Wireless Frequency Domain Data Manipulation for Embedded Devices Used in Cybersecurity Applications

Page Heller, PE

Author and Presenter

Endpoint Security Inc

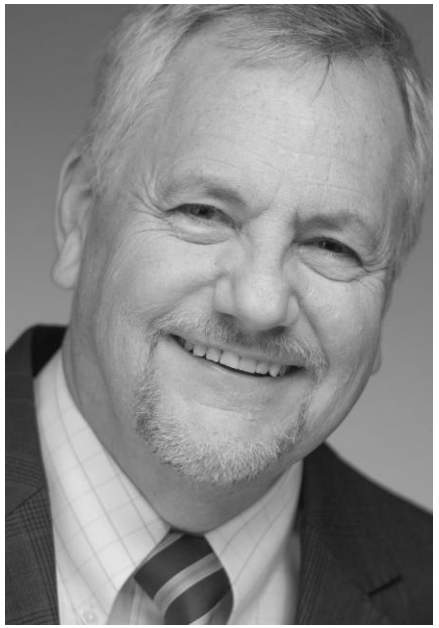
heller@endpointsecurityinc.com

ENDPOINT

Security Inc

Page Heller

Seven times founder Page Heller is an experienced manager of technology companies. He is the CEO of Endpoint Security Inc, a cybersecurity startup for industrial control systems. Working for Texas A&M and Notre Dame, he has evaluated more than 600 innovations for commercial potential and personally negotiated more than 200 license agreements. As an entrepreneur he has self-funded, angel-funded, venture-funded and formed strategic alliances with major corporations. His companies have designed products for 3M, General Electric, Schlumberger, Pirelli, NASA, and he now shares his experience by helping startups, large companies, and tech-transfer organizations.



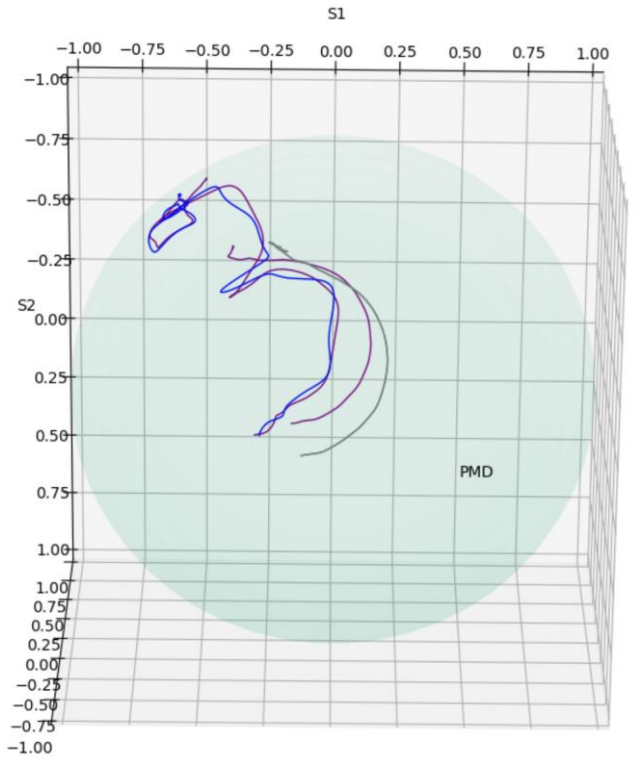
Research Interest

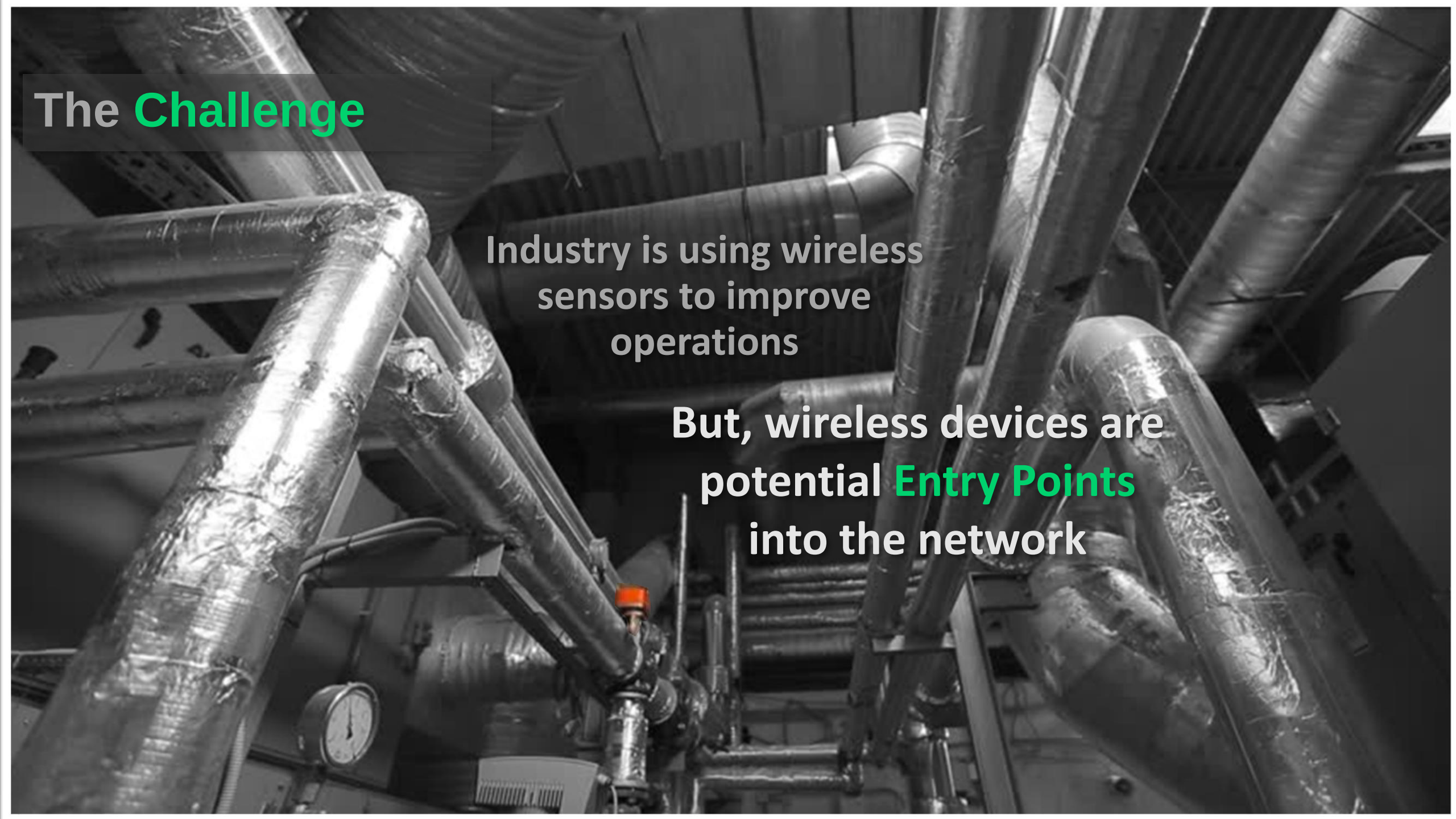
Familiar with:

- RF signal polarization characterization
- Industrial control design
- cybersecurity

Expertise needed:

- 3D Curve matching
- Machine learning for real time systems




The Challenge
Industry is using wireless sensors to improve operations
But, wireless devices are potential Entry Points into the network

ENDPOINT Statistics

opportunity

There are approximately 30 million wireless devices installed in industry. Half are inadequately protected from malicious attacks. Such attacks could result in significant down-time or even loss of life. Hardware-based security can stop that from happening.

