WARNING
1500 volts is present in this station whenever the main power is on and the cabinet interlock switches are closed.

1. LOCAL OPERATION

After the station is installed and properly adjusted, it is normally operated entirely unattended from a remote control point. However, the station may be locally operated utilizing controls on the remote control chassis and the metering chassis. This type of operation is necessary to accomplish station maintenance and testing. The following are procedures pertaining to the local operation of a remotely controlled base or repeater station.

1.1 TRANSMITTER CONTROL

To prevent the transmitter from being keyed remotely, set the station control module LINE DISABLE switch in the direction of the arrow. The DISABLE LIGHT on the module will illuminate to indicate the selected condition. At conclusion of local operation, insure that the LINE DISABLE switch is returned to its normal position (opposite direction of the arrow). Also, temporarily remove the squelch gate module of repeater stations to prevent accidental keying of the station when receiving test messages.

1.2 LOCAL MICROPHONE

Connect the Motorola Model TMN6071A or equivalent microphone to the MICROPHONE receptacle on the metering chassis.

1.3 LOCAL SPEAKER

Set the metering chassis SPEAKER switch to the ON position. This activates the speaker mounted in the meter panel so that received messages or audio on the control lines can be heard.

1.4 NORMAL OR INTERCOM OPERATION

If intercom operation with the remote control point is desired, set the MICROPHONE switch on the metering chassis to the INTERCOM position. Otherwise, for routine testing, set the MICROPHONE switch to the NORMAL position.

1.5 FREQUENCY SELECTION

For stations with a two-frequency transmitter, the frequency can be locally selected by the F1-F2 switch on the dc transfer module or on the F2 tone decoder module. For stations with a two-frequency receiver, frequency selection is made by momentarily operating the REC F1 SELECT or REC F2 SELECT switch on the dc transfer module or on the F2 tone decoder module. For four-frequency stations, the frequency is selected by momentary operation of the desired frequency select switch on the four-frequency module after the XMIT switch on the station control module is operated.

1.6 RECEIVED AUDIO

The receiver "PL" feature, if used, can be defeated by setting the station control module "PL" DISABLE switch in the direction of the arrow. (At the conclusion of local operation, insure that the "PL" DISABLE switch is returned to its normal

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position.) If necessary, the receiver can be unsquelched utilizing the receiver SQUELCH control on the receiver chassis. The VOLUME control on the receiver chassis sets the audio output level of the local speaker.

1.7 TRANSMITTING

NOTE

Before initiating any local transmissions, monitor the channel to insure that it is clear of other transmissions.

The transmitter is keyed locally by either activating the station control module XMIT switch or activating the microphone push-to-talk switch.

CAUTION

The transmitter can be keyed remotely. To prevent unexpected transmitter keying while servicing the station, be sure the LINE DISABLE switch is actuated (positioned in the direction of the arrow).

1.8 SELECTION OF OTHER MODES

All other functions that can be activated by remote control can also be activated locally. Each module has test switches to activate any such functions, such as RPTR ON and RPTR OFF. Most of these switches are momentary action, which allows the station to continue operating in the selected mode until reset. Refer to the pertinent instruction section within this manual for operators instructions of the specific modules used in the station.

1.9 CONCLUDING LOCAL OPERATION

At the conclusion of local operation, perform the following checks to insure that the station is ready for remote operation.

Step 1. Reset receiver squelch level per procedures in Receiver RF and IF Section of this manual if the squelch threshold point was changed during local operation.

Step 2. Insure that station control module switches are positioned for normal operation.

Step 3. Re-install squelch gate module if removed during local operation.

Step 4. Set all external power switches ON.

Step 5. Insure that station is operable from remote location.

Step 6. Turn local speaker OFF.

Step 7. Set the MICROPHONE switch to the NORMAL position.

Step 8. Insure that cabinet doors are closed and locked.

Step 9. Insure that vents in cabinet are not obstructed.

2. MAINTENANCE TECHNIQUES

WARNING

Dangerous voltages are present in these stations. Exercise extreme caution when troubleshooting the high voltage power supply and high power PA. Interlock switches are provided on each access door of the PA, and the rear cabinet door, which disable the high voltage power supply. Insure that the main power is turned OFF and all high voltage points have been shorted to chassis ground prior to troubleshooting the PA or high voltage power supply.

2.1 GENERAL

Maintenance procedures for individual chassis and modules which comprise this station are contained in the applicable section of this manual. As an aid to isolating a malfunction to a specific chassis or module, a variety of techniques are appropriate.

NOTE

Male connectors that mate with 50-pin flat cable connectors have been sprayed with a special compound. This compound is greasy to the touch and must not be wiped off the connector. The compound improves electrical continuity and prevents contact resistance problems.

