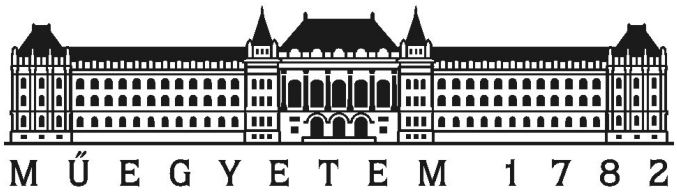

Budapest University of Technology and Economics
Faculty of Electrical Engineering and Informatics
Department of Broadband Infocommunications and Electromagnetic Theory

ARDF Receiver 80 m

Project Laboratory

Levente Dudas PhD

2022

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Abstract

This document is a LaTeX-based template for the BSc/MSc thesis of students at the Electrical Engineering and Informatics Faculty of Budapest University of Technology and Economics. The usage of this template is optional. It has been tested with the TeXLive TEX implementation, and it requires the PDF-LaTeX compiler.

Chapter 1

The 2 halves of the Project Laboratory semester

The semester is divided into two parts.

1.1 The first half

From the first to the 7 th. week: common circuit realization, measurement and documentation in V1 502.

We will use: soldering stations, soldering irons, tin, cutter, tweezer, electrical components of the circuit, PCB, oscilloscope, probes, digital multimeters.

During the first 7 weeks, there will be at least 6 laboratory presentations / introductions.

1.2 The second half

8-14 week: there are differential tasks under laboratory supervision in different laboratories (as you selected in the 7 th. week): Tab. 1.1.

Table 1.1: Laboratories and Lab. Leaders

Name of Lab.	Lab. Leader
Antennas and EMC	Lajos Nagy PhD
DOCS	János Bitó PhD
EMF	József Pavo PhD
Microwave Remote Sensing Lab.	Rudolf Seller PhD
NES	András Reichardt
Space Technology	László Csurgai-Horváth PhD

1.3 15th week

After the semester, before the exam period, oral session will be held in the same time as ProjLab (friday, 8-12h).

These oral presentations have to be presented by every students based on the second half of the semester (what happened in the Labs, only the work): 5 min presentation, 2 min questions. Only LaTeXpdf (beamer) allowed with static contents.

1.4 Result

3 LaTeXcompiled pdfs are necessary for the final mark calculation:

1. Measurement report of the realized circuit (first half, common work, 5-10 effective pages) - 33 %.
2. Report of the second half of the semester, containing the work you had been done (5-10 eff. pages) - 33 %.
3. Oral presentaton of the second half of the semester (5 min = 5 effective slides) - 34 %.

The effective slides of the oral presentation can be counted without the title slide, the outline, the content, and the acknowledgement.

Do NOT use the string of "Thank you for your kind attention!" as last slide, instead of it, you can show pictures on the last slide, what you have done in the semester. The usage of the mentioned string means minus 1 mark.

The comparision levels of the overall mark are: 40, 55, 70, 85 %.

For instance:

1. Measurement report: 67 %,
2. 2 nd. half report: 89 %,
3. Oral presentation: 98 %.

The averaged percent is: $round(\frac{67+89+98}{3}) = 85\%$, $70 < 85 \leq 85$ means 5 (excellent).

1.5 Deadlines

1. last day of the semester (14th week friday), 23:59:59 in e-mail,
2. wednesday of 15th week (two days before the oral session), 12:00:00 in e-mail,
3. thursday of 15th week (one day before the oral session), 12:00:00 in e-mail,

all LaTeXpdf as attachment to `dudas.levente@vik.bme.hu`.

1.6 Equations

If you want to use mathematical formulas, you can use this structure: *equation*.

$$F(\vartheta) = \sum_{k=0}^{N-1} I_k \cdot e^{-jk\beta dcos\vartheta} \tag{1.1}$$

and after the formula [3], all variables must be defined as:

- where $F(\vartheta)$ is the radiation pattern of the antenna system,
- N is the number of the antenna elements,
- I_k is the relative feeding current or voltages of the k th. of the antenna element,
- k is the index of the antenna element,

- $\beta = \frac{2\pi}{\lambda}$ is the wave-number,
- d is the equi-distance of the antenna elements in wavelength,
- ϑ is the direction of the incoming RF signal.

and of course, you can refenced this equation as: the radiation pattern of the antenna row can be calculated as Eq. 1.1.