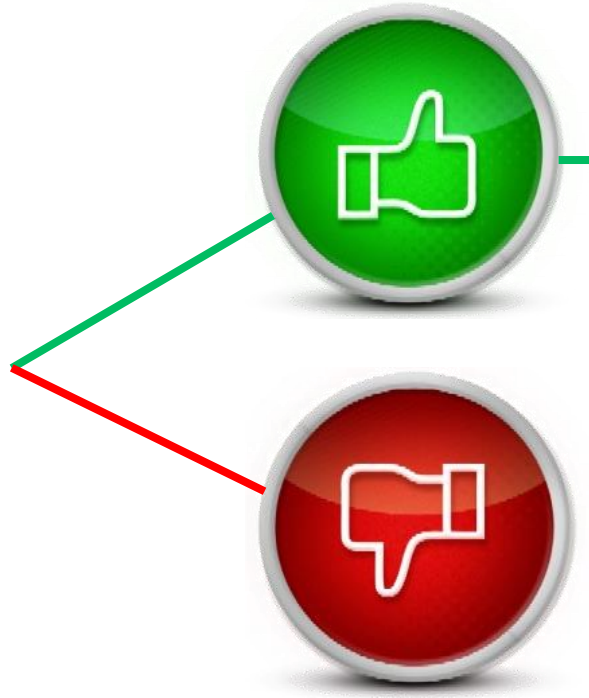
30 million Wireless Industrial Devices

$1.7 billion Semicon Sales

6% CAGR

ENDPOINT Solution

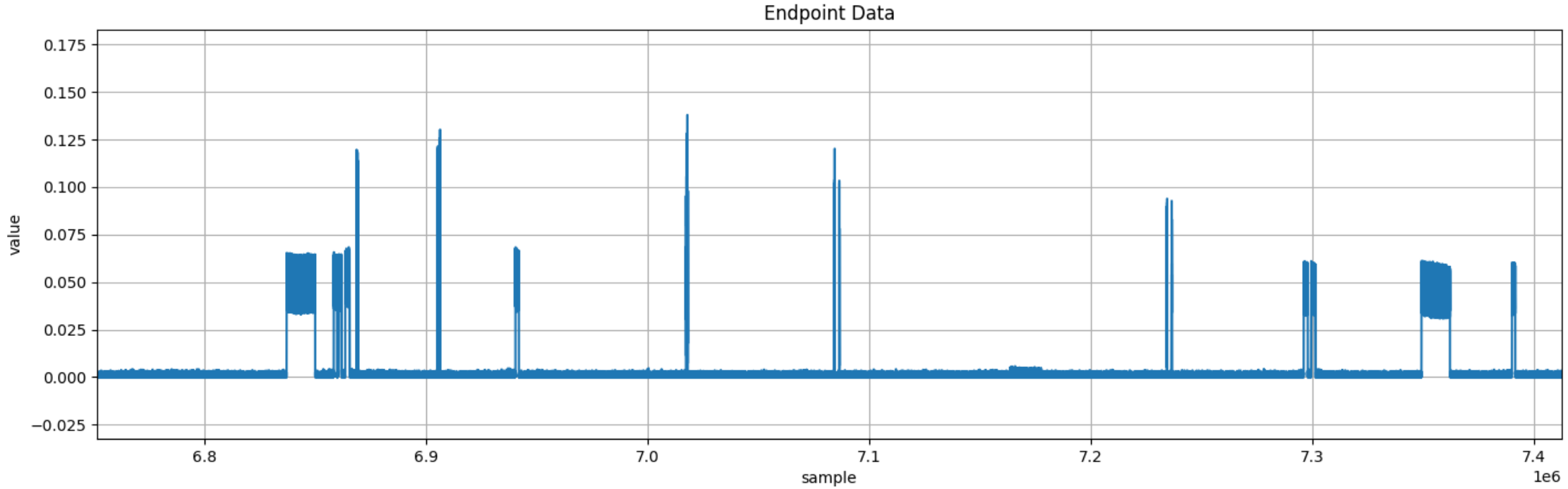
Access Point



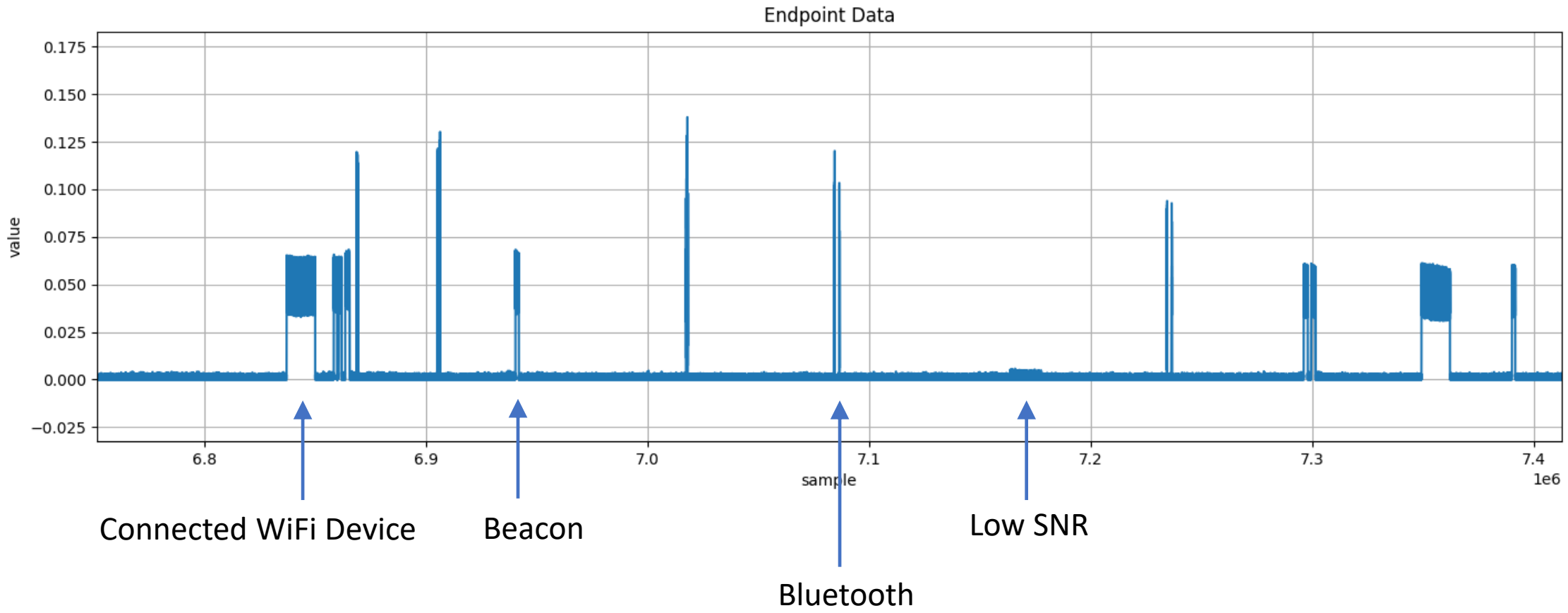
Network

