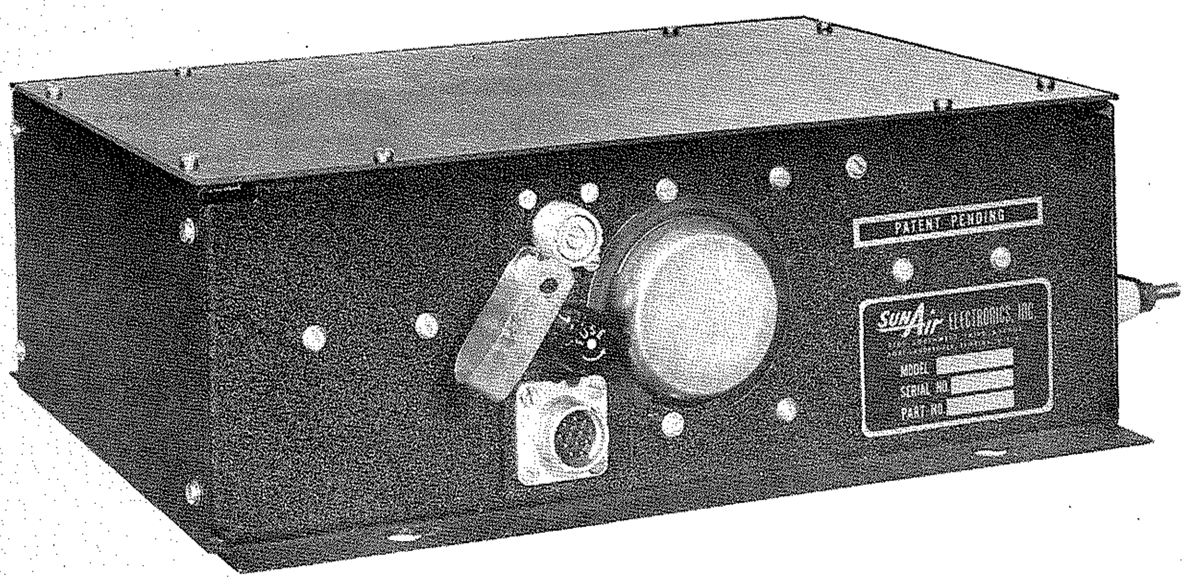


ANTENNA COUPLER

SUNAIR ELECTRONICS, INC.

3101 SOUTHWEST THIRD AVENUE

FORT LAUDERDALE, FLORIDA, U. S. A.

TABLE OF CONTENTS

ILLUSTRATIONS

PARTS REPLACEMENT

A complete stock of replacement parts for all SunAir equipment is maintained at the factory. In some cases, the part supplied against an order for a replacement item may not be an exact duplicate of the original part where the original item has been superseded by a newer and more efficient design. Such replacement parts will be interchangeable electrically. If the new part has a different size or shape, all necessary hardware to permit installation in older sets will be furnished.

Parts for SunAir equipment may be secured from SunAir distributors and dealers throughout the world. When direct orders from the factory are required, please specify the following:

a) serial number, model number and voltage of the unit
b) description of part required, and
c) quantity required

EQUIPMENT AND PARTS REPAIR

Complete factory service is available on any SunAir equipment. Repairs, adjustments or modifications which are of such a nature as to warrant factory service will be made in accordance with the instructions of the customer. A labor charge of $7.50 per hour, cost of parts and shipping charges will apply to all non-warranty work.

RETURN OF EQUIPMENT OR MATERIAL

To return equipment or material, under warranty or otherwise, advise SunAir Electronics, Inc. giving full particulars.

If the item is throught to be defective, give full information concerning the nature of the defect. SunAir will then authorize the return. Failure to secure this authorization prior to forwarding the equipment or material, or failure to provide complete information may cause unnecessary delay in processing.

PARTS SHORTAGE OR DAMAGE

Unpack and inspect all parts and equipment as soon as received. Do not accept a shipment where there are visible signs of damage to the cartons until a complete inspection is made. If there is a shortage or if any evidence of damage is noted, insist on a notation to that effect on the shipping papers before signing the receipt from the carrier.

If concealed damage is discovered after a shipment has been accepted, notify the carrier immediately in writing and await his inspection before making any disposition of the shipment. A full report of the damage should also be forwarded to SunAir.

a) Order number
b) Model and serial number
c) Name of transportation agency

When SunAir receives this information, arrangements will be made for repair or replacement.

PRODUCTION CHANGES

Engineering and production changes may be made from time to time in order to incorporate any feature or design which will improve performance, increase reliability or improve the usefulness of the equipment. Notice of such changes will be made through periodic service letters to all SunAir distributors.

When such changes affect the parts list or schematic diagram, a record of the "first used" serial number will be made and noted on the new parts list or schematic. By referring to the serial number, service personnel can quickly determine the proper schematic diagram for a given transceiver.

WARRANTY

SunAir warrants all parts of new equipment for one (1) year from date of installation providing the defective part is returned to the factory - transportation charges prepaid.

SunAir will assume warranty labor costs for 90 days from date of installation of new equipment in reasonable amount and at its discretion for the actual bench repair of the equipment involved.

Warranty card must be properly completed and returned to SunAir within ten (10) days from installation.

The obligation and responsibility of SunAir does not apply unless expressly provided herein. SunAir reserves the right to make improvements, additions or changes in design without obligation to install such changes, designs or improvements in equipment previously manufactured.

ANTENNA COUPLER THEORY

The transmitter output of the SunAir transceiver must be presented with a 50 ohm resistive load for greatest efficiency and power transfer. An end fed antenna of fixed length, configuration and proximity to a ground plane (in this case the aircraft) exhibits impedances at different frequencies which vary over a large range. At certain frequencies, the antenna appears purely resistive. At other frequencies it has inductive and resistive components and at still others, capacitive and resistive components. The function of the antenna coupler is to match or transform the impedance exhibited by the antenna, at each of the frequencies to be transmitted, to the required load impedance for the SunAir transmitter.

The combination of reactive components used to accomplish this transformation is varied. To determine the type and size of reactive components necessary for the transformation, an impedance chart is used. In the following diagram, a typical antenna is shown plotted on an impedance chart. On this chart resistance is shown increasing to the right, inductive reactance is shown increasing vertically upward, and capacitive reactance increasing downward.

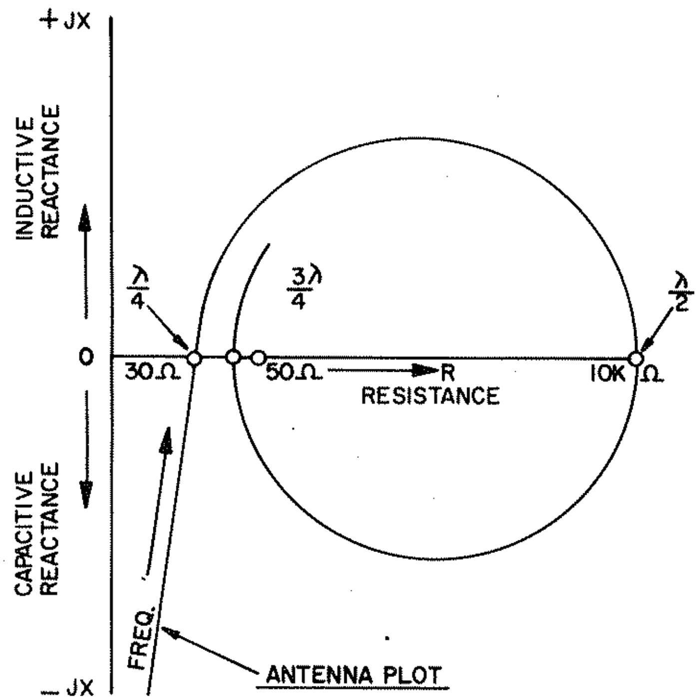


FIGURE NO. 1

From the chart it can be seen that at frequencies below quarter wave resonance, the antenna appears capactive and resistive. At frequencies between quarter and half wave resonance, the antenna is inductive and resistive. At frequencies between half and three quarter wave resonance, the antenna again appears capacitive and resistive. At quarter, half and three quarter wave resonance, the reactive components are zero and the antenna looks purely resistive.

It should also be noted that at quarter wave resonance, the antenna appears as a relatively low impedance (approximately 30 ohms) while at half wave resonance, the impedance has increased to approximately ten thousand ohms. At three quarter wave resonance the antenna is again at low impedance. Since the SunAir transceiver output is also at low impedance (50 ohms), quarter and three quarter wave resonant frequencies can be transmitted with a minimum of transformation required. For this reason, a variable length trailing wire antenna is usually tuned to either quarter or three quarter wave resonance. Because three quarter wave resonance presents an impedance more closely matched to the transceiver output, it is the obvious preference whenever practical.

A typical 29 foot "V" antenna is plotted in Figure 2. All straight and "V" antenna installations would have a similar plot; only the frequency distribution along the plot would vary.

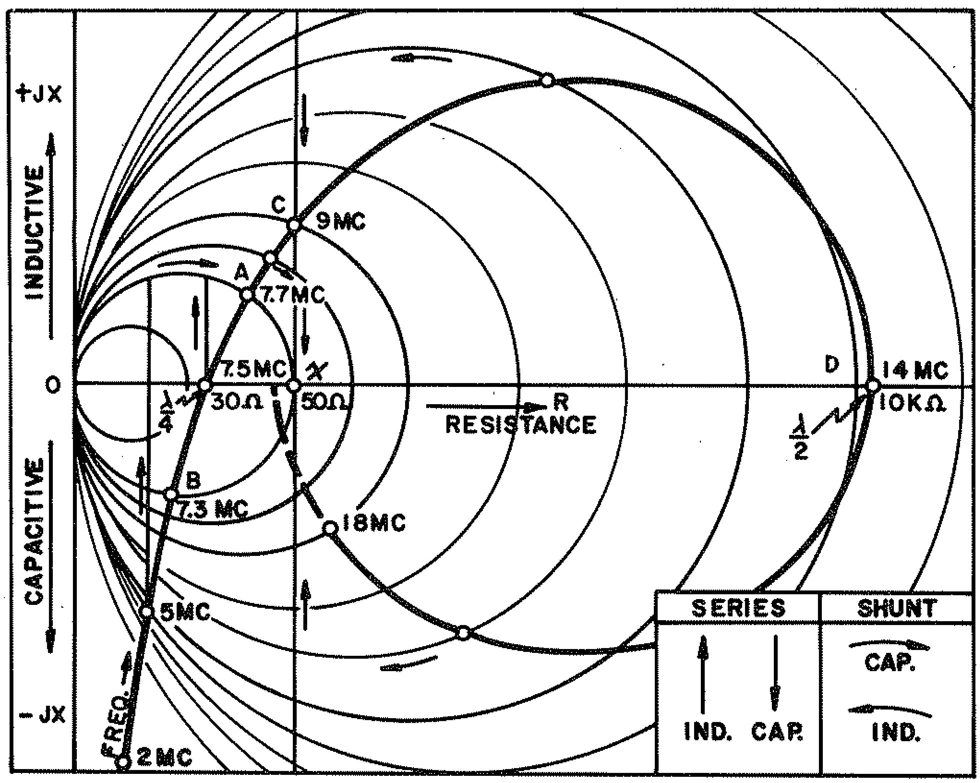


FIGURE NO. 2

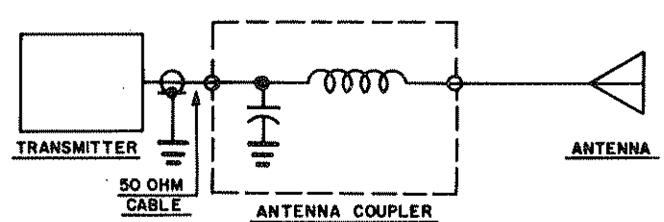
In using the impedance chart to determine the required transformer components, the following is considered. Point "X", the 50 ohm resistive point, locates the output impedance of the transmitter at all frequencies. The impedance of the antenna at any given frequency is represented by a point on the antenna plot. Impedance matching is accomplished by providing the proper reactive components to transform from a given frequency point on the antenna plot to the 50 ohm resistive point.

