

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TM 11-5820-295-35

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TO 31R2-2GRC19-42

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**FIELD AND DEPOT  
MAINTENANCE MANUAL  
RADIO SET ANIGRC-19**

This copy is a reprint which includes current pages from Changes 1 and 2.

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**DEPARTMENTS OF THE ARMY AND THE AIR FORCE**

**16 SEPTEMBER 1960**



Changes in force: C 1 and C 2

TM 11-5820-295-35  
C2

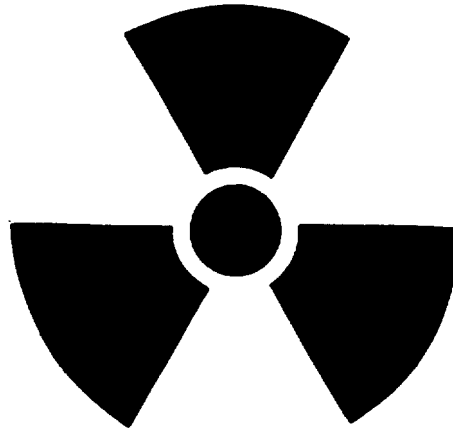
CHANGE }  
No. 2 }

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, DC, 9 April 1975

**Field and Depot Maintenance Manual  
RADIO SET AN/GRC-19**

TM 11-5820-295-35, 16 September 1960, is changed as follows: Inside front cover. Radiation warning is added after existing notices.

**WARNING  
RADIATION HAZARD**



**RADIOACTIVE MATERIAL  
CONTROLLED DISPOSAL REQUIRED  
ACCOUNTABILITY NOT REQUIRED  
STD RW-2**

Ammeter	Ra 226	0.59uCi	6625-00-569-0243
Ammeter	Ra 226	1.0uCi	6625-00-538-9700
Meter	Ra 226	0.69uCi	6625-00-669-0769
	Electron Tube	OA2WA	5960-00-5034880
EEVC	U 238	0.1uCi	
CBS Hytron	Ni 63	0.5uCi	
Raytheon	Co 60	0.2uCi	

Radiation Hazard Information: The following radiation hazard information must be read and understood by all personnel before operating or repairing Radio Set AN/GRC-19. Hazardous radioactive materials are present in the above listed components of the T-195/GRC-19, AN/GRC-19A, AN/GRC-19B, and R-392/URR.

The components are potentially hazardous when broken. See qualified medical personnel and the local Radiological Protection Officer (RPO) immediately, if you are exposed to or cut by broken components. First aid instructions are contained in TB 43-0116, TB 43-0122 and AR 75-15.

NEVER place radioactive components in your pocket.

Use extreme care NOT to break radioactive components while handling them. NEVER remove radioactive components from cartons until you are ready to use them. If any of these components are broken, notify the local RPO immediately. The RPO will survey the immediate area for radiological contamination and will supervise the removal of broken components.

The above listed radioactive components will not be repaired or disassembled.

Disposal of broken, unserviceable, or unwanted radioactive components will be accomplished in accordance with the instructions in AR 755-15.

**By Order of the Secretary of the Army:**

Official:

**FRED C. WEYAND**  
*General, United States Army*  
*Chief of Staff*

**VERNE L. BOWERS**  
*Major General, United States Army*  
*The Adjutant General*

Distribution:

To be distributed in accordance with DA Form 12-51, (qty rqr block no. 91). Direct and General Support maintenance requirements for AN/GRC19.

FIELD AND DEPOT MAINTENANCE MANUAL

RADIO SET AN/GRC-19

TM 11-80-295-35  
TO 31R2-2GRC19-42  
Changes No. 1

DEPARTMENTS OF THE ARMY  
AND THE AIR FORCE  
Washington 25, D.C., 26 July 1961

TM 11-5820-29-5/TO 31R2-2GRC1942, 16 September 1960, is changed as follows:

Page 3. Delete paragraph 2 and substitute:

2. Internal Differences in Models

Internal difference are listed in the chart below.

Item	Radio Transmitter T-195/GRC-19	Radio Transmitter T-195A/GRC-19	Radio Transmitter T-196B/GRC-19
High-voltage source.....	Dynamotor D602.....	Transistorized, high-voltage power supply	Transistorized, high-voltage power supply
Low-voltage source .....	Dynamotor D601.....	Dynamotor D1601 .....	Transistorized, high-voltage power-supply.
Pa servoamplifier chopper G201.	Vibrator type.....	Transistorized.....	Transistorized.
Antenna network servoamplifier chopper 0901.	Vibrator type .....	Transistorized.....	Transistorized.
Exhaust blower unit B602.....	Dc-type motor.....	Do-type motor.....	Ac-drive motor. Transistorized dc-to ac inverter.
Power amplifier blower unit B202.	Dc-type motor.....	Dc-type motor .....	Ac-drive motor. Transistorized dc to-ac inverter.
Autotune relays K608 and K610.	Unsealed.....	Hermetically sealed .....	Hermetically sealed.
V401 and V403 .....	Type 12AT7 .....	Type 12AT7WA .....	Type 12AT7WA.
V203, V902, and V904 .....	Type 600O/6AQ5S .....	Type 6O00/6A5 .....	Type 6005/6AQ/6098.
CR201 and CR202.....	Type IN67A.....	Type IN1.....	Type INe91.
R912 .....	270 ohms .....	470 ohms .....	470 ohms.
R928 .....	270 ohms .....	470 ohms.....	470 ohms.
R930 .....	1,800 ohm .....	Jumper wire.....	Jumper wire.
Air-intake dust filter.....			Supplied with auxiliary dust filter for use where high duet concentration exists.

Page 4, paragraph 3b. Change "Fixer Portable. For Fixer-portable" to: Fixed Portable. For fixed-portable.

Page 11, paragraph 9, line 17. After "and to the low-voltage dynamotor circuit" add: or the low-voltage, transistor-type power supply in Radio Transmitter T-195B/GRC-19.

Page 12, figure 8. Make the following changes:

After "+28V FOR HIGH-VOLTAGE DYNAMOTOR" add: OR HIGH-VOLTAGE, TRANSISTOR-TYPE POWER SUPPLY.

In the upper right-hand section, after "+28V FOR LOW-VOLTAGE DYNAMOTOR" add: OR LOW-VOLTAGE, TRANSISTOR-TYPE POWER SUPPLY.

By Order of the Secretaries of the Army and the Air Force:

**G. H. DECKER,**  
*General, United States Army,*  
*Chief of Staff.*

**Official:**

**R. V. LEE,**  
*Major General, United States Army,*  
*The Adjutant General.*

**CURTIS E. LeMAY,**  
*Chief of Staff, United States Air Forces.*

**Official:**

**R. J. PUGH,**  
*Colonel, United States Air Force*  
*Director of Administrative Services.*

**Distribution:**

*Active Army:* To be distributed in accordance with DA Form 12-7 requirements for TM 11-series (Unclas) plus the following:

USABA (2)	Unit organized under following	11-117
CNGB (1)	TOE's (2 copies each except	11-155
Tech Stf, DA (1) except	as indicated):	11-165
CSigO (18)	11-5	11-167
DASA (5)	11-6	11-237
ARADCOM (2 )	11-7	11-500 (AA-AE) (4)
ARADCOM Rgn (2)	11-15	11-555
MDW (1)	11-16	11-557
Seventh US Army (2)	11-38	11-557
EUSA (2) 11-55	11-592	
USASCS (39)	11-57	11-597
	11-95	29-56
	11-98	

*NG:* State AG (3) units—same as Active Army except allowance is 1 copy to each unit.

*USAR:* None.

For explanation of abbreviations used, see AR 320-50

TECHNICAL Manual  
No. 11-5820-295-35

DEPARTMENT OF THE ARMY  
AND THE AIR FORCE

TECHNICAL ORDER  
No. 31R2-2GRC19-42  
RADIO SET AN/GRC-19

Washington 25,D. C., 16 September 1960

**RADIO SET AN/GRC-19**

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			Paragraph	Page
CHAPTER	1.	INTRODUCTION		
		Scope .....	1	3
		Internal differences in models .....	2	3
CHAPTER	2.	INSTALLATION		
		Additional equipment required for installation.....	3	4
		Vehicular installation of radio set .....	4	4
		Fixed-portable installation of radio set .....	5	5
CHAPTER	3.	THEORY		
Section	I.	System theory		
		System applications.....	6	6
		Signal paths.....	7	7
	II.	Interunit circuit details		
		Extent of instructions .....	8	11
		Primary power circuit .....	9	11
		Antenna-switching and disabling circuit.....	10	11
		Receiver-silencing circuit.....	11	14
		Sidetone circuit.....	12	15
		Relay circuit.....	13	17
CHAPTER	4.	TROUBLESHOOTING		
		General instructions.....	14	18
		Test equipment and tools required.....	15	18
		Replacement of Cable Assembly, Radio Frequency CG-1127 U.....	16	18
APPENDIX		REFERENCES.....		20

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\*This manual, together with TIM 11-5820-295-10, 3 June 1960, and TM 11-5820-295-20, 3 June 1960, supersedes TM 11-274, 27 April 1954, including C1, 11 January 1956; C2, 27 July 1956; C3, 7 February 1957; and C4, 17 May 1957.



**CHAPTER 1**  
**INTRODUCTION**

**1. Scope**

a. This manual covers field and depot maintenance for Radio Set AN/GRC-19. It includes instructions appropriate to third, fourth, and fifth echelons for installing, troubleshooting, testing, and replacing of the equipment. It also lists tools, materials, and test equipment for third, fourth, and fifth echelon installation and maintenance. Detailed functions of the equipment are covered in the system theory section.

b. The complete technical manual for this equipment includes: TM 11-5820295-10, TM 11-5820295-10P, TM 11-5820-29.5-20, TM 115820-29520P, and TM 11-5820-2935P.

c. Forward comments concerning this manual to the Commanding Officer, U. S. Army Signal Materiel Support Agency, ATTN: SIGMS-PA-2d, Fort Monmouth, N. J.

*Note.* For applicable forms and records, see paragraph 2, TM 11-5820-29510.

