Anemometer app on Cayenne via Senet

RM1xx Series

Application Note *v1.0*

INTRODUCTION

Cayenne is an IoT data processing system that can display transmitted data in visualized form with drag-and-drop configuration. A LoRaWAN server (e.g. Senet) can be set up so that it receives data from end-devices and forwards that data to an external application server in the format it can understand. This app note shows that RM1xx captures the data (e.g. temperature and wind speed) from Etesian anemometer via BLE and send it over to Cayenne through Senet in order to visualize the data.

REQUIREMENT

- DVK-RM816 or DVK-RM191 with the latest firmware (v101.6.1.0 was used in this test with RM191)
- UwTerminalX (v1.09a or later recommended)
- smartBASIC application (scan.RM1xx.cayenne.sb located in thumb drive)
- LoRaWAN gateway (e.g. Laird Sentrius RG1xx)

OVERVIEW

This application note demonstrates that RM1xx captures data from an anemometer and sends it over a LoRa network. The gateway will be set up as packet forwarder pointing to Senet for its destination, and Senet will be configured to redirect data from end-devices to Cayenne MyDevice so that it can be displayed in widgets on a browser or mobile apps.

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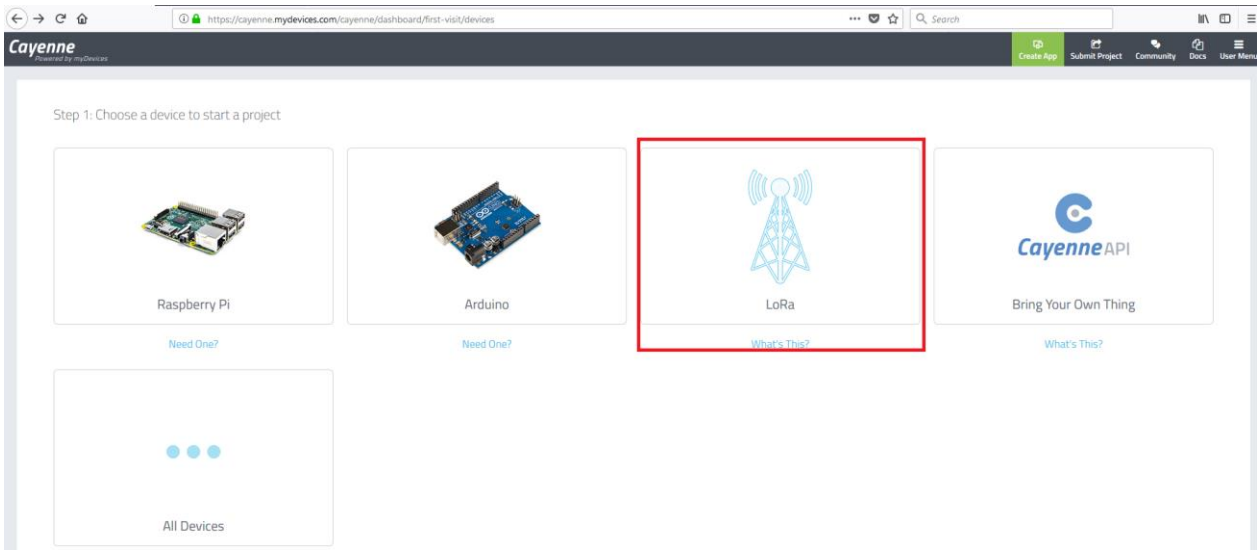
TEST SETUP

