

The AA8V 6146B Amplifier

by Greg Latta, AA8V

Amplifier Schematic Diagrams and Circuit Descriptions

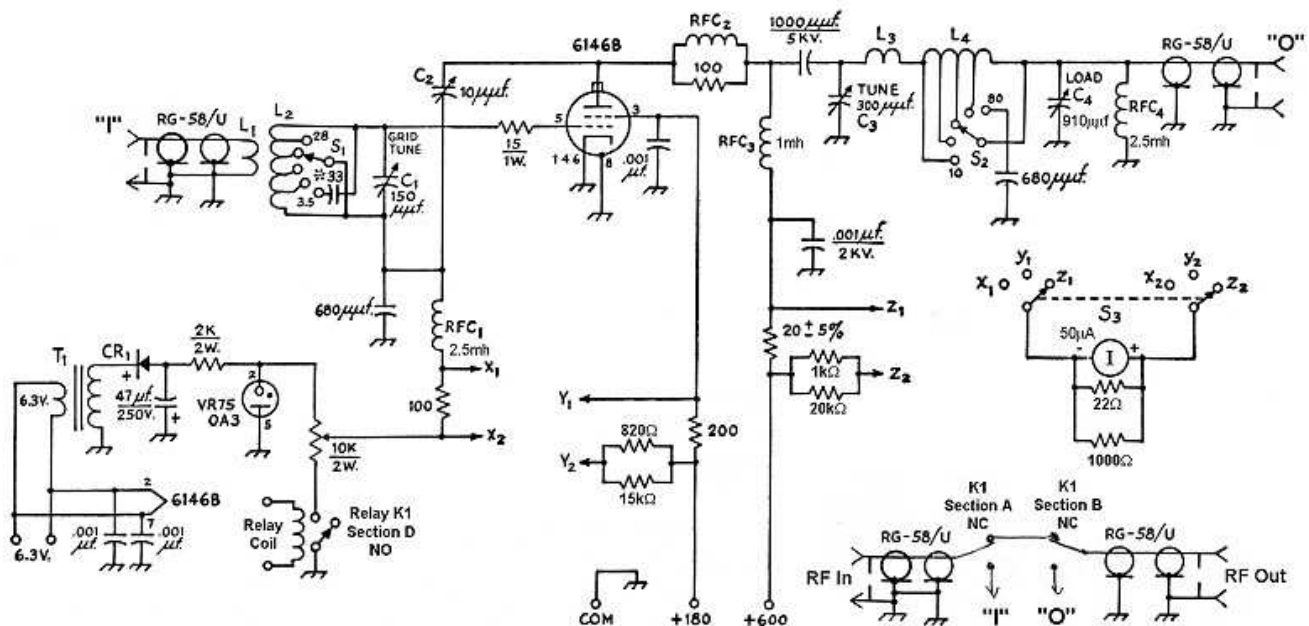
6146B Amplifier Pages:

6146 Amplifier - Main Page and Exterior Photos	Plate and 10m Tank Coil Construction Details
Interior Photos of the Finished Amplifier	Construction of Input Coils L1 and L2
Amplifier Schematic Diagrams and Circuit Descriptions	High Voltage Cage Construction
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Circuit Descriptions and Sub-Schematics

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Click On A Section of the Schematic Below for Information on That Part of the Circuit:



[Click here for a high resolution schematic.](#)

[Click here for a rotated schematic more suitable for printing.](#)

Input/Grid Circuit:

In a grid driven amplifier it is necessary to match the low impedance of the driving transmitter (typically 50 ohms) to the high impedance input of the tube (typically several thousand to several million ohms).

The signal from the input jack travels via RG-58 coaxial cable through relay K1 to the input link L1, which consists of three turns of insulated hookup wire on coil L2. L2 is tuned to resonance by the grid tuning capacitor C1. The transformer action of L1 and L2 steps up the voltage, matching the low impedance of the driving transmitter to the high impedance input of the tube. If extra driving power is available, as is the case with the [6CL6 transmitter](#), the grid tuning control is used as a drive level control, and is tuned off resonance to reduce the drive to an acceptable level.

