

SYSTEMS

TR-6000 RF OUTPUT POWER MEASUREMENTS

FINAL FET VOLTAGE, CURRENT, POWER AND EFFICIENCY

VDD POWER 1700KHz
VDC OUT AMPS EFF

21.3V 30W 1.92A 73%

19.5V 25W 1.76A 73%

17.7V 20W 1.60A 71%

15.0V 15W 1.37A 73%

12.2V 10W 1.13A 73%

8.6V 5W 0.82A 71%

2.6V 0.5W 0.28A 69%

VDD POWER 530KHz

VDC OUT AMPS EFF

17.9V 30W 2.31A 73%

16.1V 25W 2.08A 75%

14.5V 20W 1.89A 73%

12.2V 15W 1.61A 76%

9.9V 10W 1.31A 77%

6.9V 5W 0.93A 78%

2.1V 0.5W 0.29A 82%

REF LOAD

RESISTANCE: 50.0 OHMS

RETURN LOSS: -38dB

Date: 8-31-98

Test performed by: T.E.M. *TEM*

EXHIBIT-E

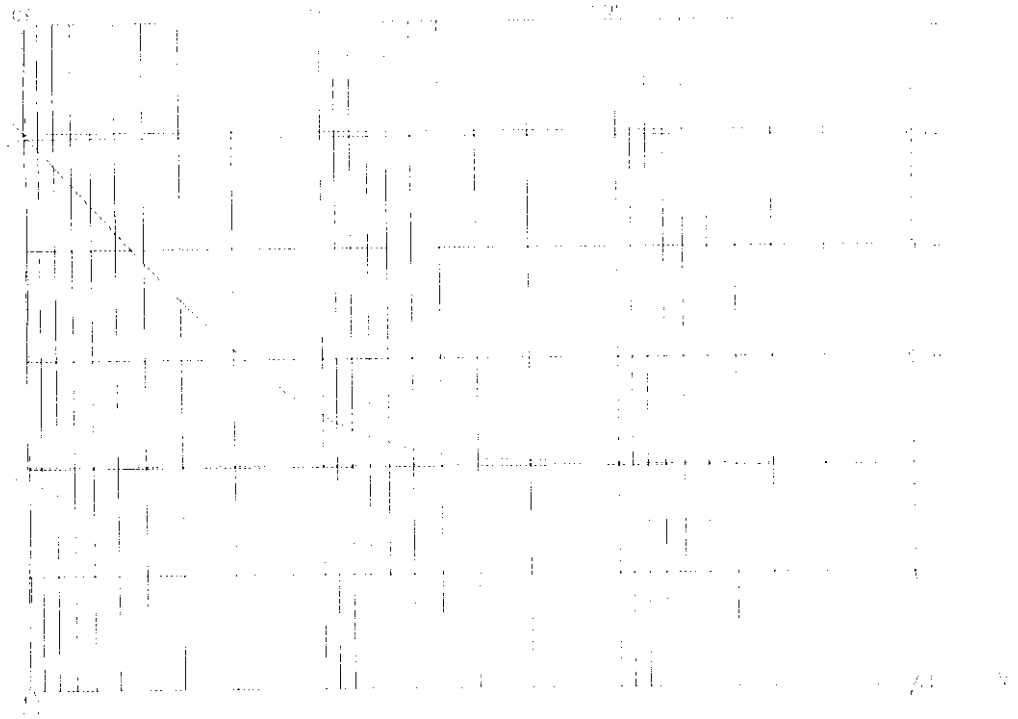
B7MTR-6000TIS-WB

TR-6000 MODULATION FREQUENCY RESPONSE

RELATIVE FREQUENCY RESPONSE AT 90% MODULATION

MODULATING FREQUENCY Hz	RELATIVE RESPONSE dB
20	-0.3
100	+0.9
200	+0.6
500	+0.5
1000	-0-
2000	-2.8
3000	-6.0
4000	-10
5000	-15

