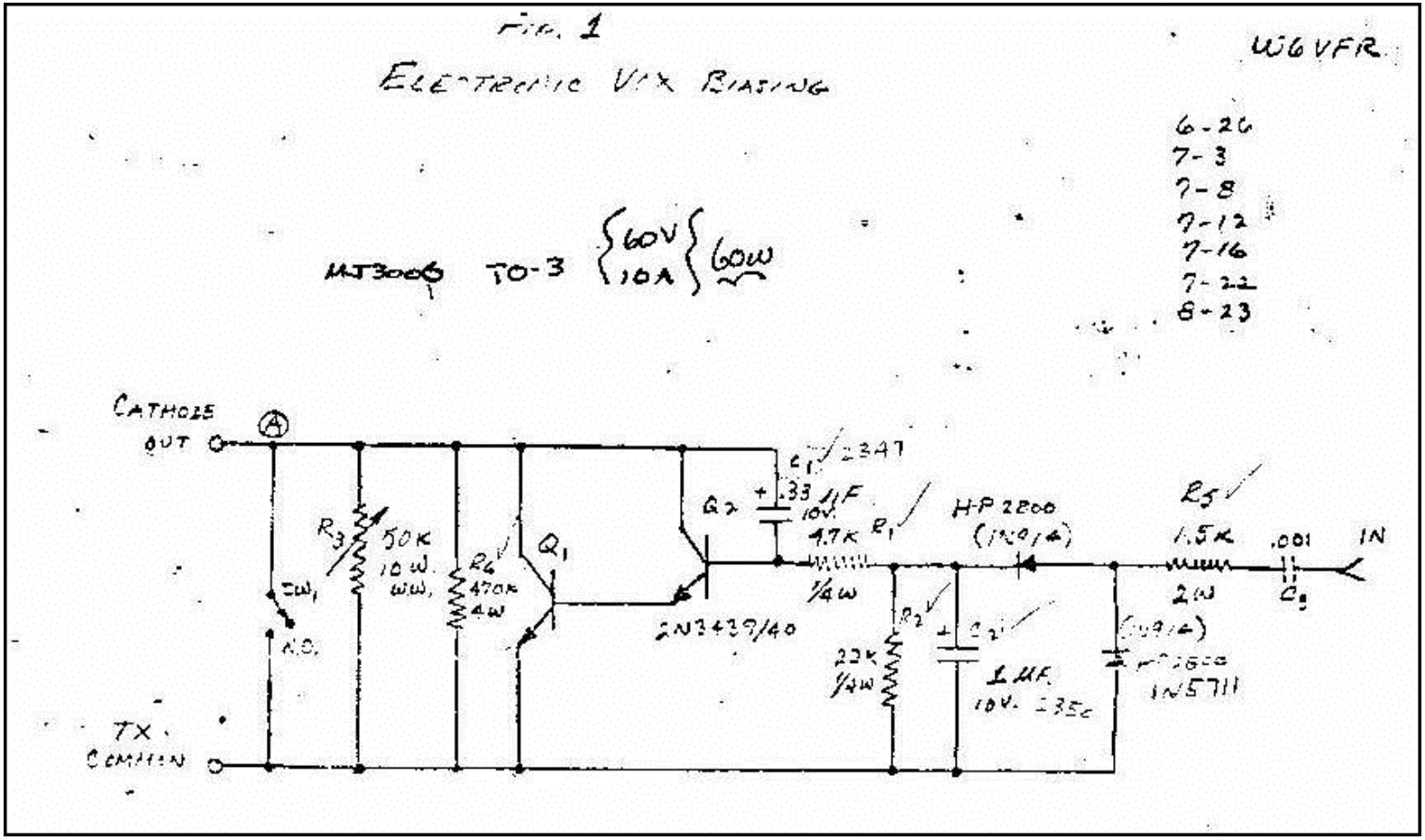
Electronic Vox Bias Ckt . . . Revisited!

