TECHNICAL MANUAL

DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE MANUAL

RADIO SET

AN/GRC-144

(NSN 5820-00-926-7356)

This copy is a reprint which includes current pages from Changes 1 through 5.

HEADQUARTERS, DEPARTMENT OF THE ARMY

AUGUST 1971

Technical Manual

No. 11-5820-695-35

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 13 May 1985

Direct Support, General Support and Depot Maintenance Manual RADIO SETS AN/GRC-144(V)1 (NSN 5820-01-048-9110) AN/GRC-144(V)2 (NSN 5820-01-061-7029) AN/GRC-144(V)3 (NSN 5820-01-100-3303) AND AN/GRC-144(V)4 (NSN 5820-01-099-7798)

			Paragraph	Page
CHAPTER	1.	INTRODUCTION	1-1 - 1-7	1-1 - 1-2
CHAPTER	2.	FUNCTIONING OF EQUIPMENT		
Section	I.	Functions of Radio Sets AN/GRC-144 (V), AN/GRC-144(V)3 and AN/GRC-144(V)4	2-1 - 2-26	2-1 - 2-52
	II.	Functioning of Transmitter, Radio T-1054(P)/GRC-144(V) and T-1054(P)A/GRC-144(V) Circuits	2-27 - 2-64.1	2-54.1 - 2.108.2
	III.	Functioning of Receiver, Radio R-1467(P)/GRC-144(V) and R-1467 (P)A/GRC-144(V) Circuits	2-65 - 2-77	2-109 - 2-118
	IV.	Functioning of Indicator, Antenna Alignment ID-1708/GRC Circuits	2-78 - 2-79	2-120
	V.	Functioning of Waveguide Switch Position Indicator Circuits	2-80	2-121 - 2-125
	VI.	Functioning of Converter-Multiplier Assembly CV-3633/GRC-144(V) Circuits	2-81 - 2-87	2-126 - 2-141
CHAPTER	3.	DIRECT SUPPORT MAINTENANCE		
Section	I.	General	3-1 - 3-3	3-1 - 3-2.1
	II.	Troubleshooting	3-4 - 3-18.4	3-2.2 - 3-30.7
	III.	Repairs	3-19 - 3-53.6	3-30.8 - 3-74.6
	IV.	Calibration and adjustment	3-54 - 3-67	3-75 - 3-83
	V.	Direct support testing procedures	3-68 - 3-79	3-83 - 3-115
CHAPTER	4.	DEPOT MAINTENANCE		
Section	I.	Repairs	4-1 - 4-13	4-1 - 4-9
	II.	Testing procedures	4-14 - 4-16	4-9 - 4-59
CHAPTER	5.	DIAGRAMS	5-15-5	5-1 - 5-265
APPENDIX	A.	REFERENCES		A-1
INDEX				Index 1

LIST OF ILLUSTRATIONS

Figure Number	Title	Page
2-1	Digital data modem 1A12, overall block diagram synchronous mode	2-10.2
2-1.1	Digital data modem 1A12, overall block diagram asynchronous mode	2-10.3
2-1.2	Digital data combiner 1A12, overall block diagram	2-10.4
2-2	Cable digital regenerator 1A12A2, PCM signal waveforms synchronous mode	2-11
2-2.1	Cable digital regenerator 1A12A12, PCM signal waveform asynchronous mode	2-12.2
2-2.2	Digital data combiner 1A12 waveforms	2-16.5
2-3	Transmitter. Radio T-1054l(P/GRC-144'(V)l; local oscillator and mixer circuits, functional block diagram	2-30.1
2-4	Radio test set (P/O 1A16), block diagram	2-43
2-5	Transmitter, Radio T-1054(P)/G(C-144(V) and T-1054(P)A/GRC-144(V) primary power distribution block diagram	2-44.1
2-6	Typical voltage regulator 1A1A1-1A1A12 block diagram	2-44.1
2-7	Receiver Radio R-1467(P)/GRC-144(V) and R-1467(P)A/GRC-144(V) primary power distribution block diagram	2-52
2-8	Receiver, Radio R-1467(P)/GRC-144(V) DC power distr	2-54
2-9	5/6 V voltage regulator 1A1A1 through 1A1A4 schematic diagram	2-56
2-10	12V voltage regulator 1A1A6 through 1A1A9 and 2A1A3, schematic diagram	2-58
2-11	15/28V voltage regulator 1AA10 through 1A1A12, 2A1A1, 2A1A2 and 2A1A4 schematic diagram	2-59
2-12(1)	Attenuator assembly 1A3 (683635), schematic diagram (Sheet 1 of 2)	2-61
2-12(1)	Attenuator assembly 1A3 (683635), schematic diagram (Sheet 2 of 2)	2-62
2-12.1	Attenuator assembly 1A3 (956429), schematic diagram	2-62.1
2-12.2	Attenuator assembly 1A3 (956431), schematic diagram	2-62.2
2-13	AF-RF Amplifier 1A4/2A11, schematic diagram	2-62.3
2-14(1)	Alarm monitor 1A5/2A12, schematic diagram (Part 1 of 3)	2-64
2-14(2)	Alarm monitor 1A5/2A12, schematic diagram (Part 2 of 3)	2-65
2-14(3)	Alarm monitor 1A5/2A12, schematic diagram (Part 3 of 3)	2-67
2-15	4.5 MHz low pass filter 1A6, schematic diagram	2-69
2-16	Transmitter frequency mixer stage 1A9, schematic diagram	2-75
2-17	Transmitter frequency multiplier group 1A10, schematic diagram	2-77
2-18(1)	Variable 1 frequency divider 1A14A4, timing diagram (Part 1 of 2)	2-99
2-18(2)	Variable 1 frequency divider 1A14A4, timing diagram (Part 2 of 2)	2-100

