



# Triplex Chapter of Vibration Institute

## Wireless Monitoring of Critical Assets

Jim Girardeau  
Uptime Solutions

[jgirardeau@uptime-solutions.us](mailto:jgirardeau@uptime-solutions.us)  
[www.uptime-solutions.us](http://www.uptime-solutions.us)

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# Agenda

- Goals of Wireless Monitoring
- Radio Technology
- Case Study - Field Deployment



# Part 1: Goals of Wireless Monitoring



# Wireless Monitoring

- Supplements route based analysis for critical machines.
- Critical areas or problem areas analyzed continuously.
- Analysts spend more time analyzing data, and less walking routes.
- Higher Reliability with more accurate data.

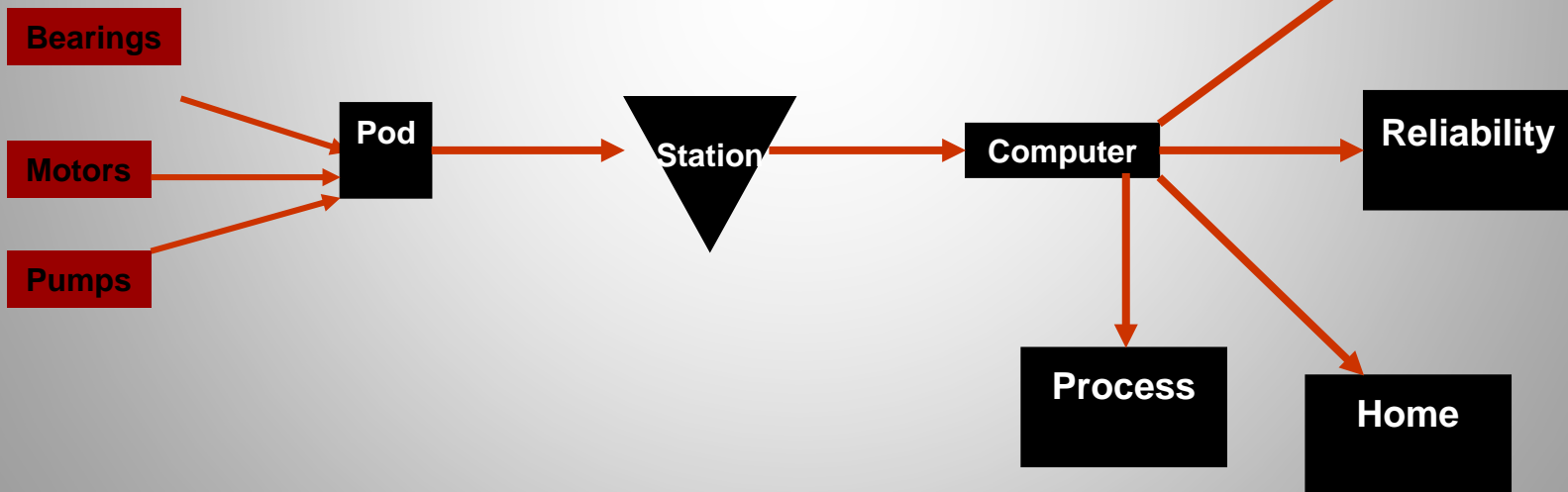


# Wireless Monitoring Goals

- High capability
  - ❖ Full spectrum analysis
  - ❖ Real time signals, dwell on asset
  - ❖ Automated fault detection
- Historian and trending; access “anywhere”
- Easy to install and flexible to expand
- Reliable and cost effective

# Wireless Network

- How does it work?
- Monitoring Sensors- Sensors are connected to the wireless transmitter unit via BNC/Pin Point connectors
- Radio- Data is sent via radio from the wireless node unit to the Base Station (transceiver)
- Mesh Network-allows the nodes to talk to one another
- Software- Displays Spectrums, Waveforms, Trend Data, Temperature Display and stores data
- Power- 24 v DC / Battery





# Part 2: Radio Technology



# Wireless Soup

WLAN  
A,B,G,N

2.4GHz  
Standards  
ISA  
Wireless HART

400/800/900M  
Hz  
ISM

GPRS



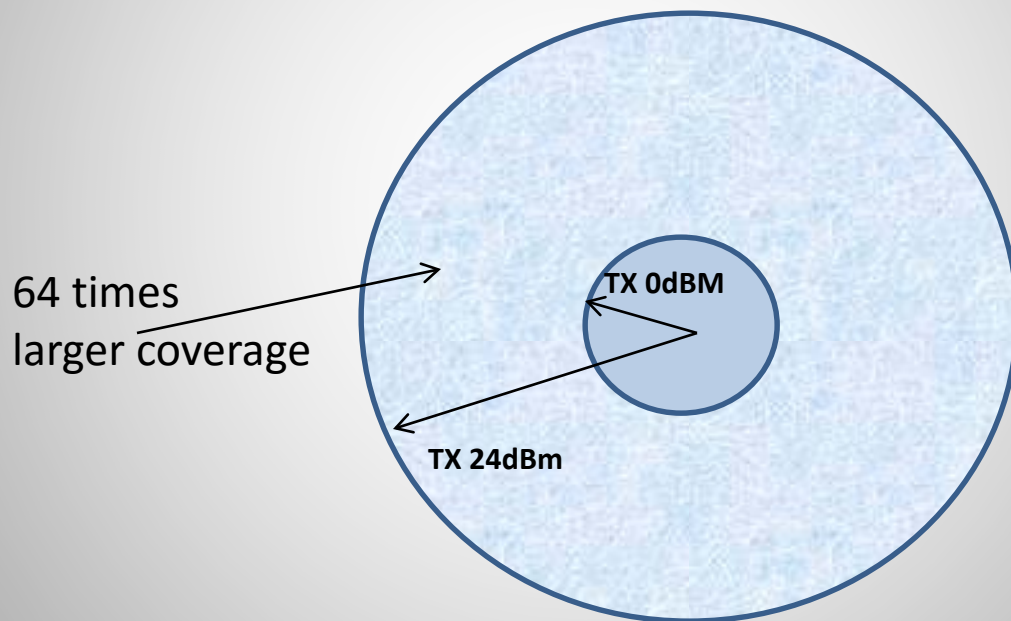


# Radio Fundamentals

- Range
  - ❖ Power
  - ❖ Frequency
  - ❖ Antenna gain
- Capability/bandwidth
- MAC Protocol, TDMA, Mesh, Star
- Deployment

