

APPENDIX A

UHF VOICE COMMUNICATIONS SYSTEM

TECHNICAL MANUAL

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GENERALIZED MAINTENANCE TRAINER  
COMMUNICATIONS SYSTEM CONFIGURATION

INTRODUCTION

Fast, reliable communications is essential for the operation of a widely dispersed Navy organization. Navy ships must communicate with distant shore stations along with close-in and medium-distant ships and aircraft. To provide ships with these capabilities, a variety of communication equipments are required. Rigid shipboard space and weight requirements demand that these equipments not only be compatible, but flexible.

A communications system consists of all the electronic and mechanical equipments used for the transmission and reception of radio messages. (See Figure 0-1). Interconnections enable the selective switching of physically separated equipments into many different and often complex configurations. A communications configuration is the functional arrangement of electronic/mechanical equipments used in the transmission and reception of radio messages. The two main configurations are voice (telephone) and teletypewriter. A minor configuration, for instance, is facsimile which is used to transmit or receive copies of pictures. For communications security, crypto (Secure) equipments may be used to encode messages for transmission and decode encrypted messages on reception.

Communications play such a vital role in today's Navy, the technician must be able to isolate system malfunctions quickly and restore the system to full operation in a minimum of time.

### COMMUNICATION SYSTEM BLOCK DIAGRAM

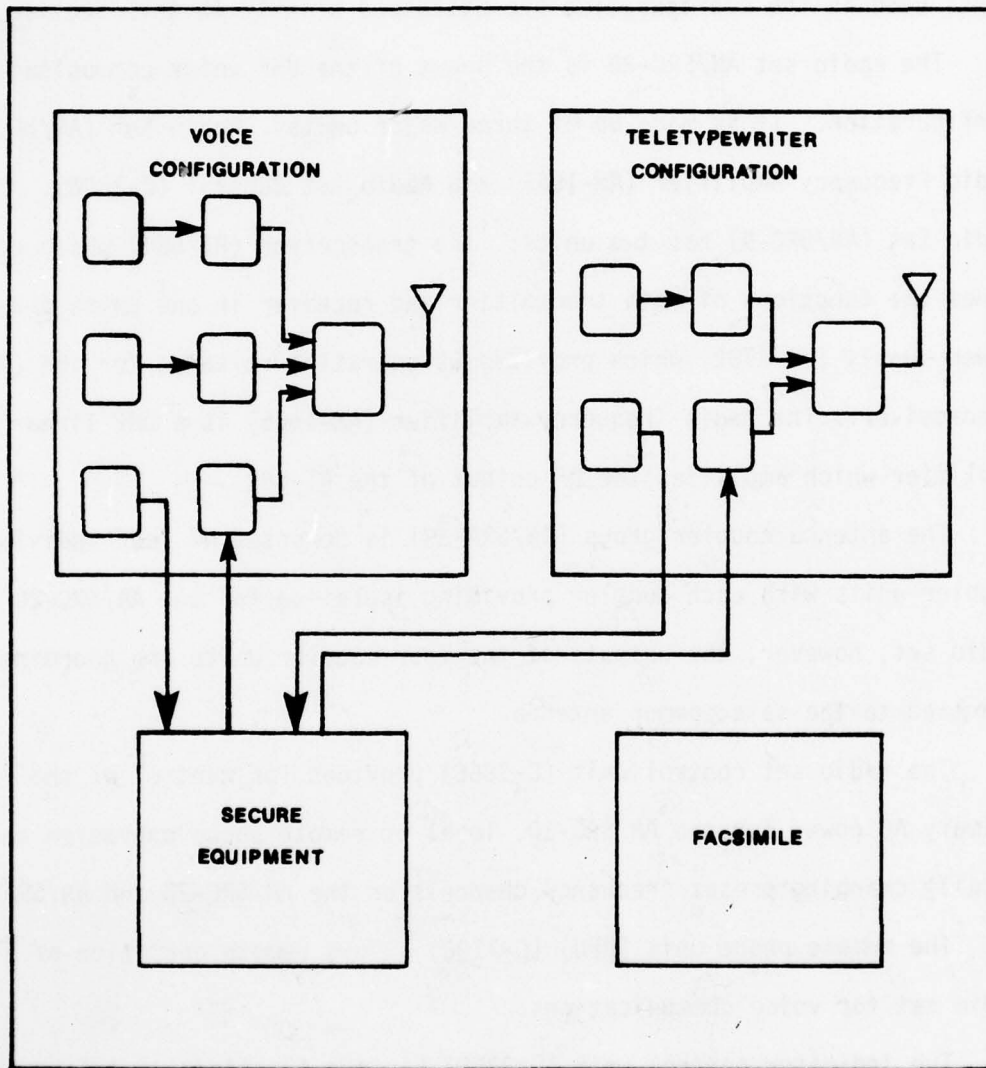


FIGURE 0-1

The purpose of GMTS is to provide system level troubleshooting for a basic communications system configuration. UHF voice is one of the communications configurations that can be simulated with GMTS. A basic shipboard UHF voice configuration is shown in (Figure 0-2). The equipments used in the configuration are discussed briefly in this section.

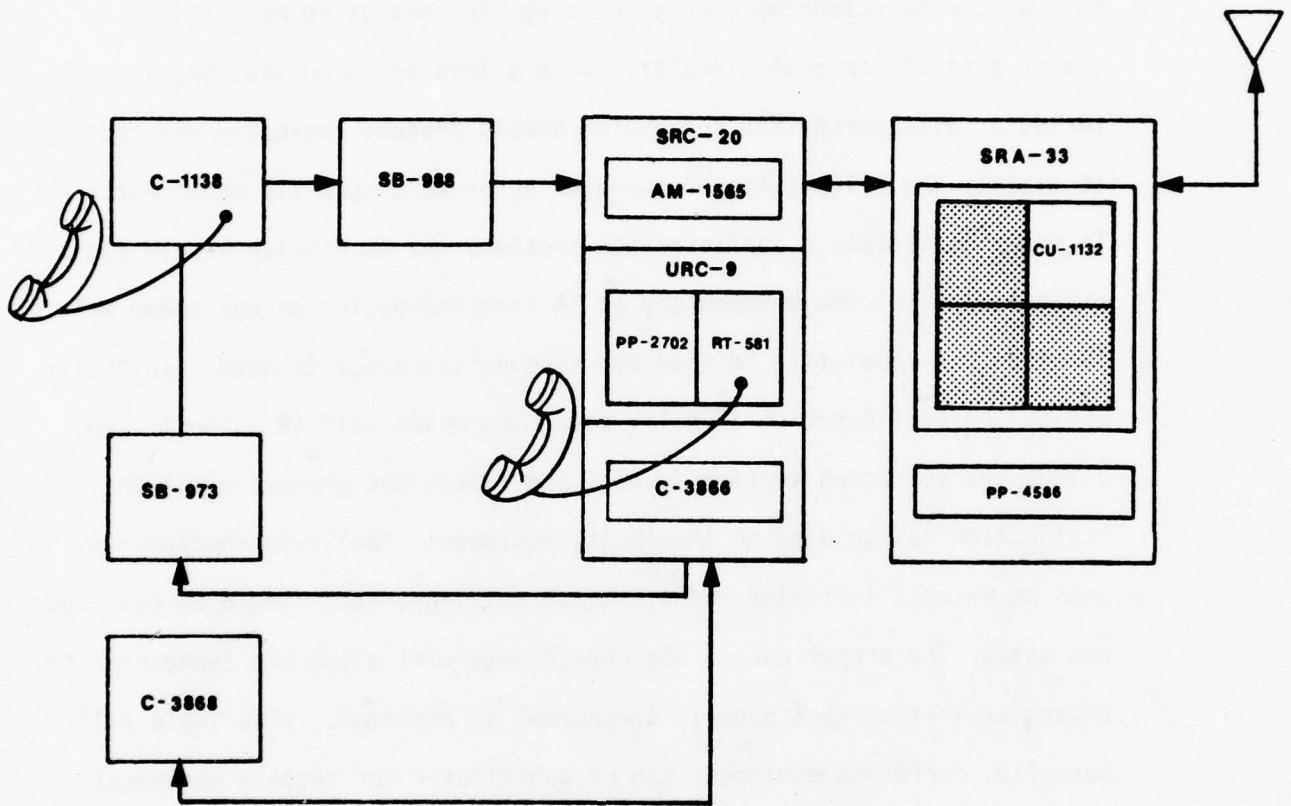
The radio set AN/SRC-20 is the heart of the UHF voice communications configuration. It is made up of three major units: Radio Set (AN/URC-9), Radio Frequency Amplifier (AM-1565) and Radio Set Control (C-3866). The Radio Set (AN/URC-9) has two units: the transceiver (RT-581) which combines the functions of both transmitter and receiver in one unit, and the power supply (PP-2702) which provides DC operating voltages for the (RT-581) transceiver. The radio frequency amplifier (AM-1565) is a UHF linear power amplifier which amplifies the RF output of the RT-581.

The antenna coupler group (AN/SRA-33) is composed of four individual coupler units with each coupler providing isolation for one AN/SRC-20 radio set, however, the outputs of the four coupler units are coordinated and tied to the same common antenna.

The radio set control unit (C-3866) provides for control of the primary AC power for the AN/SRC-20, local or remote phone operation and locally changing preset frequency channels on the AN/SRC-20 and AN/SRA-33.

The remote phone unit (RPU) (C-1138) allows remote operation of a radio set for voice communications.

The indicator control unit (C-3868) has two functions, a telephone-type dial for remotely changing preset channels and an indicator that points to the preset channel number being used.



**GMTS VOICE COMMUNICATION SYSTEM**

**FIGURE 0-2**



## COMMUNICATIONS CONFIGURATION TROUBLESHOOTING

The equipments used in a communications configuration occasionally fail or are operated improperly, causing the loss of communications on one or possibly several circuits. When a loss of communications is reported or discovered, the technician should proceed logically and rapidly to isolate the malfunction or operator error to a specific equipment. In order to isolate a configuration problem, the technician should use essentially the same methodology as in troubleshooting an equipment malfunction. A repetitive "divide and conquer" strategy is used. Initially divide the configuration in half, determine which half is suspect, then divide the suspected section in half and repeat the process until the malfunction is isolated to the faulty equipment. Built-in checkpoints such as meters, indicator lamps, switch settings, etc. should be observed and used. The proper use of the checkpoints will allow the technician to determine whether test signals are normal or abnormal. (See Table 0-1). Normally, operating equipment can be substituted for suspect equipment and the configuration checked for normal operation. Normal operation of the configuration, as in successfully conducting a radio check, indicates the malfunction has been corrected.



Table 0-1

## EQUIPMENT/COAX SUBSTITUTION LIST &amp; EXPECTED SIGNAL(S)

<u>GMTS #</u>	<u>Equipment Title</u>	<u>Expected Signal(s)</u>
1	Antenna AS-1018	UHF Mod/Unmod, (Xmit/Rec)
2	Coax (CU-1132 to Antenna)	UHF Mod/Unmod, (Xmit/Rec)
3	Antenna Coupler CU-1132	UHF Mod/Unmod, (Xmit/Rec)
4	Power Supply PP-4586	DC Power for SRA-33
5	Coax (CU-1132 to AM-1565)	UHF Mod/Unmod, (Xmit/Rec)
6	RF Amplifier AM-1565	UHF Mod/Unmod, (Xmit/Rec) Audio (Xmit/Rec) Xmit Control, Chan Select
7	Transceiver RT-581	GMTS #1-18
8	Handset H-169	Audio (Xmit/Rec), Xmitr Keying
9	Power Supply PP-2702	DC Power for RT-581
10	Coax (AM-1565-RT-581)	UHF Mod/Unmod (Xmit/Rec)
11	Radio Set Control C-3866	Audio (Xmit/Rec), Xmit Control, Chan Sel, Synchro
12	Remote Indicator/ #1 C-3868	Chan Select, Synchro
13	Switchboard SB-988	Audio (Xmit), Xmit Control, Xmitr Keying
14	Switchboard SB-973	Audio (Rec)
15	RPU #1 C-1138	Audio (Xmit/Rec), Xmit Control, Xmtr Keying
16	Handset H-169 (RPU #1)	Audio (Xmit/Rec), Xmitr Keying
17	RPU #2 C-1138	Same as RPU #1 (15) when selected by Transmitter Tran Switchboard (13)
18	Remote Indicator #2 C-3868	Same as Remote Indicator #1 when selected by Receiver Tran Switchboard (14)

## RADIO SET AN/SRC-20

The Radio Set An/SRC-20 is used for shipboard or shore, amplitude-modulated, radio voice communications. It operates in the UHF radio frequency range. It provides simplex transmission and reception. That is, it can transmit or receive, but not both at the same time. The SRC-20 frequency range is 225.0 to 399.9 MHz. It has 1750 voice channels, nineteen of these may be preset and selected locally or remotely.

The Radio Set An/SRC-20 is composed of three major units as shown in Figure 1-1.

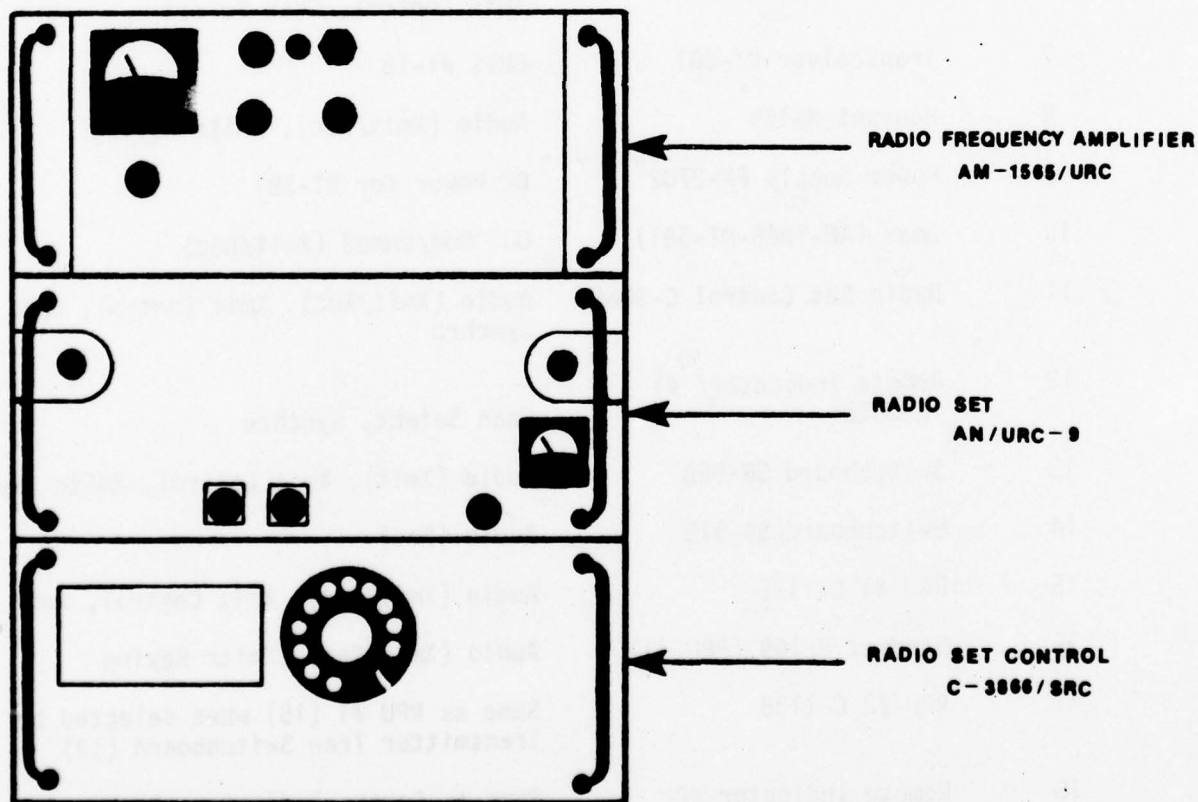


FIGURE 1-1

The Radio Frequency Amplifier AM-1565/URC is a linear RF power amplifier. It amplifies the 10 to 16 watt RF output from the Radio Set AN/URC-9 to recommended output of 100 watts. The RF Amplifier AM-1565 is continuously tunable over its frequency spectrum. Nineteen of its transmit frequencies may be preset for remote or local selection. These are called preset channels. It has its own power supply, and is a completely contained unit.

