John Linsley Hood's legendary Class A amplifier JLH-69

The sound of this amplifier was very much liked by Graham Maynard (Graham Maynard - the author of FCD), which he repeatedly mentioned.

Let's try to figure out why this amplifier is so attractive to this day, despite its extreme simplicity. It should be noted that the amplifier has a low load capacity, so highly sensitive acoustics with an impedance of 16 ohms should be considered the optimal load.

To begin with, let's take a graph of the loop gain, with a capacitive load from zero to 2 µF, fig. 1

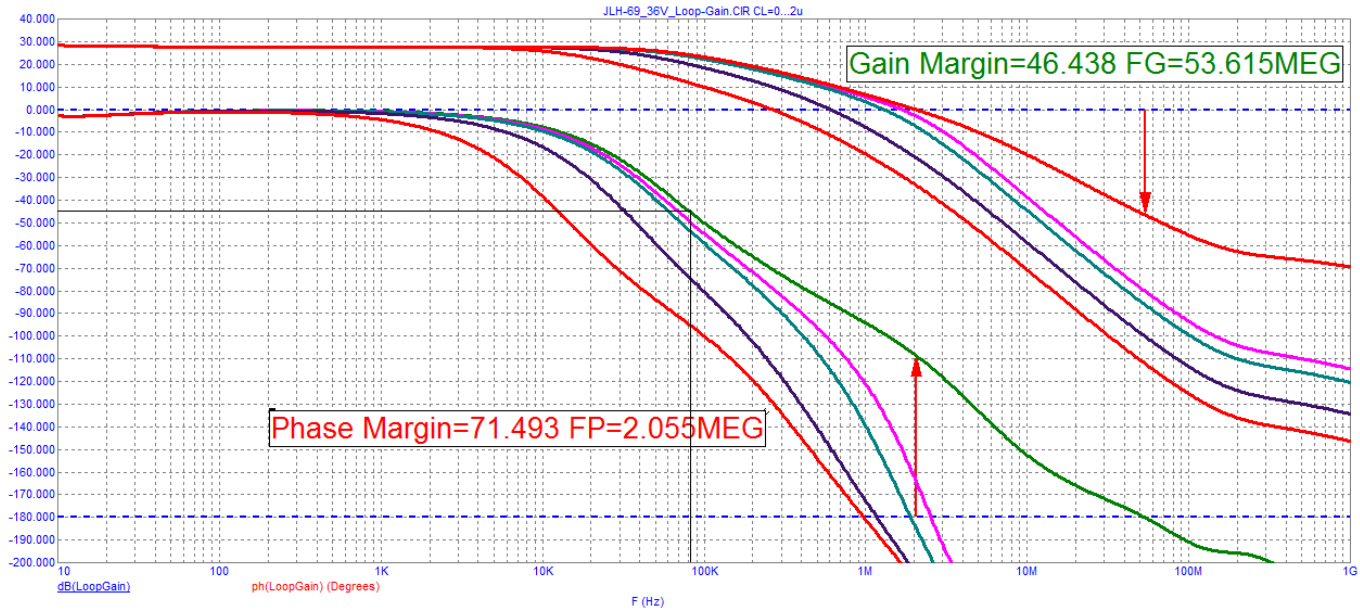

Fig. 1

The graph shows that the loop gain is about 30 dB over the entire audio range. The frequency of the first pole is above 80 kHz. Matti Otala came to the need for a high frequency of the first pole. It is the high frequency of the first pole that makes the output impedance of the amplifier purely active. Therefore, it is not necessary to include an inductance at its output to ensure stable operation. This is something John Curl and Graham Maynard have repeatedly pointed out.

Let's see what is the spectrum of the signal at the highest operating frequency of 20 kHz, fig. 2

