National Defence / Défense nationale

B-GL-351-003/FP-001

COMMUNICATIONS ELECTRONICS STANDING INSTRUCTION (CESI)

(ENGLISH)

(This publication is effective upon receipt.)

WARNING

ALTHOUGH NOT CLASSIFIED, THIS PUBLICATION, OR ANY PART OF IT, MAY BE EXEMPT FROM DISCLOSURE TO THE PUBLIC UNDER THE ACCESS TO INFORMATION ACT. ALL ELEMENTS OF INFORMATION CONTAINED HEREIN MUST BE CLOSELY SCRUTINIZED TO ASCERTAIN WHETHER OR NOT THE PUBLICATION OR ANY PART OF IT MAY BE RELEASED.

Issued on the Authority of the Chief of the Land Staff

Canada

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OPI: DAD 5-3 **2003-05-30**

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FOREWORD

1. B-GL-351-003/FP-001, *Communications Electronics Standing Instruction (CESI)* is issued on the authority of the Chief of the Land Staff.

2. This publication is effective upon receipt.

3. Suggestions for amendments should be forwarded through normal channels to the Director of Army Doctrine, attention DAD 5-3.

4. Unless otherwise noted, masculine pronouns contained herein refer to both genders.

5. This publication is available electronically on both the Defence Information Network (DIN) and the World Wide Web in the Army Electronic Library. Keyword—Army Electronic Library.

PREFACE

AIM

1. The aim of this publication is to outline Canadian Forces (CF) doctrine on the standing instructions for communications electronics. It supplements B-GL-321-002/FT-001, *Signals in Battle.*

APPLICATION

2. This publication is the source document for use by all branches and contains information required by officers and non-commissioned members (NCMs) to conduct operations and continuation training in communications electronics.

3. The doctrine contained herein supplements all B-GL-321-002/FT-001, *Signals in Battle* volumes.

SCOPE

4. This publication is divided into two sections and should be used together;

a. **Operations**. This section contains information on the preparation and execution instructions required to successfully support an operation.

b. **Equipment**. This section contains information on the specifications, techniques and instructions needed to employ communication and information systems equipment, power, antennas, and other peripherals.

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CHAPTER 1
OPERATIONS

ROLE OF SIGNALS

1. The role of Signals is to provide commanders and their staff with the means to exercise command and control (C2), and to deny and exploit the enemy's use of the electromagnetic (EM) spectrum through electronic warfare (EW).

TIME ZONES IN CANADA

	Standard	Daylight Saving
Yukon	V (9)	U (8)
Pacific	U (8)	T (7)
Mountain	T (7)	S (6)
Central	S (6)	R (5)
Eastern	R (5)	Q (4)
Atlantic	Q (4)	P (3)
Newfoundland	PQ (3:30)	OP (2:30)

2. To calculate Greenwich Mean Time (GMT), add to local time the number of hours shown in brackets. It should be noted that the majority of the Yukon has elected to use Pacific Standard Time.

TIME SIGNALS

3. For reception in North America:

CALL SIGN	LOCATION	FREQUENCY (MHZ)	
CHU	Ottawa	3.330 7.335 14.670	
WWV	US	2.5 10.0 20.0	5.0 15.0 25.0

4. Time signals may be obtained in the following ways:

   a. by phoning (613) 745-1576 CHU (Dominion Observatory Ottawa);

   b. by phoning Automated Voice Operated Network (AUTOVON) (Canadian Switched Network (CSN)) 294-1800 US Naval Observatory Master Clock; and

   c. through the use of the global positioning system (GPS) (WWV) Signal.

5. For reception in Europe/Middle East:

CALL SIGN	LOCATION	FREQUENCY (MHZ)
WWV	US	See above
GIC	England	8.640
GID	England	13.555

6. For reception in the Far East:

CALL SIGN	LOCATION	FREQUENCY (MHZ)
JJY	Tokyo	2.5 (0659 to 2259Z) 4 and 5 (24 hours/day) 8 and 10 (2059 to 1059Z)

TIME ZONES IN THE WORLD

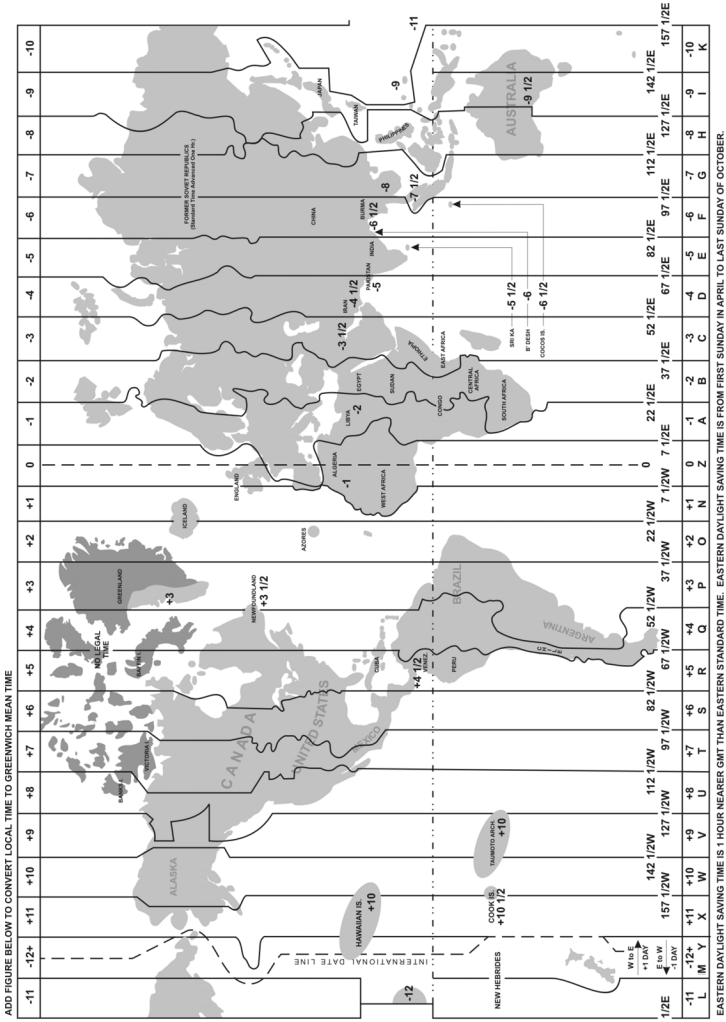


Figure 1-1: Time Zones in the World

LOSS OF CONTACT DRILL

7. See Unit Standard Operating Procedure (USOP) 202.06

COMMUNICATION SECURITY

8. See USOP 202.08.

EMISSION CONTROL

9. See USOP 202.07.

UNIVERSAL FIXED CALL SIGN SYSTEM

10. See USOP, Tactical aide-memoire (TAM) 204.

DEFENCE AGAINST EW

11. See USOP, TAM 205.

CHAPTER 2
REPORTING INTERFERENCE

MEACONING, INTERFERENCE, JAMMING AND INTRUSION

1. The following paragraphs detail the reporting procedures to be used by Canadian Forces (CF) Units and other DND agencies experiencing meaconing, interference, jamming and intrusion (MIJI). Harmful interference is to be reported through the Signals chain of command.

2. For the purpose of this instruction only, MIJI is defined as:

a. **M—MEACONING**. A system of receiving radio beacon signals and rebroadcasting them on the same frequency to confuse navigation. The meaconing station causes inaccurate bearings to be obtained by ships, aircrafts or ground stations.

b. **I—INTERFERENCE**. The radiation, emission or induction of electromagnetic energy, unintentionally causing degradation, disruption, or complete obstruction of the designed function of the electronic equipment affected. Example: The interruption of a military transmission by a civilian radio broadcast.

c. **J—JAMMING**. The deliberate radiation, re-radiation, or reflection of electromagnetic energy to disrupt enemy use of electronic devices, equipment, or systems.

d. **I—INTRUSION**. The intentional insertion of electromagnetic energy into transmission paths in any manner with the objective of deceiving operations or of causing confusion.

MIJI REPORT

3. **Type**: meaconing, interference, jamming or intrusion.

4. **Victim Unit/Net**: unit, aircraft or ship call sign/identification.

5. **Observation Post/Position/Equipment Identification**:

   a. name;

   b. position/net; and

   c. equipment type.

6. **Date-Time Group** (DTG): start and stop times/duration.

7. **Frequency**.

8. **Type of Modulation**: intentional noise, static, tones, bagpipes, Continuous Wave (CW), voice, Chatter, music, etc.

9. **Strength of Interference**: weak, medium or strong.

10. **Electronic Counter Measure (ECM) Effect**:

   a. intermittent disruption;

   b. denial;

   c. increased handling times;

   d. loss of secure mode;

   e. nuisance; and

   f. others.

11. **Electronic Protective Measures (EPM) Action**:

   a. worked through;

   b. increase power;

   c. changed locations;

   d. changed frequency to XX.XXX;

e. ceased communications (comms);

f. others; and

g. enemy reaction.

12. **Additional Information**:

a. bearing of jammer;

b. source of ECM;

c. angle of site or radar crest;

d. weather;

e. terrain; and

f. others.

TACTICAL OPERATIONS AND EXERCISES REPORTING PROCEDURES

13. Individual responsibilities are as follows:

a. The detachment which experiences the MIJI must report the incident immediately to the control station.

b. Control takes immediate action to mask, minimize or mitigate the effects of MIJI in accordance with unit and formation procedures.

c. The unit is responsible for ensuring that established reporting procedures contained in the MIJI report are followed:

(1) When the effects of the MIJI are such that the operation role of the unit is unacceptably degraded, it is imperative that the commander be informed immediately.

(2) It is not always possible for stations being interfered with to determine the cause or even the component of MIJI being experienced. It is therefore extremely important that as many details as possible be compiled and reported by the unit to enable effective analysis of the situation.

(3) The unit must use all available resources, including requesting assistance from formations and units in the same area, to isolate, identify and obtain additional data from the MIJI source. Direction finding (DF) and monitoring assistance may also be required from the formation.

14. In Canada, all units will forward MIJI reports along the Signals chain of command.

CHAPTER 3
EQUIPMENT

SECTION 1
COMMUNICATION AND INFORMATION SYSTEMS EQUIPMENT

RADIO EQUIPMENT SPECIFICATION TABLE

Radio	Description	Set	Freq Range	Band	Mod	Hop	Power Output	Range	Base Radio	Crypto
AN/VRC 513 Version (V)1	Low Power Very High Frequency (VHF) vehicle (Veh) Mounted	A	30 – 107.975 MHz	VHF	FM	Yes	.1 , 4 and 16 Watts	20 km	Receiver-Transmitter (RT)-5121	Embedded
AN/VRC 513 (V)2	High Power VHF Veh Mounted	A+	30 – 107.975 MHz	VHF	FM	Yes	.1, 4, 16 and 50 Watts	50 km	RT-5121	Embedded
AN/PRC 522	Low Power VHF Manpack	B	30 – 107.975 MHz	VHF	FM	Yes	.1 and 4 Watts	20 km	RT-5121	Embedded
AN/VRC 516	Long Range High Frequency (HF)/VHF Veh Mounted	C	1.6 – 59.9999 MHz	HF	AM/FM	No	5, 25 and 150 Watts	2000 km	RT-1694	KY-99A
AN/PRC 521	Light Assault Radio (LAR)	D	30 – 87.9875 MHz	VHF	FM	No	.5 and 2 Watts	.5 – 3 km	RT-5113	Embedded
AN/PRC 515	Manpack HF	E	2 – 30 MHz	HF	AM	No	5 and 25 Watts	>30 km	RT-5047/URC	None
AN/PRC 138	Long Range HF /VHF Manpack	E+	1.6 – 59.9999 MHz	HF	AM	No	1, 5, and 20 Watts	500 km	RT-1695/URC	KY-99A
AN/PRC 113	Air/Ground/Air Ultra High Frequnecy (UHF) Manpack	F	116 – 149.975 MHz 225 – 4000 MHz	VHF UHF	AM/FM	Yes	2, 10 Watts	50 km	RT-1319B	KY-57
AN/VRC 83 (V)2	Air/Ground/Air UHF Veh Mounted short rge tact	U	116 – 149.975 MHz 225 – 4000 MHz	VHF UHF	AM/FM	Yes	2, 10 and 40 Watts	50 km	RT-1319B	KY-57
AN/TSC-506	Very Long Range Communications System (VLRCS)		C-band, Ku-band or X-band	UHF? Super High Frequency (SHF)?		No	Depends on the Data. Not less then 40 Watts	Varible		
AN/URC-508	VLRCS		2 - 30 Mhz	HF	AM	No	Up to 1kW	2500 km		Data—TSEC KG-84C Voice—KY-99A

COMBAT NET RADIO (LAR)—AN/PRC-521

1. **Characteristics**.

CHARACTERISTICS	SPECIFICATIONS
Frequency Range	30 – 87.9825MHz
Mode of Transmission	Fixed Frequency
Operating Range	500m – 3 km • 500m—Short Antenna • 3 km—Long Antenna
Channels	14 Separate Channels Each Channel Separate Rx/Tx Freq
Crypto Ability	Embedded Crypto Card Security for Receive and Transmit Secure and Non Secure Voice/Data
Power Supply	9V DC Battery • Ni-Cad—8 – 10 hrs at 1hr Tx/1hr Rx • Lithium—24 hrs at 1hr Tx/1hr Rx

2. Control switches.

CONTROL	FUNCTION
Transmit Pwr Switch	Hi/Low Setting
Audio Connector	- Headset-Mic - Cloning Cable - Frequency Fill System (FFS) Cable

CONTROL	FUNCTION
Green LED	Transmission (Tx), Cloning, Radio Initialisation
Amber LED	Non-Secure Operations
Antenna Connector	Both Antennas
Volume Switch	Off, Whisper (position (posn) 1,2) audio output (posn 3-6)
Channel Switch	14 Channels
Mode Switch	- Z—Zeroize - A—KEK - B,C,D—Secure Mode - clear (Clr)—Non Secure Mode

3. Personality

SELECTION	SETTING
Squelch level	8 db
Transmit timeout	**30** seconds for voice or voice/data operation and set to infinite (∝) for data operation.
Continuous Tone Control Squelch System(CTCSS).	The **150 Hertz (Hz)** tone is selected for each channel for both Tx and Rx modes (VHF North Atlantic Treaty Organization (NATO) standard).
Clone Control. (MASTER, SLAVE, NO CHANGE and DISABLE)	1. Unit level—one radio as MASTER and the remainder as NO CHANGE; 2. Sub-Unit and Sub-Sub-Unit level (ie: company and platoon)—all radios set to NO CHANGE; and 3. Sub-Sub-Sub Unit level (ie: section)—all radios set to SLAVE.

INTERFACE UNIT, COMMUNICATION EQUIPMENT (IUCE) J-5250/PRC-521

4. **General**. When connected to the AN/PRC-521 as a stand-alone unit, the J-5250 interface unit is controlled via its keyboard and is used to program the radio set with frequency data. When connected to the AN/PRC-521 in conjunction with an IBM personal computer (PC) or equivalent, the J-5250 functions as a data conduit and the keypad is disabled.

5. **Keypad**. The J-5250 interface unit display contains a Liquid Crystal Display (LCD) that is capable of showing two lines of eight characters. The keypad contains twelve keys.

COMMAND KEY ENTRY	DESCRIPTION
CMD	(COMMAND) Pushed first to initiate all commands and is followed by a numerical key to form a complete command. When pushed, it is represented on the display by an asterisk (*).
KEYS 0-9	Used to designate a command when preceded by a command. Used in channel designation when preceded by a command. Used for frequency data entry when prompted by the display.
ENT	(ENTER) Used to enter all commands into the J-5250. **NOTE** The ENT key is not required when entering frequency data.

6. **Preparation for Use**.

CONNECTION	SETUP
STAND-ALONE	- Connect the J-5250 7-pin connector to the SK1 of the radio set. - Turn the radio set VOLUME switch to 1.

CONNECTION	SETUP
IN CONJUNCTION WITH AN IBM PC OR EQUIVALENT	- Connect the J-5250 7-pin connector to SK1 of the radio set. - Connect the J-5250 10-pin connector to the PC adapter cable. - If required, connect the 9-pin/9-pin receptacle-to-receptacle adapter to the PC adapter cable. - If required, connect the 9-pin/25-pin receptacle-to-receptacle adapter. - Connect the PC adapter to the PC Port COM 1 or COM 2, as required. - Turn on the PC. - Turn the radio set VOLUME switch to 1.

COMBAT NET RADIO (PRIMARY)—AN/PRC-522, AN/VRC-513(V)1 AND AN/VRC-513(V)2

7. Characteristics and Specifications

CHARACTERISTICS	SPECIFICATIONS
Frequency Range	30 to 108 MHz
Number of channels	3120
Channel spacing	25 kh
Number of preset channels	8
Mode of transmission	Fixed frequency
	Frequency Hopping
Modulation type	FM/Frequency Shifting Key (FSK) ± 6.5 kHz peak deviation
Hopping rate	100 hops per second
Traffic mode	Analog voice 300 Hz to 3 kHz
	Analog data
	Data Up to 16 kbytes/sec
Encryption modes	Clear, Secure, and VINSON compatible

CHARACTERISTICS	SPECIFICATIONS
POWER SUPPLY Supply voltage	 10 to 28 Vdc
Power output, Manpack Vehicle	 100 mW (low), 4 Watt (W) (med) 100 mW (low), 4 W (med), 16 W (high)
Operating temperature range Storage temperature range	-40°C to +48°C -51°C to +63°C

8. Controls and Indicators

NO	CONTROL	FUNCTION
1	Interlock for ON/OFF switch	Interlock for CSEC, HSET, TSEC and UNQ positions.
2	Interlock for CHANNEL switch	Interlock for HIDS and ARS positions.
3	Interlock for CRYPTO switch	Interlock for ZPTT position.
4	ON/OFF switch OFF WSPR S OFF volume CSEC HSET TSEC	 Power off. Whisper gives full modulation with voice 10 dB lower than the normal voice level. Squelch off. Audio volume setting between WSPR and S OFF, volume adjusts in four steps. Selects mode for Communication Security (COMSEC) (key zeroizing, loading, rekeying or tags display). Selects mode for frequency hopping, Over the Air Rekey (OTAR) or tags display. Selects mode for Transmission Security (TRANSEC) (key zeroizing,

NO	CONTROL	FUNCTION
		loading, rekeying or tags display).
	UNQ	Selects mode for the unique key (zeroizing, loading or tags display).
5	Display	Eight-character display with an ambient light sensor between the sixth and seventh characters. The window is scratch resistant and automatically adjusts to daylight operations and night vision goggle compatibility.
6	CHANNEL switch:	
	1	Selects channel 1 for manual channel operation.
	1 to 8	Selects channel number for operating and loading/deleting COMSEC and TRANSEC variables.
	A	Automatic Key Encryption Key (KEK) loads, deletes or displays tags.
	M	Manual KEK loads, deletes or displays tags.
	T	TRANSEC KEK loads, deletes or displays tags.
	CHK	Allows operator to check OTAR COMSEC keys.
	ARS	Airborne Radio Suite remote operation only.
	HIDS	Headquarters Information Distribution System remote operation (used in the Iris Subsystem only).
7	CRYPTO switch:	
	PT	Plain text communication mode.
	CT	Cipher text communication mode.
	CTv	Cipher text vinson compatible communication mode.
	LD	Loads COMSEC and TRANSEC variables and/or hopset with manually

NO	CONTROL	FUNCTION
		designated channel addresses through the FILL connector from a fill device.
	RxV	Allows for single-channel loading of key variables and/or hopset through OTAR and/or Over The Air Transfer (OTAT).
	LEZ	Allows bulk load of COMSEC and TRANSEC variables and/or hopset through an AN/CYZ-10 Data Transfer Device (DTD).
	TAGS	Displays the COMSEC, TRANSEC, hopset or unique key information for a selected channel.
	ZPTT TC	Zeroizes all TRANSEC and COMSEC keys when the Press-toTalk (PTT) switch on the audio ancillary is pushed.
	ZPTT CHAN	Zeroizes designated channel COMSEC or TRANSEC keys when the PTT - switch on the audio ancillary is pushed.
	ZPTT HSET	Zeroizes all hopset and frequency information when the PTT switch on the audio ancillary is pushed.
	ZKEYS	Zeroizes all keys.
8	FILL connector	Six-pin connector for loading hopsets, frequencies or COMSEC/TRANSEC/UNIQUE variables.
9	AUDIO/DATA connectors	Two 7-pin connectors for voice communication with audio ancillaries and external data devices.
10	Keypad:	For selecting the power, manual frequency, transmission modes, Built-In Test (BIT) Radio Rebroadcast (RRB), economize mode and manual HOPSET programming.

NO	CONTROL	FUNCTION
	1to 0	Enters the numerical value required by the transceiver.
		Performs BIT and shows results; selects and scrolls the transceiver menu. Controls the transceiver display, gives the transceiver status and COMSEC PWA (Print Wire Assembly) configuration.
	FXC	Selects fixed frequency compatible mode.
	FXS	Selects fixed frequency super mode.
	h/H	Selects hopping mode as a master or slave station.
	Radio Rebroadcast (RRB)	Selects radio rebroadcast mode.
	M/Hi	Selects medium or high transmit power.
	LOW	Selects low transmit power.
	NTx	Selects no transmit power (turns the transmitter off).
	ECO	In the manpack configuration, selects economize mode. On (to conserve battery power) or economize mode Off.
11	ANT	Antenna connector in the manpack configuration.
12	RRB	Connector to BLACK radio rebroadcast operation.
13	RF50 ohm coaxial	Radio Frequency (RF) connector that connects remote antennas or an external amplifier.

9. **RT-5121/U Programming**.

OPTION	MENU OPTION	SELECTION/SETTING		REMARKS
1 PROG				
	Channel 1			
		Select Channel 1		
		Enter Freq		
	Channels 2 to 8			
		Select Channels 2 to 8		
		Select Hset		
		Push ↑		FR will appear in position 7 & 8.
		Enter Freq		
	Load Easy (LEZ)			
		Connect DTD		
		Push ON/OFF on DTD		
		Select Appt on DTD		
		Select I111 on DTD		
		Select Cfd on DTD		
		Select Key or Hopset to be loaded		
		Select Ld		
		Select Channel 1 to 8		
		Select CSEC, TSEC or UNQ		

OPTION	MENU OPTION	SELECTION/SETTING		REMARKS
		Follow instructions on DTD		
	Frequency Hopping			
		LEZ		
			Channel switch to desired channel	
			Crypto switch to PT, CT or CTv	
			Initialize Synchronization	
		Manual Fill		
			ON/OFF to HSET	
			Channel Switch to channel to be loaded	
			Crypto switch to PT	
			Press ↑	FR will appear in position 7 & 8
			Enter Freq	
			Press ↑ then 0	INTERLEAF will be displayed
			Press 0 for off	
			Press 1 for on	
			Press ↑ then 0	SN will appear in position 7 & 8
			Enter Signalling Number	

OPTION	MENU OPTION	SELECTION/SETTING		REMARKS
			Press ↑ then 0	Hc will appear in position 7 & 8
			Enter Type of Hopping (position 1)	0= 30-107.975 MHz (Wideband) 1=30-43 MHz (Narrow) 2=43-56 MHz (Narrow) 3=56-69 MHz (Narrow) 4=69-82 MHz (Narrow) 5=82-95 MHz (Narrow) 6=95-108 MHz (Narrow) 7=4 Discreet freqs 8=16 Discrete freqs 9=256 Discrete freqs
			Enter Interleaving (position 5)	0= Off, 1=On
2 Time of Day (TOD)				
	View			
		Push ↑ then 9		
		Push ↑—Year		
		Push ↑—Month		
		Push ↑—Day		
		Push ↑—Hour		

OPTION	MENU OPTION	SELECTION/SETTING		REMARKS
	Program			
		Select Channel 1		
		Push <NTx>		
		Push H/h to select h		
		Press PTT for 2 secs		
		Repeat procedure for channel 2 to 8		
		Push ↑ then 9		
		Enter Year		
		Push ↑		
		Enter Month		
		Push ↑		
		Enter Day		
		Push ↑		
		Enter Hour		
		Push ↑ then 9 to exit		
3 BIT				
	Push ↑ then T			
	Pass			
		Push ↑ for Read-Only Memory (ROM) test	Pass or Fail	
		Push ↑ for Random Access Memory (RAM) test	Pass or Fail	

OPTION	MENU OPTION	SELECTION/SETTING		REMARKS
		Press each key to test keypad	Pass or Fail	
		Rotate each switch for Rotary Switch Gray Code Test		
		Push T to exit		
	Fail			
		Push ↑ to scroll through error codes		
			Push T to clear error display	
4 Selective Comm				
	Push ↑ x 3 then 1			
	Enter own address	00 – 99		
	Push ↑ x 3 Then 3			
	Enter selective address	00 – 99		
	Push ↑ x 2 To exit			
5 Banned Address				
	Push ↑ x 3 Then 0			
	Enter Banned Address	00 – 99		

OPTION	MENU OPTION	SELECTION/SETTING		REMARKS
	Push ↑ x 2 To exit			
6 Mission Configurable Link (MCL)				
	Push T x 2			
	Push ↑ to display Line 1			
	Push ↑ to display Line 2			
	Push ↑ to display Line 3			
	Push ↑ to display Line 4			
	Push ↑ to display Line 5			
	Push T x 2 To exit			

10. **RRB Configuration**.