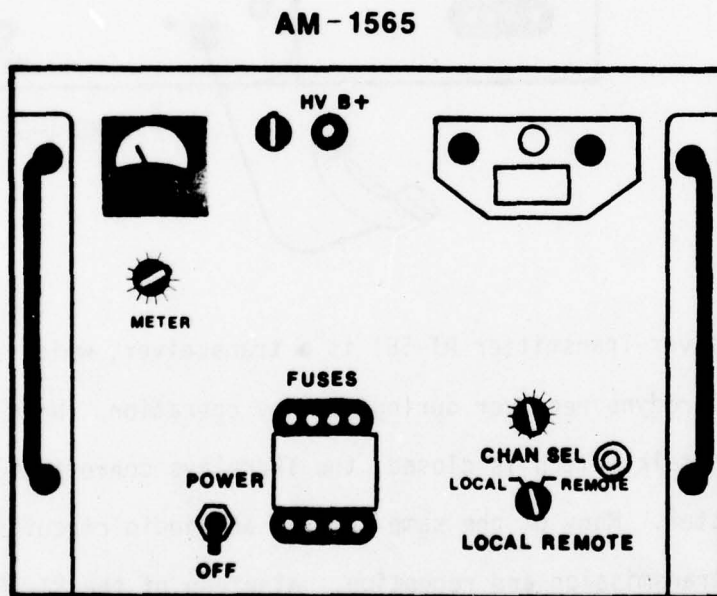


FIGURE 1-2

The Radio Set AN/URC-9 is made up of two units which are housed in the same case:

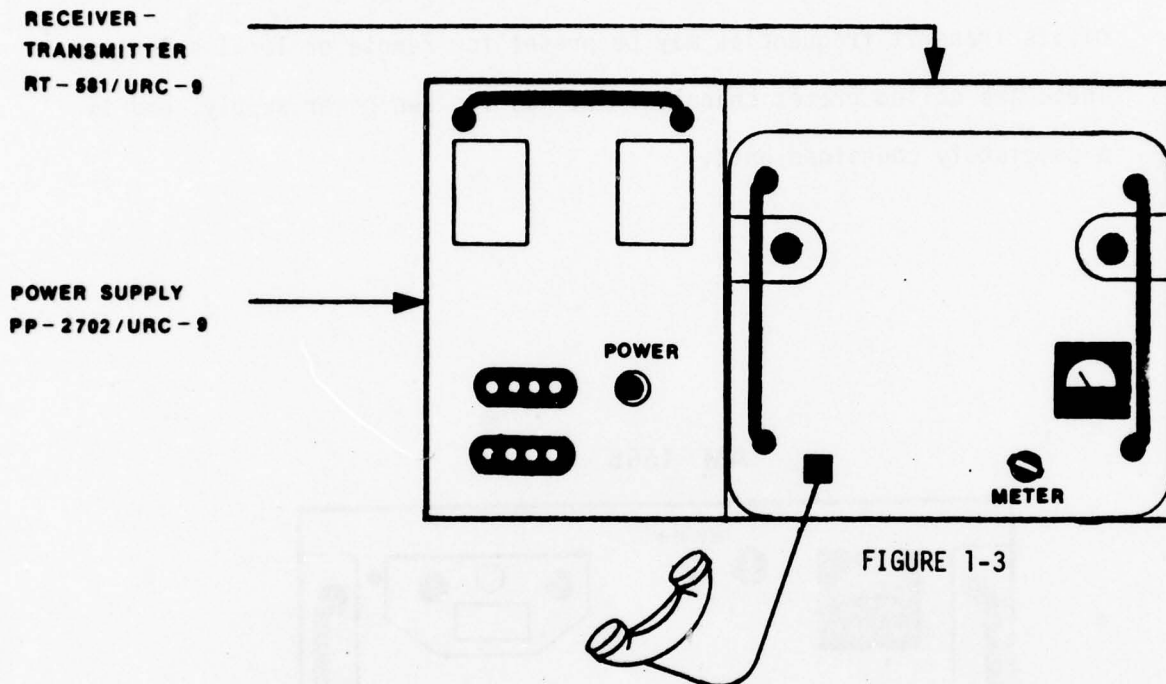


FIGURE 1-3

The Receiver-Transmitter RT-581 is a transceiver, which operates as a superheterodyne receiver during standby operation. When the microphone push-to-talk switch is closed, the TR/relays convert the RT-581 to a transmitter. Many of the same IF, RF, and audio circuits are used during both transmission and reception. Nineteen of the RT-581's transmit/receive frequencies may be preset and selected locally or remotely.

The Power Supply PP2702 provides most of the operating voltages and fusing required by the URC-9. It operates on either 115 or 230 volts a.c.

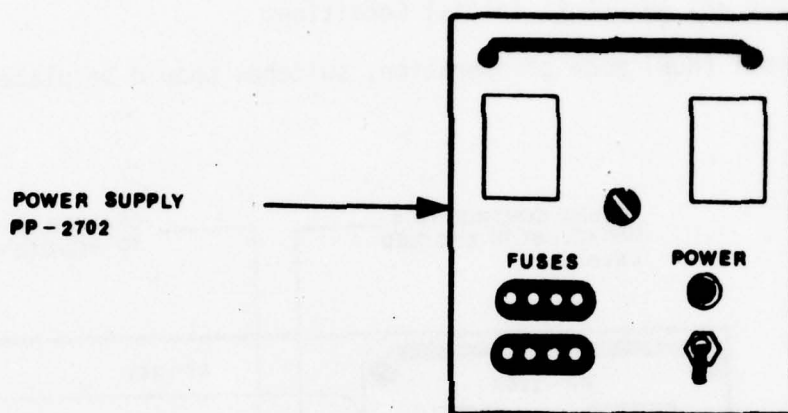


FIGURE 1-4

The Radio Set Control C-3866/SRC is a control unit which permits local or remote operation of the RT-581 and the AM-1565. All primary power for the URC-9 and the AM-1565 is routed through the Radio Set Control C-3866. A telephone-type dial is used to select any one of the 19 preset channels in the AN/SRC-20. The C-3866 provides for the setting of the squelch level for each of these channels.

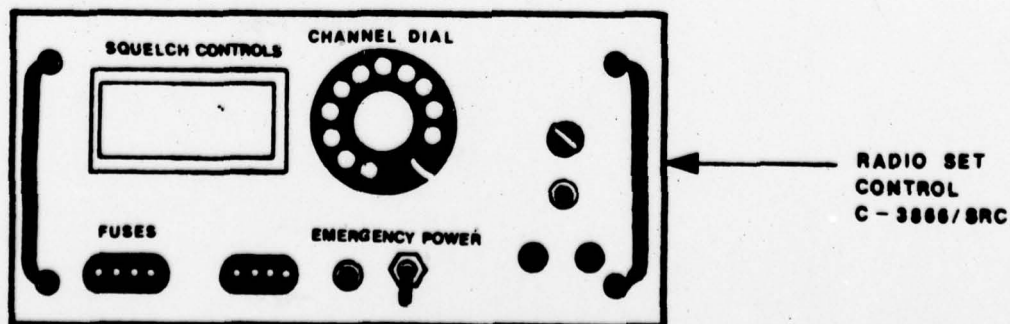


FIGURE 1-5



## RADIO SET AN/SRC-20 TURN-ON PROCEDURE

### RADIO SET AN/URC-9 Initial Conditions

Normal (NOR) mode of operation, switches should be placed as follows:

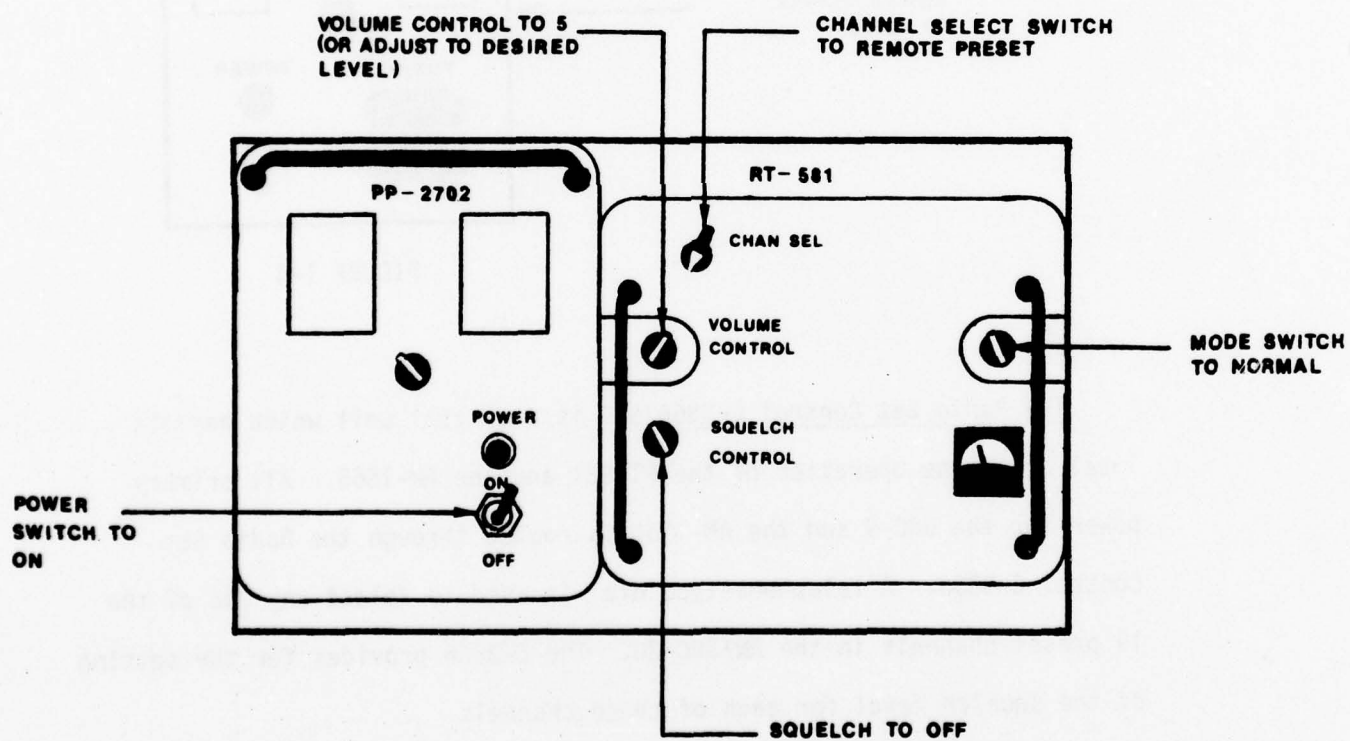


FIGURE 1-6



RADIO FREQUENCY AMPLIFIER AM-1565/URC Initial Conditions

Normal (NOR) mode of operation, switches should be placed as follows:

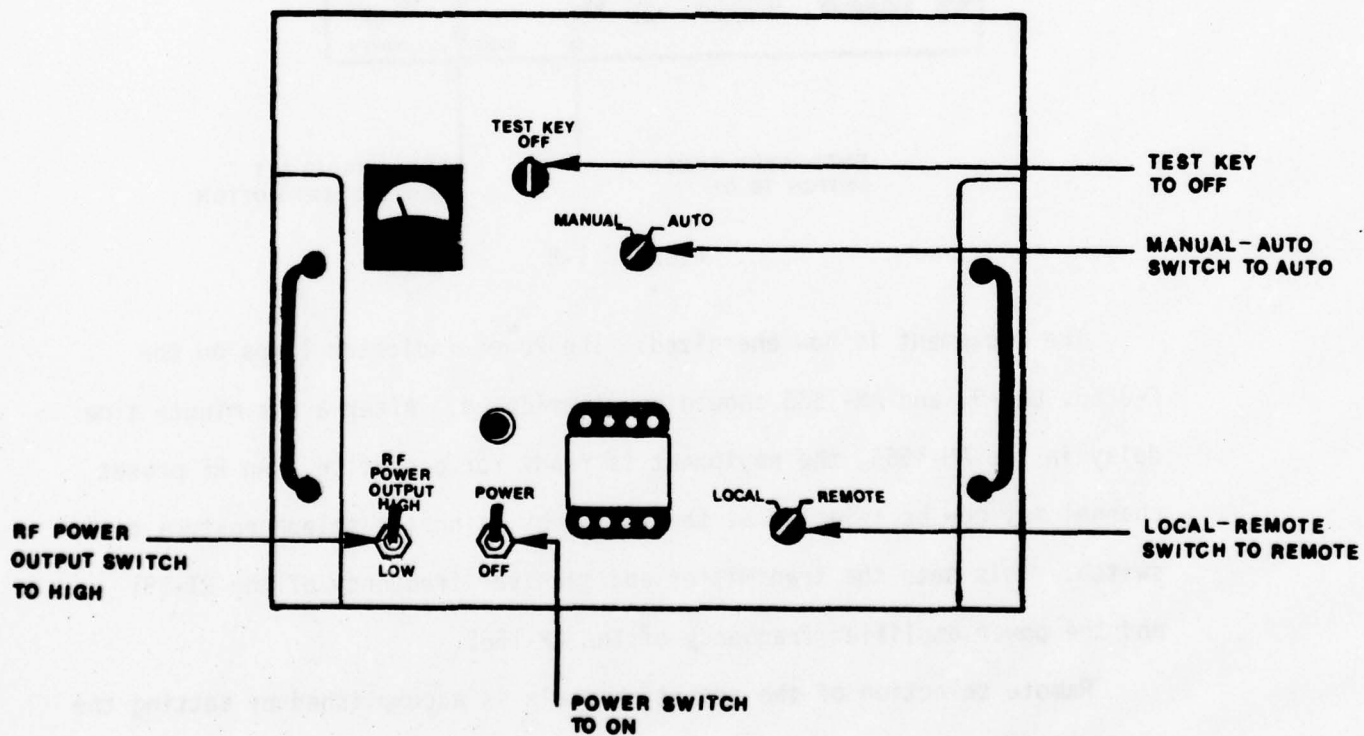


FIGURE 1-7

RADIO SET CONTROL C-3866/SRC Initial Conditions

Normal (NOR) mode of operation, switches should be placed as follows:

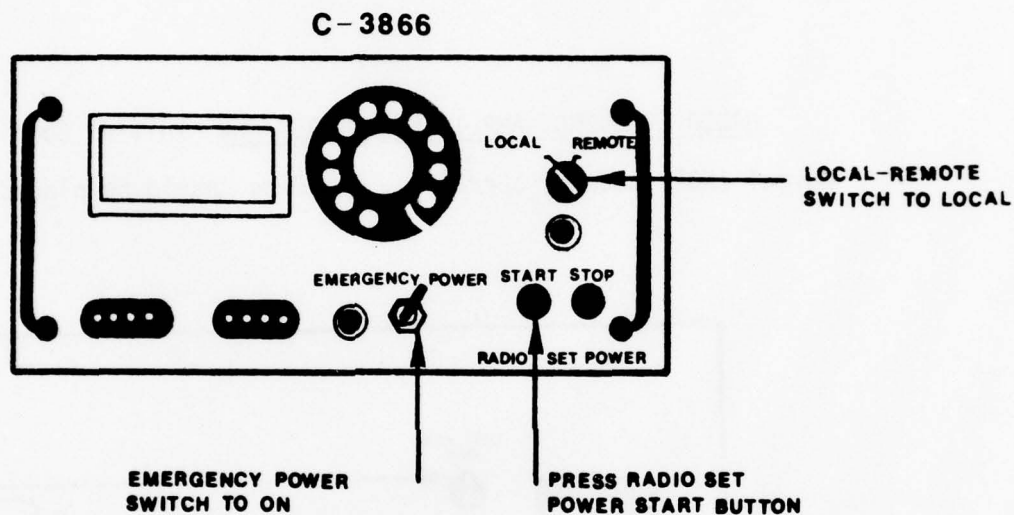


FIGURE 1-8

The equipment is now energized. The Power indicator lamps on the C-3866, URC-9, and AM-1565 should be illuminated. After a one minute time delay in the AM-1565, the equipment is ready for operation. An RF preset channel may now be selected at the C-3866 by using the telephone-type dial switch. This sets the transmitter and receiver frequency of the RT-581 and the power amplifier frequency of the AM-1565.

Remote selection of the preset channels is accomplished by setting the LOCAL-REMOTE switch on the C-3866 to REMOTE and dialing from the remote station (Remote Indicator C-3868/SRC). Up to nineteen different frequencies may be preselected.

RADIO SET AN/SRC-20 MODES OF OPERATION

Although the SRC-20 has four modes of operation, only the NOR (normal)

mode is utilized with GMTS. This mode is selected at the front panel of the URC-9 with the MODE switch set to NOR and the PLAIN-BROADBAND switch, located on the rear of the URC-9 set to the PLAIN position. During the normal mode the Radio Set An/URC-9 operates as a transceiver for voice communications. A local or remote push-to-talk microphone provides voice modulation and keying of the transmitter.

#### RADIO SET AN/SRC-20 SQUELCH FUNCTION

Squelch circuits are used in the SRC-20. These circuits are designed to eliminate noise in the speaker or headset when the received RF carrier signal is absent or below a predetermined level. If the squelch circuit is set too high, normal received signals may be eliminated. If the squelch circuit is set too low, receiver noise (hiss/crackle) will be present when no signal is being received. The CALL LIGHT lamp on the URC-9, RT-581 lights when the squelch circuit is disabled or when a signal of sufficient strength overrides the squelch level set.

