

## FREQUENCY CHANGE FOR THE GATES BC-1H TRANSMITTER

### I. Test Equipment Required

- a. Signal Generator
- b. Oscilloscope
- c. Counter
- d. AM Modulation Monitor

### II. Initial Adjustments

- a. Frequency Determining Components

Install frequency determining components and pre-set all coil taps according to chart.

- b. Second Harmonic Trap

Disconnect output strap of L41. Connect an RF generator tuned to the second harmonic of your carrier frequency to the strap. Temporarily short C44 with a jumper cable to ground and connect an oscilloscope to the connection of C43 and L41. Adjust C43 for maximum amplitude of the second harmonic as observed on the oscilloscope. Tighten vane securely. Reconnect L41.

### III. Frequency Change Procedure

Remove cover from exciter, install crystals and C16 and C17. Connect counter to TB2-26, turn on filaments and adjust C1 and C2 for correct carrier frequency when switching from crystals Y1 to Y2.

Switch multimeter to "DRIVER GRID" and adjust L1 and L2 coils for a peak reading of approximately 10 mA.

Switch multimeter to "P.A. GRID" and tune DRIVER PLATE TUNE for peak. Select L4 coil tap for maximum grid drive of approximately 100 mA.

Connect oscilloscope to dummy load. With filaments on, adjust P.A. plate coil for resonance as indicated by a peak indication. Neutralize by adjusting C40 "NEUT" for minimum scope indication.

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Select L4 neutralizing tap which gives lowest amount of feed through voltage indicated on oscilloscope, while adjusting C40 through its range. If the tap on L4 needs to be moved, retune DRIVER PLATE TUNE for peak and select L4 coil tap to keep grid drive close to 100 mA. Turn transmitter "OFF" while changing taps.

START transmitter, place in LOW power. After grid drive is up to full voltage, turn on HI voltage and tune PA for resonance and LOAD for normal power output.

### 250 WATT OPERATION

METER	METER READING
Mod. Plate Current (2 Tubes)	.120 Amperes
Filaments	9.5 to 10.5 volts
1st Audio	135 to 165 Volts
R.F. Exciter	63 to 77 mA
R.F. Driver Grid Current	6.9 to 8.5 mA
R.F. Driver Plate Current	155 to 120 mA
P.A. Grid Current	85 to 120 mA
P.A. Plate Voltage	1300 to 15800 Volts
P.A. Plate Current	200 to 256 mA
R.F. Line Current (50 Ohms)	2.25 Amps

### 500 WATT OPERATION

P.A. Plate Voltage	1900 to 2140 Volts
P.A. Plate Current	292 to 365 mA
R.F. Line Current (50 Ohms)	3.16 Amps

## BC-1H Frequency Change

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### 1 kW OPERATION

P.A. Plate Voltage	2700 to 2900 Volts
P.A. Plate Current	430 to 490 mA
R.F. Line Current	4.47 Amps

Set modulation monitor constant voltage output. Start with tap on L43 near top end and transmitter in low power. Adjust L43 for a full scale reading on the modulation monitor carrier meter (with maximum sensitivity). Then center the meter, switch transmitter to high power, and adjust R34 for approximately the same indication.

Adjust R10 for the PA Ip overload to drop out at approximately 800 mA. Tune PA off resonance quickly, and observe the increase of the PLATE Ip meter to set drop-out point.

Adjust R9 for the modulator Ip overload to drop out at approximately 800 mA. Overmodulate the transmitter at 10 Khz and observe the increase in modulator Ip to set the drop out point.

During overload tests observe recycle operation. Recheck R22 for 3 to 4 recycles before final dropout occurs.

Set up 100% modulation at 50 Hz and check that overload does not trip.

Set up 95% modulation at 1 Khz on high power and measure distortion. Adjust dynamic balance pot R1 on audio driver for minimum distortion. Change frequency to 50 Hz and recheck R1 setting. It may be necessary to seek a compromise setting for R1.

