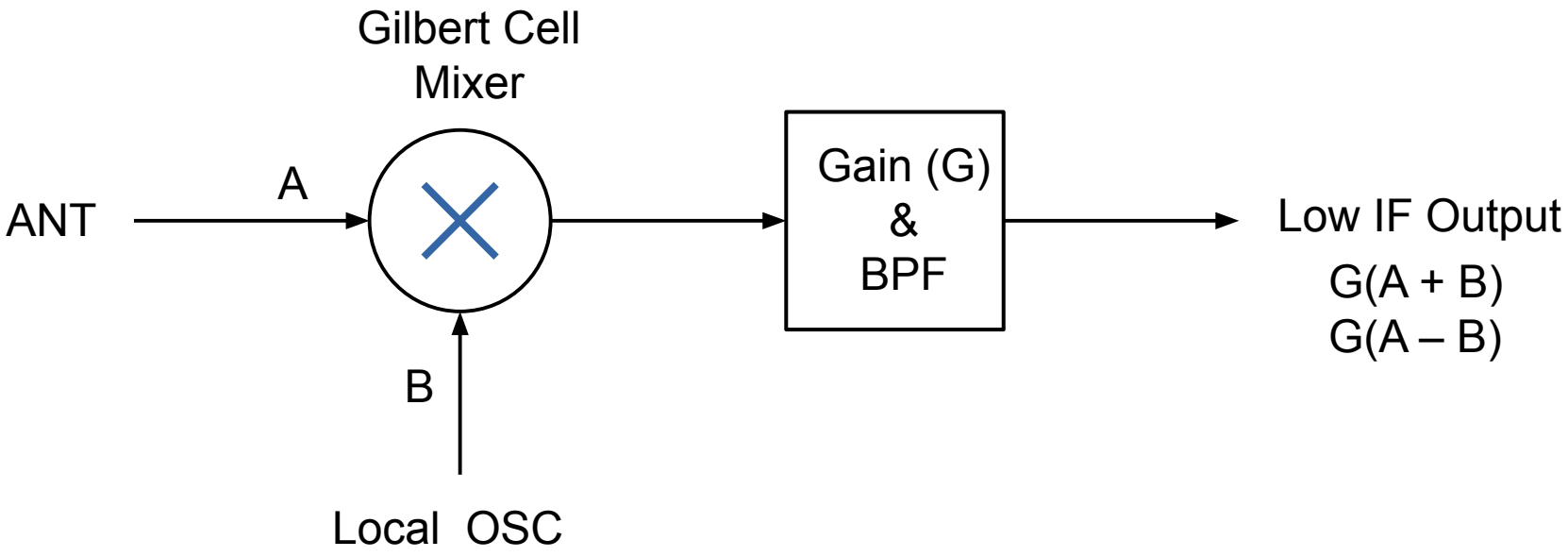
HAMSCI March 19/20, 2021

Low Cost
Personal Space Weather Station
Grape Gen 2 Receiver

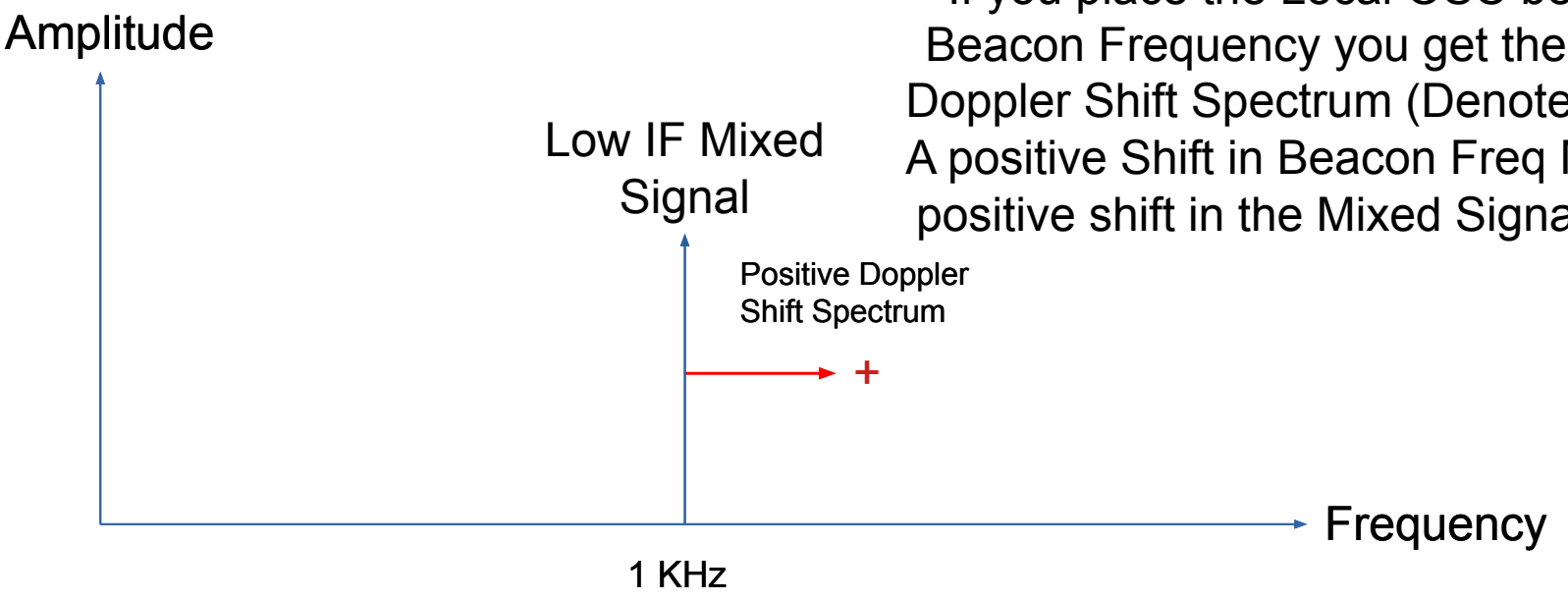
by

John Gibbons N8OBJ

Review of Receiver Basic Operation

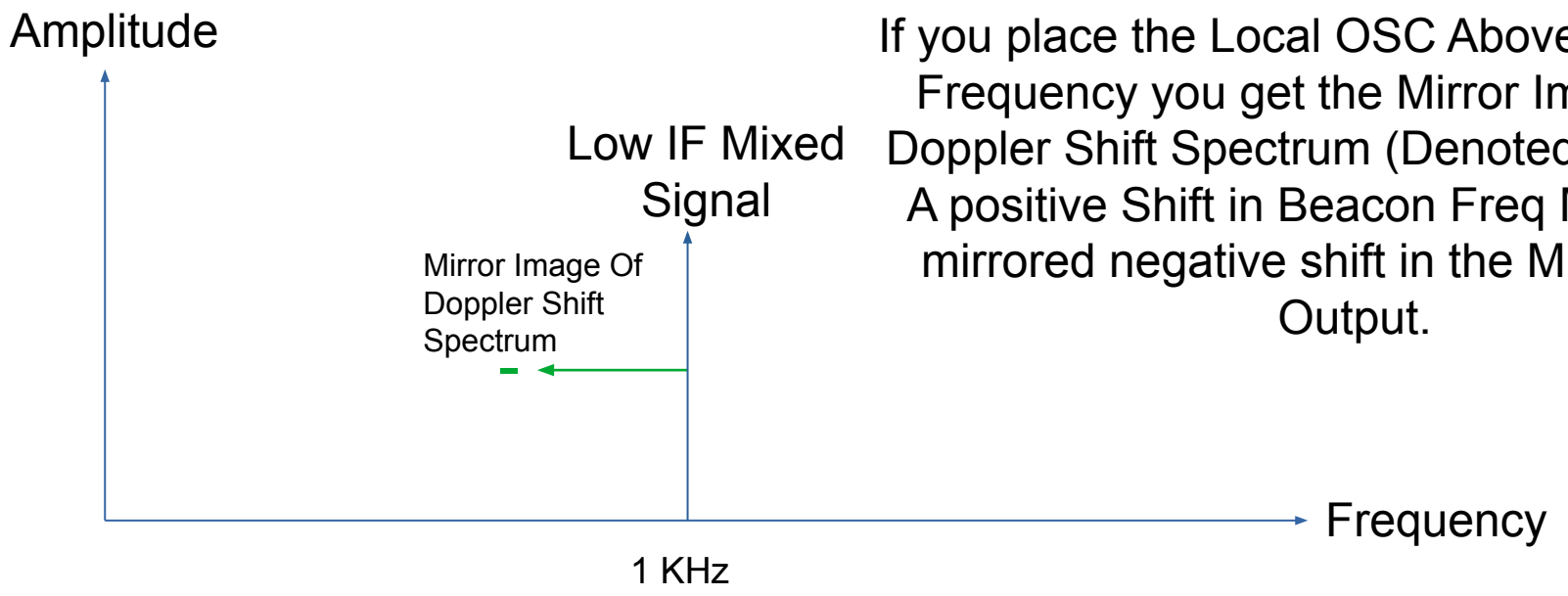