Chapter 2

Amateur Radio Direction Finder Receiver

The circuit is designed in KiCad - [4]

1. The radio receiver:
   The main blocks:
   - 9 turns from 210 cm CuZ copper wire as antenna,
   - RF (radiofrequency) amplifier,
   - RF band pass filter,
   - BJT (bipolar junction transistor) 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.

2.1 Schematic

The schematic diagram of the receiver is in Fig. 2.1.

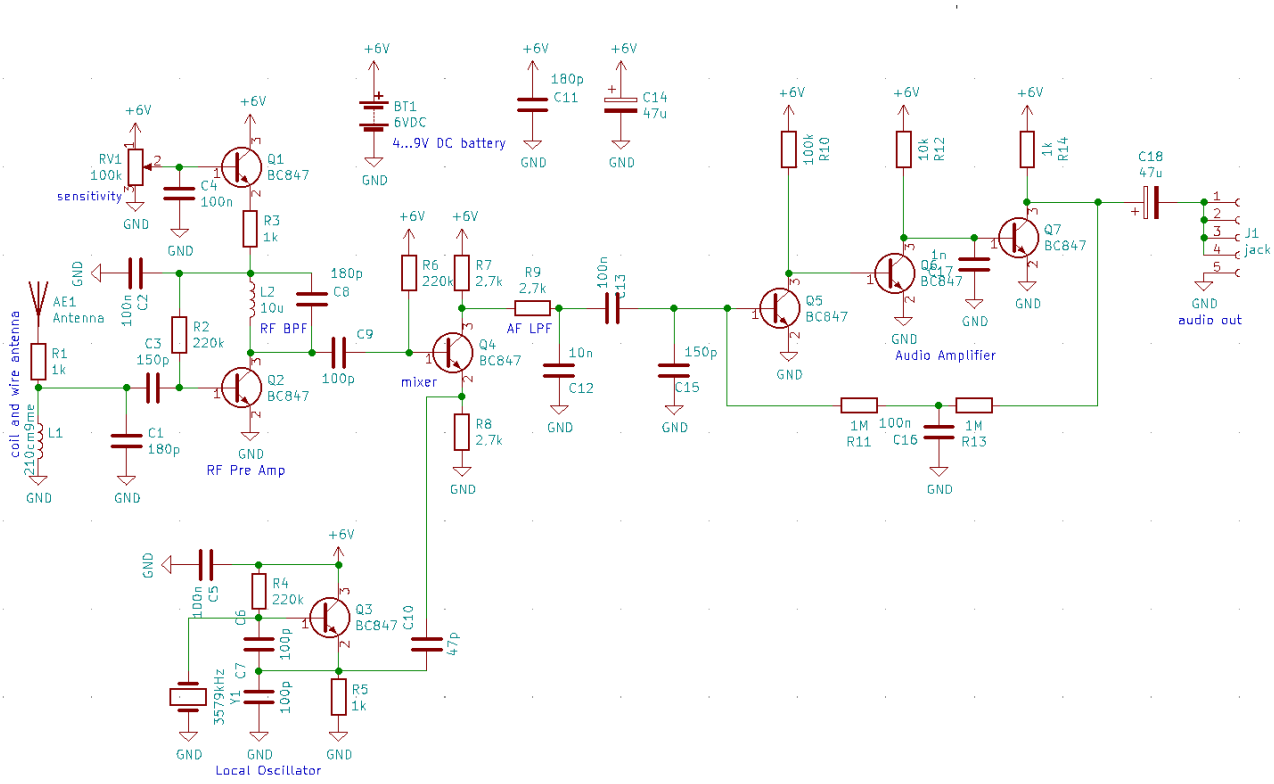

Figure 2.1: Schematic

2.2 Printed Circuit Board

The designed PCB can be seen in Fig. 2.2. There are THT and SMD type components.

