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COLLINS

URG-II Support Equipment

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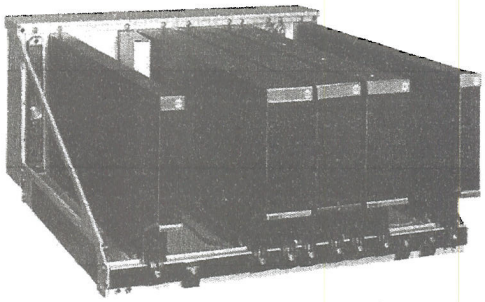
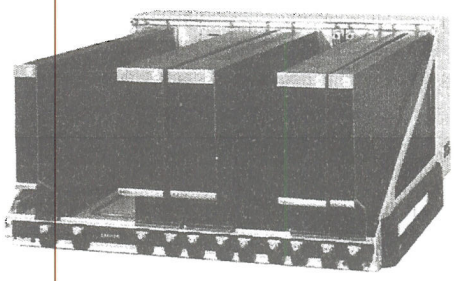
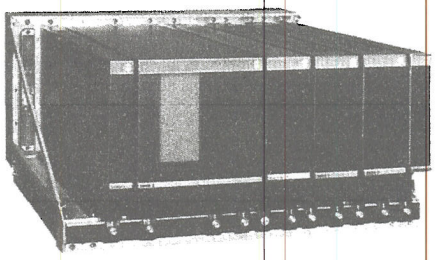


651H-( ) Receiver.



310Y-( ) Exciter.



671T-( ) Receiver-Exciter.

Typical URG-II Receiver-Exciter units are depicted above.

2.1 975K-1 CONTROL SIMULATOR, SERIAL-DIGITAL

2.1.1 Applications

The 975K-1 Test Set (792-6045-001) is intended to supply the serial control words to operate individually the ATR units of the 651H-1A/2A/2B (receiver); 310Y-1A (exciter); 671T-3A/4A (transceiver); 208U-3A (3-kW pa); 208U-10A (10-kW pa); and the 409T-3, 490T-8, and 490X-1 (antenna couplers).

2.1.2 Features

a. 24-bit illuminated monitor display
b. Selection of 24 individual control word bits
c. A 5-position subaddress switch
d. Self-contained power supply
e. Tune-start initiate button
f. Allows independent performance analysis
g. Allows testing of all serial control equipment/units

2.1.3 Functions Tested

The 975K-1 contains a serial-digital word generator and a power supply. Power supply capability is only to supply word generator functions.

The serial-digital word generator is intended to provide the four types of biphase modulated serial-digital words necessary for operating and testing the URG-II class of equipment. In addition, it demodulates monitor data from the unit under test and presents the data in binary form on a lamp display. The control and carrier bus outputs of the test set are compatible with present requirements for serial-digital control of URG-II receivers, exciters, and antenna couplers. As mentioned in paragraph 2.1.1, the word generator is not intended for use as a system control element, but can be used for local control of individual system elements on a one-at-a-time basis.

The 975K-1 contains the required cables and plug accesses necessary to fulfill its function of support for the URG-II class of equipment (figure 2-1).

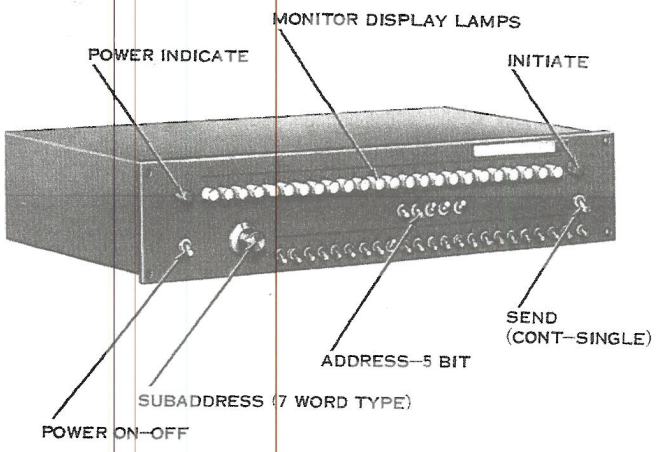


Figure 2-1. 975K-1 Control/ Simulator Serial/ Digital.

2.1.4 Technical Details

Functionally the 975K-1 serial word generator is broken into five discrete areas briefly described as follows:

a. Gate and Clock Generator

Gate and clock generator generates the master sine clock from which the square wave clock is derived. Clock is used for timing signal control, gate control, and feedback counters.

b. Control Data Register

The register provides storage for 32 bits of control data that are manually set by toggle switches on the front panel. Either single or continuous send operation is selected by a front panel switch. Control data is loaded each time the send button is depressed.

c. Modulators

The modulator translates digital-serial data to biphase modulated serial data required by the URG-II family of equipment. Discrete circuit design is used for simplification and cost considerations.

d. Demodulator

Data detection is accomplished by comparison methods, and threshold detectors are used to decode the monitor data of the unit under test. Detected data is then loaded serially into the monitor storage registers.

e. Monitor Register

Data is stored after each control word and presented on a lamp display in binary form.

This equipment fully tests the device control functions of interface boxes/cards in those units described in paragraph 3.1. Monitor responses from the unit under test are then displayed for easy performance determinations. Monitor bits displayed define functional circuit areas for troubleshooting. Advantages of the 975K-1 include the following:

a. Easily interfaces and tests a large number of system components.
b. All essential test capability is provided with reduced cost and size, and simplified performance.
c. Use of 975K-1 to test individual system components establishes a baseline reference away from system environment. It also eliminates possible damage to other components of the system in the event that diagnosis is not immediate. Continued system level operations of a malfunctioning digital control box can cause erroneous servo positioning and high dissipation in tuned elements and tubes, as well as creating mechanical defects.
d. The 975K-1 allows open loop operation of the digital interface unit under test. The 975K-1 is conveniently packaged with self-contained power supply. Dimensions are: 3-15/32 inches high, 19 inches wide, and 4 inches deep.

Standard 19-inch rack mounting is provided for auxiliary mounting or incorporation into the 975K-2/975K-3/975K-5/980H-10 Test Set groups.

2.2 975K-5 TEST SET

2.2.1 Application

The 975K-5 Test Set is designed to support the modular ATR units of the URG-II (Universal Radio Group) 310Y-1A Exciter, 651H-1A/2A/2B Receiver, and the 671T-3A/4A Receiver-Exciter. The units involved are the 599H-2/3/4 Adapter Units, 652J-4 Power Supply Unit, 887B-1 Digital Unit, and the 889B-1/A-2 and 889B-6/A-7 IF Translator Units.

The test set is designed for suitcase portability or rack/table top mounting. It is used to power, cool, terminate inputs and outputs, and control any of the above units for the purpose of unit operation, fault isolation, alignment, and adjustment.

See figures 2-2 through 2-4 for pictorial views of the 975K-5 Test Set.

2.2.2 Features

Outstanding features of the 975K-5 Test Set include the following:

a. Completely self-contained in portable carrying case
b. Allows use or storage in small area because of small size
c. Does not rely on other units of a radio system for operation of test set, thus system unknowns are eliminated
d. Has self-contained cooling air
e. Bulky unit extender cables are not required
f. Inputs and outputs accessible and measurements easily made
g. Test points and alignment and gain adjustments are readily accessible
h. Standard reference injection frequency sources are self-contained and easily checked for accuracy
i. No external power supplies required; test unit requires 115 Vac

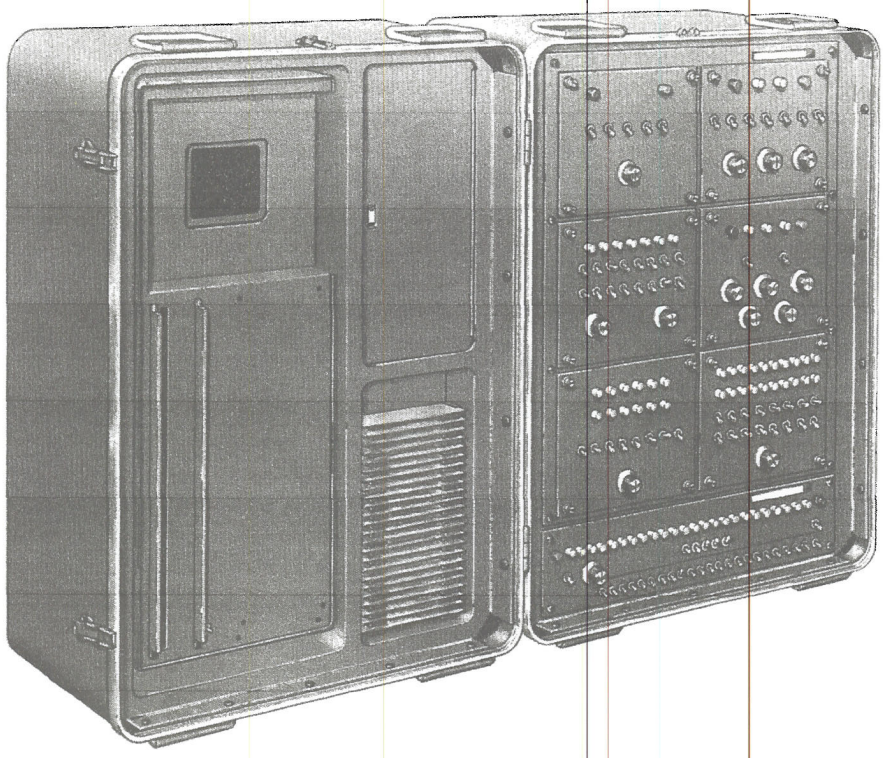


Figure 2-2. 975K-5 Test Set.

2.2.3 Functions Tested

With the use of standard test equipment and the 975K-1 or 7404A-1 Serial-Digital Word Generator, the 975K-5 Test Set allows all static and dynamic operational checks to be performed on the units listed above. All control and monitor functions may be exercised. Input/output and in-circuit ac/dc signal levels and impedance measurements may be performed. Unit alignment and gain adjustments are readily accessible and can easily be accomplished.

2.2.4 Technical Details

The 975K-5 Test Set is housed in a single, lightweight, carrying case approximately 23 inches wide, 30 inches long, and 20 inches high. The case top contains the test set chassis, unit extender cards, and miscellaneous items. The case bottom contains a standard 19-inch rack mounting panel with the 6 test set plug-in adapters and storage space for a 975K-1 serial-digital word generator.

The test set chassis is approximately 7 inches wide, 28 inches long, and 4-1/2 inches high. It is removable from the case and may be operated on a workbench or table. It provides a convenient means for securing the test set plug-in unit adapter and the unit under test. A movable unit rail allows for the different widths of the units. The chassis contains a power supply that provides the various regulated voltages required for the unit adapters and the unit under test. Metering of these power supply outputs is provided. An off/on switch circuit breaker is provided in the prime power input lead. The test set chassis also contains a blower and air plenum for providing the proper amount of air to the unit adapter and unit under test, when required.

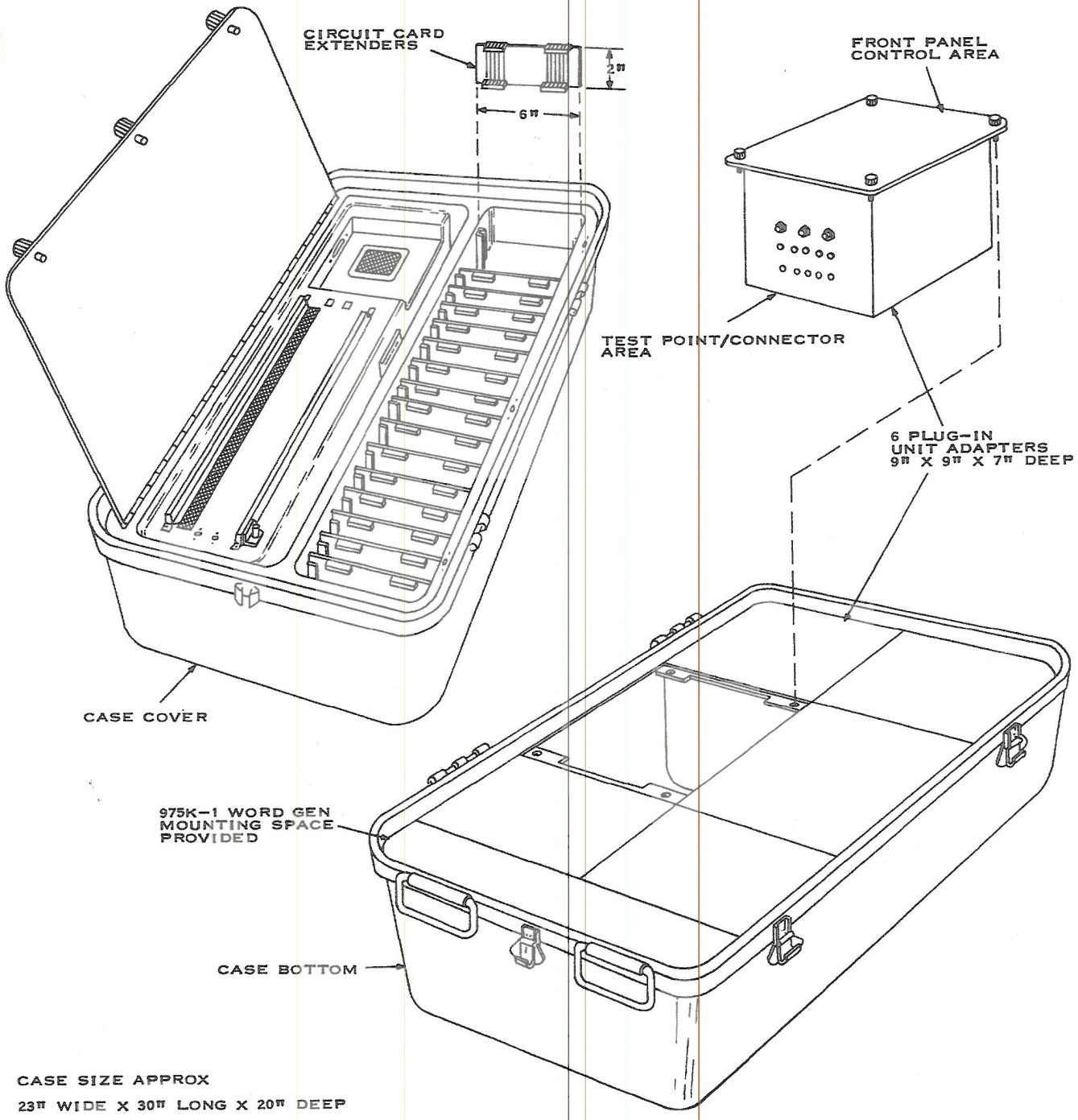


Figure 2-3. Complete URG-II Test Set Case.

