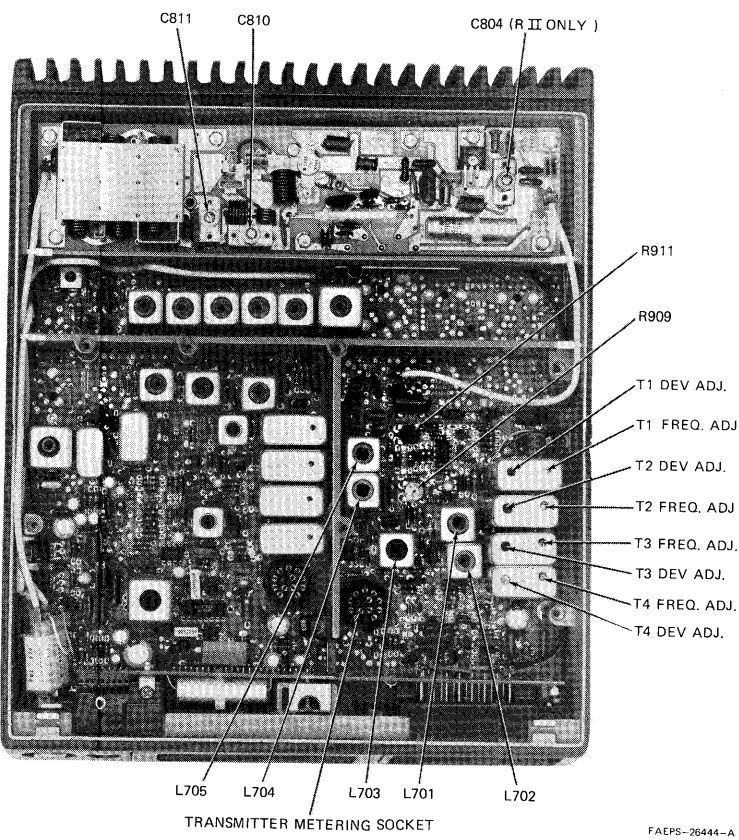


REQUIRED TEST EQUIPMENT FOR RADIO SERVICING			
GENERAL TYPE	APPLICATION	RECOMMENDED MODEL	MINIMUM SPECIFICATIONS
AC-DC VOM	DC voltage measurements, general	Motorola TI1009A	Measurement range: 0-15 V dc Sensitivity: 20,000 ohms/volt
DC Multimeter	DC voltage readings requiring a high input resistance meter.	Motorola SI063B	Measurement range: 0-15 V dc Input resistance: 11 megohms
AC Voltmeter	Audio voltage measurements	Motorola SI053C	Measurement range: 0-10 V ac Input resistance: 10 megohms
RF Voltmeter	RF voltage measurements	Motorola SI139A	Measurement range: 100 uV-3 V from 1 MHz-50 MHz Inputs: 50 ohm and high impedance
Oscilloscope	Waveform observation	Motorola RI004A	Vertical sensitivity: 5 mV-10 V/division Horizontal time base: 0.2 usec. 0.5 sec/division
RF Wattmeter	Transmitter output power measurement	Motorola SI1350A with appropriate element and TI013A RF Dummy Load.	Measurement range: 0-100 Watts
Frequency Meter	Transmitter frequency measurement	Model RI200A Service Monitor with high stability oscillator (X suffix) option. Frequency calibration recommended every 6 months or less.	Measurement range: 29.7-50 MHz Frequency resolution: 10 Hz
Deviation Meter	Transmitter modulation deviation measurement	Motorola RI200A Service Monitor	Measurement range: 0-10 kHz deviation Frequency range: 25-50 MHz
RF Signal Generator	Receiver Alignment and troubleshooting	Motorola RI200A Service Monitor with attenuator	Frequency range: 25-50 MHz Output Level: 0.1 uV-100,000 uV Must be capable of at least ± 3 kHz deviation when modulated by 1 kHz tone.
Audio Signal Generator	Audio Circuit troubleshooting	Motorola SI067B	Frequency range: 20 Hz-20 kHz Output Level: 50 mV-1 V
PL Tone Generator*	Tone-Coded "Private-Line" Encoder-Decoder Troubleshooting	Motorola SI133B	Frequency range: 10 Hz-9999 Hz Output Level: 0-3 V rms
DPL Test Set**	"Digital Private-Line" Encoder-Decoder Troubleshooting	Motorola SLN6413A	
Radio Test Set w/appropriate metering cable (SKN6012B)	Meter readings at circuit metering points for alignment and troubleshooting.	Motorola SI056B Portable Test Set, TEK5B-E Metering Panel with RPX4053A Conversion Kit, or TEK5F Metering Panel.	
Tuning Tool Kit	Receiver and transmitter alignment	Motorola HLN4023A	
DC Power Supply	DC power for shop service	Motorola RI011A	1-20 V dc 0-40A
Pulse Generator	Extender measurements	TEK47A	