LIST OF ILLUSTRATIONS - Continued

Figure Number	Title	Page
2-19	1A14 timing diagram, 0.1 MHz thumbwheel switch	2-102
2-20	Variable 2 frequency divider 1A14A5, timing with jump count	2-105
2-21	Fixed frequency divider 1A14A6, timing diagram	2-107
2-22	Fixed frequency divider 1A14A6, phase detector, timing diagram	2-108
2-23	Fixed frequency divider 1A14A6, phase detector, timing diagram with phase loop unlocked	2-109
2-24	1.0 MHz low pass filter 2A3, schematic diagram	2-110.1
2-24.1	3.8 MHz low pass filter 2A3, schematic diagram	2-110.1
2-24.2	5.3 MHz low pass filter 2A3, schematic diagram	2-110.2
2-24.3	13 MHz low pass filter 2A3, schematic diagram	2-110.2
2-25	70 MHz band pass filter (B=5.0) 2A6, (684447), schematic diagram	2-114
2-25.1	70 MHz band pass filter (B=10.6) 2A6 (956417), schematic diagram	2-114.1
2-25.2	Equalizer filter 2A6 (956462), schematic diagram	2-114.2
2-26	Amplifier-mixer 2A7 (650520), schematic diagram	2-115
2-26.1	Amplifier-mixer 2A7 (956425), schematic diagram	2-116.1
2-27	110 MHz RF oscillator 2A13Y1, schematic diagram	2-119
2-28	Indicator, Antenna Alignment ID-1708/GRC, schematic diagram	2-120
2-29	AN/GRC-144(V)3 waveguide switch position indicator simplified schematic diagram	2-123
2-30	AN/GRC-144(V)4 waveguide switch position indicator simplified schematic diagram	2-124
2-31	AN/GRC-144(V)4 optional configuration waveguide switch position indicator simplified schematic diagram	2-125
2-32	Converter-Multiplier CV-3633/GRC-144(V) primary power distribution	2-128
2-33	Converter-Multiplier CV-3633/GRC-144(V) DC power distribution	2-129
2-34	Converter-Multiplier CV-3633/GRC-144(V) functional block diagram	2-131
2-35	Converter-Multiplier CV-3633/GRC-144(V) alarm circuit diagram	2-138
3-1	Transmitter, Radio T-1054(P)/GRC-144(V) and T-1054(P)A/ GRC-144(V), parts location	3-32
3-2	Electrical equipment cabinet 1A15, partially disassembled, parts location	3-33
3-3	Electrical equipment cabinet 1A15, front view with plate assembly 1A16 removed, parts location	3-34
3-4	Meter panel assembly 1A15A8, rear view parts location	3-35
3-5	Radio patch panel (P/O 1A150) front interior view parts location	3-36
3-5.1	T-1054(P)A/GRC-144(V) radio patch panel (P/O 1A15), front interior view, parts location	3-36.1
3-6	Radio patch panel (P/O 1A15) top interior view, parts location	3-37

LIST OF ILLUSTRATIONS - Continued

Figure Number	Title	Page
3-7	Transmitter, Radio T-1054(P)/GRC-144(V), rear top view. parts location	3-38
3-7.1	T-1054(P)A/GRC-144 top rear view interface connectors	3-38.1
3-8	Assembly detail, indicator light assemblies, meter panel, assembly 1A15A8 typical	3-39
3-9	Power supply chassis assembly 1A1A13 parts location	3-40
3-10	Terminal board 1A1A13TB1, top view parts location	3-41
3-11	Terminal board 1A1A13TB2, top view parts location	3-41
3-12	Radio test set (P/O 1A16) parts location	3-42
3-13	Transmitter, Radio T-1054(P)/GRC-144(V) cable locations.	3-43
3-13.1	Transmitter, Radio T-1054(P)A/GRC-144(V) interconnecting cables	3-44.1
3-14	Repair detail, rectangular connectors with solder type removable coaxial contacts	3-44
3-15	Plate assembly 1A16 rear view parts location	3-45
3-16	Disassembly detail, orderwire assembly electrical frequency synthesizer 1A1311A14	3-46
3-17	Receiver, Radio R-1467(P)/GRC-144(V) and R-1467(P)A/ GRC-144(V), parts location	3-59
3-18	Electrical equipment cabinet 2A15, partially disassembled parts location	3-60
3-19	Electrical equipment cabinet 2A15 with plate assembly 2A16 removed, parts location	3-61
3-20	Receiver, Radio R-1467/GRC-144 top view parts location	3-62
3-21	Plate assembly 2A16, rear view, parts location	3-63
3-22	Power supply chassis assembly 2A1A5 parts location	3-64
3-23	Terminal board 2A1A5TB1, top view parts location	3-65
3-24	Receiver Radio R-1467(P)/GRC-144(V), cable locations	3-66
3-24.1	Thermostatic switch assembly 1A15A17/2A15A17, parts location	3-66.1
3-24.2	Relay board assembly 1A15A18, parts location	3-66.2
3-24.3	Fabricated allen wrench dimensions	3-74.1
3-25	Indicator, Alignment ID-1708/GRC parts location	3-74
3-26	AN/GRC-144 connector repair tools	3-75
3-27	Calibration of R-1467/GRC-144 local oscillator metering circuits, equipment connections	3-82
3-28	T-1054(P)/GRC-144(V) frequency accuracy test setup	3-86
3-29	T-1054(P)/GRC-144(V) output power test setup	3-90
3-30	R-1467(P)/GRC-144(V) frequency accuracy test setup	3-92
3-31	R-1467(P)/GRC-144(V) local oscillator power test setup,	3-94
3-32	Calibration of signal generator AN/URM-52B, equipment connections	3-96
3-33	IF gain and carrier alarm test setup	3-97
3-34	Mounting detail, van axial fans 1A15B1 and 2A1581	3-97
3-35	Exploded view, input assembly 1A15A6 and 2A15A5	3-98
3-36	Transmitter cabinet, terminal board 1A15TB4 parts location	3-100
3-37	AN/GRC-144(V)4 output power test at 14.4 to 15.0 GHz	3-102
3-38	CV-3633/GRC-144(V) reflected power alarm threshold test and calibration	3-106