SER	RAD A #1 CONFIGURATION	RAD A #2 CONFIGURATION
1	Set the RAD A #1 CHANNEL Switch to HIDS.	Set the RAD A#2 CHANNEL Switch to HIDS.
2	On Control-Indicator (CI) #1, reset the RAD A #1 by pressing CON-3-1-1-0-1-CON.	On CI #1, reset the RAD A #2 by pressing CON-3-1-2-0-1-CON.
3	On CI #1, configure the RAD A #1 NET ID by pressing CON-3-1-1-1-X-X-X-CON.	On CI #1, configure the RAD A #2 NET ID by pressing CON-3-1-2-1-X-X-X-CON
4	On CI #1, configure the RAD A #1 RAD SILENCE STATUS by pressing CON 3-1-1-2-0-CON.	On CI #1, configure the RAD A #2 RAD SILENCE STATUS by pressing CON-3-1-2-2-0-CON.

SER	RAD A #1 CONFIGURATION	RAD A #2 CONFIGURATION
5	On CI #1, configure the RAD A #1 CHANNEL to 1 by pressing CON-3-1-1-3-1-CON.	On CI #1, configure the RAD A #2 CHANNEL to 1 by pressing CON-3-1-2-3-1-CON.
6	On CI #1, configure the RAD A #1 TX Power to MEDIUM by pressing CON-3-1-1-4-2-CON.	On CI #1, configure the RAD A #2 TX Power to MEDIUM by pressing CON-3-1-2-4-2-CON.
7	On CI #1, configure the RAD A #1 MODE to FX COMP by pressing CON-3-1-1-5-1-CON.	On CI #1, configure the RAD A #2 MODE to FX COMP by pressing CON-3-1-2-5-1-CON.
8	On CI #1, configure the RAD A #1 RRB STN TYPE to RRB STN by pressing CON-3-1-1-6-1-CON.	On CI #1, configure the RAD A #2 RRB STN TYPE to RRB STN by pressing CON-3-1-2-6-1-CON.
9	On CI #1, configure the RAD A #1 NET TYPE to DIGITAL VOICE by pressing CON-3-1-1-7-1-1-CON.	On CI #1, configure the RAD A #2 NET TYPE to DIGITAL VOICE by pressing CON-3-1-2-7-1-1-CON.
10	On CI #1 configure the RAD A #1 EDAC to ENABLE by pressing CON-3-1-1-8-1-CON.	On CI #1 configure the RAD A #2 EDAC to ENABLE by pressing CON-3-1-2-8-1-CON.
11	On CI #1, configure the RAD A #1 PT DATA TX to ENABLE by pressing CON-3-1-1-9-1-CON	On CI #1, configure the RAD A #2 PT DATA TX to ENABLE by pressing CON-3-1-2-9-1-CON.

11. **Key Loading From Data Transfer Device—Procedure**.

SER	FUNCTION	OPERATION
1	**On/Off** switch	Set to the second volume level
2	**Channel** switch	Set to **1**
3	**Crypto** switch	Set to **PT**
4	CNR (P) to No Transmit	Press the **NTx** button
5	Fixed Compatible mode	Press the **FXC** button
6	VH (Vehicle Headset)	Left **audio/data** port (1) on CNR (P)
7	Zeroize the CNR (P)	Turn the crypto switch to **Z** **Keys** and back to **PT**
8	Using the VH	Confirm that the alarm tone is heard
9	On the VH	Set the PTT switch to **R** twice to clear the alarm tone. If alarm does not clear, check the radio settings

SER	FUNCTION	OPERATION
10	Turn on the DTD	Press the **ON** button
11	At the DTD MAIN menu prompt	Press the "**A**" button to select **Appl**
12	**NOTE** Make sure **LOCK LTR** is on by ensuring **LETTER** is in the bottom left corner of the screen; if not, press **LOCK LTR** to display **LETTER**.	
13	At the DTD **APPL** menu	Press **I** to select **I111**
14	**NOTE** At any time throughout this procedure if **AUDIT TRAIL FULL** appears, clear it by pressing **CLR**.	
15	At the IRIS menu	Press L to select **LEZ**
16	At **ENTER LDGID** prompt	Enter the appropriate six digit load group ID number and press **ENTER**
17	At **SELECT KEY TYPES**	Ensure all key types are capitalized. If not, press **K** for **KEK**; **T** for **TEK**; **S** for **TSK**; **R** for **FRQ**: **F** for **FM**, and then press the **CLR** button
18	At **ENTER START DATE**	Enter the proper six digit number for that particular load group ID and press **ENTER**
19	At **ENTER END DATE** prompt	Enter the proper six digit number for that particular load group ID (usually the same as the start date) and press **ENTER**
20	At the **LEZ** menu	Press **CLR** to continue
21	Set the CNR (P) **CRYPTO** Switch to **LEZ** when prompted	
22	On the DTD	Press the **CLR** button
23	Connect the DTD to the CNR (P) using the key fill cable when prompted	
24	On the DTD	Press the **CLR** button
25	On the VH	Set the PTT switch to **R** for approximately 1 second and then release when prompted
26	On the DTD	Press **SEND** to start the key load

SER	FUNCTION	OPERATION
27	**NOTE** The loading procedure will take approximately one minute to complete.	
28	When the **SELECT FUNCTION** prompt is displayed on the DTD	Turn the **CRYPTO** key to **Ctv**
29	On the VH	Set the PTT to **R** once to clear the two-tone alarm
30	**NOTE** If the alarm cannot be cleared repeat the procedure.	
31	When finished loading keys, the DTD will allow three different selections: **REPEAT, MODIFY, AND NEW**. Press the **OFF/ON** button if one of the three selections is not required.	
32	Disconnect the DTD from the CNR (P).	

12. **Procedures for Manual Key OTAR and Automatic Key OTAR**.

MK OTAR	AK OTAR
- Tx stn selects Iris Application on DTD. - Tx stn selects NCD on DTD. - Tx stn selects type of End Crypto Unit (ECU) (CNR) on DTD. - Tx stn selects OTAR on DTD. - Tx stn selects Man_key on DTD. - Tx stn enters load group on DTD. - Tx stn enters date on DTD (this can be bypassed by pressing enter). - Tx stn selects key to send amongst the load group keys on DTD.	- Tx stn selects Iris Application on DTD. - Tx stn selects NCD on DTD. - Tx stn selects type of ECU (CNR) on DTD. - Tx stn selects OTAR on DTD. - Tx stn selects Auto_key on DTD. - Tx stn selects type of key on DTD. - Tx stn enters load group on DTD. - Tx stn enters date on DTD (this can be bypassed by pressing enter). - Tx stn selects key to send amongst the load group keys on DTD.

MK OTAR	AK OTAR
- Tx stn directs out stns to select RCV, the channel and the type of key on their Combat Net Radio (Primary) (CNR(P)). - Tx stn directs out stns to go back to normal settings once they have heard the beep sound. - Tx stn sends the key. - Tx stn selects CHECK on CNR(P) and does a radio check; every out stn should answer it. - Tx stn goes back to previous settings and does a radio check; nobody should answer it. - Tx stn loads the new key in its CNR(P).	- Tx stn answers yes to DTD's question "use same filter?". - Tx stn selects all three KEKs. - Tx stn selects cont on DTD. - Tx stn directs out stns to select RCV, the channel and the type of key on their CNR(P). - Tx stn directs out stns to go back to normal settings once they have heard the beep sound. - Tx stn sends the key. - Tx stn selects CHECK on CNR(P) and does a radio check; every out stn should answer it. - Tx stn goes back to previous settings and does a radio check; nobody should answer it - Tx stn loads the new key in its CNR(P).

13. **Procedures for OTAT**.

TRANSMIT	RECEIVE
1. From the DTD MAIN Menu select Appl.	1. From the DTD Main Menu select Appl.
2. Select I111 (IRIS Menu).	2. Select I111 (IRIS Menu).
3. Select NCD.	3. Select NCD.
4. Select Cnr then OTAT.	4. Select Cnr then OTAT.
5. Select Xmit_key {OTAT}	5. Select Recv_key
6. Press the [S] key or choose Select to select the displayed key "CSEC" or "TSEC". The fol screens will be displayed: DIRECT OS TO SELECT DTD OTAT/Recv_key {CLR} **Press CLR** DIRECT OS TO SELECT	6. Select Default_tag. The fol screens will be displayed: SELECT "CSEC" OR "TSEC" ON CNR(P) {CLR} **Press CLR** CONNECT DTD TO CNR(P) PRESS [RCV] / [ABORT]

TRANSMIT	RECEIVE
"CSEC" ON CNR(P) {more} {OS} PRESS [RCV] ON DTD WAIT FOR KEY AND {more} {OS} THEN RETURN TO ORIGINAL SETTINGS {CLR} **Press CLR** SET NCS TO "CSEC" {CLR} **Press CLR** **NOTE** If "TSEC" was selected vice "CSEC" then above displays will show "TSEC" vice "CSEC" and Directions to OS shall reflect this.	RECEIVE IN PROGRESS ENTER LDGID =>?????? Enter Load Group ID **or** Press [ENTR] ENTER START DATE (DDMMYY) =>###### Enter start date **or** Press [ENTR] ENTER USE =>? then Press [ENTR] ENTER CHANNEL # =># then Press [ENTR] ENTER SHORT TITLE => ?????????????????????????????? ???? then Press [ENTR] ENTER EDITION =>?????? then Press [ENTR] ENTER SEGMENT # =>### then Press [ENTR] ENTER. REGISTER/COPY # =>############ then Press [ENTR] SELECT CLASSIFICATION U C S Ts pA pB pC then Press [ENTR] 1 KEY RECEIVED
7. The displays above instruct the user to set up his equipment for the operation and to instruct the remote station user to set his equipment to the proper settings. Use the {CLR} key where indicated to continue.	7. The displays above instruct the remote station user to set his equipment to the proper settings. Use the {CLR}/{ENTR} key where indicated to continue.

TRANSMIT	RECEIVE
8. SET NCS TO ORIGINAL SETTINGS {CLR}**Press CLR** CONFIRM QUIT {CLR}**Press CLR** SELECT FUNCTION Repeat Modify New.	8. Following the "KEY RECEIVED" message, the DTD user is returned to the fol display: CONNECT DTD TO CNR(P) PRESS [RCV]/[ABORT] The receive sequence is repeated as necessary.
9. After all transfers are complete, press the {ABORT} key to return to the NCD menu.	9. After all Keys are received, press the {ABORT} key to return to the NCD menu.
10. This completes the OTAT Transmit Key operation.	10. This completes the OTAT Receive Key operation.

14. **Crypto Key Loading Procedures**.

SITUATION	PROCEDURE
Loss of COMSEC	Contact the COMSEC custodian if a transceiver crypto variable is lost and follow the custodian's instructions.
Compromised COMSEC	Contact the COMSEC custodian if COMSEC is compromised and follow the custodian's instructions.
After the COMSEC keys are loaded	Ensure the COMSEC is loaded by establishing two-way communication in a secure mode with another radio set loaded with the same keys.
Zeroizing	To erase all stored information use ZPTT and ZKEYS switch.

15. **Table of Probable Faults**.

FAULT	PROBABLE CAUSE	CORRECTIVE ACTION
Transceiver maintains zeroized state	Transceiver	Make sure the CRYPTO switch is not set to ZKEYS. If the switch is not in the ZKEYS position, replace the transceiver.

FAULT	PROBABLE CAUSE	CORRECTIVE ACTION
Power-up BIT does not run	Fuse	Push and hold the T key to illuminate and show a normal display. Replace the battery storage fuse if there is no display.
	Battery	Push and hold the T key. If the display position 7 (battery status) is not at least two bars, replace the battery.
	Transceiver	If the battery status has two or three bars, replace the transceiver.
No modes recall at power up	Battery	Push and hold the T key. If the battery status is not at least two bars, replace the battery.
	Transceiver	If the battery status has two or three bars, replace the transceiver.
Transceiver serviceable without display	Display disabled	Push ↑followed by 1 to unlock the display and keypad.
	Transceiver	If the display does not come on after enabling the display, replace the transceiver.

FAULT	PROBABLE CAUSE	CORRECTIVE ACTION
Intermittent Receive/ Transmit (Rx/Tx) and/or reduced radio set range	Battery	Push and hold the T key. If the battery status is not at least two bars, replace the battery.
	Antenna whip/flexible assembly	Check the physical condition and connection of the whip antenna and flexible assembly. Replace the whip antenna and flexible assembly if damaged.
	Transceiver	Replace the transceiver if the battery and whip antenna are serviceable.
Error code	Transceiver	If the fuse and battery are serviceable, and the transceiver shows an error code other than ***0901*** , replace the transceiver.
Error code ***0901***	Battery	If the fuse replacement is not effective and the transceiver shows error code ***0901*** , replace the battery.
BIT test failure	Transceiver	Push ↑ followed by the T key to initiate BIT Push ↑ for the ROM test. If the test fails, replace the transceiver . Push ↑ after completion of the ROM test; the RAM test starts. If the RAM test fails, replace the transceiver. Push↑ after completion of the RAM test. Initiate the keypad test.

FAULT	PROBABLE CAUSE	CORRECTIVE ACTION
		Replace the transceiver if the test fails.
No transmit at 4 w output	No Transmit power (NTx)	Make sure NTx is not selected. Push the M/Hi key once to select the medium power setting.
	Battery	Push the T key; if the battery status is less than two bars, replace the battery.
	Transceiver	If the battery status has two or three bars, replace the transceiver.
Keypad disable	Transceiver	Try to unlock the keypad by pushing ↑ followed by 1. If the keypad cannot be enabled, replace the transceiver.
No Rx or Tx signals	Transceiver	Follow the transceiver serviceability check.

FAULT	PROBABLE CAUSE	CORRECTIVE ACTION
Loss of transmit	Headset-microphone or handset	Push and hold the T key to show the transceiver status. The display shows "r" for receive mode. Release the T key and push the PTT switch on the audio ancillaries. Push and hold the T key to display the transceiver status. The display indicates T for transmit. If there is no change in the transceiver status, replace the defective audio ancillary.
	Transceiver	If toggling the PTTswitch and the audio ancillary does not change the state of the transceiver, replace the transceiver.
Loss of receive	Transceiver	Make sure volume variations are detected through a serviceable audio ancillary. If no variations are heard, replace the transceiver.
	Headset-microphone or handset	If no sound is heard on the audio ancillary, replace the defective headset-microphone or handset.
No audio/data interface	Transceiver	Replace the defective transceiver.

FAULT	PROBABLE CAUSE	CORRECTIVE ACTION
Power up fails	Battery fuse	Make sure the 6.3 A fuse is serviceable. If defective, replace the fuse.
	Battery	If the fuse replacement is not effective, replace the battery.
	Transceiver	If the fuse and battery are serviceable, replace the transceiver.
1 kHz error tone (crypto fails)	Transceiver	Push twice on the PTT switch on the audio ancillary, connected to the Audio/Data Connector 1. If a 1 kHz tone can still be heard, make sure the transceiver has not lost its crypto fill. Refer to the serviceability check. If the transceiver has not lost its fill and 1kHz is audible, replace the transceiver.
1.6 kHz tone for 250 ms; 1.24 kHz tone for 250 ms, then 500 ms pause	Unprogrammed or bad COMSEC, TRANSEC, OR KEK	Fill the transceiver. If the tone is still heard after the fill, replace the transceiv
Alternating 1 and 2 kHz error tones	Incorrect key pad entry	Re-enter the data on the keypad.
	Two transceivers with H selected (two master stations)	Make sure that only one transceiver in the net has H selected and all other transceivers have h selected (hopping mode).
2 kHz burst (tone is 25 ms on, 475 ms off)	Battery is low	Replace the battery.

16. **Error Codes**.

ERROR CODE*	DESCRIPTION OF ERROR
0101	Fault—Rx—break in dc path
0102	Fault—Tx—break in dc path
0311	Fault—Rx—interface general
0301	Fault—Rx—crypto
0302	TRANSEC busy error—crypto
0401	Fault—ROM check sum
0402	Fault—XILINX—failed to initialize
0403	Fault—RAM
0404	Fault—Timing—F7 not present
0405	Fault—Timing—clock not counting
0407	Fault—Timing—Watchdog timed out
0408	Timing mfraco error
0409	Timing mfraco error not incremented
0411	FIFO correlation error
0412	Correlation error
0413	Timing Correlator cdp error loading
0414	Timing Correlator cdp error testing
0501	Fault—Rx—signal path
0502	Fault—Rx—no squelch
0601	Fault—Rx—signal path all bands
0602	Fault—Rx—signal path band 1
0603	Fault—Rx—signal path band 2
0604	Fault—Rx—signal path band 3
0701	Fault—Rx—not in lock
0702	Fault—Tx—general
0801	Fault—Rx—no regulation

ERROR CODE*	DESCRIPTION OF ERROR
0802	Fault—Tx—no regulation
0803	Fault—Tx—signal path all bands
0804	Fault—Tx—signal path band 1
0805	Fault—Tx—signal path band 2
0806	Fault—Tx—signal path band 3
0807	Low HUB
0811	Fault—Tx—signal path all bands
0812	Fault—Tx—signal path band 1
0813	Fault—Tx—signal path band 2
0814	Fault—Tx—signal path band 3
0901	Warning—Rx—low main battery
* Digits 1 and 2 indicate the Module Number and digits 3 and 4 represent the error nature in relation to the module.	

17. **Radio BIT Fault Kind**.

Radio Type Error Field Value	Fault Kind Error Field Values	Radio Position Description
C	10B	A1A1: Interface/Encryption Assembly—External PA data channel fault
C	10F	A1A1: Interface/Encryption Assembly—Frame clock not detected (fault could be on any assembly containing the FRAME CLOCK or the motherboard)
C	110	A1A1: Interface/Encryption Assembly—Dual Port RAM semaphore register fault (fault could either be on the Interface or Encryption Assembly)
C	111	A1A1: Interface/Encryption Assembly—Dual Port RAM fault (fault could either be on the Interface or Encryption Assembly)

Radio Type Error Field Value	Fault Kind Error Field Values	Radio Position Description
C	151	A1A1: Interface/Encryption Assembly—Real time clock not installed or not working.
C	152	A1A1: Interface/Encryption Assembly—Internal real time clock RAM fault
C	155	A1A1: Interface/Encryption Assembly—Real time clock rollover registers not operational
C	156	RTC crystal oscillator failed
C	181	A1A1: Interface/Encryption Assembly—No communication with encryption board (fault could either be on the Interface or Encryption Assembly)
C	281	A1A2: Encryption Assembly—No communication with interface board
C	282	A1A2: Encryption Assembly—ROM checksum fault
C	283	A1A2: Encryption Assembly—Non-destructive internal RAM fault
C	284	A1A2: Encryption Assembly—Non-destructive external RAM fault
C	285	A1A2: Encryption Assembly—Dual Port RAM fault
C	286	A1A2: Encryption Assembly—Dual Port RAM semaphore register fault
C	287	A1A2: Encryption Assembly—Decryption (ACE) chip fault
C	288	A1A2: Encryption Assembly—HSS internal register fault
C	289	A1A2: Encryption Assembly—Encryption/Decryption loop back fault
C	311	A3: A3 LPC Assembly—8751 ROM checksum fault
C	312	A3: A3 LPC Assembly—8751 Non-destructive internal RAM fault
C	313	A3: A3 LPC Assembly—8751 Non-destructive external RAM fault

Radio Type Error Field Value	Fault Kind Error Field Values	Radio Position Description
C	314	A3: A3 LPC Assembly—8751 Dual Port RAM fault
C	315	A3: A3 LPC Assembly—8751 Not finished with BITE
C	316	A3: A3 LPC Assembly—Hop clock not detected (fault could be on any assembly containing the HOP CLOCK or the motherboard)
C	317	A3: A3 LPC Assembly—Frame clock not detected (fault could be on any assembly containing the FRAME CLOCK or the motherboard)
C	381	A3: A3 LPC Assembly—TMS320 ROM checksum fault
C	382	A3: A3 LPC Assembly—TMS320 external RAM fault
C	383	A3: A3 LPC Assembly—TMS320 Dual Port RAM fault
C	385	A3: A3 LPC Assembly—Sample clock not detected
C	386	A3: A3 LPC Assembly—AIC chip fault
C	387	A3: A3 LPC Assembly—TMS320 not finished with BITE
C	441	A4: Signal Processor Assembly—Main Controller: No communications
C	442	A4: Signal Processor Assembly—Main Controller: Non-destructive internal RAM fault
C	443	A4: Signal Processor Assembly—Main Controller: ROM checksum fault
C	444	A4: Signal Processor Assembly—Main Controller: Non-destructive external RAM fault
C	480	A4: Signal Processor Assembly—Digital Intermediate frequency (IF): ROM checksum fault
C	481	A4: Signal Processor Assembly—Digital IF: Internal RAM fault

Radio Type Error Field Value	Fault Kind Error Field Values	Radio Position Description
C	482	A4: Signal Processor Assembly—Digital IF: External RAM fault
C	483	A4: Signal Processor Assembly—Digital IF: Dual port RAM to AGC fault
C	484	A4: Signal Processor Assembly—Digital IF: Dual port RAM to FFT fault
C	401	A4: Signal Processor Assembly—Modem Processors: Communications fault
C	414	A4: Signal Processor Assembly—Modem Processors: Hop Clock error (fault could be on any assembly containing the HOP CLOCK or the motherboard)
C	415	A4: Signal Processor Assembly—Modem Processors: Frame Clock error (fault could be on any assembly containing the FRAME CLOCK or the motherboard)
C	41F	A4: Signal Processor Assembly—Modem Processors: FEC (modem 80C51) ROM checksum fault
C	420	A4: Signal Processor Assembly—Modem Processors: FEC (modem 80C51) External RAM fault
C	421	A4: Signal Processor Assembly—Modem Processors: FEC (modem 80C51) dual port RAM fault
C	422	A4: Signal Processor Assembly—Modem Processors: MDM (80C186) not running

COMBAT NET RADIO—HIGH FREQUENCY, AN/PRC-138(V)3 AND AN/VRC-516

18. **Antenna**:

a. **Grounding**. The antenna system performance is greatly enhanced if the AN/PRC-138 (V)3 is properly grounded. Grounding can be performed with the use of radial, counterpoise wire or grounding rod.

b. **Manpack Whip Antenna Kit**. For line of sight operation, the OE-505 Manpack Whip Antenna Kit is recommended. Normally the best results can be obtained by keeping the antenna vertical and using a good RF ground.

c. **RF-1940 Dipole**. The use of the RF-1940 Dipole antenna is also possible if configured as Inverted Vee, sloping dipole or vertical dipole configuration. For skywave operation the RF-1940 Portable Dipole antenna configured as a simple dipole is normally the best choice.

d. **Near Vertical Incidence Skywave (NVIS) Antenna**. This type of antenna normally performs best in the frequency range of two(2) to 12 Mhz.

e. Usage of expedient antenna is also possible with the Combat HF System.

19. **Characteristics**:

CHARACTERISTICS	SPECIFICATIONS
MODES	- AM—3.0, 4.0, 5.0, 6.0, 8.0 kHz selectable bandwidths (3.0 default) - Upper Sideband (USB)—2.0,2.7,3.0 kHz selectable bandwidths (2.7 default) * - Lower sideband (LSB)—2.0,2.7,3.0 kHz selectable bandwidths (2.7 default) * - CW—0.35, 0.68, 1.0, 1.5, 2 kHz selectable bandwidths (1.0 default) - FM—5.0, 6.5, and 8.0 kHz selectable deviation (8.0 default) - These modes change to a default of 3.0 kHz when the built-in modem, or voice encryption is selected.

