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HANDBOOK OF OPERATING INSTRUCTIONS

for

RADAR SET AN/APQ-15

RESTRICTED

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LIST OF REVISED PAGES ISSUED

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AAF

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Destruction of Abandoned Materiel in the Combat Zone

In case it should become necessary to prevent the capture of this equipment and when ordered to do so, DESTROY IT SO THAT NO PART OF IT CAN BE SALVAGED, RECOGNIZED, OR USED BY THE ENEMY. BURN ALL PAPERS AND BOOKS.

Means:—

1. Explosives, when provided.
2. Hammers, axes, sledges, machetes, or whatever heavy object is readily available.
3. Burning by means of incendiaries such as gasoline, oil, paper, or wood.
4. Grenades and shots from available arms.
5. Burying all debris or disposing of it in streams or other bodies of water, where possible and when time permits.

Procedure:—

1. Obliterate all identifying marks. Destroy nameplates and circuit labels.
2. Demolish all panels, castings, switch- and instrument-boards.
3. Destroy all controls, switches, relays, connections, and meters.
4. Rip out all wiring and cut interconnections of electrical equipment. Smash gas, oil, and water-cooling systems in gas-engine generators, etc.
5. Smash every electrical or mechanical part, whether rotating, moving, or fixed.
6. Break up all operating instruments such as keys, phones, microphones, etc.
7. Destroy all classes of carrying cases, straps, containers, etc.
8. Bury or scatter all debris.

DESTROY EVERYTHING!

★

Unsatisfactory Report

For U. S. Army Air Force Personnel:

In the event of malfunctioning, unsatisfactory design, or unsatisfactory installation of any of the component units of this equipment, or if the material contained in this book is considered inadequate or erroneous, an Unsatisfactory Report, AAF Form No. 54, or a report in similar form, shall be submitted in accordance with the provisions of Army Air Force Regulation No. 15-54, listing:

1. Station and organization.
2. Nameplate data (type number or complete nomenclature if nameplate is not attached to the equipment).
3. Date and nature of failure.
4. Airplane model and serial number.
5. Remedy used or proposed to prevent recurrence.
6. Handbook errors or inadequacies, if applicable.

For U. S. Navy Personnel:

Report of failure of any part of this equipment during its guaranteed life shall be made on Form N. Aer. 4112, "Report of Unsatisfactory or Defective Material," or a report in similar form, and forwarded in accordance with the latest instructions of the Bureau of Aeronautics. In addition to other distribution required, one copy shall be furnished to the inspector of Naval Materiel (location to be specified) and the Bureau of Ships. Such reports of failure shall include:

1. Reporting activity.
2. Nameplate data.
3. Date placed in service.
4. Part which failed.
5. Nature and cause of failure.
6. Replacement needed (yes—no).
7. Remedy used or proposed to prevent recurrence.

For British Personnel:

Form 1022 procedure shall be used when reporting failure of radio equipment.

SAFETY NOTICE

This equipment employes high voltages which may be dangerous to operating personnel. Exercise extreme caution at all times when handling this set.