6.0 INITIAL ADJUSTMENTS

- 6.1 Install frequency determining components.
- 6.1.1 Pre-set coil taps using 815-3712-001.
- 6.2 Install modulator and PA tubes, type 833. Be sure all connections are tightened.
- 6.3 Install RF driver tubes, type 807.
- 6.4 Connect transmitter to dummy load.
- 6.5 Connect 230 volt primary power to F1 and F2. Connect neutral wire to the ground terminal.
- 6.6 Connect audio feed line to TB2, 29 and 30 and shield to 28.
- 6.7 Connect modulation monitor to TB2-24 and 25 (shield).
- 6.8 Tune second harmonic trap.
- 6.8.1 Disconnect output strap of L41.
- 6.8.2 Grid dip second harmonic trap to exact second harmonic frequency. Tighten vane securely.
- 6.8.3 Reconnect L41 output strap.
- 6.9 Disconnect wire No. 93 from plate transformer, T 40. Check that jumper strap P 40 under meter panel is in the "Ant" position.

6.10 Preset:

Audio deck R 1	Mid-range
Bias R 1 and R 2	Full CCW
Hi Pwr. Bias R 56	Mid-range
Audio Level R 14	Full CCW
Filament Metering R 7	Full CCW
Filament rhoastat R 39	Full CCW
L 43 Tap	Near Top End

- 6.11 Remove cover and install crystals and C 16 and C 17.  
A  
Connect to test fixture and set up frequency. Check padders for frequency swing both sides. Tune L 1 and L 2 for max. output. Install pre-tested exciter.
- 6.12 Set jumpers on TB 2 for customer's power requirement. If not specified, set for 250 watt power reduction.
- 6.13 Connect AC filament voltmeter to filament connections on one P.A. tube. Place multimeter switch on FILAMENT.
- 6.14 Press START button to apply primary pwr. Green START button and all tube filaments should light, and rear door fan should operate (to suck air in). Either HIGH or LOW power button should light, but cannot be switched at this time.
- 6.15 Adjust R 39 "FILAMENT" for  $10 \pm .1$  volts AC. Adjust R 7 for the same voltage on the multimeter and tighten locknut on R 7. Press "STOP", and all functions and indications should cease.
- 6.16 Move test meter to each of the modulator sockets and check for  $10 \pm .1$  volts AC on each.
- 6.17 Connect Simpson 260 meter between audio driver post #12 and chassis. Set meter to read at least -180 volts DC and switch multimeter to "1st AUDIO" position.

- 6.18 "START" transmitter. Look for  $-182 \pm 5$  volt DC on Simpson meter; and  $150 \pm 5$  volts on transmitter multimeter. Do not proceed further unless these readings are verified.
- 6.19 Switch multimeter to "DRIVER GRID" and tune exciter L 1 and L 2 for peak reading of approximately 10 Ma.
- 6.20 Switch multimeter to "P. A. GRID" and tune DRIVER PLATE TUNE for peak. Select L 4 coil tap and C 18 for maximum grid drive of approximately 100 Ma.
- 6.21 Connect oscilloscope to dummy load. "START" transmitter and adjust P. A. plate coil for resonance as indicated by peak indication. Neutralize by adjusting C 40 "NEUT" for minimum scope indication.
- 6.22 Select L 4 neutralizing tap which gives lowest amount of feed through voltage indicated on oscilloscope, while adjusting C 40 through its range. (Turn transmitter "OFF" while changing taps.) If tap on L 4 needs to be moved, repeat steps 6.20, 6.21, 6.22.
- 6.23 "START" transmitter, and press high voltage "ON".  
Verify the following:
- a. Green hi voltage light ON.
  - b. K 2 operates in HIGH power with hi voltage ON.
  - c. Power change will not operate with hi voltage on.
  - d. K 3 operates in LOW power with hi voltage ON.
  - e. Each interlock causes hi voltage drop-out.
  - f. Hi-voltage drop-out when K6 is operated manually in rapid sequence.

(continued)

- 6.23 (cont'd.) g. Hi voltage drop-out when K 7 is operated manually in rapid sequence.
- h. Adjust R-22 for drop-out after 3-4 clicks.
- STOP transmitter.
- 6.24 Set overload resistors R 9 and R 10 taps close to the lower end, and R 29 close to center position. Reconnect wire #93 to plate transformer terminal 5.
- 6.25 START transmitter, place in LOW power, and after grid drive is up to full voltage, turn ON hi voltage and quickly tune PA for resonance and load for normal low power output. See Fig. 6.1.
- 6.26 Turn OFF hi voltage and place transmitter in high power position. Turn hi voltage ON, tune for best efficiency and compare meter readings with Fig. 6.1. Efficiency should be 72 to 80%. Power output should be set for 110% or 1100 watts.
- 6.27 Check for stability by removing excitation while transmitter is operating on high power. PA plate current should drop below 300 Ma, and output should drop to zero. Transmitter should stay ON and show no indication of self-oscillation.
- 6.28 Check modulator cut-off by noting MOD Ip, no meter reading should be indicated. Replace excitation and switch transmitter to LOW power.

