TECHNICAL CORRESPONDENCE

TEN-TEC ORION II PRODUCT REVIEW

◊ There were a few assertions made in the September, 2006 Ten-Tec Orion II Product Review that I believe need some clarification. I should stress in the strongest way that none of my comments is meant to criticize either Ten-Tec or the Orion II. They are a top-notch company and the radio looks to be marvelous. I wish I had one.

As one of the authors of the FlexRadio SDR-1000 software, however, I think it is necessary to highlight some distinctions between the Orion II as a software-defined radio and the combined SDR-1000 hardware, the PowerSDR console, and our DSP core that implements the signal processing of the Flex radio. That DSP core has its own name: DttSP.

It is reported in the review that "The difference between the Orion and an open-source FlexRadio is in the development process." It is true that the development processes are very different. My co-author, Bob McGwier, N4HY, and I are not Flex employees. What we did was to provide a general-purpose DSP core for implementing a software radio on effectively any general-purpose computer. Furthermore we did it as unpaid volunteers, and have issued the software as Open Source under the GPL (General Public License). This has some profound consequences that all hit home after the development process has run its course.

1) The software is available for anyone to read, study or modify, for free.

2) The software is capable of being built and applied using free software tools.

3) It is a straightforward matter for anyone to modify, replace or enhance the software on their own and use it with the SDR-1000 hardware.

4) It is a similarly straightforward matter for anyone to use our software with some other hardware, as, for example, the SoftRock simple SDR front ends designed by Tony Parks, KB9YIG.

5) The software is portable to processors other than the x86 or similar architecture.

None of this happens to be the case with the Orion software, which runs on embedded DSP chips, and which to date has not been released to the public. Furthermore, while the Orion software can be updated in the field, the software has to come from Ten-Tec, not users or independent developers.

There are some — what you might call second-order — consequences, too. A number of features are designed into and implemented in DttSP that are not yet available in the "official" Flex console, but which have been exploited in various experimental designs by other developers. For example, DttSP is capable of realizing arbitrarily many receivers and transmitters within the front-end passband. This makes possible not just dual-watch but, say, quad or octal watch, or more. Several of the recent digital-mode programs offer an analogous feature — multiple signal decoding. DttSP extends this to full radio functionality. A prototype console offering multiple simultaneous receivers in any mode was developed over a year ago by a user, Bob Cowdery, G3UKB. Such a feature is difficult to provide using a hard-wired front panel such as is provided on the Orion II.

Again, the point of this note is not to impugn the Orion II or Ten-Tec. I hope to own one before too long. It is important to make clear, however, that there are many important differences between SDR that is tucked away in hardware, and SDR that is available and running out in the open on a user's own computer. — *73, Frank Brickle, AB2KT, 6 Kathleen Place, Bridgewater, NJ 08807*; **ab2kt@arrl.net**

MEASURING MOTIONAL PARAMETERS OF A QUARTZ CRYSTAL

◊ Wes Hayward, W7ZOI, has popularized a frequency-shift method of determining a quartz crystal's motional capacitance and inductance that was introduced by Dave Gordon-Smith, G3UUR. In his book *Experimental Methods in RF Design*, co-authored with Rick Campbell, KK7B, and Bob Larkin, W7UPA, Wes describes this method in Figure 3.35, on page 3.19 and Figure 7.69 on page 7.38. We have reproduced that drawing here as Figure 1.

In recent work I found a significant discrepancy between motional parameters measured with a G3UUR test oscillator and those measured with a network analyzer (HP8752B).[1] I was using a homemade 50 Ω to 12.5 Ω test fixture, and the G3UUR data was consistently 15 to 20% low in motional capacitance.

Experimental Methods in RF Design, page 3.19 states the relationship between C_m (motional capacitance), C_s (the added series capacitance), Δf (shift in frequency when C_s is added or removed from the circuit) and f (frequency with C_s out of the circuit) with Equation 1.

$$C_m \approx 2C_s \frac{\Delta f}{f} \quad \text{[Eq 1]}$$

In researching the matter, it appears that the equation Wes provided omits the holder

[1] Jack Smith, K8ZOA, "Designing the Z90's Gaussian Crystal Filter," May/Jun 2007 *QEX*, pp 16-26.

[2] Emmanuel P. Papadakis, ed. *Ultrasonic Instruments and Devices*, (2000) Academic Press, Inc, Chapter 7, "Frequency Control Devices," (authors John Vig and Arthur Ballato), pp 653-654. This chapter is not subject to copyright and is available on the Internet at **www.ieee-uffc.org/freqcontrol/VigBallato/fcdevices.PDF.**

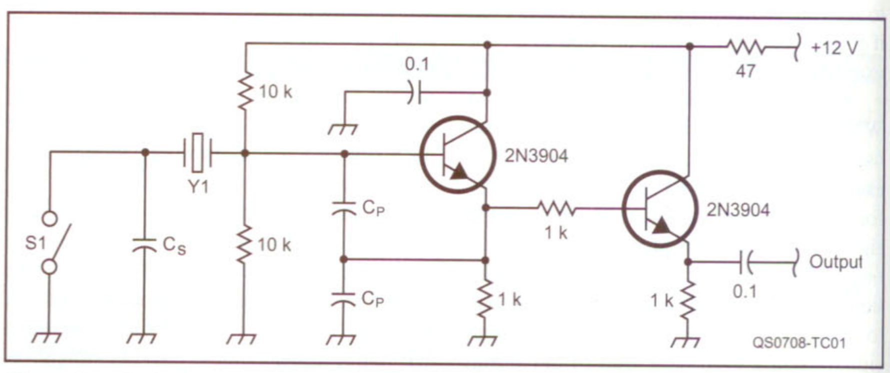

Figure 1 — A simple circuit to measure the motional parameters of fundamental mode quartz crystals, as described by Dave Gordon-Smith, G3UUR. A crystal to be evaluated is placed in the circuit at Y1 and oscillation is confirmed. The frequency is measured, then the switch is closed and the frequency is measured again. The typical values are C_p = 470 pF and C_s = 33 pF. C_m will have the same units as C_s. For the calculations in Equation 1 and Equation 2, be sure that C_s includes the stray capacitance of the switch as well as the circuit component.