PROBLEMS OF THE DEVELOPMENT OF HIGH FREQUENCY AMPLIFIERS AND ONE OF METHODS OF THEIR SOLUTION

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Problems of the development of high frequency amplifiers begin when we attempt to reach frequency 30MHz and above. They exist because of presence of input capacitance in the amplifying element. There is no element with the zero capacitance. When frequency is growing up, reactance is coming down. It decreases input and output signals respectively. Until now as an amplifying element we used a bipolar transistor. When we have started using FET transistor many problems have been solved. FET transistors have lower input capacitance and it makes possible to reach higher frequency. But it is difficult and expensive to make needed output power using one cascade. One of solutions is to use two or more cascades. First cascade is an input signal amplifier with correction of the peak-frequency characteristic on high frequency, second cascade is a buffer cascade with correction of the peak-frequency characteristic, third cascade is a power amplifier. In the first cascade we use FET transistor with as lower as possible input capacitance. One of possible circuit solutions is present on fig.1.
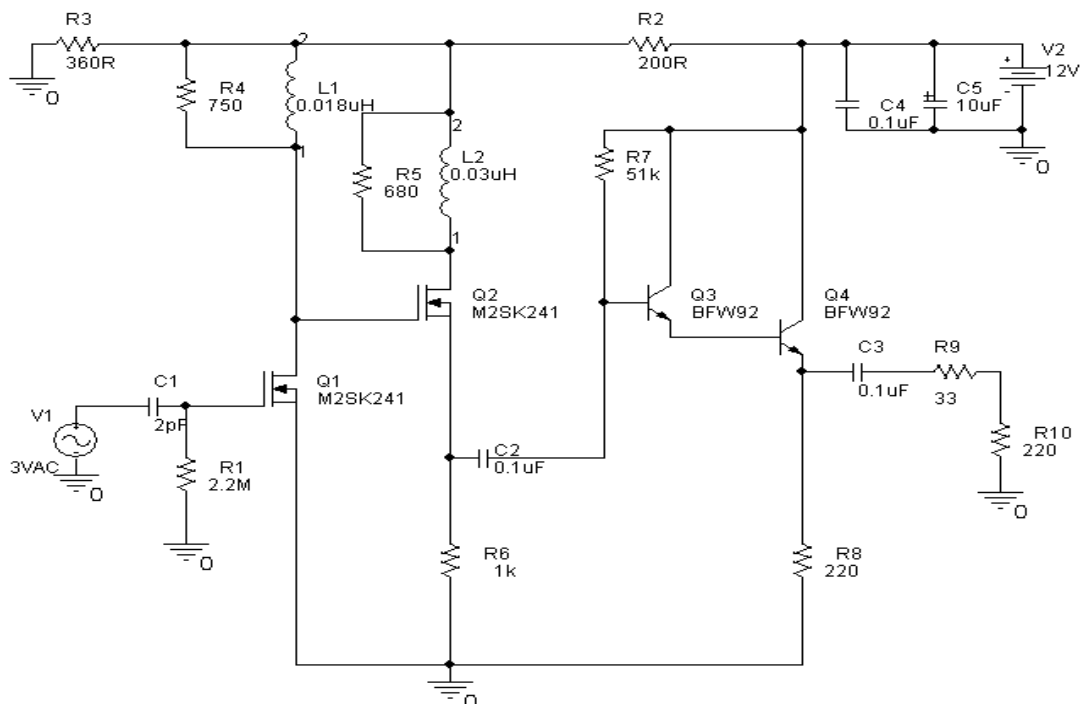

