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SDR CUBE – An Initial Overview

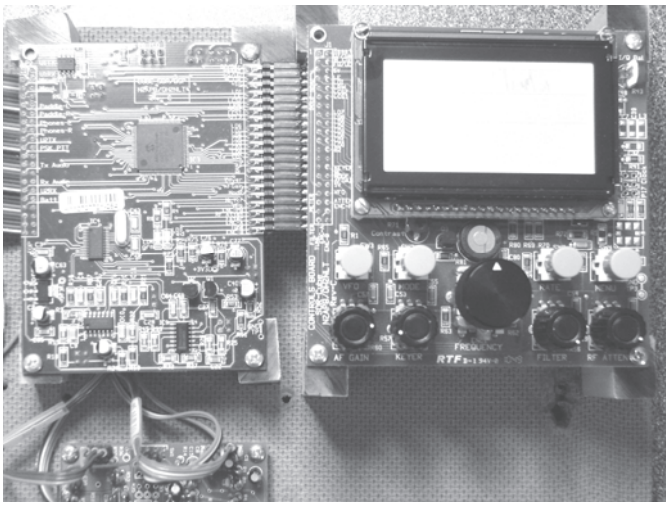
In a separate article, I gave a brief overview of the SDR2GO**(1)**. Another entry to the stand-alone support for SoftRocks (and other QSD/QSE RF decks) is the SDR Cube**(2,3)**. Both of these devices provide the backend DSP functionality necessary to process I/Q signals for receive and transmit with SoftRocks, plus frequency control (for Si570) and PTT. Both provide SSB and CW operation.

The SDR2GO is an inexpensive ($74) single-board solution (with two micros) and is somewhat basic. The SDR Cube costs more ($245 three-board kit), is much more sophisticated – and a pleasure to use. The SDR Cube has a commercial product feel, with several ordering options, including a nice case that can house a SoftRock RxTx 6.3 as well as the Cube's circuitry. They even sell a licensed version of the RxTx 6.3. Assembled and tested units are also available. Details and pricing can be found at the SDR Cube web site: www.sdr-cube.com.

HARDWARE OVERVIEW

I've only had a test-bed version of the SDR Cube for about a week, with much of that time unusable due to lightning storms, so the information here is limited. Picture 1 shows two of the boards (Controls and DSP). What hits you right away is the very sexy blue 128x64 graphic LCD display. No simple two lines of plain text here. The display shows the current operating frequency in large characters in the middle, along with several lines of important information below that. But, the most interesting part of the display is the small bandscope/panadaptor right above the frequency readout. Its use is more effective for the CW segment of the bands, since it is limited to a total of 8-kHz width, but is a very welcome addition.

In addition to the display, the front panel (Controls board) has a large rotary encoder for frequency tuning, four pushbuttons (VFO, mode, tune rate, Menu), and four smaller pots (AF gain, keyer speed, filter BW, RF atten). Each of these controls also has a secondary and tertiary function. My only nitpick is that the other controls crowd the tuning knob slightly. There is also room for either an optional Si570 or AD9851 DDS chip under the LCD display.



The IO board handles input/output connections to other devices, including mic in, and phones out. It also has connectors for 12V power in, and paddle input. The Cube provides its own keyer. An optional DB15 allows external SoftRocks or other boards to be connected as well. There is also a DIN connector to connect to a NUE-PSK unit.

The single microcontroller, a dsPIC33FJ256GP710**(4)**, resides on the DSP board, along with the TLV320AIC23B**(5)** codec. This is a larger dsPIC than on the SDR2GO, it handles not only the DSP functionality, but also all the SoftRock controls and the user interface as well. The codec is a larger package than the QFN version used on the SDR2GO board, which makes soldering easier.

The DSP board plugs into a connector on the Controls board, and the IO board plugs into the DSP board via a ribbon cable. If an RxTx 6.3 is being used, it sits behind the Controls board in the Cube's case.

There are two more optional boards to enhance the SoftRock's operation. One is a small preamp, designed to go where the 6.3 receive band-pass daughterboard normally plugs in, and a small external low-pass filter board can be added at the Cube's RF output jack, to improve the RxTx harmonic suppression.

The SDR Cube is designed to package both the Cube hardware and the SoftRock in a single cube-like box. This reduces inter-board cabling and potential connection issues. There are questions almost daily

about why QSD/QSE radios suddenly have no image suppression, which are almost always associated with bad connections between the RF deck and the sound card. Having your radio all boxed up drastic reduces the potential for image problems.

The dsPIC has a boot loader, so software updates to not require any specialized (read expensive) devices for the occasional update. Both source code and uploadable hex images are available on the SDR Cube web site. About the only thing missing from the Cube that the SDR2GO has is a PS2-style keyboard interface.

The SDR Cube online documentation is very nice. There is a 40-page operating manual that addresses how to connect it up, calibrate it, update the software, and use most of the functions. They also have Software development manuals, schematics, and other information. The SDR Cube Yahoo group has some software for WSPR operation.

SDR CUBE OPERATION

Using the SDR Cube is a breeze. It has two VFOs, which are pushbutton selectable. I've used this to quickly QSY between the CW and voice band segments while playing with it. The SoftRock 6.3 connected to this particular cube is a 20-m rig, for which I have limited antennas right now. The interested reader is encouraged to peruse the SDR Cube web site for pictures and details.

Once power is applied and turned on, the display first shows the software version, and then switches to the normal display. The operating mode (LSB/USB/CW/CWR) is clearly displayed, and the current filter bandwidth (3.6 kHz, 2.4 kHz, 1.5 kHz, 700 Hz) is shown graphically.

Tuning can be accomplished at three rates: 100 kHz, 1 kHz, and 10 Hz. The frequency display is to tens of Hertz. There are 40 frequency memories available, along with an RIT. There is both an audio gain control and an RF Atten control, which needs occasional adjustment for very strong signals.

The bandscope covers 8 kHz, and is based on a 128-point FFT. The vertical resolution is fairly limited, so there are five bandscope sensitivity settings. An An SSB signal can easily take up to more than one-fourth the scope's width, so it is more useful for CW.

For CW operation, just plug in a set of paddles. The internal keyer has several modes, with speed adjustment from 1-99 wpm. The Cube can even go into transmit automatically with any paddle operation.

The "Aux" port on the IO board is to allow an RS232 connection to the Cube. This can be used to read rig status, or run diagnostics, using a terminal program. It is also used to bootload new versions of software into the dsPIC.

The Cube can also provide band-switching information, using either digital codes or Yaesu analog voltage signals.

BOTTOM LINE

The SDR Cube costs more than the SDR2GO, and takes up more space. But, the operating enjoyment factor is dramatically higher. The display is great, and the user interface is more natural. It should also be easier to modify for other applications, since there is only the one dsPIC microcontroller that handles everything. With three boards, it will take longer to build, but the great manuals and other online documentation mitigate this. Individual boards, a complete kit, or even assembled units are available. A cost of over $700 to buy a complete, assembled unit including SoftRock seems like a lot to me as a builder, given the price of FT817s and other rigs of that ilk. But, the other options, including the purchase of a SoftRock RxTx 6.3, seems like a great way to build an SDR rig, especially if one must do it piecemeal.

I have really enjoyed my limited time playing with the SDR Cube so far, and am planning ways to take advantage of it as a back-end development package for more sophisticated SDRs, such as DDC/DUC-based designs. Get me a sharp X-acto knife!

REFERENCES

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