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OVI40 short description

The OVI40-SDR was inspired by the mcHF SDR project. Compared to the mcHF the OVI40-SDR has implemented some major hardware improvements. The OVI40-SDR is using a much more powerful MCU with more processing power, RAM and Flash ROM. The software running on the OVI40-SDR is the UHSDR software which takes full advantage of the evolving OVI40-SDR features. Both projects - OVI40-SDR and UHSDR - are initiated by the same group of hamradio amateurs and both are in active development. Due to mcHF hardware limitations a sub-set of UHSDR runs also on the mcHF.

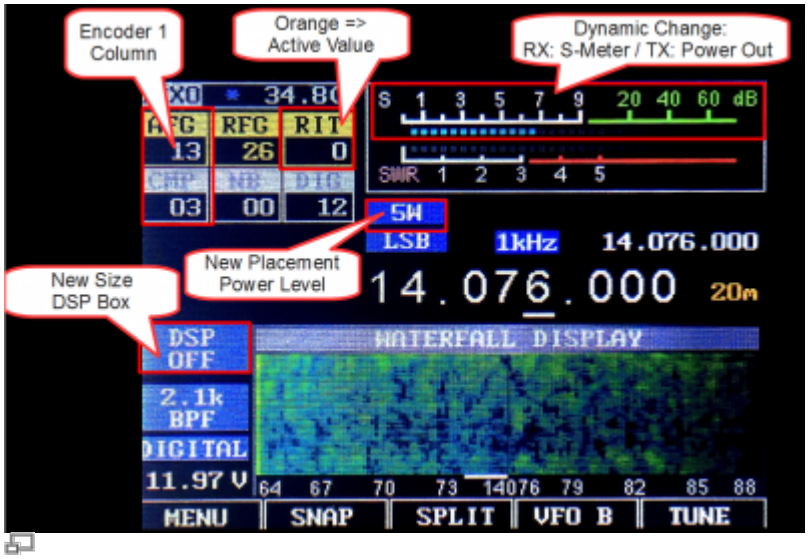
The OVI40-SDR **Hardware** is covered by the [[https://www.amateurfunk-sulingen.de/projects/ovi40-sdr#start|OVI40-SDR project]]. The **Software** is covered by the [[https://github.com/df8oe/UHSDR|UHSDR project]].

The OVI40-SDR is currently in development. The processor- and UI board is already available. The RF board is in the final stages of development with beta-testing starting soon. Both projects - OVI40-SDR and UHSDR - will continue to stay in active development as they did for the past.

OVI40-SDR Hardware

Hamradio Transceiver for the following ham bands:

- 135 kHz & 472 kHz
- 160m, 80m, 60m, 40m, 30m, 20m, 17m, 15m, 12m, 10m
- 6m, 4m, 2m



UHSDR Basic Screen Layout (from Github UHSDR Projekt)

Note: ToDo: Change screen shot to recent UHSDR screen shot

The transmit power is designed to be 50 W (software controllable). The OVI40-SDR is a true SDR

“Software Defined Radio”. It contains a STM32 microcontroller with LCD touch-screen display panel and enables operation as stand-alone rig without the need for additional laptops / PCs etc. Due to its SDR architecture many relevant characteristics are not just implemented in hardware. Many relevant characteristics and features are implemented by software in the UHSDR “firmware” - it is the UHSDR that mainly gives the OVI40-SDR its powerful performance and versatile features. The maximum visible spectrum span at the moment is 48 KHz, planned to be extended in the future. Zoom-in is possible upto a factor of 32. Waterfall display is also provided and it is even possible to display spectrum and waterfall at the same time concurrently. The OVI40-SDR tolerates 12V .. 16V supply voltage, giving a wide choice of portable or mobile power supply and battery options. The UHSDR operation is intuitive and can be done - at the user's choice - with switches / pushbuttons / rotary encoders, or with the touch-panel screen. The extensive service- and configuration menu is equally accessible via push buttons and rotary encoders. The following modulations are supported stand-alone without PC:

- LSB, USB, AM, synchronous AM
- FM (including subtome decoding)
- FreeDV for digital voice
- CW (with integrated CW decoder)
- RTTY
- PSK / BPSK

The OVI40-SDR provides plenty of software defined receive Filters:

- 300 / 500 Hz, 1.4 / 1.6 / 1.8 / 2.1 / 2.3 / 2.5 / 2.7 / 2.9 kHz
- 3.2 / 3.4 / 3.6 / 3.8 / 4.0 / 4.2 / 4.4 / 4.6 / 4.8 / 5.0 kHz
- 6.0 / 6.5 / 7.0 / 7.5 / 8.0 / 8.5 / 9.0 / 9.5 / 10 kHz

… in some casess with several selectable center frequencies, band pass or low pass filter. It is planned to introduced variable filters.

UHSDR also provides a “spectral noise reduction”, an automatic notch filter, a manual notch filter, a manual peak filter as well as a noise blanker. The noise reduction has a similar performance like the well-known DSP based external “speech extractors”. The SSB transmit signal cn be compressed digitally, the degree of compression can be changed anytime by the simple turn of a button. CW enthusiasts will appreciate the bin-aural spacial CW reception as well as the built-in keyer (providing iambic modes “A”, “B” as well as Ultimatic and straight key). The VFO tuning steps can be adjusted: 1 / 10 / 100 / 500 / 1000 / 5000 / 10000 / 100000 are possible values. Dynamic tuning is also provided, where the tuning step size changes with the VFO rotation speed. The Frequency can also be changed by a simple press on a signal in the waterfall or spectrum display and the OVI40-SDR will tune there.

