

T.O. 31R2-2URC-121

TECHNICAL MANUAL

**OPERATION AND MAINTENANCE INSTRUCTIONS
WITH ILLUSTRATED PARTS BREAKDOWN
(ORGANIZATIONAL/INTERMEDIATE)**

**RADIO FREQUENCY AMPLIFIER,
AM7224/URC, P/N 10087-0000**

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SAFETY SUMMARY

The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must at all times observe all safety regulations. Do not replace components with the power supplies turned on. Under certain conditions, dangerous potentials may exist when the power control is in the off position, due to charges retained by capacitors. To avoid casualties, always remove power and discharge circuits to ground before touching any circuit components. Remove watches and rings before performing any maintenance procedures.

DO NOT SERVICE OR ADJUST ALONE

Under no circumstances should any person reach into or enter the enclosure for the purpose of servicing or adjusting the equipment except in the presence of someone who is capable of rendering aid.

RESUSCITATION

Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Cardiopulmonary resuscitation procedures are outlined in T.O. 31-1-141-1, and annual refresher training requirements are outlined in AFOSH STD 127-50.

The following warnings appear in the text in this volume, and are repeated here for emphasis.

WARNING

Improper grounding of the 1 KW LPA equipment can cause HIGH VOLTAGE dangerous to life to be present on the equipment chassis in the event of a malfunction.

WARNING

Avoid breathing fumes generated by soldering. Eye protection is required.

WARNING

Voltages dangerous to life exist in this radio equipment. Before removing the top cover, disconnect the primary power and wait 30 seconds. This allows time for all voltages to bleed off.

HANDLING OF ELECTROSTATIC DISCHARGE SENSITIVE DEVICES (ESDS)

Electrostatic Discharge Sensitive Devices (ESDS) must be handled with certain precautions that must be followed to minimize the effect of static build-up. Consult T.O. 00-25-234, DOD Std-1686, and DOD HDBK 263. ESDS devices are identified in this technical order by the following symbol.



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GLOSSARY

A	Ampere(s)
A/D	Analog-to-Digital (Converter)
AFSK	Audio frequency shift keying; a baseband modulation scheme in which two audio frequencies are used to represent binary coded data; the frequency is shifted to one frequency to represent a 1 (mark) and to the other to represent a 0 (space).
AGC	Automatic gain control
ALE	Address latch enable
AM	Amplitude modulation; a modulation scheme in which the carrier is made to vary in amplitude in accordance with the modulating signal.
AME	Amplitude modulation equivalent
ANTIVOX	Prevents false VOX operation; see VOX
BFO	Beat Frequency Oscillator, used in SSB detection circuits
BIT	Built-in Test
BIU	Bus interface unit
BW	Bandwidth
CPU	Central processing unit
CREV	Converter reverse
CW	Continuous wave; a wave that does not vary in amplitude or frequency and is turned on and off to carry intelligence, e.g., Morse Code
D/A	Digital-to-Analog (Converter)
dB	Decibel(s)
dBm	Decibel(s) relative to one milliwatt
EMI	Electromagnetic interference
EPROM	Erasable programmable read-only memory
EU	Execution unit
HF	High frequency; a radio frequency band extending from about 3 MHz to 30 MHz; in this manual, HF includes 1.6 to 30 MHz.
HV	High voltage
IF	Intermediate frequency
IM	Intermodulation (distortion)
I/O	Input/Output
KREV	Keyer reverse
LCD	Liquid crystal display
LED	Light emitting diode
LPA	Linear power amplifier
LSB	Lower sideband; a modulation scheme in which the intelligence is carried on the first sideband below the carrier frequency; see SSB
MIC	Microphone
mA	Milliampere(s)
mV	Millivolt(s)
NBSV	Narrow band secure voice
PEP	Peak envelope power
PPC	Peak power control
PWB	Printed wiring board
RAM	Random access memory
rms	Root mean square
RTC	Real time clock
RX	Receive

GLOSSARY (Cont.d)

S TONE	Sidetone
SSB	Single sideband; a modulation scheme in which the intelligence is carried by one of the carrier sidebands, the other sideband and the carrier center frequency being suppressed
TGC	Transmitter gain control
TX	Transmit
uA	Microampere(s)
uP	Microprocessor
USB	Upper sideband; a modulation scheme in which the intelligence is carried on the first sideband above the carrier frequency; see SSB
uV	Microvolt(s)
Vac	Volts, alternating current
VCO	Voltage controlled oscillator
Vdc	Volts, direct current
VOX	Voice operated transmission
VSWR	Voltage standing wave ratio; the ratio of the maximum to the minimum voltage of a standing wave on a radio frequency transmission line
W	Watt(s)

INTRODUCTION

The purpose of this on-equipment level manual is to provide all information necessary for the installation, operation and on-equipment maintenance of Amplifier, Radio Frequency, AM-7224/URC, manufactured by the RF Communications Group of Harris Corporation, Rochester, New York. The manual is divided into eight chapters. The contents of each chapter are briefly described in the following paragraphs.

Chapter 1 provides a general description and a list of capabilities and limitations of the Amplifier, Radio Frequency, AM-7224/URC. A list of companion equipment references are included along with the components that form the AM-7224/URC.

Chapter 2 provides the information necessary for planning and carrying out the installation of the Amplifier, Radio Frequency, AM-7224/URC. A dimensional outline drawing is provided to show dimensions and other information required for proper installation.

Chapter 3 provides instructions for preparing the Amplifier, Radio Frequency, AM-7224/URC for use, including the initial application of power and checkout. Instructions for repacking the equipment for reshipment are also included in Chapter 3.

Chapter 4 provides complete operating instructions for the Amplifier, Radio Frequency, AM-7224/URC in all modes and contains a list of operating controls and indicators.

Chapter 5 provides a complete theory of operation for the Amplifier, Radio Frequency, AM-7224/URC. An overall theory and detailed theory of individual functional circuits are provided.

Chapter 6 describes the on-equipment location maintenance procedures. On-equipment location maintenance is based on the use of built-in test (BIT) features of the equipment to isolate problems to the replaceable subassembly or printed wiring board (PWB) level. Depot maintenance is supplied in a separate publication, T.O. 31R2-2URC-123. The Depot Manual is based on performance testing and trouble analysis of the subassembly or PWB to locate and replace faulty parts at the lowest replaceable unit level (LRU).

Chapter 7 contains the Illustrated Parts Breakdown (IPB) information at the on-equipment level. This includes assemblies and parts that may be replaced at the on-equipment location.

Chapter 8 contains all fold-out (FO) drawings. A cross reference list is provided as well as the individual drawings referenced throughout chapters 1 to 7. The diagrams are numbered FO-1, FO-2, etc. They are printed on sheets with page-size blank aprons to permit viewing the diagram with the rest of the book closed or opened to another page.

APPLICABLE SPECIFICATIONS

The following specifications, standards, and publications were used in the preparation of this manual.

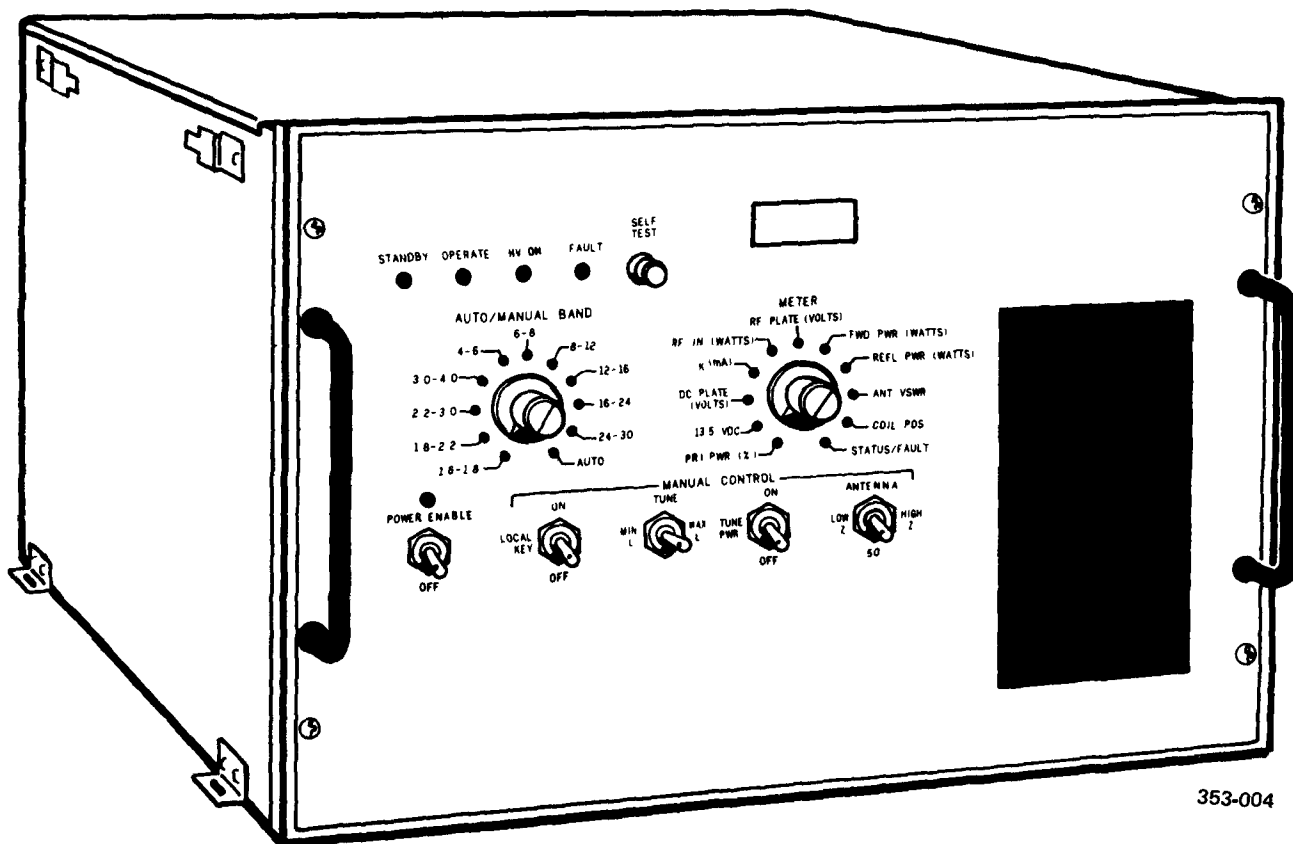
SPECIFICATION	NAME
MIL-M-38798B, para. 3.4	Combined Operation and Maintenance Instructions Manual (Equipment).
MIL-M-38807, Amend. 4	Preparation of Illustrated Parts Breakdown.
MIL-M-38790 and MIL-M-38784A	General Requirements for Preparation of Technical Manuals.

APPLICABLE STANDARDS

STANDARD	NAME
MIL-STD-12	Abbreviations for use on Drawings and in Technical Type Publications.
MIL-STD-15-1A	Graphic Symbols for Electrical Components.
MIL-STD-17-1	Mechanical Symbols.
MIL-STD-806	Graphic Symbols for Logic Diagrams.

APPLICABLE PUBLICATIONS

PUBLICATION	NAME
DOD 5200.20	Distribution Statements on Technical Documents.
USAS Y14.15-1966	Electrical and Electronic Diagrams.
USAS Y32.16-1968	Electrical and Electronic Reference Designations.
T.O. 31-1-141 (Series)	Technical Manual-Basic Electronic Technology and Testing Practices.



