NAVSHIPS 92121(A)

INSTRUCTION BOOK

for

RADIO TRANSMITTING SETS

AN/SRT-14, AN/SRT-14A, AN/SRT-15, AN/SRT-15A, AN/SRT-16 AND AN/SRT-16A

SECTION 4
OPERATION

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A division of INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION
CLIFTON, NEW JERSEY

DEPARTMENT OF THE NAVY
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OPERATION

1. INTRODUCTION.

The following operating instructions presume that Radio Transmitting Set AN/SRT–14, 15 or 16 has been installed and checked by qualified personnel.

Note

The AN/SRT–14A, 15A and 16A are nonmagnetic versions of the AN/SRT–14, 15 and 16 respectively. As the nonmagnetic versions vary from the standard types only in the material used for cabinet panels, all information on the operation of the AN/SRT–14, 15 and 16, as set forth in the following section, applies equally as well for the AN/SRT–14A, 15A and 16A.

Note

Where, throughout this section, reference is made to either low level radio modulator or high level radio modulator, it should not be interpreted as meaning the technique of modulation known as grid modulation or low level modulation, but rather as referring to the operating *power* level.

a. AN/SRT–14.—Radio Transmitting Set AN/SRT–14 has all controls necessary for accomplishing the transmission of any one of five different services at a nominal 100-watt output level. The frequency range of 0.3 to 26 mc, in steps of 10 cycles, is covered in six tuning bands. All frequency selection and tuning are manually accomplished at the site of the transmitter. The set is so constructed as to permit remote control and operation by means of a standard Navy 6-wire control system.

b. AN/SRT–15. *(See figure 4–1.)*—Radio Transmitting Set AN/SRT–15 has all the characteristics of AN/SRT–14. In addition, AN/SRT–15 may be operated at a nominal 500-watt level on any of the high-frequency bands covering the range from 2 to 26 mc.

c. AN/SRT–16.—Radio Transmitting Set AN/SRT–16 combines the characteristics of AN/SRT–14 and AN/SRT–15. AN/SRT–16 permits simultaneous transmission of the same service at different frequencies and of any two of the six services either at the 100-watt carrier level, or one at the 100-watt level and the other at the 500-watt level. AN/SRT–16 design permits remote control from two standard Navy 6-wire control systems.

d. TUNING BANDS.—At a 100-watt carrier level, AN/SRT–14, 15 and 16 radio transmitters cover the frequency range 0.3 to 26 mc in six bands.

Band 1. 0.3 to 0.8 mc Band 2. 0.8 to 2 mc	AN/SRT–14, 15, 16 100-watt level only.
Band 3. 2 to 5 mc	AN/SRT–14 100-watt level only.
Band 4. 5 to 11 mc Band 5. 11 to 19 mc Band 6. 19 to 26 mc	AN/SRT–15 100- or 500-watt level. AN/SRT–16 100-watt level only from one transmitter group, 100- or 500-watt level from other transmitter group.

Frequency band selection is a function of setting up a frequency in the RFO and of tuning in the RFA, both of which are manual operations. In the AN/SRT–15 and 16 the control circuits are such that operation of the transmitter at the 500-watt level is prevented when bands 1 and 2 are selected.

e. SERVICES.—The AN/SRT–14, 15 and 16 radio transmitting sets are equipped for selecting any one of five modes of transmission.

Service Position	Function
(1) HAND (2) MACHINE	Continuous-wave telegraphy
(3) FSK	Frequency-shift telegraphy
(4) FAX	Facsimile (picture)
(5) PHONE	Voice

Each of the five services can be operated at either the high or low power levels.

f. FREQUENCY SELECTION.—Frequency selection is made manually by the setting of nine front panel controls located on the radio frequency oscillator of the transmitter group. In the AN/SRT–16, which has two transmitter groups and two antenna systems, separate frequencies can be set up and transmitted in each of the transmitter groups.

g. TUNING.—All tuning functions are manually accomplished by the operation of tuning controls in the radio frequency amplifier, load adjusting unit, and the control-indicator.

h. POWER CONTROL.—Primary power is fed to the transmitting sets through emergency switches located on the transmitter group low voltage power supply, and on the high voltage power supply (the latter in AN/SRT–15 and 16 sets only). With these switches ON, the sets may be started either by the start-stop push-button controls on the transmitter bay or from the radiophone unit.

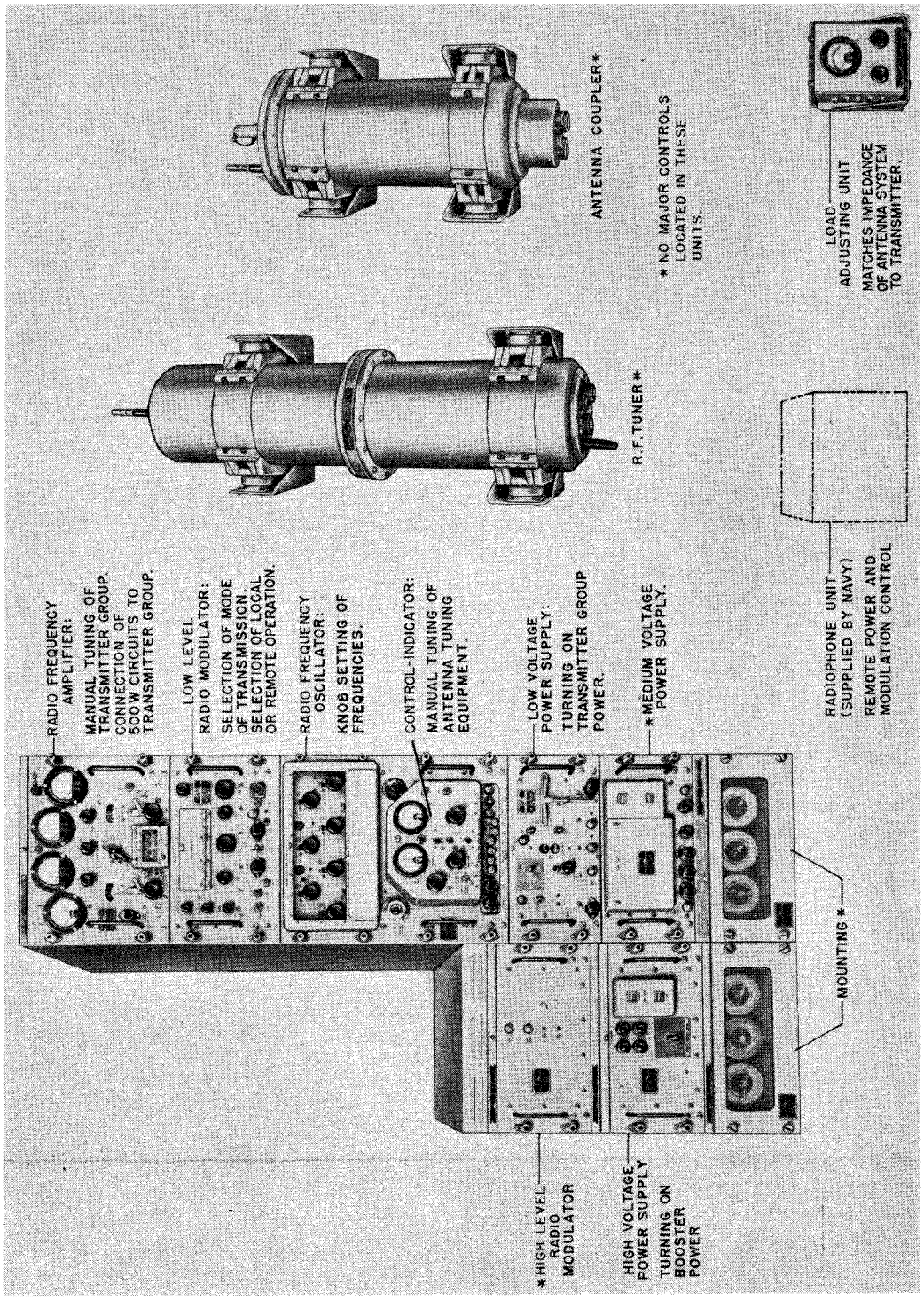


Figure 4–1. Location of Major Control Functions, AN/SRT–15.

i. MAJOR CONTROL FUNCTIONS.—Most of the controls and indicators of the AN/SRT–14, 15 and 16 are grouped together functionally to avoid confusion in operation. In this way, individual units may be associated with basic functions. Table 4–1 shows the major functions performed by the controls on each unit of the three radio transmitting sets. The radio modulator-power supply (booster) controls are only associated with the AN/SRT–15 and 16 sets.

TABLE 4–1. MAJOR CONTROL FUNCTIONS

Functions	Unit
Transmitter Group OA–684/SRT	
Turning on transmitter group power.	Low Voltage Power Supply PP–1094/SRT (figure 4–6)
Selection of mode of transmission.	Low Level Radio Modulator MD–229/SRT (figure 4–3)
Knob setting of frequencies.	Radio Frequency Oscillator O–275/SRT (figure 4–4)
Selecting local or remote operation.	Low Level Radio Modulator MD–229/SRT (figure 4–3)
Manual tuning of the transmitter group.	Radio Frequency Amplifier AM–1008/SRT (figure 4–2)
Manual tuning of the antenna tuning equipment.	Control-Indicator C–1352/SRT (figure 4–4)
Output impedance matching.	Transmitter Coupler CU–402/SRT (figure 4–8)
Connection of 500-watt circuits to a transmitter group.	Radio Frequency Amplifier AM–1008/SRT (figure 4–2)
Radio Modulator-Power Supply (Booster) OA–685/SRT	
Turning on booster power.	High Voltage Power Supply PP–1096/SRT (figure 4–10)
Remote Control Units	
Turning on power, carrier control, and modulation.	Radiophone unit, Navy Type 23500 or equivalent.

For location of the various controls of the transmitter bay, see figure 4–1.

j. OTHER CONTROL FUNCTIONS.—There are other controls on the AN/SRT–14, 15 and 16 sets that perform functions not associated with the usual operation of the units. There is a control for checking currents and voltages in the RFA, and another control on the RFA panel which resets the overload circuit. Some of the controls on the radio frequency oscillator (RFO) permit check up and alignment of the RFO circuits. On the front panel of the low voltage power supply (LVPS) are controls for heating the transmitter bay under abnormally low temperatures, for placing it in a "stand-by" condition, and for bypassing the interlocks with a "battle short".

k. UNITS WITHOUT CONTROLS.—Five units of the AN/SRT–14, 15 and 16 radio transmitters have no front panel controls. These are as follows: Power Supply PP–1095/SRT (medium voltage power supply), Antenna Coupler CU–372/SRT, Radio Frequency Tuner TN–229/SRT, Radio Modulator MD–230/SRT (high level radio modulator), and Mounting MT–1423/SRT.

l. OPERATION PROCEDURE BASED ON AN/SRT–15.—For purposes of simplicity, the statement of operation procedure will be based on the AN/SRT–15 radio transmitting set. Whenever references to the AN/SRT–14 and AN/SRT–16 are required, they will be clearly identified.