SECTION I
GENERAL DESCRIPTION

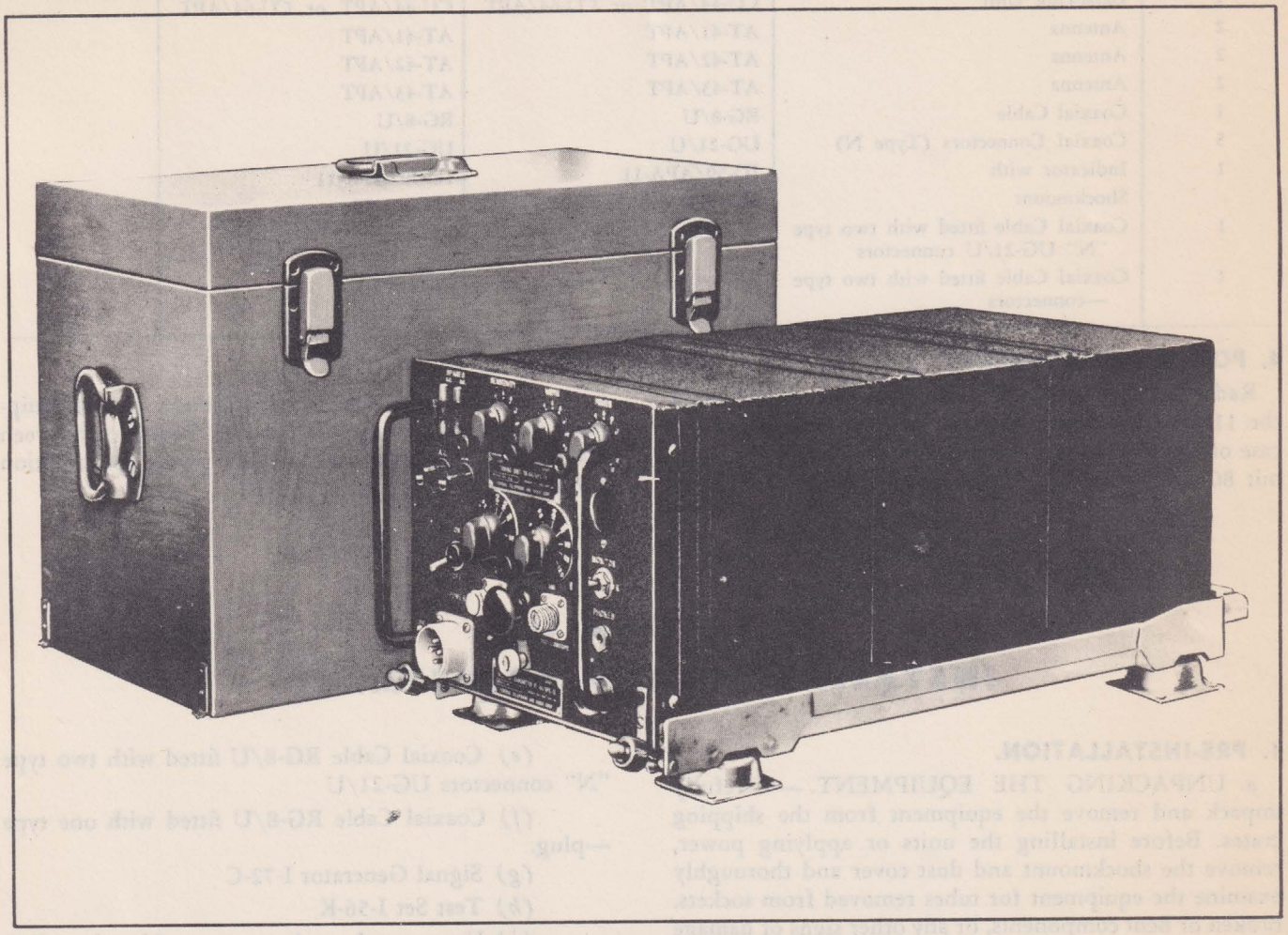

Figure 1-1. Radar Set AN/APQ-15—Overall Equipment

1. GENERAL.

It is presumed that personnel reading this Handbook are familiar with the tactical use of Radar Set AN/APQ-15. It cannot be too strongly emphasized that the success of this equipment depends to a large extent on the intelligence and care with which it is used.

