

QUANTERRA

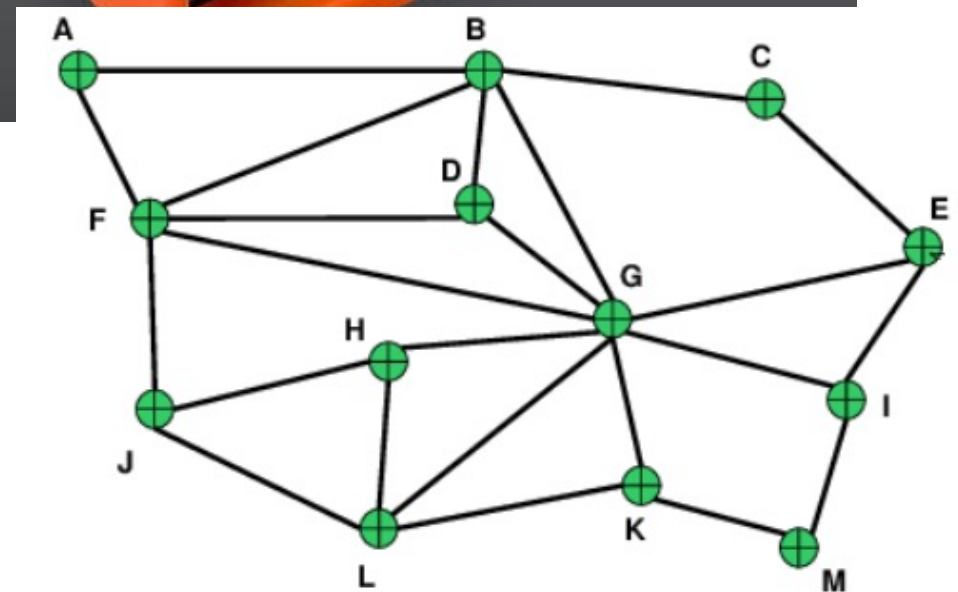
Advancement through Innovation

www.kinometrics.com

Wireless Collection of Environmental and State-of-Health Data in Seismographic Networks

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Mathias Franke, Kinometrics

AUG Meeting 2023, GeoSphere, Austria
June 5 – 7, 2023



Q8 Heritage

Quanterra's Firsts



Q8 – 7th 24-bit Channel & Wireless Data Collection

Q330HR – True 26-bit AD Converter

Q330 – Ultra Low Power < 0.5W

Q730 – Compact Field Deployable & Low Power

Q4120 – Ethernet Interface

Q680 – Patented Delta-Sigma true 24-bit AD Converter

Selected Unique Features

3

- ❖ **Web-based operation and control** – over WiFi no cable required (other interfaces Ethernet and Mesh)
- ❖ **4 x real-time telemetry options**: Q8's native "Q660 Protocols", ORB, Seedlink, and QSCD2.0
- ❖ **4 x "archival" devices** available: SD card, eMMC, internal USB drive, and external USB drive. In addition, the "Deep Packet Buffer" may be stored in RAM or on the SD card
- ❖ A **built-in accelerometer** with a resolution level of ~1mg can also be used as a tamper detector, orientation detector (tip/tilt) and/or with the "wake on shake" function
- ❖ **"Wake on Shake"** function. This wakes the system if the internal accelerometer exceeds a specified threshold or if the unit is in cycled operation mode
- ❖ **"High Resolution"** mode combines all 6 physical A/D channels to provide 3 data channels with an improvement of roughly 3dB dynamic range and 10-20dB reduction in low-frequency thermal drift
- ❖ The software supports optional packetization with less than 1s time intervals - **"low-latency"** data to provide data with minimal packetization delay. These data are transmitted in addition to the standard 1s packetized data
- ❖ Data output **throttle**



WiFi ON Button

This button is the main user control and performs 3 functions: In cycled recording mode, a brief (~½ sec) press will power up the recorder and activate the WiFi AP. If the recorder is powered, and the WiFi is off, a brief press will turn on the WiFi. If the WiFi is already on, a brief press will power down the recorder.