Gilbert Cell Frequency Mapping



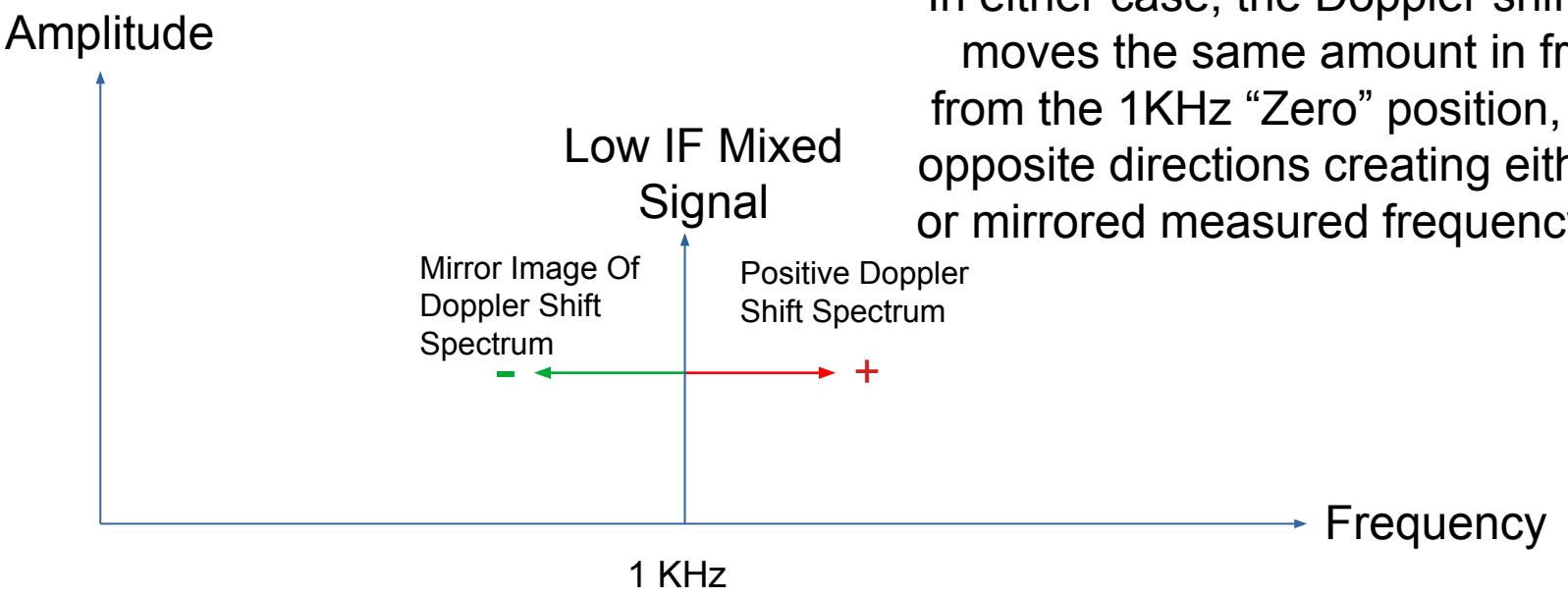
If you place the Local OSC below the Beacon Frequency you get the Positive Doppler Shift Spectrum (Denoted in Red) A positive Shift in Beacon Freq Maps into positive shift in the Mixed Signal Output.

