Letters to the Editor

Build a Low-Cost Iambic Keyer Using Open-Source Hardware (Sep/Oct 2009)

Larry,

I read the article by Richard Chapman in the Sep/Oct, 2009 issue of *QEX* with great interest. He built a keyer using the Arduino board and writing the program in *C*.

It was interesting because, although there have been many articles about keyers in the amateur literature, none of them (to my knowledge) have used a higher level language — they are all in assembler code.

To build a similar keyer to the one in the article, however, you have to buy an Arduino board, an Atmel programmer and install an integrated development environment (IDE) such as *WinAVR* to build the code. *WinAVR* is free and the hardware isn't much but it won't leave a lot of change from a $100 bill.

STMicroelectronics recently offered a $7 board called their STM8S-Discovery board, which has a built-in programmer using the USB port and they also offer a free IDE for programming it in *C*. This board is available from distributors like Digikey and Mouser and is a great deal. I've been expecting someone to write an article about using this board for Amateur Radio projects (it has lots of FLASH memory and RAM space so it could be used for quite sophisticated projects).

— Regards, Jim Koehler, VE5FP, 2258 June Rd, Courtenay, BC V9J 1X9, Canada; **jark@shaw.ca**

Hi Jim,

Thanks for the tip about this inexpensive development board. It sounds like another good learning tool. If you have a project in mind, please share it with our readers.

— 73, Larry Wolfgang, WR1B, QEX Editor; **lwolfgang@arrl.org**

A Question for QEX Readers (From May/June 2010 Letters)

Dear Rod,

I am glad to see someone else experimenting with these mixers. I use the 74HC4052, but I believe the issues will be the same. There are two issues to take a look at. The first issue is that the mixer is very sensitive to harmonics. Harmonics will directly degrade IMD performance. Harmonics would also likely mix with your clock spurs in the 300 MHz to 500 MHz range that you noted. The difference frequencies may very well be near audio. This problem is often neglected or insufficiently addressed in low cost SDRs. Try adding an RF filter ahead of the mixer to suppresses harmonics by at least 60 dB.

The second issue to look at is that the audio amplifier will react unfavorably to RF. Most low cost SDRs use a single capacitor to decouple RF from the audio amplifier. This is not enough. Try adding a passive filter between the mixer and audio amplifier. The filter should have several sections and provide good attenuation outside of your desired passband.

You may test the amplifier for sensitivity to RF by first sending a high quality audio signal to the amplifier. Make sure IM2 measures over –100 dBc. It will take a great audio oscillator to do this. I use my audio oscillator with a good LC filter. I use Linrad and my Delta44 sound card to make this measurement. Now inject some RF at various frequencies and observe the level needed to degrade IM2. It may respond to only a few millivolts.

This may give you an idea for the amount of attenuation needed. You may also evaluate the RF spectrum of the mixer output. I use a scope for this. This level may be a few hundred millivolts from only clock leakage.

Please let us know the results after you test for these two factors. I have only tested my mixer at 4 MHz. That is my intermediate frequency. The 74HC4052 is good up to about 10 MHz, but has very good dynamic range due to the higher power supply voltages used (±5 V dc).

— 73, Jim Shaffer, WB9UWA, 1310 Hanson Dr, Normal, IL, 61761; **wb9uwa@gmail.com**

Crystal Ladder Filters for All (Nov/Dec 2009)

Dear Larry,

Jack Hardcastle, G3JIR and I have recently been contacted by Dave Gordon-Smith, G3UUR, who made us aware of his development of the "quasi-equiripple" (QER) modification of the popular Cohn ladder filter. This is described in the 2010 *ARRL Handbook* in Chapter 11, section 11.6.2 (Chrystal Filter Design). It is a significant improvement, combining the simplicity of the Cohn topology with very low ripple values in the passband. This allows the design of filters with ripple values between 0.1 dB (6 poles) and less than 1 dB (12 poles) — impossible to achieve with a standard Cohn filter. I have therefore applied the Dishal equations to Dave's model and implemented it in the new version 2.0.3 of the Dishal program as "QER(G3UUR)." The help file has been updated with a short description and also shows a simulation picture of an 8-pole SSB filter with Cohn versus QER curves.

Dave also verified my suspicion that the popular simplified evaluation formula for his oscillator method to characterize crystals leads to slightly inaccurate results. This has also been updated, using the more accurate equations. The user has still the option of using the simplified form for compatibility reasons, however.

I would like thank Dave for this contribution to further enhance the Dishal program. I am sending you the complete updated