





D. GREGORY  
36A  
R. 1988

ATT TRANSMITTER NOTES

FREQUENCY RANGE:

Channel "A" - - 1.5 to 5.0 MC  
375 KC and 500 KC, Crystal only

Channel "B" - - 5.0 to 20 MC.

*Antenna  
Freq. 500kc  
DF-315*

Both channels arranged for Crystal-Controlled operation is desired. When using two low-frequency crystals on "A" channel, the external Antenna Loading Coil is required.

FACILITIES:

Three classes of service are available, CW, MCW and R/T, selected by means of the five-section TRANSMISSION SWITCH S-9. Side-tone facilities are provided on all modes of operation, and I/C is available when transmitter is used in conjunction with Receiver AR2. Switching of I/C facilities in large aircraft is done by means of the I/C Switchbox.

REMOTE CONTROL:

The LOCAL-REMOTE SWITCH, S-10, transfers control of the transmitter to the Pilot's position, where the following facilities are available:

- A - Transmitter "On-Off" Switch.
- B - Channel Selector Switch.
- C - High note-Low note switch.

POWER INPUT:

Transmitter power input delivered by junction box at end of fifteen feet of battery cable from the aircraft battery:

Condition	Channel - "A"	"B"
Telephone Standy-by	2.5A	3.5A
R/T	14.5	15.5
CW, Key "up"	15.0	16.0
CW, Key "Down"	16.5	17.5
MCW, Key "Up"	14.6	15.6
MCW, Key "Down"	15.0	16.0

Battery potential for above inputs, 14 volts.

## ATI Transmitter (cont'd)

### POWER OUTPUT:

Nominal power output to antenna for highest allowable battery voltage of 14-5V is 20 W, CW and  $7\frac{1}{2}$  W, R/T & MCW, unmodulated carrier. Maximum ratings up to 36 watts CW and 13 watts R/T may sometimes be developed. The actual Power output may vary considerable over the frequency band and is largely dependent on the particular type of antenna used.

### CIRCUIT THEORY

#### OSCILLATOR-DOUBLER:

The Cathode, Control-Grid and Screen Grid of the RK39 Oscillator function as a Colpitts osc. which is designed to operate both as a Master Oscillator and Crystal-Controlled. This oscillator section is electron-coupled to the Plate circuit which is tuned to the oscillator harmonic. When operating on M.O. the circuits are arranged so that this doubling action takes place to produce all frequencies between 1.5 and 20 MC. One dial control is used, ganged tuning being accomplished by using identical coils in each section, with a tuning capacity only one quarter of that in the Osc. used in the Doubler tuned circuit. For crystal operation the highest actual crystal frequency employed is 5.0 MC, with the plate tuned to 10 MC. There is enough output from the Osc. on Crystal operation to drive the PA as a frequency-doubler in the range from 10 to 20 MC. Variable inductance tuning is used throughout.

#### 375 and 500 KC CRYSTALS:

Switch S-1 will select either of these low-frequency crystals and when operating on these frequencies, the necessary driving voltage for the PA is developed across Plate Choke L3. The plate circuit is actually untuned and Condenser C15, or Resistors R13:1 and R13:2, are used as voltage dividers across L3 to apply the proper driving potential to the PA Grid. When on these frequencies no doubling is used and the crystal frequency is fed straight through the circuit. The external antenna Loading Coil is necessary to tune the Aircraft Antenna to these low frequencies.

#### POWER AMPLIFIER:

This is a second RK39 Beam Tetrode, operating as a class "C" amp. Driving voltage is obtained directly from the Oscillator through blocking condenser C10. Sufficient Cathode Bias to prevent excessive plate dissipation under all operating conditions is obtained with Cathode resistors R11 and R10. Resistor R10 is also used as METER SHUNT for measuring the Cathode Current, which is the sum of Screen and Plate Current.

The rectified grid current is also metered as an indication of driving voltage, R7 functioning as a grid leak and R8 as the meter shunt, R7 "C" Amp.

