

Frequency Measurement Test (FMT)

5/16/2012

Michael Perrett

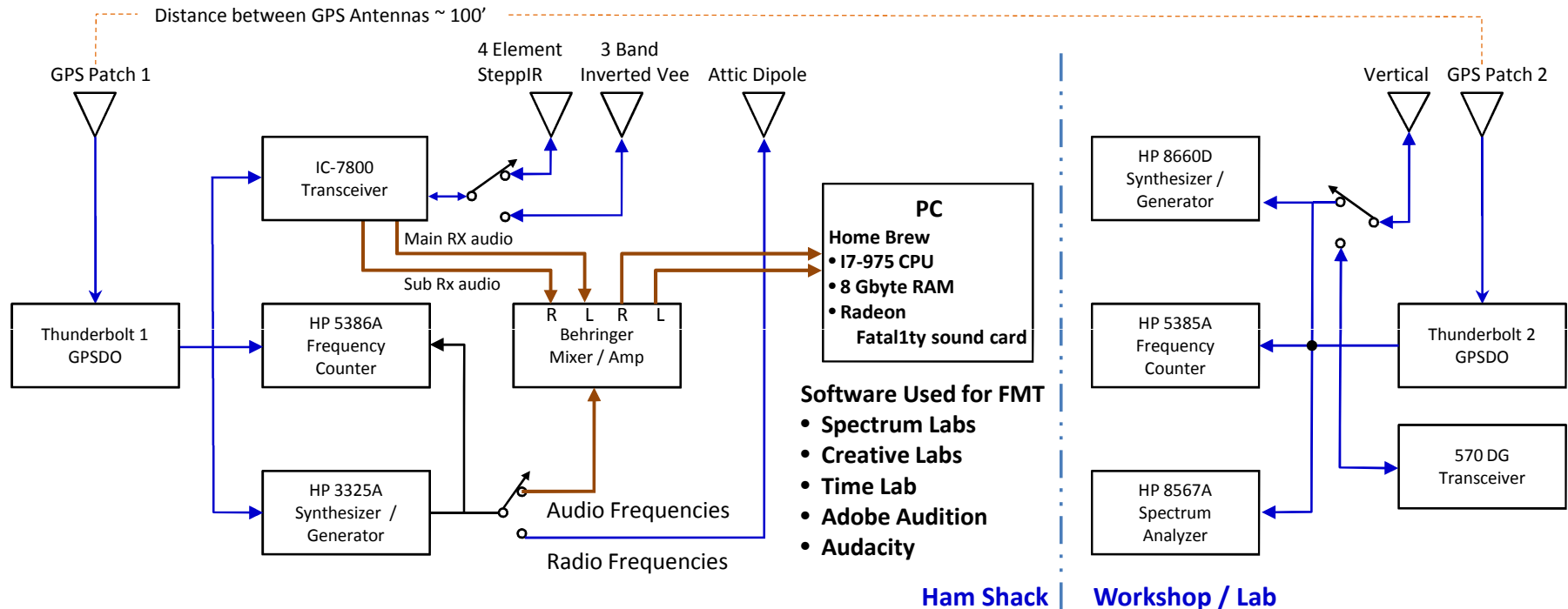
K7HIL

Major components used to determine frequency.