By K6JRF- 3/7/14

The Electronic Bias Ckt (EBC) has been around for quite some time. The ckt's big advantage is that it can save literally hundreds of watts in wasted power and subsequent heat due to tube bias power dissipation. However, many of these ckts do not perform as they need to, causing distortion so are abandoned by their users. I do believe all amps should have this feature and the ckt can be made to perform as it should.

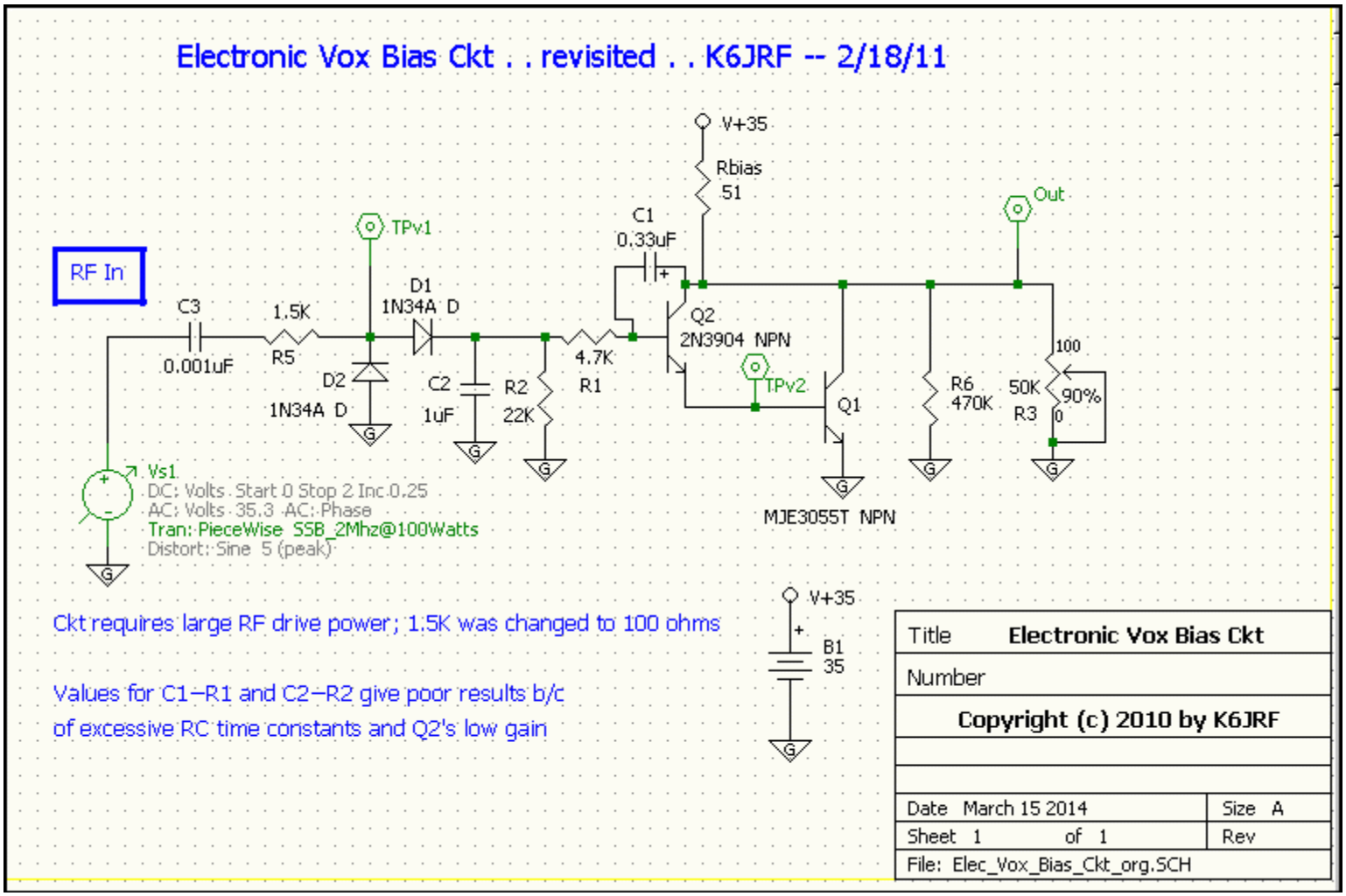
I came across this schematic of an "Electronic Vox Bias" [EVB] while browsing in my older files drawer It appeared in the 1975 time frame and had some anomalies!



