The BluTech EcoSystem – June 2022

BluTech (BT5) EcoSystem

sales@yieldpoint.com

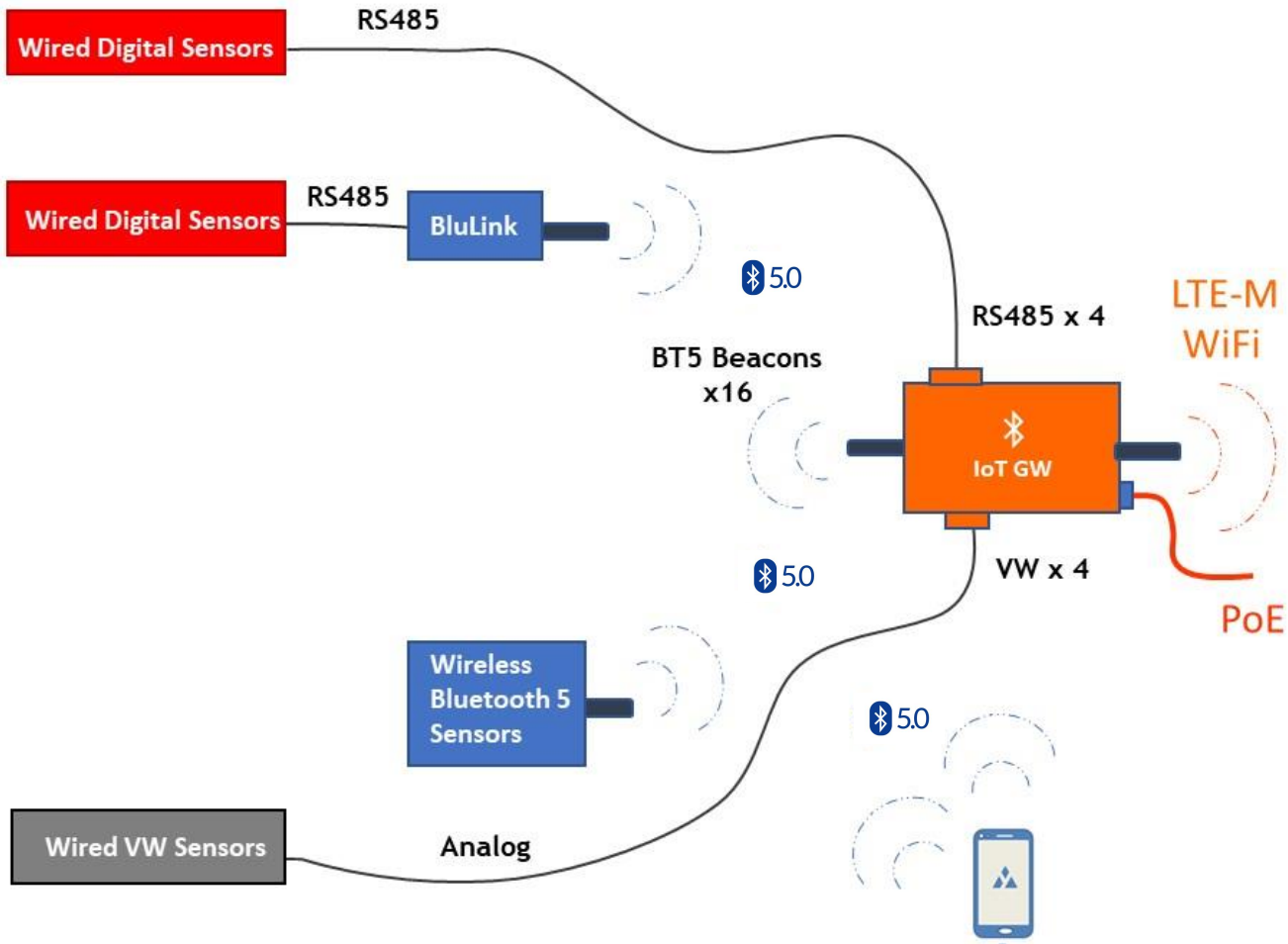
1-613-531-4722

5.0

YieldPoint *Sensing the future*

BluTech EcoSystem-2022

The BluTech EcoSystem - June 2022



GDP
Restful API

influxdata

django

amazon web services

docker

+
advanced analytics
=
+VantagePoint
(*pron:* *AdvantagePoint*)

ViewPoint
Manual readout

LogPoint
Datalogging

AccessPoint
LTE-M backhaul to cloud

VantagePoint
Browser based visualization

YieldPoint *Sensing the future*

YieldPoint's Ecosystem

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YieldPoint introduces BluPoint - a user friendly method to network clusters of geotechnical instruments without wires - changes the rules because the physical hardware actually costs less than for a wired solution.

BluPoint features include:

(i) Extended range: Reliable up to 100m
(ii) Android phone/tablet access
(iii) Low power, Battery powered.
(iv) 4 x the range of BLE4.
(v) User friendly BluLoggers for arrays of wired/wireless instruments
(vi) BluGateways enabling WiFi, LTE-M data backhaul
(vii) Cloud data platform and analytics
(viii) Operates in star configuration
(ix) Very low cost

5.0

YieldPoint Sensing the future

BluTech EcoSystem 2022

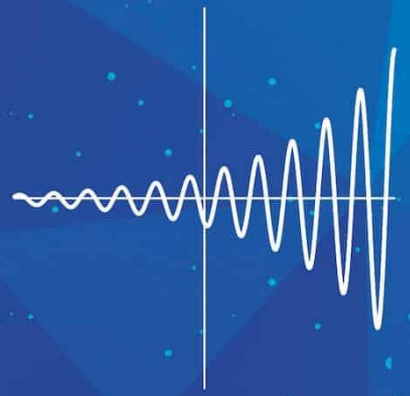
The emerging benefits of Bluetooth™ 5

Bluetooth 5 with mesh networking can technically support an **unlimited number of devices on a network**.

The range of **Bluetooth 5** is up to four times that of its predecessors, meaning you can cover larger areas using fewer devices. And with mesh **network topology enabling every device to connect to every other device, network sizes are technically limitless**.

Bluetooth 5 can deliver **up to 10 years' service from a single cell battery**.

Bluetooth beacons will be greatly improved by **Bluetooth 5**, giving assets the ability to **transmit longer messages at higher data rates over greater distances**.



Thanks to techniques such as channel hopping and slot availability masks, **Bluetooth 5 has better interoperability and coexistence with other wireless technologies**.

MOUSER ELECTRONICS

Link to webinar: **http://mou.sr/RFtechsolutions**

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Bluetooth 5

Battery Power:

BluPoint hardware is typically powered with D-cell or AA –cell **LITHIUM** primary batteries.

The energy capacity of D batteries is:

Chemistry	Nominal Voltage	Capacity
Lithium D	3.6V	13 000mAh
Lithium AA	1.5V	3000mAh

Many factors affect battery-life, the most important being the reading frequency.

Under typical operating conditions (1 reading/hr) AA Lithium batteries will last 2-3 years in a Blutech instrument, and D-cell lithium batteries over 4 years. However, always check the specifications on each device.

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Battery Requirments

Range:

Bluetooth 5 sacrifices data rate (125kbs) for increased range. Under ideal conditions the maximum range (125kb/s Coded PHY) is around 250m LoS. In testing we have routinely established reliable connection over 100m LoS.

Factors effecting range are:

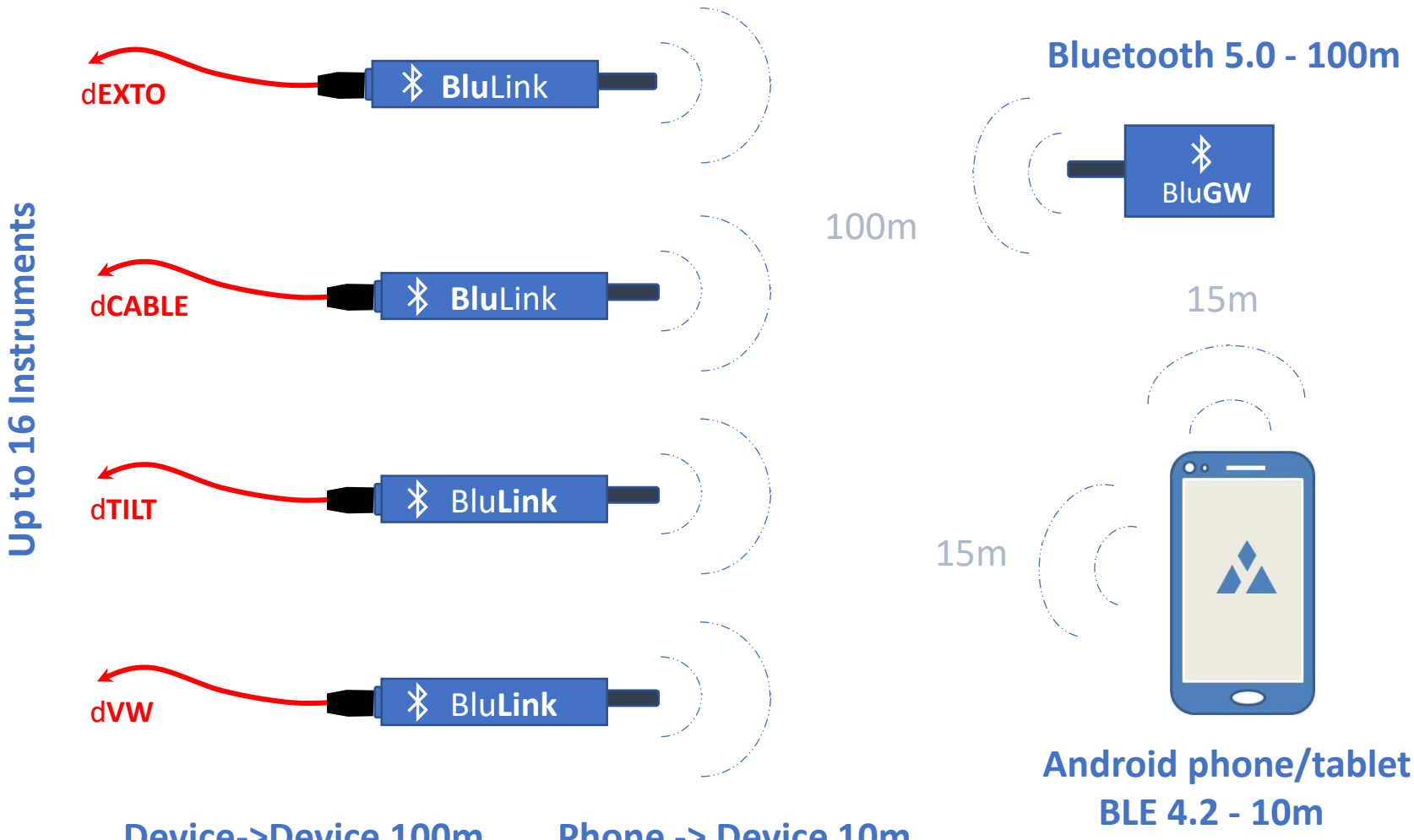
(i) Line of Sight OS: 2.4GHz technology has limited capability to pass through walls and reflect around structures.
(ii) Characteristics and orientation of antenna.
(iii) Height above ground surface.
(iv) Vegetation especially when wet.
(v) Vehicles periodically in LoS.

RSSI (Received Signal Strength Indicator):

-40 to -60 **Good**
-60 to -80 **Moderate**
<-80 **Poor**

Radios can communicate down to an RSSI of -92.

