TR-6000 10 Watt AM Broadcast Transmitter Manual

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TR-6000 AM Broadcast Transmitter

Operating Instructions

Overview

The TR-6000 is a solid-state, class D AM transmitter specially designed for traveler's information, carrier current, roadside radio, and other low-power broadcast band AM applications.

The unit features a frequency synthesized oscillator, full remote control, LED power and audio meters, 0 to 10 watt output power, short circuit protections, balanced audio inputs, and monitor and headphone outputs. The TR-6000 is shipped factory set for 10-watt operation. 10-watt units are provided with a 24-volt external power supply. The TR-6000 can be powered by storage batteries (not supplied).

The TR-6000 is FCC certified for TIS operation anywhere within the AM broadcast band.

Available Options

· brackets for wall or 19' EIA rack mounting

· super stable crystal option @ 1.5 ppm

· ultra stable crystal option

Front Panel Controls

Power switch - supplies DC to the unit
Do not power up without a 50 ohm output load.
Meter switch - illuminates power and VU LED meters.
Leave off to increase efficiency for battery or solar operation.
Power Adjust - sets RF output level
Set (with no modulation required) to desired carrier level on 10 watt scale
Mod(ulation) adjust - set for 100% modulation on VU meter

For TIS operation the internal audio filter must be engaged. Consult the internal parts layout diagram for location.

Connections

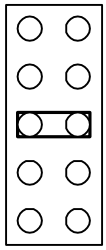
CAUTION: Make all connectors prior to applying DC voltage via the supplied transformer or any external DC source.

RF out - Connect to 50 ohm load
Audio input - Apply line-level balanced audio source
DC in - Apply 24 volts to 24 volt terminals via DC transformer connect or DC input
screw terminals (do not apply both inputs simultaneously, however DC may be derived from the DC terminals for low-current applications when the transformer is utilized).
Relay contacts - (Depending on internal strap programming) This relay can control or be controlled by the transmitter for external device remote control.
Switched monitor audio control - controls the audio output feed to a remote location for remote monitoring.
Switched monitor audio out - balanced/switched (see above) monitor feed.
Monitor audio out - balanced/non-switched audio feed.

TR-6000 Jumper Settings

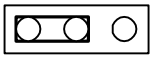
J3 Power Control Relay Configuration

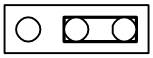
Note: * Indicates Factory Setting



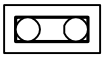
- Relay power supplied by main + input (fused)
- Relay power supplied by N.O. contact
* - Relay power supplied by common contact
- Relay power supplied by N.C. contact
- Relay power supplied by main + input (unfused)

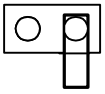
J5 TIS audio filter enable

 TIS filter disabled *

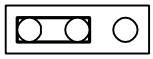
 TIS filter enabled

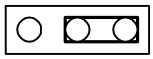
J6 VU meter display mode

Install jumper for bar mode  bar mode

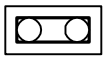
Leave open for dot mode  dot mode *

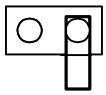
J7 Power LED to follow metering switch

 Power LED independent of metering *

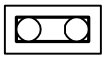
 Power LED follows metering

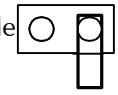
J9 Standard oscillator disable

Jump to disable the standard oscillator 

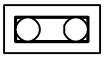
Enable the standard oscillator  *

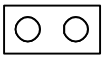
J12 Power meter display mode

Jump for bar mode 

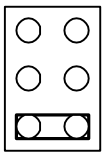
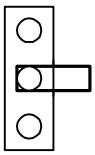
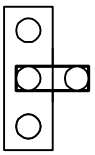
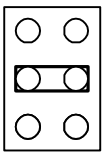
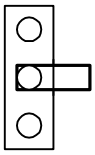
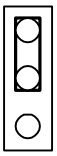
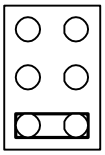
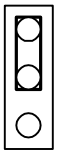
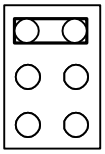
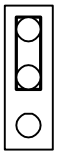
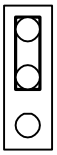
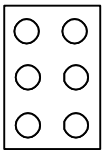
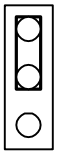
Open for dot mode  *

J15 Relay Supply Voltage

24V Supply  *

48V Supply 

Note: Jumper representations on this page are orientated to match circuit board silk screens.

	J8	Clock Source		J10	Reference I/O		J11
*		Standard Oscillator	*		No I/O	*	
		TCXO			No I/O		
		Standard Oscillator			Standard Oscillator Out		
		TCXO			TCXO Out		
		External Reference In			External Reference In		

Note: * Indicates Factory Setting

TR-6000 Frequency Change Procedure

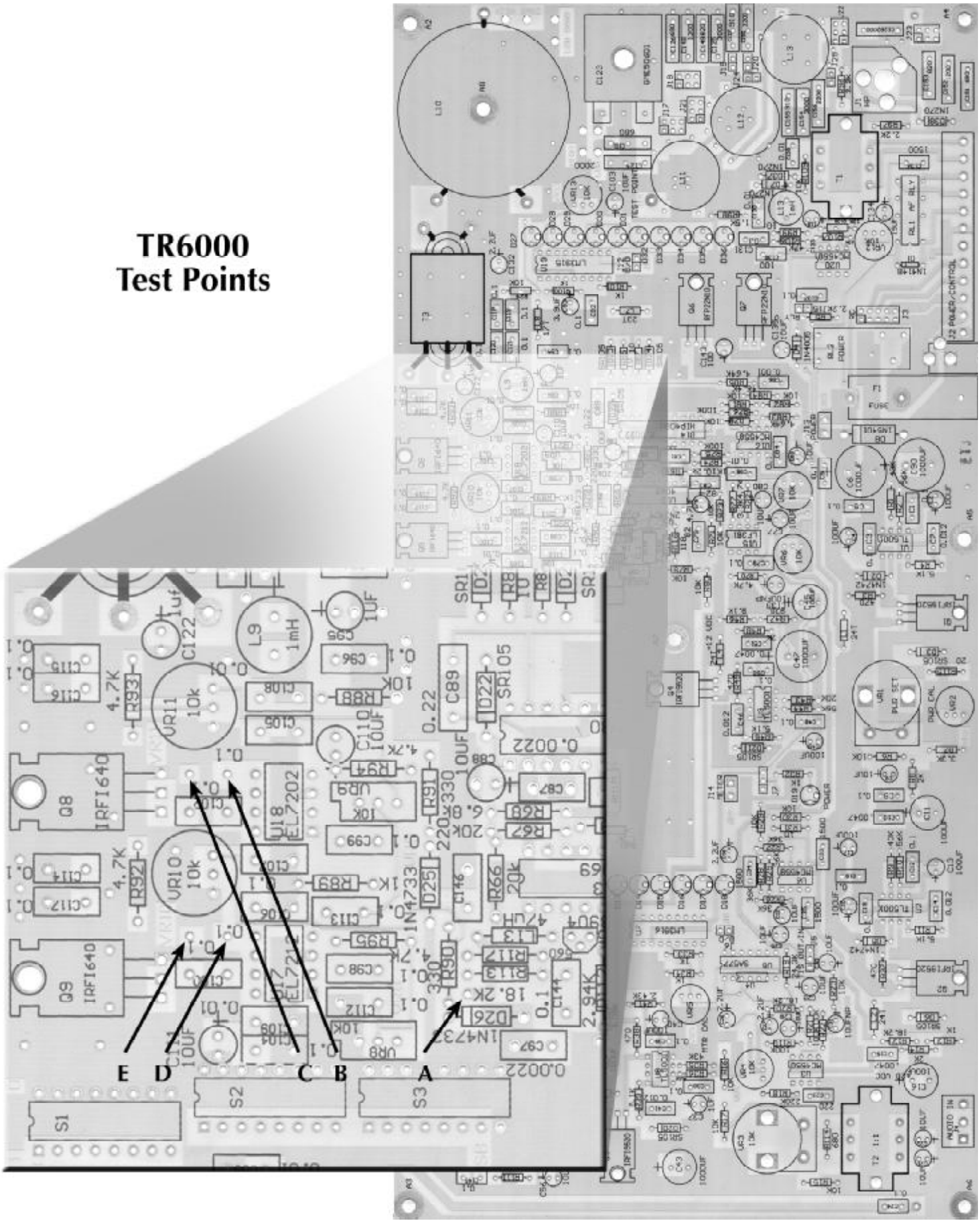
1. Set dip switches S1, S2 and S3 for the desired output frequency.
2. Set the output filter jumpers for low or high band.
3. Adjust the power control VR1 to its minimum position.
4. Turn VR10 and VR11 fully counter clockwise.
5. Apply power to the unit.
6. Measure the oscillator frequency at U11 pin 13.
7. Adjust C57 for an oscillator frequency of 10 MHz.
8. Check for the carrier frequency (Test Point A).
9. Adjust VR8 for a 45% duty cycle square wave at U17 pin 5 (Test Point D).
10. Adjust VR9 for a 45% duty cycle square wave at U18 pin 5 (Test Point B).
11. Adjust VR1 for 10 volts on the drain of Q6.
12. Adjust VR7 for 5 volts on the center tap of T3.
13. Adjust C123 for maximum power output.
14. Increase VR10 and VR11 until the bottom half the gates signals of Q8 and Q9 are just below zero volts (Test Point C & E).
15. Increase VR1 to its maximum position and adjust VR2 for the desired maximum power (Not to exceed 10 watts).
16. Calibrate the RF power meter with VR13.
17. Apply a -50 dBm, 1 KHz audio signal to J4 +/-.
18. Adjust VR3 fully clockwise.
19. Adjust VR4 for maximum modulation.
20. Turn VR3 counter clockwise to reduce the modulation percentage and re-adjust VR4 for maximum modulation.
21. Increase the audio generator level to 0 dBm and adjust VR3 to the point just below clipping of the RF envelope.
22. Adjust VR6 for 90% to 95% modulation.
23. Check the audio frequency response, carrier frequency and RF spectral purity of the unit.
24. Decrease the audio generator level in 10 dB steps and check for at least approximately 80% modulation down to a -35 dBm level.
25. Calibrate the VU meter to 0 with VR5.
26. Check the carrier frequency and RF spectral purity of the unit.
27. Seal all potentiometers except VR1, VR3 and VR12.
28. Install the top cover.
29. Turn the unit on and re-adjust C123 for maximum power output.