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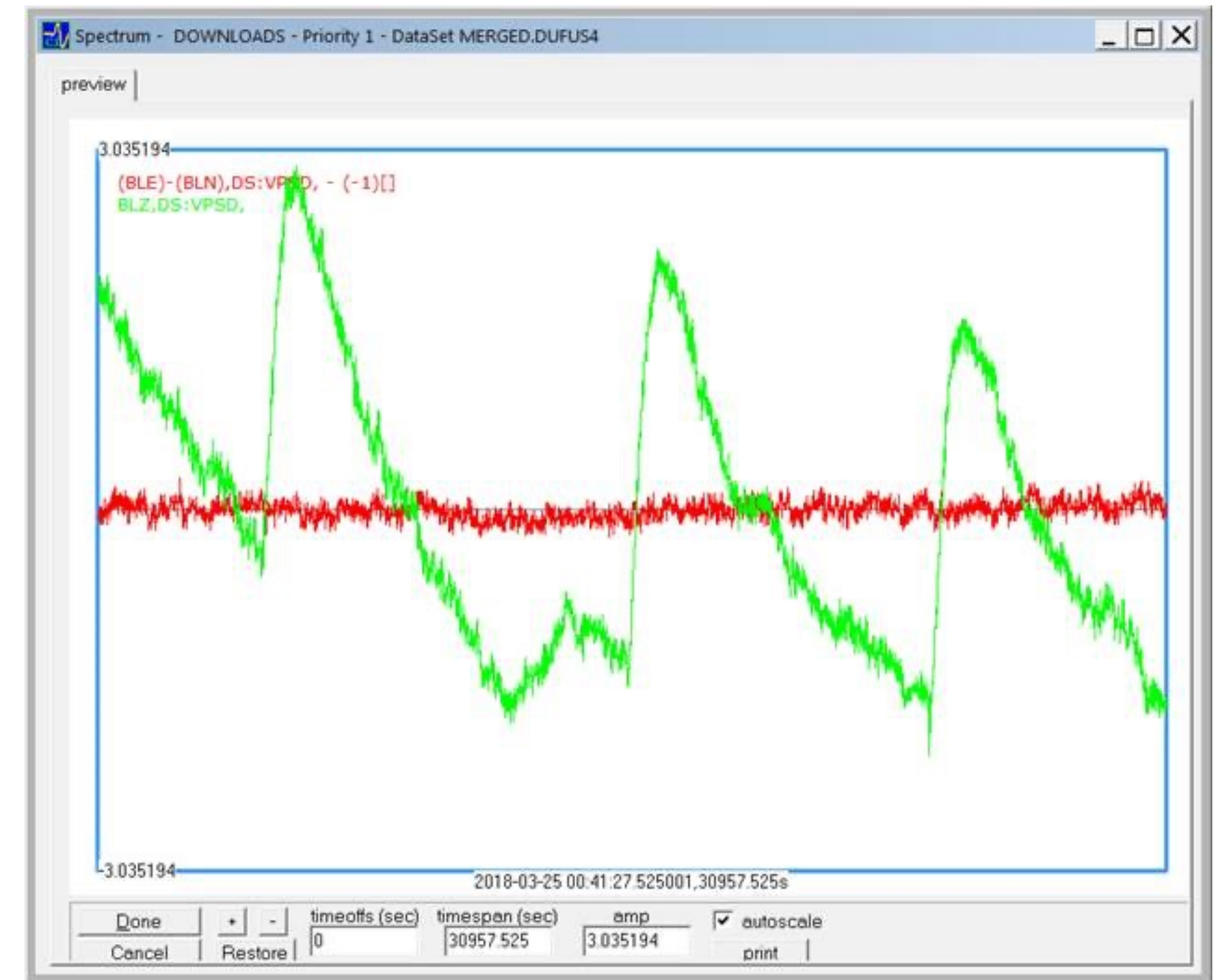
Accelerometer Orientation & Configuration



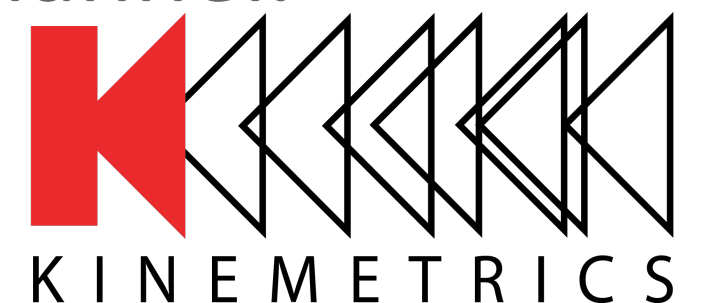
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The **red trace** is a Q8 **low-thermal drift channel**, the **green trace** is a standard channel.