IMPORTANT: Whatever the orientation of the device, the antenna should be VERTICAL



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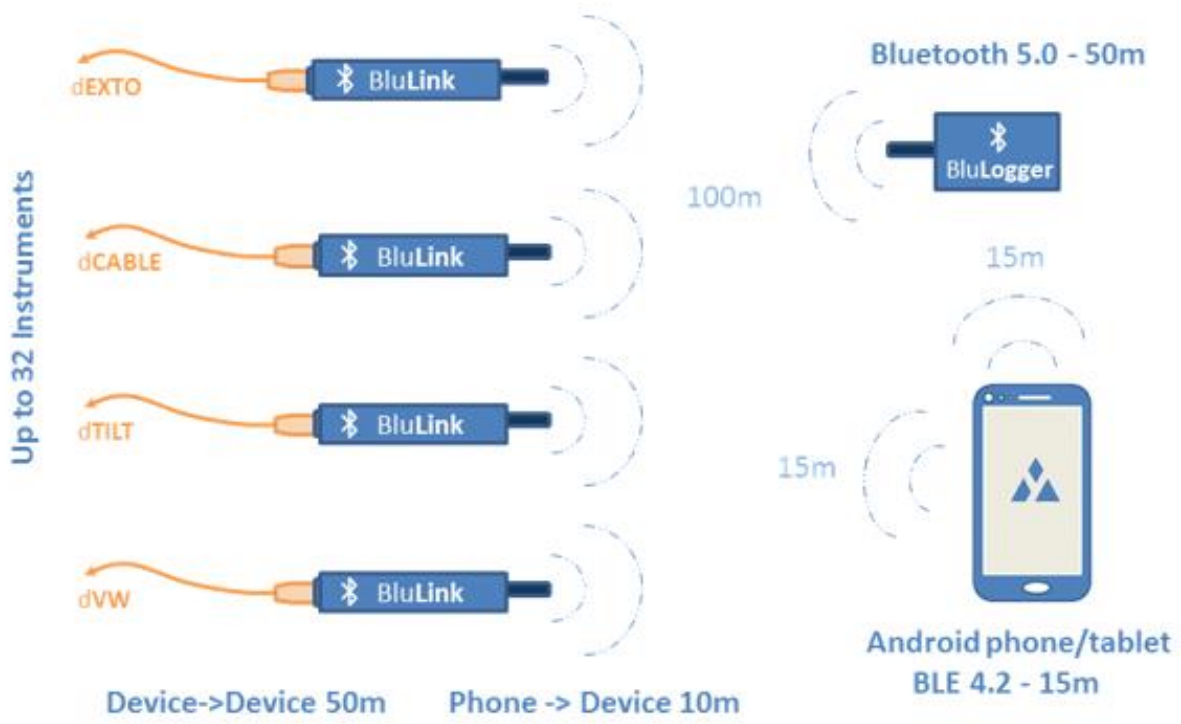
BluLink Connectivity



BluLink loggers turn any YieldPoint instrument into a data logger with Bluetooth BLE5 capability. 30,000 readings saved, 50 to 200m transmission range, adjustable frequency. BluPoint Android application. Sends data to BluGateway for networking.

The BluLink-S is fully encapsulated and will operate indefinitely underwater.

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BluLink-S (sealed)

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BluLink-R: BT5 Logger and Transmitter

Works with any YieldPoint digital instruments.

Confirms instrument connection by flashing LED.

Stores 30,000 data strings at user intervals.

Beacons new data string via Bluetooth 5.

Data strings are date & time stamped events.

Communicate with 4G LTE-Cat M1.

IP67 enclosure, external BLE5 antenna included, replaceable **lithium D-cell batteries** good for 3 years.

Batteries not included.

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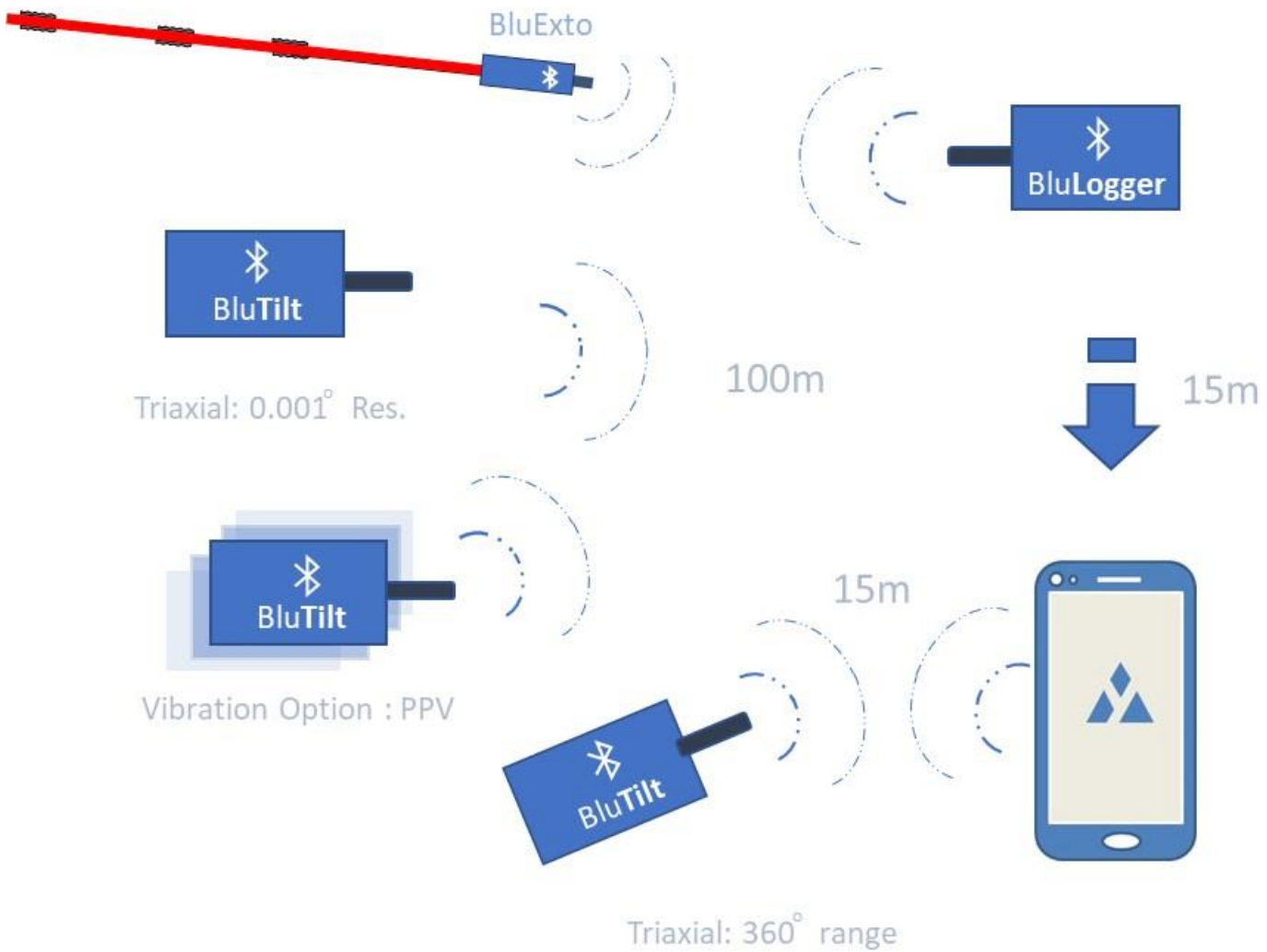
BluLink - R (replaceable)

BluPoint instruments are fully integrated geotechnical measure-ment and monitoring systems.

They combine the functional of an instrument and data-logger, and also Function as a telemetry node.



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BluPoint Instruments

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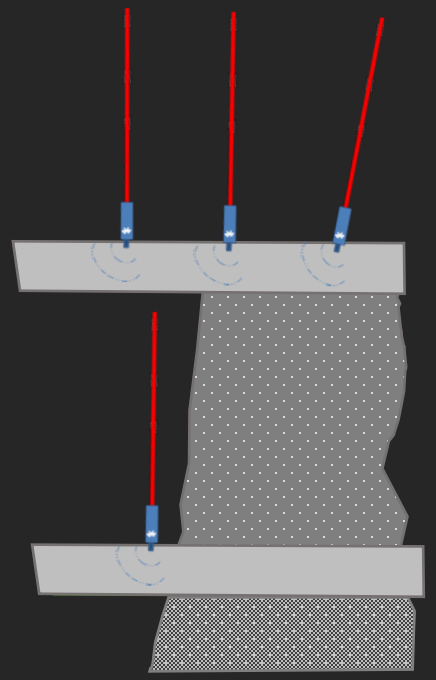
The extensometer is a 6-point borehole extensometer with measurement resolution of 0.1mm and stroke length up to 300mm. Integration includes a grout hose, a breather tube and a foaming tube which greatly simplifies the installation procedure. The diameter of the head is 57mm or 2.25” and the device is designed to be installed in 63mm or 2.5” boreholes (ask about smaller diameters).



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BluEXTO

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BluTilt: 360° Triaxial Tiltmeter.

- Data logger 30,000 readings capacity.
- IP68 metal enclosure 140x90x60mm (5.5/3.5/2.5”). Optional.
- High resolution at 1/1000th degree on all 3 axes.
- Range 360 degrees on all 3 axes.
- Mounts on any kind of structure.
- Can be installed on any angles thanks to triaxial 360 degrees range.
- Bluetooth BLE5 Communications.

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BluTilt

: HID cell interface

BluCSIRO is a single channel Bluetooth and logging enabled interface for CSIRO HID cell, made by ESS in Australia.

The device interrogates the stress cell and returns a single output string with the respective values for the 12 strain gauges.

Could also become available as a 4G LTE-M gateway in the future.

GEOSYSTEMS

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BluCSIRO

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The BluPoint App

by:

Peter Brittain

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BluPoint Solution 2022

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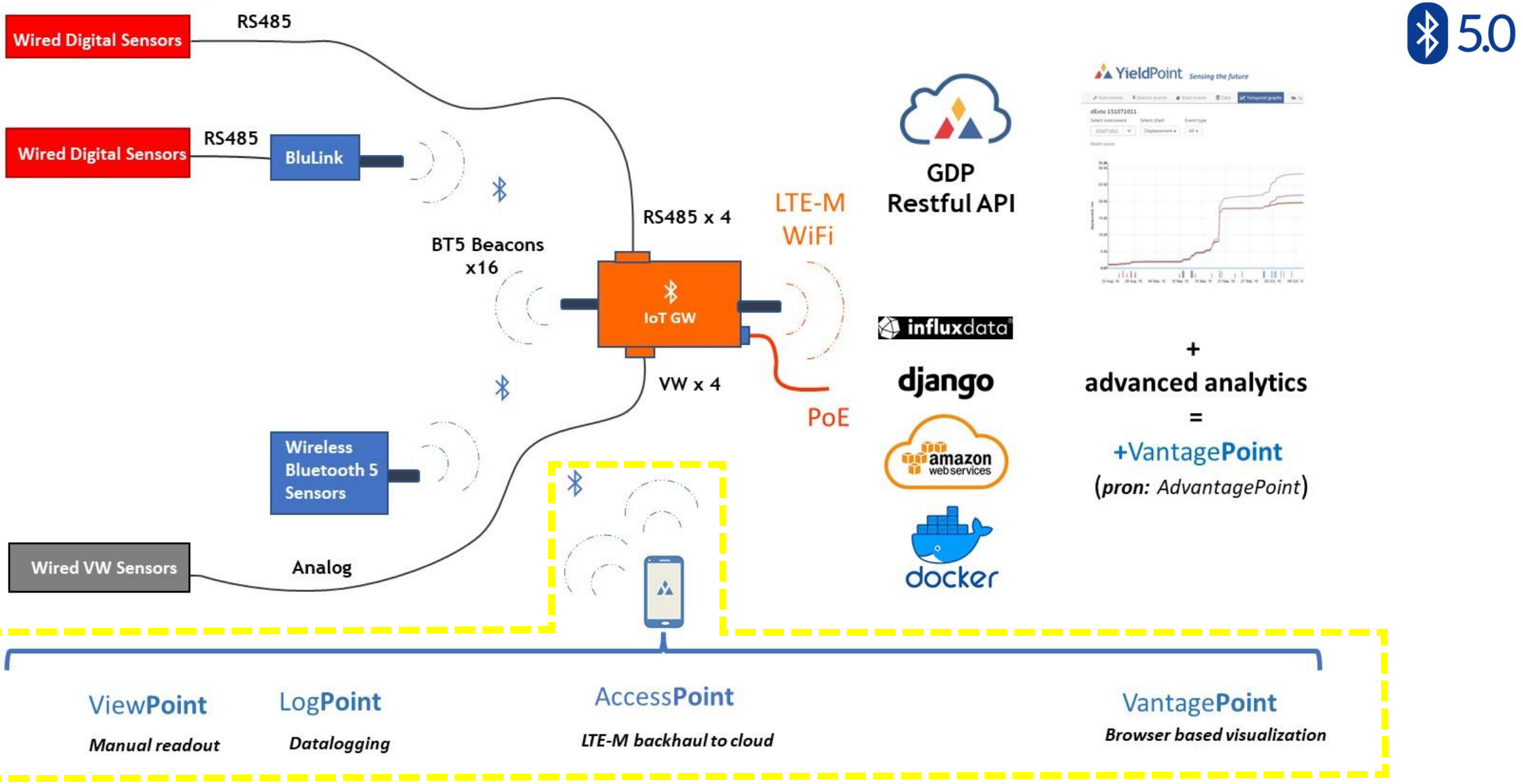