2. IDENTIFICATION OF CONTROLS AND INDICATORS.

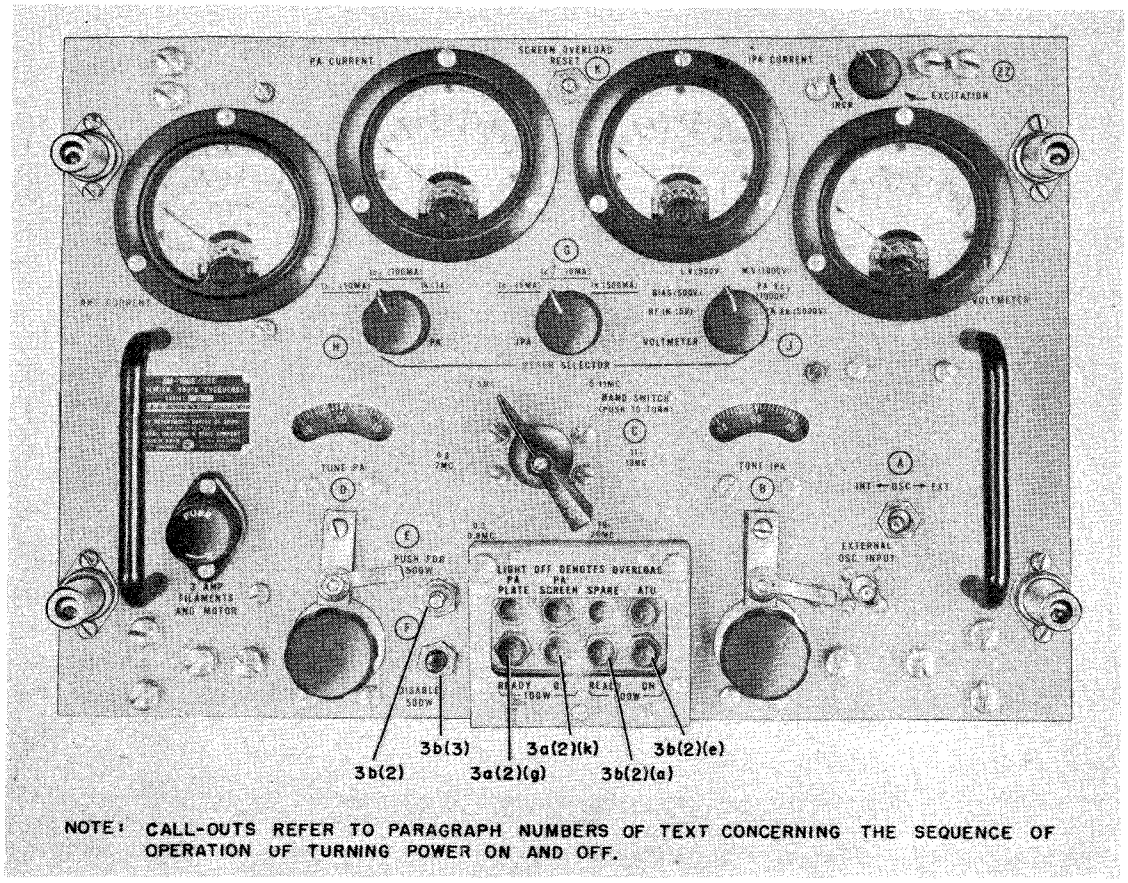
All controls and indicators associated with the operation of the AN/SRT–15 radio transmitting set are identified below, according to the individual units on which they are located.

a. RADIO FREQUENCY AMPLIFIER AM–1008/SRT.—The radio frequency amplifier (RFA) (figure 4–2) has controls for manually tuning Transmitter Group OA–684/SRT.

(1) OSCILLATOR INT-EXT SWITCH Ⓐ.—In normal operation, the INT-EXT switch Ⓐ is placed in the INT position. This connects the output of the RFO to the input of the RFA. For purposes of corrective maintenance, alignment, etc., it might be desirable to connect an external source of r-f energy to the RFA. In this instance, switch Ⓐ is placed in the EXT position and the output of the external source of r-f energy is connected through the EXT. OSC receptacle on the RFA front panel.

(2) BANDSWITCH Ⓒ, TUNE IPA Ⓑ, AND TUNE PA Ⓓ TUNING CONTROLS.—The three tuning controls are reset with each change of transmitted frequency. The BANDSWITCH Ⓒ is a rotary switch that is set to the band in which the transmitted frequency lies. The TUNE IPA control Ⓑ is a continuous tuning control that is set according to the appropriate indication on the PA CURRENT meter with PA-METER SELECTOR switch Ⓗ in the proper position. The TUNE PA control Ⓓ is a similar continuous tuning control that also is set according to the indication on the PA CURRENT meter with PA-METER SELECTOR switch Ⓗ in the proper position.

(3) PUSH FOR 500 W Ⓔ AND DISABLE 500 W Ⓕ SWITCHES.—In the AN/SRT–15 and AN/SRT–16, PUSH FOR 500 W Ⓔ push-button switch, when depressed, places the transmitter group in 500-watt operation. With the transmitter in 500-watt operation, depressing the DISABLE 500 W Ⓕ push-button switch returns the transmitter to the 100-watt level without having to take the transmitter off the air. In the AN/SRT–16, the booster is connected to only one



NOTE: CALL-OUTS REFER TO PARAGRAPH NUMBERS OF TEXT CONCERNING THE SEQUENCE OF OPERATION OF TURNING POWER ON AND OFF.

Figure 4—2. Radio Frequency Amplifier AM-1008/SRT (Radio Frequency Amplifier, RFA), Front Panel Controls and Indicators

of the two transmitter groups. Switches (E) and (F) of the transmitter group to which the booster is connected function as described for the AN/SRT–15, while the switches (E) and (F) in the transmitter group not connected to the booster are inoperative. Similarly, the switches (E) and (F) in the AN/SRT–14 are inoperative, as there is no booster.

(4) IPA (G), PA (H) AND VOLTMETER (J) METER SELECTOR SWITCHES AND IPA CURRENT METER, PA CURRENT METER AND VOLTMETER. —The three test meters with their corresponding selector switches perform the function of checking the r-f input voltage from the RFO, checking input d-c supply voltages, checking operating currents of the IPA and PA stages, and giving indications of tuning of the IPA and PA stages.

The PA METER SELECTOR (G) has three positions as follows:

Position	Indication
I_{c1} (5 ma)	IPA control grid current
I_{c2} (10 ma)	IPA screen grid current
I_k (500 ma)	IPA cathode current

The PA METER SELECTOR (H) has three positions as follows:

Position	Indication
I_{c1} (50 ma)	PA control grid current
I_{c2} (100 ma)	PA screen grid current
I_k (1 A)	PA cathode current

The VOLTMETER METER SELECTOR (J) has six positions as follows:

Position	Indication
RF IN (5 V)	RF input from RFO
BIAS (500 V)	—220 V d-c input supply
LV (500 V)	+300 V d-c input supply
MV (1000 V)	+500 V d-c input supply
PA E_{c2} (1000 V)	PA screen supply voltage
PA E_b (5000 V)	PA plate supply voltage

In the nomenclature of all of the above meter selector switch positions, the figure in parentheses indicates the full scale reading of the meter for the corresponding position.

(5) SCREEN OVERLOAD RESET SWITCH Ⓚ.—In case the PA screen overload relay is energized because of excessive PA screen grid current when in 500-watt operation, the transmitter is returned to the 100-watt level. The overload is indicated by the PA SCREEN OVERLOAD lamp. When the cause of the overload is removed, depressing the SCREEN OVERLOAD RESET switch Ⓚ restores the overload relay, and depressing the PUSH FOR 500 W Ⓔ push button allows the transmitter to return to the 500-watt level.

(6) EXCITATION CONTROL ⓏⓏ.—The input signal from the RFO varies in amplitude at the various frequencies. To compensate for this and for variances in output impedance of the PA, a control known as the EXCITATION control ⓏⓏ regulates the input level of signal from the RFO to prevent overdriving of the PA stage.

(7) INDICATOR LIGHTS.—There are eight indicator lights mounted on a panel in the lower center of the front panel. Three of these lights are overload indicators, four others indicate the condition of the carrier in either 100-watt or 500-watt operation, and the remaining light is a spare.

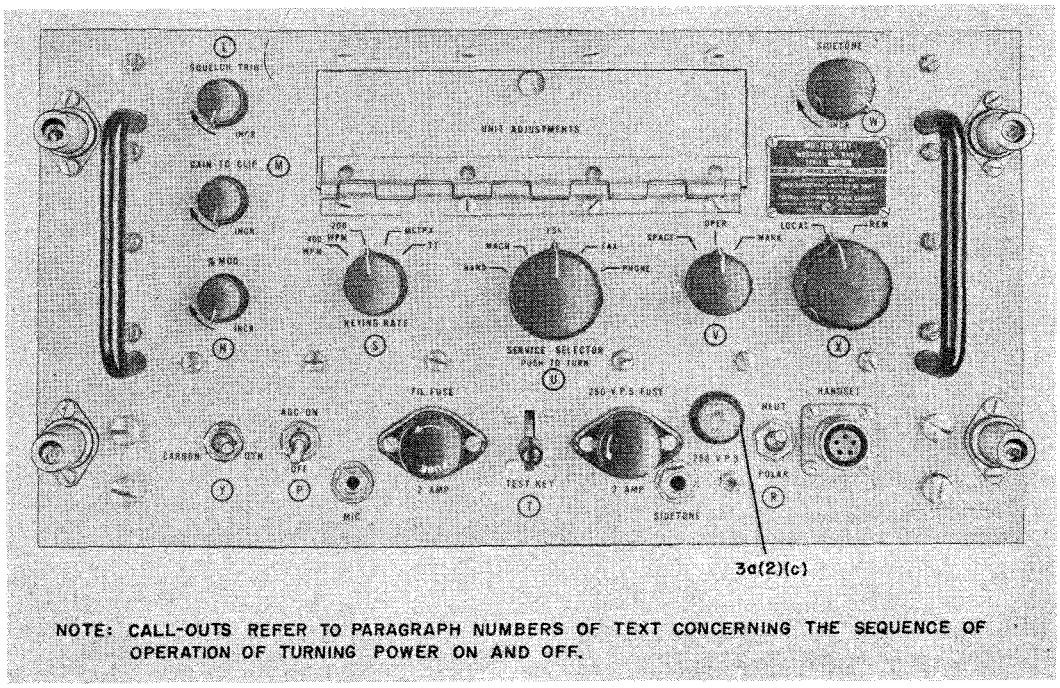
(8) ANTENNA CURRENT METER.—The ANT. CURRENT meter is placed in the output of the PA stage to give indication of amplitude of r-f line current at the output of the RFA.

(9) FUSE.—A 3-amp fuse is located on the front panel for protection of the blower motor in the RFA.

b. RADIO MODULATOR MD-229/SRT (LOW LEVEL RADIO MODULATOR).—The front panel of the low level radio modulator (LLRM) (figure 4–3) contains the following major control functions: selection of the mode of transmission, selection of local or remote transmission, and controls of audio modulator and keyer circuits.

(1) SERVICE SELECTOR CONTROL Ⓤ.—The mode of transmission of the transmitter group is determined by the manual setting of the SERVICE SELECTOR control Ⓤ. The control has five positions: HAND for hand-keyed cw, MACH for c-w keying originating from a machine-keying device such as teletype, FSK for frequency-shift keying from machine-keying equipment, FAX for facsimile transmission and phone for amplitude-modulated phone transmission. To prevent random bursts of transmission when the contacts are transferred during radio silence and to prevent switching of power supply circuits under load, a push-to-turn feature is incorporated in this switch.

(2) SQUELCH TRIG. CONTROL Ⓛ.—The SQUELCH TRIG. control Ⓛ is used only when the SERVICE SELECTOR control Ⓤ is in the PHONE position. When monitoring through SIDETONE jack, this control is adjusted to reduce the noise level between words to a minimum without sacrificing low level voice. The setting is a compromise between low level speech signals and the noise level during pauses in speech.



NOTE: CALL-OUTS REFER TO PARAGRAPH NUMBERS OF TEXT CONCERNING THE SEQUENCE OF OPERATION OF TURNING POWER ON AND OFF.

Figure 4–3. Radio Modulator MD-229/SRT (Low Level Radio Modulator, LLRM), Front Panel Controls and Indicators.

(3) GAIN TO CLIP CONTROL Ⓜ.—The GAIN TO CLIP control Ⓜ also is used only when the SERVICE SELECTOR control Ⓤ is in the PHONE position. This control is set according to operator preference for maximum signal fidelity without an excessively low signal-to-noise ratio.

(4) % MOD CONTROL Ⓝ.—The % MOD control Ⓝ is another control used only in phone operation and is set for 100 percent modulation of the carrier by the audio signal.

(5) AGC SWITCH Ⓟ.—In phone operation, the AGC switch Ⓟ is used to incorporate or bypass the automatic gain control circuit in the audio amplifier chain of the LLRM. With this switch in the ON position, variations in amplitudes of the output modulation are retained within a predetermined limit despite large variations in voice signal levels.

(6) NEUT.-POLAR SWITCH Ⓡ.—The NEUT.-POLAR switch Ⓡ must be set according to the position of the SERVICE SELECTOR control Ⓤ and the type of signal input available. With control Ⓤ in HAND, FAX, or PHONE, the position of the NEUT.-POLAR switch Ⓡ is immaterial. In the NEUT. position, the keying circuit accepts a keying voltage that varies from zero during space to a positive value for mark. In the POLAR position the circuit accepts a keying voltage that varies from a negative value for space to a positive value for mark. In the MACH and FSK positions of the SERVICE SELECTOR control Ⓤ, the NEUT.-POLAR switch Ⓡ setting is determined by the nature of the incoming keying signal from the machine-keying equipment, which can be either neutral or polar as described above.