**2. Internal Differences in Models**

Internal differences are listed in the chart below.

Item	Transmitter T-195/GRC-19	Transmitter T-195A/GRC-19
1,000-voltdc source	Dynamotor D602	Transistorized, high-voltage power supply A1200
Pa servoamplifier chopper G201	Vibrator type	Transistorized
Antenna network servoamplifier chopper G901	Vibrator type	Transistorized
V401 and V403	Type 12AT7	Type 12AT7WA
CR201 and CR202	Type 1N67A	Type 1N691
R912	270 ohms	470 ohms
R928	270 ohms	470 ohms
R930	1,800 ohms	Jumper wire
Autotune relays K608 and K610	Unsealed	Hermetically sealed

**CHAPTER 2**  
**INSTALLATION**

**3. Additional Equipment Required for Installation**

a. Vehicular. To install the radio set in a vehicle, a vehicular installation unit (kit) is required. The type of installation unit used will depend on the type of vehicle in which the radio set is to be installed.

Items in the installation unit, such as the brackets and the mounting hardware, vary for each type of vehicle. The following chart lists the Federal stock numbers of the vehicular installation units required and which must be requisitioned for the different types of vehicles.

VEHICULAR INSTALLATION UNIT		
Type of vehicle	Basic unit	Installation unit
Carrier, cargo, amphibious, M76 .....	5820-030-0155	5820-030-0156
Carrier, personnel, full tracked: armored, M59.....	5820-030-0155	5820-030-0158
Truck, cargo, x ton, 4 x 4, M37 .....	5820-030-0155	5820-537-3999
Truck, command, X ton, 4 x 4, M42 .....	5820-030-0155	5820-537-3999
Truck, cargo, 2s ton, 6 x 6, M34 .....	5820-030-0155	5820-399-7219
Truck, cargo, 2a? ton, 6 x 6, M35 .....	5820-030-0155	5820-030-7219
Truck, cargo, 2Y* ton, 6 x 6, M135 .....	5820-030-0155	5820-030-0118
Truck, cargo, 2lt ton, 6 x 6, M211 .....	5820-030-0155	5820-030-0118
Truck, utility, 4 ton, 4 x 4, M38 .....	5820-030-0155	5820-399-7220
Truck, utility, g ton, 4 x 4, M38A1 .....	5820-030-0155	5820-399-7220

NOTE. For current lists of vehicular installation units for other vehicles, see SB 11-131

b. *Fixer Portable.* Fixer-portable applications, the installation must be made on a solid, flat surface. A Power Unit PP-1451/G is required to operate the radio set. If the radio set is installed at a fixed site, it is generally desirable to install Antenna Group AN/GRA-12 (not supplied with the radio set). For installation instructions for the AN/GRA-12, refer to TM 11-2651. No special mounting hardware is provided for fixed-portable installation.

c. *Receiver and Transmitter Mounted Separately.* If the transmitter and the receiver are mounted separately, Mounting MT-925/GRC-19 is required for the transmitter and Mounting MT-36/URR for the receiver. Refer to TM 11-806 for installation instructions for the MT-925/GRC-19 and to TFM 11-858 for the MT-836/URR. Cable Assembly, Special Purpose, Electrical CX-1599/U' and Cable Assembly, Radio Frequency CG-1127/U will not be long enough if the transmitter and receiver are separated by more than 3 inches. These cable assemblies must be specially fabricated with sufficient cable to connect the transmitter and the receiver. The CX-1599/U is an eight-conductor cable with a nine-pin, right-angle connector on each end. The CG-1127/U is a Radio Frequency Cable RG58C/U with a Plug Connector UG913/U on each end.

**4. Vehicular Installation of Radio Set**

a. *General.* Instructions for each type of vehicular installation are supplied with the vehicular installation unit (para 3). Use the instructions below, as necessary, to supplement instructions provided with the particular installation unit.

b. *Antenna Installation.* Install the mast base; follow the instructions supplied with the vehicular installation unit. Assemble the mast sections as follows:

- (1) Screw together three MS-116-A sections.
- (2) Screw the MS-117-A section into the top MS-116-A section.
- (3) Screw the MS-118-A section into the MS117-A section.
- (4) Slide the antenna sheath clamp and the antenna cover up over the lowest section of MS-116-A.
- (5) Screw the MS-116-A section (on the end of the partly assembled antenna) into the mast base.
- (6) Slide the antenna cover down onto the mast base.
- (7) Slide the antenna sheath clamp down to the antenna cover and tighten it over the top.

c. *Whip Antenna Tiedown.* Rope RP-5 and insulator IN-86 are used to tie the antenna to the

vehicle. To tie down the whip antenna, tie the rope about 3 feet from the top of the antenna. Tie the rope to the insulator. Pull the rope until the top of the antenna protrudes over the rear of the vehicle. Tie the rope to the back of the vehicle.

*d. Mounting Installation.* Mounting MT851/GRC-19 is secured in place with eight bolts and nuts. Four of these are put through a plate on one end of the mounting, and four are put through the plate at the other end. The four holes in each plate are reached through an opening in the mounting, directly above each plate. (It is not necessary to take the mounting apart during installation.) Install the mounting by following the instructions supplied with the installation unit (para 3). Connect the ground straps to the vehicle, following the instructions supplied with the vehicular installation unit. Release the five retaining clamps on the front of the mounting by turning their handles to the left (counterclockwise). If more leverage is needed, put a heavy screwdriver or a bar through the hole in the middle.

*e. Receiver and Transmitter Installation.* Place the transmitter on the left side of the mounting so that the lower edge of the transmitter case slides under the four clamps at the rear of the mounting. Position the three retaining clamps so that they fit into the holes in the lower front edge of the transmitter case. Tighten the handles; use a short bar or a screwdriver to prevent the handles from becoming loose. Install the receiver on the right

side of the mounting in the same way. There are only two retaining clamps and two rear clamps on the receiver side of the mounting.

## **5. Fixed-Portable Installation of Radio Set**

*a. Antenna Installation.* Install the mast base on a mounted mast base plate. The mast base must be less than 6 feet from the transmitter, otherwise a longer wire W-146 will be required. Assemble the mast sections by following the instructions in paragraph 4b. If the radio set is installed in any fixed location for a considerable length of time, it is recommended that Antenna Group AN/GRA-12 be erected as directed in TM 11-2651.

*b. Mounting Installation.* Install the mounting on a solid, flat surface that is large enough to hold it. Mounting MT-851/GRC-19 is secured in place with eight bolts and nuts or eight screws. Four of these are put through a plate on one end of the mounting, and four are put through the plate at the other end. The four holes in each plate are reached through an opening in the mounting directly above each plate. With the mounting in place, center-punch the position of the eight mounting holes. If nuts and bolts are used to hold the mounting, remove the mounting and drill a  $\frac{3}{8}$ -inch hole at each center-punched position. Replace the mounting and secure it with 5/16-inch bolts and nuts. If wood screws are used, the center-punched positions and holes indicate where they are to be placed.

*c. Receiver and Transmitter Installation.* Install the receiver and the transmitter on the mounting as described in paragraph 4e.

# CHAPTER 3 THEORY

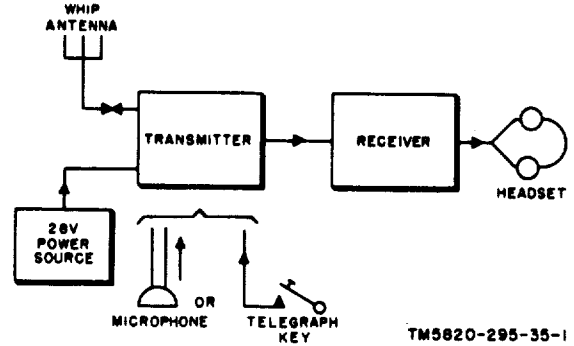
## Section I. SYSTEM THEORY

### 6. System Applications

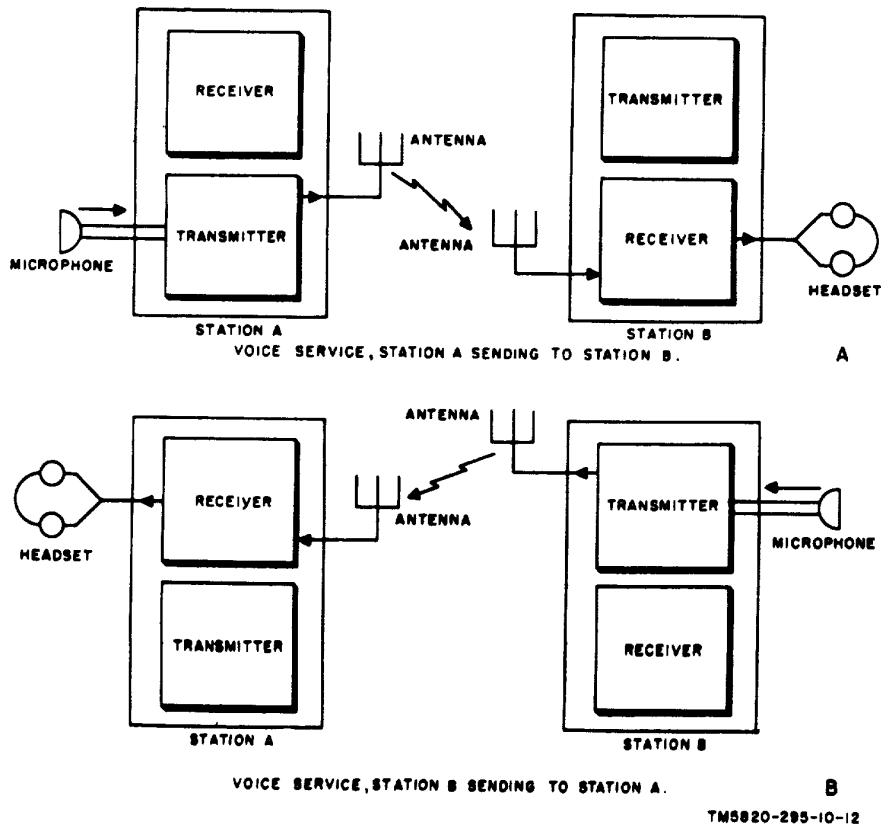
Radio Set AN/GRC-19 can be used for simplex, duplex, or relay communication in a net or as a relay station in a point-to-point system. The radio set can be used for voice, continuous wave (cw), or frequency-shift keying (fsk) service. It may also be used for simultaneous voice and fsk service.

a. During normal (simplex) operation (fig. 1 and 2), the transmitter is operated on a push-to-talk basis for voice service and the receiver is operative only when the transmitter is not being used. A single frequency and an antenna are used for both transmitting and receiving. For cw service, the transmitter is operated by the telegraph key. For fsk service (fig. 3), the transmitter is activated by the teletypewriter equipment. (The teletypewriter equipment is not supplied as part of Radio Set AN/GRC-19.) For simultaneous voice and fsk service (fig. 3), the transmitter is operated on either a push-to-

talk basis or by the teletypewriter equipment, and the receiver is operative only when the transmitter is not being used.