Endpoint Technology Secures wireless with no key

RF Signals Arriving at the Access Point

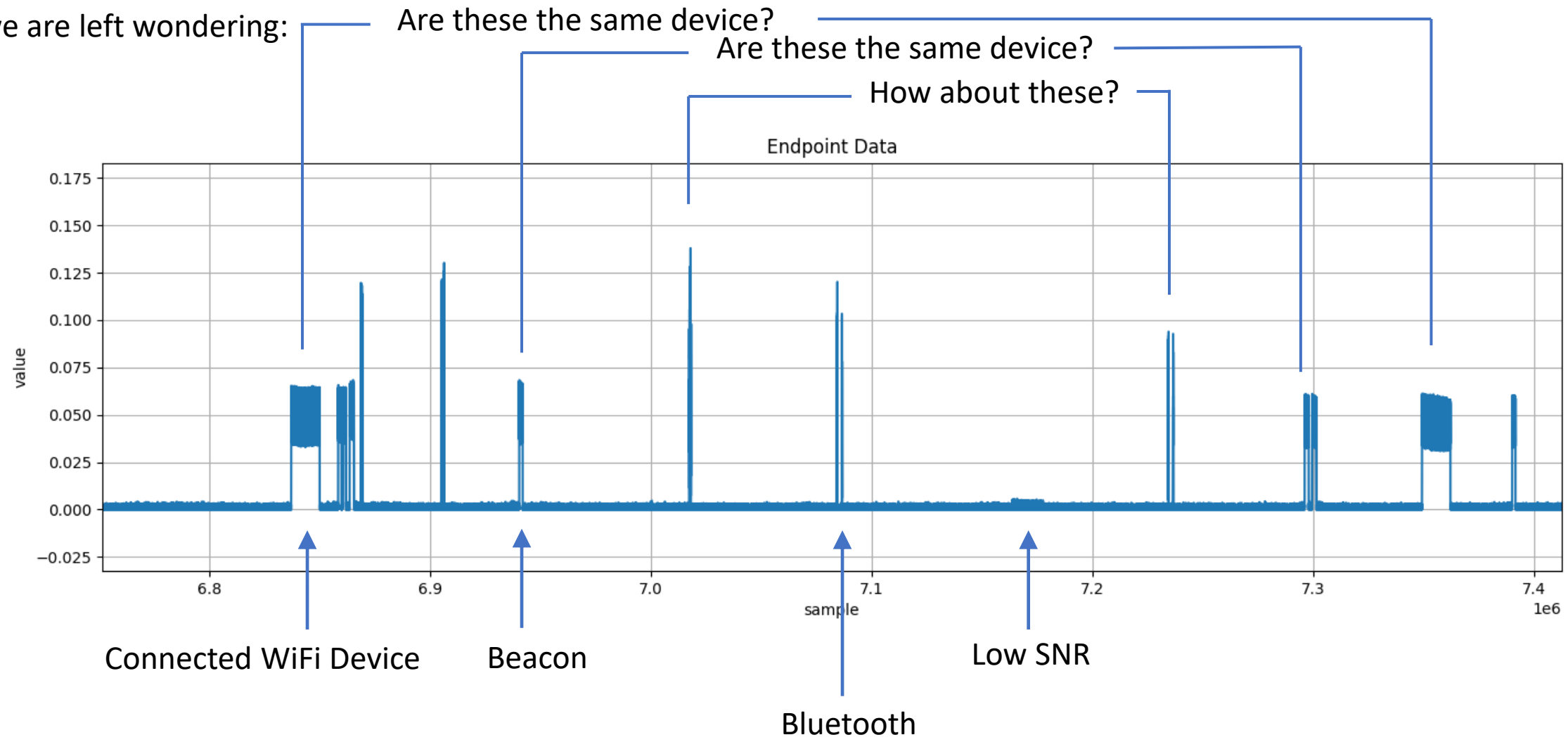


RF Signals Arriving at the Access Point

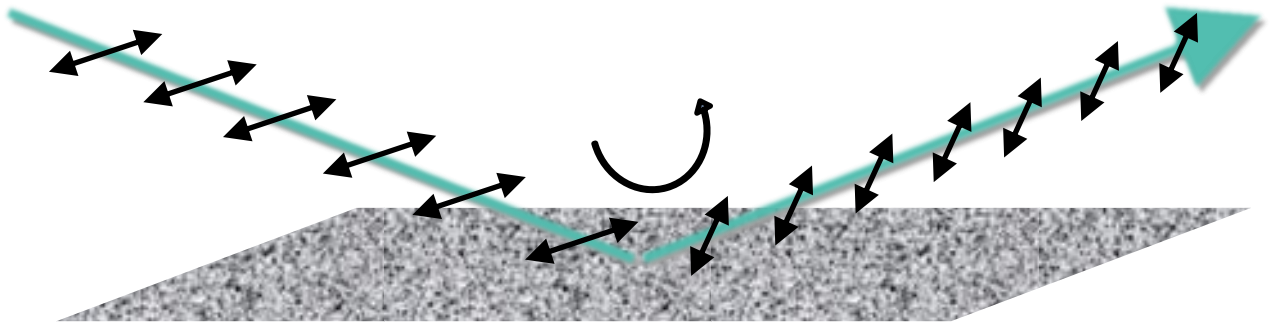


RF Signals Arriving at the Access Point

And we are left wondering:

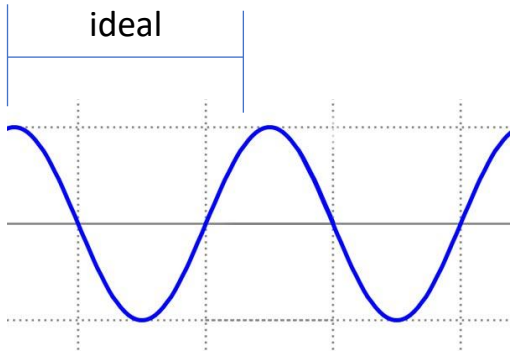


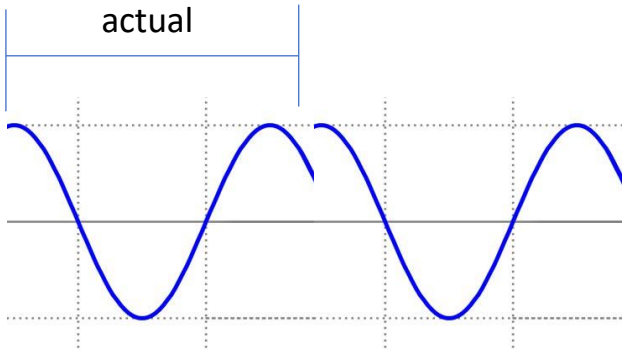
ENDPOINT Principle of Operation



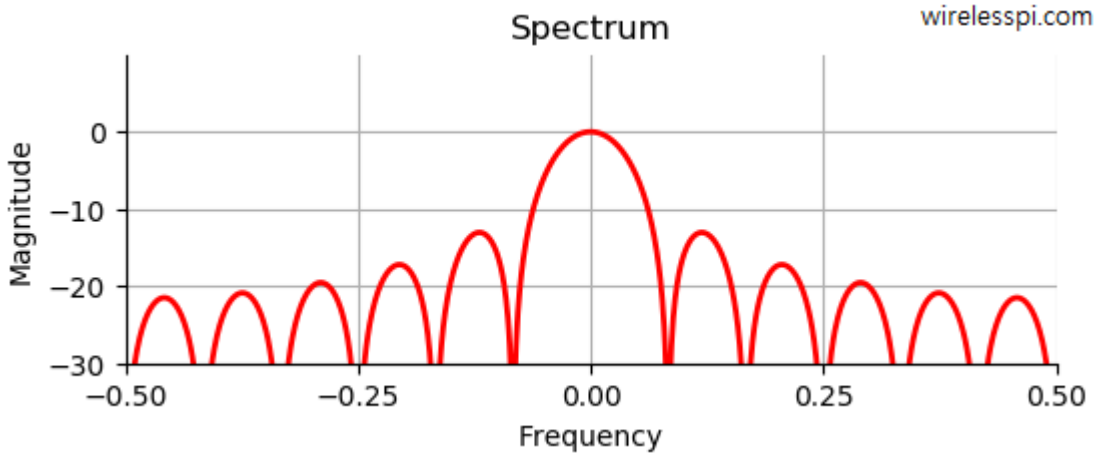
Polarization of a signal changes as it reflects off of surfaces

Moving to the Frequency Domain

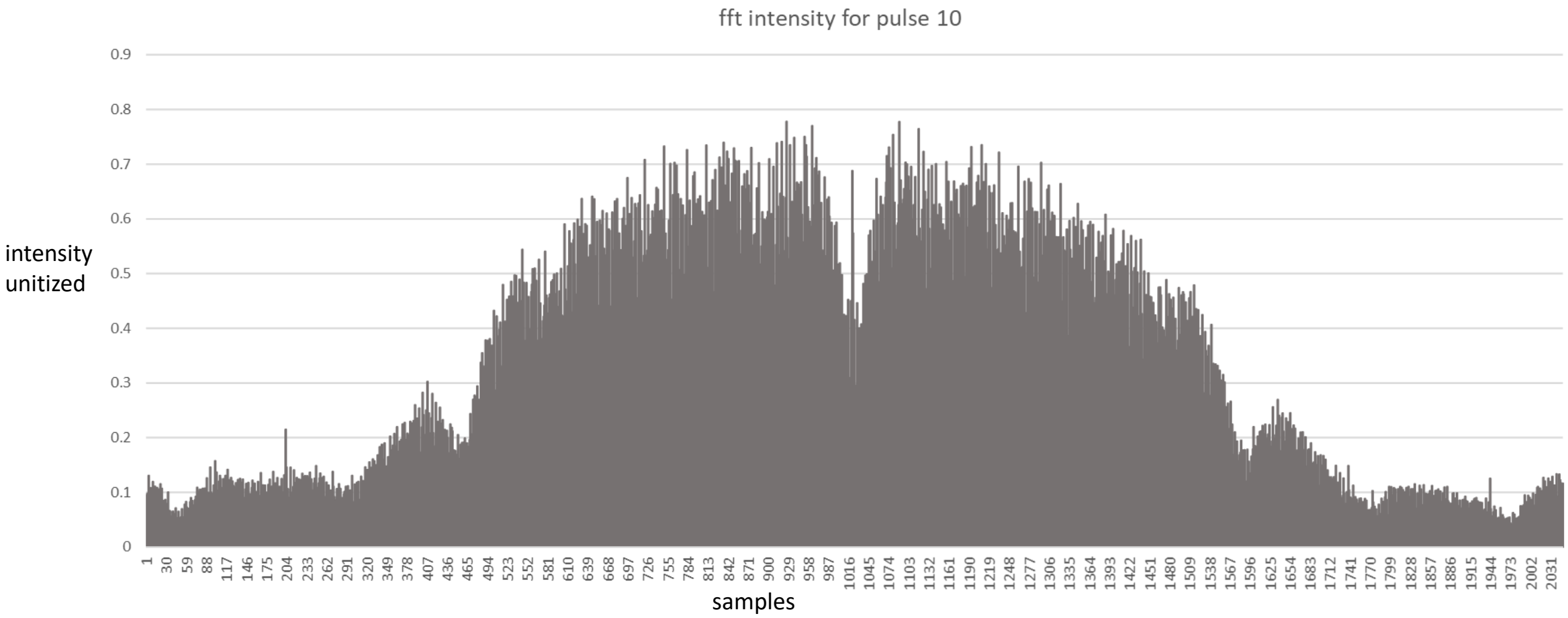




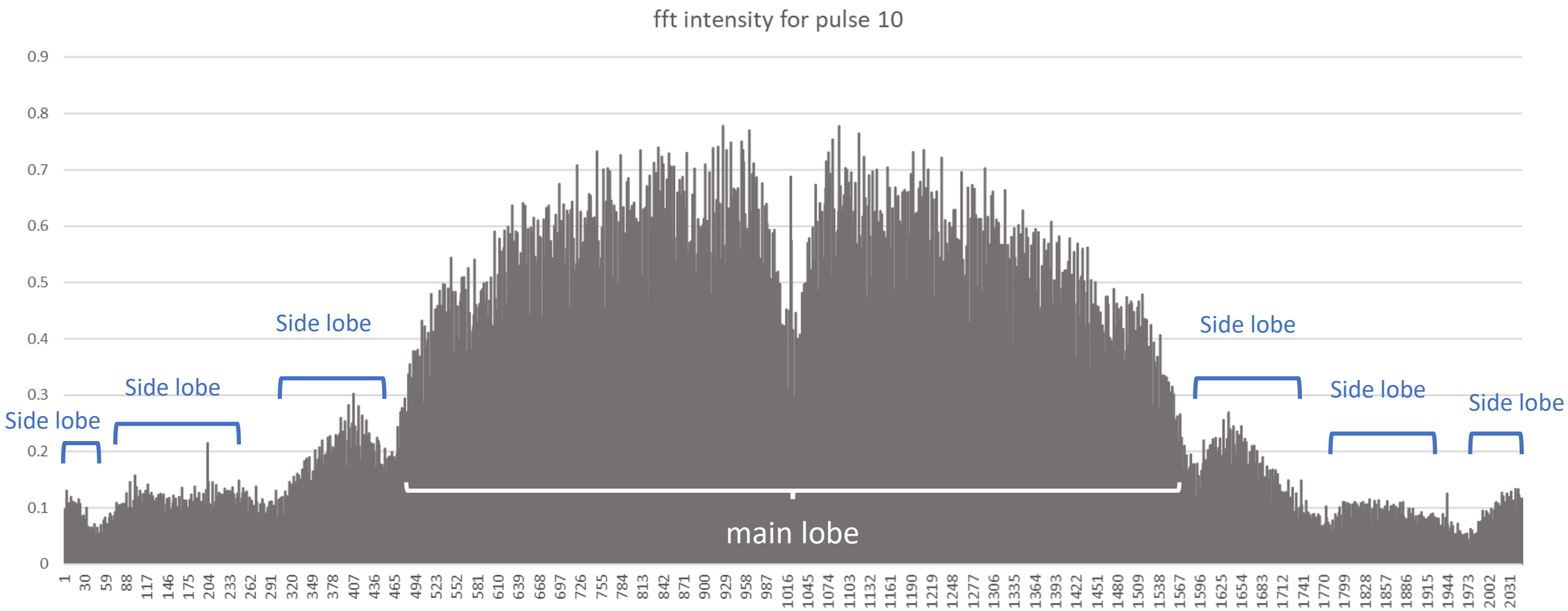
The sample window selected is assumed to be a full cycle of the frequency studied, but of course, it isn't. This introduces a discontinuity that shows up as side lobes in the resulting DFT.



