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NAVSHIPS 0967-876-5010

TECHNICAL MANUAL
for
**SPECTRUM ANALYZER
SET
AN/USM-324**

DEPARTMENT OF THE NAVY
NAVAL ELECTRONIC SYSTEMS COMMAND

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LIST OF EFFECTIVE PAGES

PAGE NUMBERS	CHANGE IN EFFECT	PAGE NUMBERS	CHANGE IN EFFECT
Title	Original	3-1 to 3-4	Original
ii to iv	Original	4-1 to 4-4	Original
v Blank	Original	5-1 to 5-2	Original
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TABLE OF CONTENTS

Paragraph	Page	Paragraph	Page
SECTION 1 - GENERAL INFORMATION			
1-1.	Scope	1-1	
1-2.	General Description.	1-1	
1-3.	Reference Data.	1-1	
a.	Frequency Range	1-1	
b.	Fixed Sweep Widths.	1-1	
c.	Variable Sweep Widths	1-1	
d.	Sweep Rates	1-1	
e.	Hum and Noise Level	1-1	
f.	Intra-Unit Impedance	1-1	
g.	Equipment Under Test Output Impedance	1-1	
1-4.	Equipment Supplied.	1-1	
1-5.	Equipment and Publications Required but not Supplied.	1-1	
1-6.	Factory or Field Changes	1-1	
1-7.	Electron Tube, Indicator Lamp, Diode, and Fuse Components	1-1	
1-8.	Preparation for Reshipment	1-1	
SECTION 2 - INSTALLATION			
2-1.	Unpacking and Handling	2-1	
2-2.	Power Requirements	2-1	
2-3.	Site Selection.	2-1	
2-4.	Installation Requirements	2-1	
2-5.	Cable Assemblies.	2-1	
2-6.	Inspection and Adjustment	2-1	
SECTION 3 - OPERATION			
3-1.	Functional Operation	3-1	
3-2.	Preparation for Use	3-2	
3-3.	Operating Procedures.	3-2	
a.	Description of Controls	3-2	
b.	Sequence of Operation.	3-2	
(1)	Before Use.	3-2	
(2)	During Use.	3-2	
(3)	After Use	3-2	
(4)	Secure.	3-2	
3-4.	Summary of Operating Procedure	3-2	
a.	Preliminary Operating Procedure	3-2	
(1)	Low Impedance Below 2 MHz	3-2	
(2)	Low Impedance Above 2 MHz	3-3	
(3)	High Impedance Above 2 MHz	3-3	
b.	Operating Instructions.	3-3	
3-5.	Operator's Maintenance	3-3	
a.	Operating Checks and Adjustments	3-3	
b.	Preventive Maintenance	3-4	
c.	Emergency Maintenance.	3-4	
SECTION 4 - TROUBLESHOOTING			
4-1.	Troubleshooting	4-1	
4-2.	Over-All Functional Description	4-3	
4-3.	Servicing Block Diagram	4-3	
SECTION 5 - MAINTENANCE			
5-1.	Failure, and Performance and Operational Reports	5-1	
5-2.	Preventive Maintenance	5-1	
a.	Maintenance Standards	5-1	
(1)	Test Equipment and Special Tools.	5-1	
(2)	Special Procedures	5-1	
(3)	Reference Standards Procedures.	5-1	
(4)	Preventive Maintenance	5-1	
(5)	Procedures.	5-1	
b.	Tuning and Adjustment	5-1	
5-3.	Repair.	5-1	
a.	Removal, Repair, and Re- placement of Parts, Subassemblies, and Units	5-1	
(1)	Unit Removal	5-1	
(2)	Unit Replacement.	5-2	
b.	Emergency Maintenance for Electronic Assemblies.	5-2	
c.	Lubrication	5-2	
5-4.	Illustrations	5-2	
a.	Parts Location Illustrations	5-2	
b.	Schematic Diagram	5-2	
SECTION 6 - PARTS LIST			
6-1.	Introduction	6-1	
a.	Reference Designations	6-1	
b.	Reference Designation Prefix	6-1	
6-2.	Maintenance Parts List	6-1	
6-3.	List of Manufacturers.	6-1	

LIST OF ILLUSTRATIONS

Figure	Page	Figure	Page
SECTION 1 - GENERAL INFORMATION		2-1.	Spectrum Analyzer Set AN/USM-324 Outline Drawing 2-2
1-1.	Spectrum Analyzer Set AN/USM-324 1-0	SECTION 4 - TROUBLESHOOTING	
SECTION 2 - INSTALLATION		4-1.	Spectrum Analyzer Set, Block Diagram 4-4

LIST OF TABLES

Table	Page	Table	Page
SECTION 1 - GENERAL INFORMATION		SECTION 5 - MAINTENANCE	
1-1.	Equipment Supplied 1-2	5-1.	Preventive Maintenance Procedures 5-1
SECTION 4 - TROUBLESHOOTING		SECTION 6 - PARTS LIST	
4-1.	Spectrum Analyzer Set Troubleshooting Chart 4-1	6-1.	Maintenance Parts List 6-1