LIST OF ILLUSTRATIONS - Continued

Figure Number	Title	Page
3-39	CV-3633/GRC-144(V) local oscillator frequency accuracy test setup	3-110
3-40	CV-3633/GRC-144(V) receive section conversion gain test	3-113
4-1	Transmitter 2nd stage frequency multiplier 1A10A1 varactor diode replacement	4-3
4-2	Transmitter 3rd stage frequency multiplier 1A10A2 varactor diode replacement	4-4
4-3	Transmitter amplifier-frequency multiplier 1A11, varactor diode replacement	4-5
4-4	Amplifier-frequency multiplier 2A10 varactor diode replacement	4-6
4-5	Reflected meter test waveforms	4-9
4-6	5/6V voltage regulator 1A1A1 through 1A1A4 bracket wiring diagram	4-11
4-7	12V voltage regulator 1A1A6 through 1A1A9 and 2A1A3 bracket wiring diagram	4-12
4-8	15/28V voltage regulator 1A1A0 through 1A1A12, 2A1A1, 2A1A2 and 2A1A4, bracket wiring diagram	4-13
4-9(1)	Attenuator assembly 1A3 wiring diagram (Part 1 of 2)	4-14
4-9(2)	Attenuator assembly 1A3 wiring diagram (Part 1 of 2)	4-14.1
4-1	AF-RF amplifier 1A4/2A11 wiring Diagram	4-15
4-11(1)	AF-RF amplifier 1A4/2A11 parts location and printed wiring diagram (Part 1 of 2)	4-16
4-11(2)	AF-RF amplifier 1A4/2A11 parts location and printed wiring diagram (Part 2 of 2)	4-17
4-12	4.5 MHz low pass filter 1A6, wiring diagram	4-18
4-12.1	Cable bypass, parts location diagram	4-18.1
4-13	4.5 MHz low pass filter 1A6, parts location	4-19
4-14	Transmitter frequency mixer stage 1A9, wiring diagram	4-20
4-15	Digital data modem chassis 1A12A12 parts location	4-21
4-16	Digital data modem chassis assembly 1A12A12A1 parts location	4-22
4-17	Digital data modem chassis assembly 1A12A12A1 parts location	4-23
4-18	Printed wiring board assembly 1A12A12A2TB1 parts location and printed wiring diagram	4-24
4-19	Printed wiring board assembly 1A12A12A2TB2 parts location and printed wiring diagram	4-25
4-20	Orderwire chassis 1A13A7 partially disassembled parts location	4-26
4-21	Printed wiring board assembly 1A13A7TB1, parts location and printed wiring diagram	4-27
4-22	Electrical frequency synthesizer 1A14/2A14, partially disassembled, front view parts location	4-28
4-23	Electrical frequency synthesizer 1A14/2A14, partially disassembled rear view parts location	4-29
4-24	Radio frequency oscillator 1A14A1/2A14A1, wiring diagram	4-30
4-250	Radio frequency oscillator 1A14A1/2A14A1, parts location and printed wiring diagram (Part 1 of 4)	4-31

LIST OF ILLUSTRATIONS - Continued

Figure Number	Title	Page
4-25(2)	Radio frequency oscillator 1A14A1/2A14A1, parts location and printed wiring diagram (Part 2 of 4)	4-32
4-25(3)	Radio frequency oscillator 1A14A1/2A14A1 parts location and printed wiring diagram (Part 3 of 4)	4-33
4-25(4)	Radio frequency oscillator 1A14A1/2A14A1 parts location and printed wiring diagram (Part 4 of 4)	4-33
4-26	Electronic frequency converter 1A14A2/2A14A2 wiring diagram	4-34
4-27(1)	Electronic frequency converter 1A14A2/2A14A2, parts location and printed wiring diagram (Part 1 of 2)	4-35
4-27(2)	Electronic frequency converter 1A14A2/2A14A2 parts location and printed wiring diagram (Part 2 of 2)	4-36
4-28	Audio frequency phase error detector 1A14A3/ 2A14A3 wiring diagram	4-37
4-29(1)	Audio frequency phase error detector 1A14A3/ 2A14A3, parts location and printed wiring diagram (Part 1 of 2)	4-38
4-29(2)	Audio frequency phase error detector 1A14A3/ 2A14A3, parts location and printed wiring diagram (Part 2 of 2)	4-39
4-30	Variable 1 frequency divider 1A14A4/2A14A4 wiring diagram	4-40
4-31(1)	Variable 1 frequency divider 1A14A4/2A14A4, parts location and printed wiring diagram (Part 1 of 3)	4-41
4-31(2)	Variable 1 frequency divider 1A14A4/2A14A4, parts location and printed wiring diagram (Part 2 of 3)	4-42
4-31(3)	Variable 1 frequency divider 1A14A4/2A14A4, parts location and printed wiring diagram (Part 3 of 3)	4-42
4-32	Variable 2 frequency divider 1A14A5/2A14A5 wiring diagram	4-43
4-33(1)	Variable 2 frequency divider 1A14A5/2A14A5 parts Location and printed wiring diagram (Part 1 of 2)	4-44
4-33(2)	Variable 2 frequency divider 1A14A5/2A14A5 parts location and printed wiring diagram (Part 2 of 2)	4-44
4-34	Fixed frequency divider 1A14A6/2A14A6 wiring diagram	4-45
4-35(1)	Fixed frequency divider 1A14A6/2A14A6 parts location and printed wiring diagram (Part 1 of 3)	4-46
4-35(2)	Fixed frequency divider 1A14A6/2A14A6 parts location and printed wiring diagram (Part 2 of 3)	4-47
4-35(3)	Fixed frequency divider 1A14A6/2A14A6 parts location and printed wiring diagram (Part 3 of 3)	4-47
4-36	1.0 MHz low pass filter 2A3 wiring diagram	4-47
4-36.1	3.8 MHz low pass filter 2A3 wiring diagram	4-48
4-37	1.0 MHz low pass filter 2A3, parts location	4-48.1
4-37.1	3.8 MHz low pass filter 2A3, parts location	4-48.2
4-37.2	5.3 MHz low pass filter 2A3 (956419), parts location diagram	4-48.3
4-37.3	13 MHz low pass filter 2A3 (956421), parts location diagram	4-48.4
4-38	Demodulator 2A4 wiring diagram	4-49