CHARACTERISTICS	SPECIFICATIONS
FREQUENCY RANGE	1.6 to 60 MHz
CHANNELS	100 via keyboard, channels 1-9 via selector switch in front panel Channel 0 acts as a “scratchpad” channel
POWER OUTPUT	- Manpack—1, 5, 20 watts (1, 5, 10 watts FM mode)—user selectable built-in antenna coupler (with open and short protection) - Vehicular—20, 125, 150, watts
BUILT-IN MODEM—DATA INTERFACE	- 39 Tone and FSK type modems - RS-232 or MIL-188 - Asynchronous (9600, 4800, 2400, 1200, 600, 300, 150, 75 bits per second (bps)) - Synchronous (2400, 1200, 600, 300, 150, 75 bps) internal or external clock - 7 data presets - Flow control: RTS / CTS or XON / XOFF - CTRL-B keys, CTRL-C unkeys modem - Full function Remote Control
BUILT-IN TEST FUNCTION	- Self test - Battery - Check Software revisions - VSWR (test condition of antenna/feedline)
AUTOMATIC LINK ESTABLISHMENT	- Radio automatically sets up comm links with other radios - Meets Military Standard (MIL-STD)-188-141A
ECCM—FREQUENCY HOPPING	- Radio changes frequency at 20 hops per second - Uses built-in modem - Voice and data (maximum data rate 300 bps)
SLEEP MODE	During times of no activity the radio will enter a mode of low power consumption

CHARACTERISTICS	SPECIFICATIONS
SECURITY	- Zeroize function - Operator lock out - Programming lock out
PASSWORD	The radio can be password protected to prevent unauthorized usage. The radio returns to the default password from the factory, which is 24458300, when zeroized
POWER REQUIREMENTS	Manpack—24 Volts direct current VDC - Two batteries (BB-590 rechargeable Ni-Cad or BB-5590 Lithium)—single battery can be used with reduced power output Vehicular - 24 VDC - 12 VDC with RF-5052PS 12V/24V Direct Current (DC) Converter - 115 Volts alternating current (VAC) with RF-5051PS—125 Alternating Current (AC) Power Supply

20. Combat HF Radio System Programming (Pgrm):

OPTION	MENU OPTION	SELECTION	SETTING	REMARKS
1. CHAN				
	CH NO—RX FREQ	0 to 9	Channel No and Rx Frequency	As per Communication Instructions
	CH NO—TX FREQ	0 to 9	Channel No and TX Freq	As per Communication Instructions
	MODULATION	USB, LSB, AM, FM or CW	USB or LSB	As per Communication Instructions
	AGC	Slow, Med, Fast	Med	For individual channel no

OPTION	MENU OPTION	SELECTION	SETTING	REMARKS
	IF BANDWIDTH		2.7	For individual channel no
	RX ONLY	Yes, No	No	For individual channel no
2. DATA				
	PRESET NUMBER	1, 2, 3 or 4	1 or 2 or 3 or 4	Each one to be programmed
	INTERFACE		Synch Data Port	For individual preset
	MODEM TYPE	Extern, 39 Tone	Extern	Cypher Text Mode
		Extern, 39 Tone	39 Tone	Plain Text Mode
	MODEM BAUD RATE	1	300	
		2	600	
		3	1200	
		4	2400	
	INTERLEAVING		Alternate Short	
	NEW PRESET NAME	1	300	
		2	600	
		3	1200	
		4	2400	
	ACTIVATE PRESET	1, 2, 3 and 4	Yes	

OPTION	MENU OPTION	SELECTION	SETTING	REMARKS
3. CFIG				
	RADIO	TX Power	Low or Med or High	As per Communication Instructions
		Robust Wake-up Active Squelch (RWAS)	Enable	
		RWAS Standby	Disable	
		Ext RWAS Func	In Use	
		RWAS Fade Time	6.0	
		Unkey Mask	Disable	
		Change RWAS Key	00	Set only new radio or after reset
		Squelch	Low	For net establishment
		CW Offset	0	
		Retransmit	Disable	
		Antenna Port for 20W Amp	Auto	
		Error Beep	Silence	When required
		Compression	Off	Cypher Text Mode
			On	Plain Text Mode
		Internal Coupler	Enable	Manpack
			Bypassed	Vehicle
		FM Deviation	6.5	
		FM Squelch	Tone	

OPTION	MENU OPTION	SELECTION	SETTING	REMARKS
		FM Transmit Tone	On	
		Receiver Preamplifier	Enable	
	PORTS	Remote (Rmt)		
		Rmt Async Rate	2400	
		Rmt Data Bits	8	
		Rmt Stop Bits	1	
		Rmt Parity	N	
		Rmt XON/XOFF	Disable	
		Rmt Async Echo	Off	
		Data		
		TX Data Clock	External	Other selections not used
		PROTOCOL		
		Async Port Level	MIL-188, RS-232	
	OPTIONS	150W PA install	No	Manpack
			Yes	Vehicle
		Prepost select	Enable	
		Prepost Antenna	Single RX/TX	
		Prepost Scan Rate	Slow, Fast, Bypass/Fast	
	TIME	12, 24 hrs	24 hrs	Time in 24 hrs format

OPTION	MENU OPTION	SELECTION	SETTING	REMARKS
4. KEY				
				This function is not used
5. SECUR				
	PASSWORD			Default 24458300 (do not change)
	LOCKOUT	Chan	Yes	Set only new radio or after reset
		Fill	Yes	Set only new radio or after reset
		Data	Yes	Set only new radio or after reset
		CFIG	Yes	Set only new radio or after reset
		Keys	Yes	Set only new radio or after reset
	OP LOCK	Modulation	Yes	Set only new radio or after reset
		Dat Preset	Yes	Set only new radio or after reset
		Encr Key	Yes	Set only new radio or after reset
		Channel 0	Yes	Set only new radio or after reset
		BFO Operation	Yes	Set only new radio or after reset
		Voice Oper	Yes	Set only new radio or after reset

21. **Combat HF Radio Automatic Link Establishment (ALE) Programming**.

OPTION	MENU OPTION	SELECTION	SETTING	REMARKS
1 CHANNEL GROUP				
		Enter Channel Group?	0-9	
		Channel Group	Add, Delete, Review	
2 ADDRESS				
	ADD			
	SELF			
		Self Address? Self x_____		
		Self x _____ Channel Group?	0-9	
	INDIV			
		Individual Address? Yyyy_____		
		Yyyy_____ Channel Group?	0-9	
		Associated Self? Self x_____		
	NET			
		Net Address? Net I _____		
		Net I _____ Channel Group?	0-9	
		Associated Self? Self X _____		
		Add Member x TACI _____		

OPTION	MENU OPTION	SELECTION	SETTING	REMARKS
	REVIEW			
		Review Address Type?		
		Self		
		Self Address _____	Scroll though list	
		Self x _____ Channel Group?	0-9	
	INDIV			
		Individual add _____	Scroll through list	
		Yyyy _____ Channel Group?	0-9	
		Associated Self Self x _____		
	NET			
		Net address? _____	Scroll through list	
		Yyyy _____ Channel Group?	0-9	
		Associated Self Self x _____		
		Net Member 01 Unit 1 _____	Scroll through list	
	DELETE			
		Address	Scroll through list	
3 Link Quality Analysis (LQA)				

OPTION	MENU OPTION	SELECTION	SETTING	REMARKS
	PROGRAM			
		LQA Type?		
		Exchange	Sound Sound using Repeat interval Start time?	
		Exchange with?		
		Repeat interval?		
		Start time?		
	REVIEW			
		View LQA		
		Repeat interval		
		Start time:		
	DELETE			
		Delete LQA?	Scroll through list	
4 CFIG				
		Max Channels to scan?	Scroll through list	
		Listen before TX	On, Off	
		Key to Call	On, Off	
		Max Tune time	00 to 60	
		Radio Silence	On, Off	
		Link Timeout	On (01 to 60), Off	
		Link to “ANY CALLS”	Yes, No	
		Link to	Yes, No	

OPTION	MENU OPTION	SELECTION	SETTING	REMARKS
		"ALL CALLS"		
		ADM?	Yes, No	
5 SECURE				
		Enter Password 00000000000		
	LOCKOUT			
		CHAN_GRP PROG Allowed?	Yes, No	
		ADDRESS PROG Allowed?	Yes, No	
		LQA PROG Allowed?	Yes, No	
		CFIG PROG Allowed?	Yes, No	
	OP-LOCK			
		Allow DAT Preset Changes	Yes, No	
		Allow ENC Preset Change?	Yes, No	

22. **TSEC/KY-99A Configuration**.

OPTION	MENU OPTION	SELECTION	SETTING	REMARKS
1. OFF LINE				
	TEST		Auto	As required
	KEYS	Load	1, 2, 3, 4, 5 or 6	TEK positions as per Communication Instructions

OPTION	MENU OPTION	SELECTION	SETTING	REMARKS
		Load	U	KEK position as per Communication Instructions
	DISPLAY	0, 1, 2, 3 or 4		As per external light condition
	LOCK			Not operational
	INTERFACE	Rd Pol Check	Mark +	
		Blk Dig		Not used
		Radio	0 Dbm	
		LOS		Not used
		Version		Information only
		Default	Init NV	
	CONFIG	ANDVT	ANDVT	
2. CT				
	VOICE		Net	
	DATA		3	Net establishment default (300 Baud's)
	KEY	1, 2, 3, 4, 5 or 6	As per Communication Instructions	Select assigned TEK for the stored net key

23. **Key Loading KY-99A with DTD**.

SER	FUNCTION	OPERATION
1	Zeroize the KY-99A	Turn the Mode Control Switch to Z ALL
2	Confirm that the KY-99A displays	ZEROED
3	Followed by	ON
4	On the KY-99A	Set the Mode Control Switch to CT
5	Confirm that the KY-99A displays	PUSH

SER	FUNCTION	OPERATION
6	Followed by	INIT
7	Turn on the DTD	ON button
8	At the DTD MAIN menu prompt	Press the “A” button to select Appl
9	At the DTD APPL menu	Press I to select I111
10	**NOTE** At any time throughout this procedure if AUDIT TRAIL FULL appears, clear it by pressing CLR	
11	At the IRIS menu	Press C to select Cfd
12	On the DTD	Select the device type (KY-99A) by pressing Y
13	On the DTD	Select the appropriate load group ID
14	On the DTD	Select Tek by pressing T
15	On the DTD	Press CLR
16	On the DTD	Select Normal by pressing N
17	At ENTER START DATE	Enter the proper six digit number for that particular load group ID and press ENTER
18	At ENTER END DATE prompt	Enter the proper six digit number for that particular load group ID (usually the same as the start date) and press ENTER
19	On the DTD	Press S to Select the key that is to be loaded and confirm that XMT is displayed in the lower right corner of the DTD display
20	On the DTD	Press C to continue
21	On the KY-99A	Turn the Mode Control Switch to OFF LINE when prompted by the DTD
22	On the DTD	Press CLR
23	On the KY-99A	Press the INIT button
24	Confirm that the KY-99A displays	CLD STRT
25	On the KY-99A	Press the INIT button
26	On the KY-99A	Press ↑ until KEYS is selected when prompted by the DTD
27	On the DTD	Press CLR

SER	FUNCTION	OPERATION
28	Confirm that the KY-99A displays	KEYS
29	On the KY-99A	Press the INIT button
30	On the KY-99A	Press → until LOAD is selected when prompted by the DTD
31	On the DTD	Press CLR
32	Confirm that the KY-99A displays	LOAD 1 (Flashing)
33	On the KY-99A	Press ↑ to select the channel required
34	Connect the DTD to the KY99A when prompted by the DTD	
35	On the DTD	Press CLR
36	On the DTD	Press SEND
37	On the KY-99A	Press the INIT button twice
38	To load additional keys select R for Repeat	
39	On the DTD	Press CLR twice to by-pass instructions that are not required
40	On the KY-99A	Press ↑ to select the next channel required
41	On the DTD	Press CLR twice to by-pass instructions that are not required
42	On the DTD	Press SEND
43	On the KY-99A	Press the INIT button twice
44	When all loading is complete, disconnect the DTD from the KY99A Fill Port and press the ON/OFF to power down the DTD	
45	On the KY-99A	Confirm that the Mode Control Switch is set to CT
46	On the KY-99A	Press the INIT button
47	On the KY-99A	Press the ↑ button until “NET” is flashing
48	On the KY-99A	Press the INIT button

COMBAT NET RADIO—AIR-GROUND-AIR (A/G/A) RADIO—AN/PRC-113(V)3 AND AN/VRC-83 (V)2

24. **Characteristics—AN/PRC-113(V)3 and AN/VRC-83 (V)2**:

CHARACTERISTICS	SPECIFICATIONS
Frequency Range	**VHF** - 116 to 149.975 Mhz - 1360 channels at 25 Khz **UHF** - 225 – 399.975 Mhz - 7 000 channels at 25 Khz
Channels	8 Preset channels
Modulation	AM Modulation
Output	AN/PRC-113 2 and 10 Watts AN/VRC-83 10 and 40 Watts (with AM-7176A)
Crypto	KY-57 (Vinson)
Hopping Capability	HAVEQUICK II Electronic Protective Measures (EPM) Hopset

25. **Configuration—AN/PRC-113(V)3 and AN/VRC-83 (V)2**:

SER	FUNCTION	OPERATION
	FREQUENCY LOADING	
1		Press the ENT key, and press 2-2-5-0-0
2		Press the 0/PST key. The display indicates “LP-”
3	**NOTE** If the display indicates “LC-”, enter 220.000 into preset channel 20 to return to preset load mode “LP-”	
4		Press 1
5		Verify that the RAD U display presents “LP-1”
6		Press the ENT key
7		Repeat steps 1 through 6 for preset channels 2 through 8, using the frequencies assigned
8		Press 0/PST-0-ENTER.

SER	FUNCTION	OPERATION
	TOD INITIATION	
9		Press the CLR/HWT key
10		Press the ENT key
11		Initiate the single WOD function by pressing 2-2-0-0-2
12		Press the 0/PST key
13		Press 2-0
14		Press the ENT key
15		Press the 3 key, and then the ENT key
	WORD-OF-DAY AND HOPSET FREQUENCY LOADING	
16		Erase any previous WOD by pressing 2-2-0-0-5-0/PST-2-0-ENT
17		Verify that the RAD display presents “ErASE”
18		Once the word ErASE has disappeared, enter 300.000 into preset 20 by pressing 3-0-0-0-0-0/ PST-2-0-ENT
19		Enter FMT mode by pressing 2-2-0-0-7-5-0/PST-2-0-ENT
20		Enter frequency 231.350 into preset 20 by pressing 2-3-1-3-5-0/PST-2-0-ENT
21		Enter frequency 240.400 into preset 19 by pressing 2-4-0-4-0-0/PST-1-9-ENT
22		Enter frequency 246.950 into preset 18 by pressing 2-4-6-9-5-0/PST-1-8-ENT
23		Enter frequency 254.450 into preset 17 by pressing 2-5-4-4-5-0/PST-1-7-ENT
24		Enter frequency 283.850 into preset 16 by pressing 2-8-3-8-5-0/PST-1-6-ENT
25		Enter frequency 291.250 into preset 15 by pressing 2-9-1-2-5-0/PST-1-5-ENT
26		Enter frequency 306.500 into preset 14 by pressing 3-0-6-5-0-0/PST-1-4-ENT
27		Enter frequency 310.900 into preset 13 by pressing 3-1-0-9-0-0/PST-1-3-ENT

SER	FUNCTION	OPERATION
28		Enter frequency 316.550 into preset 12 by pressing 3-1-6-5-5-0/PST-1-2-ENT
29		Enter frequency 328.400 into preset 11 by pressing 3-2-8-4-0-0/PST-1-1-ENT
30		Enter frequency 338.950 into preset 10 by pressing 3-3-8-9-5-0/PST-1-0-ENT
31		Enter frequency 359.350 into preset 09 by pressing 3-5-9-3-5-0/PST-0-9-ENT
32		Enter frequency 372.450 into preset 08 by pressing 3-7-2-4-5-0/PST-0-8-ENT
33		Enter frequency 380.650 into preset 07 by pressing 3-8-0-6-5-0/PST-0-7-ENT
34		Enter frequency 385.150 into preset 06 by pressing 3-8-5-1-5-0/PST-0-6-ENT
35		Enter frequency 399.450 into preset 05 by pressing 3-9-9-4-5-0/PST-0-5-ENT
	TIME-OF-DAY RECEPTION	
36		Request TOD by pressing the 8/TOD key
37		Verify that the display indicates “2t”
38		Verify that the TOD is received by verifying that the display presents “2--tod” and that a momentary 1167 Hz tone is heard in the headset
39		Press the ENT key to accept the TOD

26. **KY-57 Key Loading**.

SER	FUNCTION	OPERATION
1	Disconnect the HIDS-023/LS cable from the AUDIO Port on the KY-57	
2	Disconnect the headset from a UCD, and connect to the AUDIO Port on the KY-57 using a Handset Audio Adapter	
3	On the KY-57	Confirm the VOLUME rotary switch is set to mid-range
4	Turn on the DTD	ON button
5	At the DTD MAIN menu prompt	Press the “A” button to select Appl
6	At the DTD APPL	Press I to select I111

SER	FUNCTION	OPERATION
	menu	
7	NOTE: At any time throughout this procedure if AUDIT TRAIL FULL appears, clear it by pressing CLR	
8	At the IRIS menu	Press C to select Cfd
9	On the DTD	Select the device type (KY-57) by pressing K
10	On the DTD	Select the appropriate load group ID
11	On the DTD	Select Tek by pressing T
12	On the DTD	Press CLR
13	On the DTD	Select Normal by pressing N
14	On the DTD	Press CLR
15	At ENTER START DATE	Enter the proper six digit number for that particular load group ID and press ENTER
16	At ENTER END DATE prompt	Enter the proper six digit number for that particular load group ID (usually the same as the start date) and press ENTER
17	On the DTD	Press S to Select the key that is to be loaded and confirm that XMT is displayed in the lower right corner of the DTD display
18	On the DTD	Press C to continue
19		
20	Zeroize the KY-57	Turn the FILL Switch to Z ALL
21	On the KY-57	Set the KY-57 FILL Switch position 1
22	On the headset	Set the PTT to R and release to clear the alarm
23	On the KY-57	Set the MODE rotary switch to LD when prompted by the DTD
24	On the headset	Set the PTT to R and release to clear the alarm
25	On the DTD	Press CLR
26	Connect the DTD to the KY-57 when prompted by the DTD	
27	On the DTD	Press CLR
28	On the DTD	Press SEND
29	On the KY-57	Set the MODE rotary switch to C
30	On the headset	Set the PTT to R and release
31	On the KY-57	Set the MODE rotary switch to LD

SER	FUNCTION	OPERATION
32	On the headset	Set the PTT to R and release. Wait for key to load
33	To load additional keys select R for Repeat	
34	On the KY-57	Set the KY-57 FILL Switch to position required
35	On the DTD	Press CLR twice to by-pass instructions that are not required
36	On the DTD	Press SEND
37	On the KY-57	Set the MODE rotary switch to C
38	On the headset	Set the PTT to R and release
39	On the KY-57	Set the MODE rotary switch to LD
40	On the headset	Set the PTT to R and release and wait for key to load
41	Repeat Steps 33 to 40 for additional keys	
42	When all loading is complete, disconnect the DTD from the KY57 and press the ON/OFF to power down the DTD	
43	On the KY-57	Set the MODE rotary switch to C
44	On the KY-57	Set the KY-57 FILL Switch to position 1
45	Disconnect the headset and the Audio Adapter from the AUDIO port and return the headset to the UCD	
46	Reconnect the HIDS-023/LS to the Audio Port of the KY-57	

DTD

27. DataTransfer Device AN/CYZ10(V)3 is used for the transfer of both COMSEC and TRANSEC/frequency data received from the Canadian Key Management Unit (CKMU)/Cryptographic Material Management System (CMMS) AN/UYK-511(V)4 to the End Crypto Units (ECU). The ECU is the locally installed crypto asset such as a TSEC KY-57 or KG-84C. This transfer can be done as a bulk transfer of multiple keys, a Single Operational Fill (SOF), OTAR, or by OTAT. The AN/CYZ10(V)3 can also transfer data to and from a Common Fill Device and is capable of displaying the specific key tag information to ensure that proper loading is completed. The AN/CYZ10(V)3 is compatible with the Secure Telephone (A43) for transfer of data over the Public Switched Telephone Network (PSTN).

28. Common Fill Devices. The three types of common fill devices are:

a. **TSEC KYK-13**. This fill is a small, hand-held, self-contained crypto device used to transfer crypto keys into an ECU. The KYK-13 will also fill the independent secure devices such as the TSEC KY-57. The KYK-13 will accept fill from either an AN/CYZ10(V)3 or from the CKMU via the AN/UYK-511(V)4.

b. **TSEC KOI-18**. The TSEC KOI-18 is the device used to input keying material from a tape form into electronic form for use by a common fill device or the CKMU.

c. **TSEC KYX-15A**. The TSEC KYX-15A Net Control Device is used for OTAR and OTAT in both manual and automatic states.

29. OTAR and OTAT.

OTAR	OTAT
Overwrites a single selected piece of info over the air in a selected channel of another CNR(P).	Transfers a selected piece of info over the air from a DTD to a DTD thru a CNR(P).
MK: Manual transmit for CSEC Key. All receiving stns must have the same unique key in Ch 3.	TX KEY: Transmit a single CSEC or TSEC key.
AK: Auto transmit for CSEC key. All receiving stns must have the same unique key in Ch 1.	RX KEY: Receive a single CSEC or TSEC key.
TRANSEC: Manual transmit TSEC key. All receiving stns must have the same unique key in Ch 3.	TX HOPSET: Transmit a single hopset key.
HOPSET: Manual transmit HSET key.	RX HOPSET: Receive a Single hopset key.

INFORMATION DISTRIBUTION SYSTEM

30. The Information Distribution System (IDS) provides transparent access to Combat Net Radio (CNR), strategic networks (e.g. Military Message Handling System (MMHS) etc), interfaces to allies, the Iris Trunk System, and Tactical Cellular System (TCS), and satellites communications via an automated information handling system. The IDS consists of a Local Area Network (LAN) within the veh, a Local Distribution Network (LDN) between vehs connected by fibre optic cables and the Trunk Distribution Network (TDN) between sites.

LOCAL AREA NETWORK

31. The Local Area Network (LAN) is an interconnected network of signals equipment that provide multi-channel communications within a vehicle or shelter installation. Every LAN is managed by a detachment commander who is responsible for the configuration and control of LAN equipment.

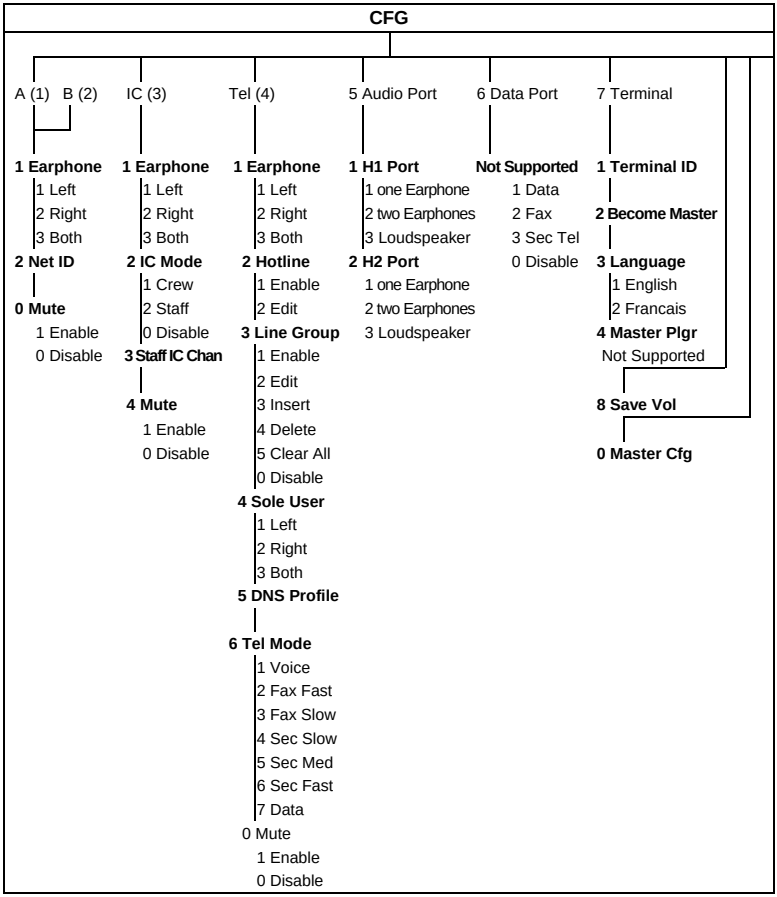
LOCAL DISTRIBUTION NETWORK

32. The Local Distribution Network (LDN) is an interconnected network of two or more LANs in a headquarters. Any of the communication services available within a LAN are available to any user connected to the LDN.

