QORVO_RADIO – Progress Report

Date	Revision	Author	Comments
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1 Objective

The objective of this project is to design and develop a modular and reconfigurable Software Defined Radio (SDR) platform tailored for educational use. The platform will support future student designed modules, offering flexibility and expandability. The objective of this paper is to provide a progress report for mentors and sponsors.

6. Work Completed

Computer aspects completed:

- Testing of communication between GNU Radio/Computer and FPGA via TCP/IP
- Testing of compilation of FPGA and GNU Radio code changes
- Initial testing of pushing frequency from GNU Radio to FPGA
- Verification of Clock Phase Locked Loop (PLL) Outputs
- Creation and simulation of SPI controller using VHDL code to control RF Front End
- Draft of technical and layman documentation for FPGA portion.
- Developed the contingency plan using the Pluto SDR as the RF front end. The Pluto SDR receives RF waves, down converts them, and transmits the signal to the Eclypse Z7's ZMOD SDR input, where it is digitized and output as audio

Electrical aspects completed:

- Redesigned and simulated low pass filters at the local oscillators output.
- Finalized the initial PCB design and submitted it for review by the industry supporter.
- Finalized the bill of materials for the PCB order.
- Assisted with the development of the contingency plan mentioned above.

Mechanical aspects completed:

- All non-PCB components have been ordered.

- Enclosure design has been completed.
- Required connectors have been configured.
- Enclosure walls have been printed to verify dimensions of newly acquired hardware.
- Power switch, power supply receptacle, and fan have been installed.
- Final print of the enclosure walls has been completed. UNCC logo and team name has been printed on the side of one of the walls.
- Holes have been drilled in the base plate, and the plexiglass lid have been cut to size.
- Threaded inserts have been inserted into the walls and assembled.

2 Issues that Need Immediate Assistance

With our PCB being ready to order, there are no issues that require immediate assistance. The only issues that we may face moving forward would be manufacturing delays.

3 Plans for the Remainder of Semester

The project plan is included in the appendix. Moving forward to the Prototype Review Presentation (PRP), our primary goal is to have a fully functional prototype that integrates both hardware and software components. This includes finalizing the PCB design, which has been completed and is under review from the industry supporter. Once finalized, the PCB will be sent for manufacturing, and we will monitor the order status closely to avoid delays, since the last progress report there have been tariffs imposed on Chinese products, we are unsure how this will affect the delivery date of the PCB. A contingency plan has been developed that uses the Pluto SDR purchased in the fall semester, the Pluto acts as our RF front end and transmits a signal that the eclipse Z7 is able to process. We aim to have a demonstration of this plan at the PRP and have it fully functional for the expo in case of the PCB not being functional.
For computer and software integration, we will focus on ensuring that the FPGA-to-PCB interface is fully functional. This includes:

- Refining the GNU Radio GUI interface
- Confirmation of correctly configured bits from GNU to FPGA registers
- Testing control output from FPGA over PMOD
- Testing and debugging to ensure usability and stability for the end user
- Developing software drivers to control and monitor system performance
- Creating a graphical user interface (GUI) if needed for user interaction
- Running simulations and debugging software to ensure real-time operation

The manufacturing of the enclosure is nearly complete, cosmetic enhancements will be made, and final assembly is all that remains. The enclosure is expected to be completed by mid-April. Once the PCB is received, we will begin assembling the support structure and integrating internal components, ensuring that heat dissipation, cable management, and accessibility are properly addressed.
Upon receiving the PCB, we will begin the initial testing phase, which includes:

- Assembling the SMA ports on the PCB.
- Running electrical and functional tests to verify signal integrity and power distribution
- Testing software-to-hardware communication between the FPGA, PCB, and any supporting systems

- Debugging any interface issues that arise during testing

After the testing is concluded, we will refine the design based on testing results. This includes assembling the final enclosure, integrating all components, and performing wire and cable management to improve the system's appearance and organization. In addition, we will finalize all software updates, ensuring stable operation of the system.

The final phase will involve preparing documentation, creating a project video, and finalizing all necessary reports for submission by the final Expo deadline on May 2nd.