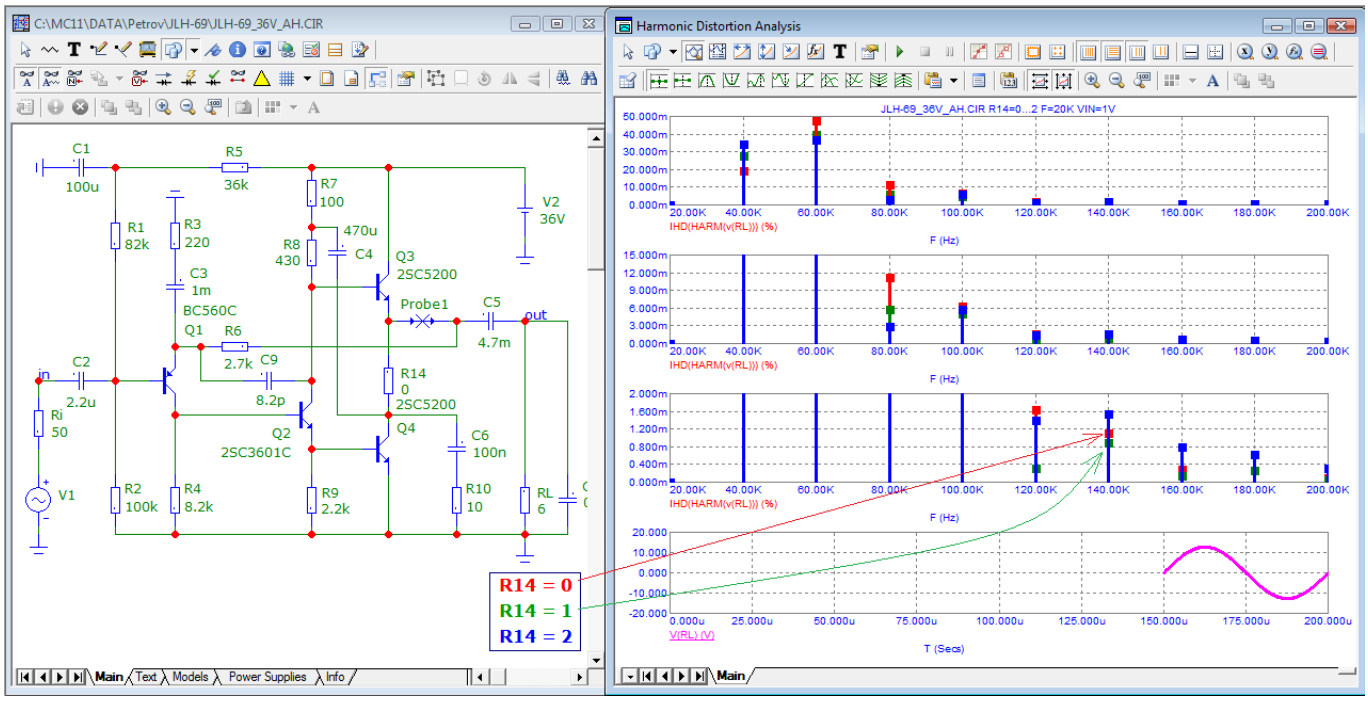

Fig. 2

As can be seen from the test result, the spectrum contains mainly 2nd and 3rd harmonics, there is practically nothing above the 5th harmonic. Resistor R14 shortens the spectrum of distortion and reduces the output impedance

Let us measure the distortion at a frequency of 10 kHz using a compensation method, fig. 3