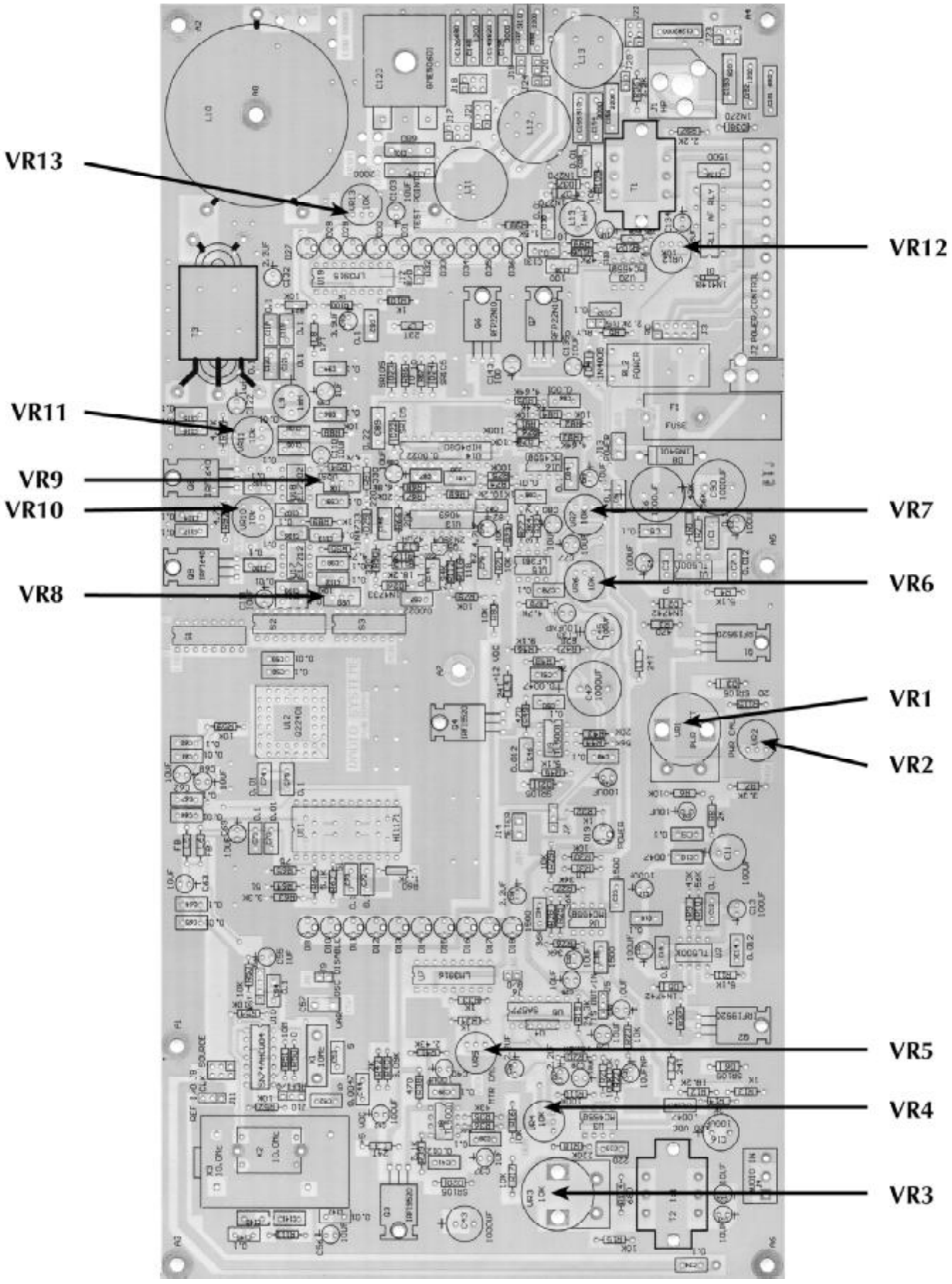
TR-6000 Test Procedure

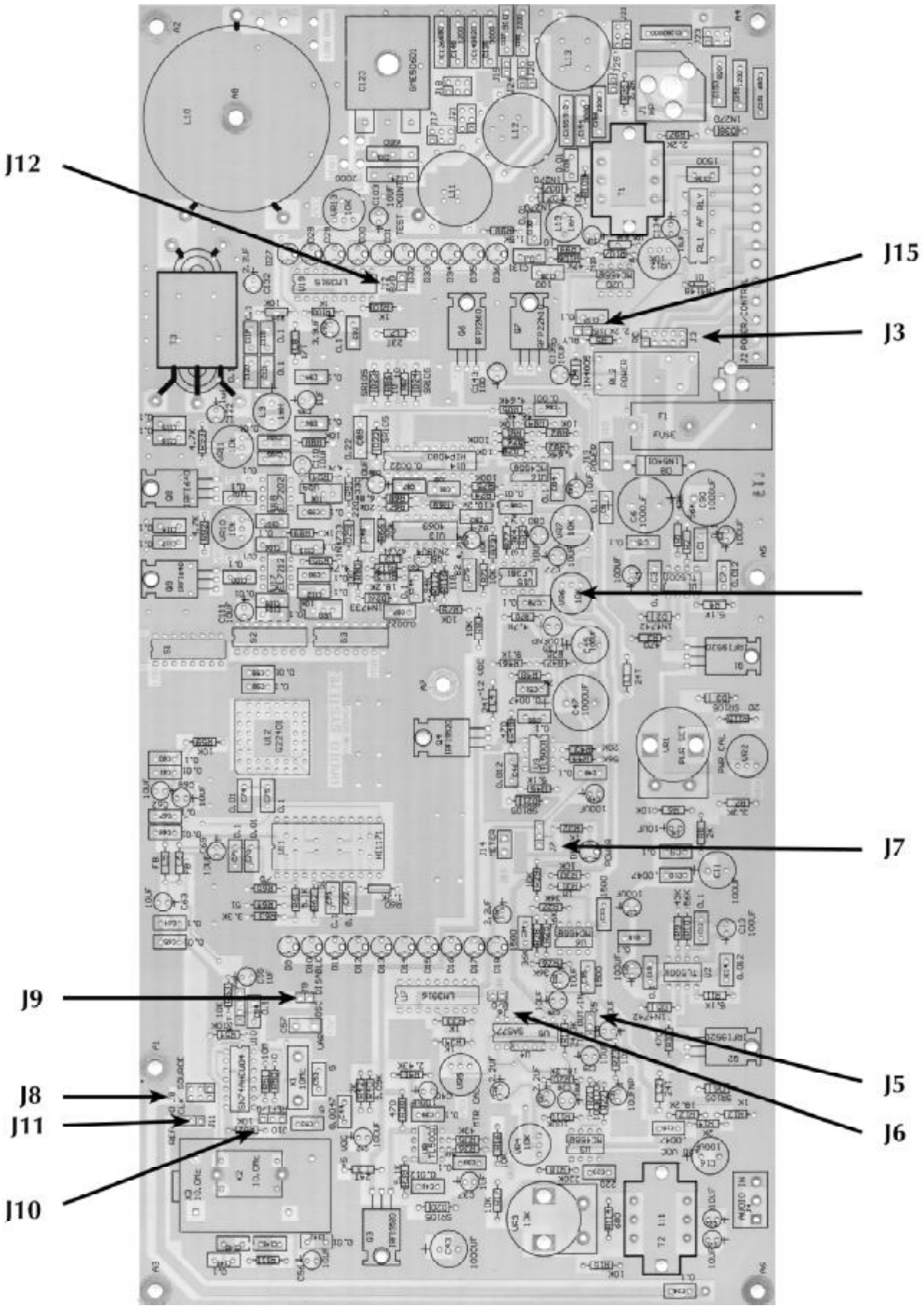
1. Check the circuit board for solder shorts and bad solder joints.
2. Check the alignment of the terminal strips, headphone jack and potentiometers.
3. Check for proper installation of diodes, transistors and IC's.
4. Set all potentiometers except VR10 and VR11 to their center position.
5. Set potentiometers VR10 and VR11 fully counter clockwise.
6. Install a jumper on J7 for "power LED independent of metering."
7. Install a jumper on J5 for "TIS filter disabled."
8. Install a power jumper on J13.
9. Remove U12.
10. Set dip switches S1, S2 and S3 for the desired output frequency.
11. Apply power to the unit and check for the power LED to illuminate.
12. Check the output of the variable regulator, twenty volt regulator, twelve volt regulator and the five volt regulator.
13. Install jumpers J8, J10, and J11 for "standard oscillator" and "no I/O."
14. Measure the oscillator frequency at U11 pin 13.
15. Adjust C57 for an oscillator frequency of 10 MHz.
16. Turn off the power and install U12.
17. Connect an RF load to the RF output.
18. Power up the unit and check Test Point A for the carrier frequency (riding on a 5 volt DC level).
19. Adjust VR8 for a 45% duty cycle square wave at Test Point D.
20. Adjust VR9 for a 45% duty cycle square wave at Test Point B.
21. Adjust VR1 for 10 volts on the drain of Q6.
22. Adjust VR7 for 5 volts on the center tap of T3. (Should be 1/2 of Q6 VDD. A lower reading improves unit distortion; a higher reading increases power output for a given Q6 VDD.)
23. Adjust C123 for maximum power output.
24. Increase VR10 and VR11 until the bottom half the gate signals of Q8 and Q9 are just below 0 volts (Test Points C & E).
25. Increase VR1 to its maximum position and adjust VR2 for the desired maximum power (not to exceed 30 watts).
26. Install a power jumper on J14 and calibrate the RF power meter with VR13.
27. Apply a -50 dBm, 1 KHz audio signal to J4 +/-.
28. Adjust VR3 fully clockwise.
29. Adjust VR4 for maximum modulation.
30. Turn VR3 counter clockwise to reduce modulation percentage and readjust VR4 for maximum modulation.