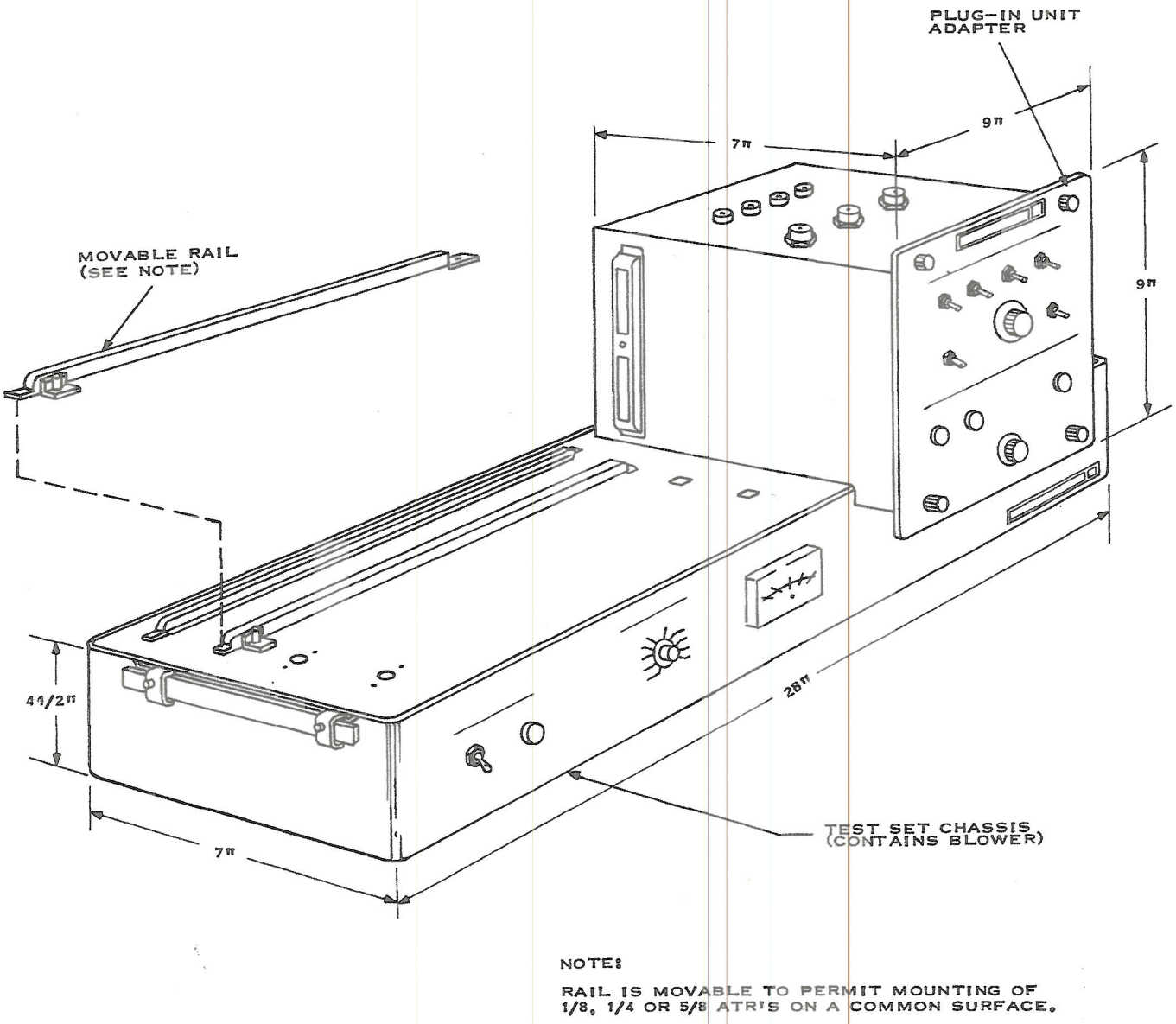


Figure 2-4. URG-II Unit Test Set.

The test unit adapters are approximately 7 inches wide, 9 inches long, and 9 inches high. They are easily removed from their storage space by loosening four thumbscrews. The adapter is then plugged into the test set chassis, which supplies air, when required, and power for the adapter and the unit under test. There are six plug-in unit adapters, one for each major type of unit: 599H-2/3/4 Unit Adapter, 652J-4 Unit Adapter, 887B-1 Unit Adapter, 888B-1/2 Unit Adapter, 889A-2/B-1 Unit Adapter and 889B-6/A-7 Unit Adapter. The adapters contain all input/output terminations, test points, controls, and indicators required for operation, fault isolation, alignment, and adjustment of the unit under test. A minimum amount of circuits, active and/or passive, consistent with the above requirement, is used.

The test set contains printed circuit card extenders for those units (887B-1 and 888B-1/2) which use perpendicular plug-in cards. These card extenders allow the extension of the unit cards out of the unit for troubleshooting and adjustment. Miscellaneous cables and connectors are also supplied.

The 975K-5 Test Set method of unit maintenance provides the best overall maintenance concept for the URG-II exciters, receivers, and receiver-exciters. A unit may quickly and easily be operated, fault isolated, aligned, and adjusted without confusing system (radio) symptoms. Each unit is set up with nominal input and output impedances and levels that duplicate original factory settings. Unit replacement and operation in any radio is, therefore, enhanced.

2.3 UNIT EXTENDER CABLES

2.3.1 Application

The unit extender cable, shown in figure 2-5, is used to extend the ATR unit from an operational equipment shelf for maintenance purposes. Extension of the ATR unit from the shelf enables access to the test points and circuit cards and/or modules in the ATR unit.

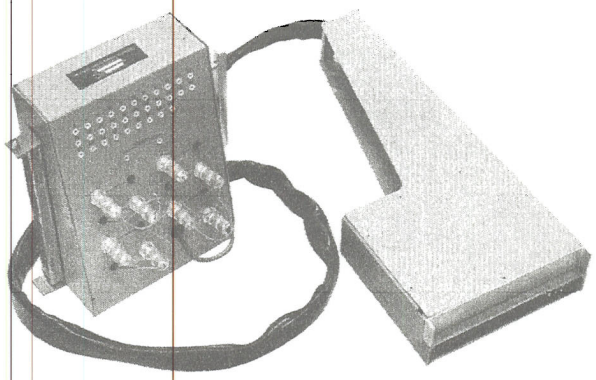


Figure 2-5. 652J-4 Unit Extender Cable.

2.3.2 Description

ITEM	PART NUMBER	USED WITH
Extender cable	787-8164-001	599H-2/3/4 Adapter
Extender cable	787-8153-001	652J-4 Power Supply
Extender cable	787-8205-001	887B-1 Synthesizer
Extender cable	787-8160-001	888B-1/2 RF Translator
Extender cable	787-8156-001	889B-1/6 IF Translator
		889A-2/7 IF Translator

2.4 CARD AND MODULE EXTENDERS

2.4.1 Application

Card extender, shown in figure 2-6, is used with the 975K-5 Test Set and/or the unit extender cables to extend the card or module from the ATR unit for maintenance purposes. Extension of the card or module, from the ATR unit, enables access to test points and components on the circuit card or module.

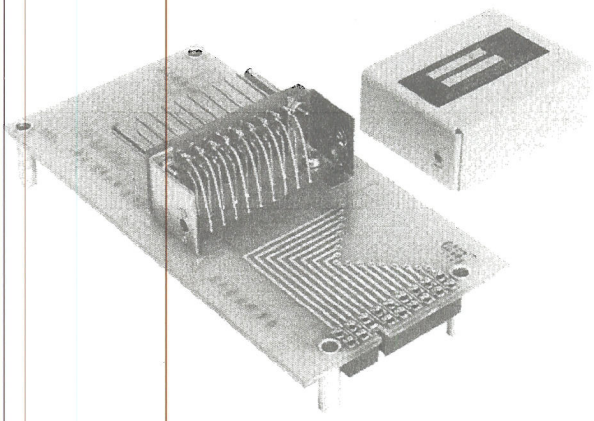


Figure 2-6. 652J-4 Card Extender.

2.4.2 Description

ITEM	PART NUMBER	USED WITH
Card extender	787-8278-001	652J-4 Power Supply
Card extender	787-8279-001	652J-4 Power Supply
Card extender	797-0374-001	887B-1 Synthesizer
Card extender	797-0375-001	887B-1 Synthesizer
Card extender	797-0376-001	887B-1 Synthesizer
Card extender	797-0377-001	887B-1 Synthesizer
Card extender	797-0378-001	887B-1 Synthesizer
Card extender	797-0379-001	887B-1 Synthesizer
Card extender	797-0380-001	887B-1 Synthesizer
Card extender	797-0383-001	887B-1 Synthesizer
Card extender	797-0384-001	887B-1 Synthesizer
Card extender	797-0385-001	887B-1 Synthesizer
Card extender	797-0388-001	887B-1 Synthesizer
Card extender	797-0389-001	887B-1 Synthesizer
Card extender	797-0390-001	887B-1 Synthesizer
Card extender	797-0391-001	887B-1 Synthesizer
Card extender	797-0392-001	887B-1 Synthesizer
Card extender	787-8167-001	888B-1/2 RF Translator
Card extender	787-8168-001	888B-1/2 RF Translator
Card extender	787-8169-001	888B-1/2 RF Translator
Card extender	787-8170-001	888B-1/2 RF Translator
Card extender	787-8171-001	888B-1/2 RF Translator
Card extender	787-8172-001	888B-1/2 RF Translator
Card extender	787-8173-001	888B-1/2 RF Translator
Rf cable extender	787-8195-001	888B-1/2 RF Translator
Preselector extender	787-8165-001	888B-2 RF Translator
Preselector card extender	787-8161-001	888B-2 RF Translator

2.5 UNIVERSAL BLOWER

2.5.1 Application

The universal blower, shown in figure 2-7, is used to provide cooling air to the ATR units when extended from the equipment shelf.

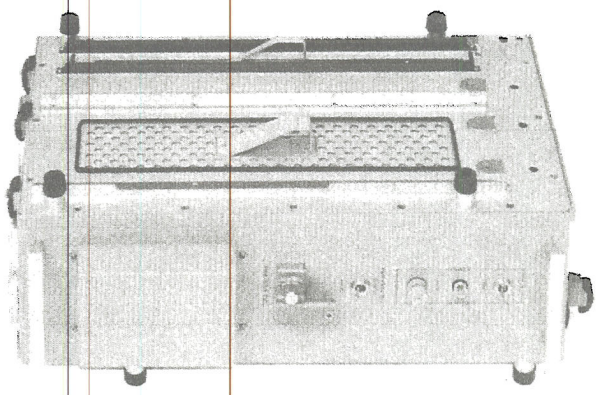


Figure 2-7. Universal Blower Unit.

2.5.2 Description

ITEM	PART NUMBER	USED WITH
Universal blower assembly	787-8154-001	652J-4 Power Supply 636Y-( ) Power Supply 639D-( ) Power Supply 648A-( ) RF Amplifier

2.6 652J-4 VARIABLE LOAD

2.6.1 Application

The 652J-4 Variable Load provides full and/or partial loading for the 652J-4 power supply. The unit is used in conjunction with an operational functional group (310Y-1, etc) to test the 652J-4 Power Supply.

2.6.2 Description

ITEM	PART NUMBER	USED WITH
652J-4 Variable Load	797-0370-001	310Y-( )/651H-( )/ 671T-( )

2.7 RF SWITCHING UNIT

2.7.1 Application

The rf switching unit, shown in figure 2-8, is used in conjunction with an operational receiver functional group (651H-1A/2A/2B) to check and adjust AGC.

2.7.2 Description

ITEM	PART NUMBER	USED WITH
Rf switching unit	617-4773-001	651H-( )/671T-( )

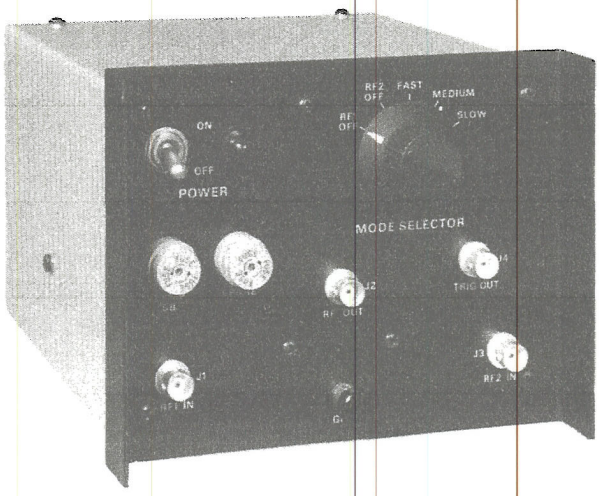


Figure 2-8. RF Switching Unit.

2.8 RF COUPLER

2.8.1 Application

The rf coupler, figure 2-9, is used in conjunction with an operational transmitter functional group (310Y-1A, etc) to check and adjust ALC and TGC.

2.8.2 Description

ITEM	PART NUMBER	USED WITH
Rf coupler	622-0406-001	310Y-( )/671T-( ) 548U-( )/208U-( )

2.9 IF PAD

2.9.1 Application

The if pad, figure 2-10, is used with the unit extender cables to provide signal generator matching for checking and aligning receivers.

2.9.2 DESCRIPTION

ITEM	PART NUMBER	USED WITH
If pad	617-4774-001	651H-( )/671T-( )

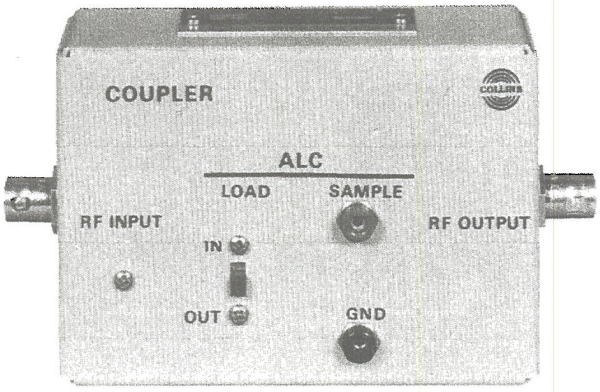


Figure 2-9. RF Coupler.