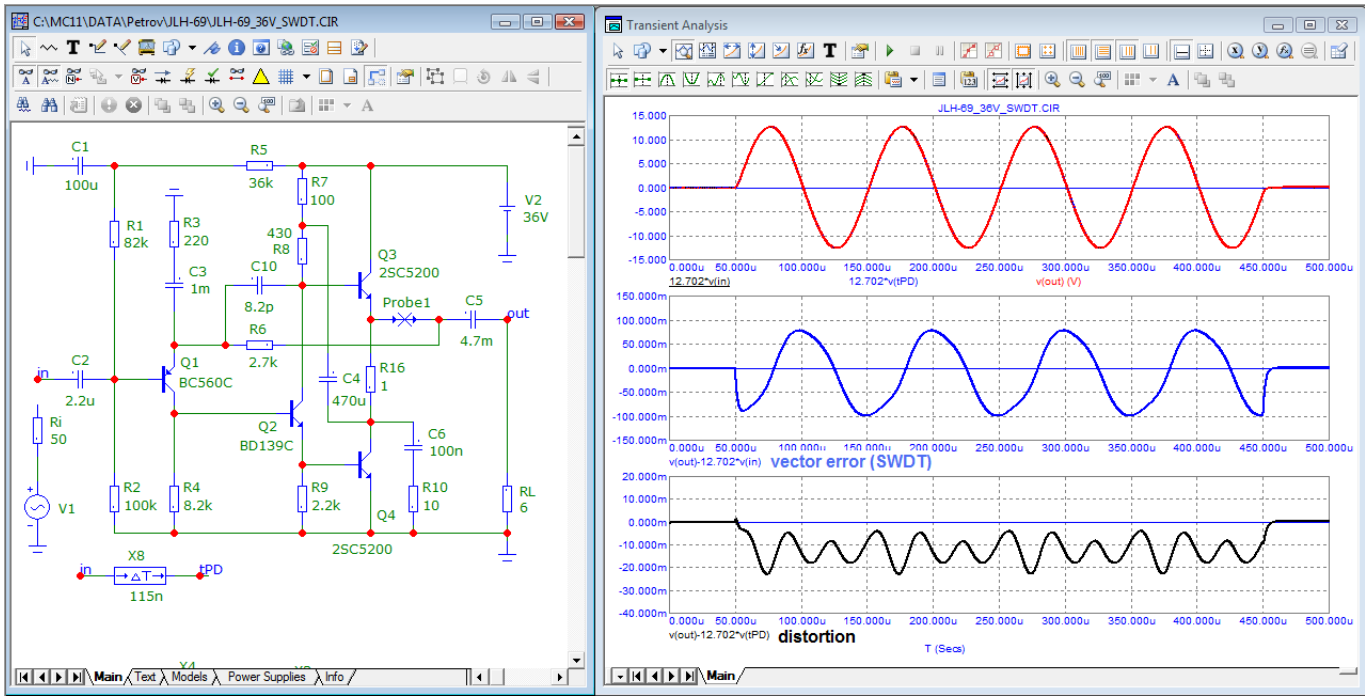

Fig. 3

As can be seen from the test result, there are no switching distortions in the distortion products. There are also no high-speed distortions at the beginning and end of the burst!

