# Device&Tools:

# USB oscilloscope

**Introduce:** software and hardware complex for visualizing data received from an analog-to-digital voltage converter via a USB cable

## Components:

1. Analog-to-digital voltage converter (converter)
2. PC software (visualizer)

## Hardware:

1. Hardware platform with a 32-bit ARM(R) Cortex(R)-M3 microcontroller (ARM platform)
2. Buffer stage on the operational amplifier with a voltage divider
3. Voltage switch

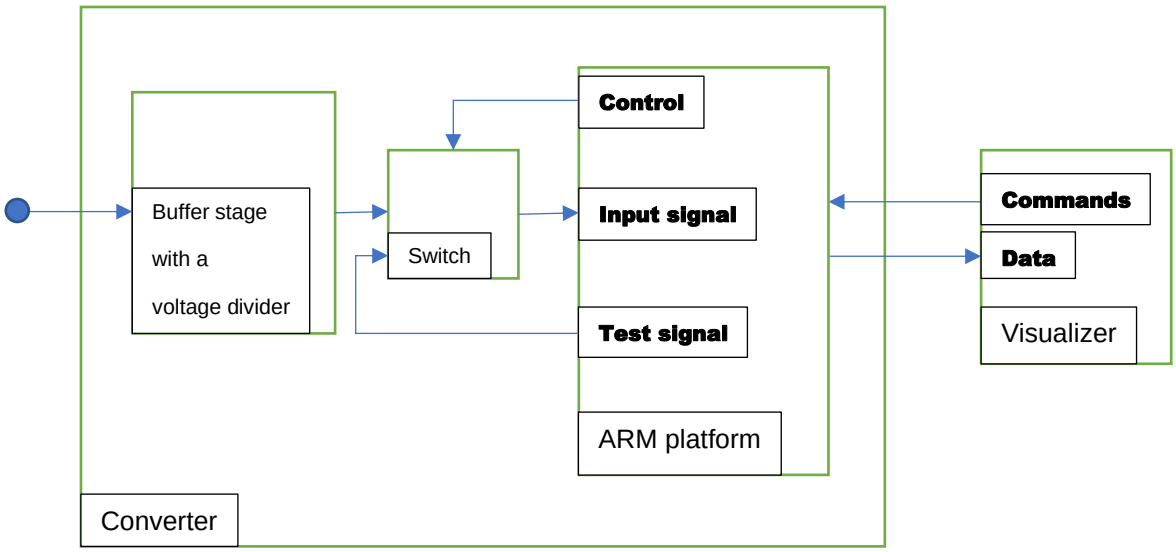
## Features of the converter firmware:

1. Language – C only
2. No third-party libraries are used, except for the standard ones for the core and peripherals from the manufacturer of the microcontroller
3. USB driver of our own development without using any libraries

## Features of the visualizer software:

1. Java 8 SE
2. For USB exchange, a third-party well-known library and a driver compatible with it are used

## Hardware flowchart:




## Technical characteristics of the oscilloscope:

1. Sample rate: 32000, Hz
2. Input voltage range: 0 ÷ 30, V
3. Supply voltage of the converter: 5, V
4. Generating test signals (sinus wave, triangle wave, meander wave) with variable amplitude and frequency

## Features of the visualizer:

1. Periodic display of accumulated signal samples in the oscilloscope window
2. Scaling along the horizontal and vertical axes
3. The ability to record signal samples in memory and view them in the oscilloscope window
4. Control of the test signal generator
5. Synchronization on the leading or trailing edges of the observed signal
6. Measurement of the amplitude characteristics and frequency of the observed signal

Figure 1. Voltage from the power supply unit (raise edge)

