WWV / WWVH / WWVB
Time and Frequency Broadcasts
(and others)

Jason Skretta, KC0EDE

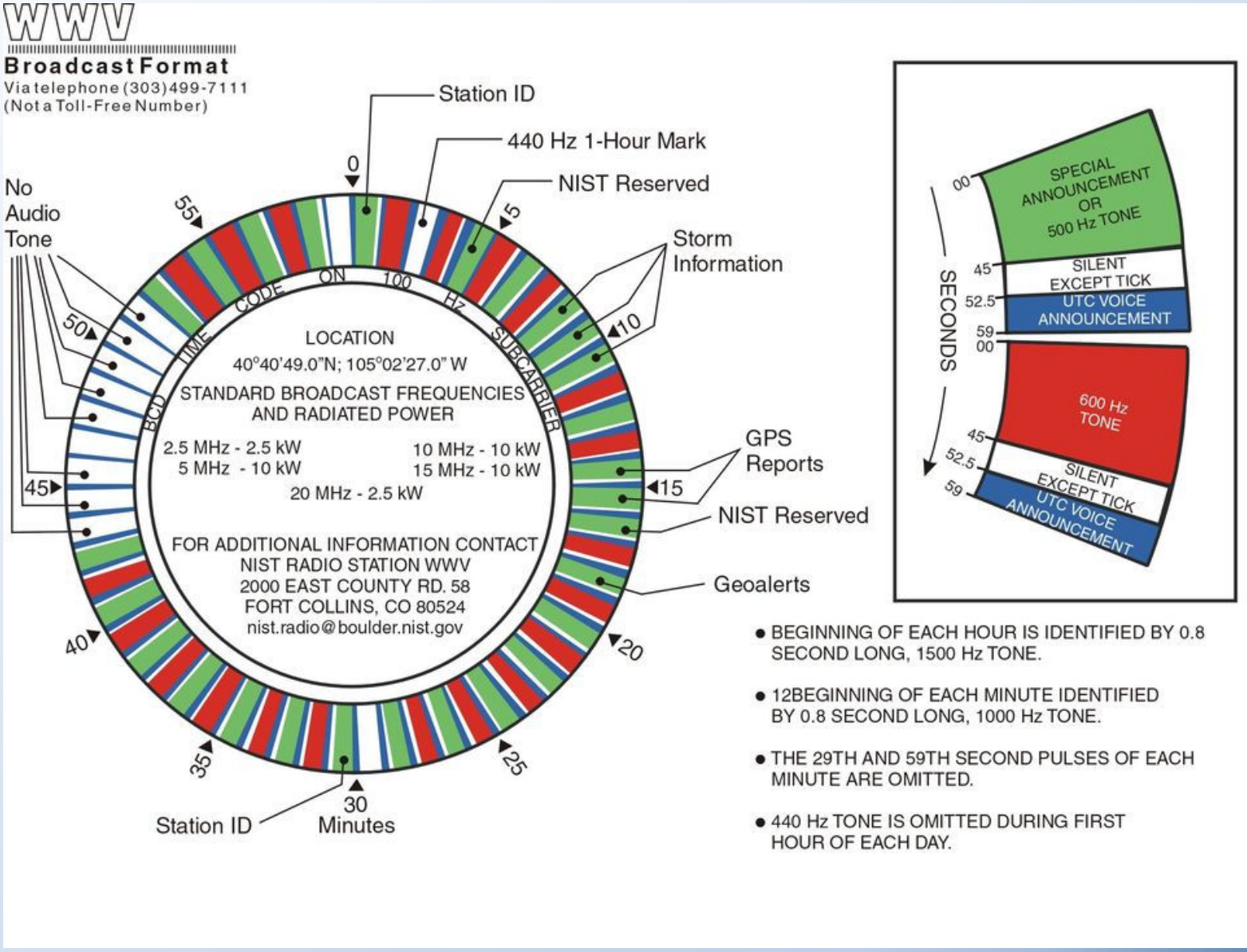
January 3, 2019

Story County Amateur Radio Club

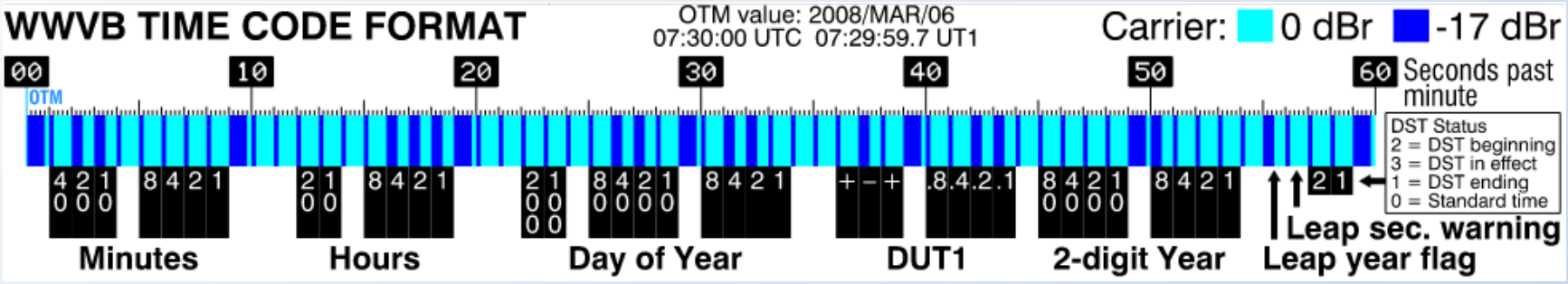
What is WWV?

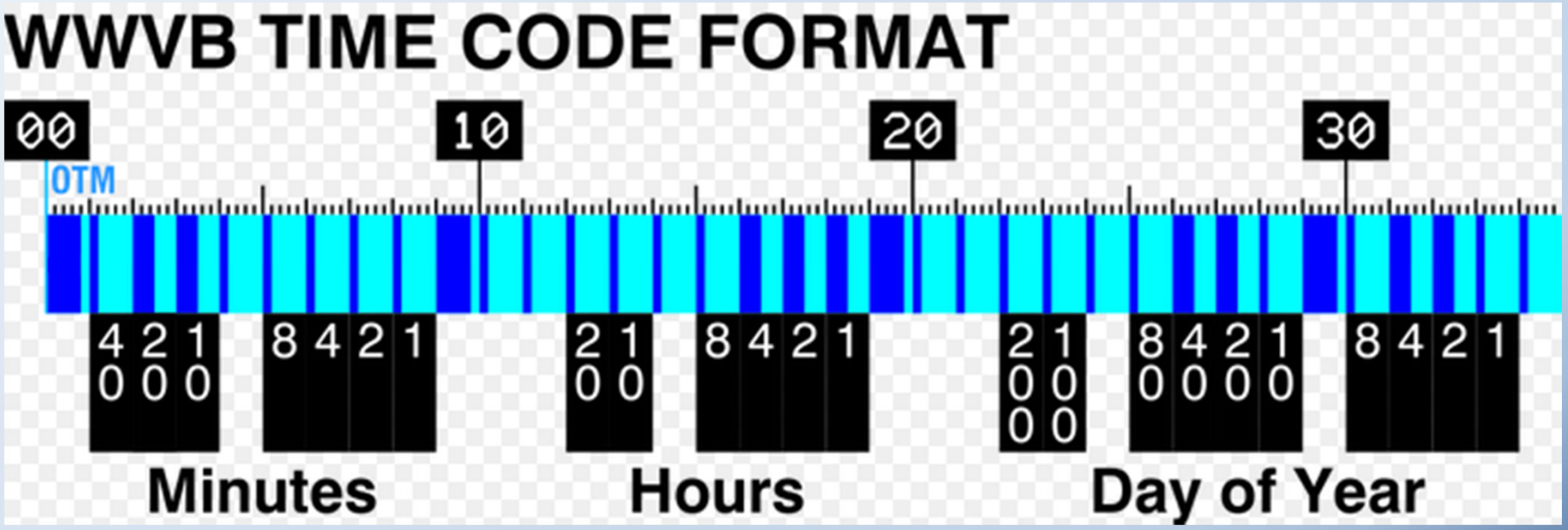
- Time and Frequency broadcast station
- NIST (US Dept. of Commerce)
- WWV – 2.5, 5, 10, 15, 20, (25) MHz
  - AM – DSB w/carrier
  - Fort Collins, CO
  - Male Voice
- WWVH – 2.5, 5, 10, 15 MHz
  - Kekaha, HI (on the island of Kauai)
  - Female Voice
- WWVB – 60 kHz
  - amplitude modulated, also phase modulated

