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FYS4260 – Spring 2019
Microsystems and electronic packaging and interconnection technologies

Lab Project
1 - Introduction

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Lab supervisors

- Halvor Strøm
- Erlend Bårdsen

- Stein Lyng Nielsen
- David M. Bang

- Offices at ELAB, rom FV115
- kurs-fys4260@fys.uio.no

- Available all week, come by at elab, send us an email or give us a call if you need help.

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Project objective

Create and build your own electronic circuit board, from idea to an assembled, fully working and tested PCB (Printed Circuit Board).

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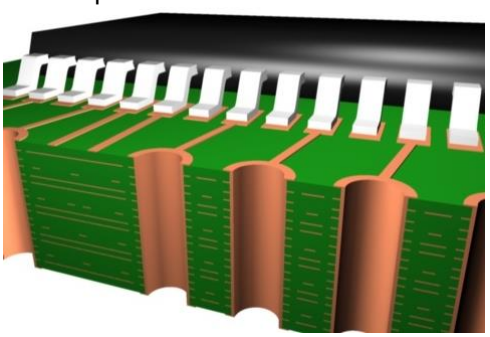
What is a PCB?

- A **printed circuit board (PCB)** mechanically supports and electrically connects electronic components using conductive tracks.
- Components are soldered to pads on the surface of the PCB.
- Using vias to connect the different conductive layers.



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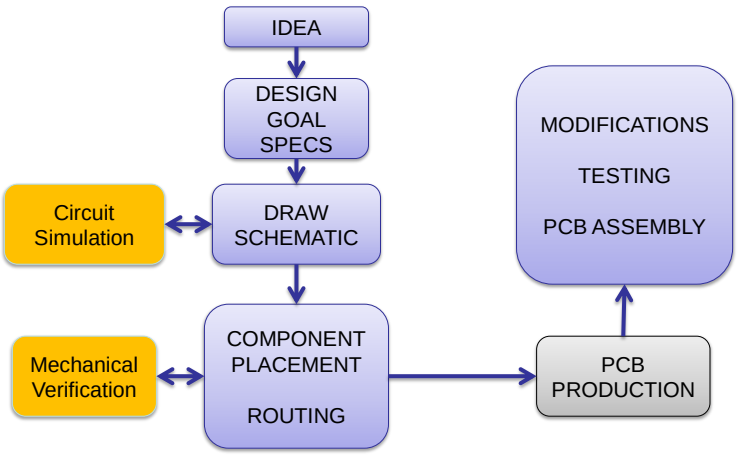
Process Flow



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Lab work

- At room FV442
- 10 computers.
- Organized as «workshops», where each week a short tutorial will be given, explaining the next step in the design phase.
- The workshops will be on wednesdays from 1215,
- Access to FV442 with your student card.
- CadSTAR can be installed on any computer only in the UiO domain.
- It's mandatory to show your work once a week, preferably in the lab!

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Lab info

- Everyone has to make their own schematics and PCB, but you are welcome to collaborate with each other on the same design.
- There is a big difference between working togheter and ending up with almost identical PCBs, and just copying someone else design.
- -> You will not learn anything, and I *will* see the difference … ;)

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Lab «Process Flow steps»

1. Find/decide on a design you want to do.
2. Make the schematics in CadSTAR.
3. Route the design in CadSTAR PR Editor.
4. Generate production files.
5. The PCB is produced externally.
6. Assemble the board at ELAB.
7. Test the board, do modifications.
8. Write a report.
9. Oral presentation.

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Time scedule 2019

- 30/1 – Deadline for project choice
- 6/2 – Deadline for Design Goal Specifications
- 13/2 – Deadline for delivering final schematics
- 28/3 – Deadline for delivering final pcb production files
- 24-25/4 – Assembly of boards at ELAB.
  - Two groups, one day each
  - Starts at 0900!
- 8/5– Deadline for delivering project report
- 14/5 – Oral presentation

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About the design

- Find a design you want to do!
- Ideas at google, www.discovercircuits.com

or pick one of these:

- Electronic dice
- Headphone Amplifier
- FM Transmitter (Mobile to car FM stereo)
- (RIAA amplifier, Guitar fuzz box)

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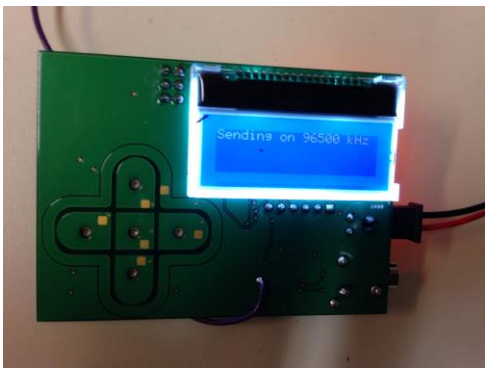
FM Transmitter

- Si4713 FM Transmitter
- ATMega48/328 8-bit Microcontroller
- Capacitive Touch Buttons
- 128 x 32 pixels LCD



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Discrete OpAmp (Amplifier)

- OpAmp built with discrete components
- No Microcontroller
- Dual Channel
- ~2W max
- Runs on batteries or from 5V switcher

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Custom Design?