Screen voltage is fed through series resistors R9:1 and R9:2 from the junction of bleeder resistors R9:3 and R9:4. Condenser C17 is the RF by-pass, and also serves to limit the high-frequency audio response of the transmitter. In order to permit proper voltage swing due to modulation, the screen voltage is reduced when on R/T or MCW to a potential of approximately 100 to 125 volts, while on CW this is increased to between 250 and 300 volts. This is done by Section 3 of Transmission Switch S-9, which connects R18 across R9:3 and R9:2 in the CW position. } RB

Plate voltage is fed through L7 and C21 is a blocking condenser between plate and antenna circuit. An "L" network is used to couple the Antenna to the transmitter, providing the simplest possible method of impedance matching, through the use of variable coupling condensers and the antenna loading coil.

#### METER CIRCUIT:

A single DC Instrument is used to meter three circuits, The PA Grid Current, PA Cathode Current and Antenna Voltage. A 6H6 diode rectifier is used in the latter position and the meter is switched across shunt resistors R10, R8 and R25 by means of Meter Switch S-13.

#### MODULATOR:

Employs a third RK39 operating as a resistance-coupled amplifier at very conservative ratings, supplying modulating voltage to the Screen of the PA. R16 is the plate load resistor and Screen Voltage is supplied through R15 and by-passed by C31. To eliminate fixed bias and prevent overloading, Cathode Resistor R17 is employed. For R/T or MCW operation the Audio signal is fed to the grid through Section 2 of Switch S-9. On CW the grid is disconnected by this same switch, and tube is inoperative, although it still draws plate and screen current. Condenser C32 is used to couple the Modulating Voltage to the PA Screen.

#### A.F. OSCILLATOR:

The AF note which is used to modulate the transmitter when on MCW, and a keying-tone (sidetone) when on CW and MCW is produced by the 6J5 AF oscillator operating in a conventional Hartley circuit using Transformer T-2 is the center-tapped inductance in the tuned circuit. The osc. frequency may be changed by use of condensers C22 to C27, associated with switch S-12, producing notes of 1850, 1450, 1000, 750, 650, and 550 c.p.s. The 1850 C.P.S. warning signal is

obtained by means of C27 across C2. Through use of Relay D-6 two notes may be selected by the Pilot who controls D-6 from the remote position by means of the high note-low note switch. High note is always 1850 and the other is determined by setting of S-12.

### TRANSMISSION SWITCH

The three modes of operation, CW, MCW and R/T are controlled by a five-section, three-position switch designated S-9:1 to S-9:5. This switch performs the following functions, corresponding to the type of TRANSMISSION being employed.

#### C.W. TRANSMISSION:

S-9:1 - connects microphone terminal (1) to the I/C terminal (II) so that I/C facilities are possible in cases where the aircraft installation does not include an I/C switching unit.

S-9:2 - connects the secondary of the input transformer T-1 to the AF osc. through the attenuator resistor R38. At the same time it opens the grid circuit of the modulator tube. In this way the AF note is transmitted to the transformer T-1 and to the sidetone circuit, terminal 10.

S-9:3 - increases the screen voltage on the PA tube by connecting R18 in parallel with screen supply resistor R9:2 and R9:3. At the same time this switch section connects the plate voltage supply to the AF osc.

S-9:4 - completes the circuit of the dynamotor starting relay D-7 operating relay and starting dynamotor. Also disconnects the mic. PRESS-TO-TALK circuit, making it impossible to start the dynamotor by operation of the mic. press-to-talk switch.

S-9:5 - connects the keying relay to the KEY terminal (4).

#### MCW TRANSMISSION:

S-1:1 - Same as CW

S-9:2 - Connects the output of the AF osc. to both input transformer T-1 and the grid of the modulator tube. AF note is now transmitted to both sidetone and modulator circuits.

S-9:3 - disconnects R18 from the screen supply circuit of PA, and connects plate voltage to the AF osc.

S-9:4 - Same as CW.

S-9:5 - Same as CW.

#### R/T TRANSMISSION:

S-9:1 - connects mic. terminal (1) to mic. input winding of T1, completing mic. DC supply circuit. Circuit to I/C connection is open, but sidetone is fed through terminal 10 to the receiver output circuit.