DFT of one signal



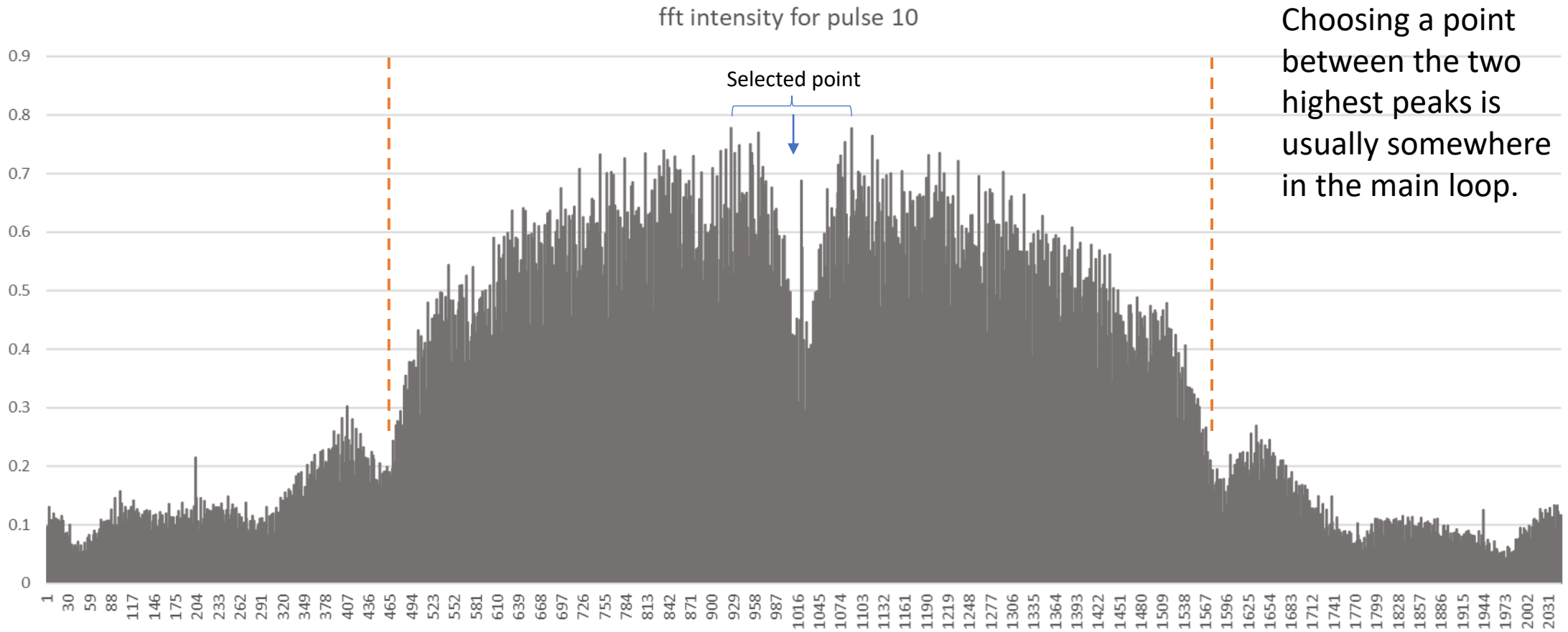
DFT of one signal



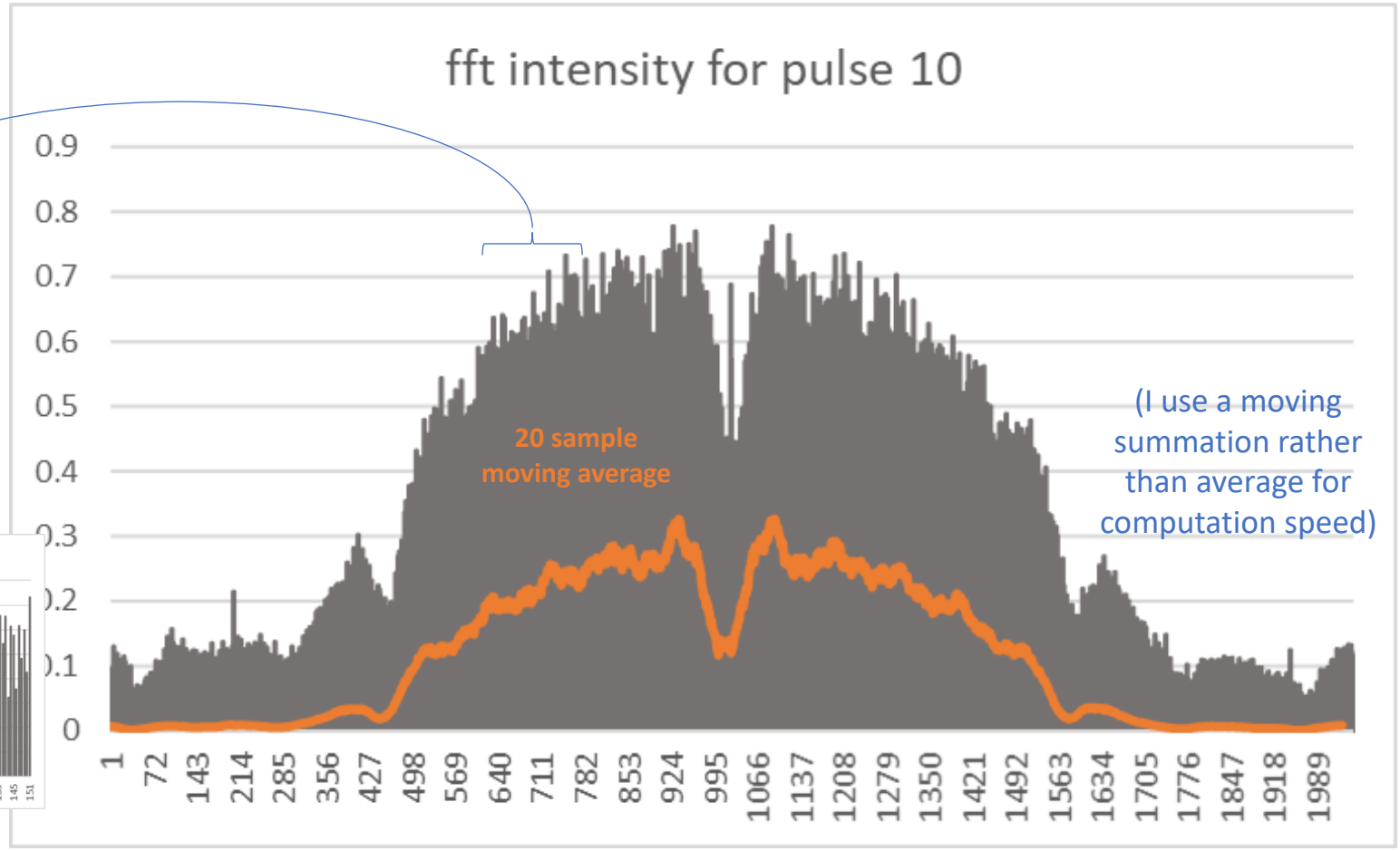
DFT of one signal

We want the portion between the red lines-the main lobe.

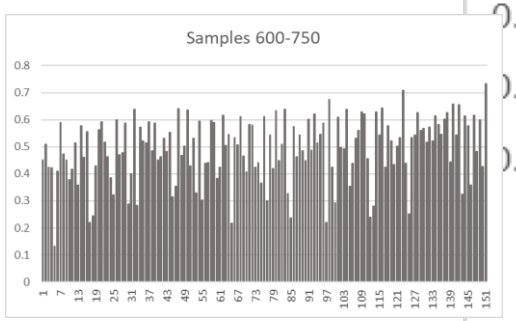
Choosing a point between the two highest peaks is usually somewhere in the main loop.



