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 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.

1.2.1 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

1.2.2 *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.

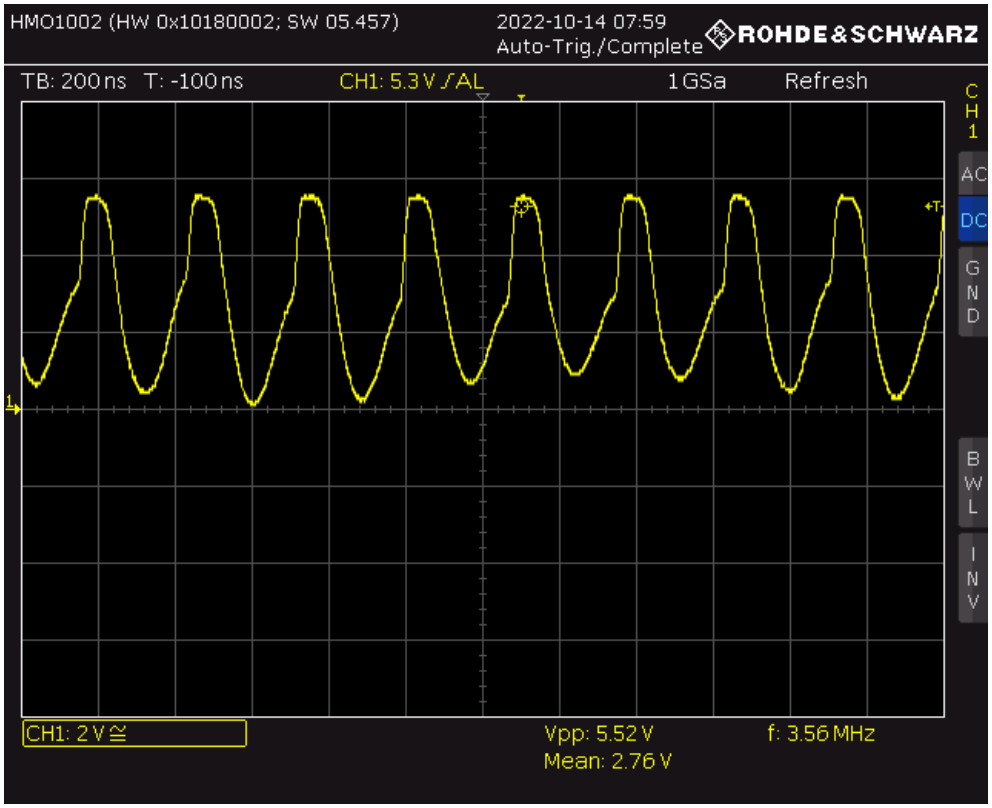
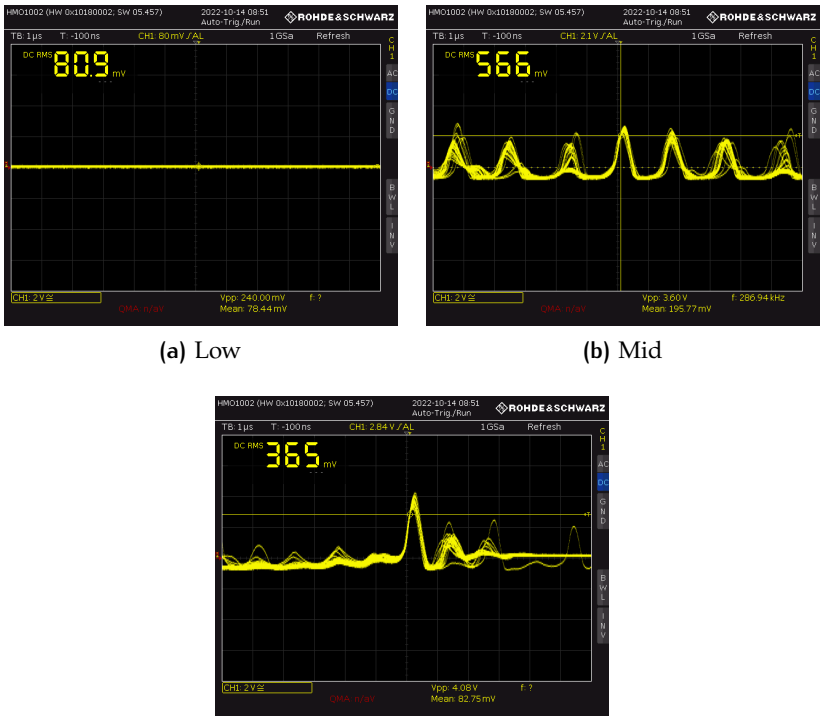


Figure 1: local oscillator output

1.2.3 Receiver audio (time domain) output signal



(a) Low

(b) Mid

(c) High

Figure 2: Receiver audio output signal in time domain

2 PART2 – 58GHZ ATTENUATION

From 8 to 14 week I worked for Space technology laboratory supervised by Dr. László Csurgai-Horváth. Our topic is to research about oxygen and rain attenuation on 58GHz radio signal.

2.1 Introduction on 58GHz band

Signal around 60Ghz band has a unique advantage. Around this frequency signal propagation is effected by oxygen molecule in the air. This phenomenon is called oxygen attenuation. Because such phenomenon, signal can not propagate for long distance. In urban area where high bandwidth communication is required this property can increse frequency reuse rate. Which will conserve frequency band resource.

2.2 Calculations

Free space loss is the loss when signal travels through open space with no other attenuation. This can be calculated using following equation [1]

$$a_{sz}^{[dB]} = 32.44 + 20\log f^{[MHz]} + 20\log d^{[km]} - G_{TX}^{[dB]} - G_{RX}^{[dB]} \tag{1}$$

Oxygen attenuation or Atmospheric attenuation is the effect of signal propagation due to gas in the atmosphere. A figure is given by

REFERENCES

[1] International Telecommunication Union. Itu-r p.525-4. calculation of free-space attenuation. [Online].Available:https://www.itu.int/dms_pubrec/itu-r/rec/p/R-REC-P.525-4-201908-I!!PDF-E.pdf, 08 2019.