

TECHNICAL MANUAL
OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT,
AND GENERAL SUPPORT MAINTENANCE MANUAL
FOR
DUAL RECEIVER
ET-A TYPE NUS 5961

Technical Manual)
)
)
)
)
No. 11-5820-583-14)

HEADQUARTERS

DEPARTMENT OF THE ARMY

Washington, DC, 6 September 1976

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT,
AND GENERAL SUPPORT MAINTENANCE MANUAL
FOR
DUAL RECEIVER
ET-A TYPE NUS 5961

REPORTING OF ERRORS

You can improve this manual by calling attention to errors and by recommending improvements and stating your reasons for the recommendations. Your letter or DA Form 202 (Recommended Changes to Publications and Blank Forms) should be mailed direct to the Commander, US Army Electronics Command, ATTN: DRSEL-MA-Q, Fort Monmouth, New Jersey 07703.

This technical manual is an authentication of the manufacturer's commercial literature and does not conform with the format and content specified in AR 310-3, Military Publications. The technical manual does, however, contain available information that is essential to the operation and maintenance of the equipment.

TABLE OF CONTENTS

Paragraph		Page
SECTION I. DESCRIPTION AND LEADING PARTICULARS		
1-1	Scope of Manual	1-1
1-3	Description	1-1
1-4	Overall Equipment	1-1
1-7	Drawers and Panels	1-1
1-17	Equipment Supplied	1-6
1-19	Specifications	1-9
1-21	Mechanical Design Features	1-10
SECTION II. INSTALLATION		
2-1	General	2-1
2-3	Component Interconnections	2-1
2-7	Test Equipment Required	2-3
2-9	Inspection	2-12
2-11	Initial Application of Power	2-12
SECTION III. OPERATING INSTRUCTIONS		
3-1	General	3-1
3-3	Controls, Indicators, Connectors, and Test Points	3-1
3-5	Equipment Turn-On	3-1
3-7	Equipment Turn-Off	3-1
SECTION IV. THEORY OF OPERATION		
4-1	General	4-1
4-3	Single Conversion Receivers	4-1
4-5	Single Conversion Tropospheric Scatter Receiver Configurations	4-1
4-7	Single Conversion Line-of-Sight Receiver Configuration	4-1
4-9	Diversity Combining	4-2
4-12	Single Conversion Receiver Circuits	4-2
4-29	Double Conversion Receivers	4-8
4-31	Double Conversion Tropospheric Scatter Receiver Configurations	4-9
4-33	Double Conversion Line-of-Sight Receiver Configurations	4-9
4-35	Diversity Combining	4-9
4-37	Double Conversion Receiver Circuits	4-10
4-52	Electrical Theory	4-11
SECTION V. MAINTENANCE		
5-1	General	5-1
5-3	Special Precautions To Be Observed	5-1
5-16	Preventive Maintenance	5-3
5-18	Metering Checks	5-4
5-20	Module Test Checks	5-7
5-22	Cleaning	5-10
5-24	Inspection of Detail Parts	5-10
5-26	Air Filter Maintenance	5-10
5-28	Corrective Maintenance	5-10
5-29	General	5-10
5-31	Removal and Replacement	5-11
5-35	Trouble Analysis	5-13

TABLE OF CONTENTS (cont)

