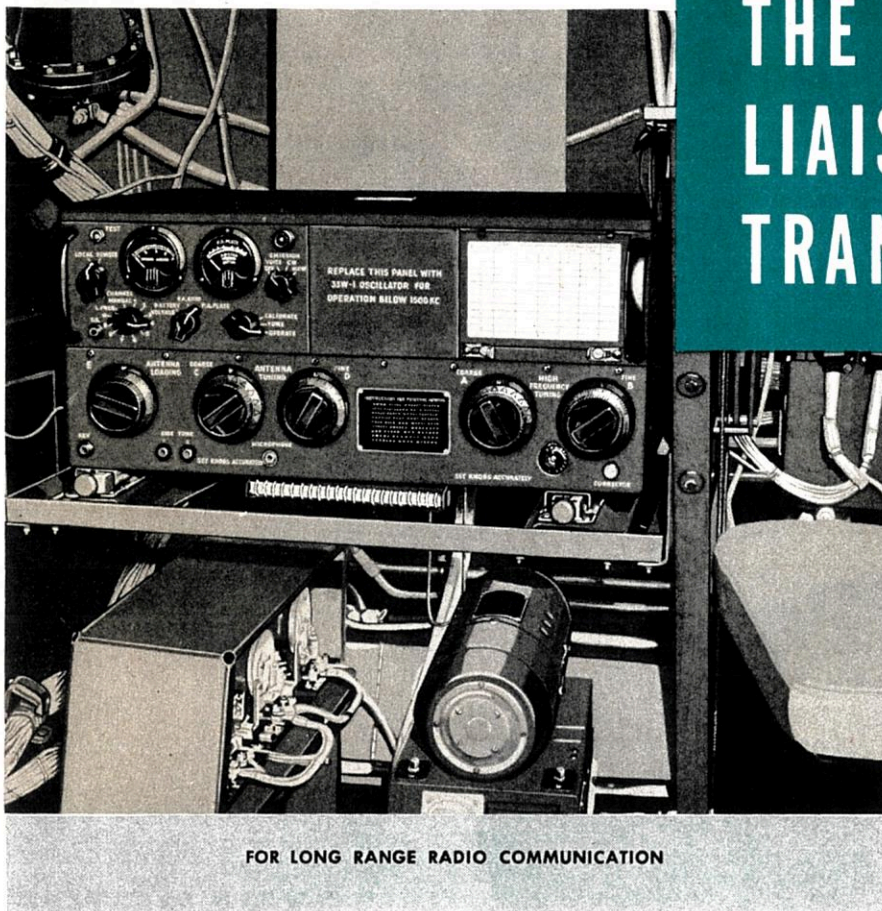


THE AN/ART-13A LIAISON TRANSMITTER



FOR LONG RANGE RADIO COMMUNICATION

The AN/ART-13A transmitter has a frequency range of 2000 to 18100 kc. You can pre-set any one of its 10 channels to any frequency within this range. The Auto-tune system, a built-in, automatic tuning device, controls all the transmitter dials. With it, you can make a complete channel change in approximately 25 seconds.

The transmitter operates on VOICE, CW, or MCW.

REMOTE CONTROL UNIT

There is a remote control unit in the pilot's compartment. It functions only when the LOCAL-REMOTE switch on the transmitter panel is set to REMOTE. The pilot's control box has a channel switch, an emission switch, and a key mounted on top of the box.

