

Chapter 4

Combat Net Radio

4-1. Overview

CNR refers to the family of both single-channel and frequency hopping (FH) radios which are organic to many types of units. In maneuver battalions, CNR is their primary means of communications.

The Army uses several types of single-channel radios which operate in different frequencies across the RF spectrum as shown in Figure 4-1.

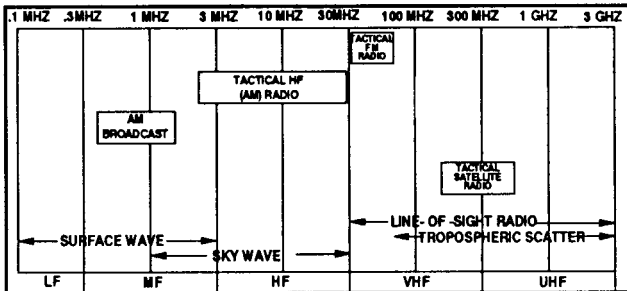


Figure 4-1. RF spectrum.

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The Army uses the following single-channel radios:

- **FM Radio.** Its range is about 35 to 40 kilometers which covers a brigade/battalion maneuver area. FM radio transmissions are normally LOS which large terrain features can block. FM radios can also transmit data.

- **HF Radio.** HF radio's longer range overcomes terrain limitations for users with greater dispersion. Using the improved high frequency radio (IHFR) provides a versatile capability for short- and long-range communications. HF is the only tactical communications asset that may achieve long-range communications independent of terrestrial or satellite relays. HF communications may be either voice or secure data. HF is also useful where LOS cannot be achieved. The capabilities of the single-channel radio make it flexible, securable, mobile, and reliable. However, the radio is the most detectable means of electronic communications and is subject to intentional and unintentional electronic interference. Good ECCM and remoting techniques are highly recommended.

- **TACSAT Radio.** The use of satellite communications gives the commander the greatest range. It is useful to users separated by long distances, such as rapid deployment forces and special operations units. The single channel TACSAT radio transmits in the UHF/VHF range which requires the antenna to have LOS with the satellite.

Satellite access time must be requested in advance. This radio has a narrow and wide bandwidth and can transmit data.

These radios are used in functional networks such as command, administrative/logistical, fire support, and intelligence nets.

CNR's primary role is voice transmission for battle command. The CNR network can assume a secondary role for data transmission when needed. Voice C² takes priority over data in most networks. The family of CNRs includes—

- AN/VRC-12 series.
- SINCGARS.
- IHFR.
- Single-channel TACSAT.

4-2. AN/VRC-12 Series Radios

AN/VRC-12 series radios are short-range, vehicular, aircraft, and fixed-station mounted units. They provide FM radio communications with NRI and retransmission capabilities. The radios also can be used with speech security or digital data equipment. Table 4-1 shows the technical specifications of the AN/VRC-12 series radios.

Note: The AN/VRC-12 series radios are being replaced by SINCGARS, discussed in paragraph 4-3 of this chapter.

Table 4-1. AN/VRC-12 technical specifications.

● PRIMARY COMPONENTS:	Receiver-Transmitter, RT-524/RT-246
● FREQUENCY RANGE:	30-75.95 MHz (50 Hz spacing)
● PLANNING RANGE:	41 km (High Power) 8 km (Low Power)
● MODES OF OPERATION:	Voice/Data
● RF OUTPUT POWER:	8 watts (Low Power) 35 watts (High Power)
● TM NUMBER:	TM 11-5820-401-10 series

The AN/VRC-12 series radio sets are designed around two types of RTs: the RT-246 and the RT-524. The RTs are combined with other components to form eight different configurations. The other components are the radio receiver, R-442; the secure retransmission set, C-10374; the antenna, AS-1729; and an auxiliary antenna. Table 4-2 show the various radio configurations.

Table 4-2. Radio configurations.