Gilbert Cell Frequency Mapping



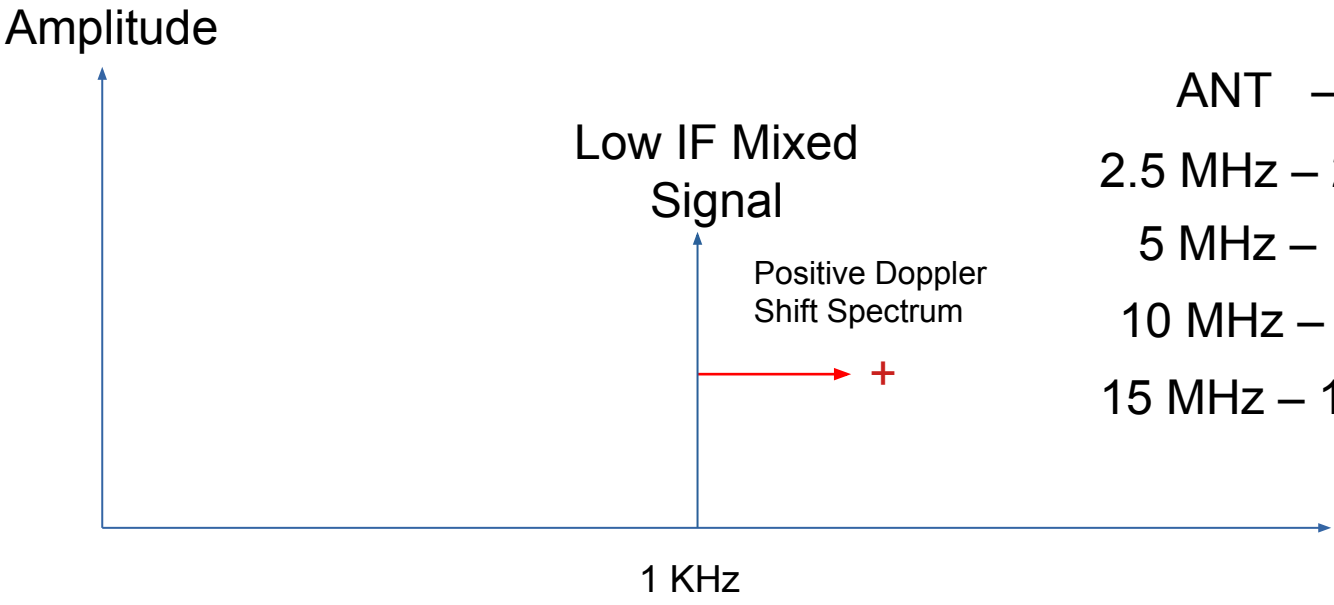
If you place the Local OSC Above the Beacon Frequency you get the Mirror Image of the Doppler Shift Spectrum (Denoted in GREEN)
A positive Shift in Beacon Freq Maps into a mirrored negative shift in the Mixed signal Output.

Gilbert Cell Frequency Mapping



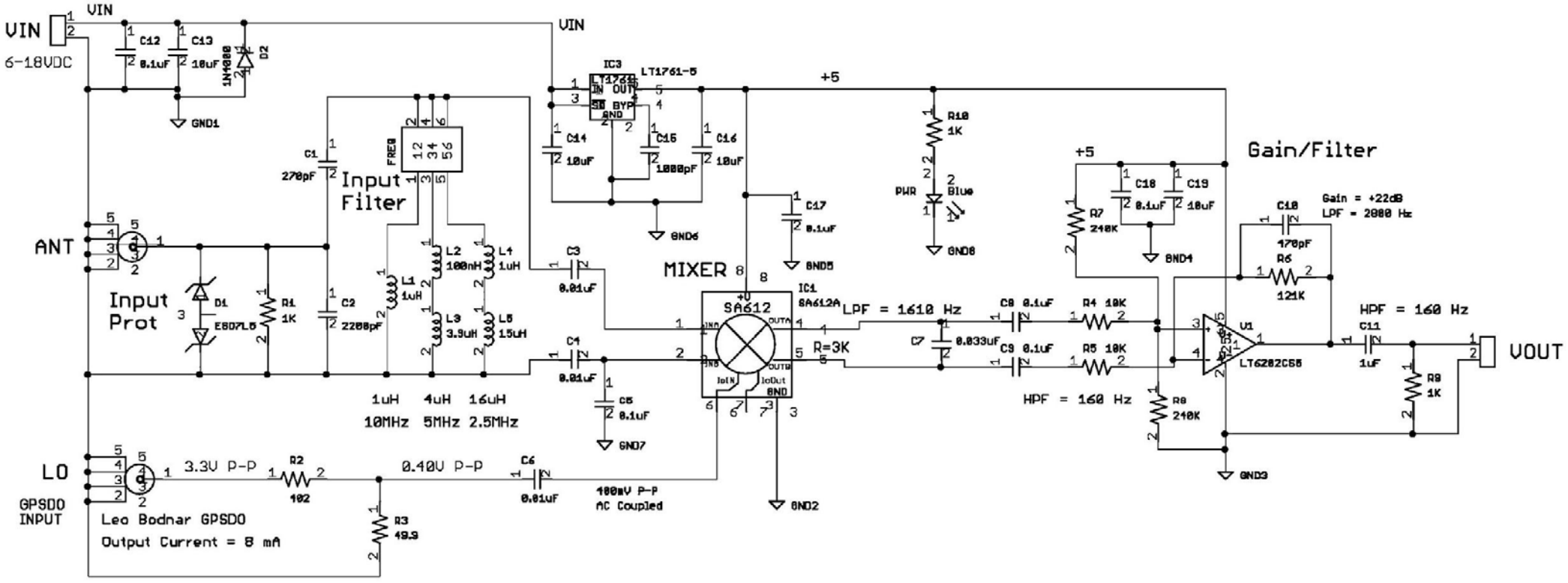
In either case, the Doppler shift deviation moves the same amount in frequency from the 1KHz “Zero” position, but just in opposite directions creating either a direct or mirrored measured frequency deviation

For the Grape 1 & 2 Receivers, we chose to place the LO below the Measured Beacon so that the measured Doppler shift frequency is in the same direction as the measured frequency shift of the Carrier Mixed Signal



ANT	–	LO	=	IF
2.5 MHz	–	2.499 MHz	=	1 KHz
5 MHz	–	4.999 MHz	=	1 KHz
10 MHz	–	9.999 MHz	=	1 KHz
15 MHz	–	14.999 MHz	=	1 KHz