353-004

Figure 1-1. Radio Frequency Amplifier AM-7224/URC

CHAPTER 1

GENERAL INFORMATION

1-1. GENERAL DESCRIPTION AND PURPOSE. Radio Frequency Amplifier AM-7224/URC, shown in figure 1-1, and hereafter known as 1 KW LPA, is a microprocessor controlled power amplifier that amplifies the selected HF (high frequency) input signal from a 100 Watt Transceiver in the frequency range of 1.6 to 30 MHz. The output level delivered by the 1 KW LPA is 1000 watts PEP (peak envelope power) with multiple tone input signals, or 1000 watts average with lock keyed CW or a continuous single tone input signal. The 1 KW LPA tunes automatically in response to frequency data from the 100 Watt Transceiver and to its own internally generated fine tuning (servo) signals. Automatic tuning is accomplished in 10 seconds or less. The 1 KW LPA can also be tuned manually, using front panel controls.

a. Applications. The 1 KW LPA is used in applications where the 100 watt output of the 100 Watt Transceiver is not sufficient to provide for the desired level of communication. Built-in test (BIT) features provide fault indications in response to a test routine initiated either at the 100 Watt Transceiver, (in automatic mode), or at the 1KW LPA front panel in the manual mode. Fault indications are sent to the 100 Watt Transceiver for display as fault codes that aid in localizing malfunctions to the problem areas in the 1KW LPA.

b. Power Requirements. The 1KW LPA requires three externally supplied operating voltages: +3000 Vdc B+ for the grounded grid amplifier, 115 Vac filament voltage for the amplifier, and +13.5 Vdc for all general support circuit functions, and one sample voltage for biasing of the grounded grid amplifier. A separate power supply within the 1KW LPA converts a part of the +13.5 Vdc input to 115 Vac @ 400 Hz for the high efficiency fan.

c. Reliability. The 1 KW LPA is designed for continuous operation under severe environmental conditions. It is intended for fixed station applications. Automatic sensing circuits protect the LPA from damage due to overdriving, abnormal tuning, or high VSWR, including open or short circuit conditions, high and low line voltages, insufficient air flow, and/or overtemperature.

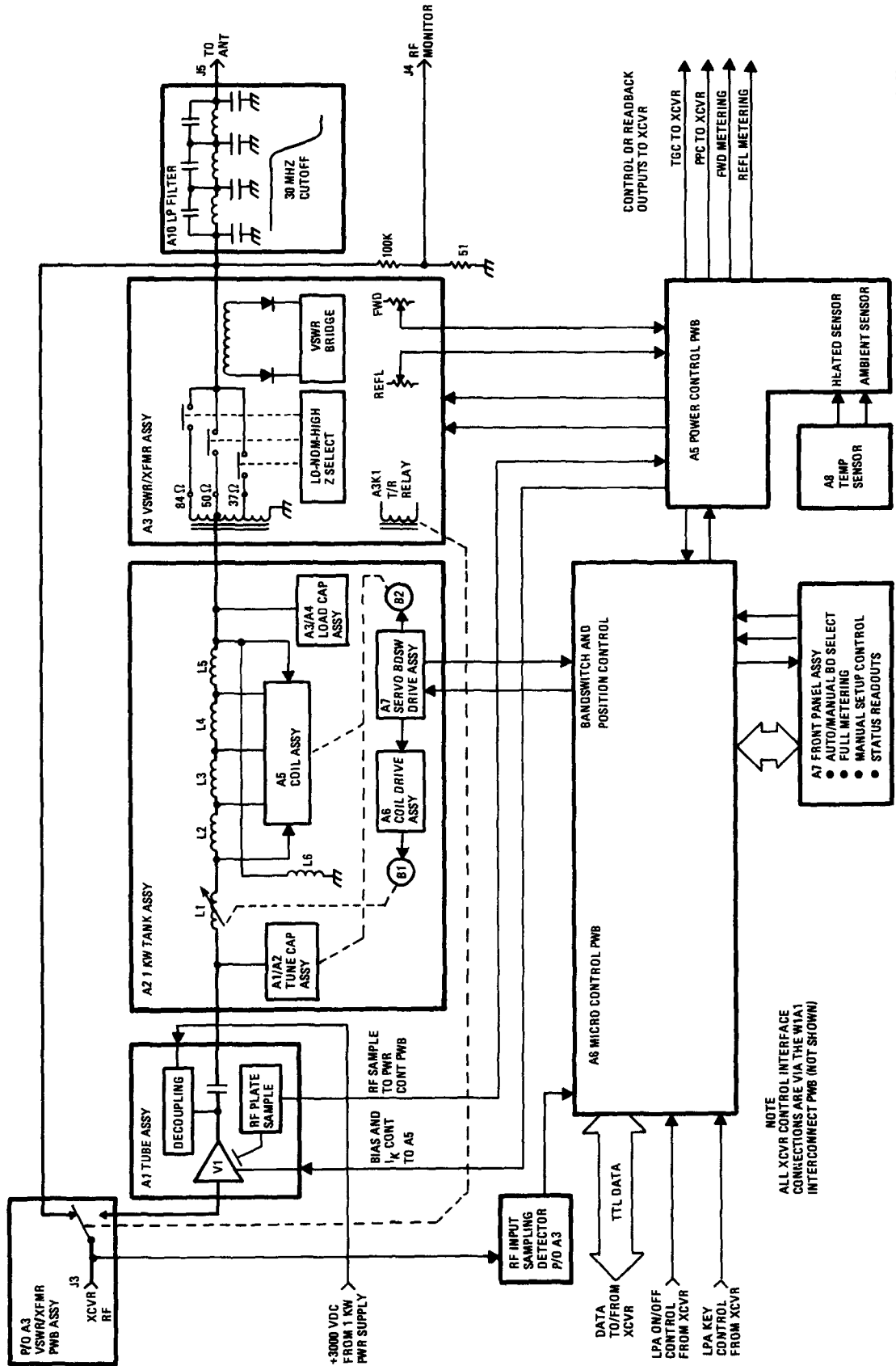
1-2. EQUIPMENT FUNCTIONAL DESCRIPTION. Figure 1-2 is a simplified functional diagram used to support the following discussion.

a. Signal Paths. Control, tuning, and support logic for the 1 KW LPA, including 100 Watt Transceiver interface data and parameters from Front Panel Assembly A7, are administered by Microprocessor Control PWB Assembly A6. Frequency information is sent to the LPA from the 100 Watt Transceiver upon initiation of a keyline command after a frequency change greater than 1%. This information is read by the microprocessor, which generates a bandswitch code that is applied through the Servo/Bandswitch Drive PWB Assembly A2A7 to an open-seeking bandswitch wafer. The microprocessor also determines the required direction of rotation of the tuning inductor to reach a pre-tune position and issues a MIN L or MAX L direction command to the coil servo. When both the inductor and the bandswitch have arrived at the pre-tune positions, the microprocessor initiates a fine tune sequence. This sequence is accomplished by calling for tune power from the 100 Watt Transceiver and monitoring the RF Plate voltage while adjusting the variable inductor slowly. When fine tuning has been completed, the 1 KW LPA informs the 100 Watt Transceiver that the PA Operate mode is established.

b. Outputs.

(1) In the transmit mode, the XCVR RF signal is routed by the T/R Relay on the VSWR/XFMR PWB Assembly A3 to Tube Assembly A1 where it is amplified. The RF signal then passes through tuned 1 KW Tank Assembly A2 to the impedance select circuit on VSWR/XFMR PWB Assembly A3. The RF signal is applied through a VSWR Bridge circuit on the VSWR/XFMR PWB Assembly to the Low Pass Filter Assembly A10 and to the ANTENNA connector J5 of the 1 KW LPA.

(2) In the receive mode, the RF signal from ANTENNA connector J5 is routed through the Low Pass Filter Assembly A10 to the XCVR RF connector J3 via the T/R Relay on the VSWR/XFMR PWB Assembly A3.



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Figure 1-2. Simplified Functional Diagram

1-3. MECHANICAL DESIGN. The mechanical construction of the 1 KW LPA is shown in figure 1-3. The unit consists of one major assembly with 11 subassemblies. The major assembly is 1KW LPA Chassis Assembly A1 which contains all of the subassemblies. The 11 subassemblies are: Tube PWB Assembly A1, Tank Assembly A2, VSWR/XFMR PWB Assembly A3, Fan Inverter PWB Assembly A4, Power Control PWB Assembly A5, Microprocessor Control PWB Assembly A6, Front Panel Assembly A7, Temperature Sensor PWB Assembly A8, Interconnect PWB Assembly A9, Low Pass Filter Assembly A10, and Fan Assembly B1. The tunable components of the 1 KW LPA are located in Tank Assembly A2. The top cover of the chassis assembly is removable so that all other assemblies are accessible for removal or maintenance.

1-4. LEADING PARTICULARS. The characteristics of the 1 KW LPA are summarized in table 1-1. This table includes physical data and operating/storage environment data.

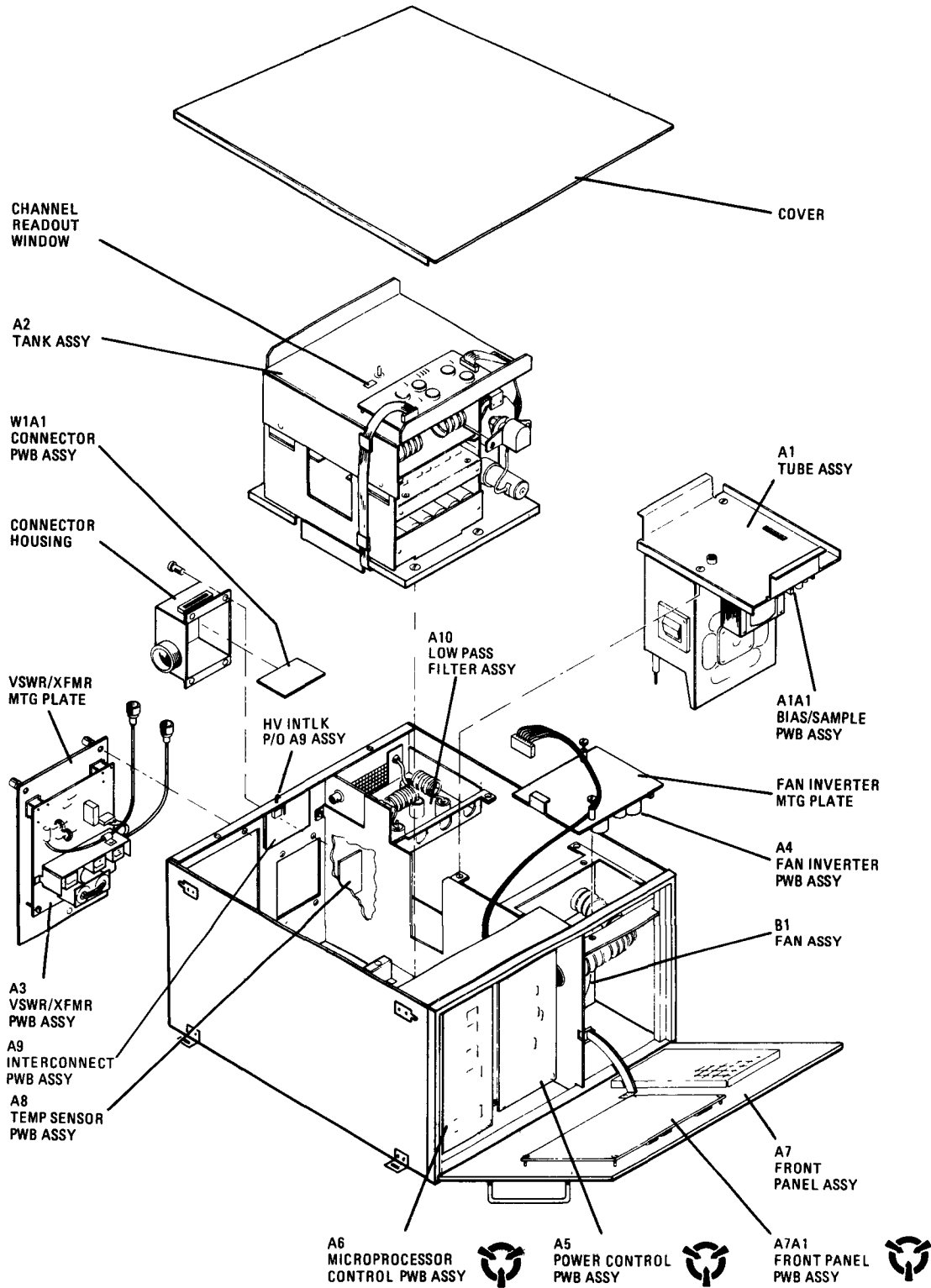
1-5. CAPABILITIES AND LIMITATIONS. The capabilities and limitations of the 1 KW LPA are described in table 1-2.

1-6. EQUIPMENT AND ACCESSORIES SUPPLIED. Table 1-3 lists the assemblies, components, units, cables, and accessory kits supplied with the 1 KW LPA.

1-7. EQUIPMENT REQUIRED BUT NOT SUPPLIED. Table 1-4 lists equipment required, but not supplied, for the installation and operation of the 1 KW LPA. It is specifically designed to interface with the equipment listed in table 1-4.

1-8. SPECIAL TOOLS AND TEST EQUIPMENT. The servicing and maintenance of the 1 KW LPA do not require any special tools, test jigs, or fixtures. All on-equipment maintenance uses the BIT feature, and replacement of indicated assemblies is completed with common hand tools, e.g., screwdriver, etc. Refer to the Depot Manual for a list of test equipment used to service this equipment at the Depot level.

