# **TECHNICAL MANUAL**

# OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL

TEST SET, RADIO AN/GRM-114 (NSN 6625-01-108-6206) TECHNICAL MANUAL

NO. 11-6625-3016-14

HEADQUARTERS DEPARTMENT OF THE ARMY Washington, D.C., 18 June 1982

### OPERATOR'S, ORGANIZATIONAL, DIRECT' SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL TEST SET, RADIO AN/GRM-114

IFR NO. FM/AM-1000S, MM-100/W PB-114, ( AC-114 ACCESSORY KIT ) (NSN 6625-01-108-6206)

#### 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, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA 2028-2 located in back of this manual direct to: Commander, US Army Communications-Electr[onics Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, New Jersey, 07703.

In either case, a reply will be furnished direct 10 you.

#### TABLE OF CONTENTS

		Paragraph	Page
CHAPTER 1. Section L	INTRODUCTION General		
	Scope	1-1	1-1
	Maintenance forms, records, and reports Reporting equipment improvement	1-2	1-1
	recommendations	1-8	1-1
	Administrative storage	1-4	1-1
	Destruction of Army electronics materiel	1-5	1-1
١١.	Description and data		
	Purpose	1-6	1-1
	use	1-7	1-1
	Description and capabilities	1-8	1-1
	Equipment characteristics	1-9	1-1
	Items supplied	1-10	1-6
	Items required (but not supplied)	1-11	1-6
	Warranty information	1-12	1-7
	Safety precautions	1-13	1-8

			Paragraph	Page
CHAPTER	2.	PREPARATION FOR USE AND INSTALLATION Unpacking Assembly Checking unpacked equipment Siting Installation instructions Power requirements Initial checks and alignment	N 2-1 2-2 2-3 2-4 2-5 2-6 2-7	2-1 2-1 2-1 2-1 2-1 2-3 2-3
CHAPTER	3.	THEORY OF OPERATION General theory Receive theory Generate theory Frequency error theory 1st local oscillator theory 2nd local oscillator theory Dual tone generator theory Oscilloscope theory Spectrum analyzer theory MM-100 (Multimeter) theory Power supply theory	3-1 3-2 3-3 3-4 3-5 3-6 3-7 3-8 3-9 3-10 3-11	3-1 3-4 3-6 3-8 3-8 3-8 3-12 3-14 3-14 3-18
CHAPTER	4.	OPERATING INSTRUCTIONS Operating procedures AN/GRM-114 controls, indicators, and connectors Operating procedures RF signal generator operating instructions Oscilloscope operating instructions Receiver operating instructions Spectrum analyzer operating instructions Audio generator operating instructions Power monitor function Master oscillator calibration Frequency error measurement Audio frequency monitor function Multimeter operating instructions	4-1 4-2 4-3 4-4 4-5 4-6 4-7 4-8 4-9 4-10 4-12 4-13 4-14	4-1 4-13 4-13 4-24 4-28 4-28 4-28 4-37 4-48 4-58 4-58 4-58 4-58 4-65 4-70 4-70
CHAPTER	5.	MAINTENANCE INSTRUCTIONS General AN/GRM-114 routine maintenance checks and services Tools and test equipment Glossary AN/GRM-114 performance test AN/GRM-114 troubleshooting AN/GRM-114 alignment and adjustments Component location diagrams Inspection Performance verification Disassembly instructions Reassembly instructions	5-1 5-2 5-3 5-4 5-5 5-6 5-7 5-8 5-9 5-10 5-11 5-12	5-1 5-1 5-4 5-4 5-4 5-125 5-125 5-125 5-125 5-125 5-125 5-166

		Paragraph	Page
CHAPTER 5. (Continued)	Preparation for reshipment or limited storage Demolition to prevent enemy use	5-13 5-14	5-176 5-176
CHAPTER 6.	SCHEMATIC DIAGRAMS		6-1
APPENDIX A. B. c.	REFERENCES COMPONENTS OF END ITEM LIST ADDITIONAL AUTHORIZATION LIST (Not Applicable)		A-1 B-1
D. E.	MAINTENANCE ALLOCATION CHART EXPENDABLE SUPPLIES AND MATERIALS LIST (Not Applicable)		D-1
F.	PINOUT TABLE FOR EXT ACC CONNECTOR		F-1