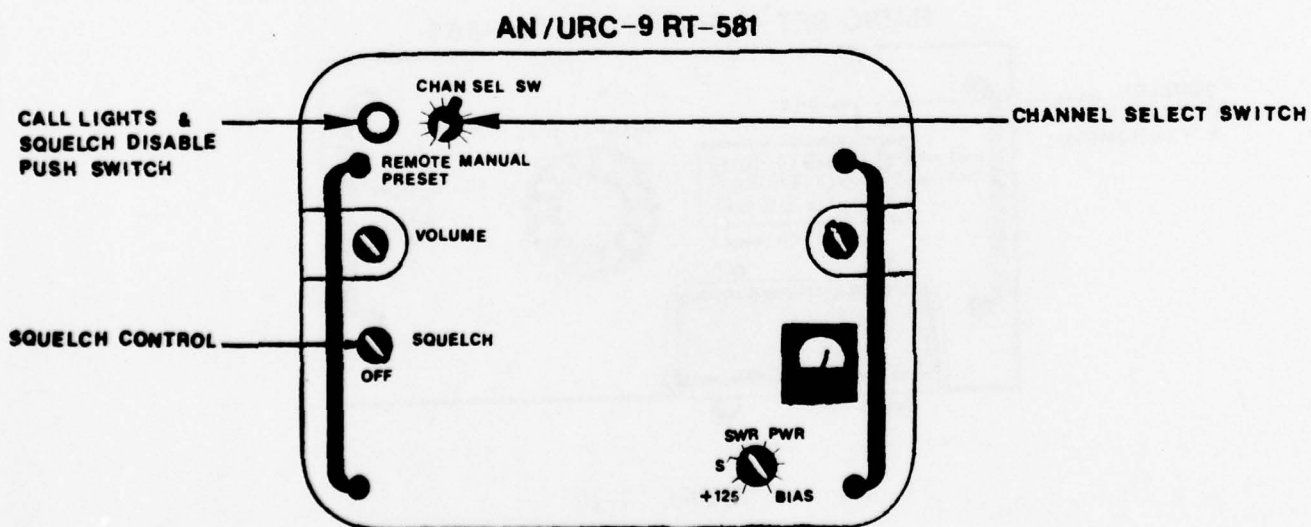


FIGURE 1-9

The Radio Set An/SRC-20 squelch function may be controlled at the RT-581 when its CHAN SEL switch is set to one of the 19 preset channels, or to MANUAL. The SQUELCH control on the RT-581 then controls the squelch level.

The squelch function may also be controlled at the Radio Set Control C-3866/SRC when the RT-581 CHAN SEL switch is set to the REMOTE PRESET position, and the RF Amplifier AM-1565 LOCAL-REMOTE switch is set to REMOTE. The C-3866 contains 19 squelch potentiometers (pot) see Figure 1-10. One pot is assigned to each RF preset channel, and each pot is individually adjusted for the desired squelch level. Squelch Pot #1 controls RF Preset Channel #1, Squelch Pot #2 controls RF Preset Channel #2, etc. There is only one squelch pot for each preset channel.

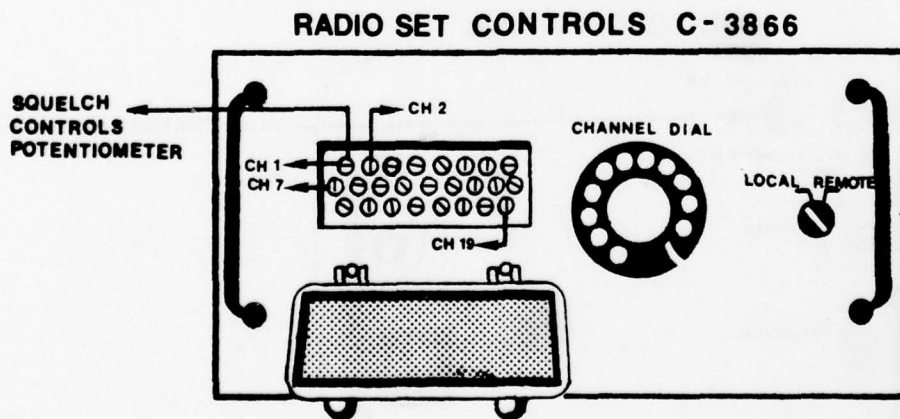


FIGURE 1-10

## RADIO SET AN/SRC-20 LOCAL-REMOTE OPERATION

LOCAL CONTROL SRC-20: The SRC-20 is set up with the initial conditions shown on Pages 1-5 to 1-8. Local control is accomplished at the Radio Set Control C-3866. The 19 preset channels for the URC-9 (RT-581), and the RF Amplifier AM-1565 are dialed at the C-3866. Voice modulation and keying of the RT-581 and the AM-1565 are accomplished at the RT-581 with a push-to-talk microphone. Squelch for each of the 19 preset channels is controlled by the squelch pots on the C-3866. The VOLUME Control on the RT-581 sets the level of audio to the headset.

REMOTE CONTROL SRC-20: Normally the SRC-20 is operated remotely in conjunction with the Radio Set Control (RPU) C-1138/UR, and the Indicator Control C-3868/UR. The Radio Set Control C-3866 LOCAL-REMOTE Switch is placed in the REMOTE position. In this setting the Indicator Control C-3868/UR telephone-type dial is used to select one of the 19 preset channels. Transmit/receive frequencies for the RT-581 and the AM-1565 are dialed at the Indicator Control C-3868. Squelch for each of the channels is controlled at the C-3866. Voice Modulation and keying of the RT-581 and the AM-1565 is accomplished at the Radio Set Control (RPU) C-1138. The EARPHONE LEVEL pot on the C-1138 controls the audio level to the headset.



## RADIO SET AN/SRC-20 NORMAL MODE KEYING

The RF carrier of the AN/URC-9 RT-581 Transceiver may be keyed (turned-on) in several ways. See Figure 1-11. With the URC-9 MODE Switch set to NOR, the RT-581 Transceiver may be keyed at the URC-9 with the microphone push-to-talk switch. With the RF Amplifier AM-1565, and the Radio Set Control C-3866/SRC LOCAL-REMOTE Switches set to REMOTE, the microphone push-to-talk switch of the remote Radio Set Control C-1138 (RPU) will key the Transceiver. Note that the Antenna Coupler AN/SRA-33 can disable the remote keying. This occurs when the antenna coupler is tuning, or when another transmitter-antenna coupler combination is set to a frequency within five megacycles and keyed to transmit. Transmitter keying may also be accomplished at the RF Amplifier AM-1565 for test purposes by setting the TEST KEY to ON or LOCK ON.



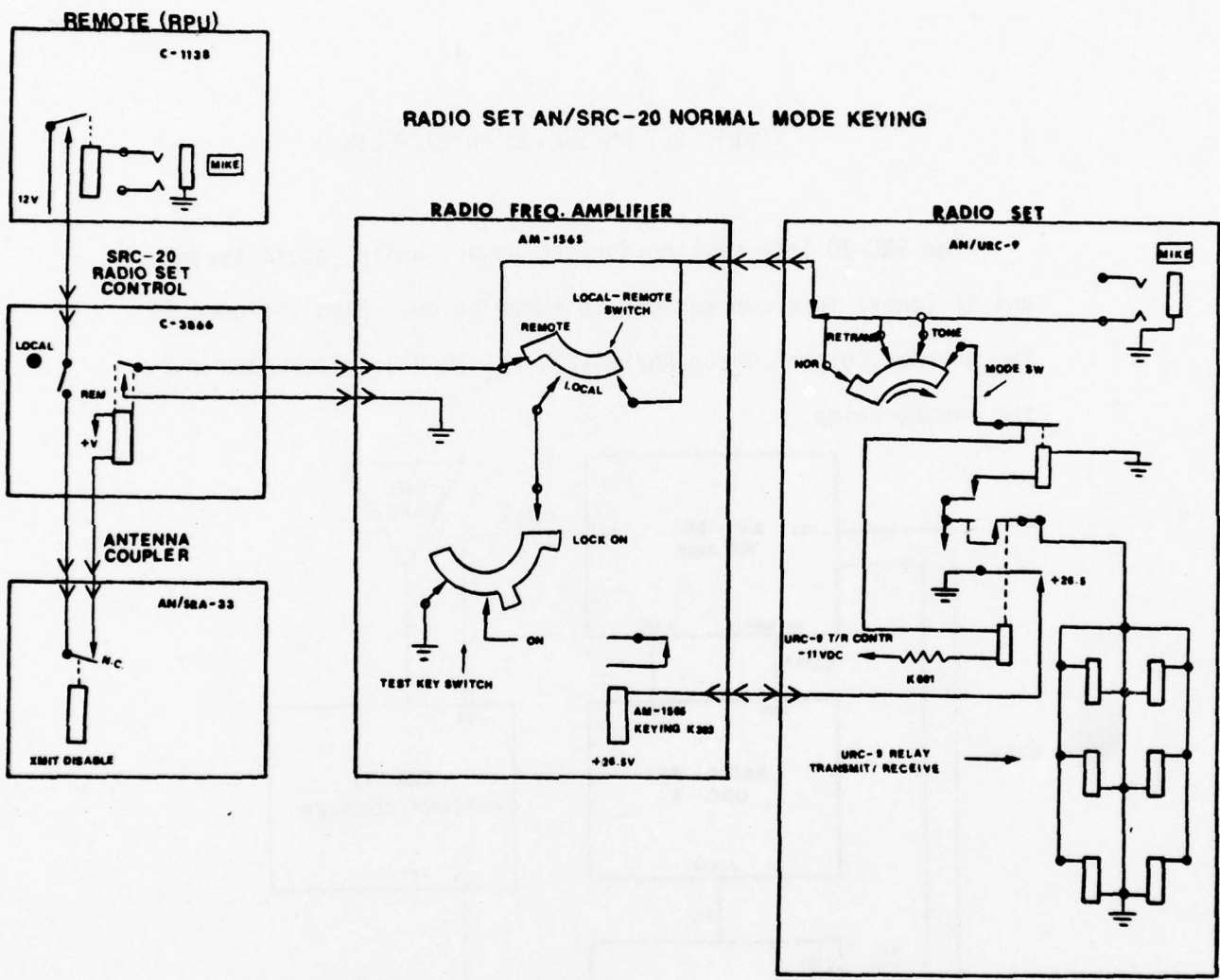


Figure 1-11

RADIO SET AN/SRC-20 INTERCABLING:

The SRC-20 intercabling for the power, audio, press-to-talk, and RF (coax) interconnections is shown below. Also included is the Antenna Coupler Group AN/SRA-33, the SB-973 switchboard and the remote units.

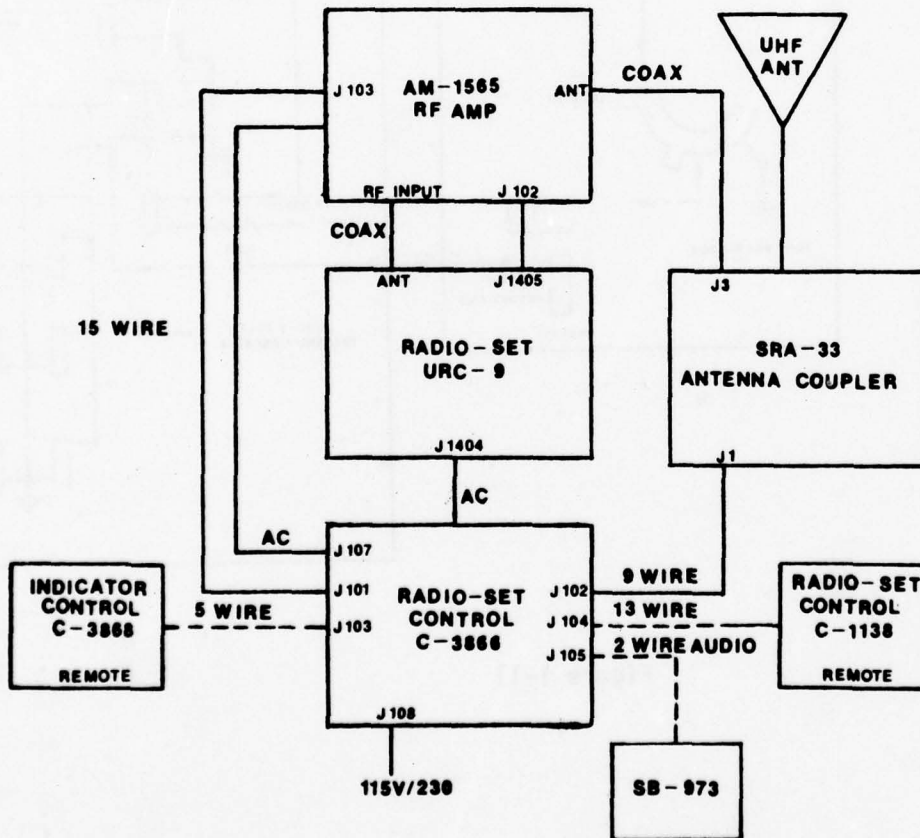


FIGURE 1-12

### RADIO SET AN/SRC-20 AC POWER DISTRIBUTION

The AC power (115/230v) is applied to the Radio Set AN/URC-9 and the RF Amplifier AM-1565 through the EMERGENCY POWER Switch and the fusing of the Radio Set Control C-3866/SRC. The URC-9 and the AM-1565 have their own POWER (ON)/OFF switches as well as additional fusing. In normal operation these switches are left in the POWER (on) position, and the equipment is turned on and off using the START-STOP pushbuttons on the Radio Set Control C-3866. The start switch has holding contacts which keep the relay power supply energized until the STOP pushbutton is pressed.

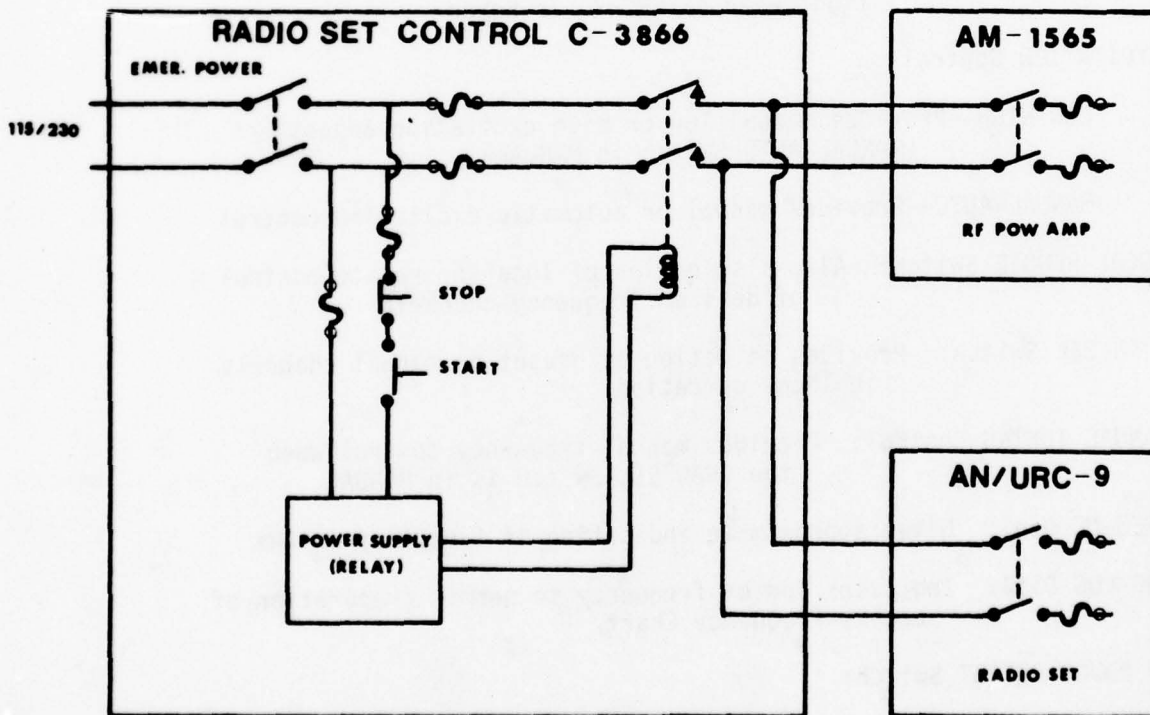


FIGURE 1-13

RADIO SET AN/SRC-20 DESCRIPTION of CONTROLS &  
NORMAL METER INDICATIONS

RADIO FREQUENCY AMPLIFIER AM 1565/URC:

POWER Switch: Controls primary input power

POWER Indicator: Indicates primary power has been applied

DIMMER Control: Controls brilliance of front panel lamps

CAUTION INDICATOR: Indicates when high-voltage protect is disabled

TEST KEY Switch:

ON--keys AN/SRC-20 to transmit for test purposes

OFF--AN/SRC-20 not keyed at AM 1565

LOCK ON--Locks AN/SRC-20 in continuous transmit condition  
for test purposes

HV B+ Indicator: Indicates that high-voltage B+ is turned on;  
light when AN/SRC-20 is keyed

EXCITATION Controls:

LOW-HIGH--Provides manual low or high excitation adjustment  
(MANUAL-AUTO Switch in MANUAL)

MANUAL-AUTO--Provides manual or automatic excitation control

LOCAL-REMOTE Switch: Allows selection of local or remote control  
of desired frequency channels

CHAN SEL Switch: Provides selection of preset or manual channels  
in local operation

MANUAL TUNING Control: Provides manual frequency control when  
the CHAN SEL Switch is in MANUAL

FREQ-MC Dial: Gives approximate indication of frequency in MHz

LOG-LOG Dial: Indicates log of frequency to permit preparation of  
Log-vs-Frequency Chart

RF POWER OUTPUT Switch:

HIGH--Couples 100-watt (average carrier) output of AM-1565  
to the antenna or coupler

LOW--Couples 16-watt of output of AN/URC-9 directly to the  
antenna or the coupler bypassing the AM-1565

RADIO FREQUENCY AMPLIFIER AM-1565/URC (continued)

Meter & METER Switch: Meter monitors any one of 11 functions selected by the METER Switch

<u>METER POSITION:</u>	<u>FUNCTION:</u>	<u>TRANSMITTER KEYED/UNKEYED:</u>	<u>NORMAL INDICATIONS:</u>
HV	+1800V dc	Keyed	Black Scale 72
Bias 1	-60V dc to V201	Unkeyed	Black Scale 50
Bias 2	-60V dc to V202	Unkeyed	Black Scale 50
+300	+300V dc	Unkeyed	Black Scale 60
27.5	-27.5V dc	Unkeyed	Black Scale 55
DELAY	30V dc	Unkeyed	Black Scale 38
SWR	Reflected power	Keyed	25 watts max
PWR OUT	RF power output	Keyed	100--130 watts
PAI <sub>b1</sub>	Plate I of V201	Keyed	Black Scale 60--95
PAI <sub>b2</sub>	Plate I of V202	Keyed	Black Scale 60--95
ATTEN	I thru var. mag. ferrite	Keyed	Black Scale 4--44

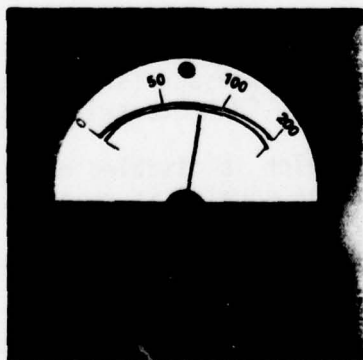


FIGURE 1-14



RADIO SET AN/URC-9 CONTROLS & METER INDICATIONS:

POWER Switch: Controls primary input power to the URC-9

POWER Indicator: Indicates primary power has been applied

DIMMER Control: Controls intensity of panel lights

CHAN SEL Switch: A 21-position switch with the following positions:

REMOTE PRESET--Transfers control to the remote CHANNEL DIAL selector

1 thru 19--Select preset channel 1 through 19

MANUAL--Transfers frequency selection to the MANUAL FREQUENCY switches

MANUAL FREQUENCY Switch: Selects operating frequency when Chan Sel Switch is in MANUAL

TENS Switch--Selects first two digits

Units Switch--Selects third digit

Tenths Switch--Selects fourth digit

CHANNEL Indicator: Indicates preset channel (or manual) in use

FREQUENCY Indicator: Indicates frequency in use

SQUELCH Control: Controls the ability to receive weak signals, and shuts off receiver noise when no signal is received

SQUELCH DISABLE PUSH Switch: Disables squelch circuit when pressed (switch is inoperative when CHAN SEL switch is in REMOTE PRESET)

CALL LIGHT: Lights when squelch is disabled or signal strong enough to override the squelch is received

MODE Switch: Selects the following modes of operation:

NOR--Normal operation (Voice communications)

RETRANS--Automatic relaying of another receiver's signals

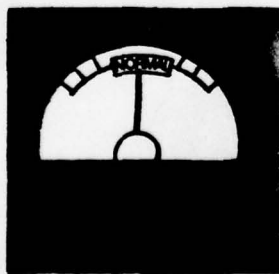
TONE--1000 Hz modulation of the carrier for Homing Beacon operation



RADIO SET AN/URC-9 (continued)

Meter & METER Switch: Meter monitors any one of 11 functions selected by the METER Switch:

<u>METER POSITION:</u>	<u>FUNCTION:</u>	<u>TRANSMITTER KEYED/UNKEYED:</u>	<u>NORMAL INDICATIONS:</u>
OFF	Meter disconnected		
S METER	Received signal strength	Unkeyed	Depends on signal
SWR	Reflected power	Keyed	Low end of NORMAL range
PWR	RF power output	Keyed	Center of NORMAL or above
DVR I <sub>b</sub>	Plate I of V105	Keyed	In NORMAL range
PA I <sub>g</sub>	Grid I of V106	Keyed	Center of NORMAL but not over max dial scale
PA I <sub>b</sub>	Plate I of V106	Keyed	In NORMAL range
% MOD	Modulator output	Keyed	With strong microphone input, deflects to center of NORMAL range
BIAS	Voltage from 11V dc	Unkeyed	In NORMAL range
+26.5V	+26.5V dc	Unkeyed	In NORMAL range
+125V	+125V dc	Unkeyed	In NORMAL range
+325V	+325V dc	Unkeyed	In NORMAL range



**AN/URC-9 METER**

FIGURE 1-15

## RADIO SET CONTROL C-1138/UR

The Radio Set Control C-1138/UR is a remote phone unit (RPU), which provides convenient control of certain radiophone transmitter and receiver functions. The RPU's are generally located in remote spaces from the radio transmitting equipment such as the Pilothouse, CIC, etc.

The Radio Set Control C-1138/UR incorporates in its circuitry a means for keying and voice modulating its RF carrier. The C-1138 provides a volume control for adjusting the audio level delivered from the distant receiver for earphones usage. Figure 2-1, below, shows the various C-1138 functions.

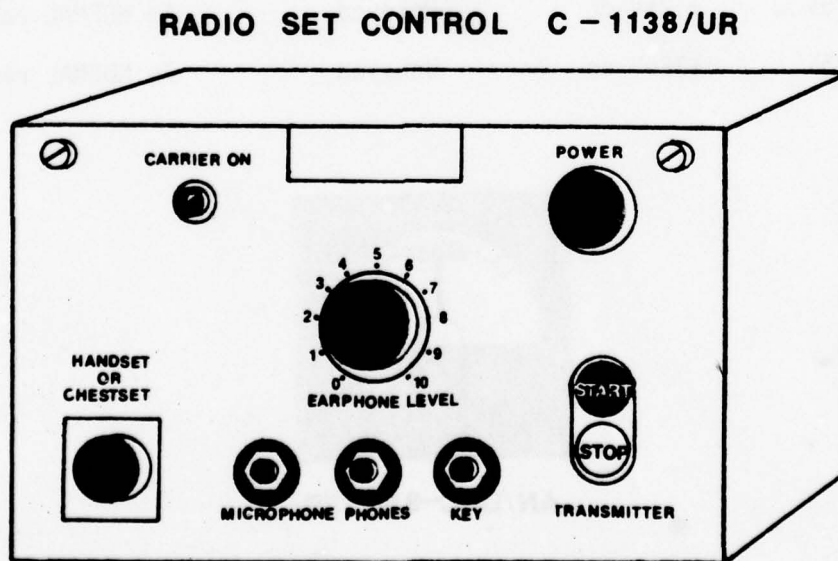


FIGURE 2-1

The START switch of the Radio Set Control C-1138/UR enables the application of 115/230 volts AC power. The STOP switch removes this power. The POWER indicator lamp reflects this action. The CARRIER ON indicator lamp shows that the RF carrier of the transmitting equipment is keyed (turned on) and ready for voice modulation. A single jack is provided for a handset or chestset on the C-1138/UR. These have a push-to-talk switch for keying the RF carrier, a microphone for voice modulating the same, and earphones for monitoring the radio receiver audio output. The EARPHONE LEVEL control adjusts the level of audio to the earphones. The MICROPHONE jack provides for keying and modulating the RF carrier only. A KEY jack is available for the C-W keying of the RF carrier.

In the GMTS Communications Configuration, the Radio Set Control C-1138/UR is used to key and voice modulate the Radio Set AN/SRC-20. The AN/URC-9 RT-581 transmit circuits, and the RF Amplifier AM-1565 high voltage and carrier, are turned on when the hand/chest set or the microphone push-to-talk switch is pressed. The control circuits and transmit audio are routed from the C-1138 through the Transfer Switchboard SB-988, the Radio Set Control C-3866, and finally through the RF Amplifier to the Transceiver RT-581. See Figure 2-2. The receive-side audio of the RT-581 is routed through the AM-1565, the Radio Set Control C-3866, and the Receiver Transfer Switchboard SB-973 to the RPU C-1138.

**AUDIO AND KEYING INTERCONNECTION  
RADIO SET CONTROL C-1138/UR AND  
RADIO SET AN/SRC-20**

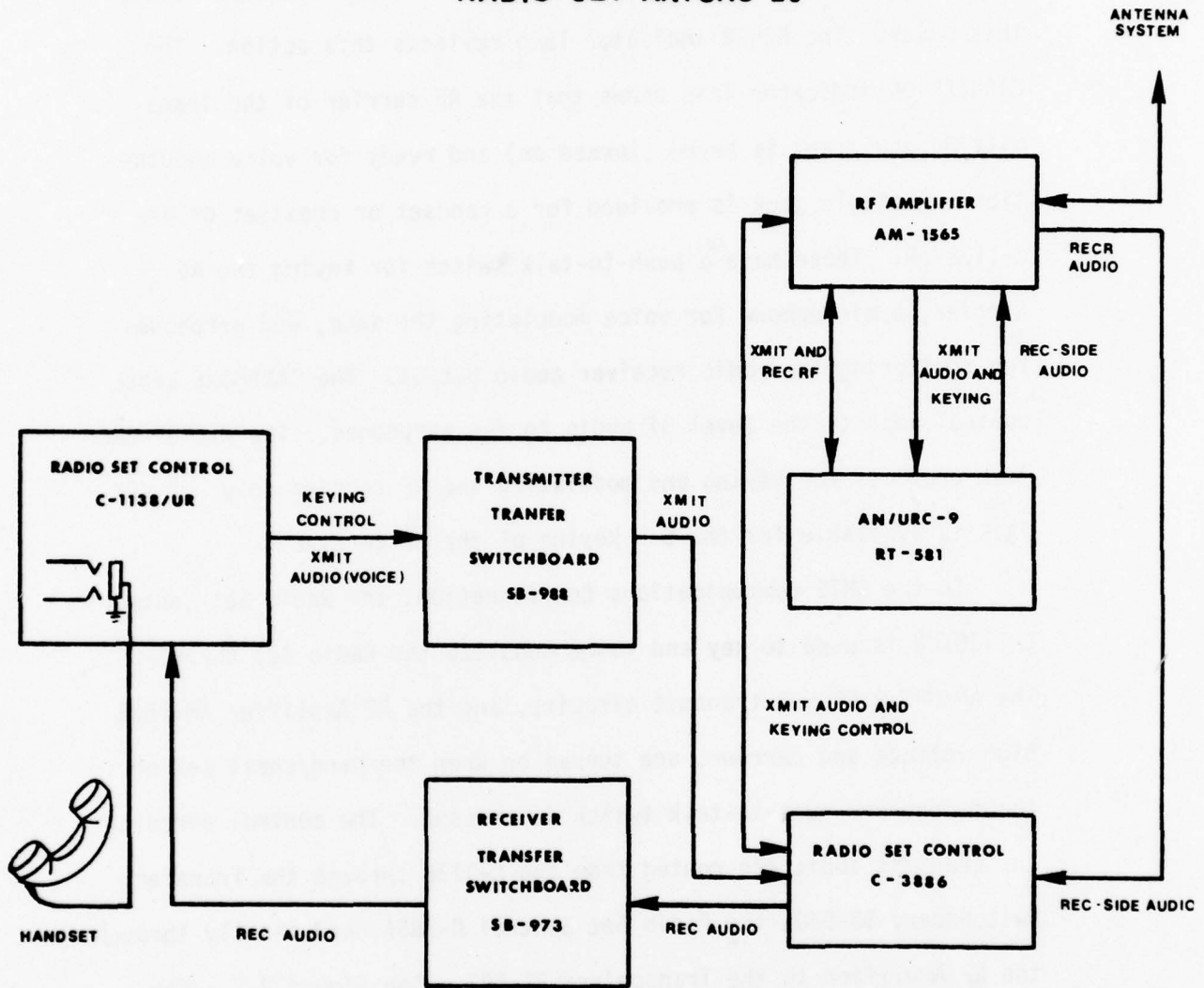


FIGURE 2-2

### INDICATOR CONTROL C-3868/SRC

The Indicator Control C-3868/SRC is a remote unit which provides selection of a radio set's RF preset channels and indicates the channel selected. Usually the Indicator Control C-3868/SRC is located with the Radio Set Control C-1138/UR in convenient spaces such as the Pilothouse, CIC, etc., distant from the radio equipment.

The selection of a preset channel is accomplished at the Indicator Control C-3868/SRC by dialing the CHANNEL SELECTOR. See Figure 3-1. The CHANNEL INDICATOR dial indicates the last RF preset channel selected by the C-3868/SRC. The CHANNEL INDICATOR remains in the LOCAL position until the C-3868/SRC is given remote control by the distant radio equipment. Both the CHANNEL INDICATOR and the CHANNEL SELECTOR are turned on and off by the C-3868/SRC ON-OFF switch.

### INDICATOR CONTROL C-3868/SRC

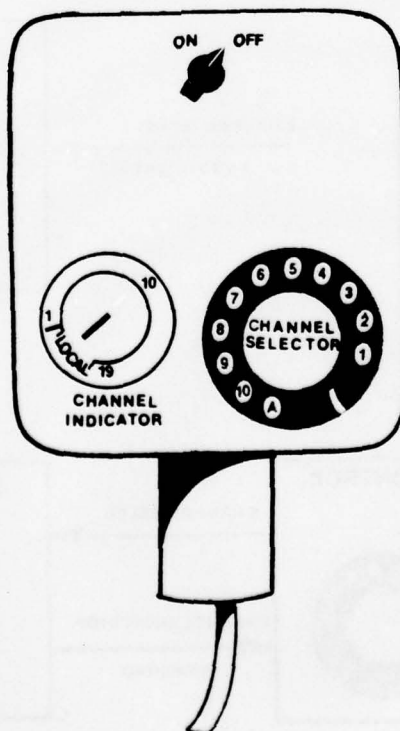


FIGURE 3-1



In the GMTS Communications Configuration, the Indicator Control C-3868/SRC is used to select and indicate the 19 preset channels of the Radio Set AN/SRC-20: AN/URC-9 RT-581 Transceiver, and RF Amplifier AM-1565. Figure 3-2 shows the interconnections between the C-3868/SRC and the AN/SRC-20. The switch settings required to transfer channel selection to the C-3868/SRC are also shown.