- S-9:2 - completes circuit from secondary of input transformer T-1 to grid of modulator tube and at same time disconnects AF osc. connection. In this way circuit is complete from mic. to modulator grid and circuit is arranged for R/T operation.
- S-9:3 - disconnects R18 from PA screen and opens plate supply to AF osc. so that no audio is generated.
- S-9:4 - connects dynamotor starting relay D-7 to mic. press-to-talk switch, so that control of dynamotor starting originates from the mic. press-to-talk switch.
- S-9:5 - connects keying in relay D-5 in parallel with D-7 so that control of this relay originates with the press-talk switch, which will now operate D-5 and D-7 simultaneously.

### KEYING AND BREAK-IN OPERATION

Complete break-in operation is made possible by the action of keying relay D-5. In order to reduce arcing of the key and mic. press-to-talk switch as relay is operated, C59 is across key contact as an arc suppressor. With every operation of the key, or mic. press-talk switch in the case of R/T operation, D-5 performs the following functions:

1. Transfers the antenna from receiver antenna post to the transmitter output circuit. At the same time it places a ground on the receiver antenna post.
2. Removes a connection between osc. cathode resistor R6 and the Osc. and PA screen supplies simultaneously. This restores screen voltages and removes additional osc. cathode bias developed across R6 so that transmitter now functions normally.
3. Simultaneously with operation (2) above, it connects the osc. screen supply to the AF oscillator so that keying tone is generated during periods of transmission on CW and MCW.

### DYNAMOTOR AND POWER SUPPLY

The dynamotor h.v. power supply is a part of the transmitter and delivers power from the 12-volt battery at approximately 500 V, 200 MA maximum. Radio interference from the primary is filtered externally by C69:1 and C69:2 and in addition C60:1, C60:2 and C61:1, C61:2 are connected from each brush to ground. The HIGH VOLTAGE FUSE which is removable from the front panel is connected between the filtered dynamotor supply and the main power supply filter condenser C34, from which point voltage is finally fed to all plate supply leads.

HEATER SWITCH

The oscillator compartment is temperature controlled by means of heater resistor R1:1 and R1:2, and the thermostat cut-off switch S-5 by the operation of the heater switch S-6. The operation of this switch is independent of the position of the on-off switches or the Local-Remote switches and connects the heater resistances directly across the aircraft battery. Its purpose is primarily to assist in the removal of hoarfrost or moisture condensation from vital parts within the osc. compartment during extremely adverse conditions of operation. The stability of the osc. is normally good enough so that temperature control is not necessary from this standpoint, but the thermostat is included in the circuit to prevent over-heating in case the heater circuit should be left on.

TYPICAL VOLTAGES

	<u>OW</u>	<u>MCW</u>	<u>R/T</u>
Battery voltage at junction box	12.3	12.3	12.3
PA plate to ground at base of L7	495	500	500
PA screen to ground	"220	100	100
PA cathode to ground	27	17	17
Osc. plate to ground at base of L3	265	265	250
Osc. screen to ground	255	255	270
Osc. cathode to ground	17.5	18.0	20.0
Modulator plate to ground	170	240	170
Modulator screen to ground	260	190	260
Modulator cathode to ground	27	23	27
AF Osc. plate volts to ground	42	42	0

" - Variations with grid drive 150 - 300.



MAINTENANCE NOTES

ATI TRANSMITTER

- (a) Check conditions of tubes.
- (b) Check to see that the wheels on the various tuning inductances are making good contact with coils.
- (c) Check to see that the wheel position and the dial setting on front of set correspond with each other.
- (d) Clean coils with carbon-tet. using a stiff tooth brush.
- (e) Check "Main Power" relay for pitting of contacts.
- (f) Check keying relay for cleanliness of contacts and check spring tension.
- (g) Check contacts of "Channel" Relay.
- (h) If necessary, apply graphite to ends of slider arm bar on the keying relay.  
This prevents sticking.