- Only components already in library
  - Possible to ask for new components, but strict rules to what we might accept.
  - Database at http://tid.uio.no/elab/FYS4260_html_Lib/index.htm
- No high power / high current designs.
- No new microcontroller designs!
  - Use FM design as a start, and add modifications (without altering original functionality) if you want to build a «custom» microcontroller board.
- Each custom design needs to be approved by us!

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About the circuit layout (pcb)

- Starting size 5x7cm
- Use ELAB components
- Four layers
- SMD Components only on top side
- Use default FYS4260 settings

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Project Tools

- For this course we are going to use CadSTAR as our main tool.
  - Design Editor to create the schematics
  - PR Editor to place and route the design
- Mechanical models in Boardmodeller
- (Circuit simulations in Pspice/LTspice)

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LAB PROJECTS WALKTROUGH

- FM Transmitter
- Headphone Amplifier

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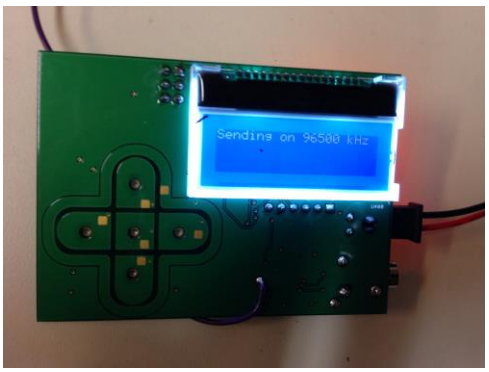
FM Transmitter

- Si4713 FM Transmitter
- ATMega48/328 8-bit Microcontroller
- Capacitive Touch Buttons
- 128 x 32 pixels LCD



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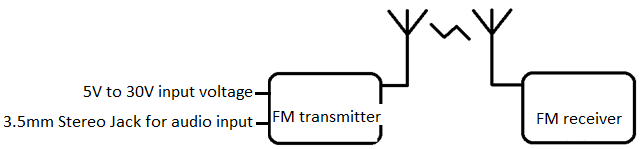
FM Transmitter Description



- Consists of a MCU which controls a FM transmitter, monitors the touch pads and updates the display.
- FM transmitter will transmitt the audio signal input on the 3.5mm stereo jack connector.
- Large input DC converter

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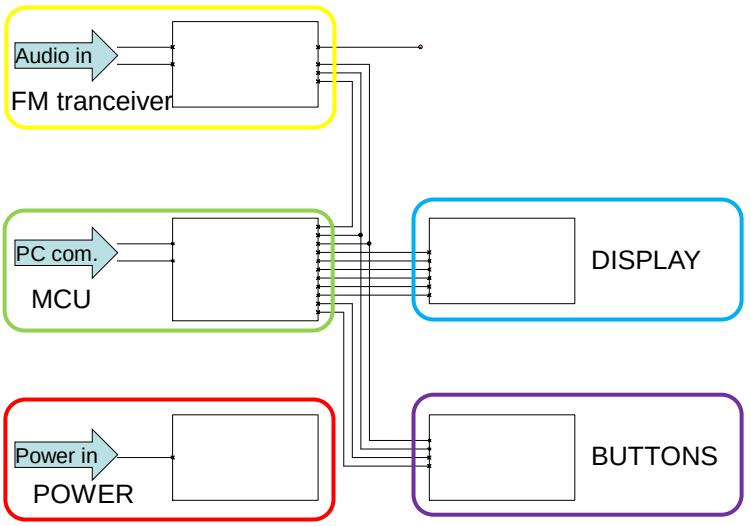
FM Transmitter Top Schematics



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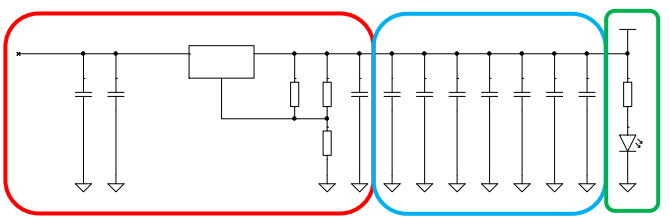
FM Transmitter Schematics - Power