Grid bias is fed into the bottom of L2 and travels through the 15 ohm resistor to the grid of the tube. When operated as a linear amplifier (SSB), the tube does not draw grid current and the 15 ohm resistor has no effect. However, if the tube is driven hard enough for grid current to flow (CW operation), the 15 ohm resistor introduces additional grid bias and the tube operates as a non-linear class C amplifier.

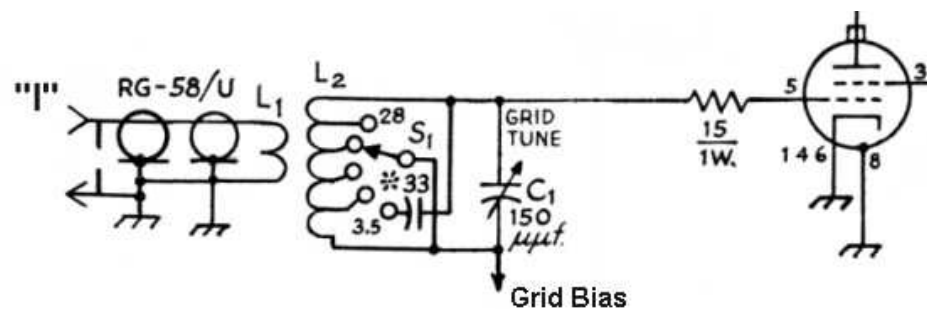


Plate Feed Circuit:

In an RF amplifier it is necessary to supply DC plate voltage to the tube (about 600 volts in this case) and at the same time extract the amplified RF that appears at the plate of the tube.

In the circuit at right, the 1 mH plate RF choke allows the direct current from the plate supply (B+) to pass through it, while preventing the RF on the plate of the tube from flowing back through the plate supply. At the same time, the 1000 uuf plate coupling capacitor (at the top in the schematic) permits the RF on the plate to flow though to the output tank circuit while blocking the plate voltage. The 0.01 uf capacitor at bottom short circuits any residual RF that might have gotten through the plate choke and prevents it from reaching the plate supply. The 100 ohm resistor and small coil (RFC2) in series with the plate lead form a parasitic suppressor, which helps prevent unwanted oscillations.

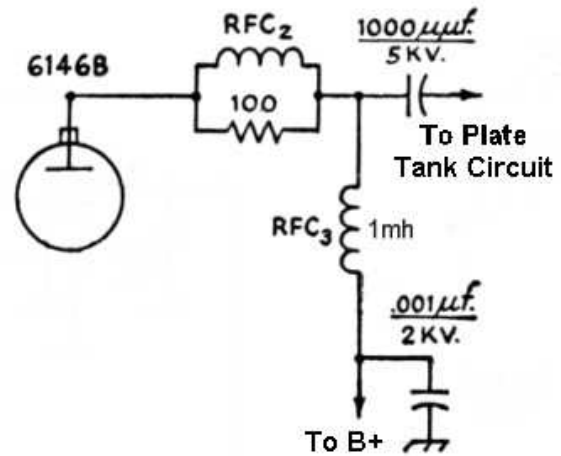
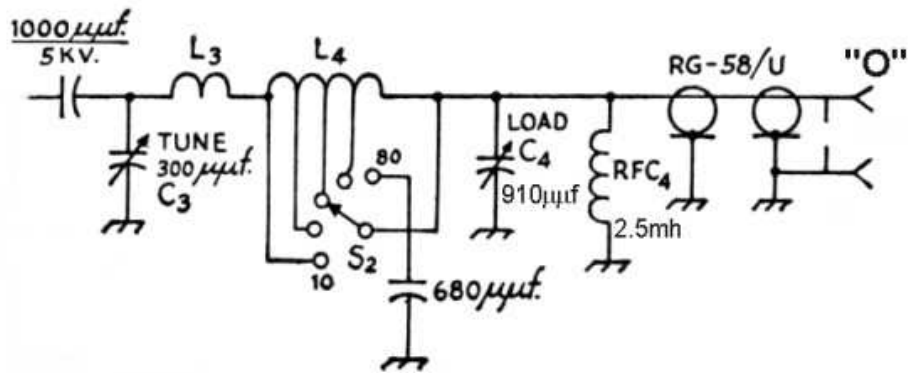