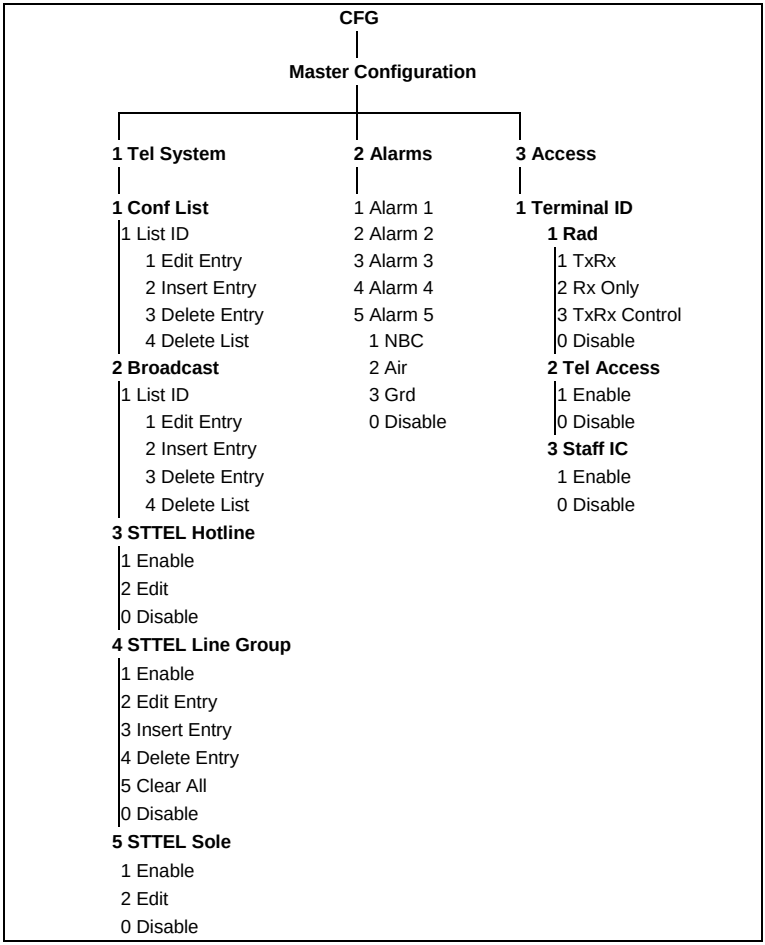
CONTROL INDICATOR

33. The Control Indicator (CI) is the primary communications equipment interface to the IDS for both data and voice communications. The C-5602/URC gives the user the capability to control, configure, and operate the radios, telephone, and intercom assets within the vehicle. The C-5602/URC will work with all vehicular mounted radios, the TCS, Iris telephone circuits, Public Switched Telephone Network (PSTN) or Canadian Switched Network (CSN) circuits, and also provides an Intercom service internal to the vehicle and to other interconnected vehicles at the same location when linked in an LDN.

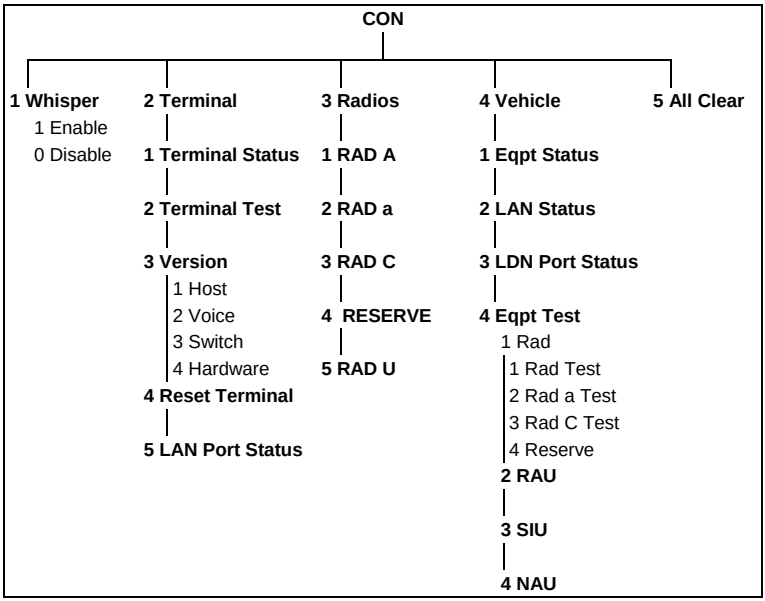
34. **Configuration**.



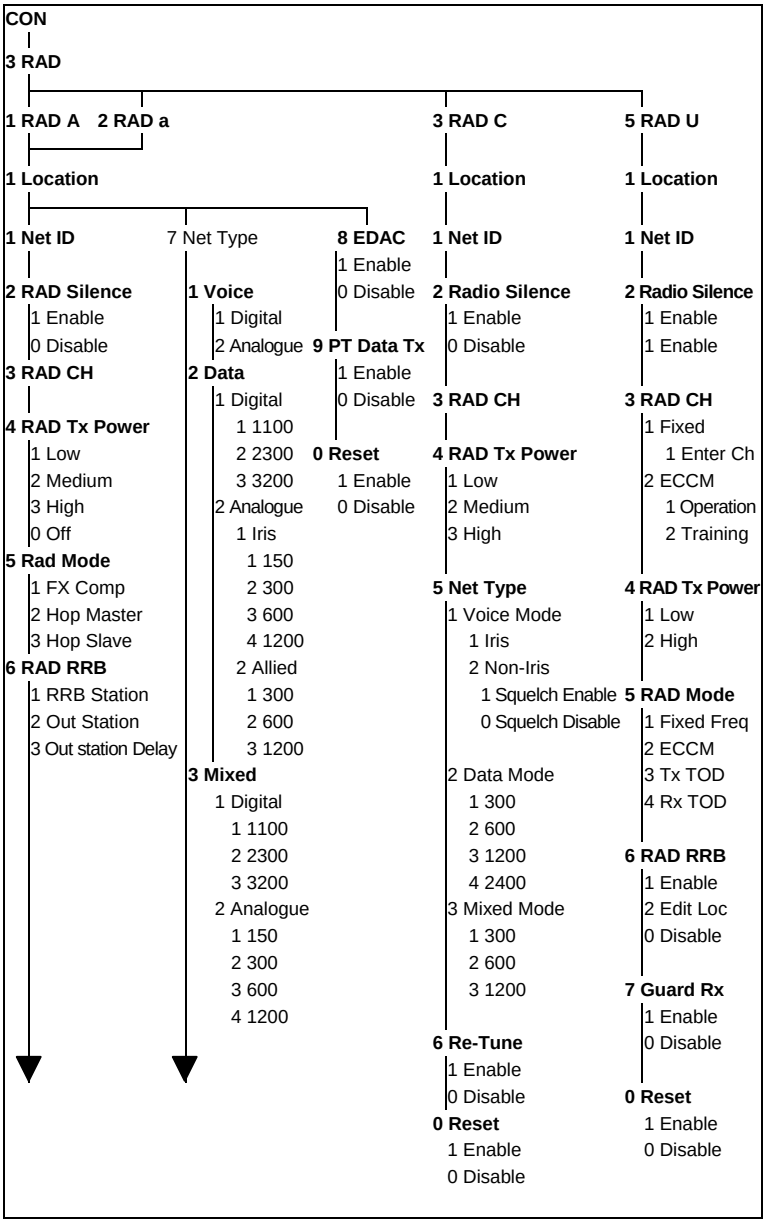
35. **Master Configuration**.



36. **Control**.


CON
1 Whisper
1 Enable
0 Disable
2 Terminal
1 Terminal Status
2 Terminal Test
3 Version
1 Host
2 Voice
3 Switch
4 Hardware
4 Reset Terminal
5 LAN Port Status
3 Radios
1 RAD A
2 RAD a
3 RAD C
4 RESERVE
5 RAD U
4 Vehicle
1 Eqpt Status
2 LAN Status
3 LDN Port Status
4 Eqpt Test
1 Rad
1 Rad Test
2 Rad a Test
3 Rad C Test
4 Reserve
2 RAU
3 SIU
4 NAU
5 All Clear

37. **Control—RAD A, RAD a, RAD C and RAD U**.



38. **Remote Kit**. A Remote Kit for the Control-Indicator may be used to permit operation of the Control-Indicator up to 1000 m from the parent vehicle. The Remote Kit for the Control-Indicator consists of the following equipment:

a. a Control-Indicator Remote Kit harness/pack;

b. a Control-Indicator Remote Cable;

c. fibre-optic cable reel;

d. two BB-590/U batteries;

e. cable(s) to connect the Control-Indicator, batteries, on/off switch and Nuclear Event Detector (NED);

f. a NED; and

g. an on/off switch.

DATA TERMINALS

39. The three variants of data terminals used in the IDS are:

a. Portable Data Terminal (PDT) AN/UYK-511(V);

b. Field Data Terminal (FDT) CP-5130/GYC; and

c. Laptop Data Terminal (LDT) CP-5151/GYC.

40. The AN/UYK-511(V) is a ruggedized Personal Computer (PC). There are five versions of the AN/UYK-511(V).

DESCRIPTION	AN/UYK-511(V)1 (PDT-A)	AN/UYK-511(V)2 (PDT-B)	AN/UYK-511(V)3 (PDT-C)	AN/UYK-511(V) (PDT-D)	AN/UYK-511(V)1 (PDT-G)
Role/User,	Common User	Communication Management System (CMS): All facility controllers (FC) System executive and Planning (SEP) and Operational System Control (OSC)	Tactical Message Handling System (TMHS)/ Gateway, Tactical Interface Equipment (TIE), Headquaters node (HN), Radio Node (RN) Technical Control Vehicle (TCV) and TSN TSV	CMMS	AN/URC-508 Medium Communication Terminal (MCT)
RAM	32 MB	128 MB	32 MB	64 MB	32 MB
Cache	256 kB	256 kB	256 kB	256 kB	256 kB
Video RAM	2 MB	2 MB	2 MB	2 MB	2 MB
Display	640 x 480 Colour	640 X 480 Colour	640 x 480 Monochrome	640 X 480 Colour	640 X 480 Colour
Keyboard	Cortron 121	Cortron 121	Cortron 121	Cortron 121	Cortron 121
Primary Hard Disk Capacity	1 GB	4 GB	540 MB	1 GB	1 GB
Secondary Hard Disk Capacity	N/A	1 GB	N/A	1 GB	1 GB
CD-ROM	N/A	6 X Speed	N/A	N/A	N/A

DESCRIPTION	AN/UYK-511(V)1 (PDT-A)	AN/UYK-511(V)2 (PDT-B)	AN/UYK-511(V)3 (PDT-C)	AN/UYK-511(V) (PDT-D)	AN/UYK-511(V)1 (PDT-G)
Interfaces	C-5602/URC, AN/UYK-511(V), CP-5131/GYC, CP-5130/GYC, and CA-5032/UYC	C-5602/URC, AN/UYK-511(V), CP-5131/GYC, CP-5130/GYC, CA-5032/UYC, MD-5079/VRC and MD-5078/VRC External connection for 19 inch Colour Monitor	C-5602/URC, AN/UYK-511(V), CP-5131/GYC, CP-5130/GYC, CA-5032/UYC, KG-84C, Automated Defence Data Network (ADDN) Modem and Integrated data Network (IDN) Modem	Secure Telephone (A43), CKMU and CA-5032/UYC	All AN/URC-508 equipment
Software	Microsoft (MS) OFFICE TMHS SCO UNIX OSR 5 IDS Operating to System Extension (IOSX) INS	MS OFFICE TMHS CMS SCO UNIX OSR 5 IOSX INS IDS Network Management (INM)	TMHS SCO UNIX OSR 5 IOSX INM	ODT3 OS CMMS	WIN 95 with RF7700MS AN/URC-508 Control Software

41. **PDT AN/UYK-511(V) Power Up/Power Down Drills**.

FUNCTION	ACTION
POWER UP	1. Press the Power ON/Off switch in conjunction with the interlock switch on the Central Processing Unit (CPU) Display control panel. Under normal circumstances, the operating software performs the Power-On Self-Test (POST) during boot up. The indicators display the following: a. AC indicator illuminates green; b. Speaker indicator flashes yellow;

FUNCTION	ACTION
	c. Hard Drive indicator flashes green, then extinguishes; and d. Battery Charging indicator does not illuminate. 2. Following boot up, the screen should be blank except for the UNIX prompt. 3. A User interface shell also appears on the screen after boot up, where the operator can select the application of their choice. **NOTE** The Power Supply module automatically selects the input power source from either AC or DC power. The AN/UYC-511(V) will not power up if an external power source is not connected.
POWER DOWN	1. Perform a SAVE on the last work performed 2. Exit any applications that have been opened. 3. Simultaneously press and release the Power ON/Off and Interlock switches on the CPU/Display control panel.

42. The CP-5130/GYC is a ruggedized, hand-held PC.

43. **CP-5130/GYC Power Up/Power Down Drills**.

FUNCTION	ACTION
POWER UP	1. Check the input power connection. 2. Press the Power On/Off controls simultaneously and quickly release (left and right mouse buttons). 3. Observe that the POWER indicator lamp lights, the BATT LOW indicator lamp is not lit, and the WARM UP indicator lamp lights and goes out when the unit is ready. 4. Adjust the display by using the right/left hand cover assembly control buttons or keypad control to adjust brightness, contrast and backlighting.
POWER DOWN	1. Exit the application program using the operator instruction provided with the program. 2. Press the power on/off controls simultaneously for approximately three seconds or until the POWER indicator blinks. Release both switches.

44. The CP-5131/GYC is a ruggedized laptop PC. The major components of the CP-5131/GYC are a CP-5130/GYC, a Power Expansion Assembly (PEA), a mounting base, a ruggedized keyboard, and a transit case. The expansion assembly provides for installation in a shelter workstation. It provides access to the TMHS. CP-5131/GYC Power up/Power Down Drills. The drills are the same as the CP-5130/GYC.

45. **Printer Drills**.

a. **Printer CA-5032/UYC**.

FUNCTION	ACTION
SAFETY	1. Do not use a power supply voltage that is out of the specified range (20 to 30 Vdc). 2. Do not touch the print head immediately after printing because it is hot. 3. Do not twist the ribbon while installing it. 4. Wait at least two seconds after turning power off before turning unit back on or the initialization process will not be performed properly. 5. Do not perform printing without the ribbon cassette and paper properly installed. 6. Turn off the printer before turning off a connected host computer. 7. Never insert or pull out an interface cable while the power to the printer and computer are still on.
POWER UP	1. Ensure that the power and data cable are connected and locked down. If AC power source is used, ensure that the Power Supply PP-5426/UYC is connected to the power connector. 2. Turn on the printer power switch located on the back of the unit. 3. Load the required paper into the printer. 4. Press the “ONLINE” switch. The indicator will light. The printer is then ready to process data.
POWER DOWN	Turn off the printer power switch located on the back of the unit.
LOADING SINGLE SHEET PAPER	1. Turn the printer power switch to “ON”. 2. Open the printer top cover by releasing the latches on both sides of the case.

FUNCTION	ACTION
	3. Move the friction lever to the friction feed position (towards the front of the case). 4. Insert the single sheet paper. 5. The paper automatically advances to the top of form position when the paper bail lever is pushed away from the platen (toward the back of the printer case). 6. Push the paper bail lever against the paper.
LOADING TRACTOR FEED PAPER	1. Turn the printer power switch to "ON". 2. Open the printer top cover by releasing the latches on both sides of the case. 3. Open the tractor cover. Insert paper through the inlet slot on the rear side of the case. 4. Align the holes in the paper with the tractor paper feed pins. If necessary, pull the tractor lock lever to release the tractor and adjust the tractor positions to allow for the width of paper being used. 5. Close the tractor cover and adjust the position of the paper. Gently push the two tractors outward to remove any slack in the paper. 6. Move the friction lever to the tractor feed position (toward the front of the printer case).

b. **Printer CA-5033/UYC**.

FUNCTION	ACTION
SAFETY	1. Do not use a power supply voltage that is out of the specified range (20 to 30 Vdc). 2. Do not touch the print head immediately after printing because it is hot. 3. Do not twist the ribbon while installing it. 4. Wait at least two seconds after turning power off before turning unit back on or the initialization process will not be performed properly. 5. Do not perform printing without the ribbon cassette and paper properly installed. 6. Turn off the printer before turning off a connected host computer. 7. Never insert or pull out an interface cable while the power to the printer and computer are still on.

FUNCTION	ACTION
POWER UP	1. Set circuit breaker CB1 to On position (up). 2. The POWER indicator illuminates and the printer performs the power-up test (BIT)>. The test will take approx one minute, and will include the fol steps: a. ON-LINE indicator off; b. Printer Not Ready signal sent to host; c. RAM test; d. EPROM test; e. Logic function test; f. Printer head; g. Paper transport ready signal sent to host; and h. ON-LINE indicator will illuminate. 3. The printer is now on-line and ready for input.
POWER DOWN	1. To remove power, set the CB1 to OFF position (down).
LOADING THE PAPER	1. Loosen the two captive screws securing the door to the printer and place the door in full open position. 2. Open the door and remove the empty paper core from the paper roll shaft. 3. Place the roll paper shaft into the core of the new roll paper. 4. Pull approx six inches of paper from the roll, then place the roll with roll paper shaft into both retainer slots of the spring clips, one side at a time. 5. Thread the end of the paper through the slot in the printer door, making sure the paper rolls freely over the idler roller and drive roller. 6. Pull the paper out through the slot. 7. Close the door and secure each side to the printer by tightening two captive screws.

AREA TRUNK SYSTEM

46. The Trunk System (TS) allows users to have access to other users of the trunk system through the various nodes and the IDS. The

TS operates over fibre optic cables and UHF and SHF Line-of-Sight—Radio Relays (LOS-RR). The switching capability of the TS extends the range of tactical communications links across tactical boundaries and through the long range capability of the Iris System to strategic, allied or commercial networks.

RADIO RELAY VEHICLE

47. The Radio Relay Vehicle (RRV), comprises an S-250/G Shelter mounted on an Medium Logistic Vehicle wheeled (MLVW) together with a main 5 kW generator and a backup 2 kW generator. The purpose of the RRV is to provide all of the multi-channel UHF (Band 1) and SHF (Band IV/V), LOS-RR links for the TS and IDS. The RRV is configurable either as a Radio Relay Terminal vehicle or as an independent Radio Relay Repeater vehicle. It has a fibre optic cable connection to a TCV or Trunk Switch Vehicle (TSV) when operating as a Radio Relay Terminal. The RRV can provide up to five simultaneous radio circuits, as follows:

a. two UHF Band I circuits;

b. one SHF Band IV circuit;

c. one SHF Band V circuit; and

d. one circuit which can be either Band IV or V.

48. The RRV contains the following equipment:

a. Radio Set AN/GRC-103(V):

(1) the two in-service Radio Set AN/GRC-103(V)s operate in the UHF band (225 – 400 MHz); and

(2) this equipment operates over LOS-RR paths of a nominal 80 km.

b. Radio Set AN/GRC-515(V:

(1) The Radio Set AN/GRC-515(V) operates in the SHF Band IV (4.400 to 5.000 GHz). A converter permits operation in Band V (14.500 to 15.350 GHz).

(2) This radio set supplies communications for a nominal distance of 10 km when using Band V and 20 km when using Band IV.

SWITCHBOARDS AND AUTOMATIC EXCHANGES

49. The SB-3614 switchboard is a tactical, ruggedized, 30-Terminal automatic switchboard. It provides rapid cordless service to various interfaces. The basic switchboard may be operated as a 30-Terminal single switchboard or may be connected with additional switchboards to form a 60 or 90 line system. The operator monitors, answers, initiates, extends, pre-empts, and releases calls through actuation of a four by four pushbutton keysender and other functional buttons. Any connection can be broken down manually, through operator intervention and action, or automatically, by a subscriber going on hook.

50. Controls, Indicators, and Connectors—Front Panel Power and Alarm Group

CONTROL, INDICATOR OR CONNECTOR	FUNCTION
POWER ON/OFF (toggle switch)	- Applies power to the power supply module.
POWER ON (indicator lamp)	- Indicates prime power is applied and all DC voltages are present at output of the power supply module.
20 HZ FAILURE (indicator lamp)	- Indicate excessive load on 20-Hz ringer line. - Occasional brief flashes are normal; however, indications in excess of two seconds are abnormal and maintenance is required.
DC FAILURE (indicator lamp)	Light steady when any of the internal DC voltages has failed or is out of tolerance.

CONTROL, INDICATOR OR CONNECTOR	FUNCTION
CCU FAILURE (indicator lamp)	- Light steady for 20 seconds on power-up while internal self-diagnostics are being done. Lights also when processor load is so heavy that processor cannot return to same place in processing cycle at least once per second. - NIGHT ALARM sounds simultaneously with illumination of CCU FAILURE lamp.
LAMP TEST/NIGHT LIGHT (three-position toggle switch)	- OFF position—LAMP TEST and NIGHT LIGHTS off.(Indicators will operate in normal manner). - NIGHT LIGHT—Three lamps illuminate. - TERMINAL STATUS area, one lamp illuminates FORMAT plate and two lamps illuminate KEYSENDER. - LAMP TEST—The following indicators illuminate: 1. 20 HZ FAILURE. 2. CCU FAILURE. 3. DC FAILURE. 4. MEMORY ACCESS CARD. 5. CALL STAUS. 6. C (Keysender). 7. P (Keysender). 8. REENTRY. 9. STAFF/DTMF. 10. CALL ANSWER. 11. ALL TERMINAL STATUS lamps for which terminal cards have been installed. 12. NIGHT ALARM sounds steady.
BRIGHTNESS (rotary control)	- Enables adjustments of intensities from minimum (LO) to maximum (HI) brightness for lamps listed above except the failure LAMPS.
NIGHT ALARM (audible alarm)	- Sounds 2900-Hz tone when CCU failure occurs. - Sounds 2900-Hz tone when a routine call is in operator’s queue.

CONTROL, INDICATOR OR CONNECTOR	FUNCTION
VOLUME-NIGHT (rotary control)	- Adjusts volume of NIGHT ALARM from minimum to maximum level as indicated.
FUSE 4.0A	- 4-ampere slow blow fuse in power supply input power line for circuitry.
FUSE SPARE	- Spare 4-ampere slow blow fuse located adjacent to active one.
HEADSET (connector)	- Provides means of connecting operator's H-182 headset to SB-3614A(V) TT.
VOLUME-HDST (rotary control)	- Adjusts volume of sound in operator's headset from minimum to maximum level as indicated.
TERMINAL STATUS lamps	- These indicators, one for each terminal, provide the operator a visual indication of the status of each terminal.
CALL ANSwer (momentary, illuminated pushbutton)	- Illuminates steady when all calls in operator's queue are routing. Flashes when one or more call(s) in operator's queue are priority or a party is on hold. Disconnects operator from previous call and connects him to first call in operator's queue.
STAFF/DTMF	- STAFF: Pressing the pushbutton when the operator is idle places the switchboard in the UNSTAFF (unattended) operation. - STAFF allows operator to perform all functions to a designated subset. - FLASHES when in unstaffed mode. - DTMF: It is lit when the keypad is in the tone sending mode. When pressed again it disables the tone sending mode.
REENTRY (momentary, illuminated pushbutton)	- REENTRY: Pressing pushbutton after operator keys a terminal number caused that terminal number to be marked for later re-entry. - REENTRY will illuminate and operator becomes idle. - Pressing REENTRY, when illuminated, will connect operator to number previous marked for re-entry.