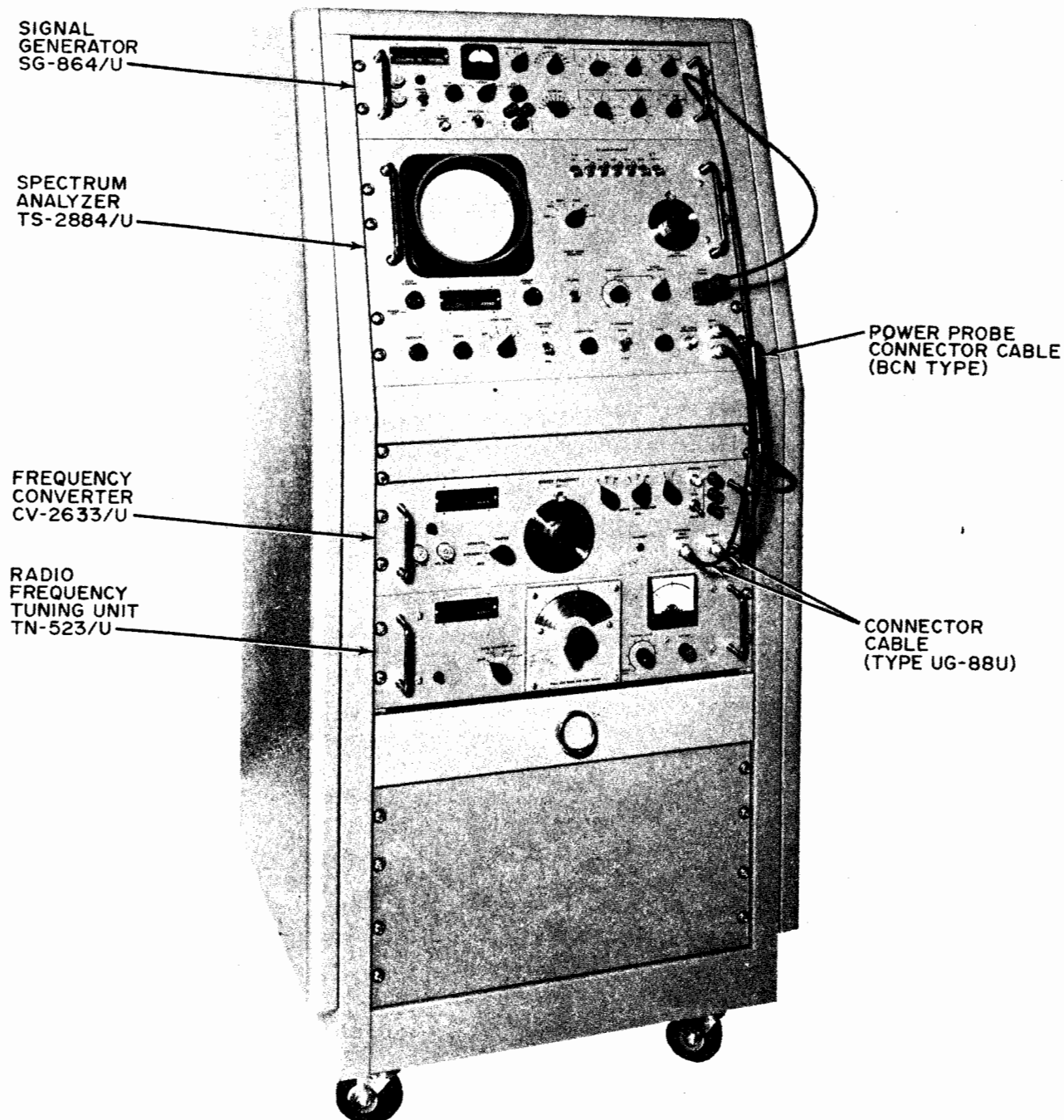


Figure 1-1. Spectrum Analyzer Set AN/USM-324

SECTION 1
GENERAL INFORMATION

1-1. SCOPE.

This Technical Manual is in effect upon receipt and does not supersede any previously issued publications. Extracts from this publication may be made to facilitate the preparation of other Department of Defense Publications.

1-2. GENERAL DESCRIPTION.

The Spectrum Analyzer Set AN/USM-324 is designed for r-f spectrum analysis, especially in narrow band communications systems. (See figure 1-1.) The Spectrum Analyzer Set provides a display of the signal amplitude distribution over a selected portion of the r-f band. The display has the form of a plot of relative amplitude versus frequency on the screen of a cathode ray tube.

The Spectrum Analyzer Set consists of Spectrum Analyzer TS-2884/U, Static Frequency Converter CV-2633/U, Radio Frequency Tuning Unit TN-523/U, and Signal Generator SG-864/U. The integrated equipments incorporate all required facilities to set up, adjust, and monitor single sideband (SSB) transmissions. The Spectrum Analyzer Set also enables rapid analysis of in-band distortion of SSB transmitters and exciters by two-tone test method (to better than 60 dB); measures suppressed carrier levels, residual unwanted sidebands, and monitors transmission bandwidths; enables out-of-band studies of harmonics, cross products, parasitics, etc.; and is ideal for narrow band r-f studies of up to ± 50 kHz in amplitude modulation (AM), frequency modulation (FM), phase modulation (PM), and multiplexed channels.

1-3. REFERENCE DATA.

The electrical characteristics of the Spectrum Analyzer Set are listed below. All values are nominal.

Note

For the electrical characteristics of the individual equipments which comprise the Spectrum Analyzer Set, refer to the associated technical manual.

- a. FREQUENCY RANGE. - 10 Hz to 40 MHz.

- b. FIXED SWEEP WIDTHS. - 150 Hz, 500 Hz, 3.5 kHz, 7.0 kHz, and 14 kHz.

- c. VARIABLE SWEEP WIDTHS. 0 to 100 kHz.

- d. SWEEP RATES. 1.0 Hz for preset sweep widths of 3.5 kHz, and above. The sweep rate is 0.1 Hz for preset sweep rates from 150 Hz to 3.5 kHz.

- e. HUM AND NOISE LEVEL. 60 db below fundamental.

- f. INTRA-UNIT IMPEDANCE. 50 ohms.

- g. EQUIPMENT UNDER TEST OUTPUT IMPEDANCE. - The Spectrum Analyzer Set can match 600 ohms balanced or unbalanced and 75 ohms unbalanced inputs below 2 MHz, and 50 ohms nominal from 2 to 40 MHz. High impedance inputs operate from 2 to 40 MHz.

1-4. EQUIPMENT SUPPLIED.

Table 1-1 lists the equipment supplied and includes the overall dimensions, volume, and weight.

1-5. EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED.

Each associated equipment Technical Manual contains a list of the equipment and publications required but not supplied. Sufficient characteristics are included in the table to permit selection of suitable equivalents.

1-6. FACTORY OR FIELD CHANGES.

No factory or field changes have been made on the Spectrum Analyzer Set.

1-7. ELECTRON TUBE, INDICATOR LAMP, DIODE, AND FUSE COMPLEMENT.

Refer to the associated technical manual for each equipment of the Spectrum Analyzer Set for electron tube, indicator lamp, diode, and fuse complements.

1-8. PREPARATION FOR RESHIPMENT.

No extraordinary precautions are required to prepare the Spectrum Analyzer Set for reshipment.

