Designing just for fun

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I'm in the process of designing and building a 10 MHz time/frequency receiver to pick up the WWV signal and to see if I can accurately reproduce the signal frequency for general lab calibration purposes. Yes, there are better ways to get accurate frequency calibration. A GPS Disciplined Oscillator (GPSDO [1]) is one way to go. But a 10 MHz receiver is something I always wanted to do, so I'm doing it. My expectation is to be able to get the frequency accuracy to within 1E7. My hope is to be able to get to within 1E8. Because of ionospheric shifts, that is probably the best that can be done. According to this calculator, [2] I'm 1378.8 Km from Boulder, Colorado (close to the the site of WWV [3]). Let us say 1500 Km for order of magnitude purposes. To hold frequency to 1E7, the path length to the ionosphere and back to ground level must hold to within 30 meters over 1 second. To get to 1E8, the path has to be constant within about 3 meters over 1 second. If I can get the receiver to work (no guarantee because the design is novel), I can use it to get ionospheric soundings between here and Boulder by comparing the receiver frequency output to a fixed oscillator. A topic for a later date if I can get the device working.

While doing research for the design, I came across a number of interesting www pages. I'm going to list a few of them. How to Use Analog Switches as Mixers [4] is one. Analog switches are very good with low-level signals, but their frequency range is limited to about 100 MHz or less for off-the-shelf components. Note that not all the links on this page are working links.

Here is a whole list of circuits [5] that captured my attention. I particularly liked the Ultra Low Noise High Input Impedance DC Amplifier [6] and Using HCMOS Gates as Frequency Multipliers [7]. The circuit diagram showing how to use a 74HC74 flip flop to multiply a frequency by 1.25 was particularly fascinating. It uses tuned components so it is not a general purpose multiplier.

This page of circuits [8] which was linked here [9] has a stunning picture of a Japanese temple on the top of the page. I particularly liked circuit #34. A one transistor AM modulated CW transmitter for code practice. The transistor generates both the RF signal and the signal that modulates it.

It is back to the bench for me now. I have some projects to complete.

M. Simon's e-mail can be found on the sidebar at Space-Time Productions [10].

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

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http://www.ecnmag.com/blogs/2012/12/designing-just-fun?qt-video_of_the_day=0

Links:
[1] http://gpsdo.i2phd.com/
[2] http://www.infoplease.com/atlas/calculate-distance.html
[3] http://www.nist.gov/pml/div688/grp40/wwv.cfm
[4] http://www.oe1ira.at/sl/mix.html
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