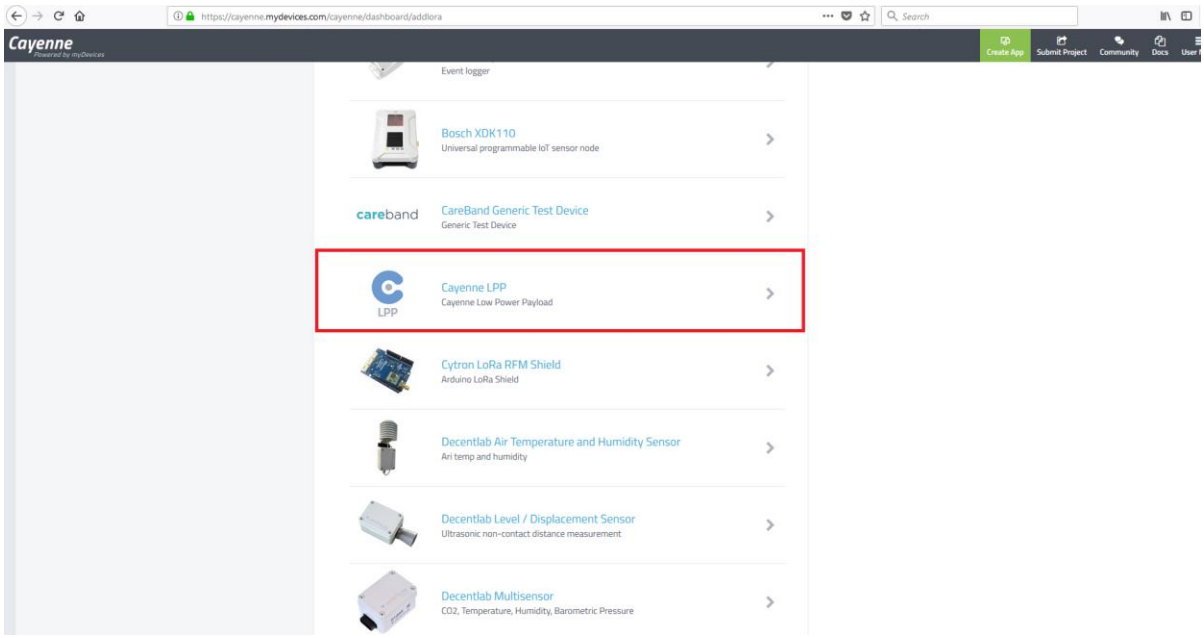
The below test setup is divided into 4 parts – Cayenne, Senet, RG1xx and RM1xx.

Frist, **Cayenne** needs to be set up.

1. Register Cayenne account at https://cayenne.mydevices.com/cayenne/login and log in.
2. Click **LoRa** on "Step 1 : Choose a device to start a project"