Moving average

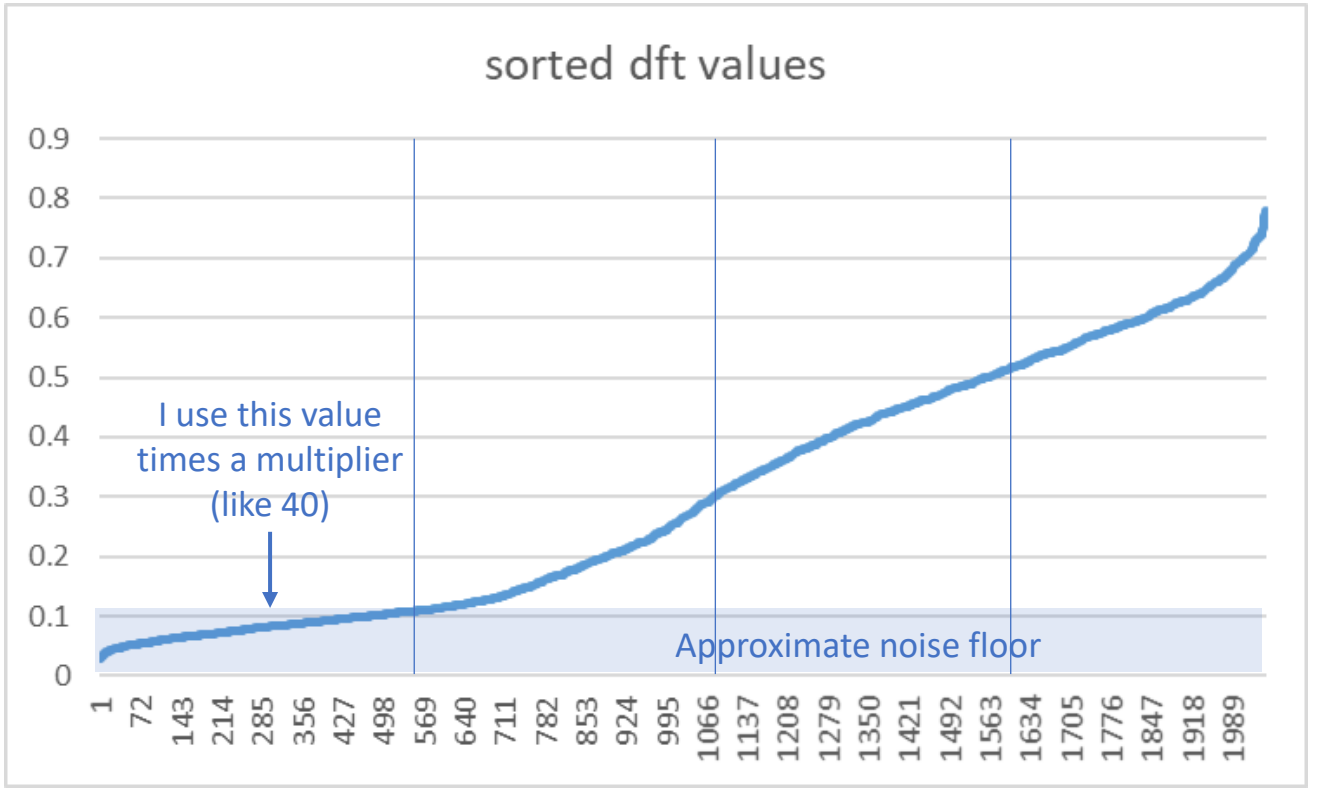


A low-pass filter is needed to remove variations

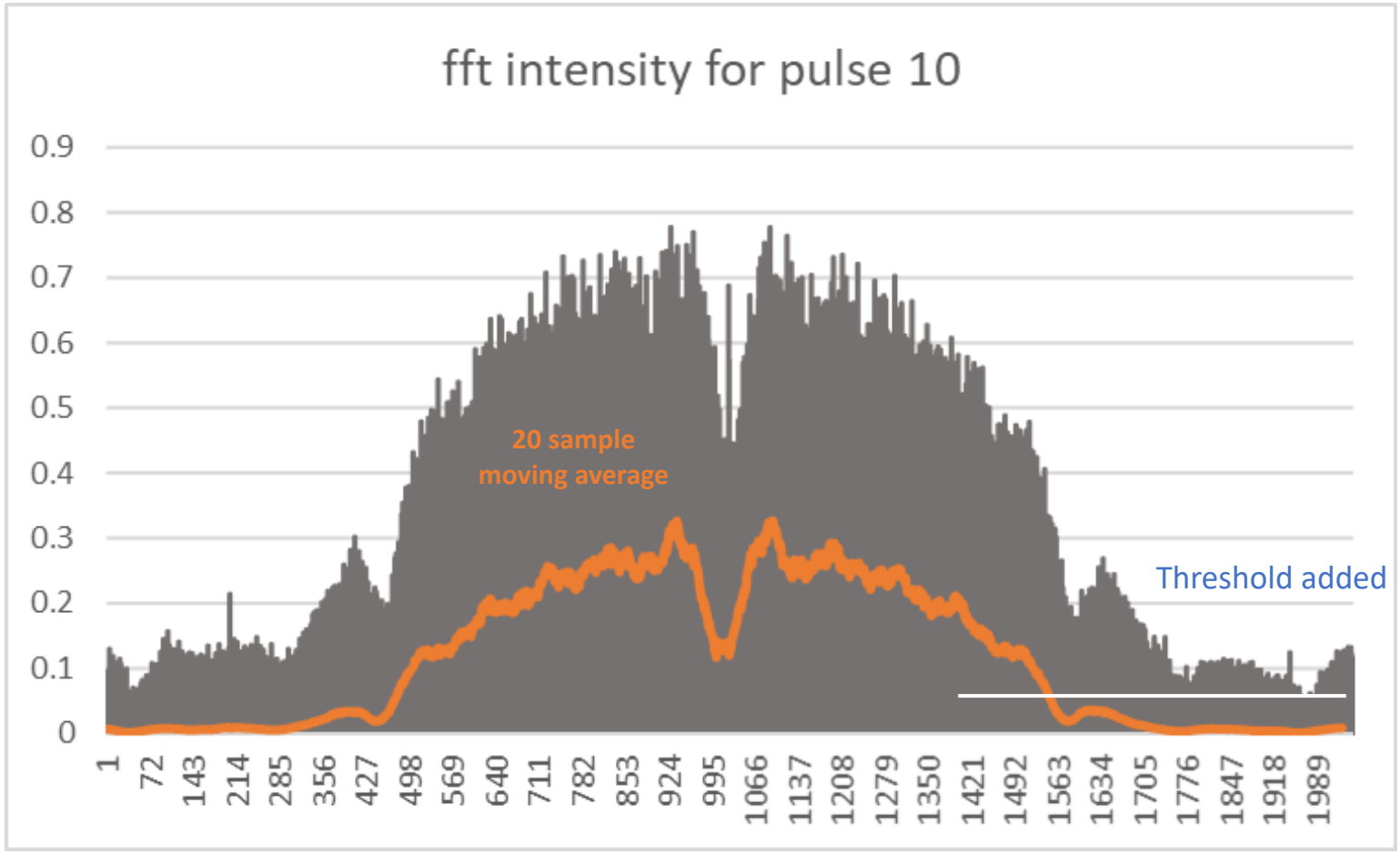