The circles appearing on the diagram are constant admittance plots. A shunt reactive component transforms along any given circle. The direction of travel on the chart is shown by the arrows at the bottom of the figure; i.e., shunt capacitance transforms clockwise while shunt inductance transforms counter-clockwise. Series reactive elements result in vertical transition on the chart. As shown, series inductance results in an upward transformation, while series capacitance moves downward.

With these rules and Figure 2, a qualitative analysis of transformer requirements for a typical 29 foot antenna can be performed.

Transformation can always be accomplished with more than one combination of elements. Theoretically, the shortest distance traveled on the impedance chart represents the preferable and most efficient transformation. From a practical stand-point, however, the shortest path is not always the one chosen. In the following discussion, SunAir's choice of transformation circuitry will be discussed with an explanation for the reason for abandonment of the shortest path wherever applicable.

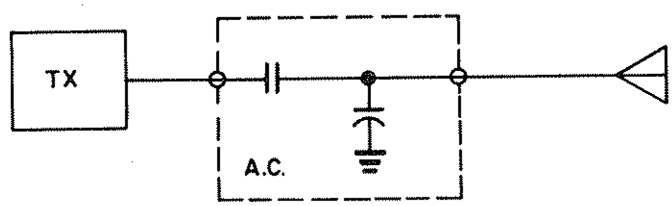
In Figure 2, quarter wave resonance is experienced at approximately 7.5 MC. Starting at this point it can be seen that transformation to the 50 ohm point is accomplished by vertical travel upward (series inductance) to the constant admittance circle which goes through the 50 ohm point, and clockwise movement along this circle (shunt capacitance) to the 50 ohm point. Transformation at quarter wave resonance would therefore appear schematically as follows:



It can also be seen that the same type of transformation can be used for all frequencies from the lowest to be transmitted (2 MC) to point "A" on the antenna plot.

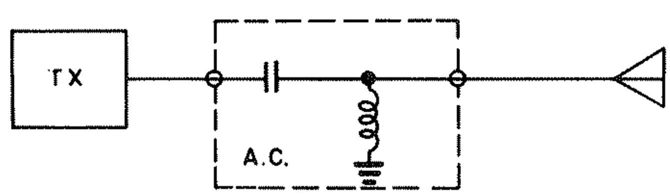
It should be noted at this time that a slightly shorter transformation is possible for the frequencies below point "B" on the antenna plot. Vertical upward travel (series inductance) to the first intersection of the circle which cuts the 50 ohm point, then counter-clockwise movement (shunt inductance) along this circle would result in a slightly more efficient transformation. But since the change in efficiency is only slight, and to gain standardization in components and circuitry and eliminate the necessity for pin pointing the exact frequency of circuit changeover for each antenna, SunAir has chosen to transform all frequencies below point "A" on the antenna plot by the same means.

The next band of frequencies to be transformed is a small one. It extends from point "A" to point "C" on the antenna plot of figure 2, and represents frequencies between 7.7 and 9 MC. Transformation is accomplished by clockwise rotation (shunt capacitance) on a circle going through the frequency to be transformed, and vertical downward movement (series capacitance) when the vertical line representing 50 resistive ohms is reached. Schematically, the transformer is as follows:



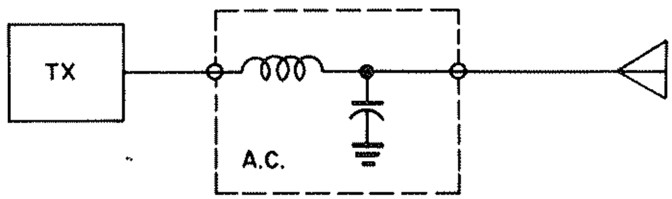
The quantity of shunt capacitive reactance required from antenna to ground is often present in the completed antenna coupler and the addition of a capacitive shunt component is not required.

The next band of frequencies extends from "C" to "D" on the antenna plot and contains all frequencies between 9 MC and the half wave resonant frequency (approximately 14 MC). Transformation in this whole quadrant can be accomplished by counter-clockwise rotation (shunt inductance) on a given circle and vertical downward movement (series capacitance) when the 50 ohm line is reached. Schematically, the transformer is as follows:



Thus, all frequencies between "A" and "D" on the diagram are transformed with series capacitance. Shunt capacitance, no shunt element, or shunt inductance is used at the antenna terminal as required.

The last band of frequencies covers the antenna plot from point "D" to the 18 MC point which is approaching three quarter wave resonance. All frequencies within this quadrant are transformed by clockwise rotation (shunt capacitance) on a given circle, and vertical upward movement (series inductance) when the 50 ohm line is reached. In schematic form the impedance matching network is as follows:

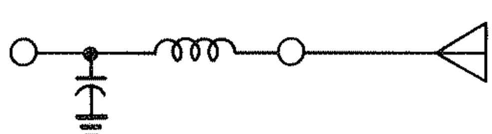


Capacitance from antenna to ground within the antenna coupler will be represented on the diagram by a slight clockwise rotation along a respective circle for each frequency to be transformed. This capacity will rotate the half wave resonant frequency (and the frequencies immediately below it) into the last quadrant discussed, and they would be transformed in the manner previously set up for this quadrant. Thus 13.3 MC, even though it is slightly below the half wave resonant frequency, is rotated into this last quadrant by shunt capacitance within the antenna coupler, and it is transformed by series inductance and shunt capacitance on the antenna terminal.

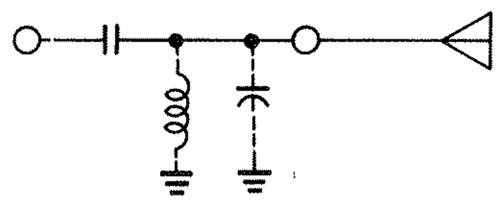
The previous discussion furnished only a qualitative indication of the reactive elements required for matching a transceiver to the example antenna. To determine the size of each type of reactive element for a given antenna and frequency line up would require a frequency plot of the antenna on a graduated impedance diagram, and a knowledge of the reactive and resistive impedances to be experienced in the physical construction of an antenna coupling.

In summary, for a given antenna, the SunAir Antenna Coupler uses the following impedance matching circuitry for the indicated frequency bands:

1) From the lowest frequency to be transmitted up to quarter wave resonant frequency

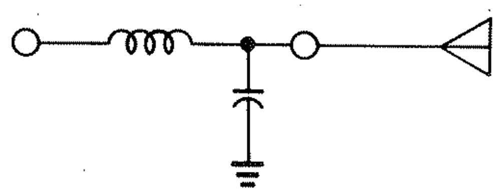


2) From the frequencies immediately above the quarter wave resonant frequency to the half wave resonant frequency:



The shunt reactive component is capacitive, non-existent, or inductive as indicated.

3) From the half wave resonant frequency to a frequency immediately below the three quarter wave resonant frequency:



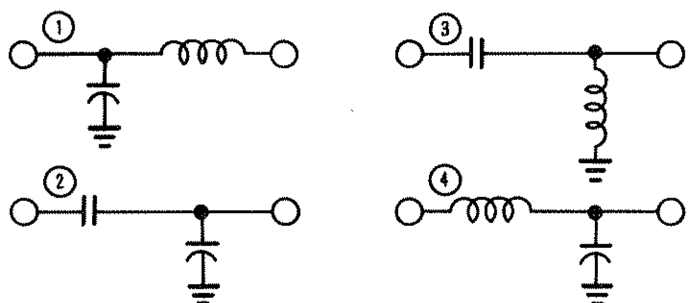
ANTENNA COUPLER CONSTRUCTION AND SWITCHING

The four major types of components which comprise the SunAir Antenna Coupler are as follows:

1) Ledex and Switch Deck Assembly
2) Air Duct
3) Fixed Reactive Components
4) Variable Reactive Components

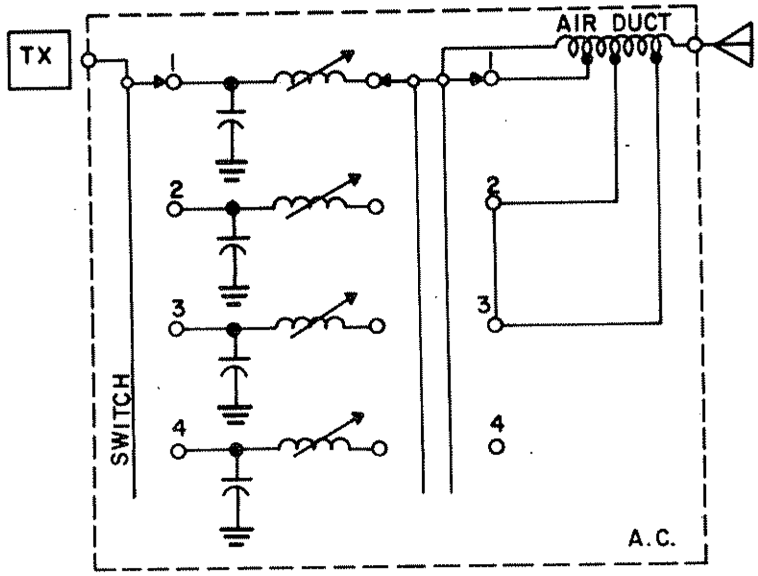
The ledex motor with its slave wafer and switch deck assembly is actuated and positioned by a master wafer in the transceiver (direct model radio) or control head (remote model radio). In this manner, a given channel position in the radio dictates a respective ledex position in the antenna coupler. The switch assembly is thus positioned to form the proper pre-selected reactive circuitry required to match transceiver to antenna at any given frequency.

As discussed in the previous theory section, the four types of matching circuits to be formed are as follows:

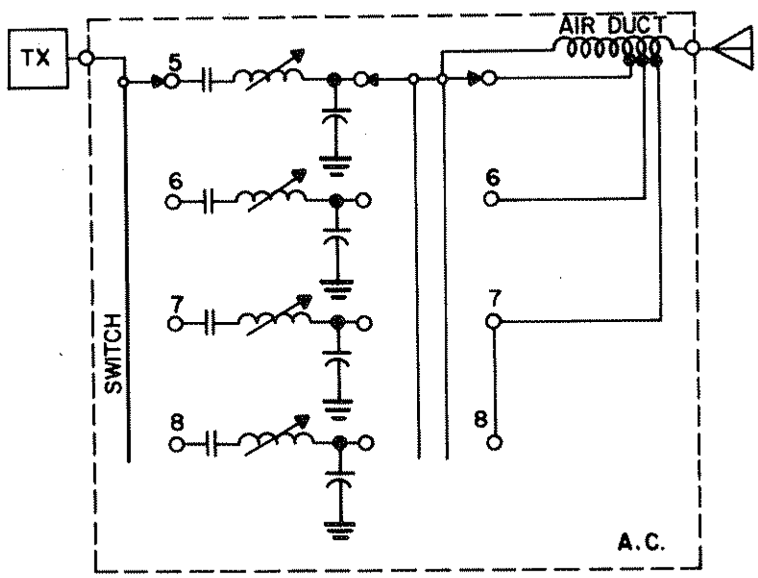


In circuit #1, a large quantity of (there is no other) inductive reactance is often required. Since the quantity is large, it is important that the "Q" of the reactive component be held at a maximum. For this reason, a tapped air duct is used for those frequencies or bands of frequencies requiring large quantities of inductive reactance. The inductance is made tunable by placing a small iron core tunable inductor in series with the tapped air duct.