TABLE 1-1. EQUIPMENT SUPPLIED

QTY PER EQUIP	NOMENCLATURE		OVERALL DIMENSIONS (IN.)			VOLUME (CU. FT.)	WEIGHT (LB)
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
1	Spectrum Analyzer Set including:	AN/USM-324	53-3/4	24-3/4	23-1/4	18	65
1	Cabinet						80
1	Spectrum Analyzer	TS-2884/U	12-1/4	19	18	2.42	45
1	Static Frequency Converter	CV-2633/U	5-15/64	19	12-15/32	0.72	16
1	Radio Frequency Tuning Unit	TN-523/U	5-1/4	19	12	0.7	16
1	Signal Generator	SG-864/U	5-1/4	19	11	0.6	15
2	Cable	Connector type UG-88/U	1ft. lg.	--	--	--	--
1	Cable	Power Probe AN type connector	45 in. lg.	--	--	--	--
1	Coaxial cable	Connector type UG-88/U	2ft. lg.	--	--	--	--
1	Tuning Wand	--	6in. lg.	--	--	--	--
1	Technical Manual for Spectrum Analyzer Set AN/USM-324	NAVSHIPS 0967-876-5010	11-1/2	9-1/2	1.	--	--
1	Technical Manual for Spectrum Analyzer TS-2884/U	NAVSHIPS 0967-876-8010	11-1/2	9-1/2	1	--	--
1	Technical Manual for Static Frequency Converter CV-2633/U	NAVSHIPS 0969-125-4010	11-1/2	9-1/2	1	--	--

TABLE 1-1. (Continued)

QTY PER EQUIP	NOMENCLATURE		OVERALL DIMENSIONS (IN.)			VOLUME (CU. FT.)	WEIGHT (LB)
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
1	Technical Manual for Radio Fre- quency Tuning Unit TN-523/U	NAVSHIPS 0967-876-7010	11-1/2	9-1/2	1	--	--
1	Technical Manual for Signal Generator SG-864/U	NAVSHIPS 0967-876-6010	11-1/2	9-1/2	1	--	--

SECTION 2

INSTALLATION

2-1. UNPACKING AND HANDLING.

No special precautions are required for the unpacking and handling of the Spectrum Analyzer Set. Standard procedures and techniques are adequate.

2-2. POWER REQUIREMENTS.

Each of the equipments comprising the Spectrum Analyzer Set requires 115-volt $\pm 10\%$, 60-cycle single phase power for operation. Power consumption of the Spectrum Analyzer Set is 210 watts.

2-3. SITE SELECTION.

The Spectrum Analyzer Set can be placed in any suitable working area where normal lighting and ventilation are present. The Spectrum Analyzer Set will normally require frequent adjustment of the front panel controls and should therefore be situated to make it easily accessible for frequent operation and to visually monitor the display.

2-4. INSTALLATION REQUIREMENTS.

The Spectrum Analyzer Set is normally furnished with the equipment panels installed. Figure 2-1 is an outline drawing of the Spectrum Analyzer Set to assist in planning installation.

2-5. CABLE ASSEMBLIES.

Four cables are supplied with the Spectrum Analyzer Set; one 2-ft. cable, two 1-ft. cables, and a 45-inch probe power cable assembly. The 2-ft. cable

is connected between RF OUTPUT jack J4 on the rear of the Radio Frequency Tuning Unit and EXT. OSC. INPUT jack J107 on the rear of the Static Frequency Converter.

A 1-ft cable is connected between the SIGNAL INPUT jack J102 on the front of the Spectrum Analyzer and OUTPUT jack J203 on the front of the Static Frequency Converter.

The second 1-ft. cable is connected between the OSC INPUT jack J103 on the front of the Spectrum Analyzer and INTERNAL OSC OUTPUT jack J403 on the front of the Static Frequency Converter.

The 45-inch power probe cable assembly is used for high impedance inputs above 2 mHz. The cable has a connector at one end that is attached to PROBE POWER jack J104 on the Spectrum Analyzer. The other end of the cable is connected to the equipment under test. Low impedance inputs (50 ohms) are connected directly to the SIGNAL INPUT jack J102 on the Spectrum Analyzer (for signals above 2 mHz).

2-6. INSPECTION AND ADJUSTMENT.

Check the fuses and mechanical operation of the controls on each of the four units as detailed in the associated technical manual. Failure of any control to operate over its entire range is sufficient cause for failure of the unit to pass the test. To check the operation of the Spectrum Analyzer Set, perform the procedures detailed in paragraph 3-5a.

