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Air Force Qualification
Training Package XXXXX-206P
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1 Nov 1999

AN/TSC-107 COMMUNICATIONS CENTRAL (QUICK REACTION PACKAGE)
FAMILIARIZATION HANDBOOK

1. This Air Force Qualification Training Package (AFQTP) was developed to familiarize personnel maintaining or operating the AN/TSC-107. The AFQTP is used by unit training managers, supervisors, trainers, trainees, and other training functions to plan and conduct OJT on the AN/TSC-107.

2. Review Air Force publishing bulletins and AFIND8 to identify other available training materials. Use this AFQTP in conjunction with other applicable Job Qualification Standards (JQS) or the Career Field Education and Training Plan (CFETP) and locally assigned tasks to identify work center duty positions. Also, use this AFQTP along with other applicable JQSs and the CFETP to evaluate newly assigned personnel and identify individual training requirements.

3. Submit recommended AFQTP improvements/corrections to the 81 TRSS/TSQS, 601 D Street, Keesler AFB, MS 39534-2229.

BY ORDER OF THE SECRETARY OF THE AIR FORCE

OFFICIAL

JOHN W. HANDY, Lieutenant General, USAF
Deputy Chief of Staff/Installations and Logistics

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Handbook

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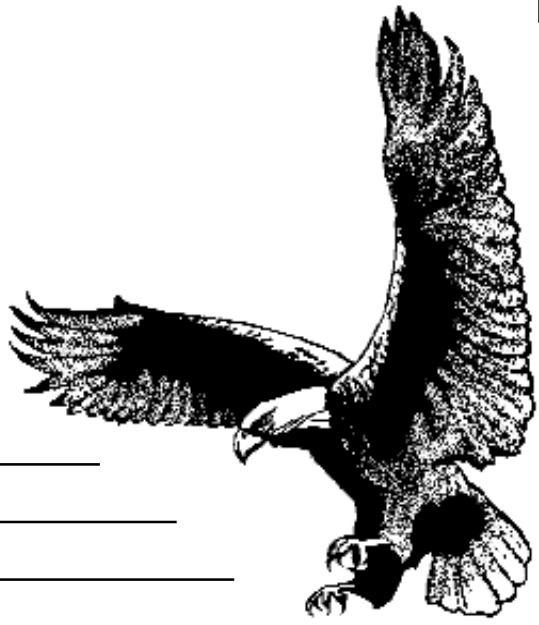
AN/TSC-107 COMMUNICATIONS CENTRAL (QUICK REACTION PACKAGE) FAMILIARIZATION HANDBOOK



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SUPERSEDES AFQTP 304X4-206P
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FOR OJT USE ONLY

AN/TSC-107 COMMUNICATIONS CENTRAL (QUICK REACTION PACKAGE) FAMILIARIZATION HANDBOOK

CONTENTS

PREFACE

This handbook is intended for use by Air Force personnel. It provides information on the AN/TSC-107 Communications Central. It is primarily designed for inexperienced maintenance and operations personnel unfamiliar with the systems and equipment that make up the TSC-107. Trainers familiar with the TSC-107 can use the handbook as a tool to train maintenance, technical control, or operations personnel.

Contents of the handbook are NOT to be used as a basis for inspection or evaluation. This handbook is a specialized publication for familiarization and training purposes only. It is NOT a technical reference.

ABOUT THIS TRAINING PACKAGE

This training package was developed by Team Indigo, 81 TRSS Qualification Training Flight, Keesler AFB, MS. The 272nd Combat Communications Squadron, Oregon Air National Guard, provided photographs. The Training and Education Specialist was Mr. Ray King. It was validated by 272nd Combat Communications Squadron, Oregon Air National Guard; 265 Combat Communications Squadron, Maine Air National Guard; 18th Communications Squadron, Kadena Air Base, Japan; 911th Air Wing Combat Communications Flight, Pittsburgh IAP Air Reserve Station, Pennsylvania; and 94th Combat Communications Flight, Dobbins Air Reserve Base, Georgia. MSgt Ron Coughlin and the team from the 272nd Combat Communications Squadron, Oregon Air National Guard, were consulted as Subject Matter Experts.

For more information on the 81 TRSS Qualification Training Flight and a list of other products that are available, feel free to visit our home page at http://www.keesler.af.mil/81trss/qflight.

CHAPTER 1
INTRODUCTION AND HISTORY

INTRODUCTION

By design, the AN/TSC-107 Communications Central provides minimum essential communications with a quick reaction time. This system is embedded in several different mission packages. Quick Reaction Package (QRP) is a common term used to describe the AN/TSC-107 and is used throughout this handbook.

This handbook is divided into three sections:

- Section A includes Chapters 1 and 2. These two chapters provide background information on the QRP and its evolution. It addresses the various versions currently in use and the differences between them. Tables show what equipment is in each version. Some general operations and maintenance information is included.
- Section B includes Chapters 3 through 9. These chapters have information on the major components or systems used in the QRP and include references to the particular system or equipment technical orders (TO), where applicable.
- Section C includes Chapters 10 through 14. These chapters cover the primary QRP system capabilities and services available to the customers and include signal flow diagrams, where applicable.

The original QRP TO 31R2-2TSC107-1, AN/TSC-107 Communications Central Operations and Maintenance Instructions with Illustrated Parts Breakdown, has not been updated to include the newer versions of the QRP. This presents a special challenge to the trainer and the trainee. This familiarization handbook and the TOs on the subsystems and equipment within the QRP can help bring a confusing picture into focus for the newcomer to the QRP.

HISTORY

The QRP has been in use since the 1980s when it was first delivered to combat communications units. The 1839th Engineering and Installation Group, Operating Location "C" at Robins AFB, GA, built the original QRP vans. Since then, some equipment items were removed and/or replaced. The original SUNAIR series high frequency (HF) equipment was replaced with SUNAIR 9000 series equipment in 1991. A HF pre-selector was also added in 1995.

Since 1995, several initiatives have impacted the configuration of the QRP. At this same time, some equipment items were removed and/or replaced. There are five versions of the QRP: the original van version,

depot modified van version, field modified van version, Pacific Air Forces (PACAF) transit case version, and Air National Guard (ANG) transit case version. Currently, there are 29 QRPs distributed among PACAF, U.S. Air Forces in Europe (USAFE), ANG, and Air Force Reserve Command (AFRC).

SUMMARY

This chapter presented an overview of the handbook sections, a brief history of the QRP, and the QRP configuration. Chapter 2 gives descriptions of the five different versions of the QRP.

ADDITIONAL READING

- TO 31R2-2TSC107-1, AN/TSC-107 Communications Central Operations and Maintenance Instructions with Illustrated Parts Breakdown

KEY WORDS AND PHRASES

- Quick Reaction Package (QRP)
- Original van version
- Depot modified van version
- Field modified van version
- PACAF transit case version
- ANG transit case version

CHAPTER 2
GENERAL DESCRIPTIONS, OPERATIONS, AND MAINTENANCE

ABOUT THIS CHAPTER

This chapter provides a general description of the original van version and the current versions of the QRP. The description of the depot modified van version uses the original version as a baseline. Subsequent version descriptions use the previous described versions as their baselines. Table 2-1 in this chapter shows the systems and equipment within each version of the QRP. Also included is general information on installation and set up of the QRP.

ORIGINAL VAN VERSION

The QRP original van version consists of three main units: a C-30 step van, W-350 support vehicle, and MJQ-18 power trailer. This version contains equipment for the transmission, reception, and processing of voice and data communications.

This QRP is designed for point-to-point and ground-to-air communications in a deployed tactical environment. It is capable of terminating two secure full-duplex data circuits, two secure voice circuits, and three nonsecure Defense Switched Networks (DSN) extended into the Defense Communications System (DCS), when deployed with a Ground Mobile Forces (GMF) satellite or North Atlantic Treaty Organization (NATO) Airbase Satellite Communication (SATCOM) (NABS) terminal. HF Independent Sideband (ISB) radio equipment in the facility provides for two secure full-duplex data circuits, or one secure full-duplex data circuit and one securable voice circuit. A telephone switchboard with subscriber instruments provides telephone service to 25 on-site users.

Nonsecure voice, secure voice, and half-duplex secure data communications with airborne and ground stations are possible using the associated HF Single Sideband (SSB), very high frequency (VHF), and ultra-high frequency (UHF) radios. These same modes are possible through a connected satellite terminal or landlines. The facility includes patching bays, test equipment, message preparation equipment, cryptographic (CRYPTO) devices, antennas and antenna couplers, trailer-mounted dual generators, skid mounted Environmental Control Units (ECU), and a utility support truck.

CURRENT VERSIONS

The current versions of the QRP include two van versions and two transit case versions. They all include equipment for the transmission, reception, and processing of voice and data communications. The following description is from the specific AN/TSC-107 Unit Type Code (UTC) 6KAB8.

The AN/TSC-107 UTC, 6KAB8, provides automatic dial telephone service to 20 on-site customers with five trunk circuits. This includes direct interface (up to three trunks) with DSN, and up to five secure data circuit terminations or eight secure data circuit terminations when deployed with the CGS-100 communications gateway system (ANG units only). It can extend up to two Voice Frequency (VF) circuits or one VF circuit and one Automatic Digital Network (AUTODIN) data circuit with a data rate up to 300 baud within the area of operation or to the DCS, via HF ISB. The QRP can terminate 48 digital/VF channels within the area of operation or to the DCS when deployed with a GMF satellite terminal, Tactical Satellite Support Radio (TSSR), or wideband terminal. Equipment provided for these capabilities includes:

- one RT-9000 HF SSB command and control radio
- one AN/ARC-186 VHF/AM/FM ground-to-air radio
- one AN/ARC-164 UHF/AM ground-to-air radio
- two SB-3614 switchboards
- four each STU-5 signaling and termination units,
- two AN/FCC-100 V6 multiplexers
- five multi-mode MDM-2001 modems
- five AN/UGC-144 communications terminals

Also included are one CGS-100 communications gateway system (ANG units only) and encryption devices (four each KG-84A, four each KG-84C, five each KY-99A, three each KY-68, two each KG-94A, one KL-43D). Additional support equipment includes MEP-003 generators mounted on a M-103 trailer, 3750 ft of 407L cable, maintenance readiness supply point, test equipment, CP308 step van, and one M-889 utility truck. For road mobility, the QRP requires two M-35 trucks (not included in the AN/TSC-107 UTC, 6KAB8). For airlift, a C-130 or larger aircraft is required. Base operating support is not included for living, but two GP-Medium (or equivalent) are required to support maintenance and operations.

Table 2-1 shows the current QRP versions and the major systems and equipment used in these versions.

Table 2-1. Systems and Equipment (See Note 1)

QTY	Item	Depot Modified	Field Modified	PACAF	ANG
1ea	C-30 Step Van	X	X	-	-
1ea	W-350 Support Vehicle 4WD	X	X	X	X
1ea	AN/MJQ-19 Power Unit	X	X	X	X
2ea	A/E 32C-30 Environmental Control Unit	-	X	X	X
2ea	T-9400 HF ISB Exciter	X	X	X	X
3ea	R-9200 HF ISB Receiver	X	X	X	X
3ea	F-9800 HF Pre/Post-Selector	X	X	X	X
2ea	LPA-9600 HF Power Amplifier	X	X	X	X
1ea	CU-9100 HF Coupler	X	X	X	X
1ea	RT-9000 HF SSB Transceiver	X	X	X	X
2ea	RTU-200 Radio Telephone Interface Unit	X	X	X	X
1ea	RCU-9310 Remote Control Unit	X	X	X	X
1ea	CU-9125 HF Coupler	X	X	X	X
2ea	AT-1011 HF Whip Antenna	X	X	X	X
1ea	CTM15J CSA Carry Mast	X	X	X	X
1ea	CSA “Longshot” Tactical Long Range HF Antenna Kit	X	X	X	X
1ea	CSA “Fanlite” HF Theater Range Reconfigurable Antenna	X	X	X	X
2ea	CA-218 Rack Adapter	X	X	X	X
1ea	AN/ARC-186 VHF Transceiver	X	X	X	X
1ea	DC-80 VHF Antenna	-	X	X	X
1ea	AN/ARC-164 UHF Transceiver	X	X	X	X
1ea	DC-190 UHF Antenna	-	X	X	X
2ea	SB-3614/3614A Telephone Switchboard	X	X	X	X
2ea	FTA-28 Telephone Terminal	X	X	X	X
4ea	STU-5 Signal Termination Unit	X	X	X	X
30ea	TA-938 Telephone	X	X	X	X
4ea	TA-838 Telephone	X	X	X	X
6ea	TA-312 Telephone	X	X	X	X
4ea	TA-1042 Telephone	X	X	X	X

Table 2-1. Systems and Equipment (See Note 1) (continued)

QTY	Item	Depot Modified	Field Modified	PACAF	ANG
5ea	AN/UGC-144 Teletypewriter	X	X	X	X
1ea	CGS-100 Communications Gateway System (See Note 2)	X	X	X	X
5ea	MDM-2001 Multimode Modem	X	X	X	X
2ea	AN/FCC-100 Multiplexer	X	X	X	X
5ea	TSEC/KY-99A Advanced Narrowband Digital Voice Terminal	X	X	X	X
2ea	TSEC/KG-94 Trunk Encryption Device	X	X	X	X
4ea	TSEC/KG-84A General Purpose Encryption Device	X	X	X	X
4ea	TSEC/KG-84C General Purpose Encryption Device	X	X	X	X
2ea	HYX-57/TSEC Wireline Adapter	X	X	X	X
3ea	TSEC/KY-68 Digital Secure Voice Terminal	X	X	X	X
6ea	Audio Patch Panel	X	X	X	X
1ea	Red Patch Panel	X	X	-	-
1ea	Black Patch Panel	X	X	-	-

Note 1: All items listed may not be assigned to all mission packages, but may be used in conjunction with, or configured for, use with the QRP.

Note 2: AFRC, PACAF and USAFE do not have the CGS-100.

DEPOT MODIFIED VAN VERSION

In the depot modified van version, the MDM-2001 dual channel, multimode modem replaces the MD-674, MD-1061, MD-1142, and MPC-1000/LCO modems that were in the original van. A computer interface panel was added to connect the provided laptop computer to either the MDM-2001 (for setup procedures) or future control of the SUNAIR radios. A red digital patch panel was added in the operator's compartment to control which teletypewriter is used with which KG-84. A black digital patch panel was added in the equipment (drivers) compartment to patch different KG-84 outputs to alternate modem channel inputs. The radio frequency (RF) and control line patch panel (1A1A1) is new and allows maintenance

personnel to patch around an inoperative exciter or power amplifier. The signal entry panel (2A1) is new. It facilitates seven 407L cable hocks, all RF cables, capability to connect 12 individual wire pairs through use of binding posts and SSB remote control and coupler control connections.

Operator compartment rearrangement better accommodates the operations personnel during deployment. The service window moved from the curbside of the van to the back door. New interconnecting cables were added and unnecessary interconnecting cables removed to facilitate all the changes to this version. Two air conditioning units (located on the rear of the step van) and a separate heating unit (located in the rear of the van) replace the original ECU. Each location that received a depot modified van also received a booklet from depot to assist the maintenance and operations personnel.

FIELD MODIFIED VAN VERSION

The field modified van version has the same basic equipment changes as the depot-modified vans. The operator's compartment is not rearranged. A new ECU is not in this version.

PACIFIC AIR FORCES (PACAF) TRANSIT CASE VERSION

Sixteen molded plastic portable cases house the PACAF transit case version. Figures 2-1 through 2-7 show these portable cases. This version contains the same equipment as the depot modified van version minus the C-30 step van. It still uses the same generator set, but initially requires rewiring the power cable and reconfiguration of the generator. This version does not have a red and a black patch panel. Each location that received a transit case version also received a booklet from depot to assist the maintenance and operations personnel.

CASE #1, HIGH FREQUENCY (HF) INDEPENDENT SIDEBAND (ISB) RECEIVER

Case #1 (Figure 2-1) contains one R-9200 HF receiver, one MDM-2001 modem, and one F-9800 preselector. This case does not directly interface with the technical control facility. The back panel provides DB-25 modem data outputs for each associated communications terminal. No interconnect cable is furnished since it is not known which type terminal will be used. This interconnect cable will be locally fabricated.

This case also has "RCVR OUT" and "MODEM IN" binding posts. Appropriate "jumpers" must be made in the proper combination to interconnect the receiver to the modem.

CASE #2 AND #3, HF ISB EXCITER

Case #2 and #3 (Figure 2-2) contain one T-9400 exciter and one storage drawer each. The back panel on these two cases has connectors for power and signal cables. They also have binding posts for Upper Sideband (USB), Lower Sideband (LSB), and remote key that are paralleled off the signal connector. These cases directly interface with the technical control facility on Patch Panel #1.

CASE #4 AND #5, HF POWER AMPLIFIER

Case #4 and #5 (Figure 2-2) contain one Linear Power Amplifier (LPA)-9600 HF amplifier each. Because of the exciter/LPA control cable, the amplifier must be co-located with the exciters in cases #2 and #3. The antenna system and coupler control cable will connect directly to the back of the amplifiers.

CASE #6, HF SINGLE SIDEBAND (SSB) TRANSCEIVER

Case #6 (Figure 2-3) contains one RT-9000 HF transceiver, one RTU-200 radio telephone interface unit, one KY-65 encryption device, and one phone patch nonsecure voice patch panel. In order to use the phone patch capabilities it is necessary to make three patches on the patch panel. Making these patches disconnects the KY-65 from the transceiver and connects the RTU-200.

This case does not interface with the technical control facility, but still contains remote operation capability. The back panel has connectors for power and remote operation by the RCU-9310 remote control unit on the “a” lines. The “b” audio lines, TX, RX, and remote key are also located on binding posts.

CASE #7, VERY HIGH FREQUENCY (VHF)/ULTRA-HIGH FREQUENCY (UHF) RADIOS

Case #7 (Figure 2-4) contains one AN/ARC-164 UHF transceiver, one AN/ARC-186 VHF transceiver, two KY-57 encryption devices, and two HYX-57 wireline adapters. This case does not interface with the technical control facility. The back panel has a connector for power and two RF antenna cables.

CASE #8 AND #9, HF ISB RECEIVER

Case #8 and #9 (Figure 2-5) contain one R-9200 HF receiver, one F-9800 preselector, and one storage drawer each. The back

panel on each case has connectors for power, signal and RF antenna. They also have binding posts paralleled from the signal connector. These cases interface directly with the technical control facility on patch panel #1.

CASE #10 AND #11, CRYPTO

Case #10 and #11 (Figure 2-5) contain one MDM-2001 modem and two KG-84 encryption devices each. The UGC-144 communication terminal cables connect directly to the back of the KG-84. If the CGS-100 communications gateway system is used, two DB-25 connectors and associated cables are mounted on the back panel to provide data input to the KG-84. The back panel on each case has connectors for power, two CGS-100s, and signal cables. Black data test points and modem audio binding posts are provided. These points can be used to aid in troubleshooting equipment and circuit malfunctions. These cases interface directly with the technical control facility on patch panel #2.

CASE #12, AN/FTA-28

Case #12 (Figure 2-1) contains one AN/FTA-28 telephone terminal and the wiring to accept another AN/FTA-28 if mission requirements dictate its need. The back panel has connectors for power and signal. It also has binding posts paralleled from the signal connector. The case interfaces directly with the technical control facility. FTA-28 #1 appears on patch panel #1, and FTA-28 #2 (if installed) appears on patch panel #2.