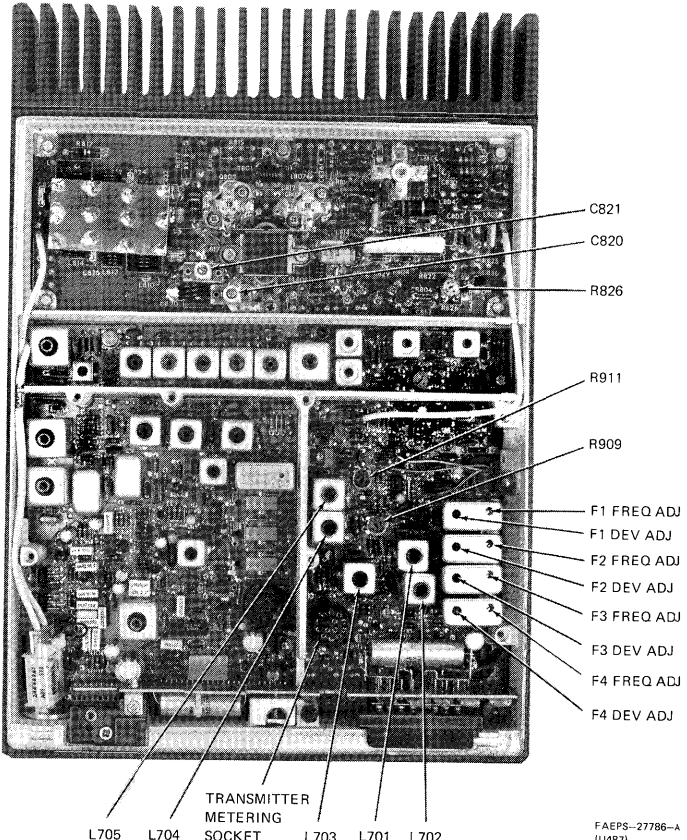
* Required for tone-coded "Private-Line" models only
** Required for "Digital Private-Line" models only

NOTE
Versions B-E of TEK5 Metering Panel must be modified with RPX4053A Conversion Kit before use with the radio.

- TRANSMITTER PREALIGNMENT NOTES**
RANGE I: 29.7-38999 MHz **RANGE II: 39-50 MHz**
- Unnecessary tuning adjustments should be avoided. Usually, only a *touch-up* transmitter alignment is needed. Complete transmitter alignment is needed *only* in the following cases:
 - after changing transmitter operating frequency.
 - after replacing a component in a frequency-sensitive network.
 - The tune-up procedure has been written for use with the Motorola portable test set or the TEK-5 Meter Panel set to position A.
 - Before beginning a complete alignment, preset tuning adjustments as follows:
 - Set C804 (Range II only), C810, and C811 to maximum clockwise (*60 W models*). Set C820 and C821 maximum clockwise (*110 W models*).
 - Set R909 and R911 to maximum clockwise (*60 and 110 W models*). Set R826 to maximum clockwise (*110 W models*).
 - Set L701, L702, L703, L704, and L705 according to the exciter preset chart. Preset positioning of the exciter coil slugs insures that the exciter is tuned to the correct harmonic of the oscillator.
 - Set power supply voltage to 13.6 V (*60 W models*) or 13.4 V (*110 W models*).
 - Key transmitter for each step in alignment procedure and de-key as soon as alignment step is completed. Avoid keying an unaligned transmitter for prolonged periods.
 - Multi-frequency radios should be aligned on the lowest operating frequency.