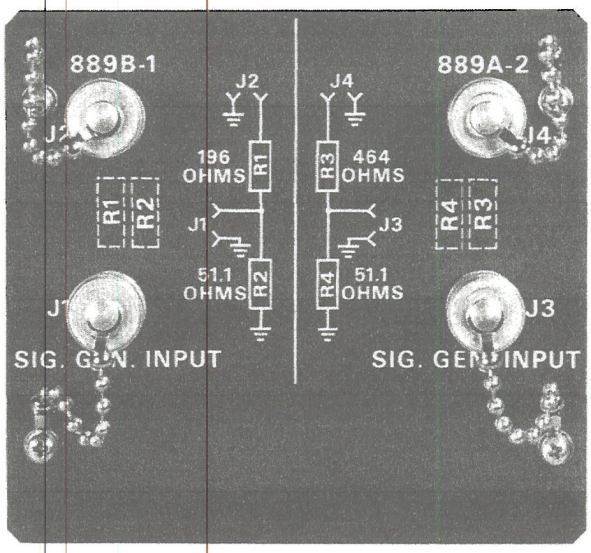


Figure 2-10. IF Pad.

2.10 514A-( ) INTERFACE UNIT

2.10.1 Application

The interface unit is used with the 975K-1 Test Set or 7404A-1 Source Generator and Display Unit to test and troubleshoot the 514A-( ) Radio Set Control Units.

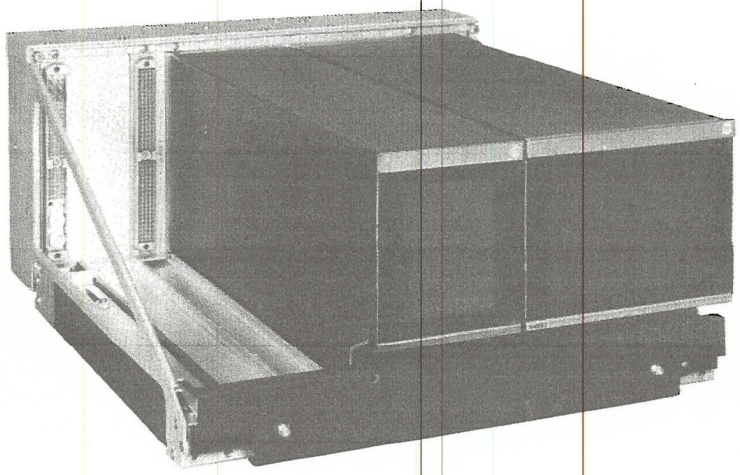
2.10.2 Description

ITEM	PART NUMBER	USED WITH
514A-( ) Interface Unit	779-6097-001	514A-( ) Control Unit
Interconnect cables	779-7398-001	514A-( ) Control Unit
	779-6106-001	514A-( ) Control Unit

2.11 STANDARD TEST EQUIPMENT

The following standard test equipment (or equivalent) is recommended to complement the 975K-5 test set and/or the unit extender cables in support of the URG-II Receiver-Exciter equipment.

ITEM	MANUFACTURER AND TYPE NO	FSN/VENDOR PN
Multimeter	AN/PSM-6	6625-643-1686
Oscilloscope	Tektronix 545B	6625-892-5251
Rf voltmeter	Boonton 91DA	6625-947-7559
Electronic counter with converter	HP E14-5245/5253B	6625-999-5364
Digital voltmeter plug-in	HP 5265A	6625-957-0511
True rms voltmeter	Ballantine 320A	6625-726-6949
Vtvm	HP 410C	6625-856-0462
Hf signal generator	HP 606A	AN/URM-25
Audio oscillator	HP 200CD	6625-806-5033
Vhf signal generator	HP 608	AN/URM-26B
Distortion analyzer	HP 332A	AN/USM-259
Video amplifier plug-in	HP 5261A	6625-269-4593
Attenuator pad (50-ohm, 6-dB)	Measurements Corp. 80-ZH3	6625-269-4593
Radio receiver	Collins 51S-1	522-2245-000
Dummy load, 50-ohm	Bird 8251	
Spectrum analyzer	HP E10-8553L	6625-105-8738
Two-tone rf generator	HP 540B	AN/URM-144
Two-tone audio generator	Singer Inst. TTG-2	
Source generator and display unit	Collins 7404A-1	6625-123-8718
Test leads	Collins	787-8201-001
		787-8202-001



548U Linear Power Amplifier.

3.1 975K-3 TEST SET

3.1.1 Application

The 975K-3 Test Set consists of a complement of test units for repair diagnosis and test of the various modules of the 548U-1/2 Power Amplifier. These modules are the 648A-1/1P Power Amplifier, 639D-1/1P, 639D-2/2P, and 636Y-1/2 Power Supplies and the 915X-2 Digital Interface Control.

3.1.2 Features

a. Provides all cooling air and mountings
b. One main control panel to test all 548U-( ) modules
c. Tests can be made to module, card, or piece part level
d. All special test devices provided
e. Standard ancillary test equipment used
f. May be used in portable case or rack mounted
g. May be used to interconnect and test complete 548U-( ) systems
h. Separate tester for nonextendable modules
i. Provides maximum high-voltage protection for maintenance personnel

3.1.3 Functions Tested

The 975K-3 Test Set provides cooling air and mounting facilities for the 548U-( ) modules, test loads for the power supply modules, and a full complement of extender cables to allow

testing of removable printed circuit cards. A main test panel provides for the input and distribution of primary power sources, metering, test point accessibility, and manual or automatic exercise of the UUT. An rf test adapter is provided to test one nonextendable rf amplifier subassembly that is contained in the 648A-1/1P Power Amplifier Module.

The full complement of 975K-3 test units provides facilities for diagnosis and repair of all slices to the piece-part level of each removable subassembly. The 975K-3 is housed in portable carrying cases. The test units may be used within these cases or removed for more permanent rack mounting.

3.1.4 Technical Description

The complement of units contained in the 975K-3 Test Set are described below.

a. Carrying Case No 1

This case contains the main test panel to be utilized for testing all the 548U modules and subassemblies. It also provides space for the 975K-1 Control Simulator utilized to test serial control functions. This case also provides storage for interconnecting cables, and is shown in figure 3-1.

b. Carrying Case No 2

Plenums for mounting the 648A-1/1P, 636Y-1/2, or 639D-1/1P units during test, and an optional power supply to power the 648A-1/1P are contained in this case. Provision is also made for storage of test cables. This case is shown in figure 3-2.

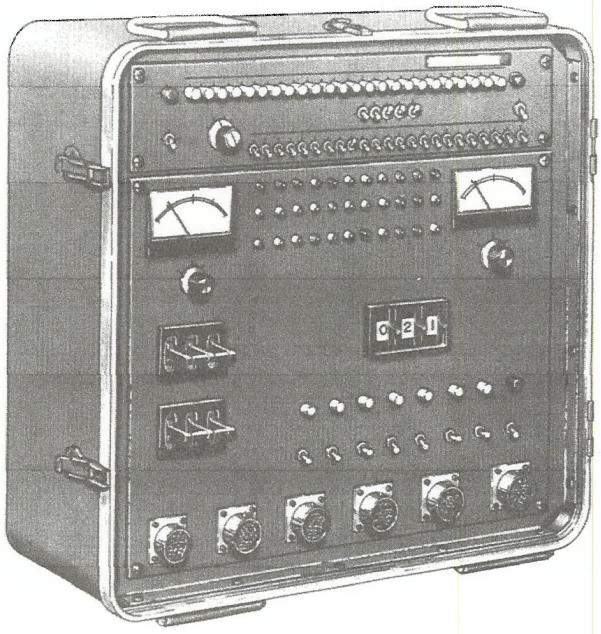


Figure 3-1. Case Number 1.

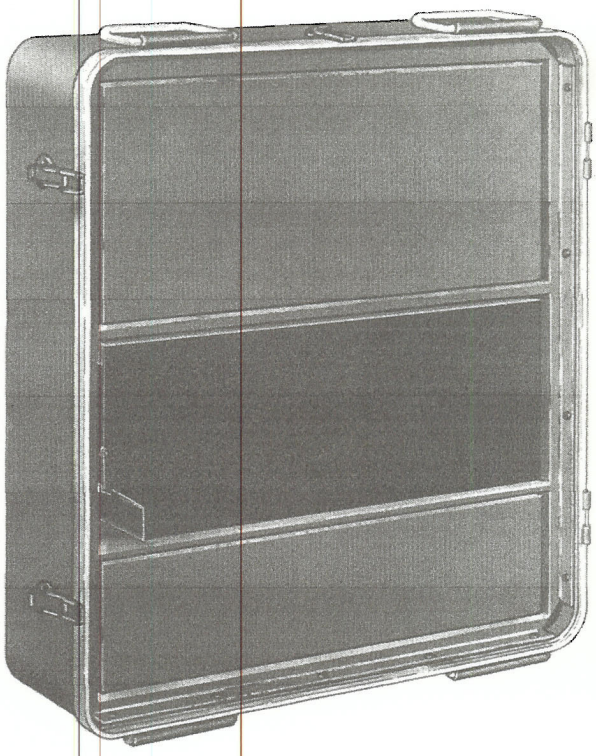


Figure 3-2. Case Number 2.

1. Plenum A

   This plenum provides a mounting base and self-contained cooling air supply for testing a 648A-1/1P Power Amplifier.

2. Plenum B

   This plenum provides a mounting base and self-contained cooling air supply for testing either the 636Y-1/2 or the 639D-1/1P Power Supplies.

3. Power Supply

   As required for specific test facilities, a standard 636D-1/1P with color-coded case and a keyed connector may be supplied to furnish low-voltage power for testing a 648A-1/1P Power Amplifier. For facilities providing 400-Hz power, a standard 636Y-1/2 with a color-coded case and keyed connector may be furnished to supply all voltages for testing a 648A-1/1P Power Amplifier.

c. Carrying Case No 3

A plenum for mounting a 639D-2/2P under test is contained in case no 3 (figure 3-3). It also provides space for a 639D-2/2P Power Supply. Provision is also made for storage of test cables.

1. Plenum C

   A mounting base and self-contained cooling air supply for testing the 639D-2/2P Power Supply is provided by plenum C.

2. Power Supply

   As required for specific test facilities, a standard 639D-2/2P with color-coded case and a keyed connector may be supplied to furnish high-voltage power for testing of the 648A-1/1P Power Amplifier.

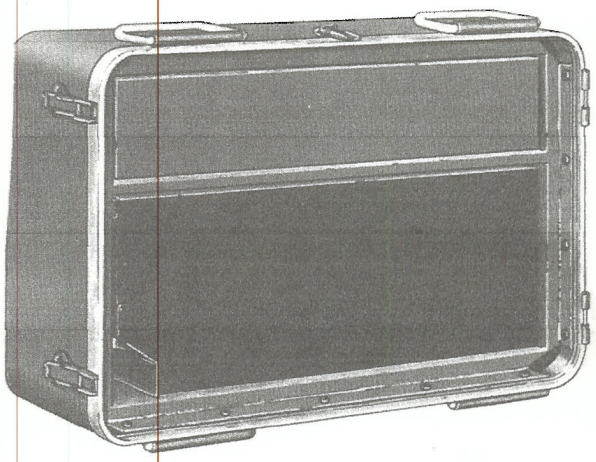


Figure 3-3. Case Number 3.

d. Carrying Case No 4

This case contains the power supply load unit utilized in testing any of the associated power supplies. All dummy loads required for testing are self-contained together with blowers to provide cooling air. This unit is shown in figure 3-4.

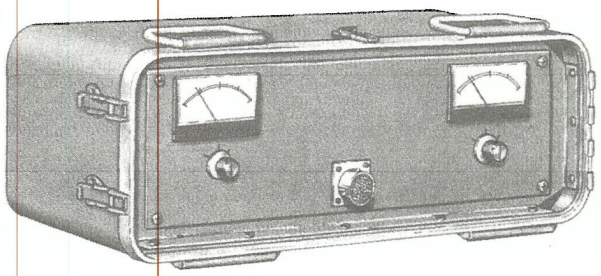


Figure 3-4. Case Number 4.

e. Carrying Case No 5

The rf test adapter unit utilized in testing the rf amplifier subassembly A2, which is part of the 648A-1/1P, is contained in case no 5. This adapter is mounted to plenum A (case no 2) to provide cooling air and power supply voltages required for testing. Controls and monitor meters mounted on the test adapter allow for full exercising and test of subassembly A2 when used in conjunction with the test panel in case no 1.

The rf test adapter provides for servo-system tests; calibrated rf voltage dividers for sampling purposes; a variable output network to simulate a properly tuned 648A-1/1P output network; controls for varying critical tube voltages; panel meter monitoring of various input and output potentials; and facility for pa tube neutralization procedures. The adapter provides the means for making adjustments and tests to the UUT that will afford the technician maximum safety protection. The rf test adapter is shown in figure 3-5.

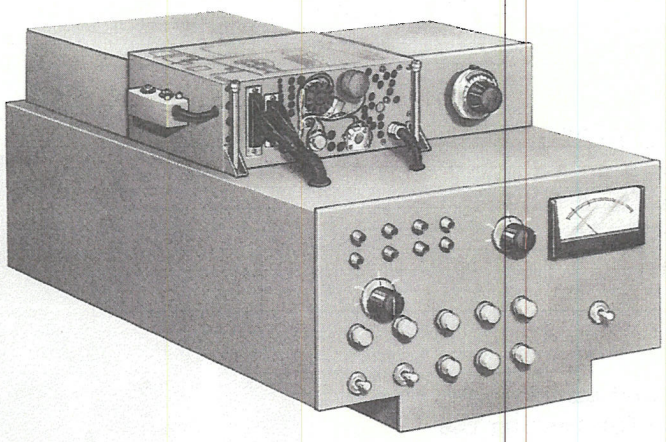


Figure 3-5. RF Test Adapter.

3.1.5 Advantages

The 975K-3 Test Set provides for diagnosis and test of each module of a 548U-1/2 Power Amplifier, either individually or as a total group. This flexibility is provided by the concept of one main test panel that is then connected to various plenum mountings and adapters by means of interconnecting cables. Figures 3-6 through 3-13 show the various optional test modes available with the 975K-3. By utilizing the cable extenders provided, fault isolation to the piece-part level in removable assemblies may be accomplished.

Figure 3-6 shows the configuration utilizing the rf test adapter for testing rf amplifier subassembly A2 for the 648A-1/1P. Subassembly A2 is shown in figure 3-14. Figure 3-15 depicts subassembly A2 as normally mounted in the 648A-1/1P chassis. The requirement for providing cooling air and rf circuit interconnections precludes extending this module by means of cables. Serious personnel safety hazards would also be encountered. The rf test adapter provides the necessary cooling air and an rf tuning network for total exercise of the A2 module. Suitable interconnects, power interrupts, and safety covers are provided for maximum protection of the operator.