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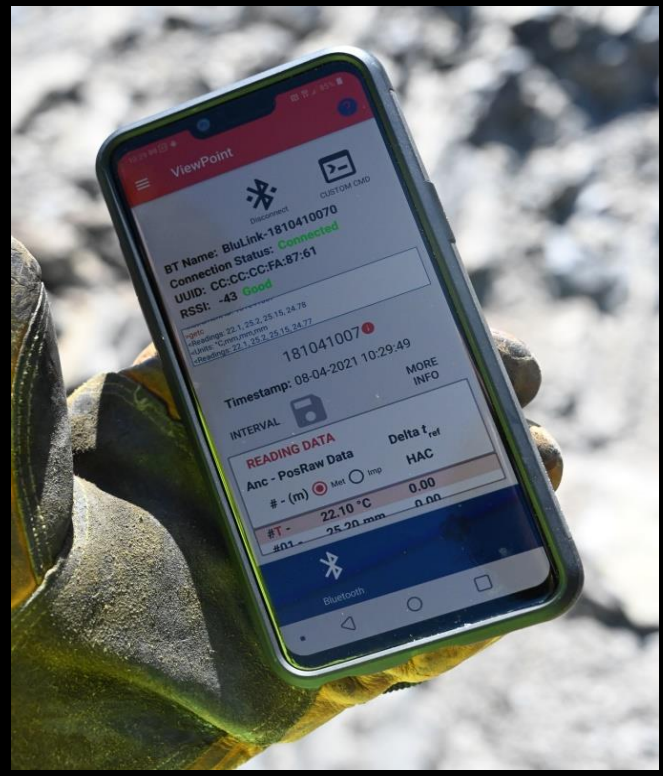
The BluPoint App

(i) Android Phone



(ii) Android tablet

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BluPoint App

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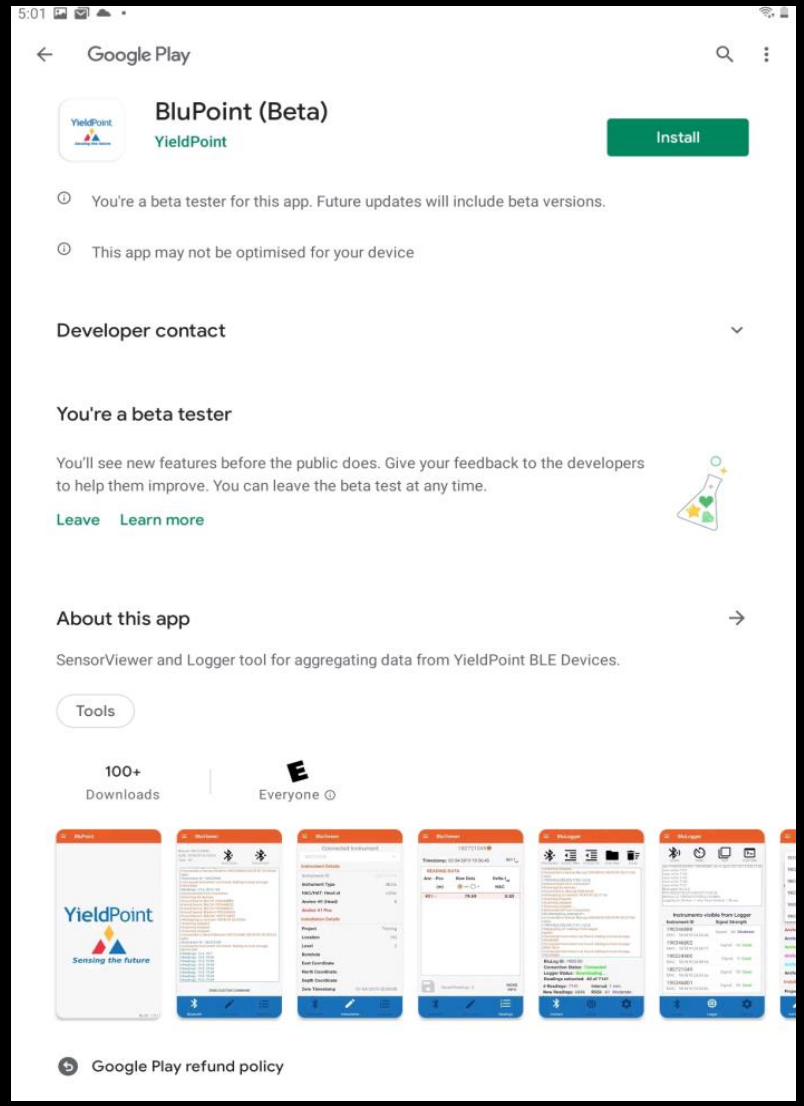
The BluPoint App can be downloaded from the Google Play Store. Search for BluPoint and then install:



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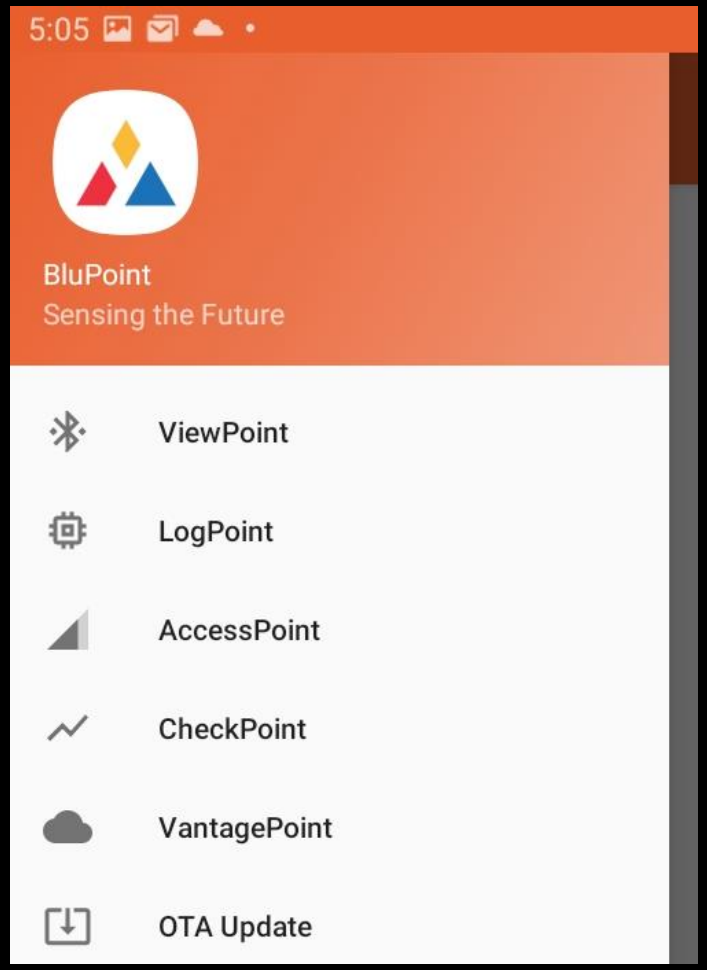
Install the BluPoint App

Step 1: Swipe from the left to activate the BluPoint Activities.



The BluPoint App is the software interface between Android devices and BluPoint hardware. Swiping from the left reveals a number of Activities that comprise the App.

ViewPoint: Connect to an instrument (10m range) to view/save the latest data

LogPoint: Connect to a BluLogger. Extract data onto Andoid device. Scan the instruments in range(50m) of the BluLogger

AccessPoint: Log onto a BluGateway. Download stored data.

CheckPoint: Android App to display data when offline

VantagePoint: A Geotechnical Data Platform (GDP) for visualization and analysis of data

OTA Update: Update Blulink and BluGateway Firmware

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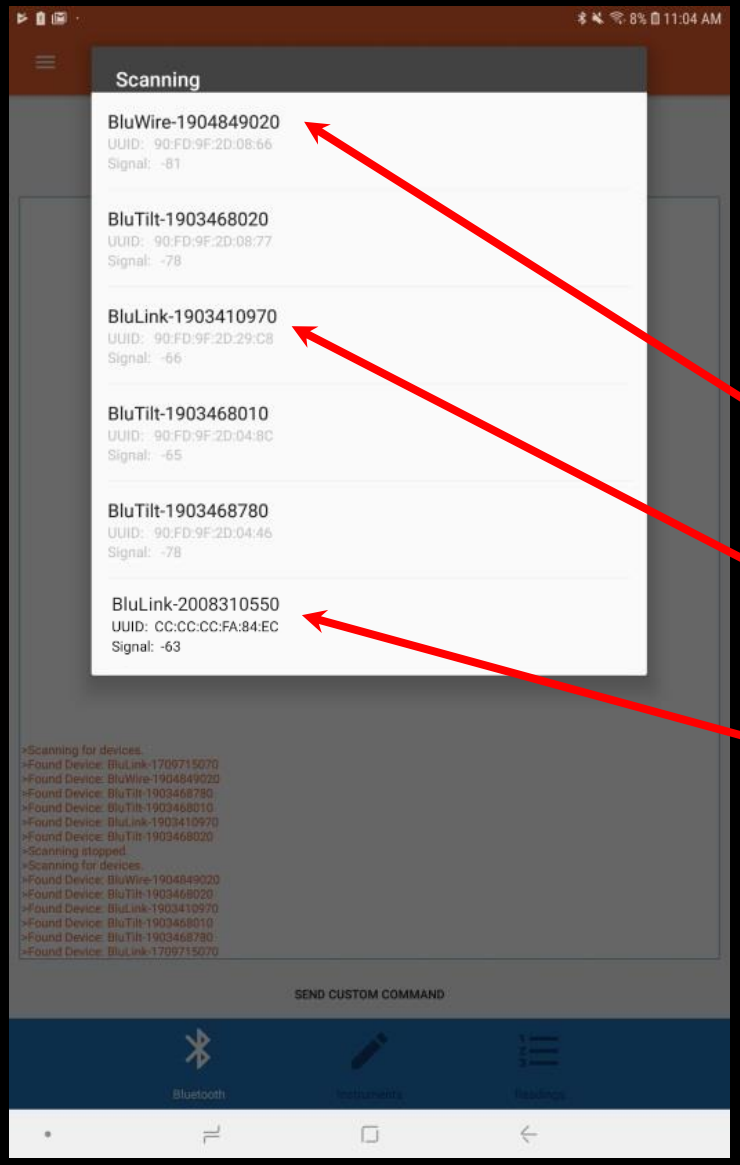
BluPoint Activities



Tap Scan to discover instruments. All instruments in range will be displayed. This may take up to 20s to complete. If you are scanning from a Bluetooth 4.2 device the range is around 15m

BluWire: 4 x vibrating wire interface

Blulink: attached to a BluWire (wired connection) with ID 200394788

Blulink: attached to a 3 point dExto with ID 200831055

3 **Blu**Tilts are also on the network

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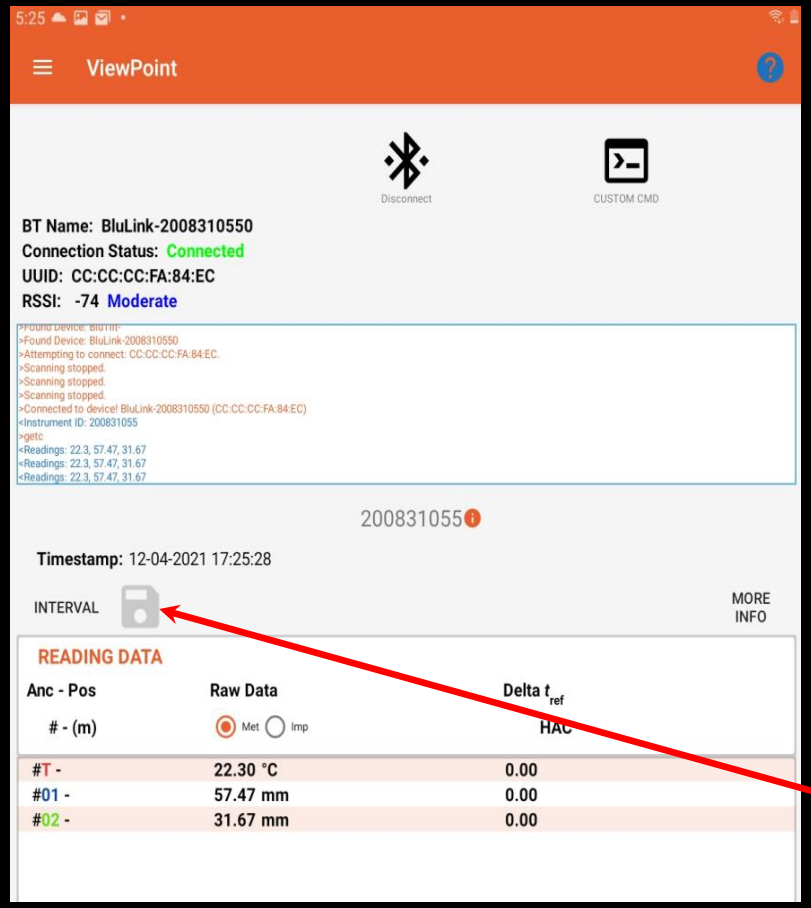
ViewPoint Activity