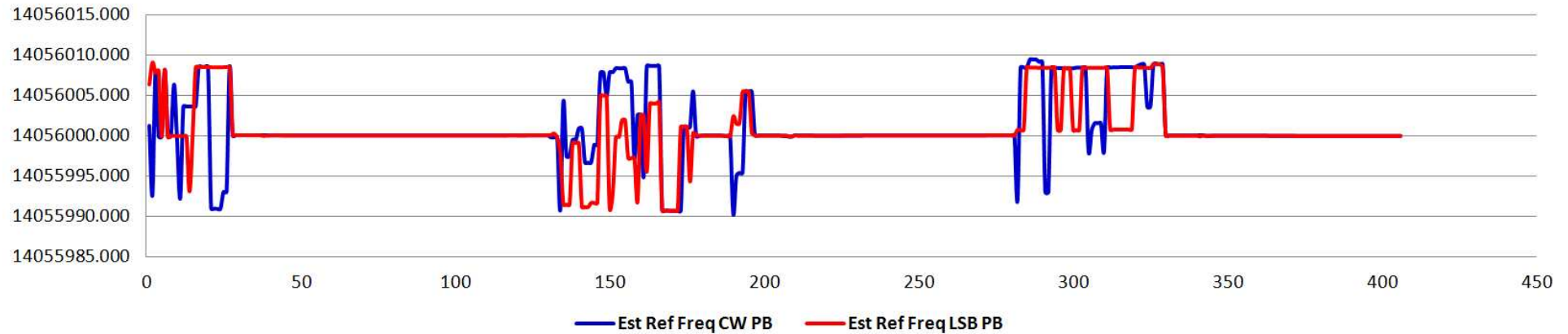
Not shown are all the “glue” items (Antenna Tuners, DX Engineering noise canceller, Power Master,)

Primary function is normal Ham Radio operations.

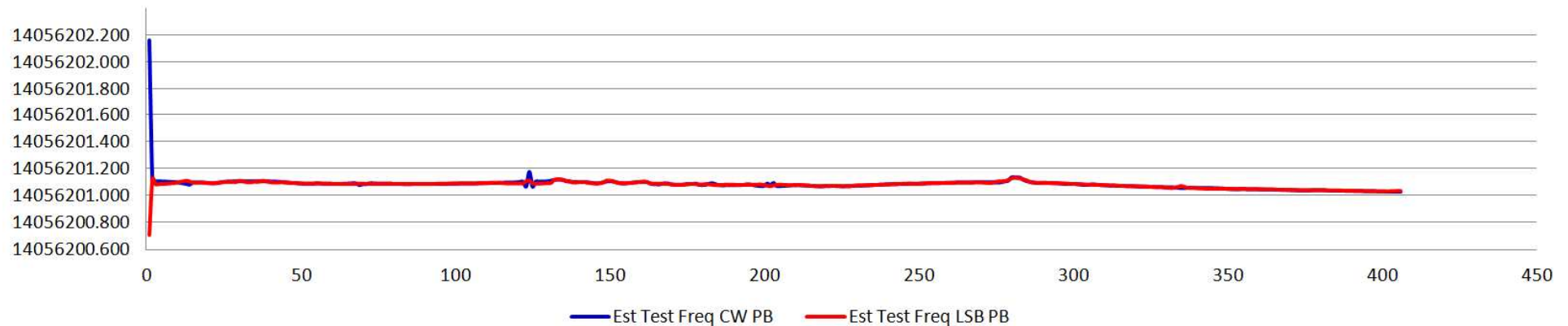
Grid square location is DM42ph (Tucson, AZ.)



