

Software Defined Radio with USB Interface

SOFTWARE DESCRIPTION

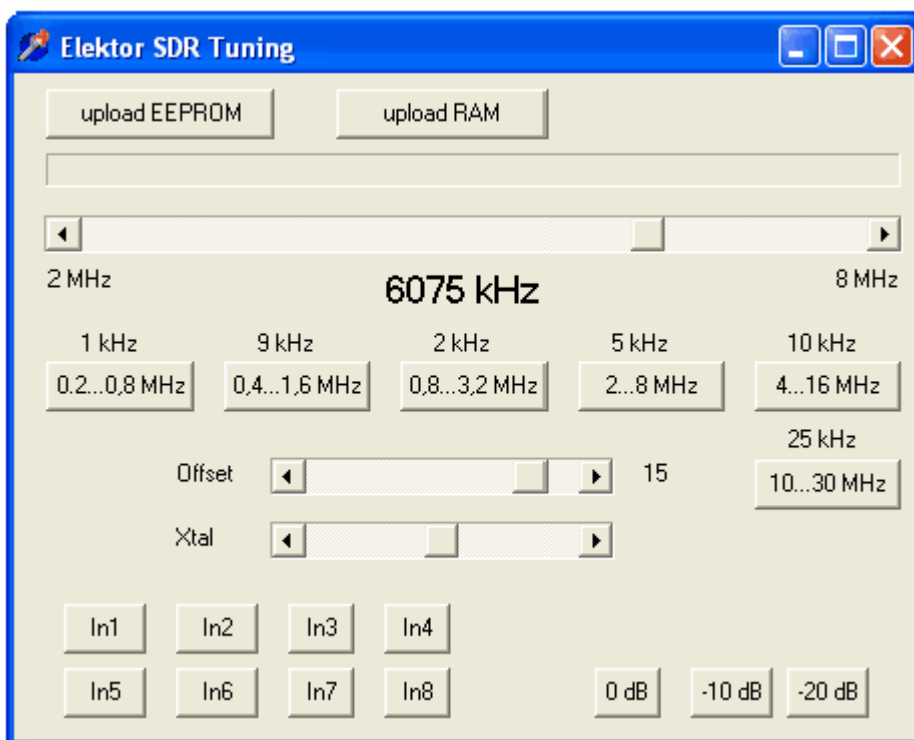


Figure 1. The control program.

The CY27EE16 programmable clock generator

must be initialised at first power-up. Click on 'Upload EEPROM' (see **Figure 1**) and load the file 'InitCal.bin' into the chip. When next powered up the device will automatically copy the data into its RAM. Now you can either unplug the USB connector and reconnect it or load the same data file into the chip's internal registers manually using 'Upload RAM'. The generator should now be producing two frequencies. At the Clock5 output there should be a $4 \times 6060 \text{ kHz} = 24240 \text{ kHz}$ signal, suitable for reception in the 49 m band; at the Clock3 output there should be a 5 MHz signal useful for calibration purposes.

A desired frequency can be set using the frequency slider. The first step is to select a tuning range. Each range has its own PLL step value: in the short wave range from 2 MHz to 8 MHz, for example, the PLL is tuned in 5 kHz steps, which is a good fit with the channel spacing typically used. Similarly, in the medium wave range the step size is 9 kHz. The offset slider setting does not affect the actual frequency, only the frequency display. The initial setting of 15 kHz assumes that the subsequent decoder software is configured to use an intermediate frequency of 15 kHz, as shown in **Figure 7**.

The third slider, 'Xtal', allows for fine adjustment of the frequency. It provides for direct adjustment of the load capacitor on the 10 MHz crystal. Normally the correct setting, even in the absence of capacitors C12 and C13, will lie at the middle of its range. If desired fine calibration can be carried out, for example by using a known broadcaster as a frequency reference.