**REMOTE DIAL INTERCONNECTION  
INDICATOR CONTROL C-3868/SRC AND RADIO SET AN/SRC-20**

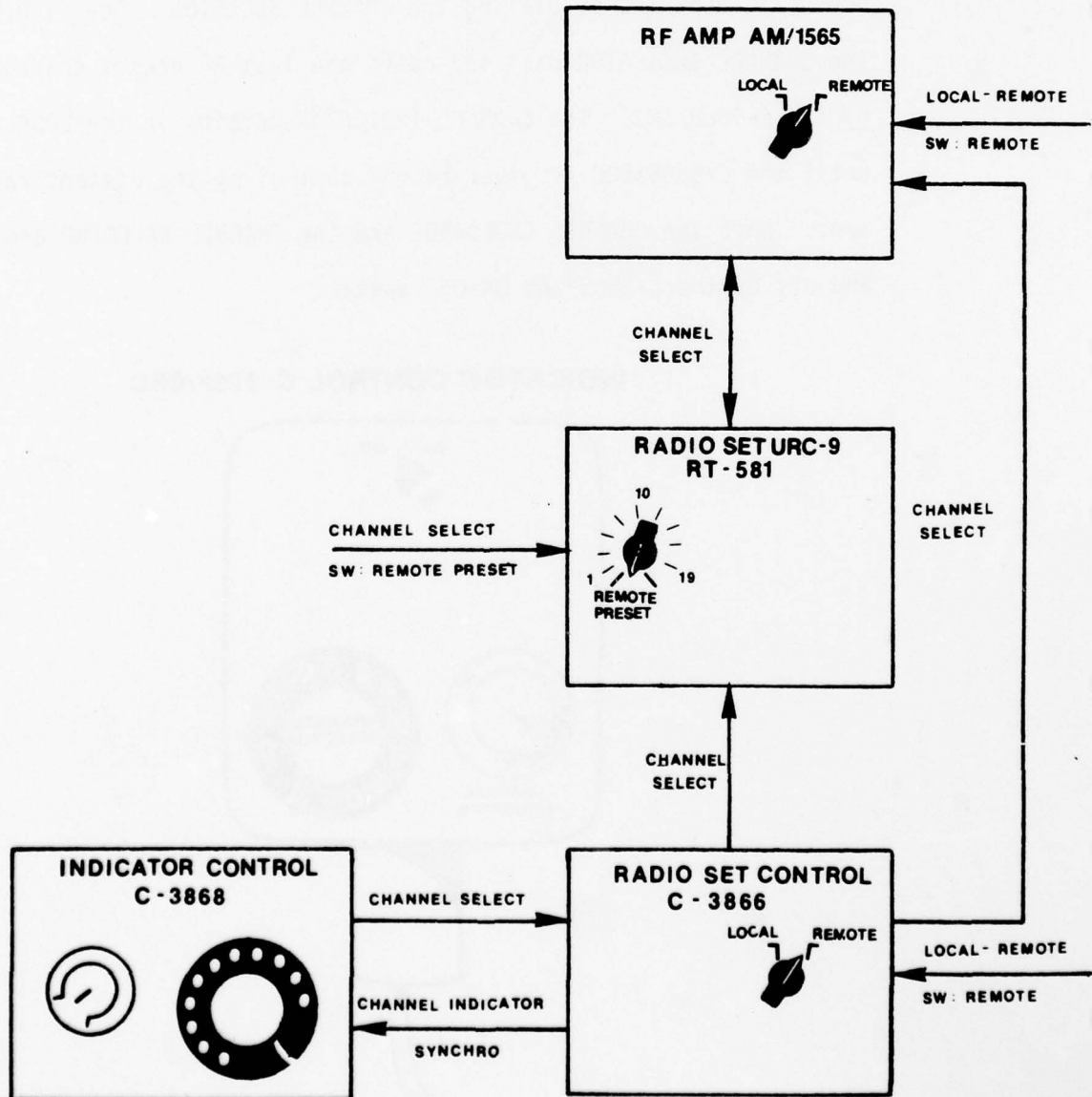


FIGURE 3-2

### TRANSMITTER TRANSFER SWITCHBOARD SB-988/SRT

The Transmitter Transfer Switchboard SB-988/SRT interconnects radio transmitters with remote control units and teletype terminal equipments. Up to ten equipments (remotes or TTY terminals) can be selectively tied to a choice of six transmitters. Any single equipment can be tied to any one of six transmitters. In the GMTS Communications Configuration, the SB-988 Switchboard connects the Remote Phone Unit (Radio Set Control C-1138/UR) to the Radio Set AN/URC-9 RT-581 Tranceiver.

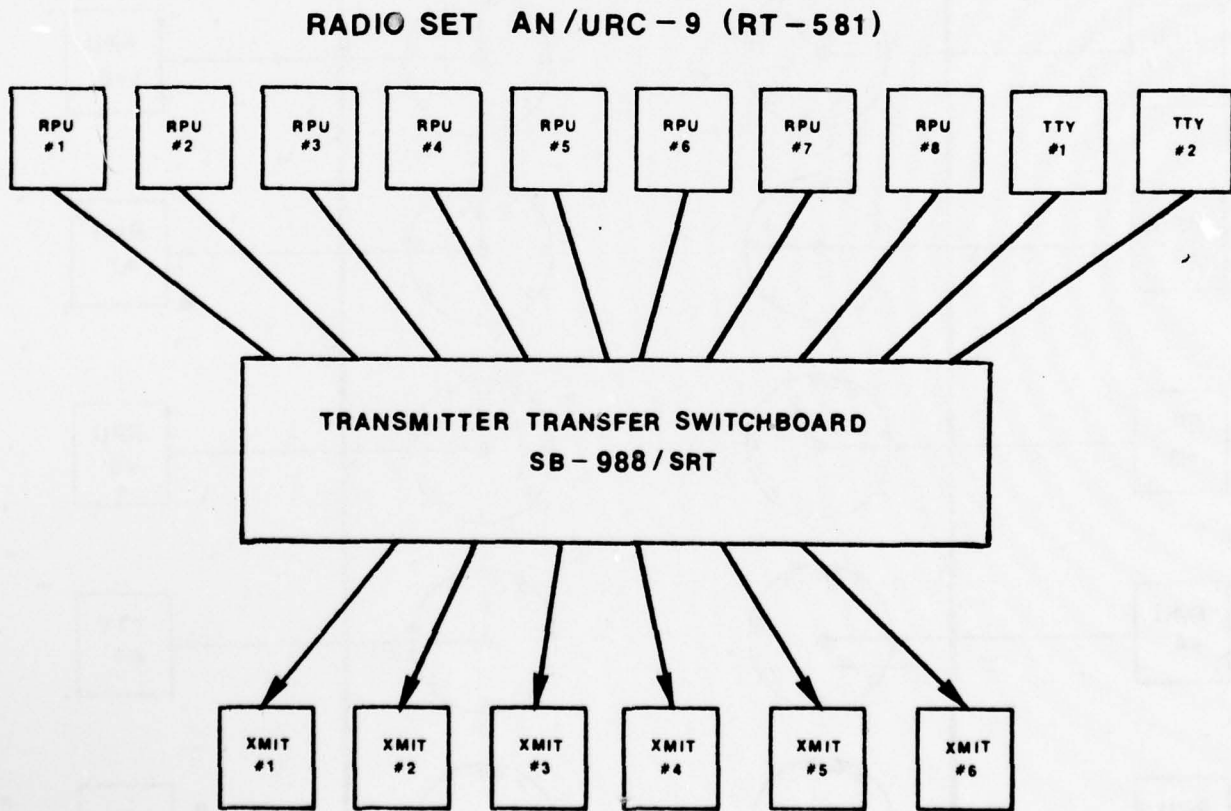


Figure 4-1

The Transmitter Transfer Switchboard SB-988 has ten switches. The wiper arm of each switch is tied to one Remote Phone Unit (RPU). RPU #1 is tied to Switch #1, RPU #2 is tied to Switch #2, RPU #3 is tied to Switch #3, etc., up to a maximum of ten RPU's.

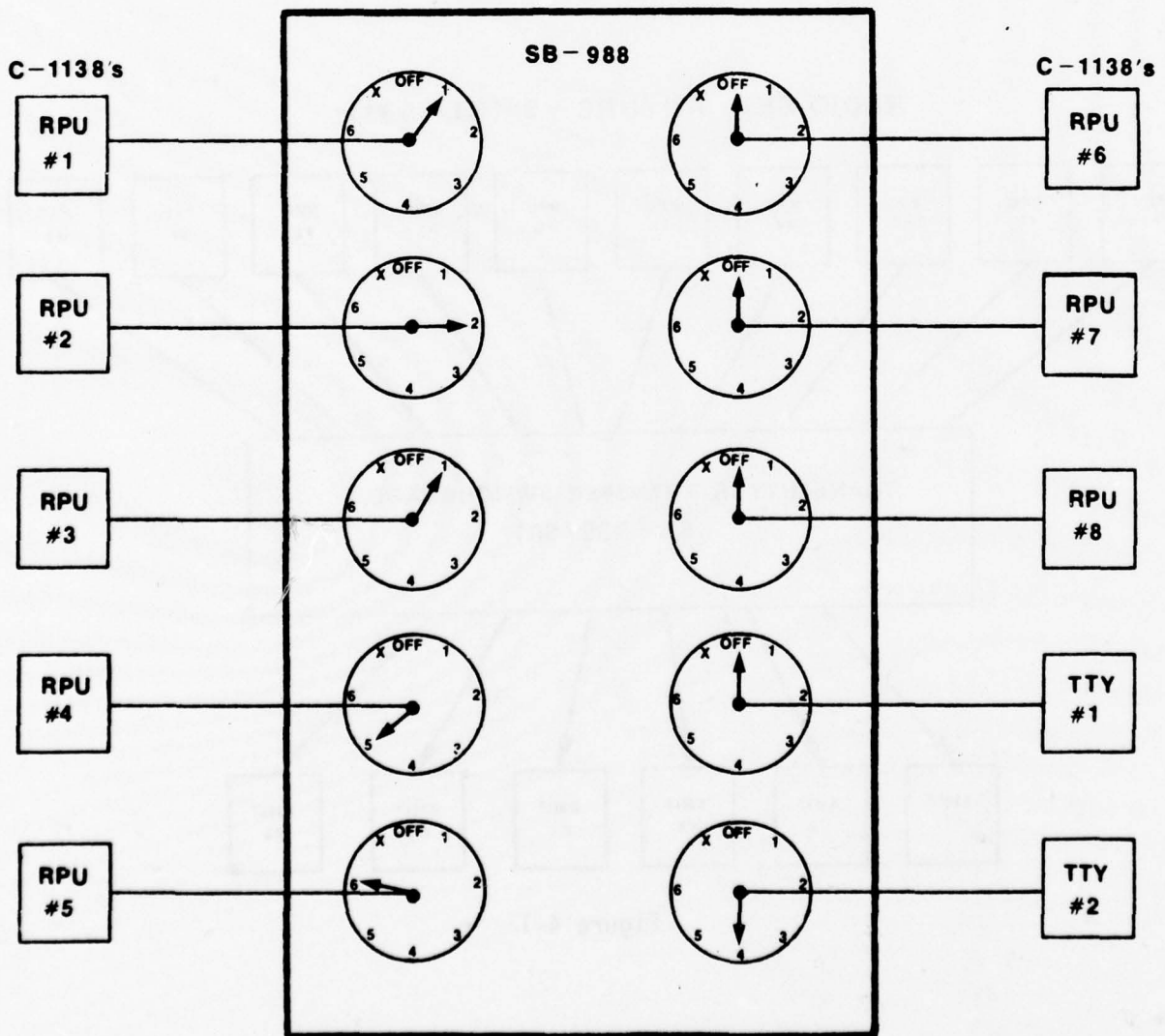
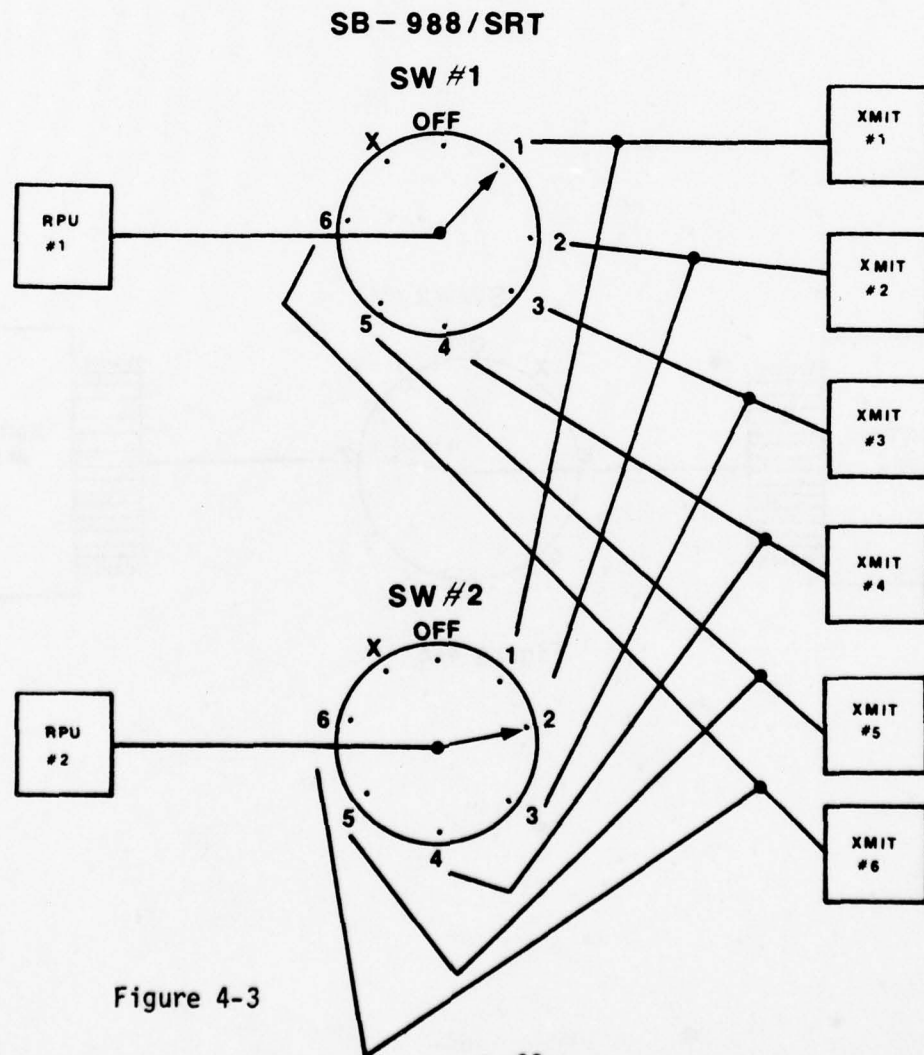


Figure 4-2

Each SB-988 switch has eight positions. Six of these positions can be tied to transmitters. Switch Position #1 is tied to Transmitter #1, Switch Position #2 is tied to Transmitter #2, Switch Position #3 is tied to Transmitter #3, etc., up to a maximum of six transmitters. Each transmitter is tied to the same switch position on each of the ten switches. Thus Switch #1 is tied to Transmitter #1, #2, #3, etc., as is Switch #2, Switch #3, etc. The X position ties the RPU to another switchboard, doubling the number of transmitters that can be selected.



Each switch position of the Transmitter Transfer Switchboard SB-988 is rotary, and handles up to 12 wires. This provides the required facilities to handle the standard Navy 12-wire transmitter control circuits. These include audio (voice or teletypewriter), squelch disable, Transmit/Receive control, 12V DC, Power Indicator light (carrier on), and AC Power On-off light. The arrangement of switches is such that it is impossible to parallel the transmitter circuits.

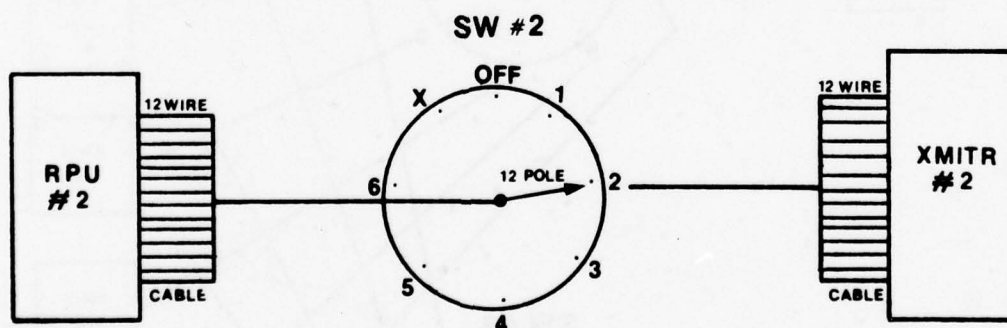


Figure 4-4



### RECEIVER TRANSFER SWITCHBOARD SB-973/SRR

The Receiver Transfer Switchboard SB-973/SRR transfers the audio outputs from a radio receiver to a speaker, a remote control unit headset, or to a teletype terminal. Up to ten equipments can be selectively tied to a choice of five receivers. Any single equipment (speaker, headset, TTY terminal) can be tied to any one of five receivers. In the GMTS Communications Configuration, the SB-973 Switchboard connects the Remote Phone Units (RPU): Radio Set Control C-1138/UR, to the Radio Set AN/URC-9 RT-581 Transceiver.

