Protocol Laboratory: Electrical Engineering #2

Hochschule Rhein-Waal

Rhine-Waal University of Applied Sciences

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	Edwin, Changiyoga / 22439
Course name:	Laboratory: Electrical Engineering
Group:	C
Faculty:	Communication and Environment
Deadline:	18.07.2019
Semester:	SS 2018/19
Supervisor:	Prof. Dr.-Ing. Christian Ressel
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Table of Contents

Study questions

Question #1 – What is the difference between analog and digital oscilloscopes?

In an analog oscilloscope, the waveform is shown in the original form.

A digital oscilloscope converts the original analog waveform by sampling it and converts them into digital numbers and then stores them in digital format.

Question #2 – What has to be kept in mind concerning the sampling rate of digital oscilloscopes?

The bigger the sampling rate, the more accurate the waveform that we can capture.

Question #3 – What is the difference of x1 and x10 probes?

X1: 1MΩ Impedance.

X10: 10MΩ Impedance, signal divided by 10.

Question #4 – What can happen if you connect the oscilloscope grounding to your circuit?

We can short the circuit if the oscilloscope grounding is connected to the positive rail of the circuit.

This can only happen if the oscilloscope and the circuit share a common ground.

Question #5 – What is triggering used for?

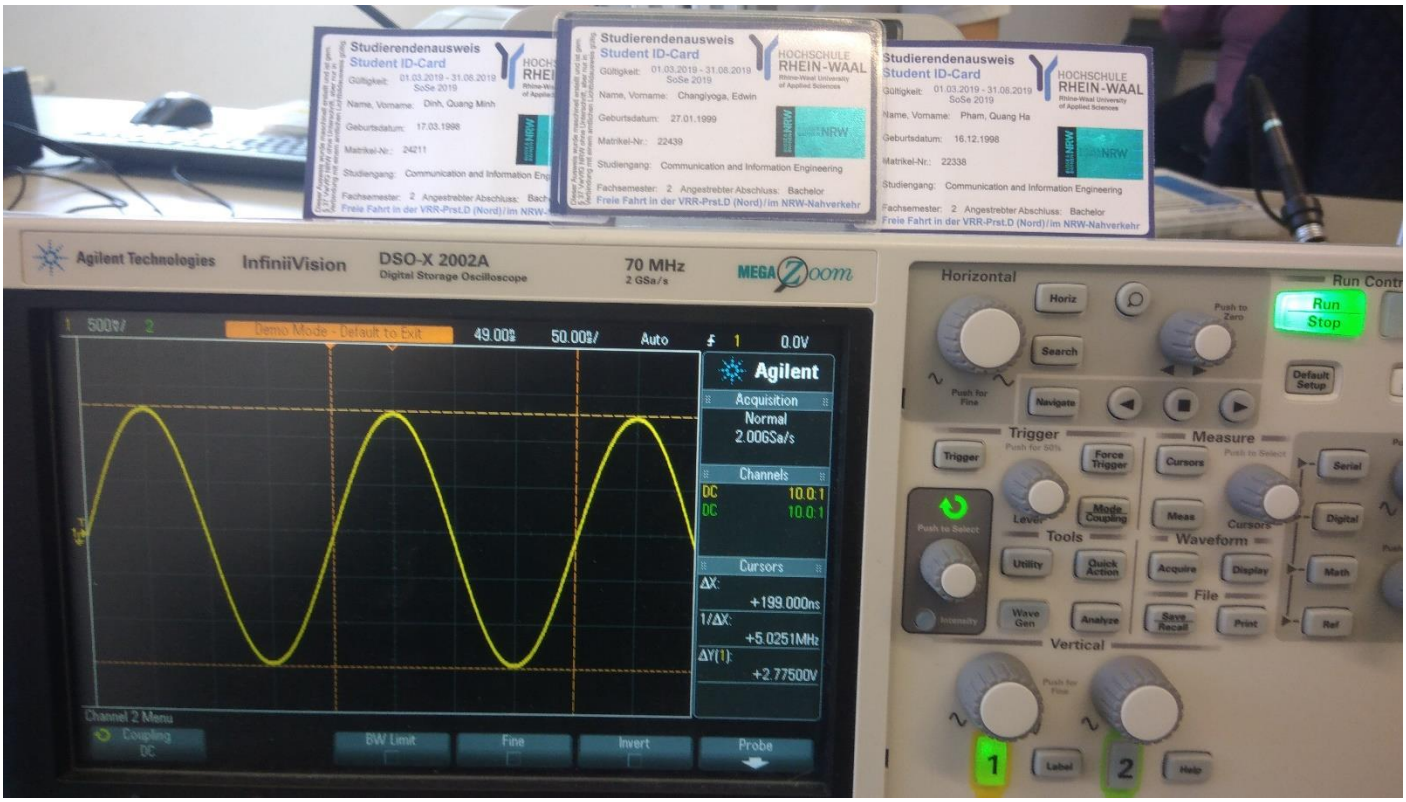
Triggering is used to stabilize repetitive waveforms and display a stable image or capture the waveform for single shot events under some specific conditions.

Challenge #1

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet and the Oscilloscope training kit.

Pictures:



Results:

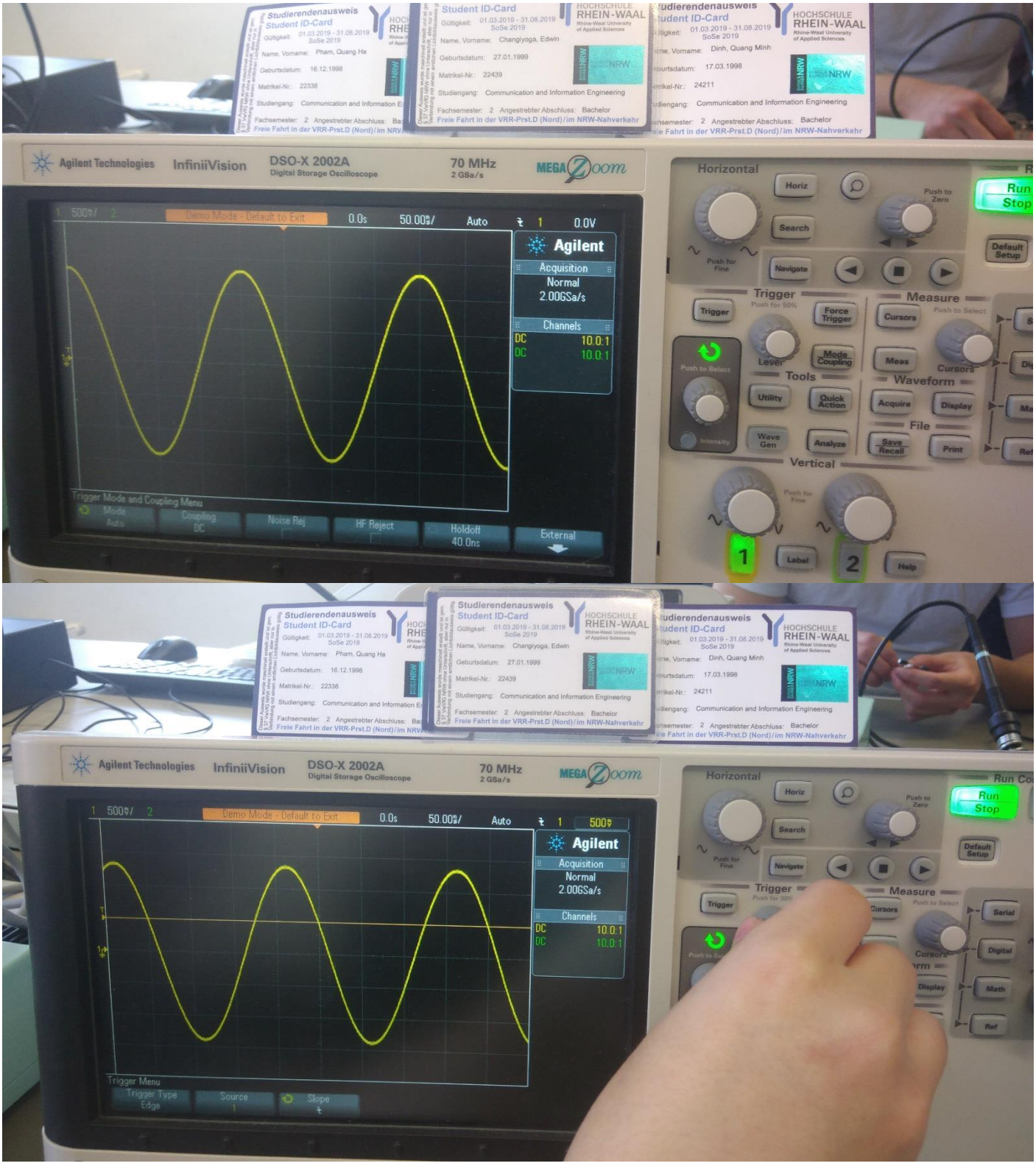
Step	Description	Result
13	T	200 ns/div
14	F	5.000 MHz
17	Vp-p	2.8 V/div
26	ΔX	199.000 ns
26	1/ΔX	5.0251 MHz
26	ΔY(1)	2.77500 V