The original analysis was done in 2011 and the Spice program called "5Spice" has made a number of program revisions Armed with one of the latest version, I re-visited the ckts in this report to see if any improvement could be made.

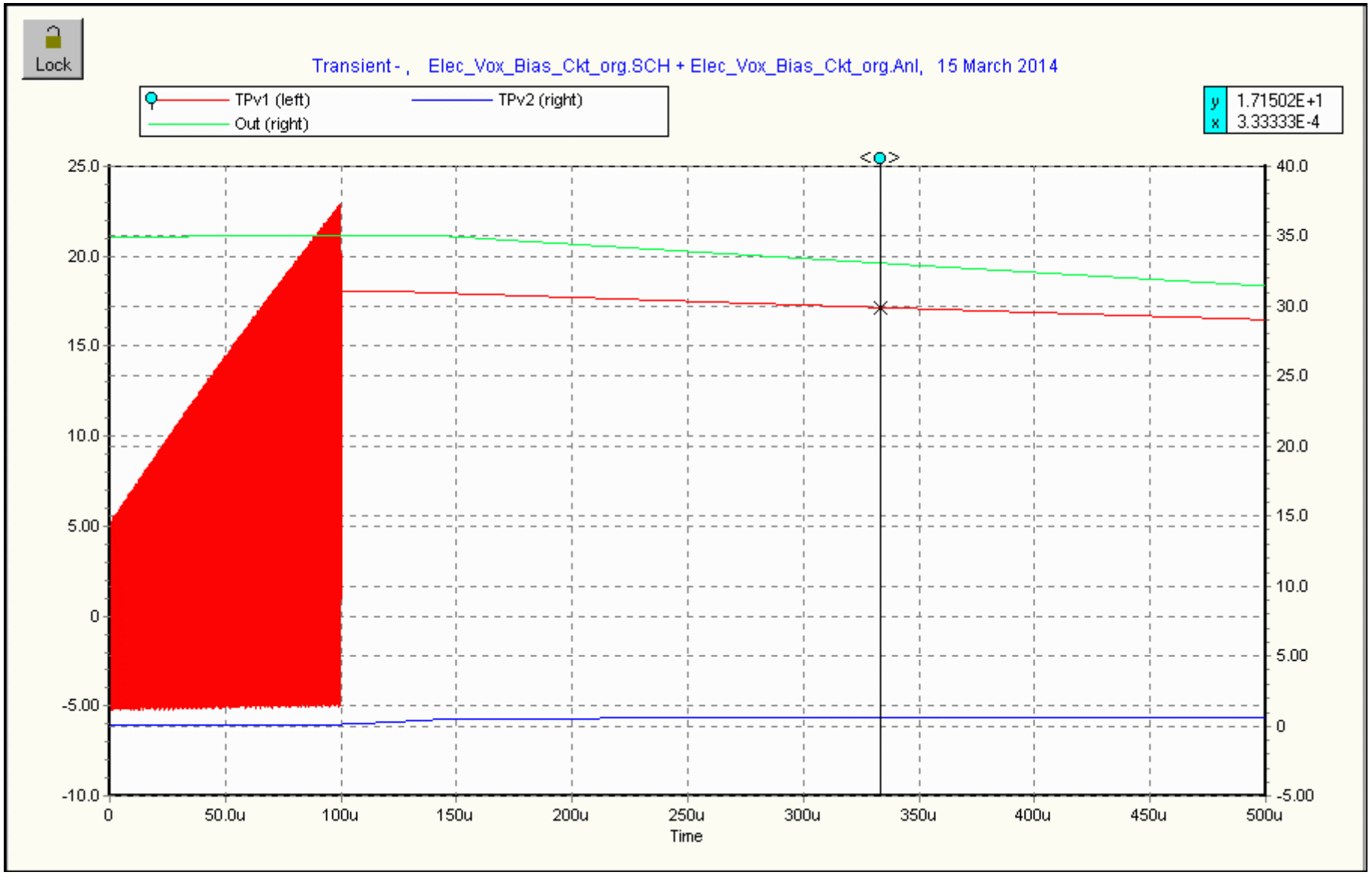
5Spice used “WinSpice” as the core for spice analysis and the author, Arthur Andresen has written a great user friendly “shell” that makes using it a breeze. So today, I put Spice to work to see if it works as advertised.