Let's measure the output impedance at a frequency of 20 kHz, fig. 4

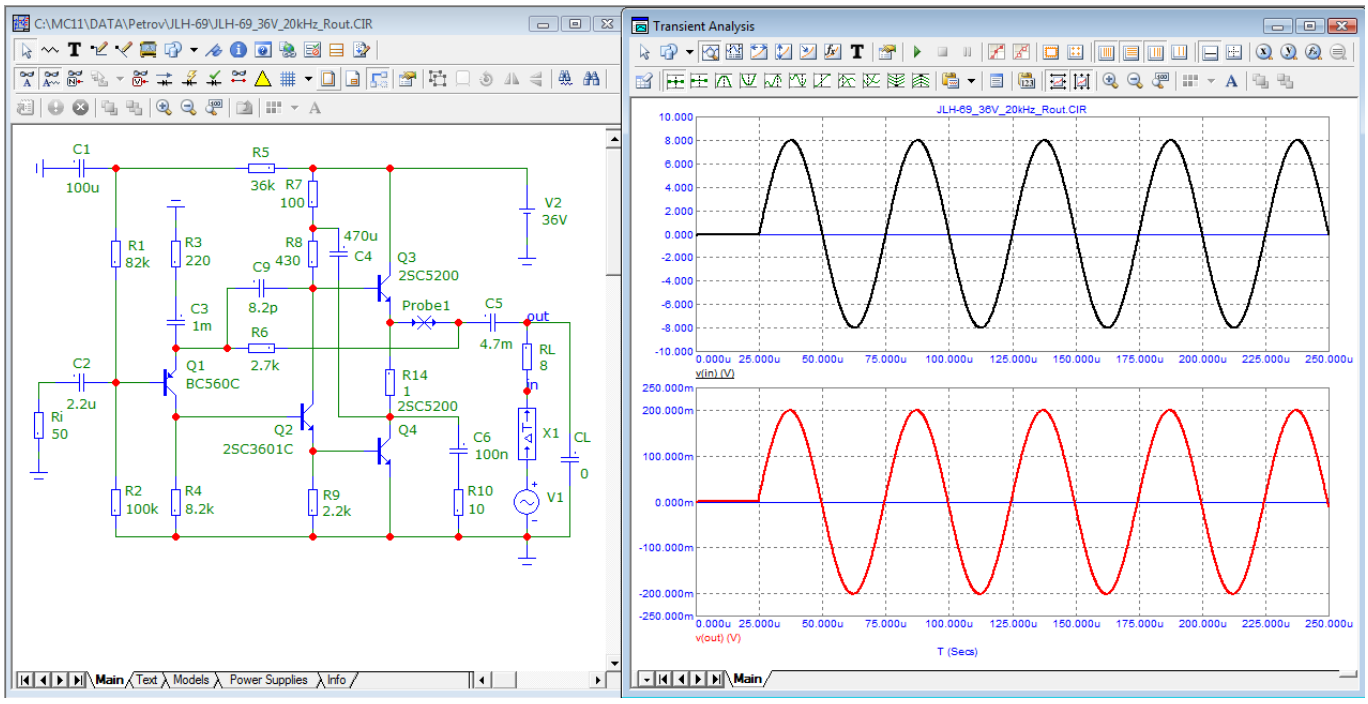

Fig. 4

In order not to go into exact calculations, we will neglect the output impedance of the amplifier. Then, with a generator output voltage of 8 V and a load resistance of 8 ohms, the current in the circuit will be approximately 1 A, and the output resistance of the amplifier is equal to the output voltage, i.e., approximately 0.2 ohms. The most important thing is that the amplifier instantly responds to external

influences and its output impedance is in phase with the external influence (signal).

In amplifiers with a low frequency of the first pole, the output responds with a 90 degree phase shift, and the output impedance increases with frequency and has an inductive impedance.

For example, let's measure the output impedance of the BC-1 amplifier at a frequency of 20 kHz, fig. 5

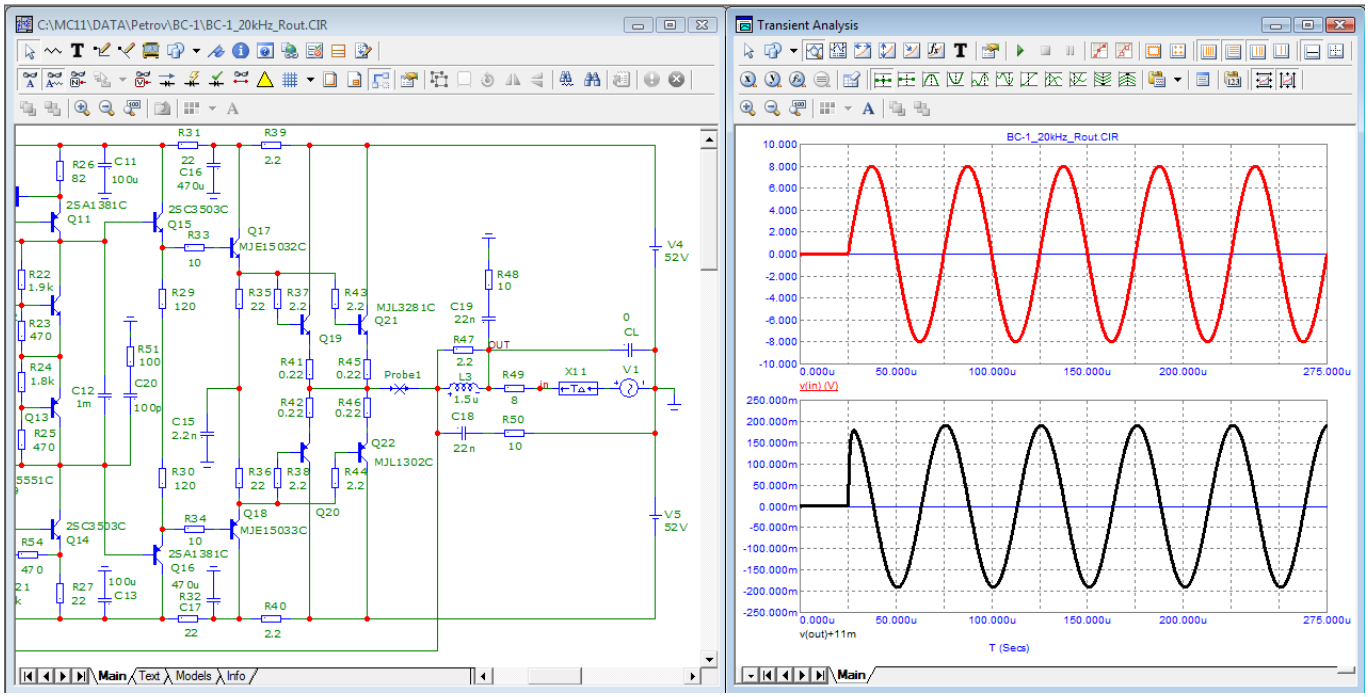

Fig. 5

As you can see, the output impedance of the BC-1 amplifier is exactly the same as that of the JLH-69
I will take the amplitude characteristic of the model with a load resistance of 6 ohms, fig. 6