1-9. RELATED PUBLICATIONS. Table 1-6 lists the technical order publications related to use of the 1 KW LPA.



353 006

Figure 1-3. Identification of Subassemblies

Table 1-1. Leading Particulars

Item	Characteristic Or Value
Dimensions: Height: Width: Depth:	10.50 inches (26.60 cm) 16.75 inches (42.54 cm) 20.00 inches (50.80 cm)
Weight:	40.00 pounds (18.18 kg) Crated weight is approximately 55.00 pounds (25.00 kg)
Mounting:	Rack or stack
Power Requirements:	Input Power with Power Supply PP-7913/URC: 115/208/230 Vac + 10%, single phase, at 50 to 400 Hz, 40/20/18 A maximum
Operating Environment:	Temperature: -30°C to +50°C Relative Humidity: 10% to 95% (non-condensing)
Storage Environment:	Temperature: -35°C to +70°C Relative Humidity: 10% to 95% (non-condensing)
Operating Altitude:	10,000 feet above mean-sea-level (MSL)
Transport Altitude:	40,000 feet above MSL
Shock/Vibration:	MIL-STD-810C
Cooling:	Convection and forced air (built-in fan)

Table 1-1. Leading Particulars (Continued)

Item	Characteristic Or Value
Cabling Requirements:	Rear Panel Connections J1 - PA-PS CONTROL J2 - XCVR CONTROL A3J3 - XCVR RF A3J4 - RF MONITOR A10J5 - ANTENNA
Transportability:	Manual methods apply
Setup Time:	Less than 1 hour

Table 1-2. Capabilities and Limitations

Description Of Characteristic	
Use:	Signal amplification from 100 watts to 1 KW between the 100 Watt Transceiver and the 1 KW Antenna Coupler (i.e., between Receiver-Transmitter, Radio RT-1446/URC and Antenna Coupler AN/URA-38().
Frequency Range and Tuning Capability:	1.6 to 30 MHz in AUTO or in ten MANUAL bands: Band 1 - 1.6 to 1.8 MHz Band 2 - 1.8 to 2.2 MHz Band 3 - 2.2 to 3.0 MHz Band 4 - 3.0 to 4.0 MHz Band 5 - 4.0 to 6.0 MHz Band 6 - 6.0 to 8.0 MHz Band 7 - 8.0 to 12.0 MHz Band 8 - 12.0 to 16.0 MHz Band 9 - 16.0 to 24.0 MHz Band 10 - 24.0 to 30.0 MHz
RF Drive Power Required:	65 watts for full power output

Table 1-2. Capabilities and Limitations (Continued)

Description Of Characteristic	
Maximum Rated RF Bypass Power:	100 watts average or 100 watts PEP
Maximum Rated RF Output Power:	With Power Supply PP-7913/URC 1000 watts continuous average power with a single-tone or CW input signal; 1000 watts PEP when loaded with two tones driven by the 100 Watt Transceiver.
Tuning Mode:	Automatic with Manual tuning backup. Automatic Tune Time - 10 seconds, Maximum.
Metering:	Forward power, reflected power, cathode current, DC plate voltage, RF plate voltage, VSWR, RF input power, 13.5 Vdc, and primary power
Channel Change Time:	5 seconds nominal
Nominal Output Impedance:	50 ohms
Working VSWR:	2:1 (self-protecting for any load)
Intermodulation Distortion:	Third order harmonic more than 33 dB down from the rated PEP output of two equal tones.
Harmonic Output:	More than 40 dB down
Features:	RF Protection Circuits protect the LPA from overdriving or abnormal tuning and from abnormal VSWR, including the condition of a short or open circuit. Automatic receive capability is available in unkeyed state. 1KW LPA can be remotely controlled from the 100 Watt Transceiver. Tests points and metering facilitate operation and maintenance. This unit provides high/low line protection and protection from overtemperature and low air flow conditions.

Table 1-2. Capabilities and Limitations (Continued)

Description Of Characteristic	
Primary Power Requirements:	115/208/230 Vac 170 W, standby (single phase) 425 W, operate (unkeyed) 3200 W, operate (keyed, 1 KW avg. power out)
Remote Capability:	100 feet (30.5 M) separation (maximum) between 100 Watt Transceiver and the 1 KW LPA 6 feet (1.83 M) separation (typical) between 1 KW LPA and 1 KW Power Supply 250 feet (76.2 M) separation (typical) between 1 KW LPA and 1 KW Antenna Coupler
Control Lines: (J1)	PWR ON : +13.5 Vdc H.V. ON : GND Filament : 115 Vac Filament : 115 Vac PWR ON Ret. : GND +13.5 Vdc : +13.5 Vdc B+ Sample : 0 - +30 Vdc +3000 Vdc : +3000 Vdc
Control Lines: (J2)	PPC - : GND PPC + : 5.6 volts (Threshold) TGC - : GND TGC + : 0 volts to 8 volts V REFLD : 4 volts = 1KW V FWD : 4 volts = 1KW LPA ON/OFF : 13.5 volts = ON RF MUTE : 0 volts = MUTE LPA KEY : 0 volts = KEYED DATA - : GND DATA + : 0 volts to 5 volts LPA ID : GND
Transceiver Interfaces:	RF coaxial cable and a 19-wire control cable (14 active and 5 spares)

Table 1-2. Capabilities and Limitations (Continued)

Description of Characteristic	
Antenna Coupler Interface:	RF coaxial cable
Tune Power Requirements:	20 to 40 watts carrier

Table 1-3. Equipment and Accessories Supplied

Qty	Item	Use
1	Amplifier, Radio Frequency AM-7224/URC	Amplify 100 Watt Transceiver output to 1KW

Table 1-4. Equipment Required But Not Supplied*

Qty	Item	Description
1	100 Watt Transceiver RT-1446/URC.	Companion equipment used for reception and transmission of RF signals.
1	Power Supply PP-7913/URC	Companion equipment used to supply high voltage to the 1 KW LPA.
1	Antenna	Required for reception and transmission of radio signals.
1 drop per screw	Loctite. #262 (Red)	Used to secure screws holding front panel handles.
1 drop per screw	Loctite. #222 (Violet)	Used to secure mounting screws for Connector PWB Assy and Low Pass Filter PWB Assy.

Table 1-4. Equipment Required But Not Supplied*

Qty	Item	Description
1	Ancillary Kit, 10087-0060, consisting of items listed below	Provides mounting hardware and interface connectors.
1	Connector, Recepticle 25 Pin 17-80250-16	Mates with J2 on rear of 1 KW LPA
1	Connector, Pins, 25 Pin, DBM25P	Mates with J8 on back of 100 Watt Transceiver
2	Hood, D Connector 25 Pos. 745173-2	Used with J22-0001-001 and J22-0001-002
2	Ferrule J55-0015-901	Used with J22-0001-001 and J22-0001-002
2	Connector, Pins, 12 Pin, 10087-0016	Mates with J1 on the back of the 1 KW LPA and the 1 KW Power Supply
2	Clamp, Cable J08-0002-243	Used with 10087-0016
4	Bracket, Stacking 10087-3106	Used with the 1 KW LPA
8	Post, Stacking 10087-3107	Used with the 1 KW LPA and the 1 KW Power Supply
1	Technical Manual TO 31R2-2URC-121	Contains installation and main- tenance procedures for the 1 KW LPA

* See table 6-3 for required test equipment.

Table 1-5. Optional Equipment

Qty	Item	Description
1	Remote Control Unit C-11329/URC	Companion equipment used where it is desired to operate the 100 Watt Transceiver from a remote location.
1	Coupler, Antenna AN/URA-38 ()	Companion equipment used to match the 1 KW LPA to the antenna system.

Table 1-6. Related Publications

Title	Publication No.
100/500 Watt Antenna Coupler, CU-2310/URC On-Equipment Manual Depot Manual Work Cards	TO 31R2-2URC-111 TO 31R2-2URC-113 TO 31R2-2URC-116WC-1
Receiver-Transmitter, Radio, RT-1446/URC On-Equipment Manual Depot Manual Work Cards	TO 31R2-2URC-81 TO 31R2-2URC-83 TO 31R2-2URC-86WC-1
Amplifier, Radio Frequency, AM-7223/URC On-Equipment Manual Depot Manual Work Cards	TO 31R2-2URC-101 TO 31R2-2URC-103 TO 31R2-2URC-106WC-1
Power Supply, PP-7913/URC On-Equipment Manual Depot Manual Work Cards	TO 35C1-2-892-1 TO 35C1-2-892-3 TO 35C1-2-892-6WC-1
Amplifier, Radio Frequency, AM-7224/URC On-Equipment Manual Depot Manual Work Cards	TO 31R2-2URC-121 TO 31R2-2URC-123 TO 35C1-2-892-6WC-1
Remote Control Unit, C-11329/URC On-Equipment Manual Depot Manual Work Cards	TO 31R2-2URC-91 TO 31R2-2URC-93 TO 31R2-2URC-96WC-1
Overall System Work Cards	TO 31R2-2URC-126WC-1
1KW Antenna Coupler Group, AN/URA-38A RF601 DR-525	TO 31R2-2URA38-1 TO 31R2-2TSC38-82 TO 31S1-4-228-1

CHAPTER 2

INSTALLATION

WARNING

Dangerous voltages exist in this radio equipment.
Before removing any covers, disconnect primary power.

Section I. INSTALLATION LOGISTICS

2-1. EQUIPMENT UNPACKING PROCEDURE. The 1KW LPA is packed in a corrugated cardboard box for shipment. A two-piece foam enclosure protects the equipment from rough handling.

a. When the unit is received, carefully inspect the exterior of the box. Look for any damage, signs of rough handling or weather exposure (e.g., water damage) or signs that the box may have been tampered with. If any of these conditions are present, carefully note and report them to the proper authority (refer to T.O. 00-35D-54). An external sticker on the shipping box provides additional instructions concerning inspection of the package.

b. Refer to figure 2-1 for instructions concerning unpacking the box. The box consists of double-walled cardboard with reinforced strapping tape. A sharp knife is required to open the box. Use the knife carefully to avoid injury. Keep the packing box in a secure place for possible future use.

c. After removing the equipment from the box, use the packing list in the ancillary package to verify the presence of each item in the shipment. Any shortages of items should be reported to the proper authority (refer to T.O. 00-35D-54).

d. The boxed equipment weighs a total of approximately 55 pounds. Use normal care to move the boxed equipment into the general location where it is to be installed. Once unpacked, the 1KW LPA weighs a total of 40 pounds and may be handled by one individual.

2-2. PREPARATION FOR INSTALLATION. Site selection is the most important consideration in

preparing for installation of the equipment. Details for site selection will vary depending on the use of the 1KW LPA.

2-3. SITE CONSIDERATION. A number of factors should be considered, from security to operational requirements, and it is the responsibility of the user to determine which has precedence. Each of the following items should be considered in site selection:

a. Power Source. Power requirements identified in table 1-1 should be observed (see chapter 1 of this manual).

