TRANSMITTER

Model Chart for Intermittent Duty Transmitter

Item	Description
TLD2532A	110 W Power Amplifier
TKN8313A	Internal Cable Kit
TFD6452A	Harmonic Filter
TLD9252A	Power Amplifier Board
TLD9272A	Power Control Board
TRN5141A	PA Hardware
TRN5378A	Closing Hardware
TLD9232A	Simplex Exciter Board (Simplex Stations Only)
TLD9242A	Duplex Exciter Board (Duplex Stations Only)

Model Chart for Continuous Duty Transmitter

Frequency Coverage Chart		
Item	**Description**	**Frequency**
TLD2601A	100 Watt Power Amplifier Deck	132-150.8 MHz
TLD2602A	100 Watt Power Amplifier Deck	150.8-162 MHz
TLD2603A	100 Watt Power Amplifier Deck	162-174 MHz

Assembly Breakdown Chart

TLD2601A	TLD2602A	TLD2603A	Item	Description
X			TFD6101A	Harmonic Filter, 132-150.8 MHz
	X	X	TFD6102A	Harmonic Filter, 150.8-174 MHz
X			TLD5952A	Power Amplifier Board, 132-150.8 MHz
	X		TLD5953A	Power Amplifier Board, 150.8-162 MHz
		X	TLD5954A	Power Amplifier Board, 162-174 MHz
X	X	X	TLD5960A	Power Control Board
X	X	X	TLN2424A	Power Amplifier Input Bracket Assembly
			includes	TRN5566A PA Input Bracket
			includes	TRN5585A Exciter Control Voltage Regulator
			includes	TKN8336A PA Cable Kit
X	X	X	TRN5577A	PA Casting & Hardware
X	X	X	TRN5586A	PA Hardware
X	X	X	TRN8069A	Suppression Network

PERFORMANCE SPECIFICATIONS

Frequency Separation	3 MHz
Number of Channels	1, 2, 3, or 4
Frequency Stability	±.0005% from −30°C to +60°C (25°C reference) ±.0002% optional*
Power Output	Intermittent duty transmitter: 60 to 110 watts continuously variable, into 50 ohm load (EIA intermittent duty cycle) Continuous duty transmitter: 50 to 100 watts, continuously variable, into 50 ohm load (EIA continuous duty cycle)
Maximum Frequency Deviation	±5 kHz @ 1 kHz
Sideband Spectrum	±30 kHz 90 dB below carrier ±1 MHz 105 dB below carrier
Hum and Noise	55 dB below 60% deviation @ 1 kHz
Audio Response	+1, −3 dB from 6 dB/octave, 300-3000 Hz, referenced to 1000 Hz
Spurious: Conducted Radiated	85 dB below carrier −13 dBm (dipole substitution method)
Audio Distortion	Less than 2% @ 1000 Hz, 60% system deviation

*Available with option C601, C602, C603, or C604.

1. GENERAL

The 110 watt intermittent duty and 100 watt continuous duty transmitters used in the Motorola *MSR 2000* VHF Base Station consist of the exciter board, mounted in the rf control chassis, and the power amplifier enclosed in a casting mounted at the top of the cabinet.

2. EXCITER

2.1 Two versions of the exciter are available. The TLD9230A Series Simplex Exciter is intended for use with stations operating in simplex (non-simultaneous transmit/receive) mode. The TLD9240A Series Duplex Exciter contains additional interconnection filtering, and is intended for use with stations operating in duplex mode, i.e., repeater stations.

2.2 The exciter board is easily accessed for alignment by swinging the rf control chassis out and down. Refer to the Maintenance section of this manual for service access procedures.

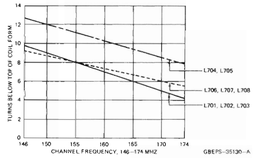
3. POWER AMPLIFIER

The TLD2532A and TLD2600A Series Power Amplifiers consist of the power amplifier board, power control board, and harmonic filter, mounted in a rugged aluminum casting. All circuitry is fully shielded, and is easily accessed for alignment and servicing without removing the PA chassis from the base station. Refer to the Maintenance section of this manual for service access procedure.