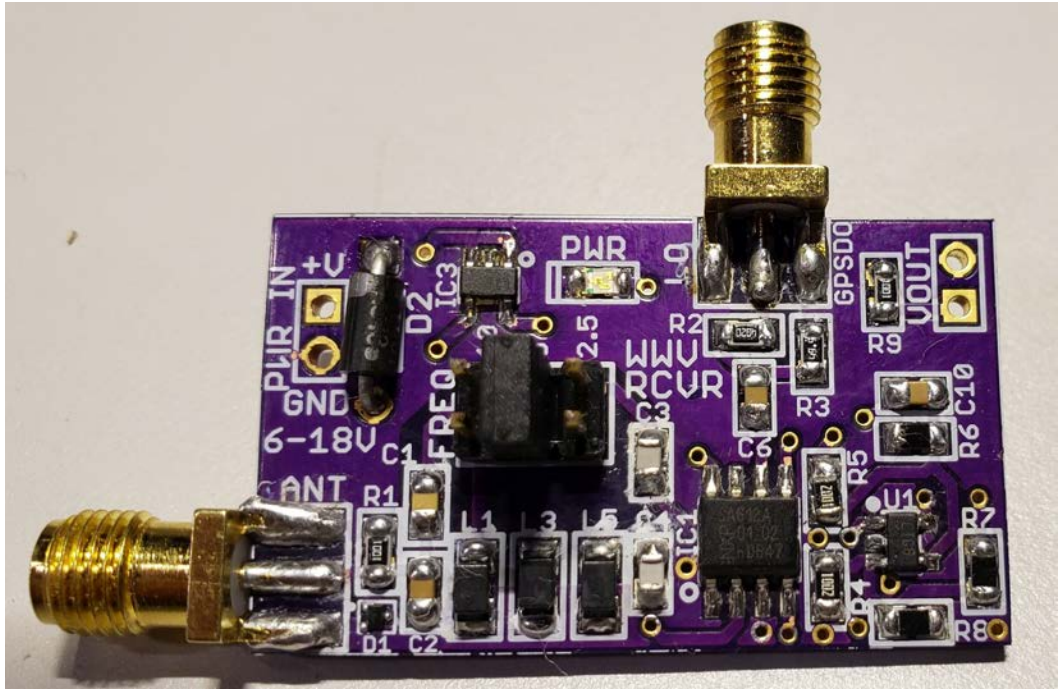
Grape Gen 1 Receiver



Grape Gen 1 PCB

PCB is a 2 layer board - 1.50” x 0.88” (38.1 x 22.4 mm)

Top



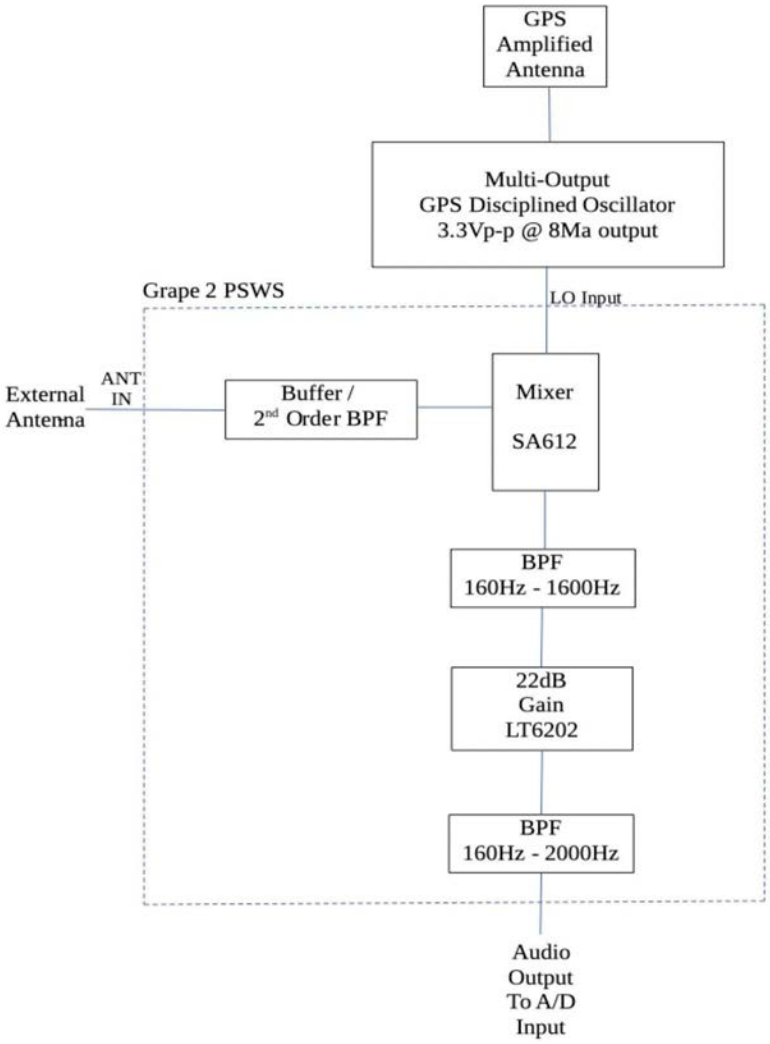
Bottom

Grape Gen 2 Receiver

- Basing new design on Grape Gen 1 Receiver
- 4 Channels will be running simultaneously
- Sampling will be synchronized on all 4 Channels
- Will Measure 2.5, 5.0, 10 & 15 MHz WWV
- Can also measure 3.33, 7.85 & 14.67 MHz CHU

Low Cost PSWS (Grape Gen 2) Radio Receiver (x4)

N8OBJ
March 2021



Low Cost PSWS (Grape Gen 2)