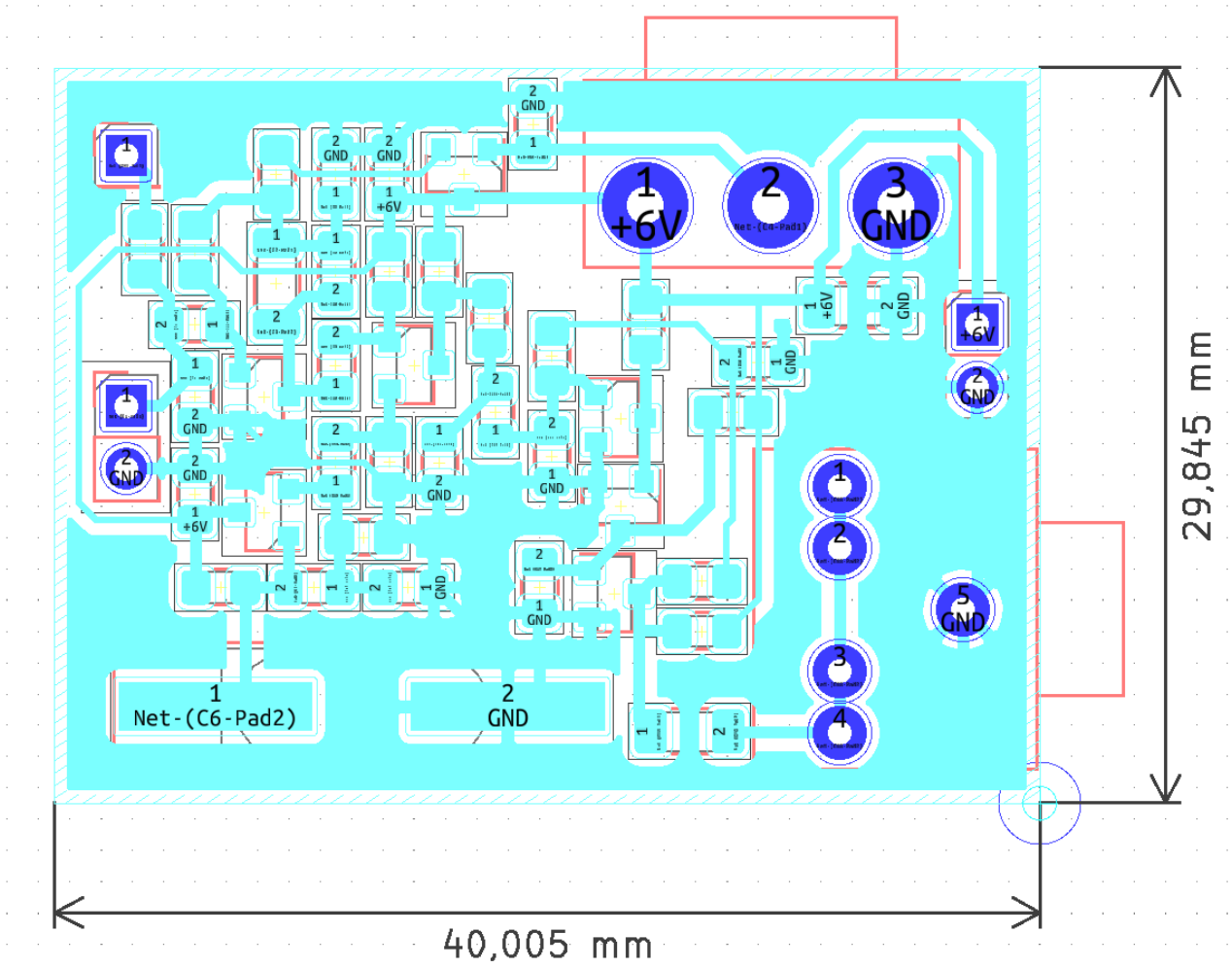

Figure 2.2: PCB

2.3 Component placement

The components with its reference is in Fig. 2.3.