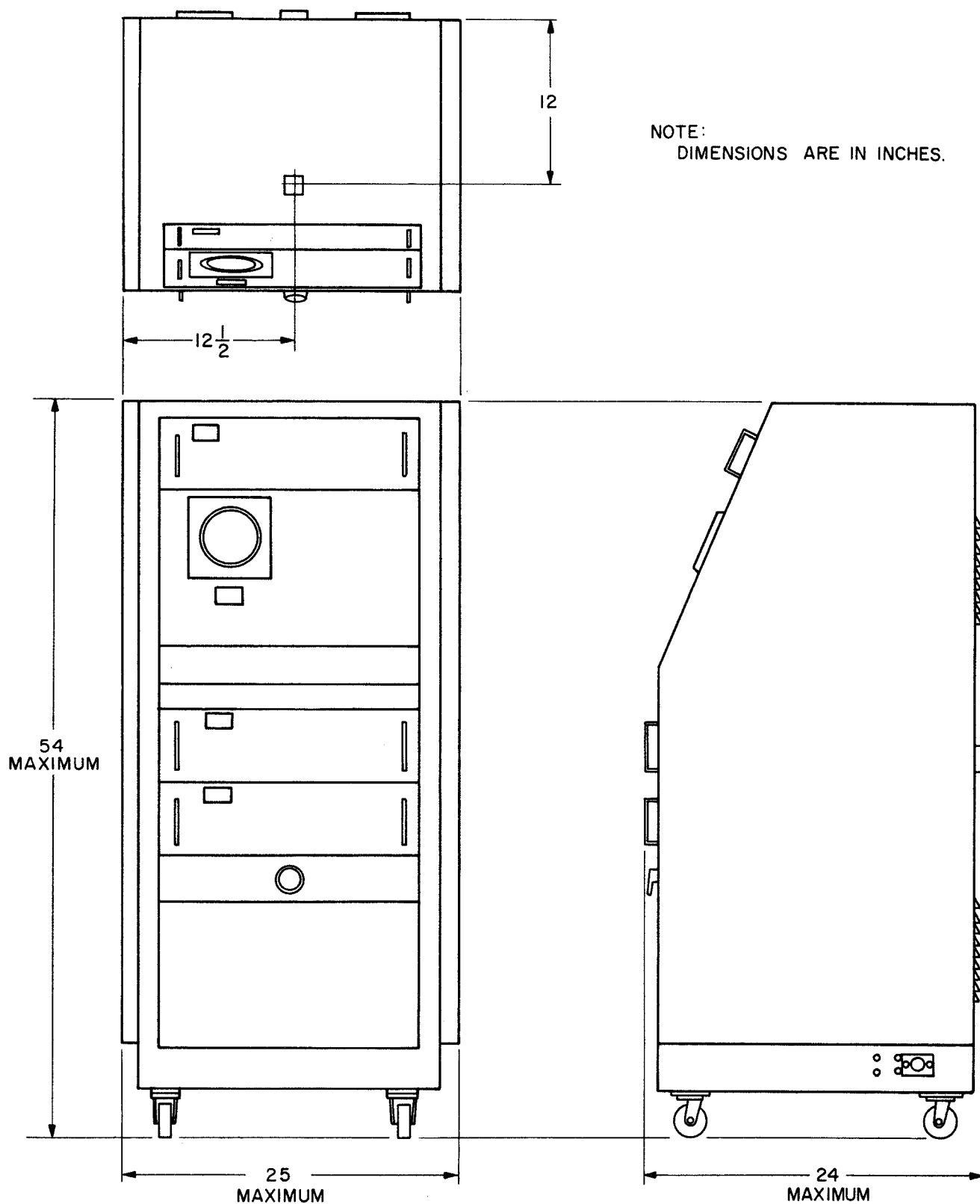


Figure 2-1. Spectrum Analyzer Set AN/USM-324, Outline Drawing

SECTION 3
OPERATION

3-1. FUNCTIONAL OPERATION.

The Spectrum Analyzer Set is designed for r-f spectrum analysis, especially in narrow band communications systems. The Spectrum Analyzer Set enables rapid analysis of in-band distortion of SSB transmitters and exciters by two-tone test method (to better than 65 dB); measures suppressed carrier levels, residual unwanted sidebands, and monitors transmission bandwidths; enables out-of-band studies of harmonics, cross products, parasitics, etc.; and is ideal for narrow band r-f studies of up to ± 50 kHz as in AM, FM, PM, and multiplexed channels.

The Signal Generator SG-864/U (two-tone generator) generates single- and two-tone audio frequency signals and dual RF signals for testing SSB communications systems, components, assemblies, modules and spectrum analyzers used for their maintenance. The Signal Generator is used to make precise measurements of intermodulation, carrier and sideband suppression, harmonics, spurious noise, and hum of SSB transmitters and precise measurements of intermodulation, noise and hum of SSB receivers. These results are obtained by a spectrum analysis and display method wherein an equal amplitude two-tone excitation is applied to the system under test and an output response amplitude-versus-frequency plot is obtained on the CRT screen of the Spectrum Analyzer.

The degree of non-linearity of the SSB system under test is determined by intermodulation measurements made by use of the two-tone test signal - highly selective spectrum analysis method. In SSB intermodulation distortion tests, adjacent or in band odd order difference frequency distortion products are of major concern and, with present day military communications system design, only the 3rd or the 5th odd order product is of specific interest. The relatively distortion free signal generators, such as the SG-864/U unit for audio and RF test, function as the proper input test signal for the system under test. The Spectrum Analyzer Set receives and measures the system's output response to such an input. The Spectrum Analyzer 100 kHz sweep width is used in the tuning and search of the system response. The remaining fixed sweep widths of 150 Hz, 500 Hz, 3.5 kHz, 7 kHz, and 14 kHz serve to provide the proper response display in accordance with the frequency separation value of the two-tone test signal being applied. The relationship of the intermodulation distortion product amplitude to the main tone amplitude gives an accurate indication of the relative level of distortion that has developed.

The Radio Frequency Tuning Unit TN-523/U is a variable oscillator that provides local oscillator injection signals over the frequency range from 2.0 to 39.5 MHz. This frequency range is covered in four bands; band 1 provides 2.0 to 4.5 MHz; band 2 provides 4.5 to 9.5 MHz; band 3 provides 9.5 to 19.5 MHz; and band 4 provides 19.5 to 39.5 MHz. The particular frequency within the selected band is obtained by the Tuning control. The Tuning control is geared to permit rapid scanning and precision tuning. For rapid scanning, the Tuning control can be pulled out so that approximately 30 turns are required to cover each band. For precision tuning, the Tuning control is pushed in and requires approximately 300 turns to cover each band. The actual frequency output of the TN-523/U is 500 kHz above the frequency indicated on the Tuning dial to provide a 500 kHz i-f signal input to the Spectrum Analyzer TS-2884/U.

Note

For signal frequencies below 2 MHz, the Tuning control is set to 2 MHz above the input signal frequency. For signal frequencies above 2 MHz, the Tuning control is set to the exact frequency of the input signal.

The Static Frequency Converter CV-2633/U is used for analyzing signals below 2 MHz (down to 100 Hz). The Static Frequency Converter mixes the input signal under test with an external oscillator signal from the Radio Frequency Tuning Unit to develop a 2.5 MHz signal. The Static Frequency Converter also contains a 3 MHz oscillator whose output signal is applied to the Spectrum Analyzer where it is heterodyned with the 2.5 MHz signal to develop the 500 kHz IF frequency. Above 2 MHz, the Static Frequency Converter is set to the standby mode and the signals, up to 40 MHz, are routed to the Spectrum Analyzer, bypassing the Static Frequency Converter.

The Spectrum Analyzer TS-2884/U contains the CRT and associated circuits for displaying relative signal power as a function of frequency. The Spectrum Analyzer has the capability of limiting the band pass to a very narrow frequency deviating about the center frequency to increase the resolution of the signals of interest. An automatic frequency control (AFC) network is inserted in the narrow band pass operation of the Spectrum Analyzer to prevent signal drift. The Spectrum Analyzer has the further capability of changing the amplitude scale of the signal displayed on the screen of the CRT through a

logarithmic network that decreases the amplitude of the displayed signal to half the value. A marker oscillator is incorporated to identify the center frequency of the display. In addition, the marker can be modulated by an external audio signal to provide further identification of skirt frequencies. Jacks are provided to enable supplying sync pulses to other equipment.