Paragraph		Page
	SECTION VI. ALIGNMENT	
6-1	General	6-1
6-3	Preliminary Steps	6-1
6-5	Calibration of HP 618 SHF Generator	6-1
6-7	Alignment of Single Conversion Receiver (Dual and Quad)	6-2
6-9	Receiver Conversion Procedures	6-2
6-16	Local Oscillator Chain Alignment Under Normal Traffic Conditions.....	6-6
6-18	Oscillator Multiplier and Frequency Multiplier Alignment	6-6
6-20	Best In-Lock Alignment	6-8
6-24	Alignment of Parametric Amplifier Gain and Noise Figure Measurement	6-10
6-26	Alignment of Mixer-Preamplifier Gain and Noise Figure Measurement	6-13
6-28	AGC Alignment Under Normal Traffic Conditions	6-15
6-30	Quad Receiver.....	6-16
6-32	Dual Receiver	6-18
6-34	APC Alignment Under Normal Traffic Conditions	6-20
6-36	Quad Receiver	6-20
6-38	Dual Receiver	6-21
6-40	Alarm Alignment Under Normal Traffic Conditions	6-21
6-42	Phase Alarm	6-22
6-43	Quad Receiver	6-22
6-45	Level Alarm.....	6-24
6-48	Threshold Extension Alignment Under Normal Traffic Conditions.....	6-26
6-50	Threshold Extension Frequency Check	6-26
6-52	Quad Operation	6-27
6-54	Initial Adjustment of Receiver Baseband Level.....	6-29
6-56	Adjustment of RF Bandpass Filter (Preselector).	6-30
6-58	Dual Parametric Amplifier Klystron Check, Replacement, and Tuning	6-31
6-60	Klystron Check	6-31
6-62	Klystron Replacement	6-33
6-64	Klystron Tuning	6-34
6-66	Pump Failure Alarm Setup	6-35
6-68	Alignment of Double Conversion Receiver (Dual and Quad).....	6-35
6-70	Receiver Conversion Procedures	6-35
6-72	Local Oscillator Chain Alignment Under Normal Traffic Conditions.....	6-35
6-74	Oscillator Multiplier and Frequency Multiplier Alignment	6-35
6-76	Lock Alignment	6-36
6-78	Alignment of Parametric Amplifier Gain and Noise Figure Measurement	6-38
6-80	Alignment of Mixer-Preamplifier Gain and Noise Figure Measurement	6-38
6-82	AGC Alignment of 9.8-MC IF Amplifier	6-38
6-84	AGC Level Adjustment of the 9.8-MC AGC Amplifier	6-40
6-85	Quadruple Diversity Receiver	6-40
6-86	Dual Diversity Receiver.	6-42
6-88	9.8-MC Phase Combiner Alignment	6-42
6-89	Quadruple Diversity Receiver.....	6-42
6-90	Dual Diversity Receiver.....	6-44
6-92	9.8-MC Phase and IF Level Alarm Alignment.....	6-46
6-93	Quadruple Diversity Receiver.....	6-46
6-95	Dual Diversity Receiver.....	6-49
6-96	Phase Locking Procedure, Double Conversion, Dual or Quadruple Diversity Receiver	6-51

TABLE OF CONTENTS (cont)

Paragraph

Page

SECTION VI. ALIGNMENT (cont)

6-98	9.8-MC Phase Combiner Phase and Level Alarm Operation.....	6-52
6-100	Initial Adjustment of Receiver Baseband Level.....	6-53
6-101	Quadruple Diversity Receiver.....	6-53
6-103	Dual Diversity Receiver	6-54
6-105	Threshold Extension Alignment.	6-55
6-107	Adjustment of RF Bandpass Filter (Preselector)	6-56
6-109	Dual Parametric Amplifier Klystron Check, Replacement, and Tuning	6-56

SECTION VII. MODULES

Oscillator-Multiplier NUS 3753-6 and NUS 3753-7
 Mixer Preamplifier NUS 3760-6
 70-Mc If. Amplifier NUS 3761-5
 70-Mc Demodulator NUS 3763-2
 Frequency Multiplier NUS 3765-4
 9.8-Mc If. Amplifier NUS 5251-23
 Second Mixer-Local Oscillator NUS 5251-31
 9.8-Mc Demodulator NUS 5252-31
 Dual Parametric Amplifier NUS 5300-7 and NUS 6580-2
 Klystron Power Supply NUS 5352-2
 Isolation Devices Assemblies NUS 5358-6 and NUS 5358-8
 200-Kc Bandpass Filter NUS 5967-6
 Power Supply and Fan Assembly NUS 5968-1, NUS 5968-3, and NUS 5968-4
 9.8-Mc AGC Amplifier NUS 5969-1
 70-Mc AGC Amplifier NUS 5969-4
 Baseband Amplifier NUS 5970-3
 150/165-VDC Power Supply NUS 5974-1
 Low Voltage Power Supply NUS 5975-1, -3, -4, -31, and -41
 70-Mc Threshold Extension Module NUS 6455
 9.8-Mc Threshold Extension Module NUS 6579
 70-Mc Phase Combiner and Alarm NUS 8315-1
 9.8-Mc Phase Combiner and Alarm NUS 8316G1
 70-Mc Redundant AGC Amplifier NUS 8317-1
 9.8-Mc Redundant AGC Amplifier NUS 8318-1
 Low Voltage Power Supply NUS 8797G1 through G5
 150/165-VDC Power Supply NUS 8798
 De-Emphasis Assembly C2336717, C233671R, C2336720, and C1260278
 4.4 Me Bandpass Filter D2338037