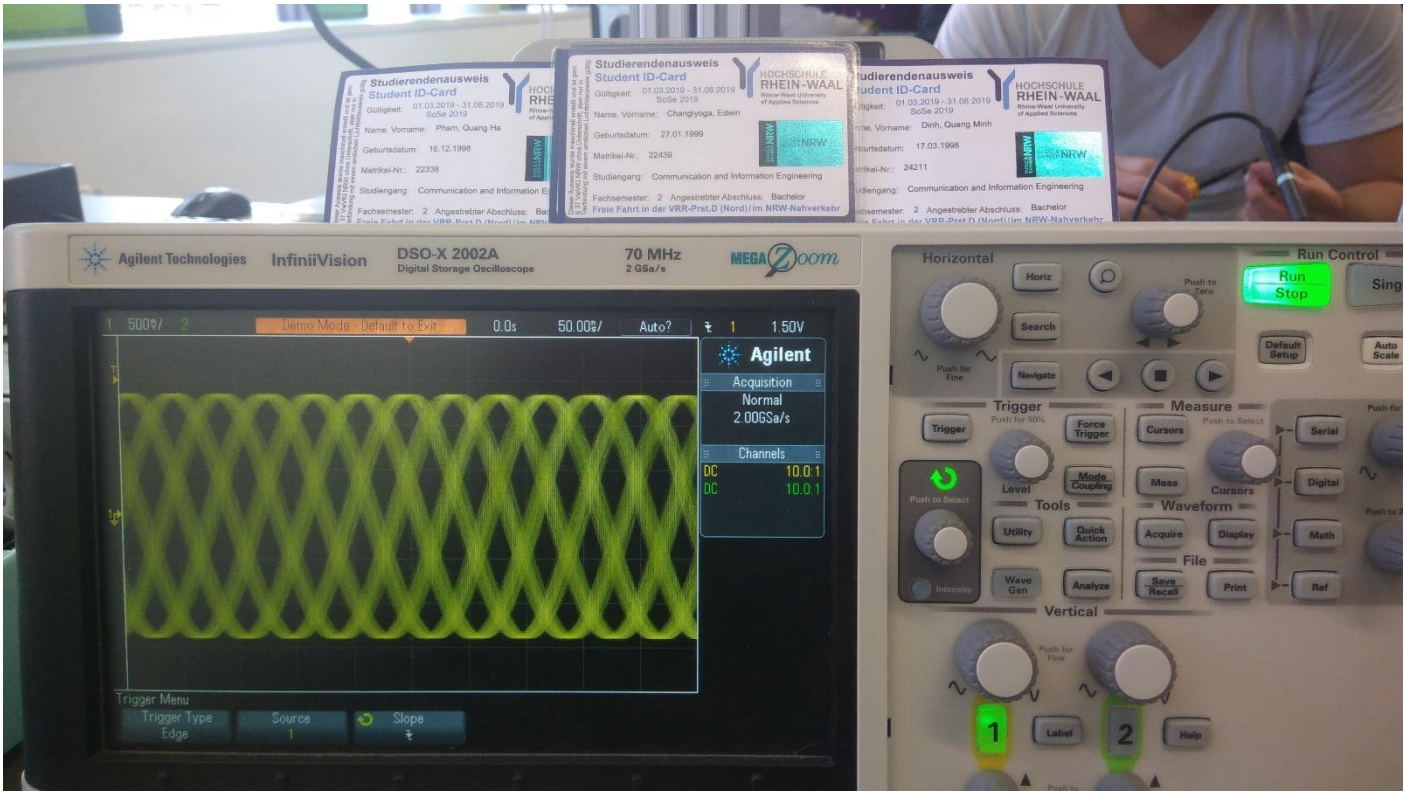
Challenge #2

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet and the Oscilloscope training kit.

Pictures:

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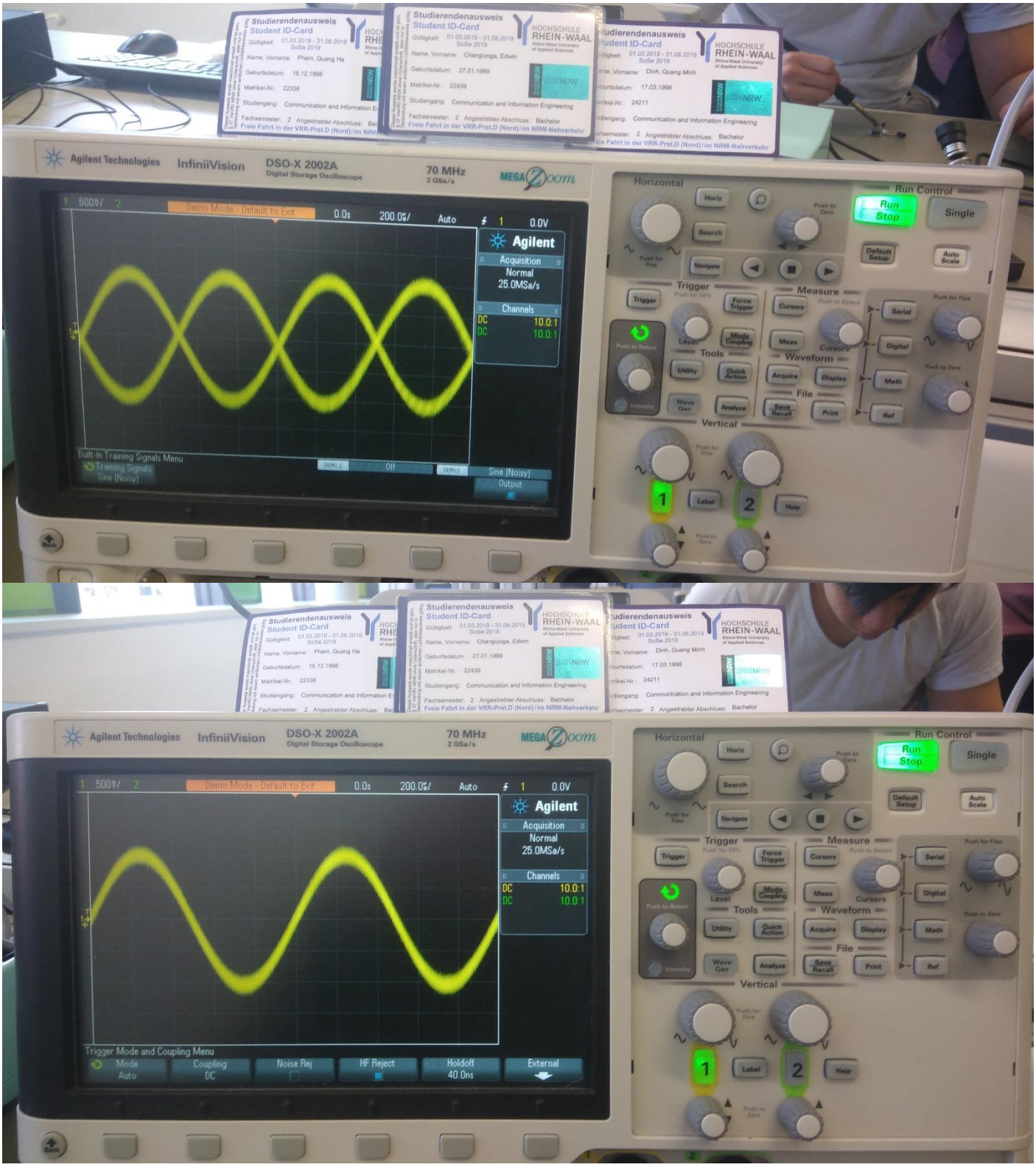
70 MHz
2 GSa/s
MEGA Zoom
Demo Mode - Default to Exit
Agilent
Acquisition
Normal
2.00GSa/s
Channels
Trigger Menu
Trigger Type
Edge
Source
Slope
Horizontal
Run Control
Run
Stop
Trigger
Measure
Tools
Waveform
File
Vertical
Label
Help