The original ckt when captured into 5Spice looks like the following chart It’s drawn in a more conventional manner w/ “input” on the left and “output” on the right.

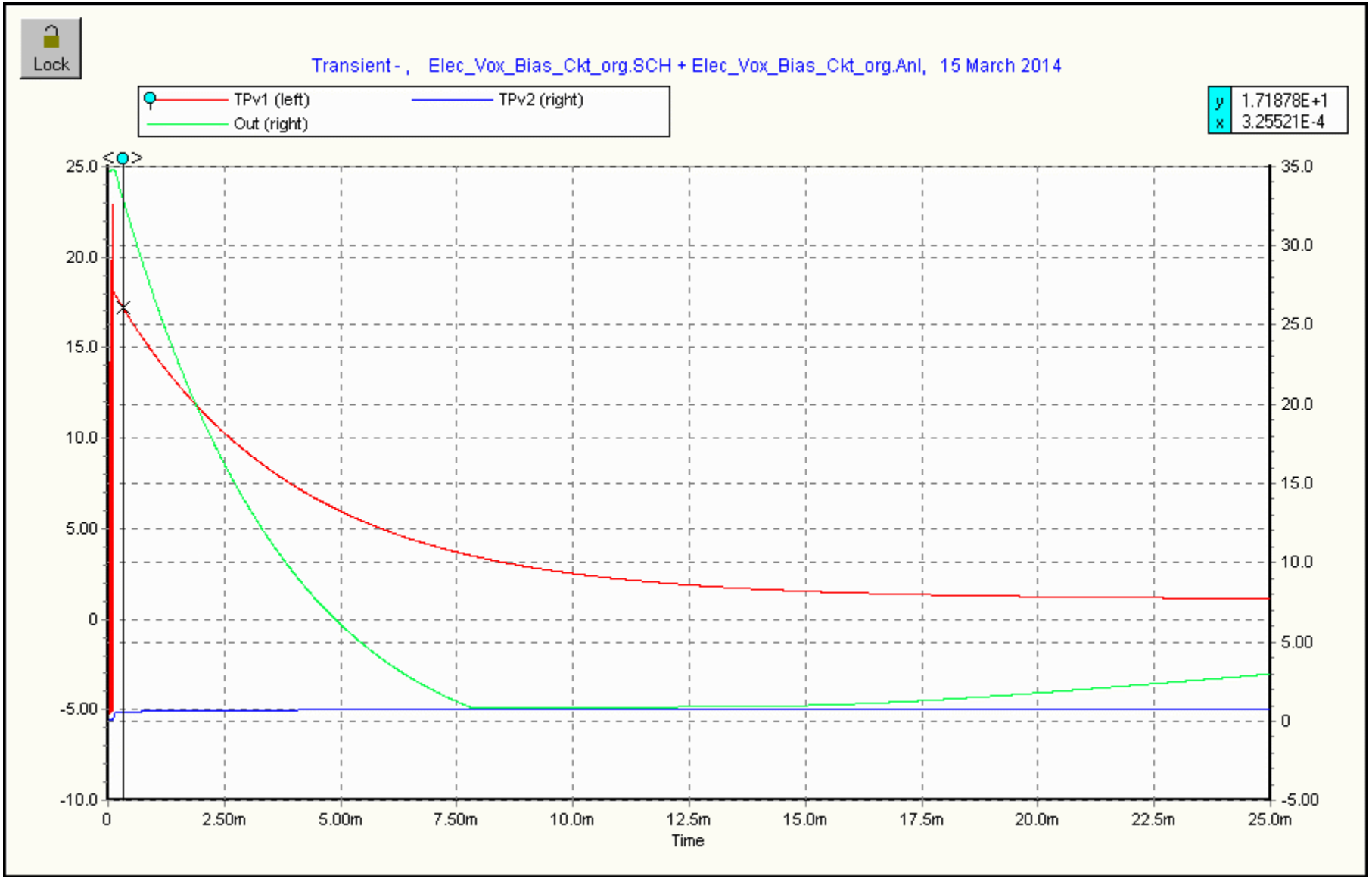


The time-constant of C1-R1 and C2-R2 are much too long for reliable ckt operation. These ckt values result in an extremely slow response time as the chart on the next page shows. The attenuating resistor, R5 had to be changed to 100 ohms to get the ckt to respond to 2Mhz signal @ 100 watts drive!! That’s due the poor choice of C1-R1 and C2-R2 RC time constants and the low gain of the main transistor “switch”, Q2.

The input RF drive (in red) signal lasts for 100us; the output (in green) starts slowly to change from the cutoff bias point (35V) and is apx 32V a
500us. Obviously, that is much too slow and is a non-functioning EBV ckt. No wonder the SSB is distorted; it's operating with cut-off bias