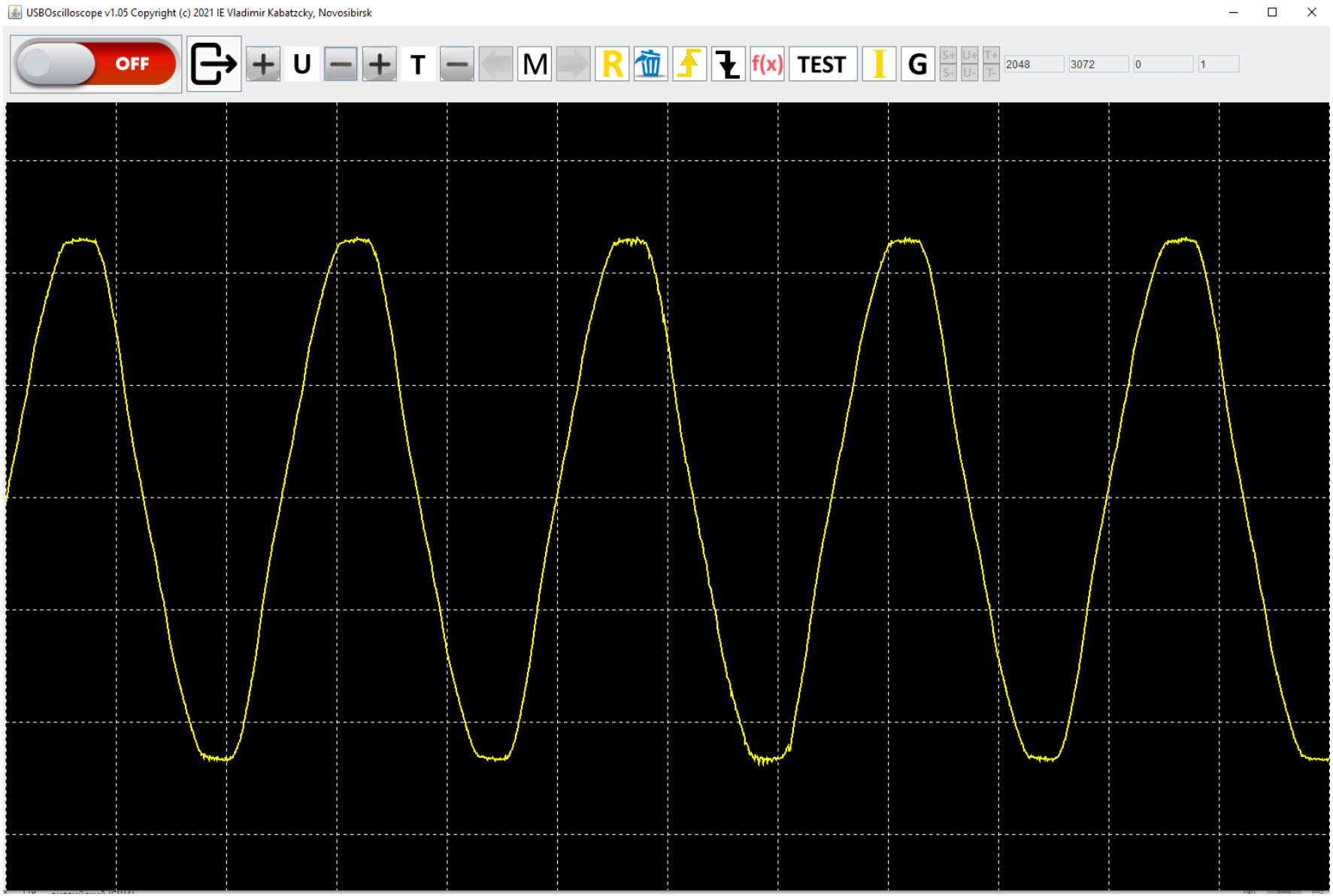


Figure 2. Test signal (sinus wave, raise edge)