The ViewPoint Activity functioning like a manual readout unit



Connected to Instrument ID 200831055

Temp: 22.3C, Anch 1: 57.47m, Anch 2: 31.67mm

Save Readings

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Connection to BluLink 200831055
(Note: the BluLink assumes the Unique ID of the instrument)

Follow the top Menu bar for L to R:

Step 1: Connect

Step 2: Extract All

Step 3: View files

Step 4: Wipe logger (within BluLink)

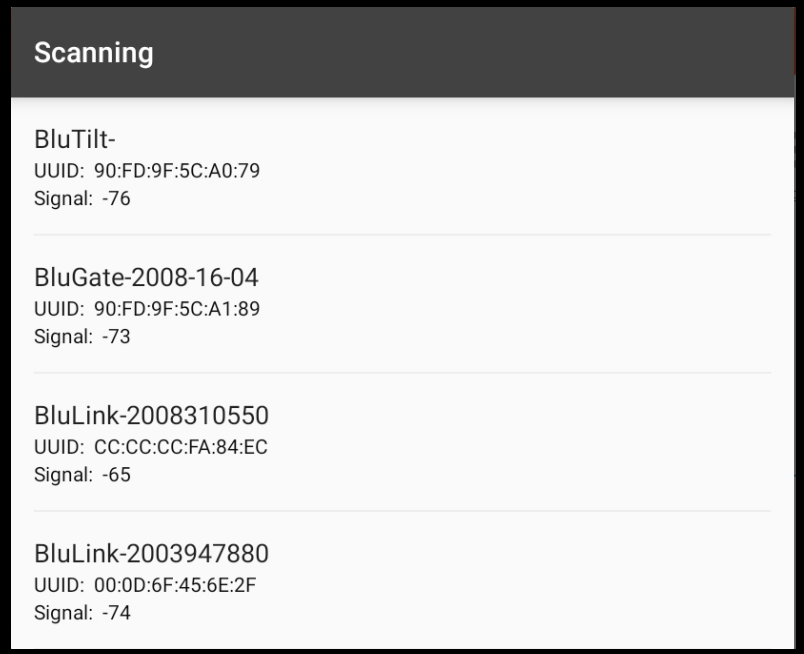
Then the dataset can be checked in either the CheckPoint or VantagePoint activities

YieldPoint *Sensing the future*

LogPoint Activity

Step 1: Swipe from the left to activate the BluPoint Activity list . Select LogPoint

Tap the Connect icon: A list of devices will appear

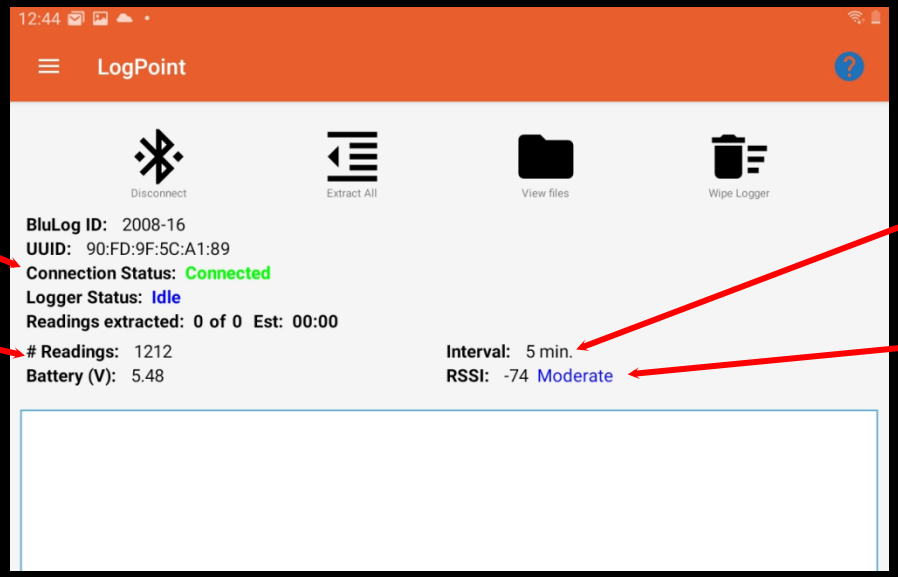


Tap a BluLink, BluLogger or BluGateway from the list to connect

After connection:

Device Names: BluGate 2008-16-04

2008 YYMM of manufacture
16 Unique identifier
04 Number of instruments in range



Connection Status

Number of readings

Logger Reading Interval

RSSI

RSSI Values:

-40 to -60	Good
-60 to -80	Moderate
<-80	Poor

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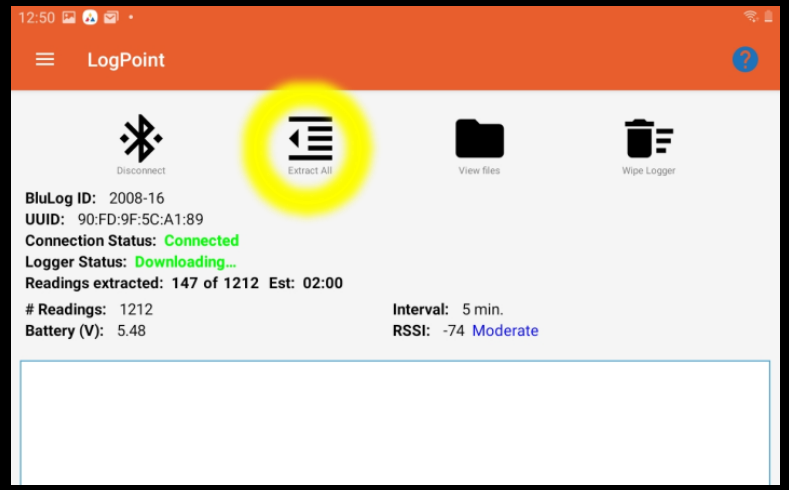
LogPoint Activity

After connection:

Tap the **Extract All** button:

The LogPoint Activity downloads all readings:



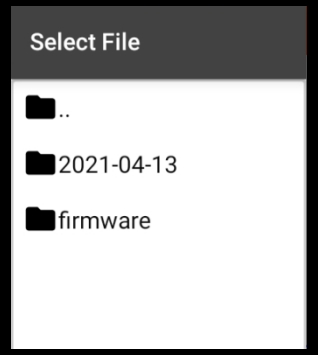
A BluLogger/BluGateway may have saved data from a whole cluster of instruments. These will all be downloaded synchronously.

Where are my Files?

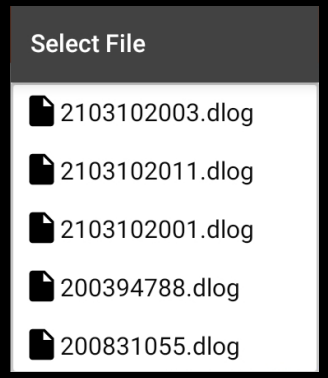
The files extracted from the BluLogger are in the directory:

/ Tablet / YieldPoint / *download_date / instrument ID* .dlog

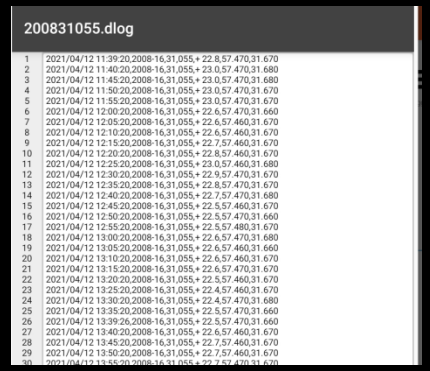
Important: A folder is created for each download date.



A new folder for each download date



6 Instruments



The data for 200831055

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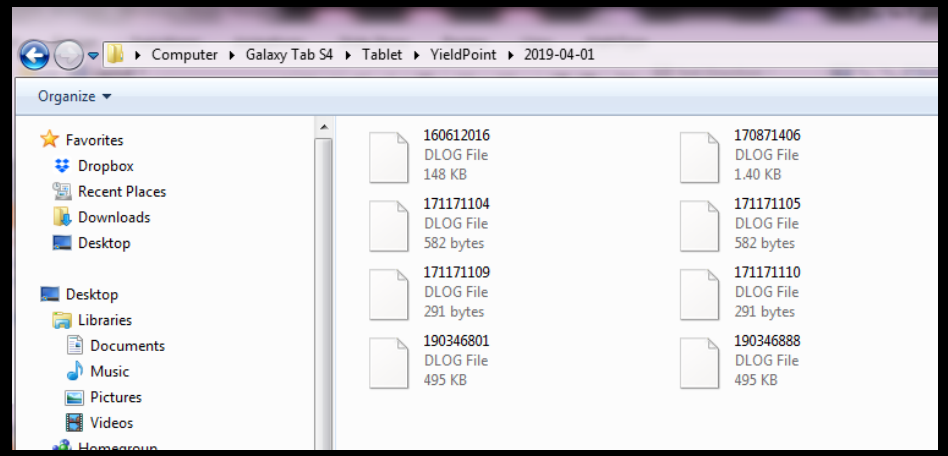
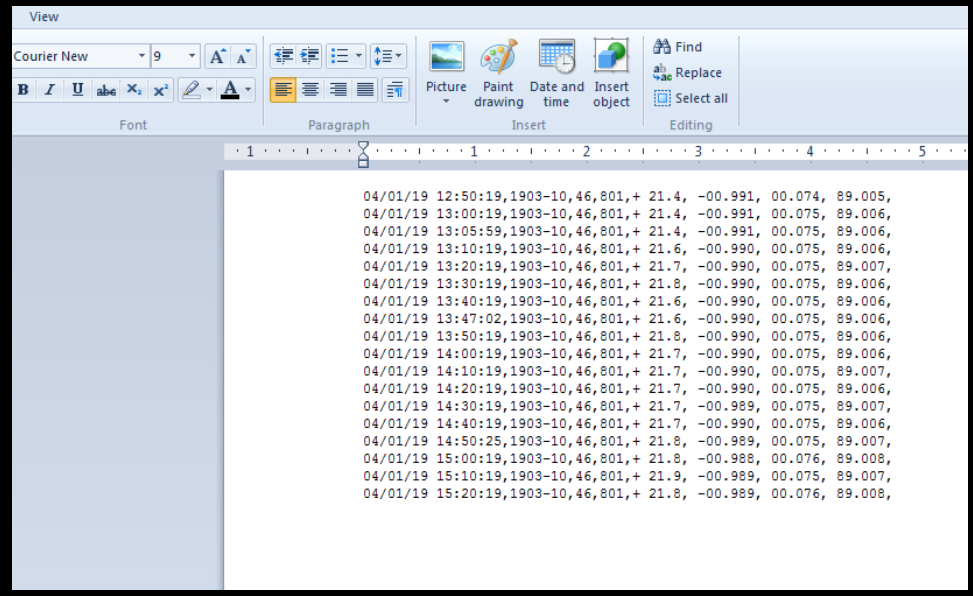
LogPoint Activity

Where are my Files?