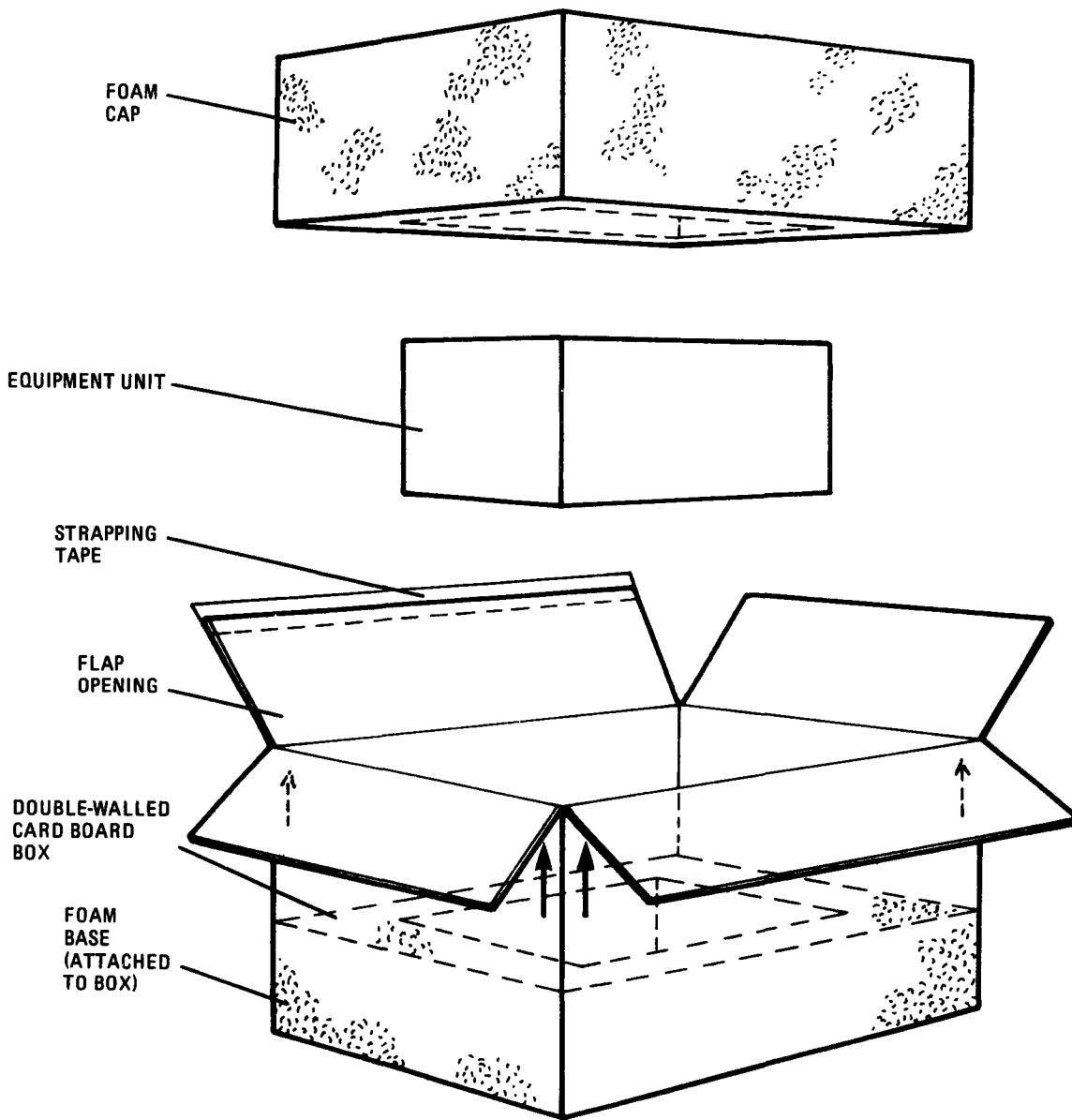
b. Loading. Depending on the installation method, be sure the selected space has adequate strength to support the weight of the equipment plus the weight of the associated 1KW Power Supply PP-7913/URC, which is approximately 175 pounds total.

c. Accessibility. Consider the space needed for access to the equipment for servicing, operating, and maintenance.

d. Transceiver Interface. Be sure the maximum length of the 1KW LPA control cable does not exceed 100 feet, and that the maximum distance between the 1KW LPA and the antenna coupler does not exceed 250 feet.

e. System Ground. Make sure the system is properly grounded for safety (e.g., lightning hazard) (refer to T.O. 31-10-24).

f. Environment. The 1KW LPA will operate normally over an ambient temperature range of -30°C to +50°C.

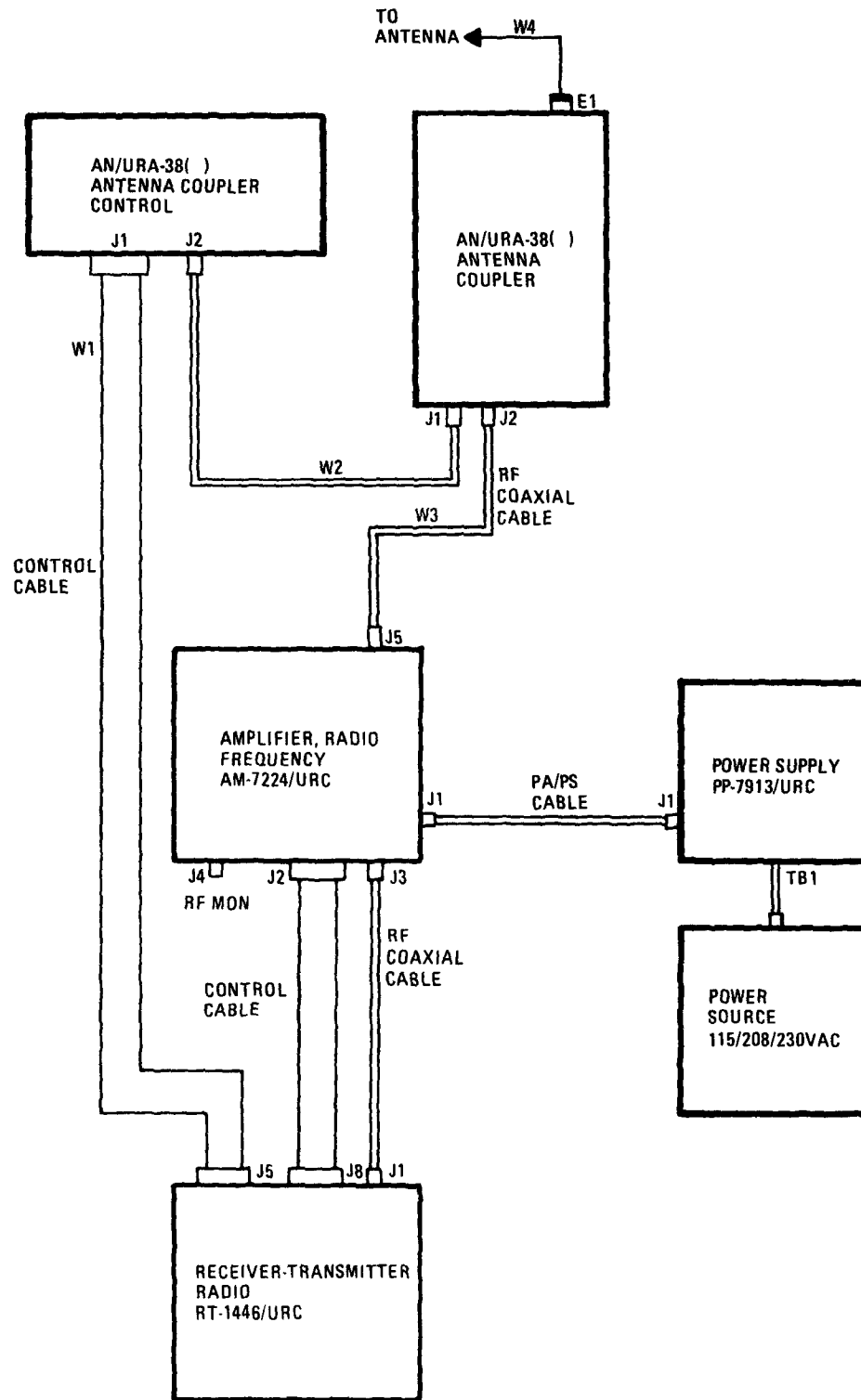


UNPACKING PROCEDURE

1. PLACE BOX ON FLOOR WITH ARROWS MARKED ON EACH SIDE POINTING UP.
2. CUT TAPE ON TOP OF BOX AND REMOVE FOAM CAP FROM BOX.
3. LIFT EQUIPMENT UNIT OUT OF BOX.
4. SAVE BOX AND FOAM CAP FOR RESHIPMENT.

350-003

Figure 2-1. Unpacking the Equipment



353 008A

Figure 2-2. Basic Equipment Configuration

T.O. 31R2-2URC-121

g. Interaction. All control interfaces are RF filtered to minimize interaction with other electronic equipment.

h. Heat Dissipation. Cooling in the 1KW LPA is accomplished by convection and forced air (built-in fan). Provide sufficient space for cooling air to enter and exhaust from the unit.

i. Servicing. Allow for space to store any replacement assemblies, servicing tools, and test equipment.

j. Companion Equipment. Since the 1KW LPA is to be operated in conjunction with some of the companion equipment identified in table 1-4 (see chapter 1 of this manual), additional considerations may be required as identified in the companion equipment manuals.

k. Mounting. Once the site has been selected, the method of mounting the equipment should be considered. Each mounting method requires a particular type of mounting hardware. The mounting holes at the sides of the equipment can be used for slide mounts, brackets, posts, etc., depending on the manner of installation. Most installations of the equipment will result in one of the mounting techniques described in the following paragraphs.

l. Installation Configuration. Figure 2-2 shows the basic equipment configuration in the 1KW LPA site installation. The 1KW LPA is connected between the 100 Watt Transceiver and the AN/URA-38() Antenna Coupler in the RF line. While both the 1KW LPA and

the AN/URA-38() Antenna Coupler have their own control interfaces with the 100 Watt Transceiver, the 1KW LPA interfaces with the 1KW Power Supply via the PA-PS control cable.

m. Grounding. Proper grounding of the 1KW LPA is recommended to prevent possible serious personnel hazards in the event of equipment malfunctions. Refer to T.O. 31-10-24. A good ground is 10 ohms or less.

WARNING

Improper grounding of the 1KW LPA equipment can cause HIGH VOLTAGE dangerous to life to be present on the equipment chassis in the event of a malfunction.

The ground straps should be constructed of wide copper strap or braid, and should be as short as possible. Ground straps should be clamped and bonded to a cold water pipe or other metal conductor that provides a good ground.

n. Typical 1KW LPA Installation. Cable type and installation precautions for this type of 1 KW LPA installation are basically the same as for an installation where an antenna coupler is not used. A typical stack mount 1KW LPA installation is shown in figure 2-3.

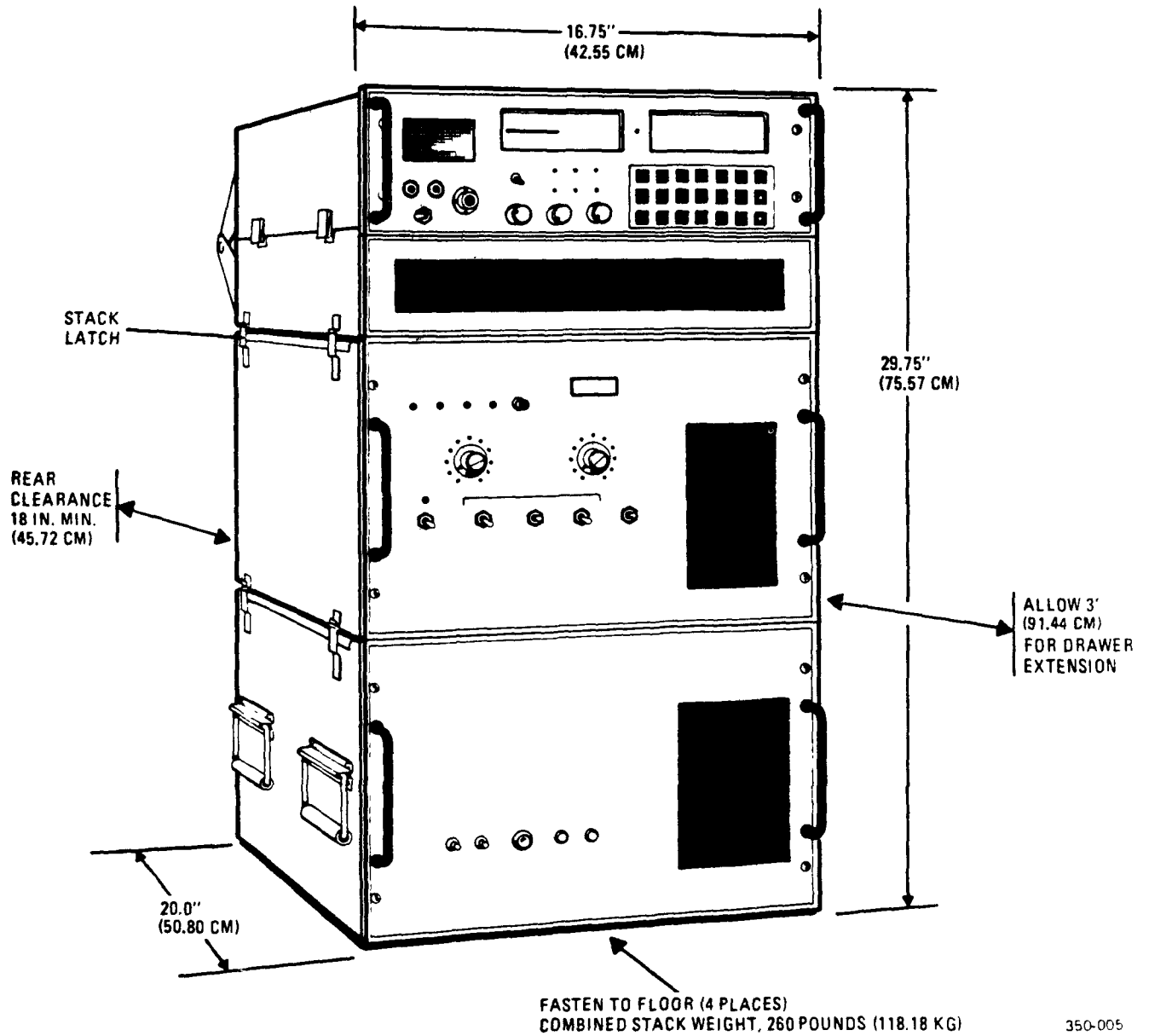


Figure 2-3. Typical Stack-Mount Installation

Section II. INSTALLATION PROCEDURE

2-4. INSTALLING THE EQUIPMENT. After unpacking the equipment and selecting the site, install the 1KW LPA as described in the following paragraphs.

a. Time Requirements. Installation should not take more than one hour regardless of the equipment configuration, not including the time necessary to install an antenna or any companion equipment, or to fabricate cables.

b. Tool Requirements. Installation is accomplished with common hand tools; e.g., socket wrenches, screwdrivers, pliers, etc.

c. Personnel Requirements. Equipment positioning requires one individual to lift and place the unit in position (two individuals are required to lift and place the 1 KW Power Supply in position). Once the equipment is positioned and secured, one person can complete the installation in approximately 30 minutes.