(7) KEYING RATE SWITCH Ⓢ.—The KEYING RATE switch Ⓢ has four positions: TT, MLTPX, 200 WPM, and 400 WPM. The proper setting of the KEYING RATE switch Ⓢ should be made in hand-key, machine-key or FSK operation, but has no purpose in facsimile or phone operation. The TT position is used for hand- or machine-key speeds up to approximately 60 words per minute. MLTPX is used for multiplex transmission from 60 to 150 words per minute. The 200 WPM position is used with high-speed tape keying between 150 and 300 words per minute. The 400 WPM position is used with high-speed tape keying rates between 300 and 600 words per minute.

This control is provided to minimize side-band frequencies. To maintain an optimum keying pulse waveshape, the amount of capacitance in the circuit is varied with the keying speed. Failure to put this control in the proper position will not prevent the keying operation, but it will affect the waveshaping and, therefore, the bandwidth required for transmission.

(8) TEST KEY Ⓣ.—The TEST KEY Ⓣ is used for front panel checking or keying. The upper locking position and lower momentary position energize the keying circuits in the LLRM. With the equipment energized and tuned, operation of the test key will cause r-f output in all positions of the SERVICE SELECTOR Ⓤ.

Note

Always return TEST KEY Ⓣ to the central or neutral position upon completion of checks or tests.

(9) SPACE-OPER.-MARK CONTROL Ⓥ.—During normal keying operation, the SPACE-OPER.-MARK control Ⓥ is in the OPER. position, which allows regular keying signals from hand- or machine-key equipment to energize the keying circuit of the LLRM. Placing this control in either SPACE or MARK makes it possible to test the action of the keying circuit without causing r-f output. This testing can be performed regardless of the position of SERVICE SELECTOR Ⓤ.

(10) SIDETONE CONTROL Ⓦ.—The SIDETONE control Ⓦ is used to regulate the volume of the signal from the sidetone amplifier. It is adjusted only when a sidetone signal is being used for monitoring.

(11) LOCAL-REM SWITCH Ⓧ.—The LOCAL-REM switch Ⓧ is set depending on the location of the place of operation. For operation from the transmitter bay location, this switch must be in the LOCAL position. For operation from a remote radiophone unit, this switch must be in the REM position.

(12) CARBON-DYN SWITCH Ⓨ.—For local phone operation only, the CARBON-DYN switch Ⓨ is set according to the type of microphone being used. As the level of signal from a dynamic microphone is less than from a carbon microphone, the CARBON-DYN switch Ⓨ adjusts the amplification in the audio chain to compensate for the different input levels.

(13) INDICATOR LIGHT.—There is one indicator light designated 250 V.P.S. which, when lit, denotes the energizing of the +250-volt regulated power supply, which is located in the LLRM. A front panel jack is also provided for measuring this voltage.

(14) FUSES.—Two fuses are provided, one for protection of overload of the +250-volt regulated supply, and the other to protect the supply that provides filament voltages for the tubes in the LLRM.

(15) TIME CONST. ADJ. CONTROL.—The TIME CONST. ADJ. control is set according to the operator's keying rate in hand-key transmission. The setting of this control is not an operational function but rather a maintenance control. Because of restrictions of front panel mounting space, this control is located on the preamplifier subchassis. To gain access to this control, the LLRM chassis must be pulled out from the cabinet a sufficient amount to reach the preamplifier subchassis. This subchassis is mounted on the top left front of the main LLRM chassis.

c. RADIO FREQUENCY OSCILLATOR O–275/SRT.—The radio frequency oscillator, RFO (figures 4–4 and 4–5), contains all controls for the manual selection of a frequency and other controls for the adjustment of operation of certain circuits within the RFO. The Control-Indicator C–1352/SRT, included as a com-

ponent of the RFO, has controls and indicators for the manual tuning of the antenna tuning equipment.

(1) ZERO ADJ. SWITCH (Z).—The ZERO ADJ. switch (Z) is used in connection with the ZERO BEAT INDICATOR, the INT. OSC. ZERO ADJ., and F.S. OSC ZERO ADJ. controls. The outputs of the frequency shift oscillator (unit 12) and the interpolation oscillator (unit 3) within the RFO should each be 100 kc. Placing the ZERO ADJ. switch (Z) in the INT. OSC. position connects the output of the interpolation oscillator to the zero beat indicator circuit where it is compared with the standard 100-kc signal from the crystal-controlled 100-kc oscillator (unit 1). The output of the interpolation oscillator can be regulated by the INT. OSC. ZERO ADJ. control, located behind the door that covers the frequency selection knobs. The electron ray tube ZERO BEAT INDICATOR gives the indication of the variance in frequency between the standard and the interpolation oscillator signal. Placing the ZERO ADJ. switch (Z) in the F.S. OSC. position connects the output of the frequency shift oscillator into the zero beat indicator circuit and permits the output of the frequency shift oscillator to be compared and adjusted in the same manner as described previously for the interpolation oscillator.

(2) FREQUENCY SELECTION KNOBS.—There are nine frequency selection knobs for the manual selection of a frequency to be transmitted (figure 4–5). They are located behind a door on the RFO front panel. This door must be opened to change a frequency setting. Incorporated in the opening of the door is a safety device that prevents the transmitter from having a 500-watt carrier on while the door is open. The nine control knobs are designated: (AA) KNOB control, (BB) KNOB control, KC (CC) control knob, 100 ~ (DD) control knob, 10 ~ (EE) control knob, BAND (FF) control knob, MC (GG) control knob, 100 KC (HH) control knob, and 10 KC (JJ) control knob. These knobs are set for the frequency desired according to instructions inscribed on the front panel. After the selection has been made, the door is closed.

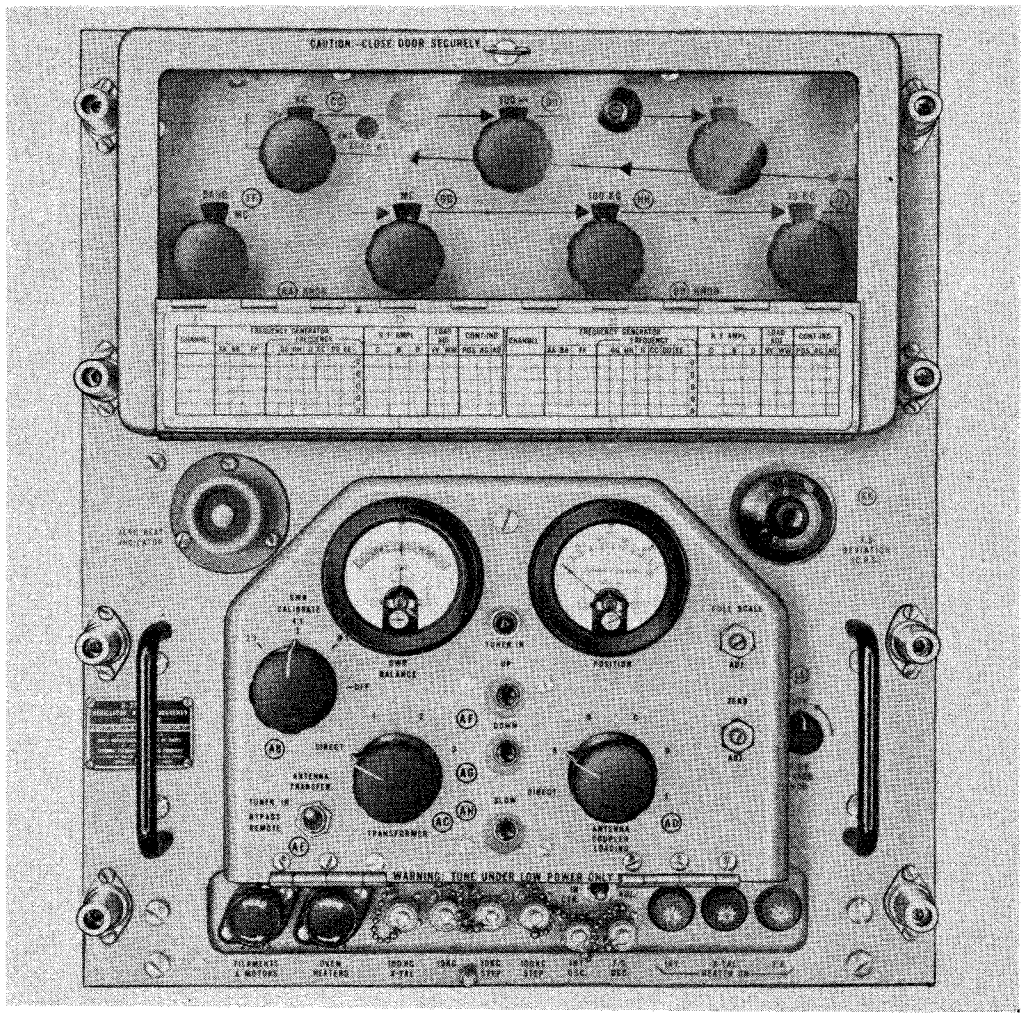


Figure 4–4. Radio Frequency Oscillator O-275/SRT (Radio Frequency Oscillator, RFO), Front Panel Controls and Indicators

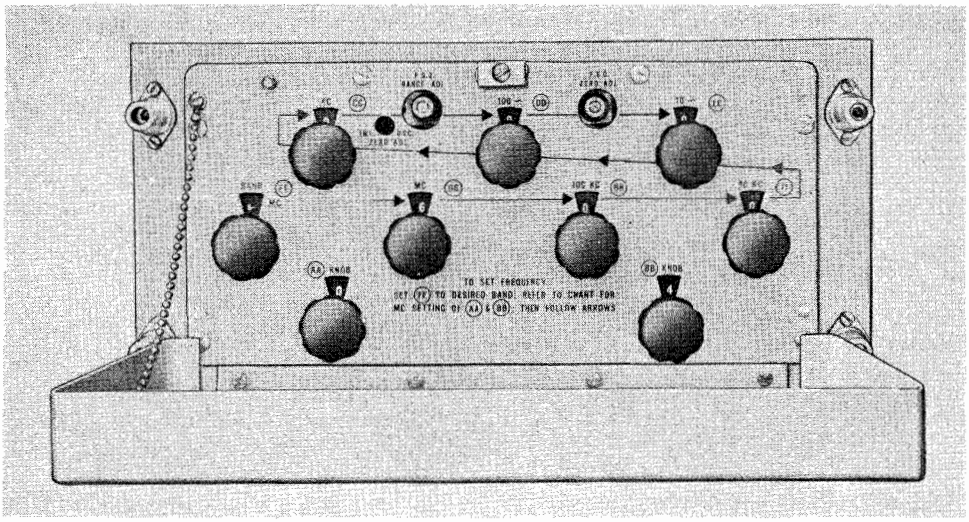


Figure 4—5. Radio Frequency Oscillator O-275/SRT (Radio Frequency Oscillator, RFO) Frequency Selection Panel Controls

(3) F.S. DEVIATION CONTROL (KK).—When in FSK operation, the F.S. DEVIATION control (KK) is set according to the degree of frequency shift desired between space and mark. This control consists of two concentric dials. The outer dial is connected to the knob, which is rotated by hand, the inner dial follows at a 1-to-10 ratio. The inner dial is calibrated in hundreds of cycles (0-10), whereas the outer dial is calibrated in cycles (0-100). Therefore, number 1 on the inner dial represents 100 cycles. One complete clockwise turn of the outer dial produces a clockwise rotation of one number on the inner dial. The combined reading of the dials gives, in cycles per second, the shift of the carrier frequency above and below the nominal frequency for FSK operation. For example, consider the frequency selection knobs set to provide a carrier frequency of 20.000000 mc and F.S. DEVIATION control (KK) set so the dials read 4 on the inner dial and 50 on the outer dial (450 cps) and the SERVICE SELECTOR (U) in the LLRM set at FSK. A space keying signal will shift the carrier to 19.999550 mc, and a mark signal will shift the carrier to 20.000450 mc. In FAX operation, the dial reading represents half of the deviation derived from a maximum facsimile signal. Paragraph 2*f*(3) of Section 2 provides a more complete description of the effect of the F.S. DEVIATION control (KK). The F.S.O. RANGE ADJ. control, located behind the door which covers the frequency selection knobs, calibrates the effect of F.S. DEVIATION control (KK) so that dial readings in cps are correct.