CONTROL, INDICATOR OR CONNECTOR	FUNCTION
	- Pressing REENTRY also causes unextended single subscriber or trunk in communication with operator to be placed in hold at the top of operator queue. - CALL ANS will flash, and operator becomes idle.
OPR RLSE (operator release) (momentary pushbutton)	- Depressing this pushbutton releases operator from any single or multiple party call and makes the operator idle.
CLEAR CDRLS (momentary pushbutton)	- Program mode (illuminated). - Depressing switch clears previously entered data. - Depressing switch after an erroneous entry clears entry so that another entry can be made. - Call processing mode: (not illuminated) If single party is connected to operator, depressing switch disconnects party from operator. - If a two party call is connected to operator, depressing switch disconnects called party. - If a conference is being established, depressing switch disconnects last conferee. - If operator monitors conferee in an established conference, depressing switch releases conferee selected by operator.
CALL STATUS (indicator lamp)	- When not illuminated, indicates the operator is idle. - When illuminated steady, indicates operator is connected to a routine party or a routine call. - When flashing, indicates operator is connected to priority party or priority call.
Keysender (four by four array of momentary pushbuttons—two illuminated)	- Used to extend calls, establish priorities, and update database. - C push-button illuminates after second conference call is initiated, indicating both conference links are busy. - P push-button flashes when depressed in program mode, indicating erase of memory is being made.

CONTROL, INDICATOR OR CONNECTOR	FUNCTION
MEMORY ACCESS IN PROCESS (indicator lamp)	- Illuminates while database is being updated. - When not illuminated, indicates switchboard is in normal operating mode.
PROGRAM/CALL PROCESS (locking toggle switch)	- When in down position, operator call processing can occur. - When in the up position, database update, erasure, or interrogation is possible. Call processing is also possible for the switchboard but not the operator.
R/CGRLS	- Press this push-button to selectively release a calling party. The called party, if any, will not be released. If a subscriber is released by R/CGRLS, the subscriber receives a busy tone until on hook.
TERMINAL STATUS (indicator lamps)	- 30 lamps—one per terminal. - Illuminates steady when terminal is off hook or is connected to another subscriber. - Two-Hz flash rate indicates terminal is connected to operator one half-Hz flash rate indicates terminal is waiting in the operator's queue. - Permanent numbers (30 per terminal) indicate the terminal number for either the 30, 60, or 90 terminal configuration. - Surface above permanent numbers is for writing optional terminal peculiar information.

51. **Controls, and Connectors—Rear Panel**.

CONTROL, INDICATOR OR CONNECTOR	FUNCTION
MASTER/SLAVE (toggle switch)	- In single switchboard configuration, must be in MASTER position. - In multiple switchboard configurations, MASTER position designates that the switchboard is used for control, call extension, etc. Slave position designates that the switchboard function is subordinated to the MASTER switchboard.

CONTROL, INDICATOR OR CONNECTOR	FUNCTION
NUMBER PLAN (three-position rotary switch)	- Used to select the number designated to terminals connected to the switchboard. In stacked configurations, each switchboard must have a different position for its NUMBER PLAN switch.
TRUNK HUNTING CONTROL 1 (not connected)	
TRUNK HUNTING CONTROL 2 (not connected)	
SWBD INTCON (upper connector)	- Connector used to connect to switchboard above in stacked configurations
SWBD INTCON (lower connector)	- Connector used to connect to switchboard below in stacked configurations
EXTERNAL TERMINAL CONNECTORS	- Used to interface directly with terminals to terminal panel for access to terminal lines through hole in head connectors

52. **Terminals—Terminal Panel**.

CONTROL, INDICATOR OR CONNECTOR	FUNCTION
2W (hole in head connectors)	- A group of 12 terminal pairs to which 2 wire lines or trunks can be connected
XMIT 4W RCV (hole in head connectors)	- A group of 18 4-wire terminal pairs to which trunks can be connected - The group can be used for 2 wire lines or trunks when connected to the 2W pairs
OPERATOR (hole in head connectors)	- A pair of terminals to which an external telephone can be connected for test purposes
Input/Output (I/O) XMIT REC GND (hole in head connectors)	- Provides bonding ground connection from the switchboard to earth

53. **Connectors and Switches—Power Supply**.

CONTROL, INDICATOR OR CONNECTOR	FUNCTION
J1 (connector)	- Input connector to which 24Vdc prime power is connected
BATTERY POWER A and B (connectors)	- Input connectors to which 24 Vdc batteries are connected. Batteries A and B are designated for J2 and J3 respectively.
BATTERY SELECT A or B (switch)	- Selects battery A or B as indicated

54. **Switches—Type I Terminal Card Switches**.

CONTROL, INDICATOR OR CONNECTOR	FUNCTION
S1 (three position toggle switch)	- Odd numbered terminal designation: - Left position selects the CBS line mode - Centre position selects the RD line mode - Right position selects the RD Trunk mode
S2 (three position toggle switch)	- Software ignores the switch position and precedence is assigned per entry in class of service table.
S3 (three position toggle switch)	- Even numbered terminal designation: - Left position selects CBS line mode - Centre position selects the RD line mode - Right position selects the RD trunk mode
S4 (three position toggle switch)	- Software ignores the switch position and precedence is assigned per entry in class of service table.

55. **Switches—Type II Terminal Card Switches**.

CONTROL, INDICATOR OR CONNECTOR	FUNCTION
S1 (three position toggle switch)	- Odd numbered terminal designation: - Left position selects CB dial pulse line mode - Centre position designates terminal is unassigned and considered out of service - Right position selects CB DTMF line mode
S2 (three position toggle switch)	- Even numbered terminal designation: - Left position selects CB dial pulse line mode - Centre position designates terminal is unassigned and considered out of service - Right position selects CB DTMF line mode

56. **Switches—Type III Terminal Card Switches**.

CONTROL, INDICATOR OR CONNECTOR	FUNCTION
S1 (three position toggle switch)	- Odd numbered terminal designation: - Left position selects 4 wire PABX trunk mode - Centre position designates terminal is unassigned and considered out of service - Right position selects 4 wire converter trunk mode
S2 (three position toggle switch)	- Even numbered terminal designation: - Left position selects 4 wire PABX trunk mode - Centre position designates terminal is unassigned and considered out of service - Right position selects 4 wire converter trunk mode

57. **Switches—Type IV Terminal Card Switches**.

CONTROL, INDICATOR OR CONNECTOR	FUNCTION
S1 (three position toggle switch)	- Odd number terminal designation: - Left position selects CB dial pulse line mode - Centre position designated terminal is unassigned and considered out of service. - Right position selects CB DTMF line mode
S2 (three position toggle switch)	- Even number terminal designation: - Left position selects recEive and transMit (or Ear and Mouth). (E&M) dial pulse - Centre position designated terminal is unassigned and considered out of service - Right position selects E&M supervision for special trunk operation.
S3 (three position toggle switch)	- Even number terminal designation: - Left position selects E&M supervision for line operation - Centre position selects E&M supervision for trunk operations - Right position selects E&M supervision for special trunk operation

58. **Switches—Type V Terminal Card Switches**.

CONTROL, INDICATOR OR CONNECTOR	FUNCTION
S1 (three position toggle switch)	- Odd numbered terminal designation: - Left position for CO connection with capability of dial pulse only - Right position for connection to CO with capability of dial pulse or DTMF dialling
S2 (three position toggle switch)	- Even numbered terminal designation: - Left position for CO connection with capability of dial pulse only - Right position for connection to CO with capability of dial pulse or DTMF dialling

59. **Preliminary Starting Procedures**.

CONTROL, INDICATOR OR CONNECTOR	FUNCTION
Turn POWER switch to on. (in expanded installations, the Slave switchboards must be turned on prior to the Master)	- POWER ON indicator is illuminated - No other indicator is illuminated - No tones are audible in headset
Turn NIGHT LIGHT/LAMP TEST switch to NIGHT LIGHT position	- Night lamps (6) will illuminate
Turn NIGHT LIGHT/LAMP TEST switch to off position	- Night lights will extinguish
Turn NIGHT LIGHT/LAMP TEST switch to LAMP TEST position and hold	- The following indicator lamps will illuminate 1. 20 Hz FAILURE 2. CCU FAILURE 3. DC FAILURE 4. MEMORY ACCESS IN PROGRESS 5. CALL STATUS 6. C (KEYSENDER) 7. P (KEYSENDER) 8. REENTRY 9. STAFF/DTMF 10. CALL ANS 11. ALL TERMIANAL STATUS lamps for which terminal cards have been installed
Rotate NIGHT ALM control cw and ccw	- Volume of NIGHT ALRAM varies in accordance with NIGHT Alm control
Rotate BRIGHTNESS control cw and ccw	- Observe that lamp intensity varies in accordance with BRIGHTNESS control, with the exception of three FAILURE lamps
Release NIGHT LIGHT/LAMP TEST switch and return to OFF position	- Indicator lamps and night lights will extinguish and NIGHT ALARM becomes silent

60. **CF 25 Panasonic Computer**. The CF 25 Panasonic is a ruggedized, menu driven, microcomputer modified to operate as a Terminal Control Device (TCD) for the 3614A. On the rear connector panel, a serial connector port is available for connecting the grid to the Input/Output (I/O) port of an SB3614A switchboard, as well a port for the printer.

61. Serious damage can occur to the CF 25 screen if the computer and switchboard are not properly grounded before turning on the equipment. Ensure the ground wire in the I/O cable is connected to the grounding bolt at the rear of the switchboard.

62. **Turn on Procedures**.

CONTROL, INDICATOR OR CONNECTOR	FUNCTION
CONNECT I/O CABLE	- Ensure proper ground
REAR FOOT IS RAISED	- For ventilation, open cover to expose screen and keyboard.
AC POWER CORD	- Connect AC power cord to CF 25 at right side rear, then plug into AC outlet
OPEN DISPLAY	- Pull the carry handle forward - Slide the latch toward the rear of the computer and hold it with one finger - Lift up the latch with another finger - Lift open the display
POWER ON/OFF	- Power switch located right beside AC inlet for CF 25, Slide power switch toward the rear of the computer and hold it approximately one second until the power indicator turns on before releasing it.
OPENING TCD PROGRAM	- Once Windows has completed setting up computer. You shall see icon for TCD program. Double click TCD icon, program shall open up.
TCD PROGRAM	- You must sign on with the appropriate HID number for the SB3614
MODE SELECTION MENU	1. Table Edit Mode 2. Mail Edit Mode

CONTROL, INDICATOR OR CONNECTOR	FUNCTION
	3. Communication Mode 4. Interactive Mode 5. File Maintenance Mode 6. Exit Mode - The two main modes you will use are INTERACTIVE, and TABLE EDIT.
INTERACTIVE MODE	- When this mode is selected the CF 25 is directly connected to the switchboards database - Everything that is done is directly modified within the switchboard - The first procedure is to enter the password – 3614 and hit enter key - This password will not be echoed onto the screen, in a couple of seconds the cursor will change to an asterix (*) and a flashing cursor is displayed
TABLE EDIT MODE	- The table edit mode allows the operator to review the files in the TCD, and to make amendments,and adjustments as he sees fit - When a new table is made and placed in the directory as “current” the prior table becomes “backup”

TELEPHONE SET RA 2000

63. **Characteristics and Operation**.

General	- Analogue telephone set suitable for connection into 2-wire magneto field telephone systems or central battery signaling (CBS) exchanges. - Operated from internal batteries, external power supplies, or from common battery (CB) line power.
Battery installation	- Remove the battery cover by unscrewing the large thumbscrew on the bottom face of the base.

	- Inset 4 C size battery cells, paying attention to correct polarity as marked in the battery compartment. - Replace the battery cover. Tighten the thumbscrew, finger tight only.
Components	- Two colour-coded polarity-sensitive terminals are provided on the rear face of the RA2000 to permit external powering from a source in the range of 11 to 32 Vdc. The terminal marked red is for voltage positive, and black for voltage negative. When external power is applied internal battery power is automatically disconnected.
LB/STBY/CB—mode switch	- Set to LB for use without self-powered telephones. Batteries must be fitted to the telephone for this mode of operation. - Set to STBY to disable the phone for receiving incoming ringing. - Set to CB for use with powered exchanges. This enables pulse or tone dialling. - Internal batteries not required for this mode of operation.
VIS.WHISP/VIS/Hi/Lo—function switch	- Set to Vis.WHISP to provide visual alarm and additional microphone gain for “whisper speech”. Not to be used in CB mode. - Set to VIS to provide visual alarm on incoming ringing. - Set to Hi to provide high level audible alarm on incoming ringing. - Set to Lo to provide low level audible alarm on incoming ringing.
LD/MF—switch (located inside battery compartment)	- Set to LD to select pulse (Loop Disconnect dialling). - Set to MF to select tone (DTMF) dialling. (outside line thru CP).
Systems connections	- Line Connections—Two insulated self-piercing line terminals are provided for connection to telephone lines. The terminals accept WD-1/TT or similar field cable. To connect the telephone to the communication system, connect the lines to the two line terminals.

	- Line Terminals—insulated 4 man screw-down “self-piercing” line terminals are provided for use with field cable. - Base Plate—The base plate incorporates two slots which will accommodate a strap or belt which enables the telephone to be carried on the body or fixed to a support.
Keypad	- A 4x3 push button keypad for DTMF or loop disconnect dialling is fitted on the topface of the instrument. The toggle switch is fitted inside the battery compartment.

Operations	- Receiving a Call—When an incoming call is detected either visually or audibly, lift up the handset and ensure that LB or CB is selected (Note that it has a magnetic hook switch). In LB or CB mode, depress the handset pressel switch to enable 2 way speech communication. Release the switch at the end of the call. At the end of the call, replace the handset rest, or alternatively select STBY mode.
	- Making a Call—To make a call, select LB or CB mode and proceed as follows:
	  - Lift up the telephone handset.
	  - In LB mode:
	  - Press the magneto ringer switch to call—an LED illuminates to confirm the call.
	  - Depress the handset pressel switch to enable 2 way communication.
	  - Release the pressel switch at end of call.
	  - In CB mode:
	  - On receipt of dial tone, dial the number required. Tone (DTMF) dialling is available, as selected by the MF switch.
	  - Depress the handset pressel switch to enable 2 way communication. Rrelease the pressel switch at the end of the call.
	  - If the system with which the telephone is used is operator controlled, there may be no dial tone. In this case wait for the operator to answer and request the number required.

STU-III

64. The Secure telephone Unit (STU)-III terminal is a dual-purpose unit capable of providing secure and non-secure voice/data communications. It may be used as an ordinary telephone completely inter-operable with the public telephone network, or once loaded with key it may be used in secure mode when connected to another STU-III terminal via a telephone network.

65. **Over the Air Transfer (OTAT) Via STU-III**.

TRANSMIT	RECEIVE
1. Enter Application menu of DTD.	1. Enter Application menu of DTD.
2. Load IRIS UAS.	2. Load IRIS UAS.
3. Enter STU menu on DTD.	3. Enter STU menu on DTD.
4. Enter Xmit.	4. Enter Recv.
5. Enter LDGID or hit Ent.	5. Set STU-III data mode to 2400 Async. On DTD Press Clr.
6. Select Key Types as reqr.	6. Establish secure call. On DTD Press Clr.
7. Select Key Category.	7. Verify authentication/security level. On DTD Press Clr.
8. Enter Start Date or hit Ent.	8. Connect DTD to STU-III. On DTD Press Clr.
9. Select Key, then select Cont, then Press Clr.	9. DTD will display—Attempting to connect.
10. Set STU-III data mode to 2400 Async. On DTD Press Clr.	10. DTD will display—Receive in progress.
11. Establish secure call. On DTD Press Clr.	11. DTD will display—# of Keys Received.
12. Verify authentication/security level. On DTD Press Clr.	12. The DTD/Recv operation is repeated as reqr. If finished Press ABORT to get to menu desired.

TRANSMIT	RECEIVE
13. Direct Out Station to select STU/Recv/[RCV]. O DTD Press Clr.	
14 onnect DTD to STU-III. On DTD Press Clr.	
15. Switch STU to Data Mode. On DTD Press Clr.	
16. DTD will display—Attempting to connect.	
17. DTD will display—Transfer in progress.	
18. DTD will display—# of Keys Transferred.	
19. Set STU to Secure Voice. On DTD Press Clr (This prompt will only show if enabled).	
20. DTD will display—Repeat/Modify/New. If you wish to transmit again choose accordingly. If finished Press ABORT to get to menu desired.	

CHAPTER 4
POWER SOURCES

SECTION 1
SAFETY SUMMARY

1. The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.

HANDLE NICKEL CADMIUM BATTERIES WITH CARE

2. Nickel cadmium (NiCad) batteries are potentially hazardous if misused or tampered with before, during and after discharge. The following precautions must be strictly observed to prevent possible injury or equipment damage:

a. Do not heat, incinerate, crush, puncture, disassemble, short circuit or otherwise tamper with the batteries.

b. Turn off the equipment immediately if the battery compartment becomes unduly hot. If possible, wait until the batteries have cooled before removing them.

c. Batteries have safety vent to prevent explosion. When batteries are venting gas, a very irritating smell is released and the sound of escaping gas may be heard. When safety vents have operated, batteries are fairly safe from bursting, but still must be handled with care because of heat.

HANDLE LITHIUM BATTERIES WITH CARE

WARNING

Do not use this equipment to charge lithium batteries.

SECTION 2
BATTERIES AND BATTERY CHARGING SYSTEM

3. The Analyzer-Charger, Battery Set is capable of operating in garrison or may be vehicle-mounted. It will accept voltage inputs of 240/120 Vac or 28 Vdc.

4. **General Description**. The Analyzer-Charger, Battery Set analyzes and then recommends reconditioning or starts to charge NiCad rechargeable batteries for portable equipment. If a power shutdown occurs while batteries are being charged, the analyzer-charger will keep the programmed charge instructions if the batteries are not removed during the shutdown period. When power is restored and the built-in Operational Readiness Test (ORT) successfully completed, the original charging instructions continue. If immediate or emergency charging of a battery is required, the analysis portion of the operation may be manually bypassed. The battery set performs four programmable charge operations as follows:

a. **Normal Charging**. Takes approximately five hours depending on the NiCad battery condition.

b. **Reconditioning**. May take as long as 70 hours; however, 24 hours is a typical duration depending on the NiCad battery condition.

c. **Battery Warm-up**. Warm-up may take up to 15 hours depending on temperature and battery type.

d. **Trickle Charging**. A maximum trickle charge period of 72 hours is recommended.

5. **Technical Description**. The Analyzer-Charger, Battery Set comprises the following subassemblies:

a. **Analyzer-Charger, Battery PP-5417/G**. This is the main body of the analyzer-charger. The front control panel contains all the controls and indicators required to operate the assembly with the exception of the 240/120 Vac voltage selection switch. The voltage selection switch is located on the left side of the analyzer-charger under a removable cover.

b. **Tray, Battery MT-5321/G**. The tray is designed to accept rechargeable batteries only. It accepts all Iris System NiCad rechargeable batteries, which may be charged in any combination at the same time.

c. **Cable Assemblies**. The cable assemblies supply the 240/120 Vac input connection to the analyzer-charger (for vehicle installations the 28 Vdc power cable is part of the vehicle cabling), and the Tray, Battery MT-5321/G.

6. **Batteries**. The following is a listing of current batteries and their specifications.

Ser	Battery	NATO Stock Number	Re-chg	Voltage	A/Hr	Eff Time	Chemistry	Disposal action	Used in
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
1	BB-503	6140 21 912 9082	Yes	12V	N/A	N/A	Ni-Cad	Thru QM	AN/PRC-522
2	BB-521/U	6140 21 911 6032	Yes	9.6V	1.2	10 hrs	Ni-Cad	Thru QM	AN/PRC-521
3	BB-590/U	6140-01-063-3918	Yes	24V	1.2	0/0	Ni-Cad	Thru QM	PRC-113, 138, PDTP, RK 1-1
4	BB-706U	6140 01 874 6916	Yes	25.2V	1.8	10	Ni-Cad	Thru QM	PRC-515
5	BB-741/GYC	6140 01 456 9636	Yes	24V	N/A	N/A	Ni-Cad	Thru QM	FDT, LDT
6	BB-742/UYK	6140 01 450 9267	Yes	21.6V	N/A	N/A	Ni-Cad	Thru QM	PDT A,B,C and D charged by the PDT itself when it's plugged into DC or AC sources.
7	BA-1372U	6135 00 801 3493	No	6.75V	N/A	N/A	Mercury	Thru QM	KG84C, KG194 , KYK -13 , KY-57
8	BA-2325	6135 01 186 4010	No	3V	N/A	N/A	Lithium	Thru QM	STU III
9	NBA 3030/U P/N	6135 21 892 7268	No	1.5V	0.0	0.0	Alkaline	Thru QM	D Cell
10	NBA 3042/U P/N	6135 21 892 7266	No	1.5V	0.0	0.0	Alkaline	Thru QM	RA-2000 (C Cell)
11	BA-3058/U	6135 21 892 7217	No	1.5V	0.0	0.0	Alkaline	Thru QM	AA Cell
12	BA-3515A	6135 21 867 8347	No	30V	0,0	0,0	Alkaline	Thru QM	PRC-66B
13	BA-5123/U	6135 01 351 1131	No	3V	0/0	N/A	Lithium	Thru QM	Data Transfer Device
14	BA-5590/U	6135 01 036 3495	No	24V	0,0	0,0	Lithium	Thru QM	PRC-113 and 138, RK 1-1, FDT, FDTP, KY99A, KY-57
15	BA-5800/U	6135 21 906 7728	No	6V	0.0	0.0	Lithium Sulphide	Thru QM	Precision Lightweight Global Receiver (PLGR), CAM
16	Battery charger AN/PRC-515	6130 21 874 7887	N/A	N/A	N/A	N/A	N/A	Thru QM	PRC-515

Ser	Battery	NATO Stock Number	Re-chg	Voltage	A/Hr	Eff Time	Chemistry	Disposal action	Used in
17	Analyser charger, Battery PP-5417/G	6130 21 912 9103	N/A	N/A	N/A	N/A	N/A	Thru QM	Needs to be attached to the tray MT5321/G
18	Tray MT5321/G	6160 21 912 9102	N/A	N/A	N/A	N/A	N/A	Thru QM	BB-503, BB-521, BB-590, BB-741 (These batteries fit on this tray but the tray needs to be attached to the Analyser/Charger PP-5417/G)
19	MA4025D	6140 99 780 8603	No	12V	0.0	0.0	Lithium	Thru QM	AN/PRC-522

NOTE

BB denotes a rechargeable battery

BA denotes a non-rechargeable battery

GENERATORS

7. The following is a listing of field generators and their specifications:

SER	GENERATOR	SPECIFICATIONS
1	GENERATOR SET, GASOLINE ENGINE DRIVEN, AC, 3 KW, 60 HZ, 120/208/240 VOLT, 1 AND 3 PHASE, MODEL MEP-016A (DOD), NATO STOCK NUMBER 6115-00-017-8237	**GENERATOR DATA** Type ..... AC, brushless, self-excited Frequency..... 60 Hz Speed..... 3 600 rpm Temperature Rise ..... 75°C Power Rating..... 3 kW Power Factor ..... 0.8 Duty ..... continuous Type Drive ..... direct Type Cooling ..... forced air **CAPACITIES** Fuel Tank ..... 14.25 L Engine Crankcase..... 1.54 L Engine Oil Filter..... 0.48 L **DIMENSIONS AND WEIGHT** Length ..... 87.5 cm Width ..... 60.0 cm Height..... 62.5 cm Weight..... 123.75 kg
2	GENERATOR SET, GASOLINE ENGINE. DC, 4-2 KW MILITARY MODEL DC-4, 2-ORD/28 NATO STOCK NUMBER 6115-00-857-1397	**GENERATOR DATA** Manufacturer..... Jack and Heintz Model ..... 23041-001 Volts..... 24/30 DC Kilowatts..... 8.4 Fuel tank capacity ..... 30.28 L Approximate running rate fuel Consumption ..... 3.6 L/hour Rope or electric (remote battery) start