LIST OF ILLUSTRATIONS - Continued

Figure Number	Title	Page
4-39	70 MHz band pass filter (B=5.0 MHz) 2A6 wiring diagram.	4-50
4-39.1	70 MHz band pass filter (B=10.6 MHz) 2A6 (956417) wiring diagram	4-50.1
4-39.2	70 MHz band pass filter(B=10.6 MHz)12A6 (956417) parts location/diagram,	4-50.2
4-40	70 MHz band pass filter (B=5.0 MHz) 2A6, parts location	4-51
4-41(1)	Amplifier-mixer 2A7, parts location and printed wiring diagram (Part 1 of 2)	4-52
4-41(2)	Amplifier-mixer 2A7, parts location and printed wiring diagram (Part 2 of 2)	4-53
4-41.1	Amplifier mixer 2A7 (956425), parts location and printed wiring diagram	4-52.1
4-42	Receiver frequency mixer stage 2A8, wiring diagram	4-54
4-43	220 MHz bandpass filter 2A8FL1, wiring diagram	4-55
4-44	Receiver frequency mixer stage 2A8, parts location	4-56
4-45	220 MHz frequency multiplier-OSC 2A13, wiring diagram	4-57
4-46	110 MHz RF oscillator 2A13Y1, wiring diagram	4-58
4-47	Indicator, Antenna Alignment ID-1708/GRC, wiring diagram	4-59
5-1	Color code marking for MIL-STD resistors, inductors, and capacitors	5-3
5-2	AN/GRC-144(V) and AN/GRC-144(V)3 standard cable terminal block diagram	5-5
5-2.1	AN/GRC-144(V)4 standard cable terminal configuration block diagram	5-5.1
5-3	AN/GRC-144 nonstandard cable terminal configuration, block diagram	5-7
5-4	AN/GRC-144 standard radio repeater configuration, block diagram	5-9
5-5	AN/GRC-144 nonstandard radio repeater configuration, block diagram	5-11
5-6	Transmitter Radio T-1054(P)/GRC-144(V), block diagram	5-13
5-6.1	Transmitter, Radio T-1054(P)A/GRC-144(V) block diagram	5-13.1
5-7	Digital data modem 1A12, cable-to-radio circuits, functional block diagram	5-15
5-7.1	Digital data modem 1A12 cable-to-radio circuits, functional block diagram asynchronous mode	5-16.1
5-8	Digital data modem 1A12, radio-to-cable circuits, functional block diagram synchronous mode	5-17
5-8.1	Digital data modem 1A12, radio-to-cable circuits, functional block diagram asynchronous mode	5-18.1
5-8.2	Digital data combiner 1A12, cable-to-radio circuits, functional block diagram	5-18.3
5-8.3	Digital data combiner 1A12, radio-to-cable circuits, functional block diagram	5-18.5
5-9	Orderwire assembly 1A13, signal distribution circuits block diagram	5-19

LIST OF ILLUSTRATIONS - Continued

Figure Number	Title	Page
5-10	Orderwire assembly 1A13, fault detection circuits, block diagram	5-21
5-11	Transmitter, Radio T-1054(P)/GRC-144(V) modulator circuits, functional block diagram	5-23
5-11.1	Transmitter, Radio T-1054(P)A/GRC-144(V) modulator circuits, functional block diagram	5-23.1
5-12	Electrical frequency synthesizer 1A14/2A14 overall block diagram	5-25
5-13	Electrical frequency synthesizer 1A14/2A14 functional block diagram	5-27
5-14	Alarm monitor 1A5, block diagram	5-29
5-15(1)	Transmitter Radio T-1054(P)/GRC-144(V), interconnecting diagram (Sheet 1 of 3)	5-31
5-15(2)	Transmitter Radio T-1054(P)/GRC-144(V), interconnecting diagram (Sheet 2 of 3)	5-33
5-15(3)	Transmitter Radio T-1054(P)/GRC-144(V), interconnecting diagram (Sheet 3 of 3)	5-35
5-15.1(1)	Transmitter, Radio T-1054(P)A/GRC-144(V) interconnecting diagram, (Sheet 1 of 4)	5-35.1
5-15.1(2)	Transmitter, Radio T-1054(P)A/GRC-144(V) interconnecting diagram, (Sheet 2 of 4)	5-35.3
5-15.1(3)	Transmitter, Radio T-1054(P)A/GRC-144(V) interconnecting diagram, (Sheet 3 of 4)	5-35.5
5-15.1(4)	Transmitter, Radio T-1054(P)A/GRC-144(V) interconnecting diagram, (Sheet 4 of 4)	5-35.7
5-16	Transmitter, Radio T-1054(P)/GRC-144(V) and T-1054(P)A/GRC-144(V), DC power distribution diagram	5-37
5-17	Power Supply 1A1, interconnecting diagram	5-39
5-18	Receiver, Radio R-1467(P)/GRC-144(V), overall block diag.	5-41
5-18.1	Receiver, Radio R-1467(P)A/GRC-144(V) overall block diagram	5-41.1
5-19	Receiver, Radio R-1467(P)/GRC-144(V), functional block diagram	5-43
5-19.1	Receiver, Radio R-1467(P)A/GRC-144(V) functional block diagram	5-43.1
5-20	Alarm Monitor 2A12, block diagram	5-45
5-21(1)	Receiver, Radio R-1467(P)/GRC-144(V) interconnecting diagram (Part 1 of 2)	5-47
5-21(2)	Receiver, Radio R-1467(P)/GRC-144(V) interconnecting diagram (Part 2 of 2)	5-49
5-21.1	Receiver, Radio R-1467(P)A/GRC-144(V) interconnecting diagram	5-49.1
5-22	Power Supply 2A1, interconnecting diagram	5-51
5-23	100 MHz radio frequency oscillator 1A2 schematic diagram	5-53
5-24(1)	Radio Set AN/GRC-144 integrated circuits schematic diagrams (Part 1 of 5)	5-55
5-24(2)	Radio Set AN/GRC-144 integrated circuits schematic diagrams (Part 2 of 5)	5-57
5-24(3)	Radio Set AN/GRC-144 integrated circuits schematic diagrams (Part 3 of 5)	5-59