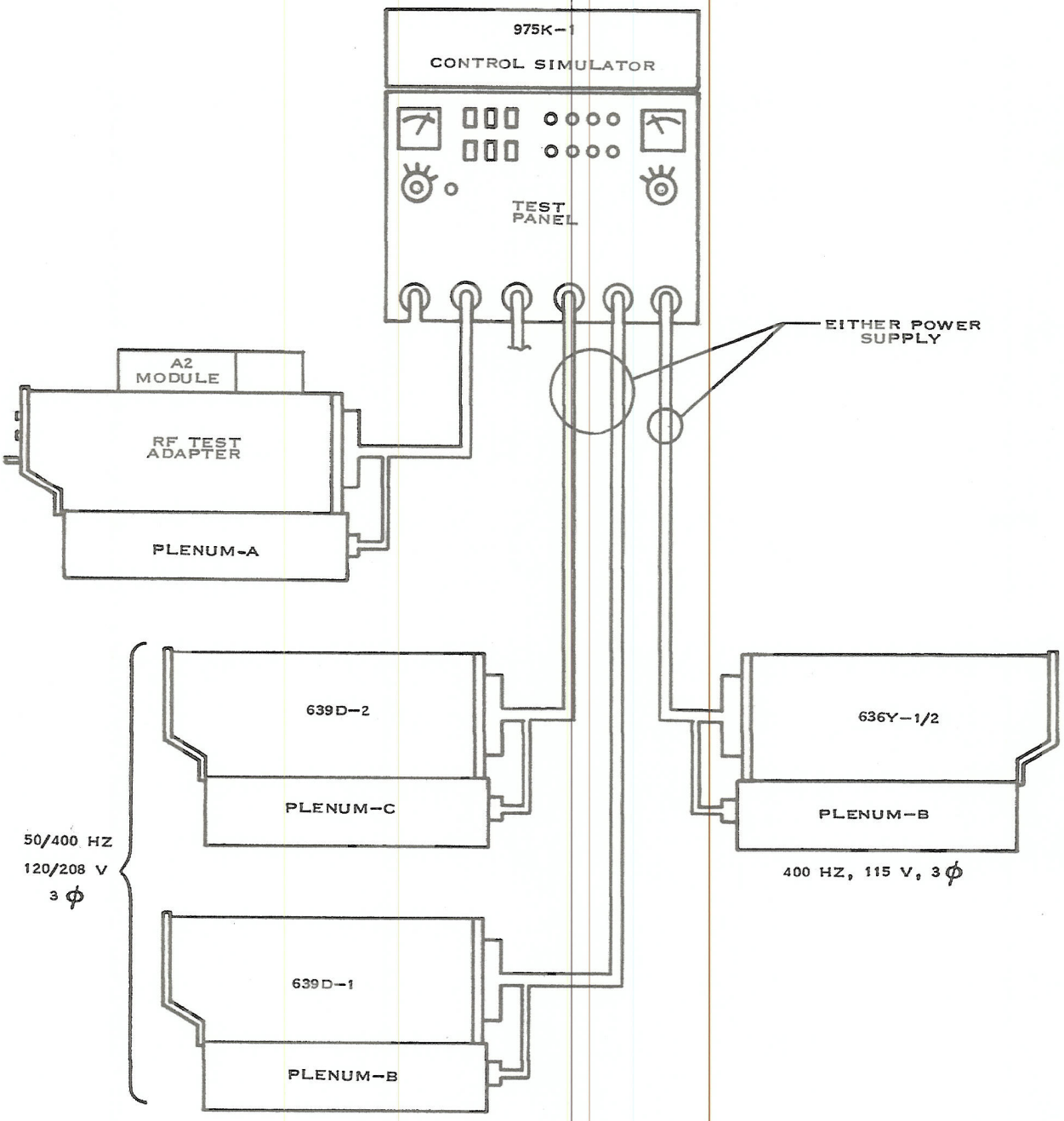


Figure 3-6. 648A-1 Test Setup Using RF Test Adapter.

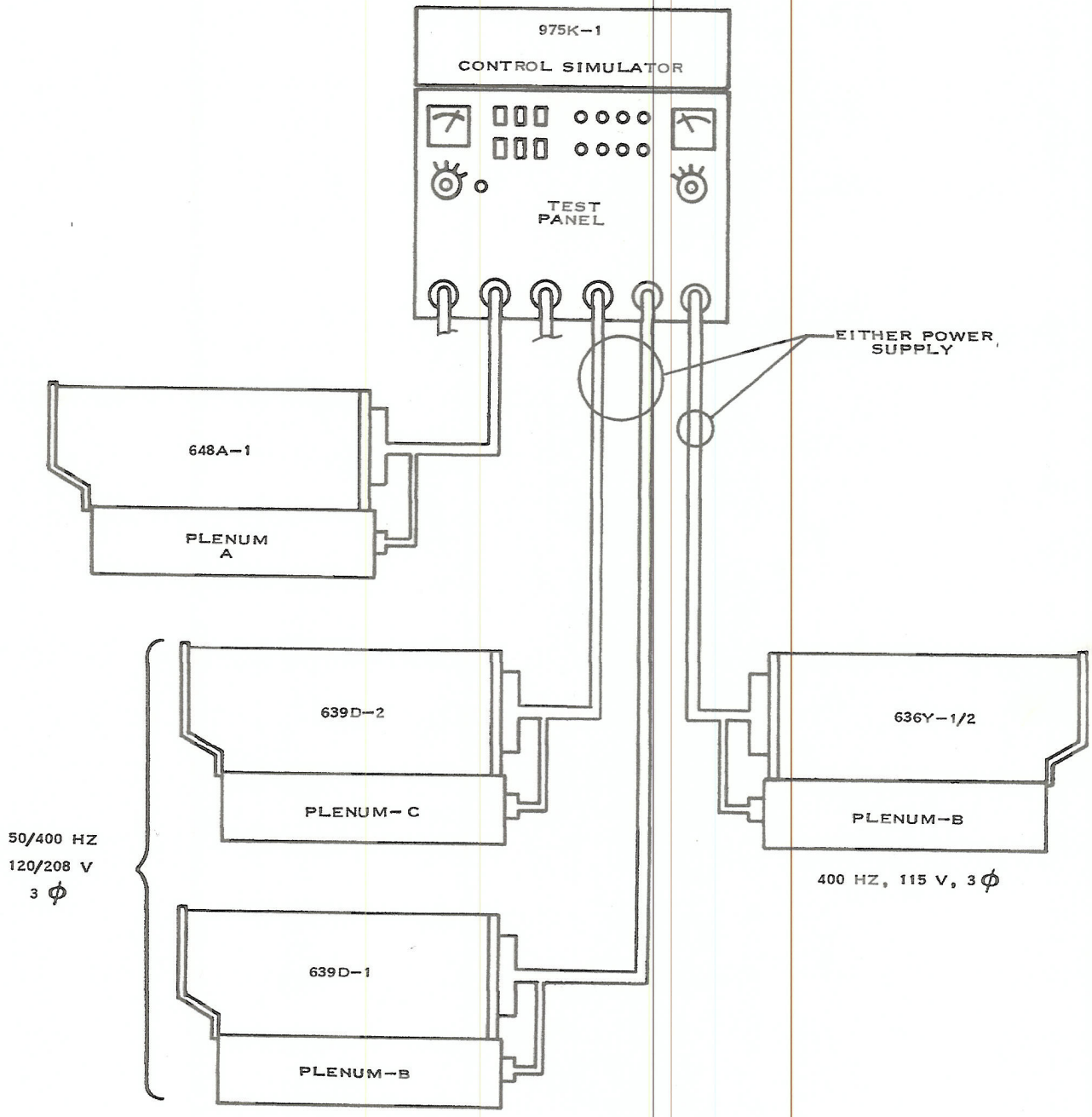


Figure 3-7. 648A-1 Test Setup.

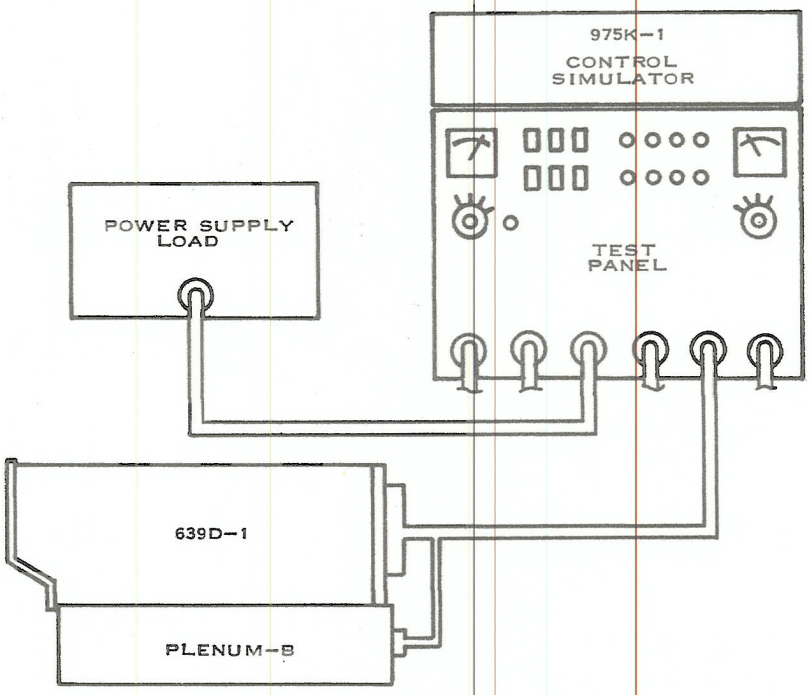


Figure 3-8. 639D-1 Test Setup.

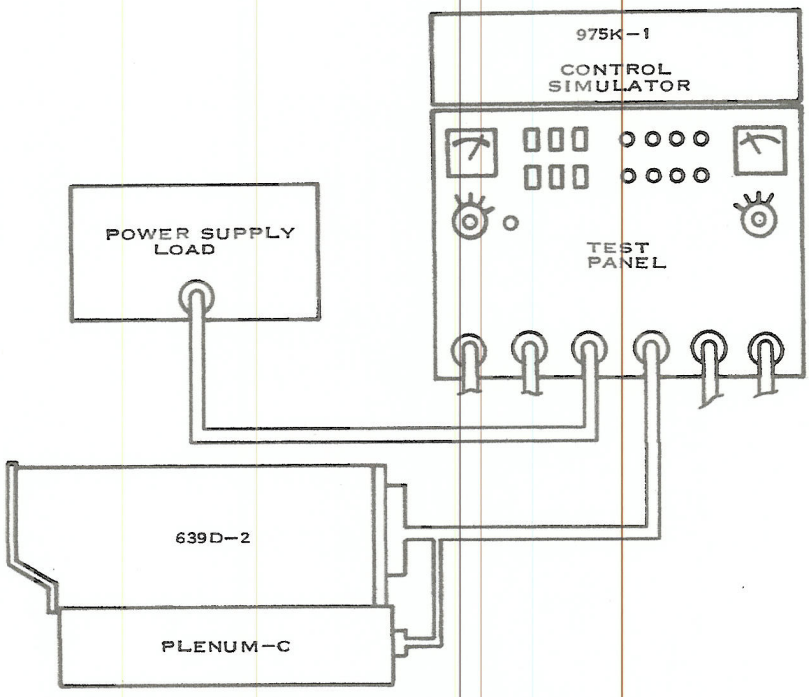


Figure 3-9. 639D-2 Test Setup.

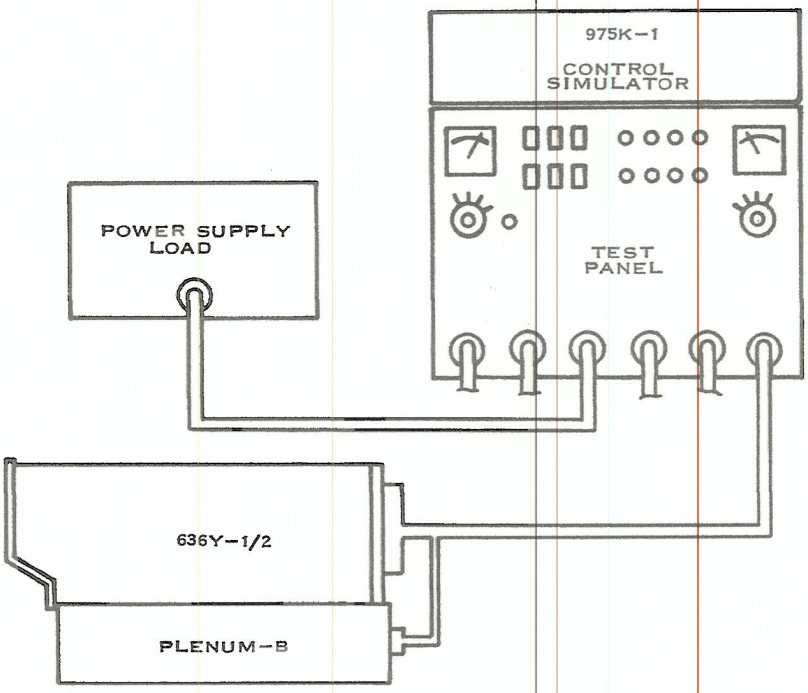


Figure 3-10. 636Y-1 Test Setup.

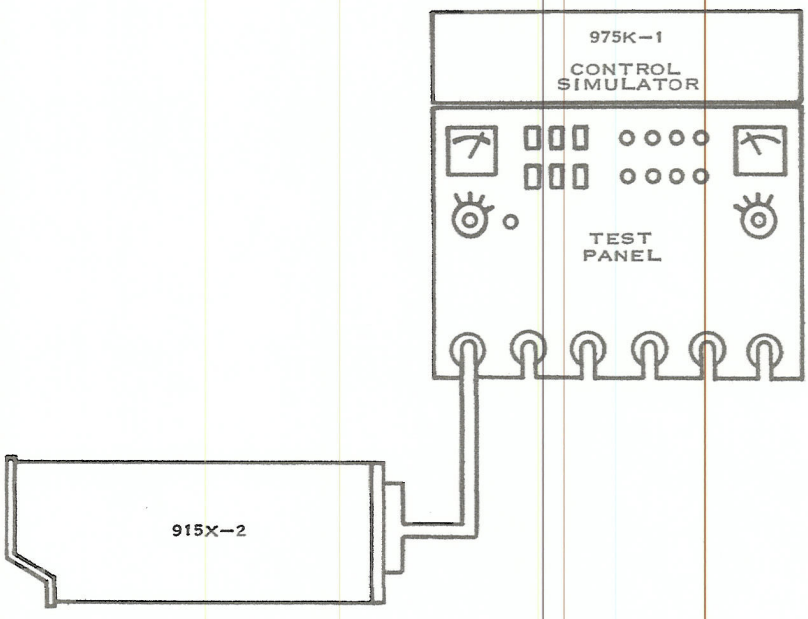


Figure 3-11. 915X-2 Test Setup.