Transmitter Adjustment Locations
(60 Watt Models)



Transmitter Adjustment Locations
(110 Watt Models)

TRANSMITTER ADJUSTMENT PROCEDURE			
STEP	TEST SWITCH POSITION	ADJUSTMENT	PROCEDURE
1	M3	L701, L702, L703	Tune coils in order listed for a peak MTR 3 reading. Repeat procedure to ensure that a peak has been obtained.
2	M5	L704, L705	Tune coils in order listed for a peak MTR 5 reading. Repeat procedure to ensure that a peak has been obtained.
3 (Range II only)	M5	C804 (60 W models)	Tune for <i>sharp dip</i> on MTR 5.
4	Wattmeter	C810 (60 W models) C821 (110 W models)	Tune for peak power output.
5	Wattmeter	R911	Adjust for power output of 65 W (<i>60 W models</i>), 130 W (<i>110 W models</i>), or maximum clockwise, whichever is less.
6	Wattmeter	C811 (60 W models) C820 (110 W models)	Tune for peak power output.
7	Wattmeter	R911	Adjust for power output of 65 W (<i>60 W models</i>) or 130 W (<i>110 W models</i>).
8	Wattmeter	C810 (60 W models) C821 (110 W models)	Tune for peak power output.
9	Wattmeter	R911	Adjust for power output of 65 W (<i>60 W models</i>) or 130 W (<i>110 W models</i>).
10 (Range II only)	M7	C804 (60 W models)	Tune for a peak MTR 7 reading.
11 (Range II only)	Wattmeter	R911	Adjust for power output of 65 W (<i>60 W models</i>).
12	M5	L705, L704	Tune coils in order listed for a peak MTR 5 reading.
13	M3	L703, L702, L701	Tune coils in order listed for a peak MTR 3 reading.
14 (Range II only)	M7	C804 (60 W models)	Tune for a peak MTR 7 reading.
15	Wattmeter	R911	Adjust for power output of 65 W (<i>60 W models</i>) or 130 W (<i>110 W models</i>).
16	Wattmeter	C810, C811 (60 W models) C820, C821 (110 W models)	Tune in order listed for a peak power output. <i>On 60 W models</i> , if MTR 7 reading is <i>greater</i> than 15 uA, <i>detune</i> C810 until the reading is 14 uA.
17	M5 (110 W models) Wattmeter	R911	<i>On 60 W models</i> , adjust R911 for a power output of 70 W. <i>On 110 W models</i> , adjust R911 for a 130 W power output, note MTR 5 and then adjust R911 for a 2 uA increase on MTR 5.
18	Wattmeter	R909, R826 (110 W models)	<i>On 60 W models</i> , adjust R909 for a power output of 65 W. <i>On 110 W models</i> , adjust R826 for 130 W and then adjust R909 for a 120 W output.
This completes the alignment for single frequency radios. For multi-frequency radios, perform the following steps. If the separation is greater than 400 kHz, the transmitter must be aligned on the lowest transmitter frequency before proceeding.			
19A	Wattmeter, M7	R909, R911, R826, C821	<i>On RII 110 W models with channel separation greater than 400 kHz</i> , set R909 and R826 to maximum clockwise. Then set R911 to 130 W on the <i>lowest</i> frequency, and turn C821 counterclockwise until M7 decreases 1 uA.
19B	—	R909, R911, R826 (110 W models)	Set to maximum clockwise.
20	M5	L704, L705	On the <i>highest</i> frequency, tune coils in order listed for a peak MTR 5 reading. Repeat procedure to ensure peak has been attained.
21	Wattmeter	R911	Adjust for power output of 50 W (<i>60 W models</i>) or 130 W (<i>110 W models</i>).
22	Wattmeter	L705	Adjust for equal power output on the <i>lowest</i> frequency and <i>highest</i> frequency (difference of 3 W or less).
23	Wattmeter	R911	On the <i>lowest</i> frequency, adjust for a power output of 70 W (<i>60 W models</i>) or 130 W (<i>110 W models</i>). Observe power output at all frequencies. On the channel having the <i>lowest</i> power output, adjust R911 for a power output of 70 W (<i>60 W models</i>) or 130 W (<i>110 W models</i>). <i>On 110 W models</i> , note MTR 5 and then adjust R911 for a 2 uA increase on MTR 5.
24A (60 W models only)	Wattmeter	R909	On the <i>lowest</i> frequency, adjust for a power output of 65 W. Observe power output at all frequencies. If power output on any frequency is less than 65 W, adjust R909 for a power output of 65 W. If the difference in power output between the <i>lowest</i> frequency and the <i>highest</i> frequency is greater than 4 W, <i>return to Step 19</i> .
24B (110 W models only)	Wattmeter	R909, R826	Select the channel with the <i>lowest</i> power output. Adjust R826 for 130 W. Observe power on all channels. If any channel is less than 130 W, readjust R826 for 130 W. Adjust R909 for 120 W. If any channel is less than 120 W, readjust R909 for 120 W. If the difference in power output between any two channels is <i>greater</i> than 10 W, <i>return to Step 19</i> .