Plate Tank Circuit:

The plate tank circuit is a pi-network that matches the high impedance of the plate to the low impedance of the antenna. At the same time the circuit filters out undesired harmonics from the output signal. The signal from the plate enters through the 1000 uuf plate coupling capacitor at the upper left in the schematic. The 300 uuf plate tuning capacitor in combination with the [plate tank coils L3 and L4](#) tunes the amplifier to resonance. The band switch varies the inductance of the [tank coil L4](#), and the 910 uuf load capacitor adjusts the network for the best impedance match.

The 2.5 mH RF choke performs two important functions: If the plate coupling capacitor should fail and short, the RF choke will short circuit the plate supply, blowing the power supply fuse. This will prevent the plate voltage from appearing on the antenna, a very dangerous situation. The choke also prevents any DC voltage from appearing across the load capacitor, lowering the voltage it is required to handle.

After passing through the matching circuit the signal then travels through RG58 coaxial cable to relay K1 and the output connector.



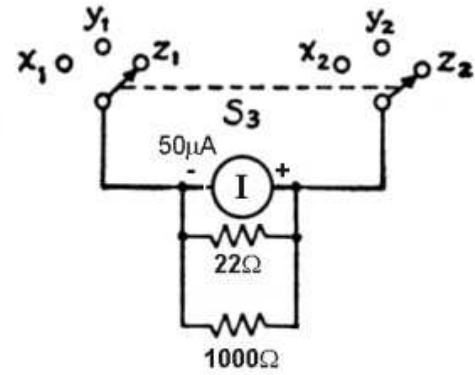
Meter Circuit:

Metering the plate, screen, and grid currents of an RF amplifier is an

important method of monitoring amplifier operation. The best way, if space and money permit, is to use a separate meter for each element, as was done in the [Wingfoot 813 Amplifier](#). Separate meters provide a simultaneous view of all amplifier currents in a single glance. They meters are, however, expensive, and take up a lot of space.

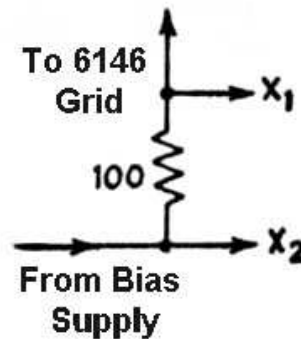
The usual method is to use a single meter that can be switched to read different currents. The original design called for a meter with a full scale sensitivity of 5 mA. However, since I had a perfect surplus meter with a full scale sensitivity of 50 uA, this was used instead. The ARRL handbook contains equations on how to determine the proper shunt resistance for a given meter. That value was used as a starting point, but then the meter was placed on the test bench and the shunt value (22 ohms in parallel with 1000 ohms=21.5 ohms) experimentally determined so that the meter read full scale when exactly 5 mA was flowing through the circuit, as measured on a high accuracy digital meter.

The two pole three position rotary switch S3 connects the meter to the desired tube element. X=control grid, Y=screen grid, Z=plate.



Grid Metering Resistor:

To meter the grid current a 100 ohm resistor is placed in series with the control grid to carry current when the meter isn't switched in. When the [meter](#) is switched in to read grid current it is placed in parallel with the 100 ohm resistor, and most of the grid current flows through the meter, since the meter and its shunt have much lower resistance than the 100 ohm resistor. Since some current does still flow through the 100 ohm resistor, the indicated current is slightly lower than the actual grid current, but the difference is not important.



