It's about time: Timing and frequency issues in engineering

M. Simon

Time and timing have been long-term interests of mine. Especially so since I got my start measuring tenths of a nanosecond in 1967. I was looking around the www for information on time and frequency and came across a group of amateurs interested in time standards. One of the favorites of these amateurs is buying surplus rubidium clocks on ebay [1] and bringing them to life.

If you want to know the theoretical details of how a rubidium clock works, Hans, DL2MDQ and Juergen, DD6UJS [2] have an excellent page up with diagrams and details including a discussion of hyperfine transitions and the various frequencies involved.

For more hands-on details and copious links, this page [3] by KA7OEI is a pleasure to read. It discusses his adventures with a LPRO-101 rubidium oscillator. He (I assume) also has a page on the FE-5680A [4], which is mostly what you will find on eBay.

VK3UM discusses some of the pitfalls [5] you may run into when dealing with surplus rubidium oscillators. He links to a page on how to bring a dead oscillator back to life with a paint stripper heat gun. The wonders of modern technology.

And how about the changes being made to the American low-frequency standard, WWVB at 60KHz [6]? It used to be easy to get a very accurate local standard by phase-locking to that broadcast. Unfortunately, that is no longer so easy since the broadcast is now phase-modulated [7] along with the amplitude modulation that has been part of the broadcast for quite some time. The phase marker that used to be part of the method for identifying the station is being (you will pardon the expression) phased out.

I had designed a receiver based on the old modulation format and was about to produce a circuit board for that when I found out about the modulation change. Back to the drawing board. It looks like I will need to get conversant with Binary Phase Shift Keying [8] (BPSK) and how to use a Costas Loop [9] for decoding it. A

good article on practical Costas Loop design can be found here [10]. There is always more to learn.

M. Simon's e-mail can be found on the sidebar at Space-Time Productions [11].

Engineering is the art of making what you want from what you can get at a profit.

Source URL (retrieved on *07/22/2014 - 4:11pm*):
http://www.ecnmag.com/blogs/2012/11/its-about-time-timing-and-frequency-issues-engineering

Links:
[1] http://www.ebay.com/sch/i.html?_trksid=p2047675.m570.l1313&_nkw=Rubidium&_sacat=0&_from=R40
[2] http://openhpsdr.org/wiki/images/8/86/Rb-Normal_paper_20.10.09.pdf
[3] http://www.ka7oei.com/10meg_rubidium1.html
[4] http://www.ka7oei.com/10_MHz_Rubidium_FE-5680A.html
[5] http://www.vk3um.com/Rubidium%20Standard.html
[6] http://www.nist.gov/pml/div688/grp40/wwvb.cfm
[7] http://www.nist.gov/pml/div688/grp40/upload/NIST-Enhanced-WWVB-Broadcast-Format-2012-09-26-2.pdf
[8] http://www.jcu.edu.au/eps/public/groups/everyone/documents/conference_paper/jcuprd_043140.pdf
[9] http://en.wikipedia.org/wiki/Costas_loop
[10] http://mobiledevdesign.com/images/archive/0102Feigin20.pdf
[11] http://spacetimepro.blogspot.com/