CASE #13, STU-5 AND WESCOM EQUIPMENT

Case #13 (Figure 2-6) contains three STU-5 signal termination units and the WESCOM equipment. The back panel contains connectors for power and signal. This case interfaces directly with the technical control facility on patch panel #1 and patch panel #2.

CASE #14, TECHNICAL CONTROL FACILITY

Case #14 (Figure 2-7) contains all necessary equipment to function as the patching and circuit control for all equipment interfaced with it. It contains one transmission test set, six audio amplifiers, six strappable attenuators three 4way-4wire bridges, one Intermediate Distribution Frame (IDF), one 2-channel speaker amplifier, and two 24VDC power supplies. It also has twelve line binding posts (front to back) that are paralleled to patch panel appearances.

The back panel has all necessary connectors for interfacing all the associated transit cases. One panel has five 407L cable hocks (HOCK #1 through HOCK #5) that interface with patch panel locations on the jackfield. Most equipment inputs and outputs are wired directly to the line jacks. The patch panel jacks are internally wired for normal through connectivity. Because of the wiring of this case, initial circuits can be made by patch cord or by cross-connects on the IDF. Chapter 9 provides more information on the patch and test capabilities.

CASE #15, POWER DISTRIBUTION

Case #15 (Figure 2-3) contains the necessary connectors for distributing the incoming 120/208, 3 phase power to its individual transit cases. A voltage and frequency meter provides a means of monitoring generator operation. Each connector on the back panel has its own circuit breaker assigned.

For safety reasons, all associated transit cases must be grounded to this case, and this case must be grounded to the station central ground.

CASE #16, TEST EQUIPMENT/SPARE MODEM

Case #16 (Figure 2-4) contains an additional transmission test set and a TM 506 consisting of an oscilloscope, digital voltmeter, frequency counter, signal generator, and sine wave generator. It also contains a spare MDM-2001 modem. This case, if interfaced with technical control, must be co-located within 10 feet of the technical control facility. Oscilloscope channels 1 and 2 and the transmission test set inputs and outputs appear on the patch panels.

AIR NATIONAL GUARD (ANG) TRANSIT CASE VERSION

The ANG transit case version is also housed in 16 molded plastic portable cases. It contains the same basic QRP equipment. Some equipment locations and configurations may vary slightly from the PACAF transit case version.

Figure 2-1. Case #1 (top)
and Case #12 (bottom)

Figure 2-2. Case #2 or #3 (top)
and #4 or #5 (bottom)

Figure 2-3. Case #6 (top)
and #15 (bottom)

Figure 2-4. Case #16 (top)
and #7 (bottom)

Figure 2-5. Case #8 or #9 (top) and Case #10 or #11 (bottom)

Figure 2-6. Case #13

Figure 2-7. Case #14

INSTALLATION AND SET UP

Installation and set up can vary significantly from unit to unit, site to site, and mission to mission. Operational requirements determine installation of the QRP and can include location of the QRP and associated antennas. The respective TOs or commercial manuals for individual systems and equipment cover installation and grounding requirements. Equipment and systems used may vary. The supported mission(s) determine the circuit requirements.

The original QRP TO covers power up/down with the generator. Power up/down for the transit case versions is site or unit specific depending on operational requirements and electrical distribution equipment. The original QRP TO covers emergency power up/down with the generator. Emergency power up/down for the transit case version is site or unit specific. There may be local safety procedures to become familiar with for any tasks involving power up or power down in normal operations or emergency operations.

The respective TOs or commercial manuals cover preliminary checks on equipment and systems. Technical control personnel normally accomplish circuit checks.

The respective TOs or commercial manuals cover preventive maintenance inspections and troubleshooting on individual systems and equipment.

SUMMARY

The general description of the original van, followed by the current versions and Table 2-1, gives an idea of how these five versions are similar with a few differences. Section B, Major Components, gives more in-depth information on the systems and equipment within the QRP. Chapter 3 covers the wheeled vehicles: the van, support vehicle, and generator.

ADDITIONAL READING

- Upgraded Van Version Booklet from depot covering the depot modified van (received with the depot-modified vans)
- Transit Case Version Booklet from depot covering the PACAF transit case (received with the PACAF Transit Cases)

CHAPTER 3
WHEELED VEHICLES AND ENVIRONMENTAL CONTROL UNIT (ECU)

ABOUT THIS CHAPTER

This chapter provides a brief overview and basic drawings of the C-30 step van and support vehicles. Equipment locations are described and shown in Figures 3-2 through 3-7. These figures use the field modified version. This chapter also includes the AN/MJQ-18 power generation system and the AE32C-30 ECU. Figure 3-1 shows the wheeled vehicles during a typical deployment.

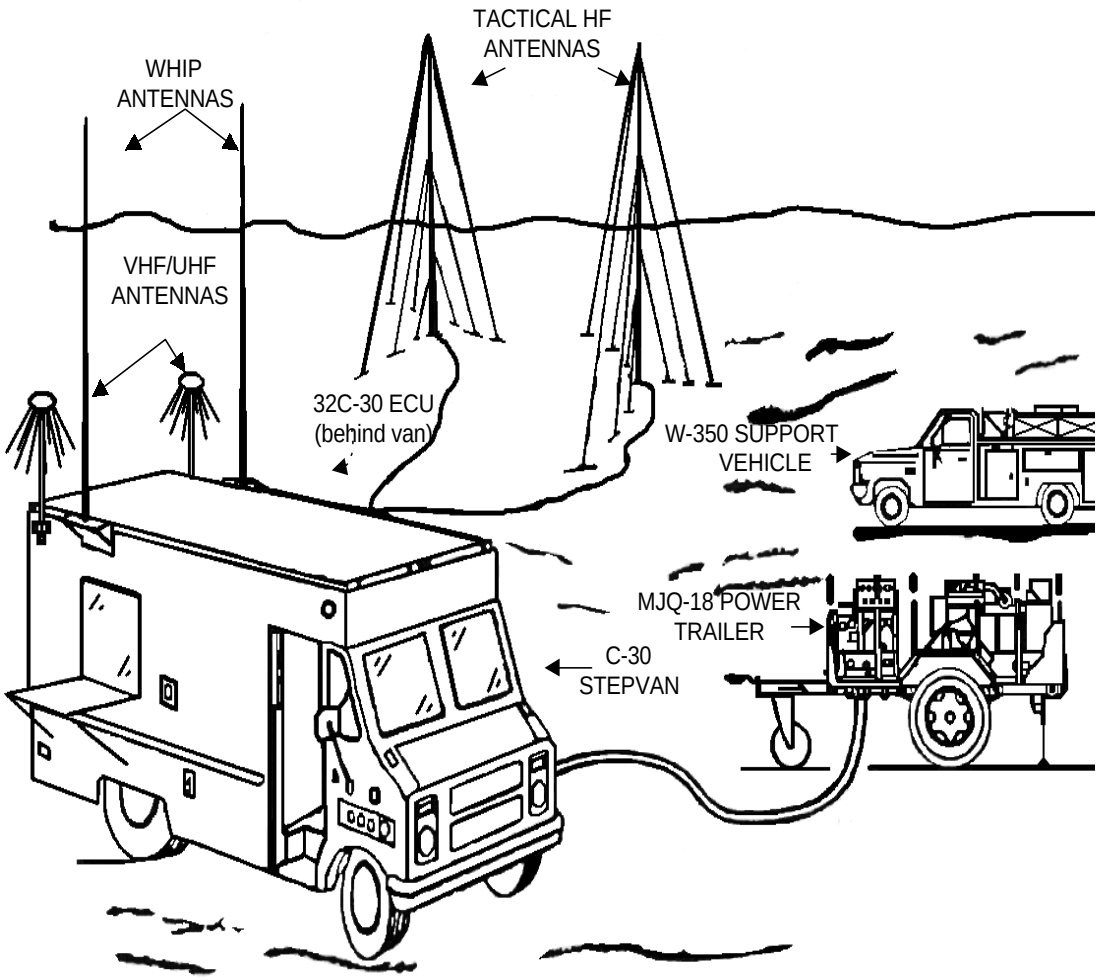
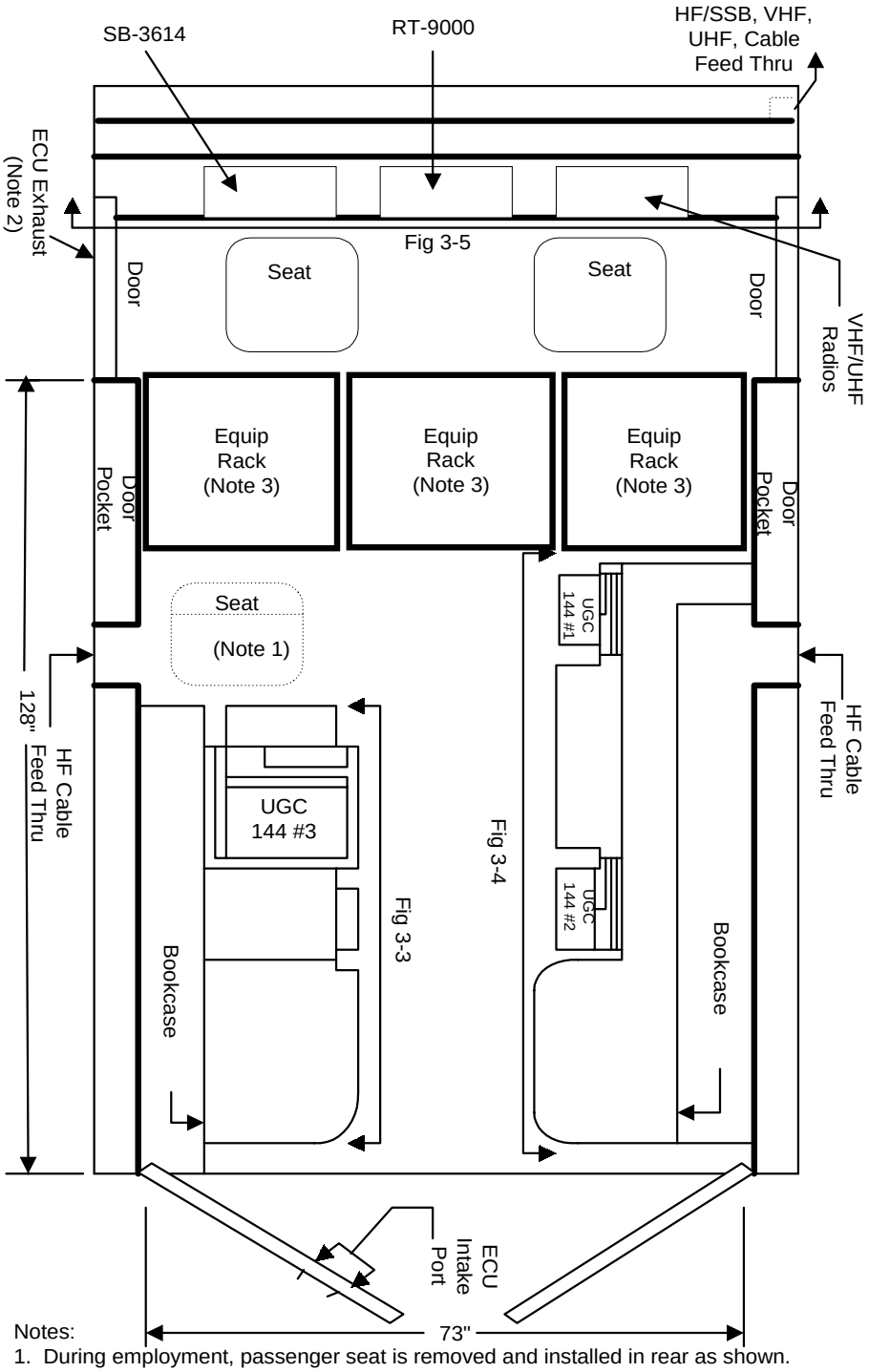


Figure 3-1. AN/TSC-107 Deployed

C-30 STEP VAN

The C-30 step van is used as an equipment shelter. Figure 3-2 shows the top view of the van floor layout.



Notes:
1. During employment, passenger seat is removed and installed in rear as shown.
2. ECU exhaust is via front door window. An adapter plate is required and provided.
3. Racks house HF, Patch and Test, Modems and other misc. equipment.

Figure 3-2. Floor Layout

The power distribution panel, AC voltmeter, frequency meter, C-551 line protectors, and shelf space for data equipment are located inside the rear compartment along the roadside wall (Figure 3-3).

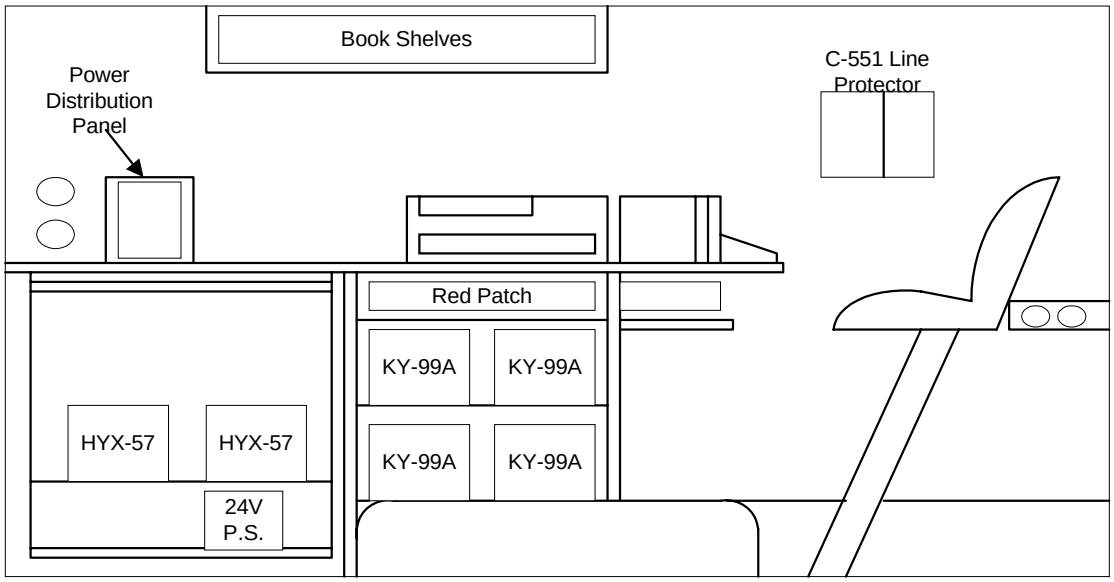


Figure 3-3. Layout of Rear Compartment, Roadside

Additional shelf space and housing for most of the Communications Security (COMSEC) equipment are located inside the rear compartment along the curbside wall (Figure 3-4).

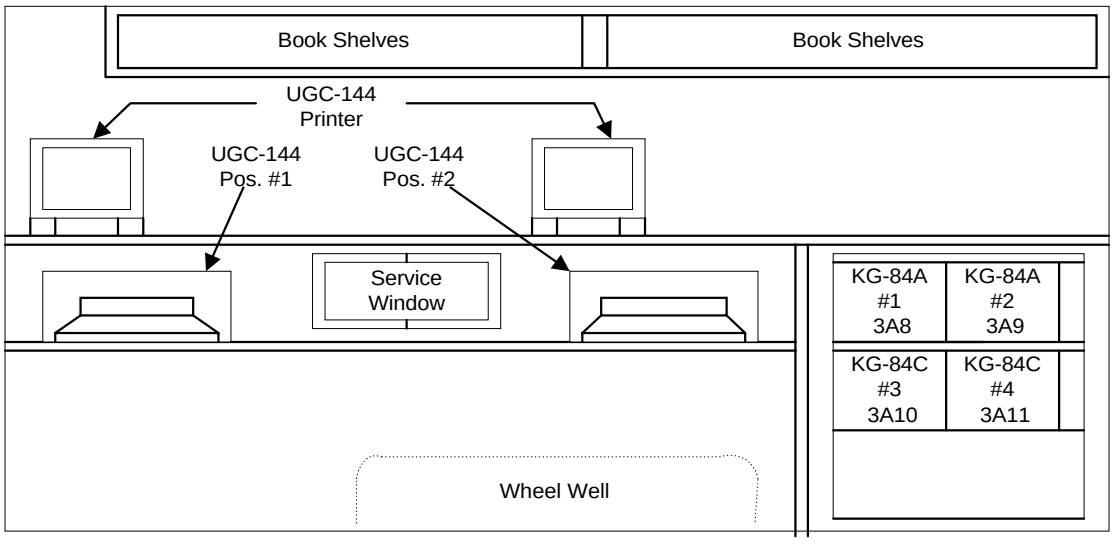


Figure 3-4. Layout of Rear Compartment, Curbside

Blackout curtains are provided for all windows in the front compartment (Figure 3-5). The communications equipment fills the rest of the interior space (discussed in more detail in Chapters 4 through 9).

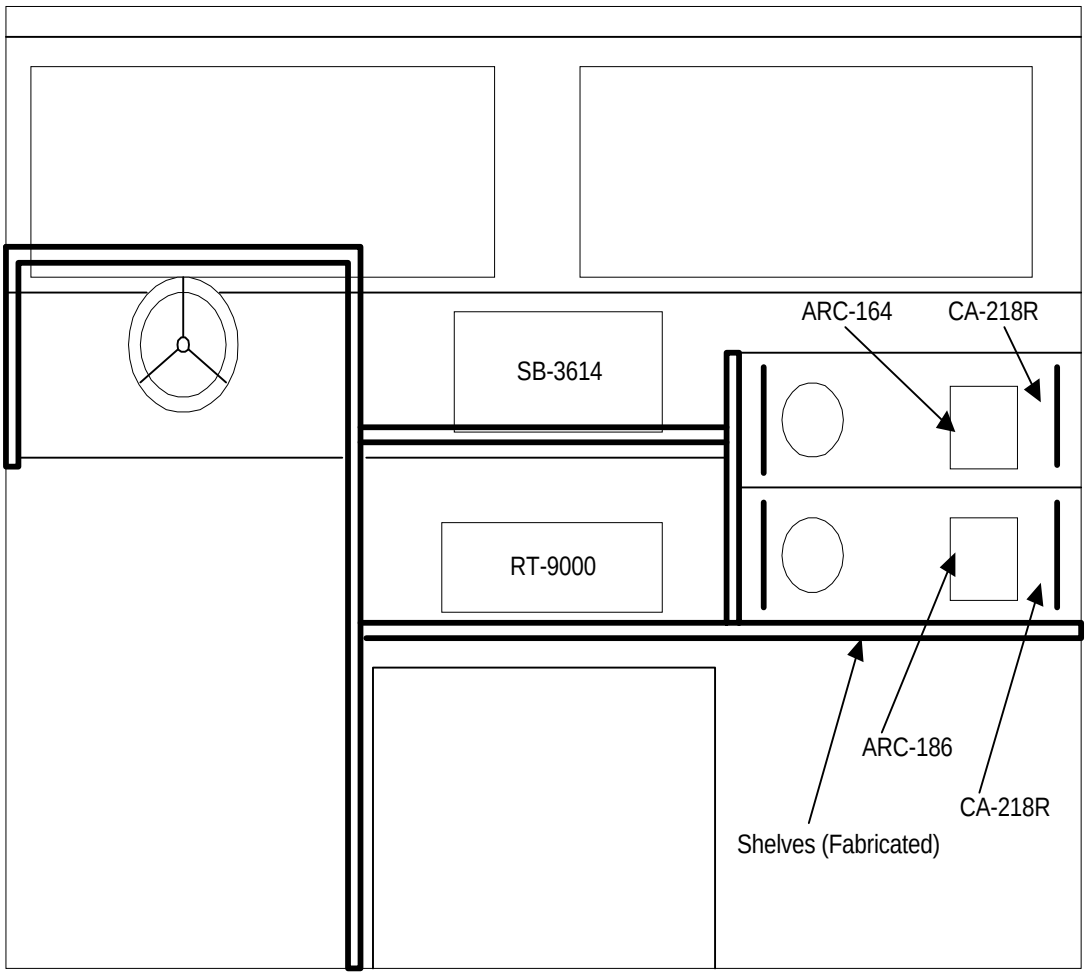


Figure 3-5. Front Compartment Layout

The exterior roadside view (Figure 3-6) has mounts for a VHF/UHF antenna, a HF whip antenna, and the HF ISB antenna coupler. This side also has external connections for power, ground, RF signals, and the 407L cable hocks.