Audio Low-Pass Filter Response Curve



SYSTEMS

601 Heron Drive, Bridgeport, NJ 08014-0458 • 609-467-8000 voice • 609-467-3044 fax • www.radiosystems.com

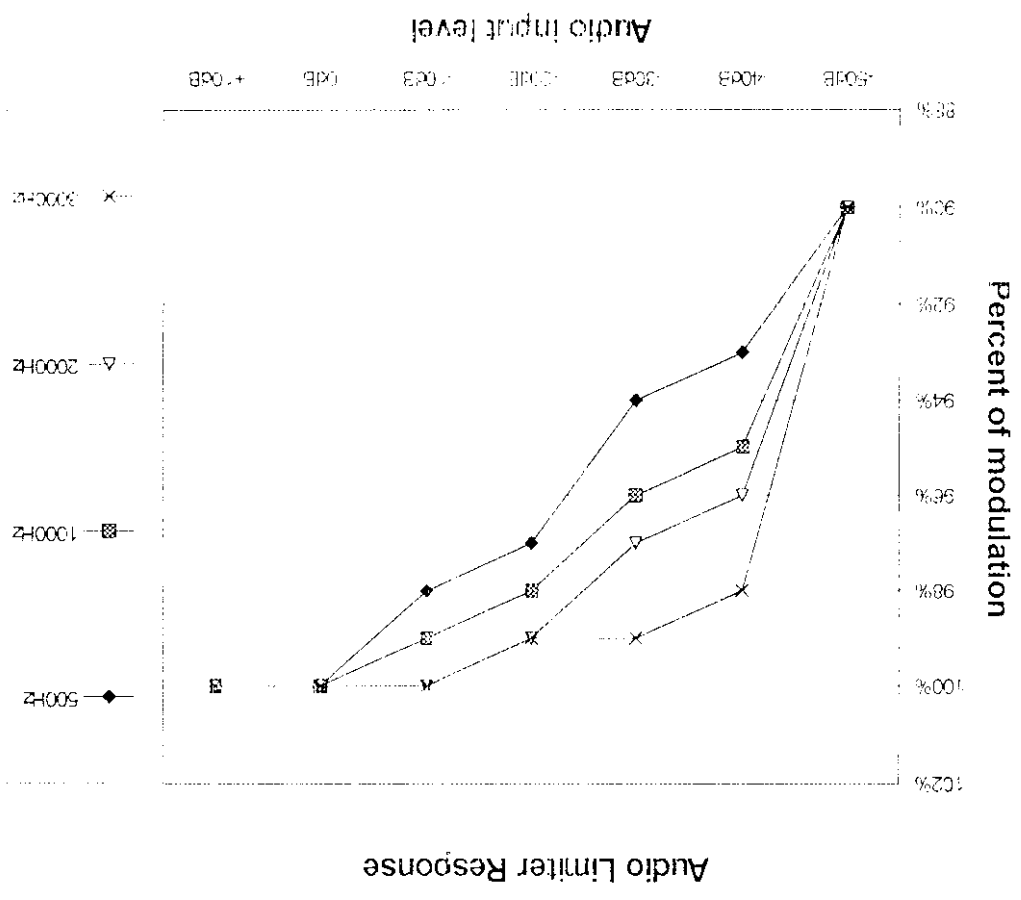
Test performed by T.E.M. 6/2/98
EXHIBIT-F
H7MT8-000113-WB
1

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S Y S T E M S

AUDIO LIMITER RESPONSE

	500Hz	1000Hz	2000Hz	3000Hz
-50dB	90%	90%	90%	90%
-40dB	93%	95%	96%	98%
-30dB	94%	96%	97%	99%
-20dB	97%	98%	99%	99%
-10dB	98%	99%	100%	100%
0dB	100%	100%	100%	100%
+10dB	100%	100%	100%	100%



Test performed by T.B.M.
 EXHIBIT-F
 B7N/IR-600/ITS-WB
 2

TR-6000 OCCUPIED BANDWIDTH

Transmitter modulated with 2500Hz at 16dB above 50% modulation at the frequency of maxim response.

Carrier Frequency:

530KHz

1110KHz

1700KHz

4.9KHz

4.7KHz

4.9KHz

Bandwidth at which the mean powers radiated are equal to 0.5% of total mean power radiated.

SYSTEMS ●

Test performed by: T.E.M. *TE M*

Date: 8-31-98

EXHIBIT-G

B7MTR-6000TIS-WB

1

TR-6000 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Transmitter modulated with 2500Hz at 16dB above 50% modulation at the frequency of maxim response.