LIST OF ILLUSTRATIONS

Figure		Page
	SECTION I. DESCRIPTION AND LEADING PARTICULARS	
1-1.	Dual Receiver Cabinet, Tropospheric Scatter Configuration	1-2
1-2.	Dual Receiver Cabinet, Line-Of-Sight Configuration	1-3
	SECTION II. INSTALLATION	
2-1.	Tropospheric Scatter Receiver Cabinet Distribution Box.....	2-2
2-2.	Tropospheric Scatter Receiver Cabinet Distribution Panel.....	2-2
2-3.	Line-Of-Sight Receiver Cabinet Distribution Box	2-5
2-4.	Line-Of-Sight Receiver Cabinet Distribution Panel.	2-5
2-5.	Dual Parametric Amplifier Drawer (NUS 6580-2) Front Panel.....	2-6
2-6.	Dual Parametric Amplifier Drawer (NUS 5300-7) Front Panel.....	2-7
2-7.	RF Panel, Front View	2-8
2-8.	Preselector and Mixer Drawer, Front Panel	2-9
2-9.	IF and Baseband Drawer, Front Panel.....	2-10
2-10.	Ancillary Equipment Drawer, Front Panel	2-11
2-11.	Power Supply Front Panel	2-13
2-12.	Power Supply Drawer, Top View.....	2-14
2-13.	Preselector and Mixer Drawer, Single Conversion, Top View.....	2-15
2-14.	Preselector and Mixed Drawer, Double Conversion, Top View.....	2-16
2-15.	Ancillary Equipment Drawer, Top View.	2-17
2-16.	Preselector and Mixer Drawers (NUS 5961-12, -15, -17, -19, -20 Receivers) Module and Cable Location Diagram.	2-21
2-17.	Preselector and Mixer Drawers (NUS 5961-9, -13 Receivers) Module and Cable Location Diagram	2-23
2-18.	Preselector and Mixer Drawer (NUS 5961-10 Receiver) Module and Cable Location Diagram	2-25
2-19.	IF and Baseband Drawers (NUS 5961-12,-17,-19, -20 Receivers) Module and Cable Location Diagram	2-27
2-20.	IF and Baseband Drawers (NUS 5961-15, -16 Receivers) Module and Cable Location Diagram	2-29
2-21.	IF and Baseband Drawers (NUS 5961-9, -13 Receivers) Module and Cable Location Diagram.	2-31
2-22.	IF and Baseband Drawer (NUS 5961-10 Receiver) Module and Cable Location Diagram	2-33
2-23.	Ancillary Equipment Drawer (NUS 5961-10 Receiver) Module and Cable Location Diagram.	2-35
2-24.	Ancillary Equipment Drawer (NUS 5961-12 Receiver) Module and Cable Location Diagram	2-37
	SECTION III. OPERATING INSTRUCTIONS	
3-1.	Dual Parametric Amplifier (NUS 6580-2) Top View	3-4
3-2.	Dual Parametric Amplifier Drawer (NUS 5300-7) Top View	3-5
3-3.	Preselector and Mixer Drawer, Bottom View	3-13
3-4.	IF and Baseband Drawer (Single Conversion Receiver) Top View	3-16
3-5.	IF and Baseband Drawer (Double Conversion Receiver) Top View	3-17
3-6.	IF and Baseband Drawer (Single Conversion Receiver) Right Side	3-21
3-7.	IF and Baseband Drawer (Double Conversion Receiver) Right Side	3-22
3-8.	IF and Baseband Drawer (Single Conversion Receiver) Left Side	3-23
3-9.	IF and Baseband Drawer (Double Conversion Receiver) Left Side	3-25

LIST OF ILLUSTRATIONS (cont)