2. EQUIPMENT SUPPLIED.

The following is a list of equipment supplied:

Quantity per Equipment	*Name of Unit*	*Army Type Designation*	*Navy Type Designation*	*Overall Dimensions (inches)*	*Weight (pounds)*
1	Receiver Transmitter, including dust cover and shock mount	RT-64/APQ-15	RT-64/APQ-15	8 x 12 x 19	35
1	Case	CY-198/APQ-15	CY-198/APQ-15		10
1	Tuning Unit	TN-65/APQ-15	TN-65/APQ-15	11 x 4 x 4	4
1	Tuning Unit	TN-66/APQ-15	TN-66/APQ-15	11 x 4 x 4	4
1	Tuning Unit	TN-89/APQ-15	TN-89/APQ-15	11 x 4 x 4	4

3. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

Following is a list of the equipment required but not supplied:

Quantity per Equipment	*Name of Unit*	*Army Type Designation*	*Navy Type Designation*	*Required Characteristics*
1	Balancing Unit	CU-63/APT or CU-43/APT	CU-63/APT or CU-43/APT	
1	Balancing Unit	CU-44/APT or CU-64/APT	CU-44/APT or CU-64/APT	
2	Antenna	AT-41/APT	AT-41/APT	
2	Antenna	AT-42/APT	AT-42/APT	
2	Antenna	AT-43/APT	AT-43/APT	
1	Coaxial Cable	RG-8/U	RG-8/U	
5	Coaxial Connectors (Type N)	UG-21/U	UG-21/U	
1	Indicator with	ID-59/APA-11	ID-59/APA-11	
	Shockmount	MT-171/U	MT-171/U	
1	Coaxial Cable fitted with two type "N" UG-21/U connectors	RG-8/U	RG-8/U	
1	Coaxial Cable fitted with two type —connectors	RG-8/U	RG-8/U	

4. POWER REQUIREMENTS.

Radar Set AN/APQ-15 is designed to operate from the 115-volt a-c power supply of the aircraft, or in the case of use in British aircraft means are provided to permit 80-volt operation. Power may be taken from practically any aircraft a-c power installation as this equipment is designed to operate on any frequency between 400 and 2600 cycles per second. The power consumption is less than 2 amperes at 115 volts.

SECTION II
INSTALLATION AND ADJUSTMENT

1. PRE-INSTALLATION.

a. UNPACKING THE EQUIPMENT. — Carefully unpack and remove the equipment from the shipping crates. Before installing the units or applying power, remove the shockmount and dust cover and thoroughly examine the equipment for tubes removed from sockets, broken or bent components, or any other signs of damage incurred during shipment. Rotate the blower fan several revolutions by hand to make certain it has not been damaged. Remove the shields on the tuning heads and make a similar examination of the tuning units.

b. BENCH TEST.

(1) GENERAL.—After unpacking the unit and before installing it in the aircraft, and if no apparent damage has been suffered during shipment, make a quick check of its operating characteristics.

(2) TEST EQUIPMENT REQUIREMENTS.—In order to check operation with certainty, it is essential to have a test bench with the following equipment available:

(a) Power sources of 115 volts a.c., 400 to 2600 cycles and 26-28 volts d.c.

(b) An LAF signal generator

(c) Headset

(d) Indicator ID-59/APA-11

(e) Coaxial Cable RG-8/U fitted with two type "N" connectors UG-21/U

(f) Coaxial Cable RG-8/U fitted with one type —plug.

(g) Signal Generator I-72-C

(h) Test Set I-56-K

(i) Vacuum tube voltmeter, capable of reading r-f voltages to 100 megacycles

(j) Adapter, with diode for power measurements

(k) Oscilloscope, with broad band amplifier.

(3) USE OF TEST EQUIPMENT.

(a) Make connections to the power receptacle through a plug, of a type similar to plug AN3106-22-4S, as follows: pin A, 115 volts a.c., 400 to 2600 cycles; pin B, 26-28 volts d.c.; pin C, no connection; pin D, ground. No precautions except to see that the equipment "ON-OFF" switch is in the "OFF" position need be taken in connecting the input lead.

(b) The pulse generator is used to modulate the output of the signal generator so that a pulsed signal simulating a received signal is fed into the antenna connection of the unit. The output of the signal generator is fed to the antenna receptacle of the tuning head through a low impedance coaxial cable terminated in a plug of

type "N," UG-21/U which mates with the Army type "N," UG-58/U antenna receptacle on the tuning head panel.