SER	GENERATOR	SPECIFICATIONS
		DIMENSIONS AND WEIGHT Height..... 40.6 cm Width ..... .66 cm Length ..... 91.44 cm Weight..... 102 kg (without fuel) **CONTROL PANEL** The control panel contains the following: 1 – Engine start button 1 – Stop/Run switch 1 – Voltage adjust rheostat 1 – Power receptacle 1 – Starter relay assembly
3	GENERATOR SET, GASOLINE ENGINE DRIVE, AC, 5 KW, 60 HZ, 120/208/240 VOLT, 1 AND 3 PHASE, MODEL MEP-017A (DOD) NATO STOCK NUMBER 6115-00-017-8240	**GENERATOR DATA** Type ..... AC, brushless, self-excited Frequency..... 60 Hz Speed..... 3 600 rpm Temperature Rise ..... 75°C Power Rating..... 5 kW Power Factor ..... 0.8 Duty ..... continuous Type Drive ..... direct Type Cooling..... forced air **CAPACITIES** Fuel Tank ..... 19 L Engine Crankcase..... 1.9 L Engine Oil Filter..... 0.5 L **DIMENSIONS AND WEIGHT** Length ..... 100.97 cm Width ..... 76.20 cm Height..... 63.50 cm Weight..... 215.55 kg

SER	GENERATOR	SPECIFICATIONS
4	GENERATOR SET, GASOLINE ENGINE DRIVE, AC, 10 KW, 60 HZ, 120/208/240 VOLT, 1 AND 3 PHASE, MODEL MEP-803A8A (DOD), NATO STOCK NUMBER 6115-00-889-1447	**GENERATOR DATA** Type ..... AC, brushless, self-excited Frequency..... 60 Hz Speed..... 3 600 rpm Temperature Rise ..... 75°C Power Rating..... 10 kW Power Factor ..... 0.8 Duty ..... continuous Type Drive ..... direct Type Cooling ..... forced air **CAPACITIES** Fuel Tank ..... 19 L Engine Crankcase..... 3.8 L Engine Oil Filter..... 0.5 L **DIMENSIONS AND WEIGHT** Length ..... 144.79 cm Width ..... 73.66 cm Height..... 73.03 cm Weight..... 382.50 kg
5	GENERATOR SET, DIESEL ENGINE 3 KW, 120V AND 240 VOLT, 50 HZ PART NO MG 321 NATO STOCK NUMBER 6115-21-884-9403	**OPERATING TEMPERATURE** Range: without external heat .....-32° to +52°C with external heat .....-45° to -32°C Maximum Rated Output ..... 3 kW (0.8 power factor) (0 – 1 500 m above sea level) Voltage..... 120 V (single phase, 2 wire) 120/240V (single phase, 3 wire) **FUEL** Temperature Range Diesel: -54° to -32°C..... DFA

SER	GENERATOR	SPECIFICATIONS
		-32° to 0°C ..... DF1 0° to 53°C..... DF2 Fuel Consumption ..... 0.26 kg/kwh Fuel Tank Capacity ..... 15.5 L **DIMENSIONS AND WEIGHT** Width ..... 711 mm Length ..... 1003 mm Height..... 814 mm Weight..... 417 kg
6	GENERATOR SET, TACTICALLY QUIET, DIESEL ENGINE 10 KW, 120/208V, 3 PHASE, 60 HZ AND 120/240V, 1 PHASE, 50 HZ PART NO MEP 803A (Modified) NATO STOCK NUMBER 6115-21-912-9965	**OPERATING TEMPERATURE** Range: without external heat ..... -32° to +52°C with external heat ..... -45° to -32°C Maximum Rated Output ..... 10 kW (0.8 power factor) (0 – 1500 m above sea level) Voltage..... 120 V (single phase, 2 wire) 120/240V (single phase, 3 wire) 120/208V (3 phase, 4 wire) **FUEL** Temperature Range ..... Diesel -54° to -32°C ..... DFA -32° to 0°C ..... DF1 0° to 53°C..... DF2 Fuel Consumption ..... 0.275 kg/kwh Fuel Tank Capacity ..... 45.5L **DIMENSIONS AND WEIGHT** Width ..... 813 mm Length ..... 1 524 mm Height..... 1003 mm Weight..... 640 kg

SER	GENERATOR	SPECIFICATIONS
7	GENERATOR SET, DIESEL ENGINE 2 KW, 120/240 VAC, 1 PHASE, 60 HZ PART NO ASB2D/DND7 NATO STOCK NUMBER 6115-21-912-0393	**OPERATING TEMPERATURE** Range: - without external heat ..... -5° to + 50°C - with external heat ..... 40° to +50°C (starting) ..... -46° to +50°C (running) Maximum Rated Output ..... 2 kW (1.0 power factor) @ 1000 m, 20°C Voltage ..... 120 VAC (single phase, 2 Wire) 240 VAC (single phase, 3 wire, emergency reconnection) **FUEL** Temperature Range -10° to +50°C ..... Diesel, Type B -46° to +50°C ..... Diesel, Type A F-34; F,35; JP-8 Fuel Consumption ..... 1.25 L/h @ 100% load Fuel Tank Capacity ..... 6.25 L **DIMENSIONS AND WEIGHT** Width ..... 406 mm Length ..... 750 mm Height..... 550 mm Weight..... .64 kg (dry) ..... 59 kg (wet)

CHAPTER 5
ANTENNAS

SECTION 1
POLARIZATION

1. **General**. The polarization of an electromagnetic wave, vertical or horizontal, is the direction of the electric field of the wave. In the VHF/UHF band, radio waves transmission from a vertical antenna are regarded as being vertically polarized, and those from a horizontal antenna are horizontally polarized.

SECTION 2
RULES FOR SITING ANTENNAS

2. What to **aim** at:

   a. an open space around the antennas, particularly in the direction of the station with which comm is desired;

   b. high ground; and

   c. the slope of a hill facing the distant station, i.e., use the hill as a reflector. Advantagescan be taken of a hill to act as a shield to suppress RF energy emitted towards the enemy.

3. What to **avoid**:

   a. electrical power lines, overhead telephone lines or any large object that is a conductor of electricity*;*

   b. trees or buildings in front of the antenna;

   c. proximity of other radio sets;

   d. places where unsuppressed engines may be expected; and

   e. electrical machinery.

4. Remember that camouflage is extremely important as the shadow of a mast shows up clearly from the air.

SECTION 3
VEHICLE GROUNDING

GENERAL

5. Proper grounding of vehicles and equipment is mandatory for safety and efficient communications.

6. A good ground ensures:

a. reduction of noise on a circuit;

b. an improved signal path;

c. elimination of AC induced hum;

d. personnel safety; and

e. equipment protection against nature generated voltage surges.

7. A good ground is considered to have less than 12 ohms of resistance between the vehicle/equipment and the ground.

GROUNDING TECHNIQUES

8. To obtain the best grounding available in a field environment some or all of the following techniques must be applied:

a. Make all efforts to locate communications vehicles and generators on good conductive soil.

b. Ensure that those portions of the ground spike that are in the ground are bare of any paint, rust or grease.

c. Ensure grounding spikes are put into the earth as deeply as reasonably possible.

d. When in very dry soil or sand, use additional ground spikes for each vehicle and for generators.

e. Soak the soil around the ground spike with water or any other non flammable liquid conductor immediately after installation. This causes the soil to make better contact with the spike. Repeat this process at regular intervals when in the same location for longer periods. For extremely poor soil, salt can be added to improve the conductivity.

f. When on very poor dry or sandy soil, use additional ground spikes, applying the same preparations as for sub-paragraph (para) e.

g. Keep contact points on vehicle/generators and ground spikes clean and ensure that they are tight.

h. Any permanent metal fixtures such as metal fences can be used to provide a more efficient ground, ensuring that the ground cable is properly fastened to the permanent fixture.

SECTION 4
NON-IONIZING RADIATION HAZARDS

INTRODUCTION

9. The basic instructions concerning non-ionizing radiation hazards are contained in CFAO 34-51, *Non-ionizing Radiation Hazards*, and in Canadian Forces technical Order (CFTO) C-55-040-001/TS-001 *Non-ionizing Electromagnetic Radiation Safety - Technical Requirements and Precautions*. The following is intended solely as a reference and initial guide.

10. The electromagnetic spectrum covers the entire spectrum of radiation. Electromagnetic waves can differ in strength, frequency and wavelength. Whenever electromagnetic energy is radiated, a hazard to

personnel, fuel and electrically sensitive ordnance could exist if the radiation is of sufficient power and is sufficiently near to cause biological damage to personnel or to ignite fuel and ordnance. This section deals only with possible personnel hazards. The radiated hazards of major concerns are radiofrequency and X-ray.

11. Radiation from antennas fed by high powered radiofrequency has the potential for injuring personnel present in the vicinity of radiating antennas. Transmitters aboard ships, aircrafts, vehicles and ground stations are potential sources of harmful radiation.

NATURE OF RADIOFREQUENCY RADIATION

12. Radio frequency and microwave radiation are part of the electromagnetic spectrum. When absorbed by personnel, this radiation may cause tissue heating and possibly other effects. The rate of heating depends on several factors including the exposure power density, frequency, humidity, and the thermally absorptive properties of the local biological tissue. The cooling mechanisms of the body will also be affected and, as a result, the body temperature will rise. CFTO C-55-040-001/TS-001 contains the maximum permitted exposure limits for personnel.

13. Some transmitter antenna sites pose an electromagnetic radiation hazard to personnel. The applicable antenna installations should be fenced or sealed with some other suitable barrier to prevent unauthorized access to the site. Radio frequency radiation safety warning signs must be installed. External antenna feed lines are another source of radiofrequency radiation. These should be adequately shielded. Applicable warning signs should be posted and appropriate safe distances observed whenever transmissions are in progress.

PRECAUTIONS FOR RADIATING ANTENNAS

14. Ensure that all personnel are clear of the direct beam before the electromagnetic radiation is switched on.

15. All surfaces, especially metals, reflect electromagnetic radiation. The reflected radiation itself could create an exposure condition that exceeds permitted exposure levels.

16. To avoid electromagnetic radiation burns, do not touch or adjust a radiating antenna. Also keep metal objects clear from wires, lines and the main beam of the antenna.

17. A visual inspection of antenna reflectors, feed horns, waveguide open ends, or any other material that emits electromagnetic energy shall NOT be made unless the equipment is OFF and secured specifically for the purpose of such an inspection.

18. Dummy loads shall be used to absorb emitted radiation rather than emit it into surrounding areas. These loads shall be used unless operational and technical requirements dictate otherwise.

PERMITTED EXPOSURE LEVEL DISTANCES

19. Adherence to permitted exposure level distances ensures that personnel are not exposed to harmful radiation levels. The permitted exposure level distance values in the following table have been calculated for equipment currently found in the Land Force and Canadian Forces inventories.

SER	NOMENCLATURE	TYPE	PERMITTED EXPOSURE LEVEL DISTANCE	REMARKS
1	Radio Set (HF)	AN/VRC 516	3 m	
2	Radio Set (HF)	AN/PRC 138	3 m	
3	Radio Set (UHF)	AN/PRC 113	1 m	
4	Radio Set (UHF)	AN/VRC 83	1 m	
5	CNR(P)	RT 5121/U	1 m	
6	M Sat		3 m	
7	INMARSAT		3 m	

SECTION 5
HIGH FREQUENCY AND VERY HIGH FREQUENCY GROUND WAVE ANTENNAS

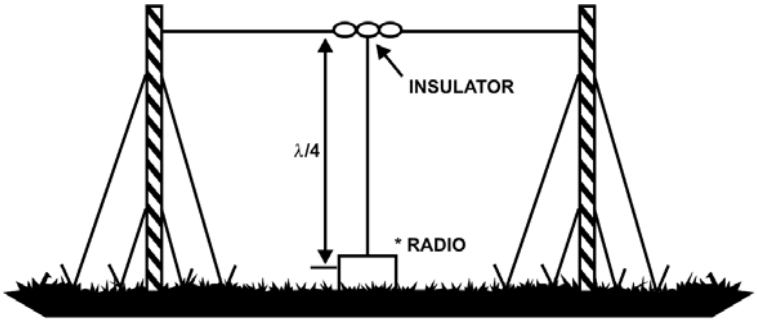
FACTORS AFFECTING EFFICIENCY

20. **Power Gain in a Particular Direction**. Power gain in a particular direction is obtained, when desired, by adding a ground vertical element 1/4 wavelength behind the driven element.

21. **Percentage of Radiation Vertically Polarized**. For maximum ground wave output, cut the vertical portion of the antenna as close as possible to one-quarter wavelength, and minimize the horizontal portion.

22. **Length of Radiator**. Physical length of the antenna should be approximately one-quarter wavelength, so that minimum electrical loading is necessary.

VERTICAL WIRE ANTENNA

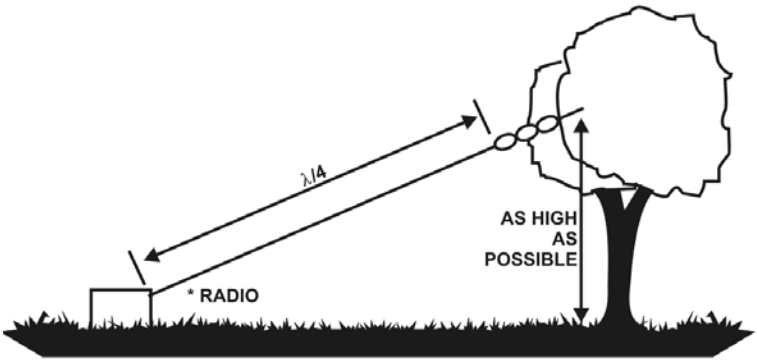


* CONNECT DIRECTLY TO ANTENNA BASE, FOR AN/PRC 515 WITHOUT AMPLIFIER CONNECT TO 8 ft (2.4 m) WHIP CONNECTOR.

Figure 5-1: Vertical Wire Antenna

Characteristics	- High support required - Erection time longer than for other vertical antennas
Construction	- Stranded copper wire insulated from its support. - Formula for determining the ideal vertical component of an antenna: $\frac{\lambda}{4} = \frac{71.3}{f}$ Lambda (λ) = wavelength in m f = frequency in MHz. - Use high masts, telegraph poles, trees, buildings, etc, as support. The latter two will absorb radiation and should be avoided if possible.
Radiation	- Omni-directional vertically polarized
Connection	- When using with AN/VRC, connect directly to Antenna Base—When using AN/PRC connect to whip connector.

SLOPING WIRE ANTENNA



* CONNECT AS FOR THE VERTICAL WIRE.

Figure 5-2: Sloping Wire Antenna

Characteristics	- As for vertical wire but more efficient than vertical wire of the same height - Easier to erect than vertical wire
Construction	- Normal stranded copper antenna wire, run straight from set terminal to some convenient point as high as possible - Length of antenna as for vertical wire antenna
Radiation	- Due to the slope of the wire, antenna radiates sky as well as surface wave, the amounts varying with the slope
Connection	- Same as Vertical Wire Antenna

INVERTED-L ANTENNA

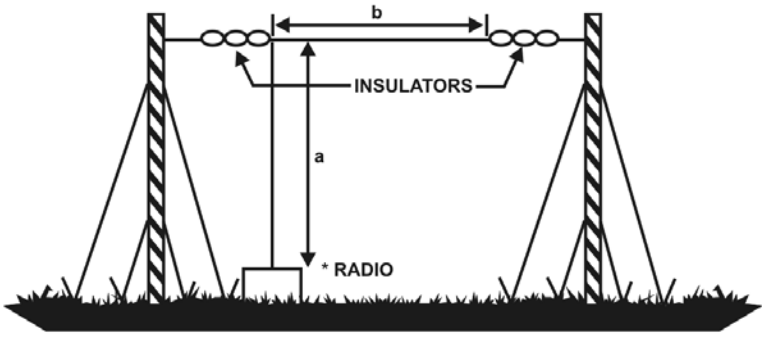


Figure 5-3: Inverted-L Antenna

Characteristics	- Easier to erect than vertical wire - Better than a rod or wire of the same height
Construction	- As for the vertical wire, with its top bent over horizontally - A rod antenna can be used as the vertical part with a horizontal wire from the top. - Total length from antenna base is one-quarter wavelength, i.e., a + b = 1/4 λ, where λ is the wavelength
Radiation	- Vertically polarized - Omnidirectional - The horizontal part will radiate sky wave and therefore should be kept as short as possible
Connection	- Same as Vertical Wire Antenna

T ANTENNA

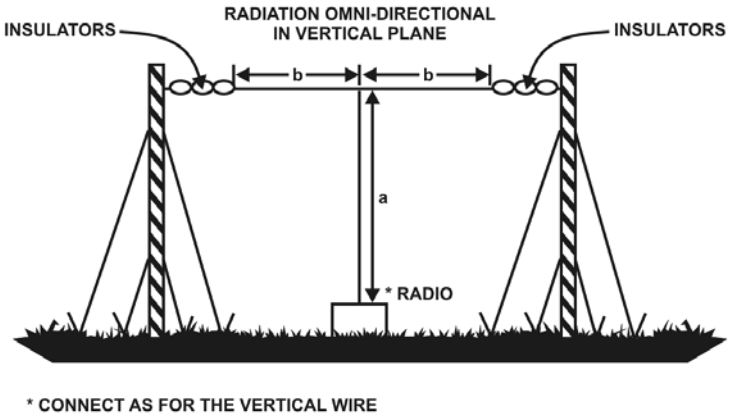


Figure 5-4: T Antenna

Characteristics	- For its height, the T Antenna is the most efficient ground wave antenna
Construction	- Vertical height "a" plus the length "b" is equal to a quarter-wavelength minus 1.524 m - The 1.524 m allows for easier tuning of the set i.e., a + b = 1/4 λ - 1.524 m - The vertical portion should be as long as possible
Radiation	- Vertically polarized as for the inverted-L - No sky wave, due to the currents in horizontal arms cancelling out one another
Connection	- Same as for the Vertical Wire Antenna

GROUND PLANE ANTENNA VHF NSN 5985-21-874-7520

Characteristics	- Designed as stationary antenna only - Simple to erect and maintain - Very efficient when elevated - Two to three times the range of a whip antenna
Construction	- No frequencies are marked on the telescopic radiator. Each of three radials are made up of a fixed "F" rod with an additional antenna element 100 cm x 6.2 mm mounted on the end of each "F" rod. To adjust the frequency the telescopic radiator has three positions. - fully extended: 30 - 37 MHz, - top down: 37 - 44 MHz, and - fully retracted: 44 - 76 MHz. - Attached to the base is an aluminium adapter for the Clark mast which must be removed when used with the telescopic 6.1 m mast
Radiation	Omni-Directional
Connection	Coaxial Cable

YAGI ANTENNA

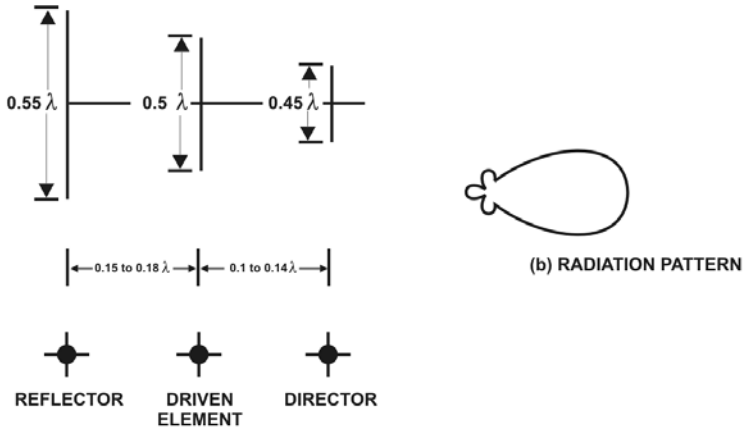


Figure 5-5: Yagi Antenna—Suitable Measurements

Characteristics	- Three element (or more) array, giving directional properties - Improved signal-to-noise ratio (SNR) at the receiver, allowing weaker signals to be received
Construction	- A driven half wave element (usually folded dipole) with an unfed parasite element each side - The element behind the driven dipole is longer than half wave and is called a reflector - The element in front is shorter than half wave and is called a director - Parasite lengths and spacings are obtained by trial methods. Suitable measurements are given in Figure 5-5
Radiation	- Forward gain: 3 to 6 db over 1/2 wave dipole - Front to back ratio: 10 to 12 db
Connection	- Coaxial Cable

CUBICAL QUAD ANTENNA

23. The Cubical Quad Antenna or "Quad" has been used for a number of years for HF bands with considerable success, both

commercially and by radio amateurs. The two element version has been found to have greater gain than the three element Yagi. It also has a greater bandwidth and it is easier to construct, adjust and erect. Tests have been carried out on VHF with favourable results.

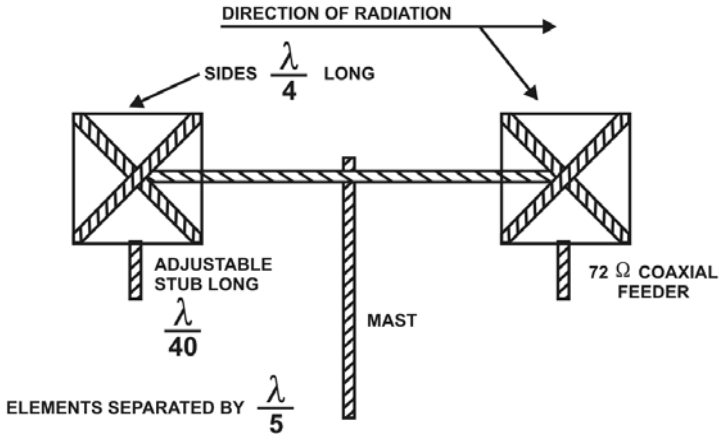


Figure 5-6: Construction of VHF Cubical Quad Antenna

24. The antenna is based on a quarter wave square loop, fed by coaxial cable so that the upper and lower sections of the radiator are in phase, and the current is reversed in the sides, so that radiation from them is negligible. The reflector is placed approximately 0.2 wavelength behind the radiator, as in the Yagi, and is tuned to a lower frequency. The standard way of tuning the reflector is to insert in the side opposite the fed side of the radiator, a matching stub which is an adjustable loop about 10% of the length of one side. The stub is then adjusted for maximum front to back ratio by using a field strength meter or by aural indication using radio back at a reasonable range. A simpler way (at the expense of a small amount of efficiency) is to make the reflector square 5% larger than the radiator. This has been found to be quite effective, but the front to back ratio has to be adjusted by varying the spacing between the elements.

25. This antenna is put forward as an alternative to the Yagi for point-to-point comm, particularly where construction of the Yagi, and the obtaining of the necessary tubing, would be difficult.

SECTION 6
HIGH FREQUENCY SKYWAVE ANTENNAS

DIPOLE ANTENNA

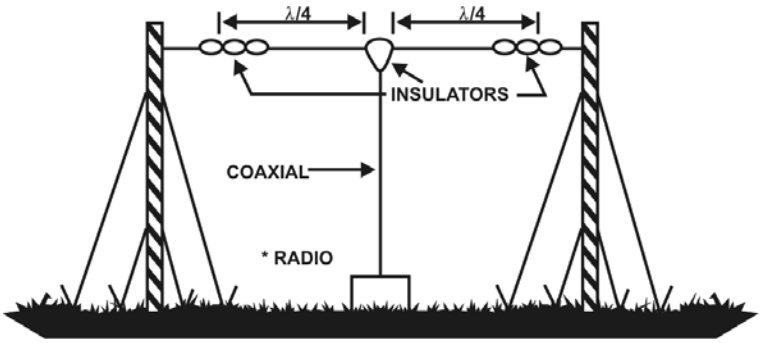


Figure 5-7: Dipole Antenna

General	- On a net, site all antennas parallel to one another - On a one-to-one link, site antennas at right angles to the path between stations - The higher the frequency the lower the angle of radiation (Antenna height fixed)
Characteristics	- A basic sky wave antenna that produces best results when used on short or intermediate distance circuits - Radiates little or no surface wave depending on type of transmission line and matching used
Construction	- The antenna must be accurately cut to a half wavelength. It should be used on frequencies within 150 kHz of the frequency for which it was cut. The formula for determining the total length of the half-wavelength antenna in metres is: $\frac{142.6\ \text{m}}{\text{Frequency (MHz)}}$ - This antenna has an input impedance of 73 ohms when fed at the centre (varies slightly with height of feedpoint) - The length of the transmission line is not critical but should be short to limit its attenuation - For ranges from 0 to 400 km. the optimum height above ground is between one-eighth and one-quarter wavelength - For ranges greater than 400 km, heights of approximately one-half wavelength will produce the side lobes necessary

	for longer distance propagation - Stranded copper should be used with porcelain insulators to facilitate work on several frequencies.
Radiation	- Good skywave propagation - Horizontally polorized - Maximum radiation at right angles to the antenna
Connection	- Uses a coaxial cable or balanced line of the correct impedance

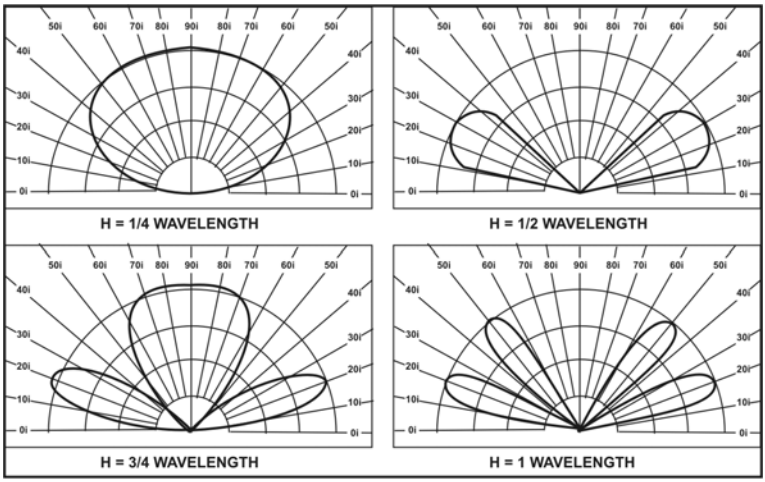


Figure 5-8: End-on Polar Diagram of a Horizontal Dipole Above Perfectly Conducting Surface

NOTE

The height of the antenna above ground has no effect on the directivity pattern, but simply changes the intensity and angle of maximum radiation. These changes are brought about by reflections of the radiated wave from the ground. The actual ground level is not generally the reflection level. The reflections usually come from a point a few metres below the actual surface of the earth. The exact location of this reflection surface can be determined only by trial and error movement of the antenna through a test range of several metres. It may be seen then, that while the general rules above are good reference heights, to produce the best signal on a given circuit on a given frequency, the optimum height can be determined only by experimentation.