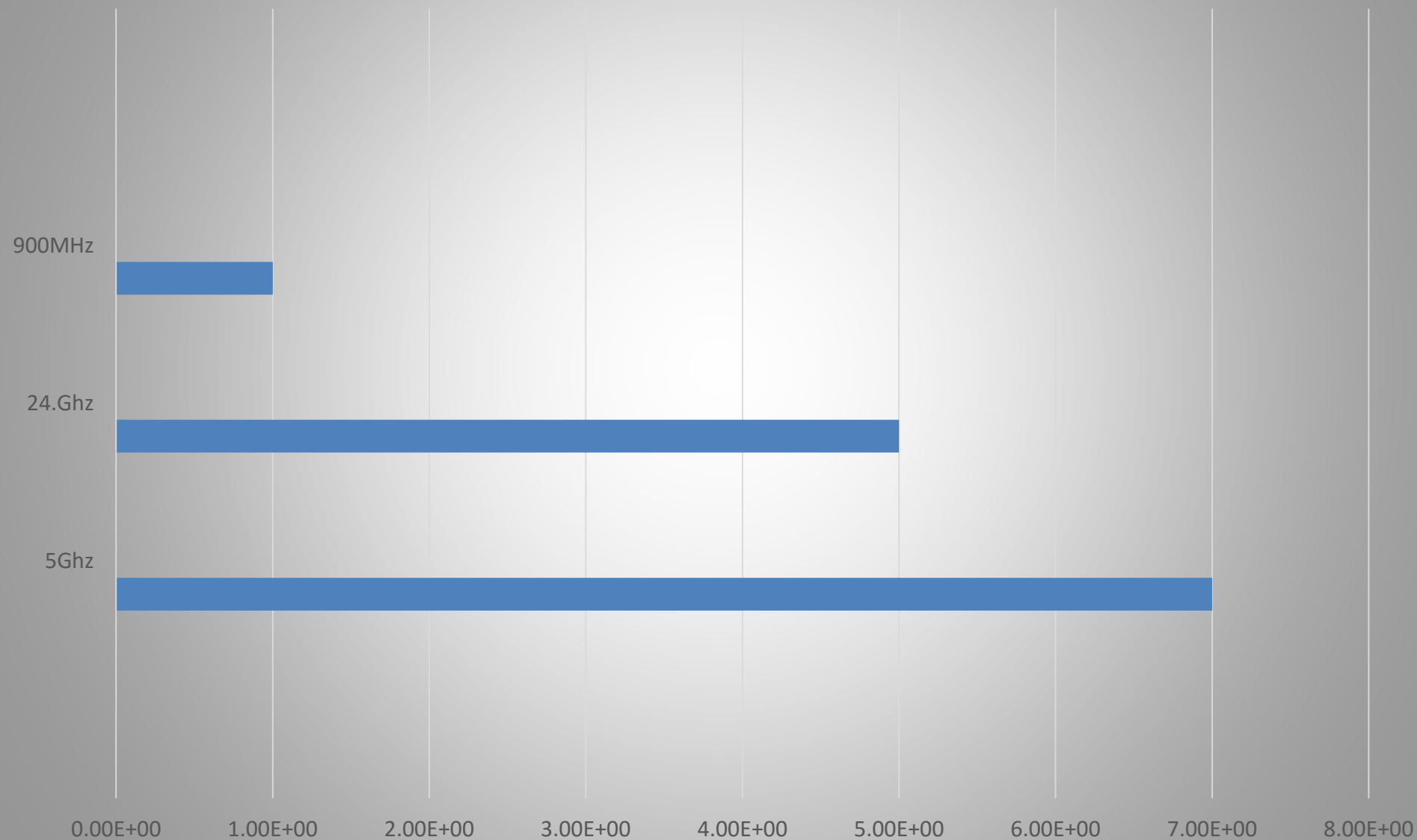
# Power Output

Coverage Area vs. Power

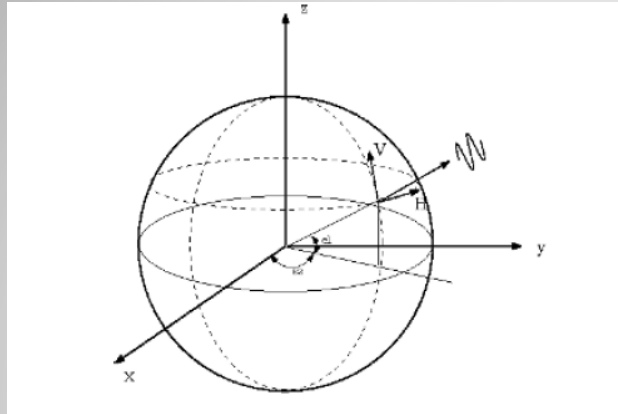




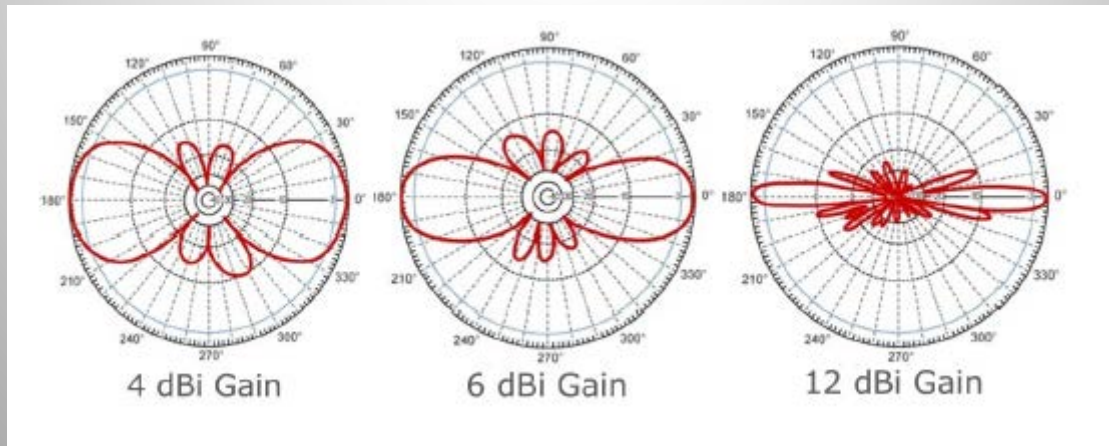
# Propagation Lost vs. Wavelength



# Antenna Gain

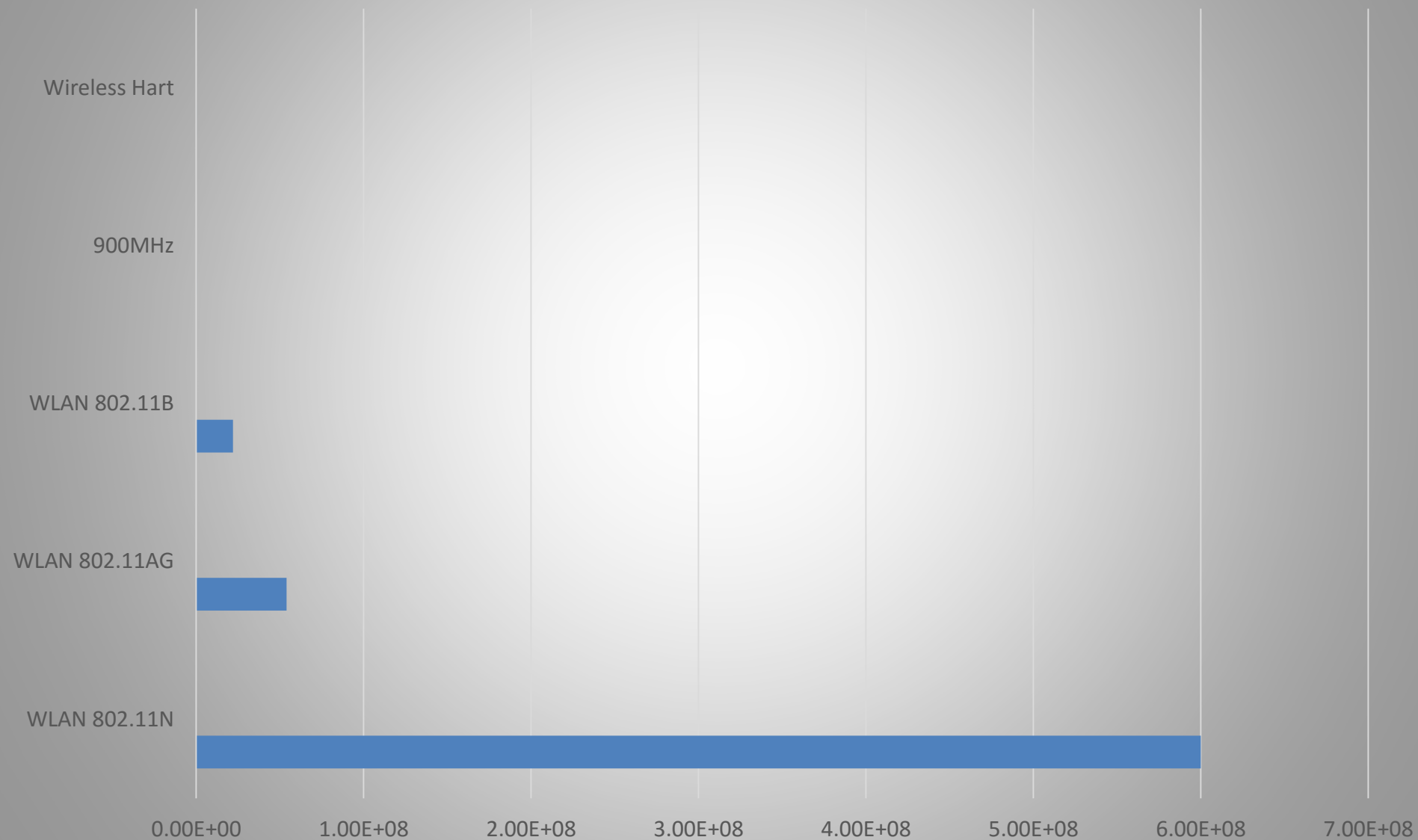


Ideal Antenna





# Typical Bit Rates



# Deployment Considerations

- Deployment on WLAN is a well know process, and involves site maps and placement of base stations.
- Deployment of 900MHz is similar, but requires less infrastructure.
- Deployment of Mesh type systems, seems easy due to their self adjusting properties and redundancy, but has difficulties in practice.