4. ALIGNMENT

The transmitter alignment procedure involves adjustments on the exciter board and on the power control board. The alignment procedure given is for use with the Motorola TEK-5 Meter Panel, S1056B Test Set, or optional station metering (TRN5080A DC Metering Chassis). When performing a complete alignment, perform the alignment procedures (exciter/PA/power control, oscillator frequency, deviation) in the order given.

COIL PRESET CHART



NOTE

The tuning procedure should be performed using the TRN5080A DC Metering Chassis, Motorola TEK-5 Meter Panel (set to position "D" for exciter or "E" for PA) or Motorola S1056-1059 Portable Test Set (used with TEK-37A Test Set Adapter).

CAUTION

Do not key transmitter for more than a few seconds at a time until it is properly tuned. Key transmitter for brief periods while reading meter and making adjustments.

Exciter-PA Alignment Procedure

Step	Metering Cable Connection	Test Switch Position (Meter)	Adjustment	Procedure
1	None	None	Frequency Select	Set to lowest frequency transmit channel (multi-channel radios only).
			L701-L708	See Preset table
			R911, R931, R939	Set fully clockwise.
			C759	Preset fully clockwise
2	Exciter	M1	L701, L702, L703	Peak L702, then peak L701, L702, L703 in order until no further improvement is obtained.
3	Exciter	M1	L704, L705	Dip L704, peak L705.
4	Exciter	M2	L706, L707, L708, L704, L705	Peak L706, L707, L708, L704, L705 in order.
	If tuning 1-frequency transmitter, or if overall channel separation is less than 500 kHz, skip to Step 12.			
5	Exciter	M1	L702	Peak on highest frequency channel.
6	Exciter	M2	L704, L706	Peak on highest frequency channel.
7	Exciter	M1	L701, L702	Peak on lowest frequency channel.
8	Exciter	M2	L705, L707	Peak on lowest frequency channel.
9	Transmit Antenna Connector	Wattmeter	C759	Adjust for highest power output at the lowest frequency. If a definate peak is not evident, i.e. if the same amount of power is obtained over a wide range of tuning of C759, turn R931 counter-clockwise until output power drops by 10 watts then peak C759.
10	Exciter	Wattmeter and M2	L708	See R931 fully clockwise. Adjust L708 for equal M2 readings on highest and lowest frequency channels. If balanced M2 readings are not possible, peak L708 on channel with lowest M2 reading.
11	Go to step 15			
12	Transmit Antenna Connector	Wattmeter	C759	Adjust for highest possible power output.
13	Exciter	M2	L707, L708	Peak.
14	Transmit Antenna Connector	Wattmeter	C759	Adjust for highest possible power output. If a definite peak is not evident, i.e. if the same amount of power is obtained over a wide range of turning of C759, turn R931 counter clockwise until power output drops by 10 watts, then peak C759.
15	Transmit Antenna Connector	Wattmeter	R931, R911	Set R931 fully clockwise. Adjust R911 for 120 watts rf output (any channel).
16	Power Control Board J1	M1, M5	Frequency Select	On each channel note M1 and M5 readings for reference.
17	Power Control Board J1	M1	R911, R931	Adjust R911 fully clockwise. On the channel with the highest initial M1, reading, adjust R931 for a reading 4 uA above that recorded in step 16.
18	Power Control Board J1	M5	R939	On the channel with the highest M5 reading, adjust for reading 3 uA above M5 reading recorded in Step 16. If a full 2 uA rise cannot be obtained, return R939 fully clockwise, read M5, and adjust R939 for a 6.5 uA drop in M5 reading.
	NOTE: Disconnect test set metering cables before performing Step 19.			
19	Transmit Antenna Connector	Wattmeter	R911	Adjust R911 so that minimum power output is 120 watts on all channels.

OSCILLATOP FREQUENCY ADJUSTMENT

Setting oscillator frequency should be done *after* exciter/power amplifier alignment, but *before* transmitter deviation is set. To set oscillator on frequency, perform the following procedure:

Step 1. Select transmitter operating frequency F1. Connect frequency meter to antenna connector via dummy load (refer to instructions provided with meter).

Step 2. Key transmitter with no modulation.

NOTE

On stations equipped with *Private-Line* or *Digital Private-Line* signaling, the PL/DPL encoder must be disabled. This is accomplished by grounding pin 14 of the PL/DPL board position on the backplane interconnect board.