3-2. PREPARATION FOR USE.

After the Spectrum Analyzer Set is installed, the electrical operation should be checked to ensure proper operation. Refer to each associated equipment technical manual and perform the detailed procedures.

3-3. OPERATING PROCEDURES.

a. DESCRIPTION OF CONTROLS. - The operating controls and indicators of each unit comprising the Spectrum Analyzer Set are detailed in the associated Technical Manual. Each Technical Manual also locates the controls and indicators.

b. SEQUENCE OF OPERATION.

(1) BEFORE USE. - Before using the Spectrum Analyzer Set, proceed as follows:

(a) Open the door at the rear of the cabinet and check that the 2-ft cable is connected between RF OUTPUT jack J4 on the Radio Frequency Tuning Unit and EXT. OSC. INPUT jack J107 on the Static Frequency Converter.

(b) Connect the Spectrum Analyzer set to a source of 115-volt 60-cycle power.

(c) On the Spectrum Analyzer, turn the EDGE LIGHTING control clockwise, off the POWER OFF position.

(d) On the Signal Generator, set the POWER switch to ON.

(e) On the Static Frequency Converter, set the POWER switch to STANDBY.

(f) On the Radio Frequency Tuning Unit, rotate the OUTPUT LEVEL control clockwise off the POWER OFF position.

(g) Check that the edgelights on the Spectrum Analyzer, and the power indicator on the Radio Frequency Tuning Unit and the Static Frequency Converter light.

(h) Allow 30 minutes for warm up.

Note

Allow the Spectrum Analyzer Set to warm up as long as possible. Nominally, frequency stability is achieved after 30 minutes.

(2) DURING USE.

(a) Frequently check that the OUTPUT meter deflection on the Radio Frequency Tuning Unit is on the red line on the meter face. Adjust the OUTPUT LEVEL control, if necessary, before making any measurements.

(b) On the Signal Generator, check the Output Level meter deflection, and adjust as required.

(c) On the Spectrum Analyzer, check the switch setting before making an observation or measurement, especially the sweep-width and attenuation settings.

(3) AFTER USE. - If the Spectrum Analyzer Set will not be used for a relatively long period (compared to the 30 minute warm up time required), deenergize each unit. If the Spectrum Analyzer Set is to be used at varying intervals, it is advisable to maintain the equipment energized for frequency stability, but the intensity of the CRT display should be turned down with the INTENSITY control.

CAUTION

If the SWEEP switch on the Spectrum Analyzer is set to MAN, a stationary dot or line on the CRT could damage the tube if maintained for a long time. Turn the intensity down or place the SWEEP switch to AUTO to avoid tube damage.

(4) SECURE. - In the event of an emergency, de-energize each unit of the Spectrum Analyzer Set as follows:

(a) On the Spectrum Analyzer, set the EDGE LIGHTING control to power OFF.

(b) On the Signal Generator, set the POWER switch to OFF.

(c) On the Static Frequency Converter, set the POWER switch to OFF.

(d) On the Radio Frequency Tuning Unit, set the OUTPUT LEVEL control to POWER OFF.

3-4. SUMMARY OF OPERATING PROCEDURES.

a. PRELIMINARY OPERATING PROCEDURE. The interconnecting cabling between the Spectrum Analyzer and the Static Frequency Converter depends on the frequency and impedance of the signal and the signal source. Three possibilities exist: low impedance below 2 MHz; low impedance above 2 MHz; and high impedance above 2 MHz.

LOW IMPEDANCE BELOW 2 MHZ.

(a) Connect a coaxial cable between the SIGNAL INPUT jack J102 on the Spectrum Analyzer and the OUTPUT jack J203 on the Static Frequency Converter.

(b) Connect a coaxial cable between the OSC INPUT jack J103 on the Spectrum Analyzer and the INTERNAL OSC OUTPUT jack J403 on the Static Frequency Converter.

(c) If the signal impedance is 600-ohms balanced to ground, connect the signal between the SIGNAL INPUT 600 Ω jacks on the Static Frequency Converter and set the SIGNAL INPUT switch to 600 Ω and the POWER switch to OPERATE.

(d) If the signal impedance is 600-ohms unbalanced, connect the signal between top of the SIGNAL INPUT 600 Ω jack and the SIGNAL INPUT GND jack on the Static Frequency Converter, connect a shorting wire between the middle (red) connector and the bottom (black) connector, and set the SIGNAL INPUT switch to 600 Ω and the POWER switch to OPERATE.

(e) If the signal impedance is 75 ohms, connect the signal to the SIGNAL INPUT 75 Ω jack on the Static Frequency Converter, connect a shorting wire between the middle (red) connector and the bottom (black) connector, and set the SIGNAL INPUT switch to 75 Ω and the POWER switch to OPERATE.

(2) LOW IMPEDANCE ABOVE 2 MHZ.

(a) Connect a coaxial cable between the OSC INPUT jack J103 on the Spectrum Analyzer and the INTERNAL OSC OUTPUT jack J403 on the Static Frequency Converter.

(b) Connect the signal to the SIGNAL INPUT jack J102 on the Spectrum Analyzer.

(c) On the Static Frequency Converter, set the POWER switch to STANDBY.

(3) HIGH IMPEDANCE ABOVE 2 MHZ.

(a) Connect a coaxial cable between the OSC INPUT jack J103 on the Spectrum Analyzer and the INTERNAL OSC OUTPUT jack J403 on the Static Frequency Converter.

(b) Connect the cable to the PROBE POWER on the Spectrum Analyzer and connect the other end of the cable to the equipment under test.

(c) On the Static Frequency Converter, set the POWER switch to STANDBY.

b. OPERATING INSTRUCTIONS.

(1) For signal frequencies below 2 MHz, tune the Radio Frequency Tuning Unit to 2 MHz.

above the input signal frequency. For signal frequencies above 2 MHz, tune the Radio Frequency Tuning Unit to the exact frequency of the input signal.