(I use a moving summation rather than average for computation speed)

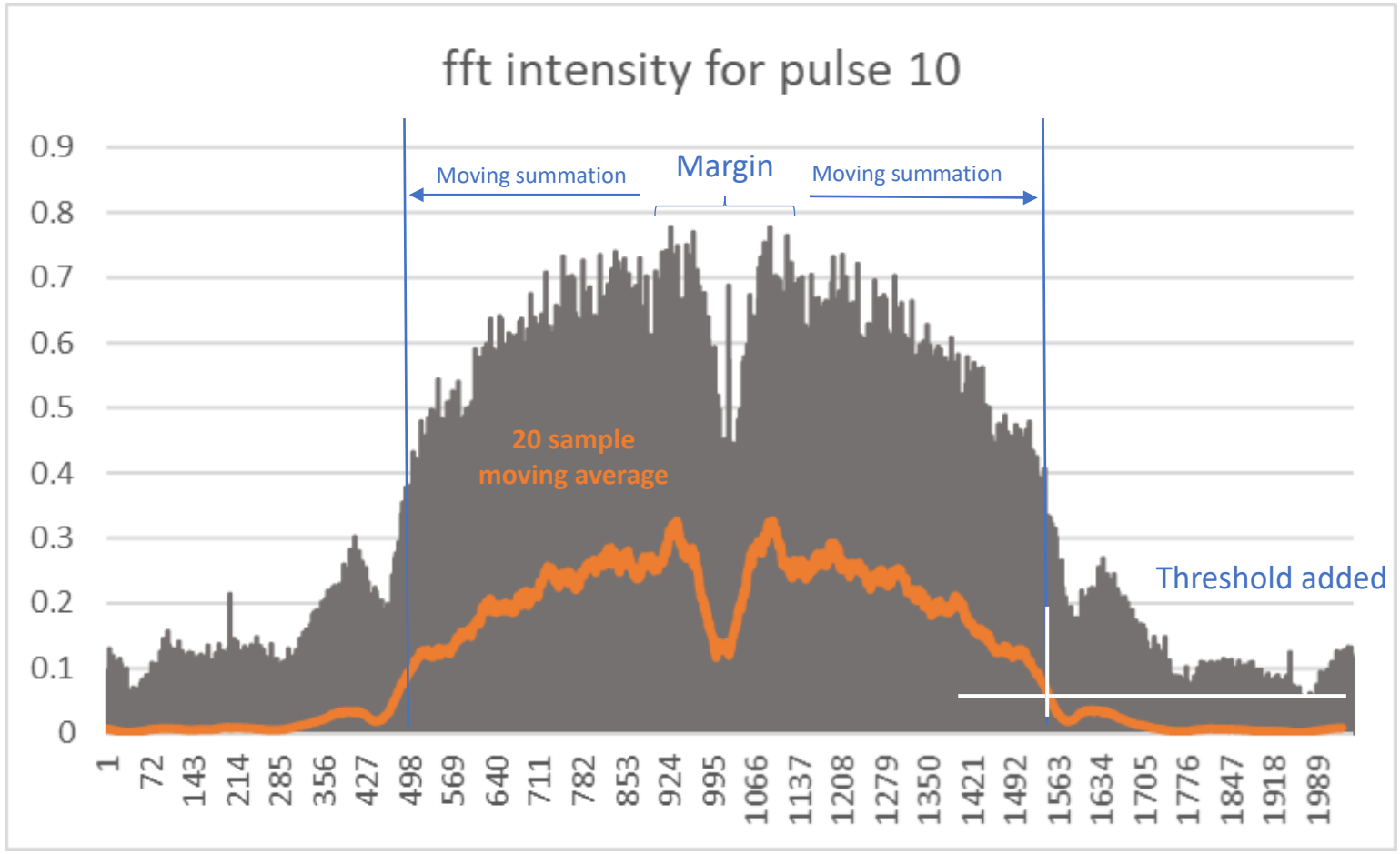
Sorted DFT values for threshold determination