3. Select **Senet** network and **Cayenne LPP** for device type.



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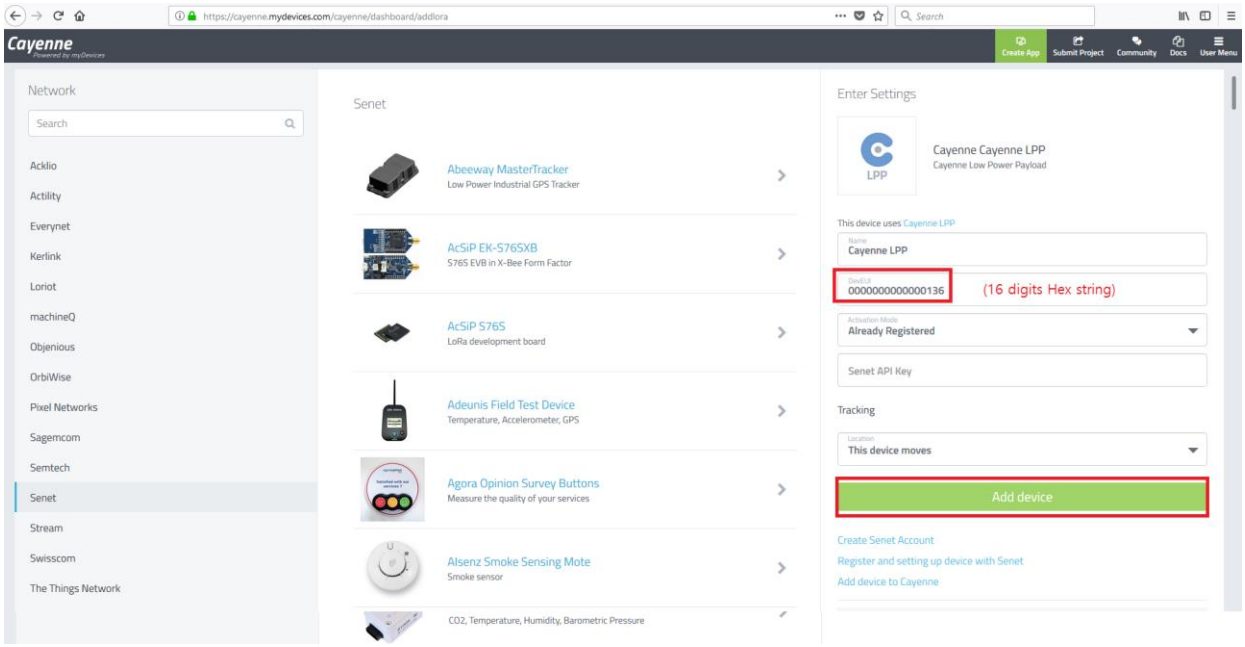
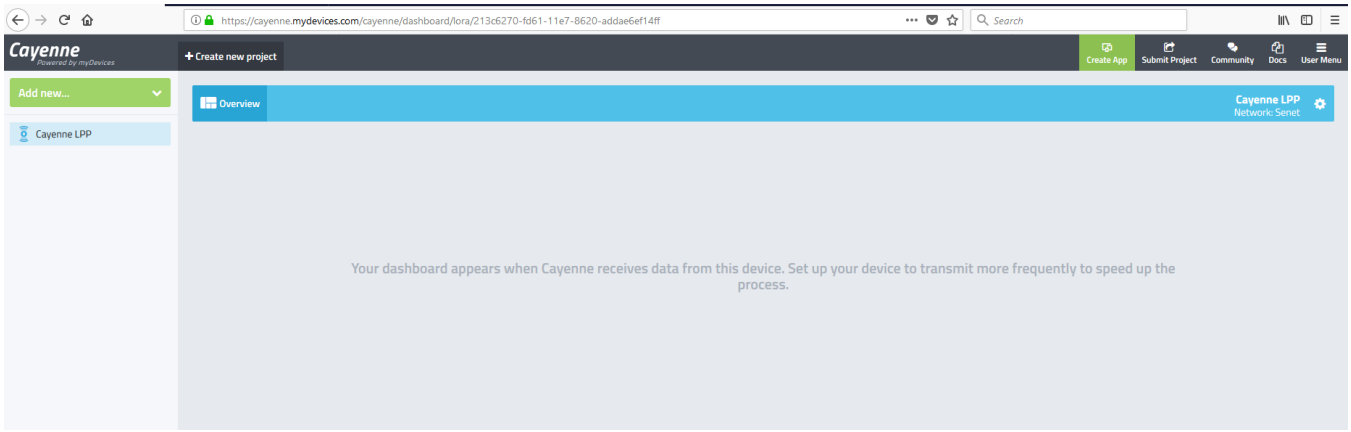
4. Enter your own **DevEUI** (16 bytes hex string) in DevEUI and click “Add device” button