Note

The actual frequency output of the Radio Frequency Tuning Unit is 500 kHz above the frequency indicated on the Tuning dial to provide the required 500 kHz i-f input to the Spectrum Analyzer.

(2) Adjust the Spectrum Analyzer for a sweep width that is just above the bandwidth of the signal(s) to be displayed.

(3) On the Spectrum Analyzer, set the SWEEP switch to AUTO, AMPLITUDE SCALE switch to RMS, VIDEO FILTER switch to OUT, GAIN maximum (extreme clockwise), I. F. ATTENUATOR switch to OUT, CENTER FREQ control to mid-range, and R. F. INPUT ATTENUATOR switches to OUT.

(4) Center the display with the Tuning dial on the Radio Frequency Tuning Unit, as required.

(5) Decrease the sweep width to increase the resolution of signal(s) of interest.

(6) Adjust the amplitude of the signal(s), as required, with the various attenuator controls available.

3-5. OPERATOR'S MAINTENANCE.

a. OPERATING CHECKS AND ADJUSTMENTS.

(1) Energize each unit. Refer to paragraph 3-3b(1).

(2) Connect a coaxial cable between the SIGNAL INPUT jack on the Spectrum Analyzer and the R. F. OUTPUT jack on the Signal Generator.

(3) Connect a coaxial cable between the INTERNAL OSC OUTPUT jack on the Static Frequency Converter and the OSC INPUT jack on the Spectrum Analyzer.

(4) On the Static Frequency Converter, set the POWER switch to STANDBY.

(5) On the Signal Generator, set the OUTPUT switch to R. F.

(6) On the Spectrum Analyzer, set the SWEEP WIDTH SELECTOR switch to VAR and the VAR SWEEP WIDTH control to 100 KC.

(7) On the Radio Frequency Tuning Unit, set the Tuning dial to approximately 2.0 MHz and center the display on the CRT. Adjust the OUTPUT LEVEL control for a red line deflection the OUTPUT meter.

(8) Set the SWEEP WIDTH SELECTOR switch to 7KC. Two signals should be observed 2 kHz apart.

(9) On the Spectrum Analyzer, set all R. F. INPUT ATTENUATOR switches and I. F. ATTENUATOR switch to OUT and set the AMPLITUDE SCALE switch to DB.

(10) On the Signal Generator, set the ATTEN DB switches to 30. The amplitude of the 3 kHz signals should be more than 40 db.

b. PREVENTIVE MAINTENANCE.- Preventive maintenance procedures for the Spectrum Analyzer Set are contained in Section 5.

c. EMERGENCY MAINTENANCE. - If the Spectrum Analyzer set fails to operate, replace a fuse as follows:

Note

Each of the four equipments comprising the Spectrum Analyzer Set contains one or more fuses, each of which is replaced in an identical manner.

(1) Remove the cap from the fuse holder.

(2) Insert a replacement fuse in the cap.

CAUTION

Do not replace with a fuse higher than the rating indicated on the chassis.

(3) Replace the fuse and cap into the fuse-holder.

CAUTION

If new fuse blows, do not replace with another fuse. Refer to troubleshooting procedures detailed in the associated equipment Technical Manual.

SECTION 4
TROUBLESHOOTING

4-1. TROUBLESHOOTING.

This section contains troubleshooting information for the Spectrum Analyzer Set. This information exists in the form of a troubleshooting chart and the functional theory of operation. The symptoms of faulty operation noted in the troubleshooting chart (table 4-1) can be recognized by observing the equipment indicators and lists the most probable troubles that can occur and the isolation procedure. The servicing block diagram contained in each associated equipment Technical Manual provides a pictorial guide for use in troubleshooting and indicates the location of test jacks and the nominal voltages that

should be measured at these points for a Spectrum Analyzer Set operating normally. When troubleshooting, also refer to the schematic diagram contained in each equipment manual to locate electrical points of measurements and to the associated parts location diagrams. Each of these schematic diagrams also contains a voltage and resistance chart for each of the vacuum tubes.

After the defective unit has been isolated, refer to the associated Technical Manual for detailed troubleshooting procedures to locate the defective stage and/or component.

TABLE 4-1. SPECTRUM ANALYZER SET, TROUBLESHOOTING CHART

STEP	SYMPTOM	PROBABLE CAUSE	REMEDY
1	Spectrum Analyzer Set inoperative	a. Interconnecting cabling incorrect and/or defective cable. b. Incorrect setting of POWER switch on Static Frequency Converter. c. Bottom two jacks on Static Frequency Converter not shorted for unbalanced inputs. d. Spectrum Analyzer defective. e. Radio Frequency Tuning Unit defective.	a. Check cabling connections and/or replace defective cable. b. Check that POWER switch is in OFF or STANDBY for signal frequencies above 2 MHz and in OPERATE for signal frequencies below 2 MHz. c. Attach a shorting wire between the middle (red) and bottom (black) jack. d. Energize the internal marker generator in the Spectrum Analyzer. If the marker is not displayed on the CRT, refer to the Spectrum Analyzer Technical Manual for detailed troubleshooting procedures. e. Adjust the OUTPUT LEVEL control for an OUTPUT meter deflection on the red line. If red line deflection cannot be obtained, refer to the Radio Frequency Tuning Unit Technical Manual for detailed troubleshooting procedures.

TABLE 4-1. (Continued)