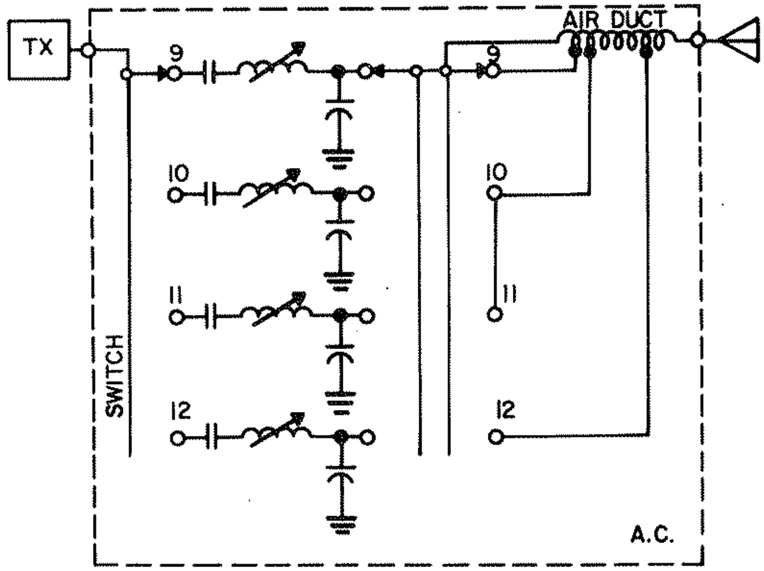
The shunt capacitance required at the transmitter terminal in circuit #1 is provided by a fixed mica capacitor. Schematically, this section of the antenna coupler may appear as follows:



Circuits #2 and #3 both incorporate series capacitive elements. Tunable series capacitive reactance is achieved by the use of a fixed capacitor in series with a small tunable inductor. The capacitive shunt reactance required in circuit #2 is provided by a fixed disc capacitor, and the inductive shunt reactance of circuit #3 is a tunable inductor. This section of the antenna coupler may appear as follows:



In circuit #4, series inductance is again required. It is accomplished in the same manner as in circuit #1 (a tunable inductor in series with a section of the air duct when necessary). The shunt capacitive reactance required is furnished by a fixed disc capacitor. Schematically, this section of the antenna coupler may appear as follows:



In this manner, the antenna coupler incorporates at least one tunable element for each of the individual frequencies to be transmitted.

ANTENNA AND ANTENNA COUPLER INSTALLATION

Proper antenna installation and equipment placement are very important factors in achieving final antenna coupler adjustment and good, efficient transmission. With a given antenna length, the most efficient transmission is made with a properly adjusted coupling unit and the following discussion pertains largely to installation requirements leading to ease and effectiveness in coupling unit adjustments.

The following factors are important in achieving a good transceiver-coupler-antenna system:

1) Antenna length (including lead-in to coupling unit)
2) Antenna configuration (straight antenna, "open V" antenna or "closed V" antenna)
3) Antenna to aircraft capacitance (proximity of antenna to fuselage)
4) Antenna coupling unit placement (location of the coupling unit in the aircraft)

Antenna Length

The exact antenna length (including lead-in) which appears on the radio-antenna coupler order should be installed on the aircraft. This is the length of antenna for which the coupler is designed and tested, and even a slight variation in length may cause difficulty in coupler alignment. A change of only 3 inches from the length of antenna used to factory align the antenna coupler will result in reflected power readings of as high as 20 watts when transmitting some frequencies. A 3 inch error in length, alone, is probably within the tuning range of all antenna coupling units at all frequencies, but when combined with differences in antenna configuration and capacitance to aircraft, the resulting electrical change may well not be within tuning range. Since antenna length is the easiest of the factors to control, it is important that every effort be made to install an antenna of the exact length.

Antenna Configuration

A straight antenna (for those aircraft large enough to accommodate 29 feet or more of straight antenna) and an "open V" antenna are preferable to a "closed V" antenna. The term "open V" refers to a standard antenna installation (see page 20 which originates at a convenient spot in the upper-center fuselage, angles upward to a point high on the vertical tail fin and is terminated near the trailing edge of a wing tip. A "closed V" antenna is one which is terminated on the wing at other than the tip or folds back upon itself and is terminated on the fuselage. A "closed V" antenna is often installed on helicopters because of their limited accommodations

A straight or "open V" antenna of given length yields greater transmission efficienc, and a more desirable transmission pattern, as well as aiding in the ease and effectiveness of antenna coupler alignment. A typical "open V" antenna and the components available for installing this antenna are shown on pages 21-24.

Antenna to Aircraft Capacitance

The proximity of the antenna to the aircraft is also an important factor. This proximity is especially important at the points of high voltage along the antenna. The termination or far end of the antenna carries maximum voltage at all frequencies. Other points of high voltage vary along the antenna with variation in frequency.

As a general rule, the antenna should not have close proximity to the aircraft at any points. In a standard "open V" installation, the three areas of closest proximity usually found are:

1) Origination, where the antenna is brought through the fuselage
2) Tail fin, where the apex of the "V" is held
3) Wing tip, where the antenna is terminated

Except at the feed through point, separation between antenna and aircraft surface should never be less than 6 inches. At the terminal end, at least one foot separation is suggested when practical.

Standardization

Through experience, SunAir has chosen two antenna lengths as standards. These are 29 and 34 feet. It has been found that an "open V" antenna of one of these lengths can be properly installed on the majority of small planes. Larger aircraft will accommodate a straight 29 or 34 foot antenna.

Installation of a standard 29 or 34 foot antenna is advantageous both to SunAir and to the customer. Because of the accumulated information and experience with these two antenna lengths, SunAir can design and pre-align the antenna coupler with greater ease, speed and effectiveness, while the customer is afforded matching circuits which are more easily aligned and have been "tried and proven" extensively in the field.

Antenna Coupler Placement

The placement of the coupling unit within the aircraft is also an important consideration. There are several factors to be considered in choosing a proper location. Three of these are:

1) Antenna coupler to feed through proximity
2) Affect on antenna length
3) Accessibility

Coupler to Feed Through Proximity

The coupling unit must be located in close proximity to the antenna feed through insulator. The lead between coupling unit and antenna feed through point is active antenna and must be held to a minimum. The most detrimental product of excess wire at this area is capacitance build-up and its undesirable (and non-productive) loading effect. The suggested length of wire between coupling unit and feed through is 6 inches; it should never exceed one foot. The choice of antenna coupler location can therefore never be separated from the choice of feed through location.

Affect on Antenna Length

Because of the proximity requirement between antenna coupler and antenna feed-through, the choice of antenna coupler location has an obvious ultimate effect upon antenna configuration and possibly upon antenna length. Ultimate objectives in installing an antenna on a small aircraft should be (a) a properly installed antenna (b) a standard antenna (29 or 34 feet) and (c) an antenna of the longer standard length whenever practical. With these objectives, and the knowledge that it is desirable to terminate the antenna one foot or more from the wing tip, it is obvious that the origination of the antenna (the feed through) may well become an important factor.

Accessibility

Once installed and re-aligned, accessibility to the antenna coupling unit is not a very important factor. For this reason, the coupling unit is often located in an area where installation and alignment are very difficult. The result is usually a poorly installed, poorly aligned coupling unit. To ease difficulties that may arise during initial installation and alignment (or during the re-alignment necessary if a transmitter frequency is changed) accessibility should be considered.

ANTENNA COUPLER ALIGNMENT

To properly align the SunAir Antenna Coupler, the following equipment tools are required:

1) A Bird Electronic Corporation Thru Line Wattmeter, Model No. 43 (Cleveland, Ohio, U.S.A.) or equivalent, with line impedance of 50 ohms and having a 2 through 30 MC, 100 watt plug-in element.

2) Standard insulated alignment tool to fit tuning slot of tunable inductors.
3) Screwdriver (when movement of the taps on the air duct is required--if the antenna is of specified length and properly installed, such changes should not be required.)

The wattmeter should be inserted into the coax cable line running from the radio to the antenna coupler. At this time the line up of equipment should be as follows:

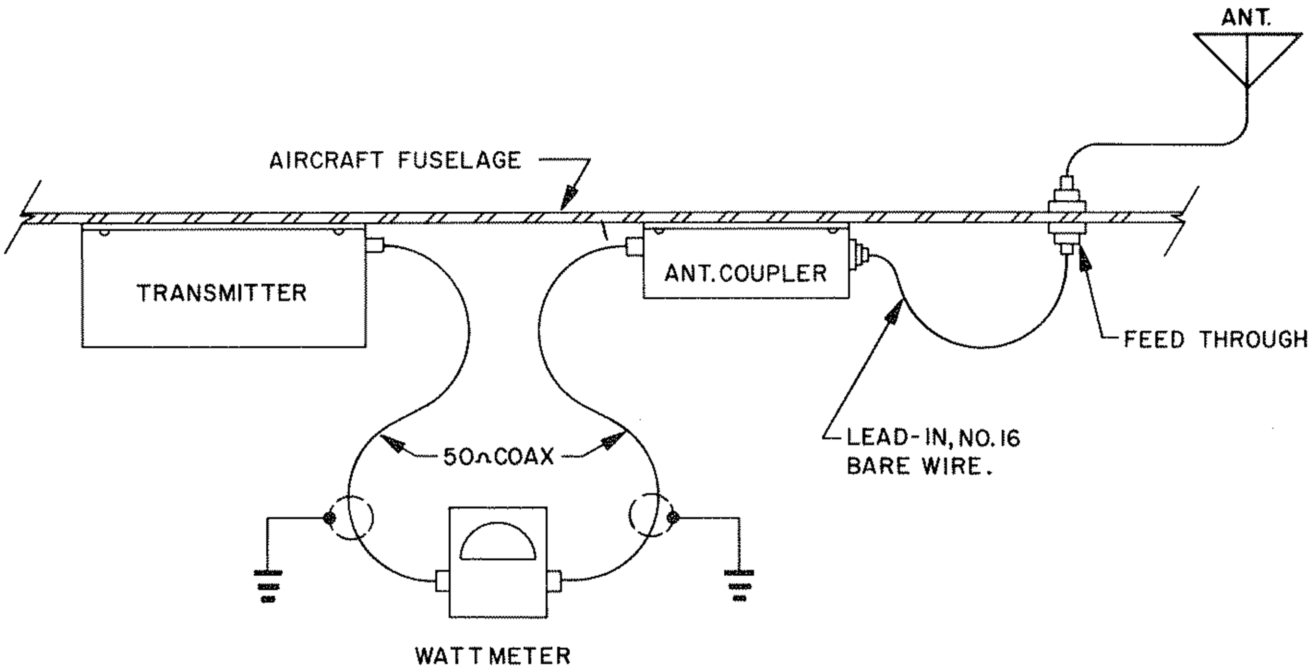


FIGURE NO. 3

Before starting alignment, the following checks should be made:

a) Antenna coupler ground - the coupling unit chassis should be provided with a good electrical ground to the aircraft fuselage.

b) Antenna length - the operator should know exactly how much active antenna has been installed (including the lead-in to the coupling unit.) This antenna length should coincide, to the inch, with the length specified on the order. If a differential exists, and it can be compensated for a slight variation in lead-in length (2 or 3 inches), this should be done. If a difference between specified and actual antenna is so great that such an adjustment would not compensate for it, it would probably save much time and labor to correct the antenna length at this time.

c) Antenna to aircraft proximity - the operator should make a quick visual observation of the proximity of the installed antenna to the aircraft skin. Except at the area of feed-through, the antenna should never be less than 6 inches from the aircraft surface at any point along its length. The chief reason for making such an observation at this time is to alert the operator to a possible cause for any difficulty which might arise during antenna coupler alignment.

Use the SunAir Feedthrough insulator Part No. 86303 only when installing an HF Antenna System. Installation of feedthrough insulators other than specified may result in failure of the system.

PRE-ALIGNMENT

Before any adjustments are made in the coupling unit, a procedure may be employed which will minimize (and possibly eliminate) the need for antenna coupler tuning. The procedure is as follows:

1) Cut a lead-in wire which is approximately 3 inches longer than the original lead-in.
2) Replace the original lead-in with the new one (using the full length of wire.)
3) Channel the radio and coupling unit to the first available frequency below the quarter wave resonant frequency of the antenna.

If the quarter wave resonant frequency of the antenna is not known, an approximate value may be obtained from the graph on page 25. Example: antenna length-29 feet, quarter wave resonant frequency - approximately 7.5 MC, first available frequency below it - 6.5 MC.

4) Turn the element of the wattmeter to read reflected power.
5) Depress the mike key momentarily and observe the wattmeter reading.
6) Loosen the lead-in wire from either coupling unit or feed through and make the lead-in approximately 1 inch shorter by bending the last inch back along the lead-in. Tighten the wire at this new length.
7) Again depress the mike key momentarily and observe the power reading.
8) In a like manner, observe the reflected power with the new lead-in 2, 3, 4, 5 and 6 inches shorter.
9) Return to the position which furnished the least reflected power reading and cut and permanently attach the lead-in at this length.

ALIGNMENT

1) Channel the radio and coupling unit to #1 channel.
2) Switch the element of the wattmeter to read reflected power.
3) Locate the tunable inductor for channel #1 (marked "1" beside the inductor on the coil mounting board), depress the mike key, and adjust the tunable inductor for minimum reflected power. If no dip is observed, note the position of the slug screw for the lowest reflected power reading.
4) If a dip is observed, channel the radio to #2 channel.

