TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL AND DIRECT SUPPORT MAINTENANCE MANUAL

RADIO RECEIVER
(R-2081/TRQ-35(V))
MODEL RCS-4B
(NSN 5820-01-005-4247)

HEADQUARTERS, DEPARTMENT OF THE ARMY
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RADIO RECEIVER MODEL RCS-4B (R-2081/TRQ-35(V))
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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 Form 2028-2 located in back of this manual 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.

TABLE OF CONTENTS

Section			Page
		WARNINGS	A
		FOREWORD	E
0		GENERAL	0-1
	0-1	Scope	0-1
	0-2	Consolidated Index of Army Publications and Blank Forms	0-1
	0-3	Maintenance Forms, Records and Reports	0-1
	0-4	Reporting Equipment Improvement Recommendations (EIR)	0-1
	0-5	Administrative Storage	0-1
	0-6	Destruction of Army Electronics Materiel	0-1
1		GENERAL INFORMATION	1-1
	1-1	Introduction	1-1
	1-3	General Description	1-1
	1-6	Unit 1,6025 Control/Display	1-3
	1-7	Unit 2,4028 HF Receiver	1-5
	1-11	Unit 3,6043 Power Divider	1-5
	1-12	Equipment Supplied	1-5
	1-16	Aircraft Installations	1-6
	1-17	Equipment Required But Not Supplied	1-6
	1-19	Specifications	1-6
	1-21	Related Publications	1-6

TABLE OF CONTENTS - Continued

Section		Page
2	INSTALLATION	2-1
2-1	Introduction	2-1
2-3	Unpacking and Inspection	2-1
2-6	Installation Requirements	2-1
2-7	General	2-1
2-8	Rack Mounting	2-1
2-9	Bench Mounting	2-1
2-10	Aircraft Installation	2-2
2-13	Environmental Case Enclosure	2-3
2-14	Power Connection	2-3
2-15	Line Voltage	2-3
2-16	Power Cable	2-6
2-17	Cables and Connectors	2-6
2-20	Data I/O Connector	2-6
2-21	Battery Installation	2-6
2-23	Non-Rechargeable Battery Supply (P/N 6025-1008)	2-10
2-24	Rechargeable Battery Supply (P/N 6025- 1018)	2-10
2-25	Post- Installation Checkout	2-11
2-27	Storage and Reshipment	2-11
2-28	Storage	2-11
2-29	Reshipment	2-11
3	OPERATION	3-1
3-1	Introduction	3-1
3-3	Controls and Indicators	3-1
3-5	Operating Instructions	3-1
3-6	General	3-1
3-7	Initial Control Settings	3-8
3-8	Start Up Procedure	3-8
3-9	Normal Operation	3-9
3-10	Synchronization	3-11
3-12	Starting Program Clocks	3-12
3-13	Setting the Program Clock with Time Offsets	3-13
3-14	Setting Path 2 or 3 Clock Relative to Path 1	3-13
3-15	Synchronization without Predetermined Sweep Timing	3-14
3-16	Sweep Synchronization	3-15
3-17	Automatic Synchronization Procedure	3-15
3-18	Manual Synchronization Procedure	3-17
3-20	Standby Power	3-18
3-21	Shutting Down the Receiver	3-18