FMT Ref Sig CW & LSB



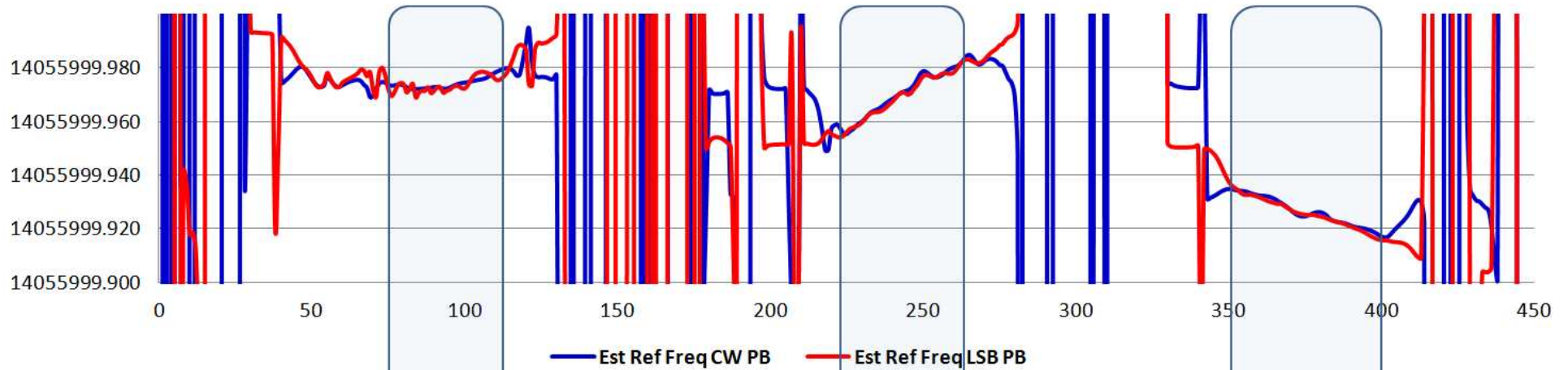
FMT Test Sig CW & LSB



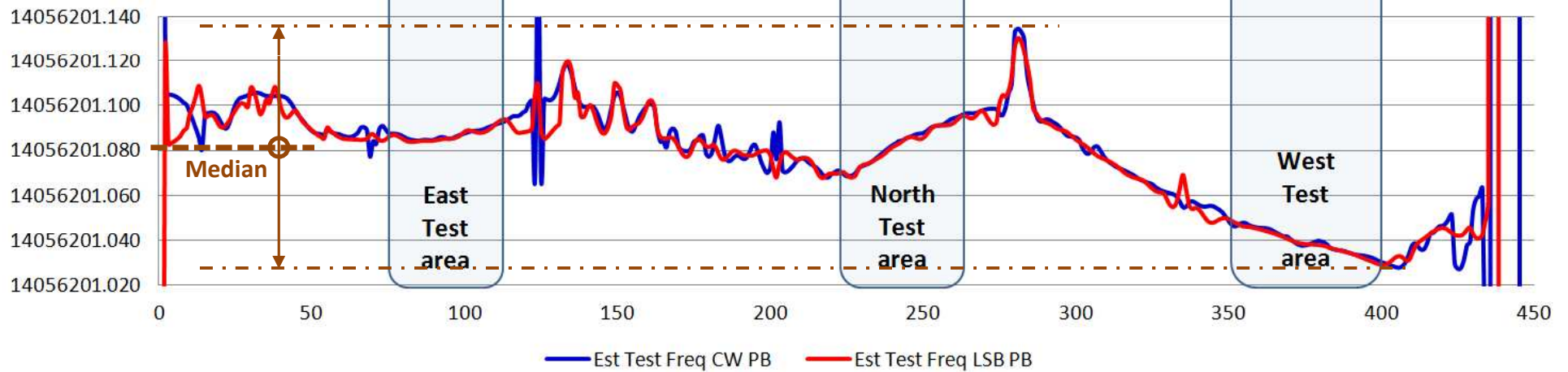
Using two methods to measure both the reference frequency (given) and the test frequency (estimated). First measurement, with no corrections shows gross errors

- Ref frequency between 14,055,995 and 14,056,005 Hz ($\Delta = 10$ Hz)
- Test frequency between 14,056201 and 14,056,201.2 Hz ($\Delta = 0.2$ Hz)