NOTE: Inductance is increased by screwing in the inductor slug, and maximum inductance is reached with approximately 1/16 inch of screw still showing. Do not mistake a dip during the last 2 or 3 turns as indication of proper tuning.

If no dip was observed, a tap on the air duct must be changed. The tap to be changed is indicated by the color of the lead. The universal color code is used: brown is channel #1, red is channel #2, etc. The schematic will indicate that some channels have a common air duct tap. This tap will carry the color of the first channel of the group. Example: if channels 4, 5 and 6 have a common tap, the lead will be yellow as 4 is the first of the group.

After the tap is located and the screw is loosened (do not remove the tap from the coil), the direction of movement on the air duct must be decided. The direction is indicated by the position of the tunable inductor slug when least reflected power was observed. If the slug of the inductor is screwed completely in, the circuit requires more inductance and the tap should be moved one position away from the antenna feed through end of the coupler unit. If the reverse is indicated, a change of one position in the opposite direction should be made. Repeat steps 3 and 4 until a dip is observed, then switch to channel #2.

5) Locate the tunable inductor for channel #2, and proceed as in step 3 above.
6) In a like manner, tune all channels of the load unit, referring to the schematic as required.

NOTE: The alignment of any channel having both series and shunt tunable elements requires adjustment of both elements until a minimum reading is obtained.

7) Final Fine Tuning - Since adjustment of any given channel may have a slight detuning effect on other channels, a final check should be given each channel for any fine adjustment necessary. During this check, the wattmeter should be switched back and forth from reflected to forward power, and the coils tuned to a condition of minimum reflected power with maximum forward power. Reflected and forward power readings should be recorded for each channel after fine tuning is completed.
8) Any tunable coils with locking nuts on the extended screw should be locked by tightening the nut against the coil mount. Care should be taken not to turn the adjustment screw during this operation.

CHECK FOR SATISFACTORY ALIGNMENT

"Good" alignment has been achieved when reflected power readings are below 2 watts on all frequencies. Alignment is considered "satisfactory" if no reflected power reading exceeds 5 watts. If reflected power readings in excess of 5 watts have been recorded, procedures indicated in the following section may correct antenna coupler-antenna incompatibility.

CORRECTING COUPLER AND ANTENNA INCOMPATIBILITY

The antenna coupler's matching circuitry for each frequency usually consists of a series and a shunt element. The shunt element may appear on either the transmitter or the antenna side of the series element. At some frequencies, the shunt reactance is formed by capacitance present in the coupler unit itself and the addition of a reactance element has not been required.

In tuning the series element of any given channel, a dip in the reflected power reading indicates that the proper series reactance has been achieved. If the dip does not bring the reflected power to zero, the shunt reactance of the system is at fault. Corrective action depends somewhat upon observations made during tuning and the results of tuning efforts. A discussion of possible corrective efforts will therefore be separated according to "symptoms" observed.

a) If all frequencies below the quarter wave resonant frequency required considerably more inductance (inward movement of tuning screws, etc.) than that provided by the pre-tuned load unit; if the majority of channels after tuning produce more than 4 watts of reflected power--better tuning would probably be possible if the antenna is lengthened slightly.

b) If all frequencies below the quarter wave resonant frequency require considerably less inductance , and the tuned channels consistently yield 4 or more watts of reflected power, better results could probably be obtained by shortening the antenna slightly.

c) If all frequencies below the quarter-wave resonant frequency require only slight adjustment; if the majority of channels reflect 4 or more watts; if the channels of higher frequency are further detuned than those of lower frequency--it is indicated that the antenna to aircraft capacitance is considerably different than that of the antenna used to factory align the coupling unit.

Antenna to aircraft capacitance can be satisfactorily increased by placing a small capacitor from antenna to ground at the output terminal of the antenna coupler unit. To determine if such a requirement exists, the following procedure may be employed; (1) Channel the system to one of the frequencies exhibiting poorest matching. Activate the transmitter and observe the reflected power reading. (2) Place a 2 pf (3KV or higher) capacitor from the antenna to ground at the antenna terminal of the coupling unit. (3) Actuate the transmitter and again observe the reflected power. If the reading is less than the previous one, the need for antenna to ground capacitance is indicated. (4) Increase the capacitance value to 4 pf, actuate the transmitter and retune the antenna coupler tuning elements for the channel. In a like manner, vary the capacitance value until a "good" reflected power reading is obtained. (5) Re-align the complete coupling unit with this capacitor in the circuit.

NOTE: A small amount of incompatibility due to antenna capacitance can be compensated for by changing the value of the capacitor across the input of the antenna coupling unit.

Less antenna to aircraft capacitance can be achieved only by increasing the distance between the antenna and the surface of the aircraft. Such a change requires re-positioning the antenna. If increased capacitance has not afforded a decrease in reflected power, excess capacitance may already exist in the system.

One practical method of gaining a temporary decrease in antenna capacitance is by inserting a mast or spacer between antenna and aircraft at areas of closest proximity. As mentioned previously, the most critical area is the far end of the antenna. Another problem condition is a considerable length of antenna (2 feet or more) positioned less than a foot from the aircraft surface. After this spacing is accomplished, transmission on any of the detuned frequencies should indicate the amount of antenna re positioning required and the critical areas to be relieved.

d) If all frequencies below the quarter wave resonant frequency require only slight adjustment, and if only a small number of channels produce objectionable reflected power, the shunt elements of these channels can be changed. If the shunt element is a capacitor, a parallel capacitor (approximately one tenth the value of the component in the circuit) will indicate whether the circuit needs more or less capacitance. If the shunt element is an inductor, it is variable, and a slight amount of tuning should indicate whether the circuit needs more or less shunt inductance.

* * * CAUTION * * *

DO NOT OPERATE TRANSMITTER FOR EXTENDED PERIODS IN A DETUNED CONDITION. SERIOUS DAMAGE MAY RESULT TO TUBES, TRANSISTORS AND ASSOCIATED PARTS.

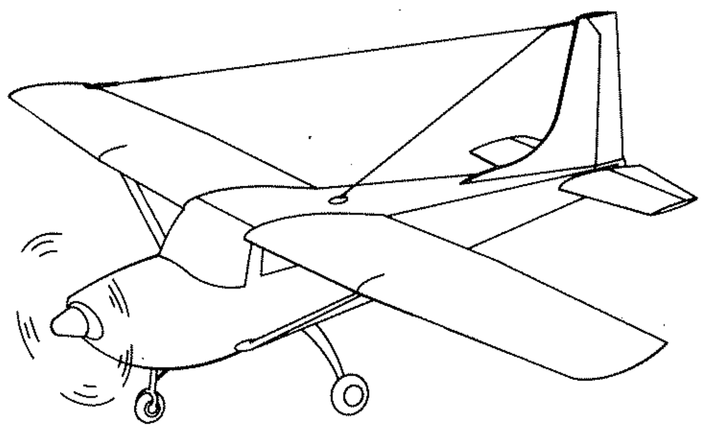


FIGURE NO. 6
Typical Open "V" (as used on Fixed Wing)

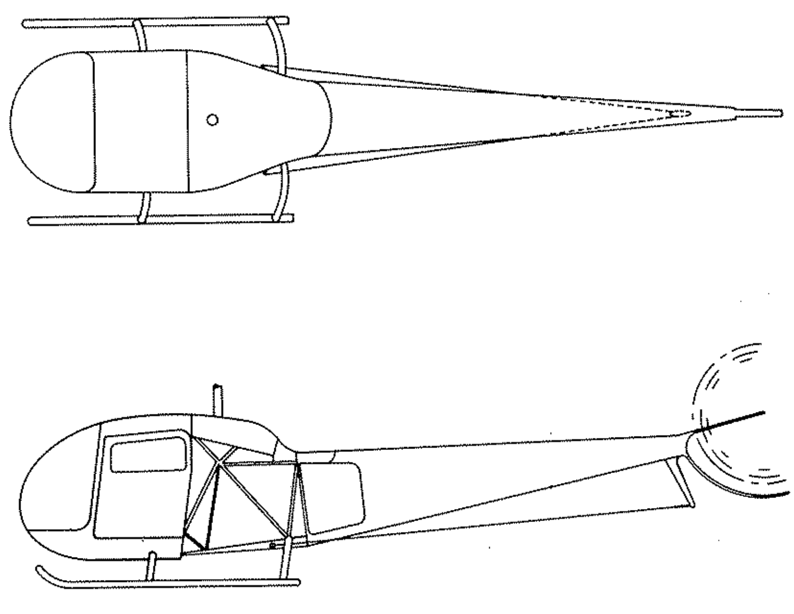


FIGURE NO. 7
Typical Closed "V" (as used on Helicopter)

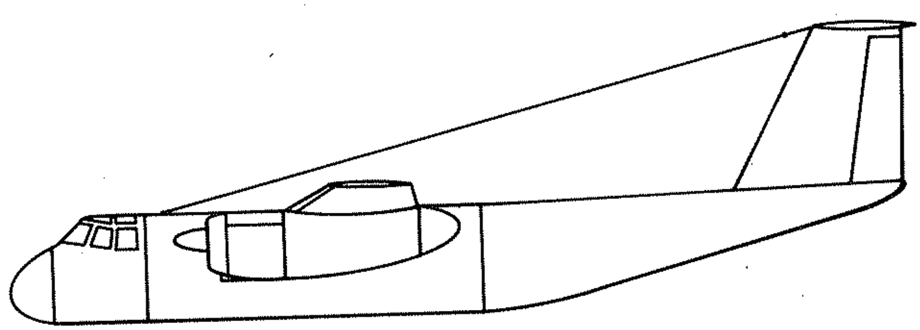
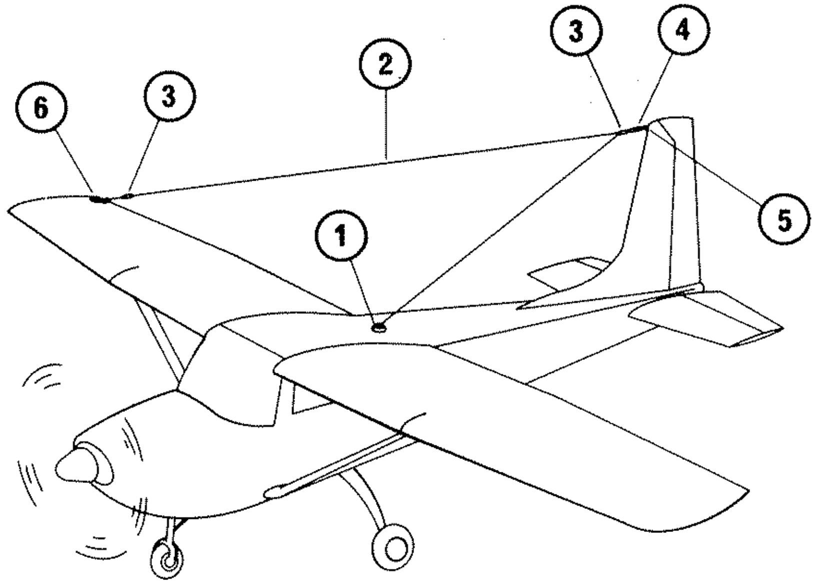


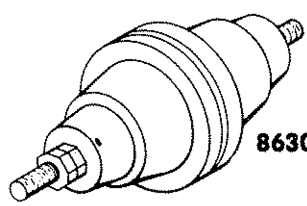
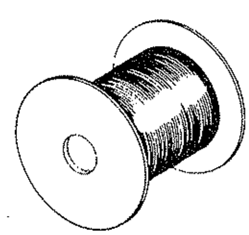
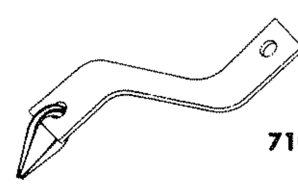
FIGURE NO. 8
Typical Straight Wire Antenna

