

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.

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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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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>

[5] <http://www.wenzel.com/documents/circuits1.htm>

[6] <http://www.wenzel.com/pdf/files1/pdfs/lowamp.pdf>

[7] <http://www.wenzel.com/pdf/files1/pdfs/hcmos.pdf>

[8] <http://www.intio.or.jp/jf10zl/index.html>

[9] <http://www.epanorama.net/links/radio.html#amtransmitters>

[10] <http://spacetimepro.blogspot.com/>