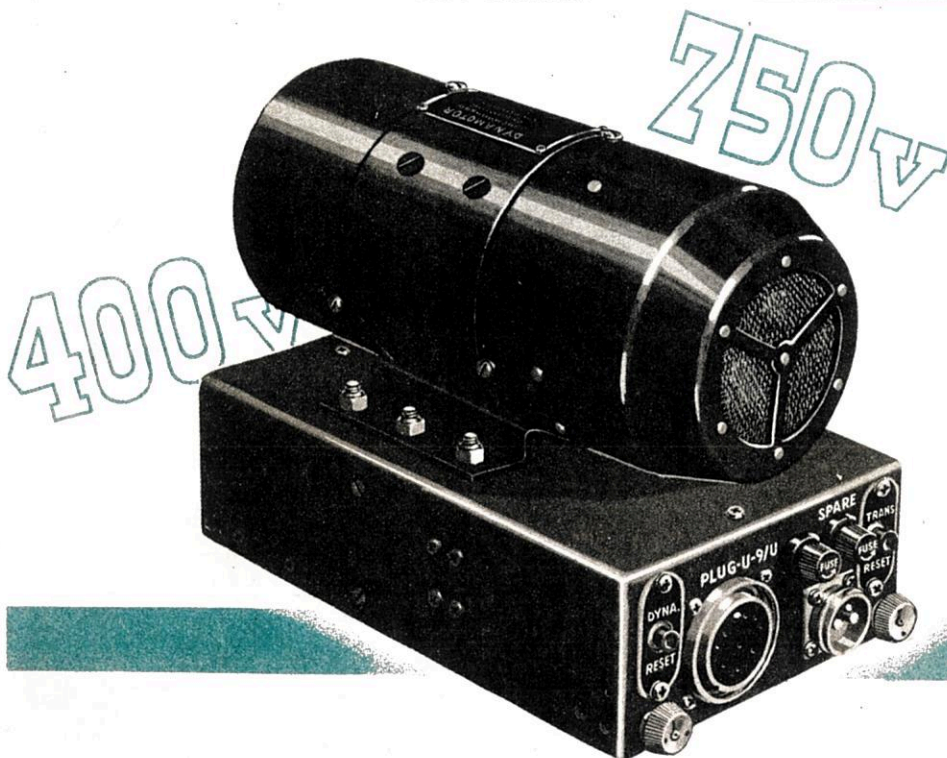
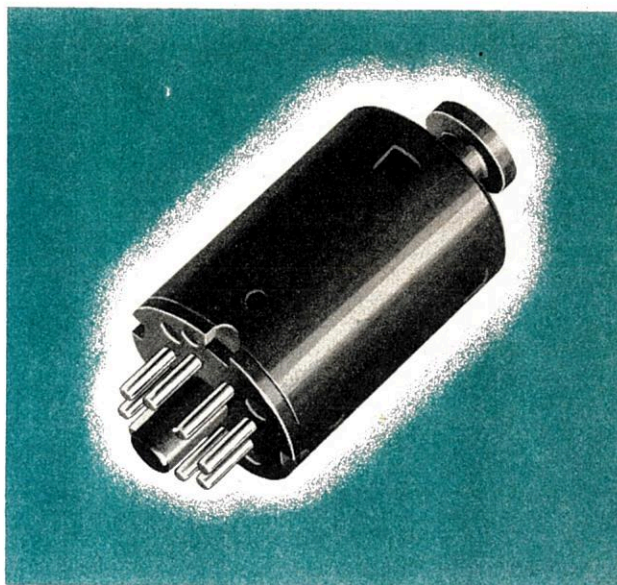
When the remote unit has control of the equipment, its red light glows. However, the light will not come on while the Autotune motor is operating.



CRYSTAL FREQUENCY INDICATOR

A crystal frequency source is built into the transmitter. It is used to calibrate the master oscillator for accurate tuning. The crystal has a fundamental frequency of 200 kc. There are two types of crystal indicator. The most common one is illustrated here. An audio signal results from the difference between the crystal oscillator frequency and the master oscillator frequency. This signal, fed into the sidetone circuit, enables you to monitor your transmissions.

CRYSTAL CHECK POINTS ARE SHOWN IN HEAVY BLACK TYPE ON THE CALIBRATION CHARTS.



DYNAMOTOR

The dynamotor unit has two high-voltage commutators, one delivering 400 volts, the other 750 volts. These are connected in series to provide the 1150 volts required for the normal output of the transmitter.

At altitudes greater than 25,000 feet, a pressure-operated switch disconnects the output of the 400-volt commutator. This reduction of total voltage prevents flashovers, which otherwise would occur at high altitudes.

A 1-ampere fuse on the connection end of the unit protects the 400-volt output.

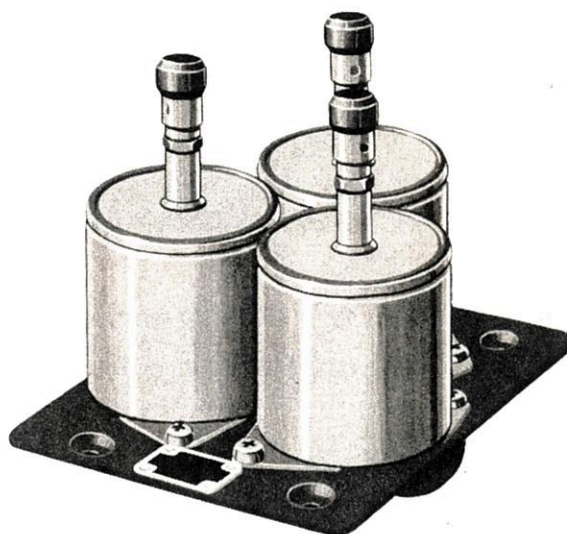
There are two thermal-type overload relays in the dynamotor unit. One controls the dynamotor input circuit. The other controls the transmitter's low-voltage circuits. The contacts of these relays open automatically as a result of excessive heat. When they have opened, return them to their normal positions by pressing the RESET buttons on the filter unit.