FMT Ref Sig CW & LSB



FMT Test Sig CW & LSB



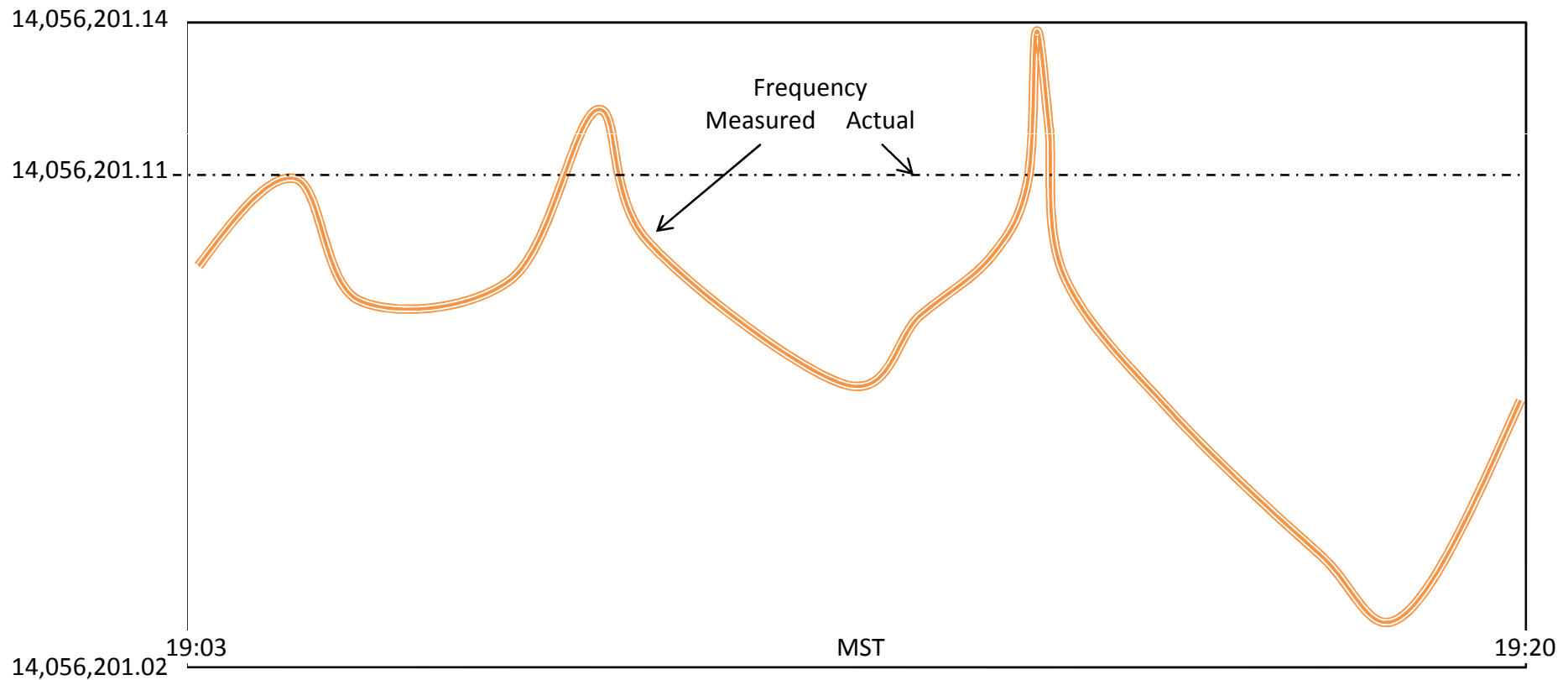
Increasing the vertical resolution of the raw data shows those areas where both the reference signal and the test signal have similar slope without any dropouts.

- Median method, without use of a reference signal to correct for Doppler, results in an estimated test frequency of $\sim 14,056,201.082$ Hz
- Median method error ~ 0.031 Hz

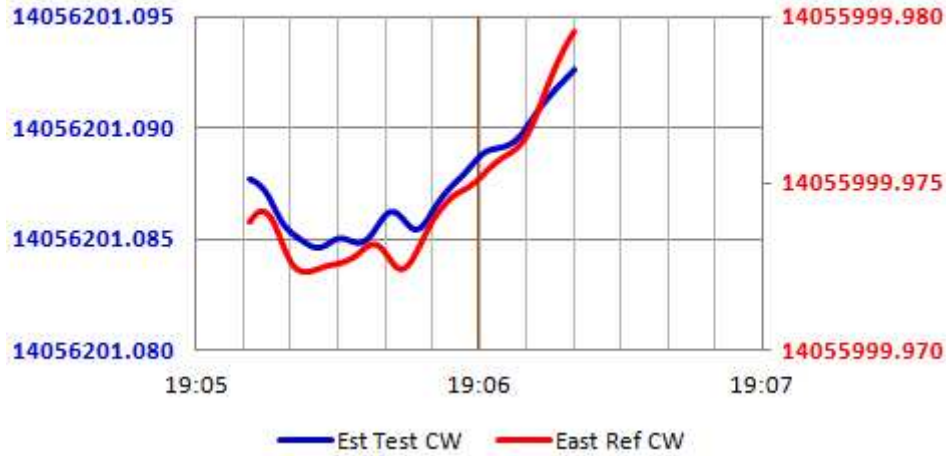
This graphic demonstrates the effect of the Doppler shift over the ~20 minutes of the Frequency Measurement Test.