RADIO	FEATURE	RT-246	R-442	RT-524	C-10374	AS-1729	AUX ANT
AN/VRC-12	Monitors 2 Nets	1	1	0	0	1	1
AN/VRC-43	Monitors 1 Net	1	0	0	0	1	1
AN/VRC-44	Monitors 3 Nets	1	2	0	0	1	2
AN/VRC-45	Retransmission	2	0	0	1	2	0
AN/VRC-46	Monitors 1 Net	0	0	1	0	1	0
AN/VRC-47	Monitors 2 Nets	0	1	1	0	1	1
AN/VRC-48	Monitors 3 Nets	0	2	1	0	1	2
AN/VRC-49	Retransmission	0	0	2	1	2	0

Figures 4-2 and 4-3 show all components for cabling used in a secure AN/VRC- 12 series radio.

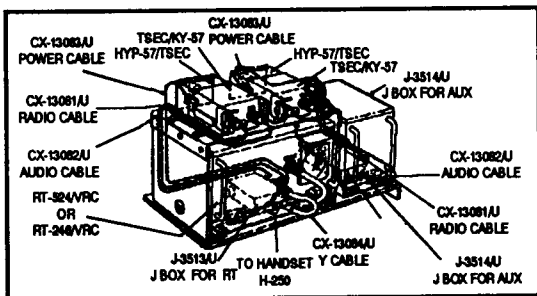


Figure 4-2. Radio set, AN/VRC-47 (secure).

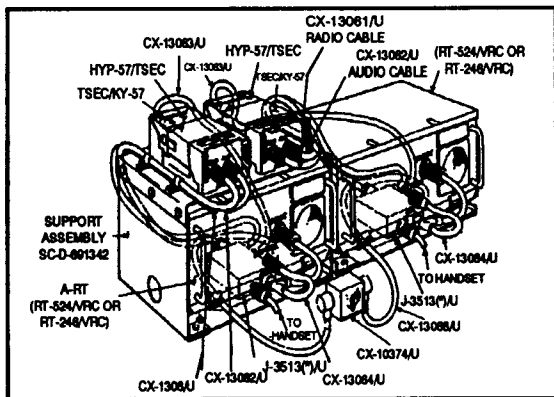


Figure 4-3. Radio set, AN/VRC-49 (secure).

4-3. Single-Channel Ground and Airborne Radio System

SINCGARS is the primary radio system used for short-range secure voice communications at brigade/battalion. SINCGARS is the secondary means for CS and CSS units.

SINCGARS is replacing all AN/PRC-77 manpack and AN/VRC-12 series vehicular mounted and airborne VHF-FM radios. SINCGARS accepts either digital or analog input. It converts the signal into a FH output. In the FH mode, the radio's transmission changes frequency about 100 times per second. This prevents threat interception and jamming units from locating or disrupting friendly communications.

SINCGARS radios may "net" with the AN/VRC-12 series radios by operating in the single-channel mode. Additionally, the AN/VRC-12 series radios may operate within FH nets by using a SINCGARS-FH to single-channel (SC) retransmission system provided by an AN/VRC-92. Figure 4-4 shows an example of an SC to FH retransmission operation.

SINCGARS provides access into the ACUS network through the NRI. The NRI (KY-90) is the interface device which links the SINCGARS with the ACUS communications network. Normally, CNR users gain access through an NRI station located in either a SEN, FES, LEN, or NC.

See FM 11-32 for detailed information on SINCGARS.

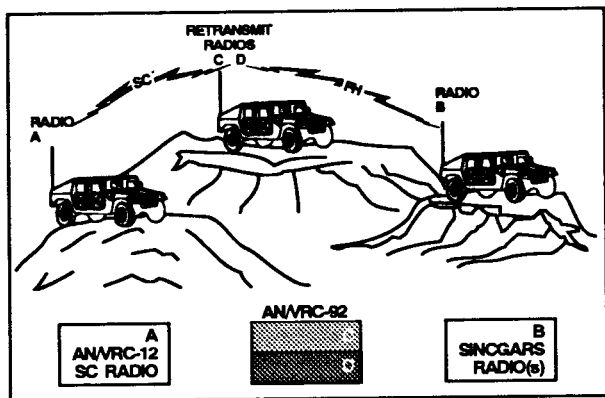


Figure 4-4. SC to FH retransmission operation.

Table 4-3 shows SINCGARS characteristics.

Table 4-3. SINCGARS characteristics.