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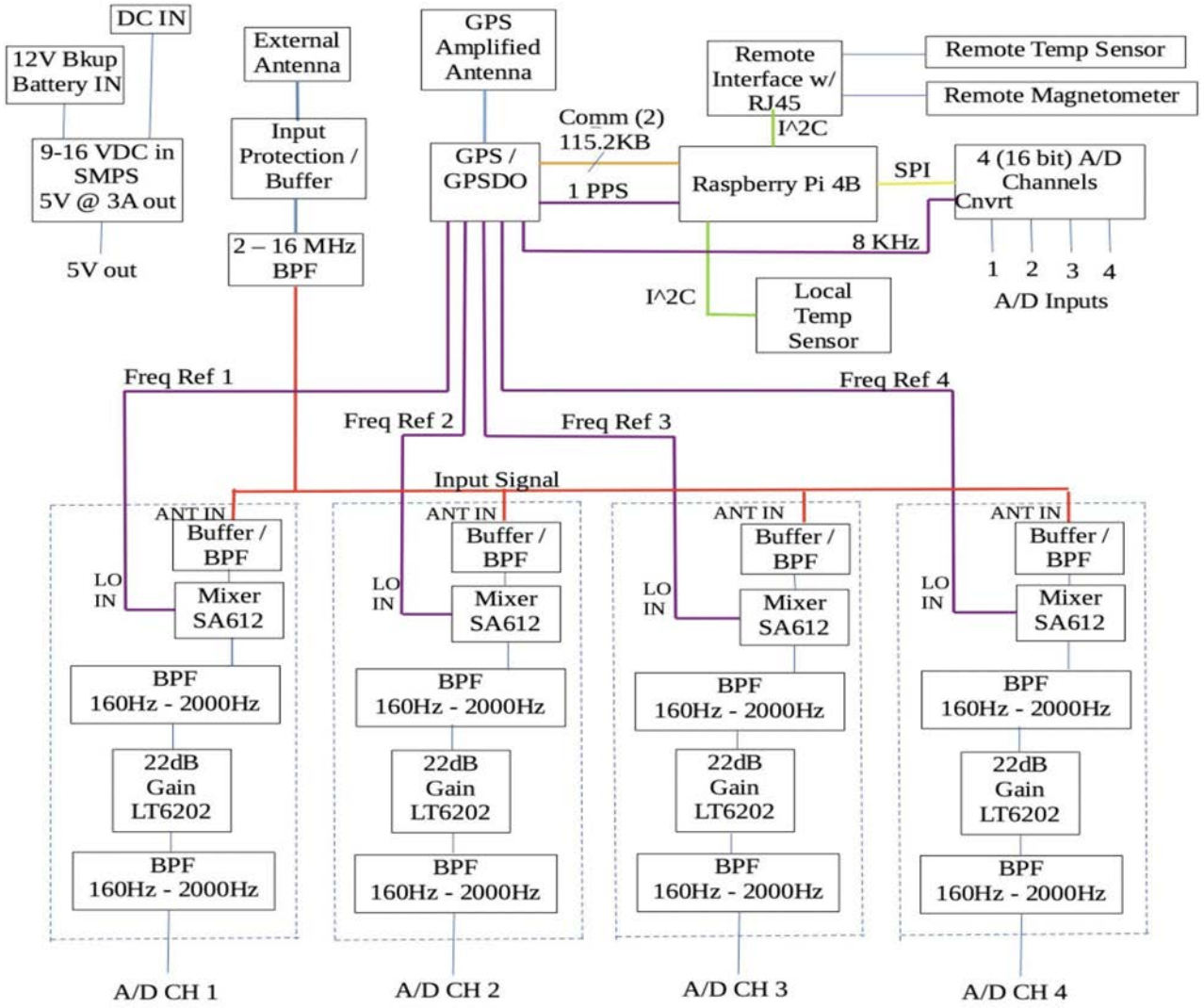
