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TECHNICAL MANUAL

FOR
HF ANTENNA TUNING UNIT
ATU-350A

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THE TECHNICAL MATERIEL CORPORATION

C O M M U N I C A T I O N S E N G I N E E R S

700 FENIMORE ROAD

MAMARONECK, N. Y.

Warranty

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes, *fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, F.O.B. factory, which may fail within the stated warranty period, PROVIDED:

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.
2. That the defect is not the result of damage incurred in shipment from or to the factory.
3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.
4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

Electron tubes furnished by TMC, but manufactured by others, bear only the warranty given by such other manufacturers. Electron tube warranty claims should be made directly to the manufacturer of such tubes.

TMC's obligation under this warranty is limited to the repair or replacement of defective parts with the exceptions noted above.

At TMC's option any defective part or equipment which fails within the warranty period shall be returned to TMC's factory for inspection, properly packed with shipping charges prepaid. No parts or equipment shall be returned to TMC, unless a return authorization is issued by TMC.

No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by TMC and the foregoing warranty shall constitute the Buyers sole right and remedy. In no event does TMC assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of TMC Products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

*Electron tubes also include semi-conductor devices.

PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT

Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

1. Model Number of Equipment.
2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

PROCEDURE FOR ORDERING REPLACEMENT PARTS

When ordering replacement parts, the following information must be included in the order as applicable:

1. Quantity Required.
2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

TMC's Warranty specifically excludes damage incurred in shipment to or from the factory. In the event equipment is received in damaged condition, the carrier should be notified immediately. Claims for such damage should be filed with the carrier involved and not with TMC.

All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

THE TECHNICAL MATERIEL CORPORATION
Engineering Services Department
700 Fenimore Road
Mamaroneck, New York

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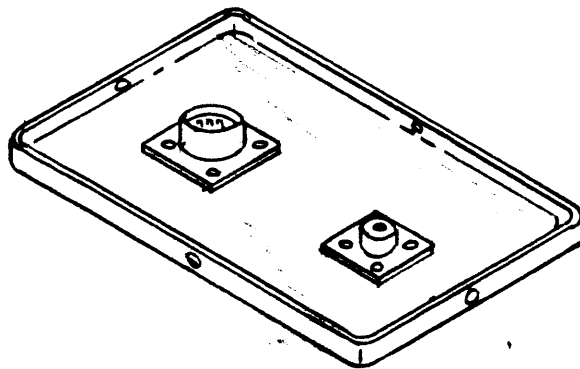
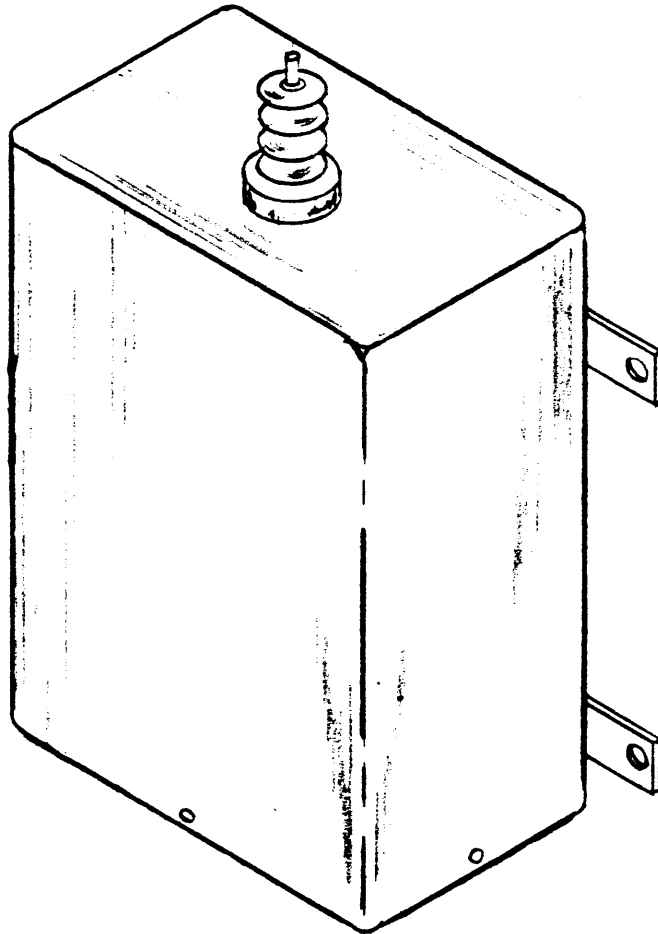
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HF ANTENNA TUNING UNIT
ATU-350A

SECTION 1
GENERAL INFORMATION

1-1. GENERAL

The Technical Materiel Corporation's Antenna Tuner, Model ATU-350A is intended for use with a 350 watt PEP channelized transmitter with a nominal output impedance of 50 ohms. The ATU-350A provides antenna impedance matching of a 350 watt transmitter to a 35 foot whip antenna in the frequency range of 2 to 26 mhz. Antenna impedance matching is provided for eight pre-set channel frequencies within the 2 to 26 mhz frequency range. The Tuner is pre-adjusted for specified channel frequencies requested by the customer, which eliminates the need for lengthy adjustments prior to operation. Once the ATU-350A is installed on location, operation consist of setting a single channel switch to the desired operating channel. If a ledex operated ATU-350A is ordered, channel selection is accomplished automatically with the application of external +24 vdc applied to the appropriate pins on the Tuner's remote jack J2.