ANTENNA SHUNT UNIT

The antenna shunt unit allows you to operate on a short fixed-wire antenna at frequencies from 2000 to 3000 kc. This unit consists of three 25-mmfd capacitors mounted on a plate which serves as a common connection to one terminal of each capacitor. The capacitors can be connected separately or in parallel, so that you can use 25, 50, or 75 mmfd of capacitance. You can connect them in the circuit by a knife switch (or SA/22) if the frequency at which you are operating requires them. However, the capacitors should not be in the antenna circuit on any other frequency.

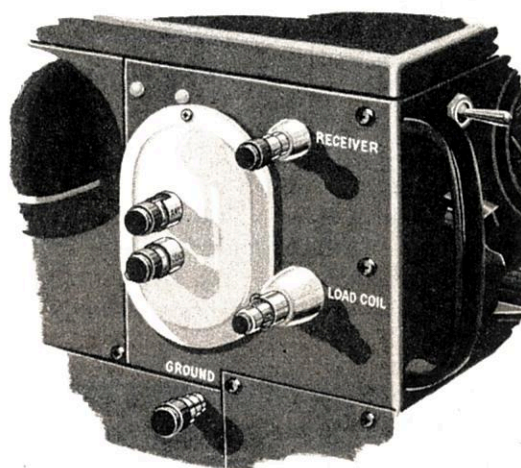
Consult the chart (ROIF 4-1-8) or your operating handbook to find how much capacitance you need.

Remember: Use these capacitors only when you must operate on a frequency that requires them.



ANTENNA CONNECTIONS

Five binding posts on the left end of the transmitter provide you with all the necessary antenna connections. Keep the leads as short as possible. Keep the insulators clean.



DUMMY LOW-FREQUENCY OSCILLATOR

If your transmitter does not have a low-frequency oscillator, a dummy oscillator will be installed in its place. This unit includes duplicate low-frequency oscillator plugs, a 28-ohm, 10-watt filament-substitute resistor, and a blank panel assembly. With the dummy oscillator in the set you can operate normally in every way in the 2000 to 18100 kc frequency range.



TRANSMITTER CONTROLS

THIS SECTION OF THE TRANSMITTER CONTAINS THE OPERATING CONTROLS:

TEST: A spring switch which closes the keying circuits. Must be held in position during testing.

LOCAL-REMOTE: A switch which transfers control from your position to the remote control unit.

CHANNEL: A selector switch which lets you select any one of the 10 pre-tuned frequency channels. The L. FREQ. position does not function unless there is a low-frequency oscillator in the set.

ANTENNA CURRENT METER: A thermocouple-type ammeter which shows the amount of current feeding into the antenna system.

BATTERY VOLTAGE-PA GRID-PA PLATE: A selector switch controlling the functions of the combination milliammeter and voltmeter above it. The meter registers power-amplifier plate current, power-amplifier grid drive, or the airplane's battery voltage, depending upon the setting of the switch.

CALIBRATE - TUNE - OPERATE: A selector switch performing the following functions:

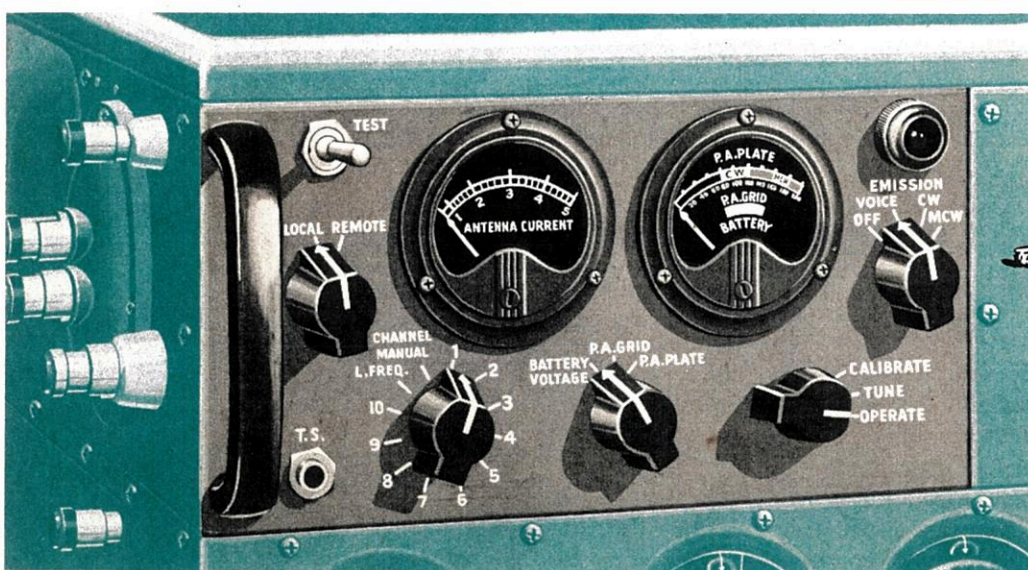
1. **CALIBRATE** switches in the crystal-frequency indicator, disables the power-amplifier and multiplier stages, and connects sidetone circuits.