Carrier Frequency:

530KHz

1110KHz

1700KHz

Spur Freq. KHz	Atten. -dBc	Spur Freq. KHz	Atten. -dBc	Spur Freq. KHz	Atten. -dBc
1060	-47	2025	-38	3400	-48
1252	-55	2220	-48	5100	-44
1590	-36	4440	-72	6800	-72
2120	-58			8500	-72
2650	-74			10200	-77
3180	-76			20400	-75

SYSTEMS

Test performed by: T.E.M. *T.E.M.*

Date: 8-31-98

EXHIBIT-H

B7MTR-6000TIS-WB

TR-6000 FREQUENCY STABILITY

CARRIER FREQUENCY STABILITY WITH TEMPERATURE

Vin: 48VDC Fc:1700kHz

Temp.

deg. C: -30 -20 -10 0 10 20 25 30 40 50

Dev.:Hz:

X1: +4.6 +6.6 +9.2 +10.4 +7.0 +3.9 0 -8.5 -6.3 -11.2

X2: +0.7 +0.5 +0.5 +0.3 +0.2 +0.2 0 -0.2 -0.3 -0.5

X3: -6.6 -1.9 +0.3 +0.3 +0.5 +0.3 0 +0.3 +0.9 +1.9

CARRIER FREQUENCY STABILITY WITH INPUT VOLTAGE

Deviation from nominal frequency at 25 deg. C. Fc:1700kHz

Vin: 40.8VDC 44.4VDC 48VDC 51.6VDC 55.2VDC

Dev.:Hz:

X1 0 0 0 0 0

X2 0 0 0 0 0

X3 0 0 0 0 0

CARRIER FREQUENCY STABILITY WITH EXTERNAL 10 MHz GPS REFERENCE INPUT

(Worst case Fc:1700KHz)

24 hour average: 0.000005ppM Max. Dev.:0.0000085Hz

7 day average: 0.0000001ppM Max. Dev.:0.00000017Hz

Test performed by T.E.M. *KEAN* Date:9-1-98

EXHIBIT-I

B7MTR-6000TIS-WB

1

TR-6000 AM Broadcast Transmitter

Operating Instructions

Overview

The TR-6000 is a solid-state, class D AM transmitter specifically 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 30 watt output power, short circuit protection, balanced audio inputs and monitor output and headphone output. The TR-6000 is shipped factory set for 10-watt or 30-watt operation. 10-watt units are provided with a 24-volt external power supply, and 30-watt units are provided with a 48-volt supply.

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 @ .5 ppm

Front Panel Controls

Power switch – supplies DC to the unit

Do not power up without an 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 applied) to desired carrier level on 10 or 30 watt scale.

Mod(ulation) adjust – set for 100% modulation on VU meter

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

Connections

Caution – Make all connections 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 (for 10 watt operation) or 48 volts (for 30 watt operation) to 24 volt terminals via DC transformer connector **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 power 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 AND TEST POINT LOCATIONS