2.2 TRANSMITTER AND RECEIVER

Most troubles in the transmitter or receiver can be quickly isolated with built-in station metering. A log of normal meter readings for this station should be maintained. Each time maintenance is performed, the meter readings

should be entered into the log. Variations from the previous readings can isolate a malfunction or may indicate an impending failure. If no previous meter readings are available, typical or minimum meter readings may be found in the receiver rf & i-f, exciter, power amplifier or power control board sections of this manual, as well as metering procedures.

2.3 POWER SUPPLY

A check of power supply voltages under load and no-load conditions (transmit and stand-by) should quickly isolate any malfunction. A comprehensive troubleshooting procedure is provided in the power supply section of this manual.

CAUTION

PA filament voltage is supplied by the constant voltage transformer. Each time primary ac power is interrupted, either by opening an interlock or the main power switch, allow at least one minute filament warm-up time after power is restored before keying the station.

2.4 REMOTE CONTROL UNIT

Isolation of a malfunction in the remote control unit requires a functional understanding of the overall station operation and the interrelationship between the various modules and chassis of the station. The "Functional Description" section along with the STATION DIAGRAM section of this manual provide necessary information. With a basic understanding of station operation, troubles may be isolated by analyzing the following questions:

(1) Can the station be operated locally but not remotely? If so, this eliminates many circuits as possible sources of trouble.

(2) How many modes are inoperable? Concentrate testing on circuits that are common to the inoperable modes.

(3) Are adjustments properly set? This i includes audio level adjustments at the station and at the remote control point.

(4) Are jumpers properly installed? The many jumpers in this equipment provides vast flexibility, but could be a source of trouble if improperly added, removed, or not removed as the case may be.

ROUTINE MAINTENANCE CHECK LIST

ITEM	CHECK
Receiver	Measure the signal level required to obtain 20 dB quieting.
	Compare meter readings with the minimum value and all previous readings taken. Realign the receiver, if necessary.
	For PL stations, check for proper operation of the PL decoder. Does the squelch open when the proper PL tone-code is detected?
Transmitter	Measure transmitter output power.
	Compare meter readings with the minimum value and all previous readings taken. Realign the transmitter, if necessary.
	Verify that each transmitter channel is on frequency and adjust if necessary.
	Tune and load the transmitter to the antenna.
	Measure transmitter frequency deviation for both voice and PL tone-coded modulation. Adjust the "IDC" control, if necessary.
	Measure the exciter modulator sensitivity.
System Operation	Measure and adjust the audio input to the exciter.
	Measure and adjust the receiver(s) audio output to the control line.
	Check control line levels and functions for proper operation.
	Adjust receiver(s) on frequency with the distant transmitter(s) in the system.
	Check for proper repeater operation on repeater models.
	Check all accessory equipment for proper operation.
After Performing Maintenance	Check all items listed in the Concluding Local Operation paragraph of this section of the instruction manual.

TABLE OF RECOMMENDED TEST EQUIPMENT

TYPE OF EQUIPMENT OR TYPE OF MEASUREMENT	EQUIPMENT CHARACTERISTICS	RECOMMENDED TYPE
Transmitter Frequency Measurement	Frequency - 136 to 174 MHz Accuracy - ±.00005% or better	Any of the following items of Motorola Test Equipment: Model R1200A Service Monitor Model S1343 Series Frequency Counter Model S1344 Series Frequency Counter & Deviation Meter
Transmitter Deviation Measurement	Peak reading type for voice or sinusoidal wave; scales for accurate reading of ±5 kHz deviation (and ±1 kHz deviation for "Private-Line" models)	Any of the following items of Motorola Test Equipment: (See NOTE) Model R1200A Service Monitor Model R1007 Series Deviation Meter Model S1344 Series Frequency Counter & Deviation Meter
Transmitter Power Output Measurement	136-174 MHz; 50 ohms; at least 0-500 watts. 50-ohm dummy load; at least 500 watts	Motorola Model S1350A "Thruline" Wattmeter with appropriate element Motorola Model T1013A RF Load Resistor
RF Signal Generator for receiver testing	136 to 174 MHz; FM; high-stability-(±.0002% or better); adjustable output 0 to 1000 microvolts	Motorola Model R1200A Service Monitor Motorola R1010 Signal Generator
Audio Voltage Measurements Audio Signal Generator for audio circuit testing in receiver and transmitter	High impedance (10 megohm); dBm scale Variable amplitude 0 to 1 volt; 1000-Hz tone (300- to 3000-Hz preferred); sinusoidal wave	Motorola Model S1053C Solid-State AC Voltmeter Motorola Model S1067B Solid-State Audio Oscillator Motorola Model TEK-1 Tone Oscillator Motorola Model R1200A Service Monitor
DC Voltage Measurements, Resistance Measurements, RF Voltage Measurements	High impedance (11 megohm) dc multimeter	Motorola S1063B Solid-State DC Multimeter with SLN6055A RF Probe Motorola Model R1001 Digital Multimeter
Waveform Measurements	Oscilloscope: Audio circuit measurements. RF circuit measurements, at least 50 MHz bandwidth	A very high quality oscilloscope is required.
"Private-Line" tone injection for PL decoder circuit measurements	"Private-Line" tone generator using "Vibrasender" resonant reed for frequency accuracy; or audio oscillator with frequency counter for accurate setting of oscillator.	Motorola Model S1333B Audio Synthesizer Motorola Model SLN6221A "Private-Line" Tone Generator
Troubleshooting "Digital Private-Line" Circuits	Generate and decode 23-bit binary code word	Motorola Model SLN6413A "Digital Private-Line" Test Set
Tuning Tool	Used for adjusting all tunable components during equipment alignment.	Motorola part number 66A84387C01
Contact Removal Tool	Used to remove female wire terminals from metering cable connector	Motorola part number 66B84690C01