# Example Deployment of Wireless Hart

- Wireless Hart foundation “fundamental rules” ---
  - ❖ The Rule of 5 – “Every Wireless Hart network should have a minimum of 5 Wireless Hart devices”
  - ❖ The Rule of 3 -- “Every Wireless Hart network should have a minimum of 3 neighbors”
  - ❖ The Rule of Percentage – “Every Wireless Hart network with greater than 5 devices should have 25% within range of the gateway”



# Putting It All Together

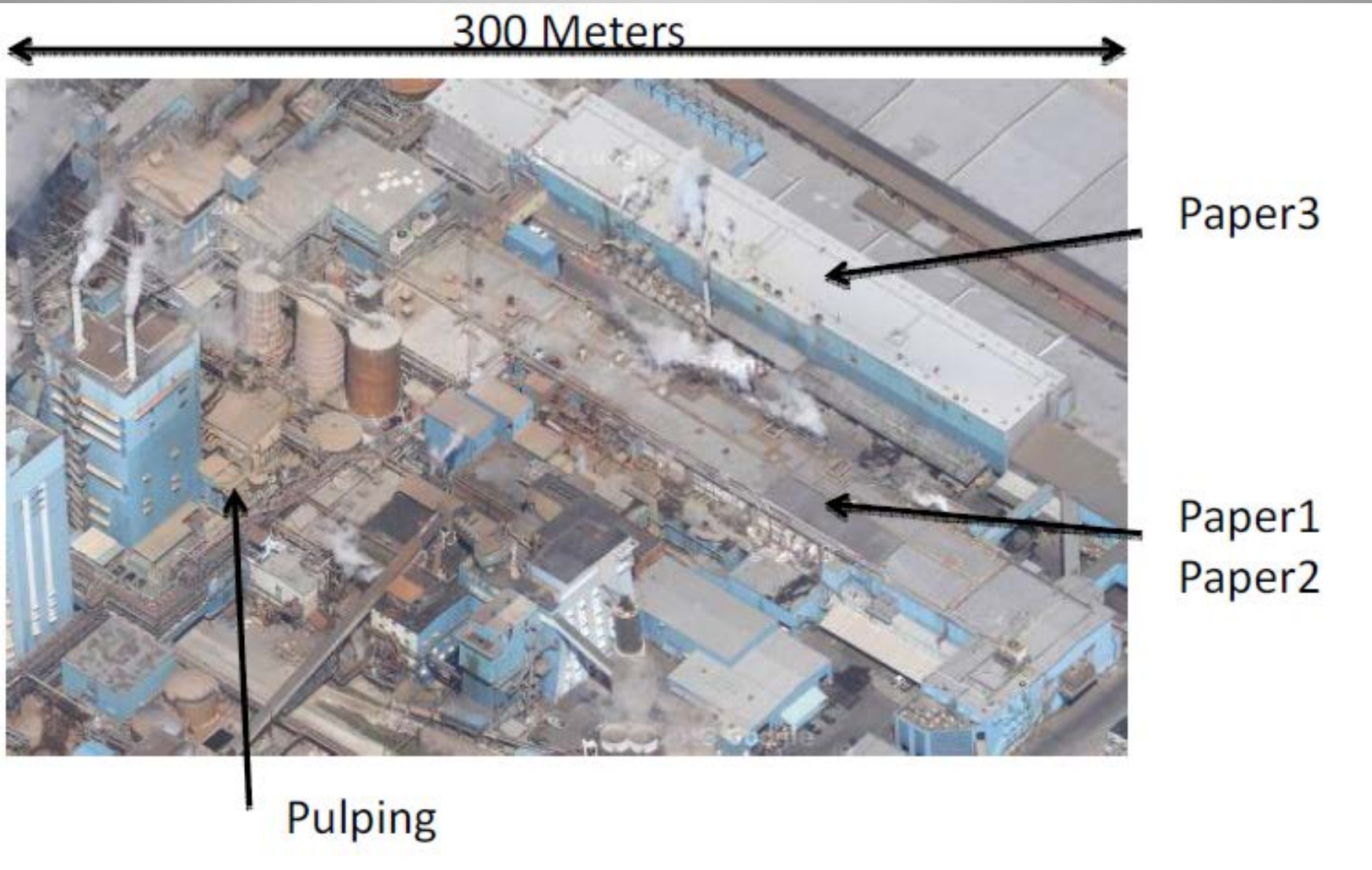
|  | WLAN   | Low ISM                            | WHart type                             |
|--|--|------------------------------------|--|
| <b>Power</b>                               | Med  | High                               | Low (mesh)                             |
| <b>Range</b>                               | Med  | High                               | Low (mesh)                             |
| <b>Bit Rates</b>                           | High   | Low                                | Low                                    |
| <b>Deployment Ease</b>                     | Well known                                   | Long Range Radio                   | Restrictions                           |
| <b>Support of Full Spectral resolution</b> | Good   | Good                               | Low                                    |
| <b>Real time Streaming</b>                 | Good   | Low                                | Not possible                           |
| <b>Dwell on Single Node</b>                | Good   | Good                               | Not Possible                           |
| <b>Standard</b>                            | Worldwide                                    | Country by country                 | Yes, some uncertainty                  |
| <b>Strong Point</b>                        | Flexible, well supported, high data capacity | Long range, full spectral analysis | Dense networks; deterministic sampling |