TABLE OF CONTENTS - Continued

Section		Page
4	THEORY OF OPERATION	4-1
4-1	Introduction	4-1
4-3	Functional Description	4-1
4-5	6025 Control/Display Unit (Unit 1)	4-1
4-7	Frequency Standard Section	4-3
4-8	Frequency Standard 1A6 (S/N 400101 and on)	4-3
4-10	Spectrum Analyzer Section	4-3
4-11	Spectrum Analyzer 1A1	4-3
4-12	Analyzer Input Section	4-4
4-14	Analyzer Output Section	4-6
4-17	Receiver Control Section	4-6
4-18	Auto Sync (lab)	4-6
4-22	Receiver Test Circuit	4-9
4-24	3-Path Controller 1A4 (S/N 400101 and on)	4-10
4-25	3-Path Programmer (S/N 400101 and on)	4-10
4-27	Receiver Control (S/N 400101 and on)	4-12
4-32	CRT Display Section	4-16
4-33	Display Section Description	4-16
4-39	Timing and Control Assembly 1A2A2	4-20
4-44	Cursor Storage and Readout (1A2A1)	4-22
4-47	Memory Load Logic (1A3A2)	4-23
4-51	CRT Display Memory (1A3A1)	4-25
4-52	CRT Display (1A7)	4-26
4-53	Standby Battery Supply, 1A8	4-26
4-55	Non-Rechargeable Supply (P/N 6025-1008)	4-26
4-56	Rechargeable Supply (P/N 6025-1018)	4-26
4-58	Numeric Display, 1A9	4-27
4-60	Sub Panel Control, 1A10	4-27
4-62	Enclosure Assembly, 1A11	4-27
4-64	4028 HF Receiver - Unit 2	4-28
4-66	Sweep Synthesizer (2A1) (P/N 5030-1001 Only)	4-28
4-71	Sweep Synthesizer	4-30
4-72	Synthesizer	4-32
4-73	Down Converter	4-33
4-74	Sweep Programmer	4-34
4-75	Receiver (2A2)	4-34
4-76	Receiver Front End	4-34
4-79	Receiver Output Section	4-36
4-83	Receiver Power Supply	4-38
4-84	6043 Power Divider Unit 3	4-38
4-86	Frequency Standard Section (S/N 400100 and before)	4-38
4-87	Frequency Standard (1A6) (S/N 400100 and before)	4-38
4-89	3-Path Controller 1A4 (S/N 400100 and before)	4-39

TABLE OF CONTENTS - Continued

Section		Page
4-90	3-Path Programmer 1A4A1	4-39
4-93	Receiver Control 1A4A2	4-40
4-94	Front Panel Select	4-40
4-95	Preselector Decode	4-40
4-96	Frequency Counter	4-40
4-97	Cursor to Frequency Converter	4-40
4-99	Auto Start	4-41
5	MAINTENANCE	5-1
5-1	Introduction	5-1
5-3	Test Equipment	5-1
5-5	Preventive Maintenance	5-1
5-7	Corrective Maintenance	5-1
5-9	Troubleshooting Procedures	5-1
5-10	Overvoltage Protection	5-2
5-11	Adjustment Procedures	5-2
5-12	General	5-2
5-13	Power Supply Adjustment	5-5
5-15	Standby Battery Supply Test	5-6
5-16	Battery Charger Adjustment (for Battery Assembly P/N 6025-1018)	5-7
5-17	Receiver Baseband Gain Adjustment	5-8
5-18	AGC Display Adjustment	5-8
5-19	System Sensitivity Adjustment	5-9
5-20	Spectrum Analyzer Bandwidth Adjustments	5-9
5-21	Frequency Standard Adjustment	5-10
5-23	CRT Display Adjustments	5-11
5-24	Horizontal Adjustments	5-12
5-25	Vertical Adjustments	5-12
5-26	Focus Adjustment	5-12
5-27	Centering	5-12
5-28	Performance Test Procedure	5-13
5-30	Receiver Test	5-13
5-31	Test Point Verification	5-13
6	WIRE LISTS	6-1
6-1	Wire List Index	6-1
7	FREQUENCY MANAGEMENT OF HF NETS USING AN/TRQ-35(V) EQUIPMENT	7-1
7-1	Introduction	7-1
7-15	Principles of Chirpsounding	7-4
7-19	Interpreting the RCS-4B Display	7-5
7-32	Managing HF Circuits Using Chirpsounders	7-13

TABLE OF CONTENTS - Continued

Section		Page
APPENDIX		
A	REFERENCES	A-1
B	MAINTENANCE ALLOCATION	B-1
Section		
I	Introduction	B-1
II	Maintenance Allocation Chart	B-4
III	Tool and Test Equipment Requirements	B-5
IV	Remarks	B-6
APPENDIX		
C	COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS	C-1
Section		
I	Introduction	C-1
II	Integral Components of End Item	C-3
III	Basic Issue Items (Not applicable)	
APPENDIX		
D	ADDITIONAL AUTHORIZATION LIST	D-1
Section		
I	ntroduction	D-1
II	ıdditional Authorization List	D-2
APPENDIX		
E	EXPENDABLE SUPPLIES AND MATERIAL LIST (Not applicable)	
FO	BLOCK DIAGRAMS AND SCHEMATIC DIAGRAMS	