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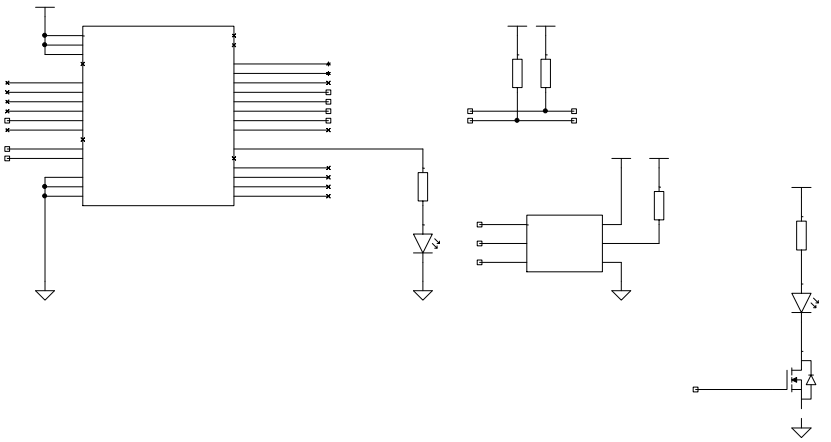
FM Transmitter Schematics - MCU



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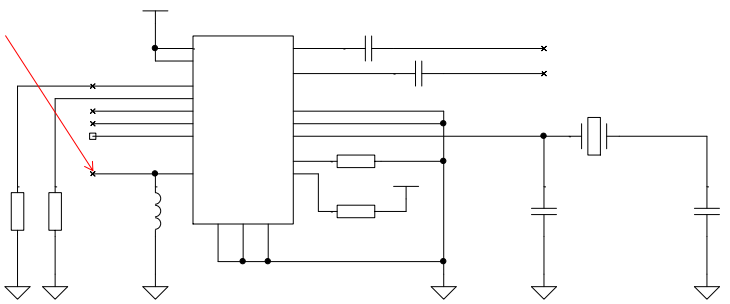
FM Transmitter Sch - Tranceiver



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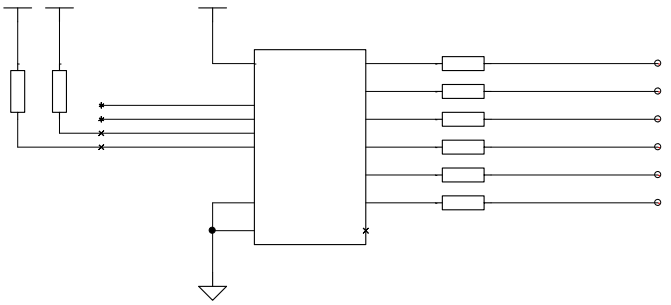
FM Transmitter Schematics – Capacitive Buttons



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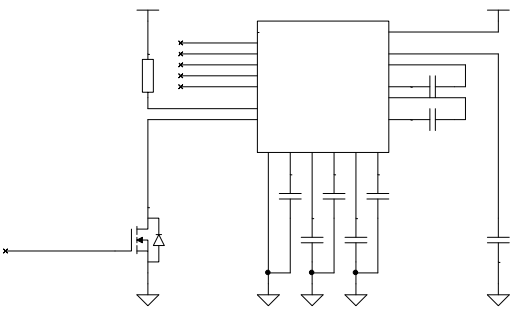
FM Transmitter Sch – Display



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Key points

- Few components
- Mechanical planning important, how do you want to «interface» with your board, used in what environment (multiroom, car, inhouse)?
  - Capacitive buttons (with LEDs?)
  - Display
  - Antenna (internal/external)
  - Power source (eg wall transformer, car adapter, battery, …)
- Possible to extend with own functionality?

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Discrete OpAmp (Amplifier)

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- Dual Channel
- ~2W max
- Runs on batteries or from 5V switcher
- Possible to add battery charger.

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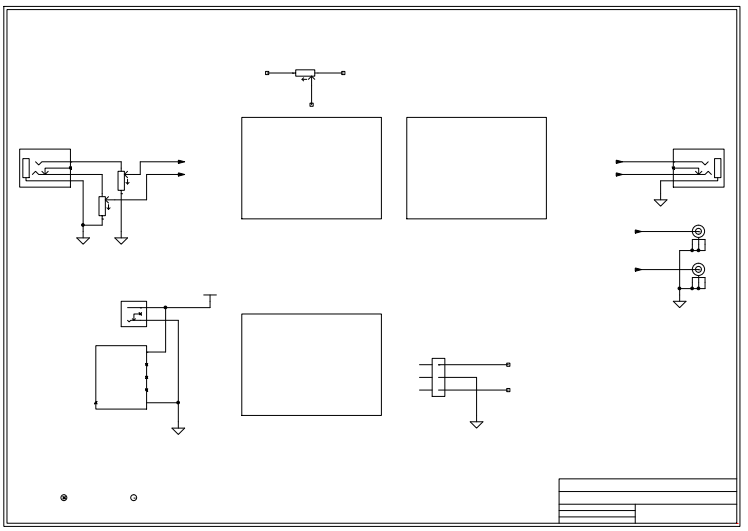
Amplifier Schematics - Top