LIST OF ILLUSTRATIONS - Continued

Figure Number	Title	Page
5-24(4)	Radio Set AN/GRC-144 integrated circuits schematic diagrams (Part 4 of 5)	5-61
5-24(5)	Radio Set AN/GRC-144 integrated circuits schematic diagrams (Part 5 of 5)	5-62.1
5-24.1(1)	Radio Set AN/GRC-144(V)3 and (V)4 integrated circuits (Sheet 1 of 6)	5-62.3
5-24.1(2)	Radio Set AN/GRC-144(V)3 and (V)4 integrated circuits (Sheet 2 of 6)	5-62.5
5-24.1(3)	Radio Set AN/GRC-144(V)3 and (V)4 integrated circuits (Sheet 3 of 6)	5-62.7
5-24.1(4)	Radio Set AN/GRC-144(V)3 and (V)4 integrated circuits (Sheet 4 of 6)	5-62.9
5-24.1(5)	Radio Set AN/GRC-144(V)3 and (V)4 integrated circuits (Sheet 5 of 6)	5-62.11
5-24.1(6)	Radio Set AN/GRC-144(V)3 and (V)4 integrated circuits (Sheet 6 of 6)	5-62.13
5-25	Electronic frequency control 1A7, schematic diagram	5-63
5-26	Radio transmitter modulator 1A8, schematic diagram	5-65
5-26.1	Modulator, radio transmitter 1A8 (956427), schematic diagram	5-65.1
5-27	Transmitter amplifier-frequency multiplier 1A11, schematic diagram	5-67
5-28	Digital data modem 1A12, interconnecting diagram	5-69
5-29	DC path through digital data modem 1A12, simplified schematic diagram	5-71
5-30	Cable digital regenerator 1A12A2, schematic diagrams, synchronous mode	5-73
5-30.1	Cable digital regenerator 1A12A13 schematic diagram, asynchronous mode	5-74.1
5-31	Cable control comparator 1A12A3, schematic diagram, synchronous mode	5-75
5-31.1	Cable control comparator 1A12A14 schematic diagram, asynchronous mode	5-76.1
5-32	Cable digital processor 1A12A4, schematic diagram	5-77
5-33	Alarm monitor 1A12A5, schematic diagram, synchronous mode	5-79
5-33.1	Alarm monitor 1A12A15, schematic diagram, asynchronous mode	5-80.1
5-34	AF amplifier 1A12A6, schematic diagram	5-81
5-35	Radio-amplifier detector 1A12A7, schematic diagram	5-83
5-36	Radio digital regenerator 1A12A8, schematic diagram	5-85
5-37	Radio control comparator 1A12A9, schematic diagram	5-87
5-38	Radio digital processor 1A12A10, schematic diagram, synchronous mode	5-89
5-38.1	Radio digital processor 1A12A16, schematic diagram, asynchronous mode	5-89.1
5-38.2	Digital data combiner 1A12, interconnecting diagram	5-89.3
5-38.3(1)	Multiplexer, digital orderwire 1A12A1, schematic diagram (Sheet 1 of 2)	5-89.5
5-38.3(2)	Multiplexer, digital orderwire 1A12A1, schematic diagram (Sheet 2 of 2)	5-89.7