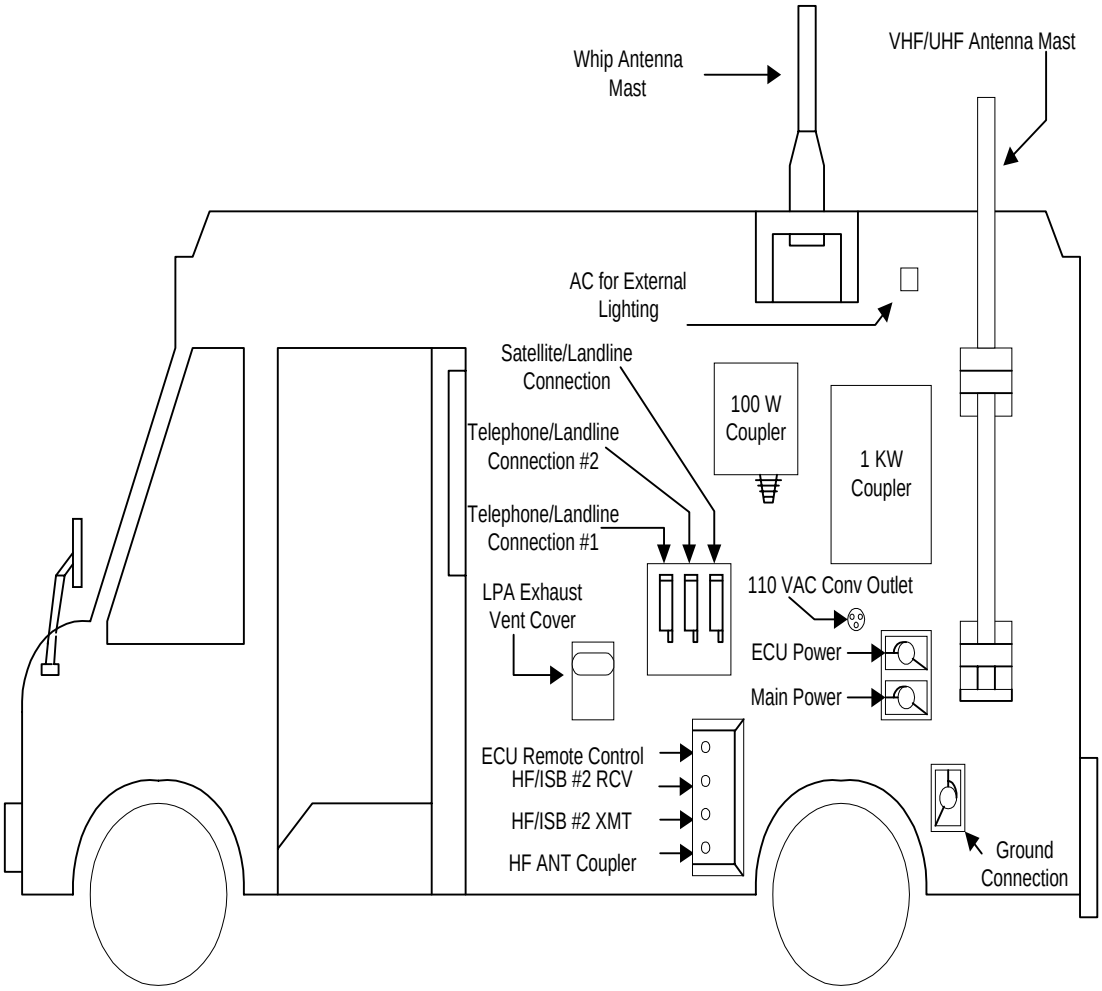


Figure 3-6. Roadside Connections and Entry Ports

The exterior curbside view (Figure 3-7) has RF connections for HF ISB #1, HF ISB #3, UHF, VHF, and the HF SSB transceiver. This side has brackets for mounting the VHF and UHF antennas. Another HF whip antenna may also be mounted on this bracket. There is a sliding window with one-way glass for the pick-up and delivery of messages.

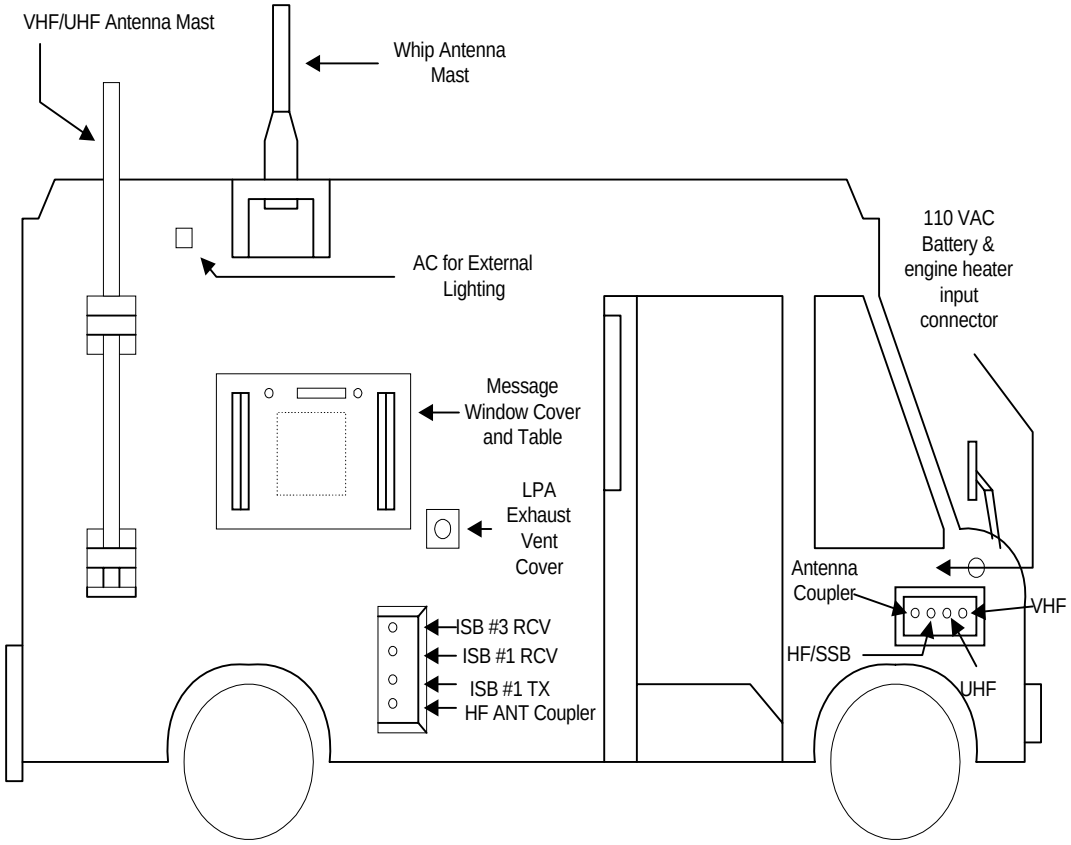


Figure 3-7. Curbside Connections and Entry Ports

W-350 SUPPORT VEHICLE

The W-350 support vehicle is a 4-wheel drive vehicle used to transport and store equipment. The antennas are stored in the vehicle. It also contains the two ECUs.

AN/MJQ-18 POWER GENERATION SYSTEM

The M-103 trailer serves as the power trailer. It contains two MEP-003A generators and a power transfer switch box. The MEP-003A generators each provide 10kW, 60Hz, 120VAC single-phase power.

- TO 35C2-3-455-1, Tactical, Diesel Engine Driven, Generator Set Operation and Maintenance Manual, provides more information on this equipment.
- AFJQS 000X0-213U, Tactical Generator Operation for Non-Power Production Personnel, and AFJQS 3E0X2-214C, MEP-003A Mobile Generator Set, include training on tactical generators and the MEP-003A respectively.

AE32C-30 ENVIRONMENTAL CONTROL UNIT (ECU)

The AE32C-30 ECU provides cooling and heating. The unit is approximately 46”H x 17”W x 20”D and weighs 215 pounds. Two ECUs are transported in the support truck. Only one unit is required at a time; the other is a backup unit. The ECU input duct is connected to the left (roadside) section of the rear door, and the return duct is connected to the driver's door.

- TO 35E9-144-11, AE-32C-30 Operation and Maintenance Manual, provides more information on this equipment.
- AFJQS 3E1X1-214Q, AE32C-30 ECU Maintenance Training Package, includes training on this ECU.

SUMMARY

The brief general descriptions and figures showing equipment locations in the van and its support equipment provide a clearer picture of overall component location. Refer to the figures in this chapter for additional equipment locations referenced later in this package. Chapters 4 through 9 give more in-depth information on the families of equipment within the QRP beginning with the radio systems.

CHAPTER 4
RADIO SYSTEMS

ABOUT THIS CHAPTER

This chapter provides an overview of the three radio systems in the QRP. It begins with the HF radio systems with a distinction made between HF ISB and HF SSB. VHF and UHF radio system descriptions finish out the chapter. Brief descriptions of the components in these systems are included.

HIGH FREQUENCY (HF) RADIO SYSTEM

The SUNAIR Series 9000 HF equipment (Figure 4-1) is a family of equipment with similar operating features between the ISB and SSB radio equipment.

Figure 4-1. SUNAIR Series 9000 HF Equipment (ANG Transit Case Version)

HF INDEPENDENT SIDEBAND (ISB)

The HF ISB equipment provides secure data and voice point-to-point or ground-to-air communication capabilities.

T-9400 DIGITAL HF/ISB EXCITER

The T-9400 is capable of providing communication from 1.6 to 29.99999MHz. It has an output of 125 watts, and the modes of operation include USB, LSB, ISB, Amplitude Modulation Equivalent (AME), and Continuous Wave (CW). Frequency Shift Keying (FSK), Facsimile (FAX), high-speed data, Automatic Request (ARQ), and Forward Error Control (FEC) are available with optional external modems. The T-9400 features include: ISB operation, manual or memory frequency selection in 10Hz steps, 128 programmable channels, AC/DC operation with auto changeover, keyboard entry, and nonvolatile memory using an Electronically Erasable and Programmable Read Only Memory (EEPROM). It also features Built-In Test Equipment (BITE) checks to a Line Replaceable Unit (LRU), computer control, and high-speed data capability.

- TO 31R2-4-1035-1, T-9400 Operation and Maintenance Manual, provides more in-depth information on this exciter.

R-9200 DIGITAL HF/ISB RECEIVER

The R-9200 is capable of providing receive communications from 100 kHz to 29.99999MHz. Modes of operation include USB, LSB, ISB, AME, and CW. FSK, FAX, high-speed data, ARQ, and FEC are available with optional external modems. The R-9200 can be computer or remotely controlled via RS232/422/485/FSK tones. The R-9200 features include: manual or memory frequency selection in 10Hz steps, 128 programmable channels, AC/DC operation with automatic changeover, keyboard entry, and nonvolatile memory using an EEPROM. It also features BITE checks to a LRU, receive scanning computer control, and high-speed data capability.

- TO 31R2-4-1034-1, R-9200 Operation and Maintenance Manual, provides more in-depth information on this receiver.

F-9800 PRE/POST SELECTOR

The F-9800 allows operation of collocated receivers and transmitters communicating on frequencies separated by as little as 10 percent. It provides an additional selectivity stage with a receiver, and it rejects spurious outputs and broadband noise in transmit signals before they reach the power amplifier. The key line does the switching of the pre/post selector to the appropriate mode in SSB. The QRP uses the F-9800 as a pre-selector.

- TM-8110000509, F-9800 Installation and Operation Manual, provides more in-depth information on this pre/post selector.

LPA-9600 SOLID STATE KILOWATT LINEAR POWER AMPLIFIER (LPA)

The LPA-9600 amplifies the low level RF output of the exciter. It produces 1kW peak envelope power or average power. It can also operate in a reduced power mode of 500 watts or a bypass mode of 100 watts. It operates in the range of 1.6 to 30MHz, with a 100 percent duty cycle. The LPA-9600 is microprocessor controlled.

- TO 31R5-4-202-1, LPA-9600 Operation and Maintenance Manual, provides more in-depth information on this amplifier.

CU-9100 DIGITAL AUTOMATIC 1KW ANTENNA COUPLER

The CU-9100 is a 1000-watt high quality remotely controlled antenna coupler capable of matching antennas 35 feet and longer to a 50-ohm transmission line. It operates over the frequency range of 1.6 to 29.9999MHz. It can also be used as a "line flattener" to correct the Voltage Standing Wave Ratio (VSWR) of resonant antennas. The LPA-9600 1kW Amplifier was designed as a companion to the CU-9100. Use of the CU-9100 directly with the 125-watt exciter is possible if the LPA is off-line or for low power operation.

- TO 31R5-4-203-1, CU 9100 Operation and Maintenance Manual, provides more in-depth information on this coupler.

HF SINGLE SIDEBAND (SSB)

HF SSB provides secure or non-secure voice or secure teletypewriter point-to-point or ground-to-air. It also can provide point-to-point or ground-to-air omni-directional command and control communications.

RT-9000 HF/SSB DIGITAL TRANSCEIVER

The RT-9000 is a 125-Watt transceiver capable of providing communications from 1.6 to 29.99999MHz (receive 100kHz to 29.99999MHz). Modes of operation include USB, LSB, AME, and CW. FSK, FAX, high-speed data, ARQ, and FEC are available with optional external modems. A computer or the RCU-9310 remote control unit can control the RT-9000 remotely via RS232/422/485/FSK tones. The RT-9000 features include: simplex or half-duplex operation, manual or memory frequency selection in 10Hz steps, 128 programmable channels, AC/DC operation with auto changeover, keyboard entry, and nonvolatile memory using an EEPROM. It also features BITE checks to a LRU, receive scanning, computer controls, and high-speed data capability.

- TO 31R2-4-1033-1, RT-9000 Operation and Maintenance Manual, provides more in-depth information on this transceiver.

RTU-200 RADIO/TELEPHONE INTERFACE UNIT

The RTU-200 provides trouble-free automatic connection between a radio system and telephone or other two-wire line. It is suited for use with HF, VHF, UHF, or satellite systems and is applicable to full-duplex, half-duplex, or simplex systems. Transmitter keying can be controlled manually from the front panel or by a built-in Voice Operated Transmit (VOX) facility. It uses a unique adaptive hybrid implemented with a digital signal processor. The RTU-200 interfaces with all types of two-wire lines, such as normal dial-up lines, dedicated lines, or twisted-pair field wire. Although the output impedance is 600 ohms, the adaptive hybrid in the unit gives excellent hybrid balance regardless of the impedance of the line connected to the unit.

- TO 31R2-4-1064-1, RTU-200 Operation and Maintenance Manual, provides more in-depth information on this interface unit.

RCU-9310 REMOTE CONTROL UNIT

The RCU-9310 allows an operator at a remote site to access and perform all transceiver primary functions. It also enables the operator to conduct BITE checks to a LRU.

- TO 31R2-4-1065-1, RCU-9310 Operation and Maintenance Manual, provides more in-depth information on this unit.

CU-9125 DIGITAL AUTOMATIC ANTENNA COUPLER

The CU-9125 is a high quality, remotely controlled antenna coupler capable of matching a variety of antennas ranging from 9-ft. whips to 150-ft. long wires over the frequency range of 1.6 to 29.9999MHz. It can also be used as a “line flattener” to correct the VSWR of resonant antennas.

- TO 31R5-4-201-1, CU-9125 Operation and Maintenance Manual, provides more in-depth information on this coupler.

HF ANTENNAS

There is a variety of HF antennas and configurations available for use with the QRP. The mission and operational requirements determine the set up and configuration of the antennas.

- AFJQS 492-212N, Tactical Antennas, deals specifically with tactical antennas. (Upon revision, this AFJQS will be renamed XXXXX-212N Tactical Antennas.)

AT-1011 HF WHIP ANTENNA

The AT-1011is a 9-foot HF whip antenna. It mounts on the van or on an AN/GRA-4 antenna mast.

CTM15 CSA CARRY MAST

The CTM15 series of carry masts are 50-foot portable telescopic masts designed for rapid deployment by one or two people. They are capable of supporting a wide range of antennas in winds up to 90 mph and designed for use under adverse conditions worldwide. The QRP and the AN/TRC-181 use the CTM15J Carry Mast. It includes a comprehensive suite of accessories required for the QRP and the AN/TRC-181 missions.

- TO 31R4-4-95-1, CSA "Carry Mast" CTM15 Operation and Maintenance Instructions, provides more in-depth information on this mast.

CSA "LONGSHOT" TACTICAL LONG RANGE HF ANTENNA KIT

The "Longshot" is a lightweight, transportable HF wire antenna system intended primarily for long range skywave communications. The "Longshot" uses the CTM15J CSA carry mast described in the previous paragraph. This antenna kit comes in two transit bags whose combined weight is less than 70 pounds. A variety of long wire configurations (including a low profile, jam resistant mode) for optimal performance in differing scenarios are available. When erected on the carry mast, two people, in less than 30 minutes, can set up any configuration. The use of a halyard allows easy adjustment of antenna azimuth or configuration changes without need to lower the carry mast.

- TO 31R4-4-96-1, CSA "Longshot" Tactical Long-Range HF Antenna Kit Operation and Maintenance Instructions, provides more in-depth information on this antenna kit.

CSA "FANLITE" HF THEATER RANGE RECONFIGURABLE ANTENNA

The "Fanlite" is a lightweight, transportable HF wire antenna intended primarily for omni-directional skywave communications to a range of about 1,000 miles, including short range Near Vertical Incidence Skywave (NVIS) operation. The "Fanlite" uses the previously described CTM15J CSA carry mast. This antenna kit comes in one transit bag and weighs 42 pounds. Configuration for unidirectional long-range (600 to 2,000 miles) point-to-point communications is an available option. When erected on the carry mast, two people, in less than 30 minutes, can set up any configuration.

- TO 31R4-4-97-1, CSA "Fanlite" HF Theater Range Reconfigurable Antenna Operation and Maintenance Instructions, provides more in-depth information on this antenna.

VERY HIGH FREQUENCY (VHF) RADIO SYSTEM

The VHF radio system provides remotable ground-to-air wideband secure voice. The system uses an AN/ARC-186 transceiver, CA-218 rack adapter, and DC-80 antenna.

AN/ARC-186 VHF AM/FM RADIO

The AN/ARC-186 provides normal and secure voice communication capability in the AM and FM bands. The AM band covers 108.00MHz to 151.975MHz range. Reception is only available in the 108.00MHz to 115.975MHz range. The FM band covers the frequencies of 30.00MHz to 87.975MHz. Radio relay, automatic direction finding in the AM band, and homing in the FM band are available. Twenty channels may be preset in addition to the preset AM and FM guard frequencies. Either wideband or narrowband operation is available.