2. **TUNE** reduces the power-amplifier plate voltage to keep the power-amplifier tubes from being damaged during preliminary tuning.

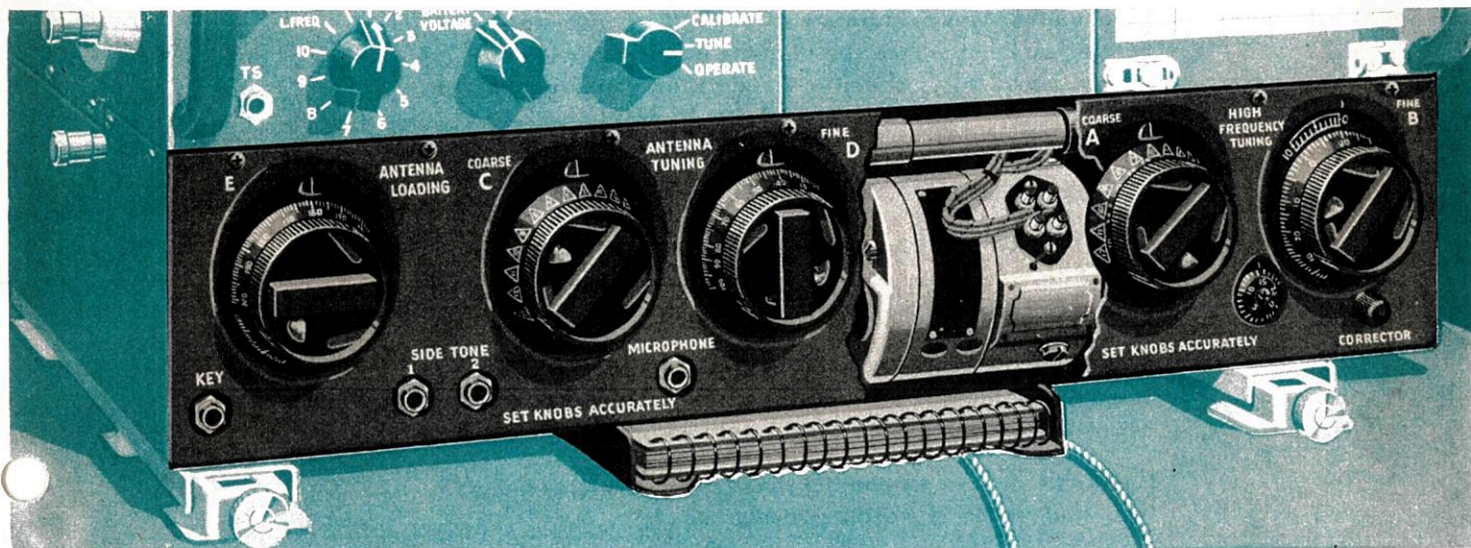
3. **OPERATE** gives you normal operation. Leave the switch in this position except when you are calibrating or tuning the transmitter.

EMISSION: A switch which allows you to select VOICE, CW, or MCW emission. It also switches the battery power into the transmitter equipment.

The TS jack is a connection for an external throttle switch. You can simplify tuning by inserting a shorted PL-68 (disconnecter-cord plug) here to close the keying circuits and let you use both hands for tuning. **Remove the plug when you finish tuning, or if you rotate the E dial through the spaces between 0 and 100 or 100 and 200.**



In order to tune and operate the set efficiently,
you must understand exactly what each control does.
The transmitter panel has been divided into
sections, here, to clarify these functions.



THIS SECTION OF THE TRANSMITTER CONTAINS THE TUNING CONTROLS.

These dials control the master-oscillator, power-amplifier, and antenna-loading circuits. All five controls are connected to the Autotune system. This is an electrically-controlled mechanical system of setting the transmitter tuning elements for any one of 10 frequency channels. These channels can be tuned to any frequency between 2000 and 18100 kc. The Autotune is driven by a reversible electric motor.

The Autotune mechanism allows considerable play in the dials. Because of this you must use the following method when you set them:

After you have determined the proper dial setting:

1. Rotate the dial to the left of the determined setting about a quarter of a turn.
2. Then rotate the dial to the right until it reaches the exact setting.

If you find you have passed the exact setting, repeat the procedure. Never back up to a setting if you have passed it.

Remember, always approach the final setting through clockwise rotation.

Here are the uses of the individual controls:

Dial A is the **coarse tuning** control of the master oscillator. It also selects the proper frequency-multiplier circuits.

Dial B is the **fine tuning** control of the master-oscillator and frequency-multiplier circuits.

Note: When you position the B dial, use the small counter dial at its lower left to set hundreds, and the B dial itself to set tens and digits. That is, for a reading of 514, set 5 on the counter dial and 14 on the B dial. The vernier adjustment on the newer transmitters lets you set dial B more accurately.

Dial C selects the most suitable type of antenna-matching network for tuning and coupling the power amplifier to the antenna system.