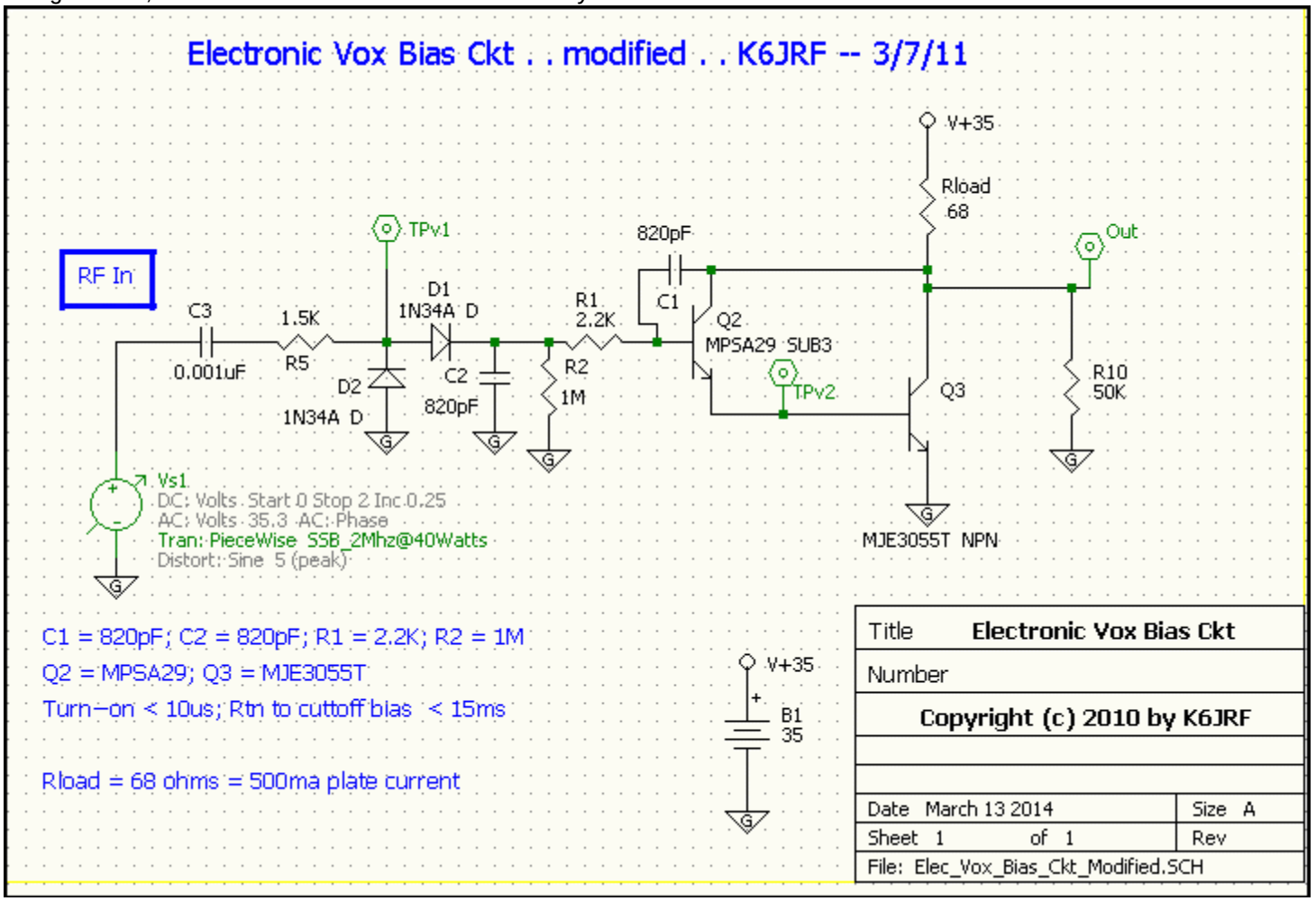


The next chart shows the same drive except a longer time scale of 25ms. Note that the output (green line) takes apx 8ms to fully turn-on, stays o