(4) F.S.K. PHASE MOD. CONTROL (LL).—In FSK and FAX operation a 200-cps signal is generated in the LLRM and fed to the frequency shift oscillator (unit 12) in the RFO to phase-modulate the output of the frequency shift oscillator to combat the effect of selective fading (see paragraph 7*c*(8) of Section 2). The degree of shift is proportionate to the amplitude of the 200-cps signal input to the frequency shift oscillator. The F.S.K. PHASE MOD. control (LL) regulates the degree of the phase shift. Full clockwise rotation of this control will produce a maximum one-radian phase shift.

(5) TEST RECEPTACLES, INDICATORS, AND FUSES.—Across the bottom of the RFO is a set of test receptacles, indicator lights, and fuses. The test receptacles bring out several of the outputs of the subunits within the RFO for purposes of examination with a standard test oscilloscope. The three indicator lights are heater indicators of the three oscillator circuits in the RFO, which have ovens to stabilize their ambient temperatures. The operation of any of these indicators means that the temperature of the corresponding oven has fallen below its minimum and that the corresponding heat element has been switched on by its thermostat. These lights will go on and off intermittently, the rate being solely dependent on the ambient temperature. There are two fuses, one being in the a-c line supply to the RFO filament supplies and the other in the a-c line provided for the oven heater supply.

(6) CONTROL-INDICATOR C–1352/SRT.—The control-indicator, mounted on the RFO front panel, has all controls and indicators required to manually tune the two components of the antenna tuning equipment, namely, Radio Frequency Tuner TN–229/SRT and Antenna Coupler CU–372/SRT.

(*a*) UP (AF), DOWN (AG), SLOW (AH) PUSH BUTTONS AND POSITION INDICATOR.—The main tuning component of the antenna tuning equipment is a length of helically wound transmission line. The length of this line is varied by positioning a sliding short. The sliding short is positioned by a tuning motor, which, in turn, is controlled by the UP (AF), DOWN (AG), and SLOW (AH) push buttons. Depressing the (AF) control causes the sliding short to move up on the tuning coil, while depressing the (AG) control causes the short to move down. Depressing the SLOW control (AH) together with either the (AF) or (AG) control will cause

movement of the sliding short in the desired direction at a reduced speed for fine tuning. The POSITION meter indicates the position of the sliding short on the tuning coil, with a reading of 100 on the meter indicating the short at the top of the coil and 0 indicating the short at the bottom. The FULL SCALE ADJ. and ZERO ADJ. screwdriver adjustments are used to calibrate the POSITION meter.

(*b*) ANTENNA COUPLER LOADING SWITCH (AD).—To extend the range of tuning of the main tuning coil, it is possible to add certain values of inductance or capacitance in series or shunt with the main tuning coil. With ANTENNA COUPLER LOADING switch (AD) in DIRECT, no reactive components are added. With (AD) in its other positions, A through E, a selection of one of five different types and values of loading is possible. Table 4–2 shows the tuning component employed for each position of the ANTENNA COUPLER LOADING (AD) SWITCH (S–404).

TABLE 4–2. FUNCTION OF ANTENNA COUPLER LOADING SWITCH (AD) (S–404)

Position of S-404*	Loading Component Used
Direct	None
A	Capacitance in series
B	Capacitance in series and in shunt
C	Inductance in series
D	Inductance in series
E	Capacitance in shunt

* Positions of S–404 correspond to same positions of the loading switch S–3511 on Antenna Coupler CU–372/SRT.

(*c*) TRANSFORMER SWITCH (AC).—At low frequencies, when the reflected resistance of the antenna on the transmission line is low, a "step-up" impedance transformer must be placed in the transmission line. Placing the TRANSFORMER control (AC) in position 1 switches the impedance transformer in, while placing (AC) control in its DIRECT position switches the transformer out. Positions 2 and 3 of the (AC) control are inoperative.

(*d*) ANTENNA TRANSFER SWITCH (AE) AND TUNER IN INDICATOR.—Placing the ANTENNA TRANSFER switch (AE) in the BYPASS position switches all the tuning components out of the transmission line and connects the antenna directly to the load adjusting unit. With (AE) in the TUNER IN position the tuning components are in the transmission line. With (AE) in the REMOTE position the tuning components are automatically switched in and out under control of the keying signals when the transmitter is operated in either HAND or PHONE. Paragraph 6*a* (step 18) of this section and paragraph 7*g* of Section 2 of this instruction book explain this operation in more detail. Whenever the tuning components are switched into the transmission line, the TUNER IN indicator will be energized.

(*e*) SWR BALANCE INDICATOR AND SWR CALIBRATE SWITCH (AB).—The indication for proper tuning of the antenna is obtaining the lowest possible standing-wave ratio (SWR) on the transmission line at the output of the transmitter. While the circuit for measuring the SWR is in the load adjusting unit, the indicator, SWR BALANCE meter, is located on the control-indicator. With the SWR CALIBRATE switch (AB) in the 8:1 position, a center reading on the SWR BALANCE meter will indicate an SWR of 8:1, reading to the right of center indicating an SWR greater than 8:1, while an indication to the left of center is less than 8:1. Similarly, with the (AB) control in the 4:1 and 2:1 positions, center readings on the SWR BALANCE meter will indicate an SWR of 4:1 and 2:1, respectively.

d. POWER SUPPLY PP–1094/SRT (LOW VOLTAGE POWER SUPPLY).—The low voltage power supply, LVPS (figure 4–6), has front panel controls that accomplish three functions: energize the transmitter, heat the transmitter bay internally, and place the radio transmitting set in a "stand-by" condition. In addition, the front panel of this unit has fuses for control and B+ voltages, and also six indicator lamps to show the degree to which the equipment has been energized. The "T" handle key used to loosen or secure the captive screws holding the drawers in the frame is also mounted on the low voltage power supply front panel.

(1) EMERGENCY SWITCH (MM).—The function of this switch is to connect primary power to the equipment terminals and energize the MAIN POWER START-STOP push-button circuits. EMERGENCY SWITCH (MM) must be turned on before depressing the MAIN POWER START push button if the transmitter group is to be energized. EMERGENCY SWITCH (MM) should be kept ON unless maintenance procedures or certain routine checks are being made.

(2) MAIN POWER CONTROL (RR).—The START STOP push buttons of the MAIN POWER control (RR) are used to start or stop an AN/SRT–14, 15 or 16 radio transmitting set. If the emergency switches ((MM) and (SS)) are on, depressing the START button of this switch will energize the entire equipment. Failure to have the EMERGENCY SWITCH on in the low voltage power supply will prevent the MAIN POWER control from energizing the transmitter group only. Failure to turn on the emergency switch on the booster prevents the MAIN POWER switch from energizing the booster only. Depressing the MAIN POWER-STOP push button will turn off equipment power.

(3) STANDBY-OPERATE SWITCH (PP).—The STANDBY-OPERATE switch (PP) has two positions. If equipment power is turned on when this switch is in the OPERATE position, plate power will be applied after the time delay in the LVPS has run out in hand-key operation. Plate power will also be applied and the carrier will be on in machine-key, FSK, and facsimile operation if the keying line is closed. In phone, depressing the press-to-talk button will apply plate power and turn the carrier on. With STANDBY-OPERATE

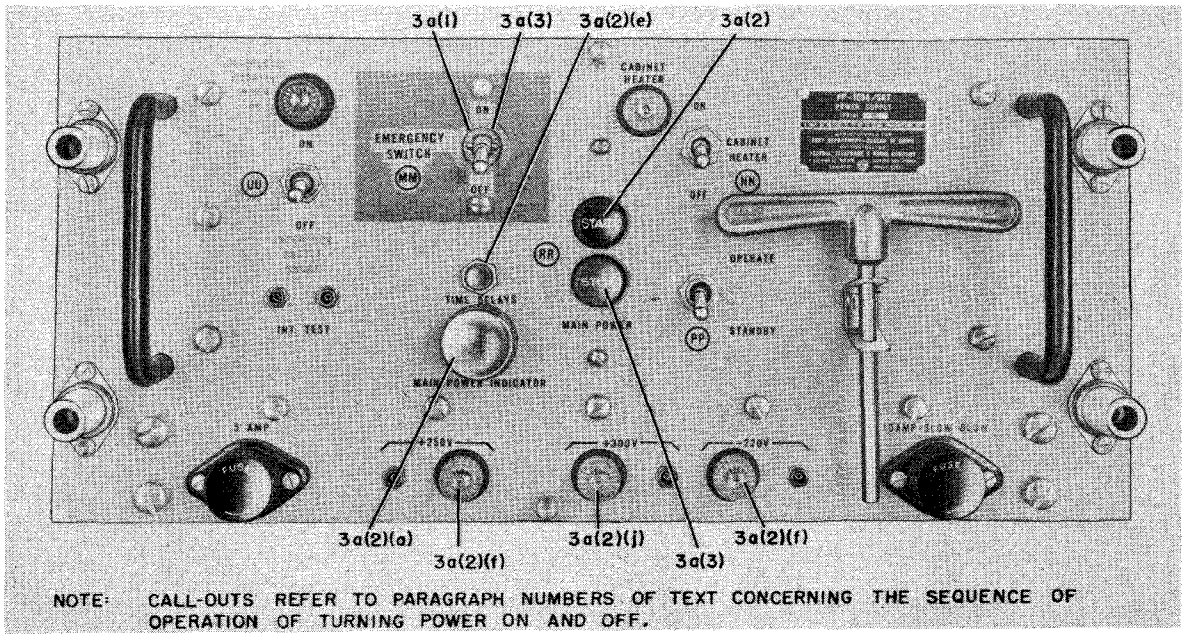


Figure 4—6. Power Supply PP-1094/SRT (Low Voltage Power Supply, LVPS), Front Panel Controls and Indicators

switch (PP) in the STANDBY position, turning the equipment power on will energize the filament power in the transmitter group, but plate power will not be present and hence no carrier will be on.

(4) CABINET HEATER SWITCH (NN).—The CABINET HEATER switch (NN) controls the heating elements installed in the sides of each mounting to heat the transmitter bay during conditions of low ambient temperature. This switch is normally off. However, if room temperature is between −1°C. (+30°F.) and +10°C. (+50°F.), this switch should be turned on for 15 minutes prior to the actual operation of the equipment. If the room temperature is under −1°C. (+30°F.), this switch should be kept on as long as the room temperature is below −1°C. (+30°F.). The CABINET HEATER indicator light glows when the heaters are turned on.

Note

In an AN/SRT-16 the heaters of each transmitter group are independently energized by the CABINET HEATER (NN) switches in the respective transmitter groups. Both CABINET HEATER (NN) switches must be on to energize the heaters in both groups.

(5) BATTLE SHORT SWITCH (JJ).—BATTLE SHORT switch (JJ) is used as an emergency measure only to bypass the action of the drawer interlocks in case of failure of these interlocks.

(6) MISCELLANEOUS INDICATOR LIGHTS AND TEST JACKS.—The +250V, −220V, and +300V indicator lights are illuminated when the corresponding voltages are supplied; they are used as servicing aids to isolate power supply troubles. Trouble-shooting these circuits is facilitated by the provision of a front-panel jack for each of these voltages to enable the operating personnel to make voltmeter readings. The MAIN POWER indicator light indicates the presence or absence of primary power in the MAIN POWER START-STOP push-button circuits. The TIME DELAY indicator light comes on after the filament time delay has run out, and the transmitter is ready for application of complete control and plate voltages. The BATTLE SHORT indicator lights when the BATTLE SHORT switch (JJ) is on with the EMERGENCY SWITCH on also. INT. TEST jacks provide an access for testing the continuity of the drawer interlocks.