J3 - Power control relay configuration

J5 - TIS audio filter enable

J6 - VU meter display mode

J7 - Power LED mode

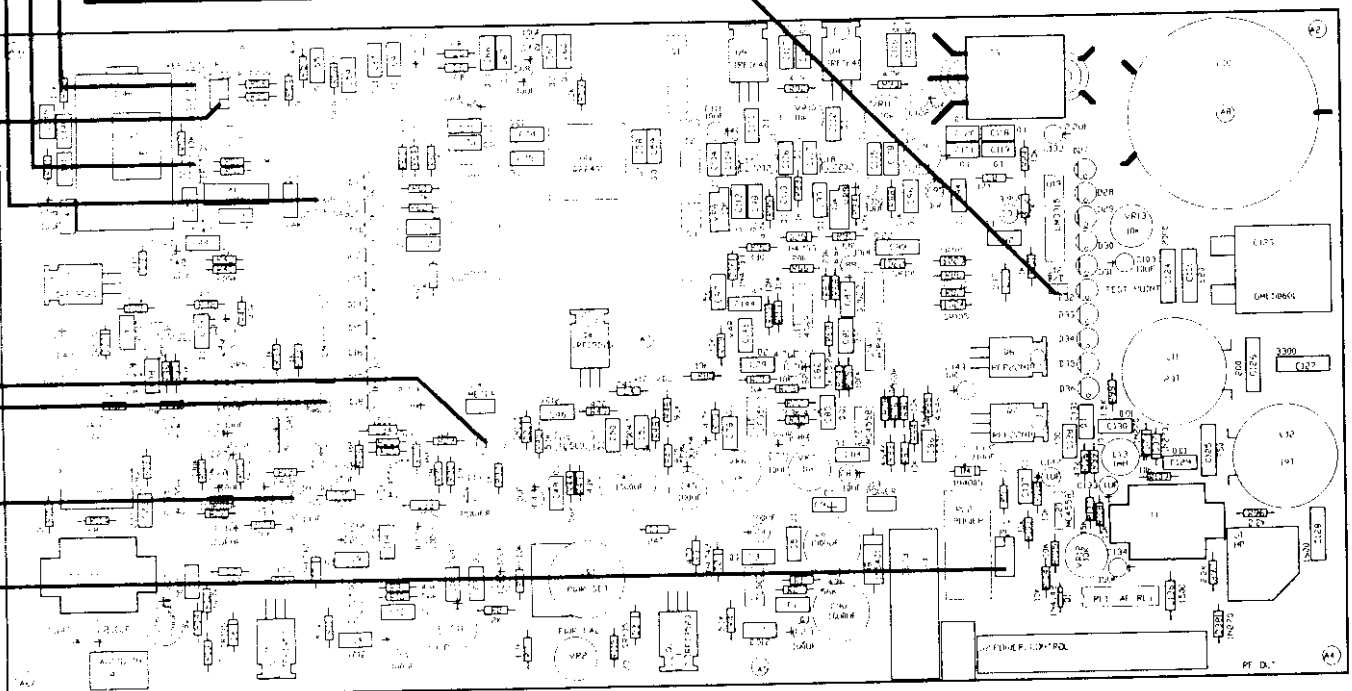
J8 - Clock source

J9 - Standard oscillator disable

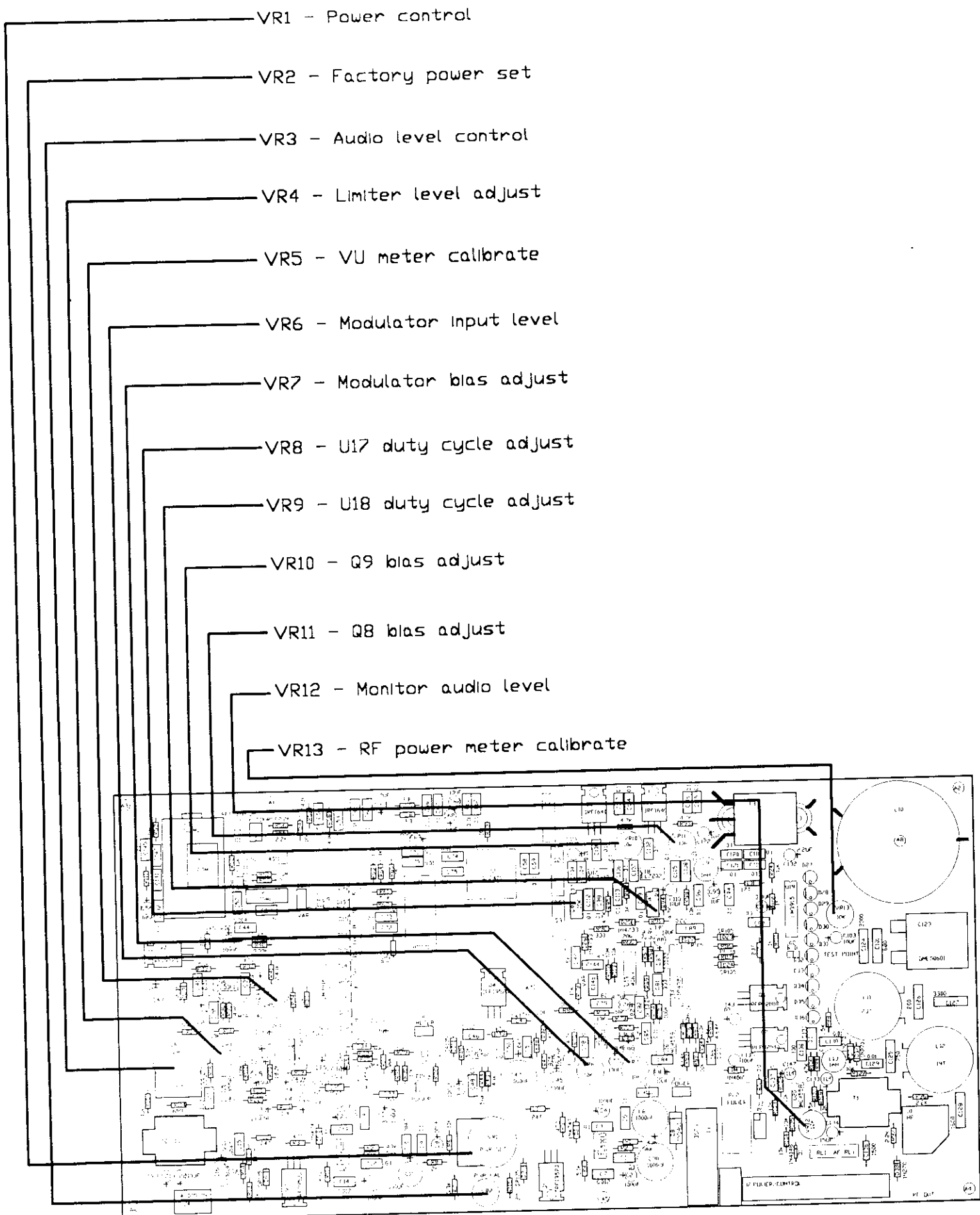
J10 - Reference I/O

J11 - Reference I/O

J12 - Power meter display mode



TR-6000 USER ADJUSTMENTS AND CALIBRATION LOCATIONS



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 it's 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 10MHz.
8. Check U13 pin one for the carrier frequency.
9. Adjust C146 for five volts peak to peak on U13 pin one.
10. Adjust VR8 for a 40% duty cycle square wave at U17 pin five.
11. Adjust VR9 for a 40% duty cycle square wave at U18 pin five.
12. Adjust VR1 for ten volts on the drain of Q6.
13. Adjust VR7 for five volts on the center tap of T3.
14. Adjust C123 for maximum power output.
15. Increase VR1 to it's maximum position and adjust VR2 for the desired maximum power. (not to exceed 30W)
16. Increase VR10 and VR11 until their effect on output power diminishes.
17. Reset VR2.
18. Calibrate the RF power meter with VR13.
19. Apply a 1KHz audio signal to J4.
20. Adjust VR3, VR4 and VR6 for 90% - 100% modulation from the point of clipping the input amplifier to the bottom end of the limiter's input range.
21. Calibrate the VU meter with VR5.
22. Check the audio frequency response, carrier frequency and RF spectral purity of the unit.
23. Seal all potentiometers except VR1 and VR3.

TR-6000 TEST PROCEDURE

1. Check the circuit board for solder shorts and bad solder joints.
2. Check for proper installation of diodes, transistor and IC's.
3. Set all potentiometers to their center position.
4. Install jumper on J7 pins one and two.
5. Install jumper on J5 pins one and two.