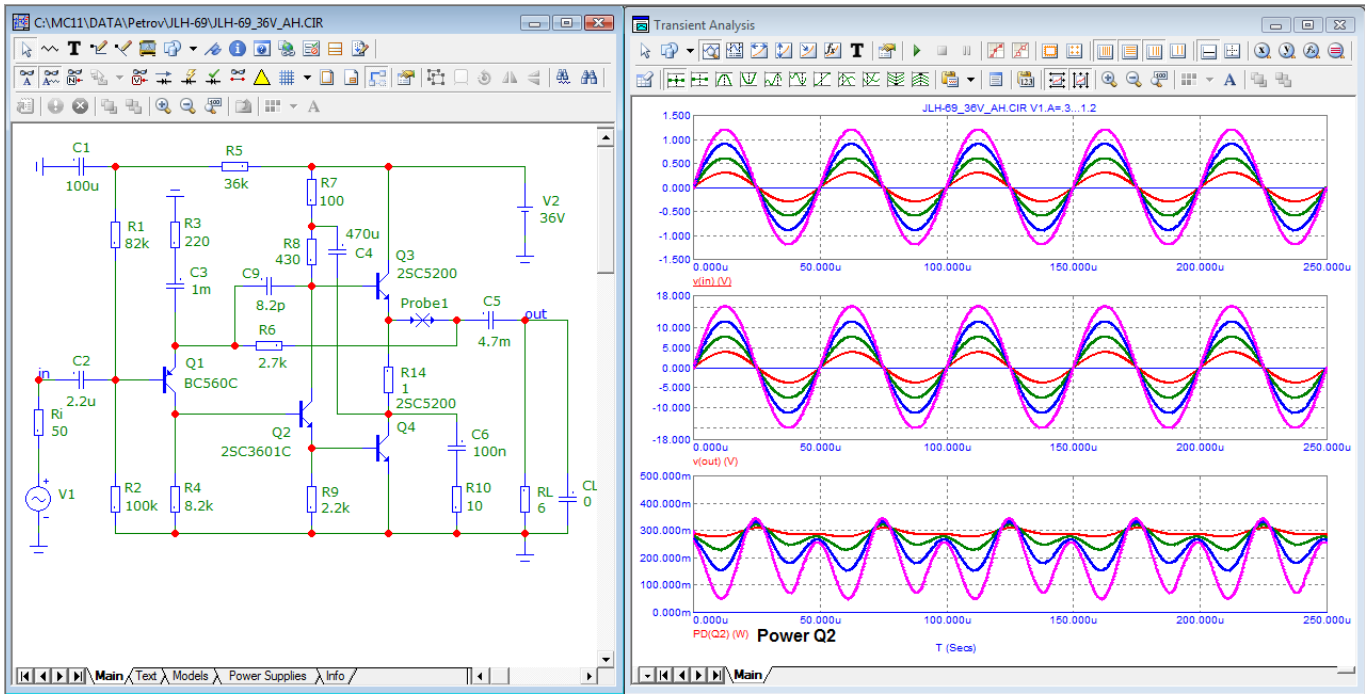

Fig. 6

The test shows that with signal amplification at a load of 6 ohms, there are no problems with clipping. The dissipated power on the transistor Q2 does not exceed 0.3 watts.

Considering that the upper arm begins to limit the signal earlier in case of overload, it makes sense to use the upper output transistor with the highest possible base current transfer coefficient.

Conclusions:

1. The JLH-69 amplifier has a high first pole frequency of 80 kHz.
2. Due to the high frequency of the first pole, the amplifier has a constant output impedance throughout the entire sound band. In this case, the impedance of the output resistance is active.
3. Thanks to the active output impedance, the amplifier does not need an output inductance to ensure stable operation on a reactive load.
4. The output signal spectrum is short, falling off, mainly 2nd and 3rd harmonics.
5. The amplifier completely lacks such types of distortion as switching and high-speed ones.
6. The full power bandwidth of at least 150 kHz is limited by the upper arm of the output stage.

Best regards

Alexander Petrov