● PRIMARY COMPONENTS:	Receiver-Transmitter, RT-1523 ICOM RT-1439 NON-ICOM RT-1476/77/78 AVIONIC
● FREQUENCY RANGE: (Channel Spacing)	30 TO 87.975 MHz 25 Hz
● PLANNING RANGE: Manpack/Vehicular:	LO - 200 to 400 meters MED - 400 meters to 5 km HI - 5 to 10 km
Vehicular Only:	PA - 10 to 40 km
● MODES OF OPERATION:	
Voice:	SC and FH
Retransmit:	SC to SC, SC to FH, FH to FH
Digital Data:	SC and FH
Remote:	With AN/GRA-39, CM, or RCU
Plain or Cipher Text (When KY-57 is attached)	
● RF OUTPUT POWER:	LO - 500 microwatts MED - 160 milliwatts HI - 4 watts PA - 50 watts
● DATA TRANSMIT RATE:	
Manpack/Vehicular:	HI - 3 to 5 km @ 600 to 4800 bps - 1 to 3 km @ 16 kbps
Vehicular Only:	PA - 3 to 10 km @ 16 kbps - 5 to 22 km @ 4800 bps - 5 to 25 km @ 600 to 2400 bps
● TM NUMBER:	TM 11-5820-890-10 series

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The primary component of SINCGARS is the receiver/transmitter. There are two ground unit versions (RT-1523 integrated COMSEC (ICOM) and RT-1439 non-integrated COMSEC (non-ICOM)). See Figures 4-5 and 4-6. The main difference between radios is the device used to provide secure communication. The RT-1523 has internal COMSEC circuits and the RT-1439 uses the VINSON secure device. The secure devices are compatible if the same cryptonet variable is used in the ICOM radio and the VINSON device. The ground versions are equipped with a whisper mode for noise restriction during patrolling or while in defensive positions. The operator whispers into the handset and is heard at the receiver in a normal voice.

NOTE: All double-stacked SINCGARS can be used as a retransmission station.

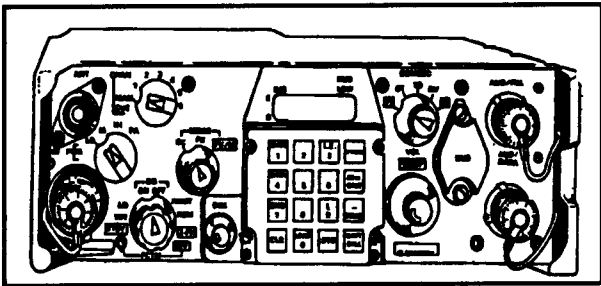


Figure 4-5. ICOM radio RT-1523.

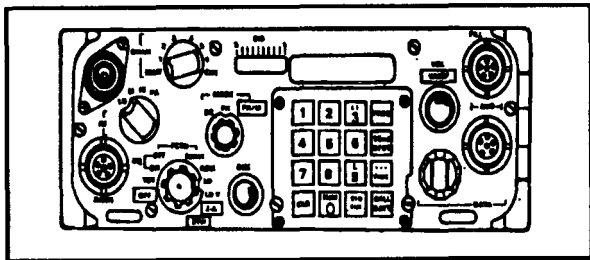


Figure 4-6. Non-ICOM radio RT-1439.

SINGARS has seven different configurations.

AN/PRC-119. This is a manpacked version of SINGARS which weighs about 20 pounds and can be carried in an all-purpose lightweight individual carrying equipment (ALICE) pack. See Figure 4-7. It is powered by a 13.5 volt lithium battery. The battery has an average life span of 12 hours (at 70° F when used with an RT ratio of 1 to 9). The average life span for the battery with the new RT-1523A/B is 26 hours. The AN/PRC-119 does not include a power amplifier and therefore has a planning range of 5 to 10 kilometers when used in the high RF position.

AN/VRC-87 and AN/VRC-88. These radios are short range and vehicular mounted. They are identical except that the AN/VRC-88 includes a battery box, whip antenna, and backpack shelf which gives it dismounting capability. See Figure 4-8.

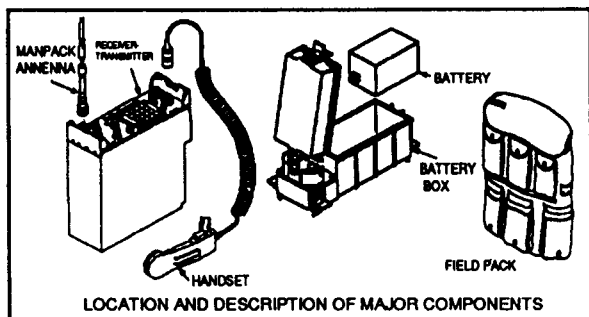


Figure 4-7. Radio set, AN/PRC-119.