6. Remove U12.
7. Set dip switches S1, S2 and S3 for the desired output frequency.
8. Apply power to the unit and check for the power LED to illuminate.
9. Check the output of the variable regulator, twenty volt regulator, twelve volt regulator and the five volt regulator.
10. Install jumper J8-A.
11. Measure the oscillator frequency at U11 pin 13.
12. Adjust C57 for an oscillator frequency of 10MHz.
13. Turn off the power and install U12.
14. Power up the unit and check U13 pin one for the carrier frequency.
15. Adjust C146 for five volts peak to peak on U13 pin six.
16. Adjust VR8 for a 40% duty cycle square wave at U17 pin five.
17. Adjust VR9 for a 40% duty cycle square wave at U18 pin five.
18. Adjust VR1 for ten volts on the drain of Q6.
19. Adjust VR7 for five volts on the center tap of T3.
20. Adjust C123 for maximum power output.
21. Increase VR1 to it's maximum position and adjust VR2 for the desired maximum power. (not to exceed 30W)
22. Increase VR10 and VR11 until their effect on output power diminishes.
23. Reset VR2
24. Calibrate the RF power meter with VR13.
25. Apply a + 20 dBm, 1KHz audio signal to J4.
26. Adjust VR3 fully clockwise
27. Adjust VR4 for 90% modulation at the point of clipping the input amplifier
28. Reduce the audio generator level by 40 dB and adjust VR6 for 90% modulation at the limiter threshold
29. Enable the TIS filter by moving the J5 jumper to pins two and three.
30. Re-adjust VR6 for 90% modulation.
31. Calibrate the VU meter with VR5
32. Check the audio frequency response, carrier frequency and RF spectral purity of the unit.
33. Seal all potentiometers except VR1 and VR3.
34. Install the circuit board in the chassis and install the top cover.
35. Turn the unit on and re-adjust C123 for maximum power output.