2-5. 1KW LPA STACK MOUNTING INSTRUCTIONS

a. Refer to table 1-1 for the 1KW LPA dimensions. Figure 2-4 illustrates these dimensions. Make sure that the mounting surface allows adequate room for ventilation intakes and outlets, and has proper clearance for cable interconnection.

b. Install the stack mounting brackets and mounting post, using the hardware provided in the ancillary kit and the screw holes provided in the chassis of the 1KW LPA.

c. Secure the 1KW LPA to the mounting surface, using appropriate hardware.

2-6. 1KW LPA RACK MOUNTING INSTRUCTIONS

a. Refer to table 1-1 for the 1KW LPA dimensions. Make sure that the mounting surface allows adequate room for ventilation intakes and outlets, and has proper clearance for cable interconnection.

b. Install slide mounting brackets and slides, using the appropriate hardware.

c. Carefully lift the LPA and insert the slides in the mounting rack slide brackets. Ensure that equipment is properly seated.

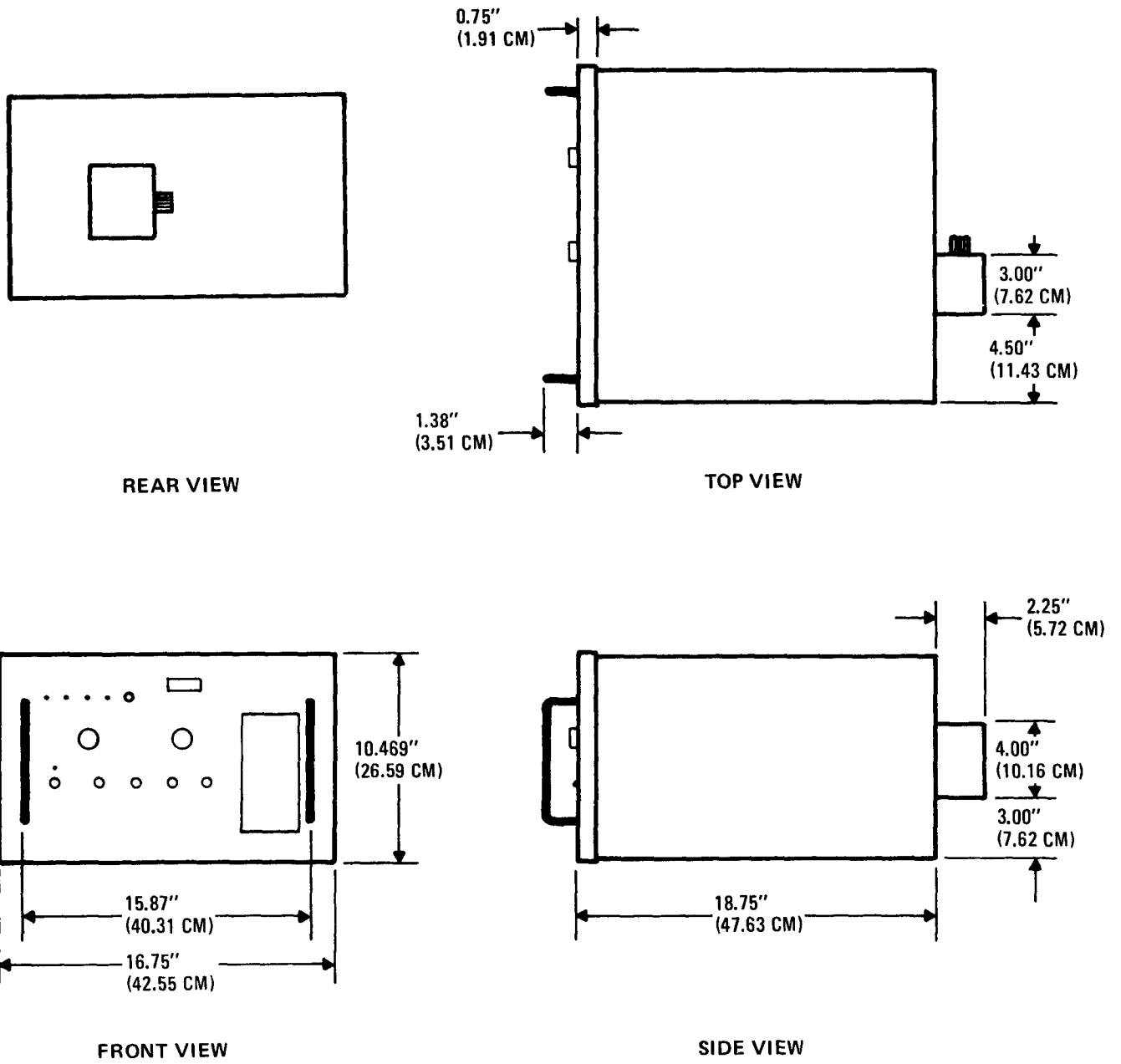
2-7. CABLING CONNECTIONS. After the equipment has been positioned and secured, fabricate and connect the 1KW LPA cables as described in the following paragraphs. Be sure the POWER ON/OFF switch is in the OFF position before connecting the equipment to any power source.

a. Interconnection and Interface. The user is responsible for fabrication of the cables. Refer to figure 2-2 for the identification of cables required for operation of the 1KW LPA. Figure 2-5 shows the locations of the rear panel connectors, and table 2-1 contains interconnection information.

b. Cable Fabrication. The fabrication of the control cable is shown in figure 2-6 (sheets 1, 2, and 3), and the fabrication of all RF coaxial cables is shown in figure 2-7.

CAUTION

High voltage wire must be a separate shielded wire rated at 20 KV as shown.



353 010

Figure 2-4. Dimensions

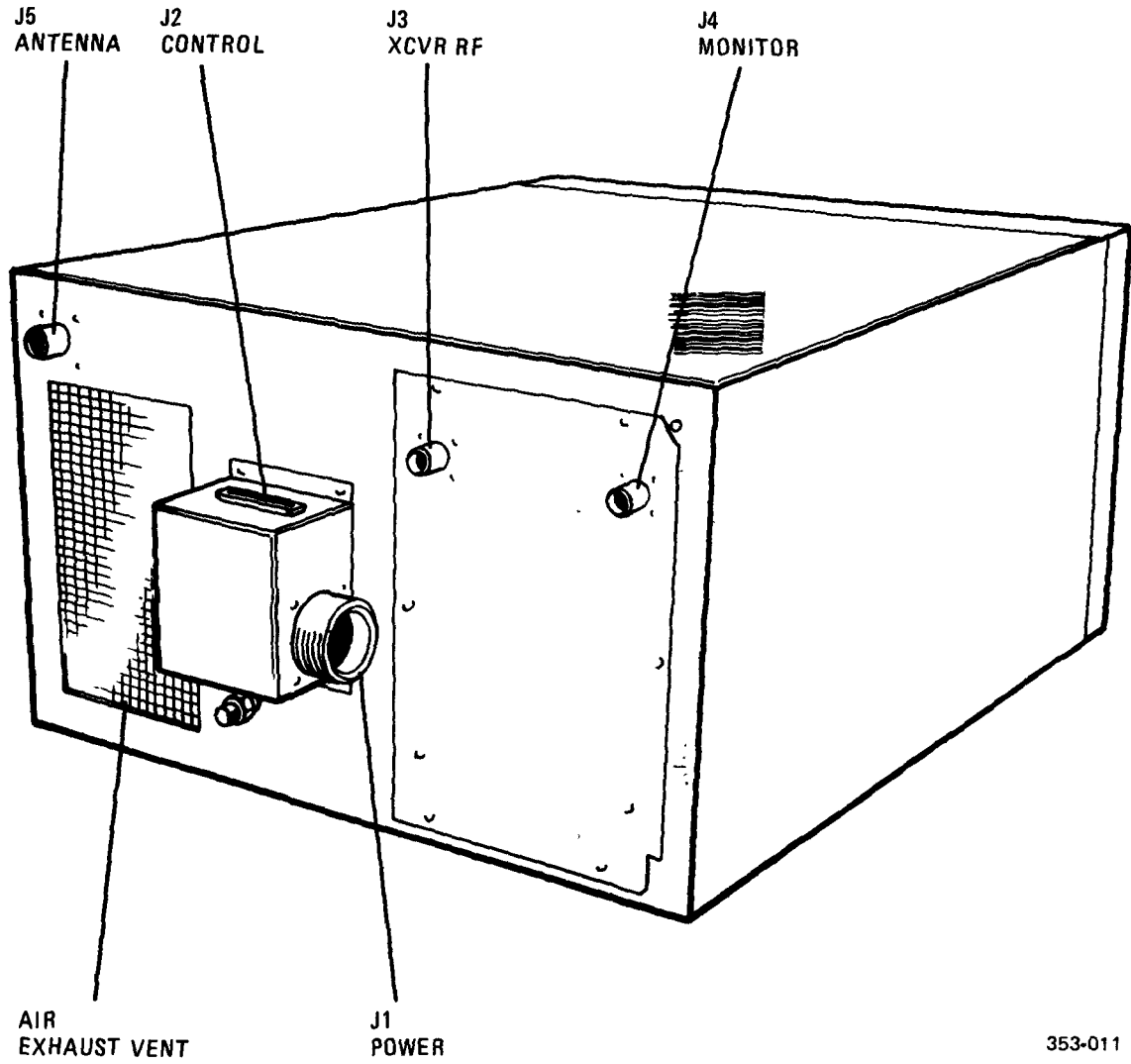
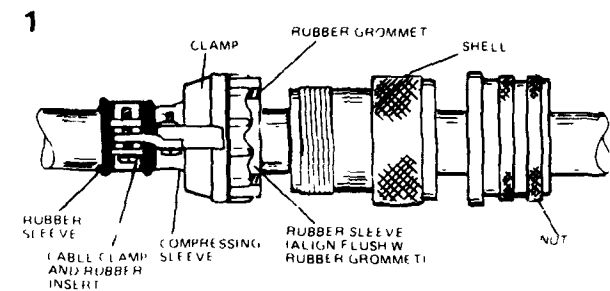
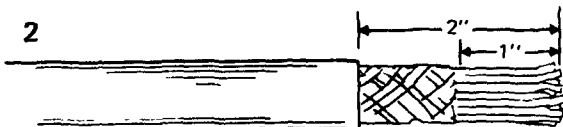


Figure 2-5. Rear Panel Connector Locations

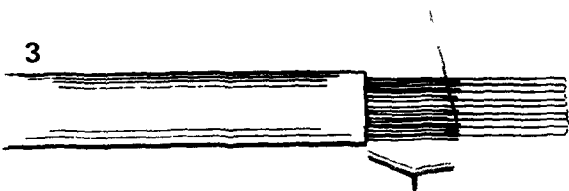
STEP



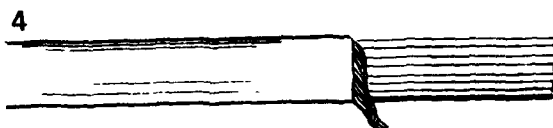
Install cable clamp and rubber insert, rubber sleeve clamp, compressing sleeve, rubber grommet, shell, and nut over cable. Assemble as shown. Leave cable clamp loose. Align rubber sleeve flush with rubber grommet inside clamp. Push assembly back out of the way to perform the steps shown below.