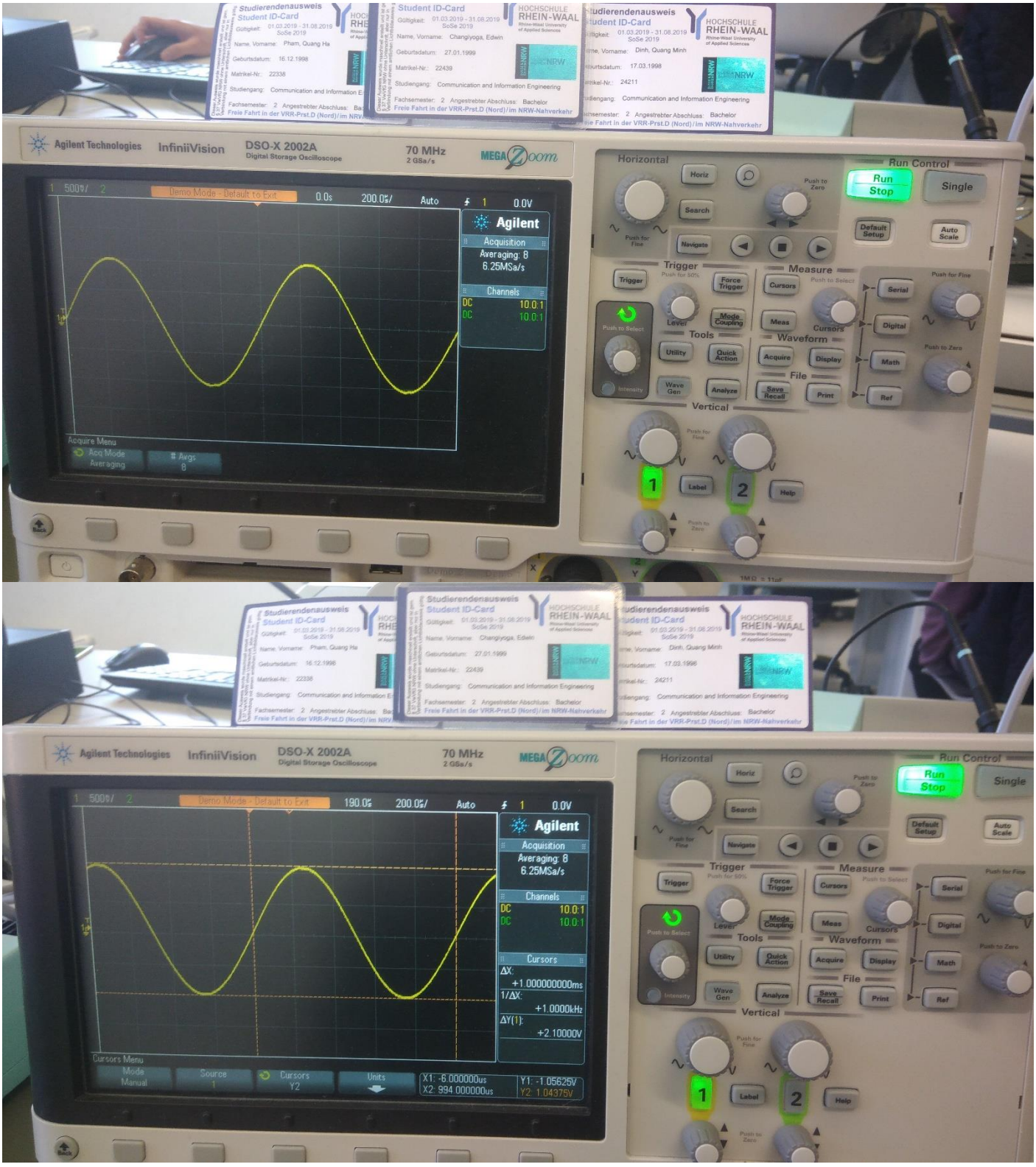
Challenge #3

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet and the Oscilloscope training kit.

Pictures:




Agilent Technologies
InfiniiVision
DSO-X 2002A
Digital Storage Oscilloscope
70 MHz
2 GSa/s
MEGAZoom
Agilent
Acquisition
Averaging: 8
6.25MSa/s
Channels
Horizontal
Run Control
Run
Stop
Single
Trigger
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70 MHz
2 GSa/s
MEGAZoom
Agilent
Acquisition
Averaging: 8
6.25MSa/s
Channels
Cursors
ΔX:
+1.000000000ms
1/ΔX:
+1.0000kHz
ΔY(1):
+2.10000V
Cursors Menu
X1: -6.000000us
X2: 994.000000us
Y1: -1.05625V
Y2: 1.04375V

Results:

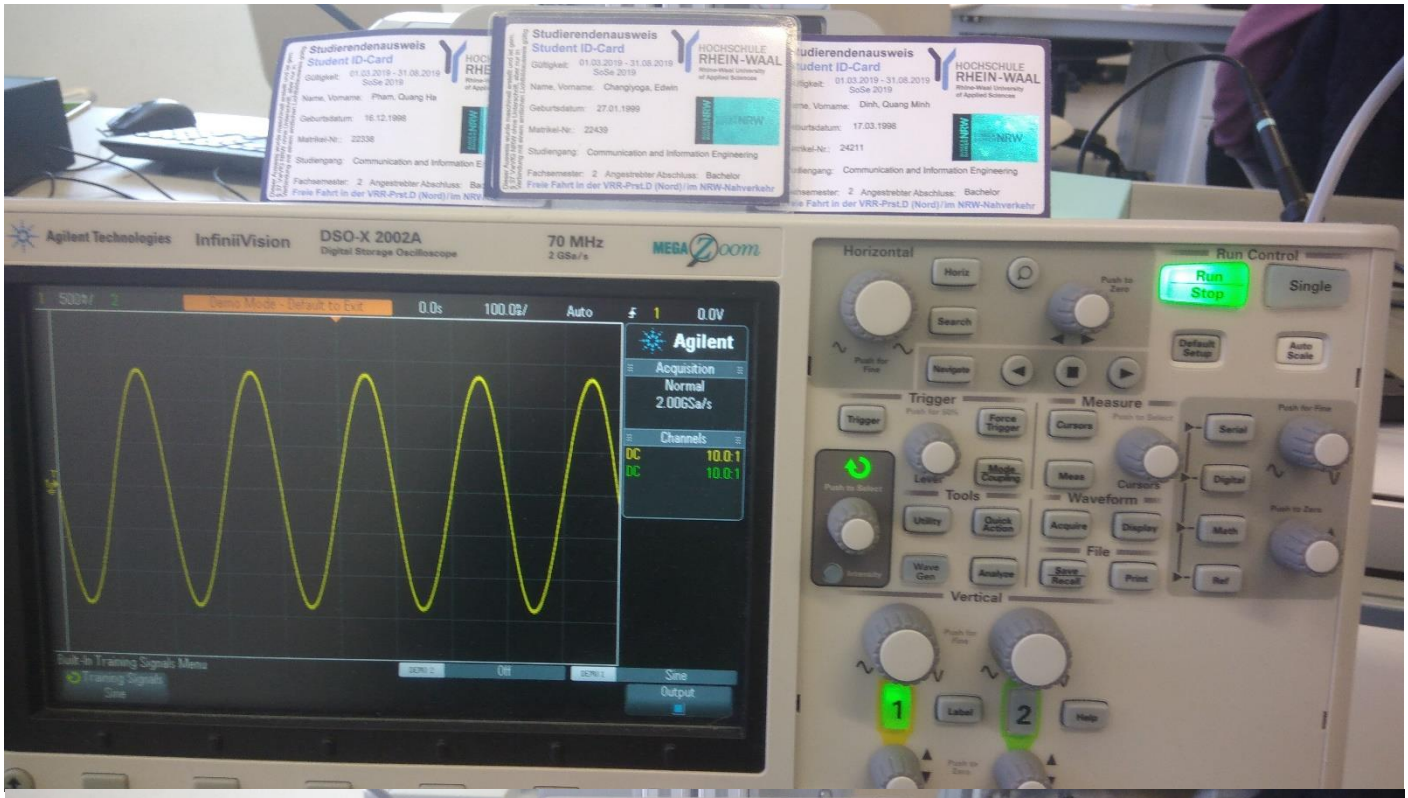
Step	Description	Result
16	Period	1.000 ms
16	Freq	1 kHz
16	Vp-p	2.100 V

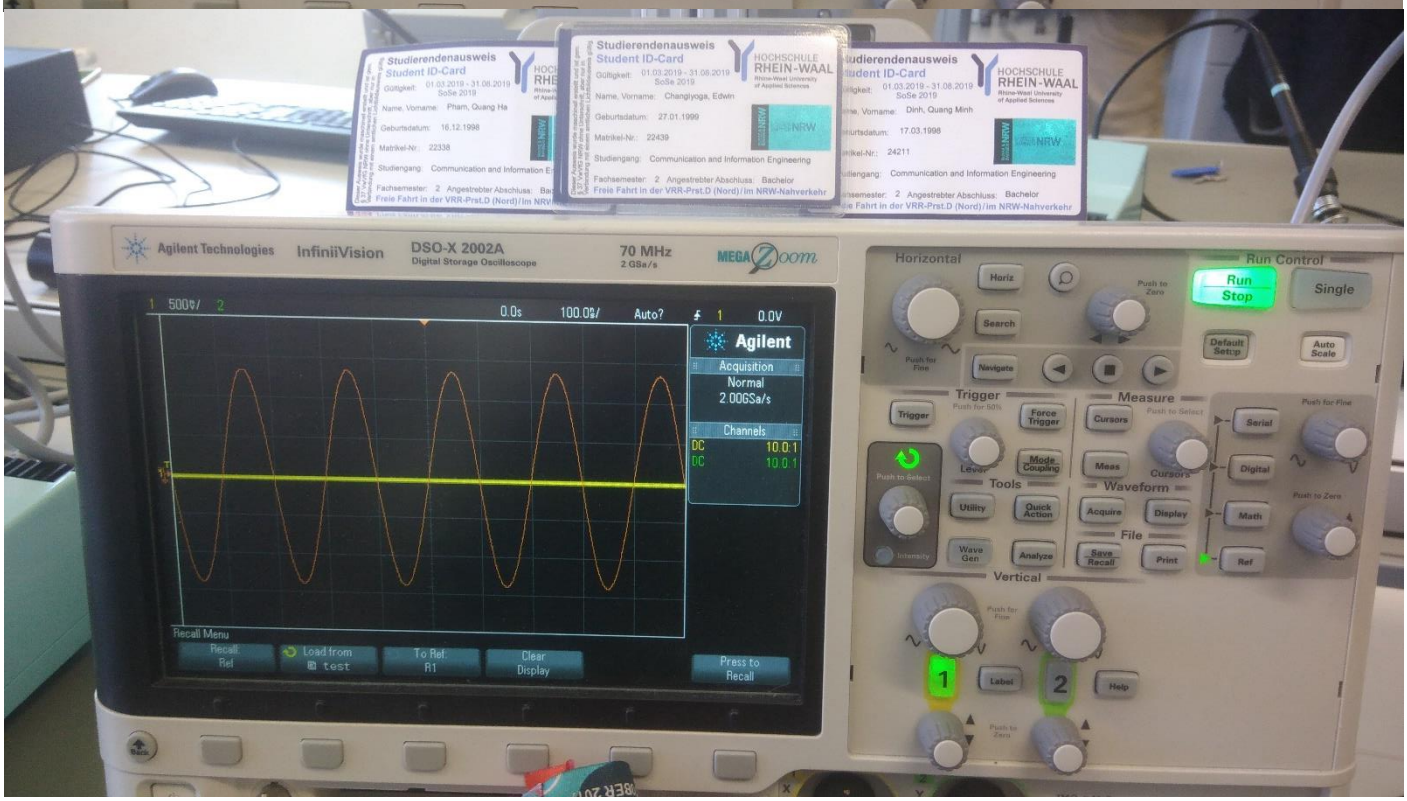
Challenge #4

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet and the Oscilloscope training kit.