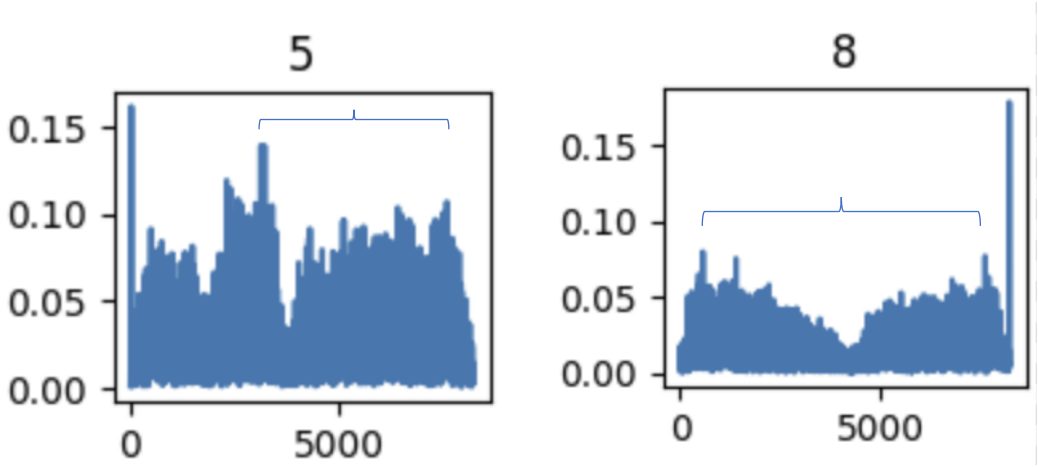
DFT of one signal



DFT of one signal



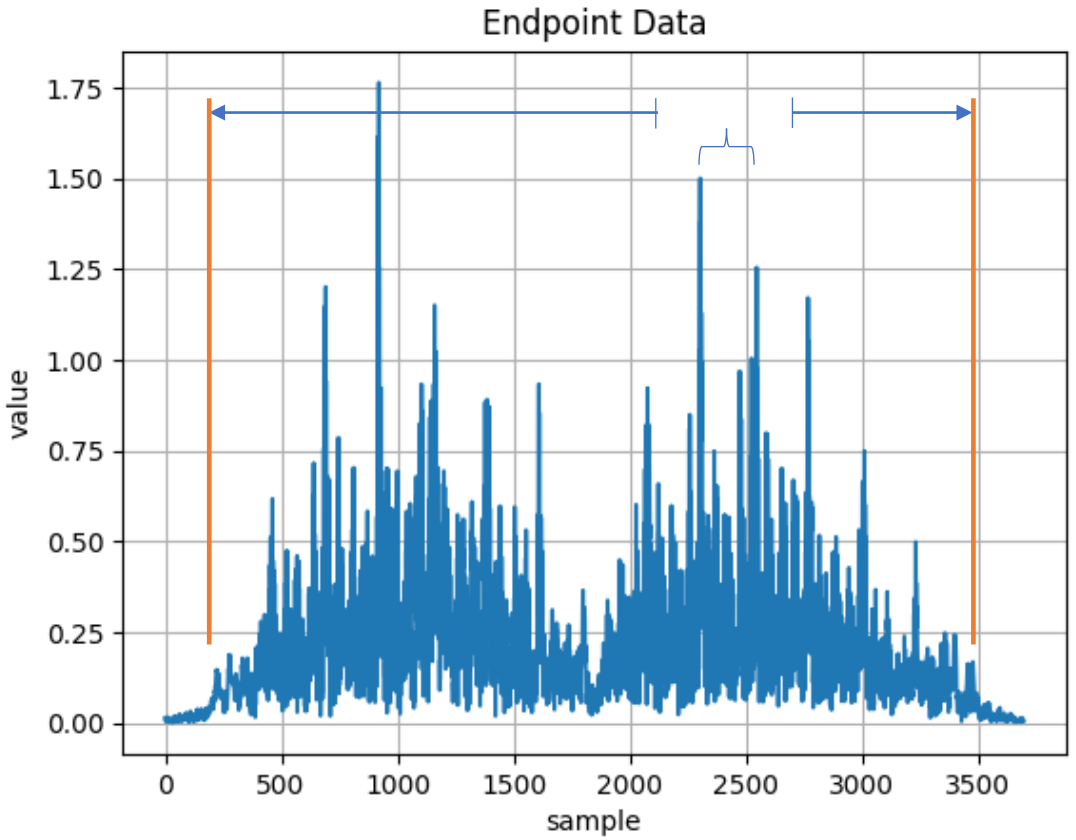
One last thing-the noise floor



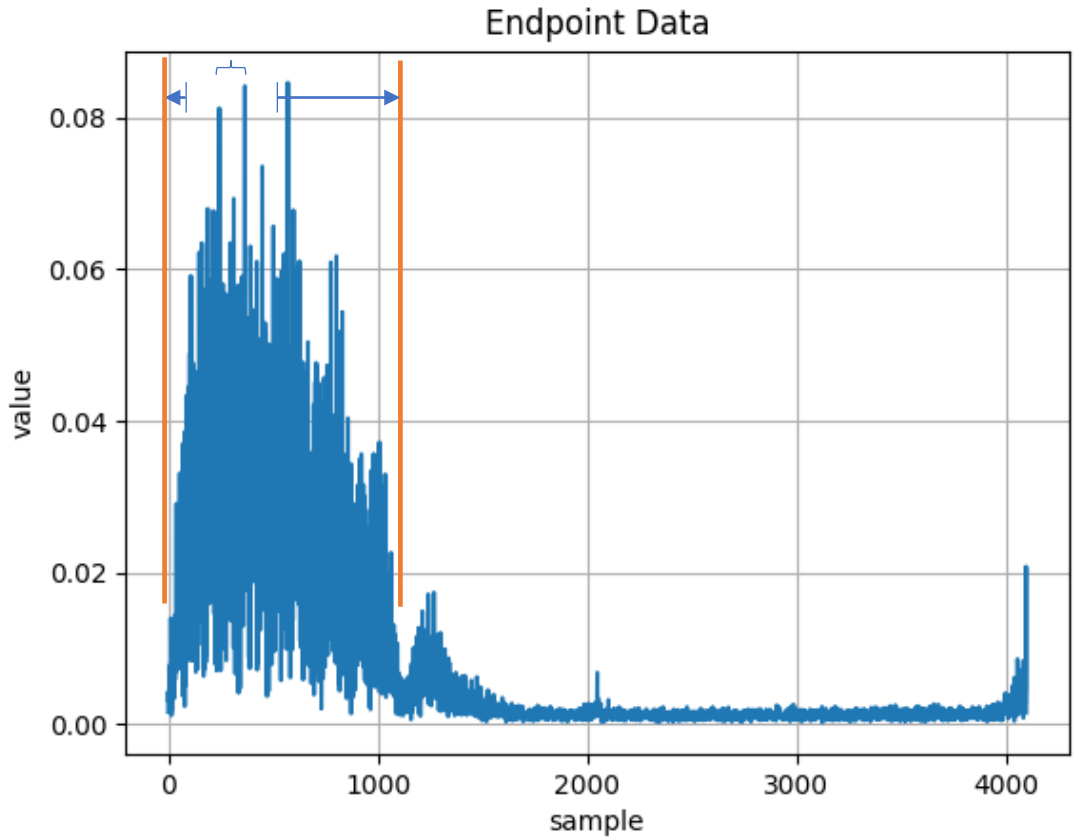
Occasionally, one frequency bin resulting from the DFT calculation has an intensity higher than any other.

To overcome, simply select a point between the second and third highest intensities.

Low SNR signals



Adjacent channel



Special *thanks* to Stan McLellan for introducing me to ICDT and to Tom Pratt at the University of Notre Dame for introducing me to the technology employed by Endpoint Security Inc.

Page Heller, PE
Author and Presenter
Endpoint Security Inc
heller@endpointsecurityinc.com

ENDPOINT
Security Inc