Plug a USB charging cable into the Android device:



A new folder is created for each download date



For import into Excel

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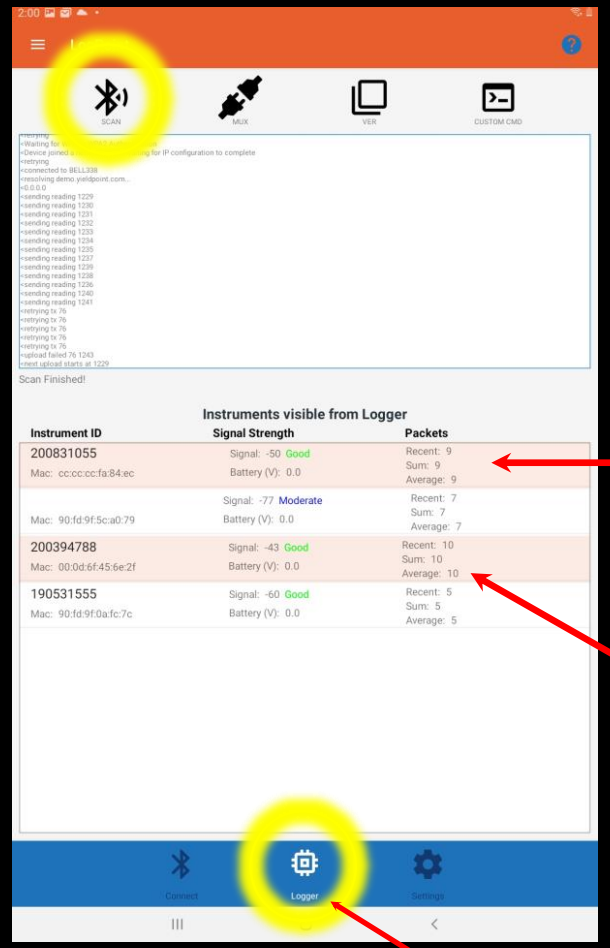
LogPoint Activity

Scanning from The Gateway:



d2EXTO + BluLink

packets received during scan window

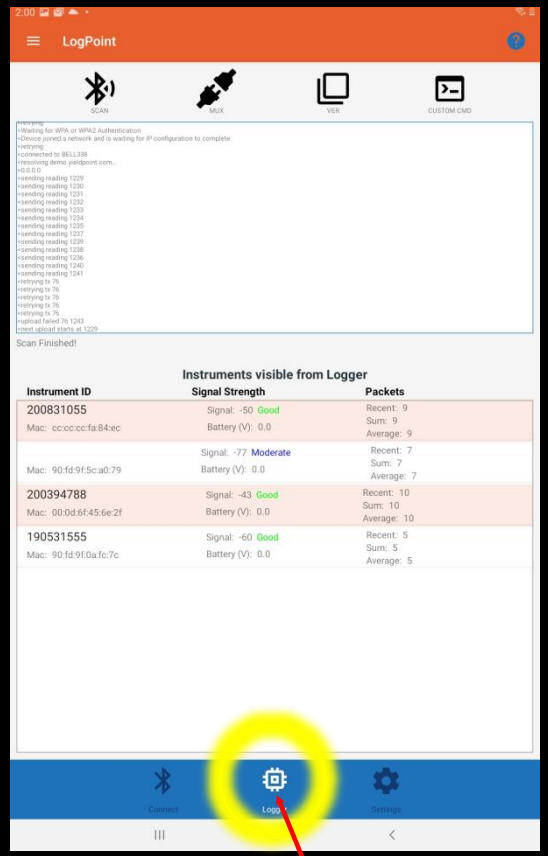
The Logger Button

The scan command instructs the Gateway to listen and count Bluetooth 5 beacons for a 20s period (note: must already be connected)

During a scan a timer will count down from 20s to 0.

The RSSI from is between the Gateway and BluInstruments and represents Bluetooth 5 extended range for the Coded PHY.

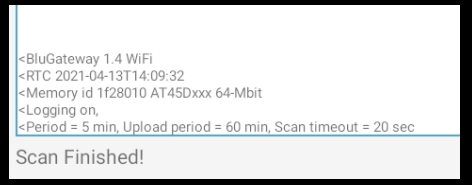
The scan may be interrupted by other logger tasks



The Logger Button

Tap the **MUX** button to reads YP 4 or 8 channel Muliplexer if the Gateway has one.

Tap the **VER** button to return information regarding the Gateway.



Custom commands:

SCAN **BluLogger will scan all instruments within a 100m radius of the BluLogger.**

Important: The BluLogger (BT 5) will detect instruments that the Android device (BLE 4.2) will not.

SYNC **Sync the time/date on the BluLogger with this Android device**

VER **Returns the BluLogger Firmware Version**

CUSTOM **Send a custom BluLogger Command.**

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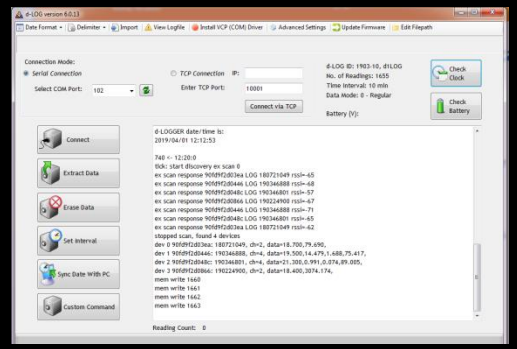
LogPoint Activity

Custom commands can be entered using the Custom Button:

Commands:

addr -> print logger Bluetooth Mac address
scan -> Bluetooth scan
stop -> stop Bluetooth scan
last -> print results of last Bluetooth scan
logon -> start periodic data logging
logoff -> stop periodic data logging
readall -> download all data
delay -> flash blue LED
sync -> send out sync packet
reset -> reset logger memory and set device id: example: “reset 1903-88” will clear memory, write memory structure, and set the logger id



Connect a USB Download Cable to the COMS BluLogger:

Option 1:

Use dLOG software identical to a wired Logger

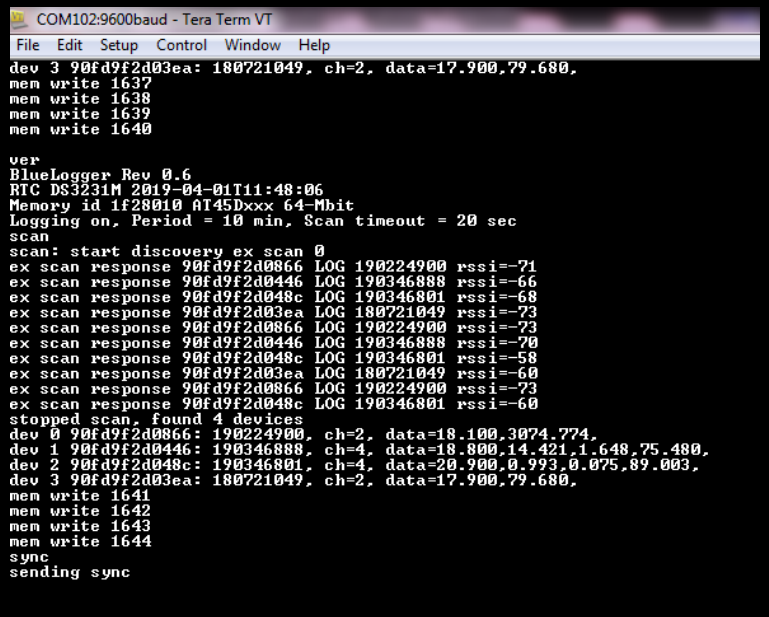
Option 2:

Use a terminal emulator such as TeraTerm.
Baud rate: 9600,N,8,1

https://en.wikipedia.org/wiki/Tera_Term

Note: USB download cable purchased separately

Custom commands are entered using a terminal window:



scheduled reading

ver — get version number

scan — scan for instruments read, save to BluLogger

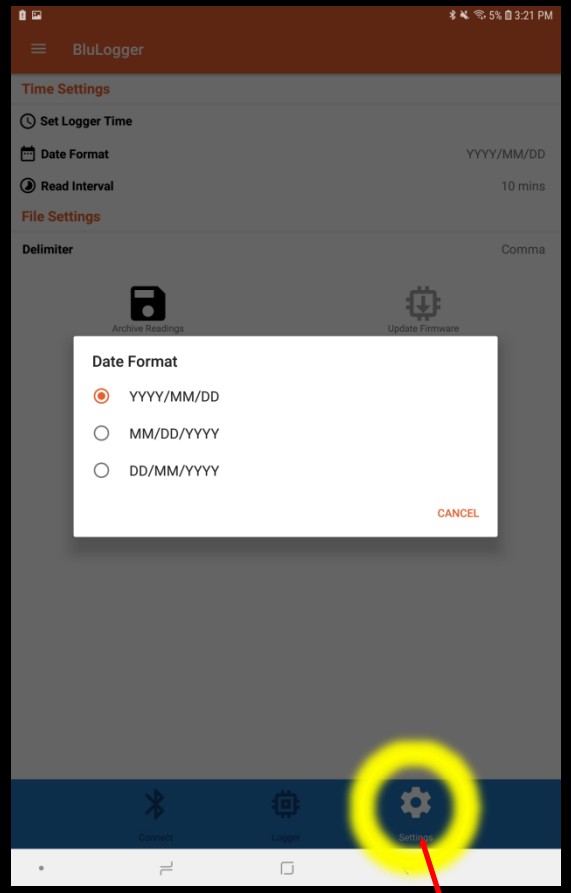
sync — synchronize BluLogger with android device

