A 1 KHz Pulser for Transceiver Testing

Testing and setting up HF transceivers and linear amplifiers is something of an art form, with plenty of traps for young players. There are several nasties which immediately come to mind, but without a doubt, the most important of these is that almost all power supplies provided in commercial amateur equipment are underrated when a radio or linear amplifier is operated at full power for long periods of time (this comment also applies to heatsinks for rf output stages) and may overheat destructively. The worst offences occur when a transceiver or amplifier is operated under FM or AM conditions, because these modes of operation create a continuous carrier. SSB is apparently more forgiving as the carrier amplitude varies in sympathy with the audio signal but of course many makers take advantage of this and provide power supplies which are very underated if the amateur decides to transmit FM or AM (or code).

One standard test method is to apply a two tone test signal to the microphone input of the item being tested, but this is a stringent test as the resulting power developed is one half of the continuous power output possible and so cannot be applied continuously. An interesting side issue is that under such s demanding conditions, power supply outputs sag, and the power obtained is less than it would be under SSB voice conditions.

So what is really needed if the test is to be realistic , is for the test signal to mimic actual voice conditions. Now voice typically has a 1:6 relationship between average power and PEP, or a 1:4 relationship if the voice signal is substantially compressed, and this circuit simulates exactly that by providing short bursts of a 1 KHz sine wave at a 10Hz rate. The duty cycle is 25% which mimics the compressed human voice and allows you to conduct continuous testing without overrating your rig. **Measuring the resulting output power will mean you will need a power meter which can display PEP.**

How it works

The 1KHz sine wave is developed by IC1a. This is the dual form of the standard phase shift oscillator to be found in the literature, which uses a high pass phase network, and is almost impossible to adjust for a good sine output. To get this oscillator working involves getting a good sine at the amplifier output , which in turn means exactly adjusting the loop gain so that a good sine is present at all points in the circuit, a process which is not helped by the high pass circuit which preferentially passes harmonics!!

This circuit works by simply providing a very large (and non critical) amplifier gain, with a square wave resulting at the amplifier output. After low pass filtering of the square wave through the low pass network, a quite good sine results at the amplifier input (pin 2) which in turn is then re-amplified to become a square wave ☺. The amplifier is biased to half supply rail (R4 and R5) resulting in a 550 mV p-p sine sitting on top of a dc level of 4.5 volts. IC1b provides unity gain low impedance buffering for this signal.

The 10Hz rectangular wave is generated as follows. The output switches rapidly between the maximum and minimum output levels possible (0.6 and 7.6volts) in turn charging and discharging C5 via R6 andD1/R7. Positive feedback via R10 to R8/R9 establishes Schmitt trigger levels at pin 5 of 2.5 and 6.1 volts which when exceeded across C5, cause the output to switch states. The rectangular output waveform is caused by C5 charging faster than it discharges due to D1 and R7.

In turn, the rectangular output of IC2a is applied to LED1 , turning it on and off and so varying the sine output of IC1b due to the potentiometer action of the LDR and R11. The LDR and LED are close coupled together within a piece of heat shrink tubing, with the LDR resistance varying from about 2K ohm (LED on) to many hundreds of K ohm (LED off). This switching technique results in NO dc level shifts during switching and so no odd audio effects.

The resultant pulsed audio is applied to IC2b (gain 3.5) and finally to the output level potentiometer and attenuator.

Final comments

When you build this, use a diecast box. You can probably use a plastic box, but don't blame the author if you experience rf feedback. Depending on demand, I may get a few pcbs made.