5. When screen is displayed like the below, Cayenne is set up properly



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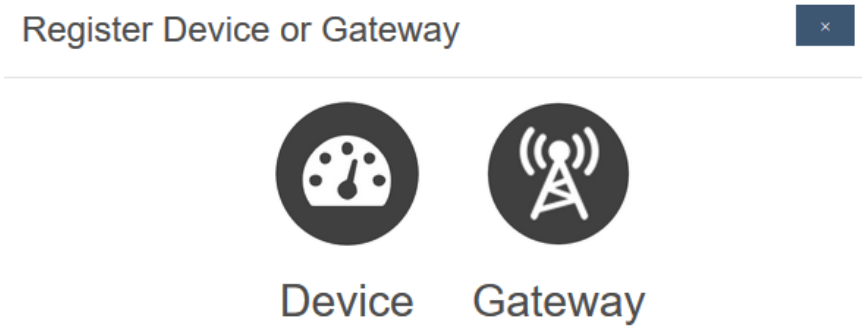
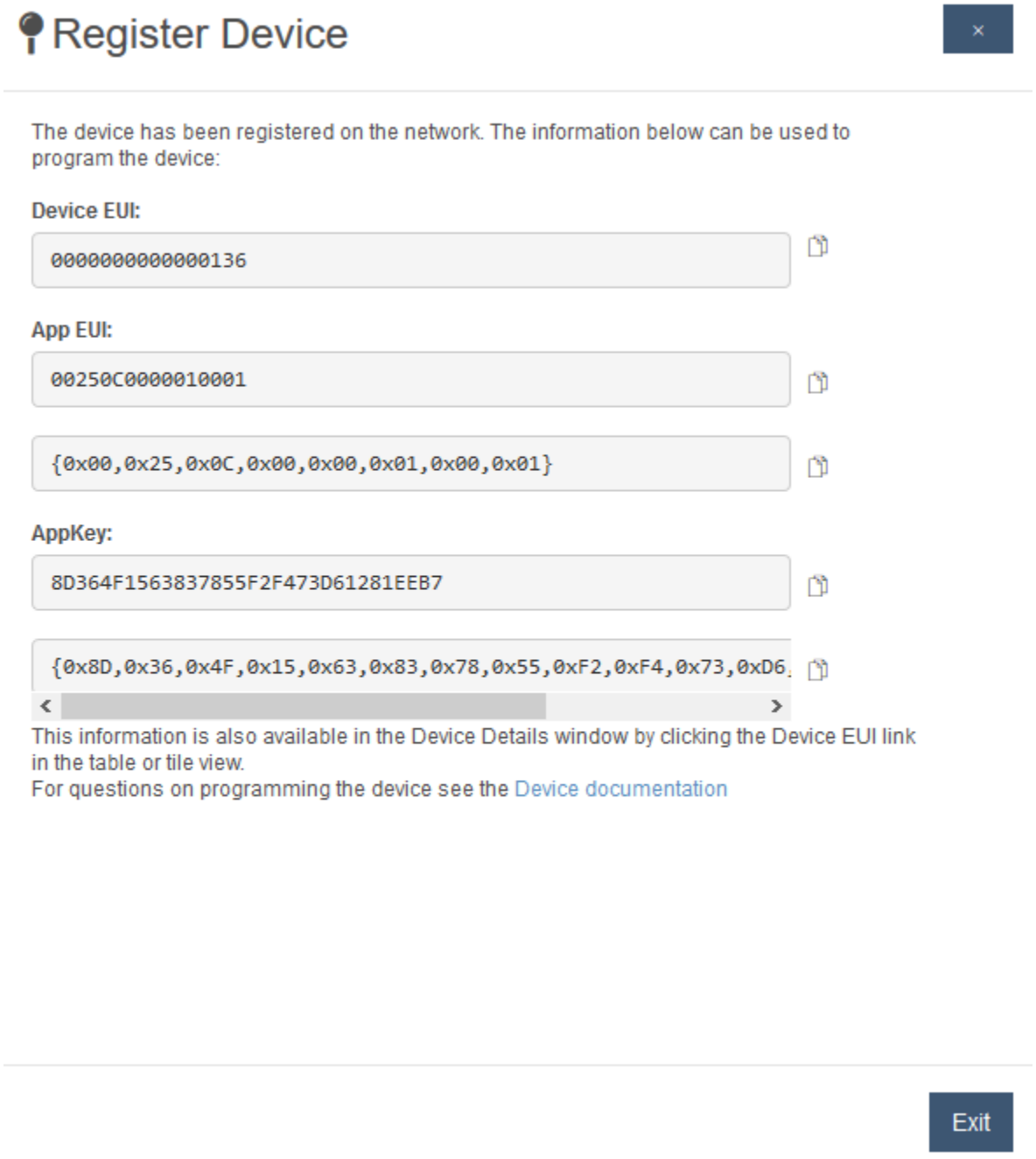
Second, the network (**Senet** in our training) needs to be set up with devices and gateways you are using and linked to Cayenne. First, end-devices need to be registered.

1. If you do not have login credential for Senet, go to https://portal.senetco.io/ and create new account
2. Once logged in, click **+ button** on **Devices & Gateways** in dashboard
3. Select Device



4. Enter **Device EUI** that is used in Cayenne and choose **Laird** for Device Type. And check the box for **Supports Senet Packet**. Then, click **Register New Device**.

5. On the next page, DevEUI, AppEUI and AppKey are generated and displayed like below. Copy these values to notes as they need to be entered to end-device, RM1xx. Then, click **Exit**.



