

# What Time is it?

By James Clarke KD7SWL

Many Hams and SWL's use WWV and WWVH as a signal check for each frequency bands for the possibility of it being open for DX or not. If you can hear a female voice announce the time, which is from WWVH in Hawaii, on of the frequencies of 2.5, 5, 10, 15 or 25 MHz then chances are that you can get good reception to the west, which is most likely to happen at night time. If you hear a male voice then you are hearing the Boulder, CO site. Both of these radio signals are a government service of the Department of the Chamber of Commerce who govern the National Institute of Standards and Technology (NIST).

The time element that you hear is kept by a cesium frequency standard that is updated continuously with the National Time standard which is currently an atomic Cesium Fountain clock (NIST-F1) accurate to less than 1 femto second. This means it would neither gain nor lose a second in more than 30 million years. This frequency standard is converted into a time code and audio signal that can be broadcast. At least 1 of the HF frequencies should be usable from any location on any given day. The received signal will have a lag time depending on your receiving location and its accuracy is 1 to 20 milliseconds. WWVB (LF 60 KHz) is a bit better with an accuracy of 0.1 to 15 milliseconds.

You could just to listen to the time but there is actually a lot more information present during an hour of the broadcast of time announcements and the almost constant tick-tock. Each part of the broadcast can be used by specialized time and frequency standard equipment that is capable of receiving the signals. Three different audio tones are sent during each hour at different intervals. A 500 Hz Tone, a 600 Hz Tone and a 440 Hz Tone (first A above middle C on the music scale). The 440 Hz tone is sent only once per hour except for the first hour of each day. This tone can be used as a starting point on a chart recorder or other timing device. The 440 Hz tone can also be used to calibrate tuning forks for musical instruments

as well. The 500 Hz and 600 Hz tones alternate after each time announcement.

The ticking sounds are 1000 Hz (WWV) 1200 Hz (WWVH) pulses that are 5 milliseconds long every 10 milliseconds unless they are at the beginning of a tone (the 29<sup>th</sup> and 59<sup>th</sup> seconds) or at the top of the hour. These tones can be used to "zero beat" your HF radio to see how much the difference the radio's indicator is off from the actual frequency. Zero beat tuning is accomplished by carefully tuning in on the center of WWV and WWVH so that the tone that will sound like a low frequency whistle goes down in scale, stopping just at the point where the tone disappears, you may need head phones to do this. At this point the station's audio will become intelligible once again. In some cases this tuning method will improve the readability of the station. In most sideband receivers use the most narrow bandwidth filters for increased selectivity. Your frequency uncertainty is limited by the resolution of your receivers read out usually to with in 100 Hz to 1-5 KHz. If you beat the frequency at the 10 MHz frequency and you receiver shows 10000.2 KHz then your dial has an offset of 200Hz.

The doubled ticks are the amount of correction to be calculated and are heard during the first 16 seconds of each minute. You can determine the amount of the correction by counting the number of doubled ticks (in units of 0.1 s). If you want to see how it is calculated go to this web site <http://www.boulder.nist.gov/timefreq/> and download the Time and Frequencies book in a PDF file at <http://www.bldrdoc.gov/timefreq/general/pdf/1383.pdf> I have it posted on the yahoo group as well.

A 100 Hz sub carrier is also broadcast on these signals with a binary coded decimal (BCD) format. This signal can be read by many consumer electronics ranging from the watch I wear to my alarm clock that I don't know how to set right. Most of these products are set

to receive the 60kHz signal of WWVB which is only the BDC signal broadcast.

You should now be able to hear and decode each part of the broadcast. Time is a very important fixture in our lives not only in the hobby but in every thing we do. If the timing events were not the same everywhere our cars would not run and the telephones would not function properly along with countless other events dependant devices we use. Our economy would not function with

out a buyer and a seller reaching each other at the same time to make a transaction or even to have your paycheck calculated properly. When you listen to the time it is fun to think about the possibilities and events that occur because a really cool atomic clock in Boulder CO is keeping the time for us, but that could just be the Metrologist in me.

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