Screen Metering Resistors:

In the screen grid circuit very accurate metering was desired. Since the expected screen current was about 15 mA, a full scale reading of 25 mA was selected. To meter the screen current, the [meter](#) was configured as a voltmeter to read the voltage drop across a 200 ohm resistor placed in series with the tube screen. The screen current creates a voltage drop across the resistor, which is then read by the meter. The meter multiplier resistor (820 ohm and 15k ohm in parallel=777 ohm) was carefully chosen so that the meter read exactly full scale when 25 mA flowed to the screen.

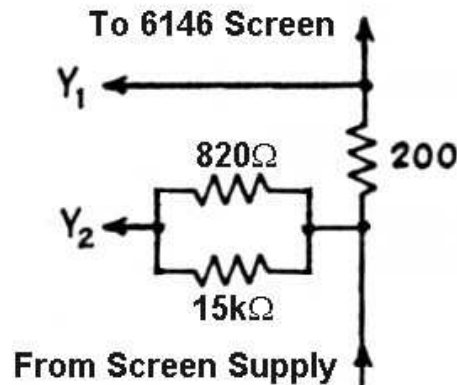
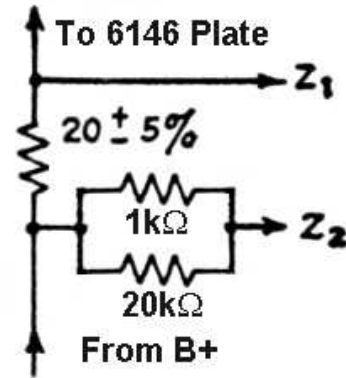


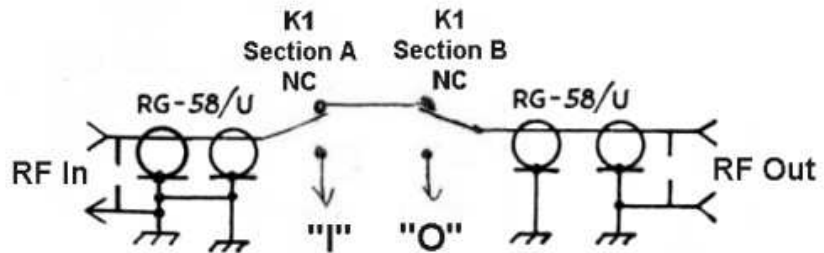
Plate Metering Resistors:

In the plate circuit very accurate metering was also desired. Since the expected plate current was about 150 mA, a full scale reading of 250 mA was selected. To meter the plate current, the [meter](#) was configured as a voltmeter to read the voltage drop across a 20 ohm resistor placed in series with the tube plate. The plate current creates a voltage drop across the resistor, which is then read by the meter. The meter multiplier resistor (1k ohm and 20k in parallel=952 ohm) was carefully chosen so that the meter read exactly full scale when 250 mA flowed to the plate.



Transmit/Receive/Bypass Circuit:

When an RF amplifier is used with a transceiver, it is necessary to bypass the amplifier during receive periods. In this amplifier sections "A" and "B" of relay K1 handle the transmit/receive switching. (Section "D" is used for bias switching.) When the coil of relay K1 is not activated (amplifier "Off" or in "Standby") the normally closed (NC) contacts of relay sections "A" and "B" connect the amplifier input jack directly to the output jack, bypassing the amplifier. When the relay coil is activated (amplifier in "Operate") the input jack is connected to the input of the amplifier "I" and the output jack is connected to the output of the amplifier "O". When used with a straight transmitter such as the [6CL6 transmitter](#) the mode switch is left in the operate position during use.



Bias Circuit:

The amplifier bias circuit applies adjustable regulated bias to the 6146B control grid. The use of regulated bias results in improved linearity, important when the amplifier is used for SSB service.

To avoid the expense of a separate power transformer, a filament transformer is run in reverse to step some of the filament voltage from the main power transformer back up to 117 V. This is then run through a simple half-wave rectifier CR1 and then filtered by the 47 uf capacitor. The OA3 gaseous regulator tube then regulates the output of the supply to 75 V.

The regulated 75 V is then applied to the 10k bias adjust potentiometer. In "Standby" mode the coil of relay K1 is not activated, and one end of the 10k potentiometer is left