NOTE: Use only R1200A Service Monitor with RTC4000A Deviation Meter Plug-In Module that has been modified for "Digital Private-Line" modulated measurements.

C

STAT

ITEM	TYPICAL VALUE	FACTORY TEST (Note 1)	DATE WHEN PLACED IN SERVICE	
Transmitter Output Power	250 or 375 W			
Transmitter Deviation: With 1000 Hz @1 volt modulation With PL modulation	 ±5 kHz 0.5 to 1 kHz			
Receiver 20 dB Quieting Level	Less than 0.5 uV			
Frequency Measurement (Note 2): T1 T2 T3 T4 R1 R2 R3 R4				
Exciter Audio Input Level (XCTR LEVEL):	Note 3			
Receiver Audio Output Line (LINE OUTPUT):	Note 3			
Repeater Level, if applicable	Note 3			
Control Line DC Current Levels and/or Function Tone Frequencies Transmit F1 Transmit F2 Disable Receiver PL Mute R2 Unmute R2				

NOTES:

1. Enter data from factory test tickets provided with the station at time of shipment.
2. Transmitter frequency stability is ±0.0005% except when the optional ±0.0002% high stability channel element(s) is u
3. Refer to the Installation & Adjustments section of this instruction manual for set up procedure and typical value.

STATIO

METERING CHASSIS SELECTOR SWITCH POSITION	METER CIRCUIT SWITCH POSITION	FUNCTION	TYPICAL METER READING	FACTORY TEST (Note 2)	DATE WHEN PLACED IN SERVICE	
RCVR	1	Extender Channel Output (If applicable)	-			
	2	Not Used	-			
	3	Channel Element Output	15 uA			
-and+	4	Discriminator Output	0 ±2 uA			
	5	3rd IF Amplifier and Limiter	Note 3			
	6	Not Used	-			
XCTR	EXTR 1	"IDC" Audio Output	Note 4			
	EXTR 2	Channel Element Output	25 uA			
	EXTR 3	Tripler Input	38 uA			
	EXTR 4	1st Doubler Input	22 uA			
	EXTR 5	2nd Doubler Input	25 uA			
	PA 1	RF Input (Exciter Output)	15 uA (min)			
	PA 5	Driver Current	8-18 uA			
	PA 6	Driver Voltage	13 V dc			
	PWR CONT 1	Forward Output Power	24-50 uA			
	PWR CONT 2	Reflected Power	5-20 uA			
	PWR CONT 5	Control Voltage	3-25 uA			
PWR AMPL	GRID LEFT	Power Amplifier Grid Drive (Note 5)	100 V			
	GRID RIGHT	Power Amplifier Grid Drive (Note 5)	100 V			
		High Power Amplifier Plate Voltage (Ep)	Note 6			
		High Power Amplifier Plate Current (Ip)	Note 6			
		High Power Amplifier Input Power P in = Ep x Ip	Note 7			

NOTES:

1. On multiple frequency stations, repeat test for each operational frequency.
2. Enter data from factory test tickets provided with station at time of shipment.
3. Reading should be 1 uA or less. If measurement is not readable, inject an on-channel signal @1.0 mV into the anten
4. The "IDC" audio should be 2 uA without modulation and 10 uA with 165 mV @1000 Hz modulation applied to the micr
5. See the complete transmitter alignment procedure included in this section of the manual for typical values.
6. Power amplifier grid readings should be within 10 volts of each other.
7. Do not exceed tube power dissipation power rating. Tube Dissipation = DC Input Power - RF Output Power.

ON OPERATING PARAMETERS

1ST CHECK DATE	2ND CHECK DATE	3RD CHECK DATE	4TH CHECK DATE	5TH CHECK DATE	6TH CHECK DATE

sed. Receiver frequency stability is ±0.0005% except when the optional ±0.0002% high stability channel element(s) and the AFC module are used.