STEP	SYMPTOM	PROBABLE CAUSE	REMEDY
1 (Cont)		f. Static Frequency Converter defective.	f. Inject an audio signal into the Static Frequency Converter from the Signal Generator. If the signal is not displayed on the Spectrum Analyzer CRT, refer to the Static Frequency Converter Technical Manual for detailed troubleshooting procedures.
2	Incorrect CRT display.	a. Interconnecting cabling incorrect and/or defective cable. b. Bottom two jacks on Static Frequency Converter not shorted for unbalanced inputs.	a. Check cabling connections and/or replace defective cable. b. Attach a shorting wire between middle (red) and bottom (black) jack.
3	Spectrum Analyzer Set inoperative below 2 MHz. Operation above 2 MHz is correct.	a. POWER switch on Static Frequency Converter not in OPERATE position. b. Incorrect cabling. c. Bottom two jacks on Static Frequency Converter not shorted for unbalanced inputs. d. Defective Static Frequency Converter.	a. Set POWER switch to OPERATE. b. Check cabling. c. Attach a shorting wire between middle (red) and bottom (black) jack. d. Refer to associated Technical Manual for detailed troubleshooting procedures.
4	Spectrum Analyzer Set inoperative above 2 MHz. Operation below 2 MHz is correct.	a. POWER switch on Static Frequency Converter not in STANDBY position. b. Incorrect cabling c. Bottom two jacks not shorted for unbalanced inputs. d. Radio Frequency Tuning Unit defective. e. Defective Static Frequency Converter.	a. Set POWER switch to STANDBY. b. Check cabling. c. Attach a shorting wire between middle (red) and bottom (black) jack. d. Adjust the OUTPUT LEVEL control for an OUTPUT meter deflection on the red line. If red line deflection cannot be obtained, refer to the Radio Frequency Tuning Unit Technical Manual for detailed troubleshooting procedures. e. Refer to associated Technical Manual for detailed troubleshooting procedures.

4-2. OVER-ALL FUNCTIONAL DESCRIPTION.

Input signals to be examined having a frequency less than 2 MHz are applied to the Static Frequency Converter. (See figure 4-1.) The Static Frequency Converter contains a mixer that heterodynes the input signal with the output of the Radio Frequency Tuning Unit to develop a 2.5 MHz output from the Static Frequency Converter. The lowest setting on the Tuning dial of the Radio Frequency Tuning Unit is 2.0 MHz which corresponds to an actual output frequency of 2.5 MHz. With no input signal ($f=0$), and a setting of 2.0 MHz on the Radio Frequency Tuning Unit Tuning dial, the output of the mixer in the Static Frequency Converter is 2.5 MHz. With an input signal of 2 MHz, the setting of the Tuning dial is 4 MHz, resulting in the mixing of the 2-MHz input signal with a 4.5 MHz beat frequency to again develop a 2.5 MHz output from the Static Frequency Converter.

The Static Frequency Converter also contains a 3 MHz oscillator whose output is applied to the Spectrum Analyzer. The first i-f frequency of the Spectrum Analyzer is 500 kHz which is derived by mixing the 2.5 MHz and 3 MHz outputs of the Static Frequency Converter.

Signal frequencies above 2 MHz are applied directly to the Spectrum Analyzer. The POWER switch on the Static Frequency Converter is then set to OFF or STANDBY which routes the output of the Radio

Frequency Tuning Unit directly to the input of the Spectrum Analyzer.

Because the actual output of the Radio Frequency Tuning Unit is 500 kHz above the indication on the Tuning dial, a 500-kHz first i-f frequency is automatically obtained by setting the Tuning dial on the Radio Frequency Tuning Unit to the exact frequency of the input signal to be examined.

The Signal Generator is used to measure inter-modulation, carrier and sideband suppression, harmonics, spurious noise and hum of SSB transmitters, and can also be used to check the operation of the Spectrum Analyzer Set. The Signal Generator has two audio frequency outputs of 20 to 20,000 Hz in adjustable steps controlled from front panel switches, and two fixed i-f outputs of 2.000 and 2.002 MHz.

4-3. SERVICING BLOCK DIAGRAM.

A servicing block diagram of each unit is contained in the associated equipment Technical Manual. Each servicing block diagram provides the maintenance technician with a pictorial guide for use in troubleshooting. Each diagram indicates the location of test jacks and the nominal voltages that should be measured at these points for a Spectrum Analyzer Set operating normally. The test jacks are assigned star test point symbols which are used to isolate functional sections in troubleshooting. Each servicing block diagram also indicates the adjustment control of each stage.