Step 3. Adjust F1 FREQ control for proper reading on frequency meter. If the frequency, as indicated on the frequency meter is too low, turn the control counterclockwise. If the frequency is too high, turn the control clockwise. Set frequency within ±75 Hz.

NOTE

Omit Steps 4 and 5 for 1-frequency stations.

Step 4. Select transmitter operating frequency F2, and repeat Step 3 using F2 FREQ control.

Step 5. Repeat Step 4 for F3 and F4 using F3 FREQ and F4 FREQ controls respectively.

INSTANTANEOUS DEVIATION CONTROL (IDC) ADJUSTMENT

NOTE

The oscillator frequency adjustment must be made prior to this adjustment.

Step 1. Connect the output leads of an audio oscillator, through a .33 uF capacitor, to exciter pins 12 (EXCITER AUDIO HI) and 11 (EXCITER AUDIO LO).

Step 2. Connect an ac voltmeter across the same terminals and adjust the audio oscillator output to 350 mV rms at 1000 Hz.

Step 3. Key transmitter and adjust F1 IDC while observing deviation monitor. Adjust control for 4.7 kHz deviation.

Step 4. Repeat Step 3 for each frequency used, adjusting IDC adjustment corresponding to each channel.

NOTE

If radio set transmits *Private-Line* or *Digital Private-Line* signals, PL/DPL deviation with audio oscillator disconnected should now be between 0.5 and 1.0 kHz.

