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# SDR Academy 2018: OVI40 Hardware

Anreas, DF90E, presented the OVI40 at SDR academy 2018 in Hamradio Friedrichshafen, Germany.

The recoding of the talk can be found [here](#)

**The OVI40 / UHSDR Project**  
**Part I (DF80E)**  
**Developing An Open Source Standalone SDR**

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signal reconstruction

$$\delta = \frac{P(|X_{k+1}| - |X_{k-1}|)}{(|X_k| + |X_{k-1}| + |X_{k+1}|)}$$

OVI40 presentation held at SDR Academy / Hamradio 2018, Friedrichshafen, Germany)

## The Birth of OVI40 / UHSDR Project

- Looking for an attractive electronics DIY project to attract young people and motivate them for Amateur Radio hobby
- Found mcHF by M0NKA (Chris) as an interesting base – but some important features (like Open Source without any restrictions) were missing
- Creating necessary elements like discussion groups and WIKIs (on <https://www.amateurfunk-sulingen.de>) with multilingual capability, a version control system (git, <https://github.com/df8oe/UHSDR/>) and milestones where the project shall move to
- Growing group of active hams in software coding, hardware creating and improving, testing and producing enhancement ideas

## Creating OVI40 Project

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OVI40 is a project that is

- Open Source in software and hardware
- I will provide hardware in different configurations (only PCBs, PCBs and complete set of components, partially assembled, fully assembled), additional cases will be available
- Modular system (UI-PCB, RF-PCB with ~8 pluggable small modules. OVI40 is meant to be a future-proof system which can grow and be changed individually. "A TRX / RX for many years"
- Connections and wiring is well documented and gives room for own creative work