31. Increase the audio generator level to 0 dBm and adjust VR3 to the point just below clipping of the RF envelope.
32. Adjust VR6 for 90% to 95% modulation.
33. Decrease the audio generator level in 10 dB steps and check for at least approximately 80% modulation down to a -35% dBm level.
34. Calibrate the VU meter to 0 with VR5.
35. Check the monitor audio output and switched monitor audio output.
36. Check the power control relay.
37. Check the headphone jack.
38. Check the audio frequency response to 10 KHz.
39. Enable the TIS filter by moving the J5 jumper.
40. Re-adjust VR6 for 90 % modulation with 1 KHz, 0 dBm audio input.
41. Check the audio frequency to 10 KHz (<= 2% modulation at 10 KHz).
42. Check the carrier frequency and RF spectral purity of the unit.
43. Seal all potentiometers except VR1, VR3 and VR12.
44. Install the circuit board in the chassis and install the top cover.
45. Turn the unit on and re-adjust C123 for maximum power output.
46. Write the date, output frequency, TIS or Non TIS and output on a “TESTED” sticker and place it over the C123 adjustment hole on the bottom of the unit.

TR6000
Test Points




VR13
VR12
VR11
VR9
VR10
VR7
VR8
VR6
VR1
VR2
VR5
VR4
VR3


J12
J15
J3
J7
J9
J8
J11
J10
J5
J6

Frequency	LSB		Switch S1						Switch S2								Switch S3							MSB
(In Khz)	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
530	On	On	On	Off	On	Off	Off	On	Off	On	On	On	Off	On	On	Off	Off	On	Off	Off	On	On	On	On
540	On	Off	On	On	Off	Off	Off	Off	On	Off	On	On	Off	On	Off	Off	Off	On	Off	Off	On	On	On	On
550	Off	Off	On	Off	Off	Off	Off	On	On	On	Off	On	Off	On	On	On	On	Off	Off	Off	On	On	On	On
560	On	On	Off	On	On	On	On	On	On	Off	Off	On	Off	On	Off	On	On	Off	Off	Off	On	On	On	On
570	Off	On	Off	Off	On	On	On	Off	Off	Off	Off	On	Off	On	On	Off	On	Off	Off	Off	On	On	On	On
580	Off	Off	Off	On	Off	On	On	On	Off	On	On	Off	Off	On	Off	Off	On	Off	Off	Off	On	On	On	On
590	On	On	On	On	On	Off	On	Off	On	Off	On	Off	Off	On	On	On	Off	Off	Off	Off	On	On	On	On
600	Off	On	On	Off	On	Off	On	On	On	On	Off	Off	Off	On	Off	On	Off	Off	Off	Off	On	On	On	On
610	On	Off	On	On	Off	Off	On	Off	Off	On	Off	Off	Off	On	On	Off	Off	Off	Off	Off	On	On	On	On
620	Off	Off	On	Off	Off	Off	On	On	Off	Off	Off	Off	Off	On	Off	Off	Off	Off	Off	Off	On	On	On	On
630	Off	On	Off	On	On	On	Off	Off	On	On	On	On	On	Off	On	On	On	On	On	On	Off	On	On	On
640	On	Off	Off	Off	On	On	Off	On	On	Off	On	On	On	Off	Off	On	On	On	On	On	Off	On	On	On
650	Off	Off	Off	On	Off	On	Off	Off	Off	Off	On	On	On	Off	On	Off	On	On	On	On	Off	On	On	On
660	On	On	On	On	On	Off	Off	On	Off	On	Off	On	On	Off	Off	Off	On	On	On	On	Off	On	On	On
670	Off	On	On	Off	On	Off	Off	Off	On	Off	Off	On	On	Off	On	On	Off	On	On	On	Off	On	On	On
680	Off	Off	On	On	Off	Off	Off	On	On	On	On	Off	On	Off	Off	On	Off	On	On	On	Off	On	On	On
690	On	On	Off	Off	Off	Off	Off	Off	Off	On	On	Off	On	Off	On	Off	Off	On	On	On	Off	On	On	On
700	Off	On	Off	On	On	On	On	Off	Off	Off	On	Off	On	Off	Off	Off	Off	On	On	On	Off	On	On	On
710	On	Off	Off	Off	On	On	On	On	Off	On	Off	Off	On	Off	On	On	On	Off	On	On	Off	On	On	On
720	On	On	On	Off	Off	On	On	Off	On	Off	Off	Off	On	Off	Off	On	On	Off	On	On	Off	On	On	On
730	Off	On	On	On	On	Off	On	On	On	On	On	On	Off	Off	On	Off	On	Off	On	On	Off	On	On	On
740	On	Off	On	Off	On	Off	On	Off	Off	On	On	On	Off	Off	Off	Off	On	Off	On	On	Off	On	On	On
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760	On	On	Off	Off	Off	Off	On	Off	On	On	Off	On	Off	Off	Off	On	Off	Off	On	On	Off	On	On	On
770	On	Off	Off	On	On	On	Off	On	On	Off	Off	On	Off	Off	On	Off	Off	Off	On	On	Off	On	On	On
780	Off	Off	Off	Off	On	On	Off	Off	Off	Off	Off	On	Off	Off	Off	Off	Off	Off	On	On	Off	On	On	On
790	On	On	On	Off	Off	On	Off	On	Off	On	On	Off	Off	Off	On	On	On	On	Off	On	Off	On	On	On
800	Off	On	On	On	On	Off	Off	Off	On	Off	On	Off	Off	Off	Off	On	On	On	Off	On	Off	On	On	On
810	On	Off	On	Off	On	Off	Off	On	On	On	Off	Off	Off	Off	On	Off	On	On	Off	On	Off	On	On	On
820	On	On	Off	On	Off	Off	Off	Off	Off	On	Off	Off	Off	Off	Off	Off	On	On	Off	On	Off	On	On	On
830	Off	On	Off	Off	Off	Off	Off	On	Off	Off	Off	Off	Off	Off	On	On	Off	On	Off	On	Off	On	On	On
840	On	Off	Off	On	On	On	On	On	Off	On	On	On	On	On	On	Off	Off	On	Off	On	Off	On	On	On
850	Off	Off	Off	Off	On	On	On	Off	On	Off	On	On	On	On	Off	Off	Off	On	Off	On	Off	On	On	On
860	Off	On	On	Off	Off	On	On	On	On	On	Off	On	On	On	On	On	On	Off	Off	On	Off	On	On	On
870	On	Off	On	On	On	Off	On	Off	Off	On	Off	On	On	On	Off	On	On	Off	Off	On	Off	On	On	On
880	Off	Off	On	Off	On	Off	On	On	Off	Off	Off	On	On	On	On	Off	On	Off	Off	On	Off	On	On	On
890	On	On	Off	On	Off	Off	On	Off	On	On	On	Off	On	On	Off	Off	On	Off	Off	On	Off	On	On	On