1-2. PHYSICAL DESCRIPTION

The tuning unit is enclosed in a fiber glass case. The units overall dimensions are 5-1/4 inches high x 8-1/4 inches wide x 12-19/32 inches deep. Mounting taps are provided for two types of installation (bulk head or upright post). A remote jack is provided for cabling to an associated transmitter for remote channel selection. A porcelain insulator terminal is provided on the housing for connection to antenna lead-in wire. Channel adjustment capacitors are located within the tuner housing for finite impedance matching adjustments.

SECTION 2

INSTALLATION

2-1. GENERAL

The ATU-350A is pre-set to channel frequencies requested by the customer. The unit is tested at the factory (into a whip antenna simulator) on the desired frequencies prior to shipment. When the ATU-350A is received at the operating site, inspect the packing case and contents for possible damage that might have occurred during transit. Unpack the equipment carefully, and inspect all packing material for parts that have been shipped as "Loose Items" (connecting plugs, cables, instruction manuals, etc.). With respect to damage to the equipment for which the carrier is liable, The Technical Materiel Corporation will assist in describing methods of repair and furnishing of replacement parts.

2-2. POWER REQUIREMENTS

The ATU-350A requires +24 vdc to operate the control ledex motor for remote channel selection. The external 24 vdc must be applied to the appropriate pins on remote jack J2-B thru J2-1. When the ATU-350A is interfaced with the TMC model TMA-350 transmitter channel selection is accomplished via the CHANNEL select control on the TMA-350.

2-3. MECHANICAL INSTALLATION

The ATU-350A should be installed so that the distance between the antenna tuner output terminal, and the antenna does not exceed 2 feet. Refer to figure 2-1 for mounting hole dimensions and a typical installation.

2-4. ELECTRICAL INSTALLATION

Electrical installation of the ATU-350A is made by means of the connectors located on the front and rear of the unit. When the ATU-350A is shipped as part of a TMC system, mating interconnecting cables for these jacks are included in the shipment of the system and directions for installation of the cables are included in the system manual. When the ATU-350A is shipped as a single unit, the mating plugs are included for making interconnecting cables. Table 2-1 lists the functions of each connection.

TABLE 2-1. ATU-350A JACK CONNECTIONS

<u>Designation</u>	<u>Mating plug Supplied</u>	<u>Function</u>
J1	PL-259	RF input jack
J2	MS3106B20-275	Remote channel selection jack. Channel selection provided with the application of +24 vdc to the following pins on J2: CHANNEL 1 PIN B CHANNEL 2 PIN C CHANNEL 3 PIN D CHANNEL 4 PIN E CHANNEL 5 PIN F CHANNEL 6 PIN G CHANNEL 7 PIN H CHANNEL 8 PIN I
J3		Antenna connection (RF output)