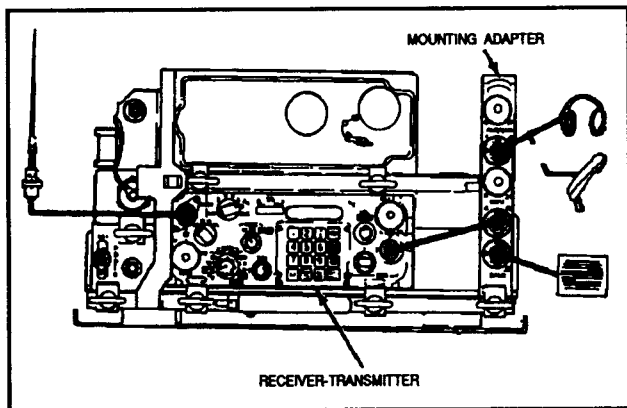


Figure 4-8. Radio sets, AN/VRC-87 and AN/VRC-88.

AN/VRC-90. This is a long-range, vehicular mounted radio set. It contains a power amplifier which uses a mount adapter to interface and support the RT. The power amplifier provides about 50 watts of RF power during transmission which boosts the radio's range. See Figure 4-9.

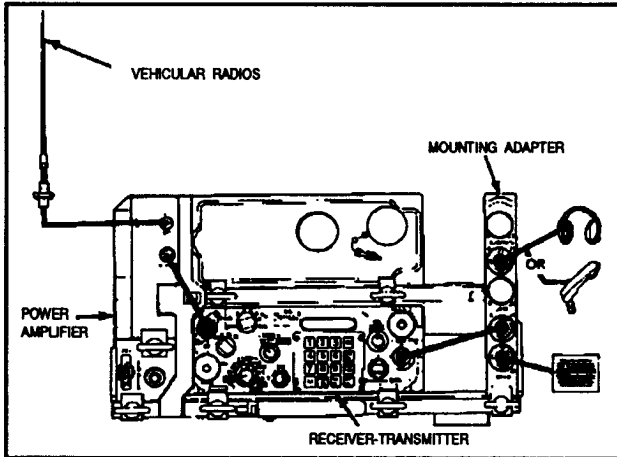


Figure 4-9. Radio set, AN/VRC-90.

AN/VRC-89, AN/VRC-91, and AN/VRC-92. These radio sets have two RTs. This enables the operator to monitor two different nets at once, or act as a retransmission station. The AN/VRC-89 and AN/VRC-91 sets have two RTs and one power amplifier which makes one radio long-

range and the other short range. The AN/VRC-91 includes a battery case, whip antenna, and backpack shelf which gives it dismounting capability. The AN/VRC-92 has two power amplifiers which boost the transmit power of its RTs. See Figure 4-10.

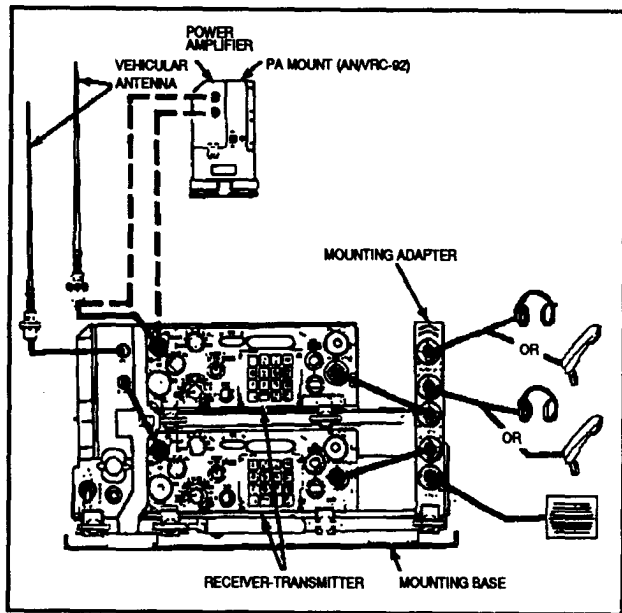


Figure 4-10. Radio sets, AN/VRC-89, AN/VRC-91, and AN/VRC-92.