Frequency	LSB		Switch S1								Switch S2								Switch S3							MSB
(In Khz)	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
900	Off	On	Off	Off	Off	Off	On	On	On	Off	On	Off	On	On	On	On	Off	Off	Off	On	Off	On	On	On
910	Off	Off	Off	On	On	On	Off	Off	Off	Off	On	Off	On	On	Off	On	Off	Off	Off	On	Off	On	On	On
920	On	On	On	On	Off	On	Off	On	Off	On	Off	Off	On	On	On	Off	Off	Off	Off	On	Off	On	On	On
930	Off	On	On	Off	Off	On	Off	Off	On	Off	Off	Off	On	On	Off	Off	Off	Off	Off	On	Off	On	On	On
940	On	Off	On	On	On	Off	Off	On	On	On	On	On	Off	On	On	On	On	On	On	Off	Off	On	On	On
950	On	On	Off	Off	On	Off	Off	Off	Off	On	On	On	Off	On	Off	On	On	On	On	Off	Off	On	On	On
960	Off	On	Off	On	Off	Off	Off	On	Off	Off	On	On	Off	On	On	Off	On	On	On	Off	Off	On	On	On
970	On	Off	Off	Off	Off	Off	Off	Off	On	On	Off	On	Off	On	Off	Off	On	On	On	Off	Off	On	On	On
980	Off	Off	Off	On	On	On	On	Off	On	Off	Off	On	Off	On	On	On	Off	On	On	Off	Off	On	On	On
990	On	On	On	On	Off	On	On	On	On	On	On	Off	Off	On	Off	On	Off	On	On	Off	Off	On	On	On
1000	On	Off	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	Off	Off	On	On	On
1010	Off	Off	On	On	On	Off	On	On	Off	Off	On	Off	Off	On	Off	Off	Off	On	On	Off	Off	On	On	On
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1060	Off	On	On	On	Off	On	Off	Off	On	Off	On	On	On	Off	On	On	Off	Off	On	Off	Off	On	On	On
1070	On	Off	On	Off	Off	On	Off	On	On	On	Off	On	On	Off	Off	On	Off	Off	On	Off	Off	On	On	On
1080	Off	Off	On	On	On	Off	Off	Off	Off	On	Off	On	On	Off	On	Off	Off	Off	On	Off	Off	On	On	On
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1260	Off	On	On	Off	On	On	On	Off	Off	On	On	On	On	On	Off	On	On	On	On	On	On	Off	On	On

Frequency	LSB		Switch S1								Switch S2								Switch S3							MSB
(In Khz)	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
1270	On	Off	On	On	Off	On	On	On	Off	Off	On	On	On	On	On	Off	On	On	On	On	On	Off	On	On
1280	On	On	Off	Off	Off	On	On	Off	On	On	Off	On	On	On	Off	Off	On	On	On	On	On	Off	On	On
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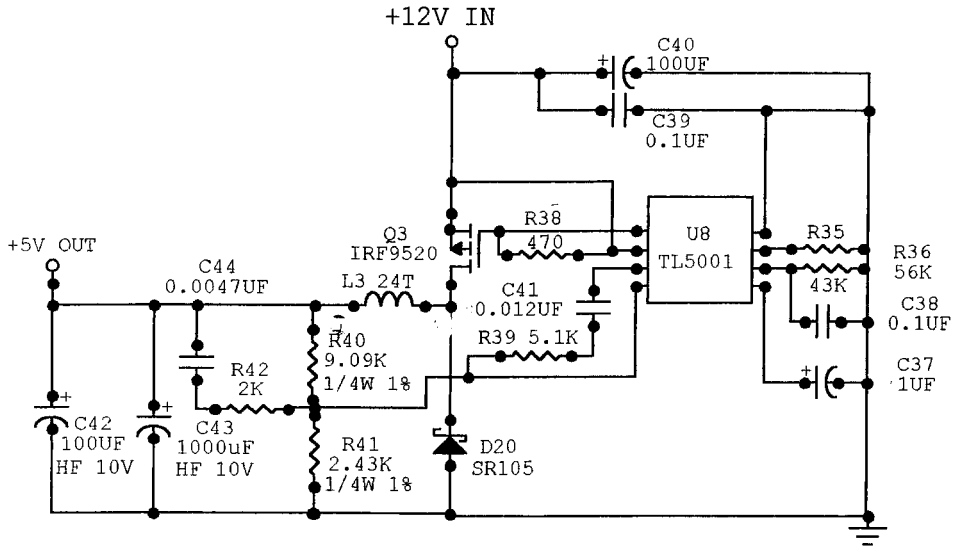
1630	On	Off	Off	Off	Off	On	Off	On	On	Off	On	Off	Off	Off	On	Off	Off	On	On	Off	On	Off	On	On

Frequency	LSB		Switch S1								Switch S2								Switch S3				MSB
(In Khz)	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
1640	Off	Off	Off	On	On	Off	Off	Off	Off	Off	On	Off	Off	Off	Off	Off	Off	On	On	Off	On	Off	On	On
1650	Off	On	On	On	Off	Off	Off	On	Off	On	Off	Off	Off	Off	On	On	On	Off	On	Off	On	Off	On	On
1660	On	Off	On	Off	Off	Off	Off	Off	On	Off	Off	Off	Off	Off	Off	On	On	Off	On	Off	On	Off	On	On
1670	Off	Off	On	On	On	On	On	Off	On	On	On	On	On	On	Off	Off	On	Off	On	Off	On	Off	On	On
1680	On	On	Off	Off	On	On	On	On	On	Off	On	On	On	On	On	On	Off	Off	On	Off	On	Off	On	On
1690	On	Off	Off	On	Off	On	On	Off	Off	Off	On	On	On	On	Off	On	Off	Off	On	Off	On	Off	On	On
1700	Off	Off	Off	Off	Off	On	On	On	Off	On	Off	On	On	On	On	Off	Off	Off	On	Off	On	Off	On	On

Bill of Materials

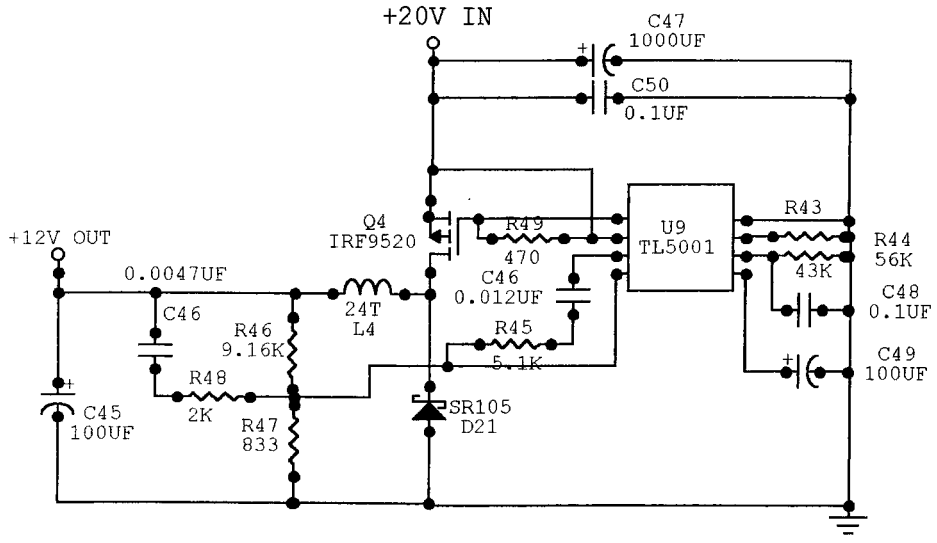
Level	Seq.	Component - Item	Component Description	UOM	Qty.
1	10	11719	TR-6000 BD ASSY VERSION 2V	EA	1.0
2	10	11194	TRIMMER CAP 250-800PF	EA	1.0
2	20	11199	IC TC4423CPA	EA	1.0
2	30	11200	IC TC4424CPA	EA	1.0
2	40	11201	IC SA577	EA	1.0
2	50	11213	COIL 24 TURN	EA	4.0
2	60	11214	COIL 17 TURN	EA	1.0
2	70	11215	COIL 23 TURN	EA	1.0
2	80	11216	COIL 29/31 TURN CT	EA	1.0
2	90	11217	COIL 6/4 TURN CT	EA	1.0
2	100	11712	COIL 35T MULTI-TAP	EA	2.0
2	110	11713	COIL 36T MULTI-TAP	EA	1.0
2	120	11790	TR-6000 BOARD SUB ASSY	EA	1.0
2	130	2840	CHOKE 8 TURN	EA	1.0
2	140	3931	POT 10K VERTICAL SINGLE	EA	2.0
2	150	13011	HEAT SINK 8 PIN DIP	EA	2.0
1	20	11230	TR-6000 CHASSIS	EA	1.0
1	30	11231	TR-6000 COVER	EA	1.0
1	40	11232	CONNECTOR BNC PANEL MOUNT	EA	1.0
1	50	11233	CONNECTOR UHF PANEL MOUNT	EA	1.0
1	60	11258	ROCKER SWITCH ASSEMBLY	EA	2.0
1	70	11720	BOX TR-6000 REV A	EA	1.0
1	80	2936	WASHER #6 FLAT	EA	7.0
1	90	1093	WASHER LOCK #6	EA	7.0
1	100	8047	SCREW 6-32 X 5/8 PH PHIL	EA	7.0
1	110	11049	SCREW 6-32 X 1/4 BH BLACK	EA	16.0
1	120	11293	BNC SOLDER LUG	EA	1.0
1	130	1155	LUG #6 SOLDER	EA	2.0
1	140	11276	KNOB TR-6000 ADJUST .25 SHAFT	EA	2.0
1	150	11235	TR-6000 24V POWER SUPPLY	EA	1.0
1	160	11337	TR-6000 MANUAL	EA	1.0
1	170	3126	FEET BUMP-ON	EA	1.0
1	180	9399	BUMPON TAPERED SQUARE	EA	1.0