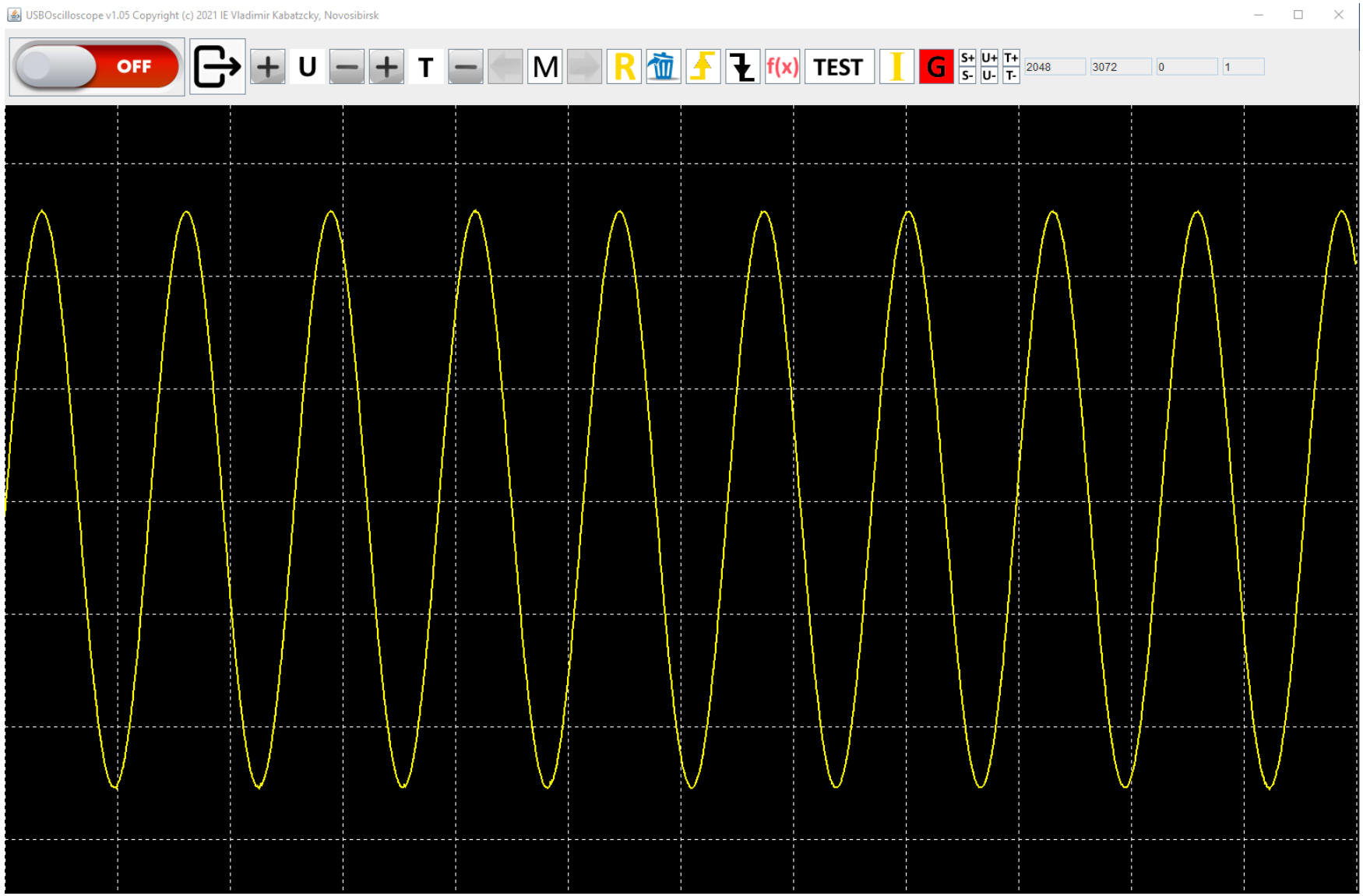


Figure 3. Test signal (triangle wave, fallen edge)

