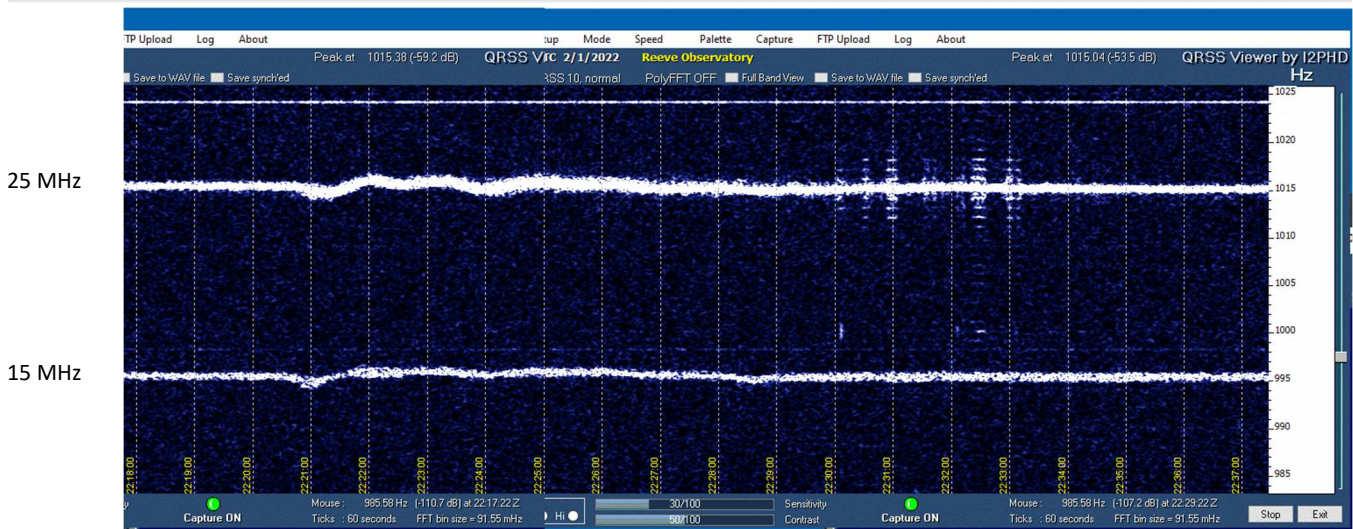
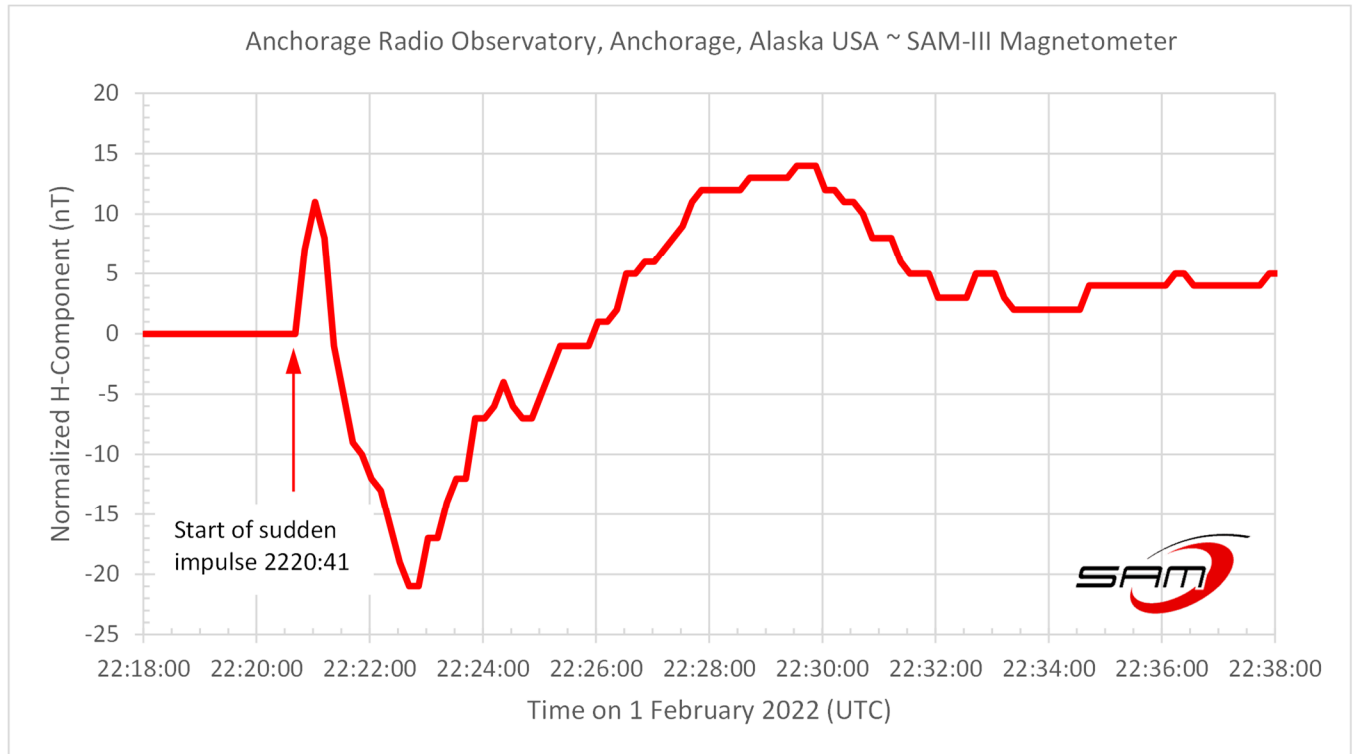