- TO 12R2-2ARC-186-2, AN/ARC-186 Maintenance Instructions, provides more in-depth information on this radio.

CA-218R RACK ADAPTER

The CA-218R houses the panel mounted radio set. It provides a local/remote selection switch, power on/off switch, microphone jack, telephone jack, and a speaker on the front side of the rack adapter. The rear of the rack adapter provides access to antenna connections, DC power, remote control (J4), and signal, keying, and control lines.

- TO 31R2-2TSC107-1, AN/TSC-107 Communications Central, contains wiring information on this adapter.
- The Magnavox Operations Manual for Model CA-218R, Fixed Ground Station Adapter, includes theory and troubleshooting information.

DC-80 VHF DISC-CONE ANTENNA

The DC-80 antenna is a rugged lightweight and waterproof antenna. It has high reliability in broadband transmitting or receiving applications. The DC-80 radiates an omni-directional pattern in the horizontal plane and provides versatile, wide frequency coverage. It is particularly effective for short-range surveillance and ground-to-air communication. This antenna uses the AN/GRA-4 antenna mast or can mount on an AB-1089/U tripod.

- The DC-80 commercial manual provides more in-depth information on this antenna.

ULTRA-HIGH FREQUENCY (UHF) RADIO SYSTEM

The UHF radio system provides remotable ground-to-air wideband secure voice or narrowband voice for radiotelephone or secure data FSK. The

UHF radio system uses an AN/ARC-164 Transceiver, CA-218 rack adapter, and DC-190 antenna.

HAVE QUICK II AN/ARC-164 UHF RADIO

The HAVE QUICK II AN/ARC-164 is designed to provide normal and jam-resistant (anti-jam or AJ) voice communications in the 225.00MHz to 399.975MHz UHF military band on 7000 separate channels. This includes a 7000 channel tunable receiver, an auxiliary guard receiver (nominally 243.00MHz), and a 7000 channel, 10 watt carrier transmitter for normal AM voice and AJ mode communications. In a jamming environment, the AJ mode enables the radio set to operate with other radios that are similarly equipped with the HAVE QUICK AJ capability.

- TOs 12R2-2ARC-164-91 and 12R2-2ARC-164-92, HAVE QUICK II AN/ARC-164 Operation Instructions and Maintenance Instructions, provide more in-depth information on this radio set.

CA-218R RACK ADAPTER

The ARC-164 uses the same CA-218R rack adapter previously described.

DC-190 ANTENNA

The DC-190 antenna is a rugged, lightweight, and waterproof antenna. It has high reliability in broadband transmitting or receiving applications. The DC-190 radiates an omni-directional pattern in the horizontal plane and provides versatile, wide frequency coverage. It is particularly effective for short-range surveillance and ground-to-air communication. This antenna uses the AN/GRA-4 antenna mast or can mount on an AB-1089/U tripod.

- The DC-190 commercial manual provides more in-depth information on this antenna.

SUMMARY

The descriptions of the HF ISB, HF SSB, VHF and UHF radio system components provide a background for understanding how this equipment fits into the overall communications capabilities and services of the QRP. Most of these capabilities and services use the radio systems covered in this chapter. Section C (Chapters 10 through 14) covers the system capabilities and services.

ADDITIONAL READING

- TO 31R2-4-1035-1, T-9400 Operation and Maintenance Manual
- TO 31R2-4-1034-1, R-9200 Operation and Maintenance Manual
- TM-8110000509, F-9800 Installation and Operation Manual
- TO 31R5-4-202-1, LPA-9600 Operation and Maintenance Manual

- TO 31R5-4-203-1, CU 9100 Operation and Maintenance Manual
- TO 31R2-4-1033-1, RT-9000 Operation and Maintenance Manual
- TO 31R2-4-1064-1, RTU-200 Operation and Maintenance Manual
- TO 31R2-4-1065-1, RCU-9310 Operation and Maintenance Manual
- TO 31R5-4-201-1, CU-9125 Operation and Maintenance Manual
- TO 31R4-4-95-1, CSA “Carry Mast” CTM15 Operation and Maintenance Instructions
- TO 31R4-4-96-1, CSA “Longshot” Tactical Long-Range HF Antenna Kit Operation and Maintenance Instructions
- TO 31R4-4-97-1, CSA “Fanlite” HF Theater Range Reconfigurable Antenna Operation and Maintenance Instructions
- TO 12R2-2ARC-186-2, AN/ARC-186 Maintenance Instructions
- TO 31R2-2TSC107-1, AN/TSC-107 Communications Central Operations and Maintenance Instructions with Illustrated Parts Breakdown
- Magnavox Operations Manual for Model CA-218R, Fixed Ground Station Adapter
- DC-80 Antenna Commercial Manual
- TO 12R2-2ARC-164-91, HAVE QUICK II AN/ARC-164 Operation Instructions
- TO 12R2-2ARC-164-92, HAVE QUICK II AN/ARC-164 Maintenance Instructions
- DC-190 Antenna Commercial Manual

CHAPTER 5
VOICE SYSTEMS

ABOUT THIS CHAPTER

This chapter provides an overview of the systems used for voice communications in the QRP. It covers the telephone switchboard, interfacing and terminating equipment descriptions, and several telephones commonly used with the QRP.

SB-3614(V)TT AND 3614A(V)TT TELEPHONE SWITCHBOARDS

The switchboard is the heart of the voice system. The SB-3614 is the analog switchboard used in the QRP. These switchboards are 30-line tactical units that provide line termination, signal sources, matrix switching, control, power, and necessary operator functions. The SB-3614 and 3614A offer a variety of services. The use and placement of five or seven different types of terminal cards determine the particular service offered. The SB-3614(V)TT can contain five types of termination cards, Type I through Type V. The SB-3614A(V)TT can contain seven types of termination cards, Type I through Type VI, and Type XI.

Terminal Card Type	Circuits per Card	Termination Modes
Type I	2 of any combination	2-wire 20 Hz ringdown line, 2-wire 20 Hz ringdown truck, or 2-wire Common Battery Supervision (CBS) line
Type II	2 of any combination	2-wire Common Battery (CB) dial-pulse line, 2-wire CB Dual Tone Multi-frequency (DTMF) line, or 2 wire CBS line
Type III	2 of any combination	4-wire tone-signaling converter trunk or Public Access Branch Exchange (PABX) 4-wire 3-digit manual tone-burst trunk
Type IV	2	6-wire E&M lead (Dial pulse (DP) or DTMF) line/trunk
Type V	2	2-wire DC closure (DP or DTMF) trunk
Type VI	2 of any combination	4-wire, DTMF confirmation trunk, tone-burst trunk, or converter trunk
Type XI	2	4-wire single-frequency signaling DSN interface line

There are 15 terminal card locations within each SB-3614 or 3614A. Each terminal card supports two circuits, which gives a 30-circuit capability with only 15 cards. The only restriction for placement of these cards is reservation of the first six cards (first 12 circuits) for 2-wire circuits. The

SB-3614 may require programming to assign trunk group or trunk terminal numbers, precedence level, operator intercept, or special classmarks. (NOTE: Special classmarks give specific operational modes of certain terminal cards that are not otherwise obtainable.) The 4X4 keysender and the program switch program the switchboard microprocessor. Other than the termination card differences, these two models are the same.

- TO 31W2-2TT-21, SB3614(V)TT Telephone Switchboard Operator's and Organizational Maintenance Manual, and TO 31W2-2TT-72, SB-3614A(V)TT Telephone Switchboard Maintenance Manual, provide more information on these switchboards and the types of termination cards.

AN/FTA-28 TELEPHONE TERMINAL

The AN/FTA-28 is capable of connecting a four-wire, full-duplex radio or landline voice circuit into a two- or four-wire telephone line. It interfaces with either automatic or manual telephone switching facilities. The FTA-28 provides a wide range of signaling options and may use either voice or tone control for send and receive functions. It has facilities for either local or remote control of ringdown signals for the radio and telephone voice circuits. It also incorporates adjustable level setting and noise-reducing amplifiers. The level setting amplifiers have an adjustment to produce the desired output level and will maintain that level for a wide range of input signal levels. This counteracts the effects of radio-link fades. The FTA-28 continuously monitors the HF radio-link status by using the tone control feature. It may require strapping changes to meet operational requirements for each deployment. In the QRP, the FTA-28 can interface the switchboard and the HF ISB radio system, although the RTU-200 Radio/Telephone Interface unit is most commonly used to provide this interface.

- TO 31W1-2FTA28-1, AN/FTA-28 Telephone Terminal, Operation and Maintenance Manual, provides more in-depth information on this unit.

STU-5 SIGNALING AND TERMINATING UNIT

The STU-5 provides capability to convert various types of audio telephone ringing and DC supervision to a tone on/off type of signaling. It interfaces various tactical field telephones and/or fixed 2-wire or 4-wire telephone equipment with standard 4-wire VF channels. Use of easily accessible circuit card jumpers can select or change options and modes in the field. In the QRP, the STU-5 interfaces with the switchboard or with individual telephone circuits. The STU-5 can operate as a stand-alone unit or mount in a 19-inch rack adapter, DNE P/N 90281164-000. The rack adapter can accommodate four STU-5 units.

The CV-4254 telegraph-telephone signal converter can also be used. The CV-4254, commonly called a MCE (modular control equipment) interface box (MIB), houses four STU-5 units. It also contains four echo canceller modules, a jack panel containing twenty-eight pre-wired telephone jacks, and a user termination panel containing 20 pairs of spring loaded binding posts with lightning arrestors. It mounts in a standard 19-inch rack.

- TO 31W2-4-422-1, STU-5 Signal and Terminating Unit, Operation and Maintenance Manual, provides more in-depth information on these units.

TA-838G/TT TELEPHONE AND TA-938G/TT TELEPHONE

The TA-838 is a 2- or 4-wire CB telephone set. The TA-938 is a 2-wire DTMF telephone set.

TA-1042A/U DIGITAL NON-SECURE VOICE TERMINAL (DNVT) WITH DIGITAL DATA PORT

The TA-1042 is a ruggedized field telephone. Voice communication is accomplished through the handset, and digital data from an external device interfaces through the digital data port at a rate of 16 or 32kbps. The digital data port allows a UGC-144 communications terminal or an AN/UXC-7 lightweight digital FAX machine to be connected to it.

- TO 31W1-2U-1461, Digital Non-Secure Voice Terminal with Digital Data Port TA-1042A/U Operation and Maintenance Instructions, contains cabling and other information on this terminal.

TSEC/KY-68 DIGITAL SECURE VOICE TERMINAL

Information on this telephone terminal can be found in Chapter 8.

SUMMARY

The descriptions of the systems used for voice communications provide a background for understanding how this equipment fits into the overall communications capabilities and services of the QRP. Section C (Chapters 10 through 14) covers the system capabilities and services. The voice communications capabilities and services use a variety of the systems covered in this chapter.

ADDITIONAL READING

- TO 31W2-2TT-21, SB-3614(V)TT Telephone Switchboard Operator's and Organizational Maintenance Manual
- TO 31W2-2TT-72, SB-3614A(V)TT Telephone Switchboard Maintenance Manual
- TO 31W1-2FTA28-1, AN/FTA-28 Telephone Terminal, Operation and Maintenance Manual

- TO 31W2-4-422-1, STU-5 Signal and Terminating Unit, Operation and Maintenance Manual
- TO 31W1-2U-1461, Digital Non-Secure Voice Terminal with Digital Data Port TA-1042A/U Operation and Maintenance Instructions

CHAPTER 6
DATA SYSTEMS

ABOUT THIS CHAPTER

This chapter provides an overview of the systems used for data communications in the QRP. It covers the teletypewriter terminal and the new communications gateway system.

AN/UGC-144 COMMUNICATIONS TERMINAL

The AN/UGC-144 is a transportable digital terminal with an automated message composing and storage capability to simplify message handling. It can provide access to AUTODIN. The terminal consists of the terminal assembly and printer. Operators can prepare, transmit or receive messages. Capabilities exist to edit, store, and print messages. The printer is an ink jet printer that uses a disposable print head. The printer case also carries a supply of fan-fold paper for printing.

- TO 31W4-2UGC144-1, AN/UGC-144 Communications Terminal Operator's and Unit Maintenance Manual, provides more information on this equipment.
- AFJQS 2E3X1-208X, AN/UGC-144 Communications Terminal, deals specifically with this equipment.

CGS-100 COMMUNICATIONS GATEWAY SYSTEM

The CGS-100 is a small, lightweight, state-of-the-art multifunction communication system that provides flexible deployment options to meet specific mission requirements for the QRP. It is also used in the AN/TYQ-66 Stand Alone Message Processing System (STAMPS) and in the Theater Deployable Communications (TDC) Package. It interoperates with multiple communications and command and control systems, serves as a bridge between diverse communication networks, and provides store and forward message switching and routing. The CGS-100 multipurpose interface capabilities allow transfer of time sensitive tactical and strategic information between rear and forward deployed areas.

The CGS-100 provides necessary protocols and formats to interface with a variety of Tactical Air Control Systems (TACS) and Tri-Service Tactical (TRI-TAC) equipment. It provides the necessary interfaces to support the Air Force Forces (AFFOR) and related Air Operations Centers (AOC), Air Support Operations Centers (ASOC), Control and Reporting Centers (CRC), and the Tactical Air Bases (TAB) of the TACS.

The CGS-100 is interoperable with the DCS and application specific circuits such as Fleet Broadcast. It is also interoperable with the Defense Data Network (DDN), including Mobile Subscriber Equipment (MSE). It

also has the capability to interface with the X.25 Defense Secure Networks. It is compatible with both current and emerging communications systems and standards. Figure 6-1 shows some operational interfaces with the message and packet switch communities and local and backside terminals (refer to key words and phrases at end of chapter). The CGS-100 can interface secure or nonsecure circuits but cannot interface both simultaneously. When the mission requires both secure and nonsecure interface, two CGS-100s are required. Figure 6-2 shows equipment interface options for the QRP.

- TO 31R2-4-1619-1, CGS-100 Communications Gateway System Operation and Maintenance Manual; TO 31S5-2TYQ66-1, Communications Control Set, Operation and Maintenance Manual; and TO 31S5-2TYQ66-2, STAMPS CGS-100 Maintenance Manual, provide more in-depth information on this system.

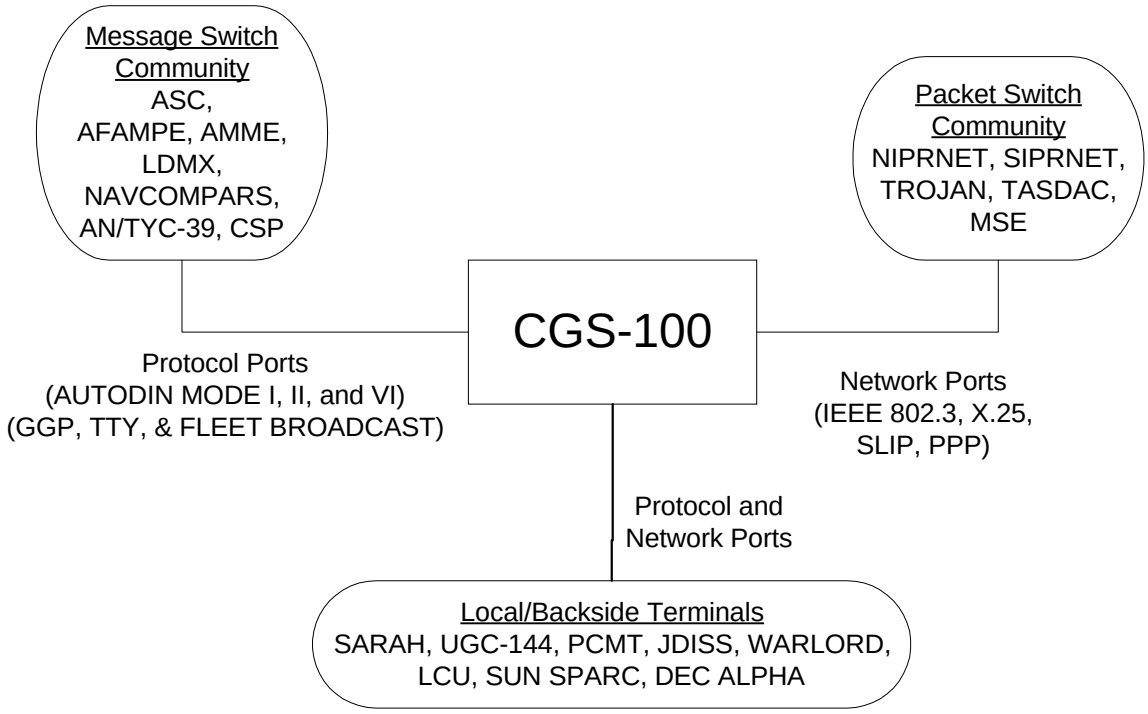


Figure 6-1. CGS-100 Operational Interfaces

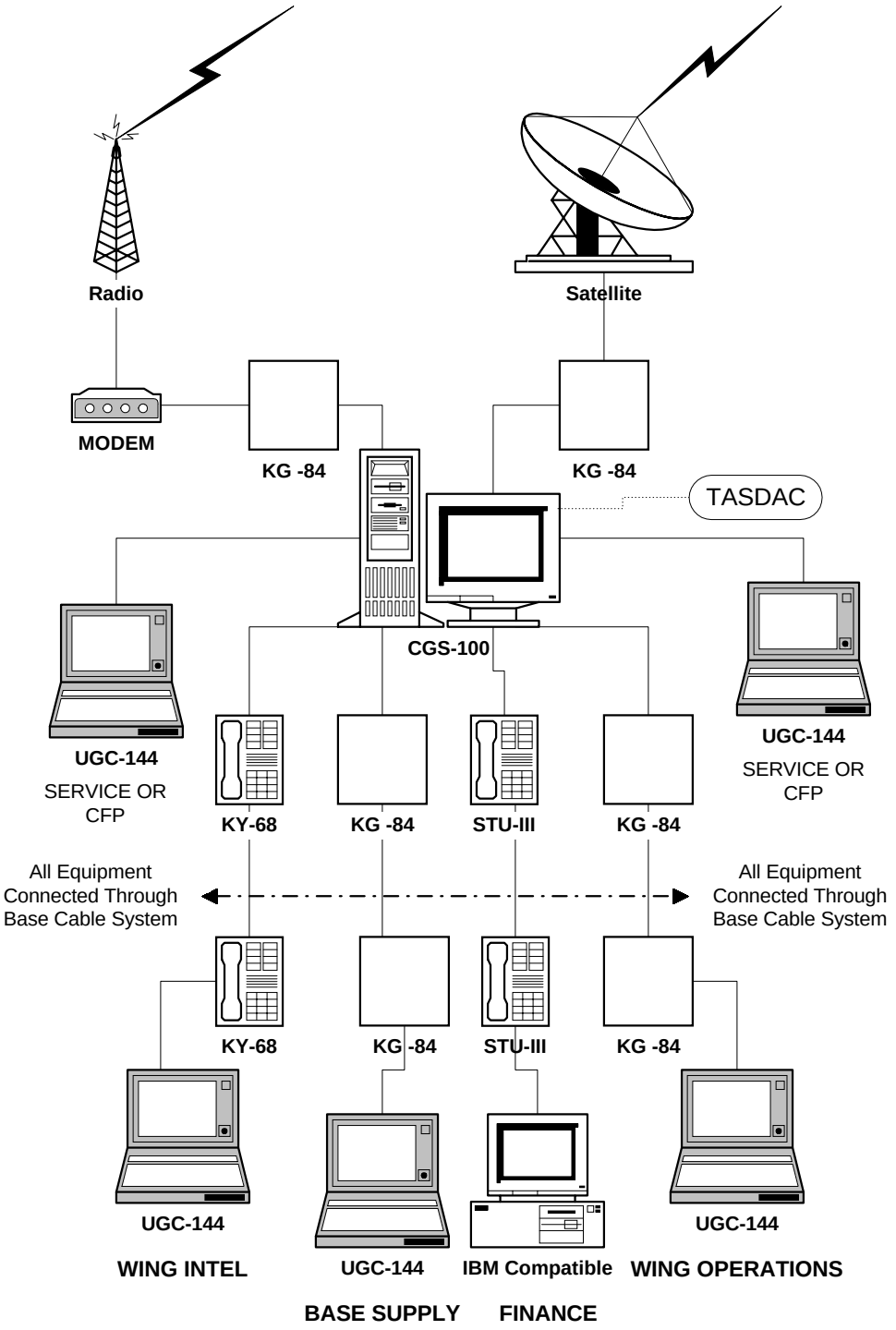


Figure 6-2. CGS-100 Equipment Interface Options for the QRP

SUMMARY

The descriptions of the systems used for data communications provide a background for understanding how this equipment fits into the overall communications capabilities and services of the QRP. Section C (Chapters 10 through 14) covers the system capabilities and services. The data communications capabilities and services use one of the systems covered in this chapter.