TR-6000 FIVE VOLT SWITCHING REGULATOR



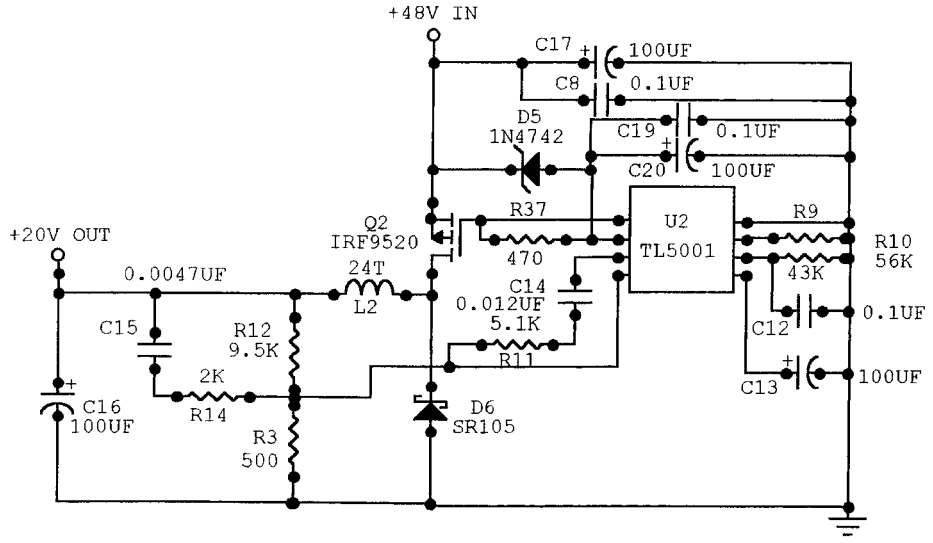
Pulse-width-modulation controller U8, switching transistor Q3, diode D20, inductor L3 and capacitor C43 comprise the main components of the regulator. The gate drive of Q3 is a square voltage pulse from U8, the width of which varies in relation to the feedback from the five volt output of the regulator. D20 is a schottky barrier rectifier diode which allows the continued flow of DC current during the interval when Q3 is off. When Q3 is on, D20 is biased off, and the current in L3 in excess of the load current charges C43. When Q3 switches off, D20 is biased on. The current in L3 starts to decrease, reversing the voltage across L3. C43 tends to maintain that voltage constant and the current in L3 decreases linearly until Q3 switches on again.

TR-6000 TWELVE VOLT SWITCHING REGULATOR



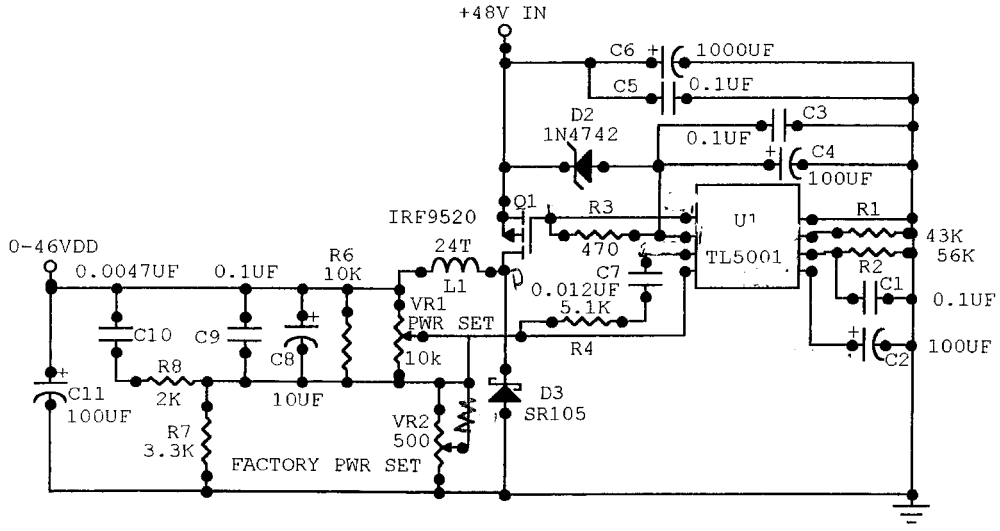
Pulse-width-modulation controller U9, switching transistor Q4, diode D21, inductor L4 and capacitor C45 comprise the main components of the regulator. The gate drive of Q4 is a square voltage pulse from U9, the width of which varies in relation to the feedback from the twelve volt output of the regulator. D21 is a schottky barrier rectifier diode which allows the continued flow of DC current during the interval when Q4 is off. When Q4 is on, D21 is biased off, and the current in L4 in excess of the load current charges C45. When Q4 switches off, D21 is biased on. The current in L4 starts to decrease, reversing the voltage across L4. C45 tends to maintain that voltage constant and the current in L4 decreases linearly until Q4 switches on again.

TR-6000 TWENTY VOLT SWITCHING REGULATOR



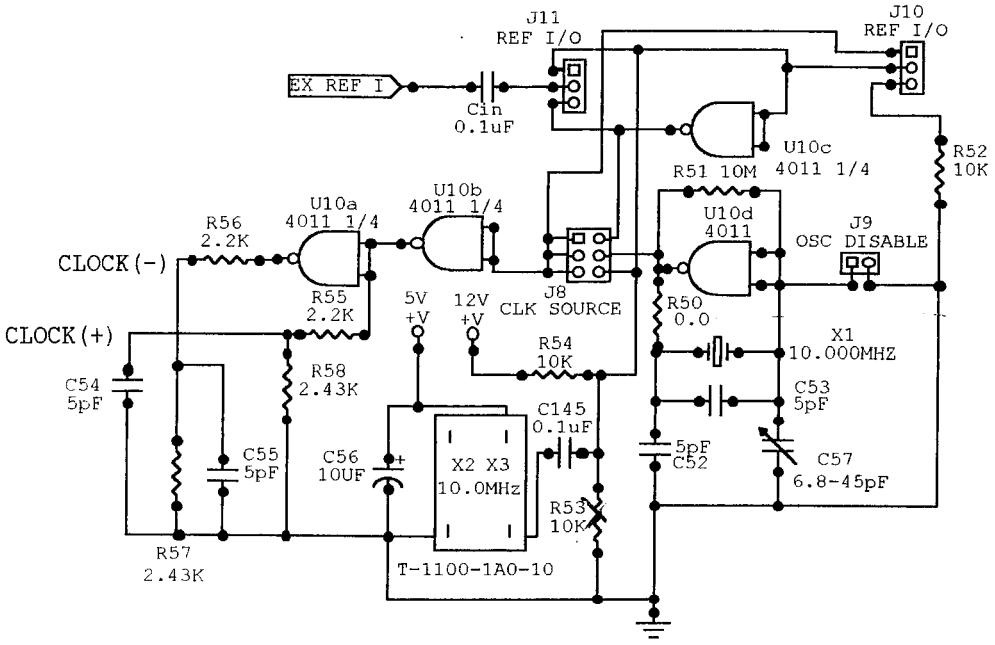
Pulse-width-modulation controller U2, switching transistor Q2, diode D6, inductor L2 and capacitor C16 comprise the main components of the regulator. The gate drive of Q2 is a square voltage pulse from U2, the width of which varies in relation to the feedback from the twenty volt output of the regulator. D6 is a schottky barrier rectifier diode which allows the continued flow of DC current during the interval when Q2 is off. When Q2 is on, D6 is biased off, and the current in L2 in excess of the load current charges C16. When Q2 switches off, D6 is biased on. The current in L2 starts to decrease, reversing the voltage across L2. C16 tends to maintain that voltage constant and the current in L2 decreases linearly until Q2 switches on again. Zener diode D5 is in series with the 48 volt input and drops twelve volts to reduce U2's VCC to 36 volts.