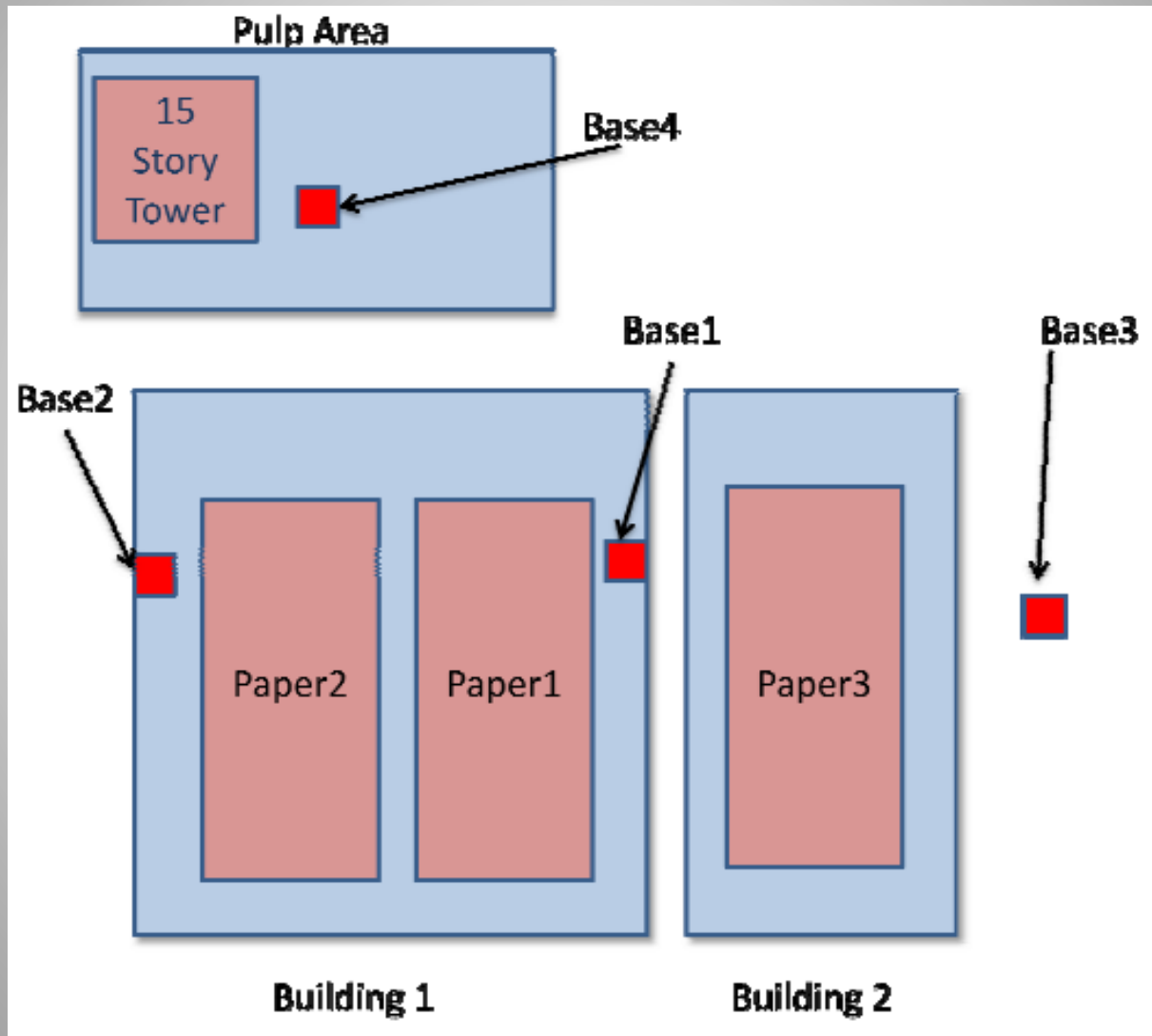


# Part 3: Field Study

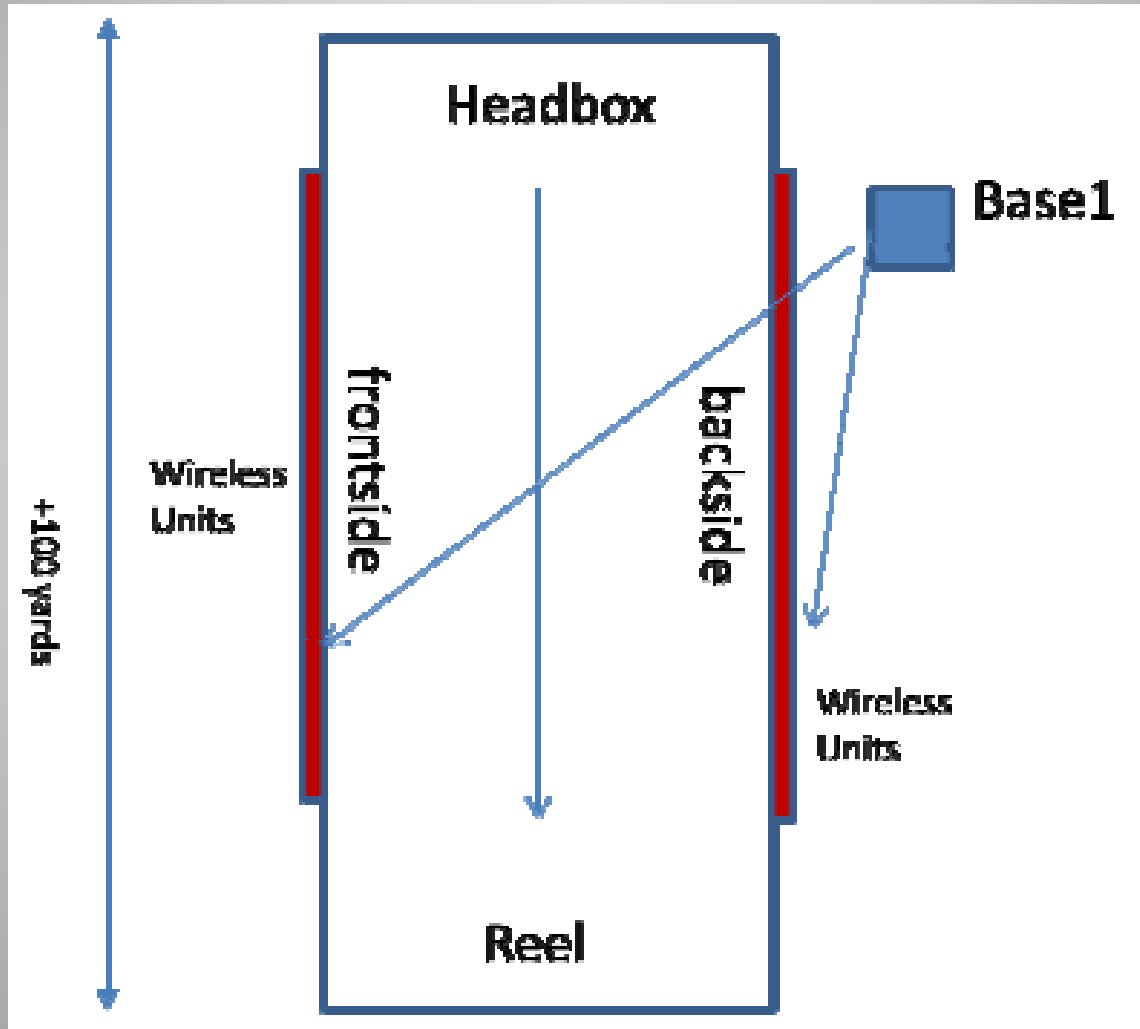