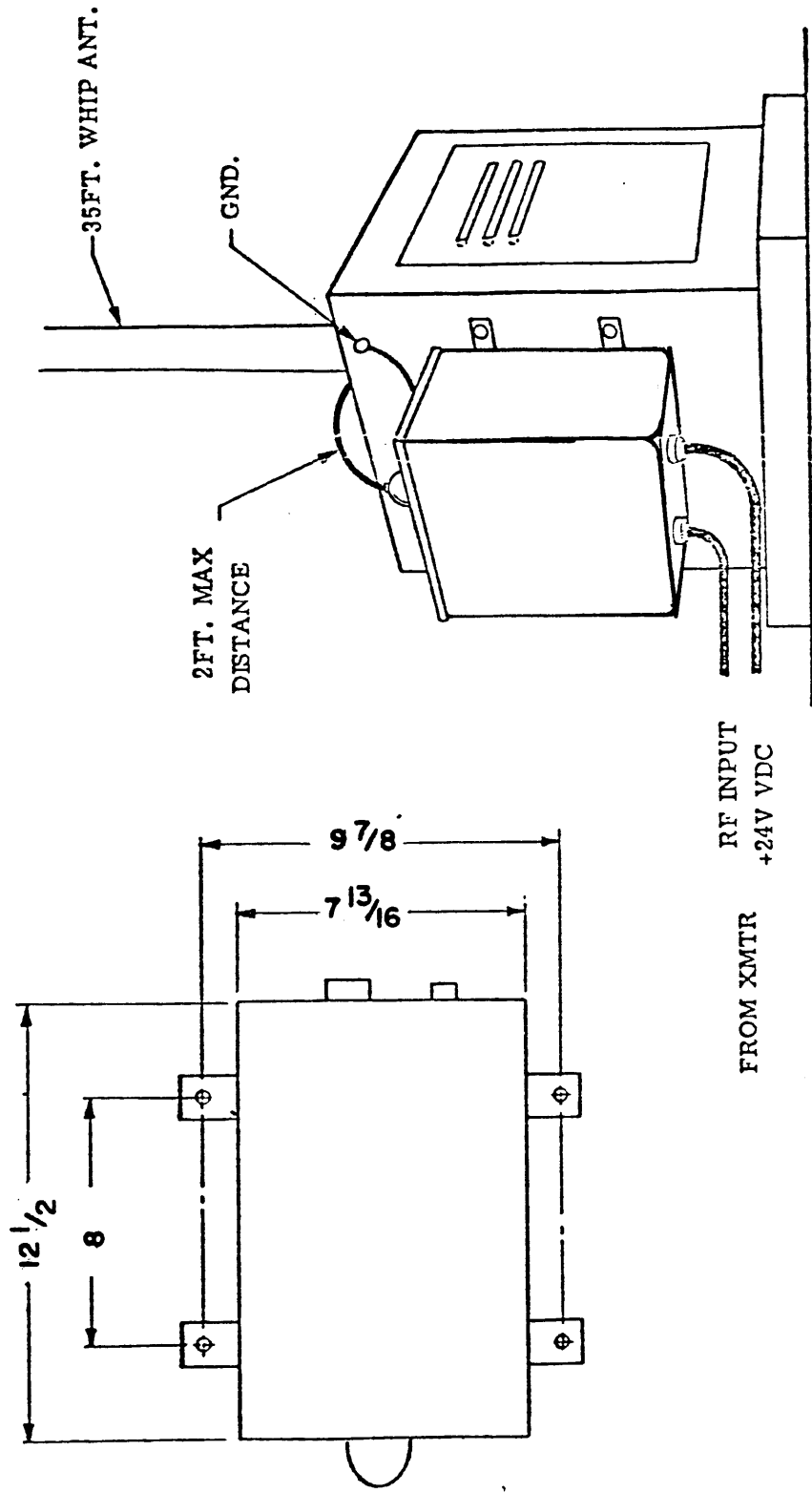


Figure 2-1. Outline Dimensional Drawing

SECTION 3

ANTENNA IMPEDANCE MATCHING

3-1. GENERAL

The Antenna Tuner is normally pre-adjusted to impedance match a 35 foot whip antenna at assigned channel frequencies. The adjustments consist of selecting the proper coil taps on impedance matching coils L1 and L2, together with the adjustment of the corresponding input variable capacitors C1 thru C8. Factory adjustments of ATU-350A are made using a 35 foot whip antenna simulator and may require finite adjustments when connected to a specific 35 foot whip antenna.

When an Antenna Tuner is ordered and the channel frequencies are not assigned, the ATU-350A resonant components are not adjusted for a specific channel frequency. Therefore, this section gives instructions for finite adjustments and initial impedance matching with a directional wattmeter or impedance bridge. Refer to the following paragraphs which outline impedance matching procedures for the ATU-350A.

3-2. ADJUSTMENT PROCEDURE (refer to figures 3-1 and 3-2)

Finite adjustments of the ATU-350A should be made after the ATU-350A is installed in its location. If the initial adjustments for assigned channel frequencies have already been made at the factory, proceed as follows:

1. Connect the ATU-350A as shown in figure 3-2A or 3-2B. Insure that the Tuner is connected to the antenna and the antenna lead is no more than 2 feet.

NOTE

If a transmitter and directional wattmeter is utilized (as per figure 3-2A) the transmitter output should not exceed 50 watts PEP. The tool used to adjust CHANNEL ADJUST capacitors MUST BE INSULATED MATERIAL, (refer to paragraph 3-4 for impedance matching with directional wattmeter and transmitter).

2. Select the desired channel (channel 1 thru 8) by applying +24 vdc to the appropriate pins on remote jack J2 (refer to figure 3-3) or if the TMC model TMA-350 transmitter is incorporated as part of the system, set the CHANNEL switch on the TMA-350, to the desired channel.
3. Refer to figure 3-1 and adjust the appropriate channel adjust capacitor for minimum reflected power indication on the directional wattmeter or impedance bridge.

TABLE 3-1. SHUNT CAPACITOR VALUES

<u>Frequency</u>	<u>Approximate Capacitance</u>
2mhz - 3mhz	200 pf
3mhz - 4mhz	300 pf
4mhz - 5mhz	150 pf
5mhz - 5mhz	250 pf
6mhz - 7mhz	100 pf
7mhz - 8mhz	50 pf
8mhz - 26mhz	No Shunt required

3-3. ANTENNA MATCHING PROCEDURE

The procedure that follows is only applicable to Antenna Tuning Units not previously adjusted to a specified frequency and or if a new channel frequency is assigned. To perform this impedance matching procedure proceed as follows:

1. Remove outer cover from ATU-350A to expose internal components. (Refer to paragraph 3-5 for removal instructions)
2. Insure that output terminal (J3) is connected to a 35 foot whip antenna. Antenna lead-in must not be longer than 2 feet.
3. Select the channel to be adjusted. (Channel selections are made by setting the TMA-350 CHANNEL switch to the desired channel or by the application of +24 vdc to the appropriate pin on remote jack J2. Refer to figure 3-3 for the pin number designation for each channel).
4. Refer to figure 3-4 and set the appropriate channel adjust capacitor to mid position. (C1 thru C8)
5. Refer to figure 3-5 and determine the tap selection of loading coil.
6. Add shunt capacitors in parallel with CHANNEL ADJUST capacitors as necessary according to table 3-1.
7. Provide a connection from switch wafer S2C contact pin to the appropriate tap position on loading coil L2. (Refer to figure 3-5)