LOWER FREQUENCY LIMIT : 5.3000000000E+05 Hz
UPPER FREQUENCY LIMIT : 1.7000000000E+06 Hz
CHANNEL SPACEING : 1.0000000000E+04 Hz
SYSTEM CLOCK FREQUENCY : 1.0000000000E+07 Hz
ACCUMULATOR SIZE : 2.4000000000E+01 BITS
FREQUENCY RESOLUTION : 5.9604644775E-01 Hz

5.2999973297E+05 Hz	8.8919200000E+05	00011011001000101101000
5.4000020027E+05 Hz	9.0597000000E+05	00011011101001011110010
5.5000007153E+05 Hz	9.2274700000E+05	00011100001010001111011
5.5999994278E+05 Hz	9.3952400000E+05	000111001010111000000100
5.6999981403E+05 Hz	9.5630100000E+05	000111010010111110001101
5.8000028133E+05 Hz	9.7307900000E+05	00011101101100100010111
5.9000015259E+05 Hz	9.8985600000E+05	00011110001101010100000
6.0000002384E+05 Hz	1.0066330000E+06	00011110101110000101001
6.0999989510E+05 Hz	1.0234100000E+06	00011111001110110110010
6.1999976635E+05 Hz	1.0401870000E+06	00011111101111100111011
6.3000023365E+05 Hz	1.0569650000E+06	00100000010000011000101
6.4000010490E+05 Hz	1.0737420000E+06	00100000110001001001110
6.4999997616E+05 Hz	1.0905190000E+06	00100001010001111010111
6.5999984741E+05 Hz	1.1072960000E+06	00100001110010101100000
6.6999971867E+05 Hz	1.1240730000E+06	001000100100111011101001
6.8000018597E+05 Hz	1.1408510000E+06	00100010110100001110011
6.9000005722E+05 Hz	1.1576280000E+06	00100011010100111111100
6.9999992847E+05 Hz	1.1744050000E+06	00100011110101110000101
7.0999979973E+05 Hz	1.1911820000E+06	00100100010110100001110
7.2000026703E+05 Hz	1.2079600000E+06	00100100110111010011000
7.3000013828E+05 Hz	1.2247370000E+06	00100101011000000100001
7.4000000954E+05 Hz	1.2415140000E+06	00100101111000110101010
7.4999988079E+05 Hz	1.2582910000E+06	00100110011001100110011
7.5999975204E+05 Hz	1.2750680000E+06	00100110111010010111100
7.7000021935E+05 Hz	1.2918460000E+06	00100111011011001000110
7.8000009060E+05 Hz	1.3086230000E+06	00100111111011111001111
7.8999996185E+05 Hz	1.3254000000E+06	00101000011100101011000
7.9999983311E+05 Hz	1.3421770000E+06	00101000111101011100001
8.0999970436E+05 Hz	1.3589540000E+06	00101001011110001101010
8.2000017166E+05 Hz	1.3757320000E+06	00101001111110111110100
8.3000004292E+05 Hz	1.3925090000E+06	00101010011111101111101
8.3999991417E+05 Hz	1.4092860000E+06	00101011000000100000110
8.4999978542E+05 Hz	1.4260630000E+06	00101011100001010001111
8.6000025272E+05 Hz	1.4428410000E+06	00101100000010000011001
8.7000012398E+05 Hz	1.4596180000E+06	00101100100010110100010
8.7999999523E+05 Hz	1.4763950000E+06	00101101000011100101011
8.8999986649E+05 Hz	1.4931720000E+06	00101101100100010110100
8.9999973774E+05 Hz	1.5099490000E+06	00101110000101000111101
9.1000020504E+05 Hz	1.5267270000E+06	00101110100101111000111
9.2000007629E+05 Hz	1.5435040000E+06	00101111000110101010000
9.2999994755E+05 Hz	1.5602810000E+06	00101111100111011011001
9.3999981880E+05 Hz	1.5770580000E+06	00110000001000001100010
9.5000028610E+05 Hz	1.5938360000E+06	00110000101000111101100
9.6000015736E+05 Hz	1.6106130000E+06	00110001001001101110101
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1.0000002384E+06 Hz	1.6777220000E+06	00110011001100110011010
1.0100001097E+06 Hz	1.6944990000E+06	00110011101101100100011
1.0199999809E+06 Hz	1.7112760000E+06	00110100001110010101100

