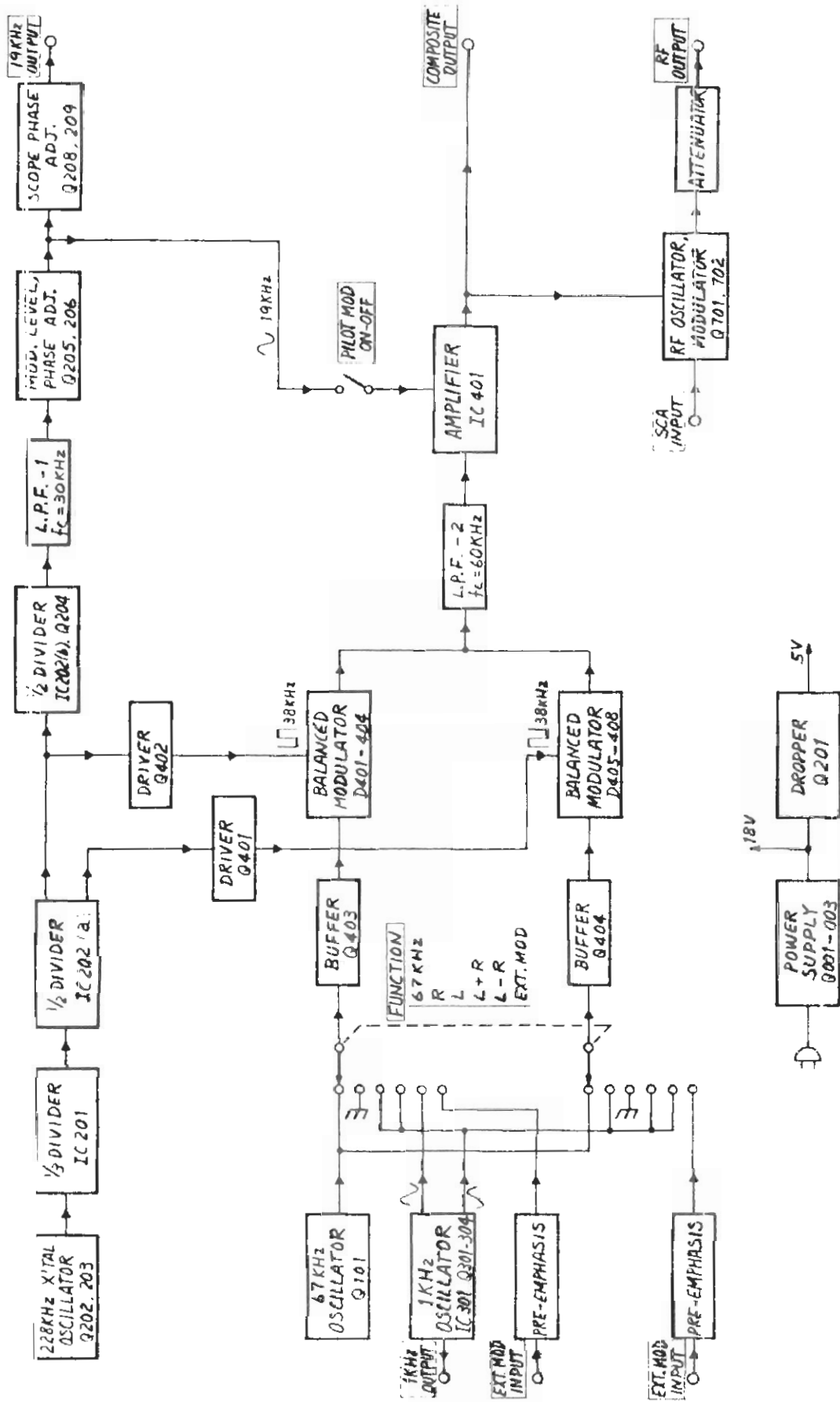


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## 6. Block Diagram



# 7. Schematic Diagram