ADDITIONAL READING

- TO 31W4-2UGC144-1, AN/UGC-144 Communications Terminal Operator's and Unit Maintenance Manual
- TO 31R2-4-1619-1, CGS-100 Communications Gateway System Operation and Maintenance Manual
- TO 31S5-2TYQ66-1, Communications Control Set, Operation and Maintenance Manual
- TO 31S5-2TYQ66-2, Stand Alone Message Processing System CGS-100 Maintenance Manual

KEY WORDS AND PHRASES

The following acronyms and definitions are from Figure 6-1.

MESSAGE SWITCH COMMUNITY

- ASC--AUTODIN Switching Center
- AFAMPE--Air Force Automated Message Processing Exchange
- AMME--Army Automated Multimedia Exchange
- AN/TYC-39--Tactical Message Switch
- CSP--Communications Support Processor
- LDMX--Local Digital Message Exchange
- NAVCOMPARS--Naval Communications Processing and Routing System

PACKET SWITCH COMMUNITY

- SIPRNET--Secret Internet Protocol Router Network
- NIPRNET--Nonclassified Internet Protocol Router Network
- TROJAN--An Army Data Network

CHAPTER 7
MODEM AND MULTIPLEXER

ABOUT THIS CHAPTER

This chapter provides an overview of the modem and multiplexer used with the QRP.

MDM-2001 HF MODEM

The MDM-2001 is a dual channel, multimode modem. It works with a variety of digital data terminal equipment, encryption equipment, and radio equipment, which allows digital communications in a broad range of adverse conditions. The modem provides on-the-air compatibility with 14 different modems, to include emerging high-performance waveform standards and a variety of HF modems in current inventories. It is capable of operating simultaneously as two independent full-duplex modems in 11 of 14 major modes. The modem is controlled by Disk Operating System (DOS) oriented software provided with the modem. This software allows any IBM compatible computer to be used as a modem controller. DOS versions of 3.2 or higher are required. The MDM-2001 replaces the original five modems in the QRP completely.

- TO 31R2-4-1411-1, MDM-2001 HF Modem Operation and Maintenance, provides more in-depth information on this modem.

AN/FCC-100(V)6 OR (V)7 MULTIPLEXER

AN/FCC-100(V)6 or (V)7 is a Low-Speed Time Division Multiplexer (LSTDM) with full-duplex transmit and receive capabilities. It is capable of both sending and receiving data, voice, and signaling information in the form of a single Mission Bit Stream (MBS) called the aggregate. The aggregate is capable of handling up to 16 separate channels. Time division multiplexing places all channels onto a single synchronous aggregate. Selection of interchangeable plug-in port modules determines the individual channels. Selection of interchangeable plug-in aggregate modules determines the aggregate. After selecting, the operator can configure the port and aggregate modules. They operate at speeds up to 256kbs and provide 16 ports capable of handling any mix of synchronous, asynchronous and isochronous (transitional encoded) diphase data transmissions. The user's site configures the FCC-100 to specific communication system requirements. Downline loading capability permits an operator to configure or reconfigure a remote unit from a centrally situated unit. The configured unit is capable of performing multiplexing, demultiplexing, timing, control, synchronization, framing, monitoring, and alarm reporting. A highly accurate internal oscillator or an external timing source provides timing for the FCC-100.

- TO 31W1-2FCC100-11-2, AN/FCC-100(V)3X, 5, and 6 Multiplexer Sets Operator's Organization, and Direct Support, Maintenance Manual, and booklets received with the OB-119/FCC-100(V)7 upgrade provide more information on this equipment.
- AFJQS 2E1X1-201V covers training on versions 1, 1X, 2, 2X, and 4. AFJQS 2E1X1-204V is the AF Form 797 only for the (V)7.

SUMMARY

The descriptions of the modem and multiplexer provide a background for understanding how this equipment fits into the overall communications capabilities and services of the QRP. Section C (Chapters 10 through 14) covers the system capabilities and services. Most of these capabilities and services use a modem or multiplexer covered in this chapter.

ADDITIONAL READING

- TO 31R2-4-1411-1, MDM-2001 HF Modem Operation and Maintenance
- TO 31W1-2FCC100-11-2, AN/FCC-100(V)3X, 5, and 6 Multiplexer Sets Operator's Organization, and Direct Support, Maintenance Manual
- OB-119/FCC-100(V)7 Upgrade Booklet

CHAPTER 8
SECURE SYSTEMS

ABOUT THIS CHAPTER

This chapter provides an overview of the secure systems used with the QRP. It includes descriptions of the encryption devices necessary for secure voice and data transmissions.

TSEC/KY-99A ADVANCED NARROWBAND DIGITAL VOICE TERMINAL

The KY-99A is a lightweight, battery-powered, tactical manpack terminal that provides secure, half-duplex voice or data communication over narrowband (2.4kbps) radio or wireline facilities. It also provides secure voice or data communication over wideband (16kbps) radio channels and is interoperable with KY-57 VINSON/SINCGARS equipment. Interconnect cables are not provided with the KY-99A and must be locally fabricated.

- LLM-9B, Limited Maintenance Manual for the TSEC/KY-99 and TSEC/KY-99A provides more in-depth information on this encryption device.

TSEC/KG-94 TRUNK ENCRYPTION DEVICE

The KG-94 and 94A are trunk encryption devices that perform bulk digital data encryption and decryption at rates from 9.6kbps to 13Mbps in full-duplex, synchronous operation. They employ identical key generators for transmission and reception.

- KAM-456A/TSEC, Limited Maintenance Manual for the TSEC/KG-94/94A, provides more in-depth information on this encryption device.

TSEC/KG-84A GENERAL PURPOSE ENCRYPTION DEVICE

The KG-84A provides for encryption/decryption of teletypewriter and digital data traffic on dedicated links over HF, wireline, or satellite terminals. Normal operation is full-duplex, but the KG-84A can operate in half-duplex or simplex modes, either point-to-point or netted.

- LLM-5A, Limited Maintenance Manual for the TSEC/KG-84A, provides more in-depth information on this encryption device.

TSEC/KG-84C GENERAL PURPOSE ENCRYPTION DEVICE

The KG-84C provides for encryption/decryption of teletypewriter and digital data traffic on dedicated links over HF, wireline, or satellite

terminals. Normal operation is full-duplex, but the KG-84C can operate in half-duplex or simplex modes, either point-to-point or netted. The main difference in the 84C versus the 84A is it has an update counter built in and numerous strapping options.

- LLM-2A, Limited Maintenance Manual for the TSEC/KG-84C, provides more in-depth information on this encryption device.

HYX-57/TSEC WIRELINE ADAPTER

The HYX-57 wireline adapter can operate half-duplex in a communications network and provides the capability to interface encryption devices with a wireline system, either directly or through a switchboard. The HYX-57 processes both analog voice signals and digital cipher signals for transmission and reception. It also sends and receives a ring signal of 20Hz.

- KAM-340A/TSEC, Maintenance Manual for the TSEC/KY57/58 and Ancillary Units HYX-57/TSEC and HYP-57/TSEC, provides more in-depth information on this wireline adapter.

TSEC/KY-68 DIGITAL SECURE VOICE TERMINAL

The KY-68 is a 4-wire digital secure telephone. It is a ruggedized unit and functions as a full-duplex or half-duplex voice or data subscriber terminal. It provides CRYPTO capability for traffic between two KY-68s. For direct encrypted voice traffic without intervening equipment, two KY-68s are used. When interfaced with a data device, the KY-68 provides secure digitized data traffic to and from similarly equipped KY-68s either directly or via a circuit switch. A KY-68 data interface cable is required to interface the Conditioned Diphase (CDI) output of the KY-68 to a RS-232 serial port. Data Interface Cable, National Stock Number (NSN) 5995-01-411-6719, is required for data transmission interfacing between the KY-68 and the CGS-100.

- KAM-403A/TSEC, Limited Maintenance Manual for the TSEC/KY-68 and TSEC/KY-78, provides more in-depth information on this secure telephone.

SUMMARY

The descriptions of the secure systems provide a background for understanding how this equipment fits into the overall communications capabilities and services of the QRP. Section C (Chapters 10 through 14) covers the system capabilities and services. The secure voice and data capabilities and services use an encryption device covered in this chapter.

ADDITIONAL READING

- LLM-9B, Limited Maintenance Manual for the TSEC/KY-99 and TSEC/KY-99A
- KAM-456A/TSEC, Limited Maintenance Manual for the TSEC/KG-94/94A
- LLM-5A, Limited Maintenance Manual for the TSEC/KG-84A
- LLM-2A, Limited Maintenance Manual for the TSEC/KG-84C
- KAM-340A/TSEC, Maintenance Manual for the TSEC/KY57/58 and Ancillary Units HYX-57/TSEC and HYP-57/TSEC
- KAM-403A/TSEC, Limited Maintenance Manual for the TSEC/KY-68 and TSEC/KY-78

CHAPTER 9
PATCH AND TEST

ABOUT THIS CHAPTER

This chapter provides an overview of the patch and test facilities used in the QRP. It begins with brief descriptions of the audio patch panel, followed by the red and black digital patch panels associated with secure communications, and ends with the overall patch and test capabilities within the QRP.

PATCH PANELS

There are three styles of patch panels used in the QRP. There are some minor differences from version to version covered in the following paragraphs.

AUDIO PATCH PANEL

The six audio patch panels provide access to equipment and lines and also a line-monitoring capability. TO 31R2-2TSC107-1 shows patch panel appearances in the original van version. Patch panel appearances in the depot modified and field modified vans have changed from the original version but are identical to each other. The books provided with the depot and field modified vans show these patch panel appearances. The audio patch panels are located in equipment rack 1A3 of the front compartment in the vans and in case #14 of the transit case versions.

The patch panels appearances for line and equipment in the original, depot, and field modified vans are normal through to the IDF.

Patch panel appearances in the PACAF and ANG transit case version are strictly line jack only. In the transit case versions, the patch panels jacks are internally wired for normal through connectivity. The IDF and patch panels are not wired for normal through connectivity. Patch cord connections on the patch panel or cross-connects on the IDF provide the normal through connections required for circuits. Cross-connects can be made prior to deployment if mission/circuit requirements are known, otherwise all circuits are established by making the necessary patches during employment. Cross-connects can be made on the IDF later, allowing removal of the patches.

RED DIGITAL PATCH PANELS

The red digital patch panel in the depot and field modified vans provides access and patching capabilities on the unsecured, unencrypted side of a data circuit. It controls which UGC-144 communications terminal uses which KG-84 encryption device. Normal through connections are from

the UGC-144 position number to the same position numbered KG-84. The red patch panel is located in the operator's compartment. The PACAF and ANG transit case versions do not have a red patch panel.

BLACK DIGITAL PATCH PANELS

The black digital patch panel in the depot and field modified vans provides access and patching capabilities on the secured, encrypted side of a data circuit. It controls the KG-84 outputs through selection of modem channel inputs. Normal through connections are from KG-84 #1, #2, and #3 to the channel one input of modem #1, #2, and #3, respectively. KG-84 #4 output is not wired to a specific modem. The black patch panel is located in equipment rack 1A2 of the front compartment.

The PACAF and ANG transit case versions do not have a black patch panel.

PATCH AND TEST CAPABILITIES

All versions of the QRP have the same basic patching and testing capabilities. The patch panels allow rapid selection of multiple communications options. The testing capabilities, through use of the patch panels, allow circuit testing, control, and conditioning. The technical control personnel normally perform the patch and test functions during employment. The combination of the patch and test capabilities provides a wide range of equipment and circuit options for the QRP. As circumstances and situations dictate, there are numerous circuit variations from the standard QRP system capabilities and services shown in Chapters 10 through 14.

PATCHING

The patch panels provide access points for system tests and the capability to rapidly restore service by patching around faulty equipment to spare equipment. The QRP can be controlled as a system through use of the patch panels. Standard patching procedures apply to working around faulty equipment to restore a circuit or service.

Patching around faulty equipment to spares in the transit case versions presents a challenge if the IDF cross-connects have not been installed to replace the temporary patches made to bring up the circuits or services. The temporary patches that provide the normal through connection from equipment to line may clutter the patch panels. Close attention prior to removing or replacing patch cords can eliminate potential lapses in circuit continuity and services.

TESTING

The testing capabilities include six line amplifiers, six strappable attenuators, three 4way-4wire bridges, one speaker amplifier, one IDF,

one 41-01 transmission test set, and two 26VDC power supplies. This equipment is located in equipment rack 1A2 and 1A3 of the front compartment in the vans and in case #14 of the transit case versions. Test equipment also includes a signal generator, wave generator, digital voltmeter, frequency counter, and a two-channel oscilloscope. This equipment is located in equipment rack 1A2 of the front compartment in the vans and in case #16 of the transit case versions.

The 4way-4wire bridges can be used for circuit conference or multiple outputs. The 41-01 transmission test set is used for circuit alignment and testing. The speaker amplifier is used to monitor audio signals. The power supplies provide operating voltages for the amplifiers and bridges.

From the patch panel and through use of the test facilities, checks of circuit continuity and signal level measuring and adjustments are accomplished. Operational capabilities of the modems and communications terminal equipment are accessible for checks and tests. The signaling and supervisory features of the telephone switchboard are also accessible.

SUMMARY

The descriptions of the patch test facilities provide a background for understanding how this equipment fits into the overall communications capabilities and services of the QRP. Section C (Chapters 10 through 14) covers the system capabilities and services. All capabilities and services route through one or more patch panels covered in this chapter.

CHAPTER 10
HIGH FREQUENCY (HF) SINGLE SIDEBAND (SSB) NONSECURE/SECURE VOICE AND DATA TRANSMISSIONS

ABOUT THIS CHAPTER

Due to the flexibility of the QRP, there are several ways to accomplish HF SSB nonsecure/secure voice and data transmissions. This chapter provides an overview of the most commonly used configuration and signal flow to transmit and receive HF SSB nonsecure/secure voice and data. All versions of the QRP are equipped with these capabilities. Although patch and test locations may vary from version to version, the basic signal flow remains the same through each version.

HF SSB NONSECURE VOICE (INCLUDES TELEPHONE PATCH) TRANSMISSION

Figure 10-1 shows a common configuration for nonsecure voice transmissions using HF SSB. The radio operations personnel access the nonsecure voice circuit at the front panel of the RT-9000 transceiver or RCU-9310 remote control unit. Subscribers can use the switchboard or any 2-wire dial line to access this circuit. The audio signal from the switchboard or subscriber equipment routes (through patch and test in the van versions) to the RTU-200 radio/telephone interface unit. From the RTU-200, the audio signal routes (through patch and test in the van versions) to an audio port on the RT-9000. (Patch and test access points provide optional audio input options to the RT-9000.) Optional routing is by way of the RCU-9310 when in remote operation (shown in Figure 10-1 by dashed lines). The transceiver output routes (through the entry panel in van versions) to the CU-9125 digital antenna coupler. The RT-9000 provides the control signal to adjust the coupler and match impedance. Antennas used with the coupler can vary from a 9’ whip to a 150’ longwire.

HF SSB nonsecure voice on the receive end comes through the antenna to the CU-9125. The signal follows the same basic path as the transmit path described in the previous paragraph, but in reverse. The radio operations personnel use the RT-9000 front panel to access the receive audio. For subscribers, the receive audio routes through the RTU-200 (through patch and test in the van versions) to the switchboard.

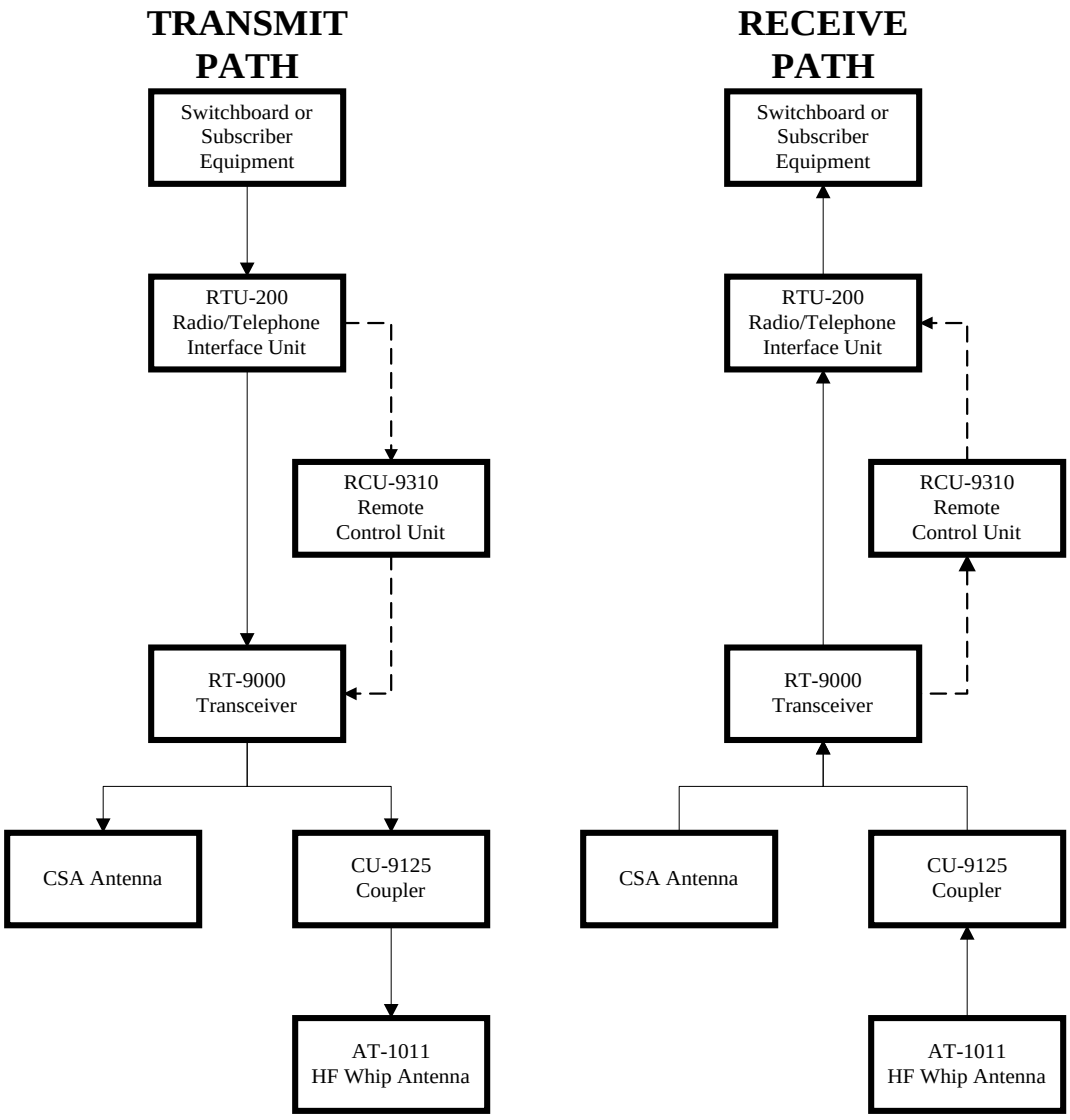


Figure 10-1. High Frequency (HF) Single Sideband (SSB) Nonsecure Voice

HF SSB SECURE VOICE TRANSMISSION

Figure 10-2 shows a common configuration for secure voice transmissions using HF SSB. The radio operations personnel or subscribers access the secure voice circuit at the front panel of the KY-99A terminal through a H-250 handset. The KY-99A encrypts the audio and routes it (through patch and test in the van versions) to an audio port on the RT-9000. (Patch and test access points provide optional audio input options to the RT-9000.) Optional routing is by way of the RCU-9310 when in remote operation (shown in Figure 10-2 by dashed lines). The transceiver output routes (through the entry panel in van versions) to the CU-9125 digital

antenna coupler. The RT-9000 provides the control signal to adjust the coupler and match impedance. Antennas used with the coupler can vary from a 9' whip to a 150' longwire.