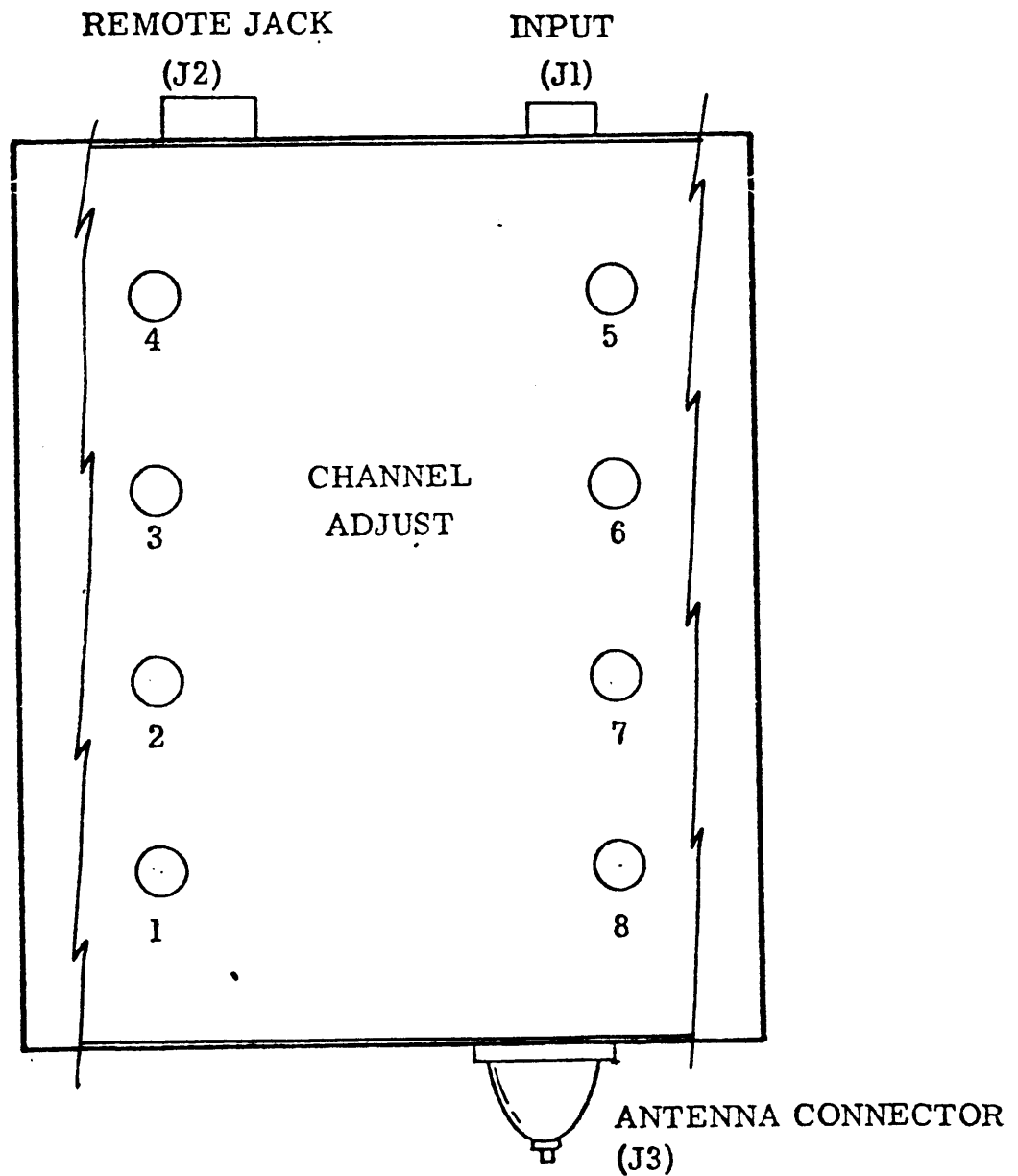
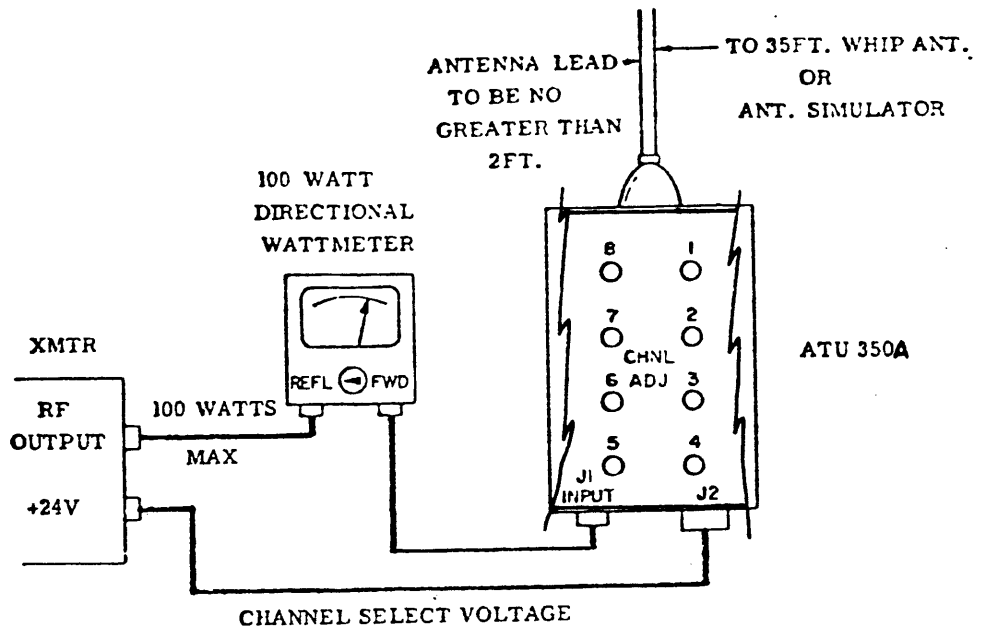
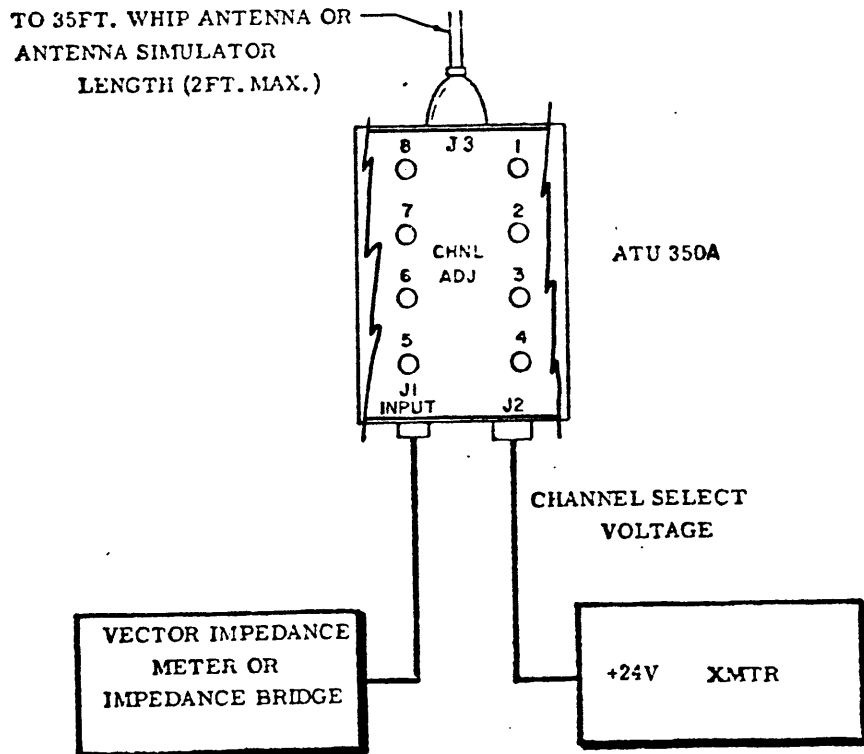