(c) Use Indicator ID-59/APA-11 in making an operation test since this equipment enables the operator to view the transmitted signal. The input to the indicator is taken from the oscilloscope receptacle on the tuning head, through an SO-259 receptacle which mates with the SO-239 plug and through a low impedance coaxial cable to the indicator.

(4) OPERATION CHECK PROCEDURE.—After all test equipment and power sources have been properly connected, proceed as follows to determine whether the equipment is operating properly. Turn on all test equipment. The tests given below do no more than indicate correct operation and are not intended for line-up or adjustment purposes.

(a) Plug a headset into the monitor jack provided on the front panel. Turn the "SENSITIVITY" and "POWER" controls to minimum; switch "MONITOR" switch to "R" position. "WIDTH" control may be at any position.

(b) Insert Tuning Unit TN-64/APQ-15.

(c) Tune the signal generator to the mid-band frequency and adjust input voltage to about 3 millivolts by means of indicators provided on the generator.

(d) Turn the "POWER" switch to "ON" position. The pilot light should light and the "magic eye" indicator tube should glow after a short warm-up period. The equipment is now ready for operation.

(e) Turn up the "SENSITIVITY" control, simultaneously rotating the "TUNE" control until the buzz of the pulse generator is heard in the headset. Also observe closure of the "magic eye" indicator tube. Adjust the "TRIM" control on the front panel of the tuning head until the signal is maximum.

(f) Turn the "MONITOR" switch to the "T" position.

(g) Slowly advance the power control until a signal is just noticeable on the screen of the indicator. Adjust the "TUNE" and "TRIM" controls until the signal is maximum. Turn the "POWER" control to maximum, and adjust gain on the indicator until the signal just fills the space between the two horizontal lines on the oscilloscope screen. This adjustment of the indicator is to be used as a comparison with the other tuning heads.

(h) Repeat test *(g)*, tuning the pulsed oscillator to the lowest rated frequency of the tuning head, to observe for power output. Return the oscillator to the highest frequency of the head, and again test for power output. The peak of the signal on the oscilloscope screen should not vary by more than 20 percent during these tests at frequencies at the ends of the tuning range.

(i) Repeat tests for other tuning heads, leaving the gain of the indicator as adjusted in *(g)* above. Amplitude of the output pulse of other tuning units should be approximately the same.

2. INSTALLATION.

a. LOCATION.—Initial installation of this unit may be in any location within the aircraft, but the following points should be observed.

(1) It is essential that, during operation, the equipment does not deviate from an up-right horizontal position by more than 15 degrees. No harm would result if the equipment should be operated in any other position, but because of certain characteristics, operation in any other position would jeopardize the effectiveness.

(2) The equipment should be located as closely as possible to the antenna so that the length of antenna transmission line will be as short as possible. Keeping the transmission lead short will minimize losses due to the effects of mismatch, line losses, and standing waves.

(3) Because of the necessity for operation of the cooling blower under some conditions, take care to see that the sides and rear of the dust cover do not butt directly up against a wall or other equipment but that an inch or two clearance is provided on all sides. It is advisable to place the unit in as clean a location as possible to avoid possible damage from dust and the necessity of frequent cleaning.

b. CONNECTIONS.

Note

Indicator ID-59/APA-11 and Radar Set AN/APQ-15 shockmounts should be thoroughly grounded to the frame of the aircraft by short flexible braid leads.

(1) Only two connections need be made to the equipment: a power input lead and an antenna lead. The power input cable should be fitted with a plug similar to plug AN3106-22-4S, having an insert wired as follows: pins A and C connect to 115 volts a-c; pin B to positive 24 volts d-c; pin D to ground or negative 24 volts d-c.

(2) No particular precautions need be taken in connecting the power lead to the equipment except to see that the equipment "ON-OFF" switch is in the "OFF" position. In connecting the coaxial antenna connector to the socket marked "ANTENNA" be sure the "POWER" control is turned down to zero so that no transmission will take place. Install both cables so they can be turned under the shockmount or off to the side of the equipment where they will not interfere with controls or otherwise get in the way of the operator.