Dials D and E are power-amplifier tuning and antenna-loading controls. Their functions depend on the setting of the C dial, as follows:

1. When C is set **below 8**, E tunes the power amplifier and D loads the antenna.
2. When C is set at **8 or above**, D tunes the power amplifier and E loads the antenna.

TUNING PROCEDURE

PREPARATION

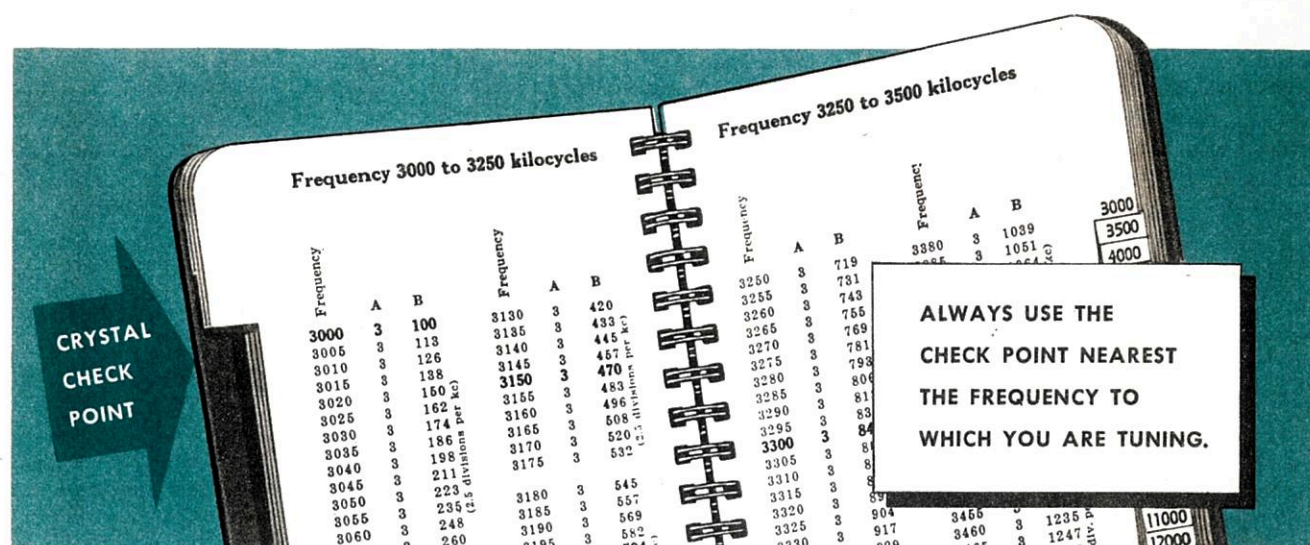
Here are the steps preparatory to tuning the transmitter. Before you begin, make sure that the antenna change-over knife switch (or its equivalent) is closed to the antenna you intend to use.

1. Set the LOCAL-REMOTE switch on LOCAL position.
2. Set the CALIBRATE-TUNE-OPERATE switch on TUNE.
3. Turn the EMISSION switch to VOICE. (The transmitter is now turned on, but the dynamotor will not run until the TEST switch, the microphone button, or the key is closed, or the shorted plug inserted.)
4. Turn the meter selector switch to BATTERY VOLTAGE position. The meter reading should fall within the narrow shaded area labeled BATTERY. See your crew chief if the battery voltage is low.
5. Select a channel number for the frequency you are going to tune, and set the CHANNEL switch on it.
6. Unlock the Autotune dials by turning the locking bars to the left about a quarter of a turn. Hold the dial with one hand and loosen the locking bars with the other.

THE SELECTED CHANNEL IS NOW READY TO BE CALIBRATED.



TRANSMITTER CALIBRATION



Before you can tune the transmitter accurately, you must check the calibration of the master oscillator. **Check it for each channel you tune.**

This is the purpose of the built-in calibration frequency indicator. By using harmonics of the crystal frequency indicator, you can check the transmitter at various points throughout its range. These harmonics are called **crystal check points**.

Crystal check points are printed in heavy type on the calibration charts. You can find these charts either in the transmitter's operating manual or in T.O. AN 08-30 ART 13-3.

Always use the check point nearest the frequency to which you are tuning.

There are two types of calibration charts. The one illustrated at the top of this page gives dial settings at 2-kc intervals from 200 to 500 kc, at 5-kc intervals from 500 to 8000 kc, and at 10-kc intervals from 8000 to 18100 kc.

The other chart lists all frequencies in single-kilocycle steps. Heavy ruled lines, appearing at intervals, help you select the proper check point accurately. Always use the check point listed between the same heavy lines as the frequency on which you are to operate.