**Figure 1. Radio set (using voice or cw service), simplified block diagram.**



**Figure 2. Normal (simplex) operation of radio set (using voice service), simplified block diagram.**

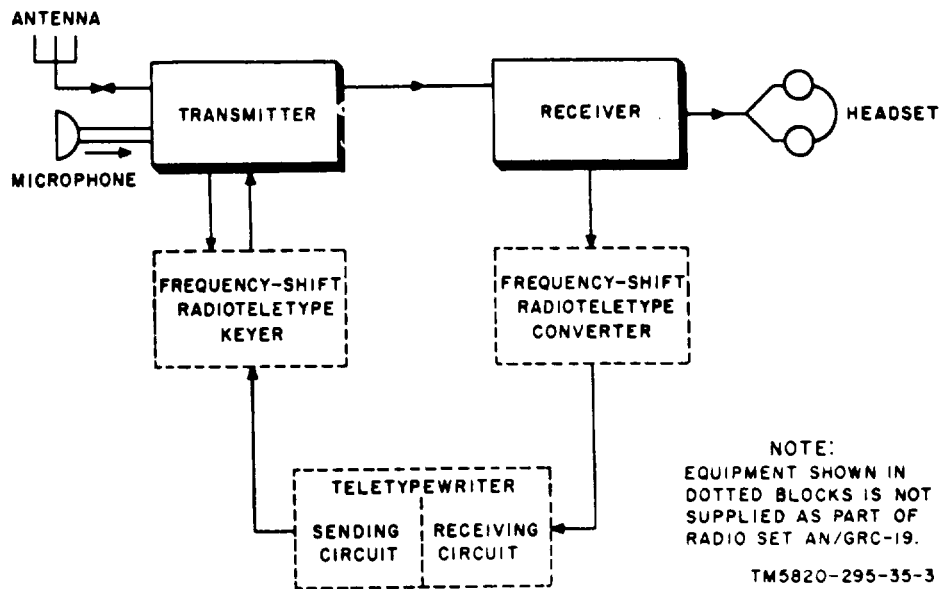


Figure 3. Voice and fsk service, simplified block diagram

b. During duplex and relay operation (fig. 4 and 5), two separate frequencies and two separate antennas are used for transmission and reception. The receiver and transmitter are operated simultaneously. The frequencies used for transmission and reception are separated by at least 1 megacycle. During duplex operation, all services are available. In relay operation, voice service is usually used.

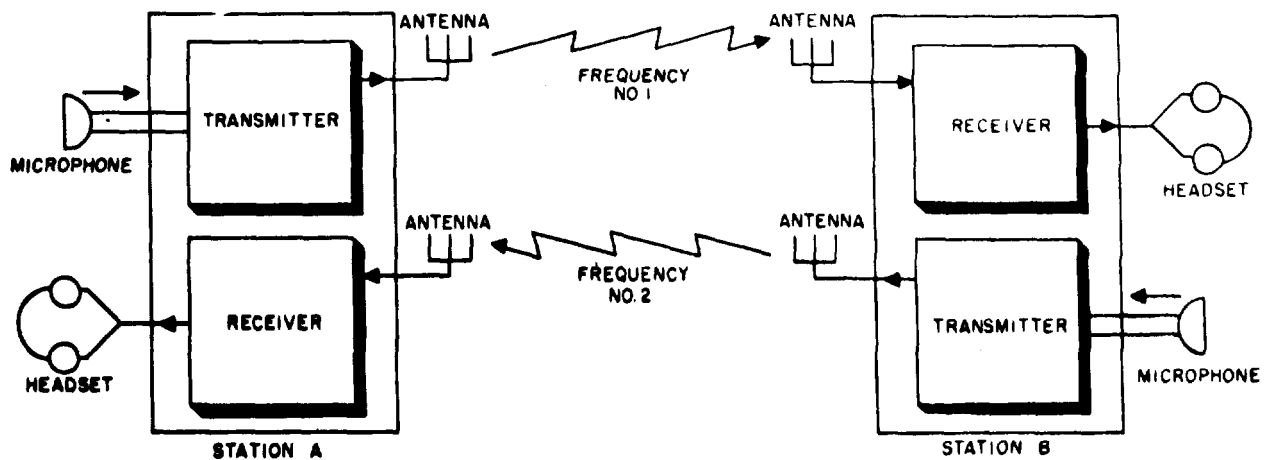
c. For net operation (fig. 6), the transmitter of station A (fig. 6) is used to transmit to the other stations in the net that are tuned to the same frequency. All transmitting and receiving services are available, and a single antenna is used for transmission and reception by

the individual stations. All the receivers in the net receive when one radio set in the net transmits.

### 7. Signal Paths

a. Normal (Simplex) Operation (A, fig. 7). During normal operation, the signal is received or transmitted from the same antenna.

- (1) In the receiving condition (A, fig. 7), the signal is received at the antenna and is fed to the antenna circuits of the receiver through contacts 4 and 5 of antenna



TM5820-295-10-13

Figure 4. Duplex operation of radio set (using voice service), simplified block diagram.

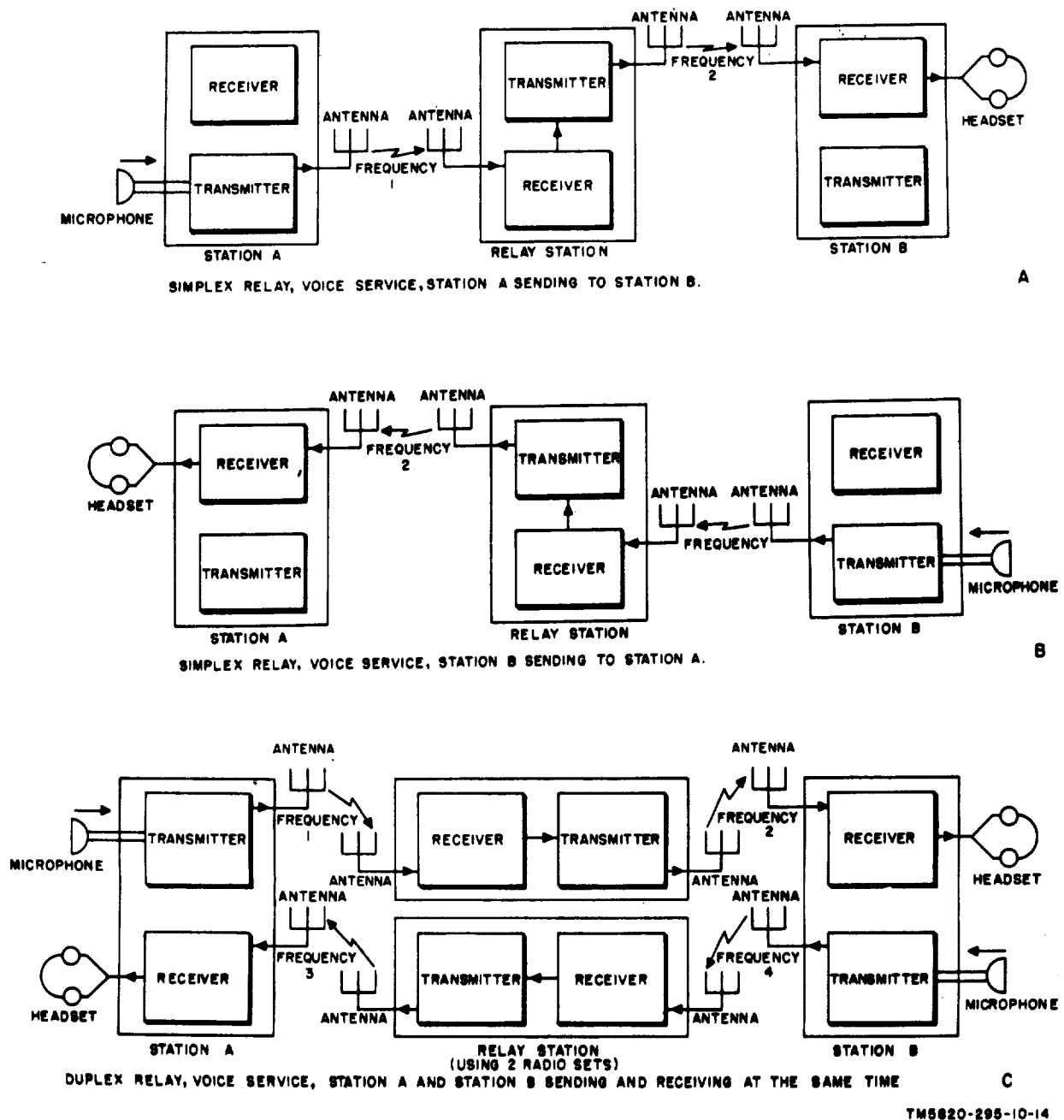
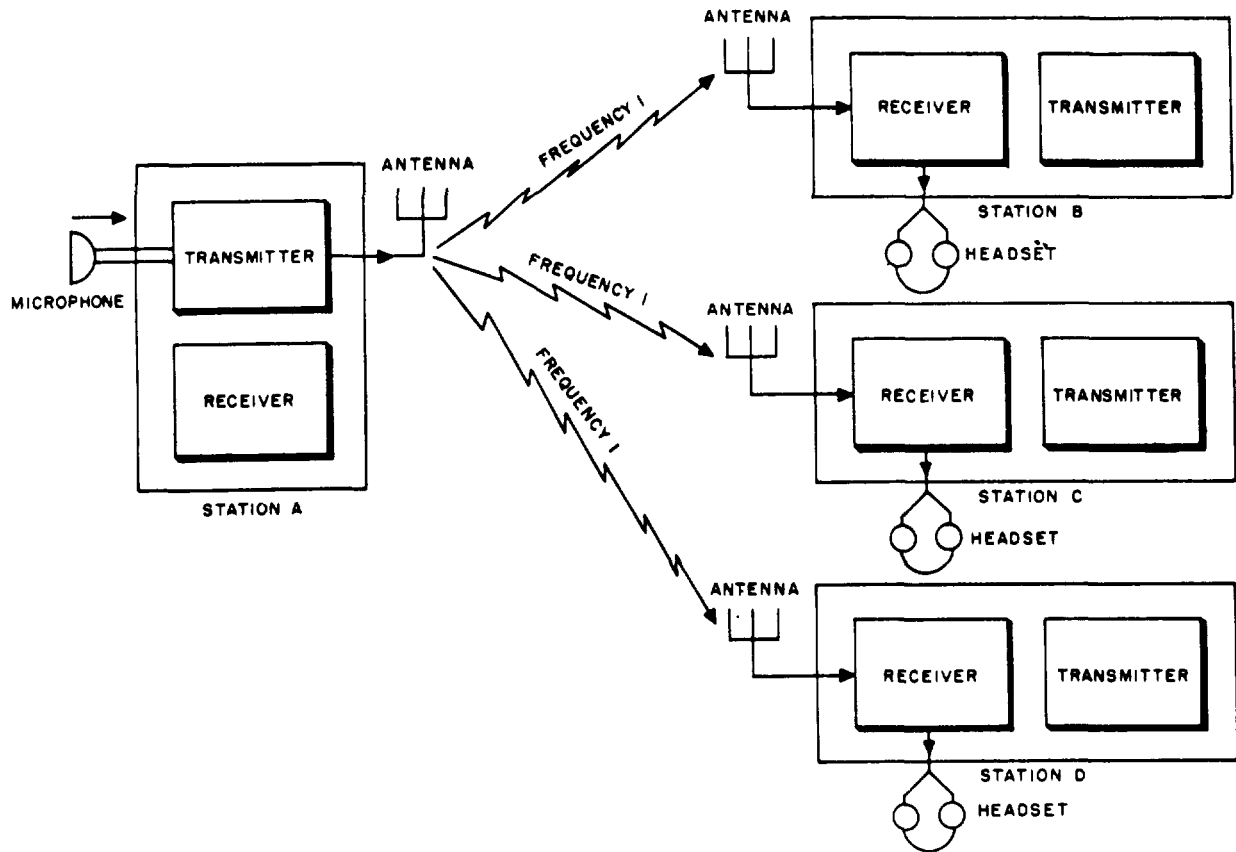