4 Communication with Faculty Mentor and Supporter – Complete

Every week the team meets with the sponsor, and bi-weekly with the mentor. The sponsor meeting is on Google Meets every Wednesday at 8:30am, the meeting minutes are attached, in the appendix. The mentor joins us for the sponsor meetings every other Wednesday at 8:30am, the meeting minutes for these are also attached, in the appendices. We also meet with the mentor bi-weekly on Monday at 12:30pm, the meeting minutes for these are also attached, in the appendices. In these bi-weekly meetings, we present 2 or more slides per student of the work they completed in the past 2 weeks, and what they plan to complete in the following 2 weeks. These slides are also attached, in the appendices.

5 References - Complete

1. Team Contract, QORVO_RADIO Senior Design Team, September 2024
2. Statement of Work (SOW), QORVO_RADIO Senior Design Team, September 2024
3. Weekly Communication Emails, QORVO_RADIO Nathan Waters, Alan Luecke, February 2024
4. Project Plan, QORVO_RADIO Nathan Waters, February 2024

6 Appendices

- **Appendix A: Project Gantt Chart**
  - Description: This appendix includes the detailed project Gantt chart outlining all major milestones, tasks, and deadlines.
  - Link to Project Plan

Unique Task Identifier	TASK	ASSIGNED TO	PROGRESS	START	END
	Phase 1: Finialize Design				
P1.1	Finalize Schematics	Team	100%	1/13/25	2/12/25
P1.2	Finialize Last Components	Team	100%	1/17/25	1/27/25
P1.3	Order All Components (non PCB)	Team	100%	1/27/25	1/31/25
P1.5	Finialize Enclousure Design	Team	100%	2/1/25	2/16/25
P1.6	Finialze PCB Design	Team	20%	1/24/25	2/16/25
P1.7	Updated BOM and Report	Team	85%	2/16/25	2/16/25
	Phase 2: Initial Review/Test				
P2.1	Manufacture Enclosure	Team	70%	2/16/25	2/23/25
P2.2	Review PCB design and order status	Team	20%	2/16/25	3/24/25
P2.3	Receive PCB	Team	0%	3/24/25	3/24/25
P2.4	Test PCB	Team	0%	3/24/25	3/28/25
P2.5	Test FPGA to PCB	Team	0%	3/24/25	3/31/25
P2.6	Begin assemebly/corrections	Team	0%	3/24/25	4/1/25
	Phase 3: Assemble/Corrections	Team			
P3.3	Assemble Enclosure	Team	0%	3/24/25	3/28/25
P3.4	Test Prototype in Enclosure	Team	0%	3/28/25	4/2/25
P3.5	Make corrections	Team	0%	4/1/25	4/18/25
	Phase 4: Testing/Final Assembly	Team			
P4.1	Finalize Project	Team	0%	3/31/25	4/18/25
P4.4	Prototype Review Presentation	Team	0%	4/7/25	4/7/25
P4.5	Project Video	Team	0%	4/18/25	4/23/25
P4.6	Reports/Documentation/Expo Prep	Team	0%	4/18/25	5/1/25
P4.7	Expo	Team	0%	5/2/25	5/2/25

- **Appendix B: Weekly Update Emails to Industry Supporter**
  - Description: This appendix contains PDFs of all weekly update emails sent to the Industry Supporter, documenting progress and decisions.
  - WEEK_1_EMAIL
  - WEEK_2_EMAIL
  - WEEK_3_EMAIL
  - WEEK_4_EMAIL
  - 3-10-2025 - MEETING
  - 3-12-2025 - MEETING
  - 3-19-2025 - MEETING

- **Appendix C: PCB Design Schematic (Preliminary)**
  - Description: This appendix provides the preliminary PCB design schematic for the SDR project. (on slide 3 of presentation)

    - meeting_agenda_week_3.pptx
- **Appendix D: Component Specification Sheets**
    - Description: This appendix includes the specification sheets for the components selected.
    - PCB_Component Research
- **Appendix E: Statement of Work (SOW)**
    - Description: This appendix includes the Statement of Work
    - statement_of_work.docx
- **Appendix F: Team Contract**
    - Description: This appendix includes the team's contract.
    - QORVO_RADIO_TeamContract.docx
- **Appendix G: Project Management**
    - Description: This appendix includes the team's to-do list.
    - TASK MANAGEMENT