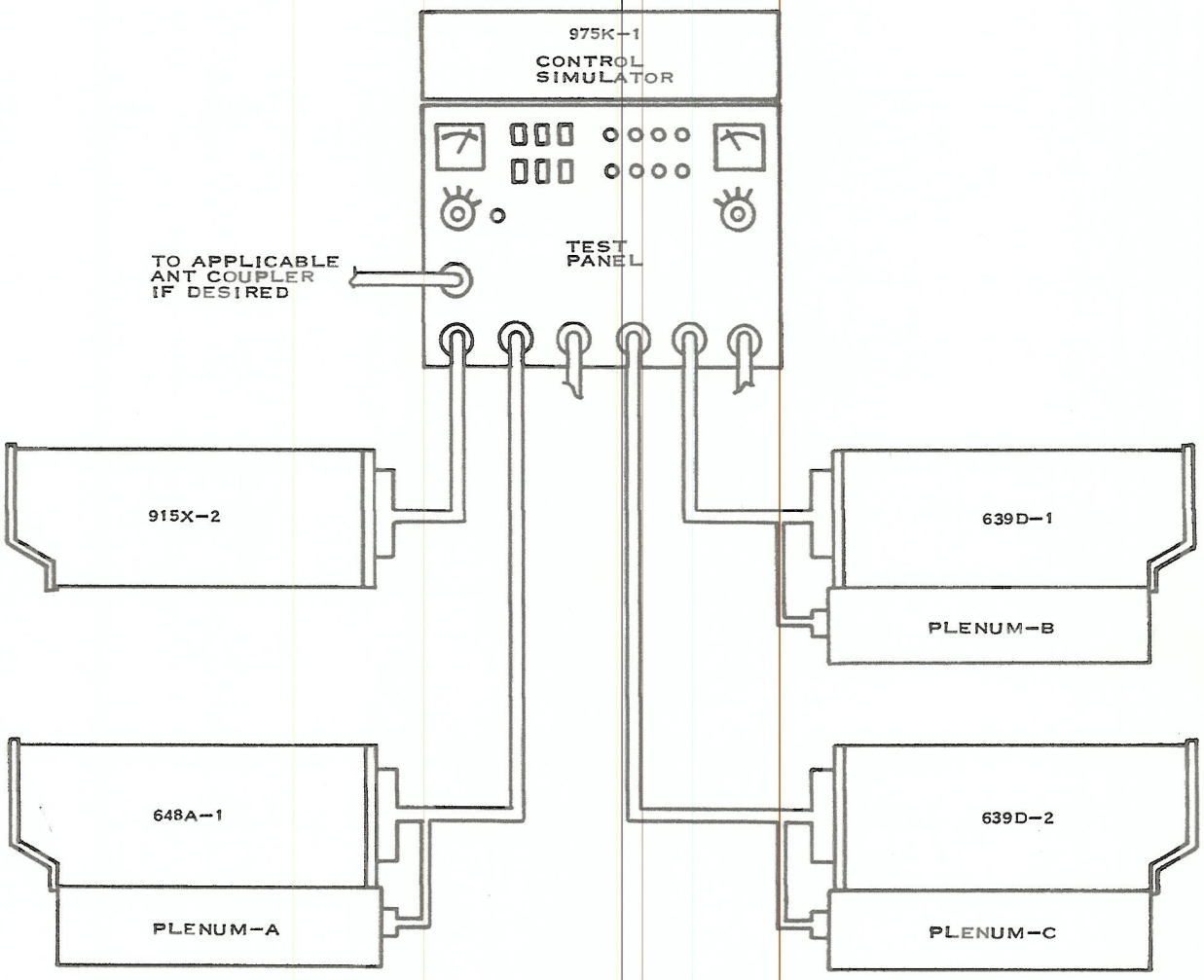


Figure 3-12. 548U-2 System Test.

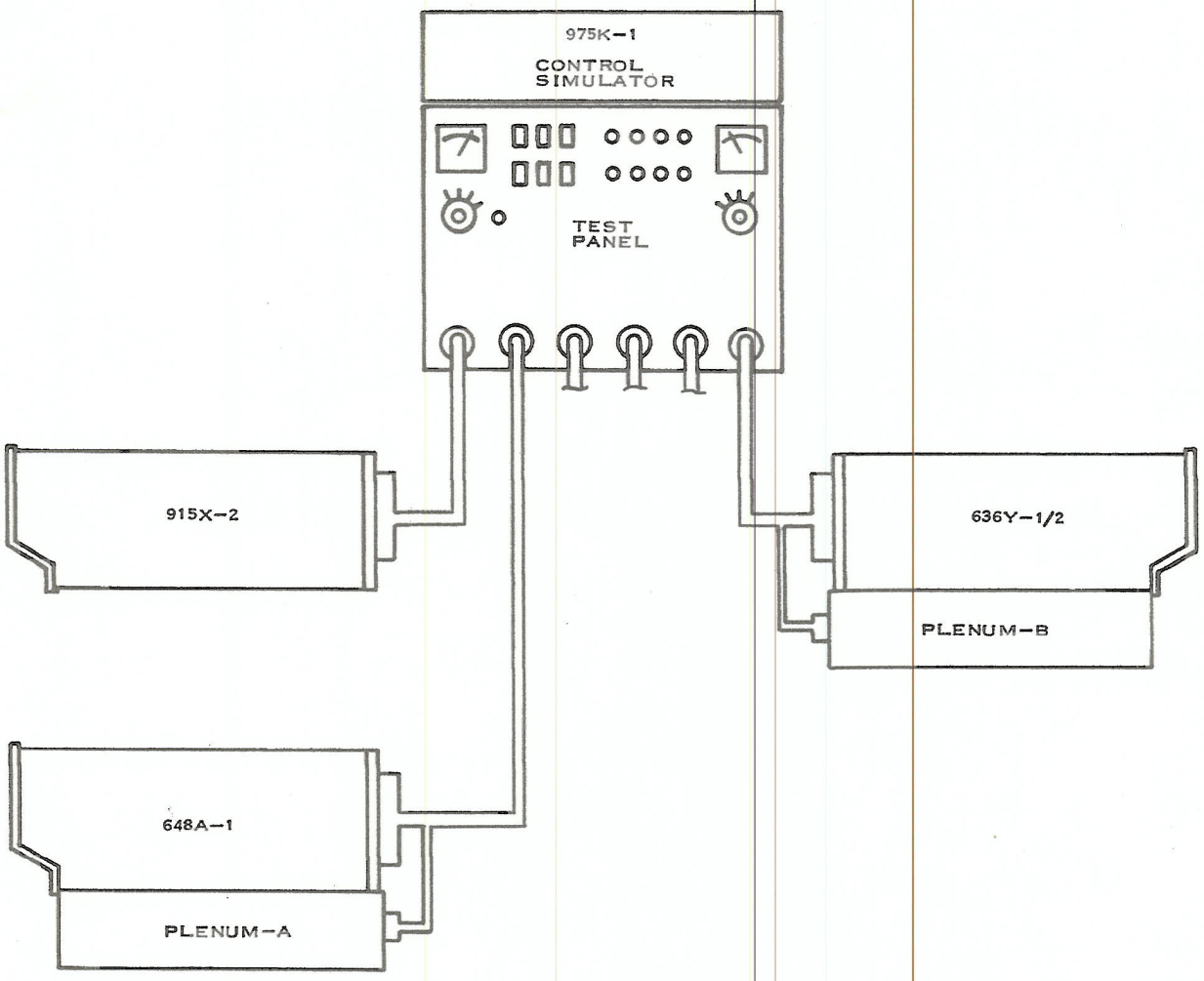


Figure 3-13. 548U-1 System Test.

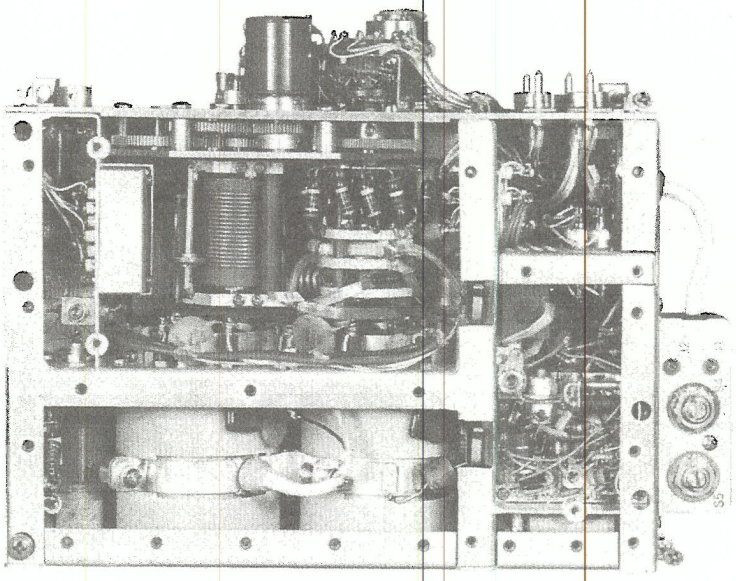


Figure 3-14. RF Amplifier Subassembly A2.

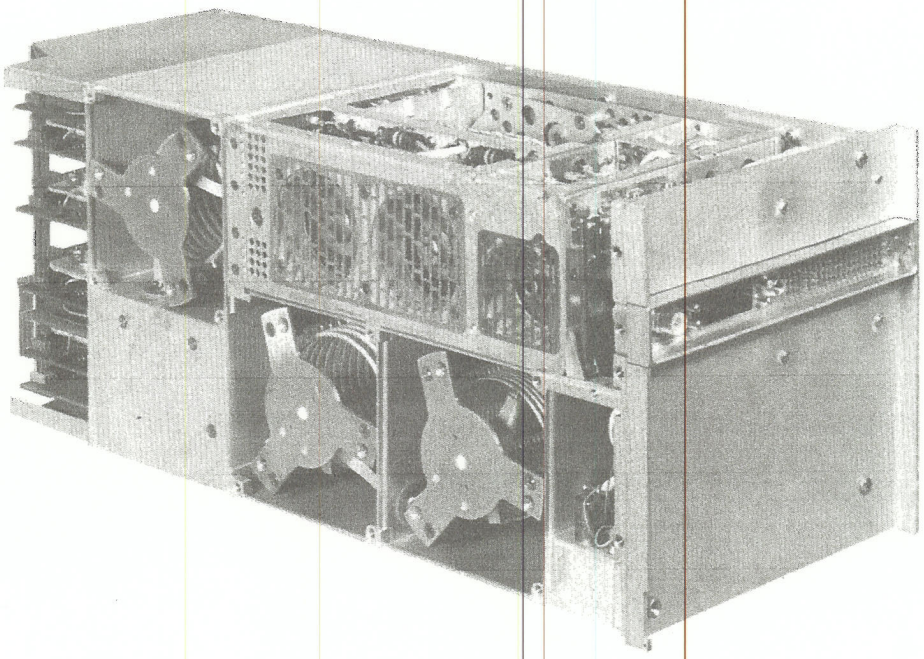


Figure 3-15. RF Amplifier Subassembly A2 Mounted in 648A-1/1P.

Standard test equipment used with the 975K-3 Test Set includes an rf signal generator, oscilloscope, vtvm, 50-ohm 1-kW rf load, and an rf spectrum analyzer. All nonstandard requirements and special interface adapters are supplied as part of the test set.

3.2 UNIT EXTENDER CABLES

3.2.1 Application

The unit extender cables are used to extend the ATR units from an operational equipment shelf for maintenanance purposes. Extension of the ATR units enables access to the test points and circuit cards and/or modules in the ATR unit.

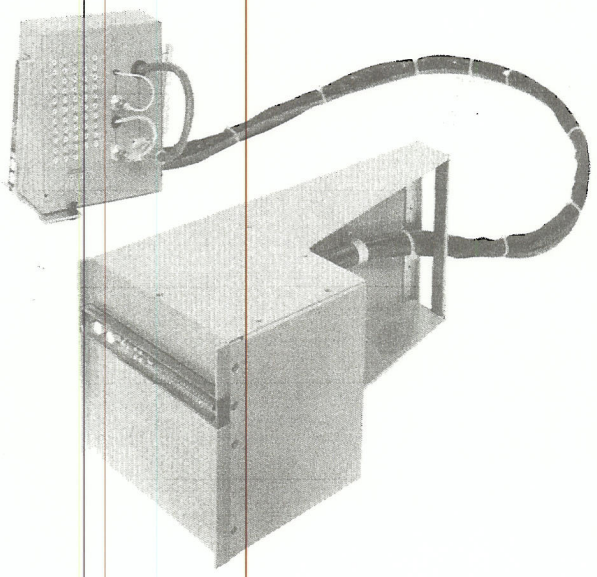


Figure 3-16. 548U-( ) Unit Extender Cables.

3.2.2 Description

ITEM	PART NUMBER	USED WITH
Extender cable	787-8155-001	648A-1 RF Amplifier
Extender cable	787-8162-001	639D-1P Power Supply
Extender cable	787-8163-001	639D-2P Power Supply
Extender cable	787-8152-001	915X-2 Digital Control
Extender cable		636Y-1/2 Power Supply

3.3 CARD AND MODULE EXTENDERS

3.3.1 Application

The card and module extenders (figure 3-17) are used to extend the card or modules from the ATR unit for maintenance purposes. Extension of the card or module, from the ATR unit, enables access to the test points and components on the circuit card or module.