LIST OF ILLUSTRATIONS

Figure		Page
1-1	RCS-4B Receiver	1-2
1-2	Example of RCS-4B Chirpsounder Record, 2-16 MHz Range, Path 2	1-4
2-1	Rack Mounting	2-2
2-2	Typical Equipment for Aircraft Installation	2-3
2-3	Receiver Outline Dimensions	2-4
2-4	Power Supply Line Voltage Switch	2-5
2-5	Receiver Interconnect Cabling	2-9
3-1	Receiver Controls and Indicators	3-2
4-1	Receiver System Block Diagram	4-2
4-2	Spectrum Analyzer Block Diagram - Input Section	4-5
4-3	Spectrum Analyzer Block Diagram - Output Section	4-7
4-4	Block Diagram 3-Path Programmer CCA	4-11
4-5	Block Diagram, Receiver Control CCA	4-13
4-6	Simplified Cursor to Frequency Converter Circuit	4-15
4-7	CRT Display Section Block Diagram	4-18
4-8	CRT Display Timing Relationships	4-19
4-9	Synthesizer Block Diagram	4-29
4-10	Sweep Synthesizer (2A1) Functional Block Diagram (Part Number 5030-1101)	4-31
4-11	Simplified Block Diagram of Synthesizer CCA 2A1A1 (P/N 5035-2001)	4-31
4-12	Receiver Block Diagram	4-35
5-1	AGC Display Gain Adjustment Setup	5-8
5-2	Bandwidth Adjustment Test Setup	5-10
5-3	Crystal Oscillator Frequency Adjust	5-11
5-4	Test Point Verification for Sweep Synthesizer Module (2A1) (P/N 5030-1001 Only)	5-14
5-5	Test Point Verification for Synthesizer Module (2A1) (P/N 5030-1101 Only)	5-15
5-6	Test Point Verification for Receiver Module 2A2	5-16
5-7	Test Point Verification for Spectrum Analyzer Module 1A1	5-17
5-8	Test Point Verification for Display Logic Module 1A2	5-18
5-9	Test Point Verification for Display Memory Module 1A3	5-19
5-10	Test Point Verification for 3-Path Controller Module 1A4	5-20
5-11	Test Point Verification for Auto Sync 1 Test Module 1A5	5-21
7-1	Simplified Characteristics of HF Propagation	7-3
7-2	Effect of Range on HF Propagation	7-5
7-3		7-6
7-4	Example RCS-4B Ionogram and Received Signal Power Display	7-7
7-5	Example of Rapidly Changing E_s Propagation	7-8
7-6	Example of Strong E_s propagation extending well past the F-mode MOF	7-9
7-7	Example comparing E_s and Surface Wave Modes	7-10
7-8	Example showing how proper use of the RCS-4B Input Attenuator can simplify display interpretation	7-12
7-9	Example correlating communication quality with Chirp sounder Display	7-14
7-10	Example of excellent communication using strong E_s propagation	7-14

LIST OF ILLUSTRATIONS - Continued

Figure		Page
7-11	Example of poor communication using weak Es propagation	7-15
7-12	Example showing correlation of communication quality with Chirpsounder Display	7-15
7-13	Example of Communications via Fading Spread F Multipath	7-16
7-14	Hypothetical Six-circuit Network Controlled by Three Sounded Paths	7-17
7-15	Factors for Extrapolating Maximum Observed One-hop F-mode Frequencies	7-20
FO-1	Block Diagram, 6025 Unit 1	
FO-2	Block Diagram, 4028 Unit 2	
FO-3	Block Diagram, CRT Display	
FO-4	Block Diagram, Timing and Control 1A2A 2	
FO-5	Block Diagram, Display Memory 1A3	
FO-6	Block Diagram, Cursor Storage and Readout 1A2A1	
FO-7	Schematic Diagram, 5 MHz Buffer (6061-2001) (S/N 400101 and on)	
FO-8	Schematic Diagram, Switch Regulator (6061-2002) (S/N 400101 and on)	
FO-9	Schematic Diagram, Spectrum Analyzer Assy (Input Section) (2006-2001) (6 sheets)	
FO- 10	Schematic Diagram, Spectrum Analyzer Assy (Output Section) (2006-2002) (6 sheets)	
FO-11	Schematic Diagram, Auto Sync/Test Assy (6025-2007) (4 sheets)	
FO-12	Schematic Diagram, 3-Path Programmer Assy (6025-2015) (4 sheets) (S/N 400101 and on)	
FO-13	Schematic Diagram, Receiver Control Assy (6025-2016) (4 sheets) (S/N 400101 and on)	
FO-14	Schematic Diagram, Cursor Storage and Readout Assy (6025- 2001) (6 sheets)	
FO- 15	Schematic Diagram, Timing and Control Assy (6025-2002) (5 sheets)	
FO- 16	Schematic Diagram, Memory Load Logic Assy (6025-2003) (5 sheets)	
FO- 17	Schematic Diagram, CRT Display Memory Assy (6025- 2004)	
FO- 18	Schematic Diagram, CRT Drive Assy (6025-2010) (2 sheets)	
FO- 19	Schematic Diagram, Numeric Display Assy (6025-1009) (2 sheets)	
FO-20	Schematic Diagram, Subpanel Control (6025-1010)	
FO-21	Schematic Diagram, Rear Panel Assy (6025-1014) (2 sheets)	
FO-22	Schematic Diagram, Rechargeable Battery Supply (6025-1018)	
FO-23	Schematic Diagram, Synthesizer Converter Assy (5030-2001) (6 sheets)	
FO-24	Schematic Diagram, Microphage Synthesizer Assy (5030-2002) (5 sheets)	
FO-25	Synthesizer Block Diagram (5035-2001)	
FO-26	Schematic Diagram, Synthesizer (5035-2001) (8 sheets)	
FO- 27	Down Converter Block Diagram (5035-2002)	
FO-28	Schematic Diagram, Down Converter (5035-2002) (3 sheets)	
FO-29	Sweep Programmer Block Diagram (5035-2003)	
FO- 30	Schematic Diagram, Sweep Programmer (5035-2003) (4 sheets)	
FO-31	Wiring Diagram, Sweep Synthesizer Assy (5030-1101)	
FO-32	Schematic Diagram, Receiver Front End Assy (4028- 2001) (5 sheets)	