EPS-16244-A

N METER READINGS (Note 1)

1ST CHECK DATE	2ND CHECK DATE	3RD CHECK DATE	4TH CHECK DATE	5TH CHECK DATE	6TH CHECK DATE

na receptacle. A 20 uA typical reading should be obtained.
phone input.

EPS-16245-O

TEST EQUIPMENT REQUIRED

Refer to the Table of Recommended Test Equipment included within this Maintenance Section for a listing of the specific test equipment models recommended for receiver alignment. These include the following items:

1. Tuning Tool
2. Service Monitor; frequency measurement and rf signal generation.

FREQUENCY CALCULATIONS

Where:

f_o = channel element frequency

f_c = carrier frequency

11.7 MHz IF Receivers 11.8 MHz IF Receivers

132-150.8 MHz

$$f_o = \frac{f_c + 11.7\ \text{MHz}}{9} \qquad f_o = \frac{f_c + 11.8\ \text{MHz}}{9}$$

150.8-174 MHz

$$f_o = \frac{f_c - 11.7\ \text{MHz}}{9} \qquad f_o = \frac{f_c - 11.8\ \text{MHz}}{9}$$

20 DB QUIETING SENSITIVITY CHECK

1. Unsquelch the receiver by turning the SQUELCH control fully counterclockwise. "Private-Line" stations must also be PL disabled.
2. Set the range switch on an ac voltmeter to the 2 V ac position and connect the voltmeter across the speaker terminals of the station. Adjust the station VOLUME control for 2 V ac on the voltmeter.
3. Connect a signal generator to the station antenna receptacle. Set signal generator to the receiver frequency. Set the rf output to minimum.
4. Increase the signal generator output until the meter reading drops to .2 volt. The generator output level now indicates the 20 dB quieting sensitivity and should be 0.5 microvolt, or less (0.25 microvolt, or less, with preamplifier).

TWO-RECEIVER STATIONS

The Two Receiver Coupler used to connect both receivers to an antenna does not require alignment. Align both receivers while disconnected from the Two Receiver Coupler. Inject signal generator output into each receiver at the rf preselector (or preamp) and align. Then reconnect the Two Receiver Coupler and check for proper connections.

RF PREAMPLIFIER ALIGNMENT

STEP	ADJUST	METERING CHASSIS SELECTOR SWITCH POSITION	RECEIVER METERING SELECTOR SWITCH POSITION	PROCEDURE
1	--	--	--	If the station is equipped with an optional preamplifier, disconnect and bypass the preamplifier. Align the receiver, then reconnect the preamplifier. Make the following adjustments.
2	L3, L2, L1	RCVR -	5	Adjust L3, L2, and L1 in that order for maximum meter indication. Repeat.
3	L2	--	--	Tune L2 for maximum quieting.