TR-6000 VARIABLE VOLTAGE SWITCHING REGULATOR



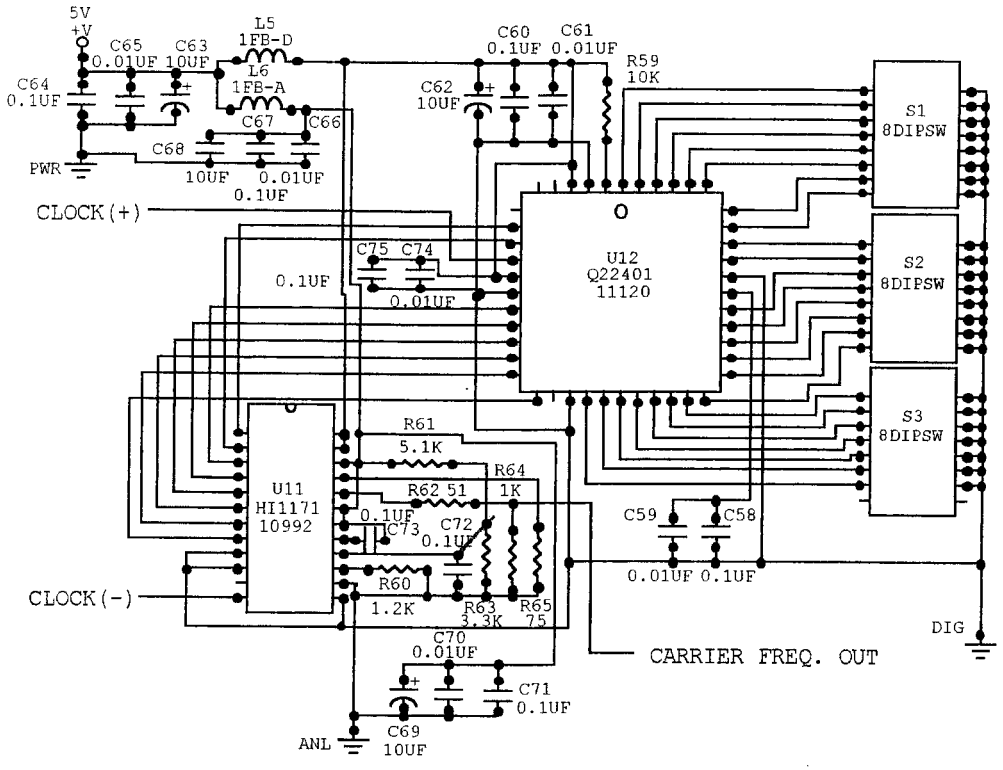
Pulse-width-modulation controller U1, switching transistor Q1, diode D3, inductor L1 and capacitor C11 comprise the main components of the regulator. The gate drive of Q1 is a square voltage pulse from U1, the width of which varies in relation to the adjustable feedback from the variable voltage output of the regulator. D3 is a schottky barrier rectifier diode which allows the continued flow of DC current during the interval when Q1 is off. When Q1 is on, D3 is biased off, and the current in L1 in excess of the load current charges C11. When Q1 switches off, D3 is biased on. The current in L1 starts to decrease, reversing the voltage across L1. C11 tends to maintain that voltage constant and the current in L1 decreases linearly until Q1 switches on again. Zener diode D2 is in series with the 48 volt input and drops twelve volts to reduce U1's VCC to 36 volts.

TR-6000 BI-PHASE REFERANCE OSCILLATOR CIRCUIT



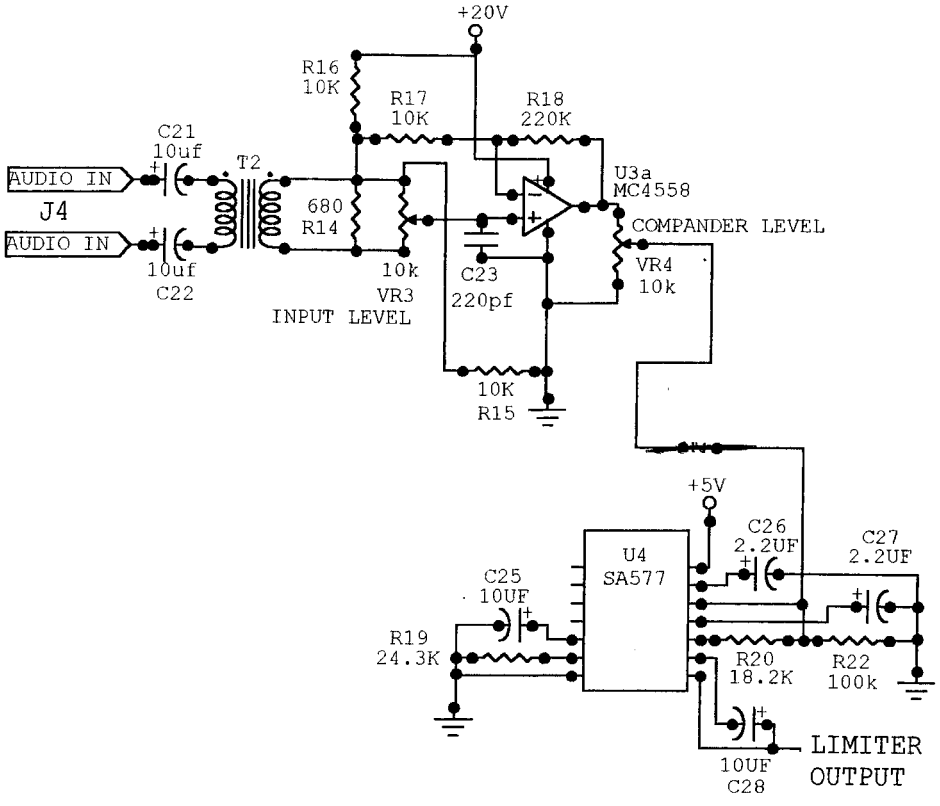
U10d and crystal X1 are configured as the standard inverter oscillator. The output is buffered and inverted by U10b producing the "Clock (+)" signal. Clock (+) is then inverted by U10a producing the "Clock (-)" signal. U10c is configured as an inverting buffer for X2 and X3 TCXO options and external GPS reference standards.

TR-6000 NUMERICALLY CONTROLLED OSCILLATOR CIRCUIT



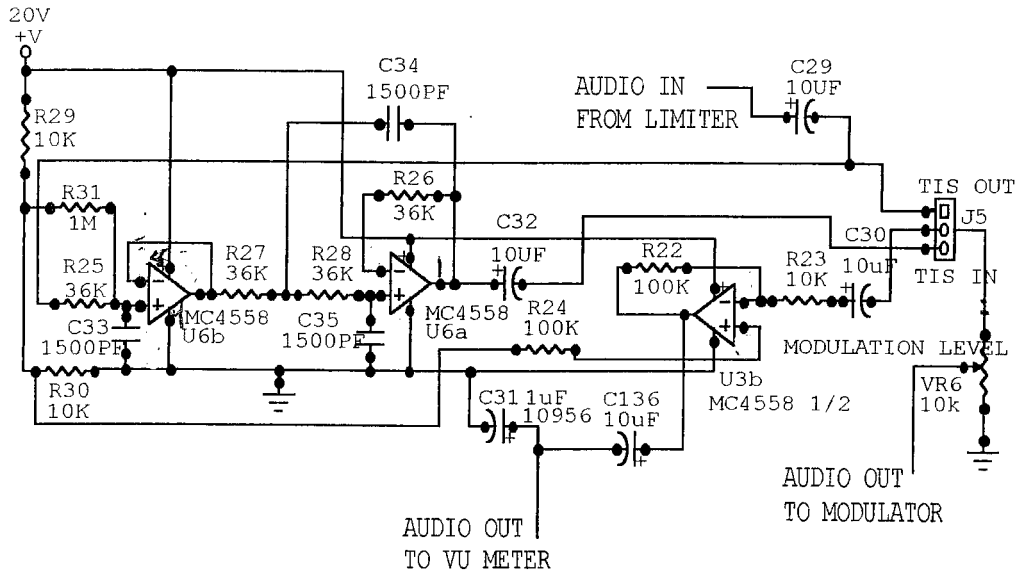
U12, a Q22401 direct digital synthesizer ASIC, along with U11, an eight bit D/A converter, generate the TR-6000 carrier frequency. DIP switches S1, S2 and S3 program the phase increment value for the desired carrier frequency. U12 generates the sine amplitude binary word output that is fed to U11's digital input. The sine amplitude value is converted into a sine waveform of the carrier frequency by U11.

TR-6000 AUDIO INPUT AMPLIFIER AND LIMITER CIRCUIT



U3a is configured as a transformer isolated non-inverting amplifier with a variable gain of zero to twenty two. The output of U3a feeds the input of U4, an SA577 unity gain level compandor. The compressor side of U4 is configured as a feed-forward hard limiter with a fast attack time (22mS) and slow release time(88mS). The expander side of U4 is not used in this circuit.

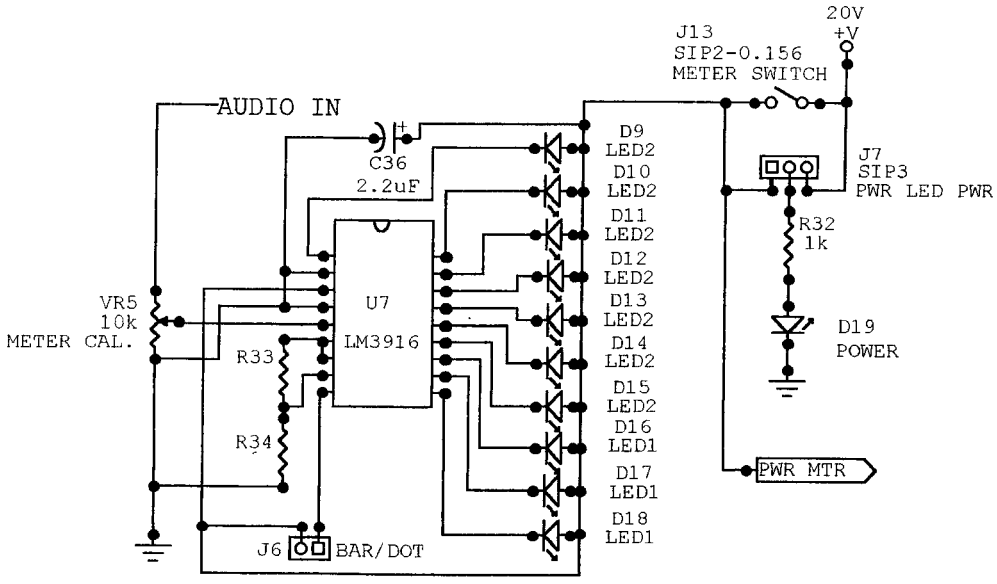
TR-6000 TIS AUDIO FILTER AND VU METER DRIVER CIRCUITS



U6 is configured as a third order voltage-controlled voltage source low-pass filter. Resistor R25 and capacitor C33 form the first pole with a cutoff frequency of 2947Hz. U6b provides unity gain. The second pole, resistor R27 and capacitor C34, and the third pole, resistor R28 and capacitor C35, along with U6a form a unity gain second order low-pass filter with a cutoff frequency also of 2947Hz. U6b and U6a are cascaded to provide the -60dB per Decade roll-off required by the FCC regulations.