# Site Overview - Flyover



# Site Overview - Schematic



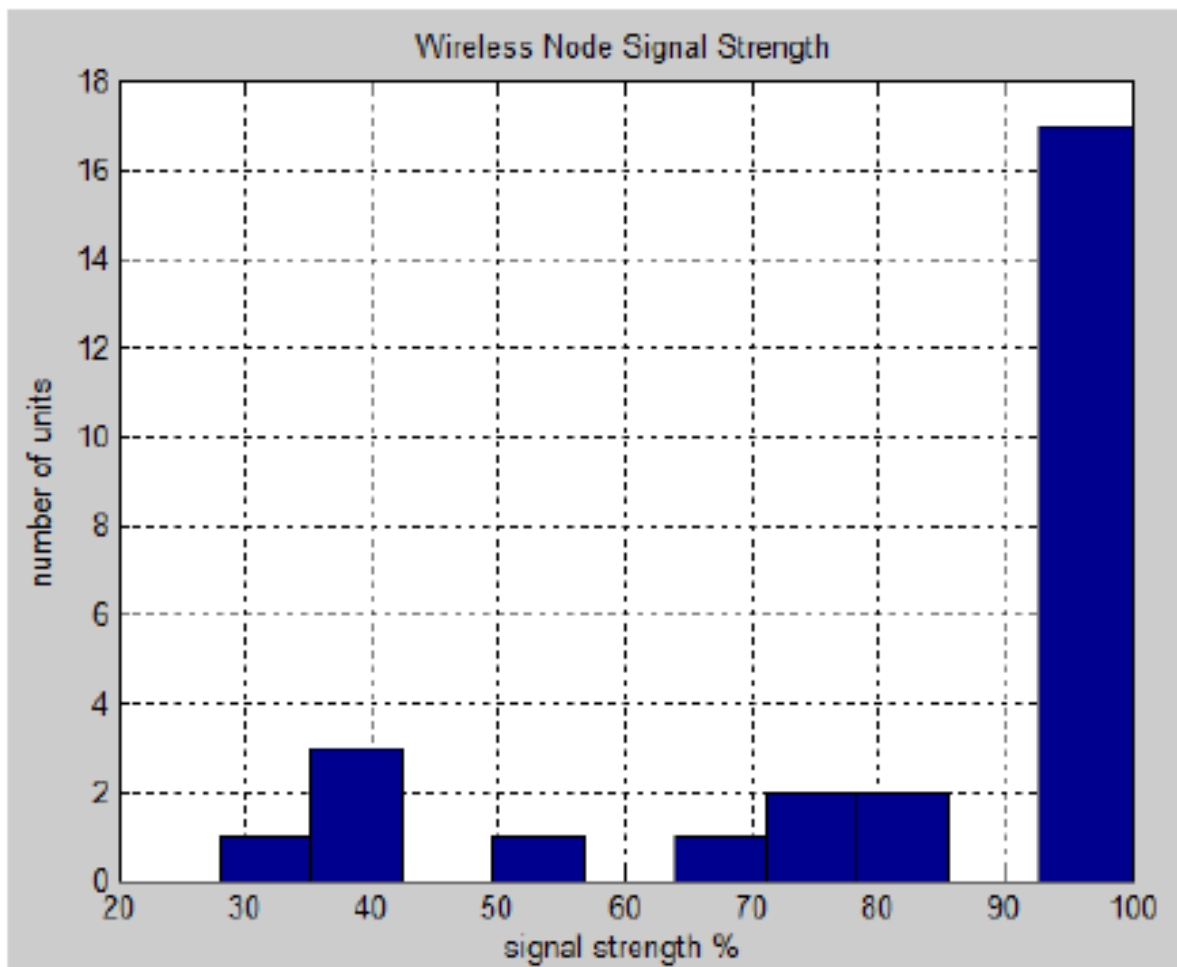