LIST OF ILLUSTRATIONS - Continued

Figure		Page
FO-33	Schematic Diagram, Receiver Output Section Assy (4028-2002) (5 sheets)	
FO- 34	Schematic Diagram, Power Supply, 4028 HF Receiver (2 sheets)	
FO-35	Schematic Diagram, 5 MHz Distributive Amplifier Assy (6025-2008) (S/N 400100 and before)	
FO-36	Schematic Diagram, +5 Volt Switching Regulator Assy (6025-2009) (S/N 400100 and before)	
FO- 37	Schematic Diagram, 3-Path Programmer Assy (6025-2005) (2 sheets) (S/N 400100 and before)	
FO-38	Schematic Diagram, Receiver Control Assy (6025-2006) (4 sheets) (S/N 400100 and before)	

LIST OF TABLES

Table		Page
l-l	Specifications	1-7
2-1	Interconnect Cables	2-7
2-2	Connectors	2-7
2-3	Remote Data Output Connector	2-10
3-1	Controls and Functions	3-3
5-1	Test Equipment Required	5-2
5-2	Preventive Maintenance Schedule	5-3
5-3	Troubleshooting Guide	5-4

SECTION 0

GENERAL

0-1. SCOPE. This manual covers Radio Receiver, R-2081/TRQ-35(V). The manual provides instructions for installation, operation, and maintenance for operator, organizational, and direct support repair personnel.

0-2. CONSOLIDATED INDEX OF ARMY PUBLICATIONS AND BLANK FORMS. Refer to the latest issue of DA Pam 310-1 to determine whether there are new editions, changes or additional publications pertaining to the equipment.

0-3. MAINTENANCE FORMS, RECORDS, AND REPORTS.

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Arm–y forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750 as contained in 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 440-54/MCO 4430.3F.

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. 33 C/AFR 75-18/MCO P461O.19D/DLAR 4500.15.

0-4. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR). If your Radio Receiver R- 2081/TRQ-35(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.

0-5. 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 2-27.

0-6. DESTRUCTION OF ARMY ELECTRONICS MATERIEL. Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

SECTION 1

GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This manual provides operating and service instructions for the RCS-4B Receiver. The information is presented in seven sections. Section 1 provides a brief description of the equipment and operating specifications. Unpacking instructions, site requirements, cabling data, and installation instructions are included in Section 2. Section 3 provides operator controls and indicator information and describes operating procedures. In Section 4 are functional descriptions of receiver circuits. Section 5 describes preventive and corrective maintenance procedures for the receiver and provides a performance verification test. Section 6 contains the wire lists for reference during maintenance. All oversize drawings, such as schematic diagrams, are grouped at the back of this manual as foldout sections. Section 7 presents procedures for managing HF circuits using the supplied equipment.