Dual VFOs are provided and allow true split operation.

Das Gerät speichert pro Band die jeweils letzten EinstThe OVI40-SDR is storing all settings (mode, frequency, filter used etc.) per band. This allows for easy operation when quickly changing bands. Further memories are planned. It will be possible to save or restore these memories an a microSD-card - the OVI40-SDR possesses an in-built microSD-card reader.

Das Gerät lässt sich mit einer einzigen USB-Verbindung zu einem PC mit CAT steuern. Es wird das Protokoll des Yaesu FT-817 emuliert. Parallel zur CAT-Schnittstelle wird über das gleiche Kabel eine USB-Audioverbindung (TX- und RX- seitig) angeboten. Der USB-Audioausgang kann via Menü wahlweise auf echtes Audio oder I/Q - Audio umgeschaltet werden, so dass man mit einem externen SDR-Programm (wie z.B. HDSDR) Zugriff auf das komplette RX - Baseband hat. Programme für

zusätzliche digitale Betriebsarten lassen sich mit nur einem USB-Kabel, über das dann ja sowohl CAT als auch Audio läuft, mit dem OVI40 verbinden.

Das Gerät besitzt auch elektrische Bandpässe, die sende- und empfangsseitig benutzt werden. Im Sendebetrieb befinden sich am Endstufenausgang noch Tiefpässe, die für einer weitere Verbesserung des Sendesignals sorgen.

Der OVI40-SDR zählt zu den wenigen Geräten, die die digitale Telefoniebetriebsart FreeDV bereits integriert hat. Damit ist FreeDV “gleich eingebaut” und zusätzliche Hardware wie Spezialmikrofone und/oder Computer sind dazu nicht nötig.

OVI40 RF Board

The OVI40 RF board comprises RF preamplifier, mixer, local oscillator and HF power amplifier. The RF board consists of a base PCB (“mother board”), providing various slots for plug-in modules. The RF board is connected with the OVI40 UI board by means of pin headers. This modular approach will enable to realise hardware performance improvements by changing plug-in boards rather than having to modify or swap the whole RF board.

The RF board development has not yet been completed. Performance data - subject to change at any time:

- RX range from VLF (i.e. a few kHz) upto about 280 MHz.
- TX power 50 W on all bands from 160m to 4m. On 2200 m, 630 m and 2m - if implemented - the TX power will be 10 to 20mW, available on a SMA socket
- pre-selector (automatically tracking)
- PA with dual LDMOSFET design. BIAS current measured with built-in ADC and adjusted separately per FET in software. UHSDR software may read out the BIAS currents and set them.
- TX and RX mixer with low capacity, resulting in reduced local oscillator feed through
- True RX QSD detector with four instrumentation amplifiers
- Use of well shielded switching power supply to generate the internal +5V and +8V voltages. The switching frequencies are adjusted by software so as to avoid harmonics of the switching supply to be in the receive spectrum
- built-in measuring bridge with logarithmic HF amplifiers so that antenna real and imaginary resistance can be measured directly
- additional HF signal, available independantly from RX. This may be used e.g. for a WSPR beacon that can be operated independantly and in parallel to the main TX.
- TRX my be used as a measurement device in the future (network analyzer)?
- Can be used with transverters

Informations above will be updated as development progresses.

Frequency Generation

The OVI40-SDR works as a direct sampling RX upto a receive frequency of 48 kHz. Above 48 kHz the RX works as a QSD.

The local oscillator consequently works as follows:

- 5KHz < F(RX) < 48KHz: direct samplerDirektwandlung
- 48KHz < F(RX) < 3,5MHz: F(LO) = F(RX) x 4
- 3,5MHz < F(RX) < 292MHZ; F(RX) = F(LO)

According to SI5351 datasheet the LO could only work upto 160MHz. Many Internet web sites (including QRP Labs) have found out that the SI5351 can be mostly operated upto 292 MHz. DF8OE has verfied this with a sample of 10 SI5351 - all of them worked upto 292 MHz.

The RF board is using a QSD. The required two LO signals, shifted by 90°, are generated directly in the SI5351 on two of its three outputs - without the need to divide the signal.

Unfortunatelly this approach cannot be used below 3.5 MHz since the 90 degree shift cannot be guaranteed for all frequencies generated anymore. This is why the RF board is using a classical divider to generate the 90 degree signals for all frequencies below 3.5 MHz.

Use with a transverter

Transverter settings in software

The UHSDR software already supports transverter offset settings:

- Choose 10m or 20m band as base band for transverter
- in configuration menu set “XVTR Offs/Mult” to “ON”
- one line below in config menu set frequency difference (usually the transverter's crystal frequency) in parameter “XVTR Offs”

OVI40-SDR transverter hardware support

The OVI40 provides various signals on internal SMA connectors. The PCB and adapter modules themselves use [[https://en.wikipedia.org/wiki/Hirose_U.FL|U.FL “Norm”]]) TE connectors. Pigtail cables will be used as connection from these TE sockets to SMA sockets to be placed on the housing as needed.

The transverter signals need to be as spectrally pure as possible. This is why they are connected to before the PA and after the RX pre-amp.