

SoftRock v.6.1 - IF module for the Elecraft K2

Tony, KB9YIG offered a SoftRock v.6.1 kit to me with a crystal set up an IF-module for the Elecraft K2. The bandpass filter at the input is adapted to the IF of the K2 receiver.

The frequency of the K2 IF is around 4915 kHz. For the standard baseband sampling we need crystals of about $4 \times 4925 \text{ kHz} = 19.700 \text{ MHz}$ or $4 \times 4905 \text{ kHz} = 19.620 \text{ MHz}$, but there no suchs cheap crystals available.

The QSD circuit also responds to odd harmonics of the clocking frequency. In case of the 3rd harmonic sampling an available crystal of 13.0625 MHz may be used with the SoftRock v.6. The jumper JP1 needs to be in the divide by 8 position with pins 2 and 3 bridged.

$$13.0625 \text{ MHz} / 8 = 1.6328125 \text{ MHz} \quad \text{and} \quad 1.6328125 \text{ MHz} \times 3 = 4.8984375 \text{ MHz}$$

I measured with the crystal on the SR6 board 1.632315 MHz whichs gives a 3rd harmonic of 4.896945 MHz.

Because the spectrum is inverted for the 3rd harmonic configuration, the I/Q channels have to be swapped to get the spectrum correctly oriented.

I am using a 'Creative Live! 24-bit External' USB soundcard with my different SoftRock modules. To determine the MDS of the K2 SoftRock v.6.1 the settings for the soundcard are 48 kHz sampling and 24 bits ADC. As presented in figure 1 a MDS of -116 dBm @500Hz bandwidth is measured. The signal in the right part of the spectrum display is the one from the generator of -70.0 dBm used for the calibration.

To compare the result with a standard SoftRock v.6.0, figure 2 presents a MDS of -124.9 dBm @500Hz bandwidth measured using the same procedure. This means about 8 dB less sensitivity for the K2 SR using 3rd harmonic sampling.