for apx 4ms and then turns off heading for cutoff bias.



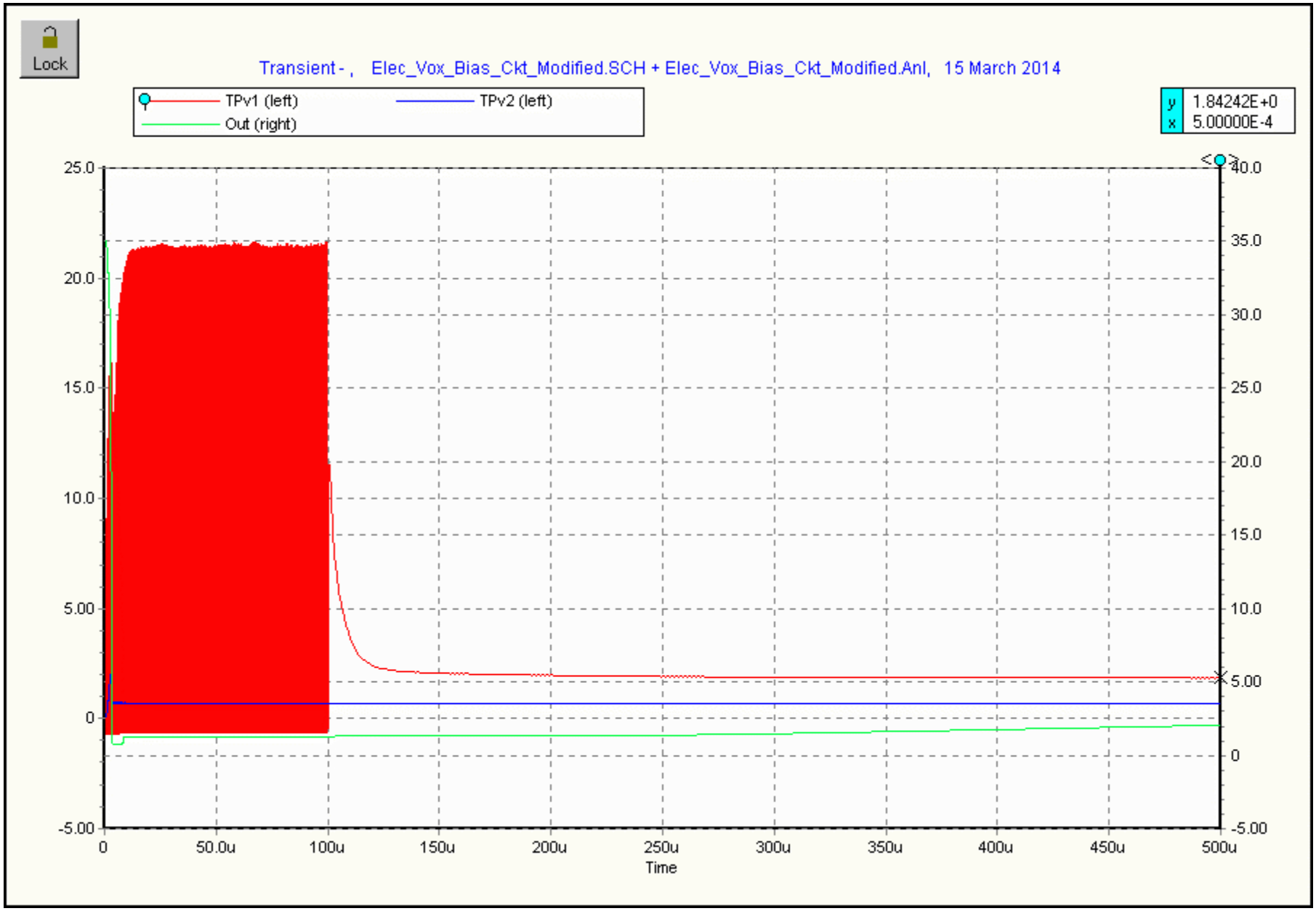
This is an example of why most users abandon the ckt . . . and I don't blame them. It just produces distorted SSE