LIST OF ILLUSTRATIONS - Continued

Figure Number	Title	Page
5-38.4(1)	Combiner alarm status 1A12A2, schematic diagram (Sheet 1 of 2)	5-89.9
5-38.4(2)	Combiner alarm status 1A12A2, schematic diagram (Sheet 2 of 2)	5-89.11
5-38.5(1)	Digital randomizer 1A12A3, schematic diagram (Sheet 1 of 2)	5-89.13
5-38.5(2)	Digital randomizer 1A12A3, schematic diagram (Sheet 2-of 2)	5-89.15
5-38.6(1)	Buffer, digital interface 1A12A4, schematic diagram (Sheet 1 of 3)	5-89.17
5-38.6(2)	Buffer, digital interface 1A12A4, schematic diagram (Sheet 2 of 3)	5-89.19
5-38.6(3)	Buffer, digital interface 1A12A4, schematic diagram (Sheet 3 of 3)	5-89.21
5-38.7(1)	Retimer digital traffic 1A12AS, schematic diagram (Sheet 1 of 2)	5-89.23
5-38.7(2)	Retimer digital traffic 1A12A5, schematic diagram (Sheet 2 of 2)	5-89.25
5-38.8(1)	Retimer, digital orderwire 1A12A6, schematic diagram (Sheet 1 of 2)	5-89.27
5-38.8(2)	Retimer, digital orderwire 1A12A6, schematic diagram (Sheet 2 of 2)	5-89.29
5-38.9	Demultiplexer, digital orderwire, 1A12A7, schematic diagram	5-89.31
5-38.10(1)	Regenerator, digital 1A12A8, schematic diagram (Sheet 1 of 2)	5-89.33
5-38.10(2)	Regenerator, digital 1A12A8, schematic diagram (Sheet 2 of 2)	5-89.35
5-39	Orderwire assembly 1A13, interconnecting diagram	5-91
5-40	Daughter Board No. 1 assembly 1A13A1, schematic diagram	5-93
5-41	Daughter Board No. 2 assembly 1A13A2 schematic diagram	5-95
5-42	Daughter Board No. 3 assembly 1A13A3 schematic diagram	5-97
5-43	Daughter Board No. 4 assembly 1A13A4 schematic diagram	5-99
5-44	Daughter Board No. 5 assembly 1A13A5, schematic diagram	5-101
5-45(1)	Electrical frequency synthesizer 1A14/2A14, interconnecting diagram (Part 1 of 3)	5-103
5-45(2)	Electrical frequency synthesizer 1A14/2A14, interconnecting diagram (Part 2 of 3)	5-105
5-45(3)	Electrical frequency synthesizer 1A14/2A14, interconnecting diagram (Part 3 of 3)	5-107
5-46	Radio frequency oscillator 1A14A1/2A14A1, schematic diagram	5-109
5-47	Electronic frequency converter board 1A14A2A1/2A14A2A1, schematic diagram	5-111

LIST OF ILLUSTRATIONS - Continued

Figure Number	Title	Page
5-48	Electronic frequency converter board 1A14A2A2/ 2A14A2A2, schematic diagram	5-113
5-49	Audio frequency phase error detector 1A14A3/2A14A3, schematic diagram	5-115
5-50	Variable 1 frequency divider 1A14A4/2A14A4, schematic diagram	5-117
5-51	Variable 2 frequency divider 1A14A5/2A14A5, schematic diagram	5-119
5-52	Variable 2 frequency divider 1A14A5/2A14A5 timing during jump count	5-121
5-53	Fixed frequency divider 1A14A6/2A14A6 schematic diagram	5-123
5-54	Demodulator 2A4, schematic diagram	5-125
5-54.1	Demodulator 2A4 (956415), schematic diagram	5-125.1
5-55	70 MHz intermediate frequency amplifier 2A5, schematic diagram	5-127
5-55.1	70 MHz intermediate frequency amplifier 2A5 (956423), schematic diagram	5-127.1
5-56	Receiver frequency mixer stage 2A8, schematic diagram	5-129
5-57	Amplifier-frequency multiplier 2A10, schematic diagram	5-131
5-58	220 MHz frequency multiplier-OSC 2A13, schematic diagram	5-133
5-59(1)	5/6V voltage regulator 1A1A7 through 1A1A4, parts location and printed wiring diagram (Part 1 of 2)	5-135
5-59(2)	5/6V voltage regulator 1A1A7 through 1A1A4, parts location and printed wiring diagram (Part 2 of 2)	5-137
5-60(1)	12V voltage regulator 1A1A6 through 1A1A9 and 2A1A3, parts location and printed wiring diagram (Part 1 of 2)	5-138.1
5-60(2)	12V voltage regulator 1A1A6 through 1A1A9 and 2A1A3, parts location and printed wiring diagram (Part 2 of 2)	5-138.3
5-61(1)	15/28V voltage regulator 1A1A10 through 1A1A12, 2A1A1, 2A1A2 and 2A1A4 parts location and printed wiring diagram (Part 1 of 2)	5-138.5
5-61(2)	15/28V voltage regulator 1A1A1D through 1A1A12, 2A1A1, 2A1A2 and 2A1A4 parts location and printed wiring diagram (Part 2 of 2)	5-138.7
5-62	100 MHz radio frequency oscillator 1A2, wiring diagram	5-139
5-63	100 MHz radio frequency oscillator 1A2 parts location	5-141
5-64	Attenuator assembly 1A3, parts location and printed wiring diagram	5-143
5-64.1	Attenuator assembly 1A3 (956429), parts location and printed wiring diagram	5-143.1
5-64.2	Attenuator assembly 1A3 (956431), parts location and printed wiring diagram	5-143.3
5-65	Alarm monitor 1A5/2A12, wiring diagram	5-145
5-66(1)	Alarm monitor 1A5/2A12, parts location and printed wiring diagram (Part 1 of 2)	5-147