TM 11-6625-3016-14

#### LIST OF ILLUSTRATIONS

#### Page Title Figure 1-0 1-1 Test set radio AN/GRM-114 2-2 AN/GRM-114 packaging 2-1 3-2 AN/GRM-114 general block diagram 3-1 3-3 3-2 Receive block diagram 3-6 Generate block diagram 3-3 3-7 3-4 Frequency error block diagram 3-9 3-5 1st local oscillator block diagram 3-10 2nd local oscillator block diagram 3-6 3-11 Dual tone generator block diagram 3-7 3-13 3-8 Oscilloscope block diagram 3-15 Spectrum analyzer circuit board 1 block diagram 3-9 3-16 3-10 Spectrum analyzer circuit board 2 block diagram 3-16 MM-100 (multimeter) block diagram 3-11 3-18 Power supply block diagram 3-12 4-2 AN/GRM-114 controls, indicators, and connectors 4-1 4-15 4-2 RF signal generator controls, indicators and connectors 4-24 4-3 Oscilloscope controls, indicators, and connectors 4-28 4-4 Receiver controls, indicators, and connectors 4-37 4-5 Spectrum analyzer controls, indicators, and connectors 4-39 4-6 Audio generator controls, indicators, and connectors 4-67 Frequency error measurement controls, indicators, and connectors 4-7 5-7 5-1 Flowchart symbol application 5-8 AN/GRM-114 performance test 5-2 5-21 5-3 Power supply troubleshooting 5-37 Audio frequency monitor troubleshooting 5-4 5-44 5-5 Receiver troubleshooting 5-58 Oscilloscope and spectrum analyzer troubleshooting 5-6 5-68 5-7 Frequency error measurement troubleshooting 5-72 5-8 RF signal generator troubleshooting 5-9 Dual tone generator - troubleshooting 5-91 5-94 5-10 RF wattmeter troubleshooting 5-98 TCXO and output distribution amplifier troubleshooting 5-11 5-102 5-12 MM-100 multimeter troubleshooting 5-13 Zero beat pattern 5-120 Front panel A1A1 (rear view) component location diagram 5-126 5-14 Mother board A1A2 component location diagram 5-127 5-15 Upper floor assemblies A1A3 component location diagram 5-128 5-16 6-129 Transmitter sensor A1A4 component location diagram 5-17 5-130 5-18 108 MHz bandpass filter A1A5 component location diagram 5-19 1200 MHz amplifier A1A6 component location diagram 5-130 Static discharge protector A1A7 component location diagram 5-190 5-20 5-131 Rear panel A1A8 component location diagram 5-21 5-132 Duty cycle regulator A1A8A1 component location diagram 5-22 5-132 High frequency phase-lock loop A1A9 component location diagram 5-23 5-133 5-24 79-80 MHz loop A1A10 component location diagram 5-25 VCO tuner A1A11 component location diagram 5-134 5-135 5-26 Dual tone generator Al Al 2 component location diagram