HF SSB secure voice on the receive end comes through the antenna to the CU-9125. The signal follows the same basic path as the transmit path described in the previous paragraph, but in reverse. The radio operations personnel or subscribers access the audio through the H-250 handset on the KY-99A.

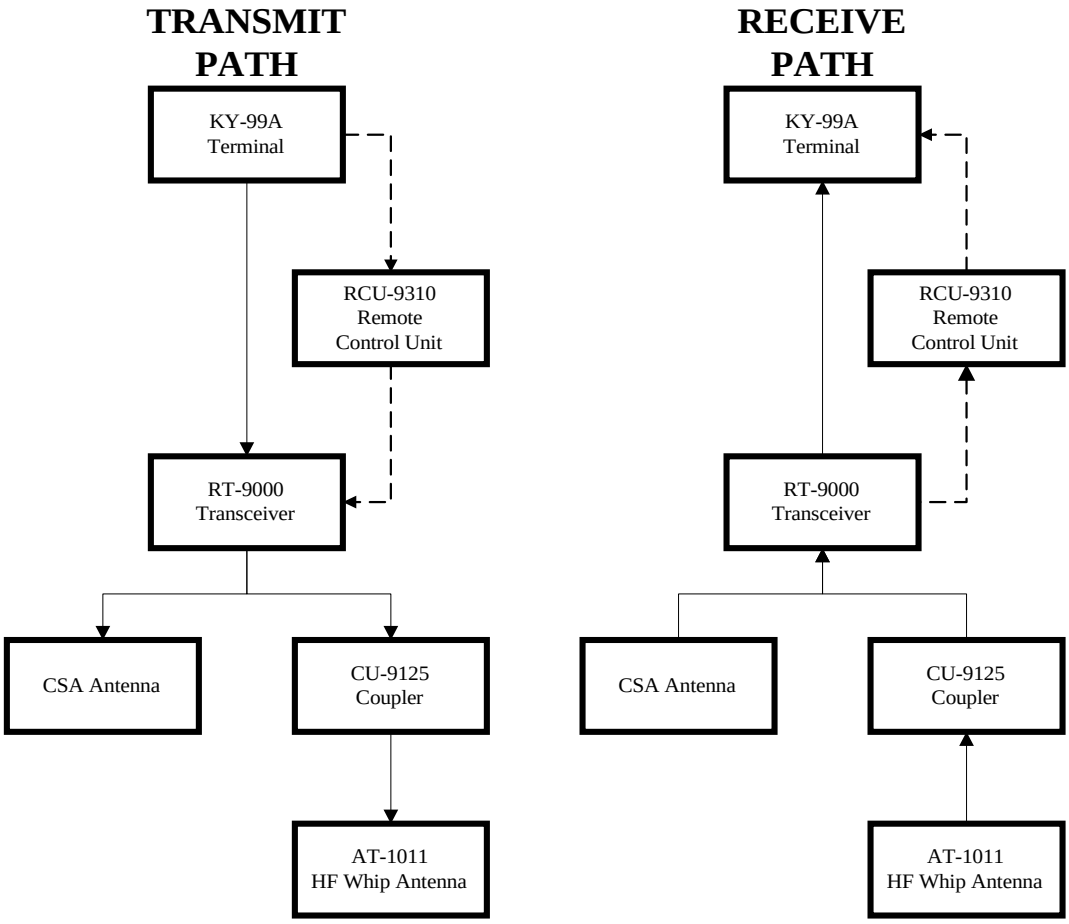


Figure 10-2. HF SSB Secure Voice

HF SSB DATA TRANSMISSION

Figure 10-3 shows a common configuration for data transmissions using HF SSB. The communications/radio operations personnel or subscribers access the data circuit at the UGC-144 or other compatible terminal device. The data routes to the KY-99A terminal, where encryption and conditioning by the KY-99A internal modem occurs. The analog signal

routes (through patch and test in the van versions) to the audio port of the RT-9000. (Patch and test access points provide optional data input options to the RT-9000.) Optional routing is by way of the RCU-9310 when in remote operation (shown in Figure 10-3 by dashed lines). The transceiver output routes (through the entry panel in van versions) to the CU-9125 digital antenna coupler. The RT-9000 provides the control signal to adjust the coupler and match impedance. Antennas used with the coupler can vary from a 9' whip to a 150' longwire.

HF SSB data on the receive end comes through the antenna to the CU-9125. The signal follows the same basic path as the transmit path described in the previous paragraph, but in reverse. The communications/ radio operations personnel or subscribers access the received data at the UGC-144 or other compatible terminal device.

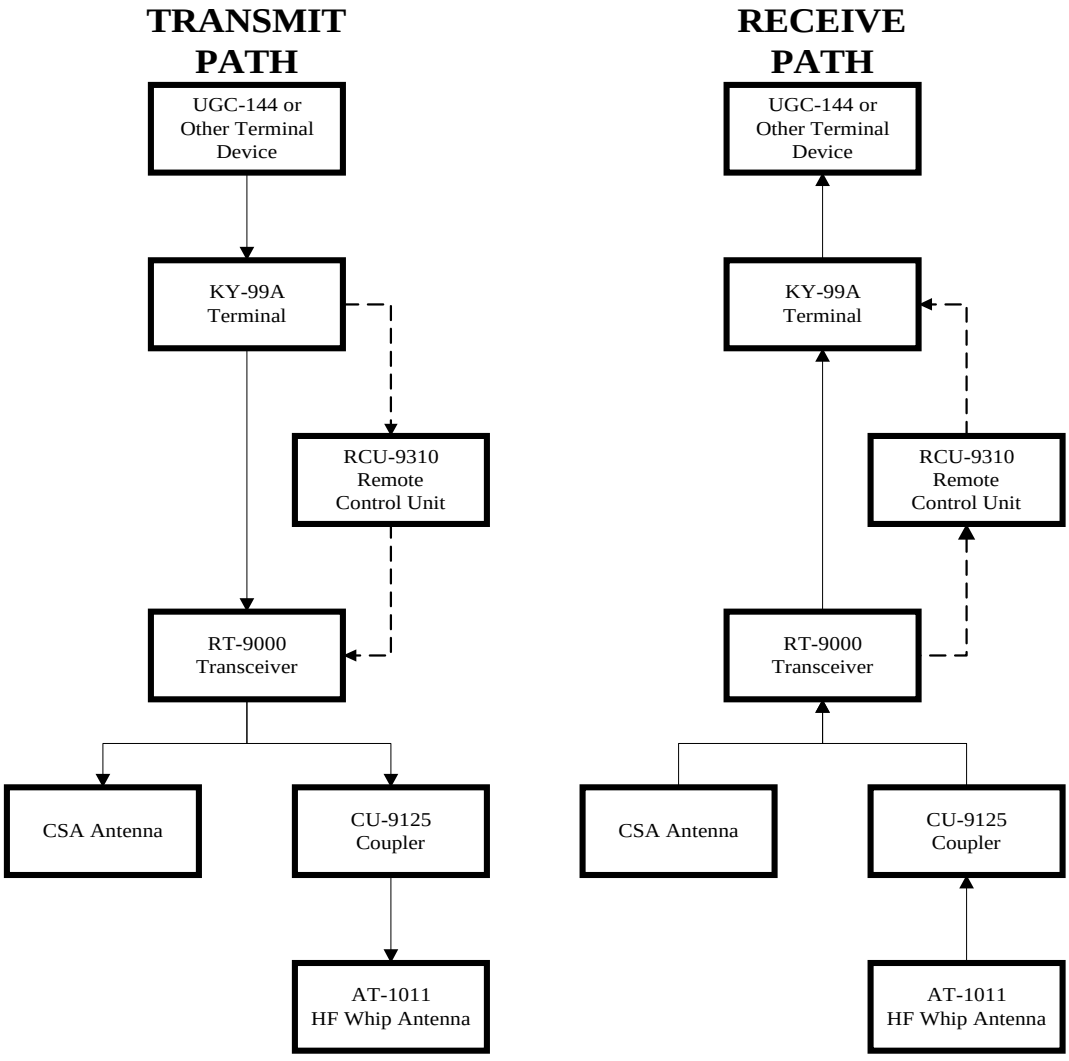


Figure 10-3. HF SSB Data

SUMMARY

This chapter provided an overview of the most commonly used configuration and signal flow to transmit and receive HF SSB nonsecure/secure voice and data transmissions. Although patch and test locations may vary from version to version, the basic signal flow remains the same through each version. An understanding of the signal flow and access points for the signal provides options to work around down equipment and other potential circuit problems.

CHAPTER 11
HIGH FREQUENCY (HF) INDEPENDENT SIDEBAND (ISB) NONSECURE/SECURE VOICE AND DATA TRANSMISSIONS

ABOUT THIS CHAPTER

Due to the flexibility of the QRP, there are several ways to accomplish HF ISB nonsecure/secure voice and data transmissions. This chapter provides an overview of the most commonly used configuration and signal flow to transmit and receive HF ISB nonsecure/secure voice and data. All versions of the QRP are equipped with this capability. Although patch and test locations may vary, the basic signal flow remains the same through each version. There are two complete HF ISB radio systems in the QRP. Normal operations use one system with the second system used as backup.

HF ISB NONSECURE VOICE TRANSMISSION

Figure 11-1 shows the most common configuration for nonsecure voice transmissions using HF ISB. The nonsecure voice uses the LSB of the radios. The radio maintenance/technical control personnel access the nonsecure voice circuit at the front panel of the T-9400 exciter. This is the orderwire for distant end data circuit coordination between the radio maintenance/technical control personnel until the DSN trunk line is operational. Subscribers use the switchboard to access the HF ISB signal path. The audio signal exits the switchboard on a trunk line and routes through patch and test to the STU-5 signaling and terminating unit or the FTA-28 telephone terminal. The signal exits the STU-5 or FTA-28 and routes through patch and test to the T-9400. (Patch and test access points provide optional audio input options to the T-9400.) Exciter RF and control outputs go to the LPA-9600 power amplifier. The amplifier output routes (through the entry panel in van versions) to the CU-9100 digital antenna coupler. The T-9400 controls the coupler. Antennas used with this coupler can be 35 feet or longer with an impedance of 50 ohms.

A separate antenna receives the HF ISB nonsecure voice signals. The signal routes (through the entry panel on van versions) to the R-9200 receiver. The signal follows the same basic path as the transmit path described in the previous paragraph but in reverse. The signal routes through the F-9800 pre-selector rather than the coupler and amplifier. The radio maintenance/technical control personnel use the R-9200 front panel to access the receive audio for the orderwire used to coordinate the data circuit until the DSN trunk line is operational. For subscribers, the receive audio routes through the STU-5 or FTA-28 through patch and test to the switchboard as a trunk line. Patch and test access points provide options to work around down equipment and other potential circuit problems.

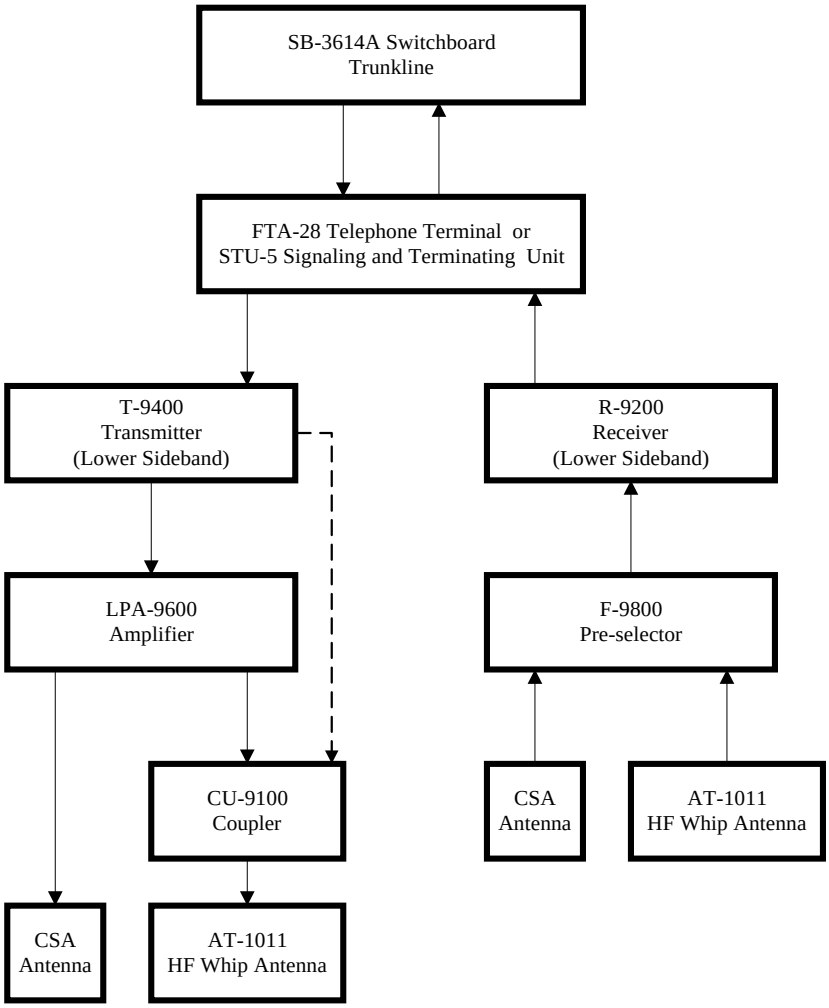


Figure 11-1. HF SSB Nonsecure Voice

HF ISB SECURE VOICE TRANSMISSION

Figure 11-2 shows the most common configuration for secure voice transmissions using HF ISB. The secure voice uses the LSB of the radios. Radio maintenance/technical control personnel access the secure voice circuit at the front panel of KY-99A terminal through a H-250 handset. Subscribers use the switchboard to access the HF ISB signal path. The audio signal exits the switchboard on a trunk line and routes through patch and test to the STU-5 signaling and terminating unit or the FTA-28 telephone terminal. The signal exits the STU-5 or FTA-28 and routes through patch and test to the KY-99A for encryption. From the KY-99A, the encrypted audio routes to the T-9400 exciter. (Patch and test access points provide optional audio input options to the T-9400.) Exciter RF and control outputs go to the LPA-9600 power amplifier. The amplifier output routes (through the entry panel in van versions) to the CU-9100

digital antenna coupler. The T-9400 controls the coupler. Antennas used with this coupler can be 35 feet or longer with an impedance of 50 ohms.

A separate antenna receives the HF ISB nonsecure voice signals. The signal routes (through the entry panel on van versions) to the R-9200 receiver. The signal follows the same basic path as the transmit path described in the previous paragraph, but in reverse. The signal routes through the F-9800 pre-selector rather than the coupler and amplifier. The radio maintenance/technical control personnel access the audio through the H-250 handset on the KY-99A. For subscribers, the receive audio routes through the STU-5 or FTA-28 through patch and test to the switchboard as a trunk line. Patch and test access points provide options to work around down equipment and other potential circuit problems.

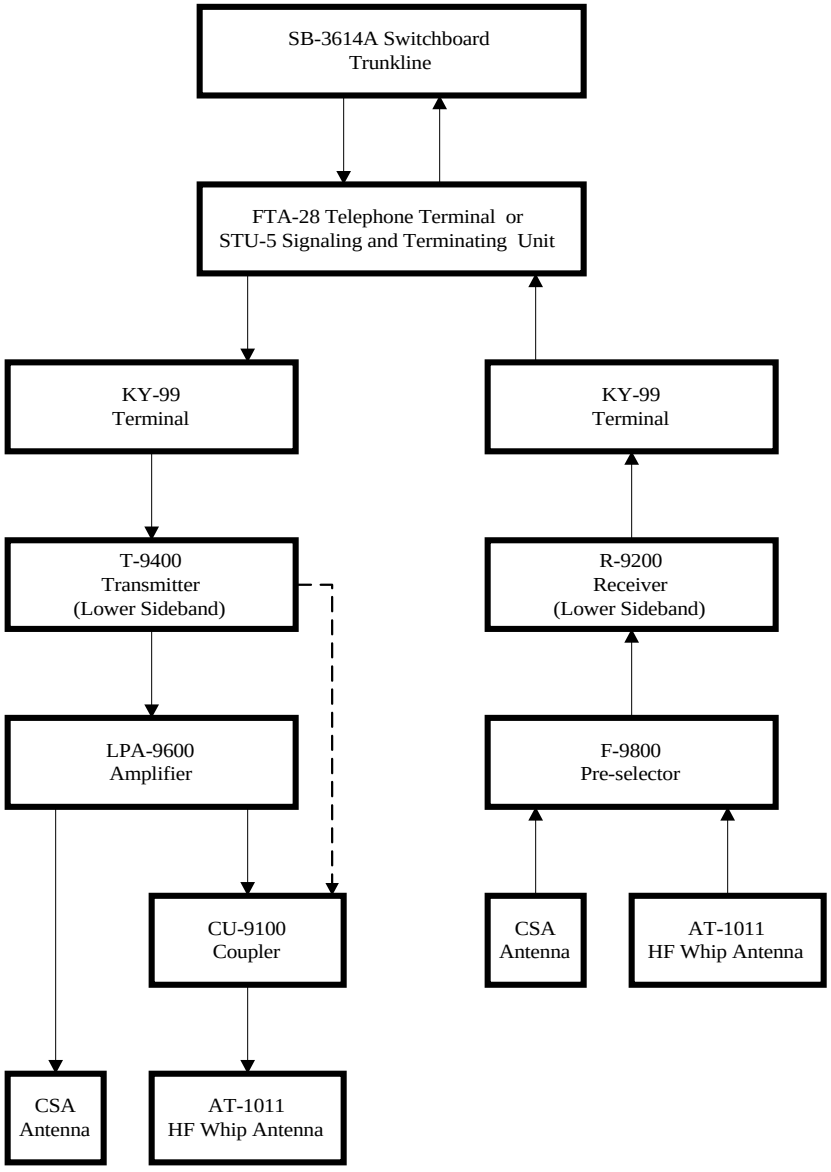


Figure 11-2. HF Independent Sideband (ISB) Secure Voice

HF ISB DATA TRANSMISSION

Figure 11-3 shows the most common configuration for data transmission using HF ISB.