(7) FUSES.—The 10 AMP. fuse on the lower right of the front panel protects all d-c control voltages. Failure of this fuse will prevent the TIME DELAY indicator light from lighting. The 5 AMP fuse on the lower left limits total current for the d-c control supplies and for the +250 V, −220 V, and +300 V supplies. Its failure will prevent the corresponding indicator lights from coming on.

e. POWER SUPPLY PP-1095/SRT (MEDIUM VOLTAGE POWER SUPPLY).—The front panel of the medium voltage power supply, MVPS (figure 4—7), mounts four indicator lights, two elapsed time meters, 3 fuses, one test point, a set of spare fuse holders. Two indicator lights (red for the a-c input, neon for the d-c output) are provided for each of the power supplies, +500 V dc and +1,050/+1,300 V dc, which are contained in this unit. One of the elapsed time meters indicates the total hours of filament operation, the other shows total hours of plate power on. One fuse limits the total filament current drawn by the two power sup-

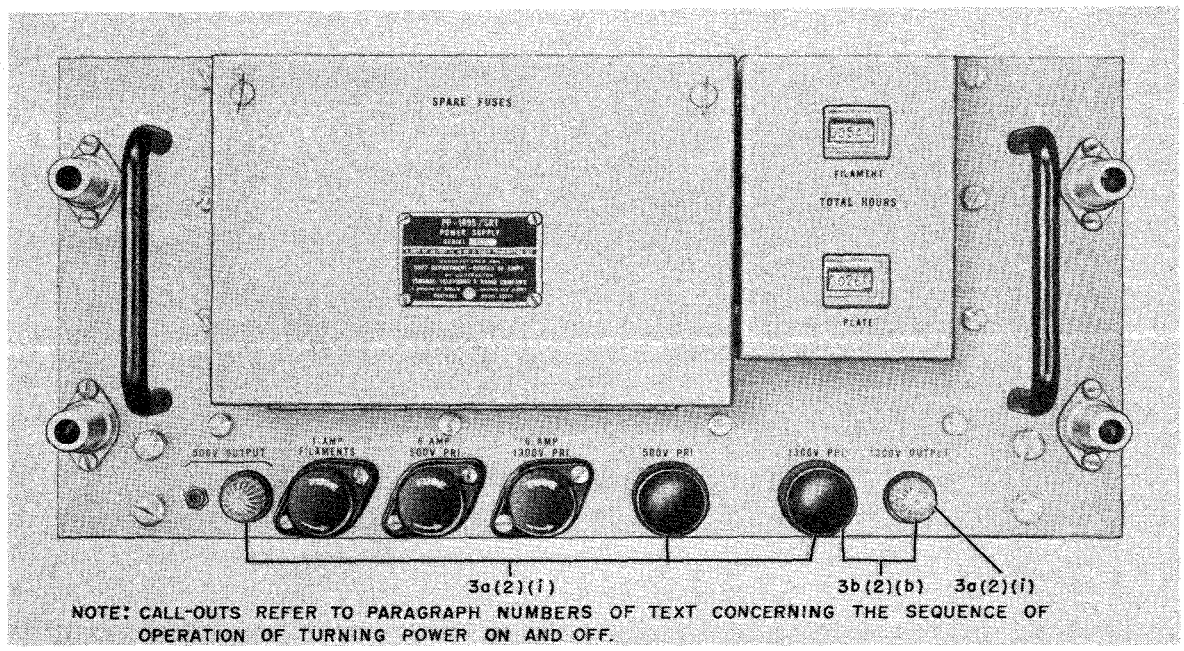


Figure 4–7. Power Supply PP-1095/SRT (Medium Voltage Power Supply, MVPS), Front Panel Controls and Indicators

plies, another fuse limits current drawn from the +500-volt supply, and the third fuse limits the drain from the +1,050/+1,300-volt supply. A front panel test jack is supplied to measure the output voltage of the +500-volt supply. A set of spare fuses for the various major units is provided under a hinged cover which is on the front panel.

f. TRANSMITTER COUPLER CU–402/SRT (LOAD ADJUSTING UNIT).—The load adjusting unit (LAU) (figure 4–8) has two controls and one indicator. The INPUT TAP (V) and OUTPUT TAP (W) controls select input and output taps on an impedance transformer that is inserted in the transmission line between the transmitter output and the antenna tuning equipment to further match the impedance presented to the transmitter output to the characteristic 50-ohm value. The r-f ammeter measures transmission line current at the output of the load adjusting unit.

g. RADIO MODULATOR MD–230/SRT (HIGH LEVEL RADIO MODULATOR).—The high level radio modulator (HLRM) (figure 4–9) is a unit of the transmitter bay for AN/SRT–15 and 16 radio transmitting sets. There are two indicator lights and two test points on this unit. The upper indicator light, marked 3000 V, comes on when the +2,400/+3,000-volt supply in the high voltage power supply is energized, and the plate voltage is applied to the final stage of the RFA. It will not light during 100-watt operation. The 350 V SCREEN indicator light comes on when the press-to-talk button is depressed during phone operation. The two test points are used in maintenance operations to check grid voltage on the two amplifier tubes in this unit.

h. POWER SUPPLY PP–1096/SRT (HIGH VOLTAGE POWER SUPPLY).—The high voltage power supply (HVPS) (figure 4–10) is a unit of the AN/SRT–15 and 16 radio transmitting sets. One control, two elapsed time meters, and four indicator lights are mounted on its front panel.

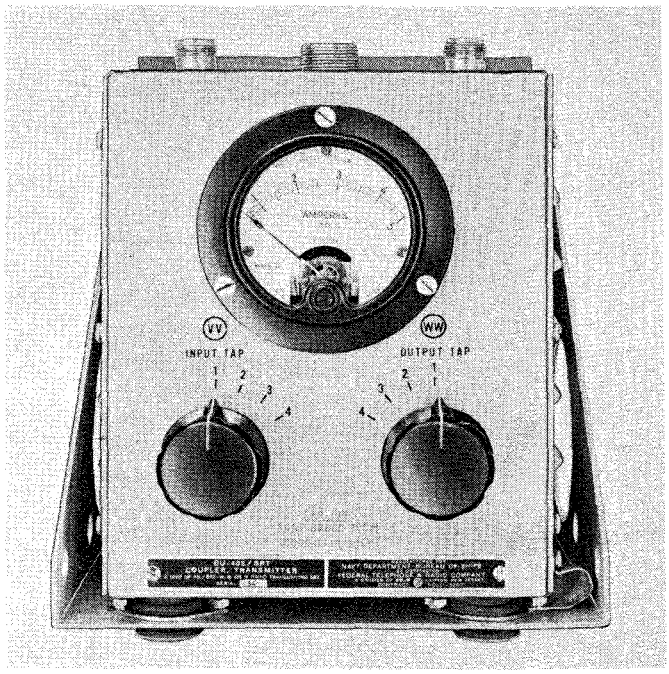


Figure 4–8. Transmitter Coupler CU-402/SRT (Load Adjusting Unit, LAU), Front Panel Controls and Indicators

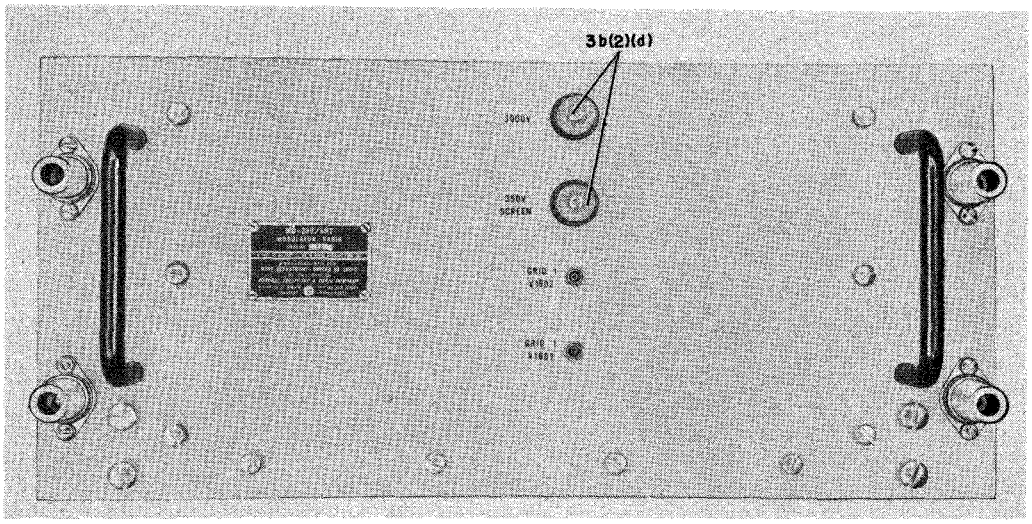


Figure 4–9. Radio Modulator MD-230/SRT (High Level Radio Modulator, HLRM), Front Panel Controls and Indicators

(1) BOOSTER EMERGENCY SWITCH (SS).—This power switch is turned on whenever 500-watt operation of the AN/SRT–15 and 16 sets is desired. Turning this switch on energizes tube filaments in the HLRM and HVPS units. Unless it is desired to operate at 500 watts, this switch should be turned off.

CAUTION

Be certain this switch is OFF before attempting maintenance procedures.

The three H.V. PRIMARY and the TIME DELAY indicator lamps are associated with the operation of this switch. The three H.V. PRIMARY indicator lights show the presence or absence of primary power in each of the three phases of the supply line.

(2) ELAPSED TIME METERS.—One elapsed time meter indicates the total hours of booster filament operation, the other total hours of booster plate power operation.

3. TURNING POWER ON AND OFF.

The sequence of operation, together with the indication given, for the turning of power on and off is given below. The front panel drawings, figures 4–2 through 4–10, inclusive, have call-outs that refer to the paragraph numbering that follows as an aid in the distinguishing of the sequence of control operation.

a. TRANSMITTER GROUP OA–684/SRT.—All the controls for turning the transmitter group power on are located on the low voltage power supply (LVPS).

(1) Turn EMERGENCY SWITCH (MM) on.

(2) Depress START push button of MAIN POWER switch (RR).

When the main power is on, the following events should take place immediately.

(*a*) The MAIN POWER indicator light on the LVPS panel is energized.

(*b*) The blower motor in the RFA starts operating.

(*c*) The −12-volt and the +250-volt regulated power supplies in the LLRM energize, which energizes the 250 V.P.S. indicator in the LLRM.

(*d*) The filament supplies in all units are energized.

After approximately 25-30 seconds, the following occurs:

(*e*) The LVPS time delay expires and the TIME DELAY indicator light on the LVPS energizes.

(*f*) The +250 V and −220 V indicator lights on the LVPS energize, denoting the presence of the corresponding supply voltages.

(*g*) The CARRIER-100W-READY indicator on the RFA energizes.

(*h*) The blower motors in the mounting start operating.

If the STANDBY-OPERATE switch (PP) in the LVPS is in the STANDBY position, there will be no plate power and nothing further will happen. However, if the equipment is in the OPERATE condition and the SERVICE SELECTOR (U) in the LLRM is set to HAND, the following will occur:

(*i*) The +500-volt and the +1,050/+1,300-volt supplies, together with the 500 V PRI., 500 V OUTPUT, 1300 V PRI., and 1300 V OUTPUT indicator lights in the MVPS are energized.

(*j*) The +300 V indicator light in the LVPS energizes, denoting the presence of this supply voltage.

(*k*) The CARRIER-100W-ON indicator light in the RFA goes on.

The above ((*i*) through (*k*)) will occur when the SERVICE SELECTOR Ⓤ is in the MACH, FSK, and FAX positions only if the keying line is closed. If the SERVICE SELECTOR Ⓤ is in the PHONE position, (*i*) through (*k*) will occur only when the press-to-talk button on the phone is depressed.

(3) Power in the transmitter group may be turned off by depressing the STOP push button on the MAIN POWER switch ⓇⓇ or by throwing the EMERGENCY SWITCH Ⓜ to the OFF position. The latter control removes all power, while the MAIN POWER SWITCH ⓇⓇ STOP push button removes all power except that to the mounting heaters.

b. RADIO MODULATOR-POWER SUPPLY OA-685/SRT.—The radio modulator-power supply (booster) is energized only when it is desired to have the AN/SRT-15 or 16 radio transmitting sets operate at the 500-watt level. To energize the booster, the transmitter group must be energized, and the STANDBY-OPERATE switch ⓅⓅ be in the STANDBY position. The booster now may be energized as follows:

(1) Turn BOOSTER EMERGENCY switch Ⓢ on the HVPS panel to the ON position. After a 30-second time delay, the TIME DELAY indicator light is energized.

(2) The PUSH FOR 500 W button Ⓔ on the RFA is now depressed to operate a transmitter group at the 500-watt level. In the AN/SRT-16 only, one transmitter group can be operated at the 500-watt level. The selection of which group can be operated at either 100 watts or 500 watts is made at the time of installation when the output of the booster is permanently interconnected to one of the transmitter groups. When the PUSH FOR 500 W button Ⓔ is depressed, the following occurs:

(*a*) The CARRIER-500W-READY indicator on the RFA is illuminated.

At this time filament power has been applied to the booster but there will be no plate power. By now placing the equipment in the OPERATE condition and having the SERVICE SELECTOR Ⓤ in the LLRM set to the HAND position, the following will occur:

(*b*) The +1,050/+1,300-volt supply in the MVPS is de-energized and the 1300 V PRI and 1300 V OUTPUT indicator lights are extinguished.