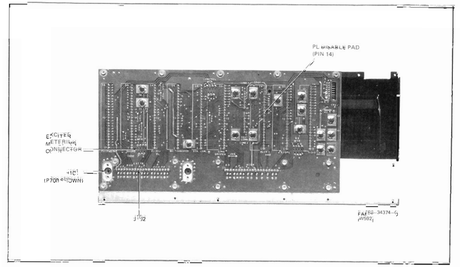


Figure 1. Basic Chassis Exciter Metering Connection Detail

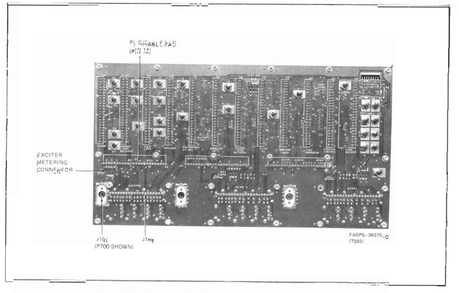


Figure 2. Fully Optionable Chassis Exciter Metering Connection Detail

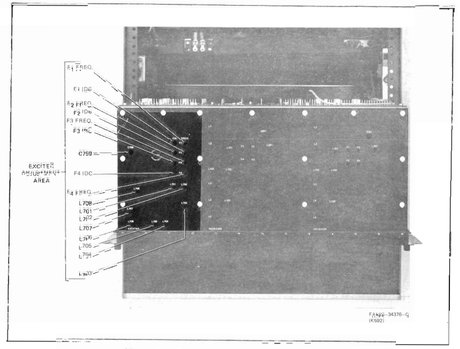


Figure 3. Exciter Adjustment Location Detail

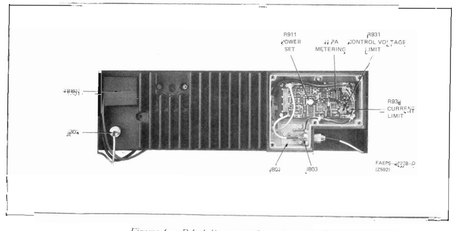
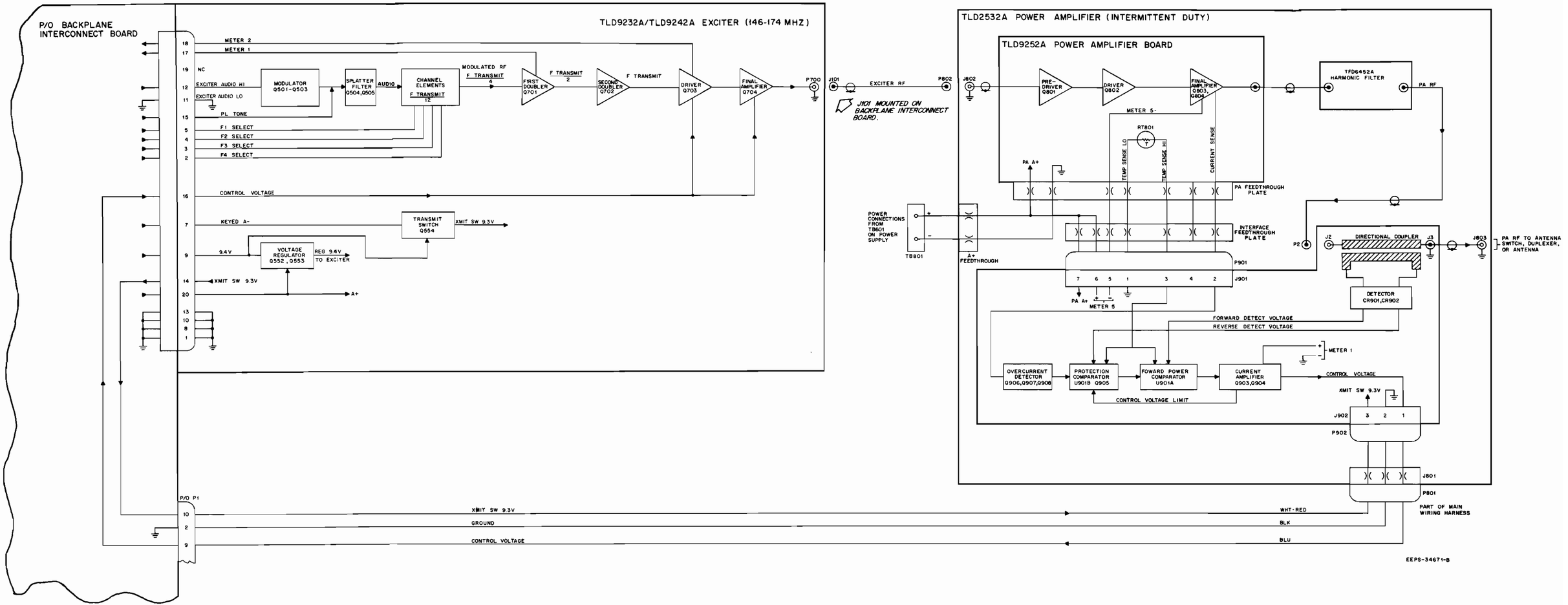
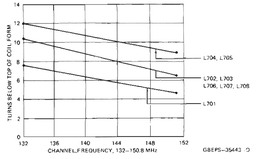


Figure 4. PA Adjustment Location Detail



Intermittent Duty
Transmitter Functional Interconnect Diagram
Motorola No. EEPS-34671-B
11/15/82 - V & G

COIL PRESET CHARTS



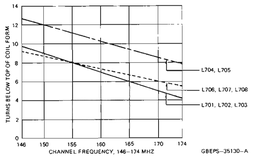


Table 1. Control Voltage Set (R901)

Model	Frequency (MHz)	Voltage*
TLD9231A or TLD9241A	132-141	5.5 V
	141-150.8	6.0 V
TLD9232A or TLD9242A	146-160	6.0 V
	160-174	6.5 V

*Voltage is measured at pin 16 of exciter.

*Table 2. Meter Limit Specifications**

Metering Cable Connection	Test Switch Position (Meter)	Min (uA)	Max (uA)
Exciter	M1	10	50
Exciter	M2	15	50
Power Amplifier	M1	10	
Power Amplifier	M2	5	
Power Amplifier	M3	10	
Power Amplifier	M4	10	
Power Amplifier	M5		29
Power Control Board	M1	15	45
Power Control Board	M2		10
Power Control Board	M5		50

* Limit specifications are applicable after the transmitter has been aligned and is operating into a 50 ohm load.

NOTE

The tuning procedure should be performed using the TRN5080A DC Metering Chassis, Motorola TEK-5 Meter Panel (set to position "D" for exciter, "C" for PA, and "E" for Power Control) or Motorola S1056-1059 Portable Test Set (used with TEK-37A Test Set Adapter).

CAUTION

Do not key transmitter for more than a few seconds at a time until it is properly tuned. Key transmitter for brief periods while reading meter and making adjustments.