The data circuit uses the USB of the radios. Communications operations personnel access the data circuit at the UGC-144, CGS-100, or other compatible terminal device. The data then routes to the KG-84A/C for encryption. The data signal exits the KG-84A/C and routes through patch and test to the MDM-2001 modem for conditioning. The data signal exits the MDM-2001 as an analog signal and routes through patch and test to the T-9400 exciter. (Patch and test access points provide optional data input options to the T-9400.) Exciter RF and control outputs go to the LPA-9600 power amplifier. The amplifier output routes (through the entry panel in van versions) to the CU-9100 digital antenna coupler. The T-9400 controls the coupler. Antennas used with this coupler can be 35 feet or longer with an impedance of 50 ohms.

A separate antenna receives the HF ISB data signals. The signal routes (through the entry panel on van versions) to the R-9200 receiver. The signal follows the same basic path as the transmit path described in the previous paragraph, but in reverse. The signal routes through the F-9800 pre-selector rather than the coupler and amplifier. Communications operations personnel access the received data at the UGC-144, CGS-100, or other compatible terminal device. Patch and test access points provide options to work around down equipment and other potential circuit problems.

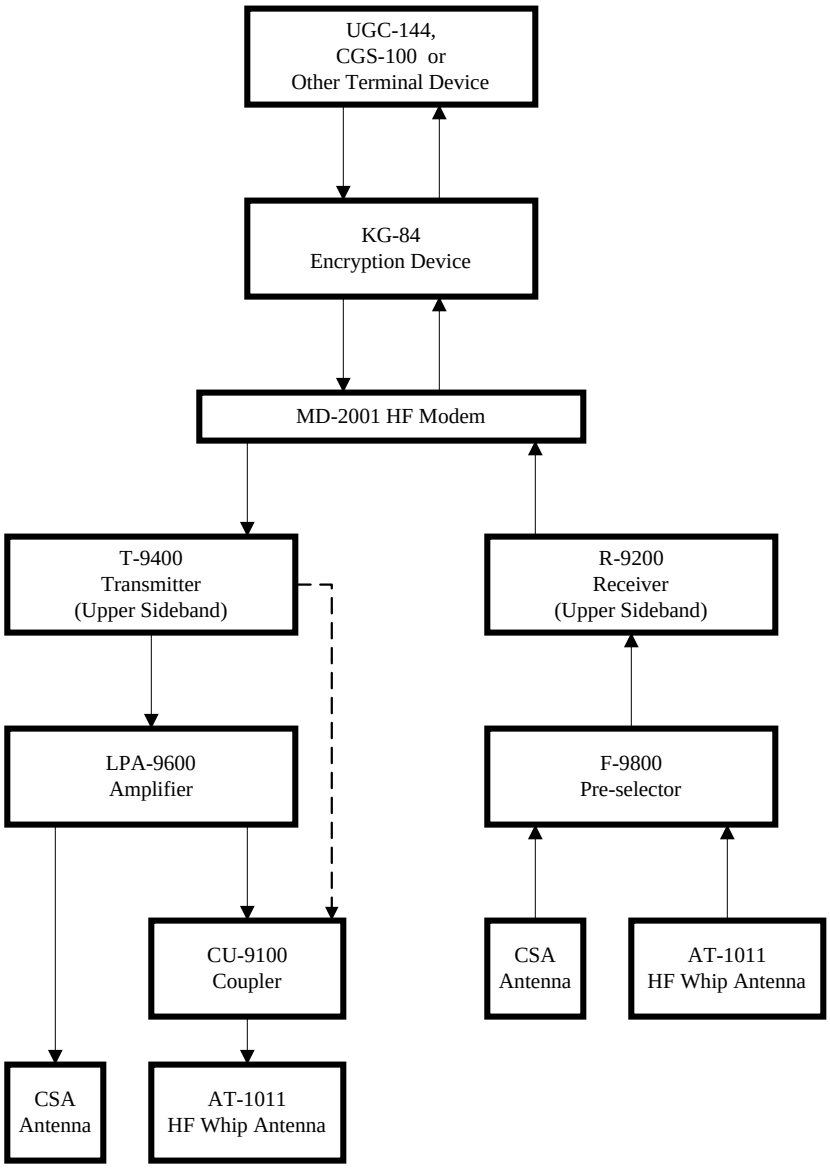


Figure 11-3. HF ISB Data

SUMMARY

This chapter provided an overview of the most commonly used configuration and signal flow to transmit and receive HF ISB data transmissions. Although patch and test locations may vary from version to version, the basic signal flow remains the same through each version. An understanding of the signal flow and access points for the signal provides options to work around down equipment and other potential circuit problems.

CHAPTER 12
VERY HIGH FREQUENCY (VHF) AND ULTRA-HIGH FREQUENCY (UHF) NONSECURE/SECURE VOICE TRANSMISSIONS

ABOUT THIS CHAPTER

Due to the flexibility of the QRP, there are several ways to accomplish VHF and UHF nonsecure/secure voice transmissions. This chapter provides an overview of the most commonly used configuration and signal flow to transmit and receive VHF and UHF nonsecure/secure voice. All versions of the QRP are equipped with these capabilities. Although patch and test locations may vary, the basic signal flow remains the same through each version. The VHF and UHF radio systems can be removed from the vans and placed at the user's location.

VHF AND UHF NONSECURE VOICE TRANSMISSION

Figure 12-1 shows a common configuration for nonsecure voice communications using the AN/ARC-186 VHF or the AN/ARC-164 UHF radios.

The user accesses the VHF or UHF signal path through a microphone or headset at the CA-218 rack adapter, which houses the ARC-186 or ARC-164 transceiver. The VHF radio output passes (through the entry panel in the van versions) to the DC-80 antenna, and the UHF radio output passes (through the entry panel in the van versions) to the DC-190 antenna.

VHF and UHF nonsecure voice signals on the receive end come through the respective antenna to the radios. The signals follow the same path as the transmit paths described in the previous paragraph, but in reverse. The user accesses the VHF or UHF receive audio through a microphone or headset at the CA-218 rack adapter, which houses the ARC-186 or ARC-164 transceiver.

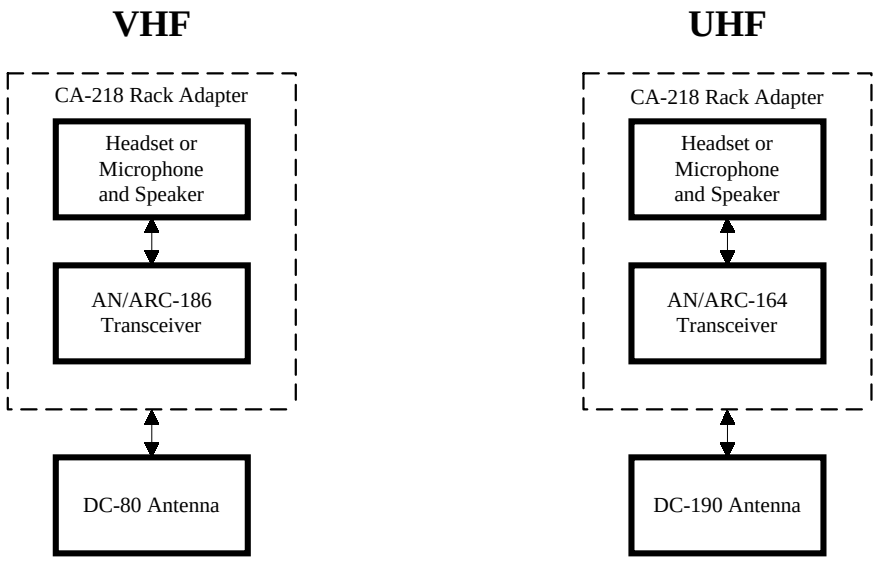


Figure 12-1. VHF and UHF Nonsecure Voice

VHF AND UHF SECURE VOICE TRANSMISSION

Figure 12-2 shows a common configuration for secure voice communications using the AN/ARC-186 VHF or AN/ARC-164 UHF radios.

The user accesses the VHF or UHF signal path at the front panel of KY-99A through the H-250 handset. The KY-99A encrypts the audio and routes it through patch and test to the VHF or UHF radio. (Patch and test access points provide optional audio input options to the radio.) The VHF radio output passes (through the entry panel in the van versions) to the DC-80 antenna, and the UHF radio output passes (through the entry panel in the van versions) to the DC-190 antenna.

VHF and UHF secure voice signals on the receive end come through the respective antenna to the radios. The signal follows the same path as the transmit path described in the previous paragraph, but in reverse. The user accesses the VHF or UHF receive audio through the H-250 handset on the KY-99A.

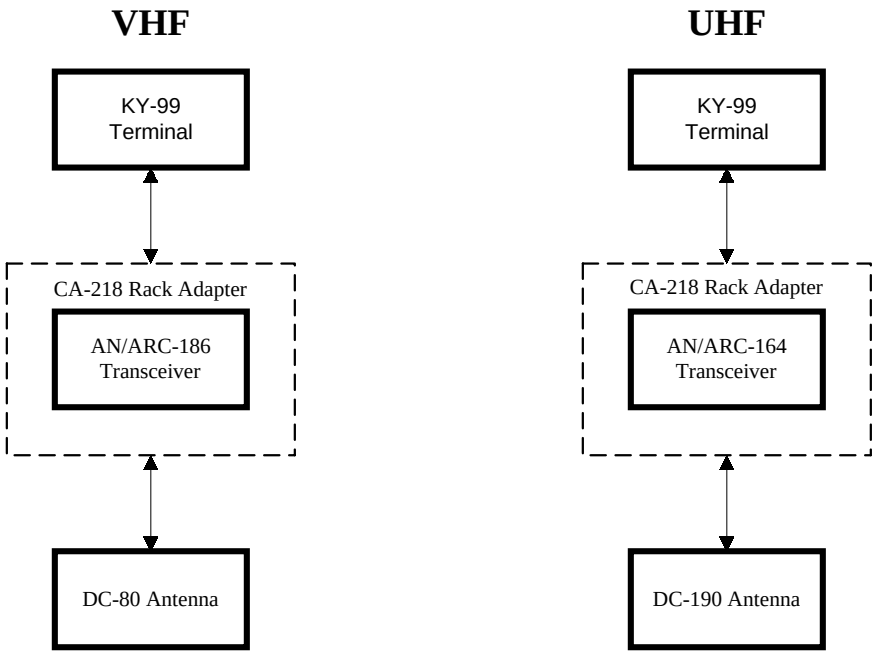


Figure 12-2. VHF and UHF Secure Voice

SUMMARY

This chapter provided an overview of the most commonly used configuration and signal flow to transmit and receive VHF and UHF nonsecure/secure voice transmissions. Although patch and test locations may vary from version to version, the basic signal flow remains the same through each version. An understanding of the signal flow and access points for the signal provides options to work around down equipment and other potential circuit problems.

CHAPTER 13
SATELLITE TERMINAL NONSECURE/SECURE VOICE AND DATA TRANSMISSIONS

ABOUT THIS CHAPTER

This chapter provides an overview of nonsecure/secure voice and data transmissions through a GMF or NABS satellite terminal. It includes the most commonly used configurations and signal flow to transmit and receive nonsecure/secure voice and data through a satellite terminal. All versions of the QRP are equipped with this capability. Although patch and test locations may vary, the basic signal flow remains the same through each van version and transit case version.

NONSECURE VOICE TRANSMISSION WITH SATELLITE TERMINAL

Figure 13-1 shows the most common configurations for nonsecure voice communications through a GMF or NABS satellite terminal. The two most common circuits are DSN trunk lines and long locals to/from the AN/TTC-39A digital switch or SB-3614 switchboard.

DEFENSE SWITCHED NETWORK (DSN) TRUNK LINES

The SB-3614 switchboard provides DSN circuit access to subscribers. An analog signal exits the switchboard and routes through the patch and test facility. The signal then goes to the satellite terminal directly, unless the distant end utilizes a commercial T1. If the distant end utilizes a T1, the signal exits the patch and test facility and routes to a FCC-100 before going to the satellite terminal.

The received signal follows the same basic path as the transmit path described in the previous paragraph, but in reverse.

LONG LOCAL TO/FROM AN/TTC-39A OR SB-3865

The TA-1042 digital telephone provides subscriber access to the AN/TTC-39A or the SB-3865 by way of a long local. A digital signal exits the AN/TTC-39A or SB-3865 and routes through its patch and test facility and other necessary equipment. The signal then goes to the satellite terminal. The satellite terminal at the TA-1042 end receives the signal and routes it through the patch and test facility to the TA-1042. At this point, the subscriber is able to hear a dial tone and make and receive calls.

The received signal follows the same basic path as described in the previous paragraph, but in reverse.

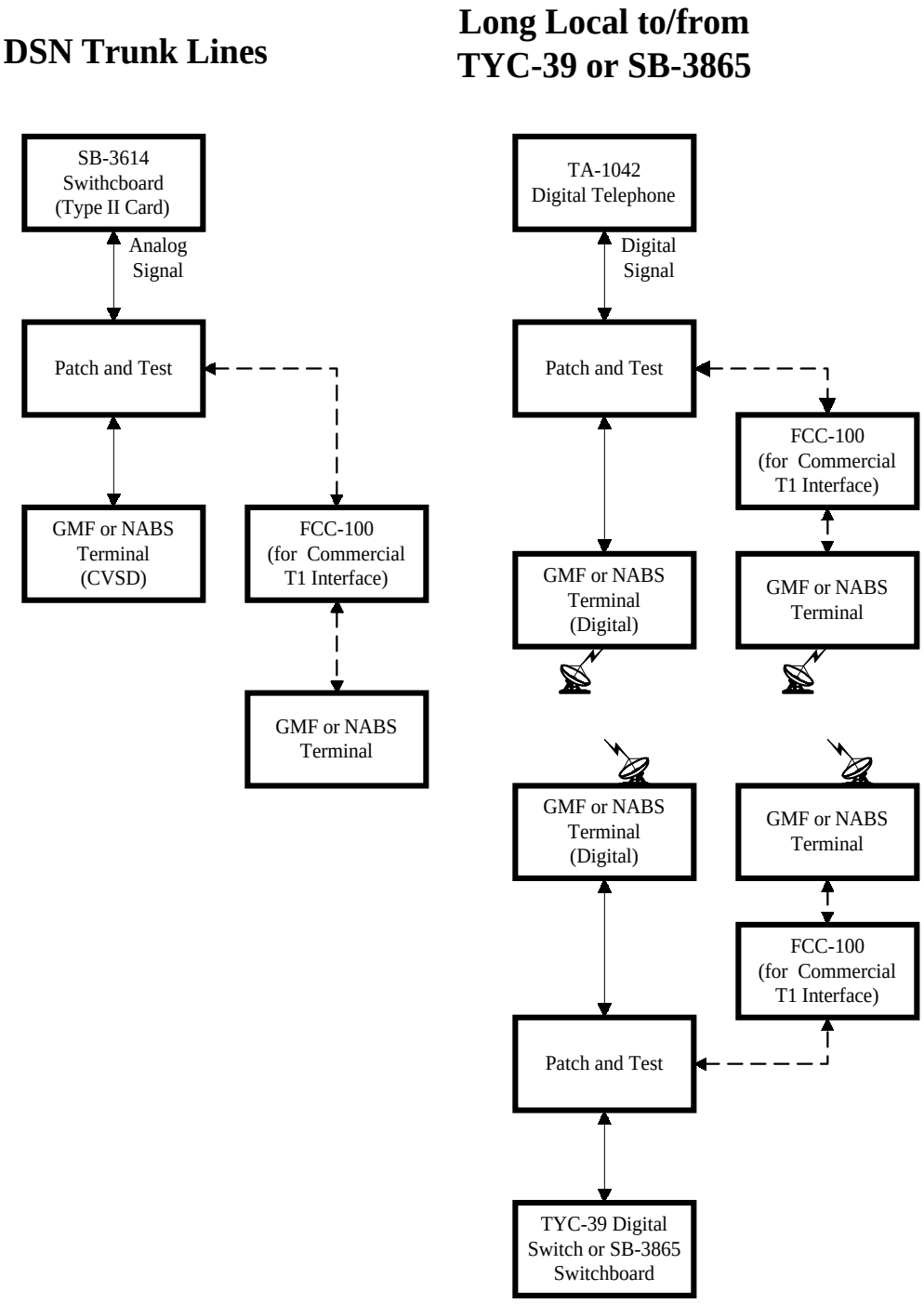


Figure 13-1. Nonsecure Voice Transmission with Satellite Terminal

SECURE VOICE TRANSMISSION WITH SATELLITE TERMINAL

Figure 13-2 shows the most common configuration for secure voice communications through a GMF or NABS satellite terminal. The two most common circuits are DSN trunk lines and long locals to/from the AN/TTC-39A digital switch or SB 3865 digital switchboard.

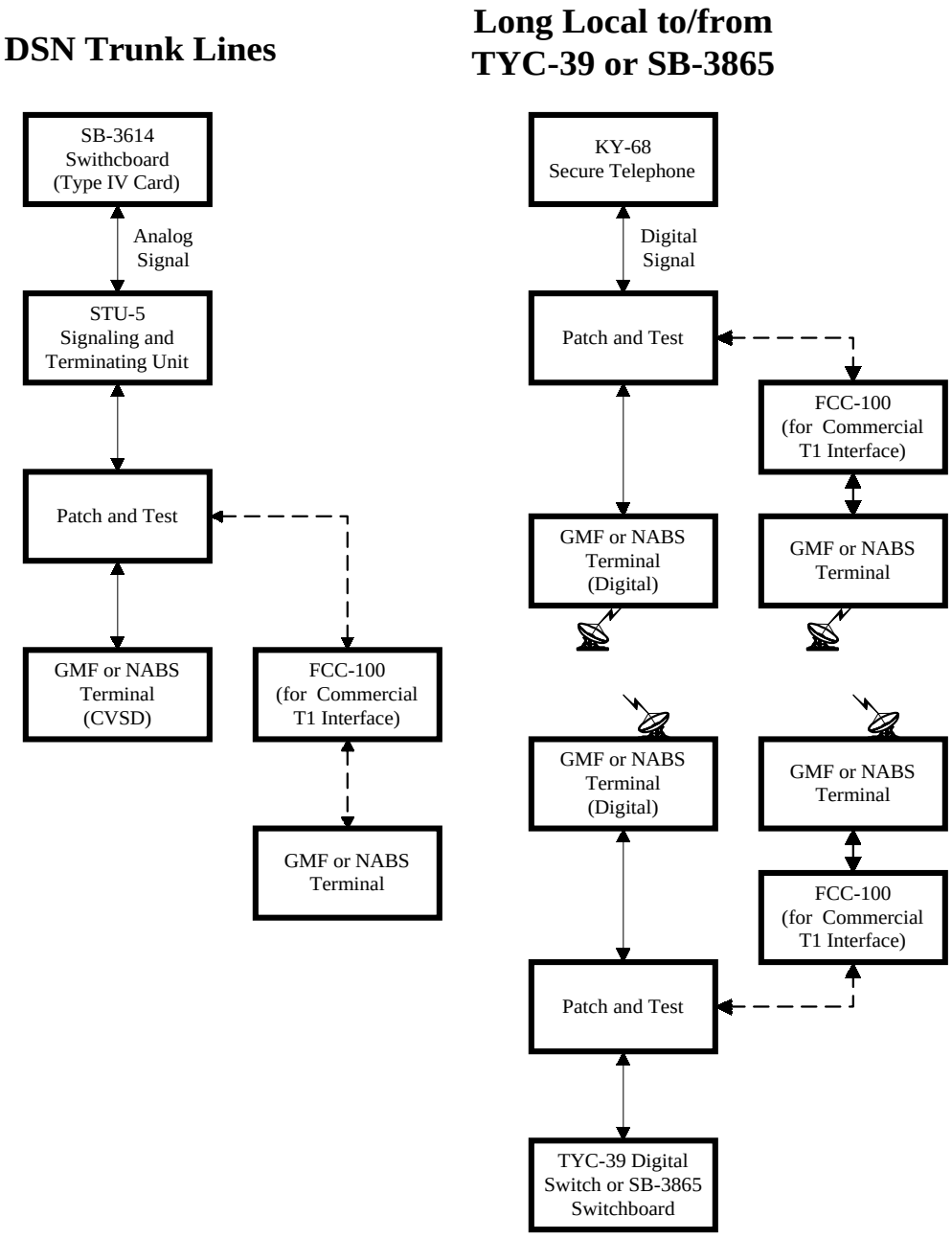


Figure 13-2. Secure Voice Transmission with Satellite Terminal

DEFENSE SWITCHED NETWORK (DSN) TRUNK LINES

The SB-3614 switchboard provides DSN circuit access to subscribers. An analog signal exits the switchboard and routes through the STU-5 to the patch and test facility. The signal then goes to the satellite terminal directly, unless the distant end utilizes a commercial T1. If the distant end utilizes a T1, the signal exits the patch and test facility and routes to a FCC-100 before going to the satellite terminal.