1-3. GENERAL DESCRIPTION

1-4. The RCS-4B receiver (figure 1-1) is one part of an HF Radio Sounder Set (also designated the TFMS) used for frequency management of HF radio circuits. It is a sweeping HF receiver that tunes through the HF spectrum at a 50-kHz per second or 100 - kHz per second rate beginning at 2 MHz. When synchronized with a TCS-4B transmitter located at the other end-of an HF circuit, the receiver provides a measurement of ionospheric propagation conditions for the circuit. A TCS-4B transmitter at one end of the HF circuit emits a CW signal which starts at 2 MHz and sweeps upward in frequency at a constant linear rate (50 kHz /second for a 2-16 MHz sweep; 100 kHz/second for a 2-30 MHz sweep.) An internal clock in the RCS-4B receiver starts the receiver sweep synchronously with the transmitter and precisely tracks the sweeping transmitter signal. Any radio frequency that can propagate over the HF circuit is received by the RCS-4B. The radio energy propagates by various modes (e. g. surface wave, one- hop, t we-hop, etc.) which have different propagation delays. The time delay created by the travel of the RF signals from the transmitter to the ionosphere and to the receiver causes the ionospherically returned signal to arrive "late" or slightly behind the exact tuned frequency of the receiver. That is, since the transmit and receive sweeps are started at exactly the same time, the receiver sweep has advanced to a slightly higher frequency by the time the transmit signal arrives at the receiver. Thus, the receiver is tuned to a slightly different (higher) frequency than the arriving transmit signal. This received frequency difference is amplified in the receiver IF and converted to a “baseband audio” tone. A tone at zero hertz indicates no time delay and tones of increasing audio frequency (up to 500 Hz) indicates increasing time delay of the ionospherically returned signal. In practice, multiple tones are present in the sounder’s baseband audio output which represent the various delays caused by the different layers, or modes, of the ionosphere. These multiple tones are processed by the sounder's spectrum analyzer to separate the tones into discrete components which identify corresponding ionospheric modes. A speaker and headphone jack are provided for audio monitoring. The output spectrum analyzer is displayed on the 6025 CRT display versus the RF sweep of the sounder. The CRT vertical axis indicates received