Even without knowing the transmitted frequency at the source, it can be readily seen that the measured frequency varies greatly ($\sim .120$ Hz) over a short time period.

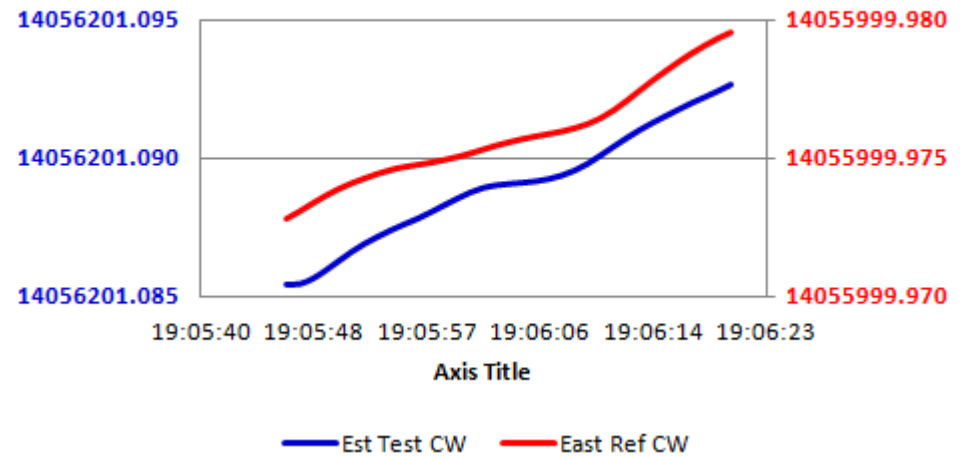
Without a known reference frequency there is absolutely no way 14,056,201.113 Hz would have been submitted.



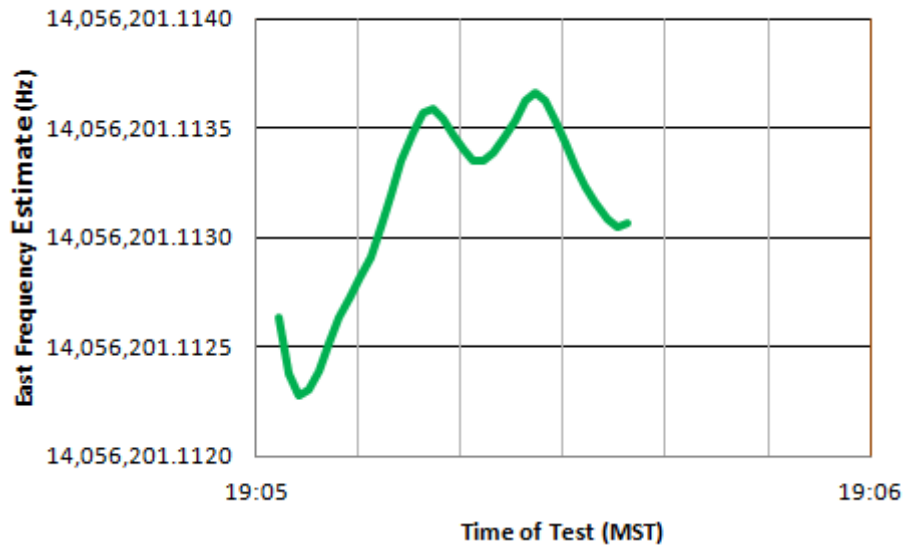
FMT (East data)



FMT (Selected East Data)