Pictures:





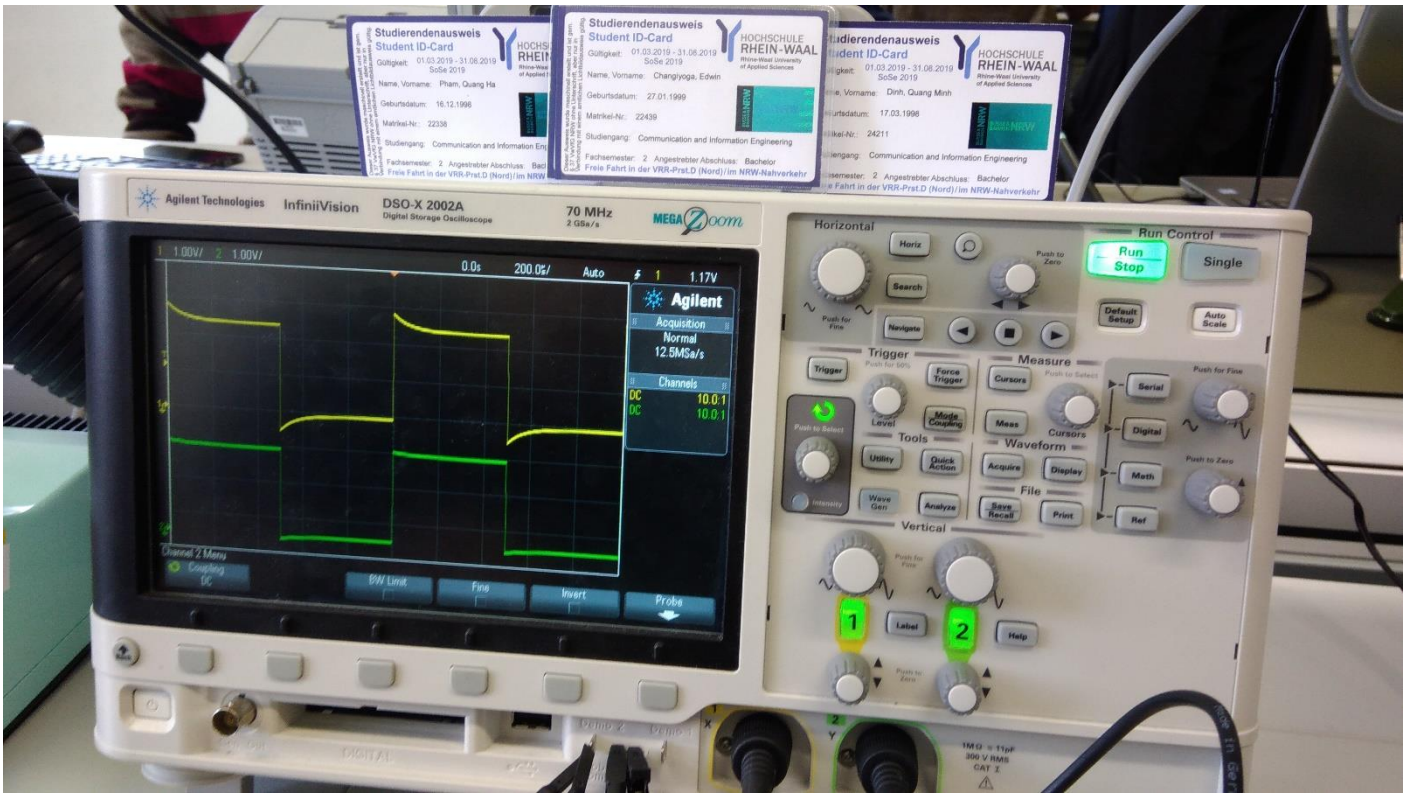
Challenge #5

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet and the Oscilloscope training kit. But there are some problems.

No matter how hard we tried to adjust the variable capacitor on the probe, we cannot get the yellow signal to become flat. In the picture below is the flattest we can get our yellow signal to become before it curves up again, same thing happens to our green signal but to a lesser degree.

Pictures:



Results:

Our group was able to calculate the Ccomp by using the given parameters and formula in the Oscilloscope training kit.

$$R_{tip} = 9\ M\Omega$$

$$R_{scope} = 1\ M\Omega$$

$$C_{scope} = 15\ pF$$

$$C_{cable} = 100\ pF$$

$$C_{tip} = 15\ pF$$

$$C_{parallel} = C_{scope} + C_{cable} + C_{comp}$$

$$C_{comp} = ?$$

$$\frac{1}{R_{tip} \times C_{tip}} = \frac{1}{R_{scope} \times C_{parallel}}$$

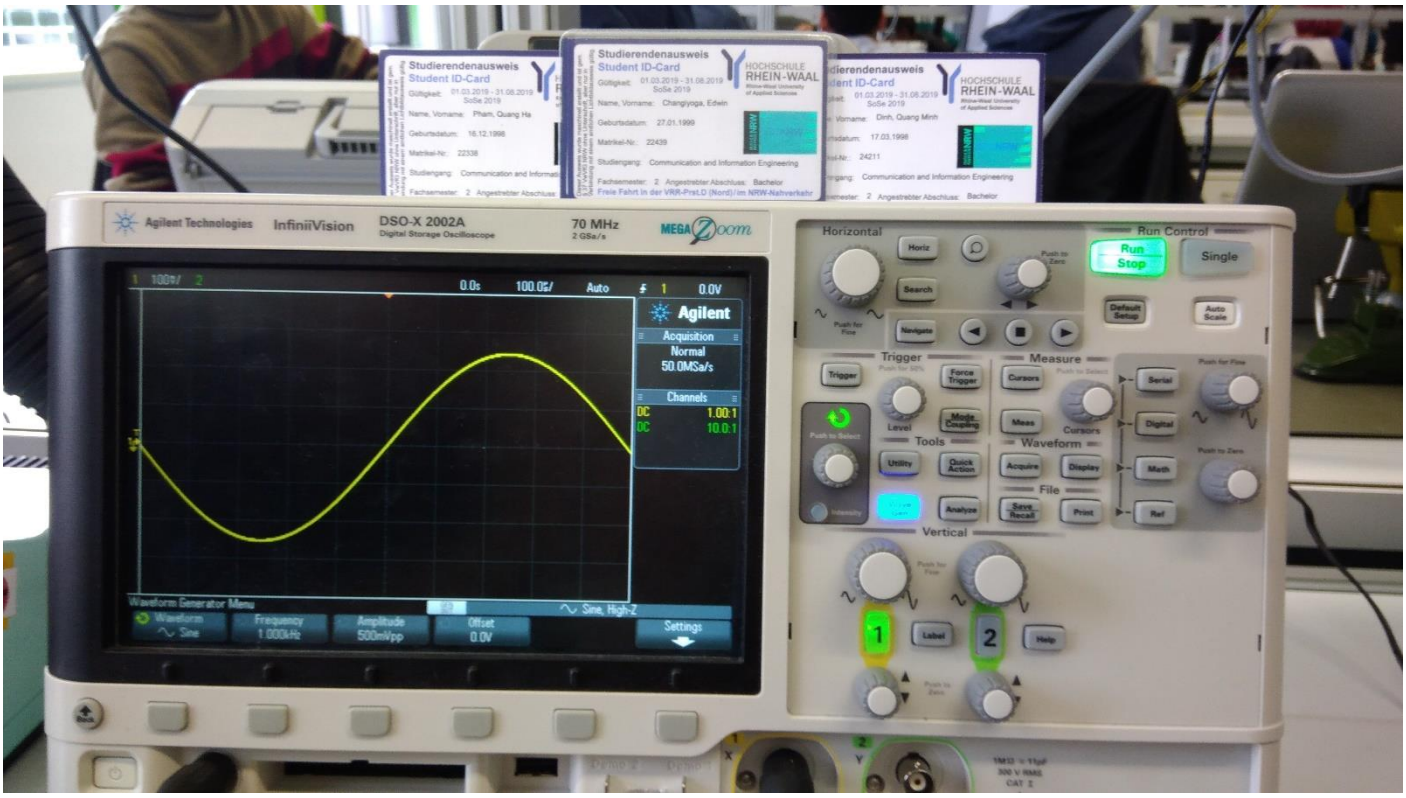
Step	Description	Result
10	Ccomp	20 pF

Challenge #6

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet and the Oscilloscope training kit.