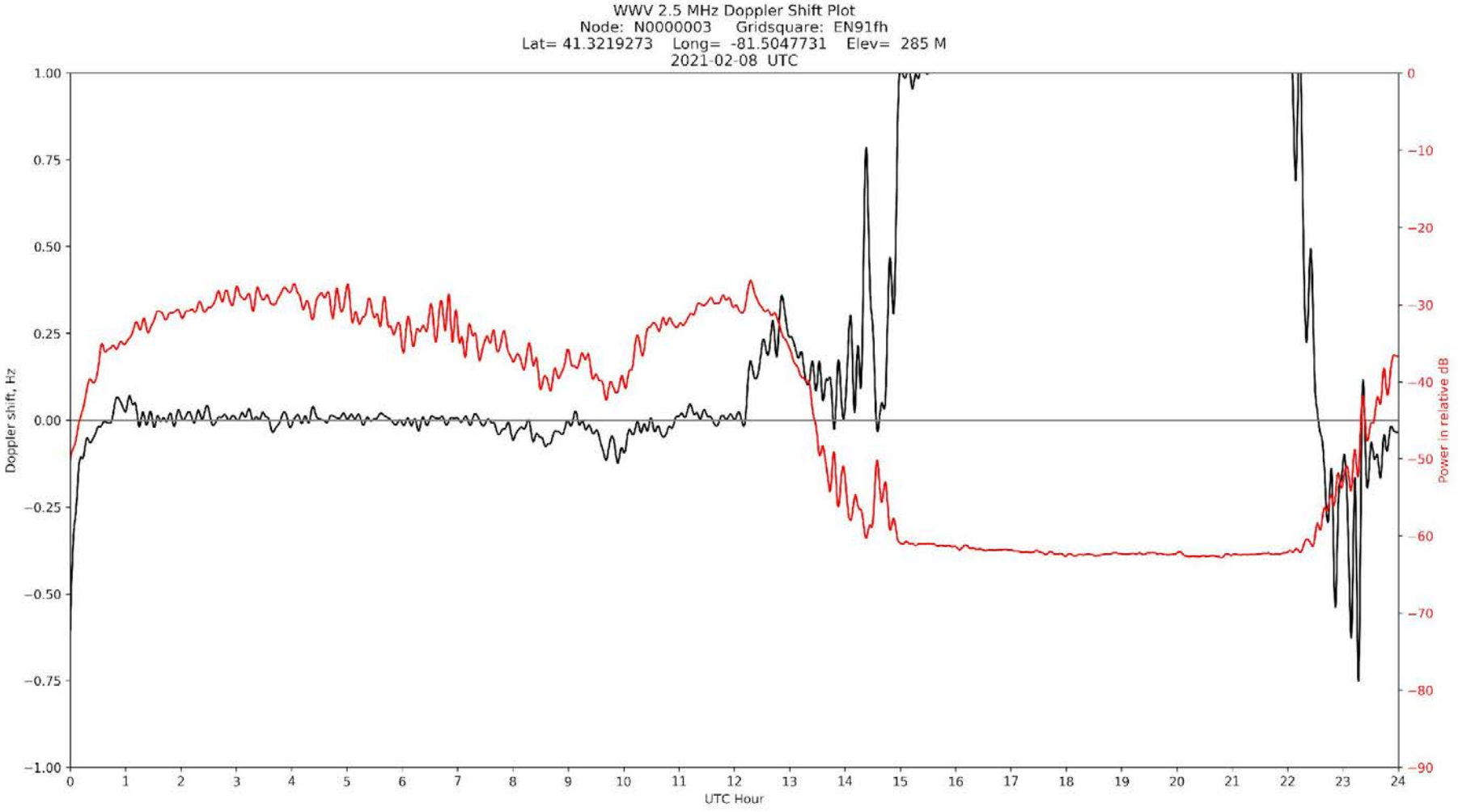
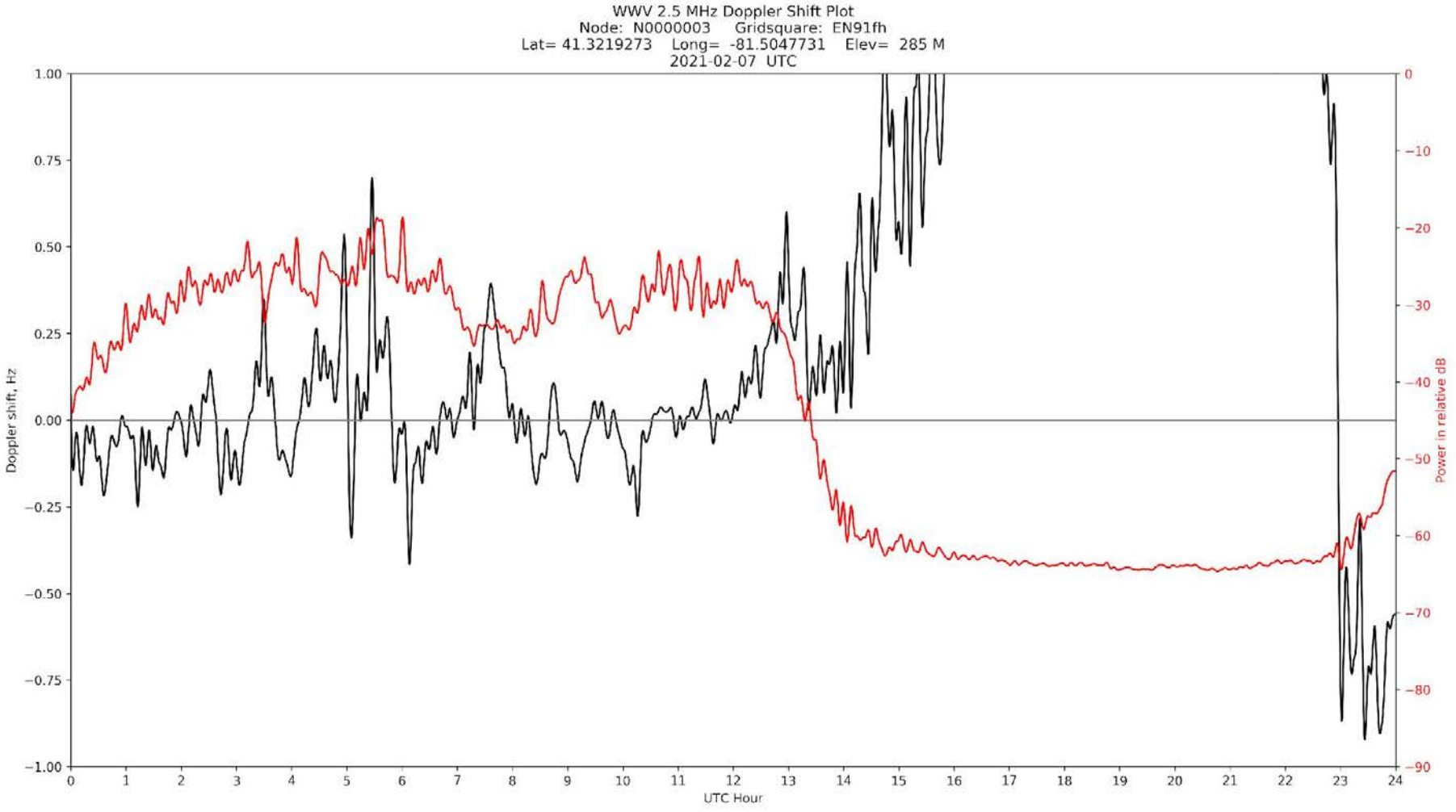
March 2021
Ver 1.00