East Test - East Ref

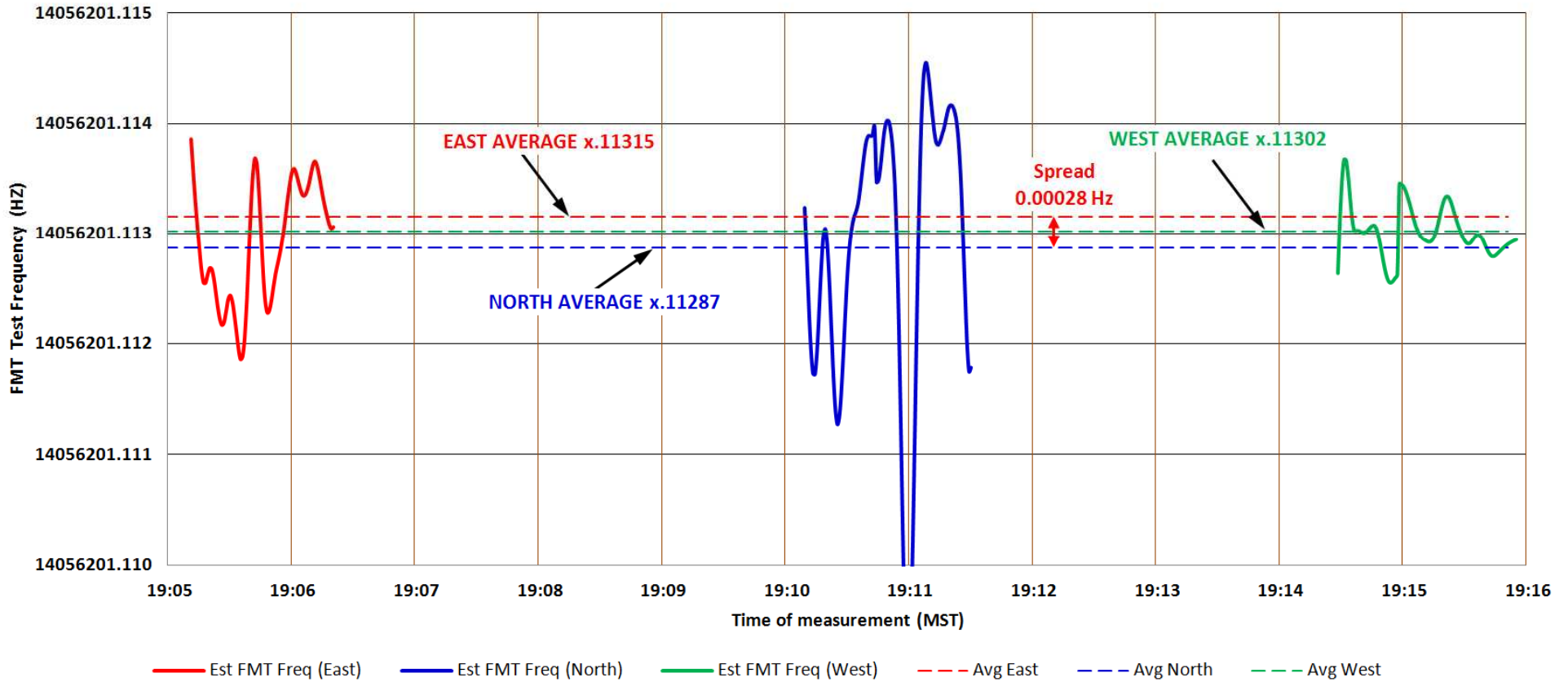


The Green trace is the individual test frequency measurements less the reference frequency error.

After data submitted saw I could have used earlier data (~30 seconds), but no appreciable change to the resultant average test frequency estimate.

Identical technique used on North and West data.

FMT Measurements K7HIL 5/16/2012



Average after correction (SUBMIT)

Estimated FMT Freq	Estimated FMT StDev	
14056201.113152	0.000425	East
14056201.112872	0.001297	North
14056201.113020	0.000238	West

14056201.113014

SUBMISSION

Error PPx
9.96002E-13

Application of the known ref frequency error to the frequency being estimated gave entirely different results!