Buttons 'In1' to 'In8' switch between the antenna inputs (i.e., between the input filters). When the program starts up In1 (no input filter) is selected. In2 selects the low-pass filter for medium wave reception, and In3 selects the input with a high-pass filter for short wave reception. Inputs In4 to In7 are reserved for future expansion, while In8 selects the 5 MHz reference signal.

The final three buttons allow the output signal to be attenuated by 0 dB, 10 dB or 20 dB, allowing for the reception of stronger signals without clipping.

DECODER SOFTWARE

All that remains is the actual radio decoder. Almost all the main characteristics of the receiver are determined by the software used. For initial testing we can use SDRadio; further possibilities include DREAM and G8JCFSDR.

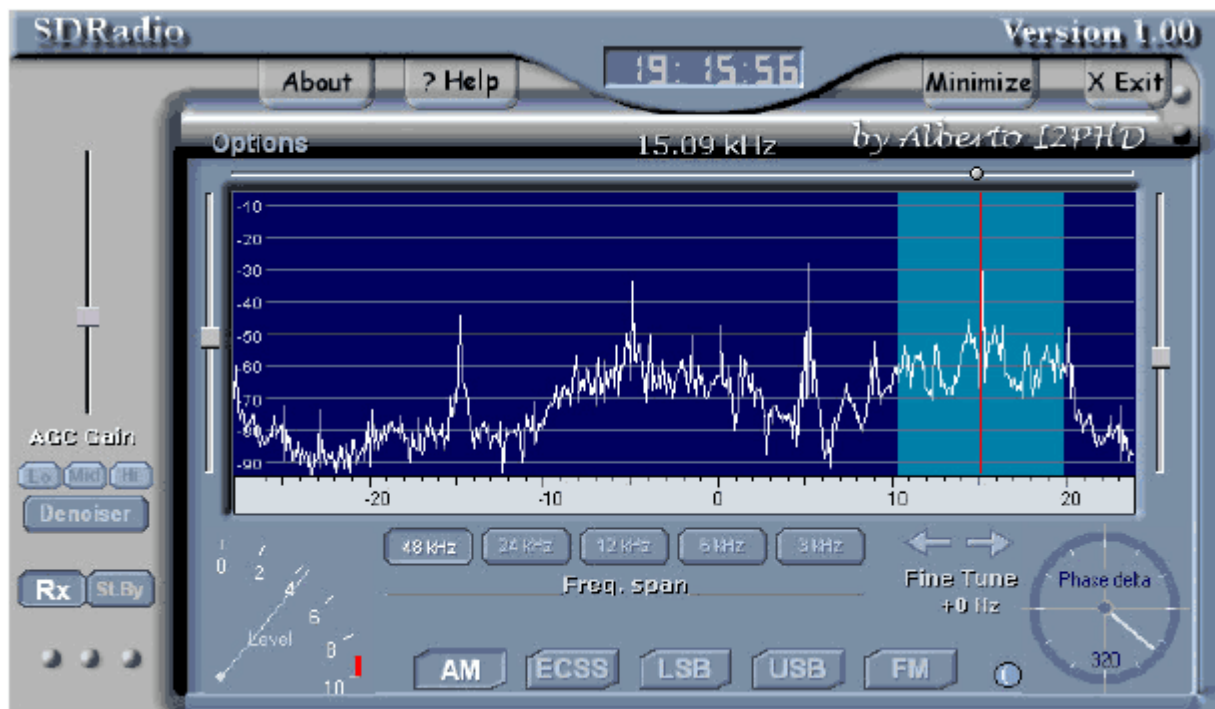


Figure 7. There are four AM stations visible in the spectrum of this received signal.

It is in any case necessary to ensure that the soundcard is configured correctly. The line-level input must be enabled and the input gain set suitably. Ideally the 5 MHz reference signal should come in at just -10 dB. This will allow the strength of a received signal to be read directly: a signal with 'S9' strength, defined as having an amplitude of $50 \mu\text{V}$ at the antenna input, will then be at -60 dB.