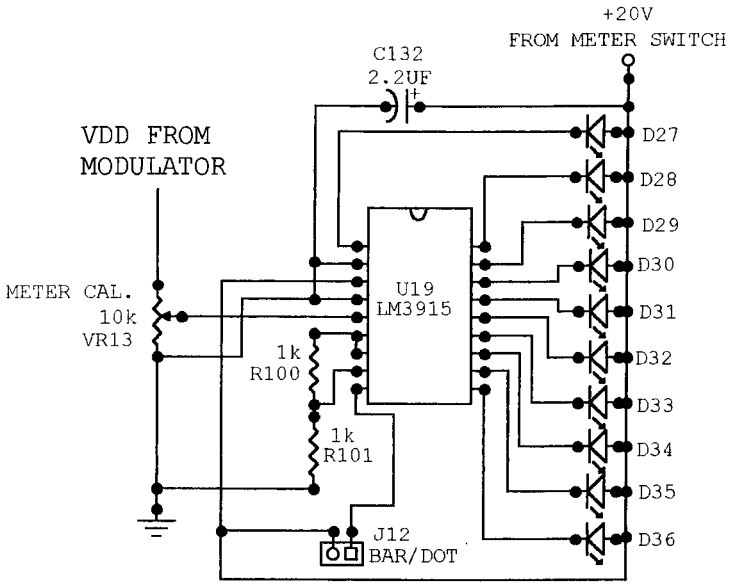
U3b is configured as a simple inverting amplifier with a gain of ten to provide isolation and adequate drive to the VU meter circuit.

TR-6000 AUDIO INPUT VU METER CIRCUIT



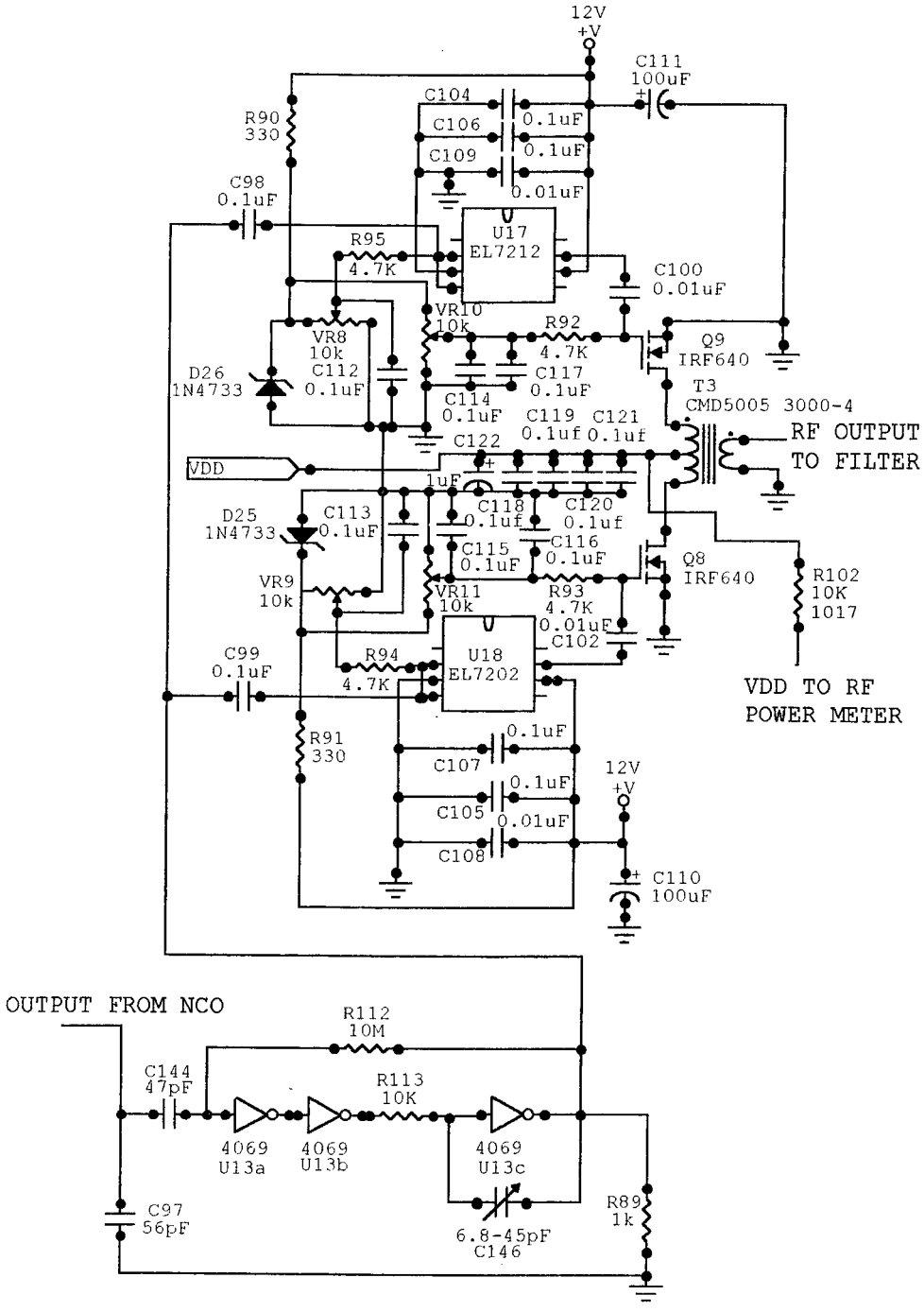
U7, an LM3916 VU responding dot/bar display driver, senses analog voltage levels present on pin five (modulation audio) and drives the ten LED's (D9 - D18) comprising the input audio VU meter display. Meter calibration is accomplished by potentiometer VR5, with LED D15 representing zero VU. LED D19 is the power present indicator.

TR-6000 RF OUTPUT POWER METER CIRCUIT



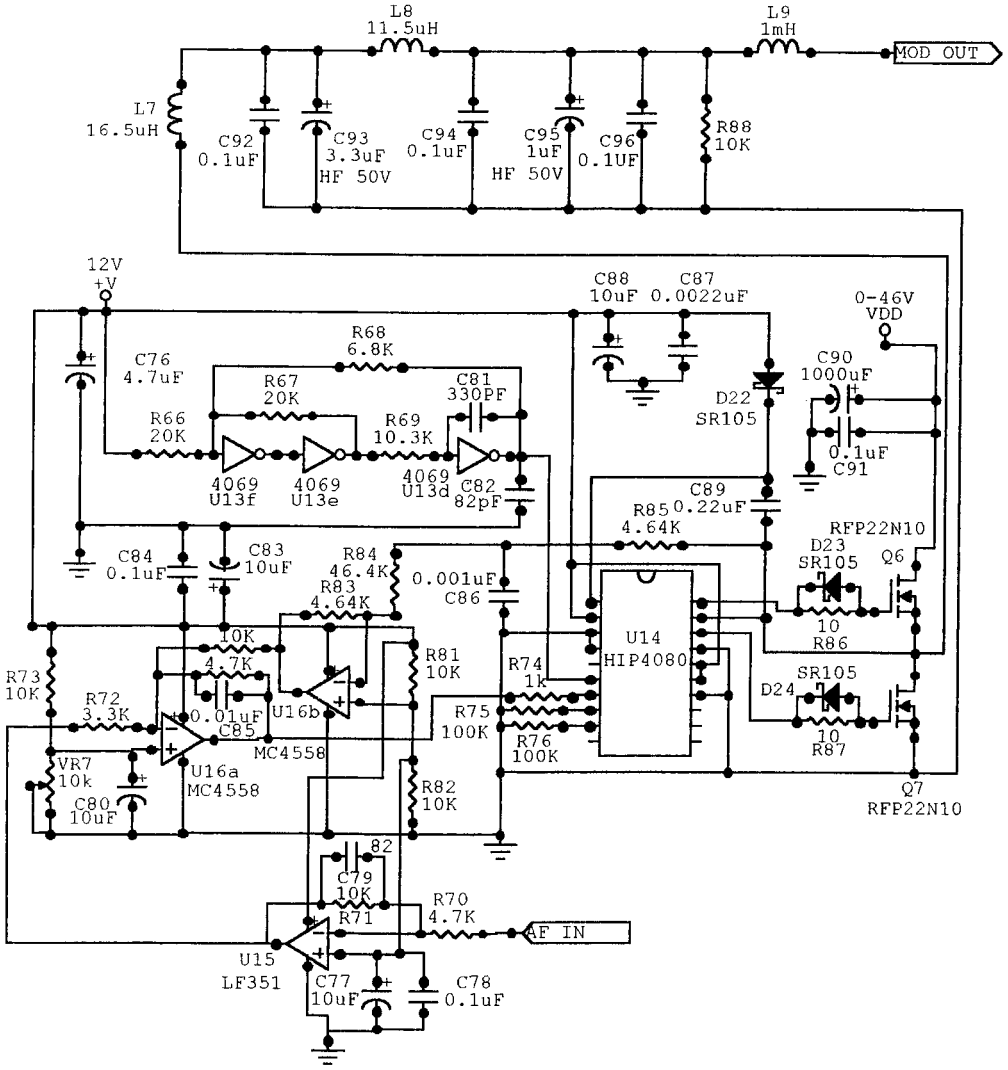
U19, an LM3915 logarithmic responding dot/bar display driver, senses analog voltage levels present on pin five (modulator VDD) and drives the ten LED's (D27 - D36) comprising the RF power output meter display. Meter calibration is accomplished by potentiometer VR13, with LED D34 representing 30 watts.