Pictures:

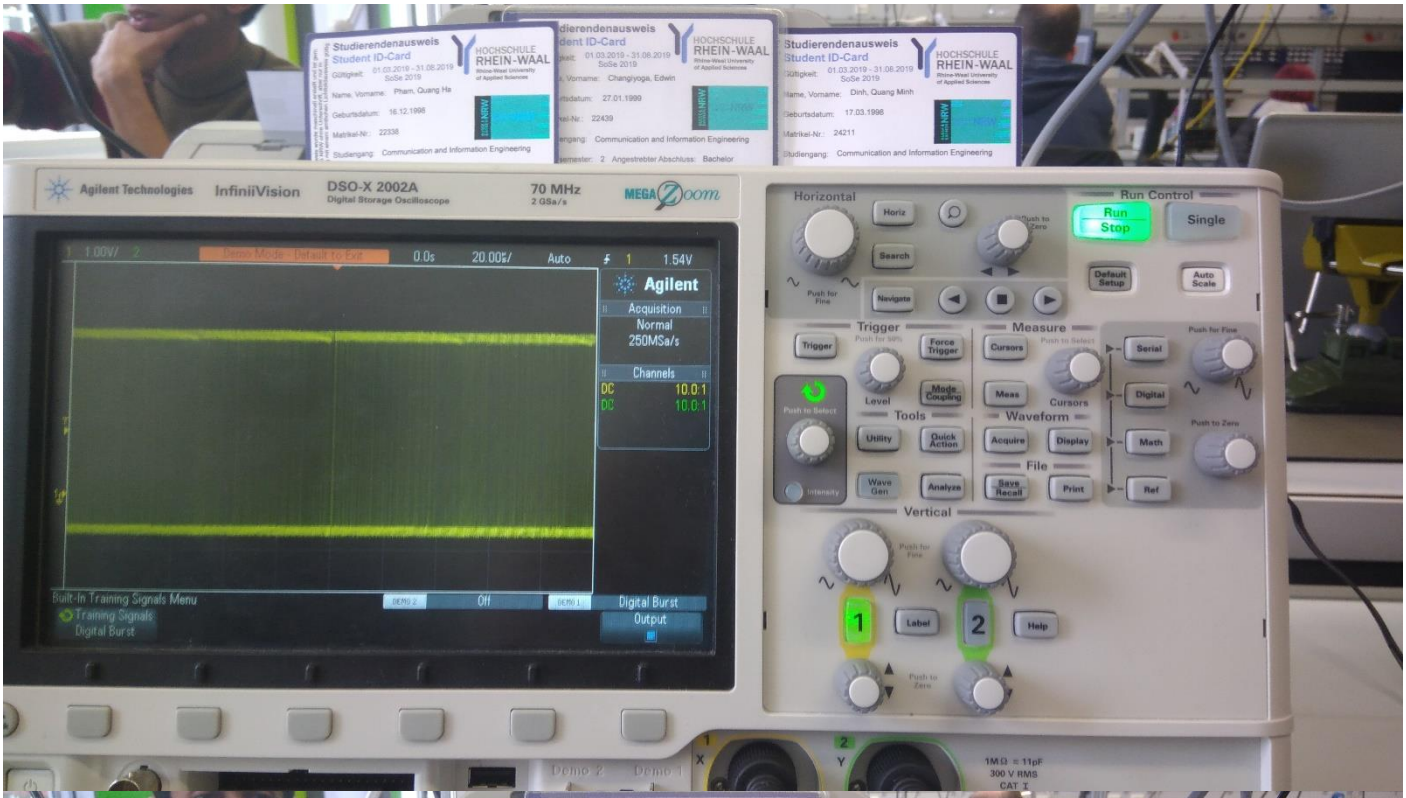


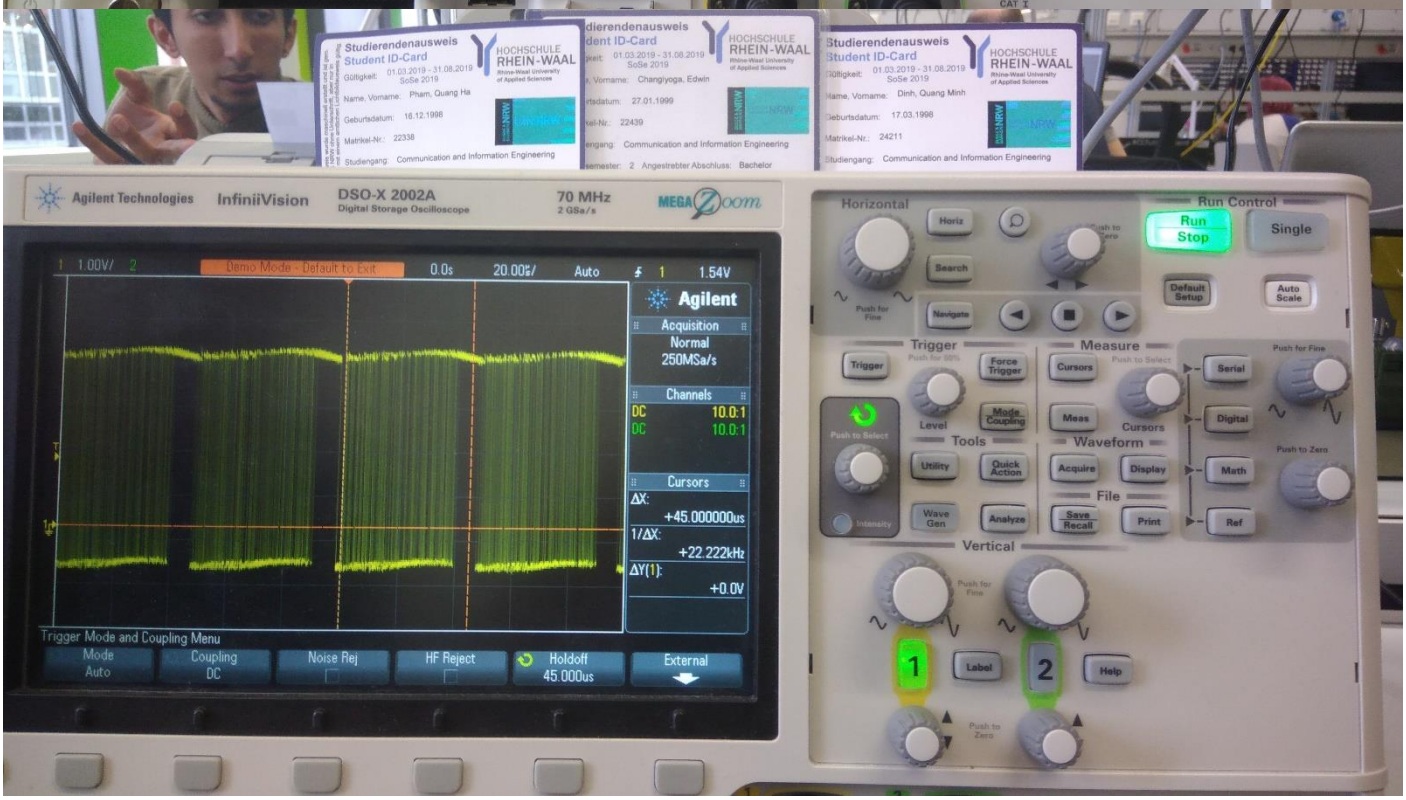
Challenge #7

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet and the Oscilloscope training kit.

Pictures:



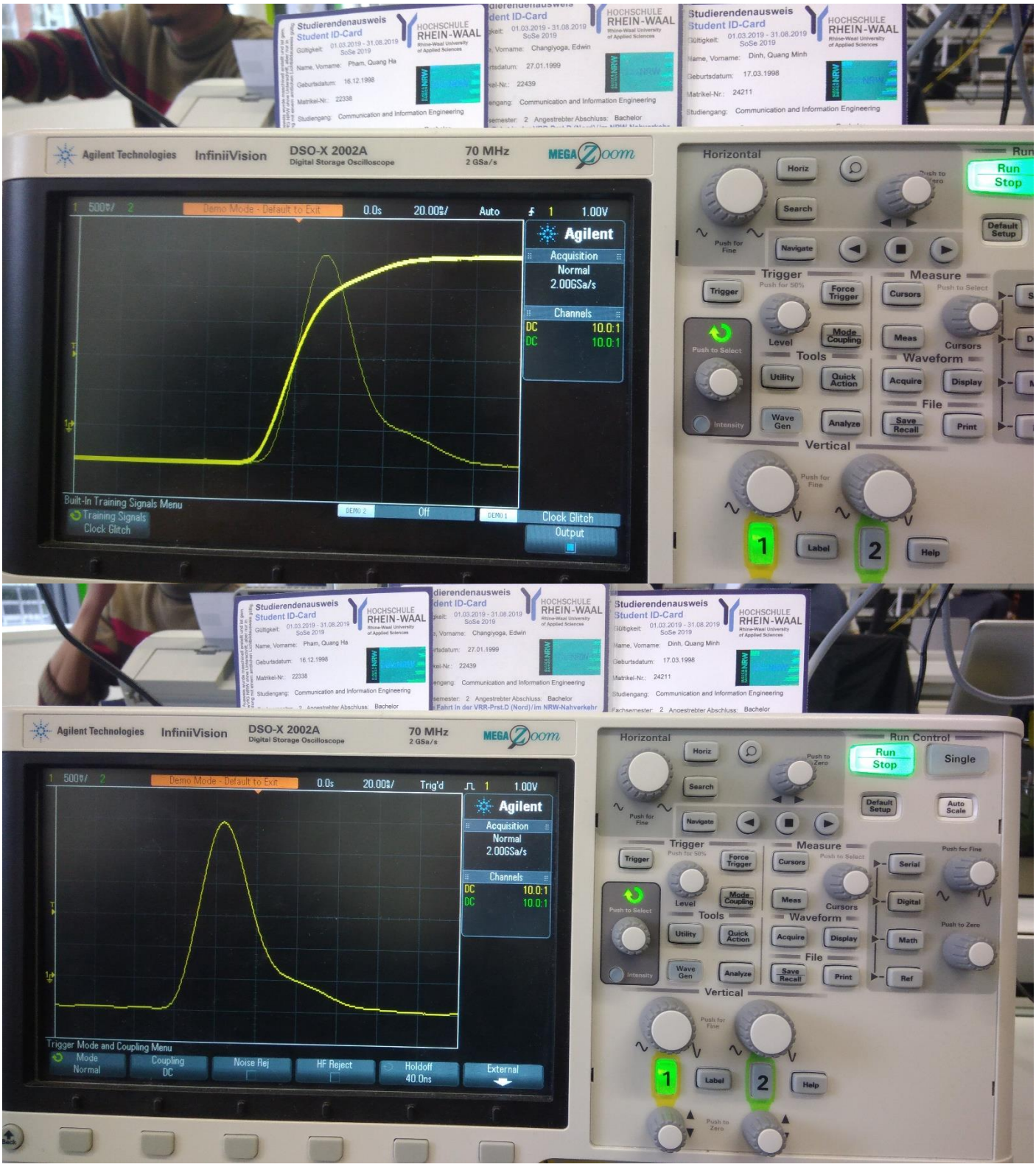


Challenge #8

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet and the Oscilloscope training kit.

Pictures:

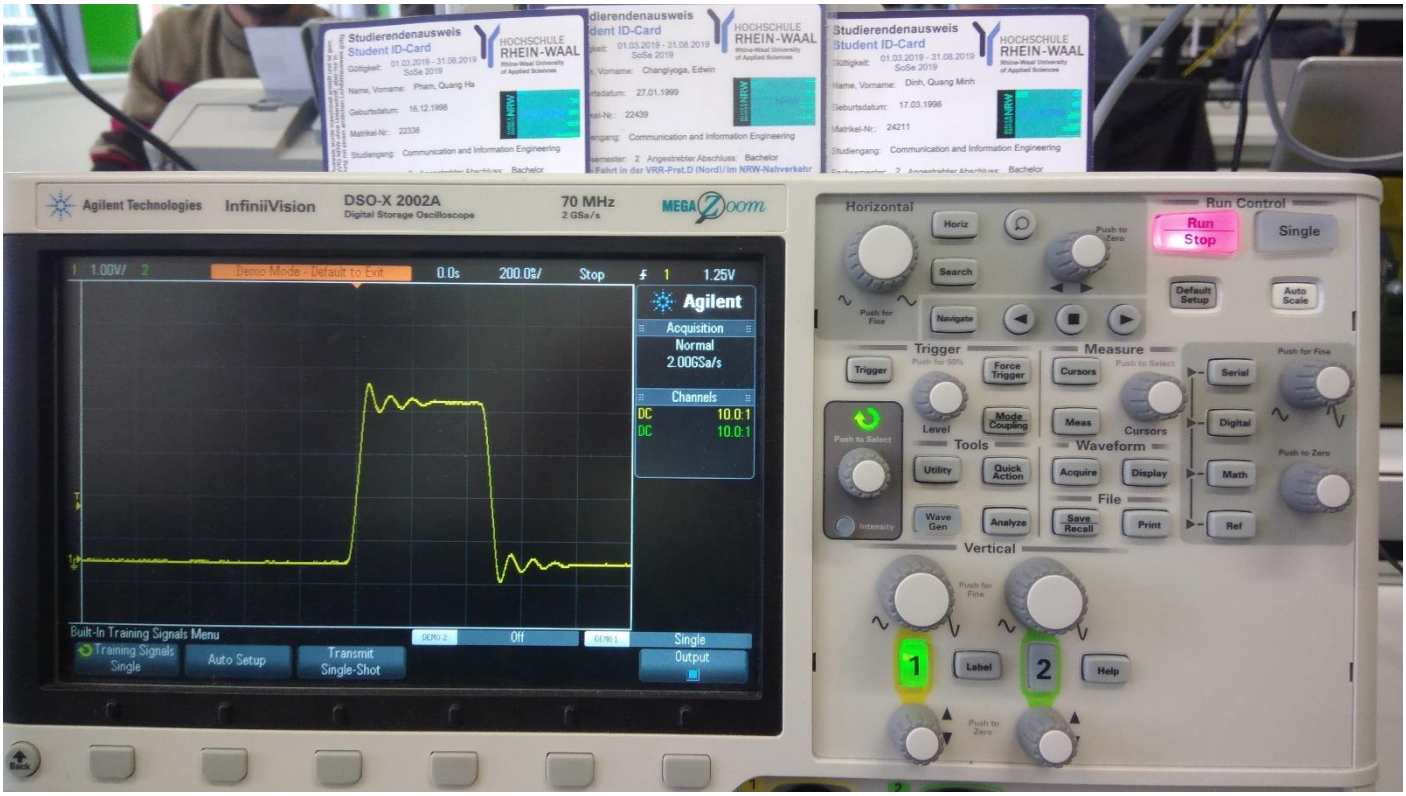


Challenge #9

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet and the Oscilloscope training kit.

Pictures:

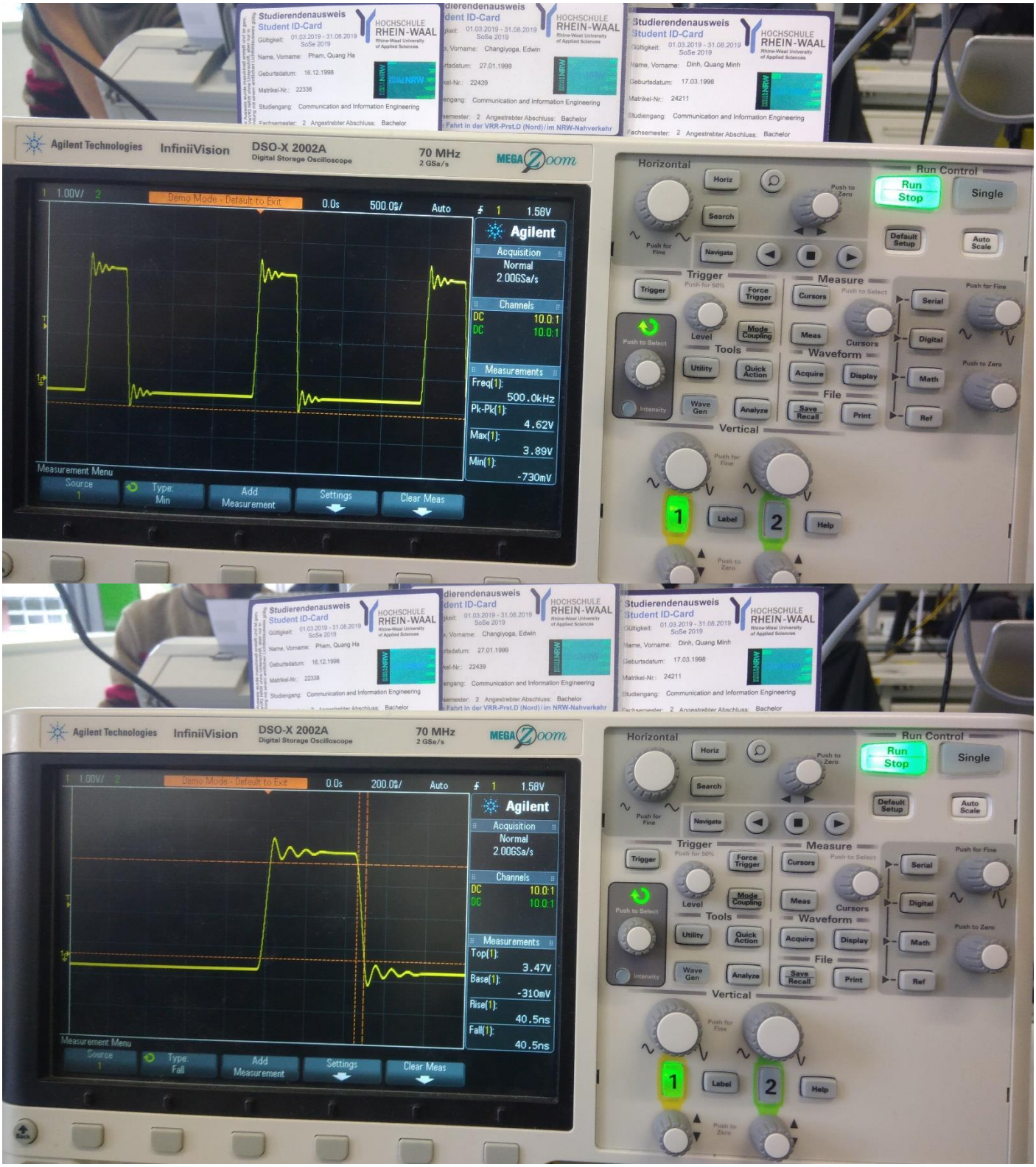


Challenge #10

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet and the Oscilloscope training kit.