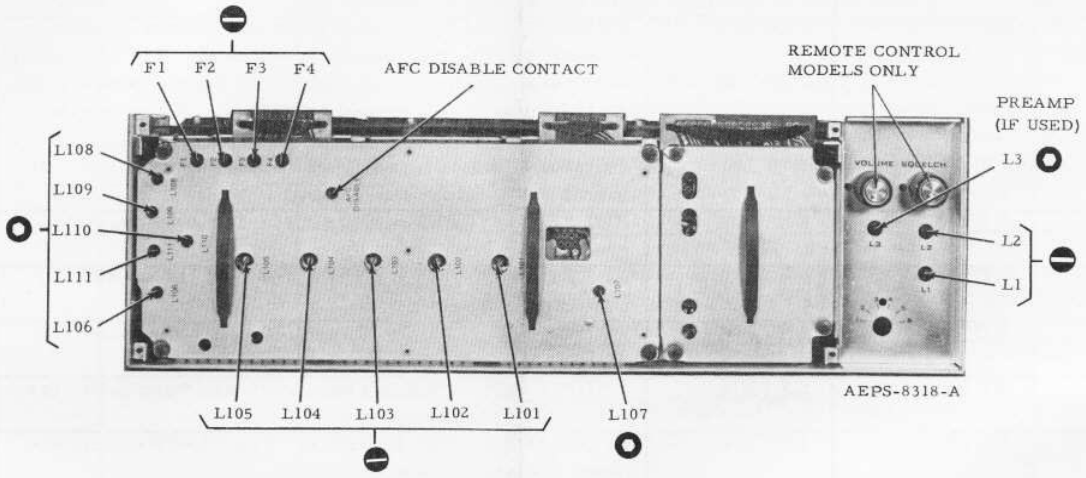


Figure 1.
Receiver Alignment Points

RECEIVER ALIGNMENT PROCEDURE

STEP	ADJUST	METERING CHASSIS SELECTOR SWITCH POSITION	RECEIVER METERING SELECTOR SWITCH POSITION	STAGE AND PROCEDURE
1	L108, L109	RCVR -	3	CHANNEL ELEMENT OUTPUT (3RD HARMONIC)- Adjust L108 and L109 for maximum meter indication. On multi-frequency receivers make this adjustment with frequency selector switch in F1 position.
2	L107	Alternate between RCVR + and RCVR -	4	DISCRIMINATOR - Unsquelch the receiver by turning the SQUELCH control fully counterclockwise. "Private-Line" stations must also be PL disabled. Connect an ac voltmeter across the speaker terminals of the station. Set to 2 V ac scale. Inject a 11.7 MHz (or 11.8 MHz) signal into L106 opening of receiver shield being careful not to contact circuit board. Insert probe into hole far enough to obtain reading 1/10 of that noted at beginning of this step (signal is "sprayed" into receiver). Hold probe in place. Adjust L107 for "0" center reading. Adjustment is critical and should be exactly on "0". Remove probe.

RECEIVER ALIGNMENT PROCEDURE (Cont'd)

STEP	ADJUST	METERING CHASSIS SELECTOR SWITCH POSITION	RECEIVER METERING SELECTOR SWITCH POSITION	STAGE AND PROCEDURE
3	L110, L111	RCVR -	5	MULTIPLIER - Connect signal generator to antenna input and apply a carrier frequency signal. Adjust L110 and L111 for maximum meter indication. If two peaks are observed, use peak with slugs farthest from circuit board. If a meter 5 indication cannot be obtained, connect center conductor of signal generator cable directly to the mixer gate.
4	L101, L102, L103, L104, L105, L106	RCVR -	5	RF PRESELECTOR AND MIXER - Turn out L101 thru L105 slugs until tip of each tuning screw extends approx. 1/4 inch beyond spring (mechanical parts list code 8). Connect signal generator to antenna input and apply carrier frequency signal. Tune L101 thru L105 for peak on meter position 5. Turn L103, L104, and L105 slugs in one turn. Peak L106 thru L101, in that order, on meter position 5. Decrease signal generator output as necessary to maintain indication between 10 and 25 uA.
5	L108, L110, L111	RCVR -	5	Adjust signal generator output for 25 uA meter indication. Detune L108 until meter indication decreases to 15 uA. Repeak L110 and L111 for maximum meter indication. Repeat entire step.
6	L108, L109	RCVR -	3	Repeak L108 and L109 for maximum meter indication.
7	L101, L102, L103, L104, L105	RCVR -	5	Repeak L101 through L105 for maximum meter indication. Repeat.
8	F1, F2, F3, F4	RCVR -	5	ON-FREQUENCY ADJUSTMENT - Disconnect signal generator and transmit carrier signal from transmitter normally received. If transmitter is known to be on frequency, meter 5 should indicate rise when transmitter is keyed (if necessary connect antenna). Check test set position 4 reading with transmitter keyed; "0" indicates on-frequency condition. Adjust F1, F2, F3 & F4 receiver warp capacitors for exact "0" reading in corresponding frequency selector switch positions. DO NOT RE-ADJUST L108 OR L109 AFTER THESE ADJUSTMENTS ARE MADE. If the receiver is equipped with AFC, short the AFC DISABLE contact while adjusting F1, F2, F3 and F4.
9	--	--	--	Perform 20 dB quieting sensitivity measurement as check of alignment.

EXCERPTS FROM FCC REGULATIONS

FCC Regulations state that:

1. Radio transmitters may be tuned or adjusted only by persons holding a first or second class commercial radiotelephone operator's license or by personnel working directly under their immediate supervision.
2. The power input to the final radio frequency stage shall not exceed the maximum figure specified on the current station authorization. This power input shall be measured and the results recorded:

   a. When the transmitter is initially installed.
   b. When any change is made in the transmitter which may increase the power input.
   c. At intervals not to exceed one year.

3. Frequency and deviation of a transmitter must be checked:

   a. When it is initially installed.
   b. When any change is made in the transmitter which may affect the carrier frequency or modulation characteristics.
   c. At intervals not to exceed one year.

TEST EQUIPMENT REQUIRED

Refer to the Table of Recommended Test Equipment included within this Maintenance Section for a listing of specific test equipment models recommended for transmitter alignment. These include the following items:

1. Tuning Tool
2. RF Dummy Load; 50-ohms at 500 watts min.
3. RF Wattmeter; 500 Watts
4. Service Monitor; frequency and deviation measurement
5. Audio Oscillator

HOW TO KEY THE TRANSMITTER

The serviceman may key the transmitter in one of two methods depending upon whether voice modulation is required. To key the transmitter without voice modulation, slide and hold the XMIT switch to the right, in the direction of the arrow. This switch is located on the front of the station control module which is mounted within the remote control chassis. To key the transmitter with voice modulation, speak into a service microphone connected to the metering chassis while depressing the microphone push-to-talk switch.

