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A Transmitter CW Power Measurement Example

Here is an example of two methods to measure/ calculate the output power of a homebrew tube type CW transmitter.

Method 1: Input Power

The example transmitter uses a 6146 Power Tetrode driving a classic PI-L tank. It is grid driven and self biased. The stage was intended to be Class C driven, and convert input power to output power at approx. 75 % (at low duty cycle). (Note: We can test our actual efficiency wit this method)

The power supply is 460 VDC and when loaded for this example into a 300 watt resistive dummy load, shows a current draw of approx 100 mA.

Input power = V * I = 460 * .1 = 46 watts.

Output power expected = Input power * Class C efficiency = 46 * .75 = 32.5 watts

This method is dependent on the accuracy of the tube final efficiency and the V and I DC power supply measurements. It also ignores any tank losses.
This power level is the continuous or RMS power since the measurements of V and I are made at DC.

Method 2: Direct measure output

Dummy load is a 300 watt carbon resistor which measures at 49 ohms. (R)

Using an oscilloscope hooked across this load, with a 10X probe and a 50 MHz Fluke Scopemeter, displayed peak to peak (P to P) voltage is 96 volts.

Peak envelope voltage is therefore 96 / 2 = 48 volts

Peak Envelope Power is V^2/ R = 48^2 / 49 = 47 watts

The average (RMS) power (over time) = (47 *.707)^2 / 49 = 22.5 watts

Predicting output tube efficiency

The dummy load – scope method is a more accurate measurement, which we can use to increase the efficiency prediction of our tube output stage.

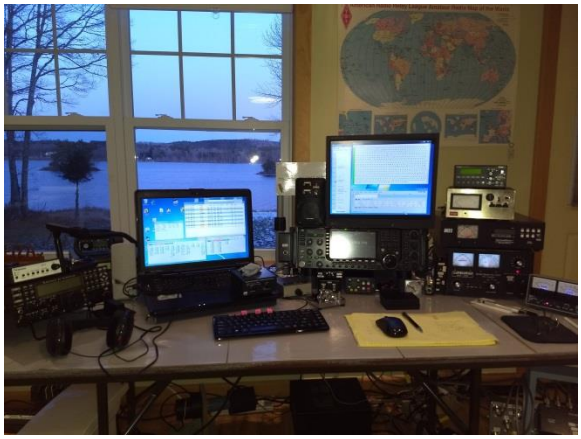
IE,

If output average (Root Mean Square) power is 22.5 watts, then effciiency = 22.5 / (V * I input DC)

= 22.5 / 46 = 49 %

In other words, our output tube is probably not working as class C, and is likely biased in the linear region. Probably B or AB bias classification is appropriate. (A scope the tube grid drive signal and the output signal could positively confirm the class.)

Now that the efficiency is refined, we can use the input power method to predict output power with increased confidence.



Shack at VE1ZAC, just after a November dawn