Pictures:

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70 MHz
2 GSa/s
MEGAZoom
Demo Mode - Default to Exit
Agilent
Acquisition
Normal
2.00GSa/s
Channels
Measurements
Rise(1):
29.5ns
Measurement Menu
Source
Type:
Rise
Add Measurement
Settings
Clear Meas
Horizontal
Run Control
Run
Stop
Single
Default Setup
Auto Scale
Trigger
Measure
Cursors
Tools
Waveform
File
Vertical
Channel 1
Pk-Pk : 4.58V
Max : 3.85V
Min : -730mV
Ampl : 3.76V
Top : 3.47V
Base : -310mV
Over : 10.1%
Pre : 0.5%
Avg - Cyc : 588.4mV
Avg - FS : 771.9mV
DC RMS - Cyc : 1.68V
DC RMS - FS : 1.84V
AC RMS - Cyc : 1.5763V
AC RMS - FS : 1.6667V
Period : 2.0000us
Freq : 500.0kHz
+Width : 480.0ns
-Width : 1.5200us
Burst Width : ---
Duty : 24.0%
Rise : 29.5ns
Fall : 29.5ns
X@Min : ---
X@Max : ---
+ Pulse Count : ---
- Pulse Count : ---
Rise Edge : ---
Fall Edge : ---
Area - Cyc : ---
Area - FS : ---
Type:
Snapshot

Challenge #11

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet and the Oscilloscope training kit.

Pictures:


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Agilent
Acquisition
Normal
2.00GSa/s
Channels
Measurements
+Width(1):
200.0ns
399.5ns
Measurement Menu
Type +Width
Add Measurement
Settings
Clear Meas
Horizontal
Run Control
Run Stop
Single
Default Setup
Auto Scale
Trigger
Force Trigger
Measure
Cursors
Serial
Digital
Math
Ref
Tools
Waveform
File
Utility
Quick Action
Acquire
Display
Wave Gen
Analyze
Save Recall
Print
Vertical
Label
Help


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Acquisition
Normal
2.00GSa/s
Channels
Measurements
+Width(1):
100.0ns
200.0ns
Measurement Menu
Source
Type:
+Width
Add Measurement
Settings
Clear Meas
Horizontal
Run Control
Run
Stop
Single
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Tools
Waveform
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Vertical
Label
Help


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Channels
Measurements
+Width(1):
300.5ns
200.5ns
Horizontal
Run Control
Run Stop
Single
Trigger
Measure
Tools
Waveform
File
Vertical
Default Setup
Auto Scale
Measurement Menu
Add Measurement
Settings
Clear Meas

Result:

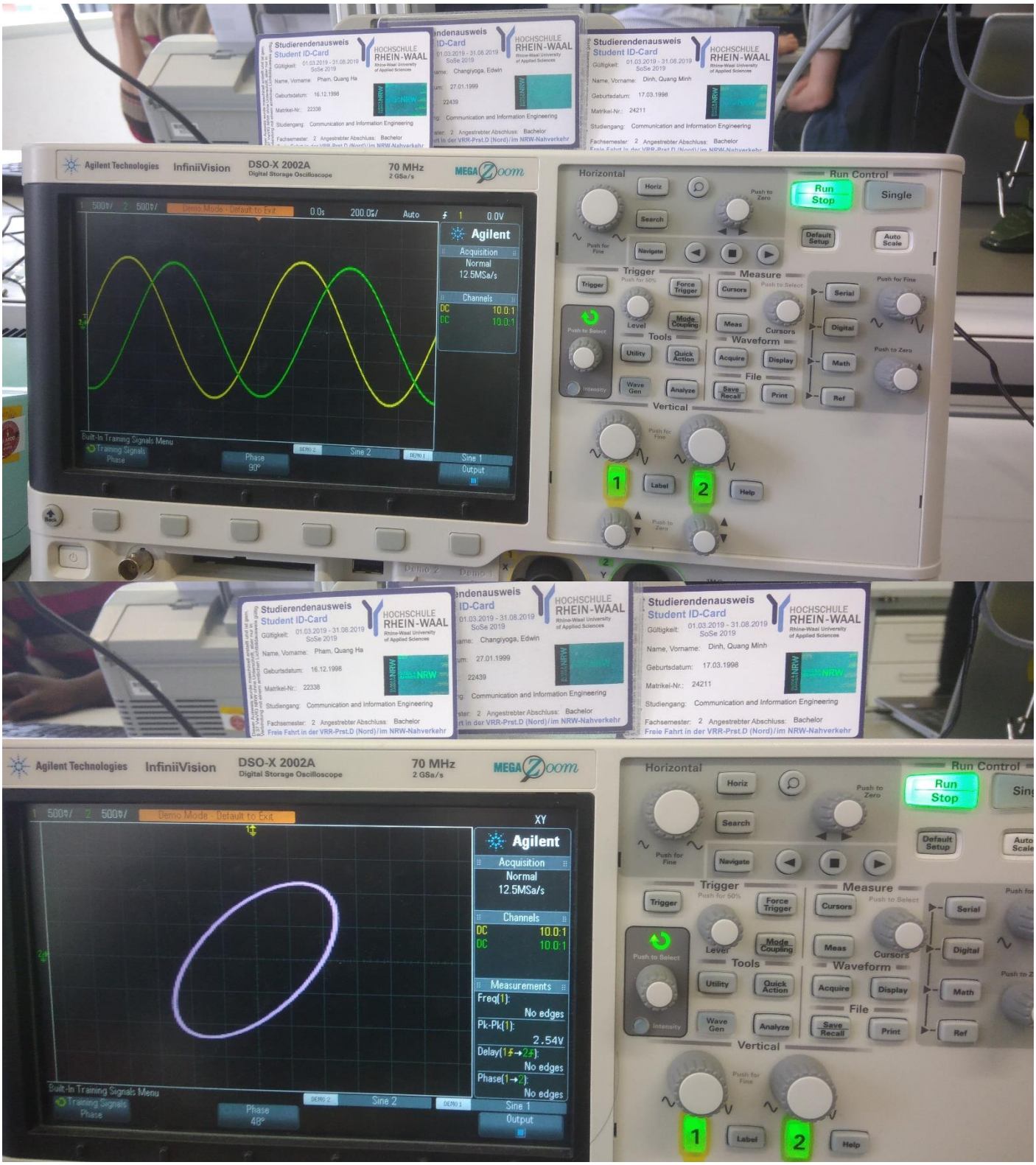
Step	Description	Result
17	Width (Pulse #1)	200.0 ns
18	Width (Pulse #2)	399.5 ns
19	Width (Pulse #3)	100.0 ns
19	Width (Pulse #4)	200.0 ns
19	Width (Pulse #5)	300.5 ns
19	Width (Pulse #6)	200.5 ns

Challenge #12

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet and the Oscilloscope training kit.

Pictures:



Results:

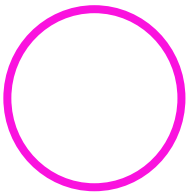
Question #1: Who was the investigator of this type of curves?

Jules Antoine Lissajous.

Question #2: What can be visualized with Lissajous Waveforms?

Complex harmonic motion.

Question #3: Draw the Lissajous Waveform for two signals of the same frequency with a phase shift of 270°.



When the phase shift is exactly 90 degrees or 270 degrees, we should see a perfect circle.

Question #4: You have a signal of 1kHz and a second of 2kHz. The phase shift is $\Delta\varphi=90°$. Draw the Lissajous waveform.

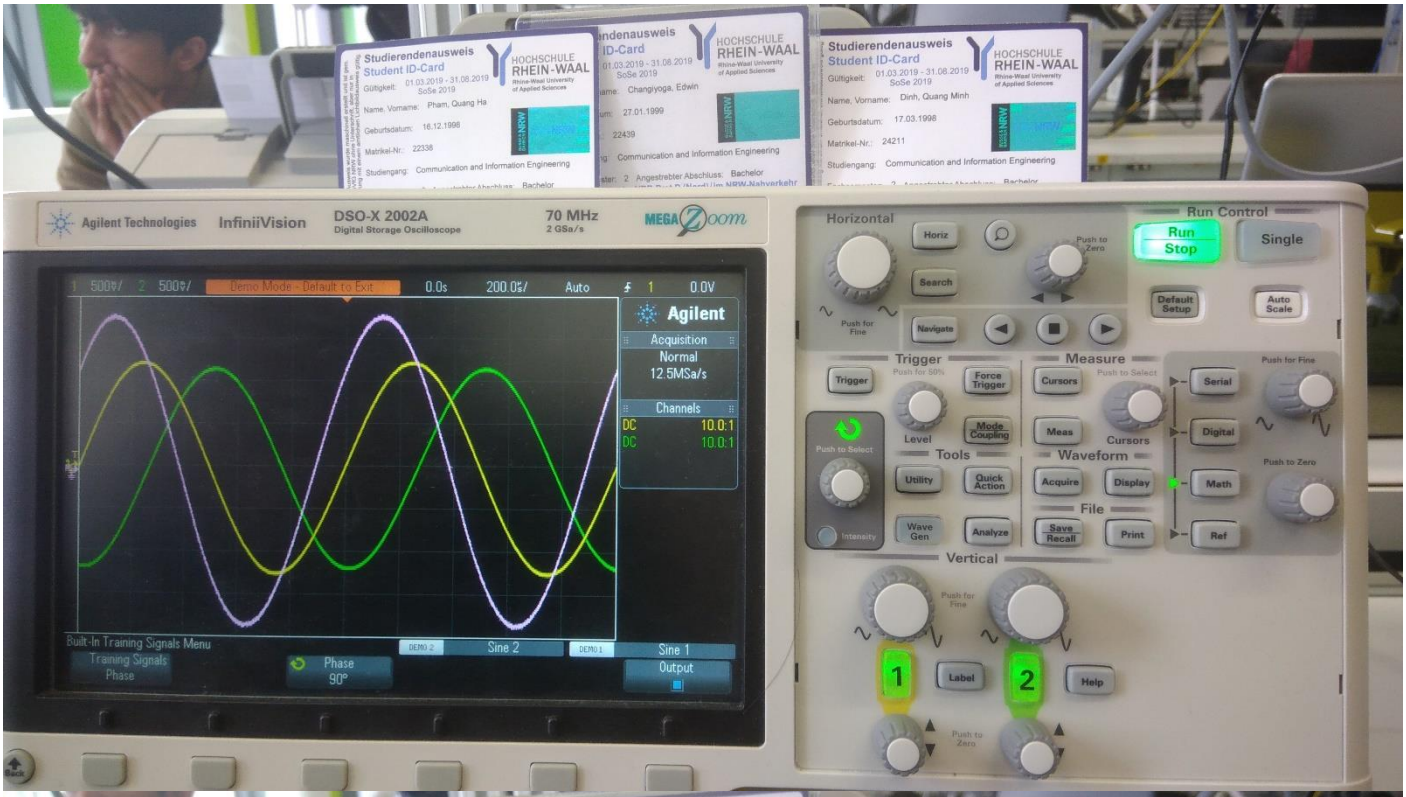
Source: https://de.tek.com/support/faqs/how-do-i-utilize-xy-display-feature-dpo-mso-mdo4000-series-oscilloscope