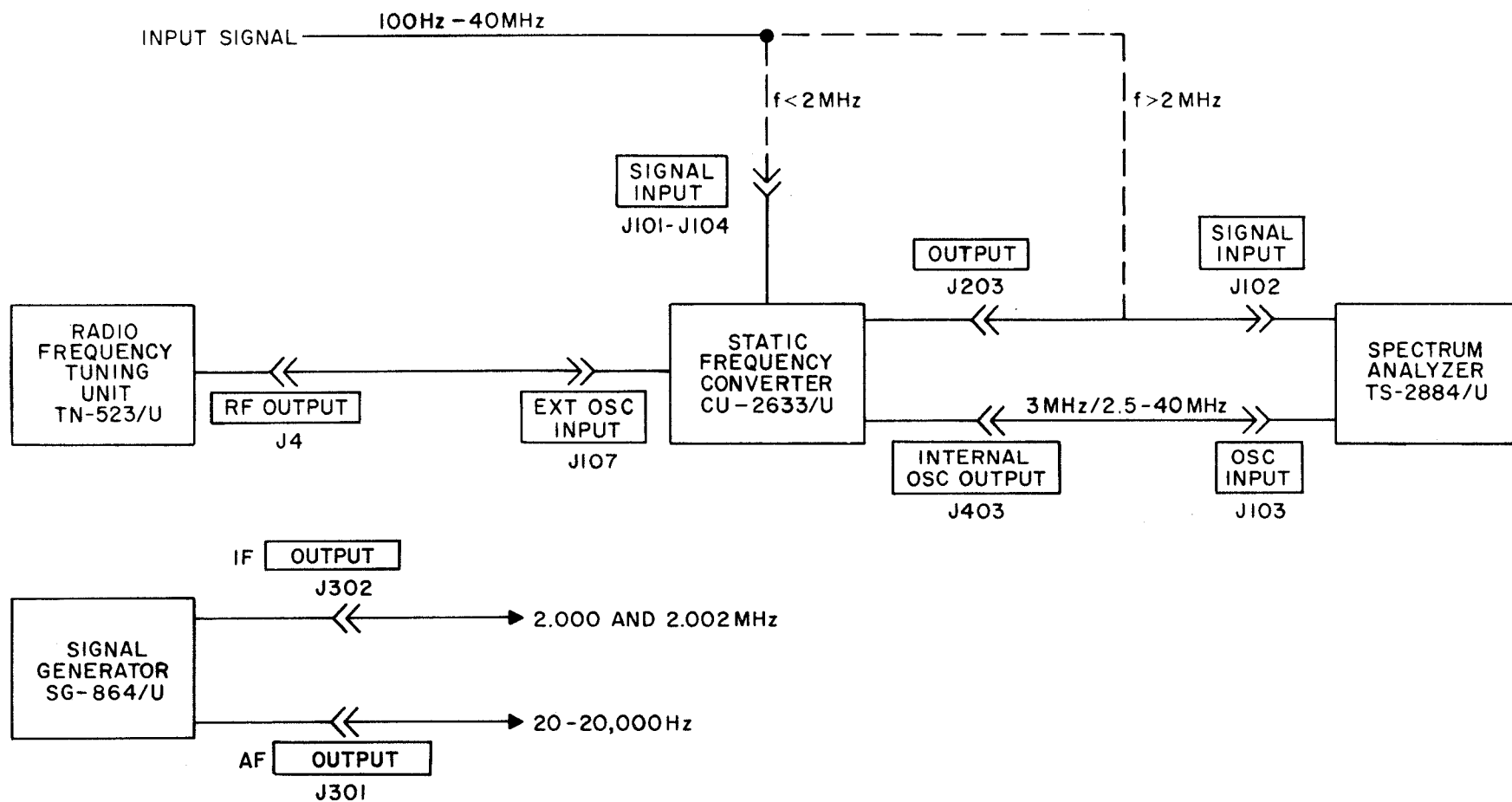


Figure 4-1. Spectrum Analyzer Set, Block Diagram

SECTION 5 MAINTENANCE

5-1. FAILURE, AND PERFORMANCE AND OPERATIONAL REPORTS.

The Naval Electronic Systems Command no longer requires the submission of failure reports for all equipments. Failure Reports and Performance and Operational Reports are to be accomplished for designated equipments (refer to Electronics Installation and Maintenance Book, NAVSHIPS 900, 000) only to the extent required by existing directives. All failures shall be reported for those equipments requiring the use of Failure Reports.

5-2. PREVENTIVE MAINTENANCE.

a. MAINTENANCE STANDARDS.

(1) TEST EQUIPMENT AND SPECIAL TOOLS. - No test equipment or special tools are required to check the operation of the Spectrum Ana-

lyzer Set. The test equipment and special tools required to check each individual unit is contained in the associated Technical Manual.

(2) SPECIAL PROCEDURES. - Before accomplishing preventive maintenance procedures, energize each unit of the Spectrum Analyzer Set and allow 30 minutes for warm up.

(3) REFERENCE STANDARDS PROCEDURES. - Detailed reference standards procedures for each unit are detailed in the associated Technical Manual.

(4) PREVENTIVE MAINTENANCE PROCEDURES. - The following preventive maintenance should be performed every 90 days.

(a) Make visual inspection and check mechanical operation of controls.

(b) Perform the tests listed in table 5-1.

TABLE 5-1. PREVENTIVE MAINTENANCE PROCEDURES

What to Check	How to Check	Correct Result
Controls	Operate all controls through all positions	Positive action
Chassis and Cabinet	Remove dust with brush or cloth	
Mechanical	Tighten all loose screws	
Operational	With the Spectrum Analyzer Set energized, connected for low frequency (+ < 2 MHz), and a 3,000 Hz signal applied to the Static Frequency Converter from the Signal Generator, observe the CRT display.	Displayed signal amplitude is less than 60 dB

b. TUNING AND ADJUSTMENT. - Refer to each associated equipment technical manual.

(b) Open the door at the rear of the cabinet and pull the power connector.

5-3. REPAIR.

a. REMOVAL, REPAIR, AND REPLACEMENT OF PARTS, SUBASSEMBLIES, AND UNITS. - The location of the four units in the cabinet is shown in figure 1-1.

(c) Remove any attached cables (from the front and rear).

(d) Remove the screws from the front panel.

(1) UNIT REMOVAL. - Each of the four units is removed in a similar manner. Proceed as follows:

(e) Grasp the two handles on the front panel of the unit and pull forward to remove the unit from the cabinet.

(a) De-energize the unit.

(2) UNIT REPLACEMENT.- Each of the four units is replaced in a similar manner. Proceed as follows:

- (a) Insert the unit in its location in the cabinet.
- (b) Secure the unit in the cabinet with the screws.
- (c) Attach cables (at front and rear).
- (d) Attach the power connector and close the door at the rear of the cabinet.

b. EMERGENCY MAINTENANCE FOR ELECTRONIC ASSEMBLIES. - Not applicable.

c. LUBRICATION.- The spectrum Analyzer Set does not require any lubrication.

5-4. ILLUSTRATIONS.

a. PARTS LOCATION ILLUSTRATIONS.- The location of the four units is shown in figure 1-1. Detailed parts location diagrams of each unit are contained in the associated Technical Manual.

b. SCHEMATIC DIAGRAM. - The schematic diagram of each unit is contained in the associated Technical Manual. Each unit is capable of independent operation; the cabinet in which the units are contained serves only as a convenience in which the units are installed and contains no circuitry required for operation of the Spectrum Analyzer Set.

SECTION 6

PARTS LIST

6-1. INTRODUCTION.

a. REFERENCE DESIGNATIONS.- Part number are identical with drawing numbers.

b. REFERENCE DESIGNATION PREFIX. - Not applicable.

6-2. MAINTENANCE PARTS LIST.

Table 6-1 lists all the maintenance parts of the Spectrum Analyzer Set. Maintenance parts are

listed alphabetically-numerically. Column 1 lists the reference designation. Column 2 lists the name and description. Column 3 identifies the illustration which pictorially locates the part.

6-3. LIST OF MANUFACTURERS.

All equipments listed in Table 6-1 are manufactured by, or are available from Probescope Co., Inc., 211 Robbins Lane, Syosset, New York; therefore a list of manufactures is not provided.

TABLE 6-1. MAINTENANCE PARTS LIST

REF DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
		Analyzer, Spectrum TS-2884/U Cabinet	1-1
		Cable, coaxial, 1-ft long, UG-88/U connector	1-1
		Cable, coaxial, 1-ft long, UG-88/U connector	1-1
		Cable, coaxial, 2-ft long, UG-88/U connector	1-1
		Cable, probe power, 45-inch long	1-1
		Converter, Frequency, Static CV-2633/U	1-1
		Generator, Signal SG-864/U	1-1
		Tuning Unit, Radio Frequency TN-523/U	1-1