(*c*) The ϕ1, ϕ2, and ϕ3 H.V. PRIMARY indicator lights on the HVPS are energized.

(*d*) The 3000 V and 350 V SCREEN indicator lights on the HLRM are energized, denoting the presence of these supplies.

(*e*) The CARRIER-500W-ON indicator is energized in the RFA.

Note

If tuning is required, it should be done at the 100-watt level.

(3) To turn the booster off, the DISABLE 500 W push button Ⓕ on the RFA may be depressed, which de-energizes the plate power only in the booster. Turn-

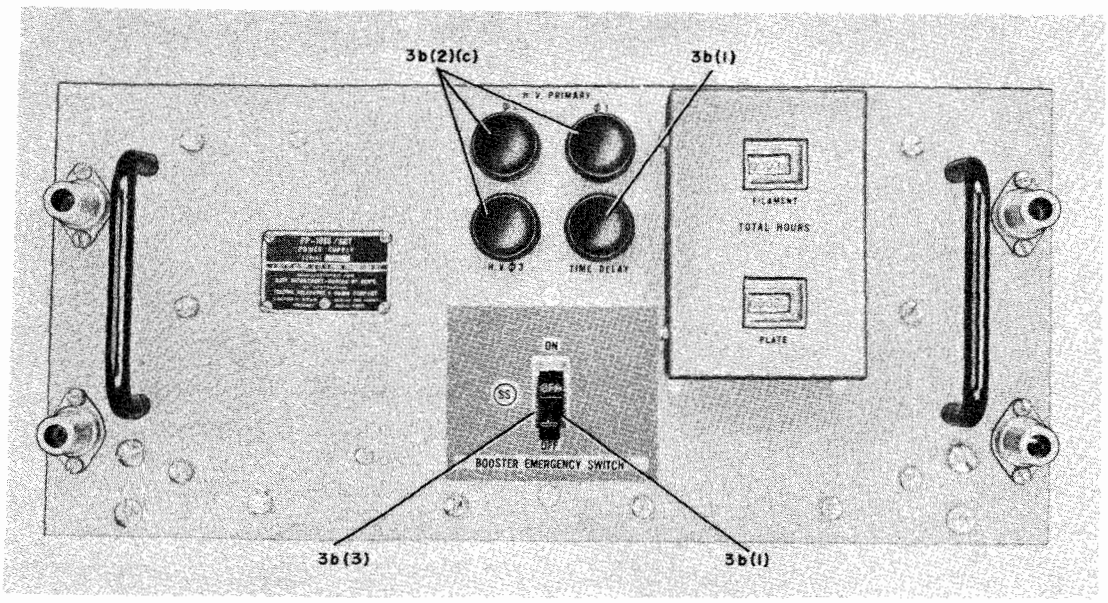


Figure 4—10. Power Supply PP-1096/SRT (High Voltage Power Supply, HVPS), Front Panel Controls and Indicators

ing the BOOSTER EMERGENCY switch (SS) to OFF removes both filament and power in the booster. If the transmitter group power is turned off as described in paragraph 3*a*(3) while booster power is still on, plate power will be removed from the booster also.

4. SELECTING A SERVICE.

The AN/SRT–14, 15 and 16 radio transmitting sets have five modes of transmission: hand key, machine key, FSK, facsimile and phone. The controls for selecting any one of these services are found on the LLRM panel. These adjustments may be made before or after radio transmitter power has been turned on.

a. HAND-KEY OPERATION.

The following TIME CONST. ADJ. control setting is normally a function of maintenance procedure.

(1) Depress SERVICE SELECTOR switch (U) and turn it to HAND. (See figure 4–3.) Be certain this switch does not remain depressed after the transfer is completed.

(2) Set KEYING RATE switch (S) to TT for hand keying.

(3) Place POLAR-NEUT. switch (R) in the NEUT. position.

(4) Loosen the captive screws on the LLRM front panel and pull out the LLRM chassis until the TIME CONST. ADJ. control, R–1134, on the preamplifier subchassis becomes accessible. "Cheat" the LLRM drawer interlock. With the transmitter on in the "standby" condition, turn the TIME CONST. ADJ. full counterclockwise. Operate the TEST KEY (T) at the operator's normal keying speed. Relay K–1102 will operate at the start of transmission and will possibly drop out during pauses between words. The TIME CONST. ADJ. is regulated clockwise until K–1102 will no longer drop out during these pauses at the operator's normal keying rate. As K–1102 is a sealed relay, the indications of K–1102 dropping out must be noted by ear.

b. MACHINE-KEY OPERATION.

(1) Depress SERVICE SELECTOR switch (U) and turn to MACH. Be certain this switch does not remain depressed after the transfer is completed.

(2) Set KEYING RATE switch (S) to TT for use with a single teleprinter or to MLTPX for multiplex operation. For high-speed tape keying set switch to 200 WPM for rates between 150 and 300 words per minute or to 400 WPM for rates between 300 and 600 words per minute.

(3) Place POLAR-NEUT. switch (R) in the NEUT. or POLAR position, according to the type of input signal available from the machine-key equipment.

c. FSK OPERATION.

(1) Depress SERVICE SELECTOR switch (U) and turn it to FSK. Be certain this switch does not remain depressed after the transfer is completed.

(2) Unscrew the lock in the center of F.S. DEVIATION control (KK). To obtain a desired frequency shift, divide total desired shift by two and set control (KK) to this latter value.

(3) Place POLAR-NEUT. switch (R) in the NEUT. or POLAR position according to the type of input signal available.

(4) Set KEYING RATE switch (S) to TT for use with a single teleprinter or to MLTPX for multiplex operation. For high-speed tape keying set switch to 200 WPM for rates between 150 and 300 words per minute or to 400 WPM for rates between 300 and 600 words per minute.

(5) Under conditions of selective fading, it may be desirable to supplement the frequency shift with a 200-cycle phase modulation. In this case, F.S.K. PHASE MOD. control (LL) should be turned clockwise approximately 60° from its counterclockwise limit.

d. FACSIMILE OPERATION.

(1) Turn SERVICE SELECTOR switch (U) to FAX.

(2) Loosen the center lock on F.S. DEVIATION control (KK) and set this control to the required number of cycles in accordance with the following formula:

$$\text{F.S. Deviation Setting} = \frac{\triangle f}{2} \times \frac{20}{V_{max} - V_{min}}$$

$$(\triangle f = f_{max} - f_{min})$$

Figures for f, V_{max} and V_{min} are specified by the photo transmission equipment. For example, if $\triangle$ f is 900 cycles, V_{max} is 20 and V_{min} is 5:

$$\text{F.S.D. Setting: } \frac{900}{2} \times \frac{20}{20-5} = 600 \text{ cycles}$$

Lock F.S. DEVIATION control (KK) in place.

(3) Set frequency control knobs to the assigned carrier frequency in accordance with the following formula:

$$\text{Frequency setting} = \text{Carrier Freq.} - \frac{\text{F.S.D. Setting}}{20} (V_{max} + V_{min})$$

For example, if V_{max} is 20, V_{min} is 5, $\triangle$ f is 900 cycles (F.S. DEVIATION setting would be 600 cycles), and the carrier frequency is to be 15,950,900 cycles:

$$\text{Frequency setting} = 15{,}950{,}900 - \frac{600}{20}(20 + 5) =$$

15,950,150 cycles

Note

If computed frequency ends in a number other than 10 cycles (for example, 15,950,153 cycles), set the carrier to the nearest 10 cycles (that is, 15,950,150 cycles). Frequency control knobs can be set only to the nearest 10 cycles.

e. PHONE OPERATION.

(1) Turn SERVICE SELECTOR control Ⓤ to PHONE.

(2) Set CARBON-DYN switch Ⓨ according to the type of microphone used. (Typical handsets are Navy Type H-51/U with carbon microphone and Navy Type H-52/U with dynamic microphone.)

(3) Turn SQUELCH TRIG control Ⓛ clockwise to the point of least noise level consistent with adequate depth of modulation. While making this adjustment, monitor the output either with sidetone or handset receiver or as described in 4*e*(7).

(4) Turn AGC switch Ⓟ on.

(5) Turn GAIN TO CLIP control Ⓜ for best volume level.

Having this control set improperly may cause abnormal modulation of the voice signal. Refer to Section 7, Maintenance, for a detailed adjustment procedure for this control.

(6) The % MOD control Ⓝ is set for 100 percent modulation by referring to the percent modulation adjustment procedures indicated in the maintenance section. There should be no need to adjust % MOD control as an operating control.

(7) To monitor microphone output, plug earphones into the SIDETONE jack. Control the volume of the earphones with the SIDETONE control Ⓦ.

Note

When using handset, excessive sidetone level may cause feedback to the microphone with consequent audio howl.

f. HIGH-SPEED OR TAPE KEYING.—This type of operation may be used when SERVICE SELECTOR switch Ⓤ is in either MACH or FSK position if an external keying voltage is provided and the signal is fed in on the machine-key input lines. When using high-speed or tape keying, set KEYING RATE switch Ⓢ to 200 WPM for rates between 150 and 300 words per minute and to 400 WPM for rates between 300 and 600 words per minute.

Note

To avoid unwanted carrier radiation when SERVICE SELECTOR Ⓤ is in MACH, FSK, or FAX, place the equipment in "stand-by" until the start of transmission. When operated locally, the STANDBY-OPERATE switch ⓅⓅ placed in STANDBY position will keep transmitter in "stand-by". When operated remotely, with the STANDBY-OPERATE switch ⓅⓅ in OPERATE, the transmitter is placed in "stand-by" by keeping the keying line open.

5. SELECTING A FREQUENCY.

A set of nine frequency selection knobs are located behind a transparent door on the RFO front panel (figure 4–5). These knobs are designated ⒶⒶ KNOB, ⒷⒷ KNOB, BAND ⒻⒻ, MC ⒼⒼ, 100 KC ⒽⒽ, 10 KC ⒿⒿ, KC ⒸⒸ, 100 ~ ⒹⒹ, and 10 ~ ⒺⒺ.

To set up a frequency the first step is to open the transparent door. The above-mentioned control knobs permit the manual selection of any frequency in 10-cycle steps from 0.3 mc to 26 mc. The dial readings corresponding to the 100 KC control knob ⒽⒽ down through the 10 ~ control knob ⒺⒺ designate directly the significant figures of the frequency setting through the 100 KC setting. The selection of the correct megacycle setting requires the regulating of the ⒶⒶ KNOB control, ⒷⒷ KNOB control, BAND control knob ⒻⒻ and the MC control knob ⒼⒼ. The following table shows the setting of ⒶⒶ, ⒷⒷ, ⒻⒻ, and ⒼⒼ according to the megacycle value of the output frequency desired.

TABLE 4–3. FINAL OUTPUT FREQUENCIES AND ⒶⒶ, ⒷⒷ, ⒻⒻ, AND ⒼⒼ CONTROL POSITIONS

RFO Output Freq. (mc)	ⒶⒶ Control Position	ⒷⒷ Control Position	ⒻⒻ Control Position	ⒼⒼ Control Position
0.3-1	0	10	0.3-6 mc	*
1-2	0	9		*
2-3	0	8		*
3-4	0	7		*
4-5	0	6		*
5-6	1	10		*
6-7	0	4	6-16 mc	6
7-8	1	8		7
8-9	0	3		8
9-10	0	2		9
10-11	1	5		0
11-12	1	4		1
12-13	2	8		2
13-14	2	7		3
14-15	2	6		4
15-16	3	10		5
16-17	3	9	16-26 mc	6
17-18	3	8		7
18-19	2	3		8
19-20	1	1		9
20-21	3	5		0
21-22	3	4		1
22-23	0	1		2
23-24	3	3		3
24-25	3	2		4
25-26	2	0		5

*In the 0.3-6-mc band the position of ⒼⒼ is immaterial.

As an example, to set up a frequency of 16.589450 mc, the following knob settings must be made: ⒶⒶ to 3, ⒷⒷ to 9, ⒻⒻ to 16-26 mc, ⒼⒼ to 6, ⒽⒽ to 5, ⒿⒿ to 8, ⒸⒸ to 9, ⒹⒹ to 4, and ⒺⒺ to 5.

Note

The highest frequency (26 mc) is obtained by setting the knob to 25.9999910, with the 10 ~ knob ⒺⒺ set to the 10 position.