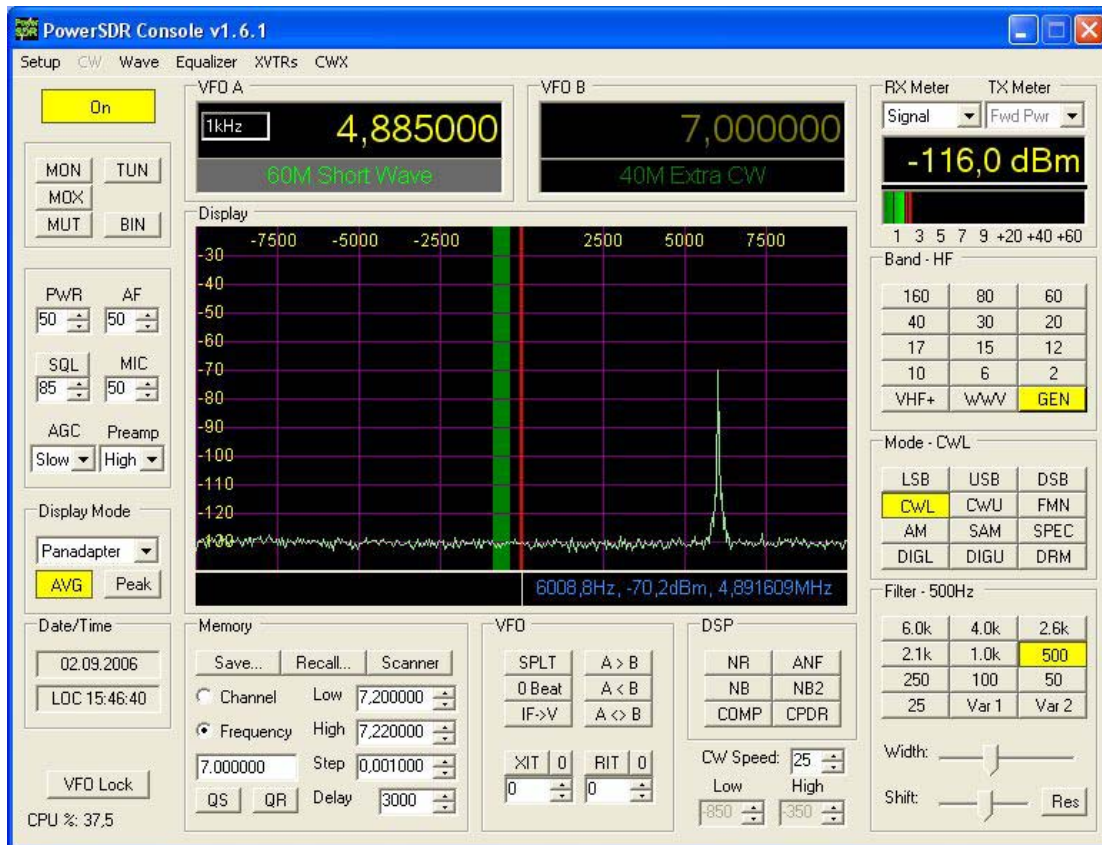


Figure 1: SoftRock v.6.1 K2 IF module MDS measurement

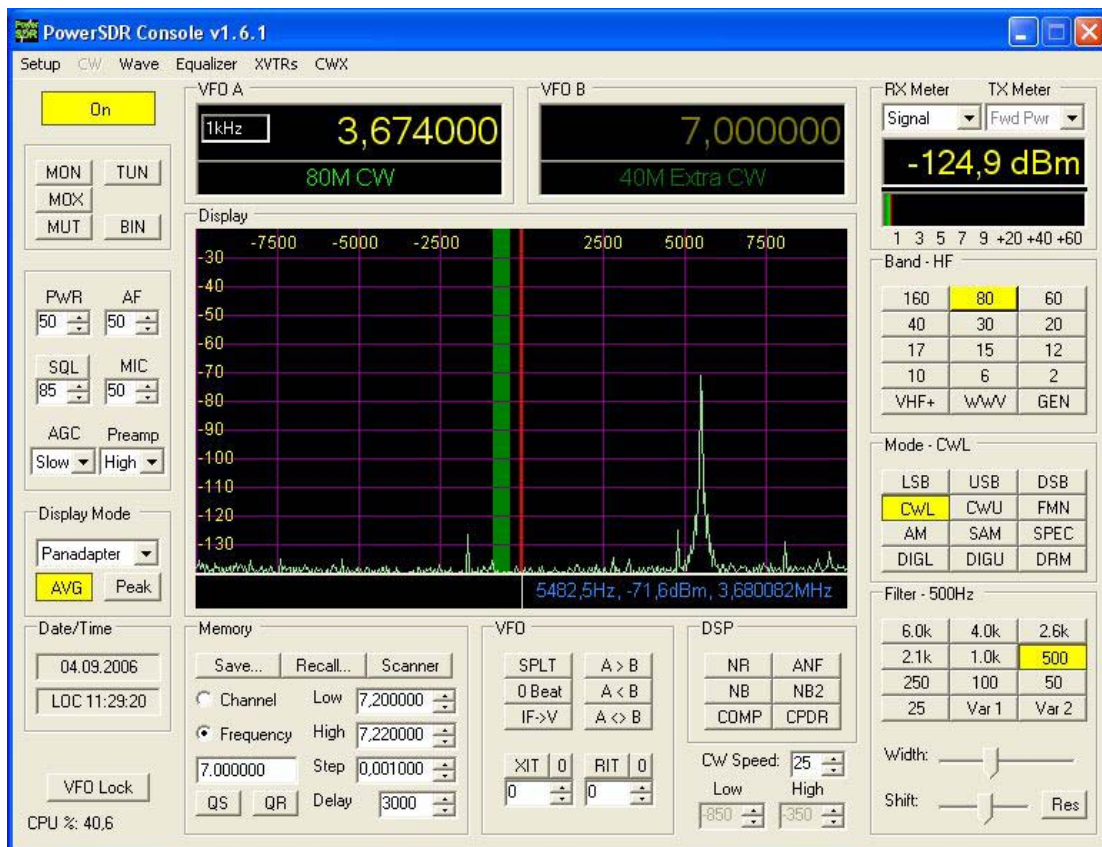
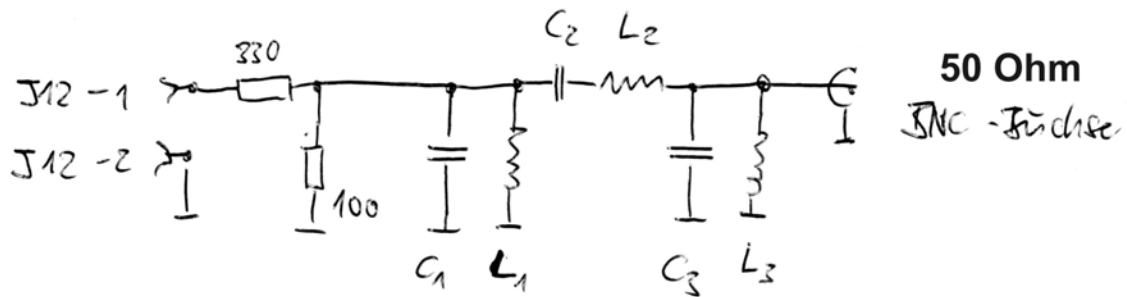
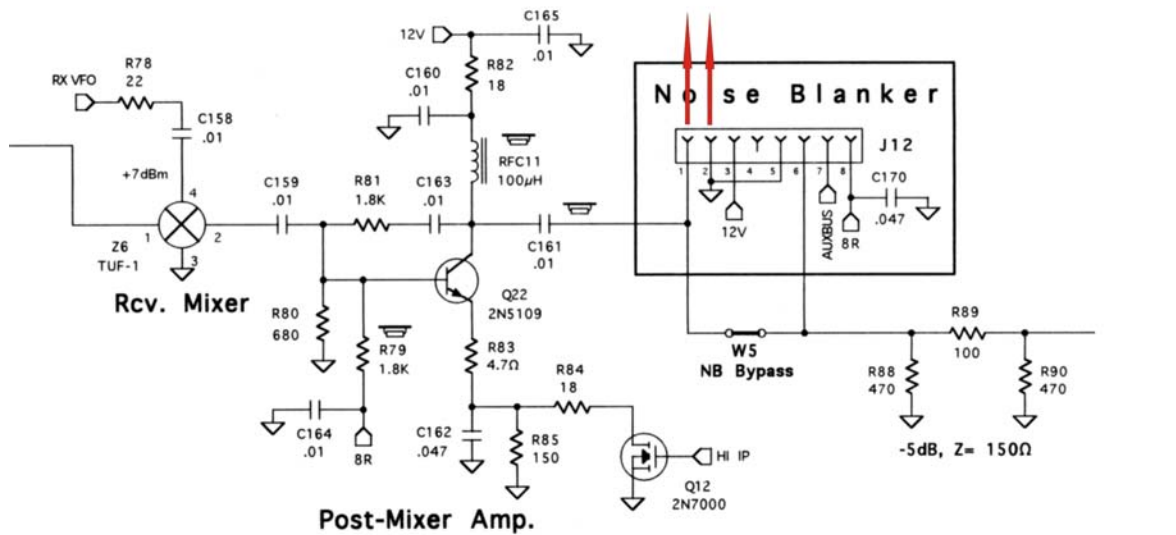


Figure 2: SoftRock v.6.0 standard 80m module MDS measurement

I equipped my Elecraft K2 with an interface to a BNC connector at rear of the rig to get an decoupled output of the IF. There is an easy to install possibility just behind the post mixer amplifier at the noise blanker port to tap the IF (figure 3).