Figure 3-1. ATU-350A, Top View



-A-



-B-

Figure 3-2. Test Set-Up

8. Select the tap that is connected to the desired channel position on switch wafer S2B (refer to figure 3-4) and loosen shorting clip attached to coil winding L1.

NOTE

The shorting clips are used to decrease the inductance of coil L1 and should be set initially at the center winding on L1. The test equipment (RF bridge or directional wattmeter) should be set up to monitor reactance and resistance or reflected power.

9. Observe the test equipment and move the shorting clip on the coil (L1) until test equipment indicates minimum reactance or minimum reflected power.

10. When the correct coil winding is selected, determined by minimum reactance or reflected power, secure shorting clip to the coil winding with hardware provided.

11. Observe test equipment and adjust the appropriate CHANNEL ADJUST capacitor as necessary to further minimize the reflected power or reactance.

12. Repeat steps 9 thru 11 as often as necessary to obtain minimum reflected power or reactance.

13. Repeat steps 3 thru 11 for each channel to be adjusted.

3-4. ANTENNA MATCHING PROCEDURE WITH WATTMETER AND TRANSMITTER

When the transmitter and wattmeter is used to determine the shorting clips position, use extreme caution and proceed as follows:

1. Before removing cover insure that transmitter is OFF.

2. Set 50 watt diode element on directional wattmeter in the reflected power position to read reflected power.

3. Set shorting clip at center winding on coil L1.

4. Turn transmitter ON and apply power. Transmitter output should not exceed 50 watts.

5. Note reflected power indication on wattmeter, then rotate diode element to forward power position. The reflected power should not be greater than 10% of the forward power indication. Turn transmitter OFF.