LOADING SECURE DEVICE KY-57

The KY-57 VINSON is an auxiliary device used to secure radio transmissions from the AN/VRC-12 series radios and the non-ICOM SINCGARS sets. See Figure 4-11. To encrypt transmissions, it must be loaded with a COMSEC trunk encryption key (TEK) from a KYK-13 or KYX-15. The procedure for loading the KY-57 is as follows:

- Connect the KY-57 to the radio set.
- Set the KY-57 to C and fill register to a numbered position/ALL.
 - Turn KY-57 power to ON (COMSEC alarm is heard).
 - Press the handset push-to-talk button twice (COMSEC alarm clears to a steady tone).
 - Set KY-57 mode to LD.
 - Connect KYK-13 to KY-57 using fill cable.
 - Turn KYK-13 to ON and fill register to a numbered position.
 - Press the handset push-to-talk, and a beep is heard and the KYK-13 lamp blinks.
 - Turn KYK-13 OFF and disconnect from the KY-57.
 - Set the KY-57 MODE to C.

NOTE: The Automatic Net Control Device (AN/CZY-10) will replace the KYK-13, KYK-15, MX-18290, and MX-10579.

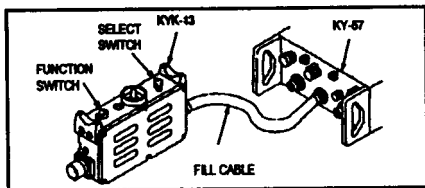


Figure 4-11. Loading a KY-57 VINSON fill.

LOADING SINGARS FH DATA (LOCAL FILL)

To frequency hop, SINGARS must be loaded with specific FH data such as the transmission security key (TSK). This data is loaded from an ECCM Device, MX-10579 and should be loaded after the radio set is powered up. See Figure 4-12. The instructions for tilling the RT are as follows:

- Ensure the ECCM fill device is loaded.
- Set ECCM fill device function switch to OFF.
- Connect ECCM fill device to RT connector AUD/FILL using fill cable.
- Set RT FCTN to LD-V.
- Set RT MODE to FH.
- Set RT CHAN to MAN.
- Set ECCM fill device select switch to T1 or T2.

- Set ECCM fill device function switch to ON.
- Press HOLD. Display will show "LOAD," then "STOP." A beep is heard, the "COLD" is displayed.
- Set RT FCTN to LD.
- Set ECCM fill device function to OFF.
- Disconnect ECCM fill device from RT connector fill.

NOTE: TSK is transparent with ICOM SINCARS and built as a part of hopset. Non-ICOM SINCARS requires separate identified TSK. There is no "LD-V" on the ICOM version.

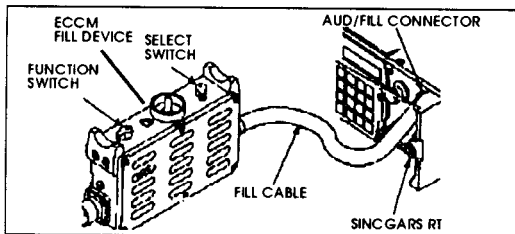


Figure 4-12. Loading FH data fill.

RECEIVING AN ELECTRONIC REMOTE FILL

SINGGARS can receive FH data from a remote station. This data can be transmitted to the RT from a distant station, such as the net control station (NCS). The electronic remote fill (ERF) allows the RT's internal clock to synchronize with the other radios operating in the net. See Figure 4-13. The steps for requesting and receiving an ERF are as follows:

- Set COMSEC device to plain or clear.
- Set RT CHAN to CUE.
- Set RF to HI or PA. Key handset and call NCS.
- When NCS responds, follow their instructions.
- Set FCTN to LD.
- Set MODE to FH.
- Set CHAN to MAN. Display will show "COLD."
- Wait for NCS to transmit ERF.
- Upon receiving an ERF, press STO; then enter the channel number (on keypad) where it is to be stored.
 - Acknowledge reception of ERF to NCS.
 - Set CHAN to channel where hopset was stored.
 - Set FCTN to ON.