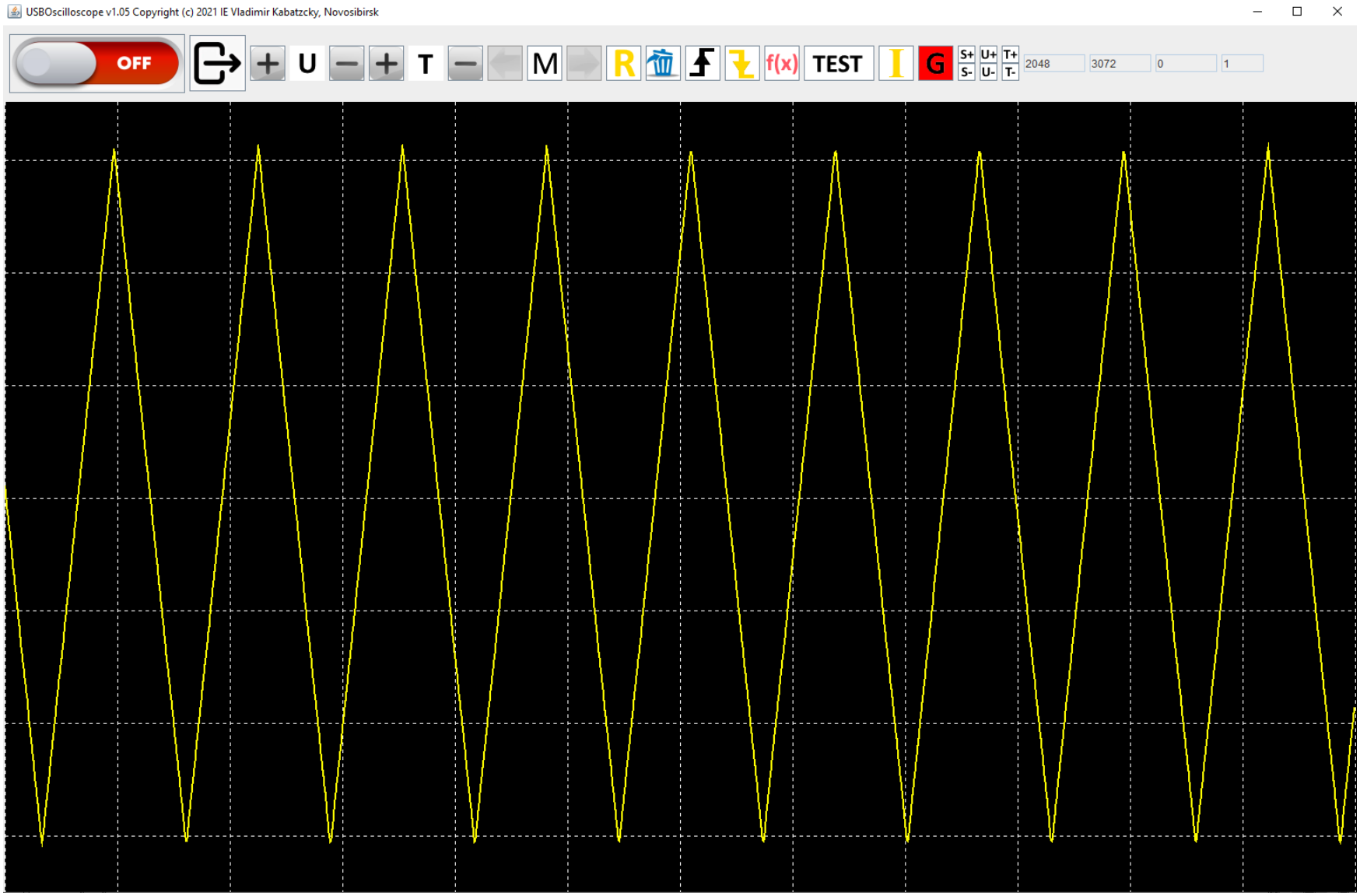


Figure 4. Test signal (meander wave, raise edge)

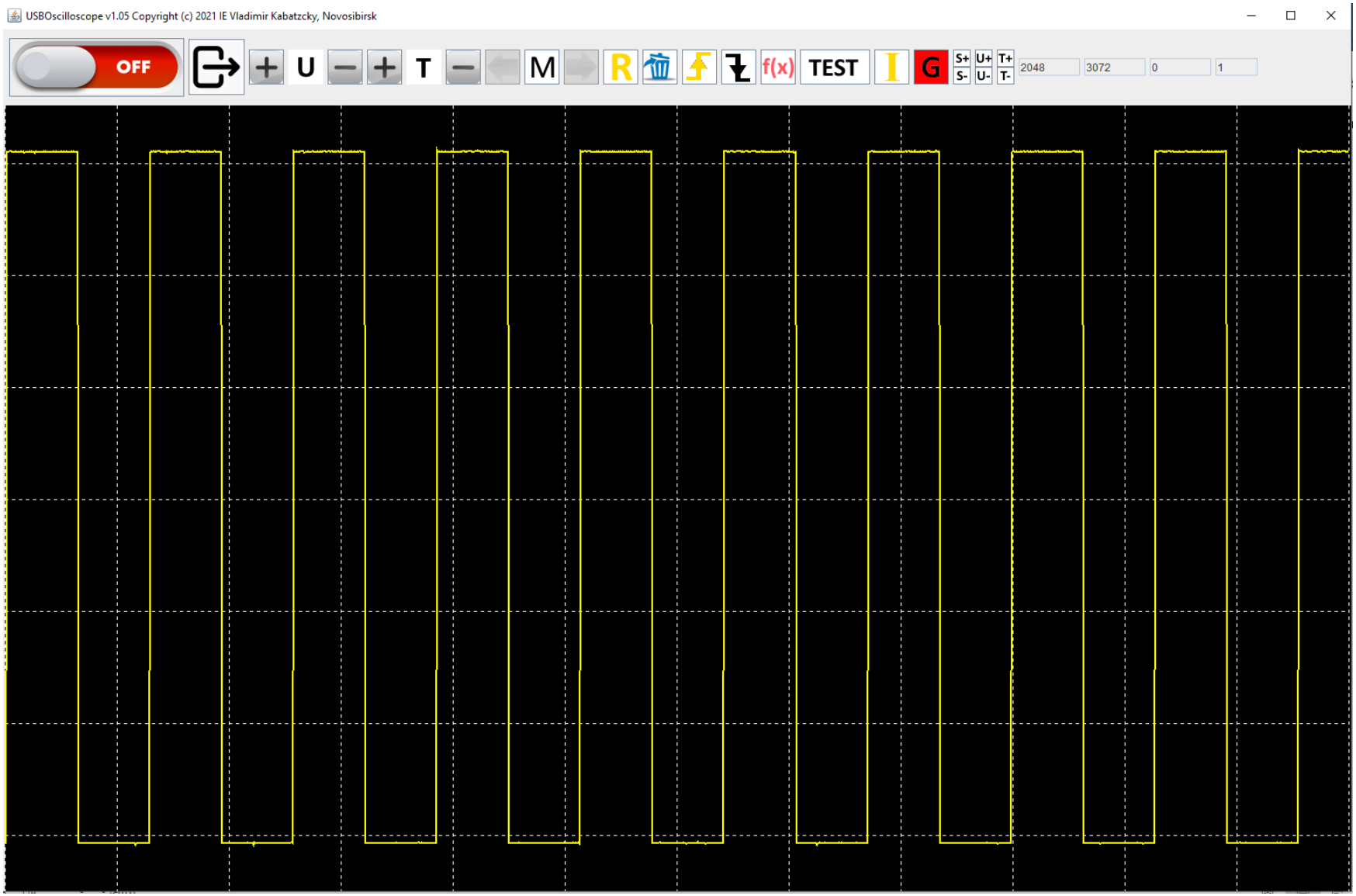


Figure 5. Test signal (sinus wave, fallen edge, amplitude have been changed)

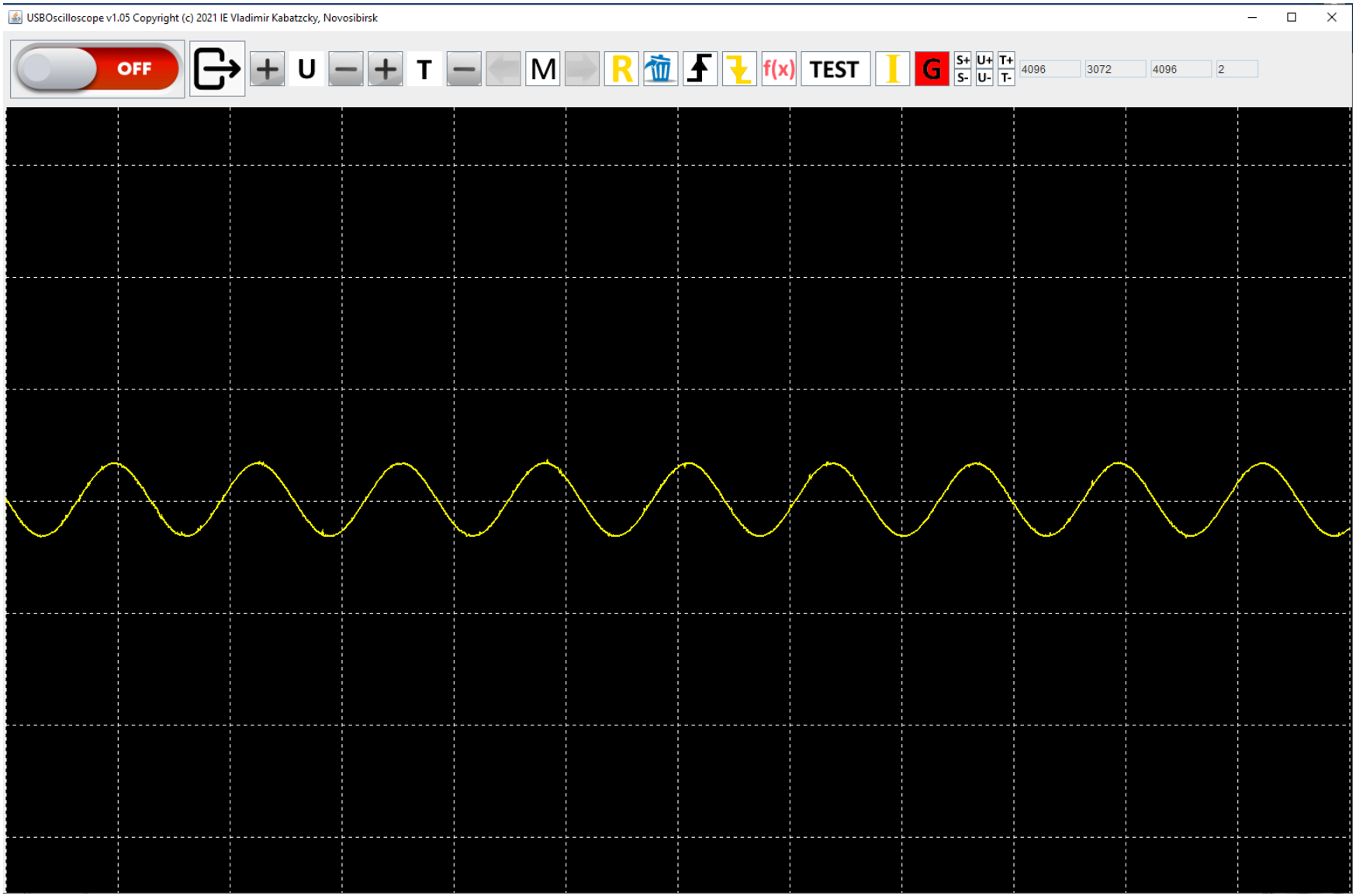


Figure 6. Test signal (sinus wave, fallen edge, amplitude and frequency have been changed, vertical scale has been changed)

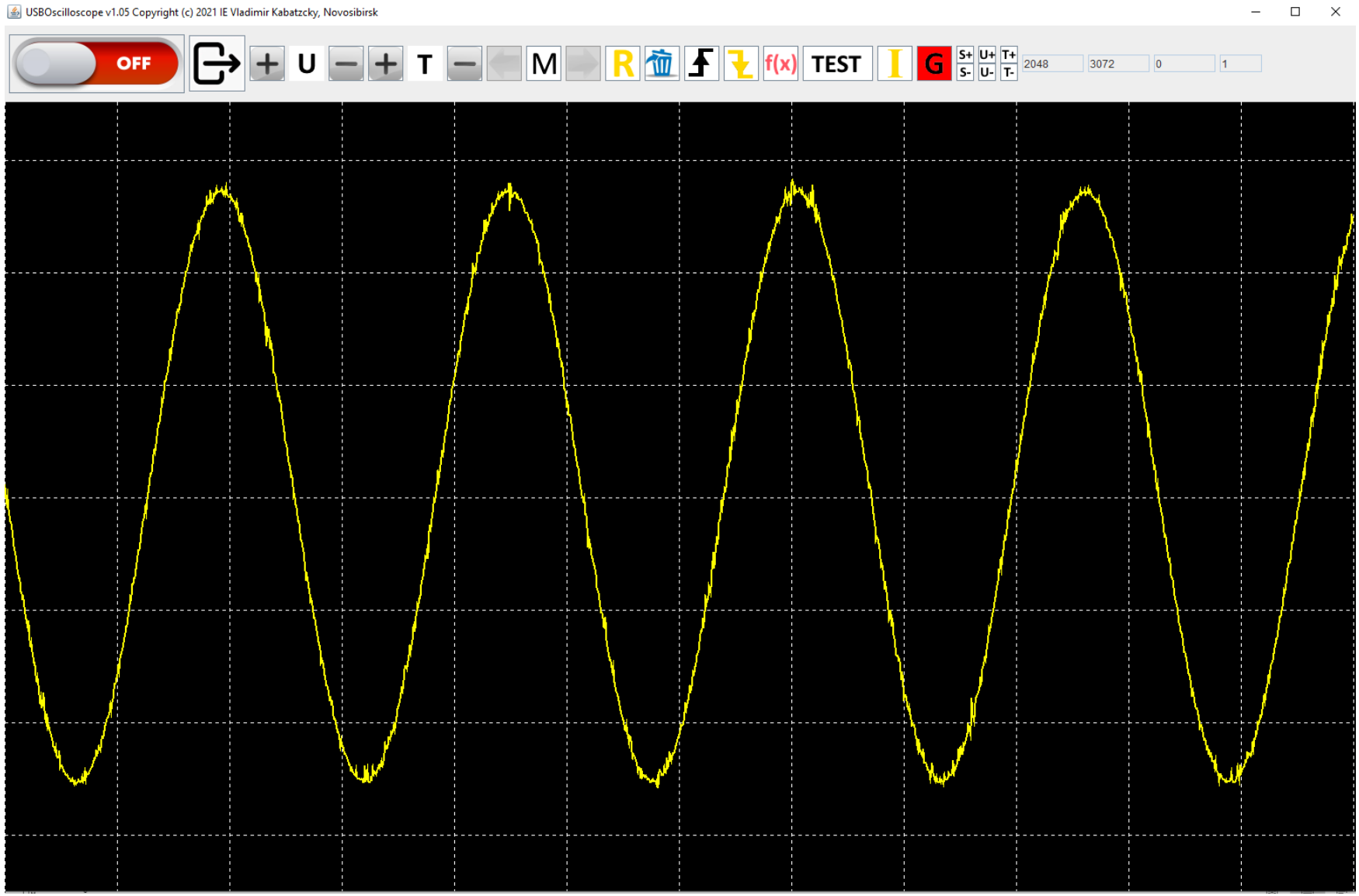


Figure 7. Test signal (sinus wave, fallen edge, amplitude and frequency have been changed, vertical and horizontal scales have been changed)