Fig.1. Amplifier's circuit

As a basis of the future amplifier, has been used amplifier, which can be found in [1]. But it needs to be an amplifier with n-p-n structure. Next condition is to extend a top boundary frequency of an amplifier. Bandwidth of an amplifier in [1] is up to 150MHz. It was also necessary to find out, on which frequency can transistors work, according to [2] and [3]. All of them are low-powered. One of solutions consists in adding automatic correction mechanism of the peak-frequency characteristic. Using inductance L1 and L2 with defined inductance can makes a correction of the peak-frequency characteristic. Correction effect consists in increasing reactance of inductance on top boundary frequency and leads the amplifying coefficient to grow up and allows making a correction on a high frequency. Using two cascades Q1 and Q2 with a little disbalance in inductance's values allows making a smooth correction of the peak-frequency characteristic. To prevent of the influence by an output cascade on correction of the peak-frequency characteristic of the second cascade and provides necessary power amplifying output cascade has been made according to Darlington's circuit. At the given values of the inductance the top boundary frequency is 1GHz. After 1GHz the peak-frequency characteristic is rapidly coming down. It happens because transistors Q1 and Q2 can not operate with frequency exceeding their own values. Resistances inserted in parallel with inductance allow changing a correction degree of the peak-frequency characteristic. The correction is not based on resonance effect. Output resistance of an amplifier is 220 Ohm. It's because of using low-powered transistor Q4. In case of using high-powered transistor, output resistance can be decreased up to 50 Ohm. Fig.2 shows the peak-frequency characteristic of an amplifier. According to this characteristic the bandwidth of an amplifier is from 35kHz up to 1GHz.
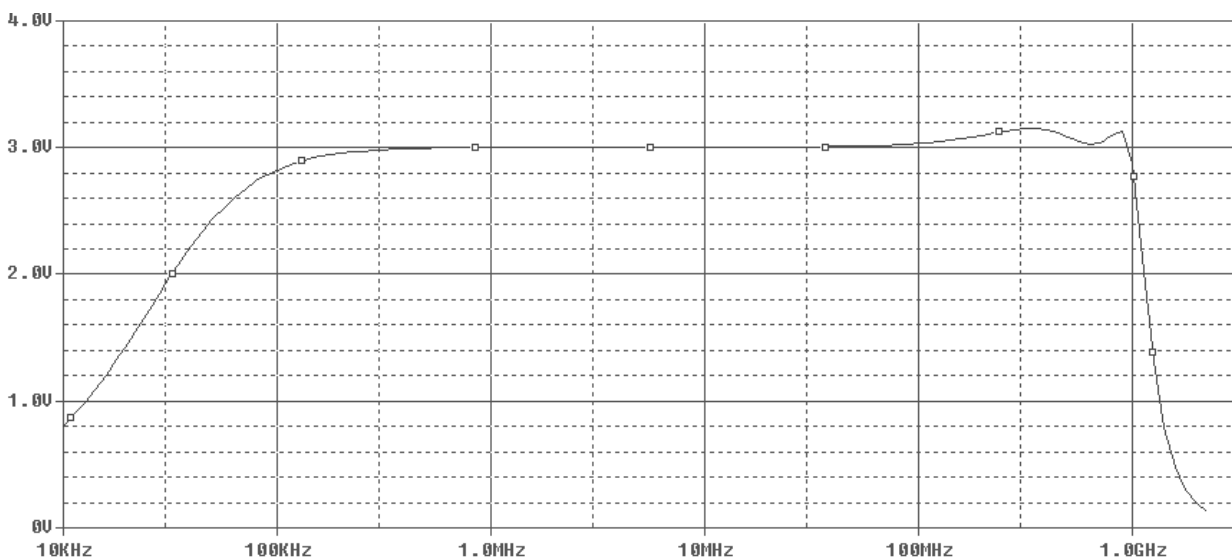

Fig2. The peak-frequency characteristic of an amplifier

Input capacitance of an amplifier is 2p. Researches show that changing input capacitance from 2p to 0.05p doesn't decrease the output amplitude of a signal. It only narrows a bandwidth in band from 3MHz up to 1GHz.

This amplifier can be used as a probe for oscilloscope, frequency meter, as an amplifier in receive-transmit systems of 10Base-2, 10Base-5, 100Base-TX, 100Base-FX category, as a compound part of the output cascade of the transmitter.

Bibliography

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