95146 FIXED ANTENNA KIT

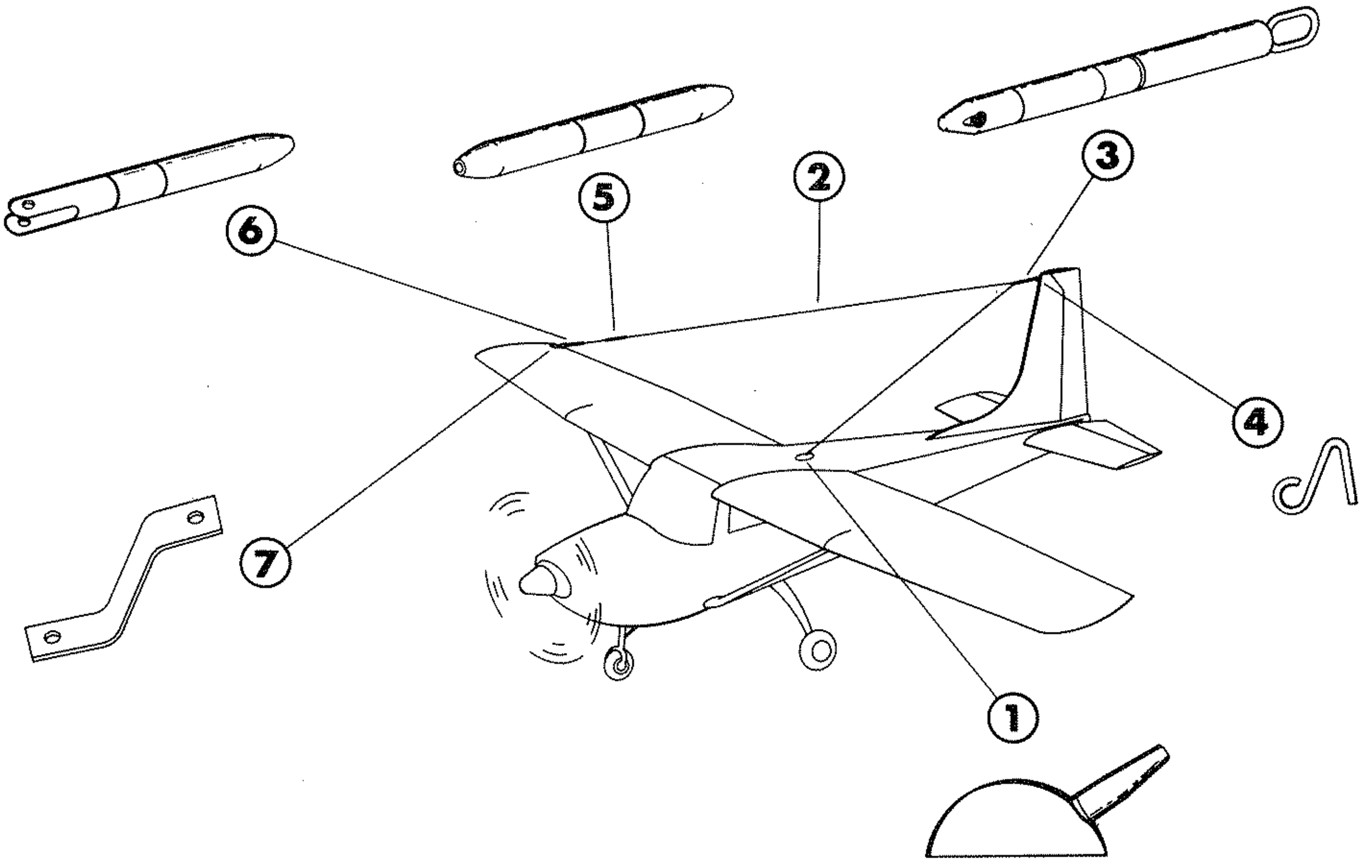
(H. F. BARE WIRE)



INSTALLATION

①  86303 FEED THROUGH INSULATOR	②  58863 100 FEET #18 COPPERWELD WIRE
③  71279 (2 Req.) STRAIN INSULATOR	④  71281 TENSION SPRING
⑤  71293 VERTICAL FIN ANCHOR	⑥  71009 WING TIP BRACKET

SUNAIR 95158 HF ANTI-PRECIPITATION STATIC ANTENNA KIT



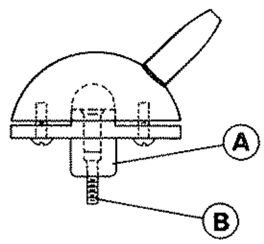
INSTALLATION

ITEM	DESCRIPTION	PART NO.
1	Feed Through Insulator	71308
2	60 Feet Insulated Antenna Wire	71310
3	Insulated Tension Unit	71322
4	Vertical Fin Anchor	71293
5	Strain Insulator	71267
6	Insulated Tension Anchor	71334
7	Wing Tip Bracket	71009
8	Wire Retraction Tool	71346

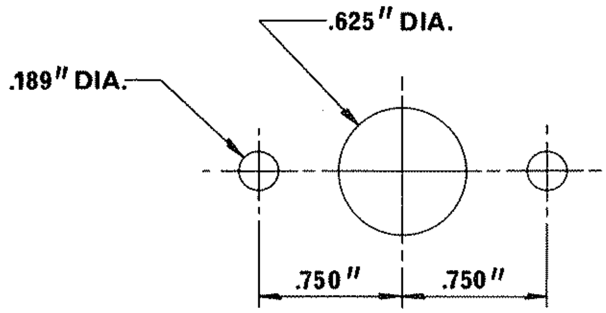
SUNAir® ELECTRONICS, INC.

3101 SOUTHWEST THIRD AVENUE • FORT LAUDERDALE, FLORIDA, U. S. A.

FEED-THROUGH INSULATOR 71308
(ITEM 1)



A NYLON BASE PLATE
B ANTENNA WIRE CONNECTOR BOLT
C ANTENNA WIRE
D WASHER
E TERMINAL LUG
F LOCK NUT



Mounting Dimensions

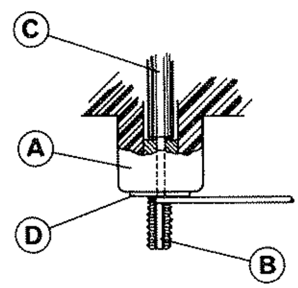


Fig. 1

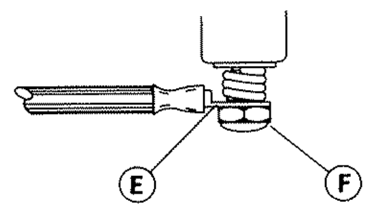


Fig. 2

STRIP BACK POLYETHYLENE SHIELD (C) TO EXPOSE APPROXIMATELY 4" OF ANTENNA WIRE CORE. INSERT WIRE CORE INTO CONNECTOR BOLT (B) AND EXTRACT FROM SLOT. INSERT WASHER "D" AS SHOWN IN FIG. 1

WIND WIRE AROUND CONNECTOR BOLT (B) 3½ TO 4 TURNS. INSTALL TERMINAL LUG (E) OF ANTENNA LEAD AND SECURE WITH LOCK NUT (F), AS SHOWN IN FIG. 2

INSULATED TENSION UNIT 71322
(ITEM 3)

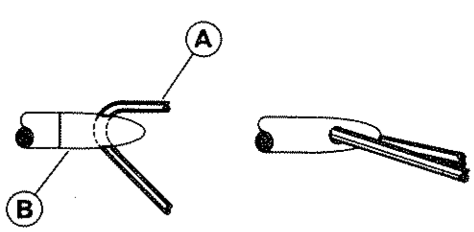


Fig. No. 3

A INSULATED ANTENNA WIRE

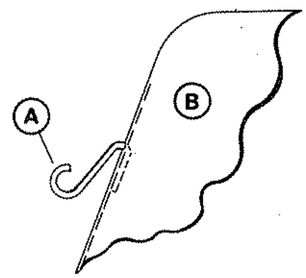
B INSULATED TENSION UNIT

APPLICATION — THE ANTENNA (A) IS CONNECTED TO THE FEED-THROUGH INSULATION ITEM 1, AND ROUTED VIA THE VERTICAL STABILIZER BY THE USE OF THE INSULATED TENSION UNIT (B), AS SHOWN IN FIG. NO. 3.

VERTICAL FIN ANCHOR 71293

(ITEM 4)

APPLICATION — THE ANCHOR IS CONNECTED TO THE VERTICAL FIN BY DRILLING A 1/8" DIAMETER HOLE ON LEADING EDGE OF THE VERTICAL FIN AT THE DESIRED HEIGHT. INSERT ANCHOR AS SHOWN IN FIG. NO. 4.



A VERTICAL FIN ANCHOR

B VERTICAL FIN

Fig. No. 4

STRAIN INSULATOR 71267

(ITEM 5)

APPLICATION — THE STRAIN INSULATOR IS USED FOR ADJUSTING THE ANTENNA WIRE TO THE DESIRED LENGTH AND IN SOME CASES MAY NOT BE REQUIRED BECAUSE THE DESIRED LENGTH EXTENDED TO THE ANCHOR INSULATOR 71334.

ANCHOR INSULATOR 71334

(ITEM 6)

APPLICATION — THE ANCHOR INSULATOR IS USED TO CONNECT THE ANTENNA WIRE TO THE WING TIP BRACKET, ITEM 7.

WING TIP BRACKET 71009

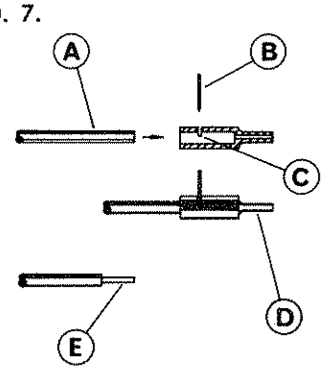
(ITEM 7)

APPLICATION — THE WING TIP BRACKET IS CONNECTED TO THE TOP SIDE OF THE WING TIP BY REMOVING ONE OF THE WING TIP SCREWS AND REPLACING IT WITH A LONGER SCREW.

WIRE RETRACTION TOOL 71346

(ITEM 8)

THIS IS A DUAL PURPOSE TOOL DESIGNED TO PREPARE THE POLYETHYLENE WIRE FOR INSERTION INTO THE INSULATOR UNIT WITHOUT DAMAGING THE WIRE CONDUCTOR. ITS SECONDARY USE IS DESCRIBED IN FIG. NO. 7.



A POLYETHYLENE WIRE

B BLADE

C BLADE RECESS

D WIRE RETRACTION TOOL

E WIRE CONDUCTOR

Fig. No. 5

INSTRUCTIONS:

INSERT POLYETHYLENE WIRE (A) INTO APERATURE OF TOOL, TO THE FULL EXTENT, AS SHOWN IN FIG. NO. 5. CUT POLYETHYLENE COATING BY PRESSING BLADE (B) FIRMLY INTO RECESS (C) AND ROTATING WIRE ONE COMPLETE TURN. EXPOSE WIRE CONDUCTOR (E) BY REMOVING THE ½" OF UNWANTED POLYETHYLENE (A). THE WIRE IS NOW READY FOR INSTALLATION ONTO THE NYLON INSULATOR.

NYLON INSULATORS

(ITEMS 5 & 6)

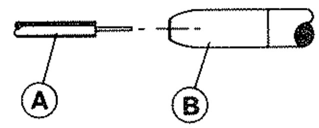
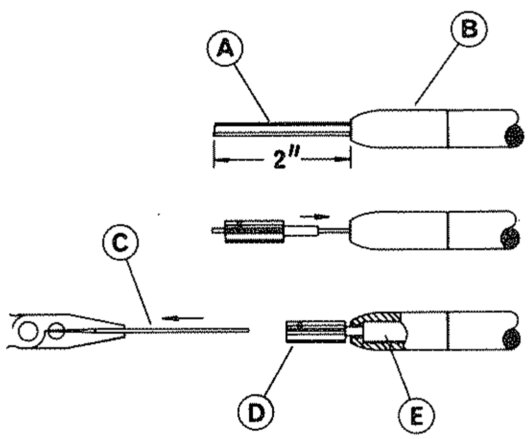


Fig. No. 6

INSERT POLYETHYLENE WIRE (A) AS SHOWN IN FIG. NO. 6, INTO THE NYLON INSULATOR (B) TO THE FULL EXTENT. AT THIS POINT IT IS FIRMLY LOCKED.