250 kHz I.F. monitor audio circuit board A1A13 component location diagram

5-136

5-27

iv

### LIST OF ILLUSTRATIONS - Continued

Figure	Title	Page
5-28	Regulator and power supply A1A14 component location diagram	5-137
5-29	1080 MHz multiplier amplifier A1A15 component location diagram	5-138
5-30	1200 MHz diode switch A1A6 component location diagram	5-138
5-31	Power monitor A1A7 component location diagram	5-139
5-32	Spectrum analyzer A1A18 component location diagram	5-140
5-33	Spectrum analyzer module no. 1 A1A18A1 component location diagram	5-141
5-34	Spectrum analyzer module no. 2 A1A18A3 component location diagram	5-141
5-35	Oscilloscope main circuit board A1A18A4 component location diagram	5-142
5-36	1st mixer A1A19 component location diagram	5-143
5-37	2nd mixer A1A20 component location diagram	5-144
5-38	100 MHz filter A1A21 component location diagram	5-145
5-39	100 MHz amplifier/108 MHz mixer A1A24A1 component location diagram	5-145
5-40	120 MHz receiver A1A24A2 component location diagram	5-146
5-41	FM/AM generator A1A24A3 component location diagram	5-147
5-42	Relay driver A1A25 component location diagram	5-148
5-43	High level amplifier A1A28 component location diagram	5-148
5-44	High frequency multiplier/mixer A1A26 component location diagram	5-149
5-45	MM-100 assembly A2A1A1 component location diagram	5-150
5-46	AN/GRM-114 disassembly/reassembly diagram	5-179
5-47	Front panel disassembly/reassembly diagram	5-181
5-48	Upper floor disassembly/reassembly diagram	5-182
5-49	MM-100 multimeter disassembly/reassembly diagram	5-183
6-1	AN/GRM-114 mother board A1A2, schematic diagram (2 sheets)	6-3
6-2	AN/GRM-114 interconnect A1, schematic diagram (2 sheets)	6-7
6-3	AN/GRM-114 front panel assembly A1A1, schematic diagram (2 sheets)	6-11
6-4	AN/GRM-114 coaxial cable assembly A1A22, schematic diagram	6-15
6-5	AN/GRM-114 upper floor assembly A1A3, schematic diagram	6-17
6-6	Heterodyne amplifier +2 prescaler A1A3A1, schematic diagram	6-19
6-7	1200-2200 MHz oscillator A1A3A2, schematic diagram	6-21
6-8	AGC system A1A3A3, schematic diagram	6-23
6-9	Clock divider A1A3A4, schematic diagram	6-25
6-10	TCXO output distribution amplifier A1A3A5, schematic diagram	6-27
6-11	Transmitter sensor A1A4, schematic diagram	6-29
6-12	108 MHz bandpass filter A1A5, schematic diagram	6-31
6-13	1200 MHz amplifier A1A6, schematic diagram	6-33
6-14	Static discharge protector A1A7, schematic diagram	6-35
6-15	Rear panel assembly A1A8, schematic diagram	6-37
6-16	Duty cycle regulator A1A8A1, schematic diagram	6-39
6-17	High frequency phase lock A1A9, schematic diagram	6-41
6-18	79-80 MHz loop A1A10, schematic diagram (2 sheets)	6-43
6-19	VCO tuner A1A11, schematic diagram	6-47
6-20	Dual tone generator A1A12, schematic diagram (2 sheets)	6-49
6-21	250 kHz i.f. monitor audio A1A13, schematic diagram (3 sheets)	6-53
6-22	Regulator and power supply A1A14, schematic diagram	6-59
6-23	1080 MHz multiplier amplifier A1A15, schematic diagram	6-61
6-24	1200 MHz diode switch A1A16, schematic diagram	6-63
6-25	Power monitor A1A17, schematic diagram	6-65
6-26	Spectrum analyzer A1A18, schematic diagram	6-67
6-27	Spectrum analyzer module no. 1 A1A18A1, schematic diagram	6-69
6-28	Oscilloscope inverter board A1A18A2, schematic diagram	6-71

### LIST OF ILLUSTRATIONS — Continued

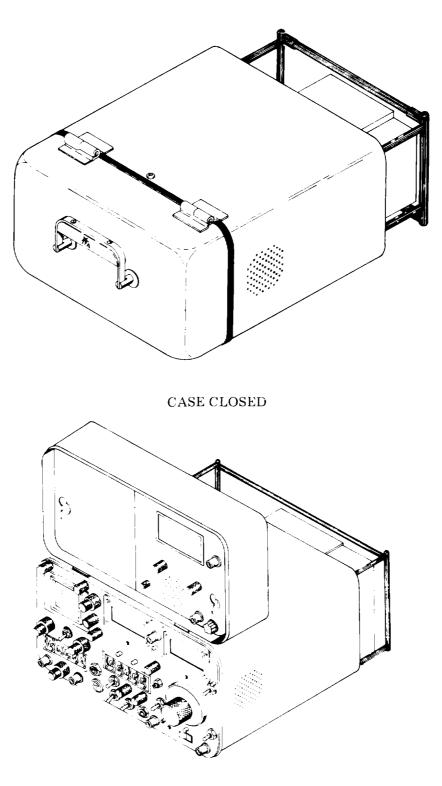
Figure	Title	Page
6-29	Spectrum analyzer module no. 2 A1A18A3, schematic diagram (3 sheets)	6-73
6-30	Oscilloscope main circuit board A1A18A4, schematic diagram (2 sheets)	6-79
6-31	Spectrum analyzer front plate assembly A1A18A5, schematic diagram	6-83
6-32	First mixer A1A19, schematic diagram	6-85
6-33	Second mixer A1A20, schematic diagram	6-87
6-34	100 MHz filter A1A21, schematic diagram	6-89
6-35	Battery, modified A1A23, schematic diagram	6-91
6-36	100 MHz amplifier/108 MHz mixer A1A24A1, schematic diagram	6-93
6-37	120 MHz receiver A1A24A2, schematic diagram (2 sheets)	6-95
6-38	FM/AM generator A1A24A3, schematic diagram	6-99
6-39	Relay driver A1A25, schematic diagram	6-101
6-40	High frequency multiplier/mixer A1A26, schematic diagram	6-103
6-41	Frequency select switch A1A27, schematic diagram	6-105
6-42	High level amplifier A1A28, schematic diagram	6-107
6-43	MM-100 assembly A2A1, schematic diagram (3 sheets)	6-109

