Maia SDR: An open-source FPGA-based SDR project focusing on the ADALM Pluto

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My handheld radio



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Maia SDR

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It even supports spectrum scanning



Dr. Daniel Estévez (EA4GPZ / M0HXM)

A DMR repeater in Antarctica



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A cell base station in Iceland



Hunting for LTE signals somewhere in Madrid



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Balint hunting for RADAR signals somewhere in the bay



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Maia SDR

- Very portable
- Ability to display and record wideband signals
- Heavy use of FPGA

Design idea:

• Use the ADALM Pluto and a smartphone

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The project:

- Open-source FPGA-based SDR project
- Goal: promote FPGA development for radio and collaboration between SDR and FPGA communities
- Focuses on the ADALM Pluto at this stage

- ADALM Pluto firmware
- Web UI. Can be used from a phone or a PC.
- Real-time waterfall display at up to 61.44 Msps
- IQ recording at up to 61.44 Mbps and 400 MiB max size (using the Pluto DDR)

Maia SDR components



- maia-hdl. FPGA design. Implemented in Amaranth.
- maia-httpd. Web server & control. Implemented in async Rust.
- maia-wasm. Web UI. Implemented in Rust, compiled to WebAssembly.

- Custom FFT core. 4096-point, radix-2² decimation-in-frequency single-delay feedback.
- Spectrometer, with FFT core and power integrator.
- Custom DMAs for spectrometer and IQ recorder (very low resource usage)



Maia SDR

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Maia SDR

- Controls the Maia SDR FPGA IP core
- Serves the web UI
- REST API for control
- WebSocket server to stream waterfall data
- Async Rust web server using Axum

maia-wasm

- WebGL2 rendering for the waterfall
- HTML form interface for control
- Developed with usage from phone in mind
- Rust compiled to WebAssembly



- Custom FPGA FFT core
- WebGL2 render engine developed from scratch for the waterfall
- Custom Linux kernel module to manage DMA buffers and cache invalidation

- Reception and transmission of analog modulations (SSB, AM, FM)
- Digital modulations?
- Fosphor?

When? Who knows...

Live demo