NOTE: Precautionary measures must be taken to ensure that the KY-57 VINSON is loaded with a COMSEC trunk encryption key (TEK) from a KYK-13 or KYX-15 and not mismatched with the transmission security key (TSK) loaded from an ECCM fill device.

See FM 11-32 for more information on this subject.

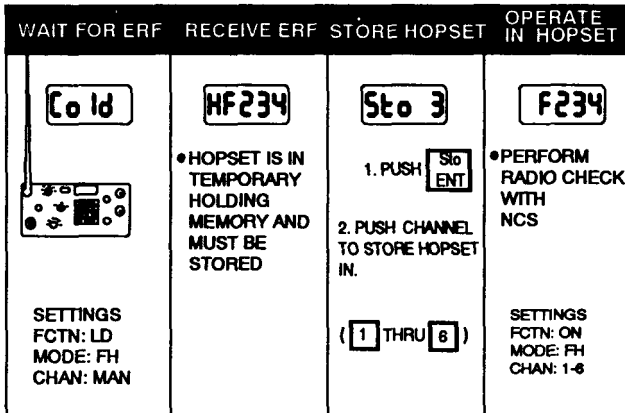


Figure 4-13. Receiving an ERF.

4-4. Improved High Frequency Radio

The IHFR is a modular designed manpack or vehicular mounted radio operating at 2 to 30 MHz. It uses ground- and sky-wave propagation paths for medium- to long-range communications. The primary component of IHFR sets is the RT-1209. It is a single sideband (SSB) radio that operates in either the upper or lower sideband. Depending on the units' mission, the RT-1209 is combined with other components to create manpacked, vehicular, or fixed station radios. The components for the different configurations are relatively small, making the sets lightweight and versatile. IHFR accepts input of voice and data rates up to 2400 bps

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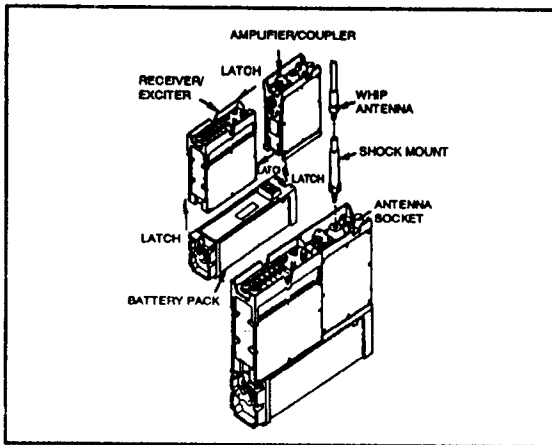
when used with appropriate data modems. IHFR passes highly perishable C² information for medium-to long-range communications (50 to 300 kilometers). Brigade and battalion units primarily use the low-power version. All IHFRs are user-owned and operated. The Near Vertical Incidence Sky Wave (NVIS) Antenna, AS-2259/GR is an issued item with the IHFR's; however the NVIS antenna is interchangeable with the AN/GRA-50 and the whip antenna. The NVIS antenna may be remoted up to 61 meters (200 feet) from the radio set. Table 4-4 shows the IHFR characteristics.

Table 4-4. IHFR characteristics.

● PRIMARY COMPONENTS:	Receiver-Transmitter, RT-1209
● FREQUENCY RANGE:	2 to 29,999 MHz (100 Hz spacing)
● MODES OF OPERATION:	Single sideband (Selectable to upper sideband or lower sideband, voice, data, continuous wave, TTY, and receive-only)
● RF OUTPUT POWER:	20 watts or 100/400 watts (AN/GRC-193 only)
● DATA TRANSMITT RATE:	2400 bps

AN/PRC-104A. This radio set is a low power, lightweight, battery powered, tactical manpack configuration that replaces the AN/PRC-70/74 manpack radios. It weighs about 14 pounds and has automatic antenna tuning. The AN/PRC-104A will provide secure voice communications with the KY-65 or KY-99. See Figure 4-14. Its components are connected by quick-disconnect latches. The radio set consists of—

- Receiver-Transmitter, RT-1209.
- Amplifier/Coupler, AM-6874.
- Battery Case, CY-7875/PRC-104.