Figure		Page
SECTION IV. THEORY OF OPERATION		
4-1.	Single Conversion Tropo Receivers (NUS 5961-15, -16, -19, -20) Block Diagram	4-3
4-2.	Single Conversion Line-Of-Sight Receiver (NUS 5961-12, -17) Block Diagram	4-5
4-3.	Double Conversion Tropo Receivers (NUS 5961-9, -13) Block Diagram	4-13
4-4.	Double Conversion Line-Of-Sight Receiver (NUS 5961-10) Block Diagram	4-15
4-5.	Tropo Dual Receiver Cabinet, Schematic Diagram	4-17
4-6.	Line-Of-Sight Dual Receiver Cabinet (NUS 5962- 15, - 16) Schematic Diagram	4-19
4-7.	Line-Of-Sight Dual Receiver Cabinet (NUS 5961-17) Schematic Diagram	4-21
4-8.	Preselector and Mixer Drawer (NUS 5964-1) Tropo Receiver, Schematic Diagram.....	4-23
4-9.	Preselector and Mixer Drawer (NUS 5964-2) Line-Of-Sight Receiver, Schematic Diagram	4-25
4-10.	Preselector and Mixer Drawer (NUS 5963-12, - 13) Tropo and LOS Single Conversion Receivers, Interconnecting Diagram	4-27
4-11.	Preselector and Mixer Drawer (NUS 5963-3) Tropo Double Conversion Receivers, Interconnecting Diagram	4-29
4-12.	Preselector and Mixer Drawer (NUS 5963-4) LOS Double Conversion Receiver, Interconnecting Diagram.....	4-31
4-13.	IF and Baseband Drawer (NUS 5965-3) Single Conversion Tropo Receiver, Schematic Diagram	4-33
4-14.	IF and Baseband Drawer (NUS 5965-6) Double Conversion Tropo Receiver, Schematic Diagram	4-35
4-15.	IF and Baseband Drawer (NUS 5965-5) Single Conversion Tropo Receivers With Threshold Extension, Interconnecting Diagram	4-37
4-16.	IF and Baseband Drawer (NUS 5965-3) Single Conversion Tropo Receiver Without Threshold Extension, Interconnecting Diagram	4-39
4-17.	IF and Baseband Drawer (NUS 5965-6) Tropo Double Conversion Receivers, Interconnecting Diagram.....	4-41
4-18.	IF and Baseband Drawer (NUS 5965-8) LOS Single Conversion Receiver, Interconnecting Diagram	4-43
4-19.	IF and Baseband Drawer (NUS 5965-7) LOS Double Conversion Receiver, Interconnecting Diagram	4-45
4-20.	Ancillary Equipment Drawer (NUS 6058) Line-Of-Sight Receiver, Schematic Diagram	4-47
4-21.	Ancillary Equipment Drawer (NUS 6062-23) LOS Single Conversion Receiver, Interconnecting Diagram	4-49
4-22.	Ancillary Equipment Drawer (NUS 6062-2) LOS Double Conversion Receiver, Interconnecting Diagram	4-51
4-23.	IF and Baseband Drawer (NUS 5965-7, -8) Line-Of-Sight Receiver, Schematic Diagram.....	4-53

LIST OF ILLUSTRATIONS (cont)

Figure		Page
	SECTION VI. ALIGNMENT	
6-1.	Parametric Amplifier Gain and Noise Figure Measurements Test Setup	6-12
6-2.	Mixer-Preamplifier Gain and Noise Figure Measurements Test Setup	6-14
6-3.	Threshold Extension Test Setup.....	6-28
6-4.	Receiver Preselector Adjustment Test Setup	6-32

LIST OF TABLES

Table		Page
SECTION I. DESCRIPTION AND LEADING PARTICULARS		
1-1.	Receiver Variations.....	1-4
1-2.	Drawer, Module, and Panel Complement	1-6
1-3.	Overall Receiver Specifications	1-9
SECTION II. INSTALLATION		
2-1.	Test Equipment Required	2-4
2-2.	Module Switch Positions for Normal Operation	2-19
SECTION III. OPERATING INSTRUCTIONS		
3-1.	Controls, Connectors, Indicators, and Test Points	3-2
SECTION V. MAINTENANCE		
5-1.	Interpretation of APC Meter Readings	5-2
5-2.	Preventive Maintenance Routines.....	5-4
5-3.	Power Checks	5-4
5-4.	AGC, APC, and Test Tone Checks	5-6
5-5.	Parametric Amplifier Checks	5-7
5-6.	Typical Module Test Point Readings	5-8
5-7.	Inspection of Detail Parts	5-10
5-8.	Tube or Module Replacement Alignment	5-11
5-9.	Receiver Fault Indications by Alarm Lights	5-14
5-10.	Receiver Troubleshooting Chart.....	5-15
SECTION VI. ALIGNMENT		
6-1.	Receiver Alignment	6-17