(3) If Indicator ID-59/APA-11 is used, a third cable (a coaxial cable similar to the antenna cable) is required to connect the indicator to the tuning head connector marked "OSCILLOSCOPE." This should also be turned out of the way of the controls to avoid interference. For optimum visibility of the screen, the oscilloscope should be located in a dark part of the aircraft, preferably directly over Radar Set AN/APQ-15. The cable length between the oscilloscope and the radar set should be as short as possible.

c. CARRYING CASE.—Place the carrying case on a shockmount near the equipment so that tuning heads

may be changed with little delay. Preferably locate it under the equipment where it will be easily accessible. Changing the tuning heads requires removing the antenna and monitoring cable, changing heads, and then replacing the cables.

d. NOISE IN PLANE.

(1) In order to insure proper operation of Radar Set AN/APQ-15, it is necessary that the plane be as free as possible from electrical interference. After the radar set is installed in the plane, make a ground test with engines running. Turn on all equipment that would normally be running when the set is in operation.

(2) Set the sensitivity control of the radar set at its maximum operation condition and observe whether there is any electrical disturbance when the engines, inverters, or other electrical equipment is turned on. If there is electrical interference, reduce it by established procedures.

3. ADJUSTMENT.

a. Once the equipment is installed in the aircraft there are no adjustments of internal controls that can or should be made while in the aircraft. Adjustments of all internal controls are made at the factory and no line-up is required in the aircraft. Do not remove the equipment from the dust cover to readjust internal controls since the operating effectiveness of the equipment may be completely destroyed. Never attempt adjustment and line-up in the aircraft, as this must be done at a test bench where proper equipment is available.

b. Since it is so necessary for the equipment to be in perfect operating condition before a flight is begun, very frequent ground checks should be made.