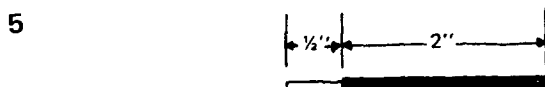
Remove 2" of vinyl jacket from cable as shown. Do not cut into shielding. Remove 1" of shielding as shown. Take care not to damage insulation on wires in cable bundle.



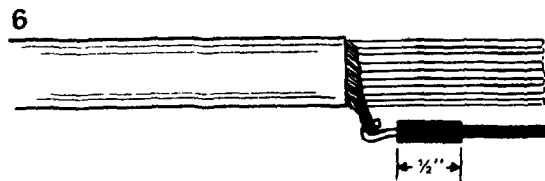
Carefully comb out shield wires as shown.



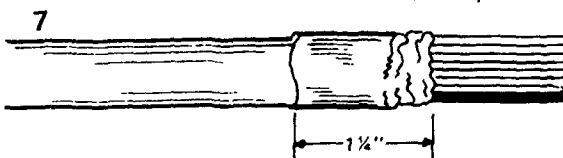
Make a part in the combed shield wires opposite the black wire in the cable. Pull the shield wires around both sides of the cable and twist together to make a pigtail as shown.



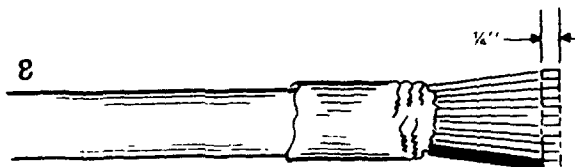
Remove 1/2" of insulation from a 2-1/2" length of No. 22 black stranded wire and tin.



Twist the stripped end of black wire with the pigtail and solder. Cut 1/2" black shrink sleeving and install over soldered connection. Use a heat gun (an alternative is an open flame) to shrink sleeving exercising caution to avoid getting heat onto cable jacketed.



Install shrink sleeving over cable as shown -- apply heat and "shrink" in place. Use heat gun. If no heat gun is available use open flame. Avoid getting heat on cable jacket. Rotate cable for an even shrinkage.



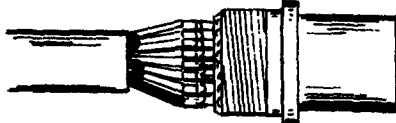
Remove 1/4" insulation from wires to be used

350-007

Figure 2-6. Multipin Connector Assembly (Sheet 1 of 3)

STEP

9.



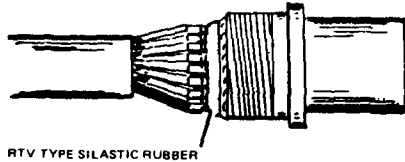
10.

Repeat assembly and soldering procedures for the other end of the cable.

11.

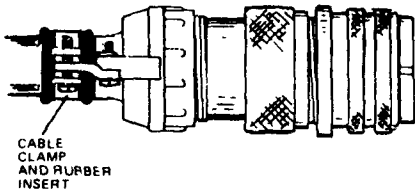
Check both ends of the cable for continuity, shorts between wires and shorts to the connector shell.

12.



RTV TYPE SILASTIC RUBBER

13.



CABLE CLAMP AND RUBBER INSERT

Refer to Table 2-1 for interface connections. Twist and tin stripped wires together to form pairs as shown for cable lengths over 100 feet (30 meters). Twist and tin remaining stripped wires. Cut sleeving supplied in connector kits into 1/2 inch (1 1/4 cm) lengths and slide over each wire. Keep wires parallel as they come out of the cable bundle to the connector pins. Ensure the black wire installed in step 6 and the black wire in the cable are lined up with and soldered to pin D. Solder wires to the solder cups using Table 2-1. Slide sleeving over solder cups. Write down wire colors assigned to each pin number for reference when assembling the connector on the other end of the cable.

AJ3

Apply RTV type silastic rubber to a thickness of approximately 1/8 inch. Use small opening of nozzle to insure getting rubber between all solder caps. Use small, slender object such as a piece of wire or toothpick to insure a smooth, continuous waterseal.

Assemble the plug as shown. Assemble clamp as tightly as possible onto the shell to assure a watertight connection around the cable. Repeat watersealing and assembling of connector on other end of cable. After connector has been threaded onto Antenna Coupler case connector J2, wrap both connectors with several layers of plastic electrical tape as close to the Antenna Coupler case as possible. (For protection against corrosion of mating threads in wet or humid environments.)

NOTE: To convert inches to centimeters, multiply by 2.540.

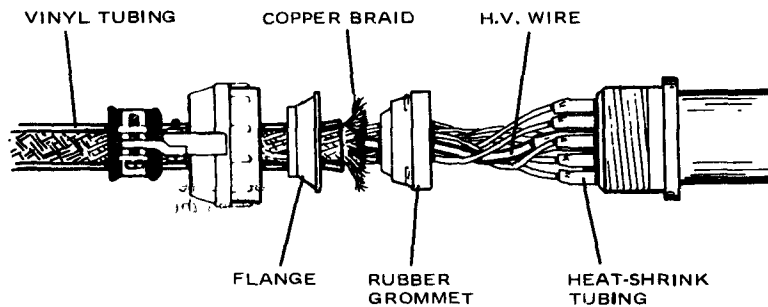
350-008

Figure 2-6. Multipin Connector Assembly (Sheet 2 of 3)

WARNING

The following instructions must be followed exactly, since the LPA - Power Supply power cable contains high voltage (approximately 4000 Vdc).

SPECIAL INSTRUCTIONS FOR FABRICATION OF LPA – POWER SUPPLY POWER CABLE



1. Select wire size and color according to the following chart:

PIN	WIRE SIZE	SUGGESTED COLOR
A	22	BROWN
B	22	RED
C	22	ORANGE
D	22	YELLOW
E *	18	WHT/RED
F *	18	WHT/ORG
G	18	BLACK
H	22	GREEN
J	16	BLACK
K	16	RED
L	22	WHT/BLK
M	18	WHITE
HIGH VOLTAGE (20 KV RATED MINIMUM), PART NO.: STYLE 3239 (FSCM: 03890)		

*115 VAC

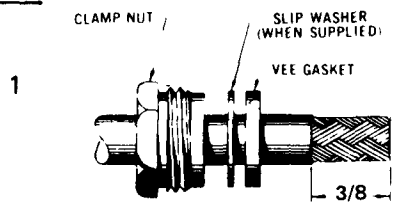
2. Insert 3/16 inch heat-shrink tubing (approximately 1/2 inch) over both ends of all wires to be soldered.

3. Feed wires through tubular copper braid, approximately equal in length to wires. Part number: 2174 (FSCM: 92194).
4. Feed copper braid through clear vinyl tubing, approximately equal to braid in length. Part number: PVC-105/9/16 (FSCM: 92194).
5. Solder wires to terminals indicated on chart.
6. Slide heat-shrink tubing over solder connections and shrink into position with heat gun or match.
7. Ground braid wire to connector shells as follows:
 - a. Push braid through flange.
 - b. Fan braid over flange.
 - c. Compress braid and flange with rubber grommet.
8. Insert vinyl tubing through cable clamp, butt it against the flange, and tighten clamp.

353-041

Figure 2-6. Multipin Connector Assembly (Sheet 3 of 3)

STEP



Cut cable end square, place clamp-nut, slip washer (when supplied), and gasket over jacket. Remove 3/8" of vinyl jacket.



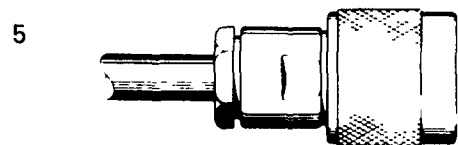
Place braid clamp over braid against jacket cut. Comb out copper braid as shown.



Fold braid back over braid clamp and trim as shown. Cut off dielectric 3/16" from end. Tin center conductor.



Solder contact to center conductor. Avoid use of excessive heat. See that end of dielectric is clean. Contact must be flush against dielectric. Outside of contact must be free of solder.



Thread assembly into connector, and lock securely. Vee gasket must be split by braid clamp.

350-009

Figure 2-7. Coaxial Connector Assembly

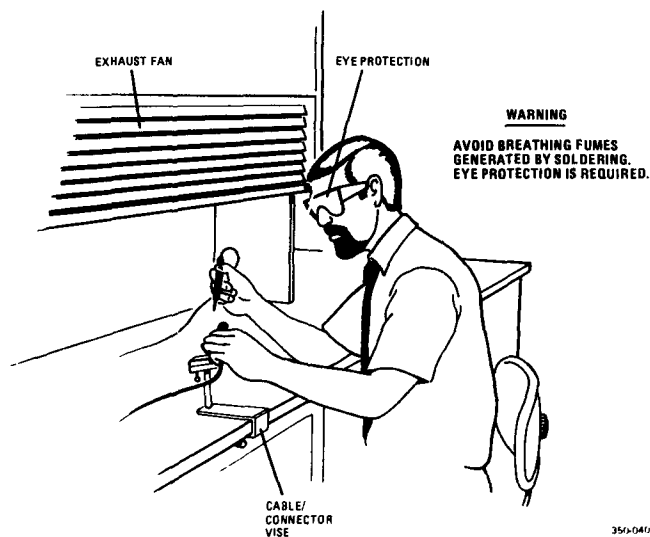


Figure 2-8. Safety Precautions for Fabrication of Cables

Table 2-1. Interconnection Cabling Information

J1 Power (LPA end) Mating connector: 10087-0016		J1 Power (Power Supply end) Mating connector: 10087-0016	
J1-A	Power-on Switch	J1-A	
J1-B	High Voltage On*	J1-B	
J1-C	Spare	J1-C	
J1-D	Spare	J1-D	
J1-E	115 VAC Filament	J1-E	
J1-F	115 VAC Filament	J1-F	
J1-G	Ground	J1-G	
J1-H	Power-on Return (Ground)	J1-H	
J1-J	Ground	J1-J	
J1-K	+13.5 Vdc	J1-K	
J1-L	B+ Sample	J1-L	
J1-M†	B+ 3000 Volts	J1-M	
J2 Control (LPA end) Mating connector: J22-0001-002 (female)		J8 Control (Transceiver end) Mating connector: J22-0001-001 (male)	
J2-1	PPC Ground	J8-1	
J2-2	TGC +	J8-2	
J2-3	Ground (VF, VR)	J8-3	
J2-4	Vfwd	J8-4	
J2-5	DATA +	J8-5	
J2-6	LPA Key	J8-6	
J2-7	LPA On/Off*	J8-7	
J2-8	Spare	J8-8	
J2-9	Ground	J8-9	
J2-10	Not Used	J8-10	
J2-11	Not Used	J8-11	
J2-12	Not Used	J8-12	
J2-13	Not Used	J8-13	
J2-14	PPC	J8-14	
J2-15	TGC -	J8-15	
J2-16	VREFL	J8-16	

* Indicates that the signal is active low. On schematic diagrams, active low signals have a bar over the top.

†Requires high voltage wire rated at 20 KV minimum.

Table 2-1. Interconnection Cabling Information (Continued)

J2-17	LPA ID*	J8-17	
J2-18	DATA -	J8-18	
J2-19	RF Mute*	J8-19	
J2-20	Spare	J8-20	
J2-21	Spare	J8-21	
J2-22	Ground	J8-22	
J2-23	Not Used	J8-23	
J2-24	Not Used	J8-24	
J2-25	Not Used	J8-25	
J3	XCVR RF (LPA end) Mating connector: M39012/01-0005 (coaxial) Cable type: RG-8/U (coaxial)	J1	XCVR RF (Transceiver end). Mating connector: M39012/01-0005 (coaxial) Cable type: RG-8/U (coaxial)
J4	RF Monitor (LPA end) Mating connector: KC-59-89 (coaxial) Cable type: RG-188 (coaxial)		
J5	Antenna (LPA end) Mating connector: M39012/01-0005 (coaxial) Cable type: RG-8/U (coaxial)	J2	Antenna (Coupler end) Mating connector: M39012/01-0005 (coaxial) Cable type: RG-8/U (coaxial)

2-8. CHECKING THE INSTALLATION. After the 1KW LPA has been installed and interconnection cables are connected, verify that each item in the list below has been completed before applying power. Power application and initial equipment testing are discussed in chapter 3 of this manual.