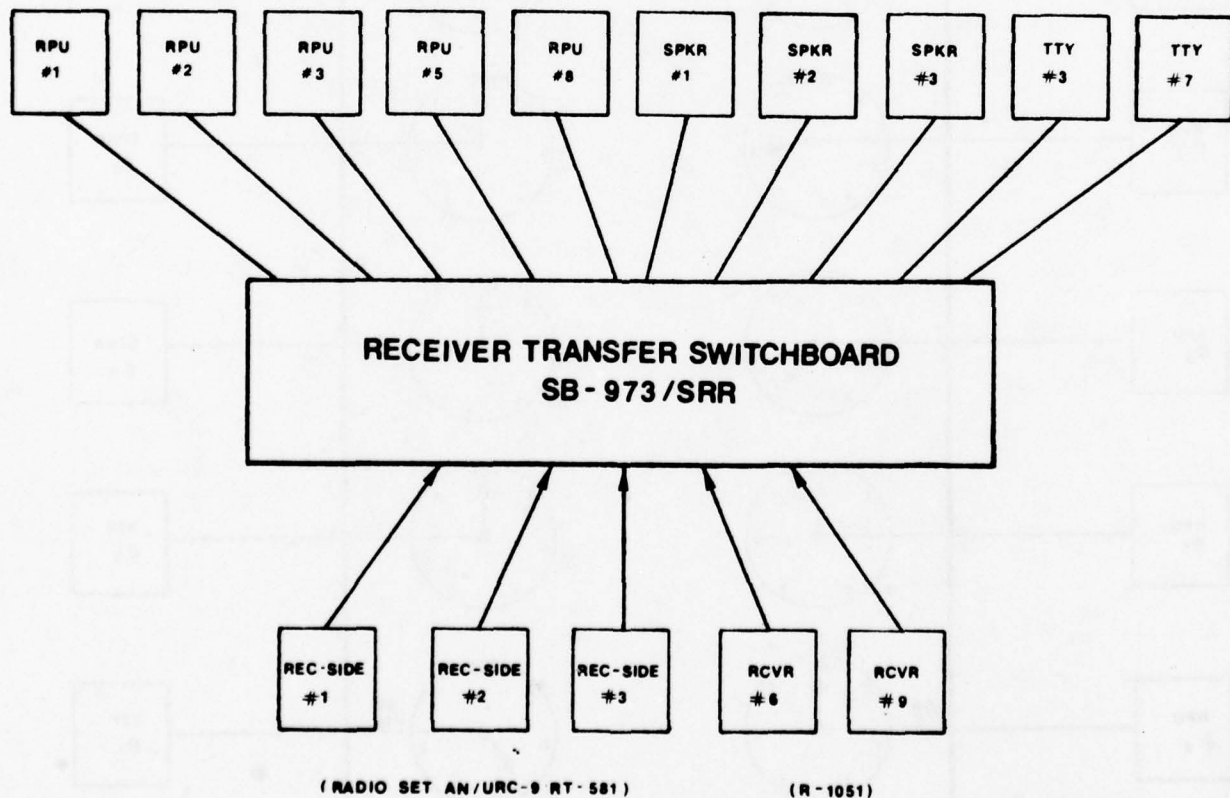


FIGURE 5-1

The Receiver Transfer Switchboard SB-973 has ten switches. The wiper arm of each switch in use is tied to one equipment: Remote Phone Unit, speaker or teletypewriter terminal. For instance in Figure 5-2 below, Switch #1 is tied to RPU #1, Switch #5 is tied to RPU #8, Switch #6 is tied to Speaker #1, Switch #9 is tied to TTY #3, etc. A maximum of ten equipments may be tied to the radio receivers by the SB-973 Switchboard.

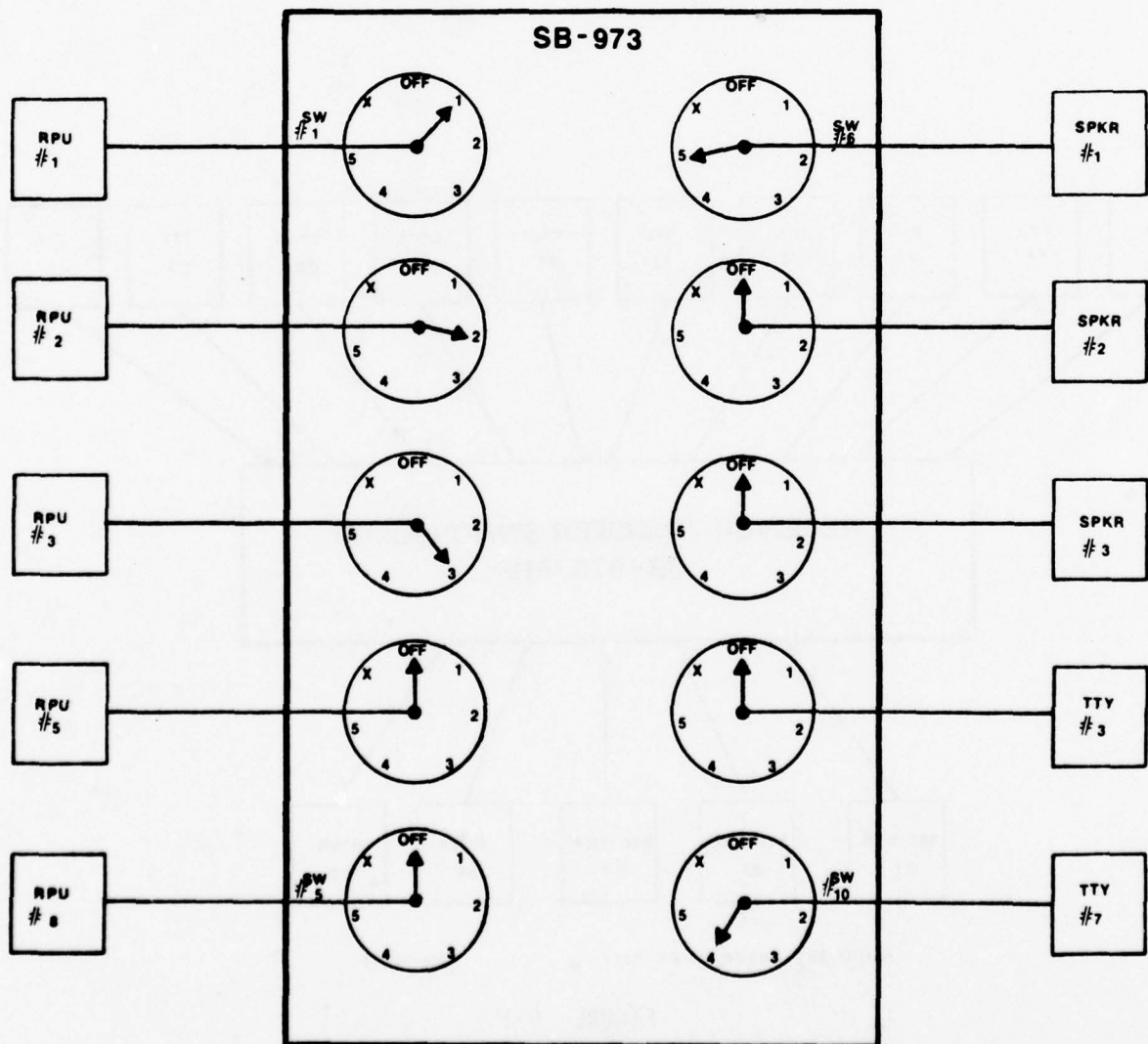


FIGURE 5-2

Each switch of the Receiver Transfer Switchboard SB-973/SRR has seven positions. Five of these switch positions can be tied to receivers. In Figure 5-3 below, Switch Position #1 is tied to receiver #1 (Receive-side of RT-581 Transceiver), Switch Position #2 is tied to Receiver #2, Switch Position #3 is tied to Receiver #3, etc., up to a maximum of five receivers. Each receiver is tied to the same switch position on each of the ten switches. Thus Switch #1 is tied to Receiver #1, #2, #3, etc., as is Switch #2, Switch #3, etc. The "X" position ties the equipments (RPU, Speaker, TTY) to another switchboard doubling the number of receivers that can be selected for an equipment. In the diagram below, Receiver #1 is shown tied to RPU #1, and Receiver #6 is tied to Teletypewriter Terminal #7.

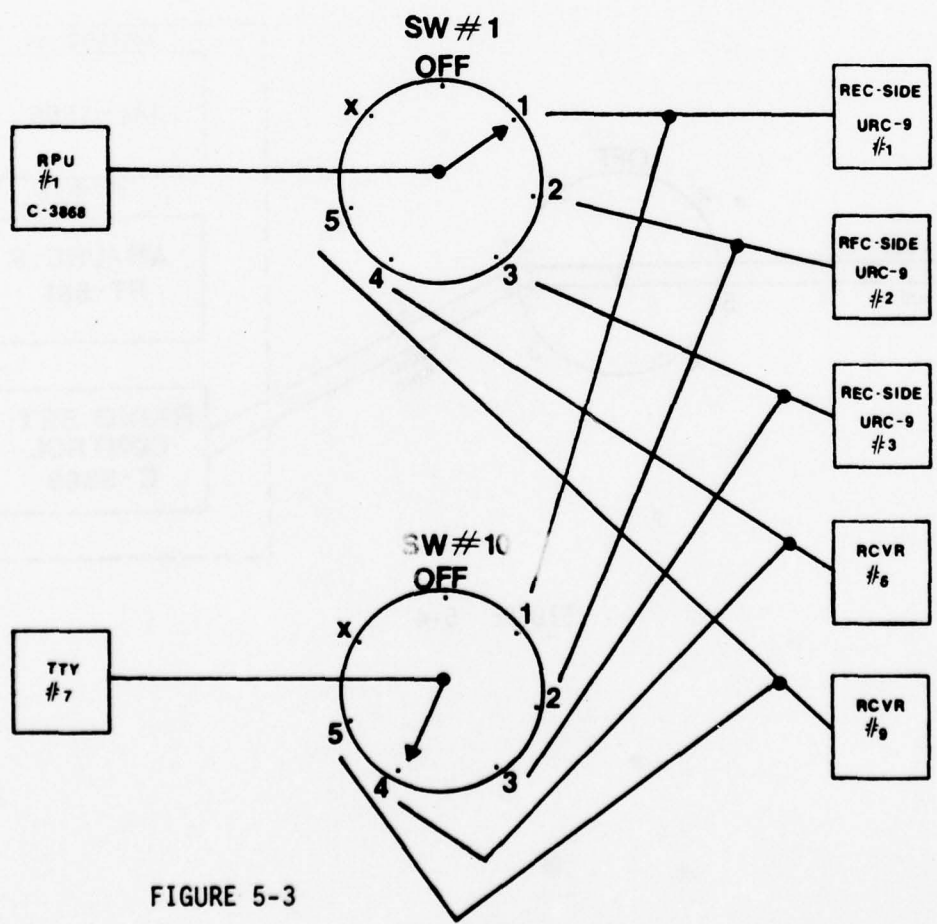


FIGURE 5-3

The switches of the Receiver Transfer Switchboard SB-973 are rotary, and handle a two-wire circuit. These switches connect the receive-side audio to the headset jacks of the remote units. As part of the AN/SRC-20 Radio Set, the receive-side audio is routed through the RF Amplifier AM-1565, and the Radio Set Control C-3866 to the Receiver Transfer Switchboard SB-973 and thence to the RPU Radio Set Control C-1138/UR. Only audio, rather than control and power, is transferred through the switchboard.

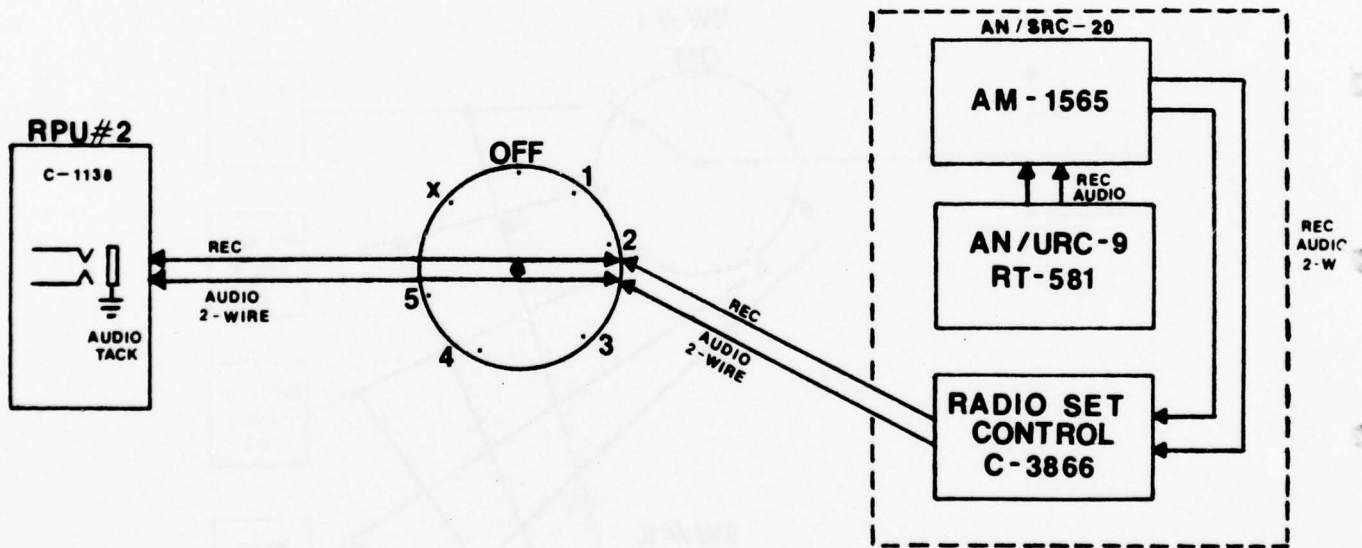


FIGURE 5-4

### ANTENNA COUPLER GROUP AN/SRA-33

Because of the large number of radio transmitters and receivers required on board a single Navy ship, it is infeasible to use a separate antenna for each equipment. The Antenna Coupler Group AN/SRA-33 permits simultaneous operation of up to four transmitter and/or receiver combinations into a single UHF antenna. The SRA-33 contains monitoring, control and protective circuits. It provides efficient coupling and impedance matching between the radio equipment and the antenna. The SRA-33 provides isolation between transmitters, and protects the receivers from transmitter RF high voltages.

The Antenna Coupler Group AN/SRA-33 is composed of three different types of units:

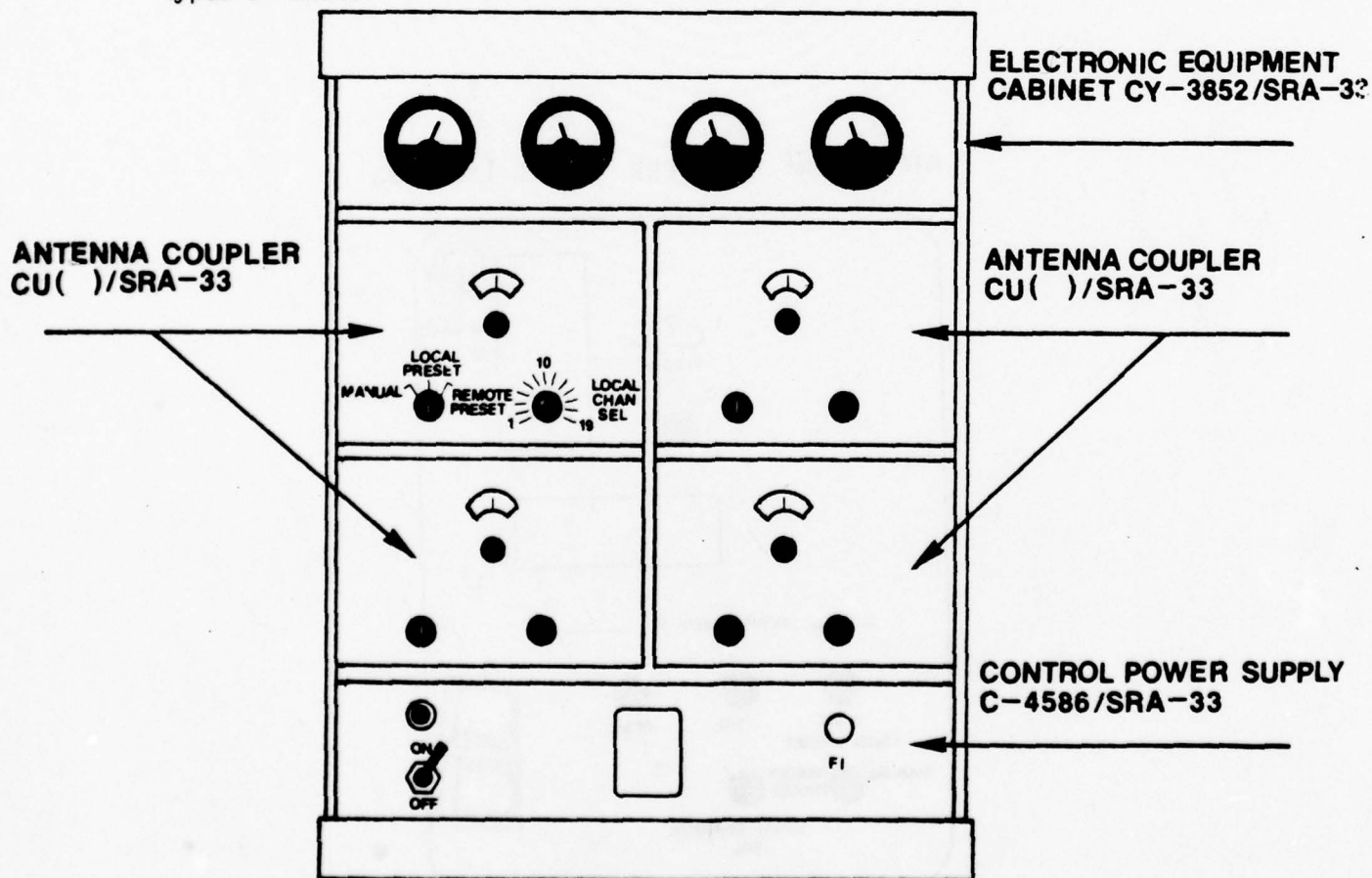


Figure 6-1



The Antenna Coupler CU-(1132)/SRA-33 is the heart of the Antenna Coupler Group. It couples one transmitter, or one receiver, or one transceiver to an antenna. Since these radio equipments are tunable to different frequencies, the Antenna Coupler is tunable over the same frequency range. This provides maximum impedance matching (and power transfer) for any radio frequency selected for transmission or reception. The Antenna Coupler frequencies can be tuned manually, or may be preset in 19 channels. These can be selected locally at the Coupler, or remotely at the radio set or the Control Indicator. See Figure 6-2 below.