SECTION III
OPERATION

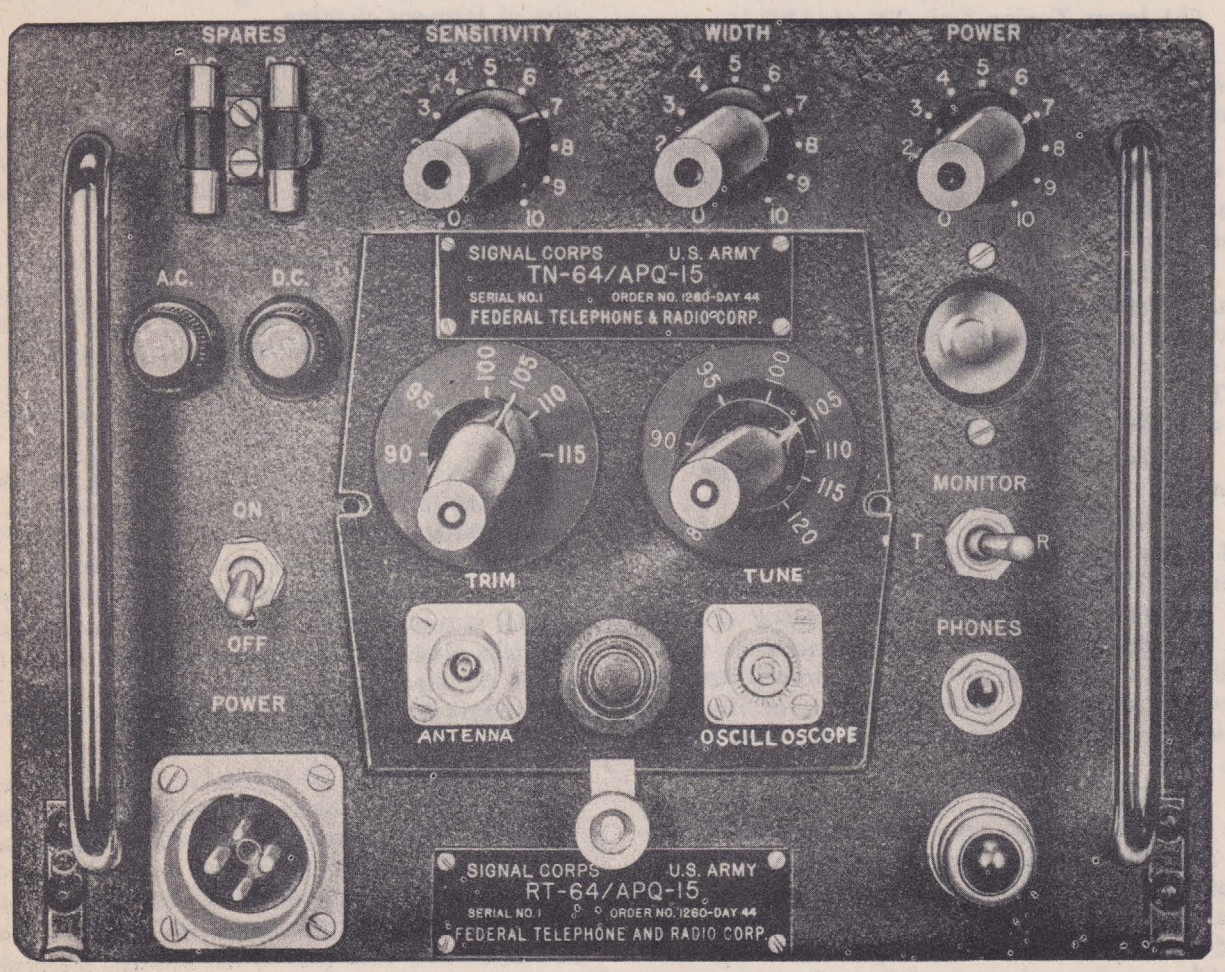

Figure 3-1. Receiver Transmitter RT-64/APQ-16, Including Tuning Unit TN-64/APQ-15—Front Panels

Note

Before a flight is made, adjust Indicator ID-59/APA-11 so that the peak output signal of Radar Set AN/APQ-15 will just fill the oscilloscope screens. In this way any variation in output from the maximum to the minimum can be detected.

WARNING

Voltage used in this equipment is dangerous to life. Use extreme care at all times when working with this set.

1. OPERATION OF EQUIPMENT.

To operate this equipment proceed as follows:

a. Turn the "POWER" control to zero before touching any other control. This automatically prevents accidental transmission.

b. Turn the main "POWER" switch to the "ON" position. After a few seconds warm-up the equipment is ready to use.

c. Plug in headset and turn "MONITOR" switch to "R" position. In this position any tone heard in the phones will be an indication of the received signal only and will have no bearing to the transmitted signal.

d. With the equipment adjusted as explained above, it is now in a position to search for signals but will not transmit. Turn the "SENSITIVITY" control to maximum, listen in the headset, and turn the "TUNE" control until the buzz of the received signal is of maximum loudness in the headset.

e. After adjusting the pulse width, assuming the use of Indicator ID-59/APA-11, turn the "POWER" control very slowly from the minimum position until the smallest observable signal appears on the oscilloscope of the indicator. Adjust the "TRIM" and "TUNE" controls for maximum amplitude of transmitted signal, at the same time reducing the "POWER" control so that the level is the smallest that can just be observed on the oscilloscope. The signal amplitude on the oscilloscope should be maintained as low as possible and should never be allowed to rise more than one-tenth of the maximum amplitude.

f. With the "POWER" control adjusted as above, the "SENSITIVITY" control may be locked in its maximum position and the "TRIM" and "TUNE" controls also locked. It will then only be necessary to watch the oscilloscope screen carefully and to correlate the position of the aircraft with the amplitude on the oscilloscope screen.

g. If an oscilloscope is not available in the aircraft, it will be necessary to monitor the output by using the "magic eye" indicator tube and headset. Turn the "MONITOR" switch to the "T" position. The "magic eye" has been adjusted to just close when the power output is maximum and may thus be used as a crude form of oscilloscope or voltmeter; however, this method is less accurate than that provided by the pulse analyzer oscilloscope. Before attempting to use this method refer to paragraph 2*b*(8), section IV.