CAUTION

Do not key the transmitter for more than a few seconds at a time until the procedure is completed. Current is excessive in untuned stages and may cause damage.

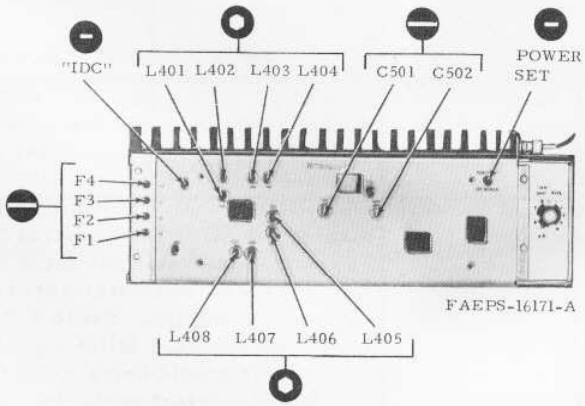
FREQUENCY CALCULATIONS

$$f_o = \frac{f_c}{12}$$

where: f_o = oscillator frequency
f_c = carrier frequency

ALIGNMENT PROCEDURE FOR LOW LEVEL SECTION OF TRANSMITTER

STEP	ADJUST	METERING CHASSIS SELECTOR SWITCH POSITION	EXCITER/ DRIVER METERING SELECTOR SWITCH POSITION	STAGE AND PROCEDURE
1	--	--	--	SET UP: Key the transmitter without modulation using the XMIT switch on the station control module.
2	POWER SET CONTROL	--	--	OUTPUT: Turn the POWER SET control on the power control board fully counterclockwise. Unkey the transmitter.
3	FREQUENCY SWITCH	XCTR	EXTR 2	CHANNEL ELEMENT: Select the desired frequency on multi-frequency stations. Key the transmitter. Meter 2 should indicate at least 10 uA. If not, check channel element.
4	ALL EXCITER COILS	XCTR	EXTR 3	PRE-ALIGNMENT: If the exciter shows no meter 3 readings, it is completely untuned. Set all tuning coil cores to the top of their coil forms (away from circuit board). Proceed to step 5. If the exciter shows meter 3 readings, set cores of all tuning coils except L401 and L402 to the top of their coil forms (away from the circuit board).
5	L401	XCTR	EXTR 2	BUFFER OUTPUT: Tune L401 for minimum meter reading.
6	L401, L402	XCTR	EXTR 3	BUFFER OUTPUT: Tune L402 and then L401 for peak meter reading.
7	L403	XCTR	EXTR 3	TRIPLER OUTPUT: Tune L403 for minimum meter reading.
8	L403, L404	XCTR	EXTR 4	TRIPLER OUTPUT: Tune L404 and then L403 for peak meter reading.
9	L405	XCTR	EXTR 4	FIRST DOUBLER OUTPUT: Tune L405 for minimum meter reading.
10	L405, L406	XCTR	EXTR 5	FIRST DOUBLER OUTPUT: Tune L406, and then L405 for peak meter reading.
11	L407	XCTR	EXTR 5	EXCITER OUTPUT: Tune L407 for minimum meter reading.
12	L407, L408	XCTR	PA 1	EXCITER OUTPUT: Tune L408 and then L407 for peak meter reading.
13				Repeat steps 6, 8 and 10.



*USED IN 90W AND 110W "COMPA-STATION" MODELS ONLY

Figure 1. Exciter Alignment Points

ALIGNMENT PROCEDURE FOR LOW LEVEL SECTION OF TRANSMITTER (Cont'd)

STEP	ADJUST	METERING CHASSIS SELECTOR SWITCH POSITION	EXCITER/ DRIVER METERING SELECTOR SWITCH POSITION	STAGE AND PROCEDURE
14	--	--	--	If the driver amplifier is to be re-aligned greater than ±1 MHz from the original frequency, proceed to Step 15. If the driver amplifier is to be re-aligned less than ±1 MHz from the original frequency, proceed to Step 20.
15	C501 R610 (POWER LIMIT)	--	--	PRE-ALIGNMENT: Set C501 fully clockwise. Use tuning tool to pre-align R610 on the component side of the power control board. Access to this control is provided by a small slot located approximately 3/4-inch from the POWER SET control access hole. Use the tuning tool to rotate the outer edge of the serrated knob. Adjust the POWER LIMIT control to the end of its travel by rotating the end of the knob toward the top of the chassis.
16	--	--	--	Disconnect the coaxial cable from the exciter-driver chassis output terminal. Connect a wattmeter and a 50-ohm rf load to the output terminal.
17	R611 (POWER SET)			TRANSMITTER OUTPUT: Adjust POWER SET control R611 to the maximum clockwise position.
18	C501	XCTR	PWR CONT 1	DRIVER OUTPUT: Key the transmitter without modulation and tune C501 clockwise for maximum power output.
19	R610 (POWER LIMIT)	XCTR	PWR CONT 1	DRIVER OUTPUT: Adjust R610 gradually toward the bottom of the chassis until the output power just starts to drop.
20	R611 (POWER SET)	XCTR	PWR CONT 1	DRIVER OUTPUT: Adjust R611 for 10 watts output power.
21	C501	XCTR	PA 5	Tune C501 clockwise for meter 5 dip. (The output power should remain 10 watts.)
22	--	XCTR	PA 5	DRIVER COLLECTOR CURRENT: The relationship between the meter 5 reading and the driver collector current is 10 uA = 1 A. The reading should be between 10 to 18 uA.
23	--	--	--	Disconnect the wattmeter and the rf load. Reconnect the coaxial cable to the driver amplifier output.