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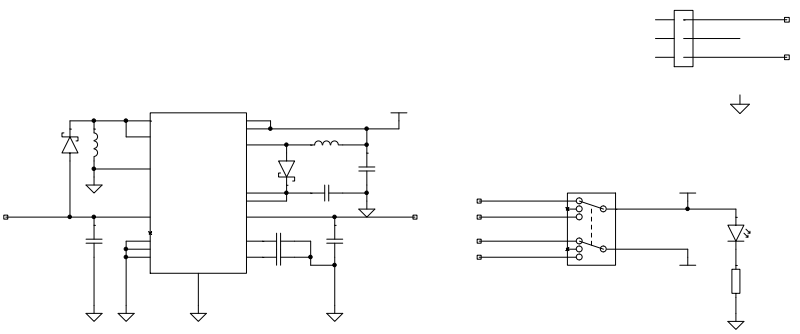
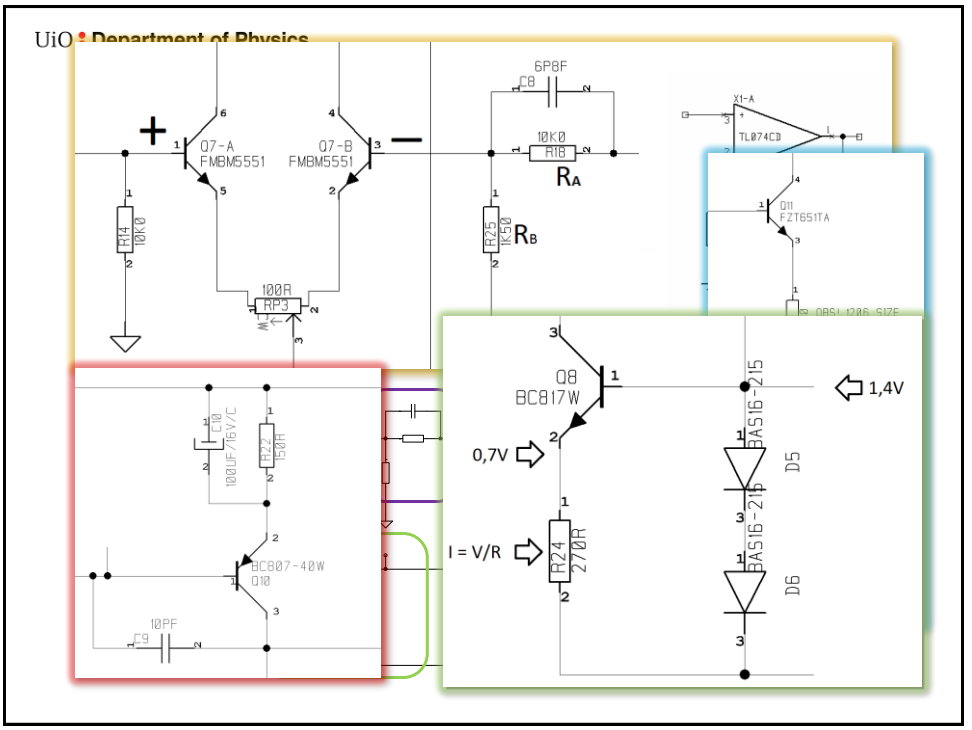
Amplifier Schematics - Power





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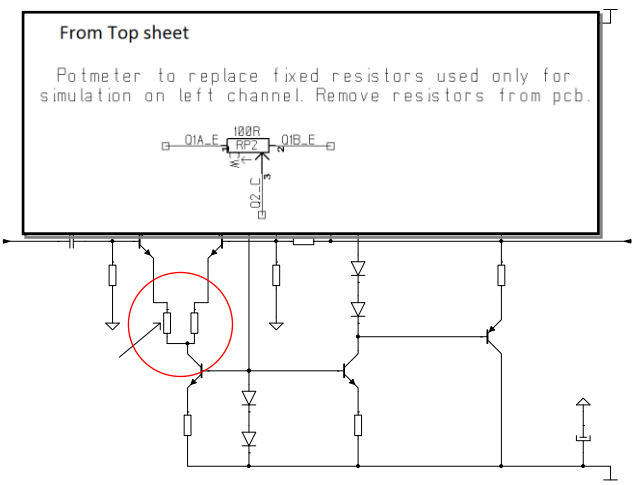
Amplifier Schematics – Simulation channel



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Key Points

- Analog design
- Most components…?
- Easiest debugging…?
  - Includes simulations, reveals most errors.
- Standard packages = easy assembly and rework.