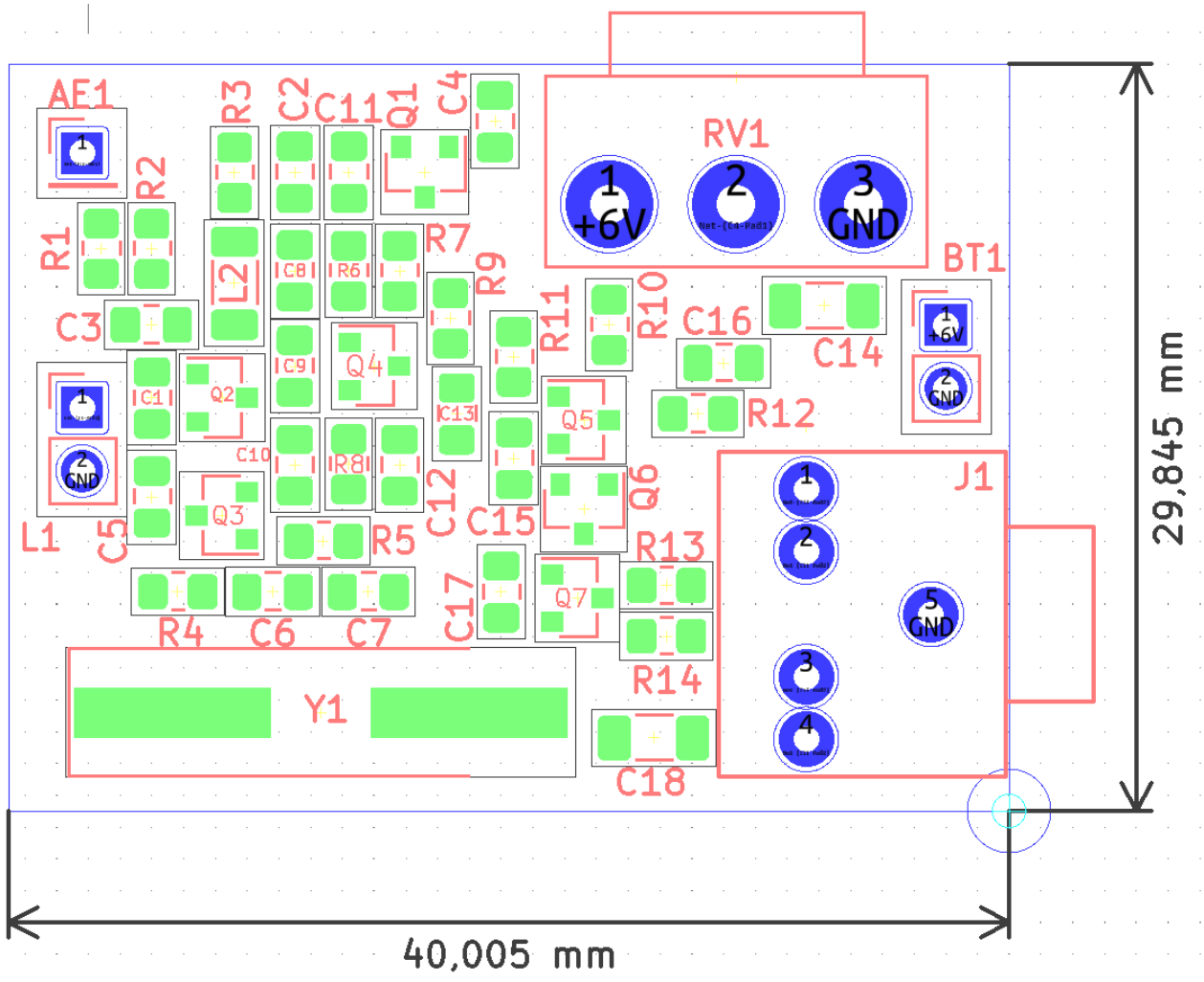

Figure 2.3: Components Placement

Placement order:

1. resistors,
2. capacitors,
3. inductors,
4. transistors,
5. connectors,
6. antenna.

2.4 Measurement of the realized circuit

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, frequency, png from the scope.
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.

Bibliography

[1] `http://hvt.bme.hu`

[2] Rádiótechnika évkönyve 2007, 172. oldaltól

[3] Dudás Levente, *Digitális nyalábformálású antenna (DBF)* diplomaterv, BME SzHVT, 2007

[4] `http://kicad-pcb.org/`

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Appendix

The chapter of appendix can contain: source codes, print-screens, figures, etc.

2.5 while1 C source code

The "while1" source code is here: 2.5.

```
1000 #include <stdio.h>
     int main(int argc, char **argv)
1002 {
       while(1){
1004     break;
       }
1006   return 0;
     }
```

while1.c