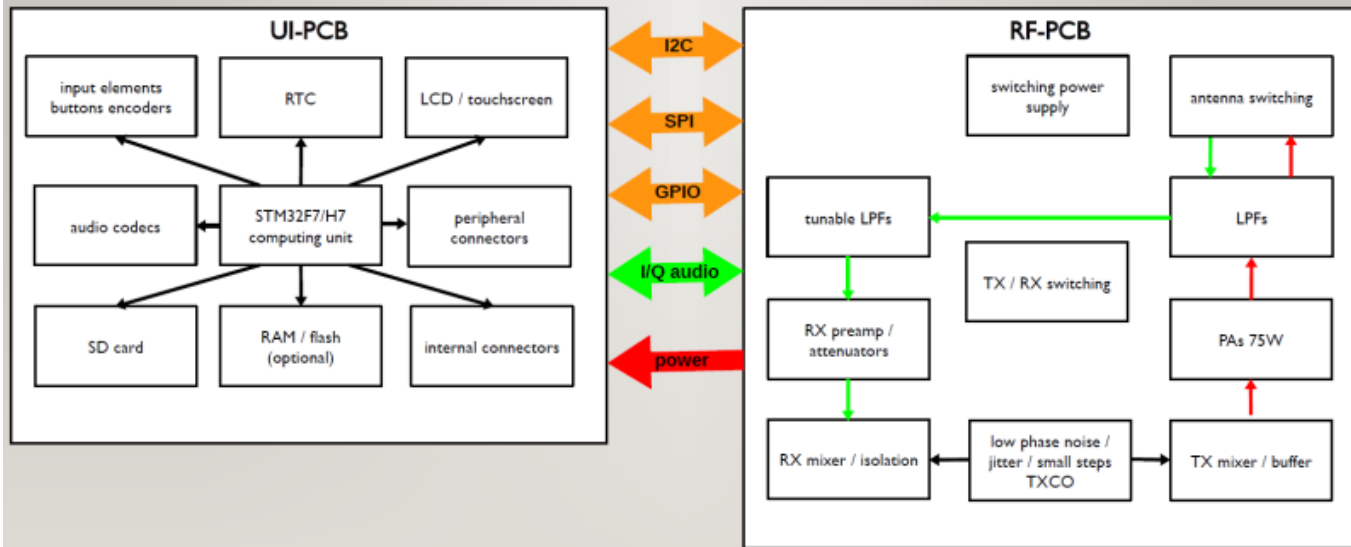
## Technical Specifications OVI40

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- Most parts available from different sources and only described by technical specification not by part-no.
- RX: few KHz ... 250MHz
- TX: same range. 160m...2m ~75W, outside 50mW out of SMA plugs
- Low power consumption, standalone SDR with as many digital modes implemented as possible, pushing functions to firmware
- Signals as clean as possible. Compromise not always on "cheapest solution"
- I2C identification of different module types and versions
- Future planned TX predistortion



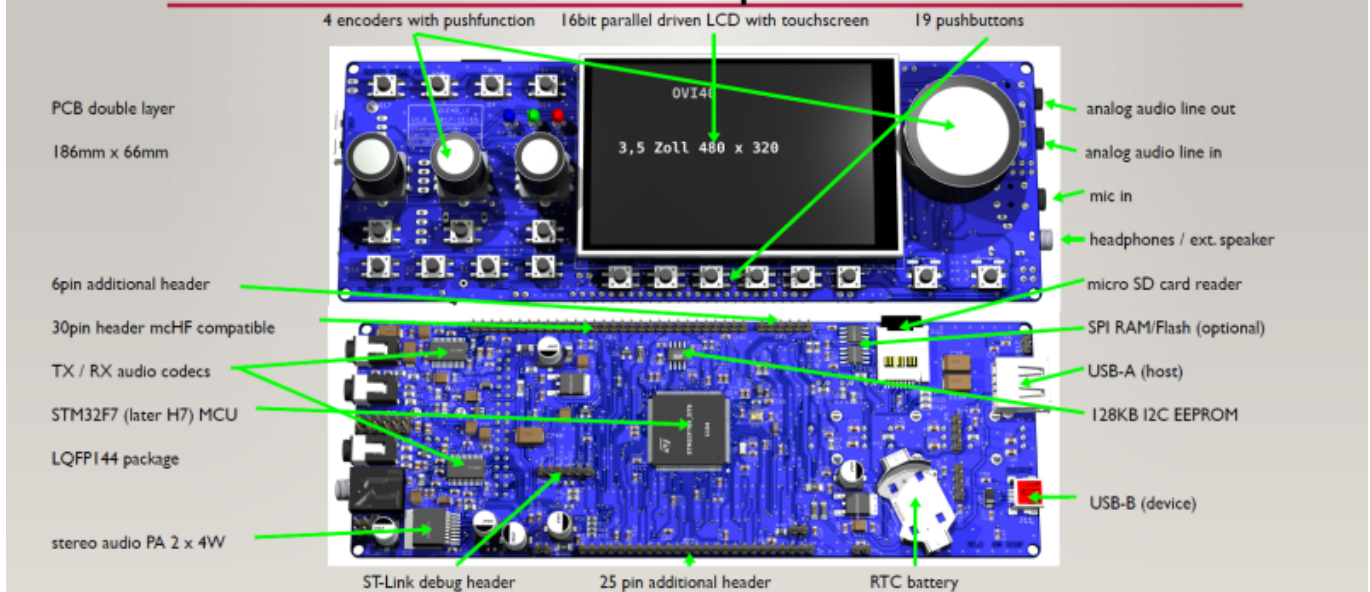
# Block Schematic Diagram



## Technical Description UI-PCB

- MCU STM32F7 (later H7 if available) in LQFP144 package
- 4 encoders with pushbutton function
- 19 pushbuttons
- 16bit parallel driven LCD with SPI touchscreen (480x320 standard resolution)
- 2 USB connections multipurpose (firmware/bootloader update via PC or USB stick, CAT/audio interface, USB memory plug and so on)
- 128KByte serial EEPROM, SD-card reader (SPI), additional flash and SPI-RAM
- 2 audio codecs for TX and RX simultaneously (future: as module)
- 30pin header compatible with mcHF, additional 25pin header