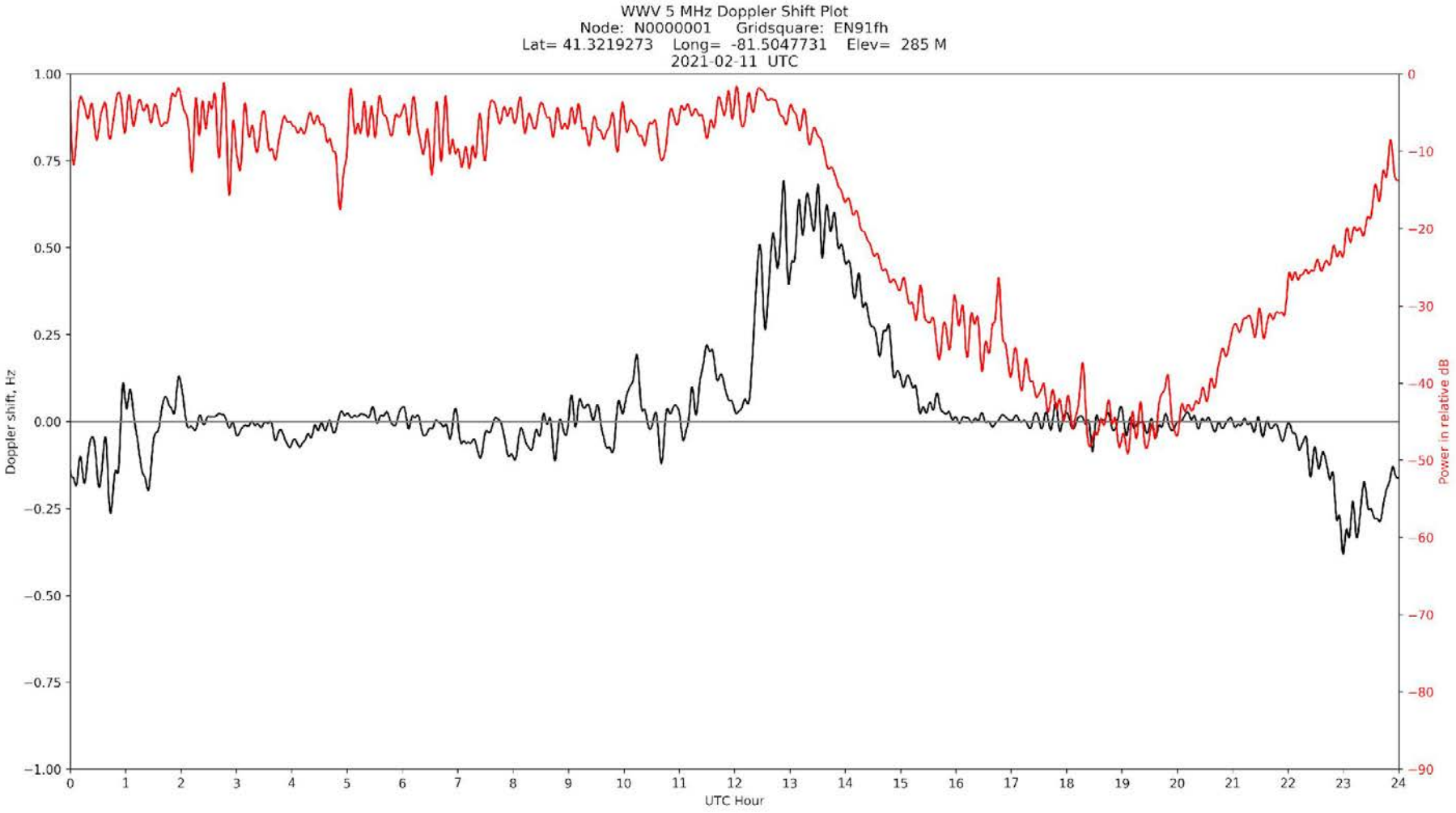
Typical Quiet WWV 2.5 MHz Day Plot



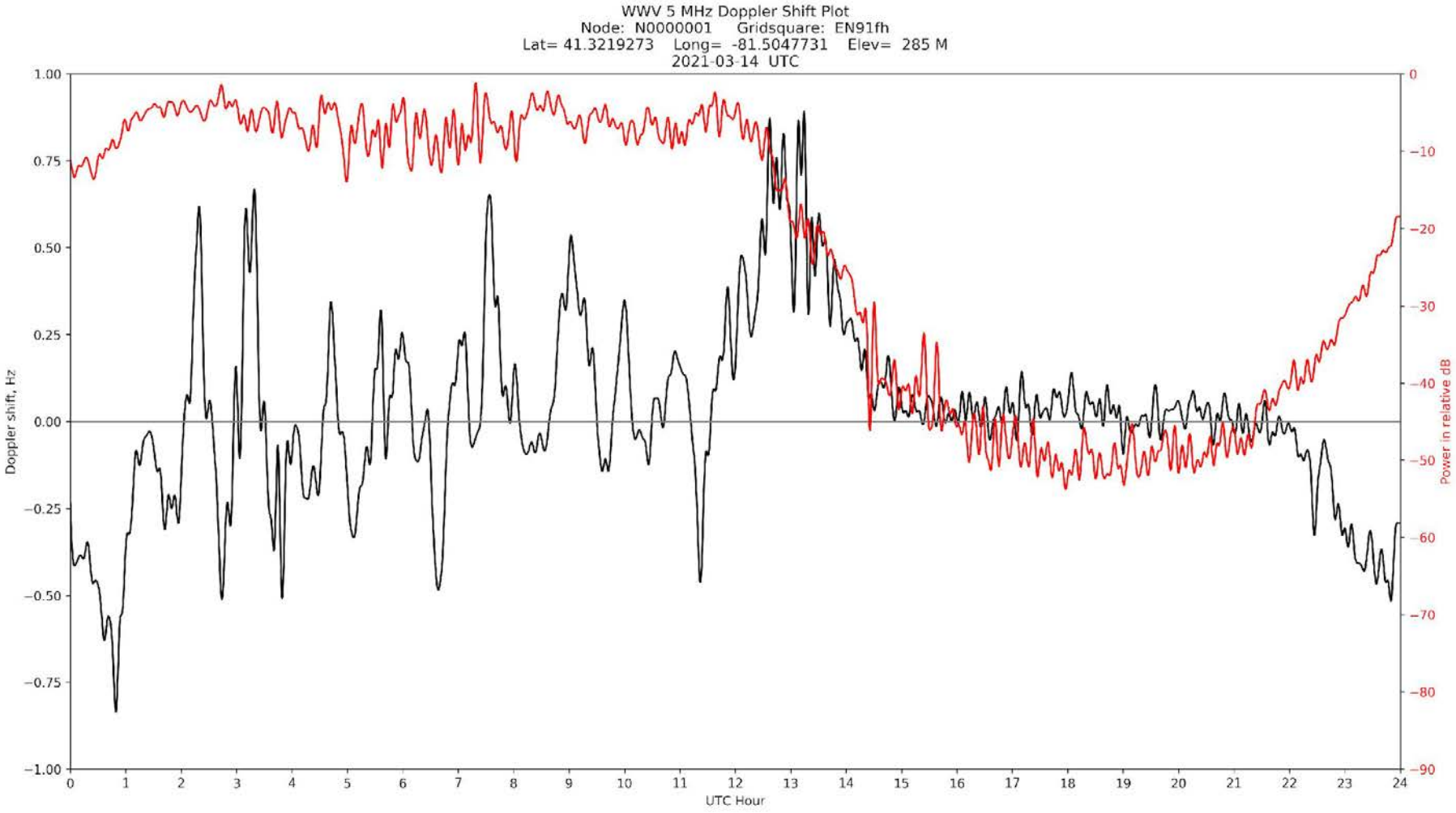
Active Space Weather WWV 2.5 MHz Day Plot



