TRAINING PROJECT LABORATORY REPORT

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ABSTRACT

This is a report for training project laboratory in electrical engineering info-communication BSc course. This laboratory consist of two parts, both will be covered by this report. The first part is circuit realization and measurements around a radio direction finder receiver. The second part is measurements, calculation and software tools realization in Space technology laboratory.

1 PART1 – RADIO DIRECTION FINDER RECEIVER

From week 1 to 7 I was working on the radio direction finder receiver. Our task is to realize the circuit following the schematic. The printed circuit board(PCB) is prepared in advance.

1.1 Components

SURFACE MOUNTED COMPONENTS All resistors, capacitors, inductors and transistor are packaged using surface mount technology(SMT). Which makes them tricky to hand solder on the board. When to much soldering is applied a short circuit could happen between pads underness components. A multimeter is very useful for troubleshooting.

THROUGH HOLD COMPONENTS Audio jack, potentiometer and crystal oscillator are through hold components which provided a firm connection to the PCB.

1.2 Circuit design

The circuit is designed in KiCad

1. The radio receiver:
   The main blocks:
   - 9 turns from 210 cm CuZ copper wire as antenna,
   - radiofrequency (RF) amplifier,
   - RF band pass filter,
   - bipolar junction transistor (BJT) based mixer,
   - local oscillator,
   - audio frequency low pass filter,
   - audio amplifier.
2. The test transmitter:
   Collpitts type oscillator, where the quartz frequency is some 100 Hz different from the receiver local oscillator frequency, in order to make audio signal and it can be heard.

1.2.1 Schematic

The schematic diagram of the receiver is in Fig. 1.

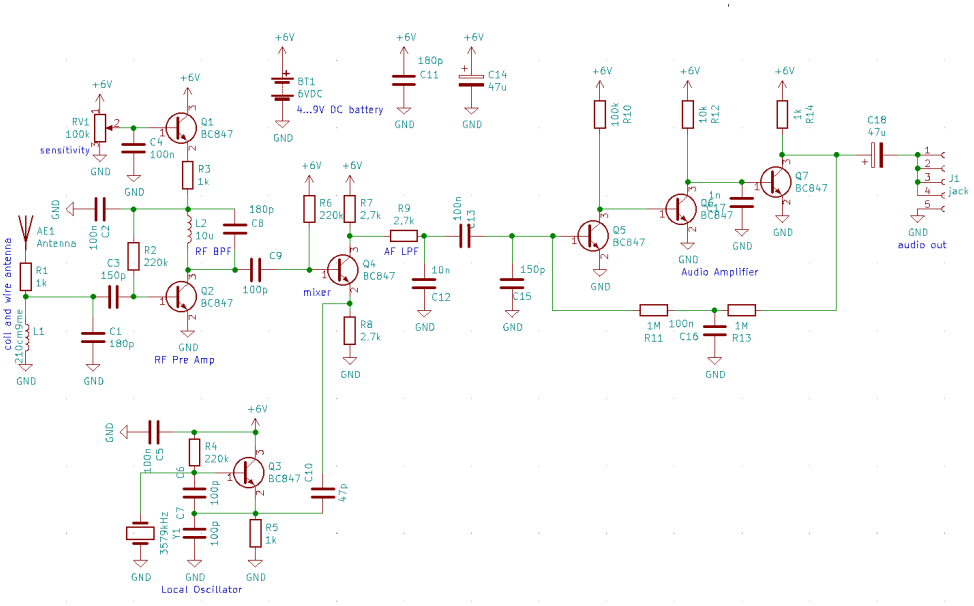


Figure 1: Schematic

1.2.2 Printed Circuit Board

The designed PCB can be seen in Fig. 2. There are THT and SMD type components.