C1 = 4720 pF	L1 = 0.225 μ H	8 t. on T25-2
C2 = 105 pF	L2 = 10.2 μ H	49 t. on T30-2
C3 = 3750 pF	L3 = 0.285 μ H	9 t. on T25-2

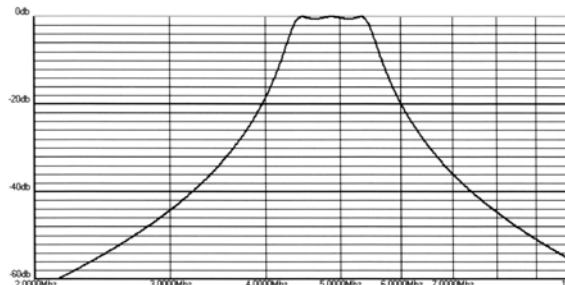


Figure 3: IF output for the K2

The operation of the SR6 K2 IF module is shown in the following screenshots. I like the program 'MOKGK SDR Decoder' very much for measurement purposes. It can be calibrated and has a lot of possibilities to configure the display.

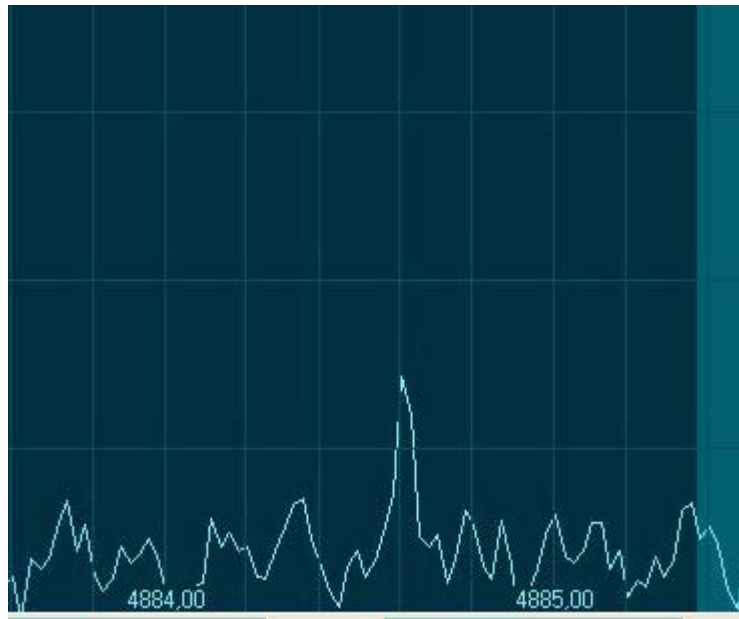


Figure 4: A S1 signal of approx. $0.225 \mu V_{\text{eff}}$ at the K2 antenna input. The K2 internal preamplifier of +14 dB is on, setting PRE. Spectrum display with vertical 10 dB/div. Obviously the noise background of the SoftRock is limiting the dynamic range.

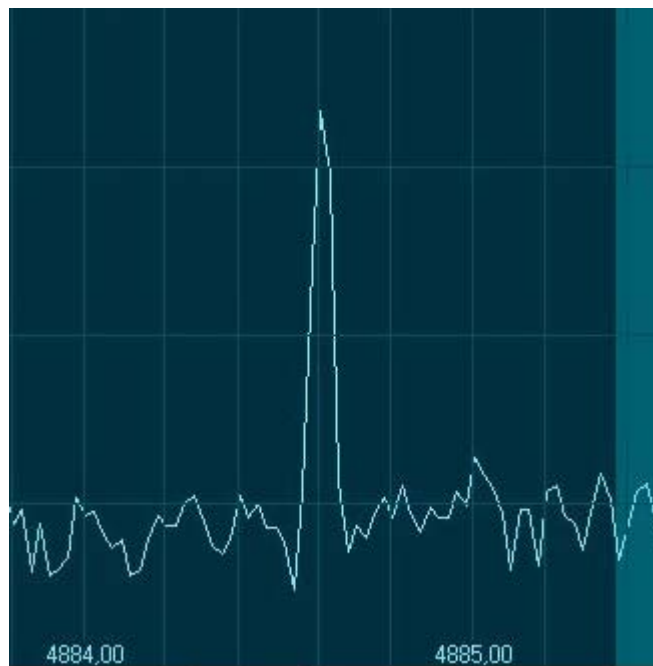


Figure 5: A S1 signal of approx. $0.225 \mu V_{\text{eff}}$ at the K2 antenna input. The K2 internal preamplifier of +14 dB is on, setting PRE. An additional amplifier of $\approx +20$ dB is introduced at the input to the SR6 K2 module. The signal level comes up by these ≈ 20 dB. The background noise comes up by only ≈ 5 dB, which means that is now the noise floor of the K2 IF. The gain in S/N is ≈ 15 dB. Spectrum display with vertical 10 dB/div.