**ANTENNA COUPLER CU-( )SRA-33**

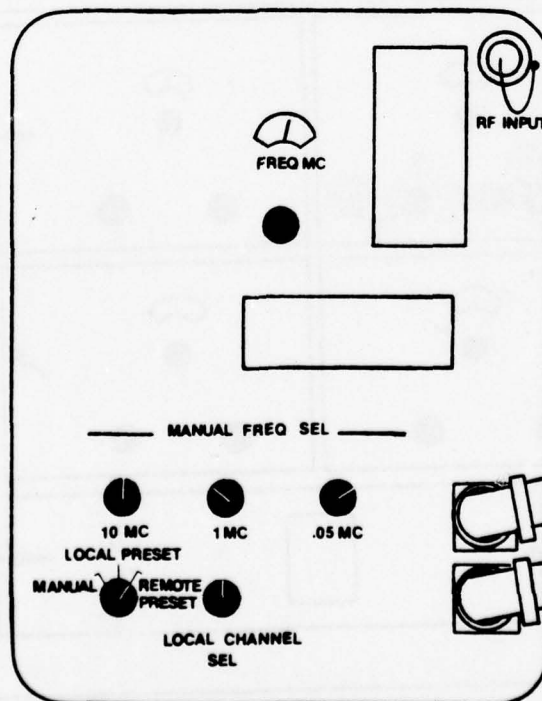


Figure 6-2

The Antenna Coupler CU-(1132)-SRA-33 mode of operation is controlled by the MANUAL-LOCAL PRESET-RREMOTE PRESET switch. When it is placed in MANUAL, the Coupler frequency is controlled by the MANUAL FREQ SEL switches. The selected frequency is displayed through the FREQ MC window. When the switch is set to LOCAL PRESET, the selection of the preset channels is set by the LOCAL CHANNEL SEL switch, channels 1 through 19. When the Switch is set to REMOTE PRESET the connected radio set (AN/SRC-20) or the remote unit (Control Indicator C-3868/SRC) controls the selection of the preset channels. There are four identical Antenna Couplers: CU-1131/SRA-33 through CU-1134/SRA-33. Each one has its own tuning system and can be operated independently in the three modes.

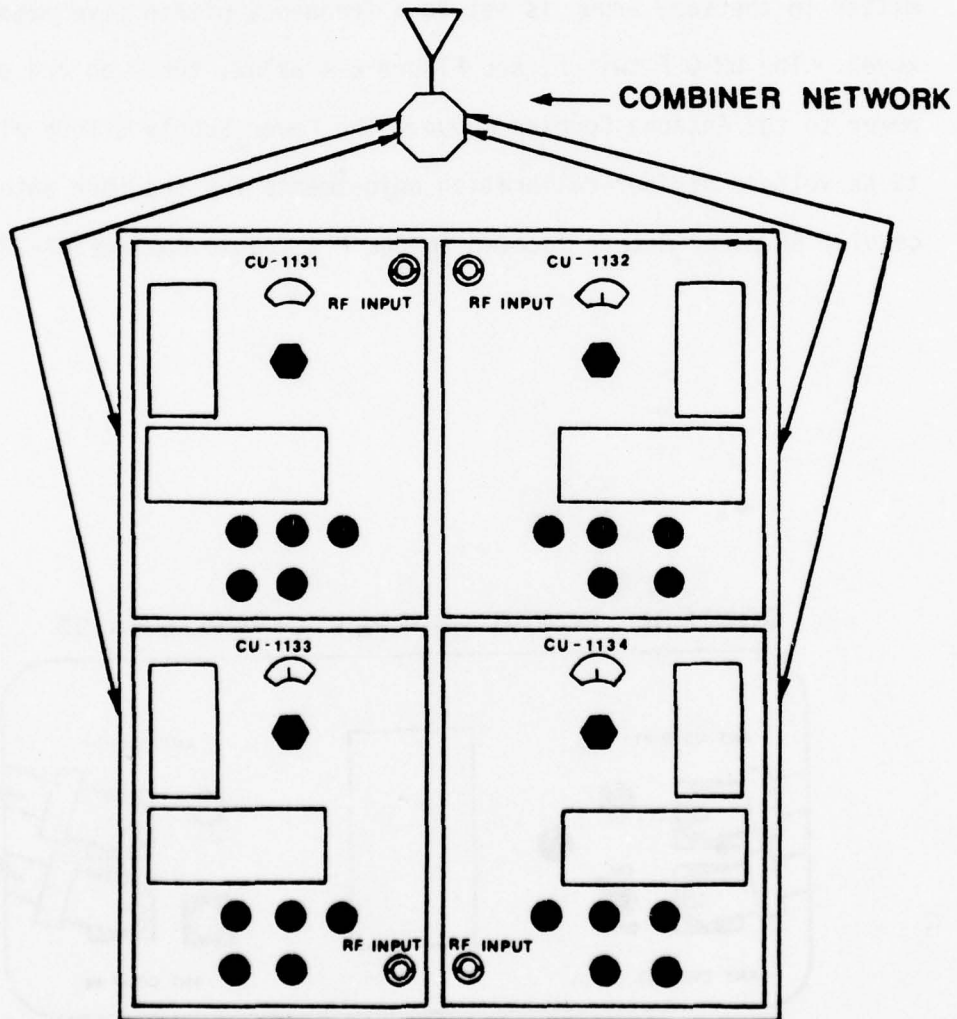


Figure 6-3

The Control Power Supply C-4586/SRA-33 contains the DC power supplies and fusing for the Antenna Coupler Group AN/SRA-33. It contains Lockout circuitry, which protects the associated radio transmitters, receivers, and antenna couplers within the Antenna Coupler Group. The Lockout Circuitry disables the involved transmitter keying circuit, (see Figure 1-11, Radio Set AN/SRC-20 Normal Mode Keying) and disconnects the RF output to the UHF antenna from the involved antenna coupler. This occurs when the antenna coupler is tuning or when another antenna coupler-transmitter in the same Group is set to a frequency within five megacycles and keyed. The ON-OFF switch, see Figure 6-4 below, turns on and off the power to the Antenna Coupler Group. The Power Supply C-4586 also contains voltage divider calibration adjustments for the four antenna coupler RF power meters located in the Electronic Cabinet CY-3852/SRA-33.

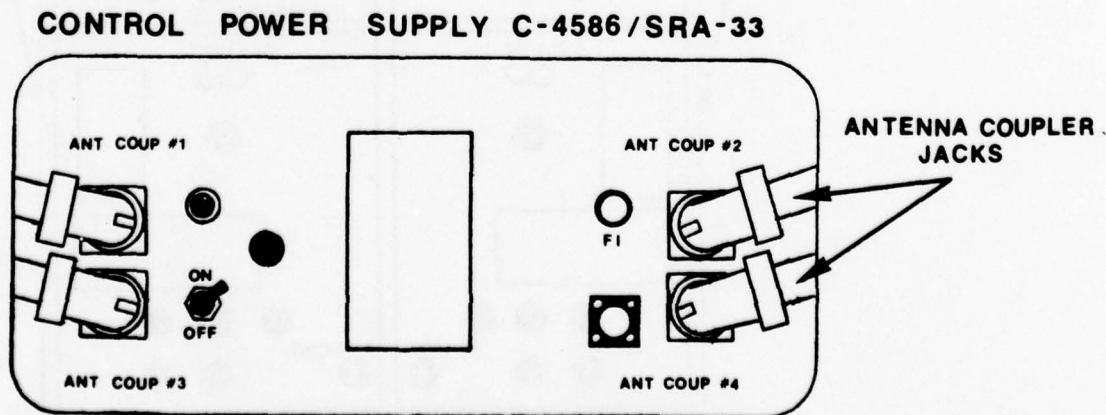


Figure 6-4

The Electronic Equipment Cabinet CY-3852/SRA-33 houses the units of the Antenna Coupler Group. An RF power meter panel is located across the top of the CY-3852 and is considered part of it. See Figure 6-5. Each meter monitors the forward or reflected RF power (as selected by the FORWARD POWER-REFLECTED POWER switch) provided from its associated antenna coupler. RF Power Meter #1 monitors Antenna Coupler #1, RF Power Meter #2 monitors Antenna Coupler #2, etc. When the associated transmitter is keyed, the reflected power should be less than 10% of the forward power. In the GMTS Communications Configuration, the Radio Set AN/SRC-20 (RF Power Amp. AM-1565 output) forward power is approximately 100 watts. The reflected power should be less than 10 watts.

The Electronic Equipment Cabinet CY-3852/SRA-33 also contains the Combiner Network. This network combines into a single common line the RF output from each of the four antenna couplers. The combined RF signal is then applied to the transmission line for delivery to the antenna.

ELECTRONIC EQUIPMENT CABINET CY - 3852 / SRA - 33

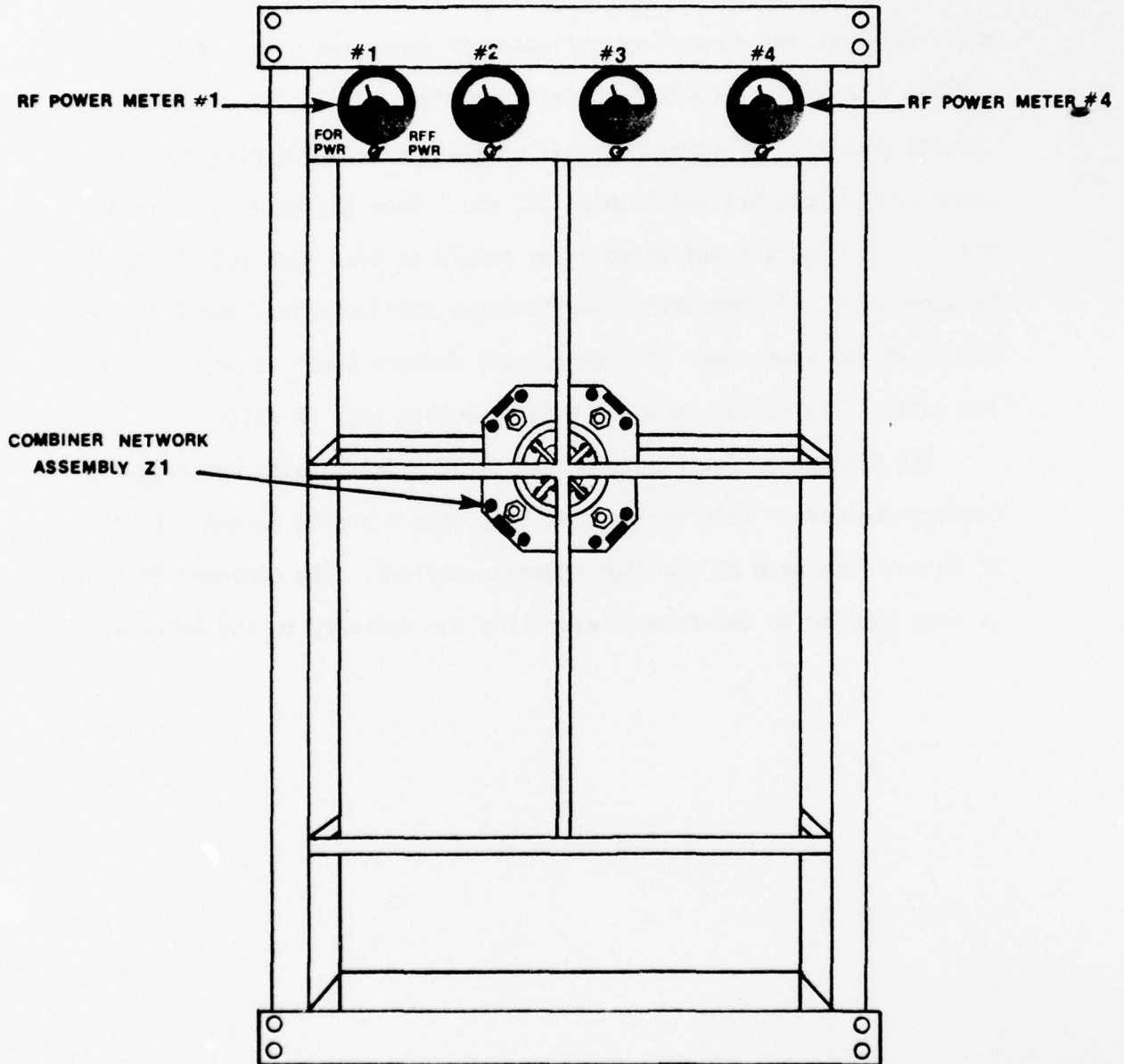


Figure 6-5



## MULTIMETER AN/PSM-4

The multimeter AN/PSM-4 is a battery operated, portable volt-ohm milliammeter. It can be used to measure DC current, DC resistance and AC or DC voltages.

There are three controls on the front panel: (1) the function switch which allows selection of the appropriate meter function, (2) the range or multiplier switch that controls the input required for a full-scale reading on the meter and (3) the zero ohms adjust used to battery voltage change for ohm operation. GMTS only uses the PSM-4 in the ohm, R-1 scale position, for checking fuses.

## MULTIMETER AN/PSM - 4

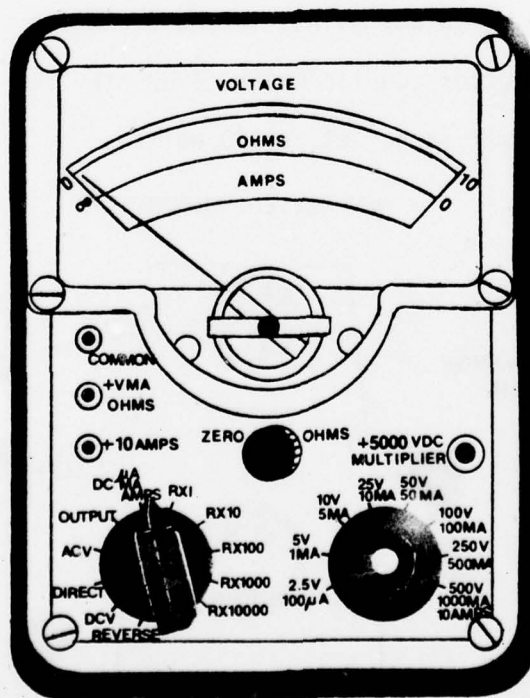
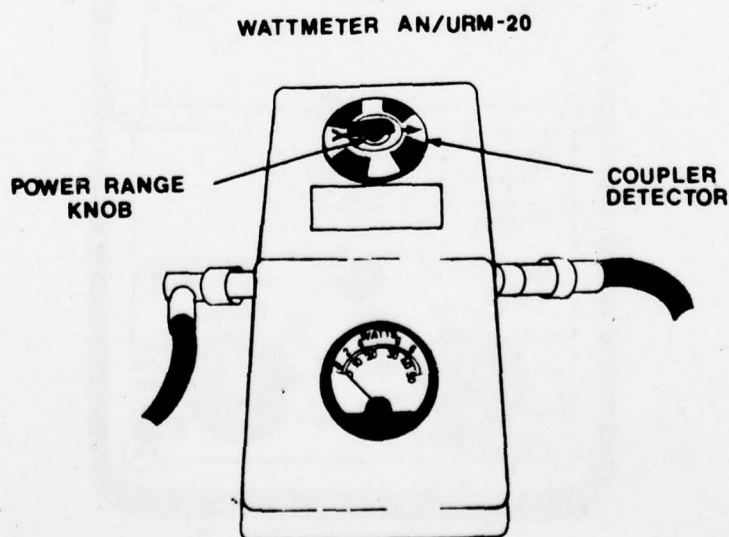


FIGURE 7-1.

### WATTMETER AN/URM-120

The AN/URM-120 in-line wattmeter is designed to measure forward and reflected RF power from 10 to 1000 watts within a frequency range of 2 to 1000 MHz. The frequency range is divided into three smaller ranges, 2-30 MHz, 25-250 MHz and 200-1000 MHz each using a separate coupler detector.