The received signal follows the same basic path as the transmit path described in the previous paragraph, but in reverse. The switchboard provides DSN access to the subscriber.

LONG LOCAL TO/FROM AN/TTC-39A OR SB-3865

The KY-68 secure telephone provides access to the AN/TTC-39A or the SB-3865 by way of a long local. A digital signal exits the AN/TTC-39A or SB-3865 and routes through its patch and test facility and other necessary equipment. The signal then goes to the satellite terminal. The satellite terminal at the KY-68 end receives the signal and routes it through the patch and test facility to the KY-68. At this point, the subscriber is able to hear a dial tone and make and receive calls. The return signal follows the same basic path as described in the previous paragraph, but in reverse.

DATA TRANSMISSION WITH SATELLITE TERMINAL

Figure 13-3 shows the most common configuration for data communications through a GMF or NABS satellite terminal. The two most common circuits are satellite DCS entry and point to point digital.

SATELLITE DEFENSE COMMUNICATIONS SYSTEM (DCS) ENTRY

The CGS-100, UGC-144 or other digital terminal accesses the circuit. The digital signal routes to the KG-84 encryption device for encryption. The signal leaving the KG-84 is digital. This signal routes to the MDM-2001 modem for conversion to a FSK or analog signal. From the modem, the signal routes to the patch and test facility. The signal then goes to the satellite terminal directly, unless the distant end utilizes a commercial T1. If the distant end utilizes a T1, the signal exits the patch and test facility and routes to a FCC-100 before going to the satellite terminal.

The received signal follows the same basic path as the transmit path described in the previous paragraph, but in reverse. The CGS-100, UGC-144 or other digital terminal accesses the circuit.

POINT TO POINT DIGITAL

The CGS-100, UGC-144 or other digital terminal accesses the circuit. The digital signal routes to the KG-84 or encryption device or KY-68 secure telephone for encryption. The signal leaving the KG-84 or KY-68

is digital. From the encryption device, the signal routes to the patch and test facility. The signal then goes to the satellite terminal directly, unless the distant end utilizes a commercial T1. If the distant end utilizes a T1, the signal exits the patch and test facility and routes to a FCC-100 before going to the satellite terminal.

The received signal follows the same basic path as the transmit path described in the previous paragraph, but in reverse. The CGS-100, UGC-144 or other digital terminal accesses the circuit.

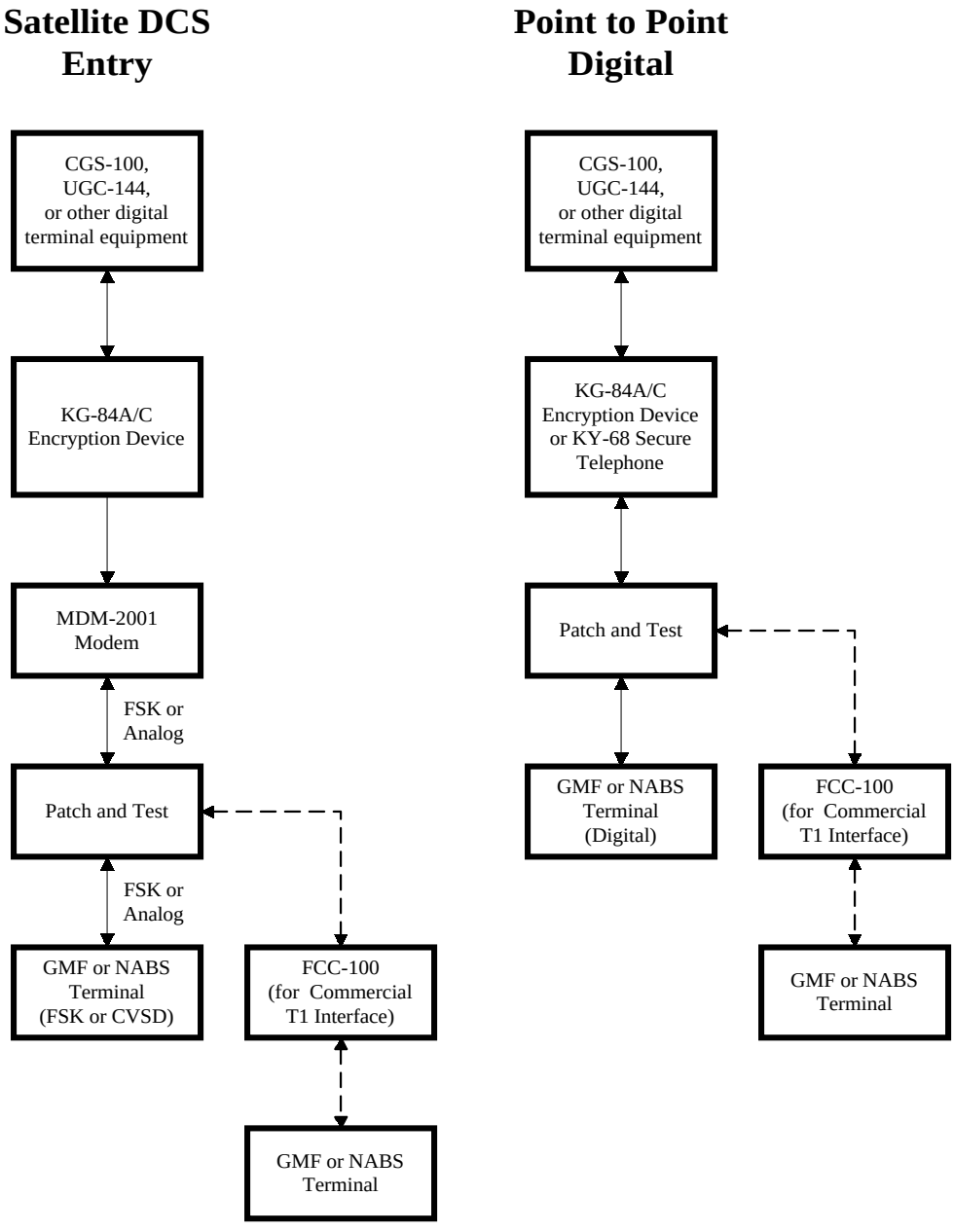


Figure 13-3. Data Transmission with Satellite Terminal

SUMMARY

This chapter provided an overview of the most commonly used configurations and signal flow to transmit and receive nonsecure/secure voice and data transmissions through a GMF or NABS satellite terminal. Although patch and test locations may vary, the basic signal flow remains the same through each van version and transit case version. An understanding of the signal flow and access points for the signal provides options to work around down equipment and other potential circuit problems.

ADDITIONAL READING

The following training packages cover items in this chapter that are not part of the QRP. This includes the GMF and NABS terminals, the AN/TTC-39A digital switch, and the T1 carrier system.

GROUND MOBILE FORCES (GMF) AND NATO AIRBASE SATCOM (NABS)

- AFQTP 2E1X1-207NA, Ground Mobile Forces Satellite Terminal Familiarization
- AFJQS 2E1X1-207NB, AN/TSC-94A(V)1/2 and AN/TSC-100A(V)1/2 Ground Mobile Forces Satellite Communications Terminals
- AFJQS 2E1X1-207NC, AN/TSC-85B(V)2 and AN/TSC-93B(V)2 NABS Terminals

AN/AN/TTC-39A DIGITAL SWITCH

- AFJQS 2E2X1-208V, AN/TTC-39A Circuit Switch

T1 CARRIER SYSTEM

- AFJQS 2E6X3-208W, T1 Carrier System (Terminal End Equipment)

KEY WORDS AND PHRASES

- CVSD--Continuous Variable Slope Delta
- FSK--Frequency Shift Keying

CHAPTER 14
FCC-100 MULTIPLEXER CIRCUIT INTERFACING AND REMOTING

ABOUT THIS CHAPTER

This chapter provides an overview of several options available with use of the FCC-100 multiplexer. It includes commercial equipment interfacing and remoting the QRP HF site from the operations site. All versions of the QRP are equipped with this capability. The basic signal flow remains the same through each van version and transit case version.

HF SITE REMOTING OPTION

Figure 14-1 (refer to key words and phrases at end of chapter) shows the HF site remote from the operations site using two FCC-100 multiplexers.

The operation or mission can call for this type of setup. This may be due to site requirements, space for the HF antennas, security precautions, or many other possible reasons. All HF equipment capabilities covered in previous chapters are possible in this remote configuration.

HF SITE AND USER CONNECTIONS

The HF site equipment connects to a FCC-100 multiplexer. The operations site equipment connects to a second FCC-100 multiplexer. The configuration of each FCC-100's interchangeable plug-in port modules accommodates the necessary control and signal lines. The type of signals sent or received by the end equipment determines what type of port module is required.

Figure 14-1 (refer to key words and phrases at end of chapter) shows the typical port modules required for the HF site and the operations site. Aggregate port modules vary depending on the type of interconnect between the two FCC-100s.

FCC-100 MULTIPLEXER INTERCONNECT OPTIONS

There are several options to interconnect the two remote FCC-100 multiplexers. Maximum separation between sites varies from 50 feet to 23 miles depending on equipment or cabling, and the aggregate port type and speed.

AN/GRC-239 TACTICAL SATELLITE SUPPORT RADIO (TSSR)

The FCC-100 multiplexers can connect by way of AN/GRC-239 Tropo TSSR The maximum separation between sites is 10 miles when using the TSSR one-foot dish. The maximum separation between sites is 23 miles when using the TSSR two-foot dish.

CX-11230 TRIAXIAL CABLE

The FCC-100 multiplexers can connect by way of CX-11230 triaxial cable. Maximum separation varies depending on the aggregate data rate. When using a CDI aggregate of 72-1024kbs, maximum separation between sites is two miles. When using a CDI aggregate of 1024-2048kbs, maximum separation between sites is one mile.

407L COPPER CABLE

The FCC-100 multiplexers can connect through 407L copper cable. A Non Return to Zero (NRZ) aggregate of 1.2 to 2048kbs allows a maximum separation of 50 feet.

COMMERCIAL EQUIPMENT INTERFACING

Figure 14-1 (refer to key words and phrases at end of chapter) also shows commercial interface at the operations site.

A variety of commercial equipment can interface with the QRP by way of the FCC-100 multiplexer. The FCC-100 interchangeable plug-in port modules need to be selected to accommodate the necessary control and signal lines. The type of signals sent or received by the commercial equipment determines the type of port module required.

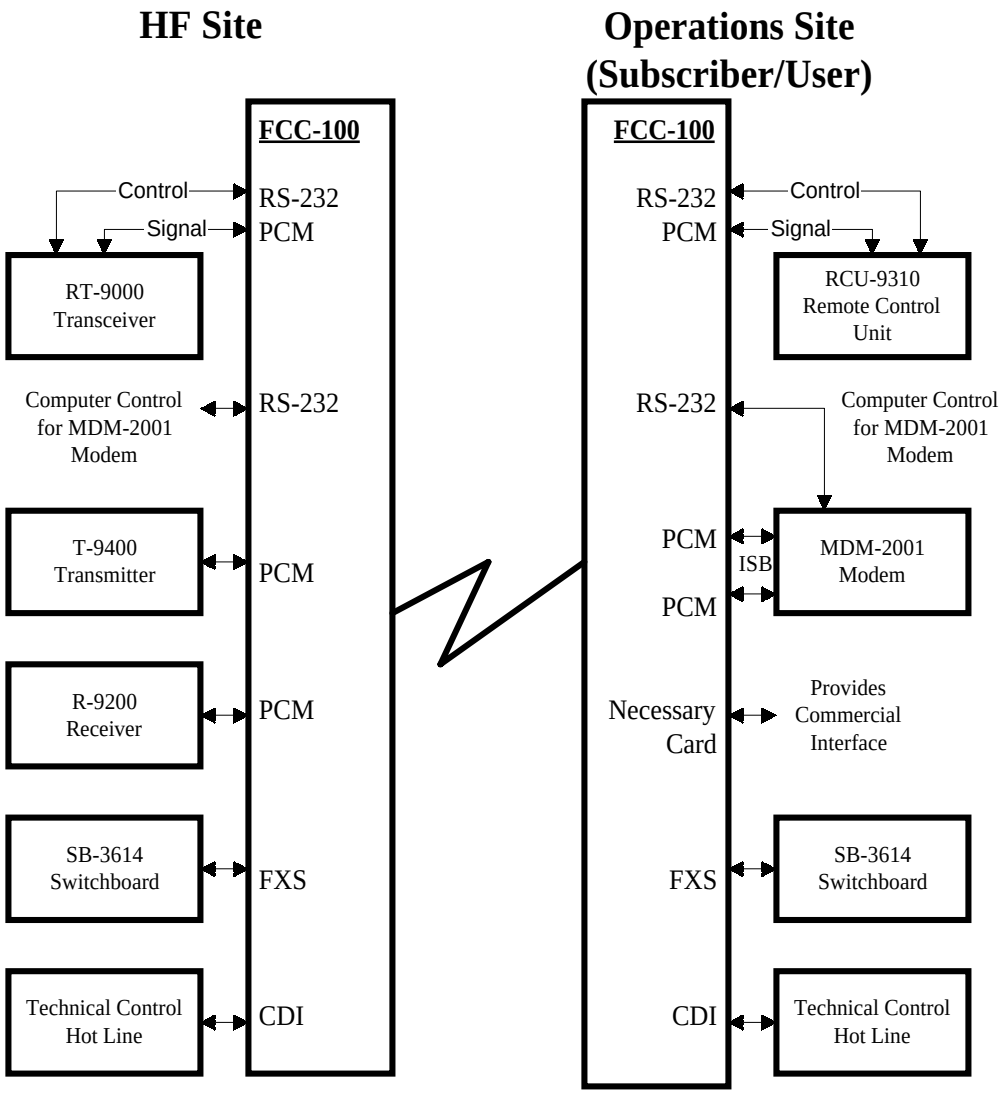


Figure 14-1. Remoting with FCC-100 Multiplexers

SUMMARY

This chapter provided an overview of several options available with use of the FCC-100. It included commercial equipment interfacing and remoting the QRP HF site from the operations site. Although patch and test locations may vary, the basic signal flow remains the same through each van version and transit case version. An understanding of the signal flow and access points for the signal provides options to work around down equipment and other potential circuit problems.

ADDITIONAL READING

The following AFJQS covers the TSSR, which is not part of the QRP.

- AFJQS 2E1X1-203TC, AN/GRC-239 Tropo Satellite Support Radio (TSSR)

KEY WORDS AND PHRASES

The following acronyms and definitions are from Figure 14-1.

- RS-232 – Serial Interface Standard
- PCM – Pulse Code Modulation
- FXS – Field Exchange Switch
- CDI – Conditioned Diphase

ATTACHMENT 1
LIST OF ACRONYMS

TERM	DEFINITION
AFAMPE	Air Force Automated Message Processing Exchange
AFFOR	Air Force Forces
AFRC	Air Force Reserve Command
AJ	Anti-Jam
AFJQS	Air Force Qualification Training Package
AME	Amplitude Modulation Equivalent
AMME	Army Automated Multimedia Exchange
AOC	Air Operations Center
ANG	Air National Guard
ARQ	Automatic Request
ASC	AUTODIN Switching Center
ASOC	Air Support Operations Center
AUTODIN	Automatic Digital Network
BITE	Built-In Test Equipment
CB	Common Battery
CBS	Common Battery Supervision
CDI	Conditioned Diphase
COMSEC	Communications Security
CRC	Control and Reporting Center
CRYPTO	Cryptographic
CSA	COMSAT Antennas
CSP	Communications Support Processor
CVSD	Continuous Variable Slope Delta
CW	Continuous Wave
DCS	Defense Communications System
DDN	Defense Data Network
DNVT	Digital Non-Secure Voice Terminal
DOS	Disk Operating System
DP	Dial Pulse
DSN	Defense Switched Network
DTMF	Dual Tone Multi-Frequency
ECU	Environmental Control Unit

TERM	DEFINITION
EEPROM	Electronically Erasable and Programmable Read Only Memory
FAX	Facsimile
FEC	Forward Error Control
FSK	Frequency Shift Key
FXS	Field Exchange Switch
GMF	Ground Mobile Forces
HF	High Frequency
IDF	Intermediate Distribution Frame
ISB	Independent Sideband
LDMX	Local Digital Message Exchange
LPA	Linear Power Amplifier
LRU	Line Replaceable Unit
LSB	Lower Sideband
LSTDM	Low-Speed Time Division Multiplexer
MBS	Mission Bit Stream
MCE	Modular Control Equipment
MIB	MCE Interface Box
MSE	Mobile Subscriber Equipment
NABS	NATO Airbase SATCOM
NATO	North Atlantic Treaty Organization
NAVCOMPARS	Naval Communications Processing and Routing
NIPRNET	Nonclassified Internet Protocol Router Network
NRZ	Non Return to Zero
NSN	National Stock Number
NVIS	Near Vertical Incidence Skywave
PABX	Public Access Branch Exchange
PACAF	Pacific Air Forces
PCM	Pulse Code Modulation
QRP	Quick Reaction Package
RX	Receive
SATCOM	Satellite Communication
SIPRNET	Secret Internet Protocol Router Network
SSB	Single Sideband
STAMPS	Stand Alone Message Processing System
TAB	Tactical Air Base

TERM	DEFINITION
TACS	Tactical Air Control System
TDC	Theater Deployable Communication
TO	Technical Order
TRI-TAC	Tri-Service Tactical
TSSR	Tactical Satellite Support Radio
TX	Transmit
UHF	Ultra-High Frequency
USAFE	U.S. Air Forces in Europe
USB	Upper Sideband
UTC	Universal Time Coordinated
VF	Voice Frequency
VHF	Very High Frequency
VOX	Voice Operated Transmit
VSWR	Voltage Standing Wave Ratio