DROOPY DIPOLE

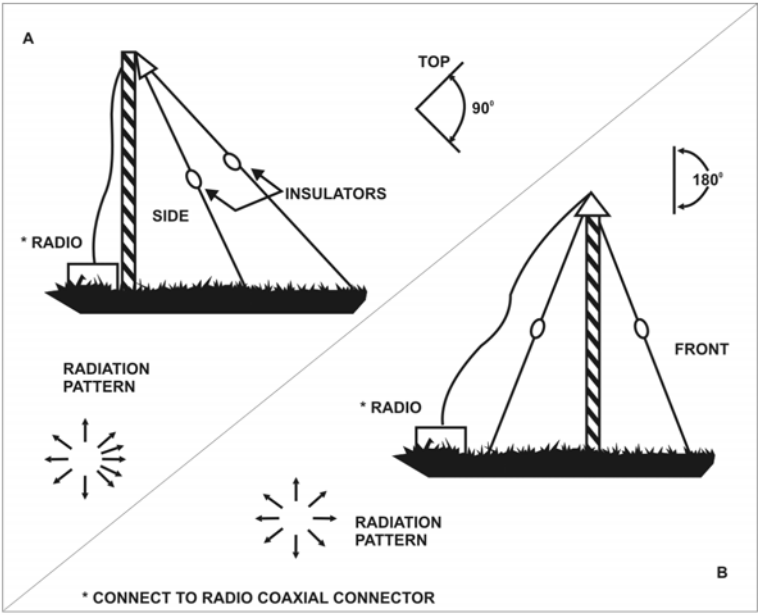


Figure 5-9: Droopy Dipole Configurations

Characteristics	- Can be used as either a field expedient antenna or a general purpose HF sky wave antenna for short or intermediate distance, 0 – 400 km - Requires only one support structure - Used with a manpack HF set, this antenna can be suspended by a cord looped over a high branch
Construction	- The antenna is a centre fed half wave dipole suspended at its centre feedpoint. Each quarter-wave leg is attached through an insulator to ground - It is used in two basic configurations, Figure 5-9. When used as an 'A', a more directional pattern results - When cut to within 5% of the transmitting frequency the antenna has an input impedance of 50 to 70 ohms and is fed from a coaxial cable - Stranded copper should be used with porcelain insulators to facilitate work on several frequencies
Radiation	- Produces both a ground and sky wave
Connection	- Uses a normal standard coaxial connector

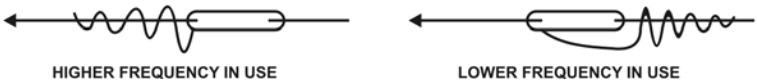


Figure 5-10: Insulators used to facilitate frequency changes on a Multi-freq Dipole

THREE-QUARTER WAVELENGTH END-FED ANTENNA

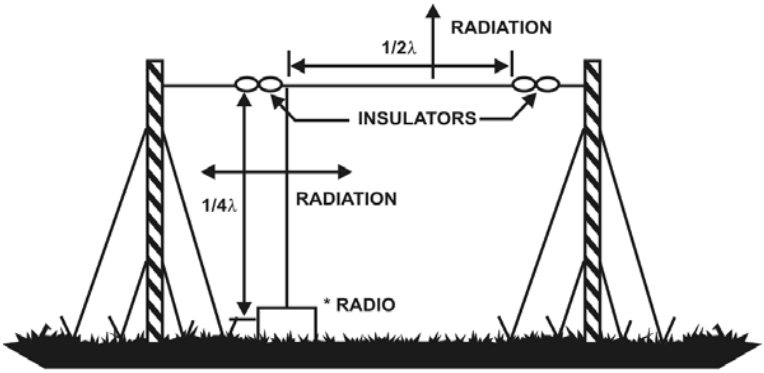


Figure 5-11: Three-Quarter Wavelength End-Fed Antenna

Characteristics	- Difficult to site and takes time to erect because of its length - A good general purpose antenna
Construction	- Uses normal stranded copper wire insulated from its support - Length of wire, including lead-in to antenna base, is three-quarter wavelength - Height is ideally one-quarter wavelength
Radiation	- Half-wavelength horizontal elements give very good sky wave - Quarter wavelength vertical elm gives good surface wave
Connection	- Uses a normal standard coaxial connector

MULTIBAND DIPOLE ANTENNA

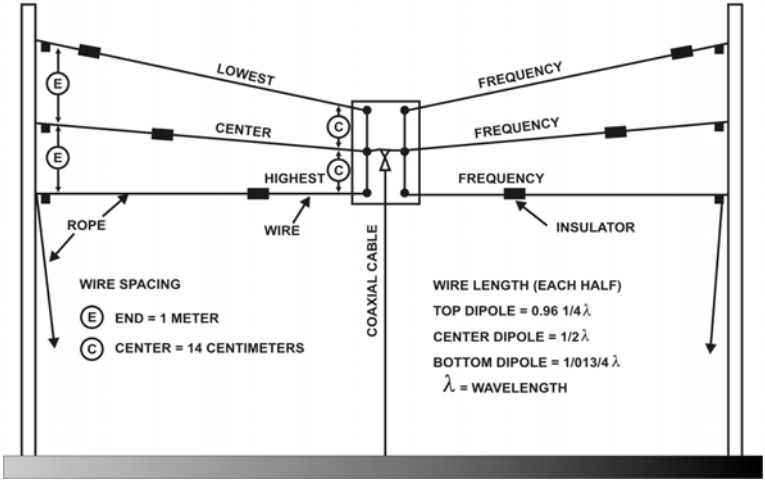


Figure 5-12: Multiband Dipole antenna

Characteristics	- Similar to dipole antenna - Can work more than one freq without using shorting straps - Easier to work with than the Multi Frequency or Segmented Wire Doublet Ant

Construction	- See Figure 15-13. Lowest freq on top, highest freq on the bottom.
	  - Centre spacing 14 cm or 31/2 inches
	  - End Spacing 1 m or 39 inches
	- Coax attached to all antenna lengths at the centre

Radiation	- Broadside to the radiating surface
Connection	- Uses a normal standard coaxial connector

LOG PERIODIC ANTENNA DESIGN

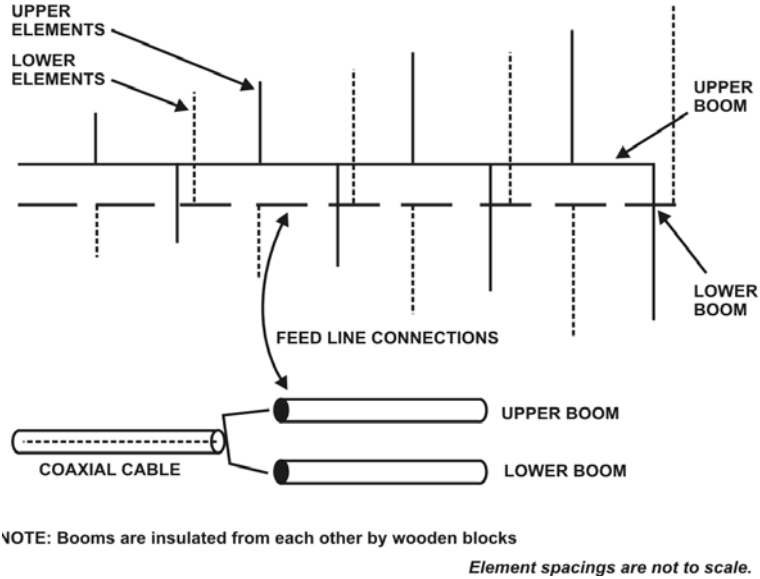


Figure 5-13: Log Periodic Dipole Antenna Basic Design Using a = 0°

26. Practical Design:

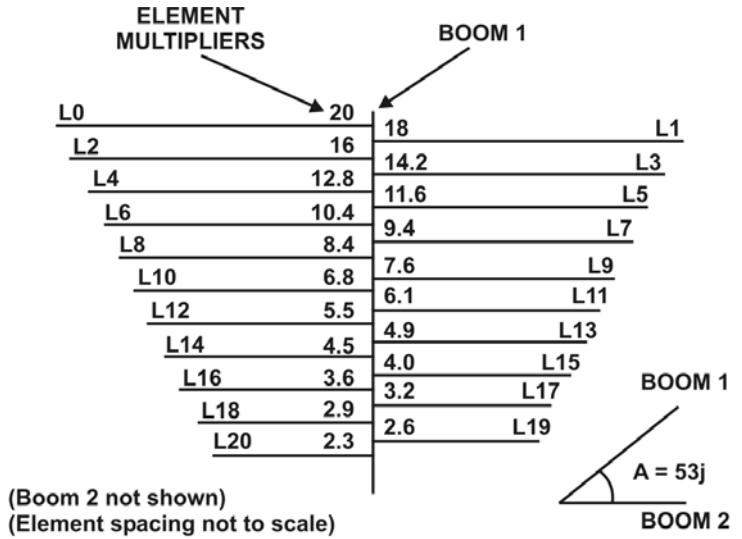


Figure 5-14: Log Periodic Dipole Practical Design Using a = 53°

Characteristics	The log periodic antenna produces a reasonable gain in a single direction over a wide band of frequencies. The gain, angle of fire, and input impedance are nominally constant over a 10:1 frequency band.
Construction	Basic Design, using a=0°: - This antenna consists of a number of half dipoles mounted on two isolated booms. The angle at which these booms intersect is subject to the design. A common type uses the booms parallel and mounted approximately two inches apart. - The longest element is a quarter wavelength at the lowest frequency. The number of elements is defined from the exponential log ratio: the more elements used, the smaller the variations of gain and impedance over the freq bandwidth of the antenna. - A diagram of a log periodic dipole using a zero angle is shown in Figure 5-13 - The zero angle log periodic dipole has an impedance of approximately 100 to 150 ohms; consequently it may be fed with either coaxial or open wire with Standing Wave Ratio (SWR) not to exceed 3:1. An open wire balun using the booms is normally used which has a characteristic impedance of 300 ohms. Practical Design Using a = 53° - The antenna is constructed on each of two booms as follows: a. Determine the length of the longest element LO with the formula; LO = $\frac{75}{f}$: LO = length of element in meters f = lowest frequency in MHz. Example: for f lowest = 30 MHz. LO = 75 ÷ 30 = 2.5 m. b. The length of each element from L1 to L20 is now determined from L0, using the element multipliers in ratio against that of L0. For example: L1 = (18 ÷ 20) x 2.5 = 2.25 m The element multipliers are shown in Figure 5-14; they have already been derived for this antenna by a factor Tan called the design factor. An apex angle of 53° is a reasonable

	compromise to achieve gain without too great a boom length; and c. Element spacing is determined easily from trigonometric tables. The ratio of the element length (L0) to the length of the element from the apex (R0) is tangent of a/2. For the previous example: Tan 53/2—L0/R0 R0 = L0/(tan (26.5)) = 2.5/.4986 = 5.01 m The spacing for the remaining elements is determined by the ratio method, as was used for finding element lengths, e.g., R1 = R0 X (18 ÷ 20) = 5.01 X (18 ÷ 20) = 4.51 m - With the elements mounted, one boom is rotated 180 degrees about the boom axis so that the two booms are complementary and the two are connected through the use of wood blocks or similar insulators as in Figure 5-13. Booms are best made of round aluminium rod, or wire mounted on wooden support. It should be possible to paint the antenna after construction, to reduce visibility of the antenna. - For an upper frequency limit of 77 MHz eliminate elements L18, L19 and L20. Element L17 can also be disregarded if the highest frequency of interest is below 68 MHz
Radiation	Direction of radiation is away from the apex
Connection	Coaxial cable

BARKER & WILLIAMSON ANTENNA—MODEL B & W 1.8-30 NSN 5985-21-895-5483

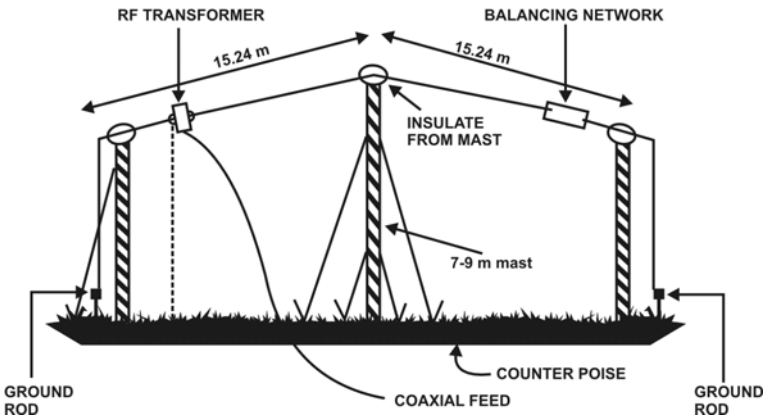


Figure 5-15: High Frequency Continuous Coverage Antenna

Characteristics	- HF continuous coverage antenna for both transmiting and receiving. The antenna covers the frequency range of 1.8 – 30 MHz, with a maximum SWR of 2:1, and an average SWR of 1.4:1. The antenna comes completely assembled, therefore there is no measuring, cutting, or soldering required in the field. The antenna wire is 7/22 #14 AWG copperweld steel wire. The antenna is capable of handling up to 1.5 Kw ICAS
Construction	- The antenna is an inverted "V" configuration which requires approximately 24.4 m of ground and a clearance of at least 7.6 m to erect. A pole is required in the centre between 7.6 m and 9.1 m high. The ends may be run directly to stakes driven into the ground or to poles 2.4 – 3.1 m high. Good grounding is required at each end. A counterpoise, provided with the antenna, may be run from the ground side of the balun to the other end of the antenna. The counterpoise is for use in poor ground or in dry soil conditions
Radiation	- Skywave
Connection	- 50 ohms coaxial cable

BARKER & WILLIAMSON ANTENNA—MODEL B & W 3.5-30 NSN 5985-21-895-5482 FOLDED DIPOLE ANTENNA

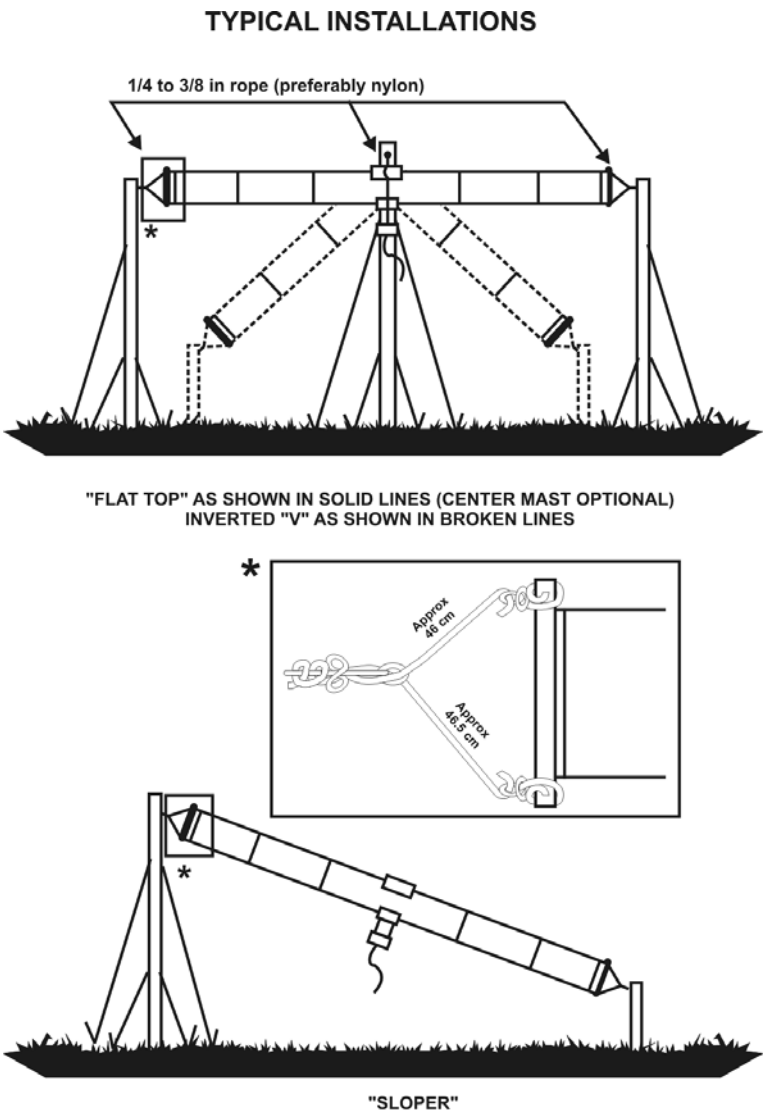


Figure 5-16: Folded Dipole Antenna

Characteristics	- Broadband Folded Dipole Antenna designed for continuous coverage from 3.5 MHz to 30 MHz. The antenna comes fully assembled and pretuned so no measuring or cutting is required. It is all weather rated at 2.5 kW—5000 watts P.E.P. CW/SSB. The antenna is fabricated with #14 stranded 40% copperweld wire and high impact space age plastic with a balun and matching network.
Construction	- The Folded dipole may be constructed as a flat-top antenna, inverted "V" or as a sloper with the low end as close as 1.8 m to the ground. (Refer to Figure 5-16 for illustrations). For the best omni-directional radiation, installation as a sloper is suggested. - Masts, trees, sides of buildings, poles etc., make good supports. A height of at least 4.5 m and an average of 7.6 to 12.2 m is suggested. “DO NOT INSTALL PARALLEL TO POWER LINES”. - Cut sufficient rope (1/4 in to 3/8 in diameter preferably) and prepare ends as shown in Figure 5-16. - Uncoil one half of the antenna, avoid twisting, kinking or springing by keeping the antenna taut during uncoiling. Install the rope as shown in Figure 5-16 ensuring the top rope is 1 to 2 inches shorter. This will allow the antenna to hang in a vertical position instead of flat. - Repeat steps for other side of antenna - Raise antenna. Again avoid twisting, kinking or springing.
Radiation	- Skywave or omni-directional depending on the method of installation
Connection	- 50 – 72 ohm coaxial cable

SECTION 7
FIELD EXPEDIENT ANTENNAS

VHF DIPOLE ANTENNA (FIELD EXPEDIENT)

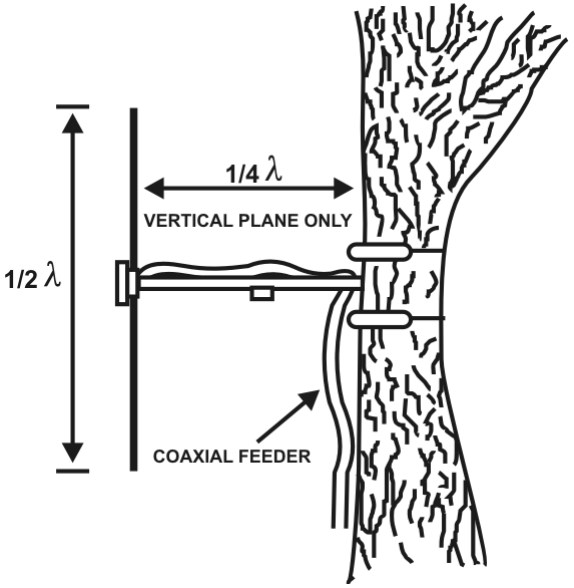


Figure 5-17: Elevated Dipole

Characteristics	- Usually employed as an elevated VHF antenna - Light, easily erected
Construction	- Rod, cut to a half wavelength
Radiation	- Omni-directional in vertical plane and bi-directional in horizontal plane and maximum at right angles to antenna
Connection	- Centre fed with coaxial cable

PATROL ANTENNA

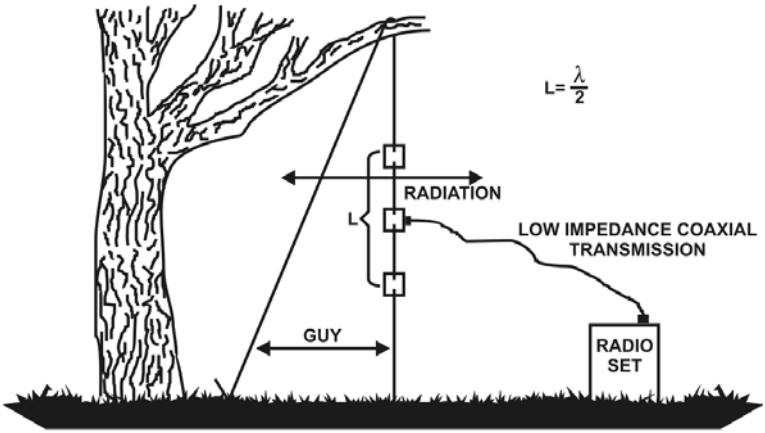


Figure 5-18: Patrol Antenna

Characteristics	- Used primarily with FM radio, it multiplies the range of a set by two to three times
Construction	- The simplest and easiest antenna to construct and carry is the single wire dipole. See Figure 015-19.
Radiation	- Omni-directional
Connection	- Fed at the centre by a low impedance coaxial cable

GROUND PLANE ANTENNA (FIELD EXPEDIENT)

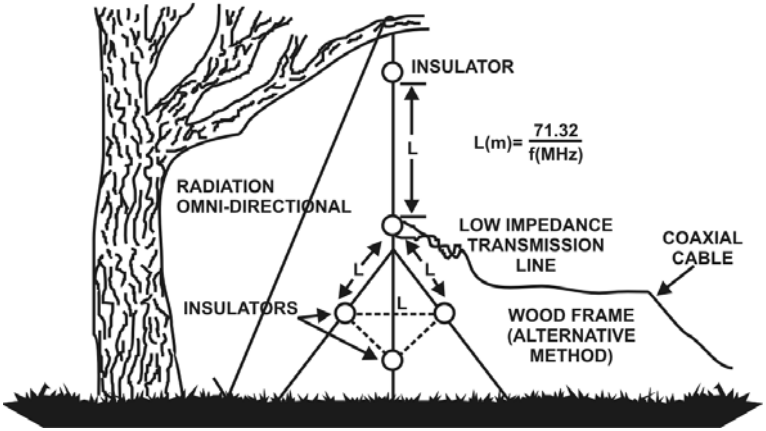


Figure 5-19: Ground Plane Antenna

Characteristics	- Used with FM radio, it multiplies the range of a set by two to three times
Construction	- The radiating element and the ground planes are cut one-quarter wavelength long at the operating frequency - The ground planes are spaced at equal angles and guyed in place. Since these planes should be kept as near horizontal as possible, in certain cases it may be advantageous to construct a triangular frame of wood or similar material to maintain the spacing of the planes.
Radiation	- Omni-directional
Connection	- Coaxial cable or other low impedance transmission line

LONG WIRE ANTENNA

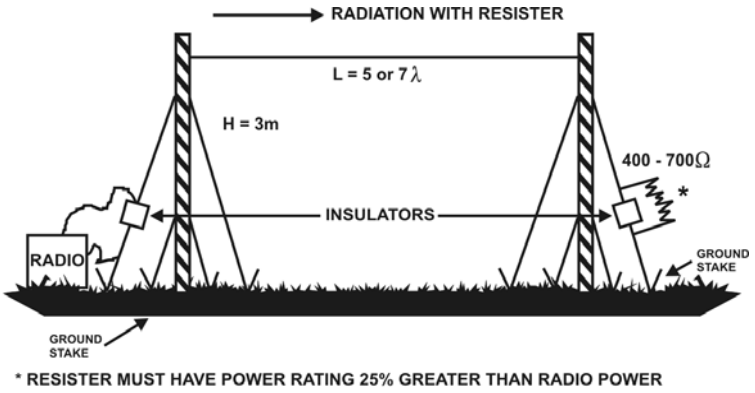


Figure 5-20: Long Wire Antenna

Characteristics	- Used with both HF and VHF radios. Normally used in open terrain. It will achieve two to three times the normal range of the set.
Construction	- The overall length of the antenna wire must be 5 to 7 wavelengths of the operating freq. - Erect the antenna as shown in Figure 5-20.
Radiation	- Unidirectional for low power VHF (with 500 to 600 ohm 2 watt carbon resistor). - Bi-directional for high power VHF and HF (without 500 to 600 ohm 2 watt carbon resistor).
Connection	- Run a wire from the antenna terminal and connect it to the antenna above the insulator. Run a second wire from a screwhead on the radio case to the bottom of the insulator.