If you must tune to a frequency between any two given on a chart, use one of these methods:

1. For the chart illustrated, find the difference between the frequency you want and the **next lower frequency** listed. Multiply this difference by the number in parentheses at the right of the column and add the result to the B-dial setting for the lower

frequency. For example:

$$3003 - 3000 = 3$$

$$3 \times 2.5 = 7.5$$

$$100 + 7.5 = 107.5, \text{ or the B-dial setting.}$$

2. For the single-frequency charts:

	Freq.	A	B	
Desired frequency,	3410	3	1114.1	Difference between these is 2.4
	3411	3	1116.6	
	3412	3	1119.0	
	3413	3	1121.5	

$$2.4 \times .5 = 1.20.$$

$$1.20 + 1116.60 = 1117.80, \text{ the B-dial setting.}$$

After you have selected the proper crystal check point, calibrate the transmitter as follows:

1. Place control A on the correct position, as shown on the calibration chart. Approach this setting through a quarter turn of clockwise rotation, then tighten the locking bar.

2. Align the moving indicator of the B dial (or 0 on the vernier scale) with the stationary indicator. Use the CORRECTOR knob to do this.

3. Leave the EMISSION switch on VOICE, and turn the CALIBRATE-TUNE-OPERATE switch to CALIBRATE position.

4. With your headphones plugged into the jack SIDETONE 1, adjust control B for a zero beat. If the dial does not indicate the exact B-dial setting for your check point frequency, adjust the movable indicator (or 0 on the vernier scale) until it does.

5. Return the CALIBRATE-TUNE-OPERATE switch to TUNE. Set EMISSION switch on CW/
The channel is now ready to be tuned.

FINAL TUNING PROCEDURE

1. Rotate control B to its proper position, as shown in the calibration chart, and lock it. Use the movable indicating mark as the index against which to set the dial.

If your transmitter has a vernier scale, and the B-dial reading has a decimal point, align the decimal reading as you do on the dial of the SCR-211 frequency meter. (See ROIF 4-4.)

2. Turn the meter-selector switch to PA GRID position and press the TEST switch. The meter reading should fall in the area labeled PA GRID. If it doesn't, check position of control A. Release the TEST switch.

3. Put the meter selector switch on PA PLATE position.

4. Refer to the antenna-tuning tables below for the approximate C, D, and E settings.

The tables below give you a quick-reference guide for tuning the antenna-matching network and power-amplifier controls, C, D, and E. They are approximately correct for any airplane using these antenna lengths. If no D setting appears on the chart, set the D control on 50.

The settings for the U. S. Emergency and Safety Frequency, 8280 kc, are listed in red.

Include the lead-in and the down-lead in calculating the total length of an antenna. With an L-type antenna, figure the length of the longest leg.

You must know the overall length of your antenna.

B-17 ANTENNA—LENGTH APPROXIMATELY 27.5 FEET. 75mmfd. (three sections) of shunt capacitance must be connected to the antenna circuit to permit tuning in the 2000-to-2600 kc range.

KC	C	D	E	KC	C	D	E	KC	C	D	E
2600	1	—	0	9100	7	100	200	9000	11	45	40
3000	2	—	75	9000	10	59	10	10000	11	40	140
3500	3-4	—	110	9500	10	57	80	12000	11	55	195
4000	4-5	—	130	10000	10	55	110	14000	11	75	200
5000	6	—	150	11000	10	60	175	16500	11	95	200
6000	6-7	—	165	12000	10	65	185	16000	13	0	180
8000	7	70	190	14000	10	80	195	17000	13	45	190
8280	7	75	185	15500	10	100	195	18000	13	60	195

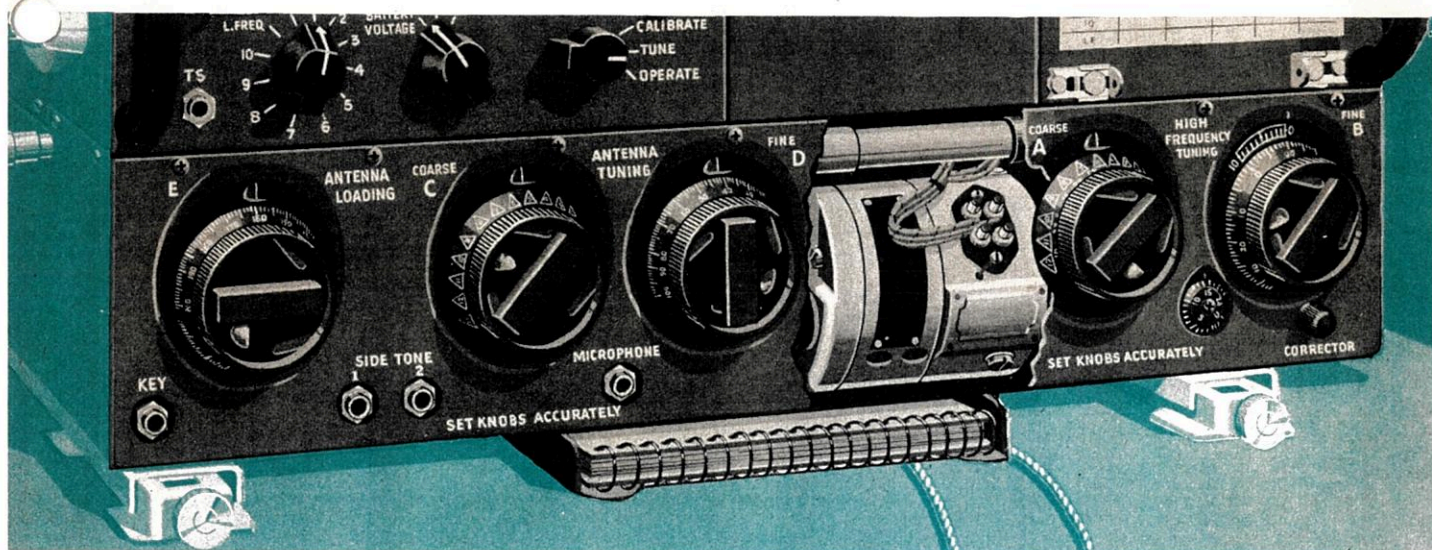
B-24 ANTENNA—LENGTH APPROXIMATELY 50 FEET. NO SHUNT CAPACITANCE REQUIRED.