IF IT SHOULD BECOME NECESSARY TO REMOVE THE WIRE FROM THE NYLON INSULATOR, IT CAN ONLY BE DONE WITH THE WIRE RETRACTION TOOL 71346, AND THE FOLLOWING METHOD SHOULD BE USED:



A POLYETHYLENE WIRE
B NYLON INSULATOR
C WIRE CONDUCTOR
D WIRE RETRACTION TOOL
E CONNECTOR

Fig. No. 7

INSTRUCTIONS:

CUT OFF WIRE (A) AS SHOWN IN FIG. NO. 7 NOT LESS THAN 2" FROM THE FITTING (B) AND REMOVE THE POLYETHYLENE SO AS TO EXPOSE THE WIRE CONDUCTOR. SLIDE TOOL (D) ONTO THE WIRE AND PRESS THE RETRACTION PRONG FIRMLY INTO THE INSULATOR. BY THIS ACTION THE CONNECTOR (E) IS "TRIPPED", THEREBY RELEASING THE GRIP ON THE WIRE (C).

NATURAL FREQUENCY VS. ANTENNA LENGTH FOR TYPICAL ANTENNAS

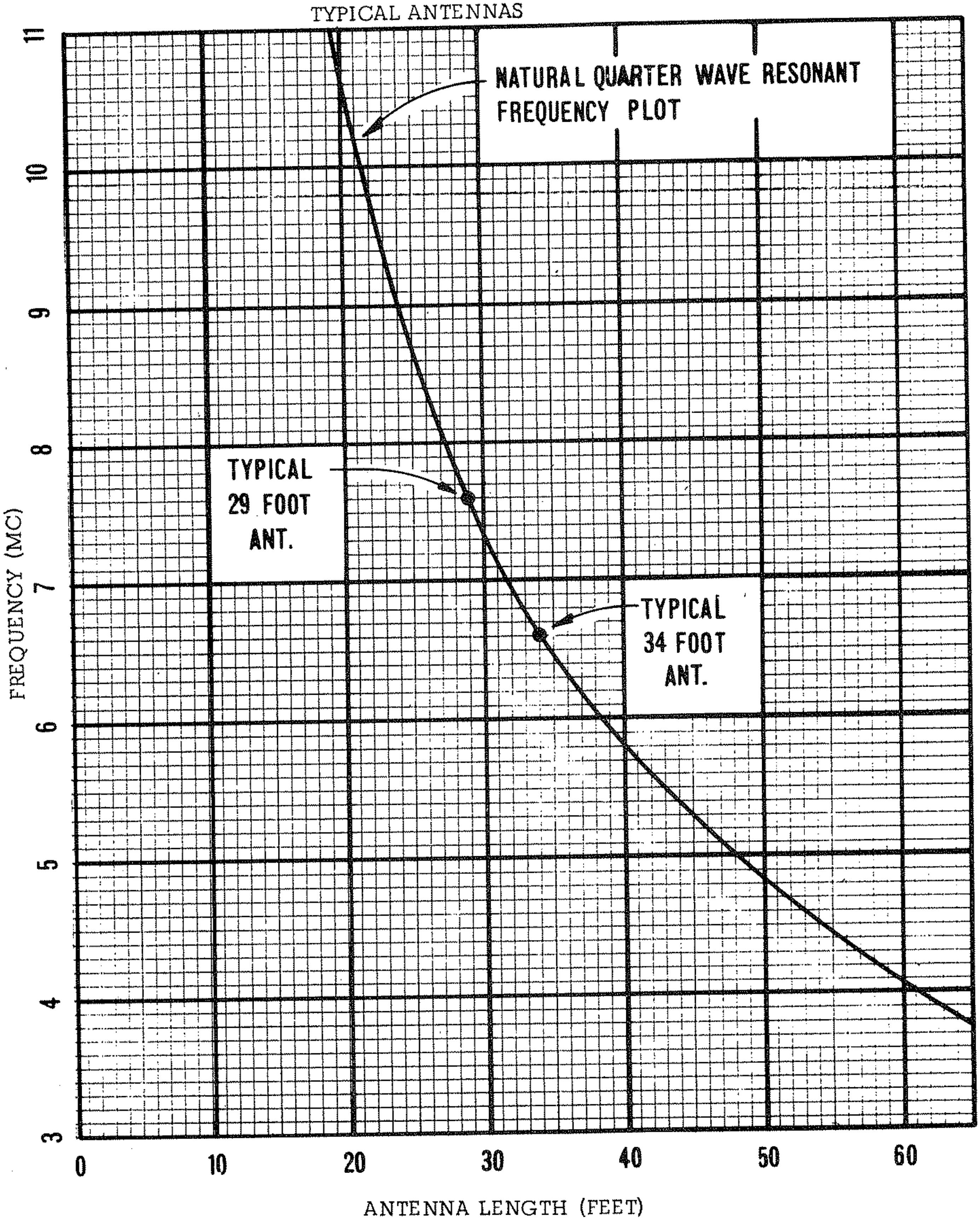


FIGURE NO. 11

EMERGENCY TUNING PROCEDURES USING THE SA-14R CALIBRATED WATTMETER OR A STANDARD VOLTMETER WITH THE SUNAIR SWRD-1 (STANDING WAVE RATIO DETECTOR) #91396

SA-14R Wattmeter

The calibrated wattmeter which is an integral part of the SA-14R system can be used in emergencies to align the antenna coupling unit. Unless a special cable is fabricated to allow installation of the control head (with its meter) in the area of the antenna coupling unit, alignment of the coupler is impractical in other than an emergency. If such a cable is fabricated for this purpose, the SA-14R wattmeter can be used to accomplish good alignment of the coupling unit. In a standard installation (with control head mounted on the instrument panel), emergency antenna coupler alignment will necessitate the relay of meter readings from the instrument panel area back to the antenna coupler area. Alignment procedure is the same as described in the "Antenna Coupler Alignment" section on page 13.

SWRD-1

In using the SunAir SWRD-1 for antenna coupler emergency alignment, the following procedure should be employed:

(1) The SWRD-1 should be mounted near the antenna coupler unit and good ground contact provided.
(2) The coaxial cable from the transmitter is connected to the plug provided and inserted into the receptacle marked "X-MTR".
(3) The coaxial cable from the antenna coupler is connected to the plug provided and inserted into the receptacle marked "ANT".
(4) The negative lead of a voltmeter having a 0-20 ma range is connected to the ground lug located directly under the X-MTR".
(5) The positive lead of the voltmeter is attached to the feed through connector marked "METER".
(6) Place switch on SWRD-1 to "X-MTR". Proceed as described in the "Antenna Coupler Alignment" section to obtain a minimum standing wave with maximum power output.
(7) After tuning is completed on all channels, leave the switch in "ANT" position if SWRD-1 is to remain in the system.