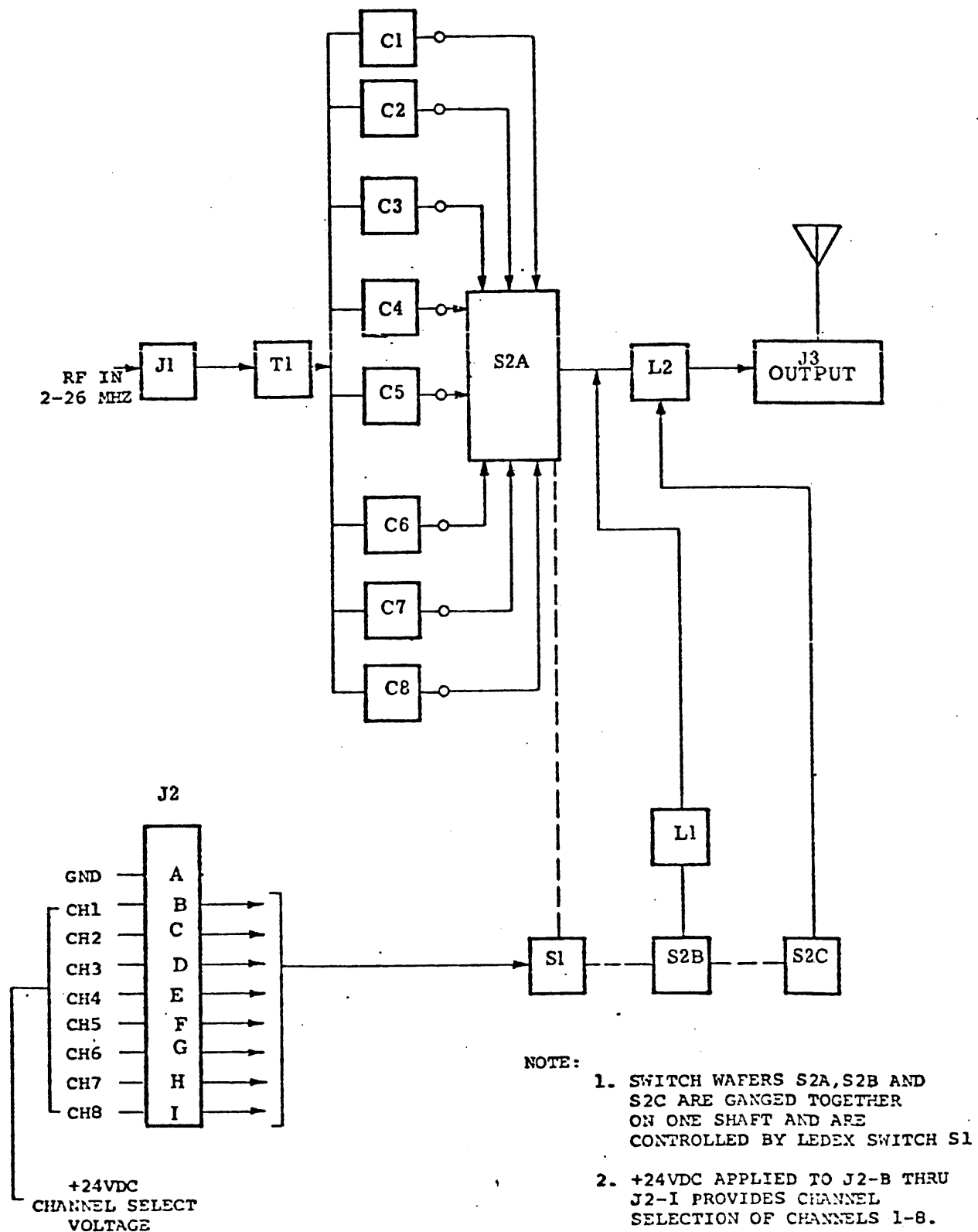


Figure 3-3. Functional Block Diagram

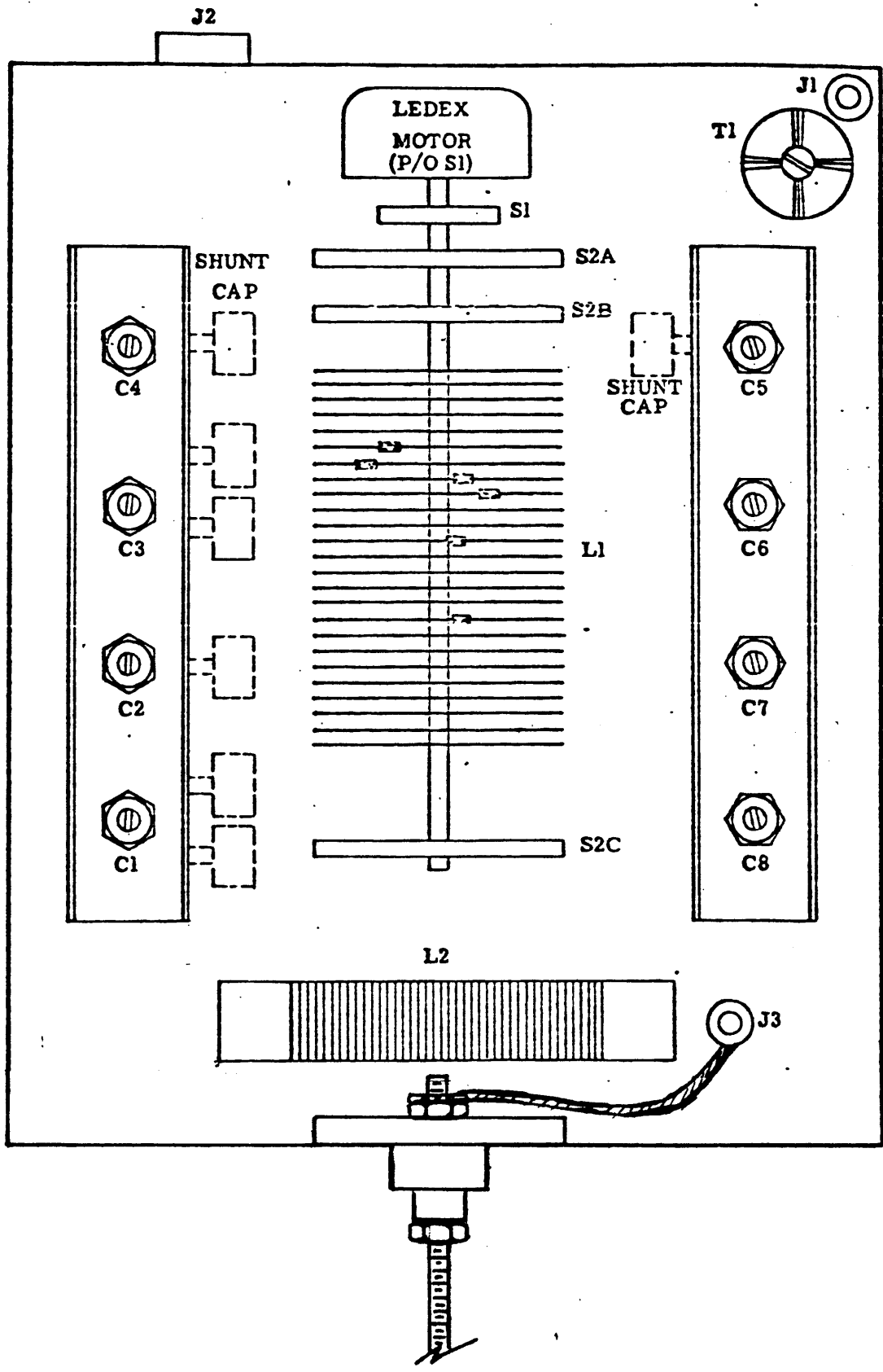
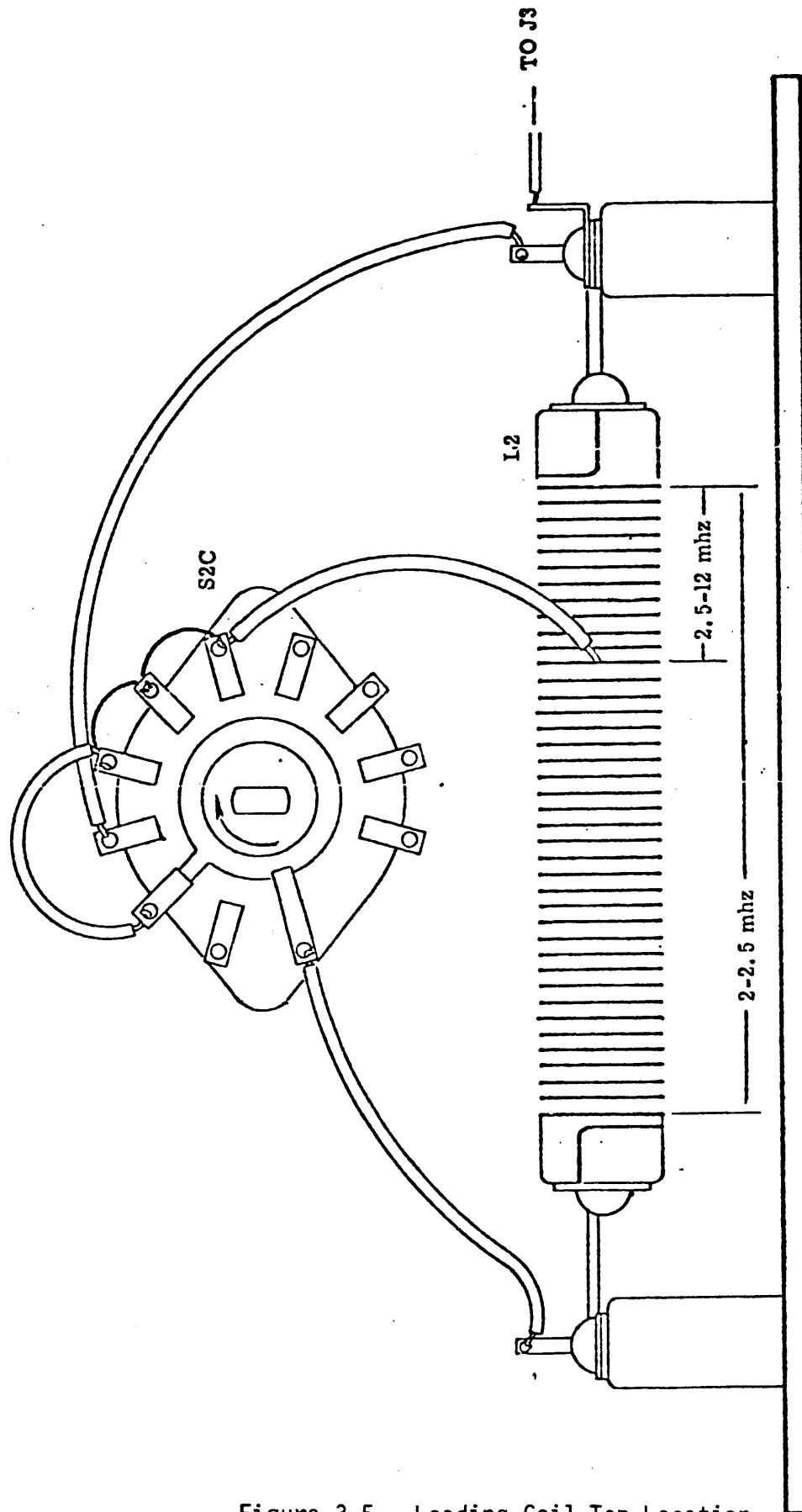


Figure 3-4. Component Location



NOTES:

- (1) S2 is shown in channel 2 position.
- (2) Loading coil L2 must be shorted for channel frequencies above 12 mhz.

Figure 3-5. Loading Coil Tap Location

6. Reset shorting clip along coil L1, and turn transmitter ON again, and apply power. Note reflected power indication, if the indication decreased, continue to move shorting clip in the same direction on coil L1 until reflected power indicates minimum. Bear in mind that the transmitter must be OFF before touching the shorting clips.
7. Once a minimum reflected indication is observed on the directional wattmeter use a insulated blade type adjustment tool, and adjust the corresponding channel adjust capacitor to further minimize the reflected power.
8. Repeat step (6) and step (7) as often as necessary to minimize reflected power indication.
9. Turn transmitter OFF, disconnect test equipment and replace cover on ATU-350A. Connect all interconnecting cables (input, output and control cable) between transmitter ATU-350A and antenna.