OSCILLATOR FREQUENCY ADJUSTMENT

1. Key the transmitter without modulation using the XMIT switch located on the station control module mounted in the remote control chassis.
2. On "Private-Line" tone-coded squelch stations, remove the "Vibrasender" resonant reed from the PL tone encoder board. On "Digital Private-Line" stations, short the code disable pins together on the "Digital Private-Line" encoder board.
3. Set-up a frequency monitor to monitor the transmitter output frequency.
4. Set each transmitter channel element on frequency by warping its tuning capacitor to the specified operating frequency.

DEVIATION (IDC) ADJUSTMENT

1. It is assumed that all operational channels have been "warped" on frequency before attempting to adjust the "IDC" circuit.
2. Connect an audio oscillator to the exciter input. (Pins 1 (AUDIO LO) and Pin 12 (AUDIO HI) of the exciter board.)
3. Set the audio-oscillator for 1000 Hz @ 1 volt. On "Private-Line" tone-coded stations, replace the "Vibrasender" resonant reed in the PL encoder. On "Digital Private-Line" stations, remove the short from the code disable pins on the "Digital Private-Line" encoder board.
4. Key the transmitter and adjust the "IDC" control for ±5 kHz deviation.
5. Reduce the audio oscillator output to 0.25 volts. Essentially full deviation should still be indicated. Less than full deviation may indicate weak or inoperative exciter audio stages.

ALIGNMENT PROCEDURE FOR HIGH POWER AMPLIFIER

PRELIMINARY ADJUSTMENTS

1. Before attempting to align the power amplifier, make certain the exciter-driver is properly aligned.
2. On multiple frequency transmitters, push the frequency select switch on the remote control chassis to the higher frequency (only momentary contact is required).
3. Series connect a 500 watt Wattmeter between the antenna output connector and the antenna.
4. Set station switches as indicated in the following table.

PRE-ALIGNMENT STATION SWITCH POSITIONS

CHASSIS	CONTROL	POSITION
High Power Amplifier	SCREEN VOLTAGE	Fully counterclockwise
	ANTENNA COUPLING	Fully counterclockwise
	PLATE TUNING	Fully clockwise
Metering Chassis	METER	PWR AMPL
Remote Control Chassis	LINE DISABLE switch	To the right
Outlet Box	MAIN POWER	ON