CHANNELING CIRCUITRY

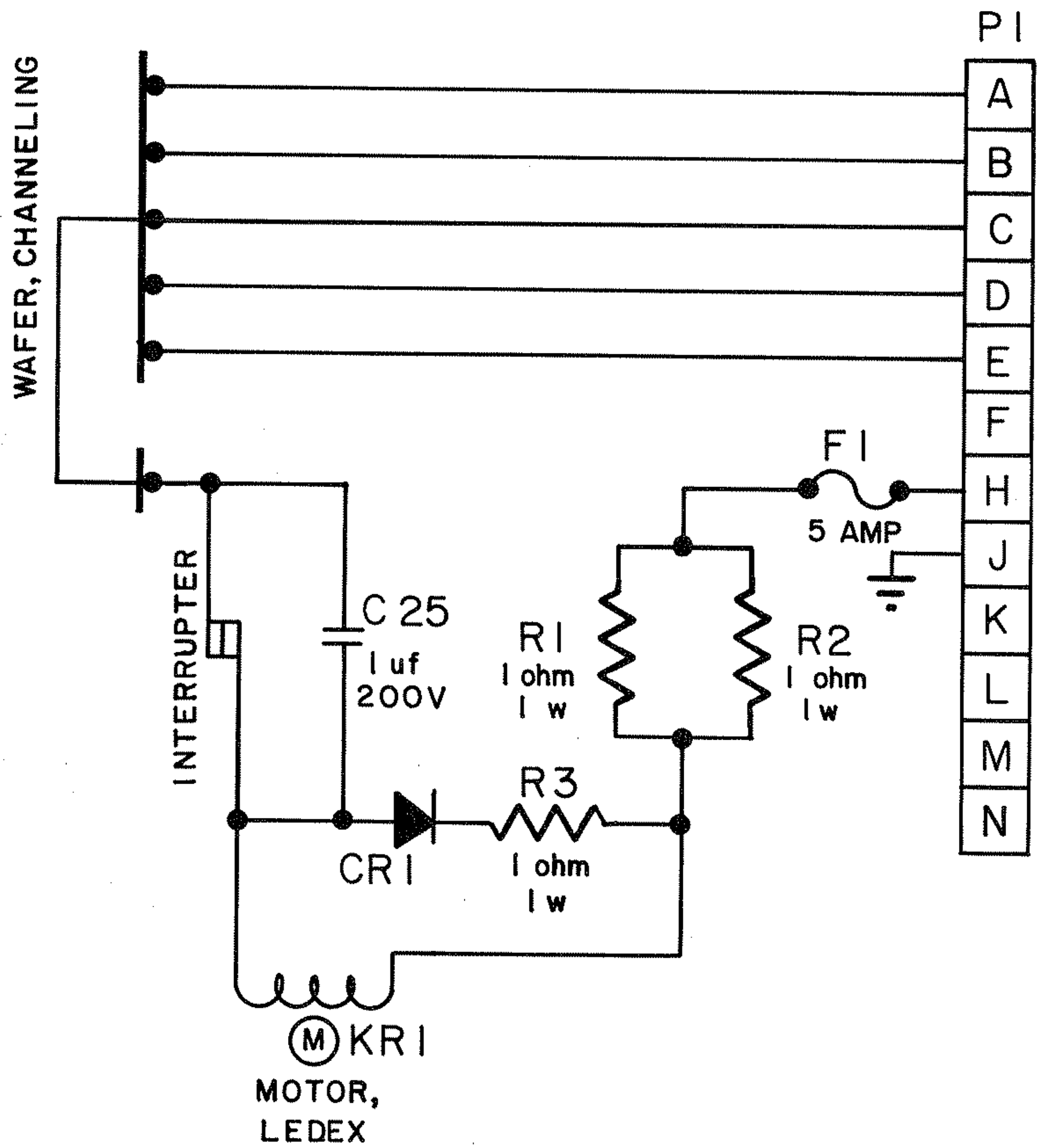


FIGURE NO. 13

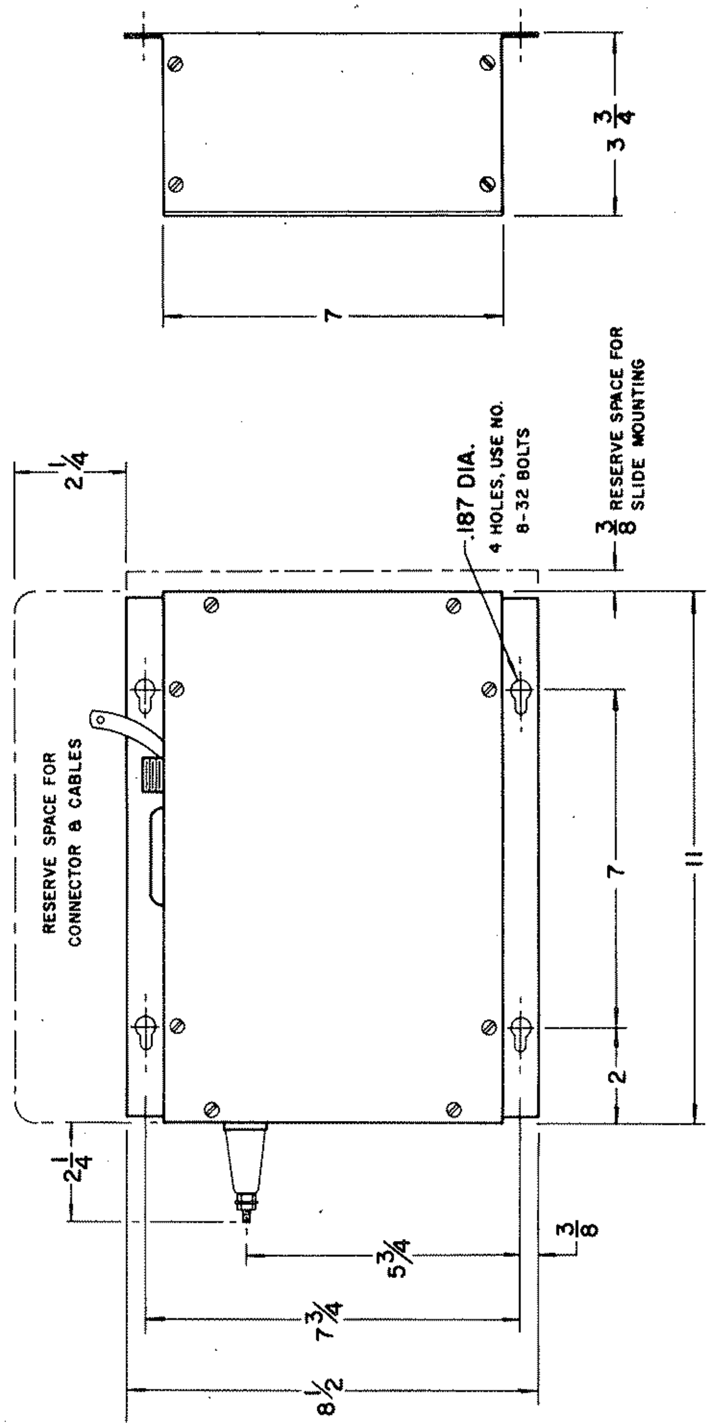
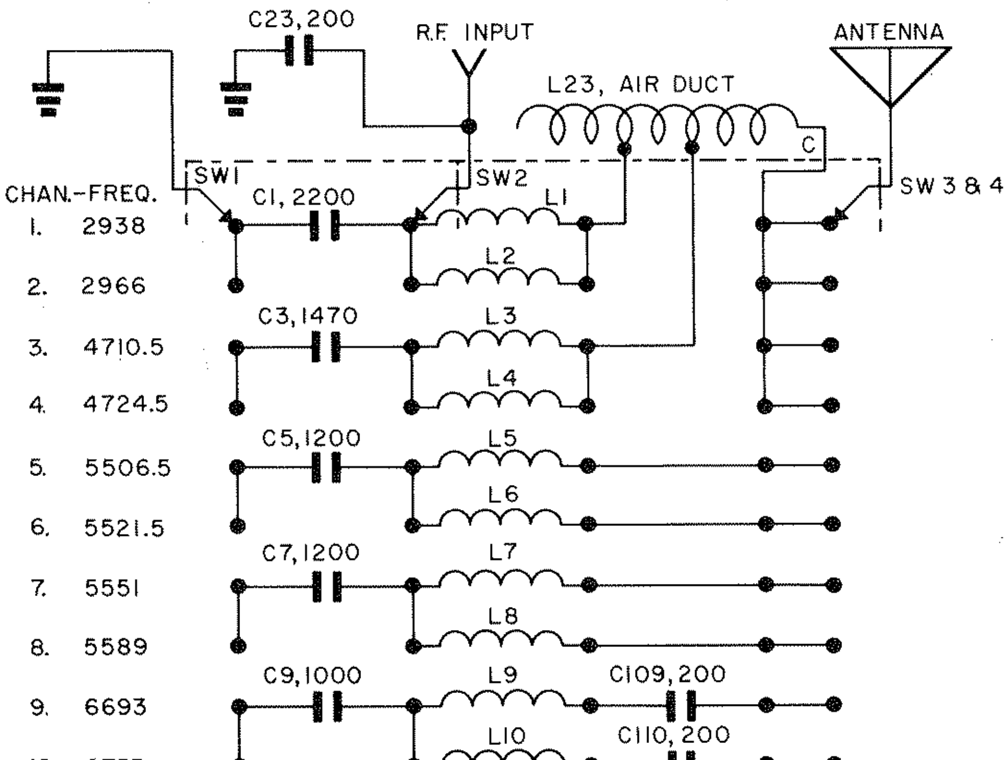
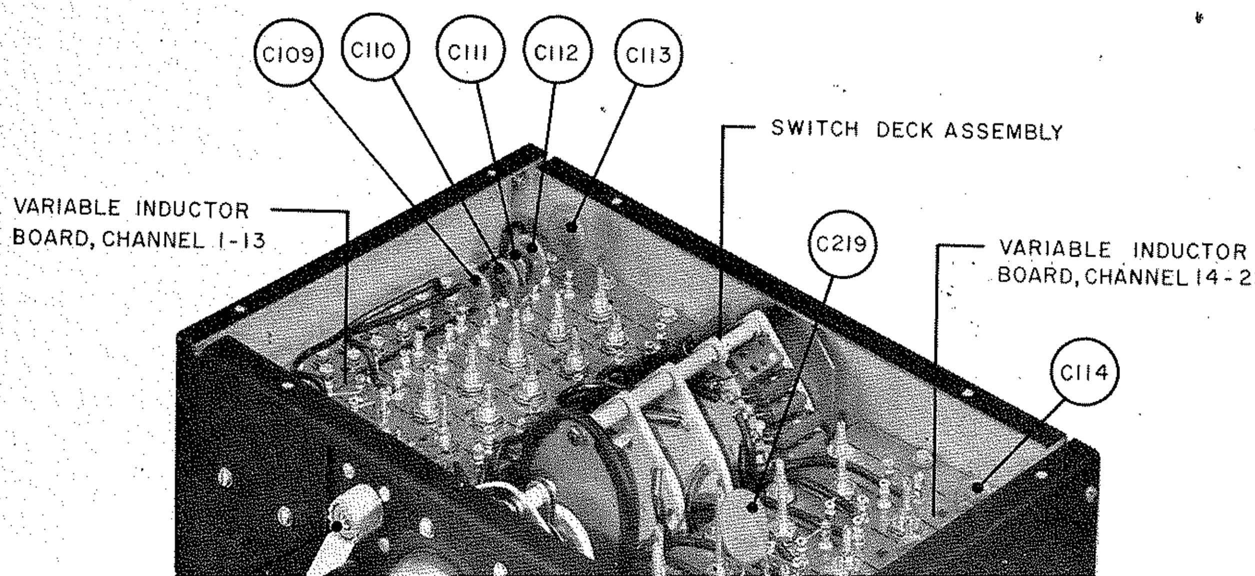
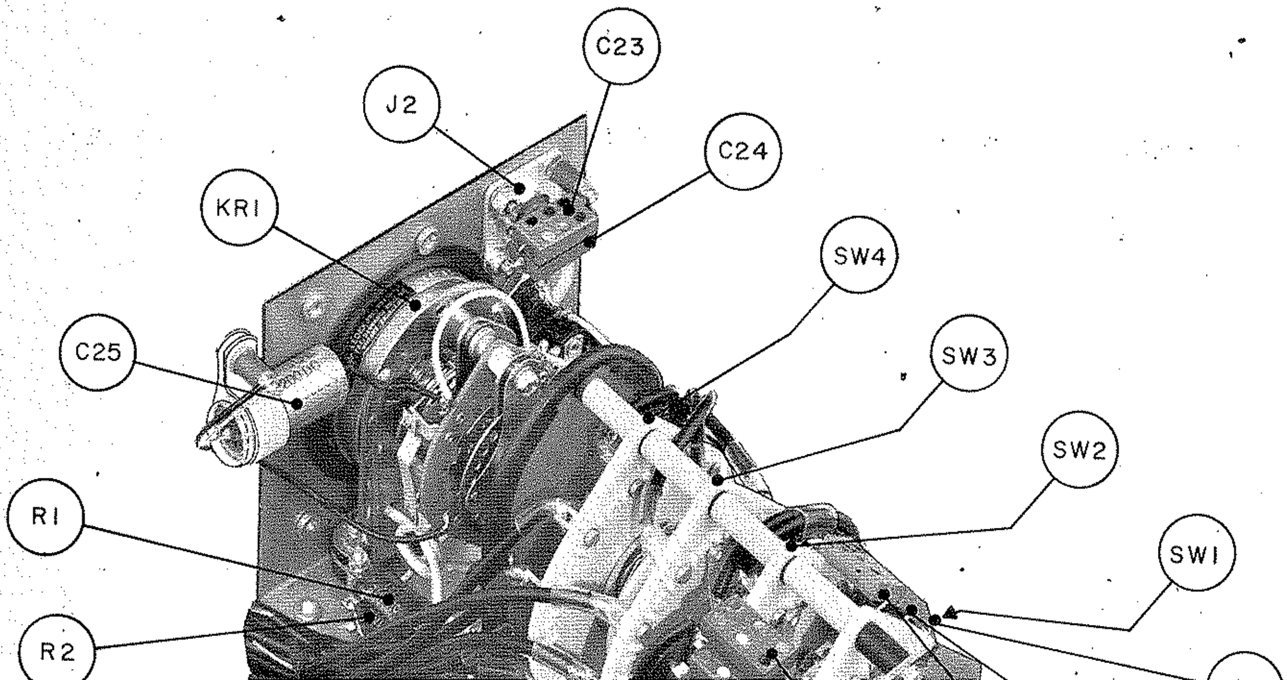


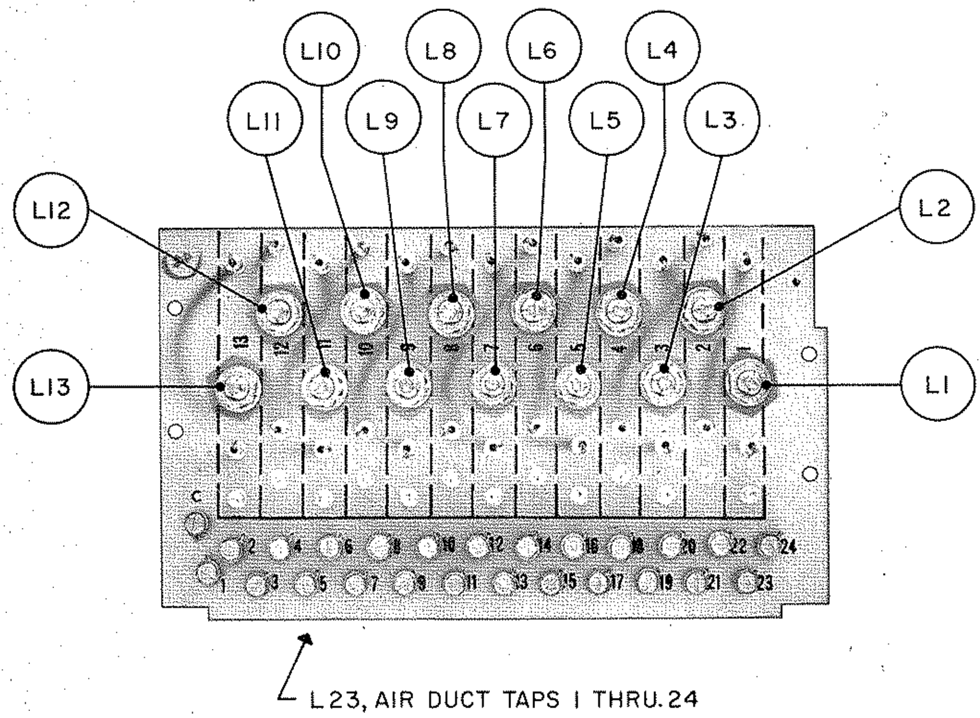
FIGURE NO. 12
ANTENNA COUPLER MOUNTING DIMENSIONS

TYPICAL SCHEMATIC




C109
C110
C111
C112
C113
SWITCH DECK ASSEMBLY
VARIABLE INDUCTOR
BOARD, CHANNEL 1-13
C219
VARIABLE INDUCTOR
BOARD, CHANNEL 14-22
C114