VERTICAL HALF RHOMBIC ANTENNA

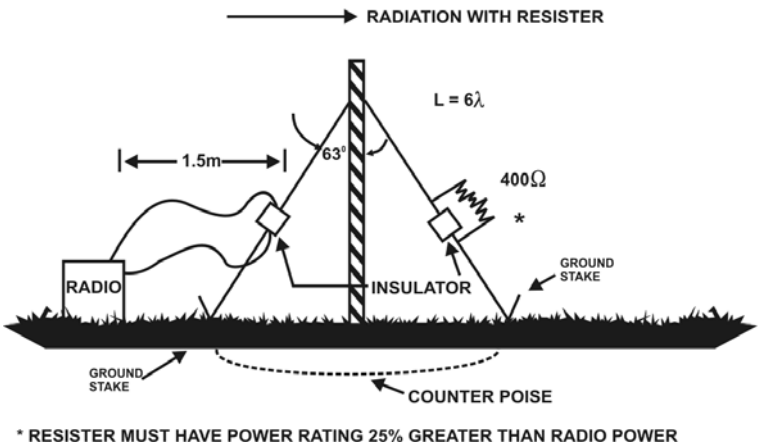


Figure 5-21: Vertical Half Rhombic Antenna

Characteristics	- Used primarily with FM radios. Used extensively in lightly wooded areas. It will achieve two to three times the normal range of the set.
Construction	- See Figure 5-21
Radiation	- Unidirectional
Connection	- Run a wire from the antenna terminal and connect it to the antenna above the insulator. Run a second wire from a screwhead on the radio case to the bottom of the insulator.

SECTION 8
CONVERSION, LENGTH AND CONSTRUCTION MATERIALS

FREQUENCY RANGE DESIGNATION

27. The following frequency bands are provided as a reference.

Band No	Symbols	Freq Range	Corresponding Metric Subdivision	Designation	Metric Abbreviations for the Bands
4	VLF	3 to 30 kHz	Myriametric waves	Very Low Frequency	Mam
5	LF	30 to 300 kHz	Kilometric waves	Low Frequency	Km
6	MF	300 to 3000 kHz	Hectometric waves	Medium Frequency	Hm
7	HF	3 to 30 MHz	Decametric waves	High Frequency	Dam
8	VHF	30 to 300 MHz	Metric waves	Very High Frequency	M
9	UHF	300 to 3000 MHz	Decimetric waves	Ultra High Frequency	Dm
10	SHF	3 to 30 GHz	Centimetric waves	Super High Frequency	Cm
11	EHF	30 to 300 GHz	Millimetric waves	Extra High Frequency	Mm
12		300 to 3000 GHz	Decimillimetric waves		

NOTES

1. "Band No N" (N= band no) extends from 0.3 x 10^{11} hz to 3 x 10^{11} hz.
2. Prefix: k = kilo (10^3), M = mega (10^8), G = giga (10^9), T = tera (10^{12})

ANTENNA LENGHTS (FREQUENCY WAVELENGTH CONVERSION)

28. Quick reference chart—Antenna lengths in Metres.

OP FREQ IN MHZ	1/4 WAVE	1/2 WAVE	3/4 WAVE	1 WAVE
2	35.66	71.30	107.00	142.65
3	23.77	47.53	71.33	95.10
4	17.83	35.65	53.50	71.33
5	14.26	28.52	42.80	57.06
6	11.89	23.77	35.67	47.55
7	10.19	20.37	30.57	40.76
8	8.92	17.83	26.75	35.66
9	7.92	15.84	23.78	31.70
10	7.13	14.26	21.40	28.53
11	6.48	12.96	19.45	25.94
12	5.94	11.88	17.83	23.78
13	5.49	10.97	16.46	21.95
14	5.09	10.19	15.29	20.38
15	4.75	9.51	14.27	19.02
16	4.46	8.91	13.38	17.83
17	4.20	8.39	12.59	16.78
18	3.96	7.92	11.89	15.85
19	3.75	7.51	11.26	15.02
20	3.57	7.13	10.70	14.27
21	3.40	6.79	10.19	13.59
22	3.24	6.48	9.73	12.97
23	3.10	6.20	9.30	12.40
24	2.97	5.94	8.92	11.89
25	2.85	5.70	8.56	11.41
26	2.74	5.48	8.23	10.97
27	2.64	5.28	7.93	10.57
28	2.55	5.09	7.64	10.19
29	2.46	4.92	7.38	9.84
30	2.38	4.75	7.13	9.51
31	2.30	4.60	6.90	9.20

OP FREQ IN MHZ	1/4 WAVE	1/2 WAVE	3/4 WAVE	1 WAVE
32	2.23	4.46	6.69	8.92
33	2.16	4.32	6.48	8.65
34	2.10	4.19	6.29	8.39
35	2.04	4.07	6.11	8.15
36	1.98	3.96	5.94	7.93
37	1.93	3.85	5.78	7.71
38	1.88	3.75	5.63	7.51
39	1.83	3.66	5.49	7.32
40	1.78	3.57	5.35	7.13
41	1.74	3.48	5.22	6.96
42	1.70	3.40	5.10	6.79
43	1.66	3.32	4.98	6.63
44	1.62	3.24	4.86	6.48
45	1.58	3.17	4.76	6.34
46	1.55	3.10	4.65	6.20
47	1.52	3.03	4.55	6.07
48	1.49	2.97	4.46	5.94
49	1.46	2.91	4.37	5.82
50	1.43	2.85	4.28	5.71

29. A simple formula converting frequency to wavelength (approximate answer only) is as follows for:

a. one wavelength antenna:

$$\lambda = \frac{285.3 \text{ m}}{\text{Frequency (MHz)}}$$

NOTE

An approximate 5% decrease in physical length versus electrical length is factored into the formula.

b. three-quarter wavelength antenna;

$$\frac{3}{4}\lambda = \frac{214\ \text{m}}{\text{Frequency (MHz)}}$$

NOTE

λ is the maximum length for a three-quarter-wavelength horizontal antenna.

c. half wavelength antenna; and

$$\frac{\lambda}{2} = \frac{142.6\ \text{m}}{\text{Frequency (MHz)}}$$

NOTE

½ λ is the:

a. sum of both horizontal arms of a dipole antenna;

b. total length of an end-fed half wavelength antenna; and

c. minimum length of the horizontal portion of a three-quarter wavelength inverted L antenna.

d. one-quarter wavelength antenna:

$$\frac{\lambda}{4} = \frac{71.32\ \text{m}}{\text{Frequency (MHz)}}$$

Example: At 2.4 MHz, λ/4 = 71.32 ÷ 2.4 = 29.71 m.

NOTE

¾ λ is the:

a. total length of an inverted-L antenna;

b. length of the vertical part plus one of the horizontal arms of a T antenna; and

c. total length of a quarter wavelength antenna.

ANTENNA CONSTRUCTION MATERIALS

30. **General**. In addition to the normal items that come with a radio set for the construction of antennas it is advisable to have available a number of other items to enable you to construct other antennas as may be necessary. This will, of course, be limited by availability of equipment and carrying storage space. Detailed requirements for specific antennas may be found in the appropriate technical manuals.

31. **Support**. Some form of mast or tower material should be carried if possible, although existing support such as trees, buildings, poles etc may be available.

32. The following equipment is required:

SER	EQPT	COMPONENT
1	Mast	
		Triangular lattice masts/towers, guyed or unguyed, tilt over or crank up (usually in multiples of 3 metres), or
		Guyed masts, normally in 1.8 m sections.
2	Radiating and Non Radiating Elements	
		Copper clad steel, solid copper, annealed copper, hard drawn copper and solid copper weld. (The smaller the AWB B and 5 gauge no, the higher the breaking strain), or
		TV type 300 ohm gibbon, or
		1/4 inch diameter aluminium tubing. (O.D. size will increase as frequency lowers).

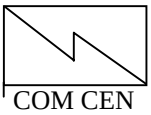
SER	EQPT	COMPONENT
3	Pulleys and Halyards	
		Pulleys. A good expedient pulley for field use is the clothes line pulley. These can be found in various strengths and are usually weather resistant.
		Halyards. The best material for general use, to support spans up to 60 m, is 6.35 mm nylon rope. Although more expensive than standard rope it withstands weather much better.
4	Guy Lines	
		Nylon rope, or
		ordinary rope, or
		high strength standard galvanized wire.
5	Pegs and Anchors	
		6 Metal or wooden pegs (with eyelets), or
		sunken plates or rods, or
		rocks, trees and other heavy or fixed objects
	NOTE Some specially made guy anchors have a plate on the end and may be screwed into the ground as they are corkscrewed for part of their length.	
6	Insulators	
		Glazed porcelain or glass,
		plastic, lucite or bakelite,
		varnished or insulated wood, or
		telephone or electrical insulators.
7	Feeders and Transmission Lines	
		Coaxial cable of the appropriate impedance;
		twin open wire (No 12 or 14 SWG) spaced as necessary for correct impedance;
		single open wire;
		copper or aluminium tubing; and
		wave guides.
8	Reflectors	
		Aluminium, copper or steel rods, or
		aluminium or copper wire, or
		metal sheets, or
		chicken wire, or

SER	EQPT	COMPONENT
		metal dishes, or
		fences, solid or mesh, or
		metal walls or buildings.
9	Counterpoises and Ground Planes	
		wire, insulated or non-insulated,
		rods, or
		wire mesh, or
		metal sheets.
10	Grounds	
		Copper rods or pipes,
		buried metal plates or meshes,
		cold water pipes, or
		common ground system.
11	Terminating Resistors	
		Any non-inductive resistor of the right value with a wattage rating greater than 25% of the transmitter output power.
12	Matching Devices	
		Baluns,
		matching stub,
		coaxial matching lengths, and
		tuners.

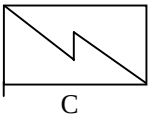
CHAPTER 6
GENERAL SYMBOLS

SIGNAL SYMBOLS

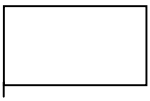
1. Communication/Signal centre at a headquarters.



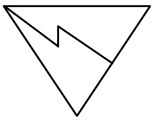
2. Exchange at a headquarters.



3. Basic symbol for an equipment concentration (Detail to be included within box, lines or terminated on outline)

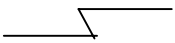


4. Communication centre (not as a headquarters).



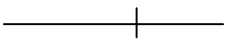
5. Test Point.
(Figures denotes pair capacity)

6. Radio Relay (RR) link (general symbol).

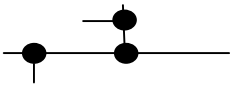


7. Line (one pair unless otherwise indicated).

8. Circuits crossing with no electrical connection.



9. Circuit crossing with electrical connection.

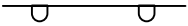


10. Unidirectional transmission.

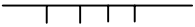
LINE SYMBOLS

11. Cable on the ground (2 pairs unless otherwise stated).

12. Buried or underground line.

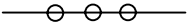


13. Overhead line.

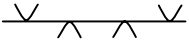


14. Underwater line.

15. Co-axial cable.



16. Overhead power cable(voltage to be stated).



17. Line facilities to be removed.

18. Remote Control Circuits.

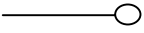
19. Telephone or carrier 2 wire.

20. Telephone or carrier 4 wire.

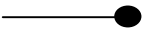
COMMUNICATION TERMINATION AND EQUIPMENT

21 Amplifier.

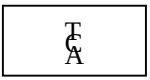
22. Telephone or telephone set.



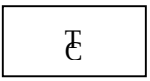
23. Remote control unit.



24. Automatic telephone exchange.



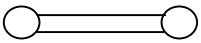
25. Manual telephone exchange



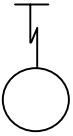
26. Facsimile.

RADIO/TRUNK SYSTEM

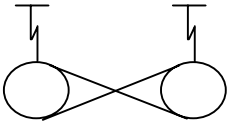
27. RRB.



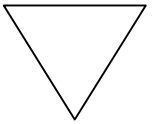
28. RR Terminal.



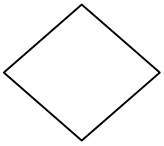
29. RR repeater.



30. Trunk node.



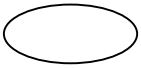
31. Rad access pt at a trunk node.



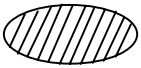
32. Multichannel SHF or optical fibre link.

33. Multichannel UHF or optical fibre link.

34. 2 x Headquarters Node (HN).

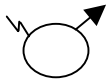


35. Headquarters Node.



36. Radio Node.

37. Long Range Terminal.



38. Tactical Cellular Telephone.

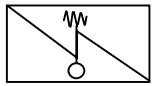
39. Cellular Node.

40. Trunk OSC.

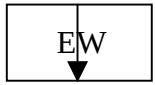
ELECTRONIC WARFARE SYMBOLS

41. EW Unit.

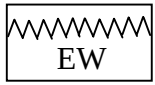
42. Radio station.



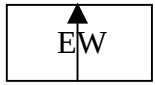
43. EW Intercept.



44. General symbol—jammer comms station.



45. Radio DF station.



46. Radar station.

LIST OF ABBREVIATIONS

AC	Alternating Current
ACP	Allied Communications Procedures
ADDN	Automated Defence Data Network
A/G/A	Air-Ground-Air
AIRCOM	Air Command
ALE	Automatic Link Establishment
AM	Amplitude Modulation
AME	Amplitude Modulation Emulation
AMI	Alternate Mark Inversion
ANR	Active Noise Reduction
ant	Antenna
ASCII	American Standard Code for Information Interchange
assy	Assembly
async	Asynchronous
ATE	Automated Test Equipment
AU	Access Unit
AUI	Attachment Unit Interface
AUTOVON	Automated Voice Operated Network
bal	Balanced
Bde	Brigade
Bde Gp	Brigade Group
BDI	BLACK Digital Interface
BFSM	Battlefield Frequency Spectrum Management
BIT	Built-In Test
bps	bits per second
BRIU	BLACK Radio Interface Unit

C&E	Communications and Electronics
CCA	Circuit Card Assembly
CDN	Canadian
CD ROM	Compact Disc Read Only Memory
CEOI	Communications Electronics Operating Instructions
CEOpO	Communications Electronics Operation Order
CF	Canadian Forces
CFTO	Canadian Forces Technical Order
CI	Control-Indicator
CIS	Control, Intercommunication Set
CKMU	Canadian Key Management Unit
CMIU	Control and Monitor Interface Unit
CMMS	Cryptographic Material Management System
CMS	Communication Management System
CMSS	Communications Maintenance Support System
CN	Cellular Node
CNR(HF)	Combat Net Radio (High Frequency)
CNR(P)	Combat Net Radio (Primary)
COM1	Communications Port1
comd	Commander
COMSEC	Communications Security
CONV	Converter
COTS	Commercial Off-The-Shelf
CP	Command Post
CPC	Communications Planning and Control
CPIC	Command Post Intercom
cps	Characters Per Second
CPU	Central Processing Unit

crypto	Cryptographic
CSCI	Computer Software Configuration Item
CSLIP	Condensed Serial Line Internet Protocol
CSMN	Canadian Supplementary Message Network
CSN	Canadian Switched Network
CSU/DSU	Computer Service Unit/Data Service Unit
CVH	Command Post Vehicle Harness
CVSD	Continual Variable Slope Delta
CW	Continuous Wave
DA	Distributing Authority
dc	Direct Current
det	Detachment
dir	Directional
DISDN	Defence Integrated Services Digital Network
div	Division
DLFM	Domain-Level Fault Management
DODB	Distributed Object Database
DOS	Disk Operating System
DRAM	Dynamic Random Access Memory
DSCS	Defense Satellite Communications System
DTS	Defence Telephone System
E&M	Electrical and Mechanical
EBIT	Equipment Built-In Test
ECU	End Crypto Unit
EMCON	Emmision Control
EPM	Electronic Protective Measures
ESU	Eurocom Switch Unit
EW	Electronic Warfare

EWCC	Electronic Warfare Control Centre
EWOC	Electronic Warfare Operations Centre
Fax	Facsimile
FC	Facility Controller
FDD	Floppy Disk Drive
FDT	Field Data Terminal
FFS	Frequency Fill System
FISN	Field Interface to Strategic Networks
FM	Frequency Modulation
fmn	Formation
F.O.	Fibre Optic
FSK	Frequency Shift Keying
gb	gigabyte
GCF	Gateway Control Facility
GIS	Geographic Information System
GMT	Greenwich Mean Time
GPS	Global Positioning System
Gp	Group
GS S/W	Government Supplied Software
GSM	Government Supplied Material
HDD	Hard Disk Drive
HF	High Frequency
HFR	High Frequency Radio
HN	Headquarters Node
HPA	High Power Amplifier
HQ	Headquarters
Hz	Hertz
I/O	Input/Output

ICOTS	IDS Commercial Off-The-Shelf
In Tfc	In Traffic
Intrusive BIT	Intrusive Built-In Test
IDN	Integrated Data Network
IDS	Information Distribution System
IDTS	IDS Data Terminal Services
IF	Intermediate Frequency
ILS	Integrated Logistic Support
INM	IDS Network Management
INS IDS	Network Services
IOSX	IDS Operating to System Extension
IP	Internet Protocol
IUCE	Interface Unit, Communication Equipment
kbit	kilobit
kbps	kilobytes per second
kb	kilobyte
kcps	kilocycles per second
km	kilometre
kw	kilowatt
LAN	Local Area Network
LAR	Light-weight Assault Radio
LCD	Liquid Crystal Display
LDN	Local Distribution Network
LDT	Laptop Data Terminal
LFCDA	Land Forces Command Distribution Authority
Ln	Line
LNA	Low Noise Amplifier
LO	Local Oscillator

LOS-RR	Line-Of-Sight—Radio Relay
LPT	Line Printer
LQA	Link Quality Analysis
LRR	Log Record Reader
LRU	Line Replaceable Unit
LSB	Lower Sideband
LSRV	Light System Repair Vehicle
LSVW	Light Support Vehicle Wheeled
LVH	Light Vehicle Harness
m	metre
M&C	Monitor and Control
MAC	Maintenance Aid Computer
MARCOM	Maritime Command
mb	Megabyte
MCT	Medium Communication Terminal
Mhz	Megahertz
MIB	Management Information Base
MIL-STD	Military Standard
mk	Mark
MLVW	Medium Logistics Vehicle Wheeled
mov O	Movement Order
MPVB	Multi-Purpose Van Body
MRT	Mobile Repair Team
msn O	Mission Order
MSRV	Medium System Repair Vehicle
MTDG	Multi-channel Tactical Digital Gateway
MTL	Multi-function Telephone Linecard
MU	Mobile User

MUX	Multiplexer
NATO	North Atlantic Treaty Organization
NAU	Network Access Unit
NBC	Nuclear, Biological, and Chemical
NDD	NATO Deductible Directory
NiCad	Nickel-Cadmium
NSN	NATO Stock Number
NSP	Net Security Plan
NVIS	Near Vertical Incidence Skywave
OEM	Original Equipment Manufacturer
OFR	Oscillator Frequency Reference
OI	Operator Interface
OMNI	Omnidirectional
OPI	Office of Primary Interest
op O	Operation Order
ORT	Operational Readiness Test
OS	Operating System
OSC	Operational System Control
OSF	Open Software Foundation
OTAR	Over-the-Air Rekeying
OTAT	Over-the-Air Transfer
OVH	Operational Vehicle Harness
para	Paragraph
PC	Personal Computer
PCM	Pulse Code Modulation
PCMCIA	Personal Computer Memory Card International Association
PDP	Power Distribution Panel

PDT	Portable Data Terminal
PEA	Power Expansion Assembly
PLGR	Precision Lightweight Global Receiver
P/P	Patch Panel
PMO	Project Management Office
PMUX	Programmable Multiplexer
PPP	Point-to-Point Protocol
PSCS	Personnel Security Clearance Status
PSTN	Public Switched Telephone Network
PTT	Press-To-Talk
QWERTY	Standard Keyboard Layout
Rad V	Radio Vehicle
RAM	Random Access Memory
RAU	Radio Access Unit
RBJ	Rotary Base Junction
RDBMS	Relational Database Management System
regt	Regiment
RF	Radio Frequency
RN	Radio Node
RN Rad V	RN Radio Vehicle
RN TCV	RN Technical Control Vehicle
Rptr	Repeater
RR	Radio Relay
RRB	Radio Rebroadcast
RRIU	RED Radio Interface Unit
RRV	Radio Relay Vehicle
RT	Receiver-Transmitter
RWAS	Robust Wake-up Active Squelch

SATCOM	Satellite Communications
SBIK	Shipborne Installation Kit
SCPC	Single Channel Per Carrier
SCSI	Small Computer System Interface
SELCAL	Selective Calling
SEP	System Executive and Planning
SHF	Super High Frequency
SIE	Strategic Interface Equipment
Sig op O	Signals Operation Order
SIGSEC	Signal Security
Sig wng O	Signals Warning Order
SITREP	Situation Report
SLIP	Serial Line Internet Protocol
SMI	System Management Interface
SMT	Secure Message Terminal
SOF	Single Operational Fill
SRH	Single Radio Harness
SRU	Shop Replaceable Unit
STANAG	Standard NATO Agreement
STH	Stand-alone Telephone Harness
STL	Stand-alone Telephone Line
STTEL	Stand-alone Telephone
STU	Secure Telephone Unit
SU	Step Up
SUPP	Supplement
synch	Synchronous
tac	Tactical
TBD	To be Determined

TCCCS	Tactical Command, Control, and Communications System
TCP	Transmission Control Protocol
TCSTRS	TCS Timing Reference System
TCV	Technical Control Vehicle
TDN	Trunk Distribution Network
TDP	Trunk Deployment Plan
TF	Task Force
TIE	Tactical Interface Equipment
TLRCT	Tactical Long Range Communication Terminal
TMHS	Tactical Message Handling System
TN	Trunk Node
TNTSV	Trunk Node Trunk Switch Vehicle
TOD	Time-Of-Day
TOSC	Trunk Operations System Control
TRANSEC	Transmission Security
TS	Trunk System
TSV	Trunk Switch Vehicle
UDS	Universal Data Set
UHF	Ultra High Frequency
UN	United Nations
unbal	Unbalanced
USB	Upper Sideband
(V)	Version
V	Volts
VAC	Volts alternating current
VBIT	Vehicle Built-in Test
VDC	Volts direct current

VGA	Video Graphics Adapter
VHF	Very High Frequency
VIC	Vehicle Intercom
VLRCS	Very Long Range Communication System
VSM	Vehicle Shock Mount
W	Watt
WST	World Standard Time