Exciter-PA Alignment Procedure

Step	Metering Cable Connection	Test Switch Position (Meter)	Adjustment	Procedure
1	None	None	Frequency Select	Turn the FREQUENCY SELECT switch to the lowest frequency channel.
			L701, L702, L703	Preset coil slugs per coil preset chart.
			L704, L705	Preset coil slugs per coil preset chart.
			L706, L707, L708	Preset coil slugs per coil preset chart.
			C759	Preset fully clockwise (CW).
			R611 — Power Set on Power Control Board	Preset fully counterclockwise (CCW).
			R901 — Exciter Level control on power input bracket	Preset fully clockwise (CW).
2	Exciter	M1	L701, L702, L703	Peak L702, then peak L701, L702, L703 in order until no further improvement is obtained.
3	Exciter	M1	L704, L705	Dip L704, then peak L705.
4	Exciter	M2	L706, L707, L708, L704, L705	Peak L706, L707, L708, L704, and L705 in that order.
If transmitter is to be tuned for a single frequency, or frequencies with a separation of less than 500 kHz, skip to Step 12.				
5	None	None	Frequency Select	Turn the FREQUENCY SELECT switch to the highest channel frequency.
6	Exciter	M1	L702	Peak L702.
7	Exciter	M2	L704,L706	Peak L704 and L706.
8	None	None	Frequency Select	Turn the FREQUENCY SELECT switch to the lowest channel frequency.
9	Exciter	M1	L701,L703	Peak L701 and L703.
10	Exciter	M2	L705, L707	Peak L705 and L707.
11	Power Amplifier	M1	C759	Peak C759 (Exciter). If M1 is greater than 50 uA, reduce exciter control voltage (R901) until a peak can be obtained.
12	Exciter (pin 16)	Voltmeter	R901	Set control voltage according to Table 1.
If the transmitter is to be tuned for a single frequency or frequencies with a separation of less than 500 kHz, skip to Step 15.				
13	Exciter	M2	L708	Adjust L708 for equal M2 readings on the lowest channel frequency and on the highest channel frequency. If M2 cannot be equalized, peak L708 on the channel with the lowest M2 reading.
14	Power Amplifier	M1	C759	Peak C759 (exciter) on the lowest channel frequency. If M1 is greater than 50 uA, reduce the exciter control voltage (R901) until a peak is observed. After peaking C759, reset exciter control voltage to the value in Step 12. Then go to Step 17.
15	Exciter	M2	L707, L708	Peak L707 and L708.
16	Power Amplifier	M1	C759	Peak C759 (exciter). If M1 is greater than 50 uA, reduce the exciter control voltage (R901) until a peak can be observed. After peaking C759, reset exciter control voltage to the value in Step 12.
17	Power Amplifier		R611	If power amplifier is to be re-aligned *greater* than ±1 MHz from original frequency proceed with Step 18. If power amplifier is to be re-aligned less than ±1 MHz from original frequency, remove power control board shield, move metering plug to power control board. Set R611, Power Set, fully clockwise (CW) and go to Step 22.

Exciter-PA Alignment Procedure (Cont'd.)

Step	Metering Cable Connection	Test Switch Position (Meter)	Adjustment	Procedure
18	Power Amplifier		C501, C502, R610	REALIGNMENT — Set cap. C501 fully clockwise. Set cap. C502 to maximum capacity (plates fully meshed). Remove power control board shield and move metering plug to power control board. Use tuning tool Motorola No. 66A82846D01 or equivalent to prealign POWER LIMIT control R610, located on the component side of the board. Access to this control is provided by a small slot located approximately 3/4" from the POWER SET access hole. The tuning tool rotates the outer edge of a serrated knob. Adjust R610, the POWER LIMIT control, to the end of its travel by rotating the edge of the knob toward the front of the station with the PA in the tilted out position.
19	Power Control Board		R611	TRANSMITTER OUTPUT — Adjust R611 (POWER SET) control to maximum clockwise (CW) position.
20	Power Control Board	M5	C501	PA (DRIVER) OUTPUT — Observe M5. If this indication is *less* than 50 uA (full scale), proceed with Step 21. If this indication is *greater* than 50 uA tune C501 for on-scale reading.
21	Power Control Board	Wattmeter	R610	TRANSMITTER OUTPUT — Adjust R610 (POWER LIMIT control) *toward* back of station until *either* rated power output is attained *or* no further increase in power output is observed. *IN EITHER CASE*, adjust POWER LIMIT control for an approximate 5 W to 10 W reduction.
22	Power Control Board	M5	C501, C502	PA DRIVER OUTPUT — Tune C501 *then* C502 for a minimum M5 reading.
23	Power Control Board	Wattmeter	R610	TRANSMITTER OUTPUT — Adjust the POWER LIMIT control (R610) for 115 W. Repeat Step 22. NOTE: If required output cannot be obtained, repeat Steps 21 and 22.
24	Power Control Board	M5 Wattmeter	R610	Replace the power control board shield. If M5 exceeds 50 uA when shield is replaced, remove shield and adjust POWER LIMIT control (R610) slightly (turn knob toward front of station) until an on-scale reading (50 uA or less) is observed when shield is replaced. Power output shall be at least that specified in Step 23.
25	Power Control Board	Wattmeter	R611	TRANSMITTER OUTPUT — Remove the meter cable and adjust POWER SET control (R611) for rated power output. Repeat Step 22.
26	Power Amplifier	M5		FINAL COLLECTOR CURRENT — Move the metering plug to the PA. Measure the final collector current (Ic). Ic, in amperes is the M5 reading: (0-50) × 1/2.
This completes transmitter tuning. Refer to Table 2 for metering limits.				