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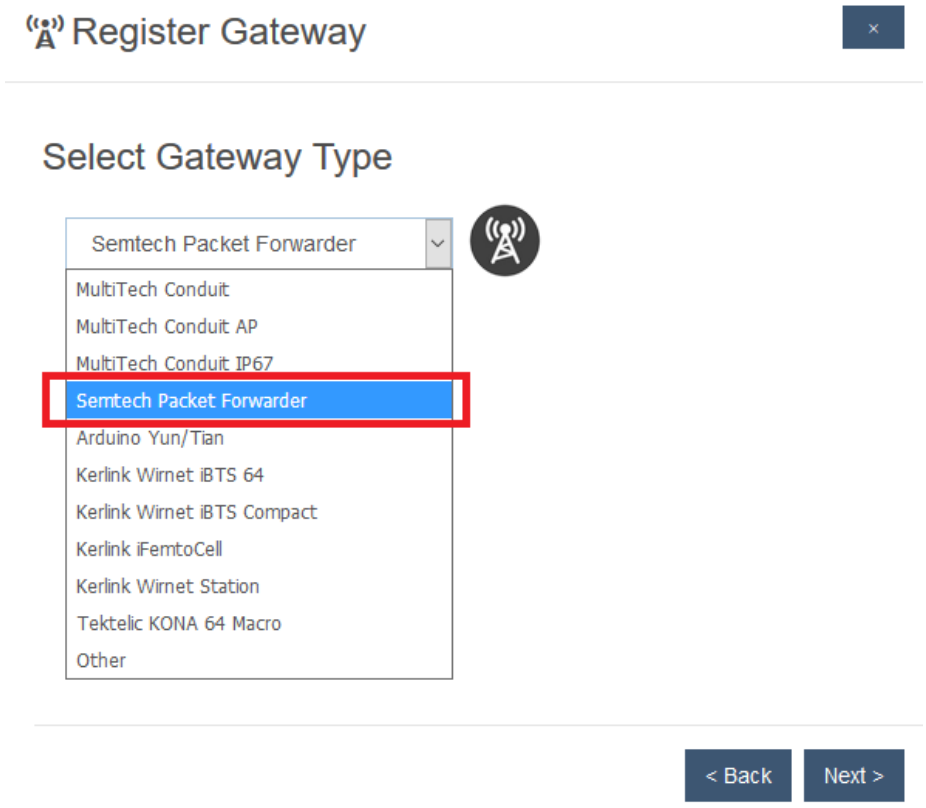
Now, gateway need to be registered (Note that this is for future reference. For this training, gateway is already set up so you don't need to proceed this part.)

1. On dashboard, click + button and gateway
2. Click **Let's Get Started** on next page.
3. Enter **address** for the gateway's location and hit **next**.
4. Select **Semtech Packet Forwarder** for gateway type and hit **next**.

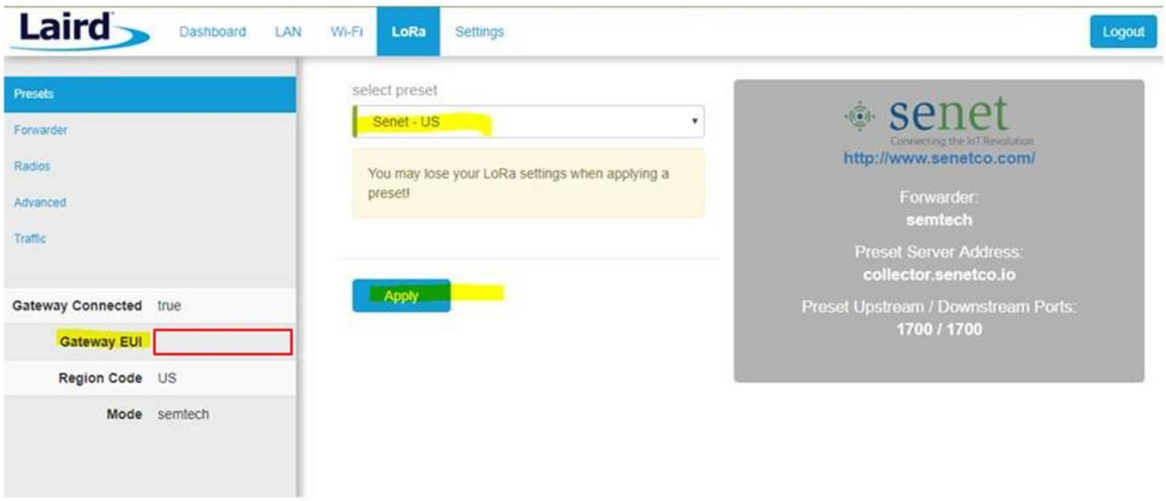


5. Enter **Serial number, gateway vender & type and description** and hit **next**. If RG1xx gateway is used, serial number can be found as M2 EUI at the bottom of gateway.
6. Enter **installation information** if needed, and hit **next**.
7. Double check information and hit **Register**.