KC	C	D	E	KC	C	D	E	KC	C	D	E
2100	1-2	—	0	5500	7	100	180	11000	11	53	200
2500	3-4	—	19	6000	8	38	90	12000	11	72	200
3000	4-5	—	55	6210	8	42	110	13000	13	82	200
3105	—	—	65	7000	8	48	148	14000	13	100	0
4000	6-7	—	120	8000	8	65	152	15000	13	52	125
4220	6-7	—	130	8280	8	70	150	16000	13	69	136
4495	7	—	140	9000	8	85	148	17000	13	71	164
5000	7	—	160	10000	11	40	200	18000	13	68	184

B-29 ANTENNA—LENGTH APPROXIMATELY 62 FEET. NO SHUNT CAPACITANCE REQUIRED.

KC	C	D	E	KC	C	D	E	KC	C	D	E
2000	2	26	0	6000	8	42	140	12000	11	71	156
2500	4	69	17	6290	8	48	140	13000	11	77	178
3000	5	100	77	7000	8	61	140	14000	11	87	168
3100	6	32	73	8280	8	85	100	15000	3	56	140
3500	6	76	117	9000	9	76	132	15500	13	73	115
4000	7	37	154	10000	10	77	3	16000	13	86	40
4495	7	75	170	10500	12	48	16	17000	13	91	122
5000	8	14	103	11000	11	69	72	18000	13	97	127

Consult your Operating Manual or T.O. for other antenna-tuning charts.



You must now use one of two procedures to tune the power amplifier and load the antenna circuit.

Use these steps
if control C is
set anywhere
from 1 through 7

5. Hold the TEST switch closed and seek a plate-current dip by rotating control E. If you do not find a resonance dip, place control C on the next higher position and rotate control E again. Repeat this process until you find a resonance dip.

6. Turn CALIBRATE-TUNE-OPERATE switch to OPERATE, and load the power amplifier with control D, re-resonating each time with E, until the dip falls within the area labeled CW. If you rotate D throughout its range and the meter reading is still low, move control C to the next higher position and adjust D again. Repeat the procedure until the meter reading is correct.

Caution: Notice that the calibrations of the E dial are divided into two sections (0 to 100 and 100 to 200) separated by short blank spaces. Do not move the dial through these blank spaces while the TEST switch, microphone button, or key is closed, or the shorted plug inserted. You will damage an internal switch if you do.