Figure 5. Relay operation of radio set (using voice service), simplified block diagram.

switching relay K614. From the antenna circuits, the signal goes through the receiver and is heard in the headset.

- (2) In the transmitting condition, the telegraph key or the microphone switch energizes keying relay K605. Relay K605 operates the oscillator, the exciter, and the power amplifier circuits. At the same time, K805

operates antenna delay tube V403B. Tube V403B energizes antenna delay - relay K601. Contacts 3 and 4 (of K601) energize break-in relay K602. Contacts 5 and 6 (of K601) energize antenna switching relay K614. The break-in relay silences the receiver by grounding the input to the audio circuits. The antenna



VOICE SERVICE, STATION A SENDING TO STATIONS B, C, AND D.

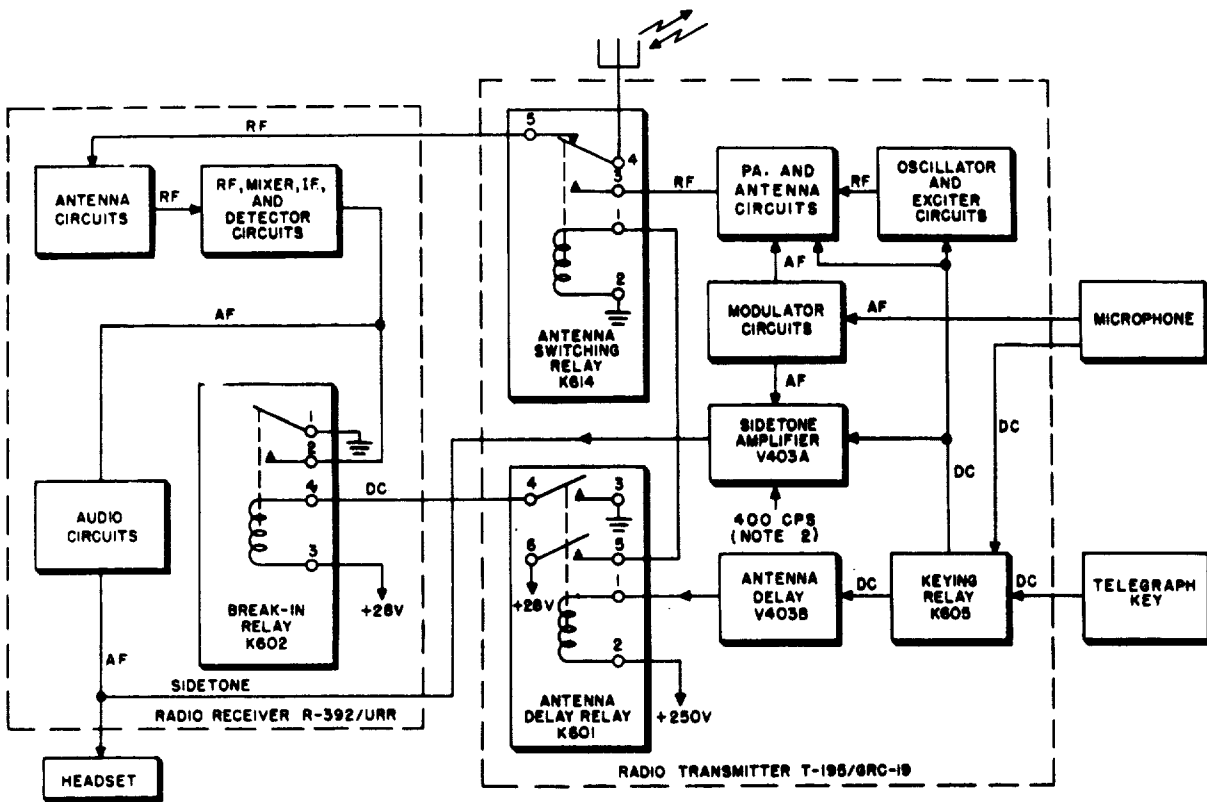
TM5820-295-35-16

**Figure 6. Net operation of radio set (using voice service), simplified block diagram.**

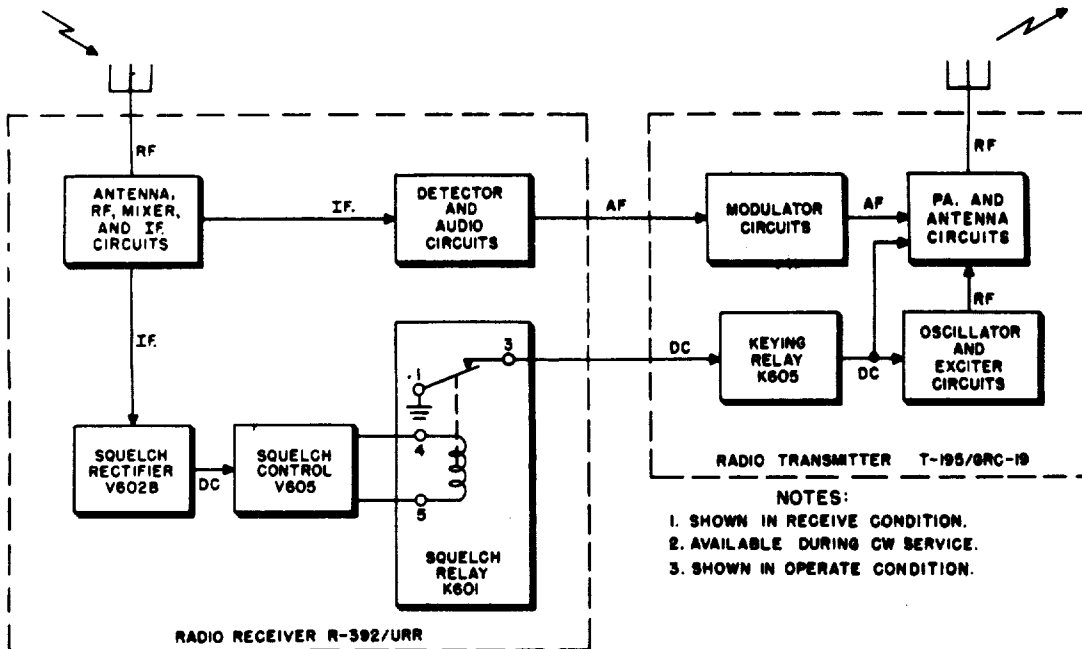
switching relay switches the antenna from the receiver to the transmitter. When a cw message is transmitted, the keying relay is energized every time its coil circuit is completed through the telegraph key. However, because of the action of the antenna delay tube, relays K601, K614, and K602 stay energized for about 1 second after the telegraph key is opened. When a voice signal is transmitted, the signal comes from the microphone. The signal is amplified in the modulator circuits. The signal then modulates the carrier frequency in the power amplifier circuit. A 400-cycle-per-second (cps) sidetone signal comes from sidetone amplifier V403A (during cw service) and is heard in the headset. During voice service, the sidetone signal comes from the modulator circuits. (This sidetone signal is used for monitoring purposes.)

b. Relay Operation (B, fig. 7). During relay operation, two antennas are needed. One antenna is

connected to the receiver, and the other antenna is connected to the transmitter. When a signal is received at the receiving antenna, the signal is amplified by the antenna circuits, the radio frequency (rf) circuits, and the intermediate frequency (if.) circuits. Part of the if. signal is fed to squelch rectifier V602B. In V602B, the if. signal develops a negative direct current (dc) voltage that is fed to squelch-control tube V605. The squelch control tube cuts off when this negative voltage is fed to its grid. When V605 cuts off, squelch relay K601 is deenergized. Contacts 1 and 3 (of K601) energize keying relay K605. Relay K605 operates the oscillator, the exciter, and the power amplifier circuits, and puts the carrier on the air. At the same time, the if. signal is fed to the detector and to the audio circuits. The audio frequency (af) signal is fed to the modulator circuits, where it is amplified. The



A-NORMAL OPERATION (NOTE 1)



- NOTES:
1. SHOWN IN RECEIVE CONDITION.
  2. AVAILABLE DURING CW SERVICE.
  3. SHOWN IN OPERATE CONDITION.