## Technical Description UI-PCB



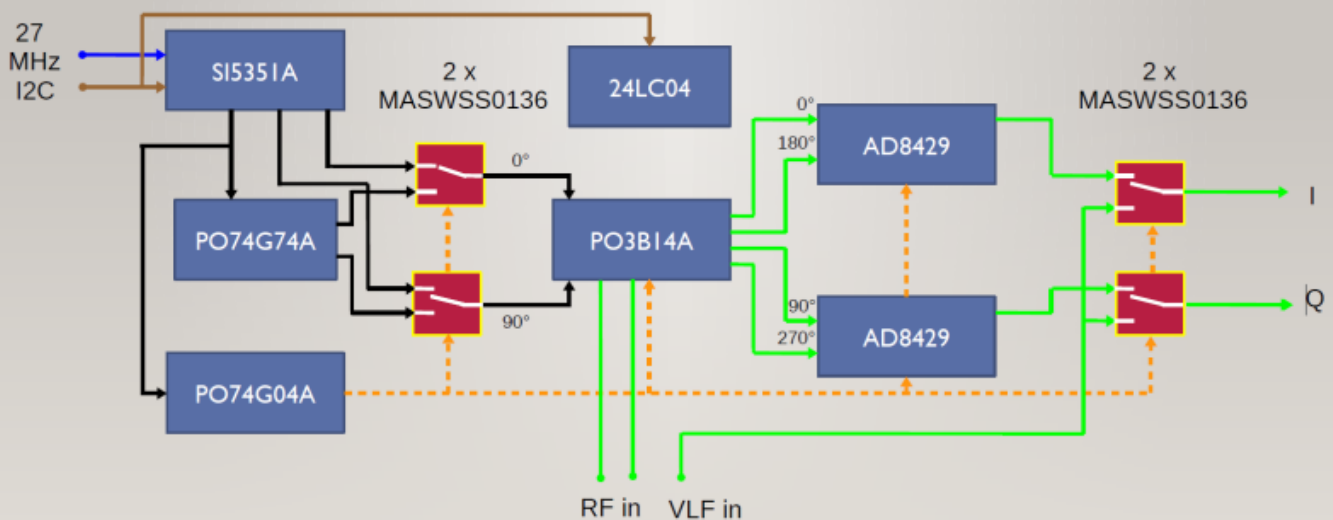
## Technical Description RF-PCB (I)

- RF "motherboard" carries small pluggable modules for future-proof design and preventing electronic waste
- Connections DC, I/O and bus systems (I2C, SPI) on RF motherboard
- RF connections via "direct wiring between modules" using UMCC connectors
- standalone block "PA" for much flexibility divided in two frequency ranges to cover 160m...2m @ 75W
- RX mixer double balanced QSD with instrumentation amps, a) SI5351 provides 90° LO signals (available > ~3.2MHz), b) 90° LO is provided by division /4 (available < ~72.5MHz), c) no mixing "direct conversion" (available < ~48KHz)
- TX mixer double balanced QSE. CW is not provided by mixing but by unbalancing mixer by DC voltage (no spurs except harmonics)

## Technical Description RF-PCB (II)

- RX filtering by tunable LPFs using varactors, individually and automatically created frequency / voltage tables, individually configurable switching frequencies between LPFs
- Switchable RX preamplifier and attenuators
- Switching voltage regulators for reducing power loss and heating
- All adjustments digitally by firmware
- Providing signal outputs / inputs to SMA connectors (programmable via firmware), 4 antenna connectors (programmable via firmware)

### Picking Out One Module – RX Mixer



## Visions for Future

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- “Standalone DIY SDR for the masses” as receiver-only, transceiver and RF measurement purposes
- High lifetime because of Open Source
- Prevention of electronic waste by modular approach and possibility of hardware updates
- Adding features via firmware (e.g. tuner access) by community contributions
- Improving hardware by community contributions
- Integrated “Hall of Fame” emphasizes community character of UHSDR

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