- a. All connectors are attached and tight.
- b. Ground wires are connected between the 1KW LPA and a known good ground. Examples of

good grounds are a cold water pipe, a long copper stake driven into solid earth, or a system ground bus at an existing site.

- c. Hardware for the equipment is properly tightened, and the equipment cannot be tipped or moved.
- d. Provisions are adequate for heat dissipation.
- e. Refer to chapter 3 for the proper power application procedures.

CHAPTER 3
PREPARATION FOR USE AND RESHIPMENT

Section I. PREPARATION FOR USE

3-1. INITIAL CONTROL SETTINGS. This section details the initial control settings prior to the application of power to the 1 KW LPA. These control settings are listed in table 3-1. Note that all controls are on the front panel of the 1 KW LPA; companion equipment controls will not be discussed. It is assumed that the 1 KW LPA is installed and correctly connected to a compatible, fully operational 100 Watt Transceiver and that the 1 KW LPA is correctly connected to a 1 KW Power Supply, as described in chapter 2 of this manual. If in doubt about the installation of the 1 KW LPA and the 1 KW Power Supply, verify the information in chapter 2 before proceeding.

3-2. INITIAL POWER APPLICATION. This portion of the manual provides a step-by-step sequence for the initial application of power to the 1 KW LPA. Upon completion of the listed steps, the operator will have confirmed that the 1 KW LPA is ready for the checkout test procedure that is found in paragraph 3-4.

3-3. STEP-BY-STEP SEQUENCE FOR INITIAL POWER APPLICATION.

- a. With the POWER ON/OFF switch set to the OFF position, complete any power application checks for the associated 100 Watt Transceiver as

Table 3-1. Initial Control Settings

Control	Initial Setting
1. POWER ON/OFF	Select OFF position.
2. LOCAL KEY ON/OFF	Select OFF position.
3. TUNE MIN L/MAX L	Spring loaded to center position (Neutral).
4. TUNE PWR ON/OFF	Select TUNE PWR OFF position.
5. ANTENNA	Select 50 OHM position.
6. AUTO/MANUAL BAND	Select AUTO position.
7. METER	Select STATUS/FAULT position.

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indicated in Receiver-Transmitter, Radio RT-1446/URC, T.O. 31R2-2URC-81, chapter 3, and the 1 KW Power Supply, as indicated in Power Supply PP-7913/URC, T.O. 35C1-2-892-1, chapter 3. Ensure that the associated 100 Watt Transceiver received a "PASSEd" on the BIT.

- b. Set POWER ENABLE/OFF switch to the ENABLE position; then turn on 1 KW LPA from the associated 100 Watt Transceiver front panel by using the [2ND][AMP PWR] keyboard controls. If the 1 KW LPA has never been turned on or if the power has been off for more than 10 seconds, there will be a three minute warm-up period upon power application before the 1 KW LPA can go to the OPERATE mode. When the power is applied, the STANDBY indicator should come on and flash during the 3-minute equipment warmup. At the end of warmup, the STANDBY indicator should show a steady indication.

3-4. STEP-BY-STEP SEQUENCE FOR MANUAL BUILT-IN TEST PROCEDURE.

- a. Set the AUTO/MANUAL BAND switch to the band corresponding to the frequency selected on the associated 100 Watt Transceiver (bands begin at 0000 and end at 9999; for example, 2.1999 would fall in the 1.8 to 2.2 band, but 2.2000 would fall in the 2.2 to 3.0 band). After one second the band switch should drive to the switch position selected.
- b. Rotate the METER switch on the LPA front panel to the STATUS/FAULT position.
- c. Press the SELF TEST button on the LPA front panel.
- d. Check that all LPA front panel LEDs come on and that all LCD segments on the meter display are on. NOTE: If the test is initiated while the LPA is in warmup (STANDBY LED was flashing before the SELF TEST button was pushed), only fault codes 2-01 through 2-08 can be displayed. This is because the full routine cannot be run until the LPA is warmed up (refer to the automatic diagnostic BIT test description in the Appendix at the end of Chapter 6).
 - (1) A "PASS" message on the METER display indicates that the BIT (Built-In-Test) has been passed.

- (2) A fault code (0001 through 0022) on the METER display indicates that a part of the test has failed. All further testing is stopped. Refer to Table 6-2 (in Chapter 6) for an explanation of the fault codes.
- (3) Moving the METER switch out of the STATUS/FAULT position removes the LPA from the test mode. The fault code may be cleared by commanding the LPA to OPERATE from the 100 Watt Transceiver (if the LPA is placed in AUTO) or by moving the METER selector switch to the STATUS/FAULT position and then out again.
 - (4) If all indications are normal, proceed to the next paragraph.

3-5. STEP-BY-STEP SEQUENCE FOR AUTOMATIC BUILT-IN TEST PROCEDURE.

- a. Set the AUTO/MANUAL BAND switch on the LPA to AUTO.
- b. Command the 1 KW LPA to perform the SELF TEST from the 100 Watt Transceiver front panel by pressing the following keyboard controls in sequence: [2ND][STB/OPR], [2ND][TX KEY], [2ND][TEST]. Then, to unkey Transmitter upon completion of test, press [2ND][TX KEY].
- c. Check that all LPA front panel LEDs come on and that all LCD segments on the meter display are on.
 - (1) A "PASSEd" message on the 100 Watt Transceiver's display indicates that the BIT (Built-In-Test) has been passed.
 - (2) A fault code (2-01 through 2-22) on the 100 Watt Transceiver's display indicates that a part of the test has failed. (The fault code will also appear on the LPA's LCD display if the METER selector switch is moved to the STATUS/FAULT position.) All further testing is stopped. Refer to Table 6-2 (in Chapter 6) for an explanation of the fault codes.
 - (3) The fault code may be cleared by commanding the LPA to OPERATE from the 100 Watt Transceiver or by moving the

LPA's METER selector switch out of the STATUS/FAULT position.

- (4) If all indications are normal, proceed to the next paragraph.

3-6. INITIAL CHECKOUT. In the initial checkout the 1 KW LPA is checked for readiness through the use of the front panel controls and indicators. The checkout procedure should be conducted immediately after performing the initial power application. This sequence does not cover each feature of the 1 KW LPA, only those necessary to prove normal performance. Refer to chapter 4, Operation, for complete operation information. Features related to the use of companion equipment are not discussed. This sequence assumes the initial power application procedure has been performed.

3-7. STEP-BY-STEP SEQUENCE FOR MANUAL TUNING PROCEDURE.

- a. Set the associated 100 Watt Transceiver to the desired frequency.
- b. Select the band corresponding to the associated transceiver frequency using the AUTO/MANUAL BAND switch.
- c. Set the ANTENNA switch to the center position (50 OHMS).
- d. Set the METER selector switch to the COIL POS position.
- e. Using the spring-loaded TUNE control, preposition the coil to the value indicated on the Manual Tune Chart, figure 3-1, for the frequency selected on the 100 Watt Transceiver. Move the TUNE control toward MIN L or MAX L until the the number on the LCD display matches the number on the chart.
- f. Set the METER switch to the FWD PWR (WATTS) position or to the RF Plate (volts) position.
- g. When the bandswitch is finished tuning the bandswitch wafer, set the MANUAL TUNE PWR switch to the ON position. When this is done, a

TUNE POWER REQUEST message is sent to the XCVR and the 1 KW LPA is keyed. If a fault is detected while this switch is active, the 1 KW LPA will drop back to STANDBY and the MANUAL TUNE PWR switch must be turned OFF before the fault can be cleared.

- h. Observing the METER display, use the TUNE switch to tune the servo coil to the maximum rf output or rf plate volts by switching to MIN L or MAX L.
- i. Turn off the MANUAL TUNE PWR switch.

NOTE

Turning off the TUNE PWR switch notifies the 100 Watt Transceiver that the LPA is tuned, whether it actually is or not. Therefore, before you turn this switch off, make sure that you have correctly tuned the LPA. Otherwise, there is the possibility of a severe mismatch between the LPA and the antenna system, resulting in low forward power or a forward power fault.

- j. Set the MANUAL LOCAL KEY switch to the ON position. The 1 KW LPA should go to the OPERATE condition and the OPERATE indicator should come on steady.

3-8. STEP-BY-STEP SEQUENCE FOR AUTOMATIC TUNING PROCEDURE.

- a. Set the LOCAL KEY switch to OFF, and set the AUTO/MANUAL BAND select switch to the AUTO position. This deactivates all of the manual tune switches. On the 100 Watt Transceiver front panel, using the [2ND], [STB/OPR] keypad controls puts the 1 KW LPA in OPERATE.
- b. Select a different frequency band at the companion 100 Watt Transceiver, and key the 100 Watt Transceiver. The 1 KW LPA should tune to the new frequency in 10 seconds or less. If not, there is a problem in the 1 KW LPA.
- c. This completes the initial checkout procedure. If any problems were encountered during this procedure, refer to chapter 6, Maintenance.

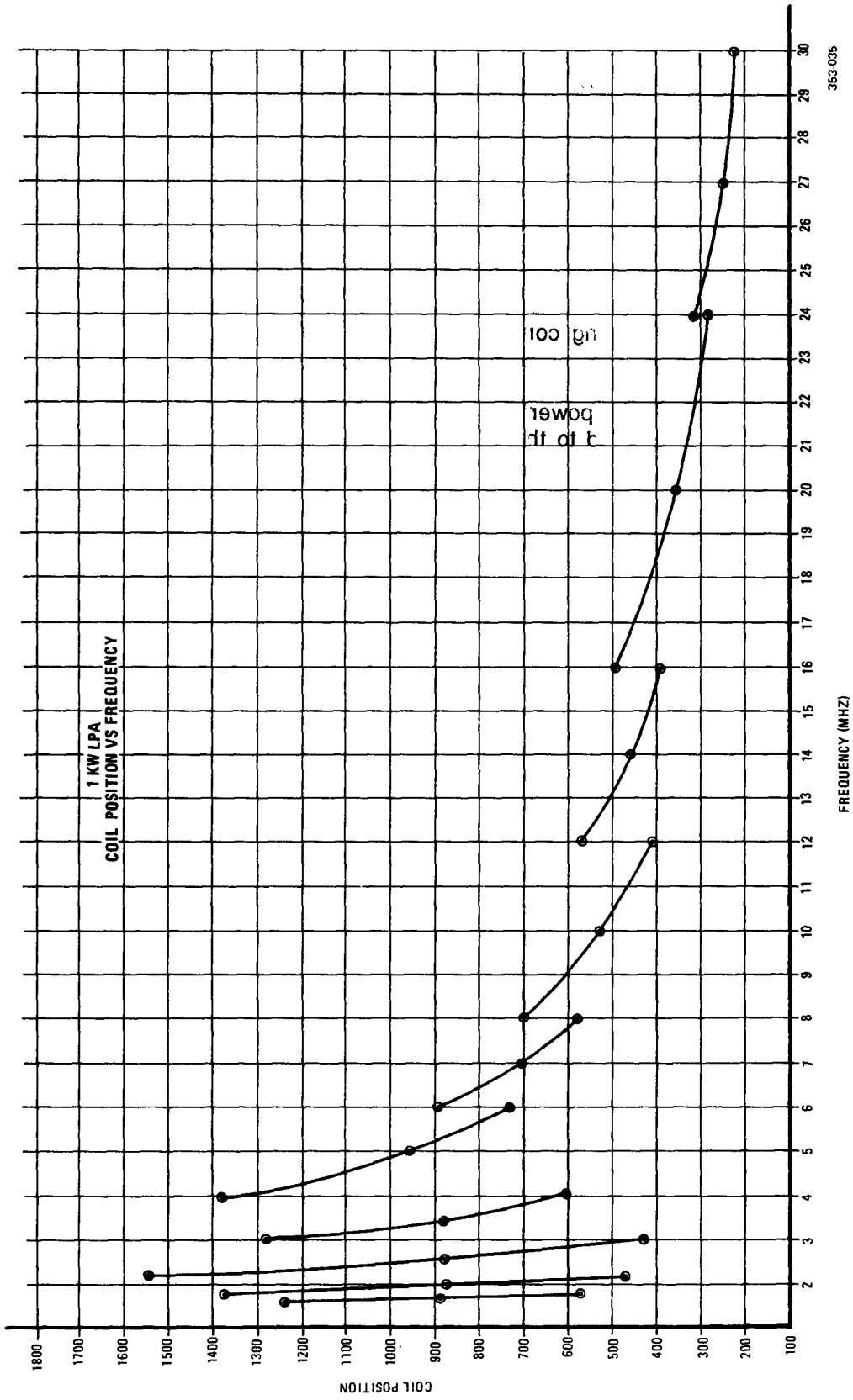


Figure 3-1. Manual Tune Chart

Section II. PREPARATION FOR RESHIPMENT**3-9. PREPARATION FOR RESHIPMENT.**

This portion of the manual contains step-by-step procedures for disassembly and repacking the 1 KW LPA for reshipment.

