An Update on the WWV/H Modulation Test and WWV ARC

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Modulation

Observation Method

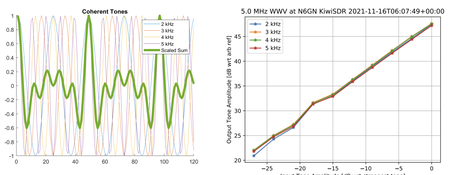
White Noise

Gaussian white noise (2 secs), repeated again at the end of the signal.

Psudorandom noise (PRN) is used in automated analysis (see "Analysis Code," right) but cannot be used in manual analysis.

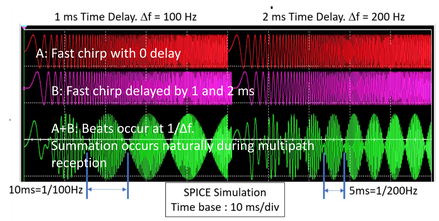
Coherent Tones

Phase-coherent 2, 3, 4, 5 kHz sine waves that drop down by 3 dB 9 times, 10 seconds total. Used to check transmitter linearity.



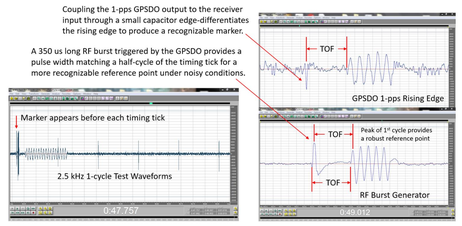
Chirps

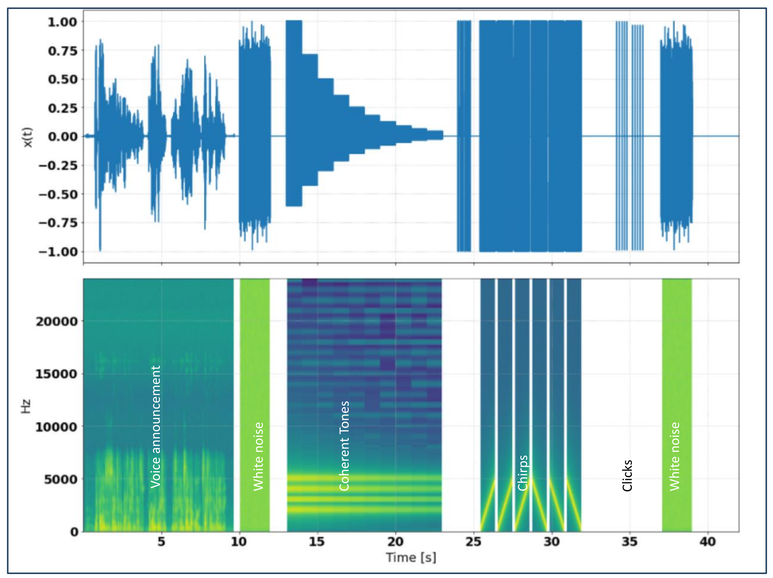
An eight-second sequence consisting of linear up-chirps and down-chirps: long is 5 kHz over 1 second (TBW = 5,000), short is 5 kHz over 0.05 seconds (TBW = 250). Used for detection of multipath.



Clicks

A one-cycle burst at 2.5 kHz frequency, for time domain measurement, repeated 5 times over the course of 1 second; then the same for 5 kHz. Used for oscilloscope-based ToF.





The Signal

The signal and MATLAB code to generate it are archived on Zenodo. You can listen with the QR code on the right.

DOI 10.5281/zenodo.5602094

Signal Recordings

Several signal recordings are available for analysis, most using KiwiSDRs. A groundwave recording from N6GN is available at www.doi.org/10.5281/zenodo.5715673. Additional recordings are available at https://osf.io/8rfq3/ and https://osf.io/casxr/.

Analysis Code

Analysis code can be found on Github:

Collins, K., Cuong, N., & Montare, A. (2022). WWV/H Working Group Software (Version 1.0.0) [Computer software]. https://github.com/KCollins/wwv-h-wg

Abstract

The WWV/H Scientific Modulation Test continues after 16 months broadcasting at minute 8 on WWV and minute 48 on WWVH. Initial evaluation of the recordings show promise in determining time-of-flight and other characteristics. Efforts have started to place a KiwiSDR receiver on Kauai for an evaluation of WWVH broadcasts similar to those made of WWV. The WWV ARC held the *Tune In: The WWV Frequency Celebration* at the beginning of March to mark the 100th anniversary of WWV providing standard frequencies. NIST and HamSCI presented talks on March 2, NIST provided tours of the Boulder and WWV facilities March 3, and The Fort Collins Museum of Discovery hosted the *Tune In: The WWV Frequency Celebration* open house on March 4. Various aspects of amateur radio were showcased including traditional HF (with a station), ARISS, ARES, satellite, HamSCI, and of course a history of WWV.

The WWV Amateur Radio Club

Tune In: The WWV Frequency Celebration three-day event featured a historic perspective on the frequency broadcasts by Glen Nelson, electronics technician at WWV , as well as a HamSCI presentation by Dr. David Kazdan, Rachel Boedicker, and Aidan Montare. The lectures were videotaped and will be available via YouTube in the near future. A highlight for many amateurs were the tours of WWV and the NIST Boulder Labs. The weekend finished with a gathering of 7 different amateur organizations and clubs for a public display of amateur radio at the Fort Collins Museum of Discovery. Photos, video link, and summary: https://wwvarc.org/WWVFrequencyCelebration

March 23, 2023 WWV ARC meeting: Our featured guest is Dr. Jeffrey Sherman, NIST Boulder, presenting "Atomic clocks and time keeping at NIST." Jeff will talk about the physical basis for atomic timekeeping, and the fundamental role time has in most of precision metrology. He'll describe how the international time scale UTC is realized, and how laboratories like NIST contribute. He'll give a broad overview of activities at the NIST Time and Frequency Division, highlighting some important current themes: increased availability of high precision time signals from NIST, and a worldwide campaign to redefine the unit of the SI second in terms of an optical atomic transition. For more info please visit: https://wwvarc.org

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