SECTION IV
EMERGENCY OPERATION AND REPAIR

1. GENERAL.

Operating checks should be made on the ground at a test bench where suitable test equipment is available. If trouble develops in flight, it is usually better to return to the base for readjustments or repairs unless, for tactical reasons, it is better to make an attempt even though the attempt may fail.

2. EMERGENCY REPAIR.

a. It is highly advisable that no adjustments or repairs be made to the equipment during flight, although it is possible to remedy some minor difficulties which may occur after the aircraft has left the base.

b. The following list of easily corrected faults may be used as a guide:

(1) If the pilot light does not light and the equipment shows no signs of operating, replace the fuse marked "A.C." and try again. If this fails, make certain that power is reaching the "POWER" plug. Check all cables. If an ohmmeter is available, remove the "POWER" input plug and check the circuit between pins D and B to make certain the circuit is continuous.

(2) If the equipment receives a signal, but the pilot light does not light, replace the pilot light.

WARNING

The plate voltage of this equipment is about 350 volts. This voltage can be fatal. Test with great care.

(3) If the pilot bulb lights but no reception is present, check the plate voltage by removing the tuning head and measuring the voltage between pin 7 (counted from the left-hand side of the equipment) and a ground contact made on the i-f chassis. This should be of the order of 350 volts d.c. If no voltage is present, replace tube V101, JAN-5U4G, in the power supply. If this does not correct the trouble, immediately shut down the equipment to prevent further possible damage.

(4) If the equipment receives but does not transmit, search for tube trouble in the second i-f stage or in the RCA-832-A tube in the tuning head.

(5) If power output seems low, investigate the aircraft power supply voltage. Replacement of the RCA-

832-A tube in the tuning head may be required, or tube trouble may be in the i-f section.

(6) If the received signal sounds intermittent or impure, or if the received signal is steady and clean but the transmitted signal intermittent, cease transmission as soon as possible and search for tube trouble in the pulse unit.

(7) If the temperature of the aircraft rises above 100°F (37.8°C) and the blower motor does not operate, try replacing the fuse marked "D.C." on the front panel. If this fails to produce operation of the motor, short-circuit the contacts of the thermostat located in a shield can on the under side of the power supply. If this also fails, and it is certain that voltage is applied to the motor, remove the brushes, clean, and replace, making sure that contact is made with the commutator.

(8) If an oscilloscope is not available in the aircraft and the indicator tube must be used to monitor the transmitted signal (refer to sec. III, par. 1*g*), a slight change must be made in the circuit. Disconnect capacitor C203-3 in the pulse section by unsoldering the bus connection to the capacitor and removing it from the equipment. This capacitor is the last component mounted at the rear of the terminal board on the right side of the pulse chassis. If an oscilloscope is made available later, restore the bus wire connection to capacitor C203-3 to its previous position in the equipment.

SECTION V

SUPPLEMENTARY DATA

1. TUBE COMPLEMENT.

Reference Symbol	*Type Designation*	
	JAN	*VT*
V101	5U4G	244
V201-1 thru		
V201-9	6AC7	112
V202-1 and -2	6AG7	247
V203-1 to -3	6SN7-GT	231
V204	6V6-GT	107
V205	6E5	215
V301-1 and -2	6C4	
V302	RCA-832-A	286
V303	6J6	
V401-1 and -2	6C4	
V402	RCA-832-A	286
V403	6J6	
V501-1 and -2	6C4	
V502	RCA-832-A	286
V503	6J6	
V1601-1	6C4	
V1601-2	6C4	
V1602	RCA-382-A	286
V1603	6J6	