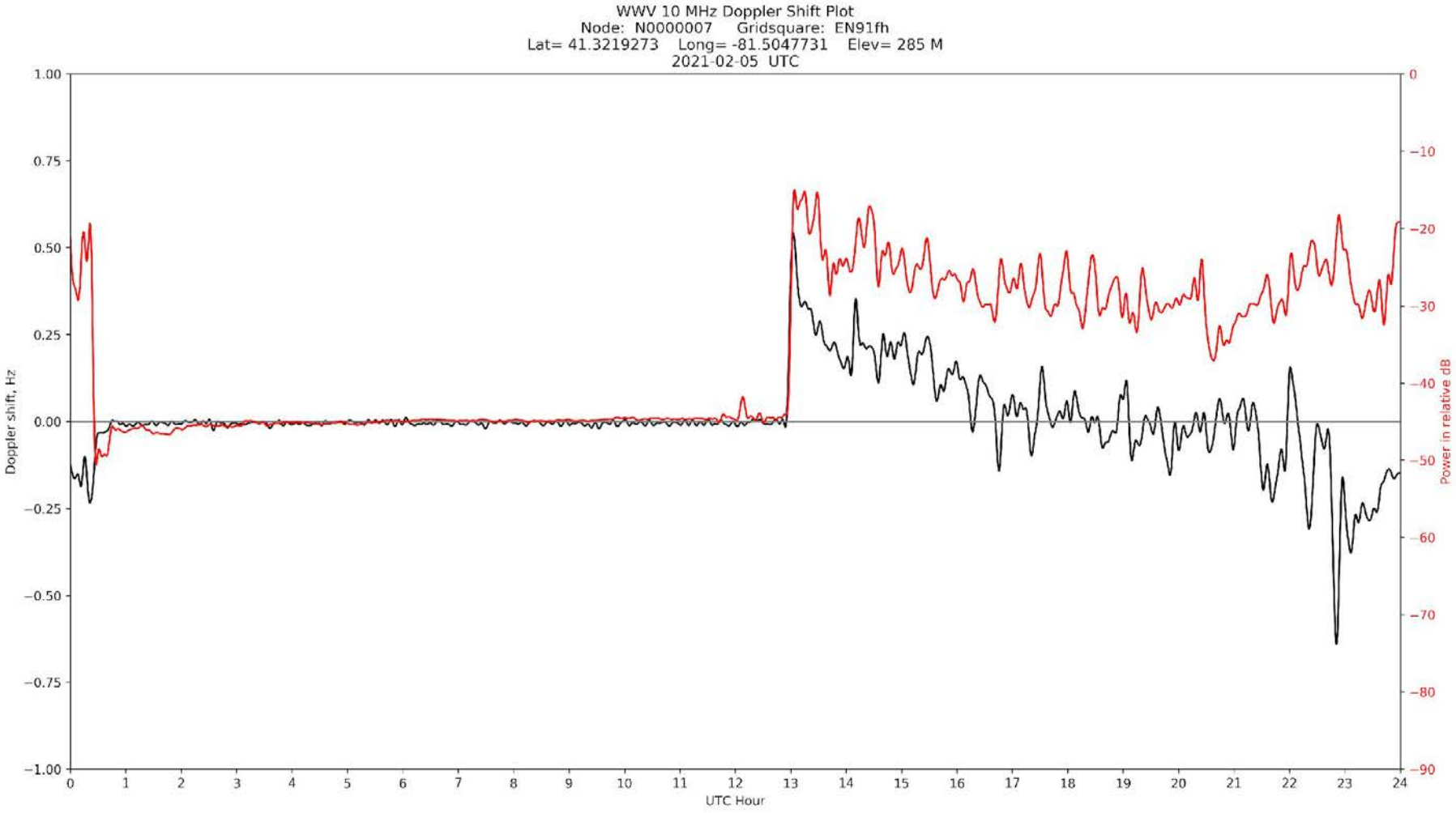
Typical Quiet WWV 5 MHz Day Plot



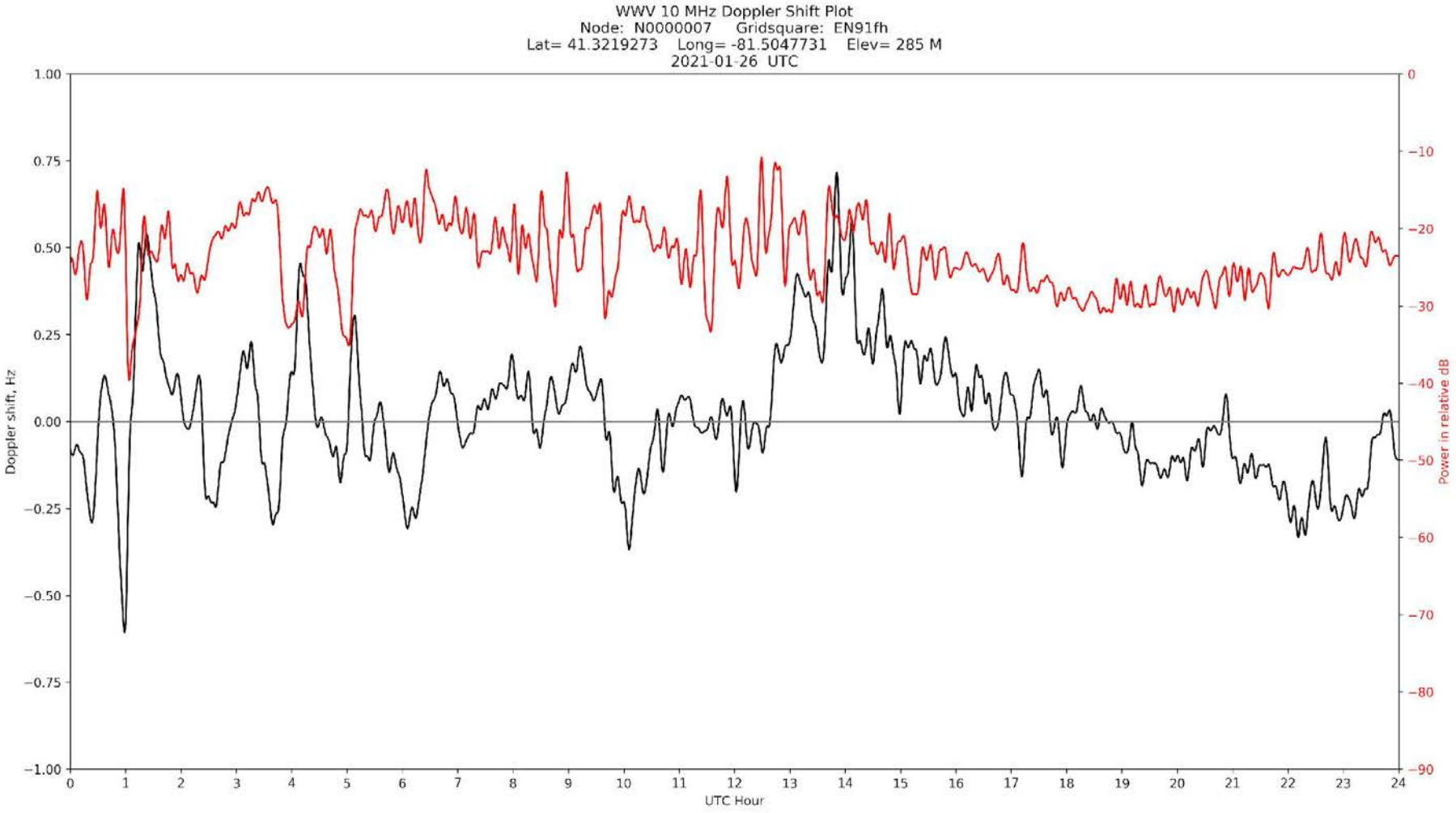
Active Space Weather WWV 5 MHz Day Plot



Typical Quiet WWV 10 MHz Day Plot



Active Space Weather WWV 10 MHz Day Plot



Questions?