3.3.2 Description

ITEM	PART NUMBER	USED WITH
Card extender	787-8174-001	648A-1 RF Amplifier
Card extender	787-8178-001	648A-1 RF Amplifier
Card extender	787-8179-001	648A-1 RF Amplifier
Card extender	787-8180-001	648A-1 RF Amplifier
Card extender	787-8181-001	648A-1 RF Amplifier
Card extender	787-8175-001	648A-1 RF Amplifier
Card extender	787-8176-001	648A-1 RF Amplifier
Card extender	787-8177-001	648A-1 RF Amplifier
Card extender	787-8182-001	639D-1P Power Supply

ITEM	PART NUMBER	USED WITH
Card extender	787-8184-001	639D-1P Power Supply
Card extender	787-8185-001	639D-1P Power Supply
Card extender	787-8186-001	639D-1P Power Supply
Card extender	787-8187-001	639D-1P Power Supply
Card extender	787-8188-001	639D-1P Power Supply
Card extender	787-8280-001	639D-2P Power Supply
Card extender	787-8183-001	639D-2P Power Supply
Card extender		636Y-1/2 Power Supply

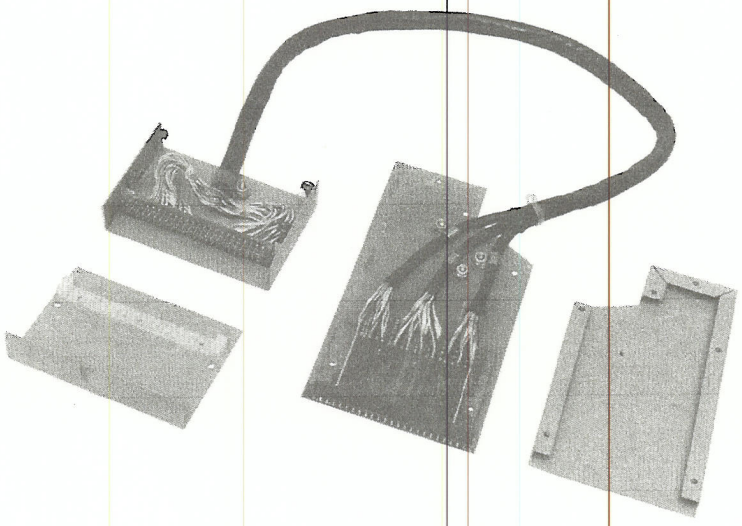


Figure 3-17. 548U-( ) Card and Module Extenders.

3.4 CARD OVERLAYS

3.4.1 Application

Card overlays are used as a troubleshooting aid. These overlays are available for those cards that do not have the test points and piece parts exposed for maintenance.

3.4.2 Description

ITEM	PART NUMBER	USED WITH
Card overlay	797-0021-001	915X-2 Digital Control
Card overlay	797-0022-001	915X-2 Digital Control
Card overlay	797-0023-001	915X-2 Digital Control
Card overlay	797-0024-001	915X-2 Digital Control
Card overlay	797-0026-001	915X-2 Digital Control
Card overlay	797-0027-001	915X-2 Digital Control
Card overlay	797-0028-001	915X-2 Digital Control

3.5 UNIVERSAL BLOWER

3.5.1 Application

The universal blower (figure 3-18) is used to provide cooling air to the ATR units when extended from the equipment shelf.

3.5.2 Description

ITEM	PART NUMBER	USED WITH
Universal blower	787-8154-001	636Y-( ) Power Supply 639D-( ) Power Supply 648A-1 RF Amplifier 652J-4 Power Supply

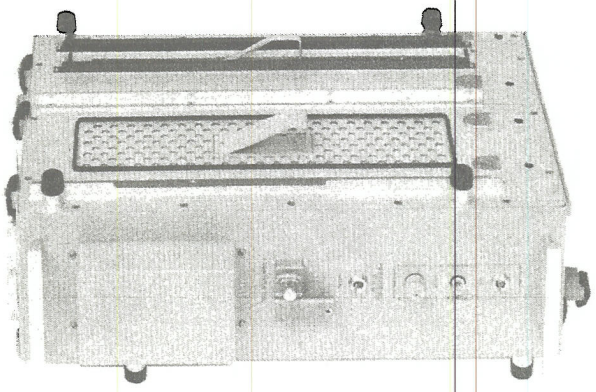


Figure 3-18. Universal Blower Unit.

3.6 TUNE SEQUENCE SELECTOR

3.6.1 Application

The tune sequence selector (figure 3-19) is used to manually interrupt and/or force a tune sequence of the 648A-1 RF Amplifier for maintenance purposes.

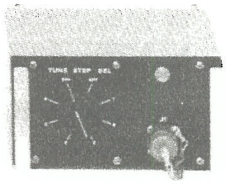


Figure 3-19. Tune Sequence Selector.

3.6.2 Description

ITEM	PART NUMBER	USED WITH
Tune sequence selector	787-8166-001	648A-1 RF Amplifier

3.7 CAPACITIVE LOAD

3.7.1 Application

The capacitive load (figure 3-20) is used to test and adjust the 648A-1 RF Amplifier.

3.7.2 Description

ITEM	PART NUMBER	USED WITH
Capacitive load	787-8193-001	648A-1 RF Amplifier

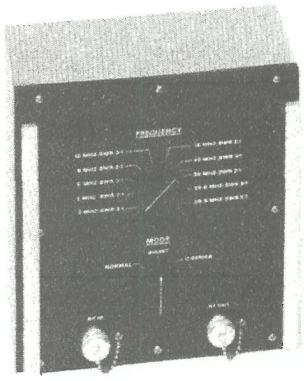


Figure 3-20. Capacitive Load.

3.8 RF COUPLER

3.8.1 Application

The rf coupler (figure 3-21) is used with the unit extender cables to check and adjust TGC and ALC of the exciter/power amplifier.

3.8.2 Description

ITEM	PART NUMBER	USED WITH
Rf coupler	622-0406-001	648A-1 RF Amplifier

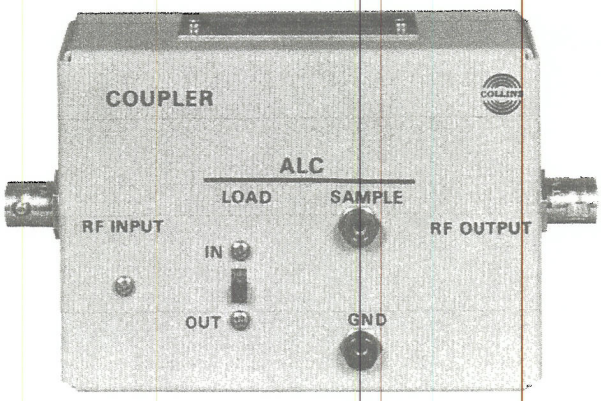
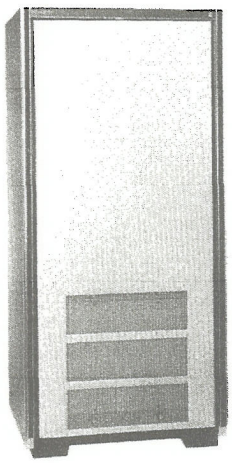


Figure 3-21. RF Coupler.

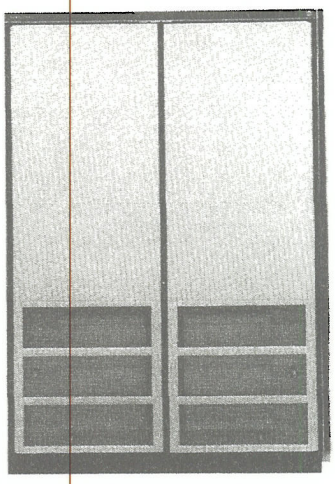
3.9 STANDARD TEST EQUIPMENT

The following standard test equipment (or equivalent) is recommended to complement the 975K-3 Test Set and/or the unit extender cables in support of the 548U-( ) 1-kW Power Amplifier.

ITEM	MANUFACTURER AND TYPE NO	FSN/VENDOR PN
Multimeter	AN/PSM-6	6625-643-1686
Rf voltmeter	Boonton 91 DA	6625-947-7559
Rf wattmeter	Sierra	AN/URM-120
Rf coaxial load	Bird 8890	6625-772-2592
Vtvm	HP 410C	6625-856-0466
Hf signal generator	HP 606A	AN/URM-25
Vector impedance meter	HP 4815A	6625-061-0225
Oscilloscope	Tektronix 545B	6625-892-5251
Capacitive voltage divider	HP 11040A	6625-628-6514
Probe coax T-connector	HP 11042A	6625-648-2756
Digital voltmeter	HP 3440A	6625-013-2630
Voltmeter plug-in	HP 3444A	6625-903-8098
Spectrum analyzer	HP E10-8553L	6625-105-8783
Two-tone rf generator	HP 540B	AN/URM-144
Source generator and display unit	Collins 7404A-1	777-1426-001
Test leads	Collins	787-8201-001 787-8202-001



208U-3A Linear Power Amplifier



208U-10A Linear Power Amplifier

4.1 975K-4 MAINTENANCE CONTROL PANEL TEST SET

4.1.1 Application

The 975K-4 Maintenance Control Panel provides field support for the 208U-3A and 208U-10A HF Linear Power Amplifiers. With this compact test set, the power amplifiers can be locally controlled and monitored by maintenance personnel while performing adjustments and isolating faults. The 975K-4 is placed in the ATR shelf of either the 208U-3A or 208U-10A in the space normally occupied by the 915X-1 Digital Interface Control. The test set is self-contained and obtains its operating power from the linear amplifier under test.

The 975K-4 Maintenance Control is built in a hinged "T" configuration so that it may be stored in minimum space. A photograph of the unit is shown in figure 4-1. All switches, lamps, and meters needed for local control, monitoring, and frequency selection are located on the front panel of the unit. An rf diplexing unit is available in addition to the 975K-4 for use when the 208U-3A or 208U-10A is driven locally from a standard rf signal generator.

4.1.2 Features

a. Compact, self-contained control
b. Local control of 208U-3A or 208U-10A
c. Selection and continuous hold of any of seven tuning sequence steps
d. Meters all critical circuits
e. Monitors fault conditions
f. Generates coarse positioning digital signals

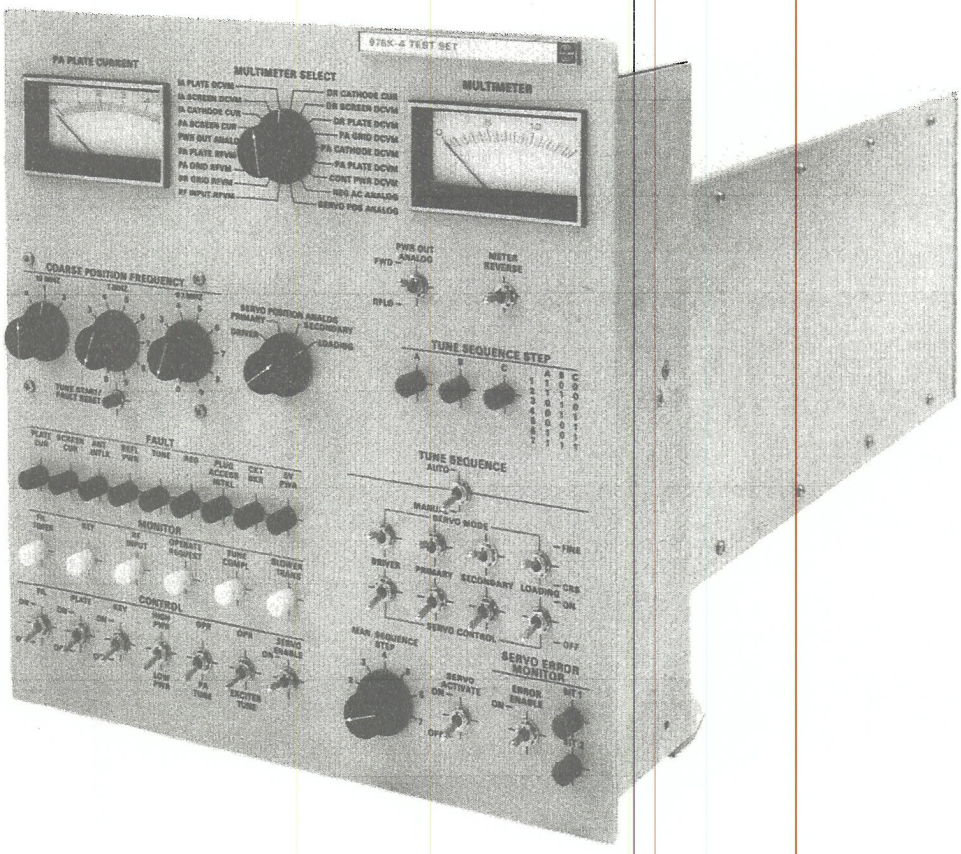


Figure 4-1. 975K-4 Maintenance Control.

4.1.3 Functions Tested

The 975K-4 Maintenance Control provides the following manual controls:

a. Frequency control for coarse positioning of the power amplifier tuning servos from 2.0 to 29.9 MHz in 100-kHz steps
b. Operational control of filament, plate, key, power level, tune/operate, servo enable, and auto/manual mode
c. Maintenance control of all tuning servos including the ability to control the power amplifier under test in any of the seven tune-sequence steps

Additionally, the 975K-4 provides metering of the following functions:

a. Plate current
b. Servo position analog (4)
c. Forward/reflected power
d. Rf input
e. Driver grid rf
f. Pa grid rf
g. Pa plate rf

h. Pa screen current
i. Input amplifier cathode current
j. Input amplifier screen Vdc
k. Input amplifier plate Vdc
l. Driver cathode current
m. Driver screen Vdc
n. Driver plate Vdc
o. Pa grid Vdc
p. Pa cathode Vdc
q. Pa plate Vdc
r. Control power Vdc
s. Regulated ac analog

Monitor indicator lamps also provide visual readout of the following fault conditions:

a. Plate current
b. Screen current
c. Antenna interlock
d. Reflected power
e. Tune sequence
f. Line regulator
g. Plug/access interlock
h. Circuit breaker
i. 5-volt power interrupt

4.1.4 Technical Details

A multimeter on the face of the 975K-4, combined with function selector switches, permits measurement of 22 analog metering samples. An additional panel-mounted taut-band meter displays the plate current analog continuously. Digital monitors for equipment operating mode, fault indication, servo error monitor, and tune sequence position are displayed on color-coded lamps.

Serial frequency data and timing signals for coarse positioning the power amplifier under test are generated by the frequency control unit of the 975K-4 Maintenance Control. Three panel-mounted switches provide frequency selection from 2.0 to 29.9 MHz.