Listen to WWV audio clip



WWVB Data Format





Other Stations

- CHU – 3.330, 7.850, 14.670
  - Near Ottawa, Ontario, Canada
  - Proposed new station near Kelowna, British Columbia, Canada (100mi east of Vancouver)
- Guayaquil, Ecuador
- Cadiz, Spain
- Moscow, Russia
- 5, 10, 15 MHz – Japan, Taiwan, China, South Korea, Italy, UK, Germany, France, Argentina, Venezuela, India, others? probably

Listen to CHU audio clip

The first minute of each hour commences with a full 1 s pulse of 1000 Hz tone, followed by 9 s of silence, and then the normal pattern of 0.3 s pulses of 1000 Hz at one-second intervals. The normal pattern for each of the next 59 minutes starts with a 0.5 s 1000 Hz pulse, followed by the DUT1 code employing split 0.3 s pulses where required, and normal 0.3 s pulses up to and including that at 28 seconds. The pulse at 29 seconds is omitted. Following the normal pulse at 30 seconds, for a 9 s period, 1000 Hz pulses of 0.01 s occur, each followed by the CHU FSK digital time code described in CHU broadcast codes. The pulses between 40 and 50 seconds are of normal length. In the final 10 s period of each minute a bilingual station identification and time announcement is made, with the 1000 Hz seconds pulses shortened to "ticks". Each minute's announced time refers to the beginning of the pulse which follows. Since April 1, 1990, the announced time is always UTC.

The difference [UT1- UTC] is called DUT1, and this fraction of a second [-0.8 s to +0.8 s] is broadcast by means of an internationally accepted code. To decode the size of DUT1, in tenths of a second, a user counts the number of emphasized seconds markers in one minute. For CHU, the emphasized seconds pulses are split, so that a double tone is heard. When the emphasis is on seconds 1 through 8, DUT1 is positive; and when DUT1 is negative, seconds 9 through 16 are used.

CHU Data Format

For seconds 31-39:

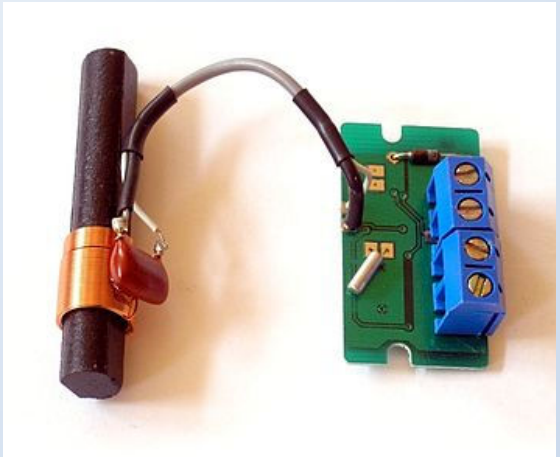
The data is in the form of an FSK data stream. The frequencies are compatible with the Bell 103 standard: 2225 Hz mark and 2025 Hz space. The carrier is active between 0.010 and 0.510 seconds past the second. Each byte of data is encoded as one start bit, 8 data bits and two stop bits. There are ten bytes in each packet, and the last stop bit ends at precisely 500 ms past the second. (1 start bit + 8 data bits + 2 stop bits) x 10 characters = 110 bits. Each bit takes 1/300 of a second (300 bps). So the whole code takes 366.66... ms, and starts at 500 - 366.66... = 133.33... ms past the second. So graphically, each second looks like this:

1. Ticking noise (10 cycles of 1000 Hz)
2. 2225 Hz mark tone for 123.33... ms to allow modems to set up
3. Data stream for 366.66... ms
4. 2225 Hz mark tone for 10 ms to avoid false overrun of the stop bits
5. Silence until the end of the second.

The data stream itself consists of ten bytes. There are two formats: format "**B**" for second 31 and format "**A**" for seconds 32 through 39. Each format has 5 bytes of data, then 5 bytes of redundancy. The "**A**" format redundancy bytes are exactly the same as the data bytes. The "**B**" format redundancy bytes are exactly inverted (one's complement, NOT, XOR 0xff, etc) from the data bytes. This is how one can tell what sort of frame was received.

Uses

- Sync your clock
- Check your receiver
- Validate frequencies



WWV Shutdown?

- 2019 NIST budget proposed eliminating WWV, WWVH, and (probably) WWVB broadcasts
- See QST article NOV 2018, pg 84
- See CQ article OCT 2018, pgs 42-43

Questions