#### LIST OF TABLES

Number	Title	Page
1-1	Physical characteristics	1-2
1-2	Electrical characteristics	1-2
1-3	Environmental characteristics	1-6
1-4	Items supplied	1-6
4-1	AN/GRM-114 controls, indicators, and connectors	4-1
4-2	AN/GRM-114 operating instructions	4-13
4-3	RF signal generator initial adjustments and control settings	4-15
4-4	RF signal generator operating instructions	4-16
4-5	RF signal generator operating instructions for AM RF signals	4-18
4-6	RF signal generator operating instructions for FM RF signals	4-22
4-7	Oscilloscope initial adjustments and control settings	4-25
4-8	Oscilloscope operating procedures	4-25
4-9	Initial adjustments and control settings	4-29
4-10	Receiver operating instructions	4-29
4-11	Initial adjustments and control settings	4-38
4-12	Spectrum analyzer operating instructions	4-38
4-13	Spectrum analyzer operating instructions for spurious signal detection	4-43
4-14	Audio generator initial adjustment and control settings	4-49
4-15	Audio generation with MM-100 operating instructions	4-50
4-16	Audio generation with oscilloscope operating instructions	4-53
4-17	Power monitor operating instructions for measuring transmitter carrier power	4-58
4-18	Master oscillator calibration using received time standard signal	461
4-19	Master oscillator calibration using an external frequency standard	4-65
4-20	Initial adjustments and control settings	468

#### LIST OF TABLES — Continued

Number	Title	Page
4-21	Frequency error measurement operating instructions	4-68
4-22	Multimeter operating instructions	4-71
5-1	Tools and test equipment	5-1
5-2	Glossary of abbreviations	5-4
5-3	AN/GRM-114 performance test - initial conditions	5-5
5-4	AN/GRM-114 performance test - initial conditions	5-6
5-5	Receiver troubleshooting - initial conditions	5-41
5-6	1st and 2nd local oscillators	5-41
5-7	Frequency error measurement - initial conditions	5-65
5-8	1st and 2nd local oscillates	5-65
5-9	RF signal generator troubleshooting initial conditions	5-71
5-10	AN/GRM-114 assemblies and interactive assemblies	5-112
5-11	VCO tuner adjustment	5-114
5-12	Tune pulse frequency and amplitude tests	5-116
5-13	Disassembly sequence	5-151



CASE OPEN

Figure 1-1. Test Set Radio AN/GRM-114

#### CHAPTER I

#### INTRODUCTION

#### Section I. GENERAL

#### 1-1. Scope.

a. This manual describes Test Set, Radio AN/GRM-114 and contains information for installation, operation, and direct support (DS), and general support (GS) maintenance.

b. Repair parts and special tools to support the AN/GRM-114 are listed in TM11-6625-3016-24P.

#### 1-2. 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 TM 38-750, The Army Maintenance Management System.

b. Report 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 4355.73/AFR 400.54/MCO 4430.3E.

c. Discrepancy in Shipment Report (DISREP) (SF 36/). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR 75-18/MCO P4610.19C/DLAR 4500.15.

1-6. Purpose. Test Set, Radio, hereinafter referred to as Communications Service Monitor ANK2RM-114, or AN/GRM-114, (fig. 1-1) is a compact, light-weight, portable maintenance instrument which provides test and measurement capabilities to effectively test and service a variety of avionics and communications equipments.

1-7. Use. The AN/GRM-114 contains an internal rechargeable battery pack, and can be used almost anywhere without concern for immediate power. It can also be operated from an ac line voltage or an external dc source.

1-3. Reporting Equipment Improvement Recommendations (EIR). If your AN/GRM-114 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, Tell us why a procedure is hard to perform. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, New Jersey 07703, We'll send you, a reply,

1-4. 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 are covered in paragraph 5-7.

1-5. Destruction of Army Electronics Materiel. Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

#### Section IL DESCRIPTION AND DATA

1-8. Description and Capabilities. The AN/GRM-114 incorporates the functions of an FM/AM signal generator, FM/AM receiver, RF spectrum analyzer, oscilloscope, audio generator, power monitor, and a multimeter. These functions permit the test set to perform general diagnostic tests end transmitter/receiver performance tests.

1-9. Equipment Characteristics, Table 1-1 lists the physical characteristics of the Communications Service Monitor AN/GRM-114. Table 1-2 lists the electrical characteristics, and table 1-3 lists the environmental characteristics.