- 1. Clean and re-grease case where it makes contact with chasis.
- 2. Check generators for excessive noise and grease.
- 3. Check condition of fibre gears.
- 4. Clean rotary switch contacts with carbon-tet.
- 5. Check Junction Box. Tighten the screws, connections and examine cable sheathing grounds.
- 6. Check all phone and mike cables for breakage.
- 7. Check I/C Box.
- 8. Check all remote control units.
- 9. Check all remote control flexible drive cables for operation and setting and wear on the shielding.

CHECKING CHANNEL "A" FOR M.O. TRACKING.

- (a) Set the controls on the transmitter for LOCAL CONTROL on CHANNEL "A".
- (b) Rotate the FREQUENCY "A" control to 010.0 turns after 20.6.3.
- (c) Set the Channel "A" CRYSTAL-MO. switch to M.O.
- (d) Set the TRANSMISSION switch to R/T.
- (e) Switch the meter to GRID.
- (f) Press the microphone press-to-talk starting the dynamotor.
- (g) Adjust trimmer condenser C72 for maximum grid current (with bottom oscillator compartment shield screwed securely in position).
- (h) Rotate FREQUENCY "A" CONTROL from 010.0 turns to approximately 074. turns and observe variation in grid drive from 30 min. to 120 max. across the band. Grid drive outside these limits indicates:

1. Defective Equalizer circuit or connections.
2. Incorrect adjustment of plate trimmer condenser.
3. Poor coil or relay, switch contact causing poor roller or wiping spring contact throughout the range. These are dependent on the correct mechanical adjustment of spring tensions and complete freedom from adhering dirt. Clean contacts with carbon tet. if necessary.
4. Short circuited turns caused by small specks of metal will show sharp dip in the grid current or a complete disappearance of grid current. A sharp dip in grid current will also be caused by poor grounding of the oscillator compartment shield. Tightening of the four mounting screws which ground this plate to the chassis will remedy this trouble.

#### CHECKING CHANNEL "B" FOR MO. TRACKING.

- (a) With conditions as for Channel "A", adjust trimmer condenser C73 for maximum grid current.
- (b) Rotate FREQUENCY "B" control to 004.2 turns to approximately 032.0 turns and observe the variation in grid drive across the band. The same applied here as for par. (h) in above but in addition it indicates that another oscillator tube must be selected.

#### VACUUM TUBE REQUIREMENTS.

Oscillator stability and output at 20 mc/s are largely dependent on the selection of good tubes. Bad tubes are characterized by:

- (a) Unsteady note or "chirping" as the transmitter is keyed.
- (b) Audible parasitics or sideband hash in the 5 to 7 mc/s range of the "B" Channel.
- (c) Low drive at 20 mc/s.

In the RF amplifier stage a defective tube is characterized by:

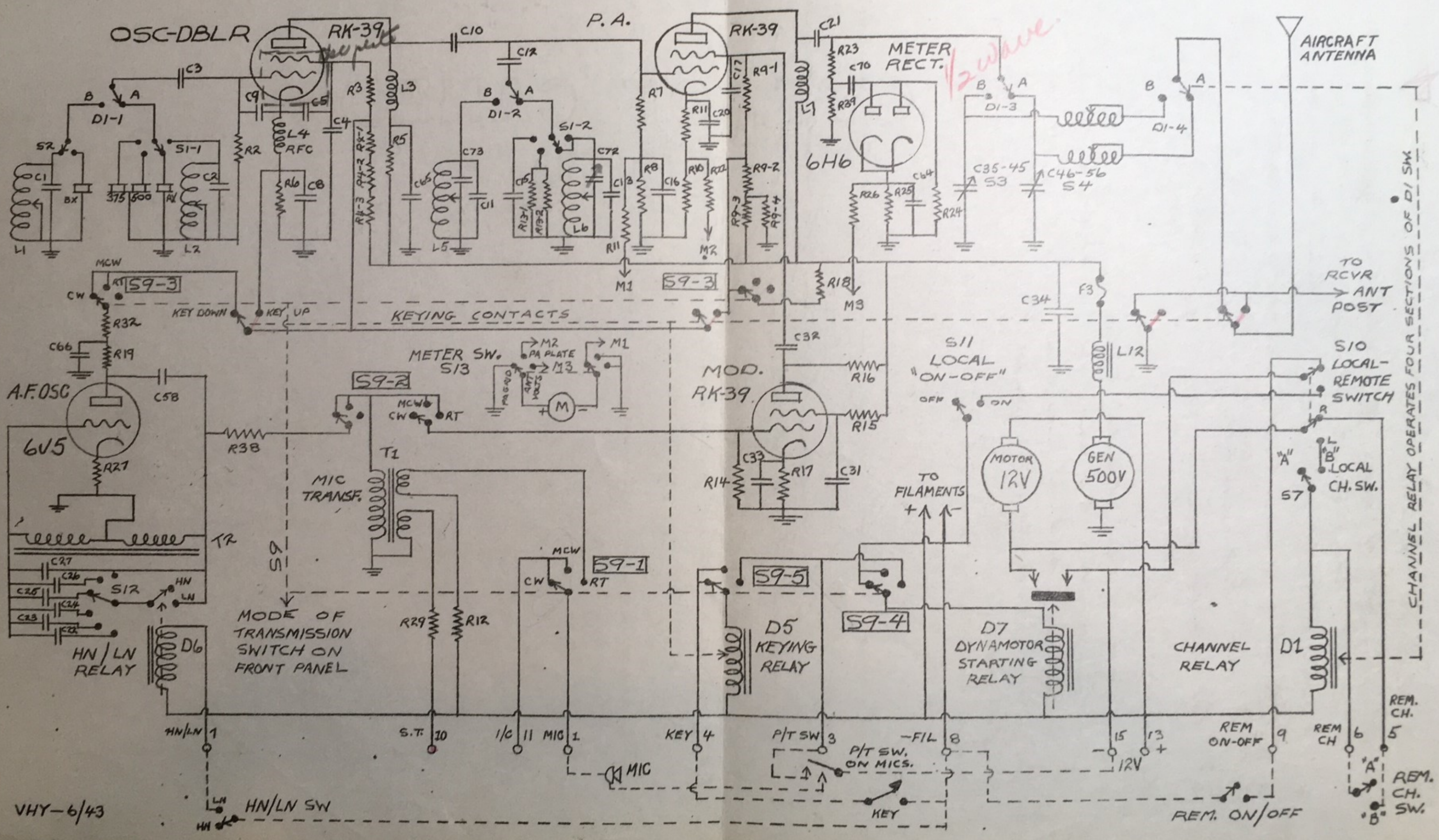
- (a) Low output.
- (b) Bright glow in the cathode region due to gas (a slight glow is allowable here).

Sustained off-tune conditions especially on CW cause this tube to gas and should be avoided. Owing to the action of the getter most tubes recover after a short period of normal operation