B-RELAY OPERATION (NOTE 3)

TM5920-295-35-6

Figure 7. Control circuits of radio set, simplified block diagram.



af signal is then used to modulate the carrier frequency in the power amplifier circuits. From the power amplifier circuits, the modulated carrier is fed to the transmitting antenna. The transmitting antenna retransmits the signal. During relay operation, the antenna-switching and disabling circuit, the receiver-silencing circuit, and the sidetone circuit are disabled.

c. *Duplex Operation.* During duplex operation, the antenna-switching and disabling circuit, the receiver-silencing circuit, the sidetone circuit, and the relay circuit are disabled. The only circuits connected between the transmitter and the receiver are the primary power circuits and the parallel connections between the AUDIO connectors. Except for these two circuits, the receiver and the transmitter operate separately. The transmitter and the receiver each need a separate antenna.

## Section II. INTERUNIT CIRCUIT DETAILS

### 8. Extent of Instructions

a. Interunit theory is presented to provide an understanding of the interrelations of the units in the various operations of the radio set. Such an understanding will help maintenance personnel, when troubleshooting, to sectionalize trouble to a defective unit and, in some cases, to localize trouble to a defective part within the unit.

b. Detailed circuit theory of individual units is discussed only where the units are interconnected in a common circuit. Complete details on the individual units are published in the technical manuals listed below:

Unit	Technical manual
Radio Transmitter T-195 (*)/GRC-19.....	TM 11-806
Radio Receiver R-392/URR.....	TM 11-858

### 9. Primary Power Circuit

(fig. 8)

The primary power is supplied from a 28-volt dc power source. This voltage is applied to the 24 VOLTS DC connector J605, through the power cable. Pins J605-A and J605-B are connected to the positive side of the power source. Pins J605-C and J605-D are connected to the negative side of the power source and are grounded in the transmitter. Pin J605-B is connected to part of filter Z601 (C641, C604, and L601). From the output of this filter, the voltage is fed to the high-voltage dynamotor circuit or high-voltage power supply in Radio Transmitter T-195A/GRC-19. Pin J605-A is connected to part of filter Z601 (C646, C603, and L622). From the output of this filter, the voltage is fed to the transmitter filament circuits through 15-ampere fuse F601, and to the low-voltage dynamotor circuit. Pin J604-E is grounded in the transmitter. RECEIVER CONT connector J604 is connected to the POWER INPUT-TRANS CONT

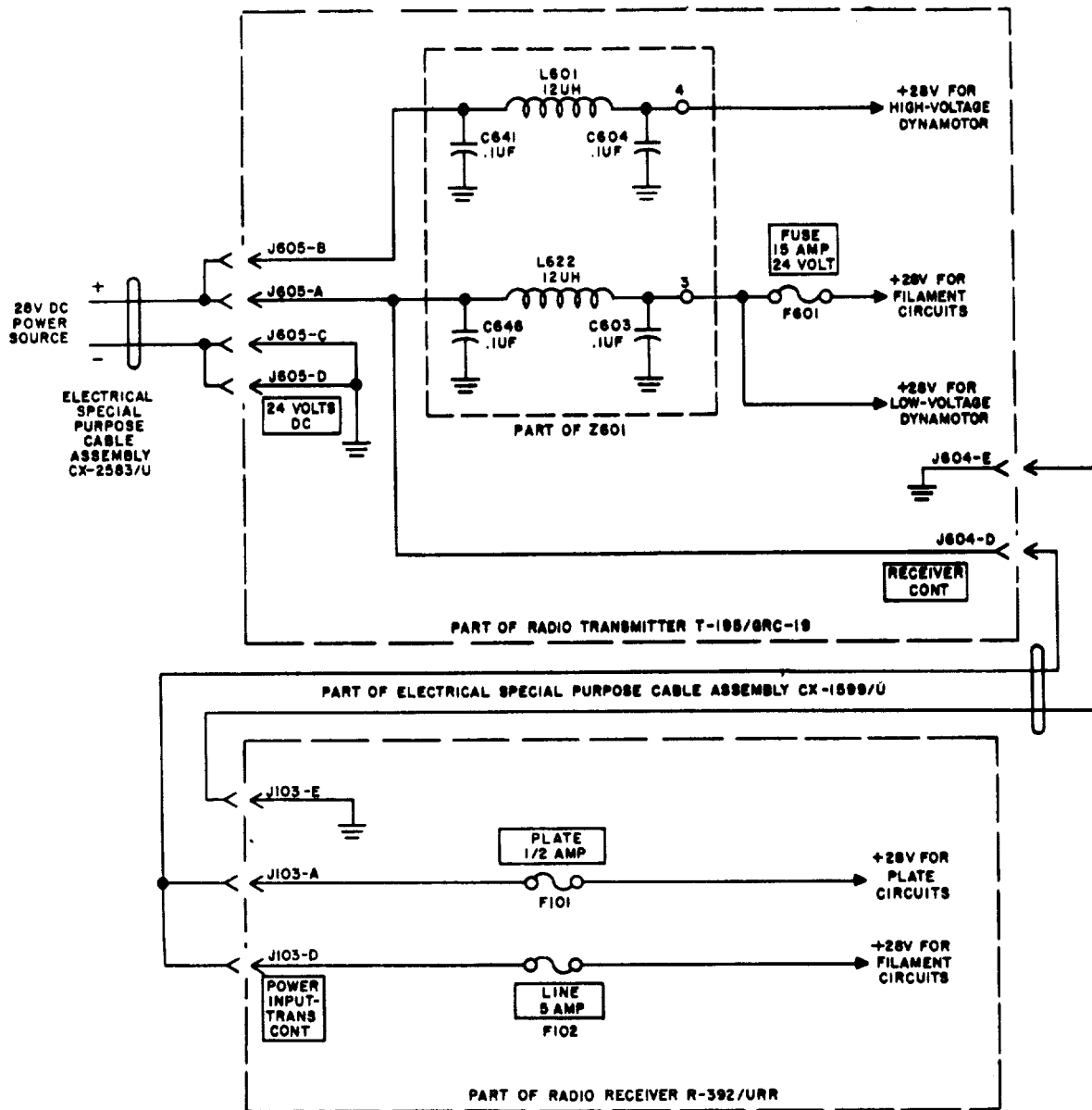
connector J103, through the interconnecting cable. Twenty-eight volts is fed through pin J604-D, through pin J103-D, and through LINE 5 AMP fuse F102, to the receiver filament circuits. Twenty-eight volts is also fed through pin J604-D, through pin J103-A, and through PLATE 1/2 AMP fuse F101, to the receiver plate circuits. Pin 103-E is grounded in the receiver.

### 10. Antenna-Switching and Disabling Circuit

a. The antenna-switching and disabling circuit connects the antenna to the transmitter when the radio set is transmitting, and connects the antenna to the receiver when the radio set is receiving. When the radio set is transmitting, the receiver antenna circuit is grounded to prevent the transmitted rf energy from damaging the receiver antenna coils. This antenna-switching and disabling circuit is used only for normal operation, because separate antennas are needed for relay operation and for duplex operation.

b. In the receiving condition, antenna-delay tube V403B is cut off, and antenna-delay relay K601 is deenergized. When K601 is deenergized, its contacts are open and antenna-switching relay K614, receiver-antenna relay K615, and antenna relay K101 are deenergized. The rf signal from the antenna is applied through WHIP ANTENNA binding post J615 (or 50 OHMS OUTPUT connector J614), through contacts 4 and 5 (of K614), through contacts 9 and 8 (of K615), through RECEIVER ANTENNA connector J616, through the rf cable, and through ANT connector J104, to the receiver antenna circuit.

c. When the transmitter is put in operation by the microphone switch, the telegraph key, or by some other means, V403B conducts. When V403B conducts, its plate current energizes K601. Contacts 5 and 6 (of K601) complete two circuits from the 28-volt primary power supply. The first circuit



TM5820-295-35-9

Figure 8. Primary power circuit of radio set, simplified schematic diagram.

is through the coil of K614 to ground. The second circuit is through the coil of K615 to ground; this energizes both relays (K614 and K615). Antenna switching relay K614 disconnects the antenna from the receiver antenna circuit and connects the antenna to the transmitter antenna circuit. This provides a path for the rf signal from the transmitter antenna circuit to the antenna. Contacts 7 and 8 (of K615) ground the receiver antenna circuit.

d. When the radio set is in the transmitting condition, the circuit that operates K101 is also

completed. Contacts 1 and 2 (of K101) ground the rf voltage that would otherwise appear across the receiver antenna coils. This prevents damage to these coils and also prevents interference. The circuit that energizes K101 is from ground (K601), through contacts 3 and 4 (of K601), through contacts 10 and 9 of the RELAY-NORMAL-DUPLEX switch S602 (rear section), through part of filter Z601 (C615, L613, and C640), through pin J604-B of the RECEIVER CONT connector, through the interconnecting cable, through pin J103-B of the