PREFACE

This manual describes the dual receiver used at the mainline and tributary sites. It provides installation instructions, operating procedures, theory of operation, and maintenance information. Theory of operation is described at the equipment level, and emphasis is placed on the interrelation of the modules rather than on circuit details. The modules are described in Section VII.

The dual receiver conforms to a modular concept and is maintained to the direct support (3rd echelon) level. Maintenance to this level of support is concerned with localizing trouble to a particular module. When the trouble is localized, replace the defective module. Refer to Instruction Manual for Test Facilities Kit MK-884/GRC-81(V), TM 11-6625-647-14/1 and -14/2 for maintenance information on the modules.

The dual receiver is a component equipment in the ET-A communications system. The following is a list of publications pertaining to the ET-A communications system component equipments.

SECTION I

DESCRIPTION AND LEADING PARTICULARS

1-1. SCOPE OF MANUAL.

1-2. This instruction manual provides information on Dual Receiver NUS 5961. The equipment is built by ITT Federal Laboratories, Nutley, N. J. Included herein is information on description and theory of operation of the receiver, and instructions for its installation, operation, and maintenance. A separate manual is included (in Section VII) for each module contained in the receiver.

1-3. DESCRIPTION.

1-4. OVERALL EQUIPMENT.

1-5. BASIC RECEIVER. The basic NUS 5961 receiver is a dual diversity receiver operating in the 4400- to 5000-mc frequency range. The receiver employs either single conversion (70-mc if frequency) or double conversion (70-mc first if frequency and 9.8-mc second if frequency). The single conversion receiver is a broadband receiver and has a bandwidth compatible with multi-channel voice frequency operation. The double conversion receiver is a narrowband receiver and is used for single or dual voice frequency channels.

1-6. VARIATIONS ON THE BASIC RECEIVER. There are eight variations to the NUS 5961 dual receiver. Single conversion receivers have six variations (NUS 5961-12, -15, -16, -17, -19, and -20) and double conversion receivers have three variations (NUS 5961-9, -10, and -13). Six receivers (NUS 5961-9, -13, -15, -16, -19, and -20) are equipped for tropospheric scatter operation. Each tropospheric scatter receiver configuration consists of two dual receiver cabinets (figure 1-1) interconnected for quadruple diversity operation. NUS 5961-9, -15, and -20 receivers employ a Dual Parametric Amplifier at the rf input. NUS 5961-13, -16, and -19 receivers employ an RF Panel in place of the Dual Parametric Amplifier. NUS 5961-9, -13, -15, and -16 have a threshold extension module at the demodulator input. Two receivers (NUS 5961-10 and 12) are equipped for line-of-sight operation. The 5961-12 takes the place of a 5961-17 receiver which was used in the initial system equipment. The 5961-17 is identical to the 5961-12 except in the alarm circuit wiring. Throughout this book the description and instructions for the 5961-12 receiver apply for the 5961-17 receiver. Each line-of-sight receiver configuration consists of one dual receiver cabinet (figure 1-2) operating in dual diversity fashion. The line-of-sight receivers include an ancillary drawer. This drawer contains back-up (redundant) demodulator and baseband amplifiers permitting one section of the dual receiver to continue operation in the event of a failure in the other section. Power requirements for the ancillary drawer make necessary a second power supply drawer which also provides redundancy. All eight receiver variations are summarized in table 1-1.

1-7. DRAWERS AND PANELS.

1-8. DISTRIBUTION PANEL. The Distribution Panel provides a means of connecting the IF and Baseband drawer with the central equipment cabinet. The baseband amplifier output of the IF and Baseband drawer (and the Ancillary Equipment drawer when applicable) is connected to the Distribution Panel through a length of coaxial cable and a coaxial attenuator which terminates in a BNC coaxial fitting. This fitting which is on the front of the Distribution Panel is connected to the central equipment cabinet by means of an additional length of coaxial cable.