C23
J2
C24
KR1
SW4
C25
SW3
SW2
R1
SW1
R2



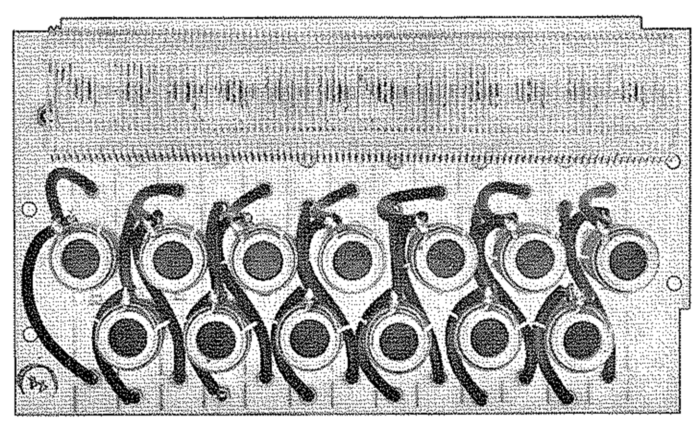
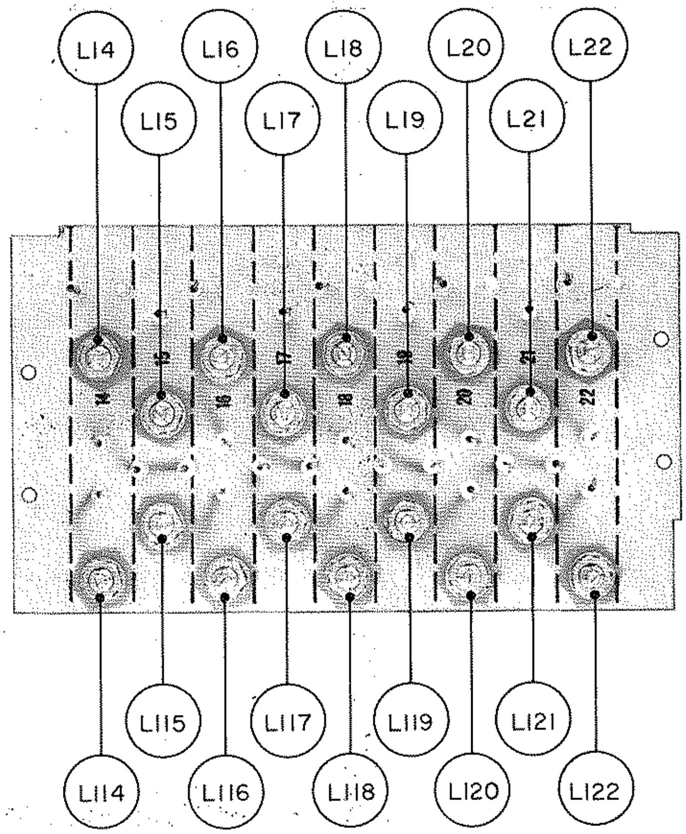


FIGURE NO. 17
AIR DUCT & COIL BOARD ASSEMBLY
CHANNEL 1 THRU 13



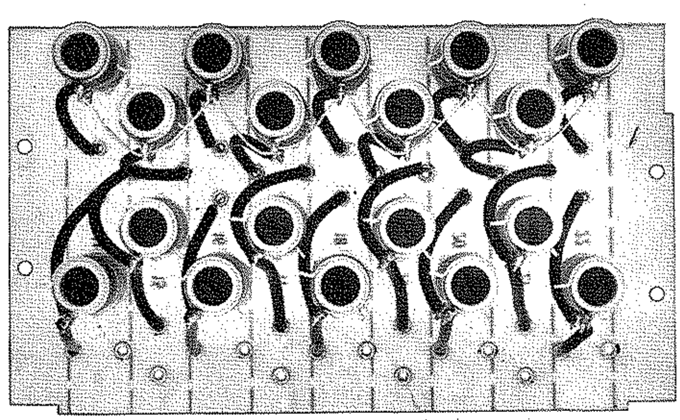


FIGURE NO. 18
COIL BOARD ASSEMBLY
CHANNEL 14 THRU 22

PARTS LIST

Symbol	Description	Part Number
C1-C24	Capacitor, Mica 300-500v - Dependent upon Frequency	
C25	Capacitor, 1 uf 200v	24525
C101-C122	Capacitor, Disc @ 3kv - Dependent upon Frequency	
C214-C222	Capacitor, Disc @ 3kv - Dependent upon Frequency	
R1-R2	Resistor, 1 ohm 1w	16968
R3	Resistor, 1 ohm 1w	17027
L1-L13	Coil, Var. LU-1	63399
L14-L22	Coil, Var. B-3-R	63052
L23	Coil, Air Duct	97821
L114-L122	Coil, Var. B-3-R	63052
CR1	Diode, Codi 534	40165
F1	Fuseholder	84903
	Fuse, 5 Amp.	85866
KR1	Motor, Ledex	32285
SW1-SW2	Wafer, 24 Pos.	33162
SW-3	Wafer, Space B	33150
SW-4	Wafer, Space A	33148
P1	Plug, Chan.	74350
J2	Plug, RF Input	74192
	Strap, Grounding	11803
	Feedthru, Antenna	71035

ANTENNA COUPLER CAPACITORS
C1 THRU. C22

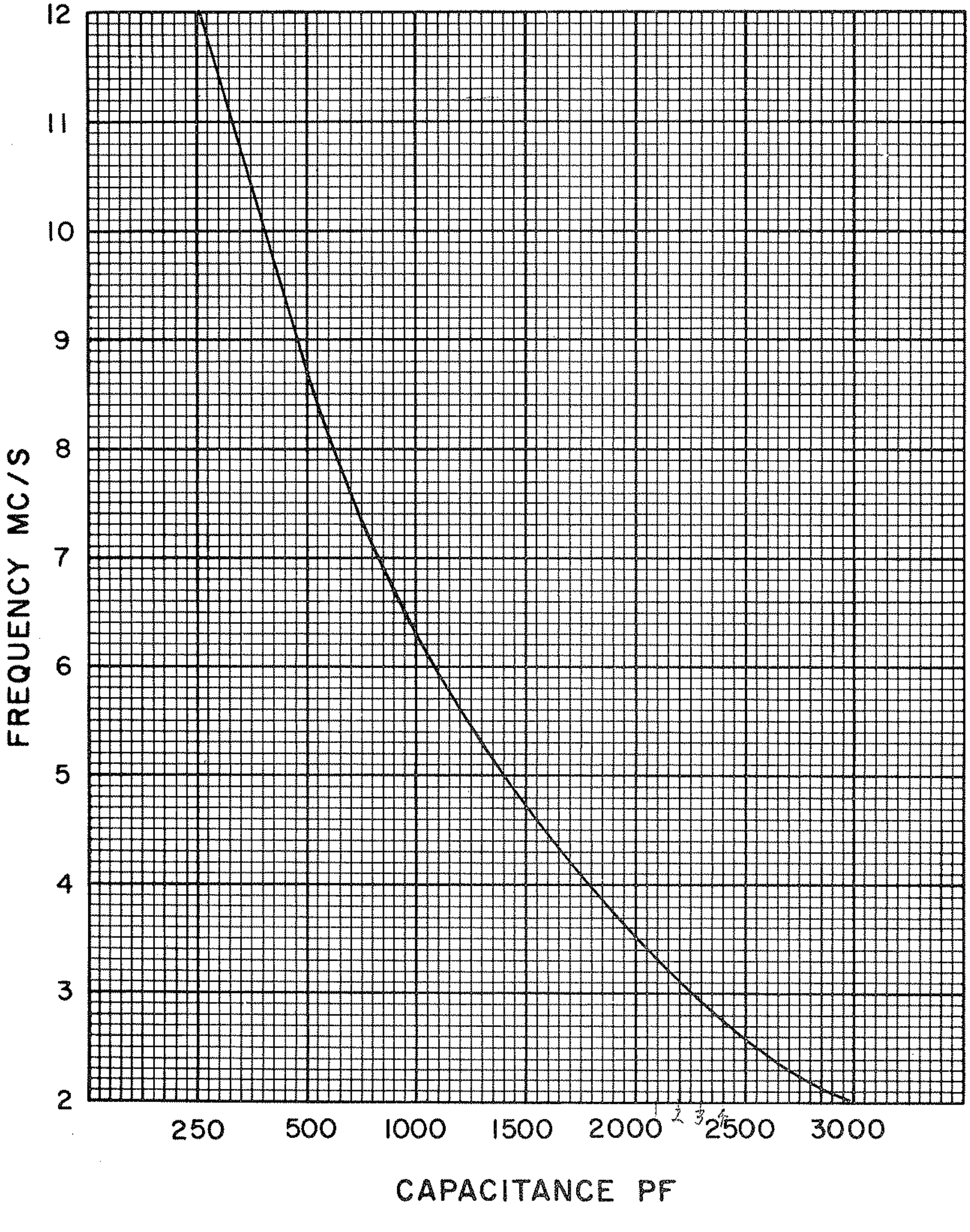


FIGURE NO.19

ANTENNA COUPLER CAPACITORS
C101 THRU. C122

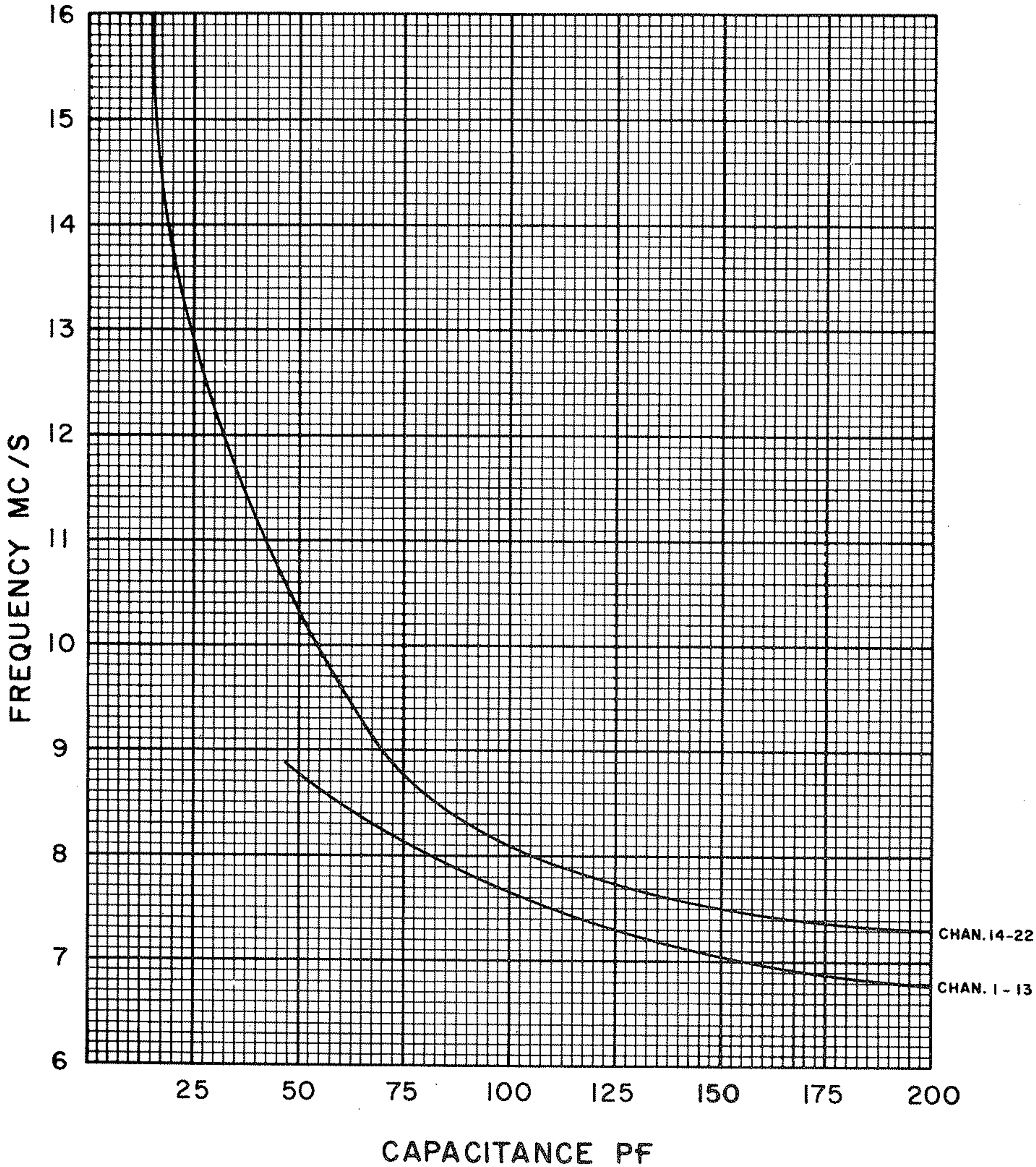


FIGURE NO. 20