- 6.29 Adjust R1 and R2 for static bias of 40 Ma for each modulator tube (50 Ma for 500 watt low power option). Switch to HIGH power and adjust R 56 for approximately 120 Ma.
- 6.30 Set modulation monitor constant voltage output. Start with tap on L 43 near the top end and transmitter in low power. Adjust L 43 for a full scale reading on the modulation monitor carrier meter (with maximum sensitivity). Then center the meter, switch transmitter to high power, and adjust R 34 for approximately the same indication.
- 6.31 Adjust R 10 for the PA Ip overload to drop out at approximately 800 Ma. Tune PA off resonance quickly and observe the increase of the PLATE Ip meter, and the drop-out point.
- 6.32 Adjust R 9 for the modulator Ip overload to drop out at approximately 800 Ma. Overmodulate transmitter at 10 kHz and observe the increase of the modulator Ip meter and the drop-out point.
- 6.33 During overload tests observe recycle operation. Recheck R 22 for 3 to 4 recycles before final dropout occurs.
- 6.34 Set up 100% modulation at 50 Hz and check that overload does not trip. Attenuate signal generator output by 2 dB for 80% modulation and slowly run frequency down to at 30 Hz. Overload should not operate above 35 Hz.



- 6.35 Set up 100% modulation at 1 kHz on high power. Input level must be  $10 \pm 2$  dB. Switch transmitter to low power and use R 14 to adjust for 100% modulation without changing input level. Record exact level on test data sheet.
- 6.36 Set up 95% modulation at 1 kHz on high power and measure distortion. Adjust dynamic balance pot. R 1 on audio driver for minimum distortion. Change frequency to 50 Hz and recheck R 1 setting. It may occasionally be necessary to seek a compromise setting for R 1.
- 6.37 Check noise figure for 60 dB below 100% modulation at 1 kHz in high power. Filament phasing, tube selection, L 45 phasing and L 47 phasing may help in lowering noise.
- 6.38 Connect remote control test fixture to appropriate terminals of TB1 and TB2. Switch transmitter for REMOTE operation and exercise remote functions. Check that R28 will control rmt. Ep and R31 will control rmt. Ip. Check items on test data sheets. Remove test fixture.
- 6.39 Freq. monitor output should be checked by measuring RF output voltage at TB2, 26 - 27. Average levels of from 30 to 60 volts p-p (unloaded) can be expected. Check off test data sheet.

7.0 SPECIFICATION TESTING:

Following specifications should be measured without need for any adjustments to be made to the transmitter. Fill in test data sheets.

- 7.1 Set up 100% modulation at 1000 Hz. Remove excitation and record noise figure.
- 7.2 Measure distortion at 1000 Hz, 10 kHz, and 50 Hz at 95% modulation.
- 7.3 Measure frequency response at 80% modulation. Set up 0 reference at 1000 Hz and use constant input level.
- 7.4 Record transmitter meter readings as indicated on test data sheet.
- 7.5 Measure carrier shift by setting carrier meter to the red line on the monitor, then switching in 400 Hz at a 100% modulation level. Shift in carrier meter is read directly in percent on carrier meter.
- 7.6 Calculate efficiency and record.
- 7.7 STOP transmitter and change P-40 to DUMMY. START transmitter and retune P.A. as necessary for rated power. STOP transmitter, turn off and disconnect primary power.
- 7.8 Record values of frequency determined capacitors in use.
- 7.9 Mark coil turns and taps in use. Record in test data sheet.  
Replace panels and door.

## TYPICAL METER READINGS

*NOTE: All readings are based on 1000 watts output into a known load.*

### 1 KW OPERATION

METER	METER READING
Mod. Plate Current (2 Tubes)	.120 Amperes
Filaments	.9.5 to 10.5 Volts
1st Audio	135 to 165 Volts
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R. F. Driver Grid Current	6.9 to 8.5 mA
R. F. Driver Plate Current	155 to 200 mA
P. A. Grid Current	85 to 120 mA
P. A. Plate Voltage	2700 to 2900 Volts
P. A. Plate Current	430 to 490 mA
R. F. Line Current (50 Ohms)	4.47 Amps