3-10. STEP-BY-STEP DISASSEMBLY PROCEDURE.

- a. Ensure that all power sources associated with the 1 KW LPA and any interfacing companion equipment are shut down.
- b. Disconnect all interface cables, power cables, and grounding straps connected to the 1 KW LPA.
- c. Replace plastic dust caps on all LPA connectors.
- d. Carefully remove the 1 KW LPA from the stack mounted or rack mounted system configuration.

- e. Unbolt mounting brackets or slide brackets and slides, whichever the case may be, and pack them for shipment.

3-11. STEP-BY-STEP PACKING AND CRATING PROCEDURE.

- a. Refer to figure 2-1. Repackage the interface cables, the power cable, and the mounting hardware associated with the 1 KW LPA in the original or an equivalent container.
- b. Place the 1 KW LPA into the original or an equivalent container or packing box.
- c. Close and bind the container or packing box, using reinforced tape for reshipment.

CHAPTER 4
OPERATION

Section I. CONTROLS AND INDICATORS

4-1. CONTROL AND INDICATOR DESCRIPTIONS. All 1 KW Linear Power Amplifier (1 KW LPA) controls and indicators are explained in table 4-1 and shown in figure 4-1.

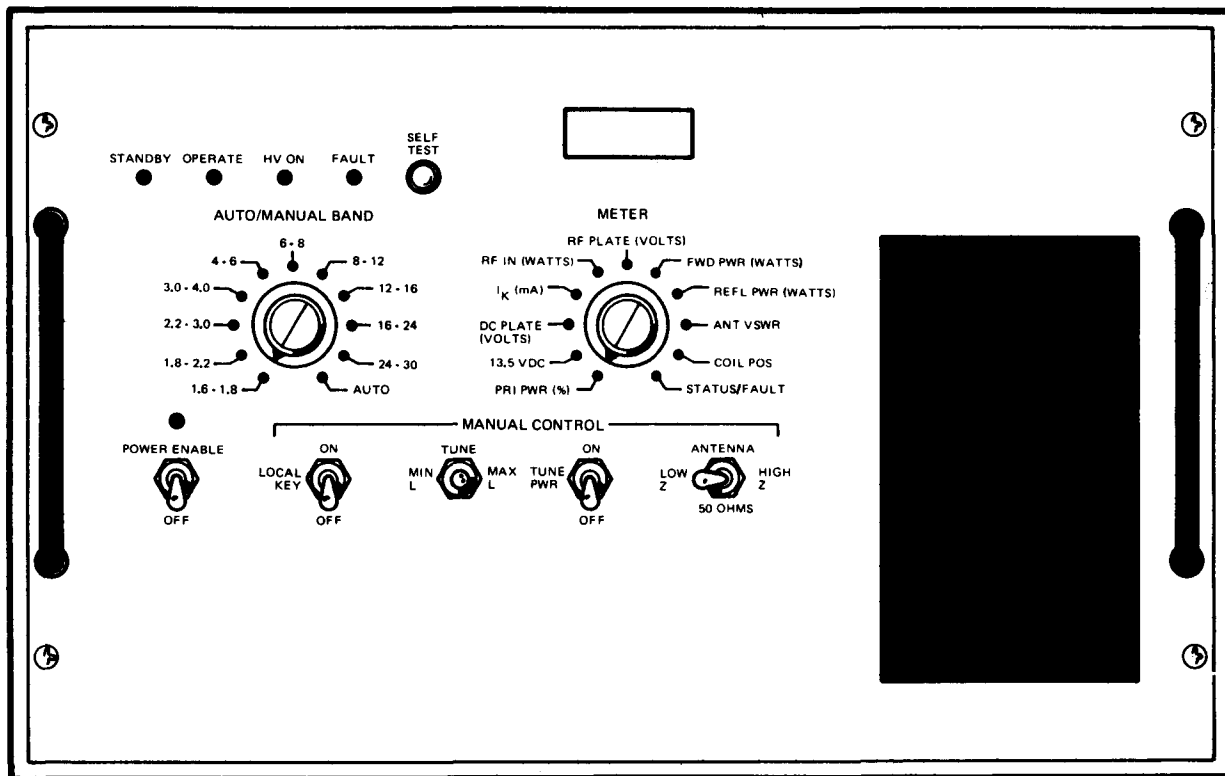
tuning, and status reporting. Most of the 1 KW LPA control functions are selected via two rotary switches. Toggle switches control the primary power application and MANUAL tuning mode.

4-2. FRONT PANEL CONTROLS. The three main functions associated with the 1 KW LPA controls and indicators are AUTOMATIC tuning, MANUAL

4-3. OPERATING CONTROLS. For specific information regarding the operating instructions of the 1 KW LPA, see section II of this chapter.

Table 4-1. 1 KW LPA, Operating Controls and Indicators

Controls or Indicators	Function
<p>STANDBY (Indicator)</p>	<p>Indicates when the LPA is in STANDBY or WARMUP mode. Flashes for 3 minutes after power application (WARMUP mode) and is on steady during STANDBY mode.</p>
<p>OPERATE (Indicator)</p>	<p>Indicates when the LPA is in OPERATE mode. Light goes out if there is a fault and the LPA returns to STANDBY mode.</p>
<p>HV ON (Indicator)</p>	<p>Indicates when the high voltage (i.e., more than 100 volts) is applied to the power amplifier tube.</p>
<p>FAULT (Indicator)</p>	<p>Indicates when a FAULT exists in the LPA. Remains lit until the fault is cleared.</p>
<p>SELF TEST (Push button switch)</p>	<p>Used to activate the BIT self test routine.</p>
<p>METER (LCD Indicator)</p>	<p>Four digit LCD (Liquid Crystal Display) that displays the selected METER function; e.g., % of PRI PWR, 13.5 VDC, DC PLATE (VOLTS), I_k (mA), RF IN (WATTS), RF PLATE (VOLTS), FWD PWR (WATTS), REFL PWR (WATTS), ANT VSWR, COIL POS, or STATUS/FAULT.</p>



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Figure 4-1. 1 KW LPA, Operating Controls and Indicators

Table 4-1. 1 KW LPA, Operating Controls and Indicators (Continued)

Controls or Indicators	Function
AUTO/MANUAL BAND (Control Wafer Switch)	Selects auto or manual self test routine operation in the chosen band. In Auto mode, tuning is initiated by a Tune command from the 100 Watt transceiver and is controlled by the microprocessor. In Auto mode, the MANUAL TUNE, MANUAL TUNE POWER, and MANUAL LOCAL KEY controls are inactive. When not in Auto mode, the switch controls the position of the band wafer. The 1 KW LPA has 10 bands.
METER (Control Wafer Switch)	Selects the input to the METER display (e.g., PRI PWR (%), 13.5 VDC, DC PLATE (VOLTS), I _K (MA), RF IN (WATTS), RF PLATE (VOLTS), FWD PWR (WATTS), REFL PWR (WATTS), ANT VSWR, COIL POS, or STATUS/FAULT).
POWER ENABLE (Control Toggle Switch)	Controls the primary power input.
MANUAL CONTROL-LOCAL KEY (Control Toggle Switch)	Active only in Manual mode. When in the ON position, sends a Local Key message to the transceiver and keys the 1 KW LPA.
MANUAL CONTROL-TUNE (Control Spring-Loaded Center Toggle Switch)	Active only in Manual mode. Used to control the position of the tune variable coil.
MANUAL CONTROL-TUNE PWR ON/OFF (Control Toggle Switch)	Active only in Manual mode. Used to request or inhibit tuning power from the 100 Watt Transceiver.
ANTENNA LOW Z/50 OHM/HIGH Z	Active only in Manual mode. Used to improve impedance matching to the antenna. This three-position switch selects LOW Z, 50 OHMS, or HIGH Z.

Section II. OPERATING INSTRUCTIONS

4-4. INTRODUCTION. Operating instructions include only those for the 1 KW LPA. Refer to the technical manuals for any companion equipment such as the 100 Watt Transceiver, 1 KW Power Supply, or AN/URA-38 () Antenna Coupler.

4-5. OPERATING SEQUENCES. A summary of the paragraphs containing the operating instructions is provided for reference.

4-6. POWER-UP

4-7. WARM-UP

4-8. BASIC FUNCTION OPERATION

- a. Auto/Manual Band Selection
- b. MANUAL TUNE PWR Switch
- c. MANUAL CONTROL-LOCAL KEY Switch
- d. MANUAL CONTROL-TUNE Switch
- e. ANTENNA Loading Selection
- f. SELF TEST Switch
- g. METER Function Selection

4-9. TRANSCEIVER CONTROLLED OPERATIONS

4-10. MICROPROCESSOR CONTROLLED OPERATIONS

- a. Meter Display Update
- b. Fault Check
- c. Built-In-Test (BIT)

4-6. POWER-UP. The POWER ENABLE/OFF switch on the front panel must be in the ON position for the 1 KW LPA to operate. Power is then turned on and off from the front panel of the 100 Watt Transceiver.

4-7. WARM-UP. When the 1 KW LPA is turned on for the first time or if the power has been off for more than 10 seconds, a three-minute warm-up period must elapse before the 1 KW LPA can be placed in the OPERATE mode. During this time the MANUAL controls, TUNE PWR, LOCAL KEY, and ANTENNA, are disabled. The STANDBY LED indicator flashes during the warm-up period. After three-minutes the STANDBY LED indicator stops flashing and stays lighted. If the BIT (Built-In-Test) is initiated during the warm-up period, some but not all functions are tested.

4-8. BASIC FUNCTION OPERATION. The functions selected from the 1 KW LPA front panel include: Auto/Manual Band selection, Manual Tune

Power, Manual Local Keying, Manual Tuning, Manual Antenna Loading, Self Test, and Meter Functions.

a. Auto/Manual Band Selection.

(1) The front panel, 11-position, AUTO/MANUAL BAND rotary switch selects between the automatic mode of operation and the manual mode of operation in the chosen frequency band. In AUTO mode, tuning is automatic and is controlled completely by signals from the associated 100 Watt Transceiver. In this mode, the Manual Tune, Manual Tune Power, Manual Local Key, Manual Antenna Loading, and Self Test controls are disabled.

(2) When AUTO/MANUAL BAND switch is not in the AUTO position, the 1 KW LPA is in MANUAL mode and the switch selects the current operating frequency band. The 1 KW LPA has 10 operating frequency bands. Selecting a new switch position causes the internal band switch wafer to be turned to its corresponding position. Before the wafer can turn, the microprocessor will wait until the operator leaves the band switch in one position for more than one second. Then the microprocessor sends an RF Mute signal to the associated 100 Watt Transceiver and unkeys the 1 KW LPA. The microprocessor will not turn the bandswitch wafer while there is RF power at the XCVR RF input of the 1 KW LPA. The Manual Tune Power and Manual Local Key controls are disabled while the wafer is turning.

b. MANUAL TUNE PWR Switch. When manual band is selected and the MANUAL TUNE PWR switch is moved to the ON position, a Tune Power Request message is sent to the associated 100 Watt Transceiver, and the 1 KW LPA is keyed. When the MANUAL TUNE PWR switch is activated, any previous fault indications are cleared. If a fault is detected while this switch is active, the 1 KW LPA will drop back to STANDBY and the MANUAL TUNE PWR switch must be turned off before the fault can be cleared. Activation of the tune mode causes the 100 Watt Transceiver to transmit a CW carrier emission. This level is then controlled by the 1 KW LPA to that which causes about 400 milliamperes of cathode current.

c. MANUAL LOCAL KEY Switch. When the MANUAL LOCAL KEY switch is set to the ON position, the 1 KW LPA is placed in OPERATE, and is