OSCILLATOR FREQUENCY ADJUSTMENT

Setting oscillator frequency should be done *after* exciter/power amplifier alignment, but *before* transmitter deviation is set. To set oscillator on frequency, perform the following procedure:

Step 1. Select transmitter operating frequency F1. Connect frequency meter to antenna connector via dummy load (refer to instructions provided with meter).

Step 2. Key transmitter with no modulation.

NOTE

On stations equipped with *Private-Line* or *Digital Private-Line* signaling, the PL/DPL encoder must be disabled. This is accomplished by grounding pin 14 of the PL/DPL board position on the backplane interconnect board.

Step 3. Adjust F1 FREQ control for proper reading on frequency meter. If the frequency, as indicated on the frequency meter is too low, turn the control counterclockwise. If the frequency is too high, turn the control clockwise. Set frequency within ±75 Hz.

NOTE

Omit Steps 4 and 5 for 1-frequency stations.

Step 4. Select transmitter operating frequency F2 and repeat Step 3 using F2 FREQ control.

Step 5. Repeat Step 4 for F3 and F4 using F3 FREQ and F4 FREQ controls respectively.

INSTANTANEOUS DEVIATION CONTROL (IDC) ADJUSTMENT

NOTE

The oscillator frequency adjustment must be made prior to this adjustment.

Step 1. Connect the output leads of an audio oscillator, through a .33 uF capacitor, to exciter pins 12 (EXCITER AUDIO HI) and 11 (EXCITER AUDIO LO).

Step 2. Connect an ac voltmeter across the same terminals and adjust the audio oscillator output to 350 mV rms at 1000 Hz.

Step 3. Key transmitter and adjust F1 IDC while observing deviation monitor. Adjust control for 4.7 kHz deviation.

Step 4. Repeat Step 3 for each frequency used, adjusting IDC adjustment corresponding to each channel.

NOTE

If radio set transmits *Private-Line* or *Digital Private-Line* signals, PL/DPL deviation with audio oscillator disconnected should now be between 0.5 and 1.0 kHz.