In contrast to the original ckt, this modification ckt works extremely well Here's how an EVC ckt is SUPPOSED to work.

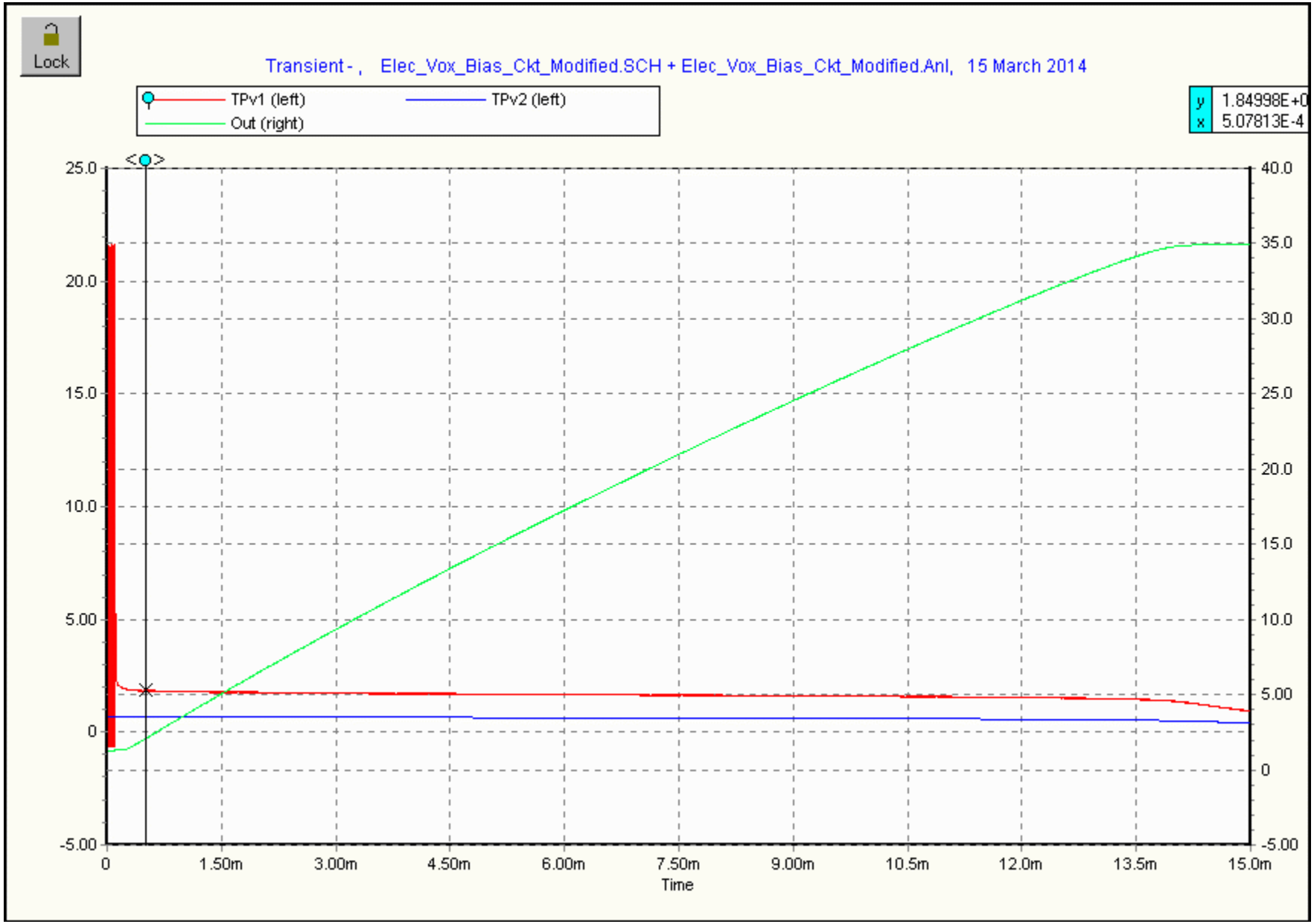


The 5Spice ckt values were modified or replaced with ckt values that make it work as a "real" Electronic Vox Bias ckt. New values for C1 and C2 = 820pF as well a replacement for Q1, MPSA29 have been employed. Resistor R2 stays the same. The ckt, with short time constant, can be used fo either "CW" or "SSB" operation.

The ckt's output responds quickly so that the tube's cutoff bias is removed within micro-secs (< 10us) to operating bias. It stays biased following the speech pattern of the SSB signal for 500us and has a quick return to cutoff bias when the RF drive signal is removed. The chart below shows the output (green line) with complete ckt turn-on [operating bias] 10us after the signal is introduced and has short hang-time.



The drive signal (red) pulses is a 2Mhz @ 40 watts. Works with as low as 10W RF drive. With Q2's added-gain, the ckt can be driven with low power The output (green) attains operating bias in < 10us after RF drive signal is introduced. The tube stays biased for the dead time interval as the chart below shows.



From 0us to 15ms (chart above), the EVB ckt starts to turn off at 500us time point. It takes apx 12ms to return to cutoff bias. This is perfect for CW users but works equally well for SSB where long hang-time is not desired.

After the ckt part changes, the ckt does switch from cutoff bias to operating bias in less than 10us and stays operational w/ a hang-time of < 1ms The ckt can be driven with any RF power level as low as 10 watts. The new parts (C1, C2, R1, R2 and Q2) have optimized this ckt's response time.

So in summary, the ckt was taken from basically a non-operating ckt to one that responds in less than 10us. The revised ckt holds tube's operating bia for all input SSB RF drive modulation between 40hz to 5Khz with a short hang-time optimized for CW work.

The intent of the first ckt's performance has been incorporated to my AL-1500 amp apx 2.5 years ago. To see what was done, click the link to see the ckt mods: http://www.k6jrf.com/FT2k_AL1500_EBS_new.html

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