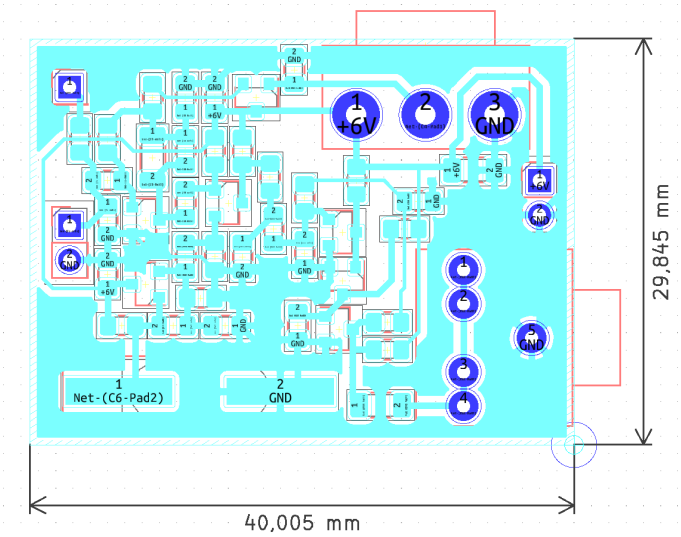


Figure 2: PCB

1.2.3 Component placement

The components with its reference is in Fig. 3.

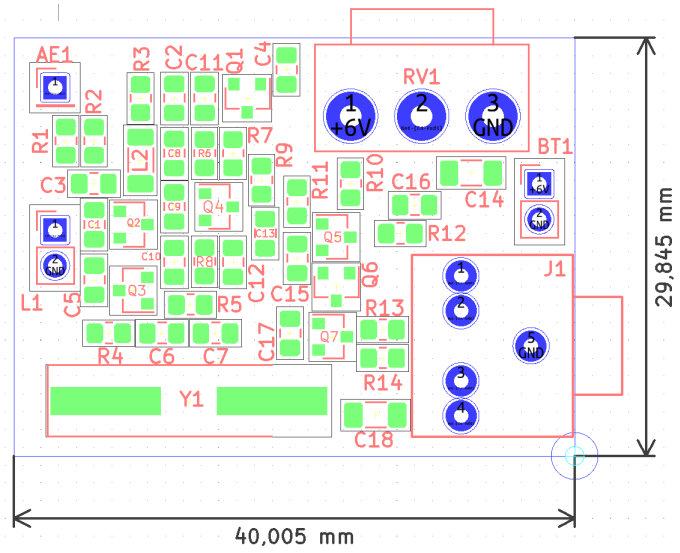


Figure 3: Components Placement

1.3 Measurements

The task is to measure the following parameters of the realized circuit and make test and measurement report based on the measurement results.

1. Bias DC voltages to the reference GND point on all pins of all semiconductors.
2. Voltage curve in time of the local oscillator output (emitter): peak-to-peak voltage and frequency.
3. Receiver audio (time domain) output signal on the AF output connector: variable resistor low, middle, high position: peak-to-peak voltage, frequency, curve. During this measurement, a single test transmitter will be run near to the receiver.

1.3.1 Bias DC voltage of transistors

DC voltage is measured reference to ground. And potentiometer is set to a low position during measurements.

Transistor	Voltage
Q1	807mV
Q2	72.4mV
Q3	2.79V
Q4	1.94V
Q5	96.5mV
Q6	97.2mV
Q7	96.9mV

Table 1: Transistor voltage measurement

1.3.2 *Voltage curve in time domain of the local oscillator output*

In this measurement 10x probe gain is used. I used the quick measure function on the oscilloscope.