The coupler detector has a knurled knob (drum) projecting through the wattmeter to the top of the case. A nameplate on the knurled knob describes the wattmeter's power readings. Centered on the nameplate is a power range selector knob which can be rotated 360 degrees for selection of the desired power range. The coupler detector, however, rotates only 180 degrees to allow reading of forward or reflected power. The arrow on the nameplate points in the direction of power flow. GMTS uses only the detector coupler which covers the 200-1000 MHz frequency range with the power range set to 100 watts.



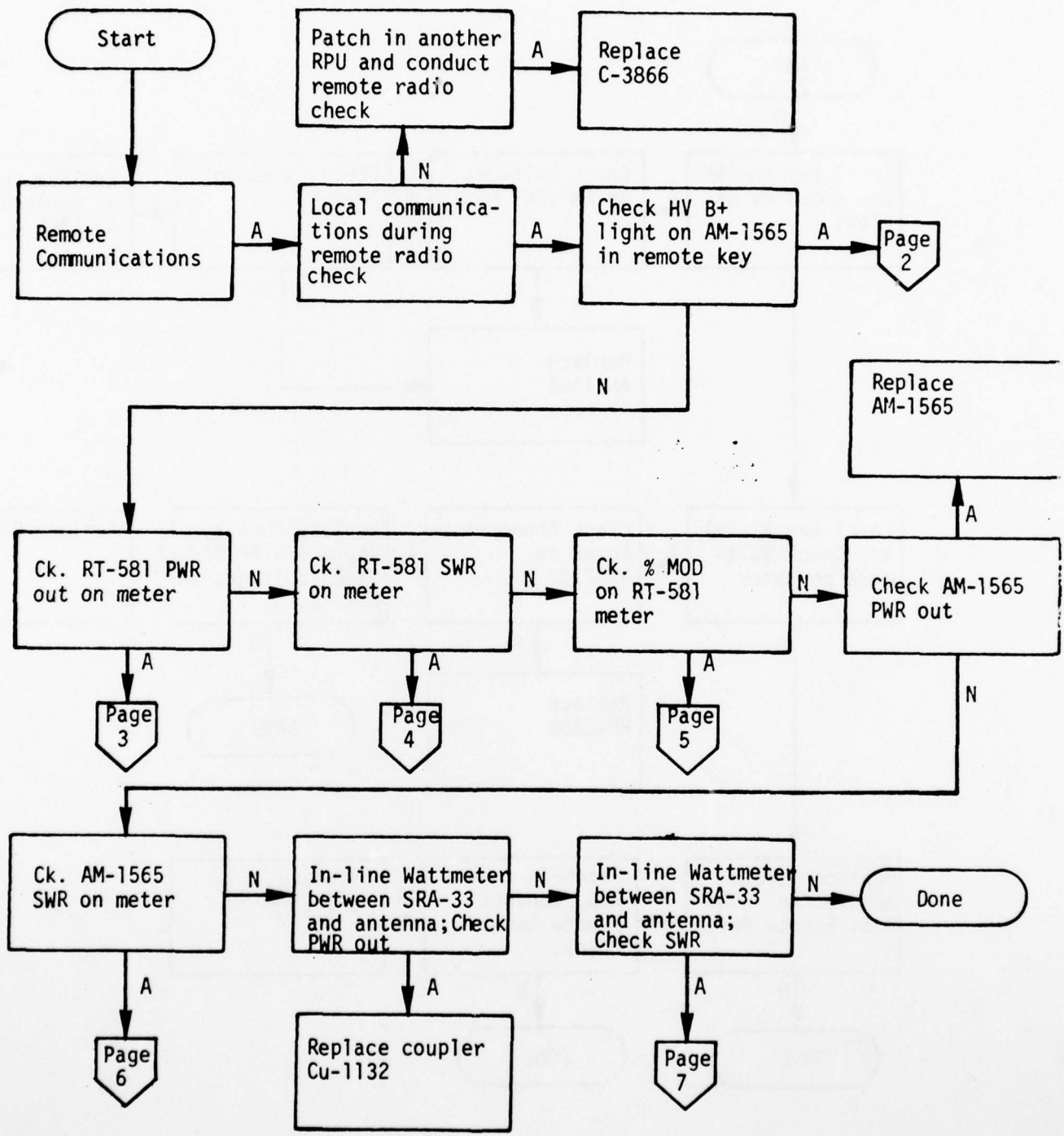
**FIGURE 8-1.**

DUMMY LOAD DA-274

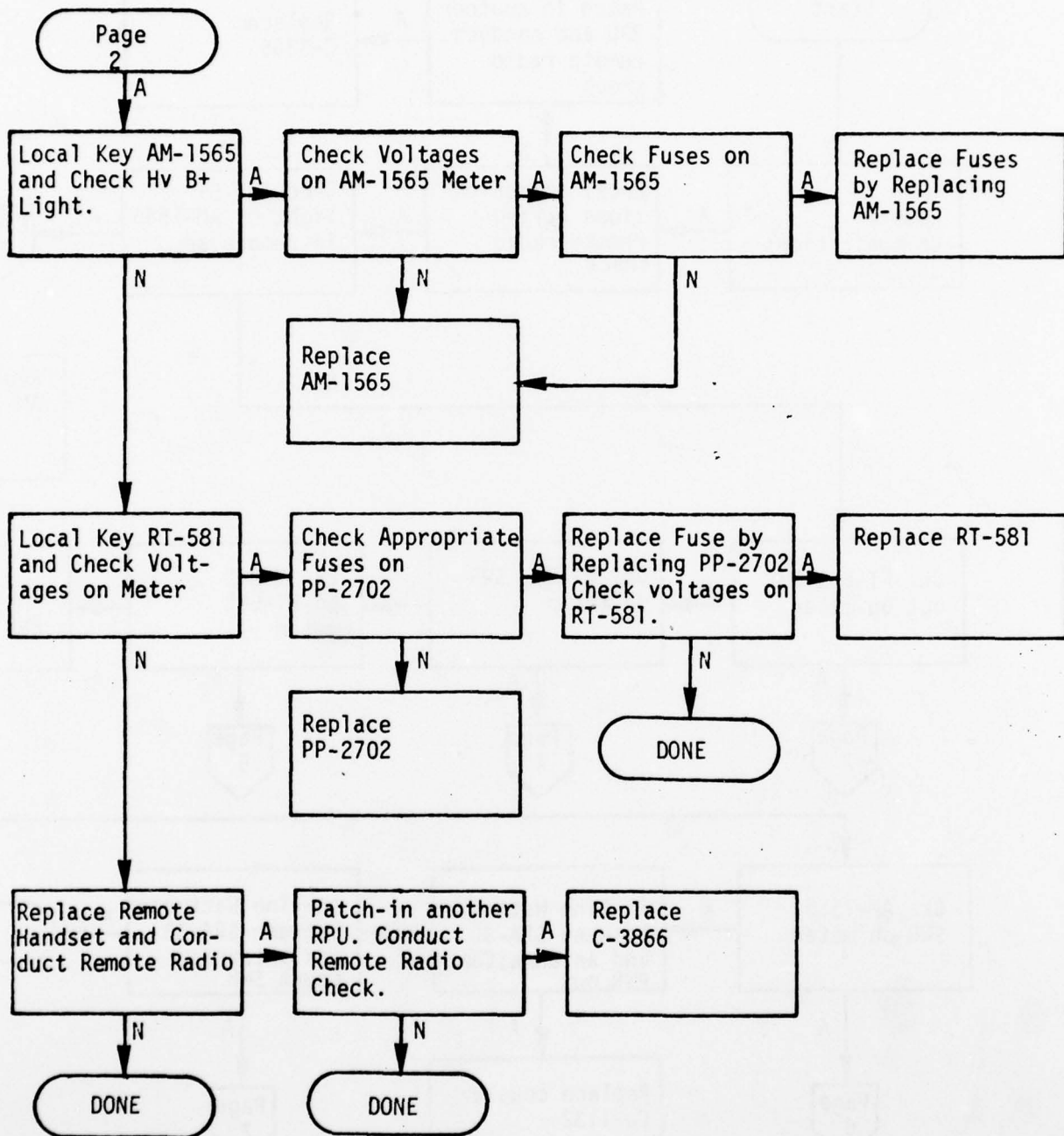
The DA-274 is an oil filled dummy load with an input resistance of 50 ohms, a frequency range of 2 to 250 MHz and power dissipating capabilities of 600 watts.

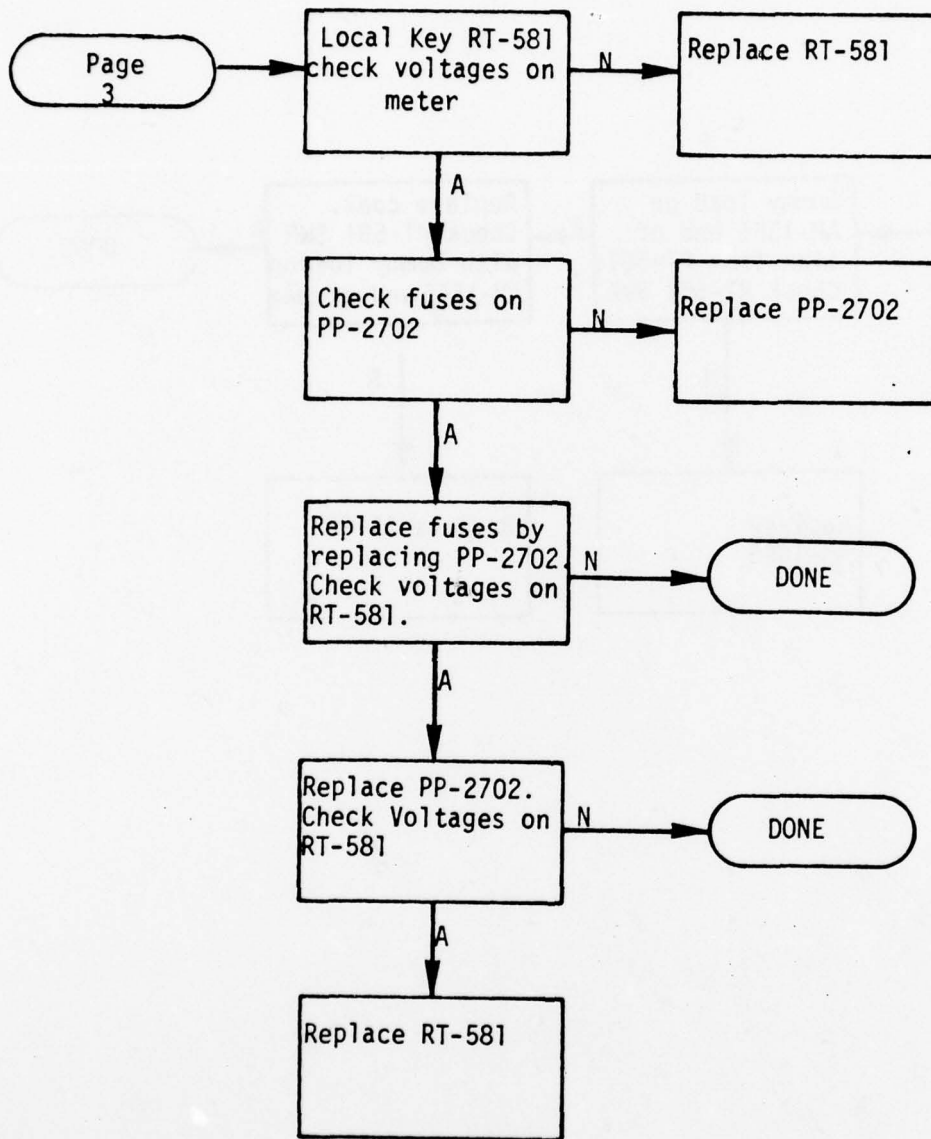
APPENDIX B

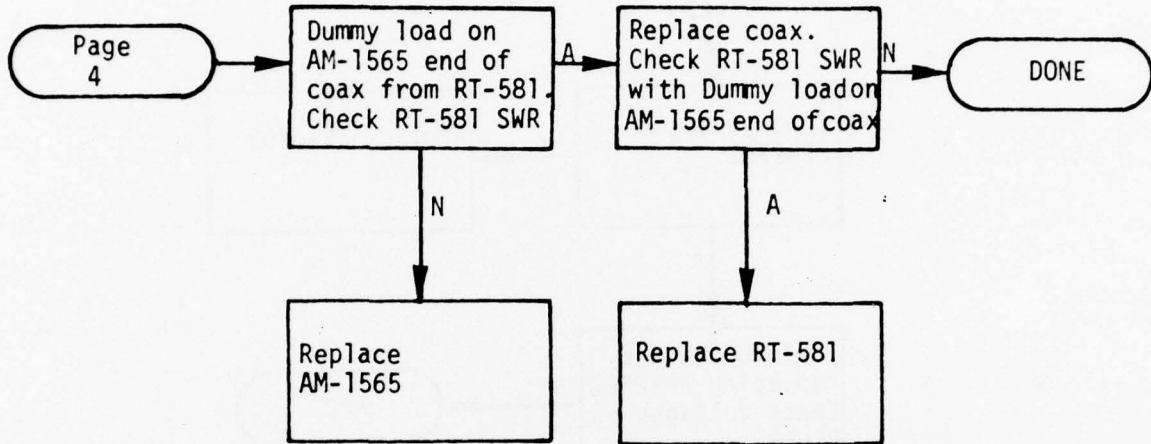
UHF VOICE COMMUNICATIONS SYSTEM  
TROUBLESHOOTING TREE

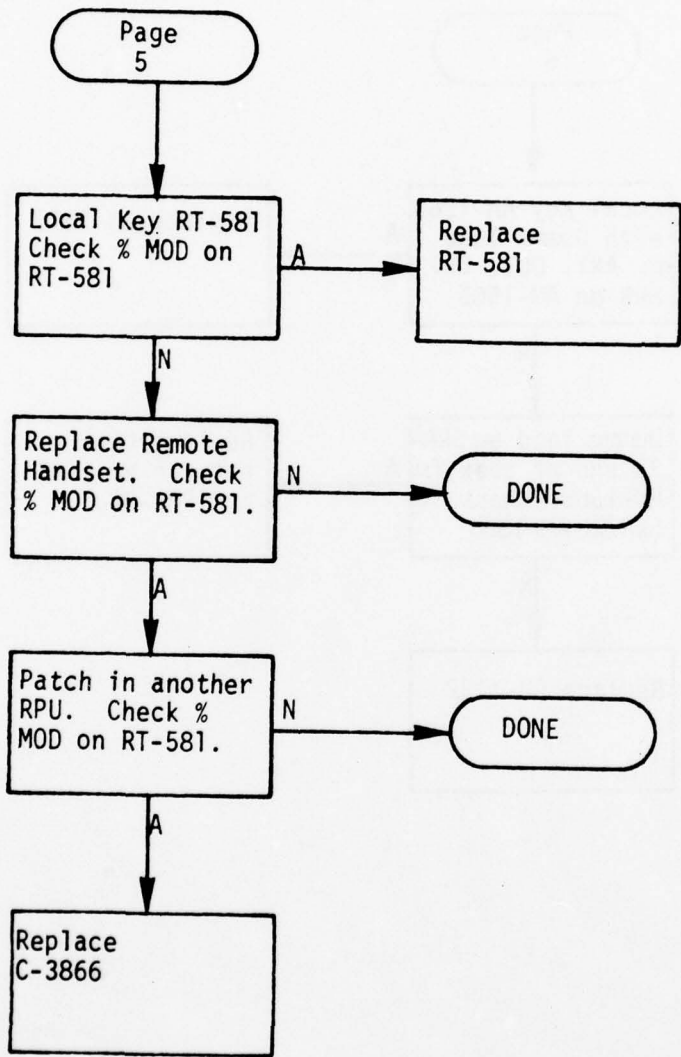




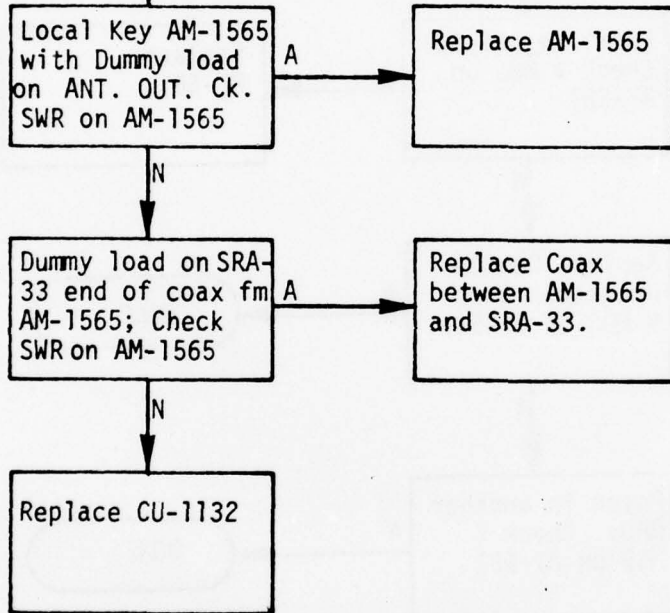








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