### 500 WATT OPERATION

P. A. Plate Voltage	1900 to 2140 Volts
P. A. Plate Current	292 to 365 mA
R. F. Line Current (50 Ohms)	3.16 Amps

### 250 WATT OPERATION

P. A. Plate Voltage	1300 to 1580 Volts
P. A. Plate Current	200 to 256 mA
R. F. Line Current	2.25 Amps

Figure 6-1

FREQ	C16	C17	C18	G2 C42	G2 C44	F1 C43	G2 C45	TURNS IN USE				FREQ
								L40	L41	L42	TRAP	
540	.005	.00091	.00047	.001	.003	.005	.006	35	23	13	9	540
600		.00082		.001				31	20	14	7	600
650	.0036	.00042						29	18	13		650
700	.003			.0008	.005	.004	.004	31	21	14		700
750	.0025							28	20	14	6	750
800	.0022	.00033	.00025	.0005				33	20	3.3	1	800
850								31	19	5.1	5	850
900					.003			29	20	13		900
950								27	18	13		950
1000	.0015	.00012		.0003		.003		33	19	5.0		1000
1050			.0001					31	18	6.0		1050
1100					.002		.003	30	21	10		1100
1150								29	19	10	4	1150
1200								27	18	10		1200
1250								26	17	10		1250
1300						.002	.002	27	17	9	5	1300
1350				.0002	.001			29	21	11	1	1350
1400								29	22	11	4	1400
1450								27	20	10		1450
1500	.001							26	19	10		1500
1550								25	18	10		1550
1600								24	18	10		1600

C16 and C17 are type CM05 and CM06  
 C42, C44 and C45 are type G2  
 C43 is an F1  
 C18 is a type F2  
 Coil Turns are approximate only

LATER 50 OHM CHART

GATES RADIO COMPANY  
 QUINCY, ILLINOIS

TITLE  
 FREQUENCY DETERMINED CHART  
 50 Ohms OUTPUT  
 BC1H TRANSMITTER

DATE

10/16/75 816-8174-001

1975

LTR	DATE	REVISION	DFTM	ENG	CM	LTR	DATE	REVISION	DFTM	ENG	ECM
C	1-11-72	REVISED	AB			A	12/11/71	FOR PER MANICLIN			
D	10-19-73	REVISED	AB	564		B		FOR PER MANICLIN			

FREQ	C16	C17	C18	G2 C42	F2 C44	F1 C43	G2 C45	TURNS IN USE				FREQ
								L40	L41	L42	TRAP	
540	.005	.00091	.00047	.0015	.004	.005	.006	30	14	21	9	540
600	↓	.00082		.001	.0025	↓	↓	32	13		7	600
650	.0036	.00042		↓	↓	↓	↓	↓	↓			650
700	.003			.0008	.0015	.004	.004	30	19			700
750	.0025	↓		↓			.003	↓	20		6	750
800	.0022	.00033	.00025	.0005			.0025	31	26			800
850							.002	↓	23		5	850
900	↓	↓					↓	28	20	20		900
950	↓	↓					.0015	↓				950
1000	.0015	.00012	↓	.0003	.001	.003	↓	34				1000
1050			.0001		.0008		.001	↓		21		1050
1100					↓			32				1100
1150					.0005		↓	31			4	1150
1200				.00025			.0008	↓				1200
1250								↓				1250
1300						.002		28			5	1300
1350								25	18			1350
1400				.0002				26		19	4	1400
1450								24				1450
1500	.001							22				1500
1550	↓							↓				1550
1600	↓	↓	NONE					20				1600

C16 AND C17 ARE TYPE CM05 AND CM06  
 C42 AND C45 ARE TYPE G2  
 C43 IS F1  
 C18 AND C44 ARE TYPE F2  
 COIL TURNS ARE APPROXIMATE ONLY

NOTE:

EARLY 50 OHM CHART

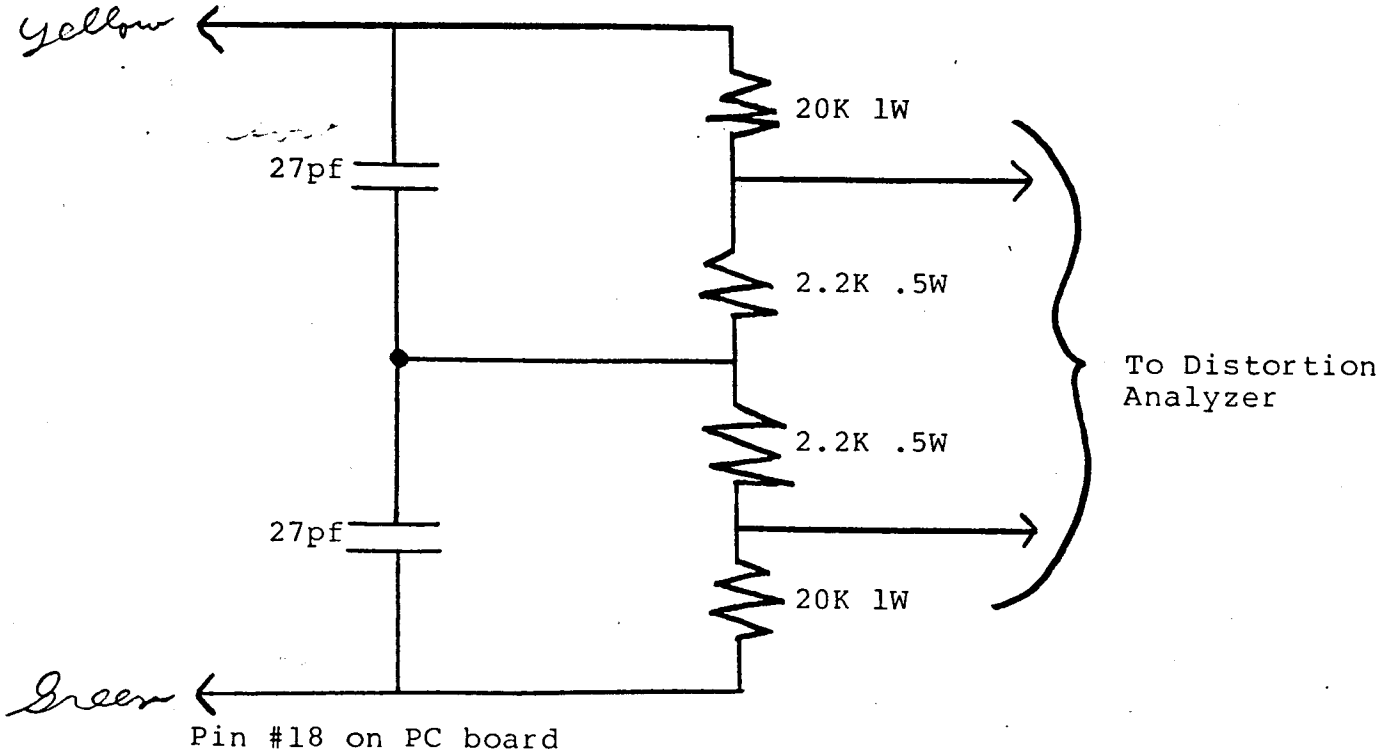
HARRIS	<b>GATES RADIO COMPANY</b>	
INTERTYPE	QUINCY, ILLINOIS	
CORPORATION		
TITLE FREQUENCY DETERMINED CHART-50 OHMS OUTPUT BC-1H TRANSMITTER		
DFTM 9-7-71 R. H. H. H.	PROJ. ENG. 18/71 R. B. B.	DWG NO. 815 3712 001

1971

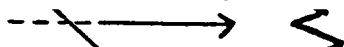
M-7069 AUDIO DRIVER  
TEST PROCEDURE

- 1) Connect a 1K-<sup>175</sup>~~5W~~ resistor across R47. (A 5K-50W resistor located on the deck plate.)
- 2) Connect wires from the load test jig to pins #17 and #18 on the PC board.