1.0299998522E+06 Hz	1.7280530000E+06	001101001011111000110101
1.0399997234E+06 Hz	1.7448300000E+06	00110101001111110111110
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1.0900002718E+06 Hz	1.8287170000E+06	00110111110011101101101
1.1000001431E+06 Hz	1.8454940000E+06	00111000010100011110110
1.1100000143E+06 Hz	1.8622710000E+06	00111000110101001111111
1.1199998856E+06 Hz	1.8790480000E+06	00111001010110000001000
1.1299997568E+06 Hz	1.8958250000E+06	00111001110110110010001
1.1400002241E+06 Hz	1.9126030000E+06	00111010010111100011011
1.1500000954E+06 Hz	1.9293800000E+06	00111010111000010100100
1.1599999666E+06 Hz	1.9461570000E+06	00111011011001000101101
1.1699998379E+06 Hz	1.9629340000E+06	00111011111001110110110
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1.1900001764E+06 Hz	1.9964890000E+06	00111100111011011001001
1.2000000477E+06 Hz	2.0132660000E+06	00111101011100001010010
1.2099999189E+06 Hz	2.0300430000E+06	00111101111100111011011
1.2199997902E+06 Hz	2.0468200000E+06	00111110011101101100100
1.2300002575E+06 Hz	2.0635980000E+06	00111110111110011101110
1.2400001287E+06 Hz	2.0803750000E+06	00111111011111001110111
1.2500000000E+06 Hz	2.0971520000E+06	01000000000000000000000
1.2599998713E+06 Hz	2.1139290000E+06	01000000100000110001001
1.2699997425E+06 Hz	2.1307060000E+06	01000001000001100010010
1.2800002098E+06 Hz	2.1474840000E+06	01000001100010010011100
1.2900000811E+06 Hz	2.1642610000E+06	01000010000011000100101
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1.3200002909E+06 Hz	2.2145930000E+06	01000011100101011000001
1.3300001621E+06 Hz	2.2313700000E+06	01000100000110001001010
1.3400000334E+06 Hz	2.2481470000E+06	01000100100110111010011
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1.3599997759E+06 Hz	2.2817010000E+06	01000101101000011100101
1.3700002432E+06 Hz	2.2984790000E+06	01000110001001001101111
1.3800001144E+06 Hz	2.3152560000E+06	01000110101001111111000
1.3899999857E+06 Hz	2.3320330000E+06	01000111001010110000001
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1.5499997139E+06 Hz	2.6004680000E+06	01001111010111000010100
1.5600001812E+06 Hz	2.6172460000E+06	01001111110111110011110
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1.5899997950E+06 Hz	2.6675770000E+06	01010001011010000111001

1.6000002623E+06 Hz	2.6843550000E+06	01010001111010111000011
1.6100001335E+06 Hz	2.7011320000E+06	01010010011011101001100
1.6200000048E+06 Hz	2.7179090000E+06	01010010111100011010101
1.6299998760E+06 Hz	2.7346860000E+06	01010011011101001011110
1.6399997473E+06 Hz	2.7514630000E+06	01010011111101111100111
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1.6600000858E+06 Hz	2.7850180000E+06	01010100111111011111010
1.6699999571E+06 Hz	2.8017950000E+06	01010101100000010000011
1.6799998283E+06 Hz	2.8185720000E+06	01010110000001000001100
1.6900002956E+06 Hz	2.8353500000E+06	01010110100001110010110
1.7000001669E+06 Hz	2.8521270000E+06	01010111000010100011111