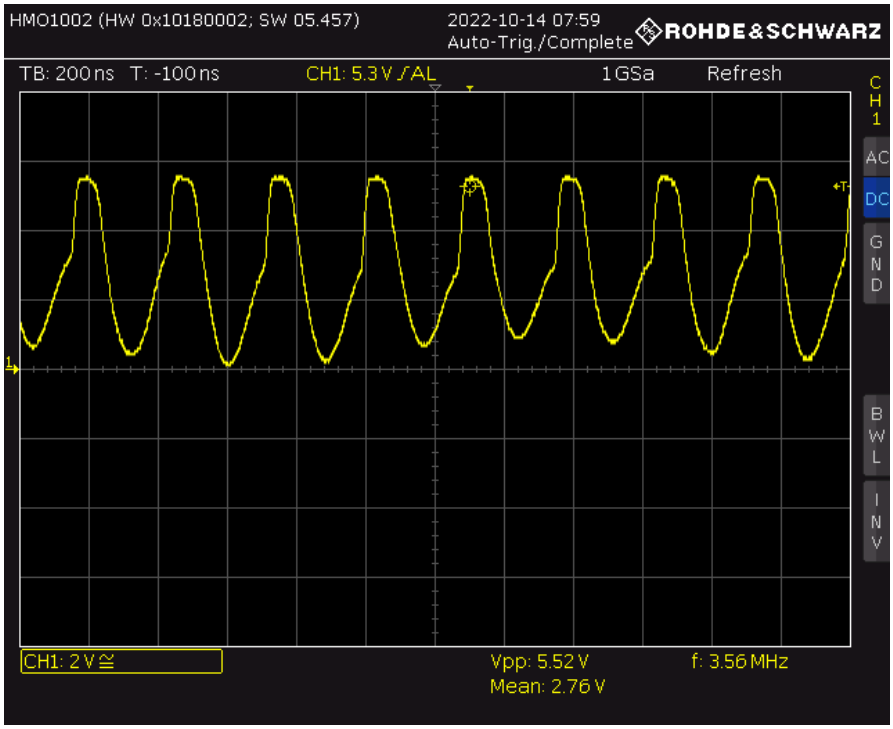
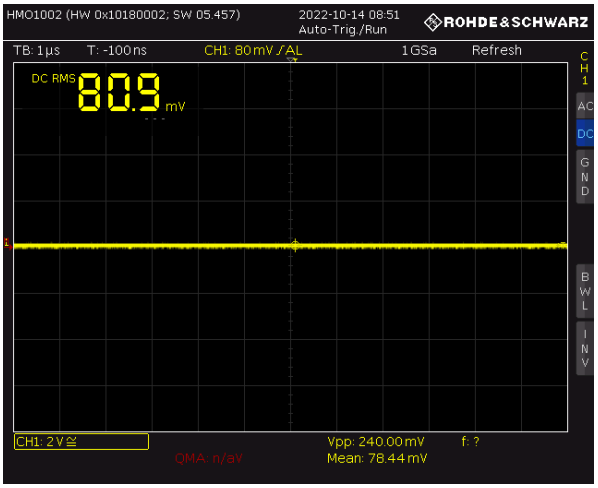


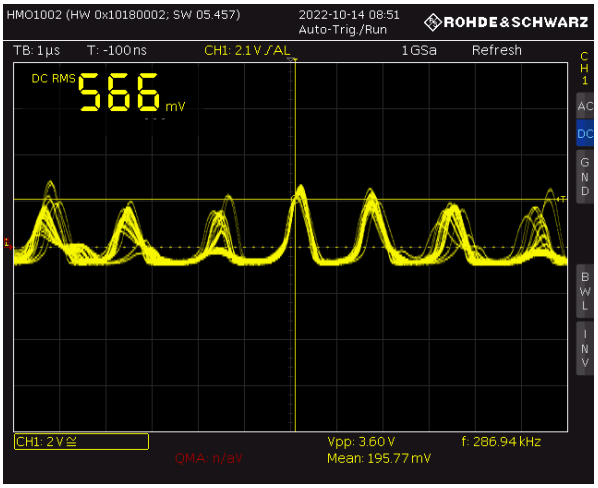
Figure 4: local oscillator output

From the schematic 1 we can see that a crystal oscillator with 3.579MHz frequency is used. Our measurement result matches this value within 0.5% of error.

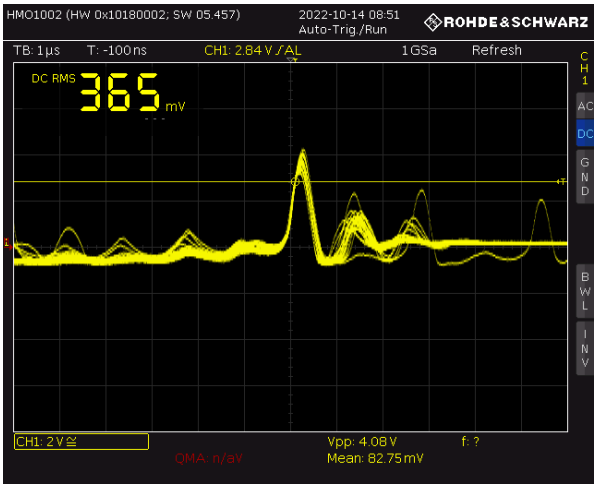
1.3.3 Receiver audio (time domain) output signal



(a) Low



(b) Mid



(c) High

Figure 5: Receiver audio output signal in time domain

REFERENCES