The control and measurement functions provided by the 975K-4 give the maintenance personnel distinct advantages compared to monitoring of the 208U-3A or 208U-10A in an automatic system. In an automatically tuned system, it is not possible to hold the power amplifier in any one of its six preliminary tuning steps. Using the 975K-4 and an external standard signal generator as the excitation source, the operator can make multimeter measurements while pausing indefinitely in a particular tuning step. The ability to coarse position the tuning and loading servos gives the maintenance operator a means of servo positioning that is independent of the system status. Further, it facilitates set up of ALC and threshold levels that are otherwise difficult at the system level.

4.2 975K-2 TEST SET, ELECTRONIC CIRCUIT PLUG-IN UNIT

4.2.1 Application

The 975K-2 (792-6261-001) is a versatile electronic plug-in unit test set, designed to support ATR units in the 208U-3A and 208U-10A Power Amplifiers. This unit, which may be housed

in a portable carrying case (figure 4-2), provides a compact arrangement of test functions and provides power for the unit under test. Specific ATR units tested in the power amplifiers include the 652J-13 AC Power Supply, 333H-2 Servo Amplifier, 915V-1 and 915V-2 Internal Gain Control Units, 309F-1 Tune Sequence Control, and 915X-1 Digital Interface Control.

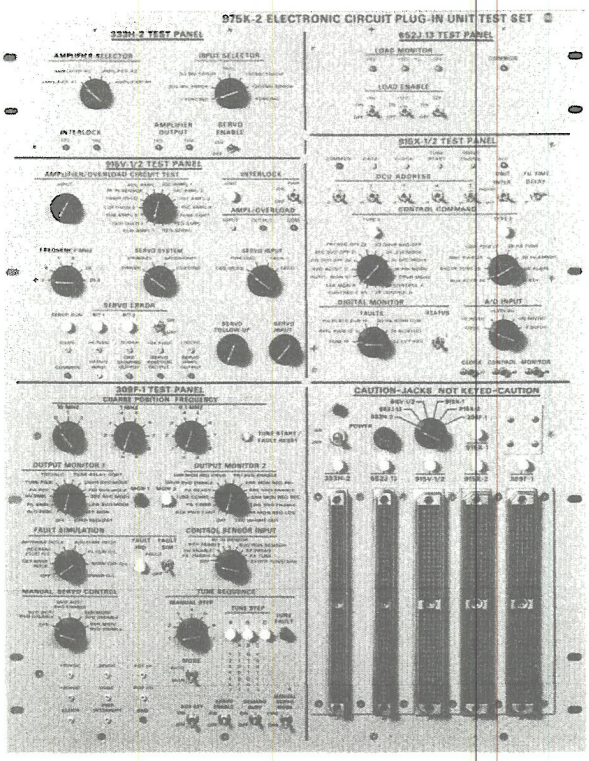


Figure 4-2. 975K-2 Module Test Set.

4.2.2 Features

a. Compact arrangement of test functions
b. Tests all operational plug-in ATR units of large power amplifiers
c. Provides easy determination of unit status
d. Provides critical circuit access through test points
e. Self-contained power supply
f. Provides complete set of extender cables with 100 percent ATR pin access
g. Sturdy carrying case provides safe storage capability (975K-2A).

4.2.3 Functions Tested

Functions tested by the individual test panel sections are described as follows:

a. 652J-13 Power Supply Test Section

The test section provides switched loads for +5, +12, and -12 volt power supply outputs. Test points provided on the test unit allow monitoring of the supply voltages. Tests that may be performed include output voltage at full load and no load, regulation, and ripple level.

b. 333H-2 Test Servo Amplifier Section

The test section provides a 2-level, positive and negative polarity input signal and a load resistance to individually test each of the four electronic control amplifiers of the ATR unit. Test points to monitor the gain and null condition as well as the enable function are provided. Power to the test unit is provided by the self-contained power supply.

c. 915V-1/2 Internal Gain Control Test Section

Specific coarse position frequency test points provide a means of testing the coarse position circuit card. The floating coarse position supply voltage is provided by the test set power supply. Logic level changes and output monitoring are implemented with switches and lamps.

d. 309F-1 Tune Sequence Control Test Section

The test section provides the fault simulation switches and visual displays required for testing or troubleshooting the 309F-1 Tune Sequence Control. A frequency control unit, consisting of three frequency selectors, generates the serial frequency data needed for operation of the d/a converter in the 309F-1.

Test points are also provided for monitoring d/a power supply voltages and d/a converter output.

e. 915X-1/2 Digital Interface Control Test Section

This section contains the fault simulation switches, test points, reference voltage sources, and visual displays needed to test the 915X-1/2 Digital Interface Control. Serial-digital control for the unit under test is provided by a 975K-1 Control Simulator or 7404A-1 Control Simulator.

4.2.4 Technical Details

This test set was designed to provide factory level test capability for ATR units in the large power amplifiers. Conventional circuits and components are used throughout to ensure good reliability at lower cost. Simplified test procedures are performed using controls and switches conveniently located on the operating panel. Results of these tests are either go or no-go, and are presented on a lamp display or test points. The tester also provides all local stimulus to perform the specific tests, eliminating the need for special auxiliary test equipment. Details of tests performed are covered in the following descriptions:

a. 652J-13 Power Supply Test Section

Regulation is tested under minimum/maximum loading condition for the ±12-Vdc and 5-Vdc supplies. Overload conditions are also provided to test the current overload control action.

b. 333H-2 Servo Amplifier Test Section

The 333H-2 contains four identical amplifiers. Open-loop test conditions provided by this tester make possible improved troubleshooting aids for each of the four units. Both plus and minus servo errors are provided for up to 200-mV input signal levels (that is, amplifier saturation level). Input null conditions are also part of the tests. Test goals require that all functional leads be exercised to determine proper operation.

c. 915V-1/2 Internal Gain Control Test Section

The internal gain control amplifier is one of the more diversified units of the pa due to the large number of nonrelated circuits that it houses. Tests are again established for worst case conditions. These included tests for nonlinear coarse outputs of 4 servos, fine tune gain, fine tune runaway of the pa loading circuit, servo error and servo summary performance. In addition, stimulus is provided and performance indicated for the line voltage regulator control. In the area of internal gain control of the pa, this tester provides references for 4 pa overload functions (IP, ISG, vswr, and rf input), inputs to test the plate and screen current metering functions, and voltage sources to 5 IGC inputs in the pa. Sharing of voltage references/sources reduces the number required as well as eliminating the need for external stimulus.

d. 309F-1 Tune Sequence Control Test Section

Testing and troubleshooting the 309F-1 Tune Sequence Control is provided by a test section containing a frequency control unit that generates serial frequency data needed to operate the d/a converter. The d/a power supply voltages and d/a converter output is monitored at test points provided on the test panel face. Critical system setup voltages are simplified when using this tester. Further capability is provided to determine that all tune cycle functions are performing properly. These include servo summaries, enables, fault timers, delays, tune-step counters, special control functions, interlocks, and overloads.

e. 915X-1/2 Digital Interface Control Test Section

Testing the 915X-1/2 Digital Interface Control is accomplished by a test section that contains fault simulation switches, test points, reference voltage sources, and visual displays as described earlier. Control inputs are supplied by the 7404A-1 or 975K-1 Control Simulator. Digital functions that are outputs of the 915X-1/2 are lamp displayed for simplicity. The tester also properly terminates all functional leads. Commands of the biphase control word, when correctly demodulated, furnish digital outputs for response by the tune sequence control. Other pa features, such as multiplexing of 24 bits of analog data for metering purposes, are tested by this unit.

The test set approach to maintenance of the 208U-3A and 208U-10A equipment provides improved test results outside of the closed loop environment of the system. In addition to offering a greater degree of safety from the high voltages present in the pa, it also improves the test confidence level, by providing for conditions simulating worst case. Other features include reduced risk in damage to interfacing boxes, and components of the pa. More flexibility in troubleshooting is also possible by providing preset stimuli for each phase of testing, and thereby reducing standard test equipment requirements.

The 975K-2 Test Set may be housed in a carrying case, which provides a convenient storage facility when the test set is not in use.

4.3 UNIT EXTENDER CABLES

4.3.1 Application

The unit extender cables are used to extend the ATR units from the 208U-3A/10A Power Amplifier for maintenance purposes.

4.3.2 Description

ITEM	PART NUMBER	USED WITH
Extender cable	787-8159-001	333H-2 Electronic Control Amplifier 652J-13 Power Supply 599Z-1 Adapter
Extender cable	787-8152-001	915V-1/2 Internal Control Amplifier 915X-1 Digital Control 309F-1 Tune Sequence Control

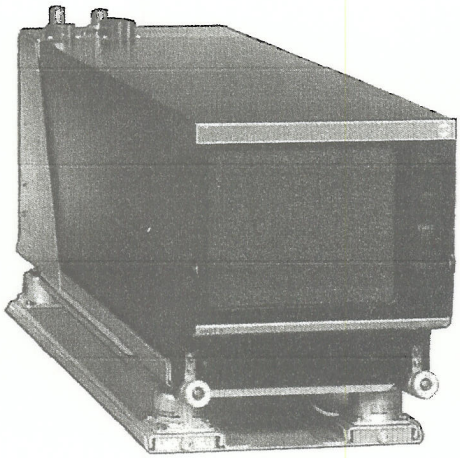
4.4 CARD OVERLAYS

4.4.1 Application

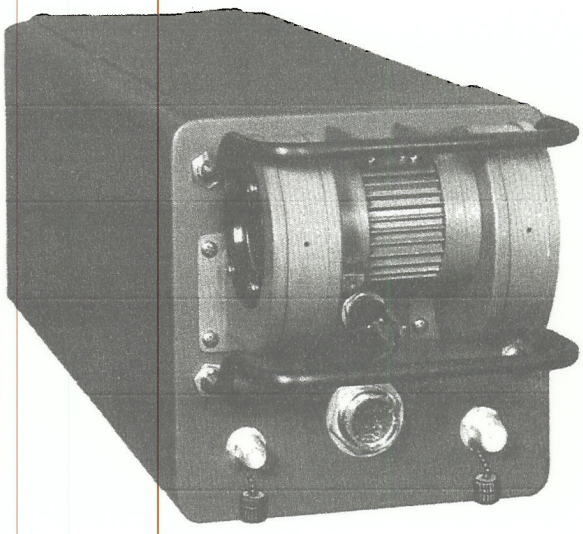
Card overlays are used as a troubleshooting aid. The overlays are available for those cards whose test points and piece parts are not exposed for maintenance.

4.4.2 Description

ITEM	PART NUMBER	USED WITH
Card overlay	797-0016-001	915V-1/2 Internal Control Amplifier
Card overlay	797-0017-001	915V-1/2 Internal Control Amplifier
Card overlay	797-0018-001	915V-1/2 Internal Control Amplifier
Card overlay	797-0015-001	915V-1/2 Internal Control Amplifier
Card overlay	797-0020-001	915V-1/2 Internal Control Amplifier
Card overlay	797-0021-001	915X-1/2 Digital Control
Card overlay	797-0022-001	915X-1/2 Digital Control
Card overlay	797-0023-001	915X-1/2 Digital Control
Card overlay	797-0024-001	915X-1/2 Digital Control
Card overlay	797-0026-001	915X-1/2 Digital Control
Card overlay	797-0027-001	915X-1/2 Digital Control
Card overlay	797-0028-001	915X-1/2 Digital Control
Card overlay	797-0025-001	915X-1 Digital Control
Card overlay	797-0029-001	309F-1 Tune Sequence Control
Card overlay	797-0030-001	309F-1 Tune Sequence Control
Card overlay	797-0031-001	309F-1 Tune Sequence Control
Card overlay	797-0032-001	309F-1 Tune Sequence Control
Card overlay	797-0033-001	333H-2 Electronic Control Amplifier
Card overlay		333H-2 Electronic Control Amplifier
Card overlay		915V-1/2 Internal Control Amplifier



490T-3 Antenna Coupler



490T-8 Antenna Coupler

5.1 980H-10 ANTENNA COUPLER TEST SET

5.1.1 Application

The 980H-10 Antenna Coupler Test Set provides a method of testing the subassemblies of the 490T-3/8 Antenna Coupler and a means of isolating defective modules and cards to the component level.

5.1.2 Features

a. Go/no-go determination of module under test without use of external test equipment.
b. Provides its own dc voltage, 400-Hz primary power only required.
c. Logic card test set designed to test new or modified logic cards by changing plug-in program boards.
d. Provides test bed for isolation to component level.
e. Three individual test sets allow simultaneous testing of several modules.

5.1.3 Functions Tested

The 980H-10 will test the following subassemblies of the 490T-3/8.

a. Discriminator A2
b. Coil and drive assembly A3
c. Coil and drive assembly A4

d. Coil and drive assembly A5
e. Capacitor and drive assembly A6
f. Capacitor and drive assembly A7
g. Servo amplifier A8
h. Power supply A12
j. Logic card A9 antenna coupler control no 1
k. Logic card A10 antenna coupler control no 2
l. Logic card A11 adapter-control

5.1.4 Technical Details

The 980H-10 test set consists of three splashproof carrying cases in which are mounted five test units.

5.1.4.1 Case No 1 Discriminator Test Unit

This test unit, shown as the right-hand case in figure 5-1, simulates the actual operating conditions under which the discriminator operates in the antenna coupler. A 50-ohm resistive load simulates a properly matched antenna coupler and antenna. Reactance switched in parallel with the resistive load simulates an unmatched antenna coupler and antenna. The discriminator error signals are monitored by the meter on the test panel. An rf source of 200 to 1000 watts, such as the 975K-3 Test Set and 548U-1 Power Amplifier, is required for use with this unit.