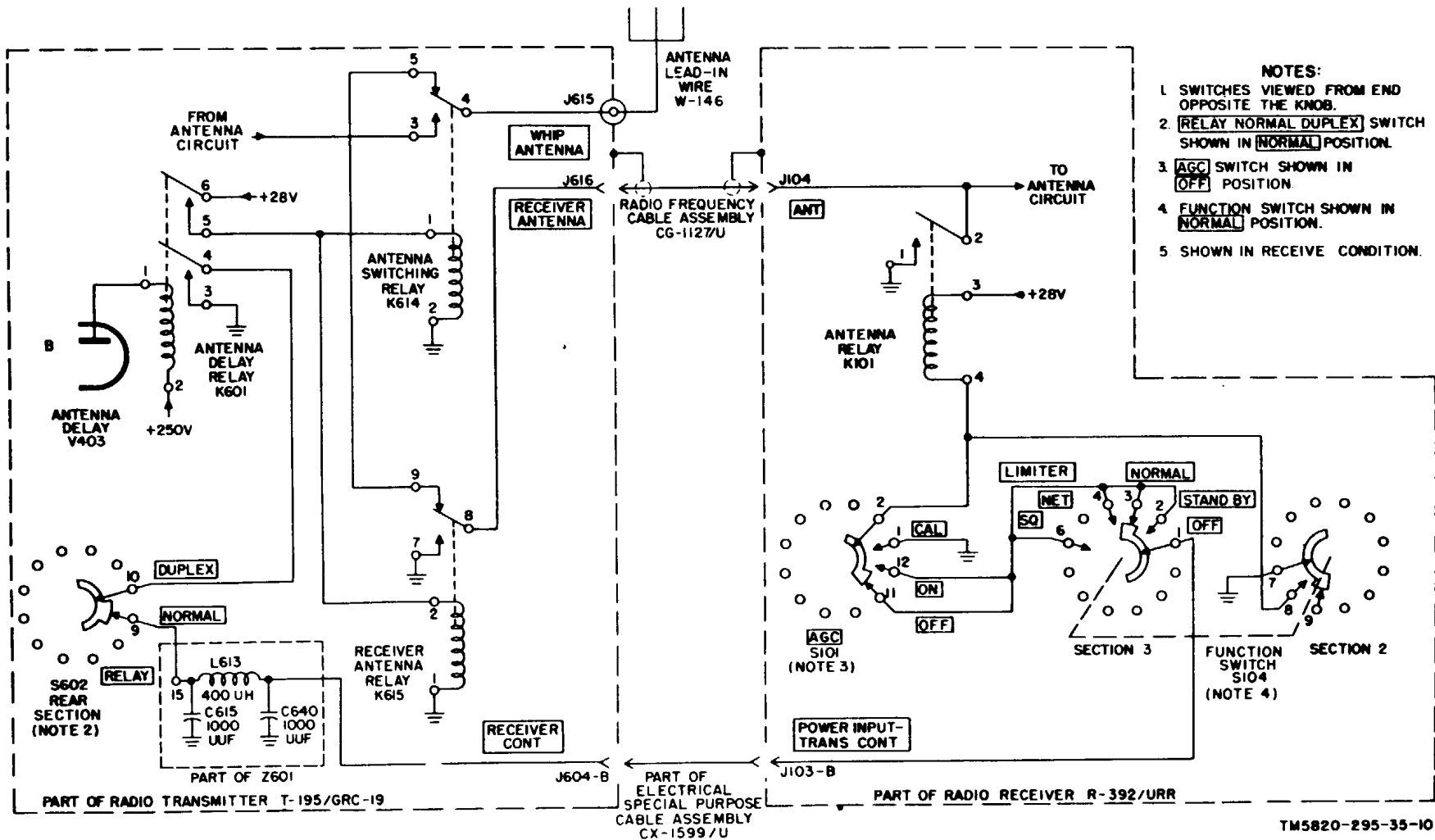
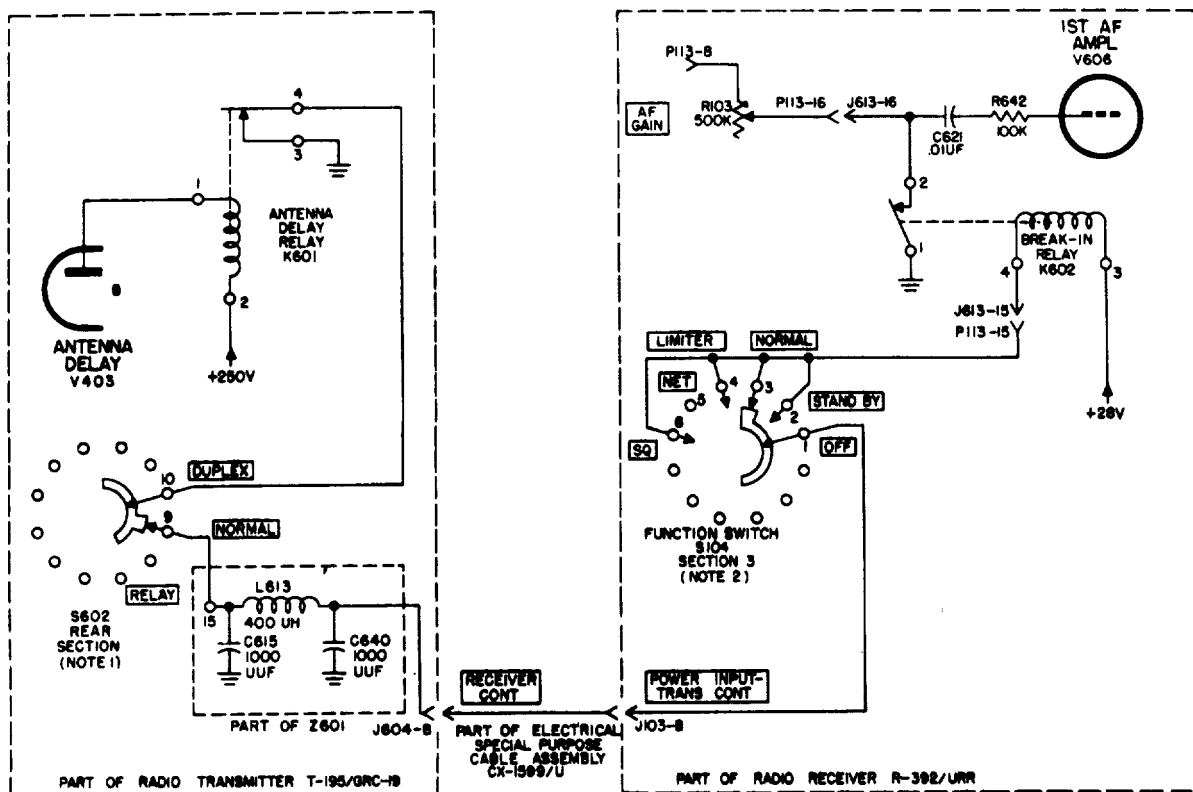


Figure 9. Antenna-switching and disabling circuit of radio set, simplified schematic diagram.



- NOTES:
1. THE [RELAY NORMAL DUPLEX] SWITCH SHOWN IN THE [NORMAL] POSITION.
  2. THE FUNCTION SWITCH IS SHOWN IN THE [NORMAL] POSITION.
  3. SHOWN IN TRANSMIT CONDITION.
  4. SWITCHES VIEWED FROM END OPPOSITE THE KNOB.

TM5620-295-35-11

Figure 10. Receiver-silencing circuit of radio set, simplified schematic diagram.

POWER INPUT-TRANS CONT connector, through contacts 1 and 3 of the function switch S104 (section 3), through contacts 11 and 2 of AGC switch S101, and through the coil of K101 to the 28-volt supply. This circuit (which energizes K101) is also completed when S101 is in the ON position, or when S104 is in the LIMITER position, the STAND BY position, or the SQ position.

e. Relay K101 is also operated independently of the transmitter when S101 is in the CAL position, or when S104 is in the STAND BY position. In the CAL position (of S101), the energizing circuit for K101 is completed (to ground) through contacts 2 and 1 of S101. In the STAND BY position (of S104), the energizing circuit for K101 is completed (to ground) through contacts 8 and 7 of S104 (section 2).

## 11. Receiver-Silencing Circuit

(fig. 10)

a. The receiver-silencing circuit cuts off the receiver when the transmitter is operating (during

normal operation). This prevents howling and squealing caused by feedback from the receiver to the transmitter. It also reduces unnecessary noise at the operating site. During duplex operation and relay operation, this silencing circuit is not used because the receiver and the transmitter must operate at the same time.

b. When the transmitter is put in operation by the microphone switch, the telegraph key, or by some other means, V403B conducts. The plate current of V403B energizes antenna-delay relay K601. Contacts 3 and 4 (of K601) complete the circuit that operates break-in relay K602. This circuit (which operates K802)) is from ground (K601), through contacts 3 and 4 (of K601), through pins 10 and 9 of S602 (rear section), through part of filter Z601 (C615, L613, and C640), through pin J604-B of the RECEIVER CONT connector, through, the interconnecting cable, through pin J103-B of the POWER INPUT-TRANS CONT