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AN/GRC-193A. This radio set is high-powered and can be used in a vehicular or fixed station configuration. See Figure 4-15. IHFR sets perform retransmission for CNR when connected through the AN/VIC-1. Although more complex and bulkier than the other configurations, the AN/GRC-193A having strong output makes it ideal for long-range vehicular communications. The AN/GRC-193A radio is secured with the KY-65. Its components are—

- Receiver-Transmitter, RT-1209.
- Antenna Coupler, CU-2064.
- Amplifier/Converter, AM-6879.
- Power Amplifier, AM-6545A.
- Mounting Base, MT-6232.

AN/GRC-213. This radio set is a vehicular version of the 20 watt AN/PRC-104 radio and can be converted into a manpack configuration. The set includes three antennas: the whip, the doublet, and the NVIS antenna. The AN/GRC-213 will provide secure voice and data communications when used with the KY-65 voice or KY-99. See Figure 4-16. Its components are—

- Receiver-Transmitter, RT-1209.
- Amplifier/Coupler, AM-6874.
- Amplifier/Power Supply, AM-7512.
- Battery Case, CY-7152/PRC-104.
- Vehicular Mount.

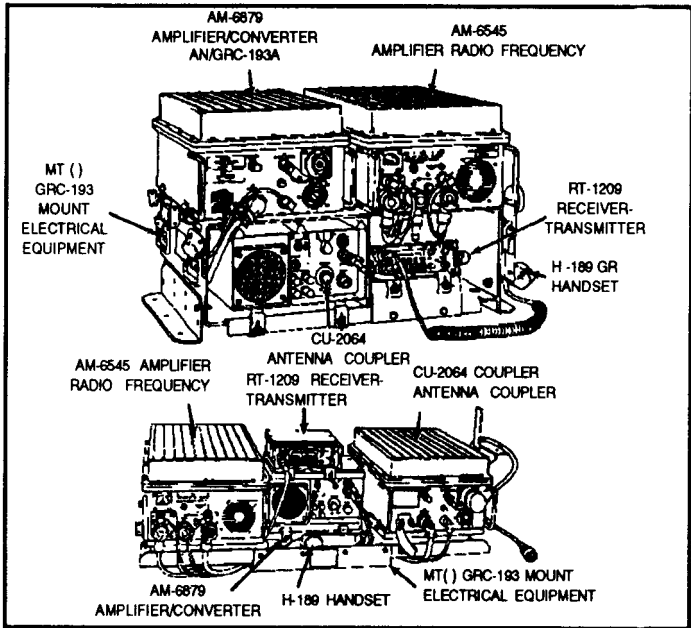


Figure 4-15. Radio set, AN/GRC-193A.

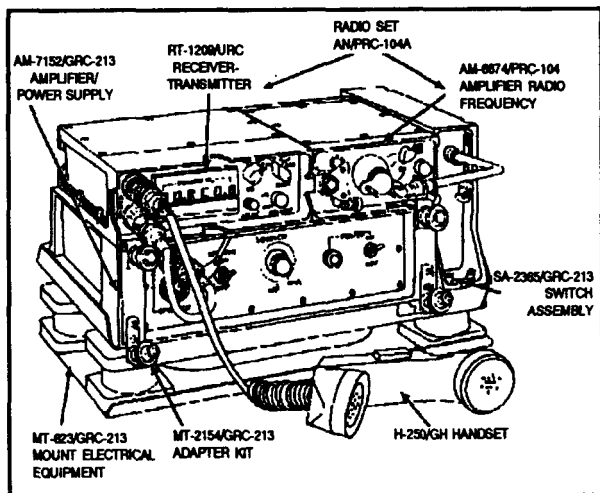


Figure 4-16. Radio set, AN/GRC-213.

4-5. Single-Channel TACSAT System

The current single-channel TACSATs are the AN/URC-101, AN/URC-110, AN/VSC-7, AN/PSC-3, AN/PSC-5, and the AN/PSC-7 (MST-20 plus). These terminals provide reliable, highly portable communications support. They have minimum setup and teardown time and satisfy a need for extended distance communications. The systems operate between 225 to 400 MHz and use fleet satellite (FLTSAT) and Air Force satellite (AFSAT) space segments. The Army terminals using the FLTSAT space segments are the AN/PSC-3, AN/VSC-7, AN/URC-101, and the AN/URC-110.