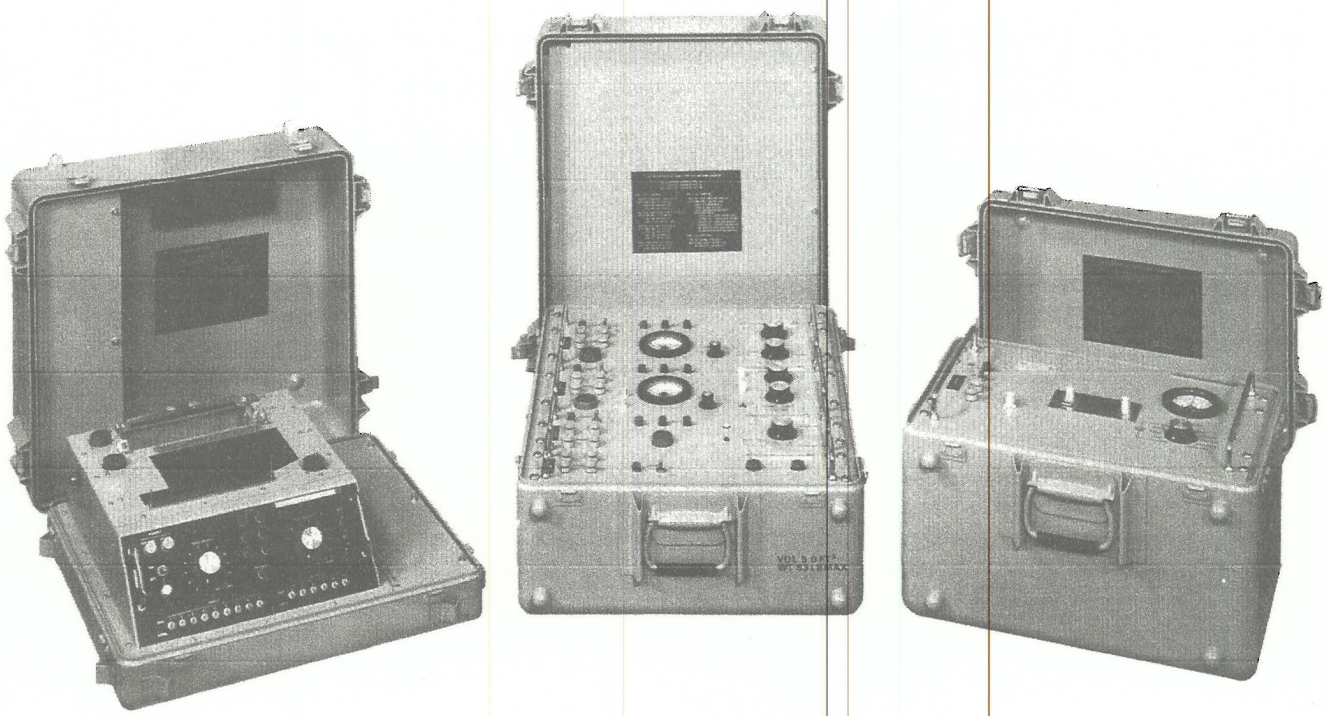


Figure 5-1. 980H-10 Antenna Coupler Test Set.

5.1.4.2 Case No 2 Power Supply/Servo Amplifier/Coil-Capacitor Test Unit

This test unit, shown as the center case in figure 5-1, contains individual test panels for testing the 490T-3/8 power supply, servo amplifier, and the five coil/capacitor tuning elements.

a. Power Supply Test Panel

This test panel measures voltage levels, frequency, and ripple of the various output voltages of the power supply and compares the measured parameter to a desired standard. Any excessive deviation from the standard is shown on a fault indicator on the test panel.

b. Servo Amplifier Test Panel

This test panel provides all voltages and circuits necessary to check both amplifiers on the A8 servo amplifier card. Positive and negative dc voltages are applied to the card to simulate error voltage inputs. A meter monitors the servo amplifier outputs. Loads are provided in the test set to simulate the dc motors normally driven by the amplifiers. Sense signals are monitored by test lamps; the 400-Hz clock, timer, arc fault, rf interlock, temperature fault, and power switching circuits are checked using a front panel selector switch and test lamps.

c. Coil-Capacitor Test Panel

The coil-capacitor test panel provides the voltages and controls required to operate the motor driven tuning elements and their associated wiring, relays, and limit switches. These tuning elements can be exercised while mounted in the coupler or they can be individually removed from the coupler and extended on a pendant cable for troubleshooting and repair.

5.1.4.3 Case No 3 Logic Card Test Unit

This test unit, shown as the left-hand case in figure 5-1, is used to test and troubleshoot the coupler control cards and adapter control card used in the 490T-3/8 Antenna Coupler. It consists of a manually programmable input logic generator, input selector circuits, output selector circuits, a comparator, a manually programmable output logic generator, and normal/fault indicators. Logic cards A9, A10, and A11 (except A11 CCCS) can be fully tested and fault isolated using only this test panel. Logic card A11 (CCCS) requires a 975K-1 or 7404A-1 control simulator to be connected to provide serial control inputs and to read monitor outputs from the card.

5.1.5 Advantages

The 490T-3/8 Antenna Coupler cannot be tested to a card, module, or replaceable assembly in a hot mockup or while operating normally. Removal of the side panels or extension of any of the subassemblies during normal operation results in erratic operation due to rf pickup from the antenna lead or from the tuning elements. Troubleshooting under these conditions is impossible and in some instances dangerous due to high rf potential. In addition, faulty components located in the logic circuit cannot be isolated during automatic operation due to rapid transition (in some cases microseconds) from one logic state to another.

5.2 ADDITIONAL SPECIAL TEST EQUIPMENT

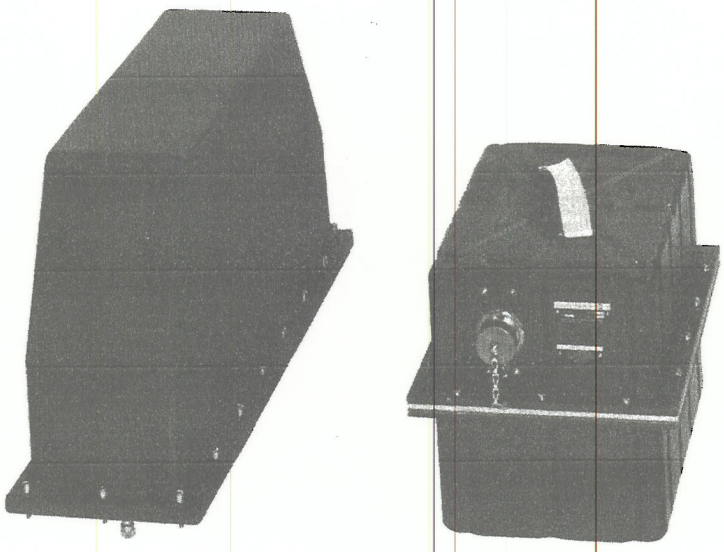
The following special test equipment (or equivalent) is required to support the 490T-3/8 Antenna Coupler:

ITEM	MANUFACTURER AND TYPE NO	FSN/VENDOR PN
Control simulator	Collins 975K-1	792-6045-001
Test set	Collins 975K-3	792-6262-001
Rf source	Collins 548U-1	777-1472-001

5.3 STANDARD TEST EQUIPMENT

The following standard test equipment (or equivalent) is recommended to complement the 980H-10 test set in support of the 490T-3/8 Antenna Coupler:

ITEM	MANUFACTURER AND TYPE NO	FSN/VENDOR PN
Multimeter	AN/PSM-6	6625-643-1686
Oscilloscope	Tektronix 545B	6625-892-5251
Vtvm	HP 410C	6625-856-0466



490X-1 Antenna Coupler and 309H-1 Antenna Coupler Control.

6.1 980H-11 ANTENNA COUPLER TEST SET

6.1.1 Application

The 980H-11 Antenna Coupler Test Set provides a method of testing the subassemblies of the 490X-1 Antenna Coupler and the 309H-1 Antenna Coupler Control and a means of isolating defective modules and cards to the component level.

6.1.2 Features

a. Go/no-go determination of module under test without use of internal test equipment.
b. Provides its own dc voltage, 400-Hz primary power only required.
c. Logic card test set designed to test new or modified logic cards by changing plug-in program boards.
d. Provides test bed for isolation to component level.
e. Three individual test sets allow simultaneous testing of several modules.

6.1.3 Functions Tested

The 980H-11 will test the following assemblies and subassemblies of the 490X-1/309H-1:

a. Discriminator
b. Coupler, including motor-driven tuning elements and chassis-mounted components
c. 309H-1 chassis including wiring and chassis mounted components

d. Servo amplifier board A6
e. Servo amplifier board A8
f. Servo compensation board A7
g. Device control unit A1
h. Device control functional element A2
i. Tune sequence board A3
j. Tune sequence board A4
k. Tune sequence board A5

6.1.4 Technical Details

The 980H-11 Antenna Coupler Test Set consists of three splashproof carrying cases in which are mounted five test units.

6.1.4.1 Case No 1 Discriminator Test Unit

This test unit, similar in appearance to the right-hand case shown in figure 6-1, simulates the actual operating conditions under which the discriminator operates in the 490X-1 Antenna Coupler. A 50-ohm resistive load simulates a properly matched antenna coupler and antenna. Reactance switched in parallel with the resistive load simulates an unwanted antenna coupler and antenna. The discriminator error signals are monitored by the meter on the test panel. An rf source of at least 200 watts, such as the 975K-3 Test Set and 548U-1 Power Amplifier is required for use with this test unit.

6.1.4.2 Case No 2 Servo Amplifier/Coupler/Chassis Test Unit

This test unit contains three separate test panels mounted in a carrying case and will be similar in appearance to the center case shown in figure 6-1.

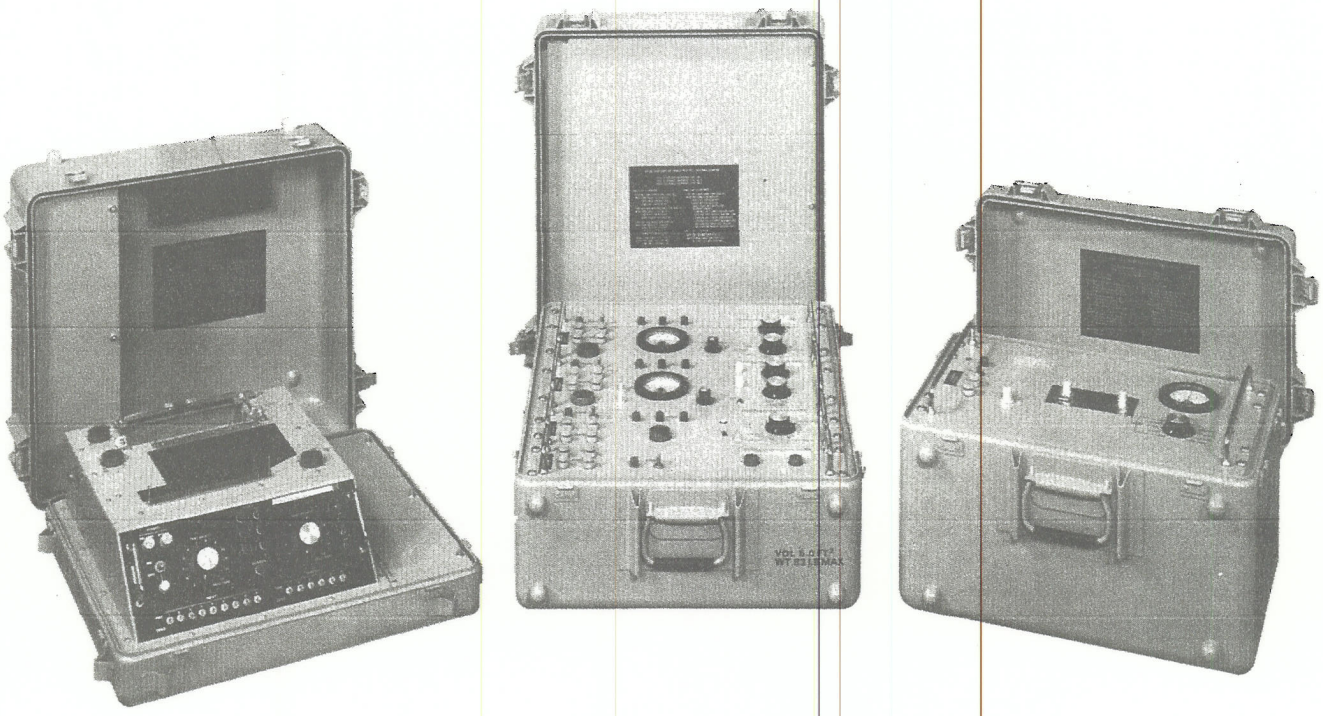


Figure 6-1. 980H-10 Antenna Coupler Test Set.

a. Coupler Test Panel

The coupler test panel checks the chassis wiring and chassis-mounted components, such as relays, resistors, capacitors, diodes, and switches, of the 490X-1 coupler. It also checks the motor-driven capacitors and their limit switches.

b. Chassis Test Panel

The chassis wiring and chassis-mounted components including the power supply of the 309H-1 Coupler Control are checked by the chassis test panel.

c. Servo and Servo Compensation Test Panel

This test panel provides all voltages and circuits necessary to check the A6 and A8 servo amplifier cards and the A7 servo compensation card. Positive and negative dc voltages are applied to the cards to simulate servo signal inputs and/or forcing voltages. Lamps monitor the servo outputs and servo sense signals. Loads are provided in the test set to simulate the dc motors normally driven by the servo outputs.

6.1.4.3 Case No 3 Logic Card Test Unit

This test unit is used to test and fault isolate the following cards used in the 309H-11. It is similar in appearance to the left-hand case of figure 6-1.

a. A1 -- DCU
b. A2 -- DCFE
c. A3 -- tune sequence 1
d. A4 -- tune sequence 2
e. A5 -- tune sequence 3

This test unit consists of a manually programmable input logic generator, input selector circuits, output selector circuits, a comparator, a manually programmable output logic generator, and normal/fault indicators. Logic cards A3, A4, and A5 can be fully tested and fault isolated using only this test panel. Logic cards A1 and A2 require a 975K-1 or 7404A-1 Control Simulator to be connected to provide serial control inputs and to read monitor outputs from the card.

6.1.5 Advantages

Because the antenna couplers tune automatically from an rf source, it becomes impossible to stop the operation of the coupler at any given point in order to check a questionable circuit or component when operating in a normal or hot-mockup fashion. In order to detect component or circuit failure, each individual plug-in subassembly must be tested in such a fashion that a suspect circuit or faulty component can be detected. This is accomplished by means of the various test panels described.

6.2 ADDITIONAL SPECIAL TEST EQUIPMENT

The following special test equipment (or equivalent) is required to support the 490X-1 Antenna Coupler and 309H-1 Antenna Coupler Control.

ITEM	MANUFACTURER AND TYPE NO	FSN/VENDOR PN
Control simulator	Collins 975K-1	792-6045-001
Test set	Collins 975K-3	792-6262-001
Rf source	Collins 548U-1	777-1472-001

6.3 STANDARD TEST EQUIPMENT

The following standard test equipment (or equivalent) is recommended to complement the 980H-11 Test Set in support of the 490X-1 Antenna Coupler and 309H-1 Antenna Coupler Control.

ITEM	MANUFACTURER AND TYPE NO	FSN/VENDOR PN
Multimeter	AN/PSM-6	6625-643-1686
Oscilloscope	Tektronix 545B	6625-892-5251
Vtvm	HP 410C	6625-856-0466