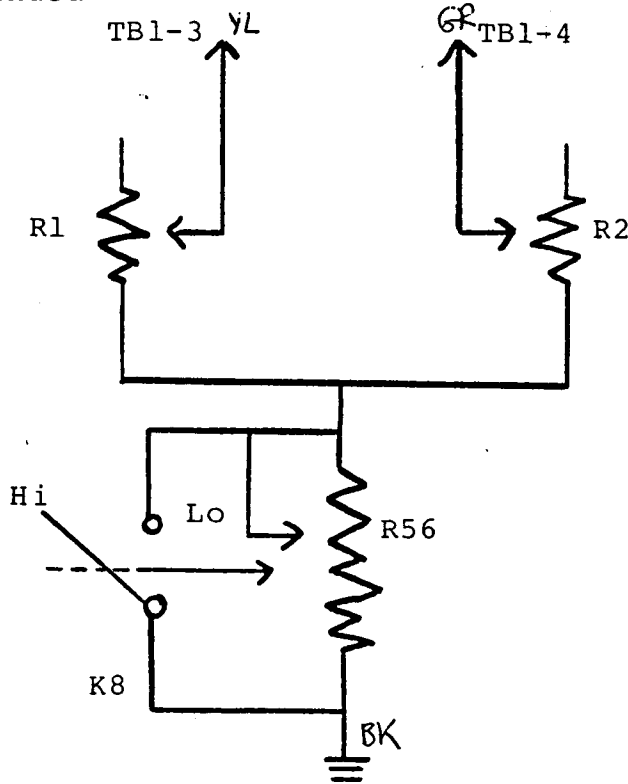
Pin #17 on PC board



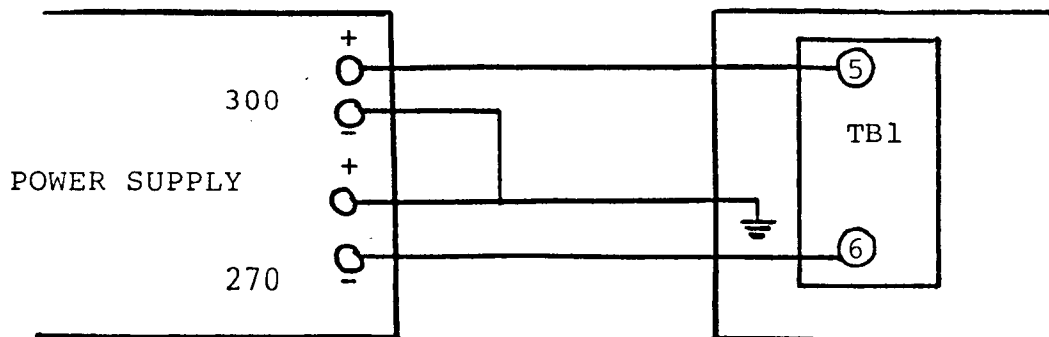
- 3) Connect TB1 pins #1 and #2 to Audio Generator. (600 ohm load bal.)
- 4) Mount the bias pot test jig on the aluminum base plate to the right side where the holes line up. Connect the yellow clip lead on the bias pot jig to TB1-3. Connect the green clip lead on the bias pot jig to TB1-4. Connect the black clip lead to any convenient ground, such as the Audio Driver base plate.



4) Continued



- 5) Connect TB1-6 to Negative 270V supply. (dual 300 Volt Supply)
- 6) Connect TB1-5 to +300 supply. (dual 300 Volt Supply)
- 7) Connect three grounds:
  - a. One from the power supply common to the Audio Driver chassis.
  - b. One from power supply chassis to Audio Driver chassis.
  - c. Connect ground Banana plug of Audio Oscillator to chassis of Audio Driver.



- 7) Turn on both power supplies and check the plus 150V and negative 182 V supplies on the PC boards, pins #16 and #12, respectively.
- 8) Connect two digital multimeters to the outputs, pins #17 and #18 on the PC board. Ground leads go to chassis.
- 9) Put the switch S1(K8) on the bias pot jig, to the "hi" position. (This is the same as the transmitter "hi" power setting.) Adjust the two pots L and R and the "po adjst" pot so that the two multimeters read -70 DC volts. The two bias controls must end up in the same position; somewhere between 11:00 o'clock and 1:00 o'clock. The "po adjst" pot position is immaterial. If the bias pots are not in the same positions, trouble shoot the Audio Driver board for DC bias problems.
- 10) Throw the switch to "lo" position. The output voltage should be somewhere between -40 and -60 volts and still within  $\pm 1$  volt of each others.
- 11) Return the switch to "hi" power.
- 12) Connect two scopes to the output pins #17 and #18 using 10X probe at 50V per division to read at least 250 VPP on the scope. *1 kHz*
- 13) Apply *1-15* audio at -10 dbm. The output should not clip with at least 150 VPP each side.
- 14) Vary control, R1 on deck and observe that relative amplitude of signals will vary and be about the same amplitude with R1, at mid position.
- 15) Adjusting R1, and tweaking the two bias pots only should get the best distortion about .5-1%. This is just below the clipping point. Distortion should be no more than 1.0%.
- 16) Noise should be better than -80 db because the output load is a 10 to 1 divider to the Distortion Analyzer. (Note: Be sure all grounds are secured properly.)

August, 1979

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