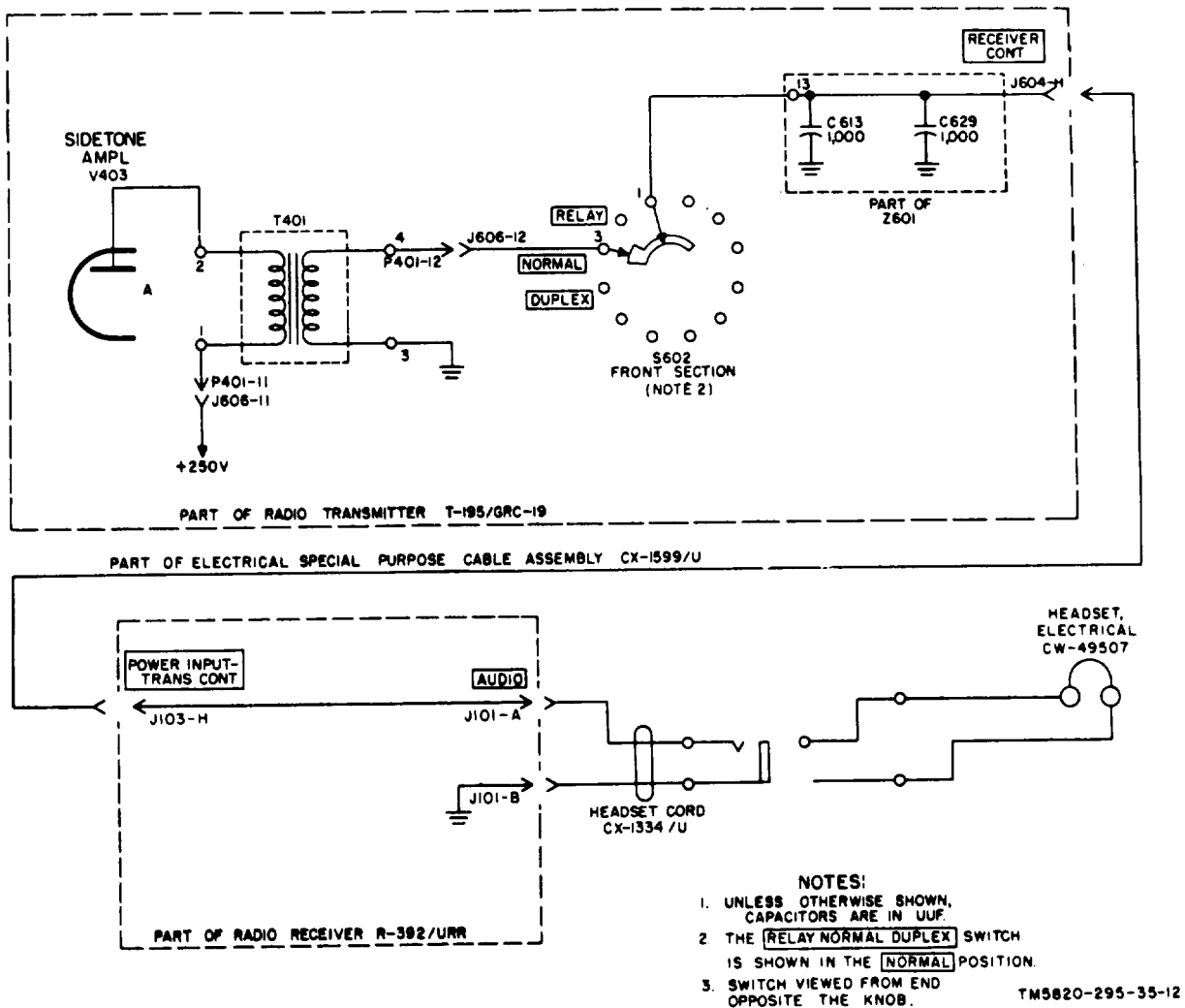


Figure 11. Sidetone circuit of radio set, simplified schematic diagram.

connector, through pins 1 and 3 of S104 (section 3), through pins P113-15 and J613-15, and through the coil of K602 to the 28-volt supply. When K602 is energized, contacts 1 and 2 (of K602) close. This shorts the audio signal to ground and silences the receiver.

c. In the receiving condition, V403B is cut off and K601 is deenergized; contacts 3 and 4 (of K601) open. This deenergizes K602. Contacts 1 and 2 (of K602) open and remove the short from the audio signal path. The af signal from AF GAIN control R103, is fed through C621 and through R642 to the grid of the first af amplifier, V606.

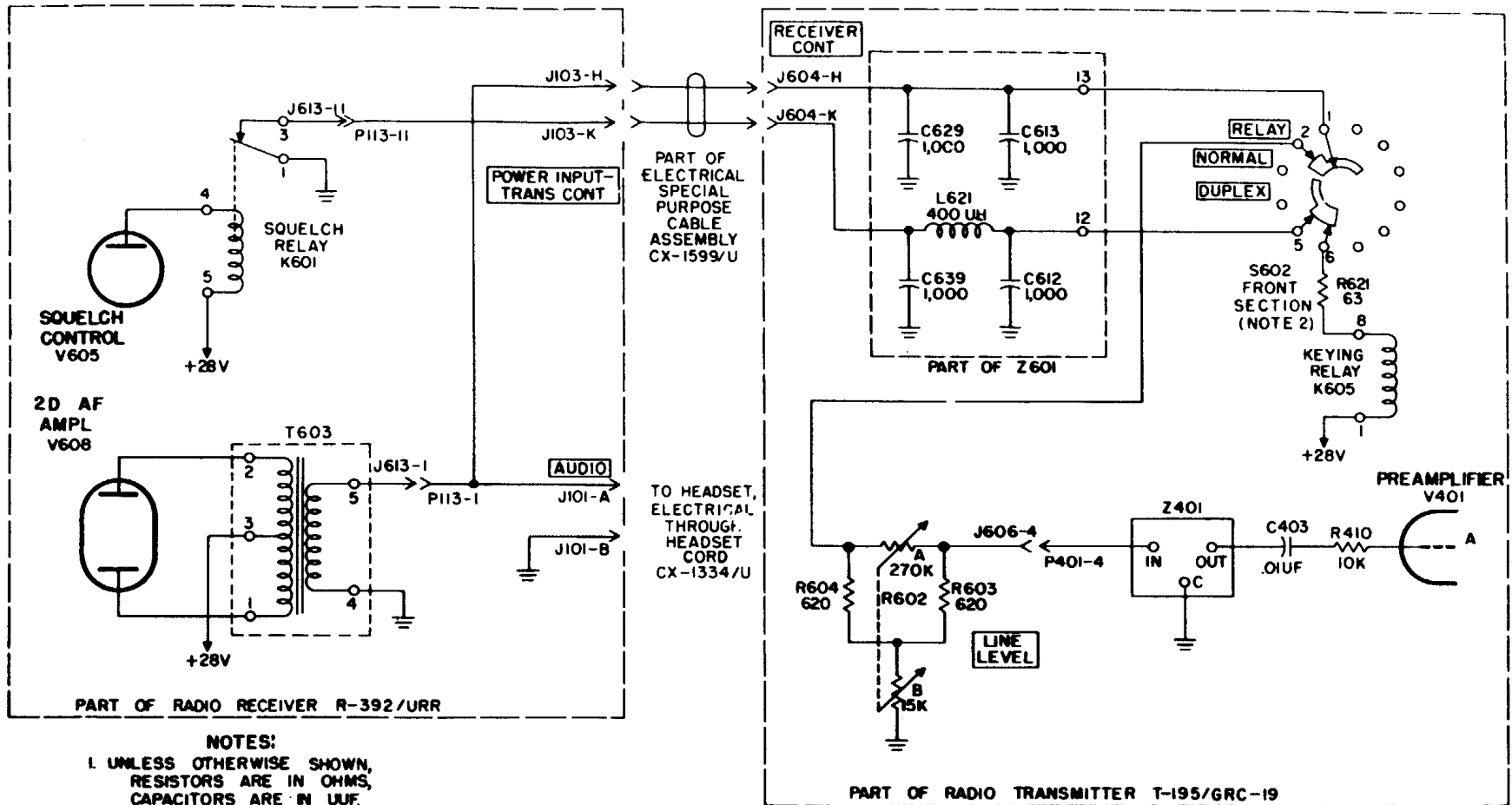
d. This silencing circuit is also connected when S104 is in the STAND BY position, the LIMITER

position, or the SQ position (with S602 remaining in the NORMAL position).

## 12. Sidetone Circuit (fig. 11)

a. The sidetone circuit is used only when transmitting during normal operation. The operator can hear the audio signal (during voice service) or a 400-cps tone (during cw service).

b. The audio signal from the microphone is amplified in preamplifier V401A, and in sidetone amplifier V403A. The amplified audio signal goes through transformer T401, through pins P401-12 and J606-12, through contacts 3 and 1 of S602 (front section), through part of filter Z601 (C613 and C629), through pin J604-H of the RECEIVER



TM5820-295-35-13

Figure 12. Relay circuit of radio set, simplified schematic diagram.

CONT connector, through the interconnecting cable, through pin J103H of the POWER INPUT-TRANS CONT connector, through pin J101-A of the AUDIO connector, through the headset cord to the headset, and to ground through the headset cord and pin J101-B.

### 13. Relay Circuit

(fig. 12)

During relay operation, the signal received is transmitted automatically on a different frequency.

a. When a signal is received by the receiver, a negative voltage is fed to the grid of squelch control tube V605. Squelch control tube V605 is cut off and squelch relay K601 is deenergized, and contacts 1 and 3 (of K601) close. This completes the circuit that operates keying relay K605. This energizing circuit for K605 is from ground (K601), through contacts 1 and 3 (of K601), through pins J613-11 and P113-11, through pin J103-K of the POWER INPUT-TRANS CONT connector, through the interconnecting cable, through pin J604-K of

the RECEIVER CONT connector, through part of filter Z601 (C639, C612, and L621), through contacts 5 and 6 (of S602, front section), through R621, and through the coil of K605 to the 28-volt supply. When K605 is energized, the contacts of this relay complete the circuits that cause the transmitter carrier to be fed to the antenna.

b. The audio signal from V608 is fed through T603, through pins J613-1 and P113-1, through pin J103-H of the POWER INPUT-TRANS CONT connector, through the interconnecting cable, through pin J604-H of the RECEIVER CONT connector, through part of filter Z601 (C629 and C613), through contacts 1 and-2 (of S602, front section), through the LINE LEVEL control, R602, through pins J606-4 and P401-4, through filter, Z401, through C403, and through R410 to the grid circuit of preamplifier V401A. From V401A, the signal goes to the modulator, where it is amplified enough to modulate the carrier. The modulated carrier is then retransmitted.

CHAPTER 4

TROUBLESHOOTING

**Warning:**

**There are circuits in the radio set that operate at voltages over 1,000 volts. When servicing the radio set, be very careful with these high-voltage circuits. Make sure that all power is turned off before touching any of the connections.**

**14. General Instructions**

When servicing a defective radio set, sectionalize the fault to a defective unit such as the transmitter or the receiver. This may be done by using the equipment performance checklist (TM 115820295-20). When the defective unit has been determined, the individual unit's technical manual should be consulted for detailed testing and troubleshooting procedures. Refer to TM 11-806 for the transmitter and to TM 11858 for the receiver.

