VantagePoint 2022

# d-Mesh
# 900MHz 1 for 1 radio Telemetry

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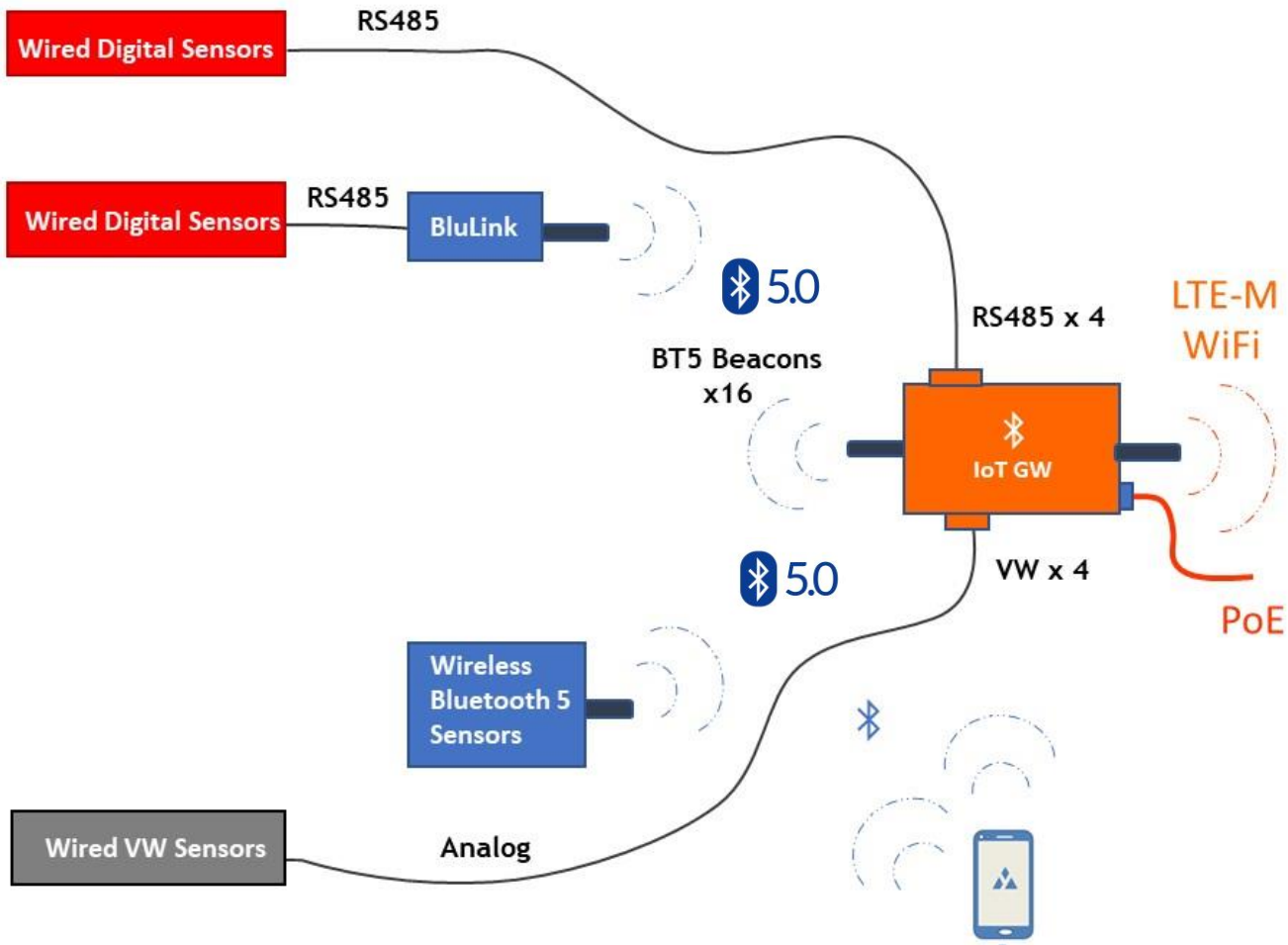
d-Mesh

VantagePoint 2022





ViewPoint
*Manual readout*

LogPoint
*Datalogging*

AccessPoint
*LTE-M backhaul to cloud*

VantagePoint
*Browser based visualization*

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# The YieldPoint EcoSystem

# 1 For 1 Radio: Components


1. Gateway


2. 900MHz radio

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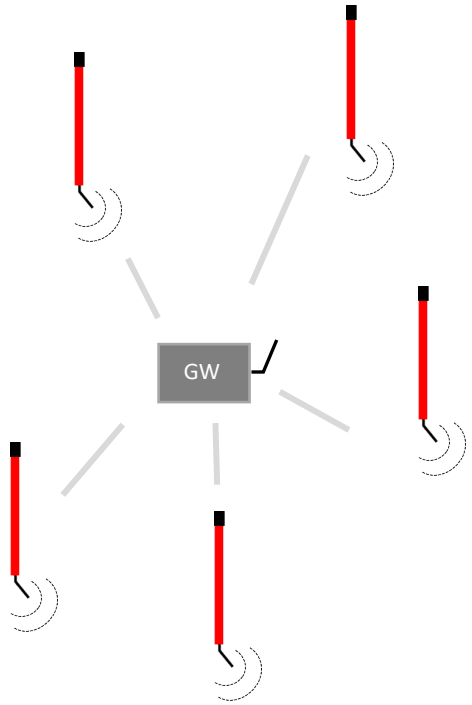
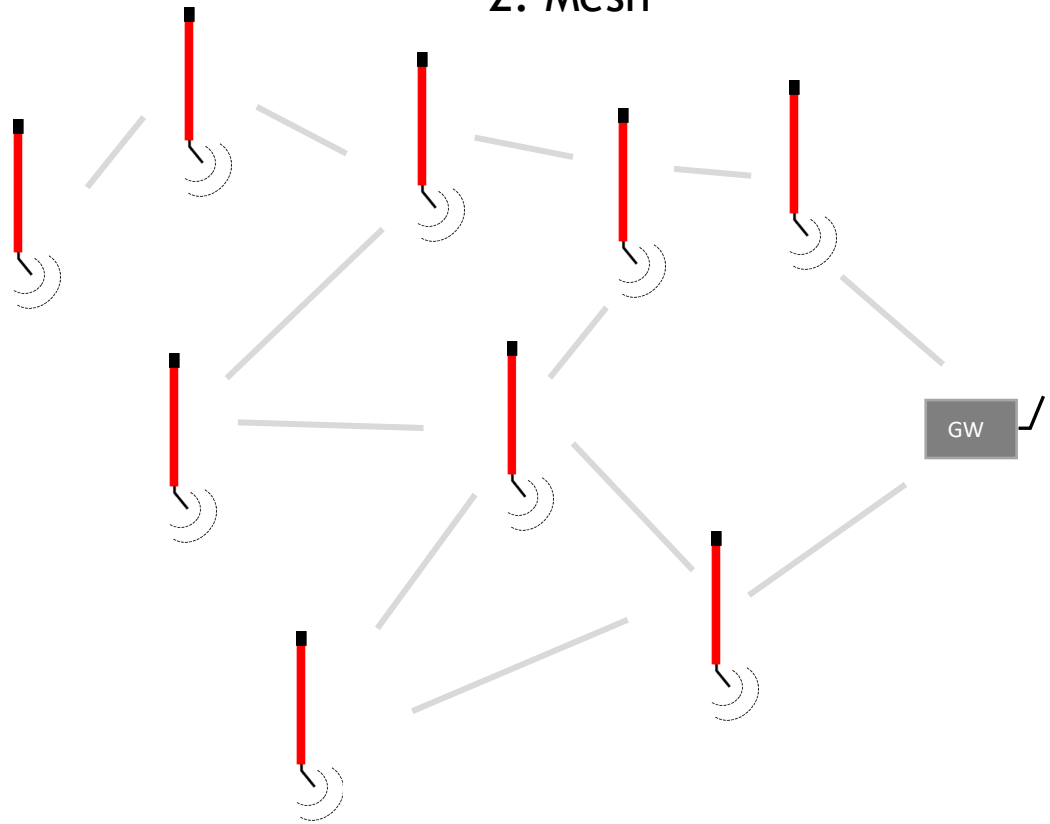
Hardware

# 1 For 1 Radio: Topologies

1. Star




2. Mesh

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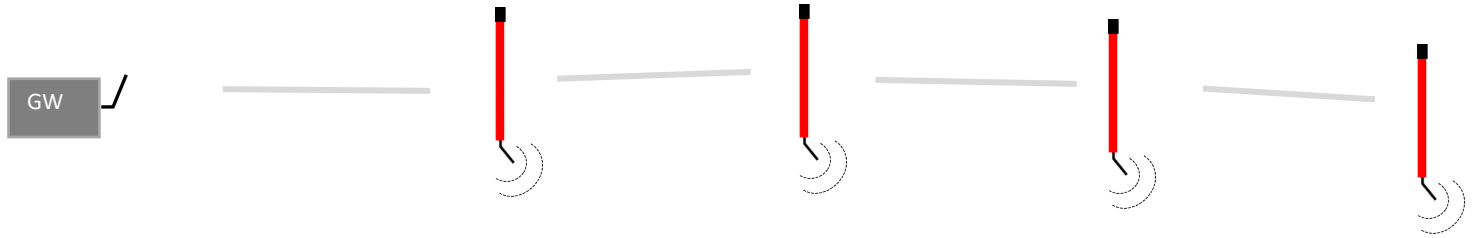
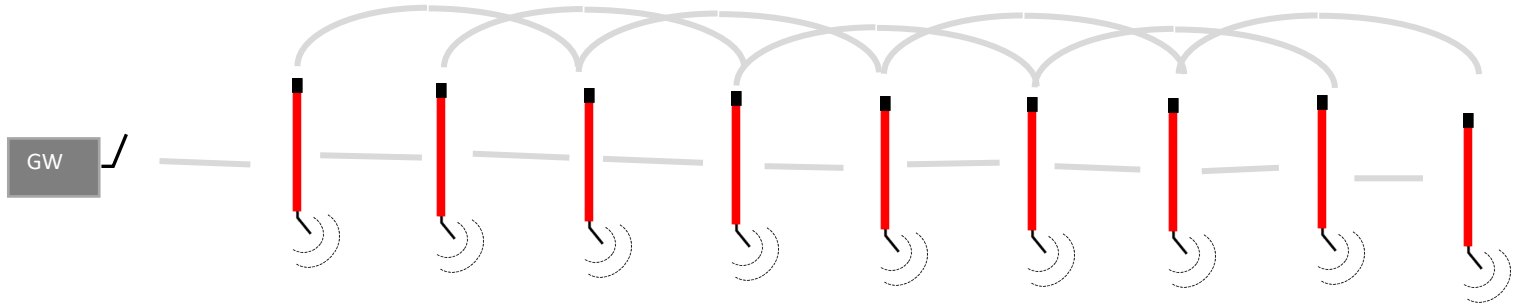
Topology

# 1 For 1 radio Topologies

1. Weak Linear Hop Array




2. Stronger Linear hop array

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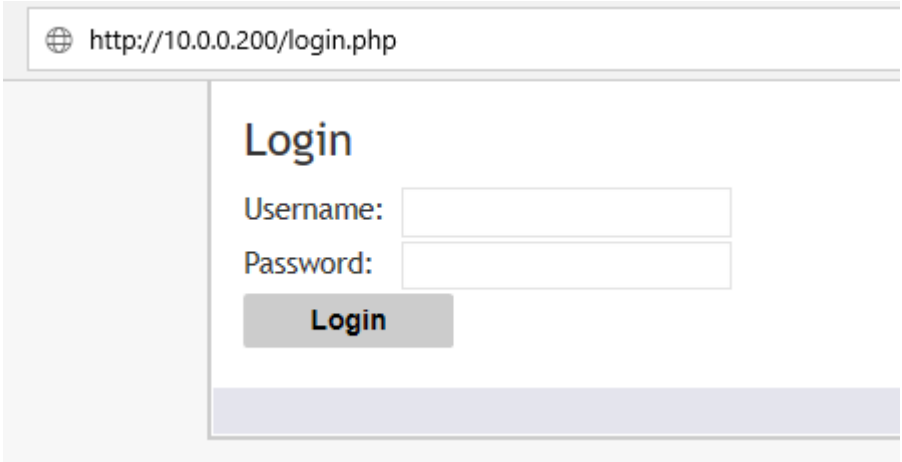
Topology

# Deploy 1 For 1 Gateway

- Install Gateway and hook up to Ethernet network
- Make sure that you have access to the web interface and can connect to the gateway via YieldPoint dMesh using a laptop
  - If your Ethernet substation does not have WiFi, an additional Ethernet port will be required for your laptop to plug into the network
  - The gateway needs to be in *Manual Mode* for dMesh to connect
- If no Ethernet network is available, set the gateway to a static IP and use your laptop Ethernet port
  - Most corporate laptops require administrative IT permissions to change the Ethernet port to a static IP
  - If you laptop does not have an Ethernet port, a USB to Ethernet dongle will be required

# How to log into Gateway Web Interface

- Once gateway has been powered up and attached to network
- Browse to the gateways assigned IP address
- Username: *yieldpoint*
- Password: *YPfuture*

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GW Web Interface

# Gateway settings for deployment

- On the Settings tab:
  - *Data Access*: Automatic Mode
  - *Instrument Sampling Interval*: 60 second
- On the *Advanced Settings* tab:
  - *Radio Wake Time*: 5 Seconds
  - *Radio Node Identifier Broadcast*: Enabled
  - *Radio Command*: :H
  - *Radio Wake Delay*: 0 Seconds


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Settings

# 1 For 1 Borehole Radio Assembly Instructions

- Install supplied black washer before putting cap back on
  - This washer prevents the radio being installed too deep in the borehole
- Tighten Battery Cap with wrench
  - Make sure the internal Battery Cap O-ring is properly in place
- Install 1 For 1 Anchor on the end of radio body
  - The anchor should be screwed onto the 3/8” stud 1 inch or 2.54 cm
  - The anchor should be able to spin freely for future battery replacements
- The 1 For 1 Anchor is single use only and cannot be retrieved after installation

# Power Up 1 For 1 Radios

- Make sure 1 For 1 Gateway has been completely installed before adding batteries to 1 For 1 Radios
- While in the same physical location as the installed gateway, start installing batteries into 1 For 1 Radios
- Only install new batteries into 1 For 1 Radios. All batteries should be from the same manufacturer and brand if possible. If not possible, all batteries should be the same brand per radio
- Each 1 For 1 Radio needs to have an antenna installed
- Borehole 1 For 1 Radios require a large flat head screwdriver to install the 4 or 8 D cell batteries
- Plastic Box 1 For 1 Radios require a medium sized Phillips head screwdriver to install the 4 D cell batteries

# Two types of 1 For 1 Radios

## Borehole Design


## Plastic Box Design


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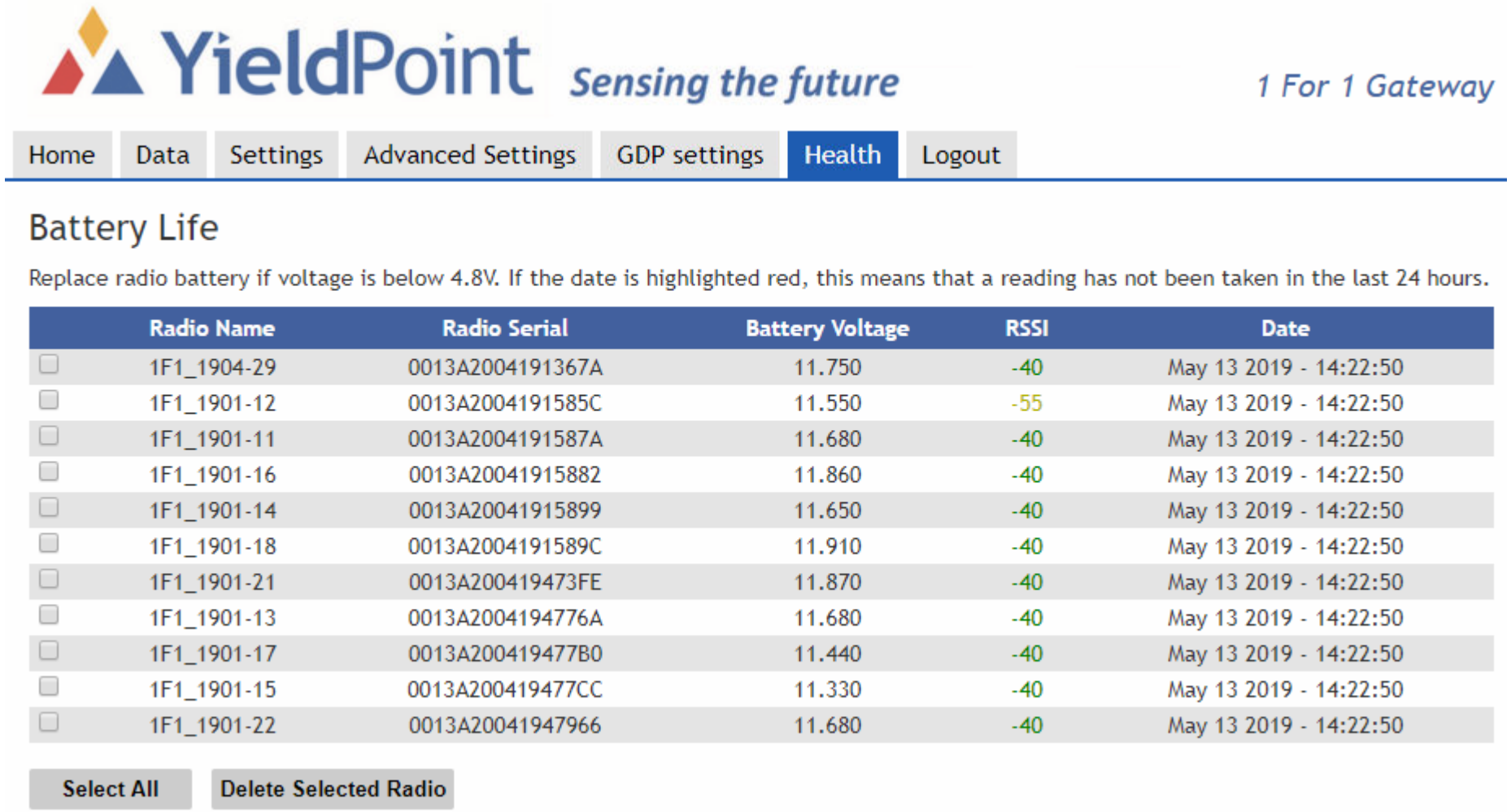
Types

# 1 For 1 Gateway Health Tab

- Navigate to 1 For 1 Gateway Health Tab
- 1 For 1 Radios should start to show up 5 minutes after power up
- A RSSI value of -40 is considered perfect signal
- RSSI values range from -40 to -100
- RSSI text is shown as green, yellow and red to indicate signal strength
- Make sure the radio date reading is recent
- Make sure all powered up 1 For 1 Radios are present



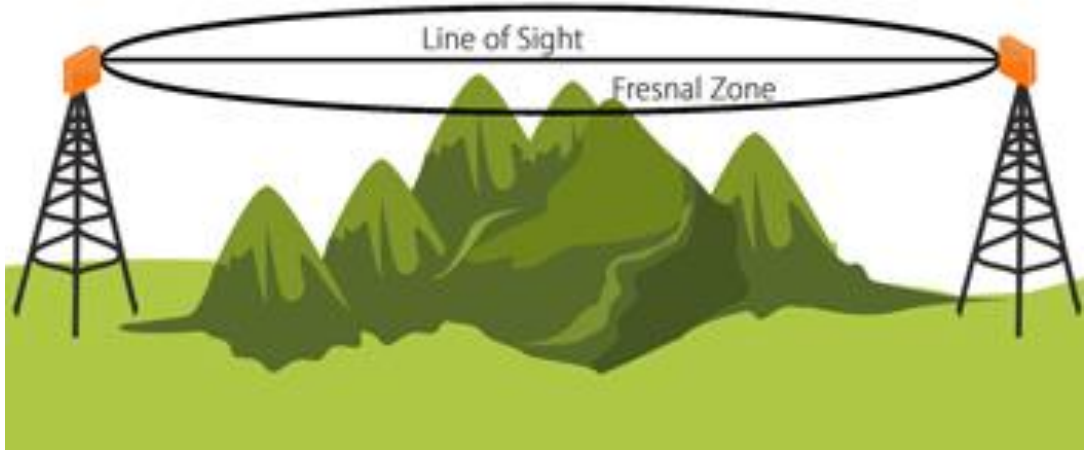
# 1 For 1 Radio Note Taking Recommendations

When installing a 1 For 1 Radio, record the following:

- Instrument ID
- Radio ID
- Location in Mine
- How the radio was installed(Roof vs Walls)
- Battery life of Radio
- Radio RSSI
- Antenna orientation

# Antenna Orientation Recommendations

- Antennas should be oriented perpendicular to the direction of signal travel
  - On a flat surface, the antennas should be pointing straight up or down
  - On a 15° hill, the antennas should be perpendicular to the hill or 75° up or down
- Line of sight between radios is very strongly recommend
- Line of sight with minimal obstructions in the Fresnal Zone is even better

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Antenna stuff

# Fresnel Zone Example

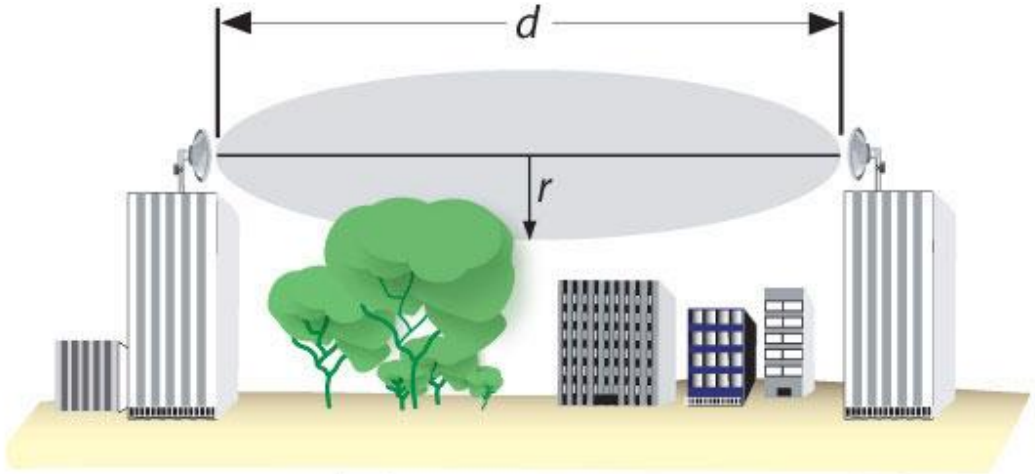
Frequency(f): 900 MHz

Distance(d): 0.5 Km

Fresnel Radius(r): 6.45 m

When possible, having antennas away from the ground or centered in tunnels boosts radio performance

This is usually not possible in a mining or tunnel environment due to the roof or walls blocking half of the transmission ellipsoid




$$r_{(\text{in mts})} = 17.32 \times \sqrt{\frac{d}{4f}}_{(\text{in Km})(\text{in GHz})} \qquad r_{(\text{in ft})} = 72.05 \times \sqrt{\frac{d}{4f}}_{(\text{in miles})(\text{in GHz})}$$

# Deploying 1 For 1 Radios

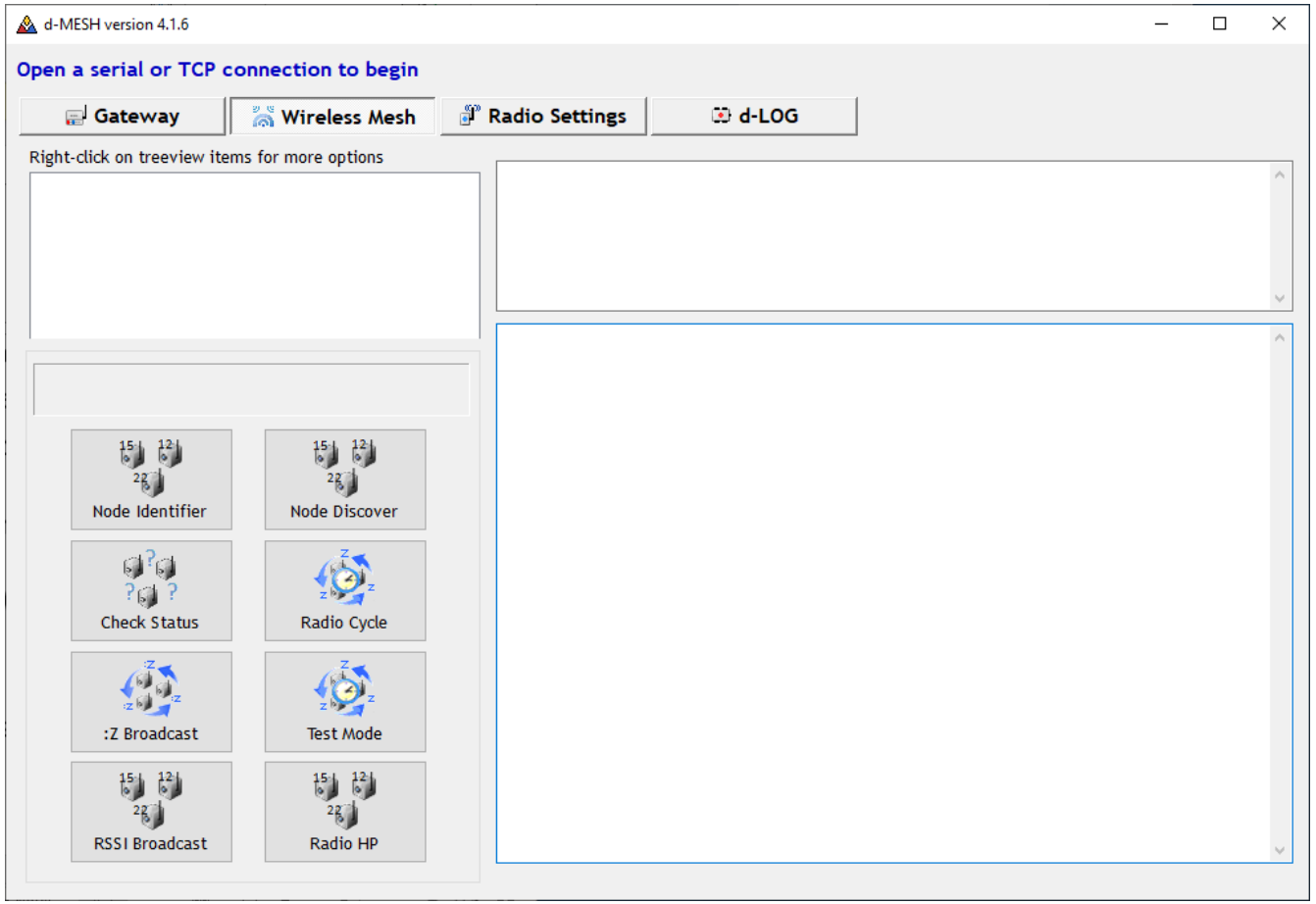
- Pull all powered up radios in truck and drive to nearest instrument
- Plug instrument into 1 For 1 Radio
- Install 1 For 1 Radio in borehole or with zip ties
- Neatly coil and zip tie excess instrument leadwire
- Angle antenna to optimize signal strength
- Install the radios one at a time, nearest instrument to furthest away
- Once the final 1 For 1 Radio has been installed, return to the gateway and check for instrument data using the *Data* tab and evaluate the mesh health using the *Health* tab.

# dMesh Method of Deployment

YieldPoint's dMesh program can be used for radio deployment or for range testing. This program allows for more real time feedback.

- Open dMesh and connect to gateway
- Use the *Check Status* button to make sure the radio is working properly
- Set the mesh to permanently awake using the *Test Mode* button
- Use the *Node Identifier* and *RSSI Broadcast* buttons to make sure all radios in the mesh are working properly with a RSSI of -40
- Deploy radios while a second engineer relays RSSI values over a mine phone/radio
- Set *Radio Cycle* to 1 min with a 5 second wake in dMesh and on web interface
- Set gateway back to *Automatic Mode*

# dMesh - Wireless Mesh Interface

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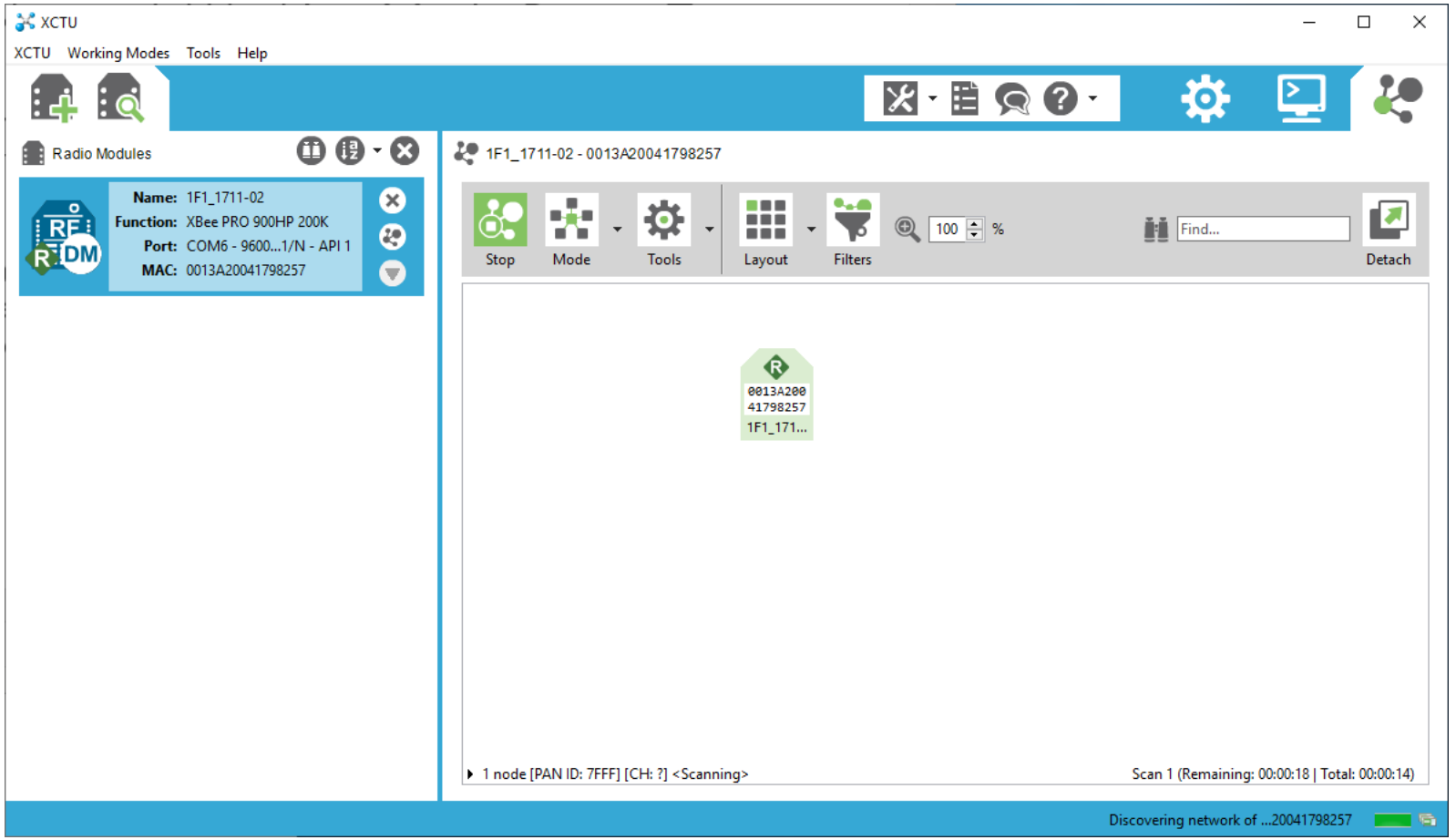
d-Mesh software

# XCTU - Network Working Mode

If you have time, you can perform a more in-depth radio range test using the *Network Working Mode* with XCTU. The gateway will need to be in *Manual Mode* and the mesh in *Test Mode.* You will need to bring an additional USB XBee Radio to conduct this range test. This *Network Working Mode* test will tell you how the radios are hopping and which radios can see each other. Instead of getting a single RSSI from a radio, you get a list of the RSSI values between all nearby radios.

# XCTU - Network Working Mode

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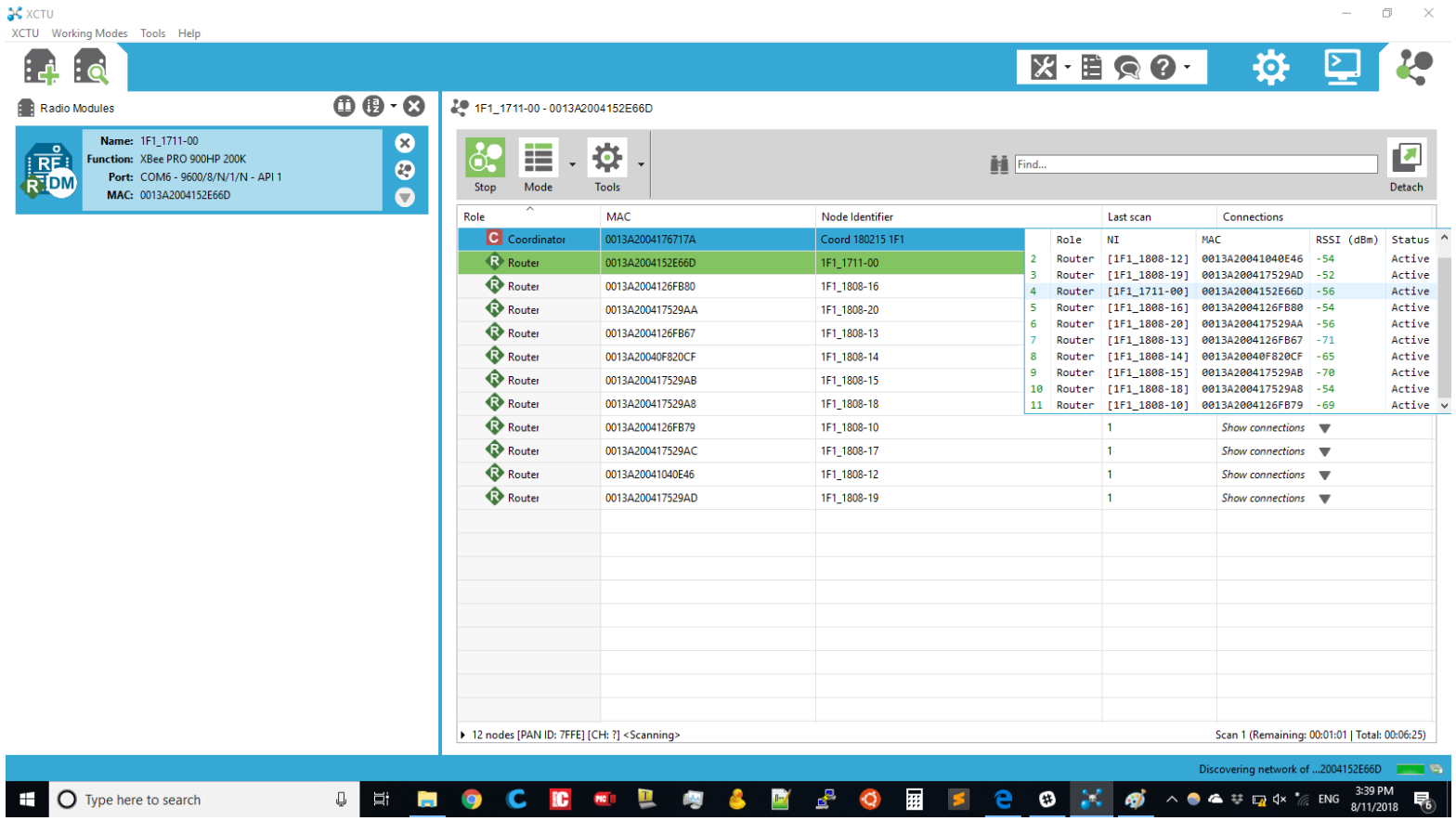
X-CTU

# XCTU - Network Working Mode

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X-CTU

# Most Valuable Advice

After setting up your 1 for 1 network and verifying through health monitoring that it is running well:

LEAVE IT ALONE TO DO ITS THING!!!

# Using the MeshPoint App

MeshPoint is an Android application that enables the configuration, management and monitororing of a dMesh network over Bluetooth BLE

It is best used on a Sumsung Galaxy Tablet

# MeshPoint at The Google Play Store

MeshPoint can be downloaded at The Google Play store free of charge.

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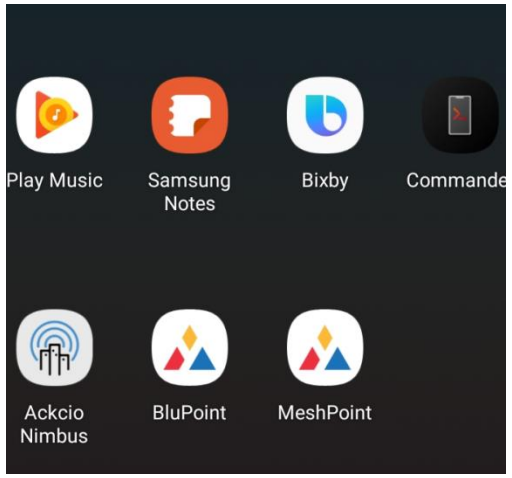
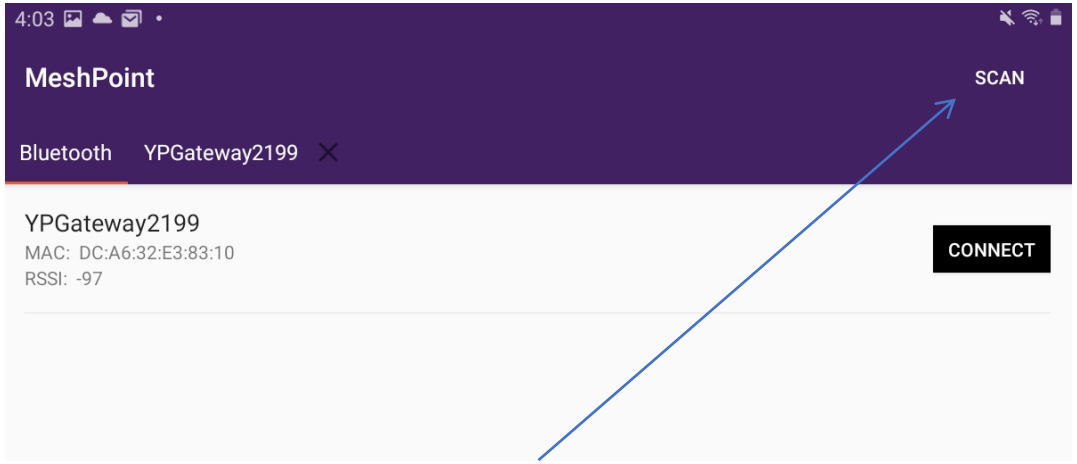
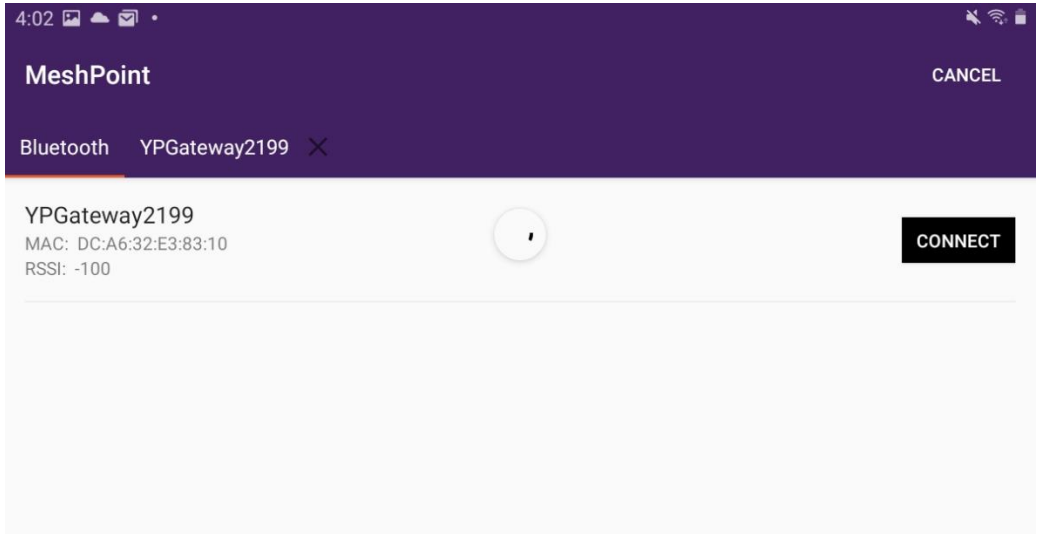





## STEP1:
## Press Scan  to scan for gateways in range




## STEP 2:
## Then connect to the gateway

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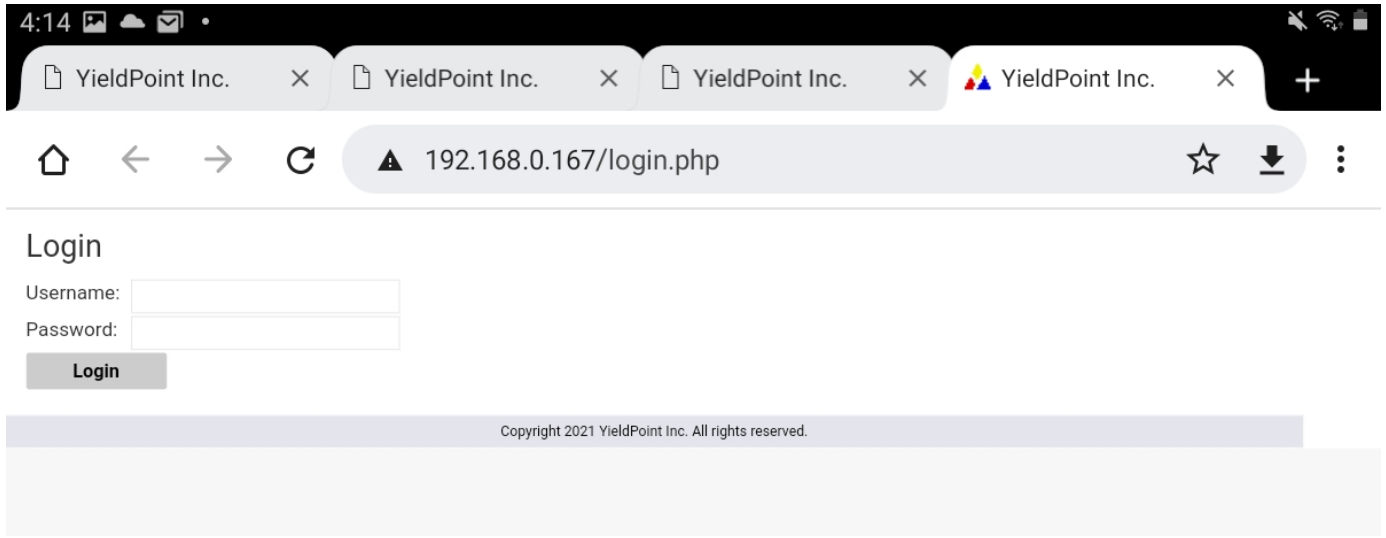
# MeshPoint App

# Successful connection


Double clip on the IP Address to browse to the Gateway's web interface

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MeshPoint App

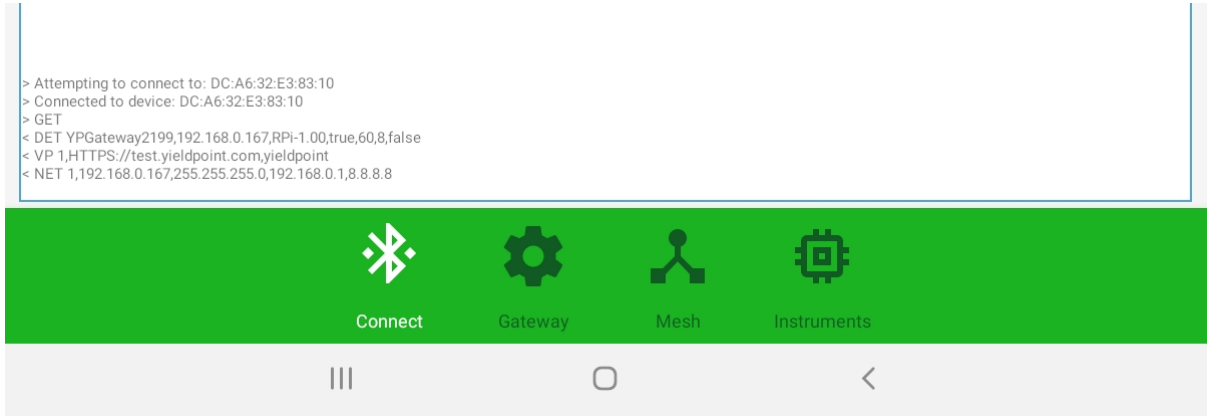
# The power of MeshPoint

MeshPoint can be used to configure/monitor:

(i) The LAN (TCP/IP) side of the **Gateway**

(ii) the coordinator mesh radio in the **Gateway** and radio nodes that comprise the **Mesh**

(iii) The individual **Instruments** attached to the node radios

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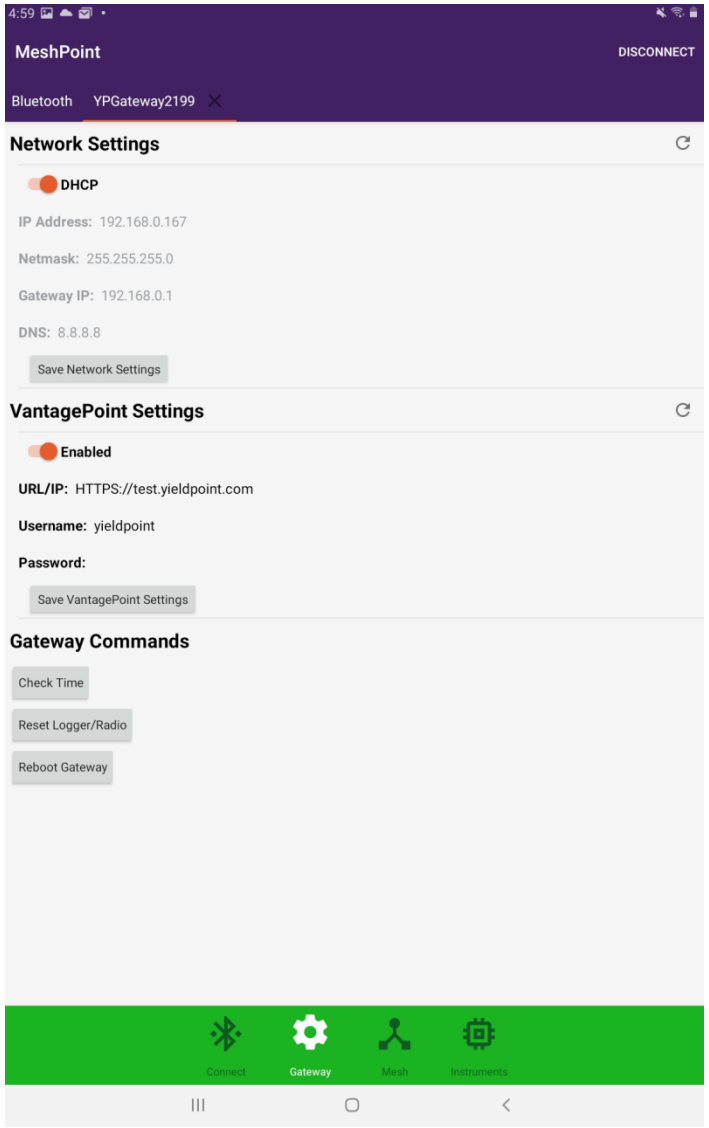
MeshPoint App

# Gateway

Set the TCP/IP network setting for either Ethernet (shown) or WiFi Gateway

Set the URL or network address for VantagePoint Cloud database.

Wirelessly  check/set the Gateway clock or Reset / Reboot

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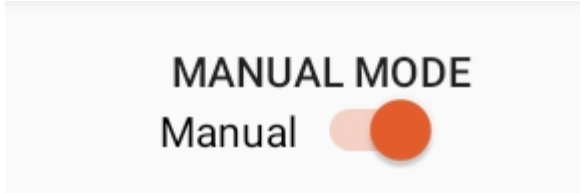
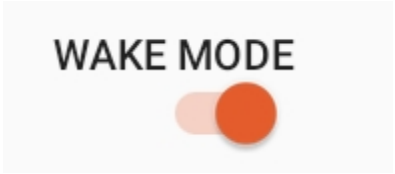
MeshPoint App

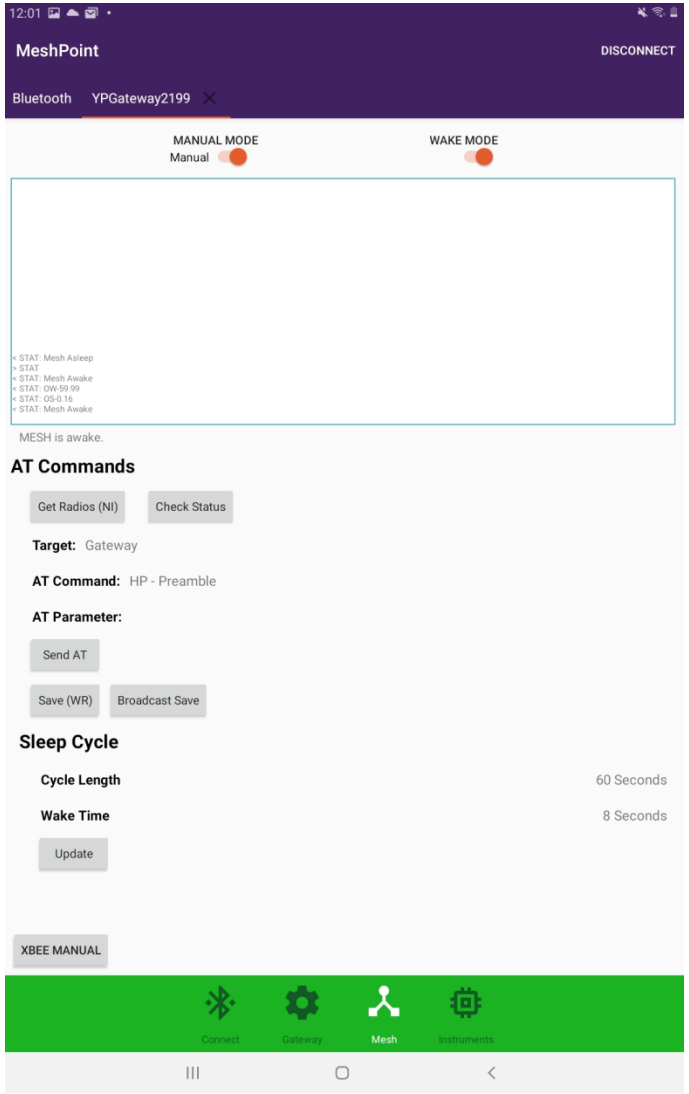
# Mesh

To interact with the mesh most effectively set manual mode  to on.




Also set wake mode on and the mesh will remain awake

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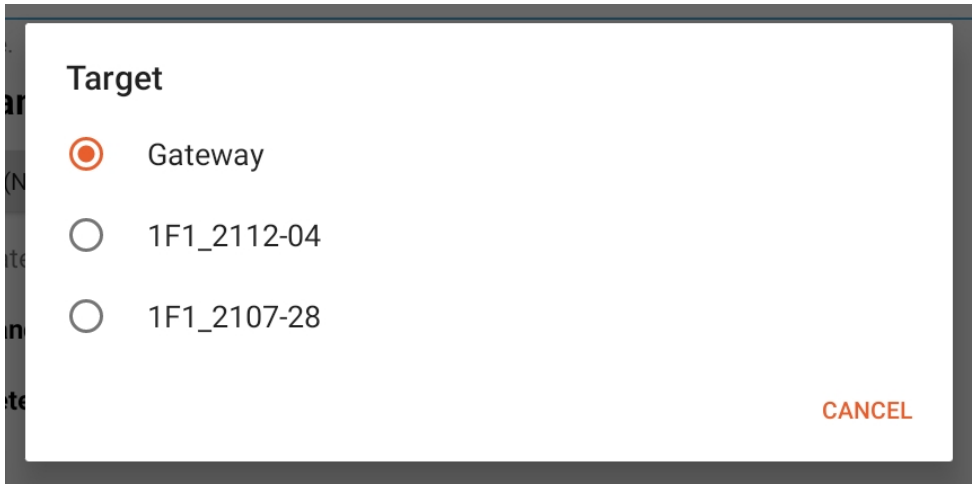
MeshPoint App

# Mesh – Get Radios (NI)

**Get Radios** broadcasts an AT+NI (node identifier) to find all aadios on the mesh.

After the command has executed, when selecting a **Target** the dropdown of all radios on the mesh will populate and the remote nodes can be configured using Remote AT commands.

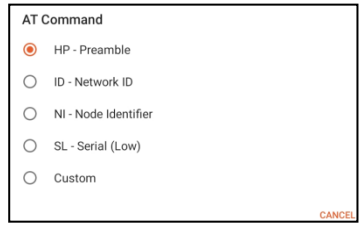


# Mesh – Send AT command

AT commands are used to configure the gateway and radios so that they operate correctly. Each command c
onsists of two letter(upper case) eg. “NI” for node identifier

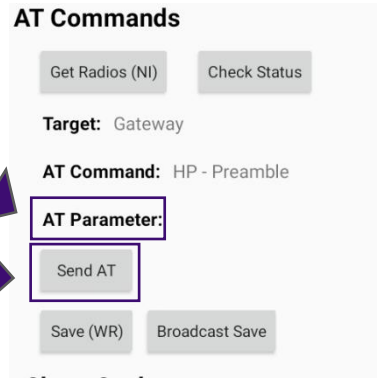
**Step 1:** Select a **Target** (run **Get Radios** if necessary)


**Step 2:** Select an **AT command**




**Step 3: Parameter:** Blank = Get, Value = Set

**Step 4: Send AT** Sends the AT command




AT parameter Blank: Gets AT Parameter

AT parameter has value: Sets AT Parameter

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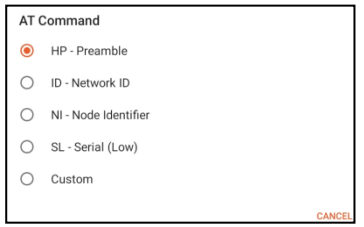
MeshPoint App

# Mesh – Send AT command – Example 1

Read the Preamble ID (AT command = HP)  from the Gateway

**Step 1:** Select the **Target (Gateway)**

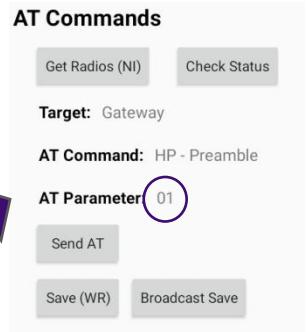

**Step 2:** Select an **AT command (HP – Preamble)**

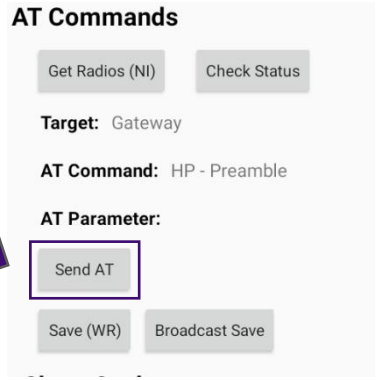



**Step 3: Send AT** Sends the AT command

**Result**:

Preamble is 01

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MeshPoint App

# Mesh – Send AT command – Example 2

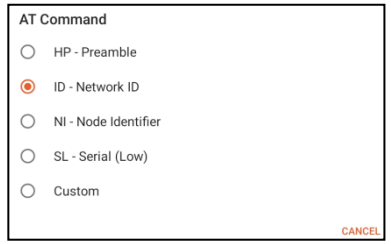
Set the **Network ID** (AT command = ID) to the Gateway

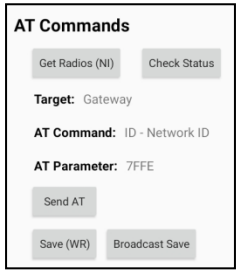
**Step 1:** Select the **Target (Gateway)**

**Step 2:** Select an **AT command (ID – Network ID)**

**Step 3:** Enter the **AT paramter (7FFE)**

**Step 4: Send AT** Sends the AT command (AT+ID7FFE)




**IMPORTANT:** Changing the **Preamble ID** or the **Network ID** can cause radios to become invisible from the mesh

# Mesh – Send AT command – Example 2

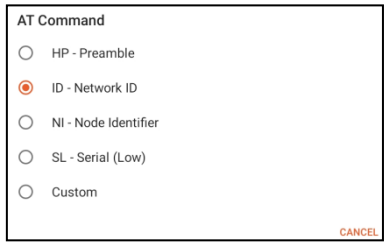
Set the **Network ID** (AT command = ID) to the Gateway

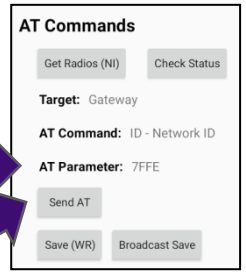
**Step 1:** Select the **Target (Gateway)**

**Step 2:** Select an **AT command (ID – Network ID)**

**Step 3:** Enter the **AT paramter (7FFE)**

**Step 4: Send AT** Sends the AT command (AT+ID7FFE)

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# Mesh – Send AT command – Example 2

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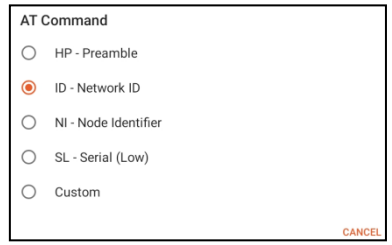


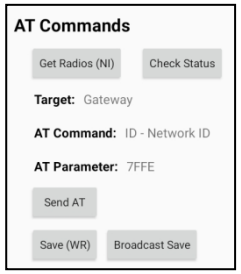


**Step 4: Send AT** Sends the AT command (AT+ID7FFE)

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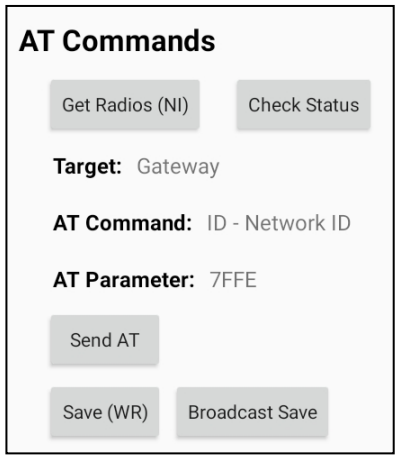
MeshPoint App

# Mesh – Issuing the Save (WR) Command

Parameters that are changed during an AT session will be applied but will **not be written to flash memory**. Hence they will not be saved after a power cycle.

Only when the **Save(WR)** (AT+WR) command is sent will the values written to permanent memory.

If AT parameters are being changed it is recommended that proper operation of the gateway and the mesh is verified before issuing the **Save(WR)** command.



# Instruments – Monitoring the mesh traffic

The 1for1 mesh will wake up at regular defined cycles based on the **Sleep Cycle** settings.

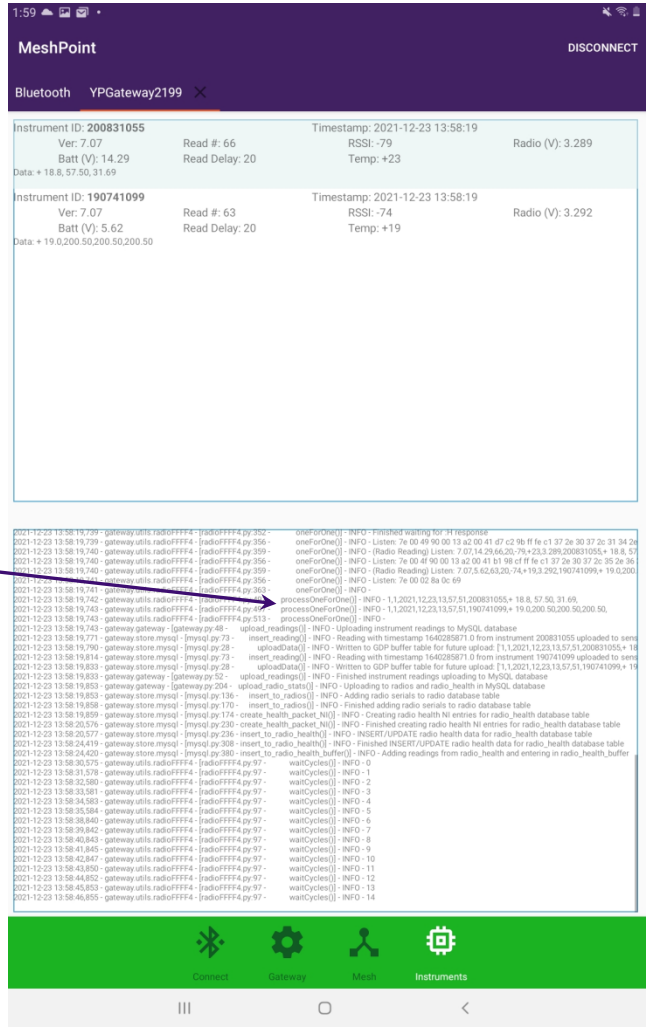
Once synchronized Nodal radios will take readings from attached instruments 20s before mesh wakeup.

Upon wakeup wakeup the nodal radios on the mesh will report their:

(i) Instrument readings (2 instruments are reported here)
(ii) Health data.

The order in which instruments are reported should depend on the last digit of the instrument ID.

This information is collated into the table at the top of the Instruments screen.

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MeshPoint App