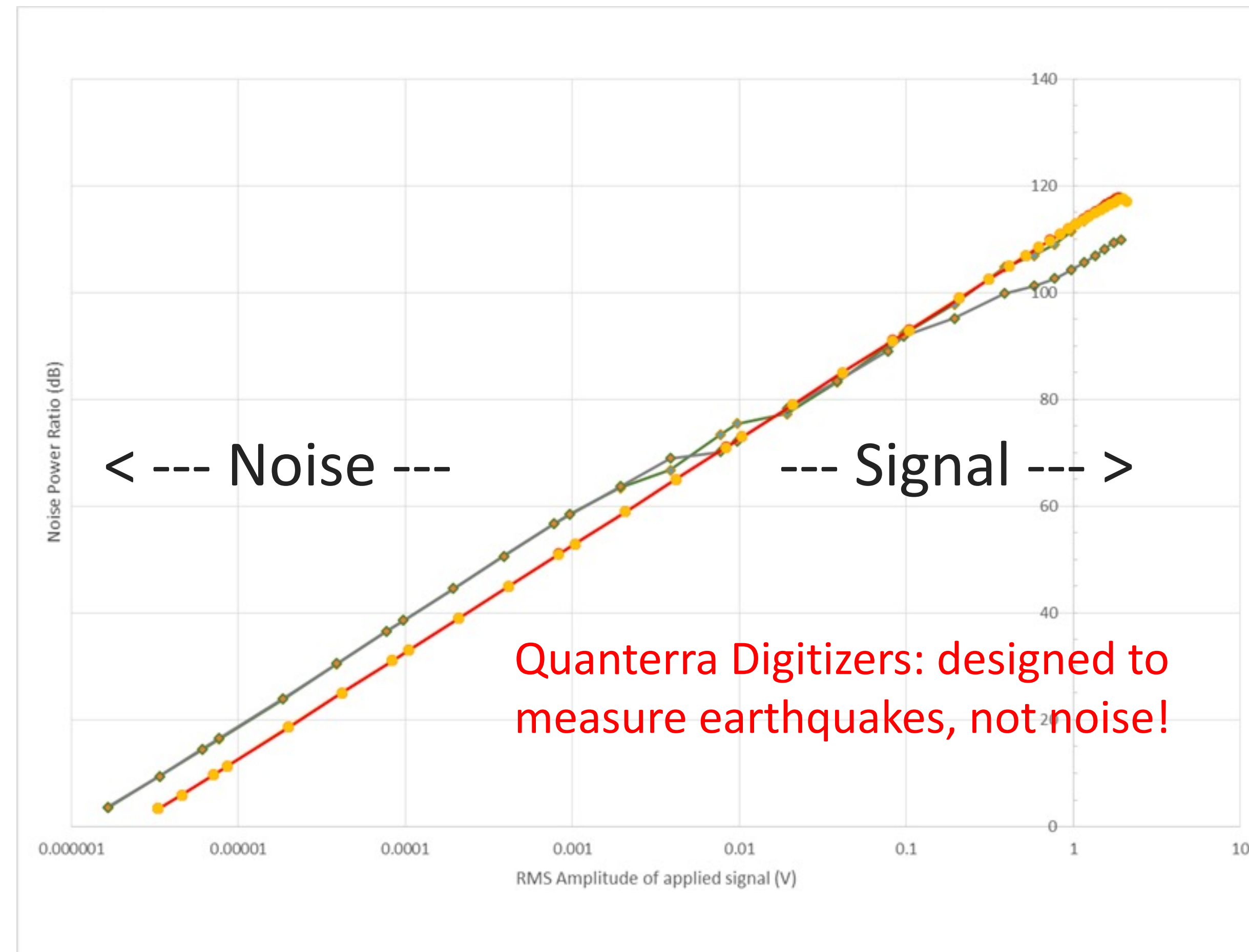


On Total Signal Integrity

Dynamic range is not only abused, but by definition, it's measured with shorted input or small resistor (with no signal!), called **Maximum Potential Dynamic Range (MPDR)**, & therefore it does NOT consider the possible signal generated noise.

Modified Noise Power Ratio (MNPR)

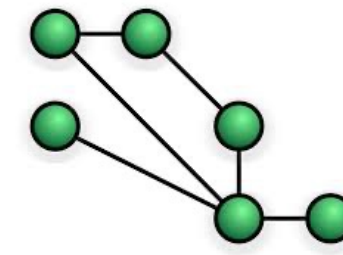
The **MNPR** graphic illustrates the true signal integrity. Therefore, a linear system should respond accordingly as the signal amplitude increases.



Using Data Published in Sandia Reports SAND2019-6501 & SAND2018-11442

Mesh (Dust) Networking

Extending Your Reach



A new way to extend your Q8, wirelessly

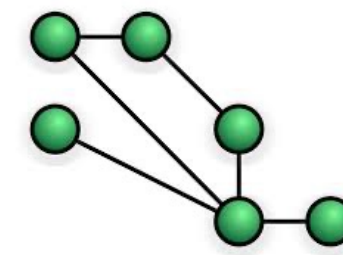
First implementation, supplies low rate data from auxiliary environmental inputs as well as from a Vaisala WXT-53X weather station. This data is fully integrated into the Q8 data streams, telemetry, and recording with accurate timing from the Q8

Mesh devices are paired wirelessly with a specific Q8 and data can “hop” via other network nodes in range and give a range of approximately 100m using a 2.4GHz frequency



Mesh (Dust) Networking

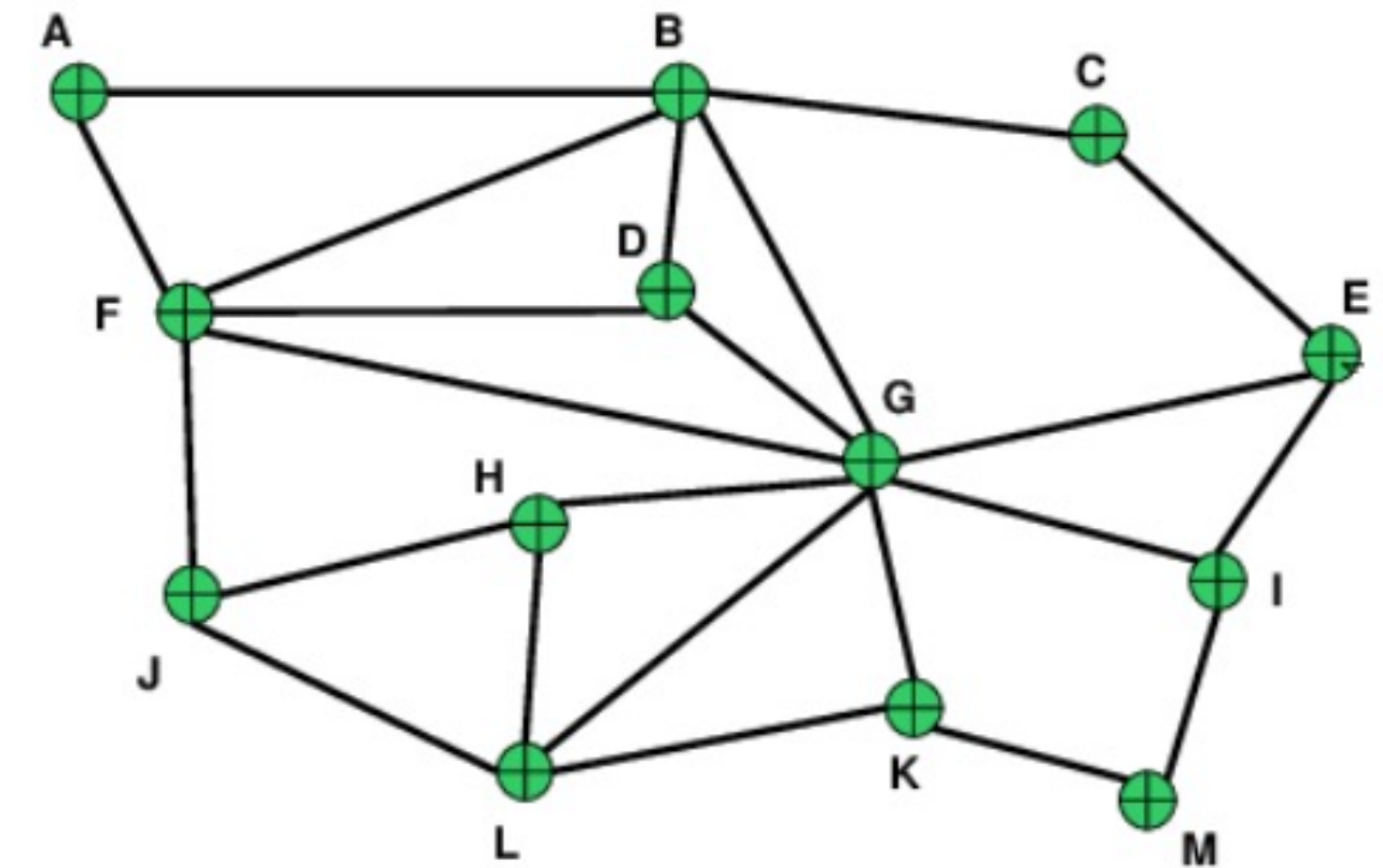
Extending Your Reach



Exact range varies with terrain and obstacles,
50m to >500m

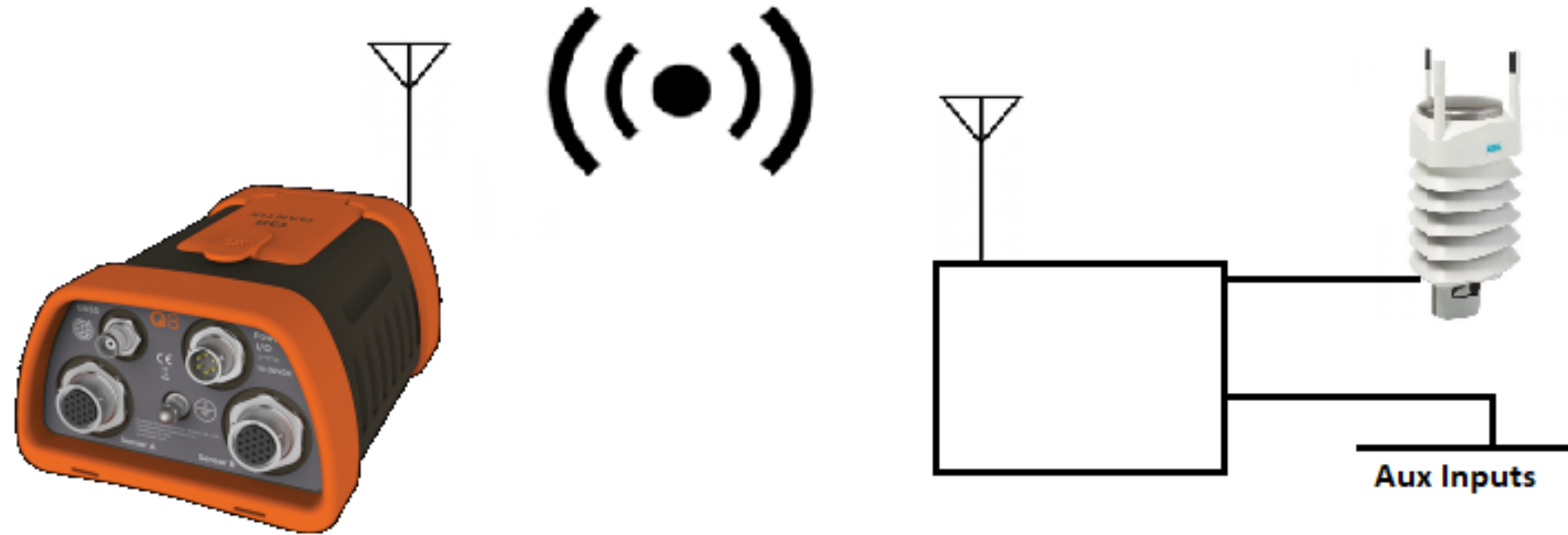
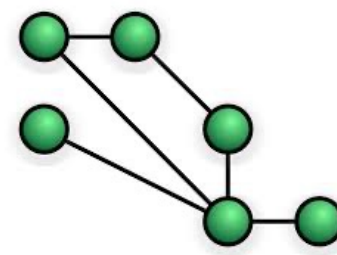
The network is really a mesh. Remote devices can forward communications from other remote devices to the Q8 host. In principle, this increases the total size of the mesh, and allows for communications that might not otherwise be line-of-sight from the Q8 to the most remote unit

- Number of remote devices: 8
- Number of channels per device: 16
- Total number of channels: 128
- Max sample rate: 1 sps



Mesh (Dust) Networking

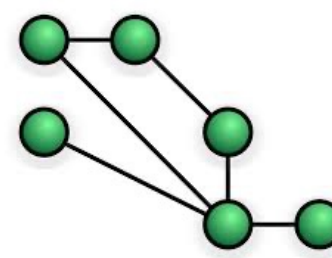
Ancillary Data Without Compromise



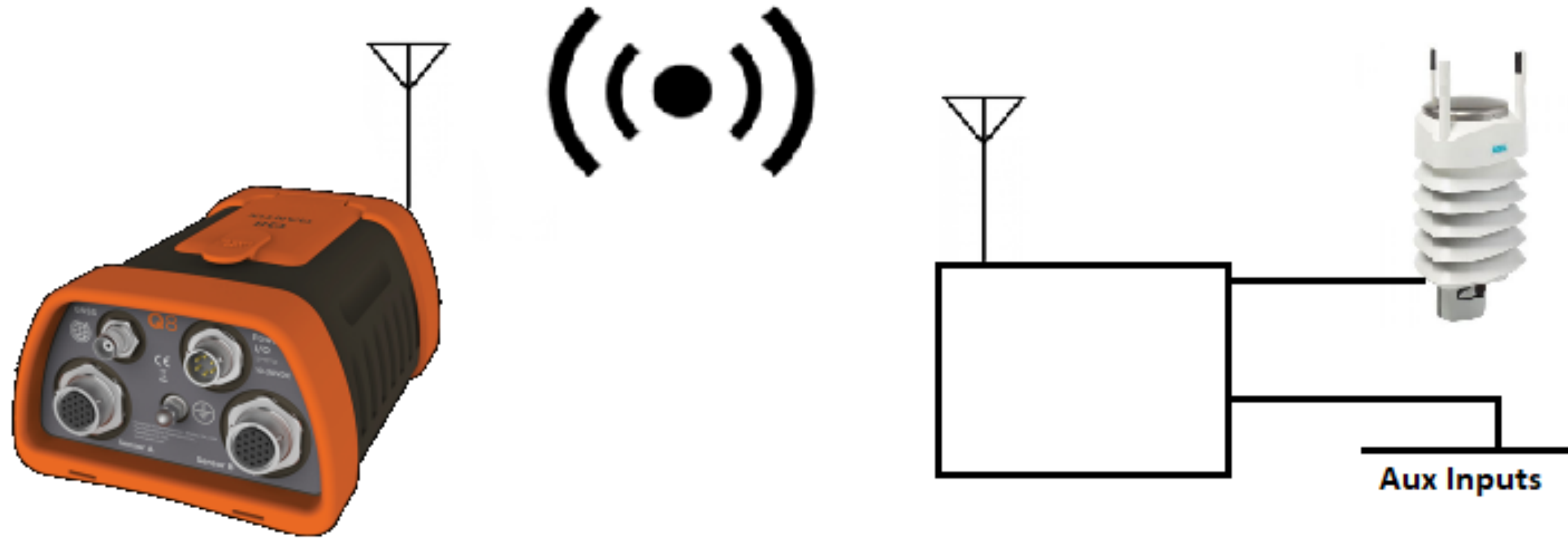
- This is not for bringing data in from a mountaintop remote unit. It's for intra-site communications **without**
 - wires
 - complicated connections
 - compromising data quality
- Improves survivability to lightning due to absence of ground loops introduced by wired connections

Mesh (Dust) Networking

Ancillary Data Without Compromise



10

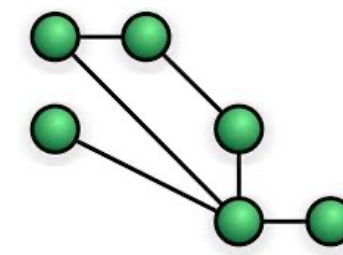


- QME Interfaces

- 1x SDI-12, primarily for the Vaisala station
- 1x Power pass-thru for the Vaisala heater power (so the QME does not provide heater power; it can be on the same cable from the QME to the Met station)
- 3x single-ended 16-bit ADC channels (generic)
- 2x differential 16-bit ADC channels (generic)
- 4x isolated digital inputs (GPIO $<0.8V = 0$, $>1.35V = 1$)
- 4x isolated digital outputs (generic GPIO)
- 1x internal pressure sensor (Infineon DPS368XTSA1, measuring ambient pressure)

Configuration

Example for a Weather Station



Mesh Devices

☒ Enable Mesh Subsystem Mesh Network ID

Device Number	Tag ID	Enable Data	Enable Status
1	<input type="text" value="283"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>

[help](#)

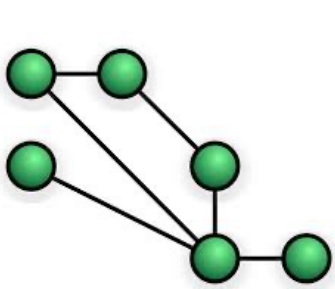
If checked, the Mesh Network manager in the Q8 is enabled.

A number between 1 and 65535 to allow multiple Dust Networks in the same area.

Each Mesh Device has a unique Tag ID between 1 and 1048575, something like a (unique) serial number.

Configuration

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2	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>

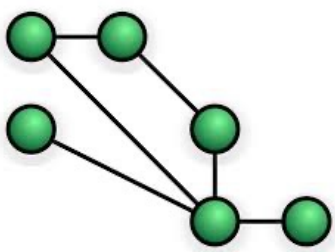
Update

Checked to tell the Mesh Device to send status packets to the Q8.

Checked to tell the Mesh Device to send data packets to the Q8.

Configuration

Example for a Weather Station



Mesh Devices

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1	<input type="text" value="283"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
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4	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>

[help](#)

Mesh Data

Device 1: Weather Station Version 1.0

Channel	Rate	Loc-Name	Channel	Rate	Loc-Name
1	1.0 SPS	<input type="text" value="W1-LWD"/>	2	1.0 SPS	<input type="text" value="W1-LWS"/>
3	1.0 SPS	<input type="text" value="W1-LDO"/>	4	1.0 SPS	<input type="text" value="W1-LKO"/>
5	1.0 SPS	<input type="text" value="W1-LIO"/>	6	1.0 SPS	<input type="text" value="W1-LRR"/>
7	1.0 SPS	<input type="text" value="W1-LRH"/>	8	1.0 SPS	<input type="text" value="W1-LKH"/>
9	1.0 SPS	<input type="text" value="W1-LEH"/>	10	1.0 SPS	<input type="text" value="W1-LEP"/>
11	1.0 SPS	<input type="text" value="W1-LER"/>			

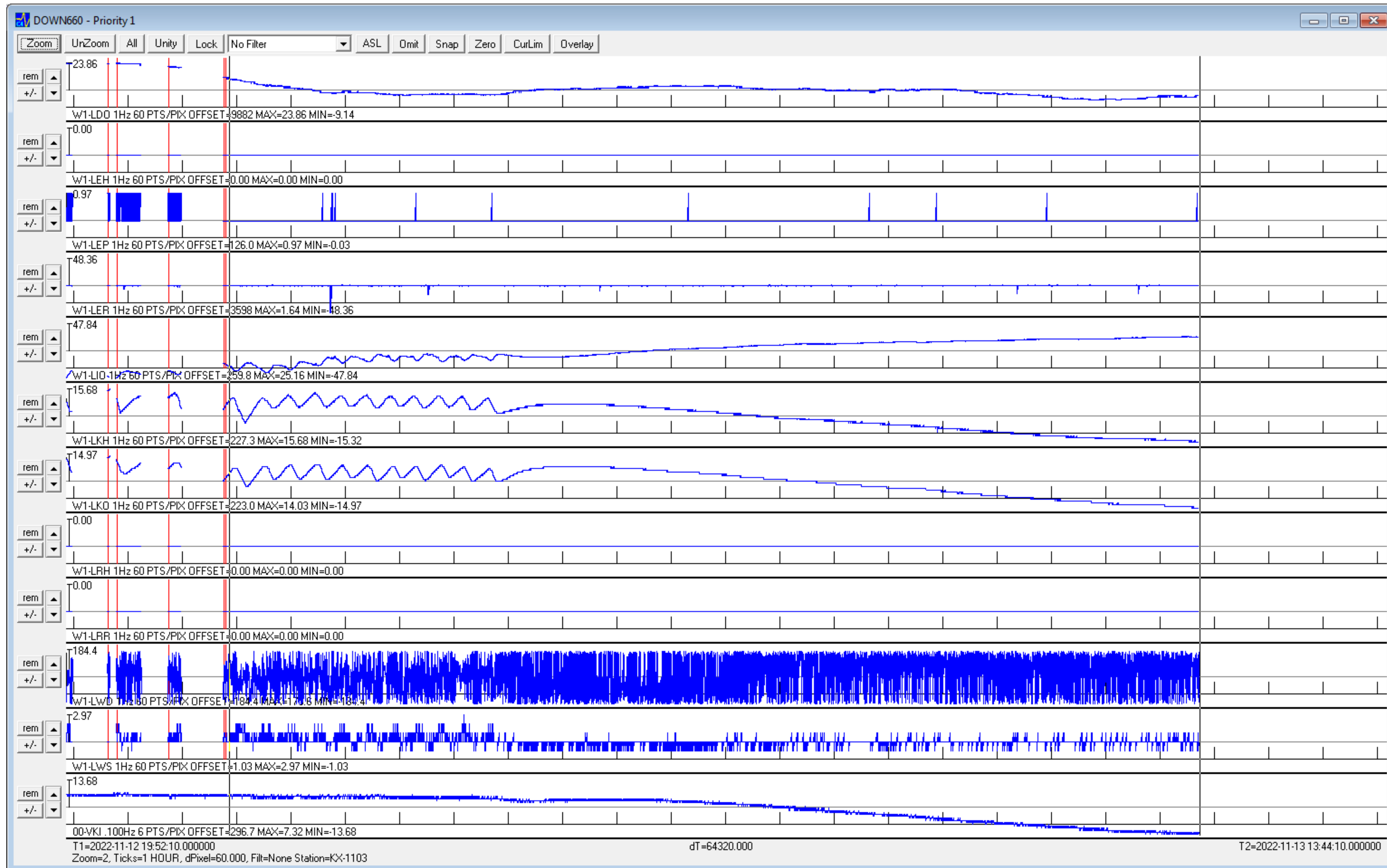
[help](#)

Mesh Status

Device 1	Weather Station Version 1.0
Last Received	2022-11-14 14:11:40
	Status Line One
	Status Line Two
	T31,V3.617,R132,C2

Mesh Status

Data Appears as Additional Channels

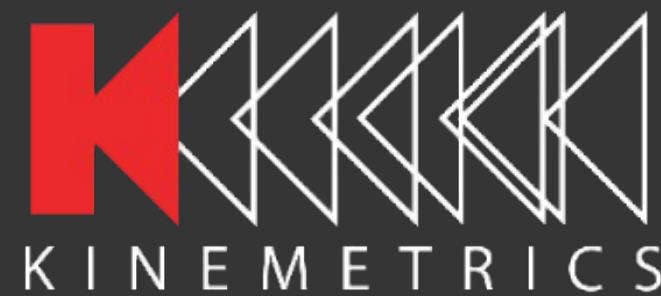


Q & A

Qantix Q8



Thank you!



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