The selection of a frequency should be made with the power off or with the power on and the transmitter in the "stand-by" condition. Opening the door to change a frequency incorporates a safety feature that prevents the transmitter from being in 500-watt operation while this door is open.

6. TUNING OPERATIONS.

The system tuning of the components of the transmitter group and the associated antenna tuning equipment is normally accomplished by the regulation of controls in three of the units of the Transmitter Group OA–684/SRT. These components are the Radio Frequency Amplifier AM–1008/SRT (radio frequency amplifier), the Transmitter Coupler CU–402/SRT (load adjusting unit), and the Control-Indicator C–1352/SRT (a subunit of Radio Frequency Oscillator O–275/SRT). A tuning chart is available on the RFO front panel (figure 4—4) which provides space for recording the settings of all frequency selection and tuning controls for 10 pre-established channels. However, to establish these settings for the first time or operate at a frequency other than a pre-established one, a more defined procedure must be followed. Also a calibration chart on the RFO governs settings of controls on the control-indicator, assuming the equipment works into a standard Navy 35-foot whip antenna. If this type of antenna is not used, this calibration chart must be disregarded and a more detailed procedure followed for adjusting the controls of the control-indicator.

a. TUNING TO AN UNCALIBRATED FREQUENCY.—The following will cover the tuning procedure in detail to tune the equipment to a frequency that has not been previously calibrated. This procedure does presume, however, that a standard Navy 35-foot whip antenna is used.

Step 1. Place STANDBY-OPERATE switch (PP) in STANDBY on LVPS and check LOCAL-REM switch (X) for LOCAL position.

Step 2. Select the service desired as per paragraph 4.

Step 3. Turn transmitter group power on as per paragraph 3.

Step 4. If required, select a new frequency in the RFO in accordance with paragraph 5.

Step 5. Set the BANDSWITCH (C) in the RFA to the band in which the selected frequency falls.

Step 6. Set the EXCITATION (ZZ) control in the RFA at its maximum clockwise setting.

Step 7. On the under side of the hinged flap, which is mounted on the door covering the frequency selection knobs on the RFO is a tuning chart (figure 4—11) used for presetting the controls on the control-indicator. If the tuning chart indicates BYPASS for the selected frequency, the ANTENNA TRANSFER (AE) control should be set to BYPASS, and no further tuning will be required on the control-indicator. For other frequencies, set the TRANSFORMER (AC) control and the ANTENNA COUPLER LOADING (AD) control to the positions indicated under the XFMR and COUP columns, respectively, of the tuning chart according to the frequency being transmitted. The (AE) control should be set to the TUNER IN position. Set SWR CALIBRATE (AB) control to 8:1.

Step 8. Set both the INPUT TAP (VV) and the OUTPUT TAP (WW) on the load adjusting unit to position 4.

Step 9. Place STANDBY-OPERATE (PP) switch in OPERATE.

Step 10. Throw the TEST KEY (T) on the LLRM to its locking position, which will energize a carrier.

Step 11. With the VOLTMETER-METER SELECTOR (J) in the RF IN position, the voltmeter reading should not exceed 5 volts. If it does, adjust the EXCITATION (ZZ) control to reduce the reading to 5 volts maximum.

Step 12. Loosen the dial lock of the TUNE IPA (B) control. Set the TUNE IPA (B) control for maximum output of the buffer and IPA stages. Maximum tuning of these stages is indicated by maximum PA grid drive as shown by a maximum reading on the PA CURRENT meter in the RFA with the PA-METER SELECTOR (H) in the I_{c1} position. In tuning, two peaks may be noted on the PA CURRENT meter. The TUNE IPA (B) control should be set to the peak at the lowest TUNE IPA dial reading to insure that the tuning is to the desired

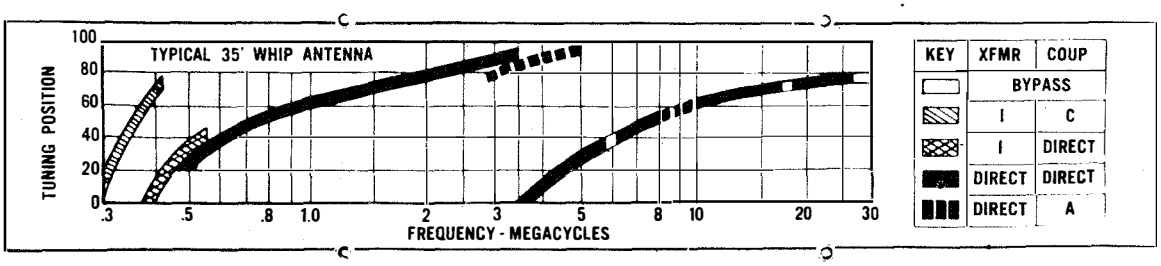


Figure 4—11. Tuning Chart on Radio Frequency Oscillator Front Panel

frequency and not to the second harmonic thereof. Tighten the dial lock.

Step 13. Loosen the dial lock of the TUNE PA Ⓓ control. Set TUNE PA Ⓓ control for maximum output of the PA stage. Maximum tuning of this stage is indicated by maximum reading on the PA CURRENT meter with PA-METER SELECTOR Ⓗ in the I_{c2} position. As with TUNE IPA, TUNE PA control Ⓓ should be set at the peak at the lowest TUNE PA dial reading. If the meter reading should go "off scale", adjust the EXCITATION ⓩⓩ control to bring meter reading "on scale".

Step 14. On the control-indicator, depress the UP ⒶⒻ button until POSITION meter reads 100. Depress DOWN ⒶⒼ button until the indicator on the SWR BALANCE meter shows a dip towards the low (green) area.

Note

The calibrations 8:1, 4:1, and 2:1 on the SWR CALIBRATE ⒶⒷ meter denote that, when the indicator of the SWR BALANCE meter reads 0 (center of scale), the standing-wave ratio on the line will be either 8:1, 4:1, or 2:1, depending on the setting of ⒶⒷ. A reading in the green area of the meter indicates a SWR lower than the indicated center reading value, while a reading in the red area of the meter indicates a SWR of a higher value than the center reading.

Jog the UP ⒶⒻ and the DOWN ⒶⒼ buttons, holding the SLOW ⒶⒽ button depressed until a maximum left-hand deflection is found. As the jogging is done the SWR CALIBRATE ⒶⒷ control should be set to 4:1 for a more sensitive tuning indication. If the SWR BALANCE meter still reads near the left-hand end of the scale, change the setting of ⒶⒷ to 2:1.

Note

If the tuning chart designates that ANTENNA TRANSFER ⒶⒺ control be set to BYPASS (see paragraph *6a*, step 7), the tuning procedure described above in paragraph *6a*, step 14, is not required.

Step 15. If, upon completion of the tuning adjustments described in the previous paragraph, the SWR BALANCE meter indicates a SWR higher than 2:1, adjust the positions of both the INPUT TAP Ⓥ and the OUTPUT TAP ⓌⓌ on the load adjusting unit, to improve the SWR reading. If no improvement of SWR is obtained, after trying all combinations of Ⓥ and ⓌⓌ control settings, return both the Ⓥ and ⓌⓌ controls to the initial position 4.

Step 16. The TUNE PA Ⓓ control on the RFA should be "touched up" for optimum reading on the r-f ammeter on the load adjusting unit to compensate for the changes in output impedance caused by the tuning of subsequent components after the first setting of TUNE PA Ⓓ control. Tighten the dial lock.

Step 17. With the PA-METER SELECTOR Ⓗ in the I_{c2} position, check the PA screen grid current. If the reading is in excess of 70 ma, adjust the EXCITATION ⓩⓩ control to reduce the value to 70 ma. If the reading is below 70 ma, and if the ⓩⓩ control is not in the fully clockwise position, increase ⓩⓩ to approach a reading of 70 ma, making sure RF IN reading on the VOLTMETER does not exceed 5 volts.

Note

If operating at the 500-watt level in an AN/SRT–15 or AN/SRT–16, the PA I_{c2} reading should be checked again for possible further readjustment of the EXCITATION ⓩⓩ control.

Step 18. The integrated tuning of the transmitter and its associated antenna tuning equipment is now complete. Restore the TEST KEY Ⓣ on the LLRM to its normal off position. If the equipment is to be operated either in HAND or PHONE, and the automatic "bypass" feature is desired, place the ANTENNA TRANSFER ⒶⒺ control in the REMOTE position after tuning is completed. This allows automatic bypassing of the antenna tuning equipment during periods of no transmission for purposes of using a receiver with the same antenna being used for transmission. This feature is more completely covered in paragraph 7*g* of Section 2 in this instruction book.

b. TUNING TO A CALIBRATED FREQUENCY.—The tuning chart on the outside of the hinged flap, which is mounted on the door covering the frequency selection knobs on the RFO (figure 4–4), has tabular space for recording all the frequency selection and tuning control settings for 10 preselected frequencies. Use of this chart will permit tuning to any one of the 10 chosen frequencies under "radio silence" conditions without energizing a carrier for tuning purposes.

To establish the values for the first time to be recorded on the chart, the tuning procedures as described in paragraph *6a* should be followed.

Note

After the final optimum setting for the TUNE PA Ⓓ control has been established (paragraph *6a*, step 16), detune slightly by turning the TUNE PA Ⓓ control counterclockwise five divisions on the TUNE PA dial. Now slowly rotate the TUNE PA Ⓓ control clockwise until the optimum setting is again read on the r-f ammeter on the load adjusting unit. The TUNE PA dial reading now established should be recorded on the chart under the "D" column. (The above procedure is followed to take in account the slight backlash in the chain-drive mechanism of the PA tuning.)

If it is established for any of the 10 frequencies that the correct setting for the control-indicator is "BYPASS", the word "BYPASS" should be entered on the chart under the combined "POS", "AC", and "AD" columns.

Once the proper values for each of the 10 preselected frequencies have been recorded on the chart, the following tuning procedure can be followed:

Step 1. Perform preliminary steps outlined in paragraph *6a,* step 1 through step 3.

Step 2. Set EXCITATION (ZZ) control on the RFA at its maximum clockwise setting.

Step 3. Make all frequency selection and tuning control settings according to the readings recorded on the chart.

Note

When setting the TUNE PA (D) control, start with the TUNE PA dial reading less than the desired reading and turn control (D) clockwise until the recorded dial setting is reached.

If the recorded setting for the control-indicator controls is "BYPASS", place ANTENNA TRANSFER (AE) control in the BYPASS position and the settings of the POSITION meter, (AC) and (AD) will be immaterial. If specific values are recorded on the chart for the settings of "POS", "AC" and "AD", these values should be set and the ANTENNA TRANSFER (AE) control placed in the TUNER IN position.

Step 4. Place STANDBY-OPERATE (PP) switch on the LVPS in OPERATE.

Step 5. Throw TEST KEY (T) on the LLRM to its locking position, which will energize a carrier.

Step 6. With the PA-METER SELECTOR (H) in the I_{c2} position, check the PA screen grid current. If the reading is in excess of 70 ma, adjust the EXCITATION (ZZ) control to reduce the value to 70 ma. If the reading is below 70 ma, leave (ZZ) control at its full clockwise rotation if the RF IN reading on the VOLTMETER does not exceed 5 volts. If RF IN reads in excess of 5 volts, reduce the (ZZ) control regardless of the reading of the PA I_{c2}.

Step 7. Restore the TEST KEY (T) on the LLRM to its normal off position. Tuning is completed.

c. VARIANCES IN TUNING PROCEDURES WHEN AN ANTENNA OTHER THAN A STANDARD NAVY 35-FOOT WHIP IS USED.—Variances in the tuning procedure described in paragraphs *6a* and *6b* caused by employing an antenna other than a standard Navy 35-foot whip are reflected only in changes in setting up the controls on the control-indicator.

In tuning to an uncalibrated frequency, the following procedure can be followed:

Step 1. Perform preliminary steps outlined in paragraph *6a,* step 1 through step 6.

Step 2. Place ANTENNA TRANSFER (AE) control on the control-indicator in the BYPASS position. Set SWR CALIBRATE (AB) control to 2:1.

Step 3. Perform steps to tune the transmitter bay as outlined in paragraph *6a,* step 8 through step 13.

Step 4. Set the controls on the control-indicator in accordance with one of the following alternatives. (If none of the following adjustments provide a reading on the SWR BALANCE meter of 2:1 or lower, accept the setting which provides the lowest SWR reading.)

If SWR BALANCE meter reads an SWR of 2:1 or lower, no further regulation of controls on the control-indicator is required.