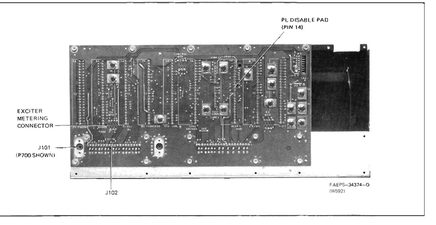


Figure 1. Basic Chassis Exciter Metering Connection Detail

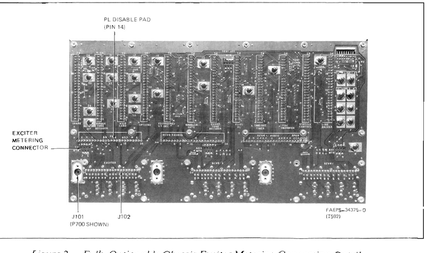


Figure 2. Fully Optionable Chassis Exciter Metering Connection Detail

CONTINUOUS DUTY TRANSMITTER ALIGNMENT

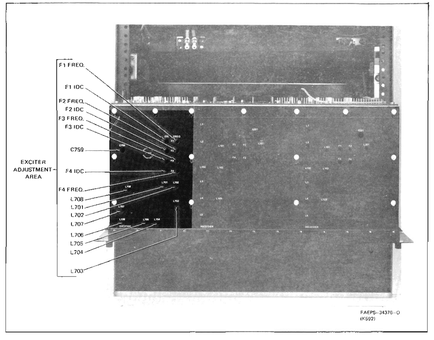


Figure 3. Exciter Adjustment Location Detail

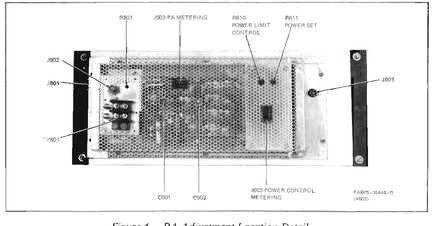
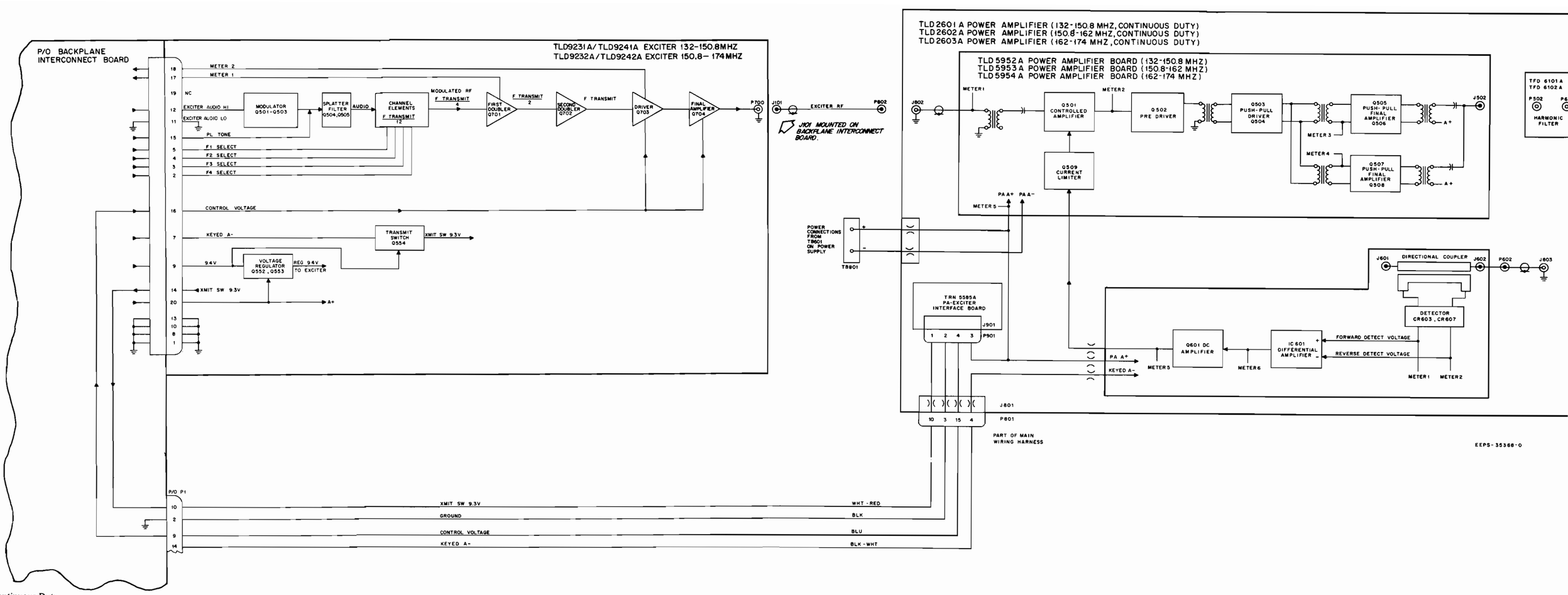


Figure 4. PA Adjustment Location Detail



Continuous Duty
Transmitter Functional Interconnect Diagram
Motorola No. EEPS-35368-O
11/15/82 - V & G