# Single Machine



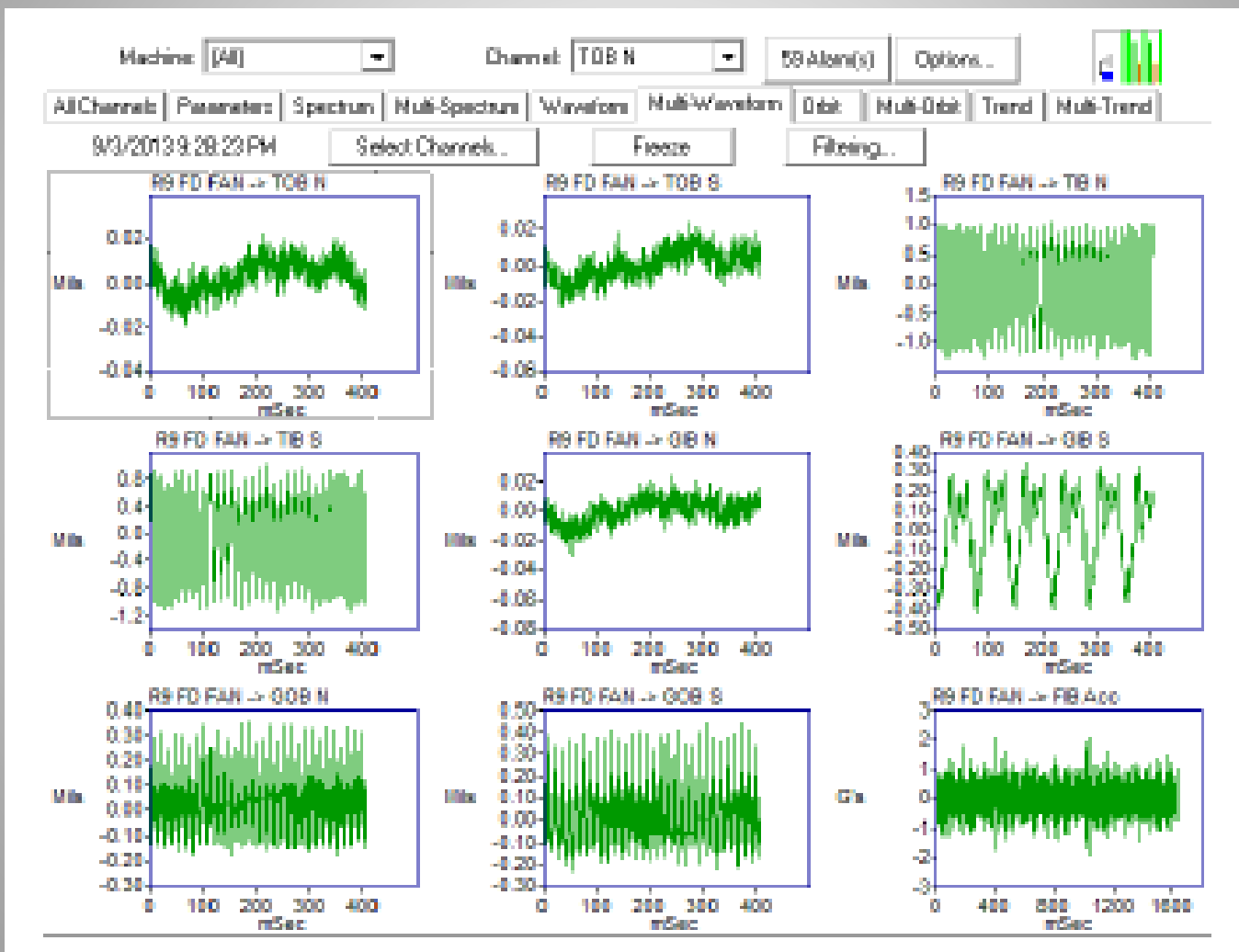
# Lots of Metal in the Way...