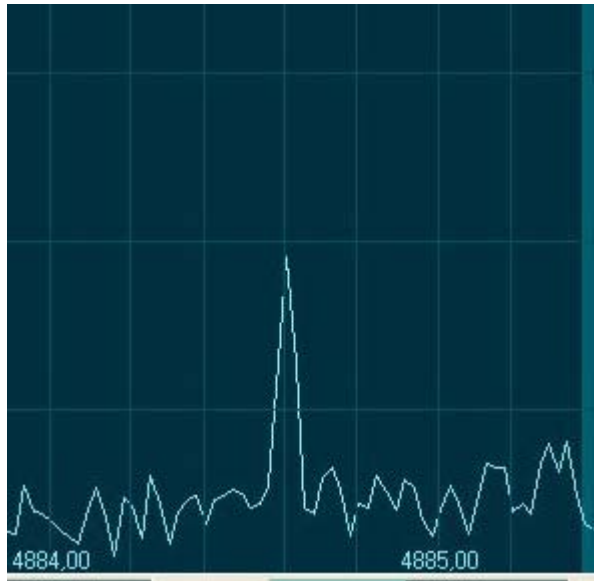


Figure 6: A S1 signal of approx. $0.225 \mu\text{V}_{\text{eff}}$ the K2 antenna input. The K2 internal preamplifier off. An additional amplifier of $\approx +20 \text{ dB}$ introduced at the input to the SR6 K2 module. Spectrum display with vertical 10 dB/div.

In the complete configuration **K2 -> BPF adapter -> SR6 K2 module** the sensitivity is too low. This result follows from the measurement of figure 4. Only with the K2 internal preamplifier switched on, a S1 signal will be detected. Beside the signal levels of the K2 IF, the loss in signal level due to the bandpass filter adapter of figure 3 is the other main reason. A simple preamplifier has been introduced at the input of the 'SR6 K2' (figure 7) which enables the results presented in the figures 5 and 6.

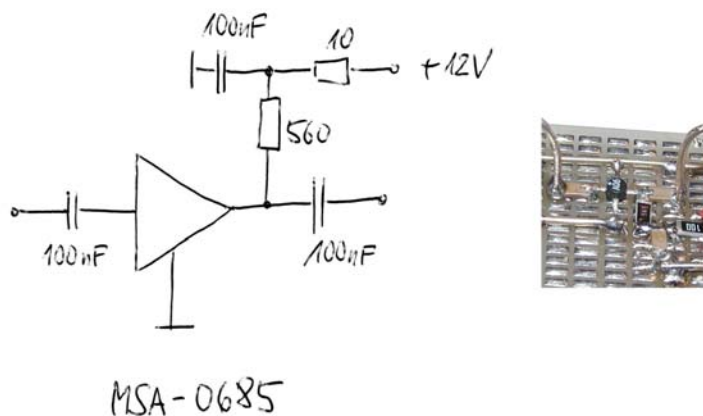


Figure 7: Preamplifier used at the input of the SR6 K2 module.

This is a list of adapted values for this SoftRock v.6.1 – K2

5 MHz Oscillator and BPF for v6.0 IF use

SoftRock operated in 1/3 sub-harmonic sampling mode. Reverse audio cable connection to board with tip going to R on board and ring going to T on board. JP1 needs to be in the divide by 8 position with pins 2 and 3 bridged.

OSC:

Crystal X1 is 13.0625 MHz

C5 220pF

C6 100pF

BPF:

C21 = C23 = 1000 pF

C22 = 220 pF

L1 14T of #30 on a T30-2 core (0.85 uH)

L2 30T of #30 on a T30-2 core (3.9 uH)

T1 14T of #26 on primary and 7T of #30 in each of the four secondary windings "bifilar" over the top of the primary on a T30-2 core (0.85 uH on primary)