The multi-frequency transmitter has now been completely aligned.

- FINAL METER READINGS**
- Each time a transmitter is aligned or tested, final meter readings should be made and entered in a logbook.
 - All readings given in the following table are minimum (based on a nominal dc supply voltage of 13.6 volts (except M7 (PA current) which is a maximum reading).
 - The readings at M3 and M5 are purely relative and do not give actual current or voltage measurements.
 - Multiply the microampere scale reading obtained at M7 by 0.8 to determine the approximate final amplifier current in amperes.

TRANSMITTER METERING TABLE			
SI056B-9B SERIES SWITCH POSITION	3	5	7
METER READING	20 uA (min)	5 uA (min)	15 uA max (60 W models) 18 uA max (110 W models)
FUNCTION METERED	Buffer Output	Exciter Output	PA Final Current

OSCILLATOR FREQUENCY ADJUSTMENT

Setting the oscillator "on frequency" should be done *after* the transmitter has been aligned, but *before* transmitter deviation is checked and set. To set the oscillator on frequency, perform the following steps:

- Set up the frequency meter as described in the frequency meter instruction manual.
- Set the frequency selector switch on the control head to the F1 position (multi-frequency radios only).

Step 3. Key the transmitter with no modulation using the portable test set. On "Private-Line" or "Digital Private-Line" coded squelch models, disable the "Private-Line" encoder by shorting the code disable points on the "Private-Line" or "Digital Private-Line" encoder/decoder board.

Step 4. Adjust the T1 FREQ ADJ control for proper readings on the frequency meter. If the frequency as indicated on the frequency meter is too low, turn the T1 FREQ ADJ control counterclockwise; if too high, turn the control clockwise. Set the frequency to within ± 30 Hz.

NOTE
Omit Steps 5 and 6 for single frequency units.

Step 5. Set the frequency selector switch to the F2 position and repeat Step 4 using the T2 FREQ ADJ control.

Step 6. Repeat Step 4 for F3 and F4, using the T3 and T4 FREQ ADJ controls, respectively.

Step 7. On "Private-Line" or "Digital Private-Line" models, remove the short added in Step 3.

DEVIATION ADJUSTMENTS

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

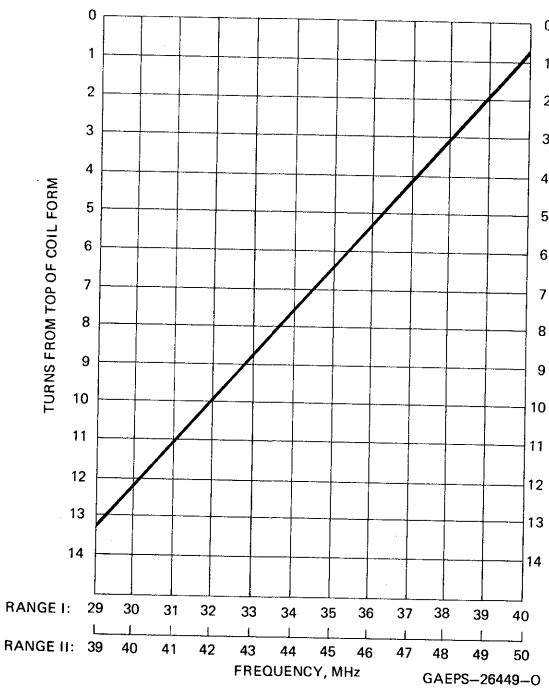
Step 1. Connect the output leads of the tone oscillator through a 0.33 uF capacitor to the transmitter audio input (microphone receptacle).

Step 2. Connect the ac voltmeter across the same terminals and adjust the tone generator output to 1 volt at 1000 Hz.

Step 3. Place the frequency selector switch in the F1 position (in multiple frequency models) and key the transmitter using the portable test set. Adjust the T1 DEV ADJ control, for 4.8 kHz deviation as read on the deviation measuring instrument used. For multiple frequency models adjust the F2, F3, and F4 DEV controls with the frequency selector switch in the corresponding position.

Step 4. "Private-Line" tone deviation should be between 0.5 and 1 kHz.

LOW BAND TRANSMITTER ALIGNMENT



Exciter L701-5 Preset Chart

Transmitter Alignment
Motorola No. **PEPS-27787-A**
6/30/80-PHI