LIST OF ILLUSTRATIONS - Continued

Figure Number	Title	Page
5-66(2)	Alarm monitor 1A5/2A12, parts location and printed wiring diagram (Part 2 of 2)	5-148
5-67	Electronic frequency control 1A7, wiring diagram	5-149
5-68(1)	Electronic frequency control 1A7, parts location and printed wiring diagram (Part 1 of 2)	5-151
5-68(2)	Electronic frequency control 1A7, parts location and printed wiring diagram (Part 2 of 2)	5-153
5-69	Radio transmitter modulator 1A8, wiring diagram	5-155
5-70	Radio transmitter modulator 1A8, parts location	5-157
5-70.1	Radio transmitter modulator 1A8 (956427), parts location diagram	5-157.1
5-71	Transmitter frequency mixer Stage 1A9, parts location	5-159
5-72	Transmitter frequency multiplier group 1A10, parts location	5-161
5-73	Transmitter amplifier-frequency multiplier 1A11, wiring diagram	5-163
5-74	Transmitter amplifier-frequency multiplier 1A11, parts location	5-165
5-75	Cable digital regenerator 1A12A2, parts location and printed wiring diagram, synchronous mode	5-167
5-75.1	Cable digital regenerator 1A12A13, parts location and printed wiring diagram, asynchronous mode	5-168.1
5-76	Cable Control-Comparator 1A12A3, Parts Location and printed wiring diagram, synchronous mode	5-169
5-76.1	Cable control-comparator 1A12A14, parts location and printed wiring diagram, asynchronous mode	5-170.1
5-77	Cable digital processor 1A12A4, parts location and printed wiring diagram	5-171
5-78	Alarm monitor 1A12A5, parts location and printed wiring diagram, synchronous mode	5-173
5-78.1	Alarm monitor 1A12A15, parts location and printed Wiring diagram, asynchronous mode	5-174.1
5-79	AF amplifier 1A12A6, parts location and printed wiring diagram	5-175
5-80	Radio amplifier-detector 1A12A7, parts location and printed wiring diagram	5-177
5-81	Radio digital regenerator 1A12A8, parts location and printed wiring diagram	5-179
5-82	Radio control-comparator 1A12A9, parts location and printed wiring diagram	5-181
5-83	Radio digital processor 1A12A10, parts location and printed wiring diagram, synchronous mode	5-183
5-83.1	Radio digital processor 1A12A16, parts location and printed wiring diagram, asynchronous mode	5-184.1
5-83.2	Digital data combiner 1A12, parts location and printed wiring diagram	5-184.3
5-83.3	Multiplexer, digital orderwire 1A12A1, parts location diagram	5-184.5
5-83.4	Combiner, alarm status 1A12A2, parts location diagram	5-184.7
5-83.5	Randomizer, digital 1A12A3, parts location diagram	5-184.9

LIST OF ILLUSTRATIONS - Continued

Figure Number	Title	Page
5-83.6	Buffer, digital interface 1A12A4, parts location diagram	5-184.11
5-83.7	Retimer, digital traffic 1A12A5, parts location diagram	5-184.13
5-83.8	Retimer, digital orderwire 1A12A6, parts location diagram	5-184.15
5-83.9	Demultiplexer, digital orderwire 1A12A7, parts location diagram	5-184.17
5-83.10	Regenerator, digital 1A12A8, parts location diagram	5-184.19
5-84	Daughter Board No. 2 assembly 1A13A1, wiring diagram	5-185
5-85	Daughter Board No. 1 assembly 1A13A1, parts location and printed wiring diagram	5-187
5-86	Daughter Board No. 2 assembly 1A13A2, parts location and printed wiring diagram	5-189
5-87	Daughter Board No. 3 assembly 1A13A3, parts location and printed wiring diagram	5-191
5-88	Daughter Board No. 4 assembly 1A13A4, parts location and printed wiring diagram	5-193
5-89	Daughter board assembly 1A13A5, parts locations and printed wiring diagram	5-195
5-90(1)	Demodulator 2A4, parts location and printed wiring diagram (Part 1 of 2)	5-197
5-90(2)	Demodulator 2A4, parts location and printed wiring diagram (Part 2 of 2)	5-198
5-90.1(1)	Demodulator 2A4 (956415), parts location and printed wiring diagram (Sheet 1 of 2)	5-198.1
5-90.1(2)	Demodulator 2A4 (956415), parts location and printed wiring diagram (Sheet 2 of 2)	5-198.3
5-91	70 MHz intermediate frequency amplifier 2A5, wiring diagram	5-199
5-920	70 MHz intermediate frequency amplifier 2A5, parts location and printed wiring diagram (Part 1 of 2)	5-201
5-920	70 MHz intermediate frequency amplifier 2A5, parts location and printed wiring diagram (Part 2 of 2)	5-202
5-92(1)	70 MHz intermediate frequency amplifier 2A5 (956453), parts location diagram	5-202.1
5-92(2)	Equalizer filter 2A6, parts location diagram	5-202.3
5-93	Amplifier-mixer 2A7, wiring diagram	5-203
5-94	Amplifier frequency multiplier 2A10, wiring diagram	5-205
5-95	Amplifier-frequency multiplier 2A10, parts location	5-207
5-96	Amplifier-frequency multiplier 2A13A, wiring diagram	5-209
5-97(1)	220 MHz frequency multiplier-OSC 2A13, parts location (Part 1 of 2)	5-211
5-97(2)	220 MHz frequency multiplier-OSC 2A13, parts location (Part 2 of 2)	5-213
5-98(1)	Converter multiplier CV-3633/GRC-144(V) Unit 3, interconnecting diagram (Sheet 1 of 2)	5-215
5-98(2)	Converter Multiplier CV-3633/GRC-144(V) Unit 3, interconnecting diagram (Sheet 2 of 2)	5-217
5-99	Alarm monitor 3A1, schematic diagram	5-219