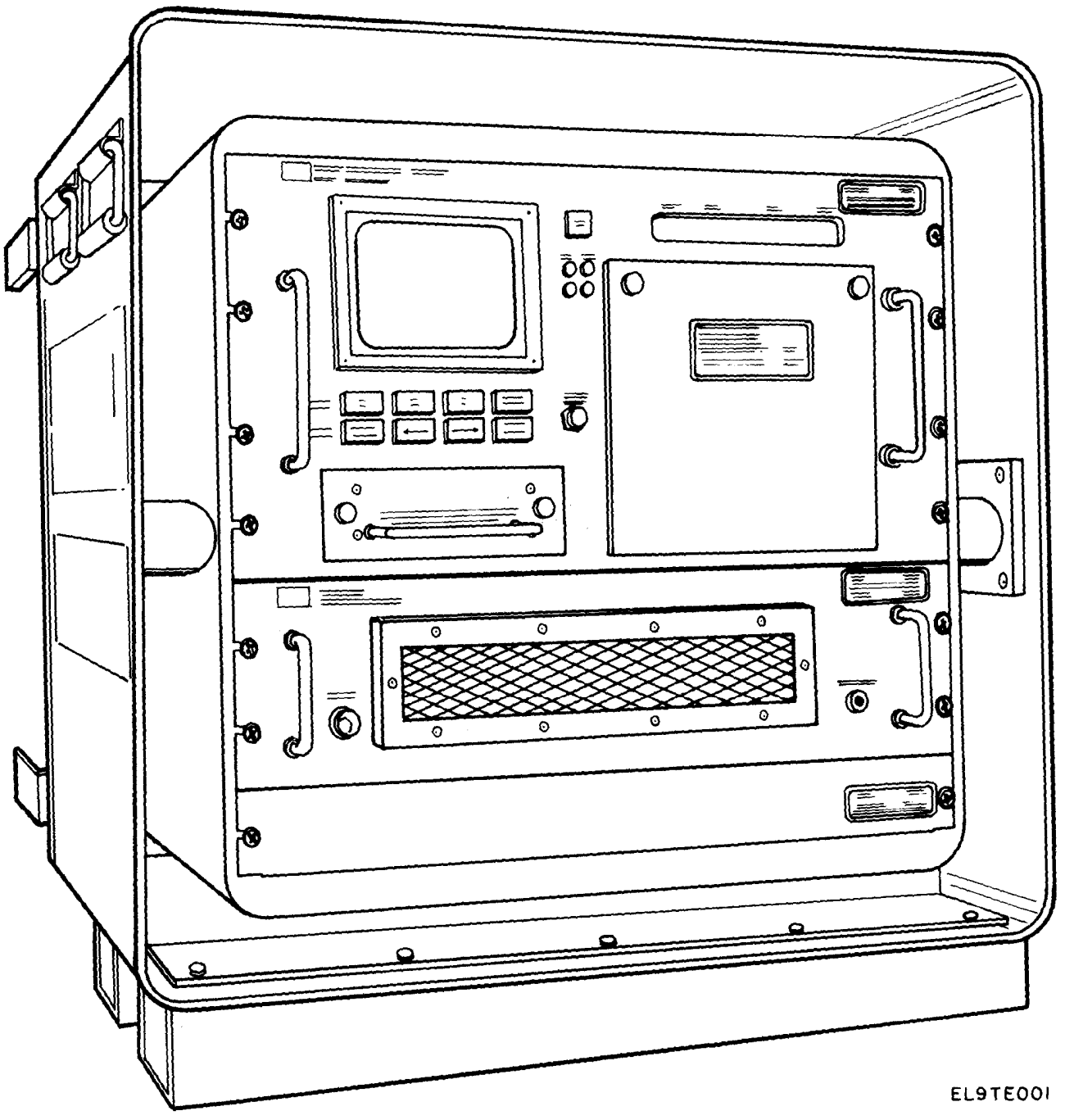

FIGURE 1-1. RCS-4B Receiver.

signal time delay (ionospheric mode structure) versus the CRT horizontal axis of radio frequency; 2-16 or 2-30 MHz. The result is a display of propagating modes versus frequency, referred to as a Chirp sounder record (or ionospheric sounding) as shown in figure 1-2. In addition, as radio energy at various levels is received, the receiver gain is automatically adjusted to provide a constant level output to the spectrum analyzer. The automatic gain control (AGC) voltage versus radio frequency provides a measure of received signal strength vs frequency which is also displayed on the CRT (refer to top of figure 1-2) . Thus, the receiver operating at one end of a radio circuit in association with a transmitter at the other end of the circuit provides a real-time measurement of propagation conditions on the circuit. The receiver is designed to be synchronized with up to three different TCS-4B transmitters and can receive transmissions from one of the three transmitters every five minutes. The latest Chirpsounder record for each of the three circuits is stored in memory within the receiver and can be displayed at any time upon operator command.

1-5. The RCS-4B receiver consists of three units. Unit 1, the 6025 control display unit contains the internal clock and control circuits of the receiver, the spectrum analysis, and CRT display. Unit 2, the 4028 HF receiver, contains the radio receiver, sweeping frequency synthesizer and power supply. Unit 3, the 6043 power divider, contains three, 4-way power dividers that allow the RCS-4B to share up to three antennas (one for each path) with other HF receiving equipment, for example, an RSS-4 Spectrum Monitor and two HF communications receivers. Each of the three power dividers has one input (from an antenna) and four outputs (to the receivers) . One output of each power divider is prewired to one of the three RCS-4B inputs.

1-6. Unit 1, 6025 CONTROL/DISPLAY. The 6025 Control/Display unit contains electronics assemblies required to perform the following functions:

a. Provide accurate timing for each of three clocks used to maintain synchronization with up to three TCS-4B transmitters (each clock referenced to an oven-stabilized crystal oscillator with 5 MHz output drifting less than 5 parts in 10^{-9} per day) ;

b. Select the transmitter to be received during any of twelve 5-minute periods each hour:

c. Automatically lock onto, and synchronize with, each transmitter provided the receiver's sweep tuning is started within ± 1 second of transmitter sweep;

d. Control the sweeping frequency synthesizer used as the receiver's first local oscillator;

e. Spectrum analyze the receiver output and store in memory the spectra vs tuned frequency that results from receiving each propagating mode:

f. Display via a CRT upon operator command the latest Chirpsounder record and received signal strength versus frequency data for each of the three paths;

g. Provide a standby battery supply to maintain the three path clocks for up to 24 hours (at 23° C) in event of a primary AC line failure;