1.5 - 20 mc/s

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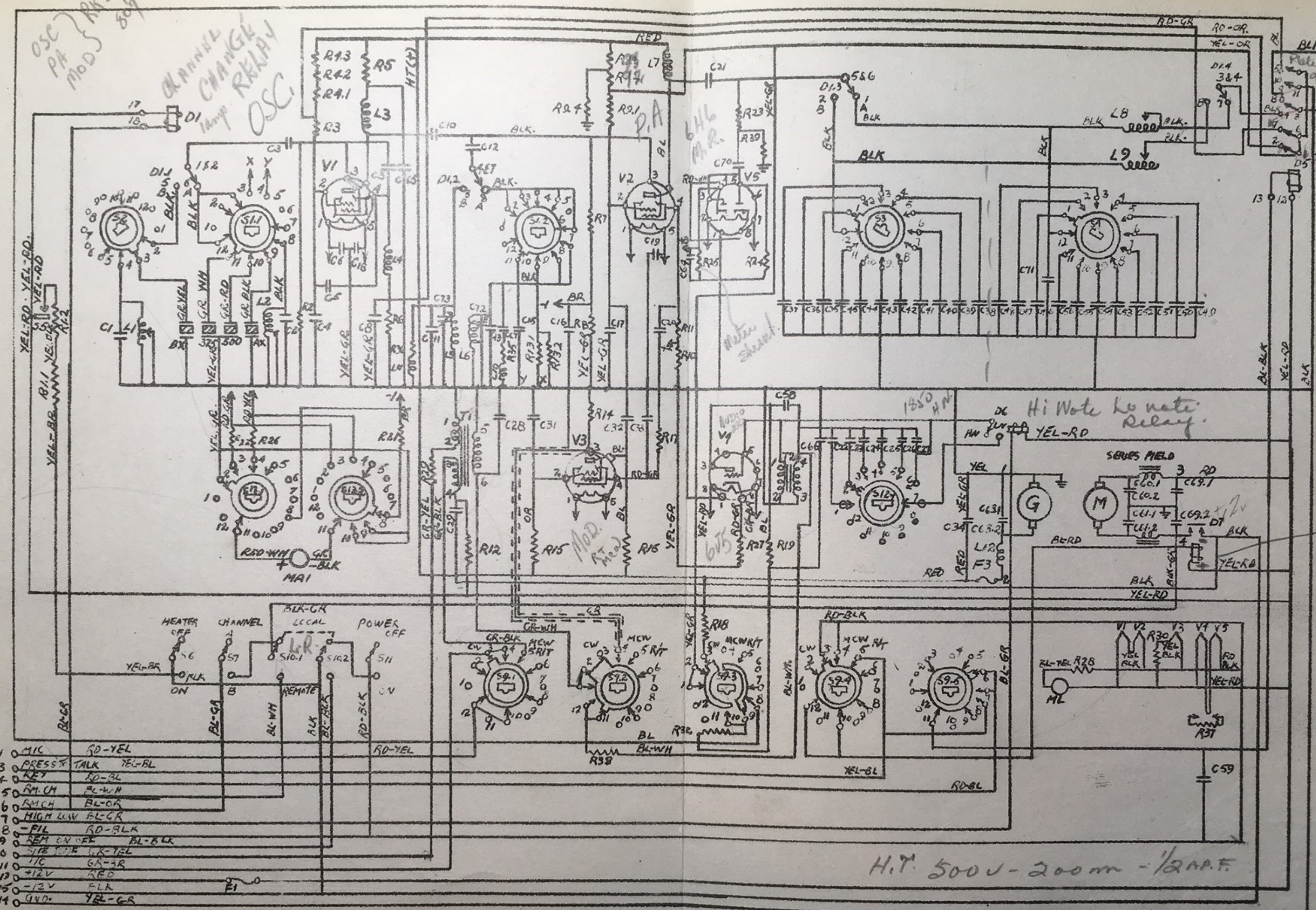
# TYPE AT-1 TRANSMITTER -- ABRIDGED DIAGRAM



VHY-6/43

OSC PA MOD 39 809

CHANNEL CHANGE RELAY OSC.