**15. Test Equipment and Tools Required**

a. The following chart lists test equipment, required for troubleshooting Radio Set AN/GRC-19, and their associated technical manuals.

Test equipment	Technical manual
Analyzer, Spectrum TS-723/U, or equal.....	TM 11-5097
Audio Oscillator TS-382/U, or equal.....	TM 11-2684A
Electronic Multimeter TS-505/U, or equal .....	TM 11-5511
Frequency Meter AN/URM-32, or equal	TM 11-5120
Frequency Meter AN/URM-79.....	TM 11-5094
Multimeter AN/URM-105 .....	TM 11-6625-203-12
Oscilloscope OS-8A/U, or equal	TM 11-1214
Power Supply PP-1243/U.....	TB 11-5120-1
Rf Signal Generator AN/URM-25	TM 11-5551
Voltmeter, Meter ME-30A/U, or equal.....	TM 11-5132

b. The tools and materials contained in Tool Equipment TE-113 are required for installation and field maintenance of Radio Set 4N/GRC-19.

**16. Replacement of Cable Assembly, Radio Frequency CG-1127/U**  
(fig. 13)

To assemble Plug Connector UG913/U to Radio Frequency Cable RG58C/U, proceed as follows:

- a. Cut the end of the coaxial cable evenly.
- b. Place the nut and gasket on the cable and remove the outer insulator 9/32 inch as shown in A, figure 13. *Do not nick the braid.*
- c. Comb and fan out the braid; remove the cable dielectric, exposing the center conductor 5/32 inch as shown in B, figure 13. *Do not nick the center conductor.*
- d. Pull the braid wires forward, taper them and assemble the clamp as shown in C, figure 13. *Be sure the clamp is butted against the end of the outer insulator.*
- e. Fold back the braid wires, trim to the proper length, and form them over the clamp as shown in D, figure 13. When performed correctly, the required dimensions will be as shown.
- f. Solder the contact to the center conductor.
- g. Insert the cable and parts into the plug body as shown in E, figure 13. Be sure that the sharp ridge of the clamp is properly seated in the gasket groove, tighten the nut.



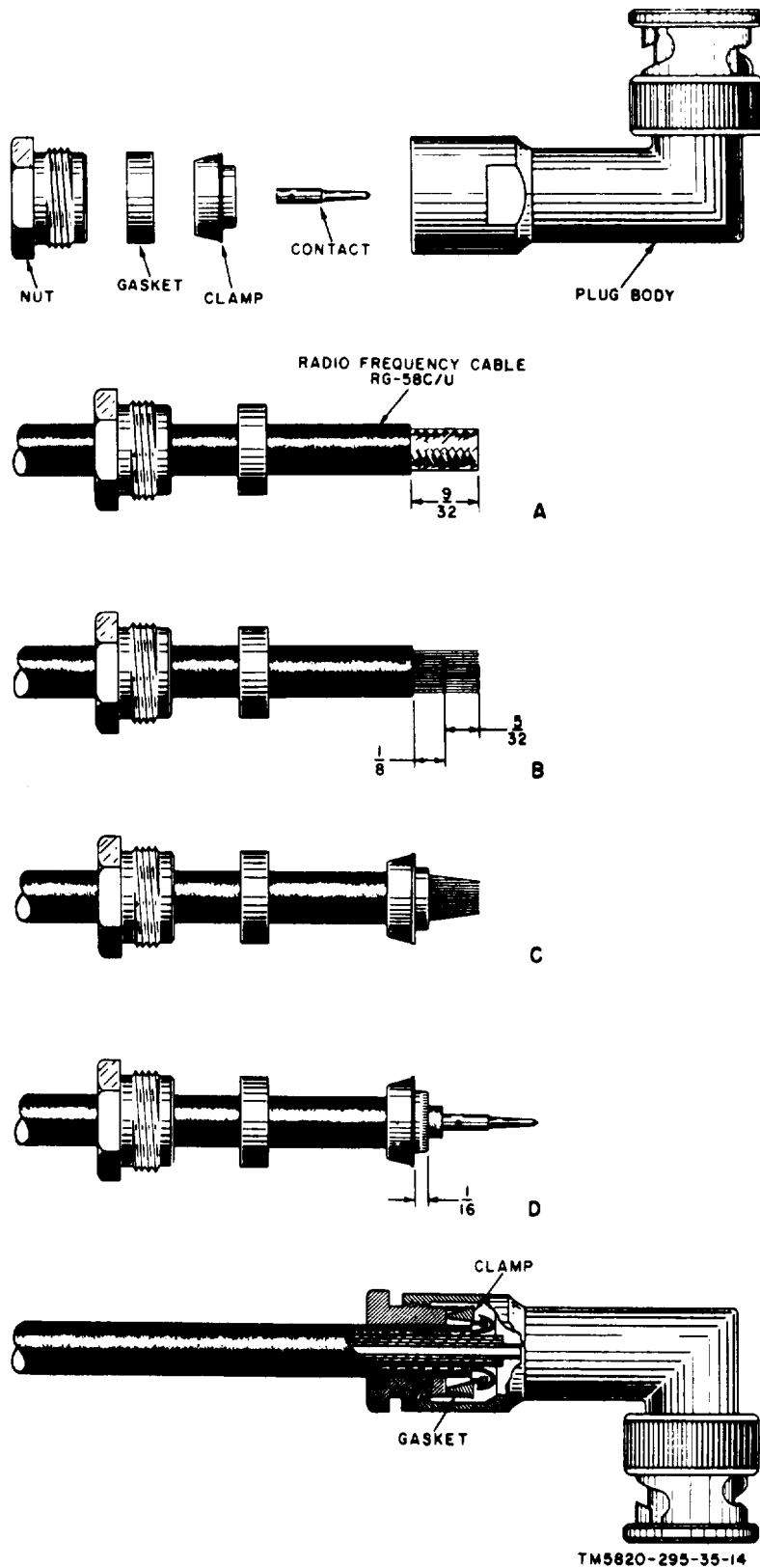


Figure 13. Replacement of Cable Assembly, Radio Frequency CG-1127/U.

## APPENDIX

### REFERENCES

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Following is a list of references applicable and available to the field and depot maintenance repairman of Radio Set AN/GRC-19:

SB 11-131	Distribution of Vehicular Radio Sets.	TM 11-5820-295-10P	Operator Maintenance Repair Parts and Special Tools List: Radio Set AN/GRC-19.
TM 11-806	Radio Transmitters T-195/GRC-19 and T-195A/GRC-19.	TM 11-5820-295-20	Organizational Maintenance, Radio Set AN/GRC-19.
TM 11-858	Radio Receiver R-392/URR.	TM 11-5820-295-20P	Organizational Maintenance Repair Parts and Special Tools List and Maintenance Allocation Chart for Radio Set AN/GRC-19.
TM 11-1214	Instruction Book for Oscilloscope OS-8A/U.	TM 11-5820-295-3P	Field and Depot Maintenance Repair Parts and Special Tools List for Radio Set AN/GRC-19:
TM 11-2651	Antenna Groups AN/GRA-4 and AN/GRA-12.	TM 11-582033410P	Operator's Maintenance Repair Parts and Special Tools List: Receiver, Radio R-392/URR.
TM 11-2684A	Audio Oscillators TS-382A/U, TS-382B/U, TS-382D/U, and TS-382E/U.	TM 11-5820-334-20P	Organizational Maintenance Repair Parts and Special Tools List and Maintenance Allocation Chart: Receiver, Radio R-392/URR.
TM 11-5094	Frequency Meters AN/URM-79 and AN/URM-82.	TM 11-5820-334-35P	Field and Depot Maintenance Repair Parts and Special Tools List: Receiver, Radio R-392/URR.
TM 11-5097	Spectrum Analyzers TS-723A/U and TS-723/U.	TM 1162203-12	Operation and Organizational Maintenance: Multimeter AN/URM-105, including Multimeter ME-77/U.
TM 11-5120	Frequency Meters AN/URM-32 and AN/URM-32A.		
TM 11-5132	Voltmeter, Meter ME-30A/U and Voltmeters, Electronic 30B/U and ME-30C/U.		
TM 11-5511	Electronic Multimeter TS-505/U.		
TM 11-5551	Instruction Book for R-f signal Generator Set AN/URM-25.		
TM 11-5820-295-10	Operator's Manual, Radio Set AN/GRC-19.		

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**USAR:** None.

For explanation of abbreviations used, see AR 320-50.

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## The Metric System and Equivalents

### Linear Measure

1 centimeter = 10 millimeters = .39 inch  
 1 decimeter = 10 centimeters = 3.94 inches  
 1 meter = 10 decimeters = 39.37 inches  
 1 dekameter = 10 meters = 32.8 feet  
 1 hectometer = 10 dekameters = 328.08 feet  
 1 kilometer = 10 hectometers = 3,280.8 feet

### Weights

1 centigram = 10 milligrams = .15 grain  
 1 decigram = 10 centigrams = 1.54 grains  
 1 gram = 10 decigrams = .035 ounce  
 1 decagram = 10 grams = .35 ounce  
 1 hectogram = 10 decagrams = 3.52 ounces  
 1 kilogram = 10 hectograms = 2.2 pounds  
 1 quintal = 100 kilograms = 220.46 pounds  
 1 metric ton = 10 quintals = 1.1 short tons

### Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce  
 1 deciliter = 10 centiliters = 3.38 fl. ounces  
 1 liter = 10 deciliters = 33.81 fl. ounces  
 1 dekaliter = 10 liters = 2.64 gallons  
 1 hectoliter = 10 dekaliters = 26.42 gallons  
 1 kiloliter = 10 hectoliters = 264.18 gallons

### Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch  
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches  
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet  
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet  
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres  
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

### Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch  
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches  
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

## Approximate Conversion Factors

To change	To	Multiply by	To change	To	Multiply by
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

### Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
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PIN: 010221-000