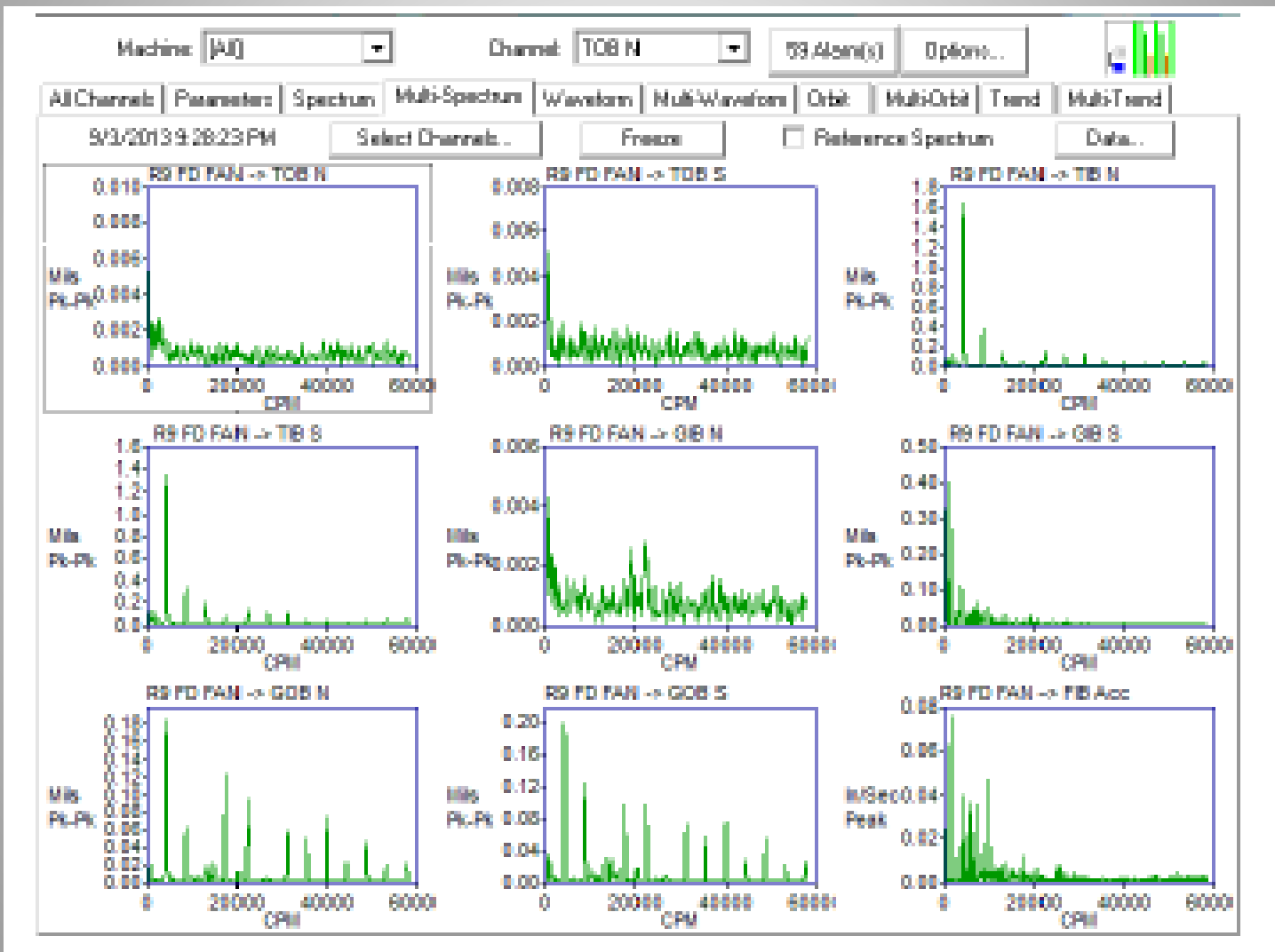
# Wireless Performance



# Time Domain Wave Forms

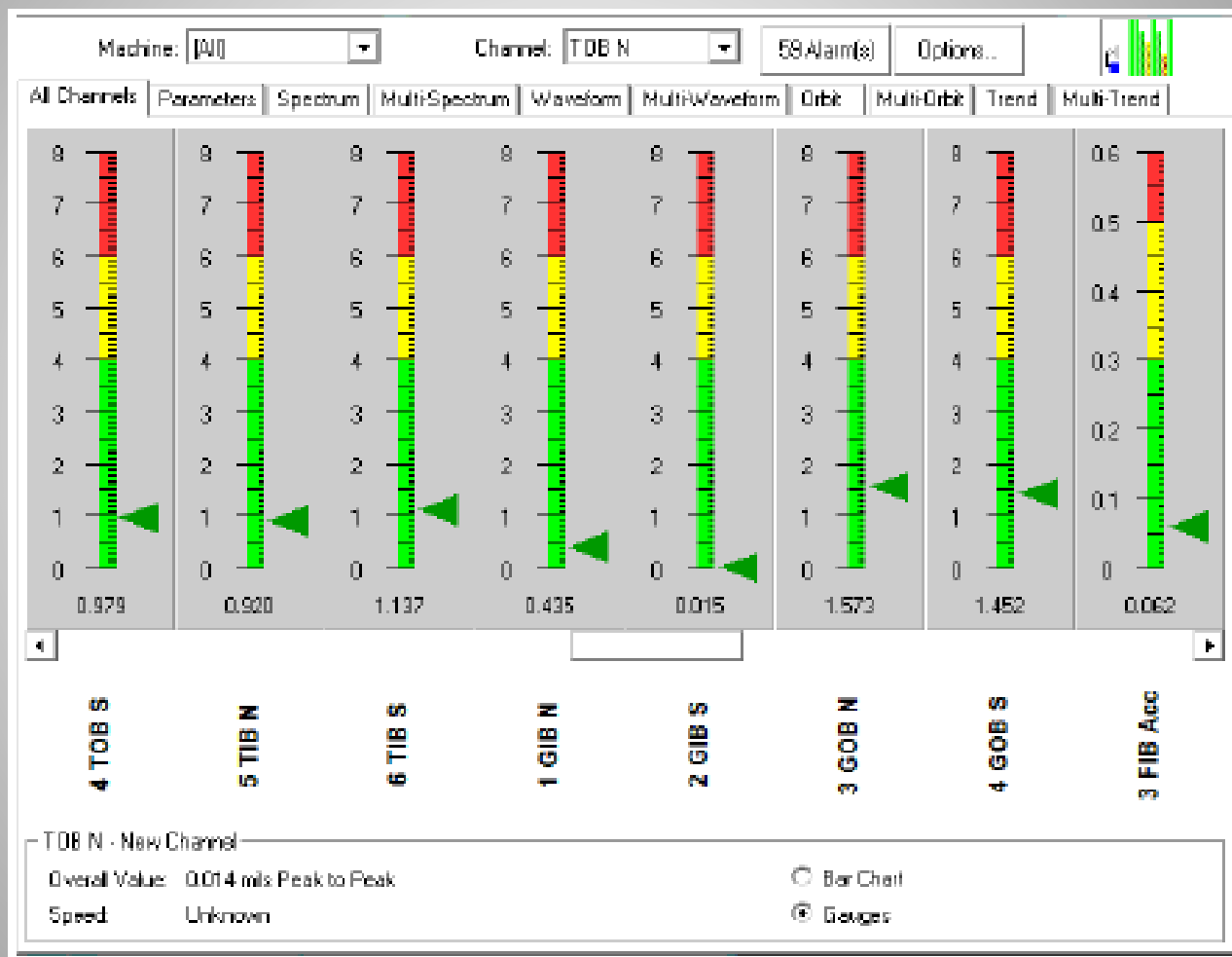


# Frequency Domain





# Gauges – Trend Values





# Results

- Multiple points were monitored reliably over a period of years.
- The system was expanded after the trial to cover a large area of the mill.
- Multiple defects were identified.
- Key problem areas were put on 24/7 watch with email/text alerts



# Q&A



# Backup Slides