These commands can be sent using the custom button in dLOG software

YieldPoint *Sensing the future*

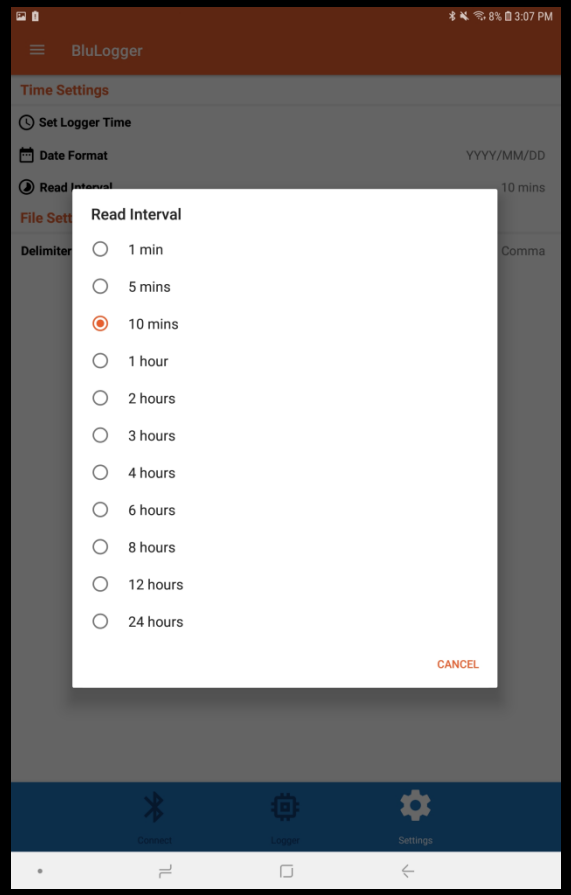
LogPoint Activity

Date Format Options



The Settings screen

The BluLogging Interval



YieldPoint *Sensing the future*

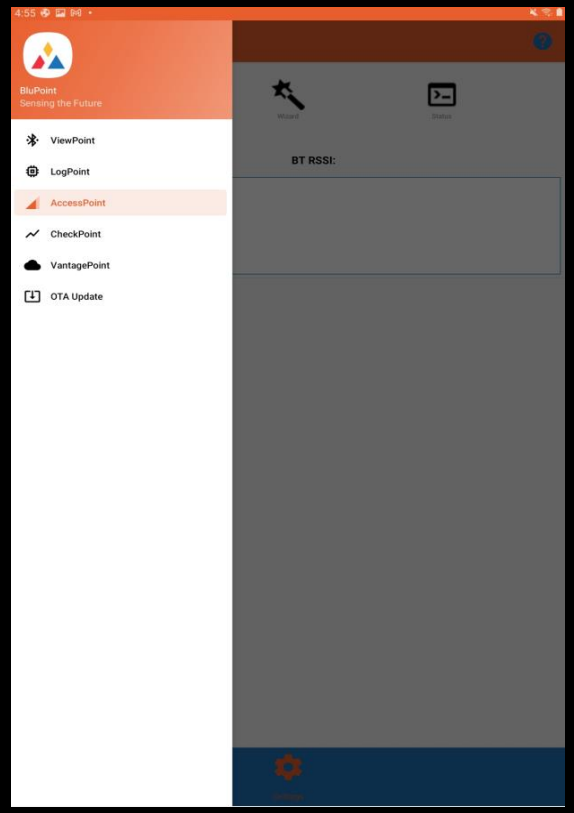
LogPoint Activity

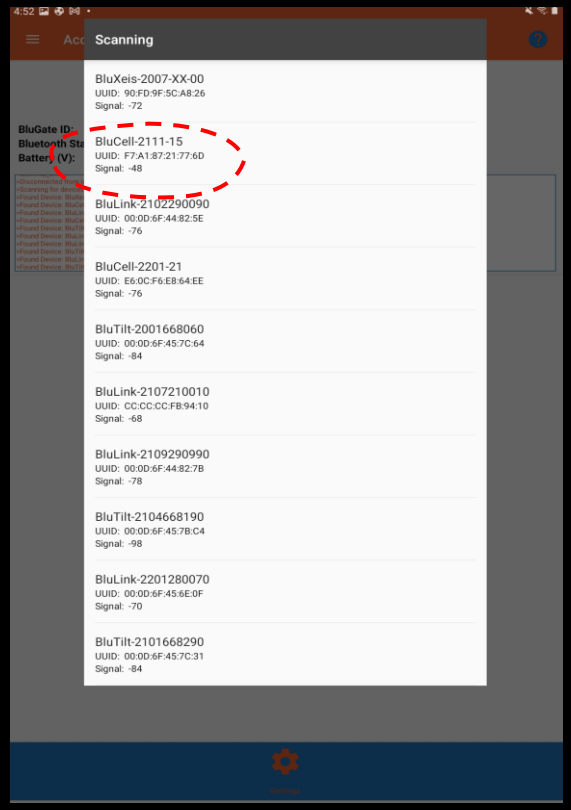
AccessPoint App?

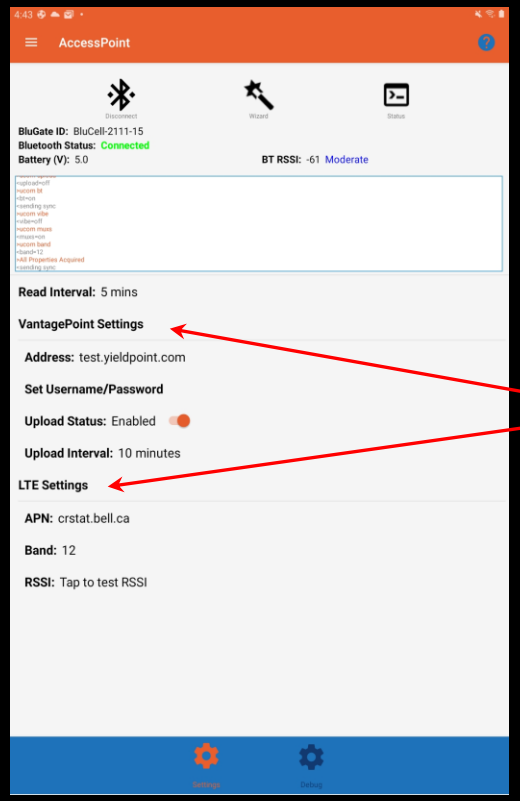
AccessPoint, which is a module within the BluPoint Android App is used to:

(i) Configure the Time and Reading Interval
(ii) Configure the LTE APN
(iii) Configure the upload interval
(iv) Configure the cloud DB target
(v) Check that the system is running correctly
(vi) Generate trouble-shooting logfiles

YieldPoint *Sensing the future*







Tap to expand

1. Open BluPoint and drag from the left to show Vantagepoint

2. Tap connect and select the BluCell ID

YieldPoint *Sensing the future*

AccessPoint Activity

Signal strength or RSSI

RSSI (Received Signal Strength Indicator): Radios can communicate down to an RSSI of -92.

Range: -40 to -60 Good
-60 to -80 Moderate
<-80 Poor

IMPORTANT: Whatever the orientation of the device, the antenna should be VERTICAL

YieldPoint Sensing the future

AccessPoint Activity

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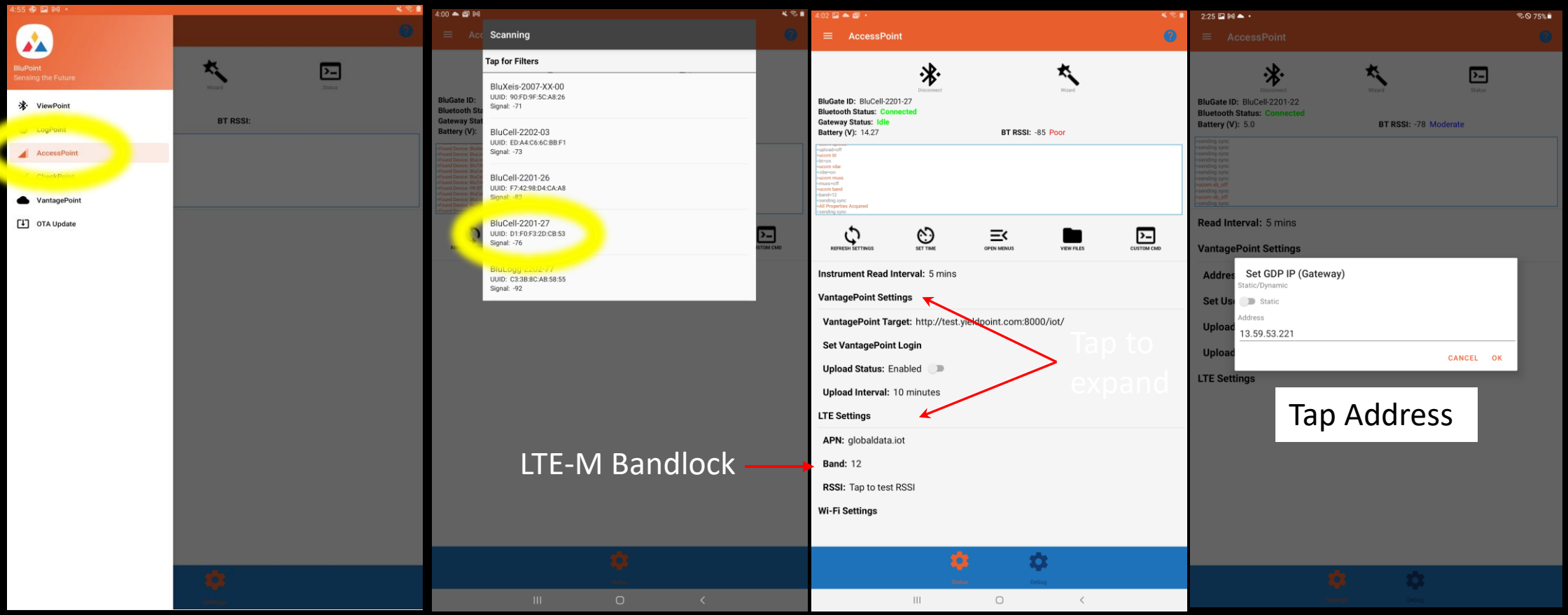
VantagePoint is an Activity within the BluPoint App



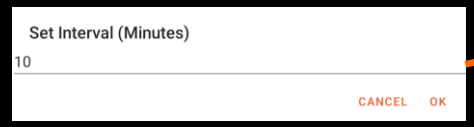
YieldPoint *Sensing the future*

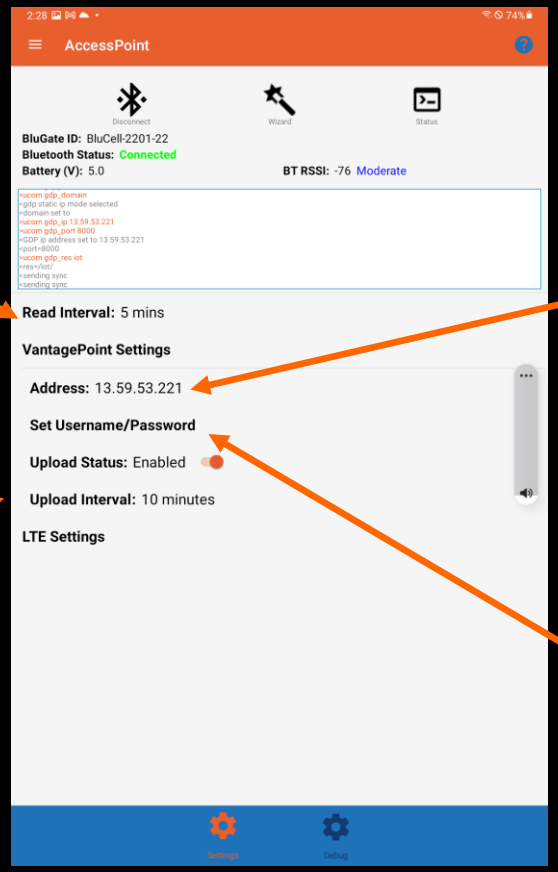
AccessPoint Activity

Backhaul Configuration

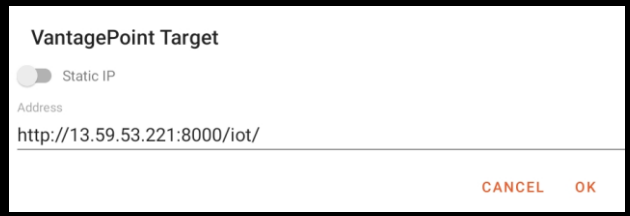
Instrument Read Interval:

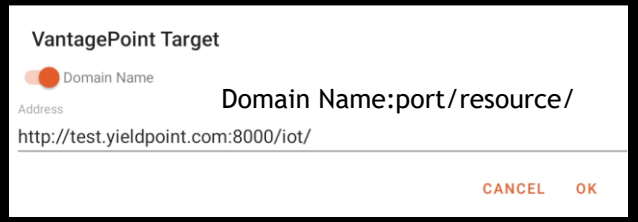
LTE-M upload interval





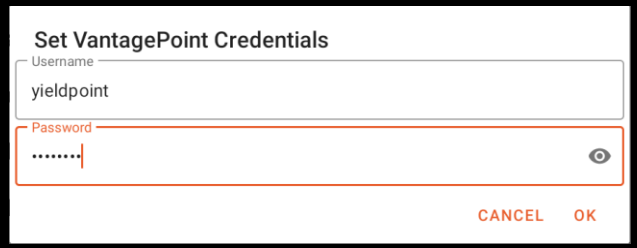
VantagePoint Target:





Domain Name:port/resource/

VantagePoint Login:



YieldPoint *Sensing the future*

AccessPoint Activity

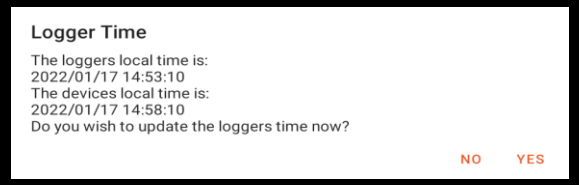
Check Status

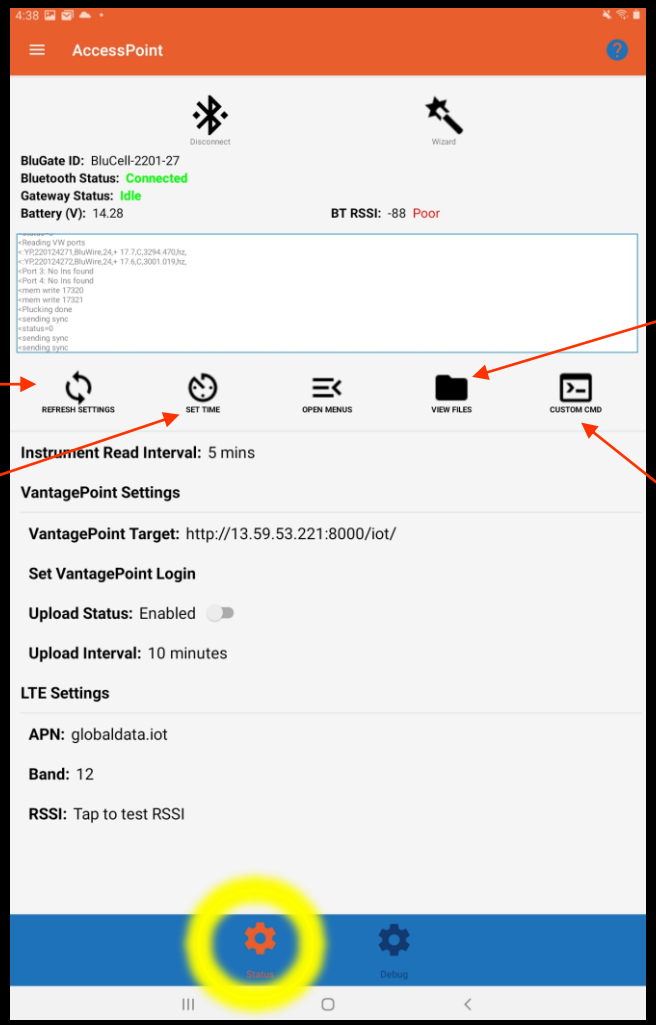
Gateway Status:

0: Idle (responsive)
1. BT Scan
2. RS485 Mux
3. VW Scan
4: LTE-M Upload

Refresh Settings

Sync Gateway time to Tablet





Logfile of commands/responses generated from session :

See Appendix 1 for list of custom commands

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AccessPoint Activity

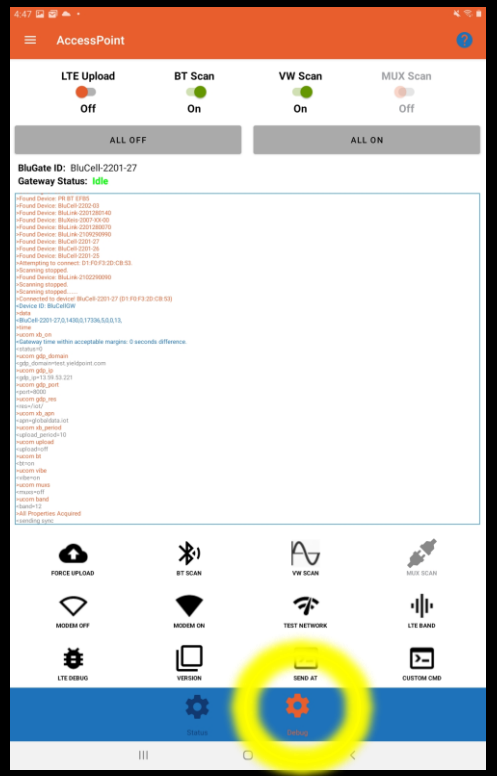
Troubleshooting-1

Auto tasks

ID + status

Activity: Stored to Log File

Manual tasks



The principal reason to access the debug window is because one of the gateway core functions is not working. e.g.

1. LTE-M upload (data not arriving at cloud target**) LTE-M Upload**
2. Bluetooth 5 scan not returning devices **BT Scan**
3. VW sensors not being read properly **VW Scan**
4. Wired mux not operating correctly RS 485 **MUX Scan**

Each of the processes, especially the **LTE-M Upload**, can consume the Gateways resources when not operating correctly so that the device becomes unresponsive to the user. Hence when troubleshooting it is convenient to suspend all Auto tasks and troubleshoot using manual cpmmands.

Tap “ALL OFF” to suspend all auto tasks or “” ALL ON” to turn them on

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AccessPoint Activity

Troubleshooting-2 Manual BT Scan

Tap “ALL OFF” to suspend all auto tasks

The BT Scan task listens for BT5 beacon (Extended Advertising Packets)
For **20 seconds**

```
>ucom scan
<scan: start discovery ex scan
<scan: start discovery ex scan 0
<stopped scan, received 47 packets, found 6 devices
<dev 0 000d6f44825e: rssi=-61, id=210229009, packets=7, ch=2, data=-1.910,1035.700,
<dev 1 000d6f457c31: rssi=-72, id=210166829, packets=7, ch=6, data=13.200,0.747,-107.538,0.000,0.000,2.000,
<dev 2 000d6f44827b: rssi=-37, id=210929099, packets=9, ch=2, data=-3.680,97.730,
<dev 3 ccccccfb9410: rssi=-10, id=210721001, packets=10, ch=2, data=17.900,52.020,
<dev 4 000d6f457c64: rssi=-70, id=200166806, packets=7, ch=6, data=15.900,0.484,0.318,0.000,0.000,2.000,
<dev 5 000d6f456e0f: rssi=-42, id=220128007, packets=7, ch=2, data=23.950,97.020,
<mem write 43
<mem write 44
<mem write 45
<mem write 46
<mem write 47
<mem write 48
<rtc: 15:9:20
<Scanning done
```

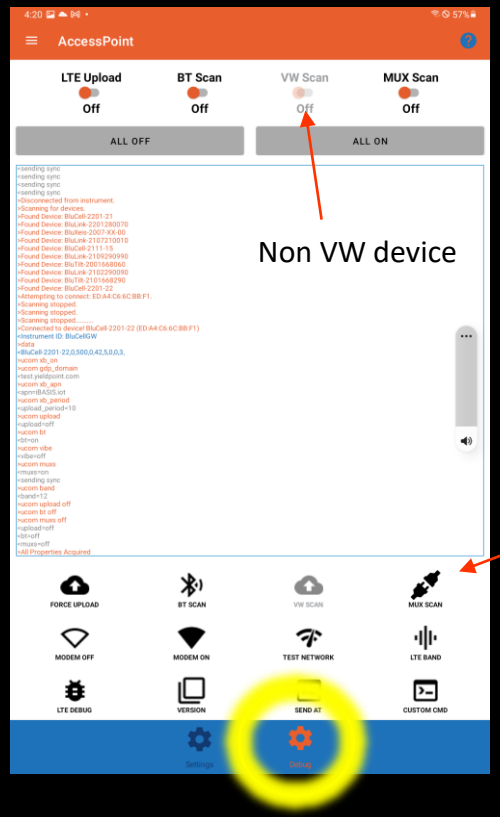
47 BT5 beacons detected in 20s

6 devices found

6 devices Written to memory

Troubleshooting-3 Manual Mux Scan

Tap “ALL OFF” to suspend all auto tasks



Find instruments plugged into the 4 x YP RS485 instrument ports

```
>ucom mux
<Reading MUX ports
<:YP,210721001,d1EXTO,21,+ 18.1,C, 52.01,mm,
<Port 2: No Ins found
<Port 3: No Ins found
<Port 4: No Ins found
<mem write 18378
<Muxing done
```

d1Exto on Port 1

Written to memory

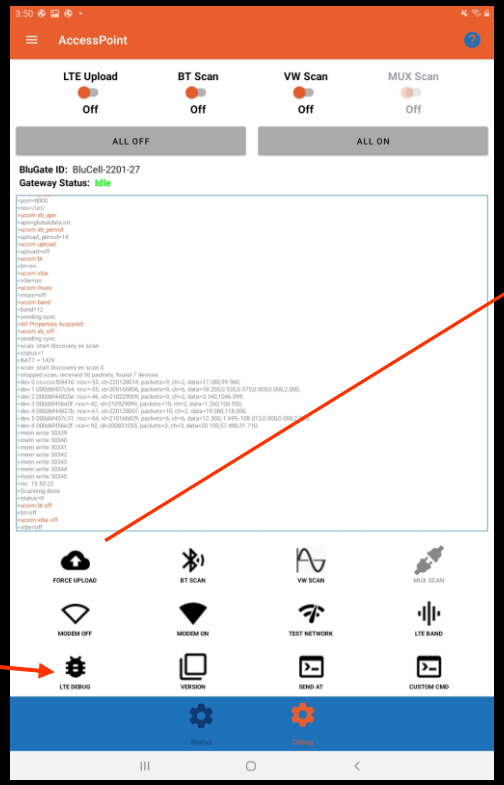
YieldPoint *Sensing the future*

AccessPoint Activity

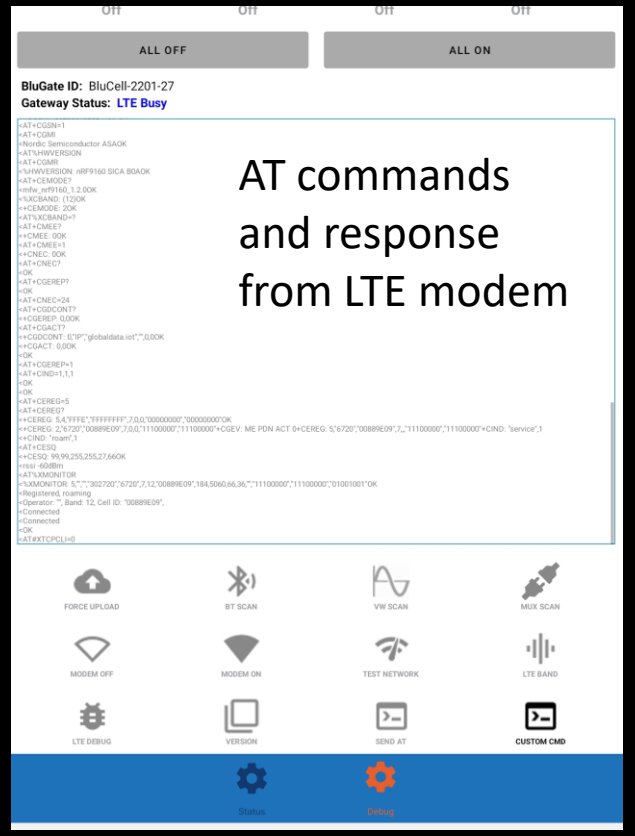
AT commands LTE-M Gateway

Tap “ALL OFF” to suspend all auto tasks

Auto functions Off



Tap LTE Debug



https://developer.nordicsemi.com/nRF_Connect_SDK/doc/latest/nrf/applications/serial_lte_modem/README.html

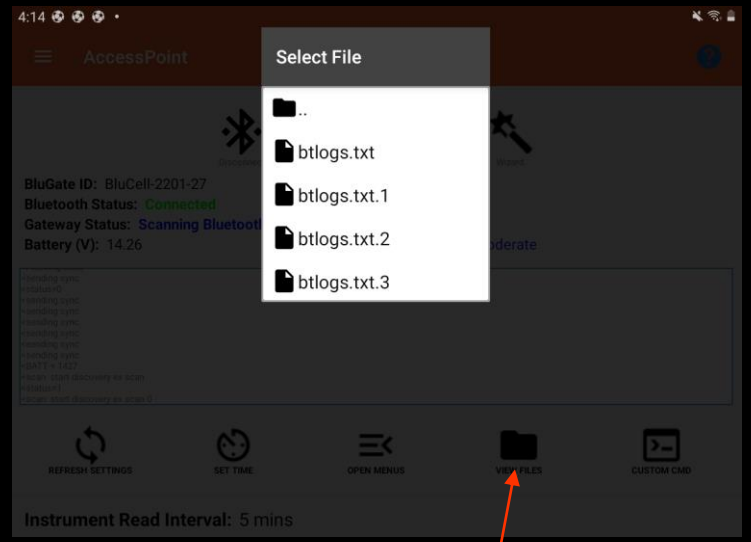
YieldPoint *Sensing the future*

AccessPoint Activity

Connection Log Files

AT Commands and responses with the LTE modem exchange quickly. A logfile of connection session is stored in the logfile

On the Status page:



Click view files to select a Logfile. Btlogs, btlogs.txt.1 are the youngest.

```
75  2022-02-08T15:50:47.693-05:00: <OK
76  2022-02-08T15:50:47.701-05:00: <AT+CFUN?
77  2022-02-08T15:50:47.707-05:00: <+CFUN: 1OK
78  2022-02-08T15:50:47.770-05:00: <+CGSN: "352656102524439"OK
79  2022-02-08T15:50:47.777-05:00: <AT+CGSN=1
80  2022-02-08T15:50:47.843-05:00: <AT+CGMI
81  2022-02-08T15:50:47.851-05:00: <Nordic Semiconductor ASAOK
82  2022-02-08T15:50:47.858-05:00: <AT%HWVERSION
83  2022-02-08T15:50:47.927-05:00: <AT+CGMR
84  2022-02-08T15:50:47.941-05:00: <%HWVERSION: nRF9160 SICA B0AOK
85  2022-02-08T15:50:47.997-05:00: <AT+CEMODE?
86  2022-02-08T15:50:48.008-05:00: <mfw_nrf9160_1.2.0OK
87  2022-02-08T15:50:48.078-05:00: <%XCBAND: (12)OK
88  2022-02-08T15:50:48.088-05:00: <+CEMODE: 2OK
89  2022-02-08T15:50:48.101-05:00: <AT%XCBAND=?
90  2022-02-08T15:50:48.154-05:00: <AT+CMEE?
91  2022-02-08T15:50:48.165-05:00: <+CMEE: 0OK
92  2022-02-08T15:50:48.174-05:00: <AT+CMEE=1
93  2022-02-08T15:50:48.225-05:00: <+CNEC: 0OK
94  2022-02-08T15:50:48.235-05:00: <AT+CNEC?
95  2022-02-08T15:50:48.245-05:00: <OK
96  2022-02-08T15:50:48.296-05:00: <AT+CGEREP?
97  2022-02-08T15:50:48.304-05:00: <OK
98  2022-02-08T15:50:48.313-05:00: <AT+CNEC=24
99  2022-02-08T15:50:48.373-05:00: <AT+CGDCONT?
100 2022-02-08T15:50:48.385-05:00: <+CGEREP: 0,0OK
101 2022-02-08T15:50:48.453-05:00: <AT+CGACT?
102 2022-02-08T15:50:48.465-05:00: <+CGDCONT: 0,"IP","globaldata.iot","",0,0OK
103 2022-02-08T15:50:48.524-05:00: <+CGACT: 0,0OK
104 2022-02-08T15:50:48.532-05:00: <OK
```

Part of the LTE-M connection exchange

```
120 2022-02-08T15:50:51.236-05:00: <Operator: "", Band: 12, Cell ID: "00889E09",
121 2022-02-08T15:50:51.246-05:00: <Connected
122 2022-02-08T15:50:51.264-05:00: <Connected
123 2022-02-08T15:50:51.519-05:00: <OK
124 2022-02-08T15:50:51.527-05:00: <AT#XTCPCLI=0
125 2022-02-08T15:50:51.667-05:00: <AT#XTCPCLI=1,"test.yieldpoint.com",8000
126 2022-02-08T15:50:52.212-05:00: <#XTCPCLI: 1,"connected"OK
127 2022-02-08T15:50:52.225-05:00: <AT%XMONITOR
128 2022-02-08T15:50:52.347-05:00: <%XMONITOR: 5,"","","302720","6720",7,12,"00889E09",184,5060,6
129 2022-02-08T15:50:52.355-05:00: <Uploading 30328
130 2022-02-08T15:50:52.444-05:00: <AT#XTCPSEND="POST /iot/ HTTP/1.1Host: test.yieldpoint.com
131 2022-02-08T15:50:53.186-05:00: <#XTCPSEND: 230OKHTTP/1.1 201 CreatedDate: Tue, 08 Feb 20
132 2022-02-08T15:50:53.340-05:00: <: 213SEND: 230OKHTTP/1.1 201 CreatedDate: Tue, 08 Feb 2022
133 2022-02-08T15:50:53.397-05:00: <Uploading 30329
134 2022-02-08T15:50:53.472-05:00: <AT#XTCPSEND="POST /iot/ HTTP/1.1Host: test.yieldpoint.com
135 2022-02-08T15:50:54.166-05:00: <#XTCPSEND: 230OKHTTP/1.1 201 CreatedDate: Tue, 08 Feb 20
136 2022-02-08T15:50:54.296-05:00: <: 213SEND: 230OKHTTP/1.1 201 CreatedDate: Tue, 08 Feb 2022
137 2022-02-08T15:50:54.304-05:00: <Uploading 30330
138 2022-02-08T15:50:54.456-05:00: <AT#XTCPSEND="POST /iot/ HTTP/1.1Host: test.yieldpoint.com
139 2022-02-08T15:50:55.133-05:00: <#XTCPSEND: 229OKHTTP/1.1 201 CreatedDate: Tue, 08 Feb 20
140 2022-02-08T15:50:55.283-05:00: <Uploading 30331
141 2022-02-08T15:50:55.295-05:00: <: 213SEND: 229OKHTTP/1.1 201 CreatedDate: Tue, 08 Feb 2022
142 2022-02-08T15:50:55.351-05:00: <AT#XTCPSEND="POST /iot/ HTTP/1.1Host: test.yieldpoint.com
143 2022-02-08T15:50:56.172-05:00: <#XTCPSEND: 252OKHTTP/1.1 201 CreatedDate: Tue, 08 Feb 20
```

Posting data to VantagePoint

YieldPoint *Sensing the future*

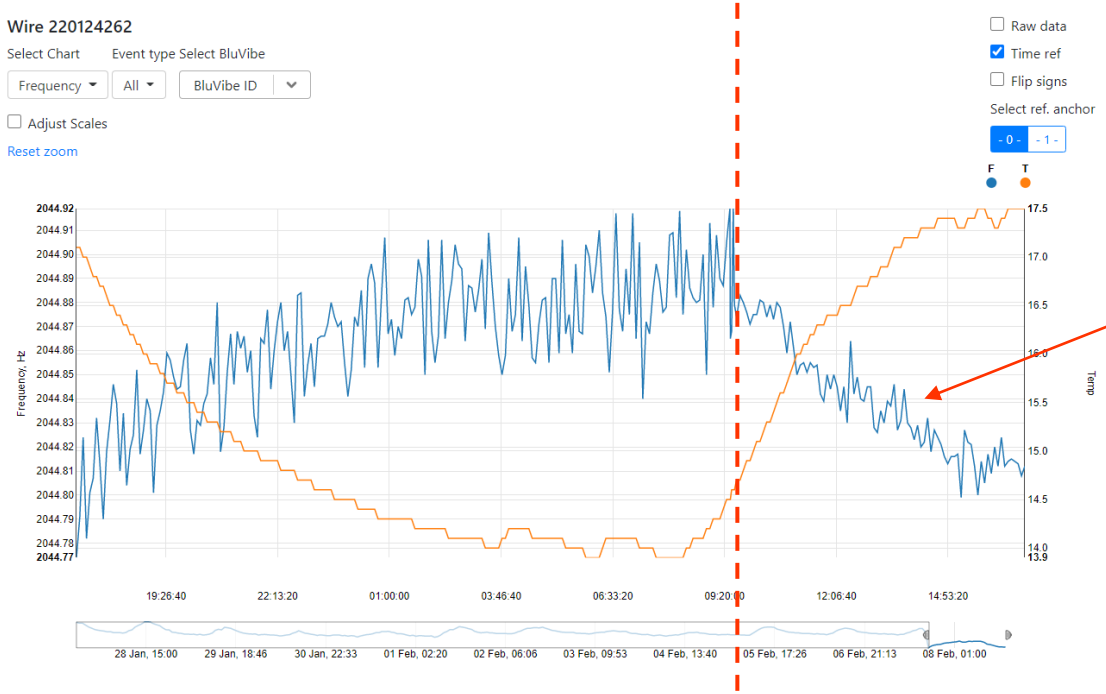
AccessPoint Activity

VW Range setup

Freq Ch# Start(Hz) Span(Hz)

freq 2 1000 4000

freq 2 1800 500



Chirp is from 1800hz to 2300Hz

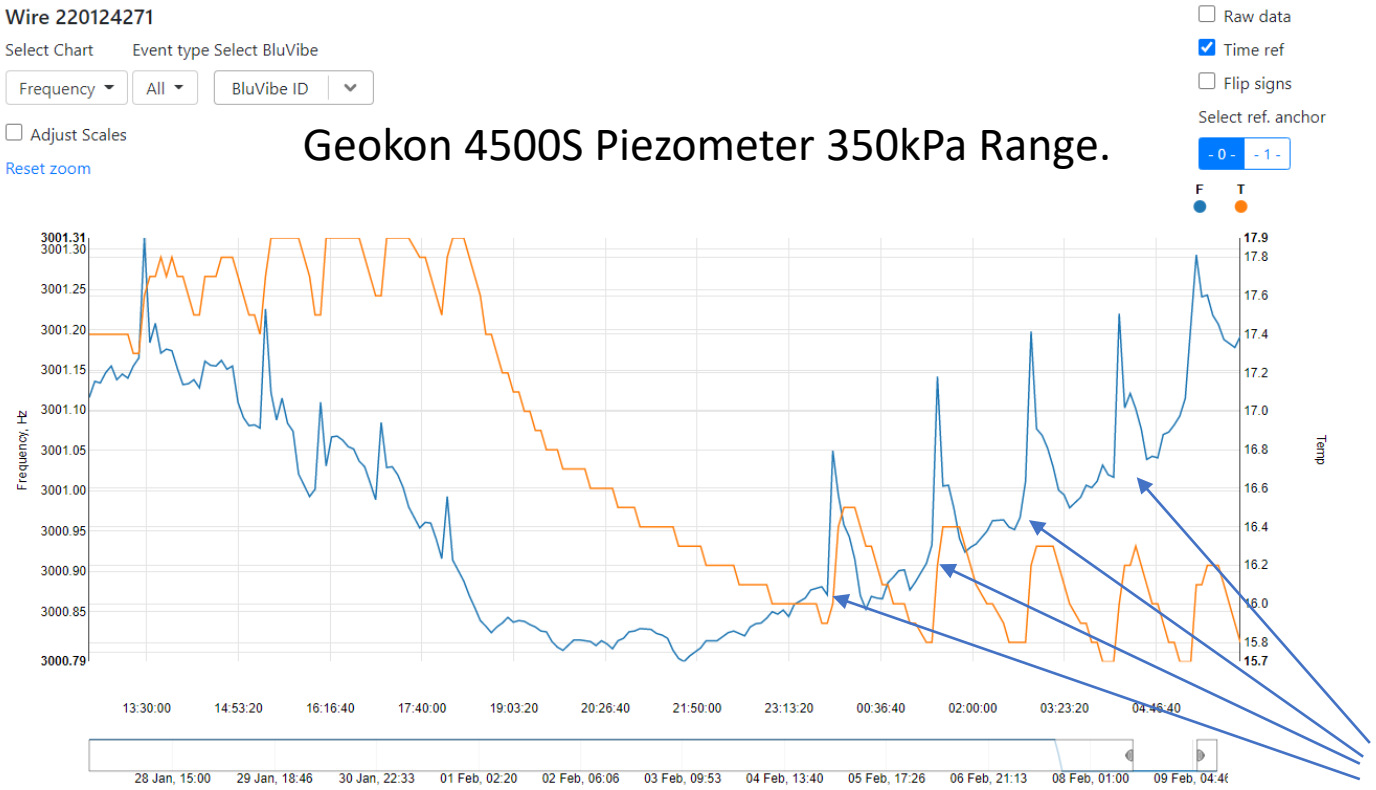
Reduced noise due to lower frequency range for excitation chirp

Output from Roctest PWL -70kPa vented piezometer

YieldPoint *Sensing the future*

AccessPoint Activity

VW Range setup



ΔP due to Indoor Heating system cycles

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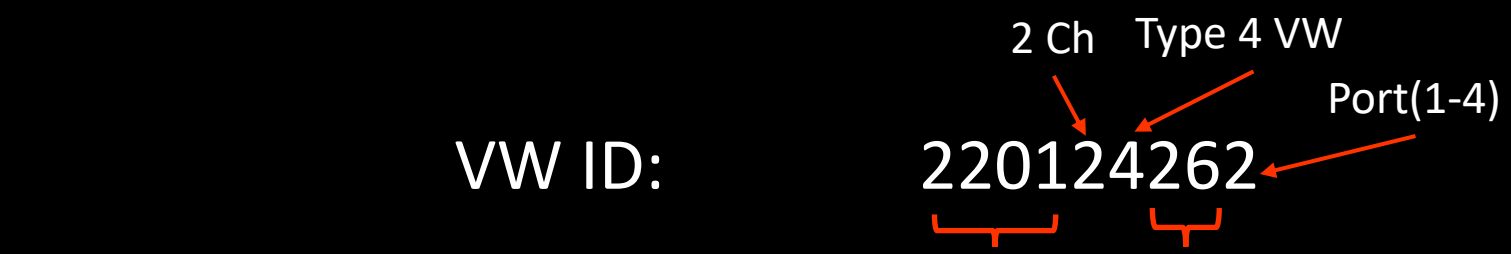
AccessPoint Activity

VW details



Freq Ch# Start Span

freq 2 1000 4000

freq 2 1800 500