Coronal Mass Ejection (CME) Causes Sudden Frequency Deviations (SFD) of ± 2 Hz at 15 and 25 MHz

Whitham D. Reeve, Anchorage, Alaska

Space Weather Prediction Center, Forecast Discussion: At 2138 UTC on 1 February 2022, ACE RTSW (Real-Time Solar Wind) data indicated the anticipated arrival of a CME from 29 January. Solar wind speeds increased impulsively from $\sim 360 \text{ km s}^{-1}$ to $\sim 475 \text{ km s}^{-1}$. Total field Bt increased from $\sim 5 \text{ nT}$ to 12 nT in a matter of minutes.... The geomagnetic field was quiet until 2221 UTC when a Sudden Impulse was detected at the Honolulu geomagnetic observatory with a maximum deviation of 22 nT . This was in response to anticipated CME shock arrival and caused a response to active levels during the day's final (3 h) synoptic period.

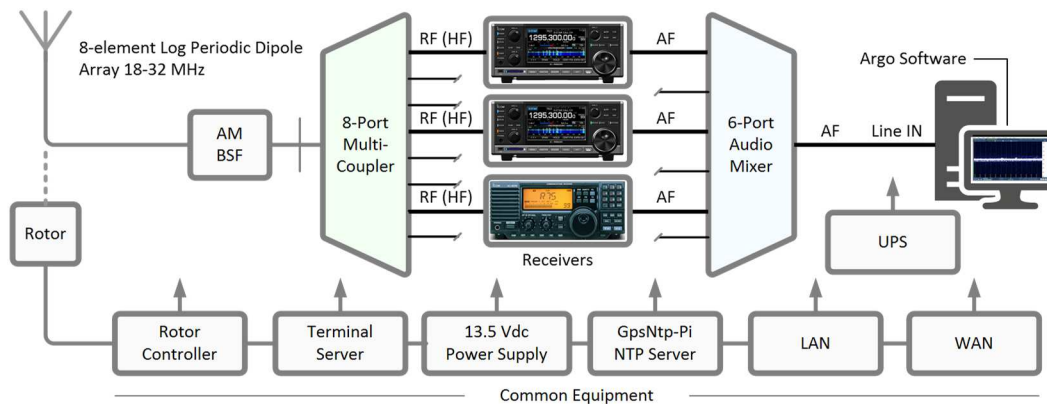
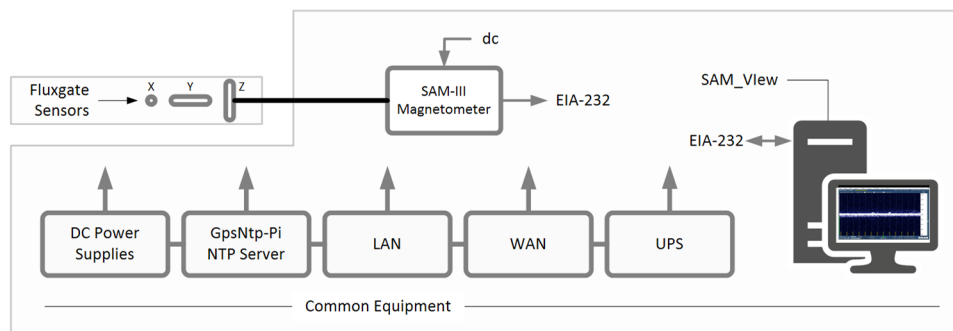


Discussion:

- ⚙ Signal sources (location, distance): WWV-15, WWV-25 (Colorado, 3800 km) and WWVH-15 (Hawaii, 4400 km);
- ⚙ Phenomena: Rapid compression of the geomagnetosphere adds heat and alters ionosphere altitude, changing propagation path length and wave number. This CME-induced SFD is unusual in that SFDs usually are caused in real-time by solar flares. See For further reading;
- ⚙ Geomagnetic field: Sudden impulse amplitude 11 nT at Anchorage; ended up being sudden storm commencement (SSC) because a geomagnetic storm followed and continued for several days;
- ⚙ Observatory was on the sunlit side of Earth; event occurred between 1:20 and 1:24 pm Alaska DST.

Instrumentation at Anchorage Radio Observatory:

- ⚙ Magnetometer settings: 0.1 Hz sample rate. $H = \sqrt{X^2 + Y^2}$
- ⚙ Receiver settings: LSB, Receiver tuning 15.000 995 and 25.001 015 MHz, AGC off. Argo software.



For further reading:

- ⚙ https://www.reeve.com/Documents/Articles%20Papers/Propagation%20Anomalies/Reeve_SuddenFreqDev_Concepts_P1.pdf
- ⚙ https://www.reeve.com/Documents/Articles%20Papers/Propagation%20Anomalies/Reeve_SuddenFreqDev_Meas_P2.pdf