3-5. REMOVAL OF TUNER OUTER COVER

The ATU-350A Tuner assembly must be removed from its outer cover only to perform initial impedance matching adjustments. To remove the Tuner assembly proceed as follows:

1. Remove (4) screws from (2) mounting case brackets.
2. Remove (6) screws from front cover.
3. Remove insulator (NS109) J3, remove nut, insulator and 2 gaskets.
4. Carefully pull front cover away from case. Keeping in mind connectors are still intact.
5. Reassemble in the reverse order after adjustments are completed.

NOTE

The top cover is sealed with a catalyst RTV made by (Dow Corning). This seal must be removed before the cover is pulled away from the case. When reassembling a equivalent seal must be placed around the cover.

Part Number	Description	Used On	Qty	Symbol Number
CB118SSX200	Cap, Var	ATU-350A	1	C1,C2,C3,C4, C5,C6,C7,C8
CL477	Coil, Load	ATU-350A	1	L2
CL480	Coil, RF	ATU-350A	1	L1
MS3102A20-27P	Conn, Recp. Male	ATU-350A	1	J2
NS109	Ins., Feed-thru	ATU-350A	1	J3
S0239A	Conn, Recp, VHF	ATU-350A	1	J1
TZ232	XFMR,Torroid	ATU-350A	1	T1
1N547	Scond, Dev, Dio	ATU-350A	1	CR1
SW560	Switch, Rotary	ATU-350A	1	S1
WS115	Wafer, Switch	ATU-350A	1	S2

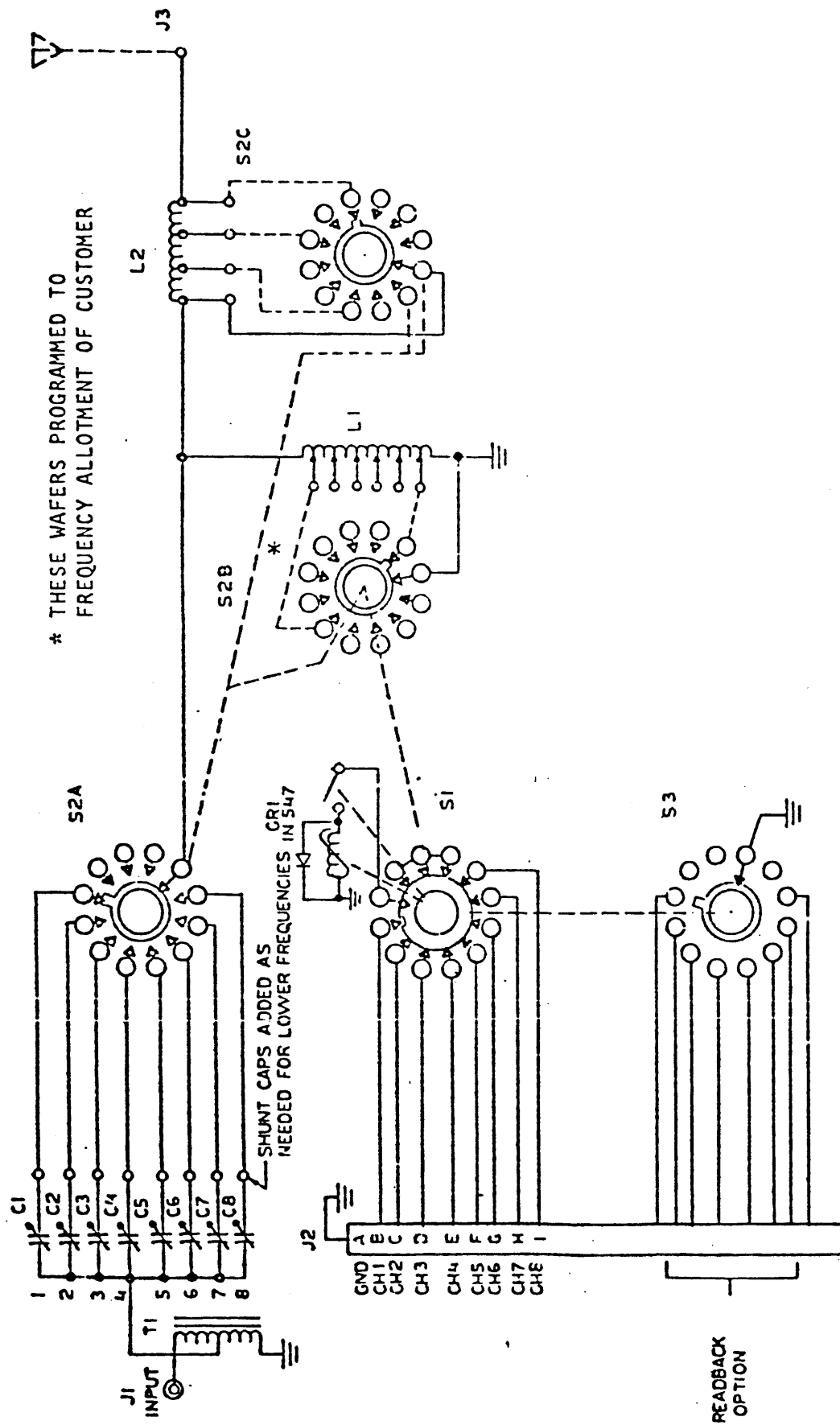


Figure 3-6. ATU-350A, Schematic Diagram