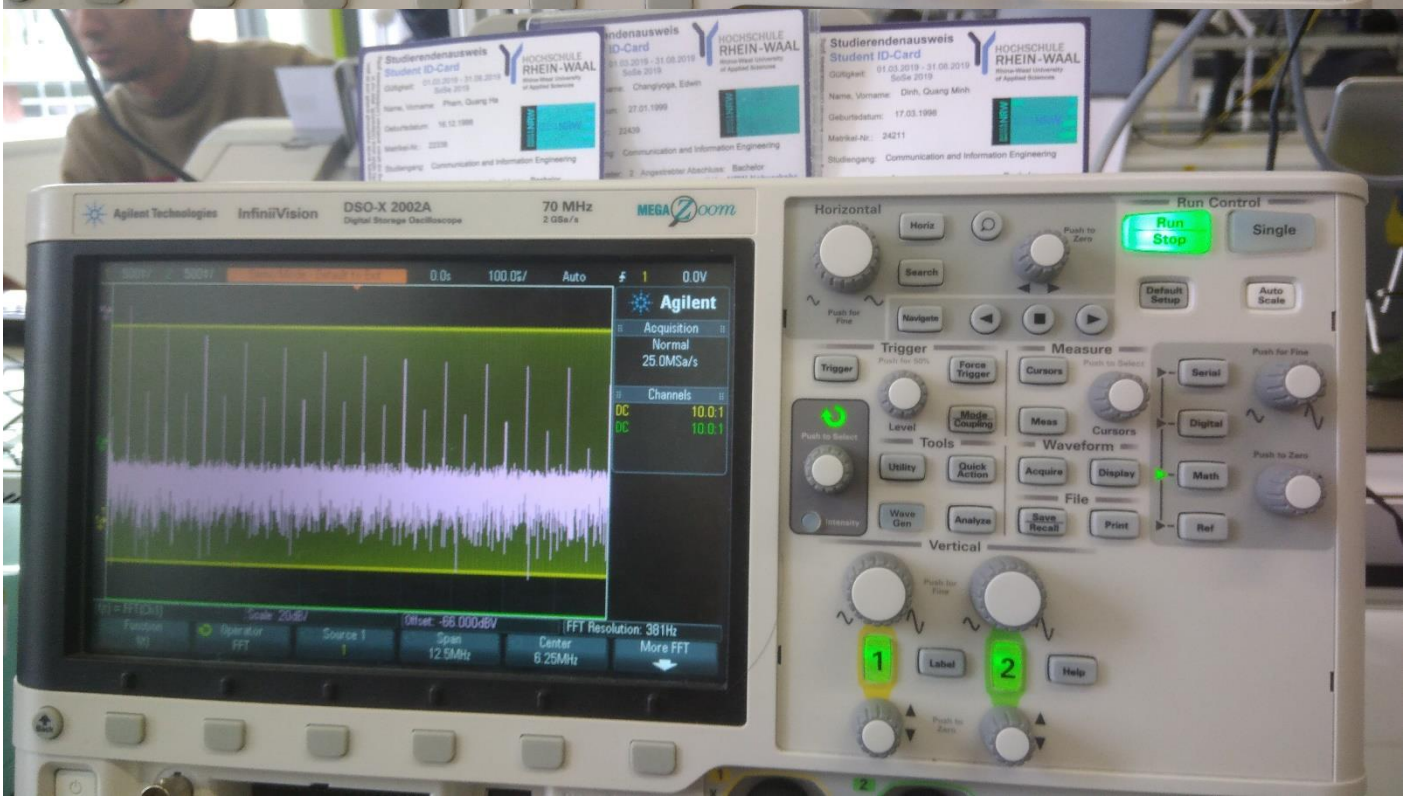
Challenge #13

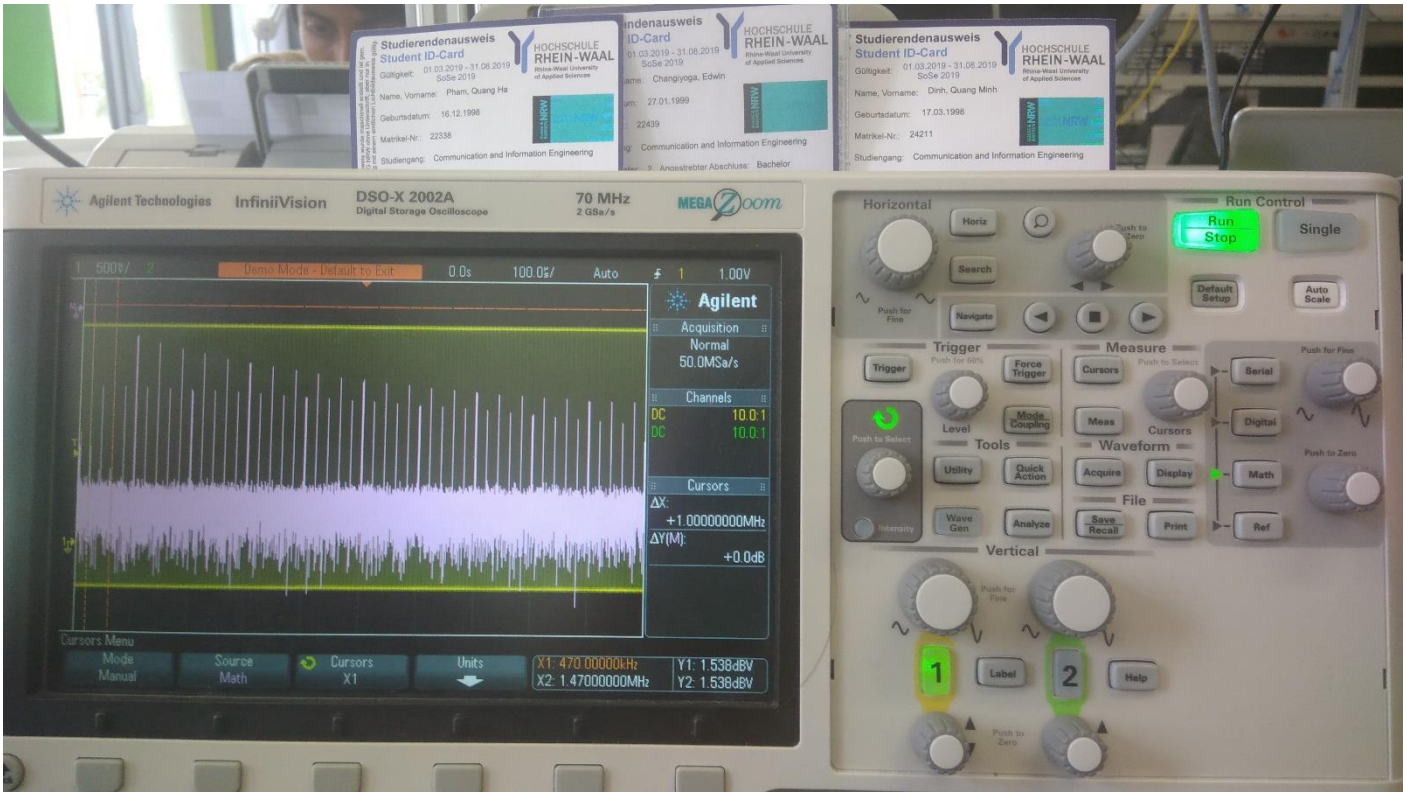
Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet and the Oscilloscope training kit.

Pictures:







Results:

Step	Description	Result
28	F1	1.4700 MHz
29	F3	470.00 kHz

Challenge #14

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet and the Oscilloscope training kit.

Pictures:

Results:

We learned that Peak Detect mode is useful for capturing frequently occurring glitches or to get more accurate information about narrow pulses or peaks within a signal.

Challenge #15

Abstract:

Our group managed to completed the challenge by following the steps given in the Description of the Laboratory booklet and the Oscilloscope training kit.

Pictures: