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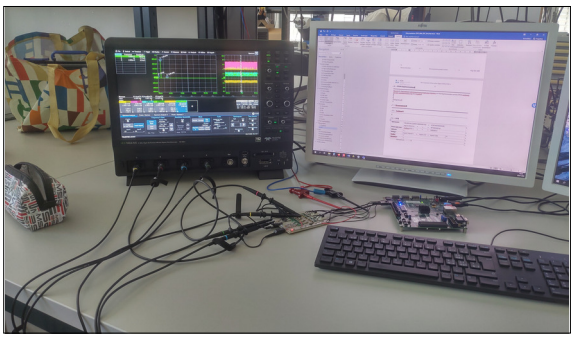
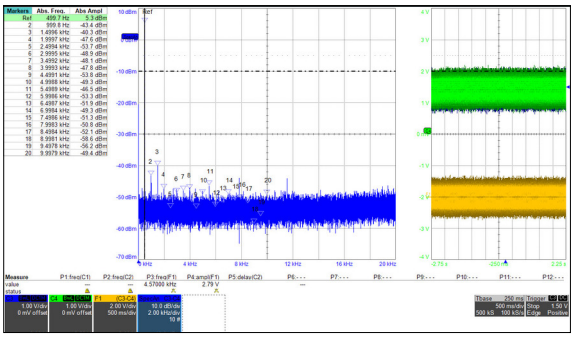
Subject Area	Sensor, Actuator and Communication Systems

Development of an audio Delta-Sigma DAC

Project work 2



Lab workstation with prototype
Own presentment

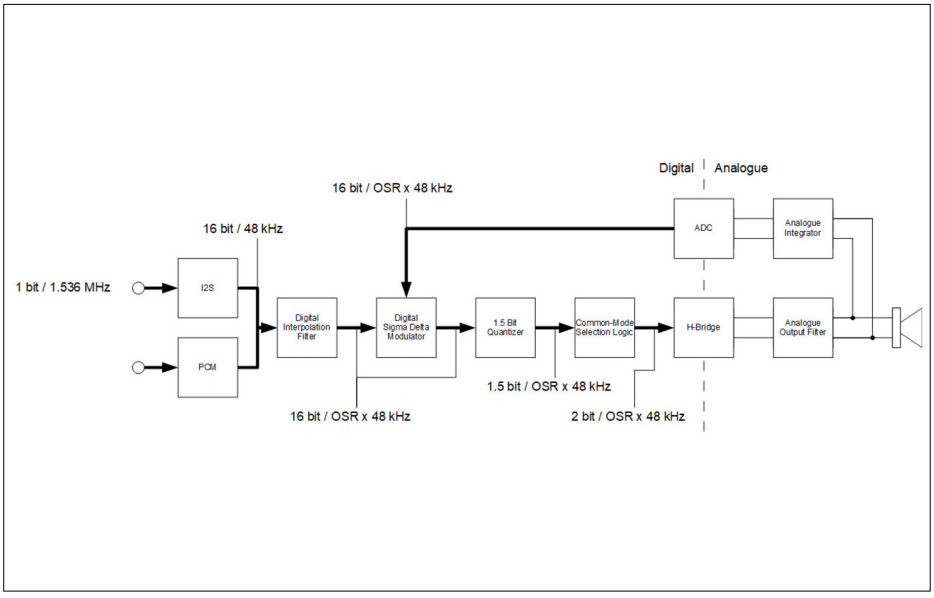


Resulting FFT measured with LeCroy HDO9404-MS
Own presentment

Introduction: Human interaction with the environment is increasingly taking place in the digital domain. The world itself, however, is and remains analogue. It is therefore infinitely variable and can theoretically contain an infinite amount of information. To change from an ambiguous to an explicit system, it needs certain building blocks. The links between the two worlds are the analogue-digital and digital-analogue converters.

Definition of Task: In this project, a digital-to-analog converter of the Delta-Sigma family was developed for demonstration purposes, which can drive loudspeakers or other actuators in the audio frequency range via an H-bridge. To save power, three (high, idle, low) instead of two (high, low) states were implemented. During the project, the original problem definition had to be adjusted due to measures to restrict the spread of Covid-19. Instead of measuring the influence of different load impedances on the quality of the output signal, more time was invested in system design with more complex delta-sigma modulator structures. This measure meant that less time was spent in the lab, but more time was spent on calculation and simulation.

Result: A delta sigma digital analogue converter was successfully developed and tested. The setup can be easily implemented on any AVNET ZedBoard. In the end, the only external part that is needed is a H-bridge with appropriate filters. All digital components are tested extensively. This ensures that the blocks can also be used in future projects. The performance, defined by the total harmonic distortion and the signal to noise ratio, of the digital analogue converter is below expectations. The reasons for this are the transistors in the built-up H-bridge. These have proven to be too slow. Since all digital components have been thoroughly tested and found to be functional, an improvement of the H-bridge will significantly increase the performance of the digital-analogue converters.



Block diagram of Delta-Sigma digital-analogue converter
Own presentment