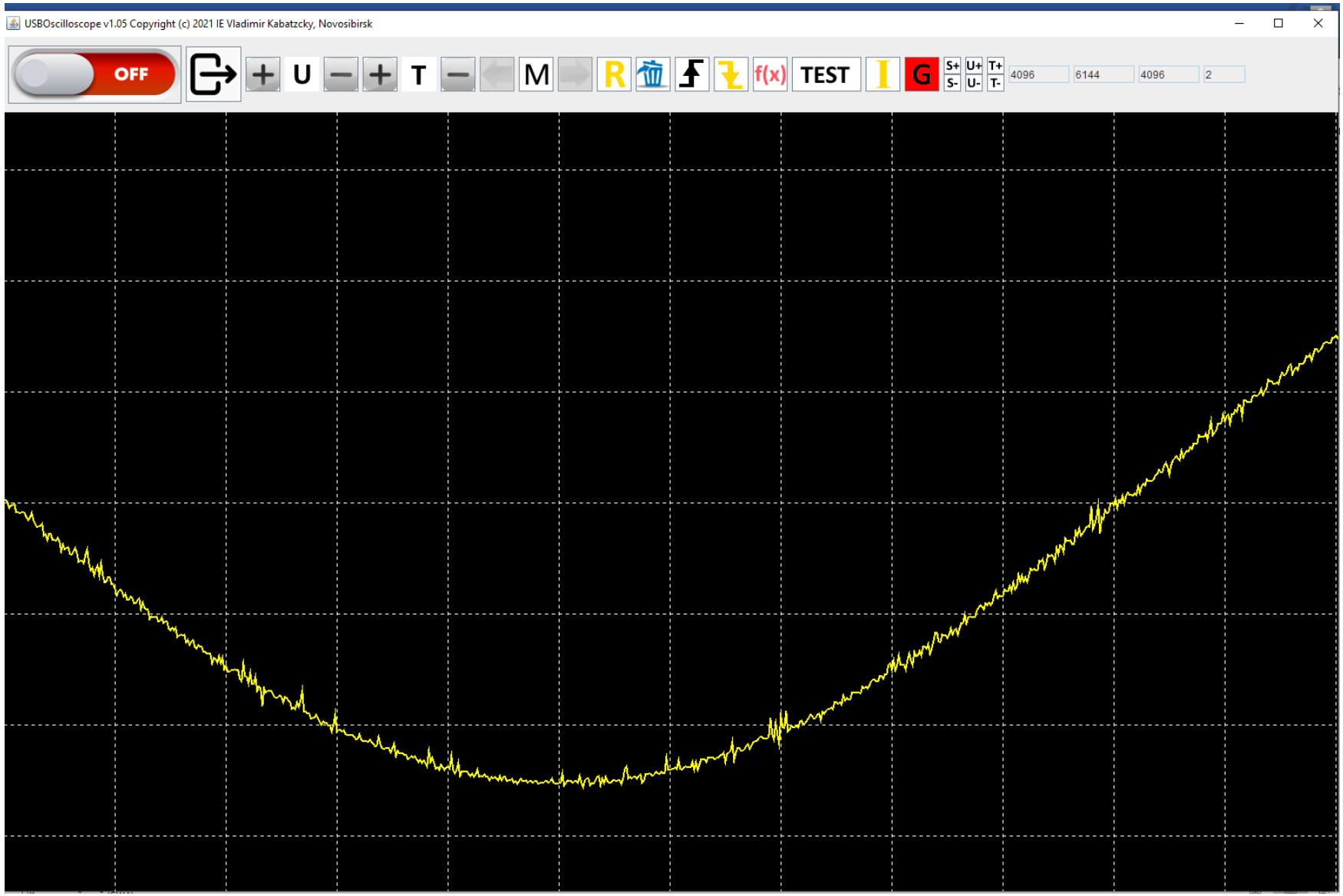
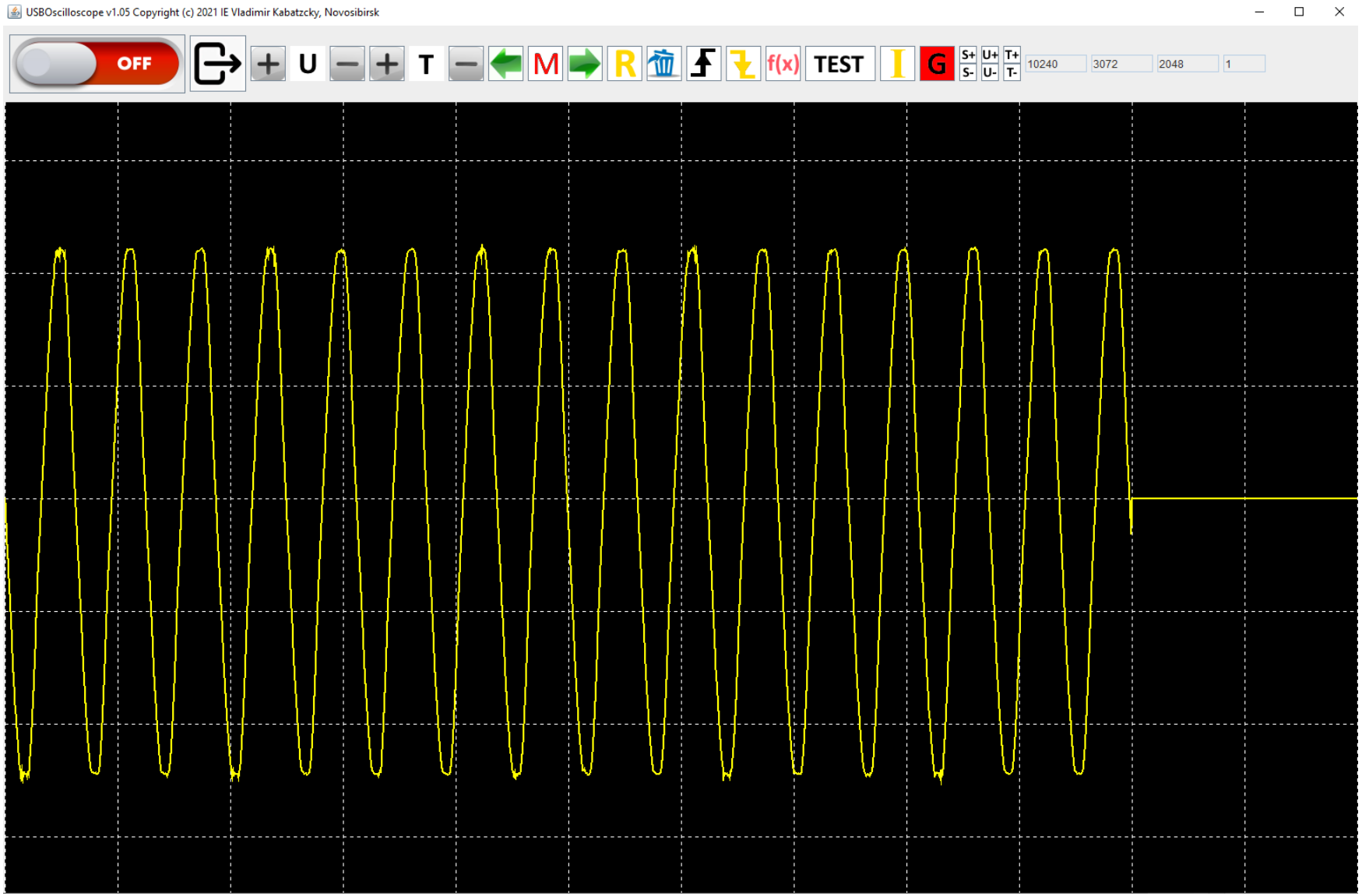


Figure 8. Voltage from the power supply unit has been stored to the memory (5120 samples)



# Thanks for attention!