18-MHz amplifier

In this task you work with an **18-MHz amplifier** whose schematic is shown in Fig. 1.

1. Build this circuit. Use Virtual Bench to measure that biasing is ok (that the DC quantities are ok), see the instructions below.

   Check also the example circuit and how it is constructed, see Fig. 2. Recall also to leave space for the RF connector and to check the pinout of KSP10, Fig. 3.

2. Use the VirtualBench to test the circuit at MHz-range, use the signal generator and oscilloscope for inspection, see the instructions below.

3. Simulate the circuit with Multsim. If you are unable to find KSP10 transistor in Multisim, use MPSH10 instead (the two transistors should have very similar characteristics).

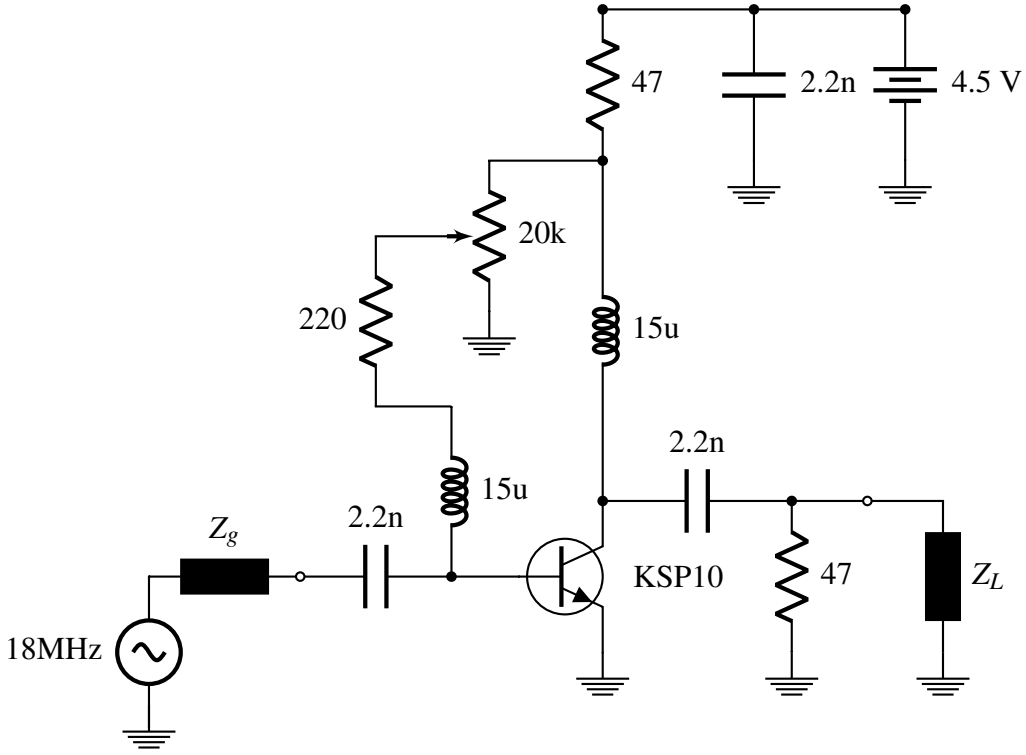

Figure 1: An 18-MHz amplifier, an external signal source (generator and Z_g) and load (Z_L) also shown.

Testing DC operation

- Connect 4.5 V from the Virtual Bench (VB) DC power power supply.
- Check with the VB multimeter that the transistor gets biased properly: measure the voltage across the upper 47-Ω resistor, and, using Ohm's law, determine the DC current consumption of the modulator. Alternatively you may just read the current from the DC power supply. If the DC operation is not satisfactory, see what happens if you turn the potentiometer knob. The current probably changes between zero and about 60 mA. (The transistor will not damage even if the knob is at either extreme, as long as the circuit is correctly constructed.)
- Measure the base-to-emitter voltage V_{be}. Notice how it changes when you adjust the potentiometer from one extreme to the other. The base to emitter voltage probably varies between zero and about 0.9 V.

Testing the voltage gain

- Feed an 18.4-MHz the signal from the Virtual Bench to the RF input.
- Monitor the RF signal both at the at the RF input (v_{in}) and at the RF output (v_{out}) with the Virtual Bench oscilloscope. Use a time scale on the horizontal axis such that you are able to see a sine wave with several periods. The period length is $\tau = 1/(18.4\text{MHz}) = 54$ ns. For the vertical scale, you might use something like 200 mV/div.
- Set the VB function generator amplitude to 50 mV_{pp}.
- Observe how the voltage gain $G_v = |v_{out}|/|v_{in}|$ changes as you adjust the potentiometer.
- Turn the knob to find how high the gain can go.

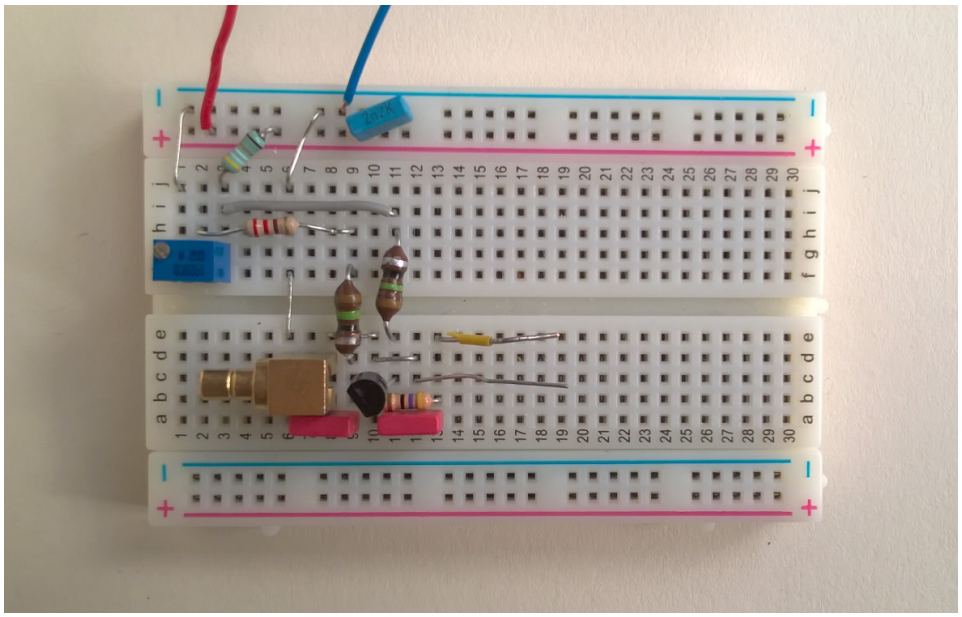

Figure 2: The SMB connector is the input, the yellow jumper wire is the output.

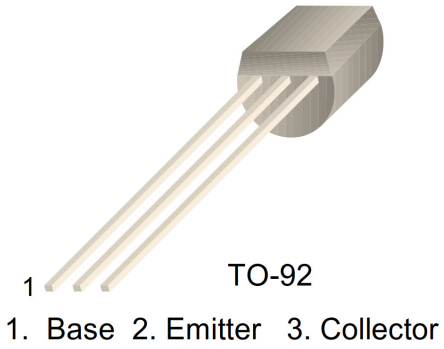

Figure 3: KSP10 pinout.