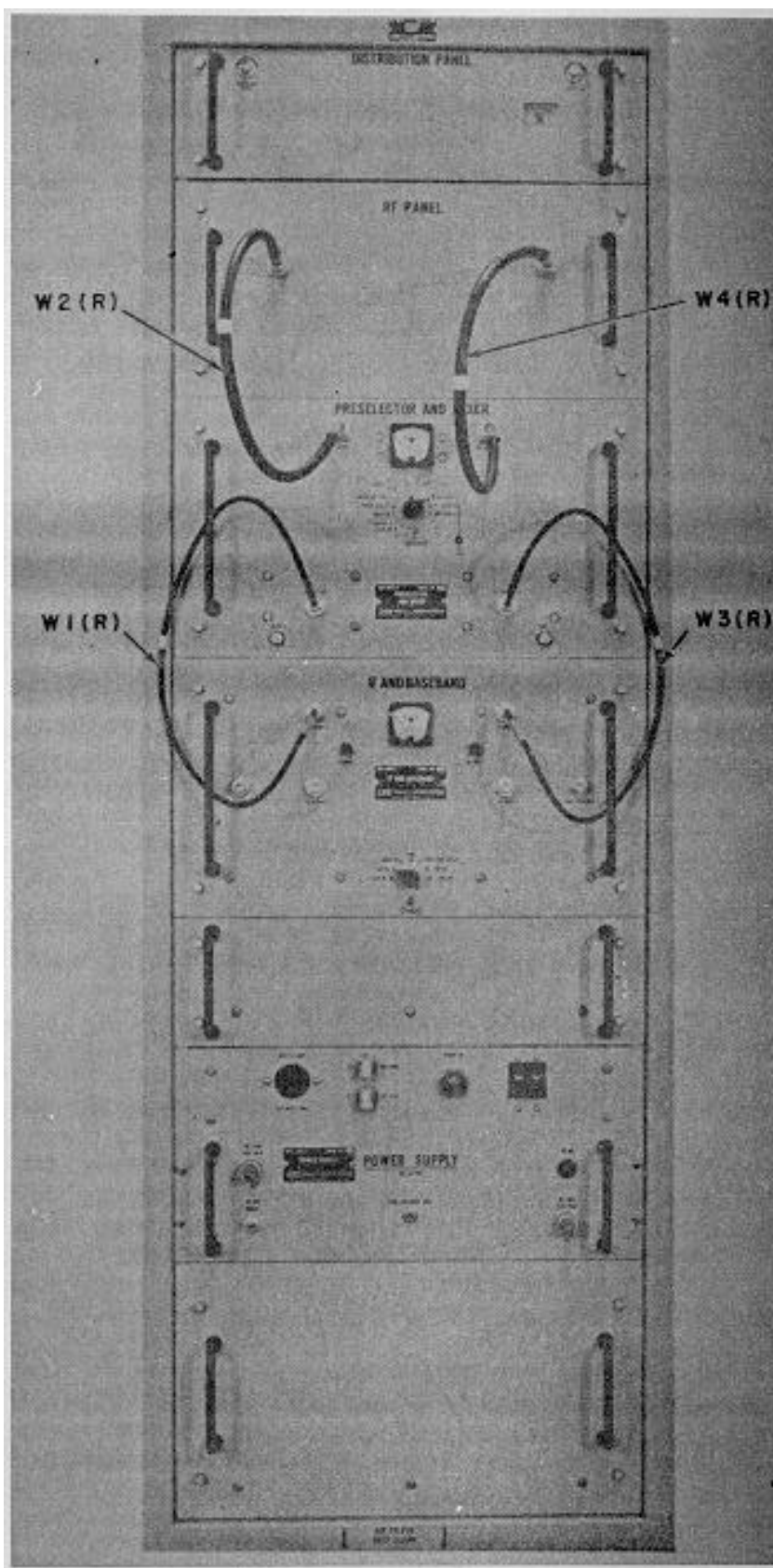


Figure 1-1. Dual Receiver Cabinet, Tropospheric Scatter Configuration