LIST OF ILLUSTRATIONS - Continued

Figure Number	Title	Page
5-100	Converter, frequency electronic 3A2, schematic diagram	5-221
5-101	Amplifier multiplier 3A5, schematic diagram	5-223
5-101.1	Frequency Multiplier 3A5A1, schematic diagram	5-223.1
5-101.2	Converter-Regulator 3A5A1A2, schematic diagram	5-223.3
5-102	Current regulator 3A5A8, schematic diagram	5-225
5-103	Power supply 3A6, schematic diagram	5-227
5-104	Voltage regulator (28 VDC) 3A6A1, schematic diagram	5-229
5-105	Voltage regulator (100 VDC) 3A6A2, schematic diagram	5-231
5-106	Status panel 3A8, schematic diagram	5-233
5-107(1)	Converter-Multiplier Assembly CV-3633/GRC-144(V) parts location (Sheet 1 of 4)	5-235
5-107(2)	Converter-Multiplier Assembly CV-3633/GRC-144(V) parts location (Sheet 2 of 4)	5-237
5-107(3)	Converter-Multiplier Assembly CV-3633/GRC-144(V) parts location (Sheet 3 of 4)	5-239
5-107(4)	Converter-Multiplier Assembly CV-3633/GRC-144(V) parts location (Sheet 4 of 4)	5-241
5-108	Alarm monitor 3A1, parts location and printed wiring diagram	5-243
5-109	Converter, frequency electronic 3A2, parts location diagram	5-245
5-110	Amplifier multiplier 3A5, parts location diagram	5-247
5-111	Frequency multiplier 3A5A1, parts location diagram	5-249
5-112	Bias "T" cavity assembly 3A5A2, 3A5A5 and 3A5A7 parts location diagram	5-251
5-113	Impatt amplifier 3A5A3, 3A5A4, and 3A5A6, parts location	5-253
5-114	Current regulator 3A5A8, parts location and printed wiring diagram	5-255
5-115(1)	Power supply 3A6, parts location diagram (Sheet 1 of 2)	5-257
5-115(2)	Power supply 3A6, parts location diagram (Sheet 2 of 2)	5-259
5-116	Printed wiring board, voltage regulator (28 VDC) 3A6A1 parts location and printed wiring diagram	5-261
5-117	Printed wiring board, voltage regulator (100 VDC), 3A6A2 parts location and printed wiring diagram	5-263
5-118	Status panel 3A8, parts location diagram	5-265

CHAPTER 1
INTRODUCTION

1-1. Scope

a. This manual contains detailed functioning of the equipment (chapter 2) and instructions covering direct support (chapter 3) and depot maintenance (chapter 4) for Radio Sets AN/GRC-144(V), DDM (digital data modem) and ADDM (asynchronous digital data modem) operating modes; AN/GRC-144(V)3, HI-CAP LOS (high capacity line-of-sight) and AN/GRC-144(V)4, SRWBR (short range wideband radio) configurations. It includes instructions for periodic checks and calibration, troubleshooting; testing, aligning and repairing the equipment. It also lists tools materials, and test equipment to perform the maintenance of the equipment.

b. The complete manual for this equipment includes TM 11-5820-695-12, Operator and Organizational Maintenance Manual Including Repair Parts and Special Tools Lists for Radio Sets AN/GRC-144(V), AN/GRC-144(V)3 and AN/GRC-144(V)4.

1-2. Consolidated Index of Army Publications and Blank Forms

Refer to the latest issue of DA Pam 310-1 to determine whether there are any new editions, changes or additional publications pertaining to the equipment.

1-3. Reporting Errors and Recommending Improvements

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) direct to: Commander, US Army Communications Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort Monmouth, New Jersey 07703 -5007. In either case, a reply will be furnished direct to you.

1-4. Maintenance Forms, Records, and Reports

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750 as contained in the Maintenance Management Update.

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/ DLAR 4140.55/NAVMATINST 4355.73A/AFR 400-54/MCO 4430.3F.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33C/AFR 75-18/MCO P4610.19D/DLAR 4500.15.

1-5. Reporting Equipment Improvement Recommendations (EIR)

If your Radio Set AN/GRC-144(V) needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications Electronics Command and Fort Monmouth, ATTN: AMSEL -ME-MP, Fort Monmouth, New Jersey 07703-5007. We'll send you a reply.

1-6. Administrative Storage

Administrative Storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the PMCS Charts before storing. When removing the equipment from administrative storage the PMCS should be performed to assure operational readiness. Disassembly and

repacking of equipment for shipment or limited storage is covered in paragraphs 6-1 and 6-2.

1-7. Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

NOTES

Radio Set AN/GRC-144 has been renomenclatured as AN/GRC-144(V) with variations as follows:

- **AN/GRC-144(V)l 48 channel synchronous operation Digital Data Modem (DDM) with MK-1835/GRC-144(V) installed.**
- **AN/GRC-144(V)2 48/96 channel asynchronous operation Digital Data Modem (ADDM) with MK-1836/GRC-144(V) installed.**

AN/GRC-144(V)3 HI-CAP LOS (high capacity line-of-sight) consisting of Radio Set Transmitter T-1054(P)A/GRC-144(V) equipped with Digital Data Combiner OB-93/GRC-144(V) and Radio Set Receiver R-1467(P)A/GRC-144(V). AN/GRC-144(V)4-HI-CAP LOS/SRWBR (shortrange wideband radio) consisting of Radio Set Transmitter T-1054(P)A/GRC-144(V) equipped with Digital Data Combiner 08-93/GRC-144(V) and Radio Set Receiver R-1467(P)A/GRC-144(V) equipped with Converter Multiplier Assembly CV-3633/GRC-144(V).

Radio Set Transmitter T-1054/(GC-144 is now nomenclatured T-1054(P)/GRC-144(V) and Receiver R-1467/GRC-144 is now nomenclatured R-1467(P)/GRC-144(V) for (V)l and (V)2 configurations.

Equipment delivered under contract DAAB-5-72-C05507 differs slightly from those delivered under contracts DAAB05-68-C-0027, DA28-043-AMC -02614(E), and DA36-039-AMC-03282.

***References to the AN/GRC-144(V)1 and AN/GRC-144(V)2 configurations are shown throughout this manual as AN/GRC-144 or AN/GRC-144(V). Radio Set AN/GRC-144(V)1 and AN/GRC144(V)2 Transmitter and Receiver designations throughout this manual will appear as either T-1054/GRC-144 or T-1054(P)/GRC-144(V) and R-1467/ GRC-144 or R-1467(P)/GRC-144(V) respectively.**