Buying Relay

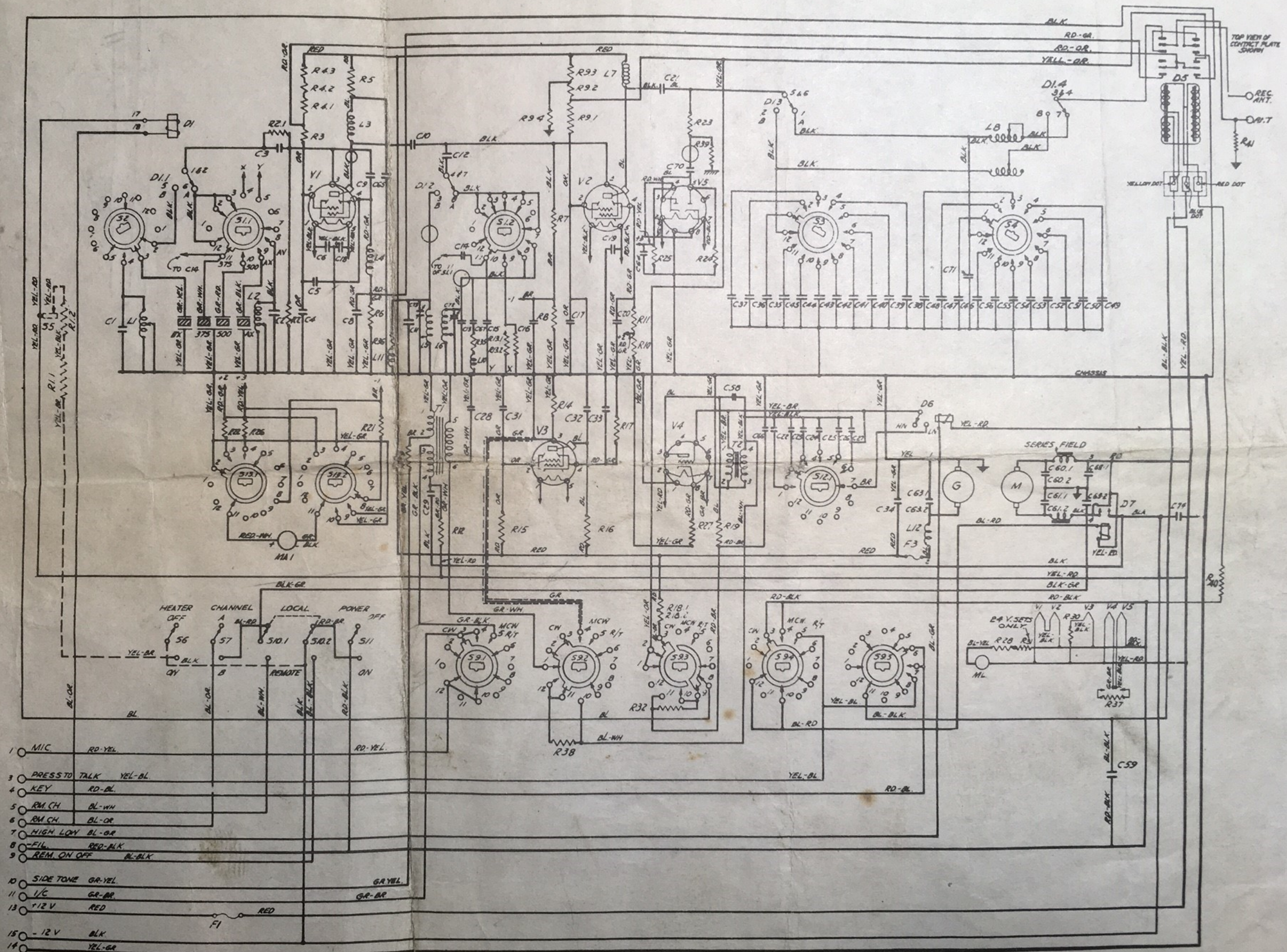
ATA SCHEMATIC.

Screen Grid Mod.

- 1 MIC RD-YEL
- 3 PRESS TALK YEL-BL
- 4 KEY RD-BL
- 5 RM CH BL-WH
- 6 RM CH BL-GR
- 7 HIGH LW BL-GR
- 8 FIL RD-BLK
- 9 REM ON OFF BL-BLK
- 10 SIB OFF GR-YEL
- 11 110 GR-BR
- 13 +12V RED
- 15 -12V FLK
- 14 GND YEL-GR

H.T. 500V-200m-1/2A.P.F.

L.T. 12V-30AMP.



GENERAL PURPOSE AIRCRAFT RADIO TRANSMITTER SCHEMATIC

FIG. 9

TYPE AT1 REF. NO. 10A/1267

### NOTES

1. FRONT PANEL ENGRAVING FOR SWITCHES 53, 54 IS ROTATED AHEAD ONE NOTCH.  
FRONT PANEL NO 1 IS SWITCH POSITION 12 SHOWN.  
" " NO 2 " " " " " " ! " " .  
ETC.
2. COMPONENTS SHOWN DOTTED (55, R1.1, R1.2, 36) HAVE BEEN REMOVED FROM LATER PRODUCTION LOTS.
3. AT7 HAS 24V. SERIES-PAR. HEATER CIRCUIT.