TR-6000 CLASS D RF POWER AMPLIFIER



The carrier frequency signal from the NCO D/A converter is amplified and converted into a triangle wave by U15a, U15b and U15c. This signal is fed to the matched driver IC's, U17 and U18. Zener diodes D25 and D26 are used as bias regulators for U17 and U18 (duty cycle adjustment) and for the final transistors Q8 and Q9 (forward bias). The gates of Q8 and Q9 are fed differentially from U17 and U18 respectively. The drains of Q8 and Q9 are connected to the primary of the output transformer T3 and are fed VDD through the center tap. The secondary side of T3 provides power to the output filter section.

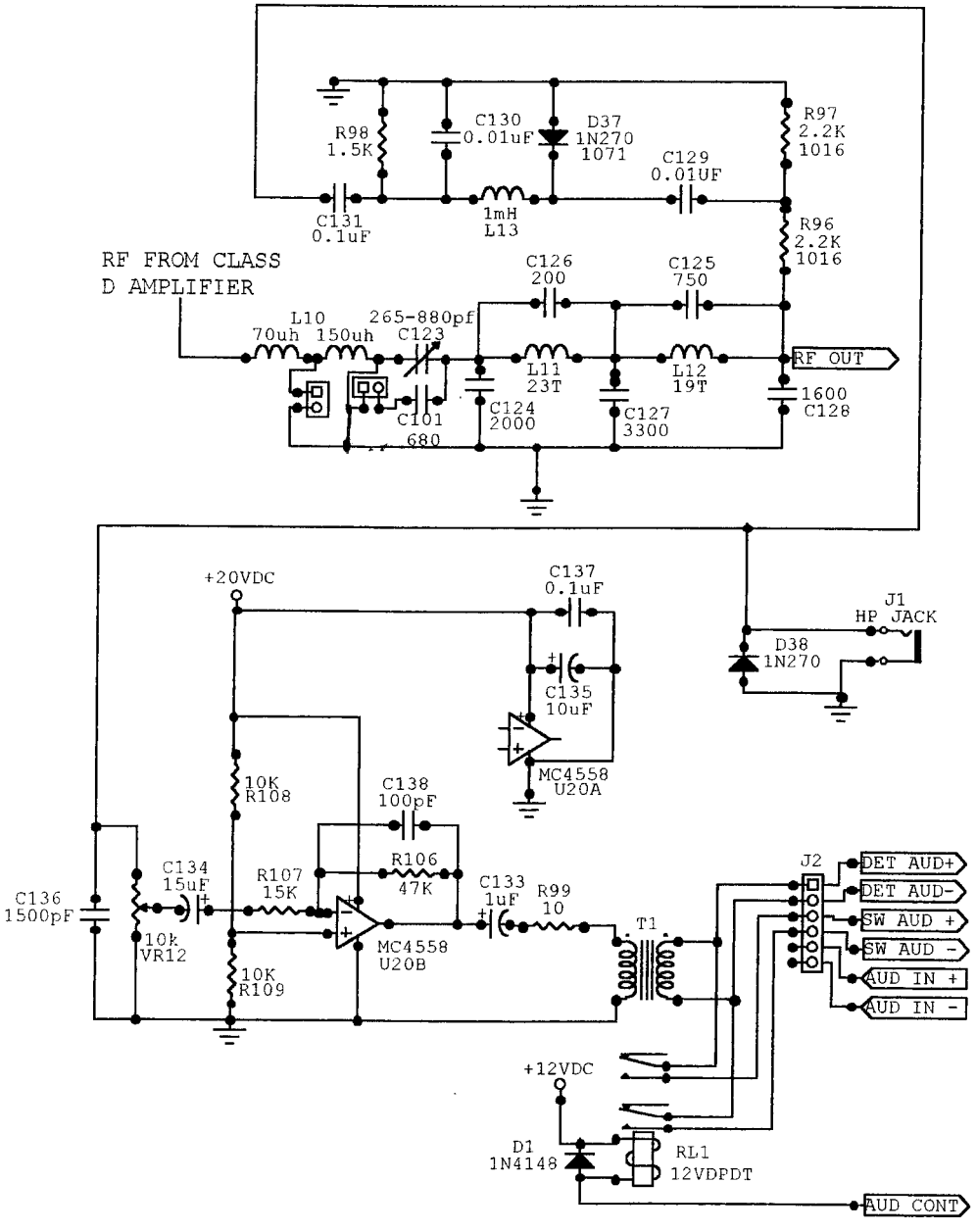
TR-6000 CLASS S AMPLITUDE MODULATOR CIRCUIT



U14, a Harris HIP4080A high frequency H bridge driver, along with transistors Q6 and Q7, operational amplifiers U15 and U16 and inverters U13d, U13e and U13f are the main components of the amplitude modulator. U13d, U13e and U13f are configured as a triangle wave generator for the U14 input comparator. U15 is configured as a simple inverting amplifier used to pre-amplify the audio input signal by a factor of 2.1. U16a and U16b comprise the feedback amplifier and input mixer. The feedback amplifier U16b has a gain of 0.1. The input audio and feedback signals are combined and fed to U14 by U16a. Only half of H bridge driver is utilized to drive the complementary voltage switching transistors Q6 and Q7. The output from Q6 and Q7 is then filtered by the low-pass filter formed by inductors L7 and L8 and capacitors

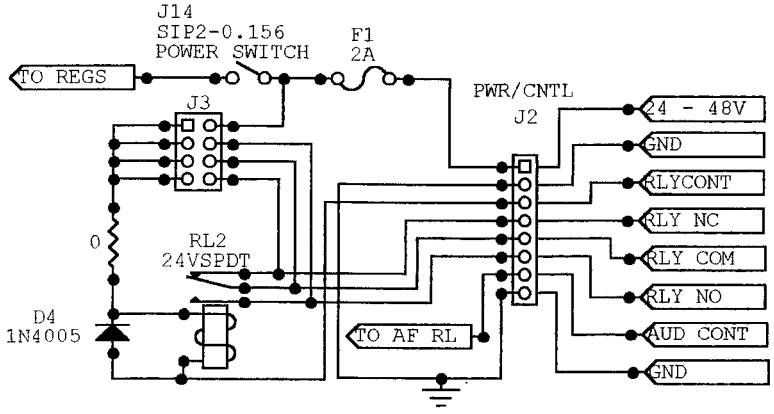
supply for the high side output gate drive. Diodes D23 and D24 shunt the gate resistors R86 and R87 respectively improving the switching performance of transistors Q6 and Q7.

TR-6000 RF OUTPUT FILTER AND DETECTOR CIRCUIT



The output of the class D RF power amplifier is fed to series tuned LC filter, comprised of inductor L10 and capacitors C123 and C101 and then to an elliptical low pass filter. The low pass filter consists of capacitors C124, C125, C126, C127 and C128 and inductors L11 and L12. Diodes D37 and D38 are envelope detectors for headphone and monitor audio. Operational amplifier U20b is configured as an inverting amplifier with an adjustable gain of zero to 3.1 to drive the monitor audio and switched monitor audio outputs. U20a is not used in this circuit. Diode D1 is the counter EMF diode for switched monitor audio relay RL1's coil.

TR-6000 POWER CONTROL RELAY



Relay RL2 is used for remote control of the transmitter input power supply. Header J3 allows the relay to be configured with jumpers so the relay coil can be energized by the main power input or any of the relay contacts. Diode D4 is the coil counter EMF diode.

Warranty

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Repair Policy

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During the warranty period, shipment of small parts and assemblies may also be made at a charge to the user. Emergency shipments of replacement parts and circuits will be made at the user's request for an extra shipping and service charge. Chargeable services will be made COD or on Net-30 day terms to users with established accounts.

During the warranty period, full credit or return of COD charges (less any service and expedited shipping charges) will be made to users who return the defective parts or circuits within 30 days, if the damage is covered under the terms of the warranty.

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Pack all items carefully and ship prepaid, via UPS insured, to:

Radio Systems, Inc.
Attn: R.A. # _____
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Enclose a note that includes your name, company, phone number, the serial number, return address (no box numbers), and a complete description of the problem.

For Assy:
Part #11234
2/06

601 Heron Drive
Logan Township, NJ 08085
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