If SWR is greater than 2:1, place (AE) control in the TUNER IN position. Set (AB) control to 8:1. Set the TRANSFORMER (AC) control to DIRECT and the ANTENNA COUPLER LOADING (AD) control to DIRECT. Depress the UP (AF) button until the POSITION meter reads 100. Then depress the DOWN (AG) button until the indicator on the SWR BALANCE meter shows a dip towards the low area. Jog the UP (AF) and DOWN (AG) buttons, holding the SLOW (AH) button depressed until a maximum left-hand deflection is found. If the reading is 2:1 or lower, no further adjustments on the control-indicator are needed.

(1) If the SWR is higher than 2:1 and if the tuned frequency is higher than 2.0 mc, try position A (series capacitor in) on the (AD) control. Rescan the tuning with the UP (AF) and DOWN (AG) buttons; starting downwards from 100 on the POSITION meter, look for a dip in the SWR BALANCE meter. If no dip is found, set (AD) control to B and, if necessary, to E, rescanning each time.

(2) If the SWR is higher than 2:1 and if the tuned frequency is lower than 0.5 mc, select position C (series inductor) on the (AD) control and position 1 on the (AC). Rescan the tuning with the UP (AF) and DOWN (AG) buttons; starting downwards from 100 on the POSITION meter, look for a dip in the SWR BALANCE meter. If no dip is found, set the (AD) control to D and rescan.

CAUTION

Positions C and D on the ANTENNA COUPLER LOADING (AD) control should not be used above 2.0 mc.

(3) If the SWR is higher than 2:1 and if the tuned frequency is between 0.5 mc and 2.0 mc, select position 1 on the (AC) control with the (AD) control in DIRECT. Rescan the tuning with the UP (AF) and DOWN (AG) buttons; starting downwards from 100 on the POSITION meter, look for a dip on the SWR BALANCE meter.

Step 5. Complete final tuning adjustments as outlined in paragraph *6a,* step 15 through step 18, after which tuning will be completed.

7. REMOTE OPERATION.

The turning on or off of power, the energizing of a carrier, and the originating of a signal, the latter in hand-key or phone operation only, can be accomplished from a remote position. The two transmitter groups of an AN/SRT-16 may be operated independently from two different remote locations. To operate remotely, several preliminary steps must be accomplished at the transmitter bay location.

a. PRELIMINARY SETTINGS.—The preliminary settings required depend on whether or not frequency selection and tuning are required.

(1) FREQUENCY SELECTION AND TUNING REQUIRED.—The following are the preliminary steps required at the transmitter bay location when frequency selection and tuning are required.

(*a*) With the LOCAL-REM switch (X) in the LLRM in the LOCAL position, accomplish all frequency selections and tuning functions required as detailed in paragraphs 5 and 6.

(*b*) Turn power off by depressing the STOP button of the MAIN POWER switch (RR) on the LVPS; the EMERGENCY SWITCH (MM) remains on.

(*c*) Put LOCAL-REM switch (X) in the REM position.

(*d*) Select a service in accordance with paragraph 5.

(*e*) Place STANDBY-OPERATE switch (PP) in the LVPS in the OPERATE position.

(*f*) Turn the BOOSTER EMERGENCY switch (SS) to the ON position if it is desired to transmit at the 500-watt level (AN/SRT-15 and 16 only).

(2) FREQUENCY SELECTION AND TUNING NOT REQUIRED.—The following are the preliminary steps required at the transmitter bay location when frequency selection and tuning are not required.

(*a*) Put LOCAL-REM switch (X) in the REM position.

(*b*) Turn EMERGENCY SWITCH (MM) to the ON position.

(*c*) Select a service in accordance with paragraph 5.

(*d*) Place STANDBY-OPERATE switch (PP) in the OPERATE position.

(*e*) Turn the BOOSTER EMERGENCY SWITCH (SS) to the ON position if it is desired to transmit at the 500-watt level (AN/SRT-15 and 16 only).

Note

If there is any doubt as to the condition of the transmitter prior to transmission at the 500-watt level, the tuning procedures as described previously should be followed prior to energizing of a carrier.

b. TURNING POWER ON.—Energizing of transmitter group power may now be done from the remote location using a remote radiophone unit (Navy Type 23500 or equivalent). To turn booster power on for 500-watt operation (AN/SRT-15 and 16 only) requires control from the transmitter bay location.

(1) TURNING ON TRANSMITTER GROUP POWER.—Depressing the START push button on the remote radiophone unit will energize the POWER indicator light. Simultaneously, in the transmitter group, the same indicator lights and circuits as described in paragraph 3*a*(2)(*a*) through paragraph 3*a*(2)(*b*) will be energized. If the service chosen was hand key, the indicator lights and circuits in the transmitter group, as described in paragraph 3*a*(2)(*i*) through paragraph 3*a*(2)(*k*), will also be energized at this time.

(2) TURNING ON BOOSTER POWER.—To turn on booster power in the AN/SRT-15 and 16 when in remote operation, the preliminary settings described in paragraph 7*a* must be made, followed by the energizing of transmitter group power, per paragraph 7*b*(1). The final step is to depress the PUSH FOR 500 W push button (E) on the RFA of the transmitter group, which energizes the CARRIER-500 W-READY indicator on the RFA. If the service chosen was hand key, indicator lights and circuits, as described in paragraph 3*b*(2)(*b*) through paragraph 3*b*(2)(*e*), will be energized at this time.

c. ENERGIZING A CARRIER.—In remote control, a "standby-operate" control is available in all services to control the presence of a carrier at the transmitter output.

(1) HAND-KEY OPERATION.—As described in paragraph 7*b*(1), plate power is applied in the transmitter group in hand-key operation when the START button on the remote radiophone unit is depressed. However, a carrier is not radiated until a hand key is inserted in the KEY jack of the remote radiophone unit. As hand-key operation is a c-w transmission, a "key-down" (mark) signal from the hand key will energize the carrier while the "key up" (space) signal cuts the carrier off.

(2) MACHINE-KEY, FSK, AND FACSIMILE OPERATION.—In machine-key, FSK, and facsimile transmission, the remote control of the carrier is accomplished by controlling the application of plate power in the transmitter group. Closing the keying line, using a key inserted in the KEY jack, energizes the plate voltage, which places the transmitter in the "operate" condition. In FSK and facsimile transmission, this simultaneously energizes the carrier. In machine-key operation, which is a c-w transmission, a mark signal must be received in addition at the transmitter group to energize the carrier. Opening the keying line removes plate power in the transmitter group, and it returns to the "stand-by" condition.

(3) PHONE OPERATION.—As above, closing the keying line from the remote radiophone unit, in PHONE operation, energizes plate power and the carrier in the transmitter group. In this case, the keying line is closed by depressing the press-to-talk button on the phone. Release of the press-to-talk button opens the keyline and restores the transmitter group to "stand-by" by de-energizing the plate power. When press to talk is depressed, the CARRIER ON indicator light on the remote radiophone unit will be energized.

d. ORIGINATING A SIGNAL.—A hand-key or phone signal may be originated at the remote radiophone unit. In hand-key operation, the carrier is keyed on and off. This is covered in paragraph 7*c*(1). In phone operation, a carbon phone is inserted in the HANDSET or CHESTSET jack and the voice signal transmitted through it to the transmitter group will be the modulating signal. In machine-key and FSK operation, the originating signal comes from machine-key equipment and is supplied directly to the transmitter group. In facsimile operation, the originating signal also is connected directly from the facsimile equipment to the transmitter group.

e. TURNING POWER OFF.—As long as the transmitter group remains in operation under control of the remote radiophone unit (LOCAL-REM switch (X) in REM), transmitter group power can be turned off remotely. With the transmitter group energized, depressing the STOP push button on the remote radiophone unit de-energizes transmitter group power in the same manner as depressing the STOP push button of the MAIN POWER switch (RR) does in local operation (paragraph 3*a*(3)).

8. MONITORING SIGNALS.

a. RFO OCSILLOSCOPE TEST RECEPTACLES.—Across the bottom of the RFO front panel are located six receptacles that bring out the signals from various subunits of the RFO for checking purposes (figure 4–4). These receptacles are designated 100 KC XTAL, 10 KC, 10 KC STEP, 100 KC STEP, INT. OSC., and F.S. OSC. These outputs can be connected to a standard test oscilloscope (Navy type OS-8/U or equivalent) for observation of the various outputs.

b. ZERO BEAT INDICATOR.—To monitor the outputs of the interpolation oscillator and frequency-shift oscillator subunits of the RFO against the crystal-controlled standard, an electron ray tube designated ZERO BEAT INDICATOR is provided on the RFO front panel (figure 4–4). ZERO ADJ. switch (Z) is used to select which of the two signals is to be compared to the standard. The INT. OSC. ZERO ADJ. and F.S.O. ZERO ADJ. controls are adjusted to give a zero beat condition of the shadow angle on the ZERO BEAT INDICATOR. The adjustments are located behind the door on the RFO panel that covers the frequency selection knobs (figure 4–5).

Note

If the beat frequency between the measured output and the standard is large, the opening and closing of the shadow angle on the ZERO BEAT INDICATOR will be so rapid as to appear as a blur. Care should be taken to distinguish this condition from a zero beat indication.

c. SIDETONE.—The LLRM has a front panel control and jack that permit the local monitoring of an audio signal (figure 4–3). With a headset connected to the SIDETONE jack, the SIDETONE control (W) should be turned clockwise as far as required for the desired level of earphone reception.

d. CHECKING MODULATION.—For setting and checking 100 percent modulation in phone operation, follow the procedure outlined in paragraph 4*e*(6). A more exact method of checking for 100 percent modulation to be made by a technician with test equipment is found in paragraph 6*a*(1) of Section 7 of this instruction book.

9. SUMMARY OF OPERATION.

a. TURNING THE POWER ON.—Turn on the EMERGENCY SWITCH (MM) in the LVPS. If 500-watt operation is desired, turn on the BOOSTER EMERGENCY switch (SS). Depress the START button of the MAIN POWER switch (RR) on the LVPS.

b. SELECTING A SERVICE.—Turn the SERVICE SELECTOR switch (U) on the LLRM to the desired service. For hand-key operation, set controls (S), (R), and TIME CONST. ADJ. control (paragraph 4*a*). For machine-key operation, set controls (S) and (R) (paragraph 4*b*). For FSK operation, set controls (KK), (R), (S), and (LL) (paragraph 4*c*). For facsimile operation, set control (KK) (paragraph 4*d*). For phone operation, set controls (Y), (L), (P), (M), (N), and (W) (paragraph 4*e*).

c. SELECTING A FREQUENCY.—Open the door covering the frequency selection knobs on the RFO. Set frequency selection knobs (AA), (BB), (FF), (GG), (HH), (JJ), (CC), (DD), and (EE) according to the desired frequency (paragraph 5). Close the door covering the knobs.

d. TUNING OPERATION.—Place the STANDBY-OPERATE switch (PP) in STANDBY. Turn transmitter group power on. Set BANDSWITCH (C) on the RFA to the band of the frequency selected. Set EXCITATION control (ZZ) on the RFA full clockwise. Preset control-indicator controls (paragraph 6*a*, step 7). Preset (VV) and (WW) controls on the load adjusting unit to position 4. Place STANDBY-OPERATE switch in OPERATE position. Throw TEST KEY (T) on the LLRM to the locking position. Adjust EXCITATION control (ZZ) if required (paragraph 6*a*, step 11). Set TUNE IPA control (B) (paragraph 6*a*, step 12). Make initial setting of TUNE PA control (D) (paragraph 6*a*, step 13). Regulate UP (AF) and DOWN (AG) controls on the control-indicator (paragraph 6*a*, step 14). If required, adjust (VV) and (WW)

controls on load adjusting unit (paragraph 6*a*, step 15). "Peak up" TUNE PA Ⓓ control (paragraph 6*a*, step 16). Check setting of Ⓩ control (paragraph 6*a*, step 17). Restore TEST KEY Ⓣ to its normal off position.

e. REMOTE OPERATION.—Turn EMERGENCY SWITCH Ⓜ to ON. Make all preliminary settings at the transmitter group location (paragraph 7*a*). Depress START push button on the remote radiophone unit. Energize a carrier (paragraph 7*c*). Transmit a signal in either hand-key or phone operation. Open keying line to de-energize a carrier (paragraph 7*c*). Depress STOP push button on the remote radiophone unit to turn transmitter group power off.

NOTES