5. Unless otherwise noted, key the transmitter without modulation while performing each step of the alignment procedure.

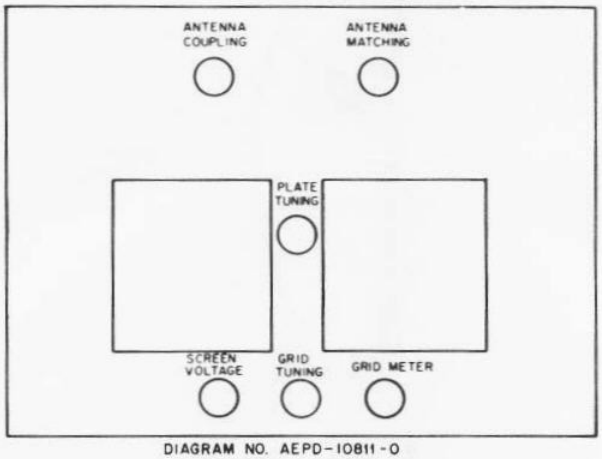


Figure 2.
High Power Amplifier Alignment Controls

ALIGNMENT PROCEDURE

STEP	ADJUSTMENT CONTROL	METER	READING	PROCEDURE
1	GRID TUNING	TUNING	Maximum	Adjust GRID TUNING control for maximum PA grid voltage.
2	GRID METER Switch	TUNING	70 volts minimum	Set the GRID METER switch to the LEFT TUBE and RIGHT TUBE positions. Meter readings should be equal within 10 volts and higher than 70 volts.
3	PLATE TUNING	PLATE CURRENT	Minimum	Rotate the PLATE TUNING control counter-clockwise until the plate current dips to its minimum value. NOTE As plate resonance is approached, the plate current will rise before dipping.
4	ANTENNA MATCHING	Wattmeter	Maximum	Adjust the ANTENNA MATCHING control for maximum power output.
5	--	--	--	Repeat steps 3 and 4 two times.
6	ANTENNA COUPLING	Wattmeter	Maximum	Increase ANTENNA COUPLING (clockwise) until power output is maximum.
7				Repeat steps 3 and 4 until readjustment of respective controls does not result in lower plate current or higher power output. NOTE Do not readjust ANTENNA MATCHING after this step.
8	SCREEN VOLTAGE	PLATE CURRENT	267 mA (250 W) or 400 mA (375 W)	Increase SCREEN VOLTAGE (clockwise) until plate current is 267 mA for 250 W stations, or 400 mA for 375 W stations. NOTE If a plate current of 267 or 400 mA cannot be obtained with the SCREEN VOLTAGE control, increase the ANTENNA COUPLING to obtain the necessary plate current.
9				Repeat step 1.
10		PLATE VOLTAGE		Note the indicated plate voltage and calculate (or refer to the appropriate POWER INPUT table) the required plate current for the input power. For 250 W stations, $I_p\ (mA) = \frac{400\ watts}{E_p\ (volts)} \times 1000$ CAUTION DO NOT EXCEED 400 W INPUT POWER. For 375 W stations, $I_p\ (mA) = \frac{600\ watts}{E_p\ (volts)} \times 1000$ CAUTION DO NOT EXCEED 600 W INPUT POWER.

ALIGNMENT PROCEDURE (Cont'd)

STEP	ADJUSTMENT CONTROL	METER	READING	PROCEDURE
11	SCREEN VOLTAGE	PLATE CURRENT	Calculated Current	Readjust the SCREEN VOLTAGE control and if necessary the ANTENNA COUPLING control until the calculated current is obtained. NOTE If calculated current is much higher or lower than 267 mA for 250 W stations, or 400 mA for 375 W stations, the indicated plate voltage will change from its step 10 value. Recalculate the plate current required for the tube input, 400 or 600 watts, using the new plate voltage. Adjust the SCREEN VOLTAGE control for this current.
12	ANTENNA COUPLING	PLATE CURRENT	Calculated Current plus 20 mA	Increase ANTENNA COUPLING until plate current is increased by approximately 20 mA.
13	PLATE TUNING	PLATE CURRENT	Minimum	Adjust the PLATE TUNING control for minimum plate current.
14	SCREEN VOLTAGE	PLATE CURRENT	Calculated Current	Reduce the SCREEN VOLTAGE until the current returns to the calculated value.
15		Wattmeter	Maximum	Note the obtained output power. Repeat steps 12, 13 and 14. If power output increases with the 400 W or 600 W input, continue repeating this sequence. When the sequence results in a lower power output, proceed with the following steps.
16	ANTENNA COUPLING	PLATE CURRENT	Calculated Current minus 10 mA	Decrease ANTENNA COUPLING until plate current is reduced 10 mA.
17	PLATE TUNING	PLATE CURRENT	Minimum	Adjust the PLATE TUNING control for minimum plate current.
18	SCREEN VOLTAGE	PLATE CURRENT	Calculated Current	Increase SCREEN VOLTAGE until the current returns to its calculated value.
19		Wattmeter	Maximum	If necessary, repeat steps 16, 17 and 18 until maximum power output (obtained in step 15) is restored.

NOTES:

1. It is recommended that the METER switch be left in the PWR AMPL position after the tuning is completed.
2. Neutralization of the power amplifier is fixed for all frequencies.
3. After aligning a multiple frequency transmitter, switch to each of the other frequencies and reduce ANTENNA COUPLING if necessary, to avoid exceeding the 400 or 600 watt input.
4. Return the LINE DISABLE switch located on the remote control chassis to the left.

400 W POWER INPUT TABLE

PLATE VOLTAGE	PLATE CURRENT
1700 V	235 mA
1600 V	250 mA
1500 V	267 mA
1400 V	385 mA
1300 V	307 mA

UNDER NO CIRCUMSTANCES MAY TUBE POWER DISSIPATION EXCEED 300 WATTS.

DO NOT EXCEED 500 mA PLATE CURRENT.

Tube Power Dissipation = Input Power - Output Power

Input Power Formula: $E_p \times I_p = 400\ W\ P_{in}$

600 W POWER INPUT TABLE

PLATE VOLTAGE	PLATE CURRENT
1700 V	353 mA
1600 V	375 mA
1500 V	400 mA
1400 V	430 mA
1300 V	460 mA

UNDER NO CIRCUMSTANCES MAY TUBE POWER DISSIPATION EXCEED 300 WATTS.

DO NOT EXCEED 500 mA PLATE CURRENT.

Tube Power Dissipation = Input Power - Output Power

Input Power Formula: $E_p \times I_p = 600\ W\ P_{in}$