Use these steps
if control C is set
anywhere from
8 through 13

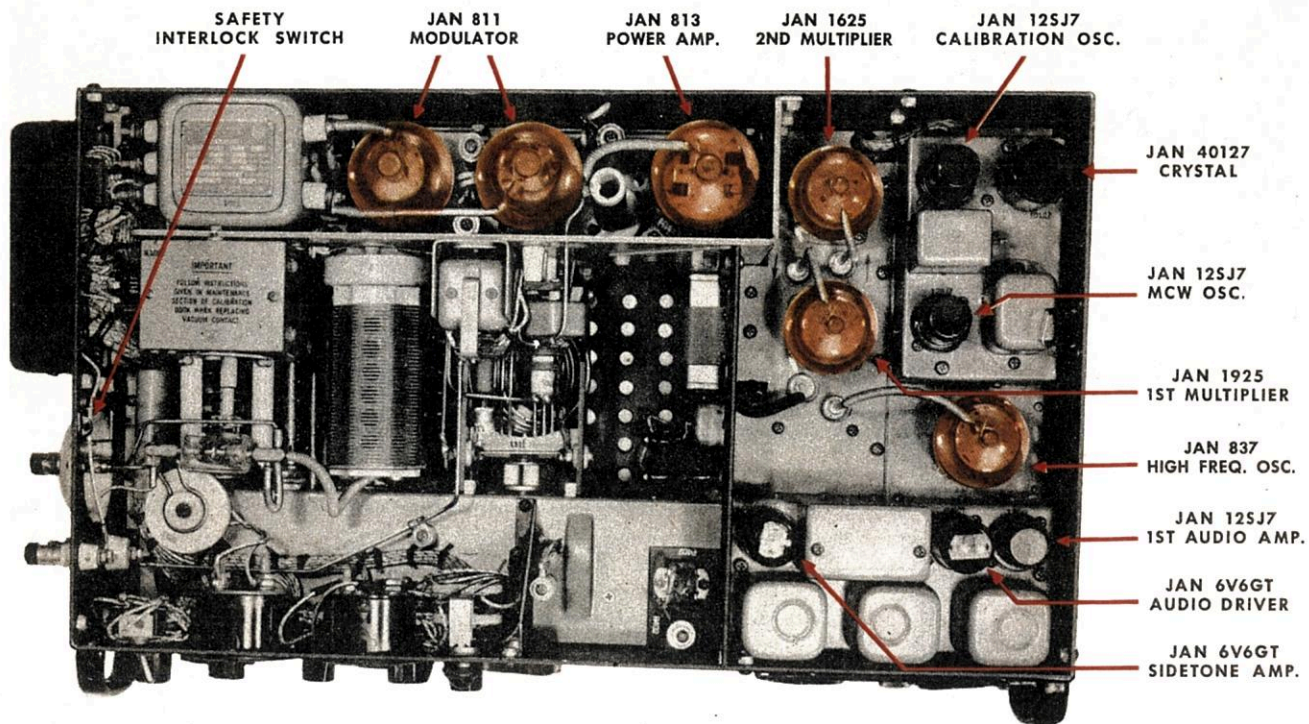
7. Hold the TEST switch closed, and seek a plate-current dip by rotating control D. If you do not find a resonance dip, place control C on the next higher position and rotate control D again. Repeat this process until you find a resonance dip.

8. Turn the CALIBRATE-TUNE-OPERATE switch to OPERATE, and load the power amplifier with control E, re-resonating each time with D, until the dip falls within the area marked CW. If you rotate E throughout its range and the meter reading is still low, move control C to the next higher position and adjust E again. Repeat the procedure until the meter reading is correct.

For VOICE or MCW, set the EMIS-
SION switch accordingly. The meter
should read about 150 ma for voice
operation, and up to the MCW por-
tion of the scale for MCW.

9. Lock C, D, and E. Observe their settings closely before you back them off to start locking. To make sure they have not slipped, turn the CHANNEL switch to a different channel, then back. The Autotune thus makes a complete cycle, and afterward the meter should still read CW. If it doesn't, repeat the locking procedure. **Be sure to lock the dials** before you change channels, or you will disturb the settings of the channels already tuned.

EMERGENCY OPERATIONS



TUBE FAILURE

If certain of the transmitter's tubes fail, you can still operate on CW, using a minimum number of tubes. CW operation is possible without any of these: audio, calibration-frequency-oscillator, MCW-oscillator, and sidetone-amplifier tubes.

If you replace the speech-amplifier tube with either an MCW or a calibration-frequency-oscillator tube, CW and VOICE operation are still possible. However, the calibration-frequency oscillator and the MCW oscillator will be disabled.

The six tubes illustrated in color **must be intact** to permit any emergency operation.

SWITCHING UNIT FAILURE

Connect the ANT post on the transmitter directly to the antenna lead-in. This lets you carry on high-frequency operation.

VACUUM SWITCH FAILURE

Remove the wire from the ANT post and connect it to the COND post. Connect a wire from the RECEIVER post on the transmitter to the antenna you

are not using (either fixed- or trailing-wire). Be sure the trailing-wire antenna is reeled out.

This operation may damage the receiver, especially if you are using the same frequency for transmission and reception. To prevent possible damage, disconnect the wire from the ANT post on the receiver while you transmit.

AUTOTUNE FAILURE

If the Autotune should fail to set all the tuning dials properly:

1. Turn all the incorrectly-set controls counter-clockwise as far as they will go. Then turn them clockwise until they stop.

2. If that fails, put the CHANNEL switch on MANUAL and set the controls on the proper positions for the frequency at which you are to operate.

Don't loosen the locking bars when you are tuning manually; you'll de-tune all the pre-set channels.

Notes: B-29 installations include a coupler (CU-92/ARN) which lets you use the LORAN antenna if the liaison antenna is disabled. LORAN reception is cut off only when you use the transmitter.

A safety interlock switch is now part of this set and will be installed in all units in the future.