Third, **gateway** (RG1xx in our training) needs to be configured. (note that this is for future reference. A gateway is already set up for our training)

1. Connect the gateway to the local LAN (the gateway is DHCP-enabled by default)
2. Launch a browser to the following URL: https://rg1xxYYYYYY where YYYYYY is the last 3 octets of the gateway ethernet MAC
   - The URL for the below gateway would be: https://rg1xx29378B

3. Accept the security certificate
4. Log into the gateway with the following credentials:
   - Username: sentrius
   - Password: RG1xx
5. Change the default access credentials
6. On the Main Menu, navigate to **LoRa**->**Presets** and select the appropriate option (**Senet - US**) and select Apply.



And last, RM1xx needs to be set up.

1. Open up UwTerminalX and configure the AppEUI, DevEUI and AppKey with the values obtained from Senet by using the following command respectively for OTAA. (For using ABP, refer to LoraWAN Keys/ID document)
   - at+cfgex 1010 "<AppEUI>"
   - at+cfgex 1011 "<DevEUI>"
   - at+cfgex 1012 "<AppKey>"
2. Set up a sub-band to be used with at+cfg 1001 and at+cfg 1002. For example, use the following commands to use sub-band 1 (Table 1 for more details)
   - at+cfg 1001 1 (This sets the sub-band 1 among available sub-band options ranging from 1 to 8)
   - at+cfg 1002 1 (This allows at+cfg 1001 chooses a sub-band to be used)
   -

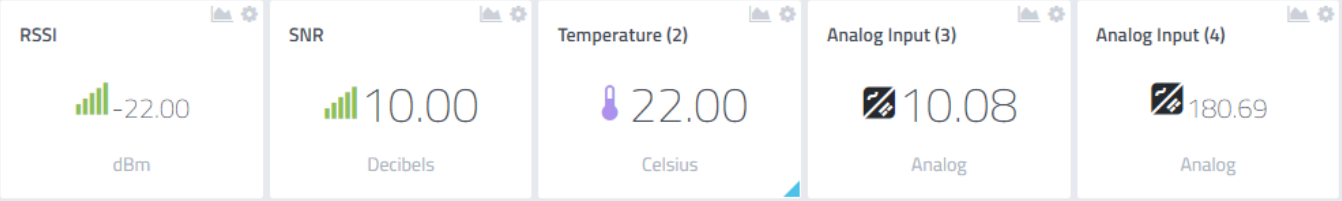
Table 1 ChannelMask commands

Sub-Band	Frequency Range (MHz)		Channels	Command
	US	AU		
1	902.3–903.7	915.2-916.6	0-7	at+cfg 1001 1
2	903.9–905.3	916.8-918.2	8-15	at+cfg 1001 2
3	905.5–906.9	918.4-919.8	16-23	at+cfg 1001 3
4	907.1–908.5	920.0-921.4	24-31	at+cfg 1001 4
5	908.7–910.1	921.6-923.0	32-39	at+cfg 1001 5
6	910.3–911.7	923.2-924.6	40-47	at+cfg 1001 6
7	911.9–913.3	924.8-926.2	48-55	at+cfg 1001 7
8	915.5–914.9	926.4-927.8	56-63	at+cfg 1001 8

3. Reset via “atz” in UwTerminal
4. Right-click on UwTerminalX and click “XCompile + Load + Run”, and choose the smartBASIC application (scan.RM1xx.cayenne.sb)
5. If successfully downloaded, the application starts immediately. RM1xx joins a LoRaWAN network, get adverts data from anemometer via BLE and then transmits the data to Cayenne periodically

RESULTS

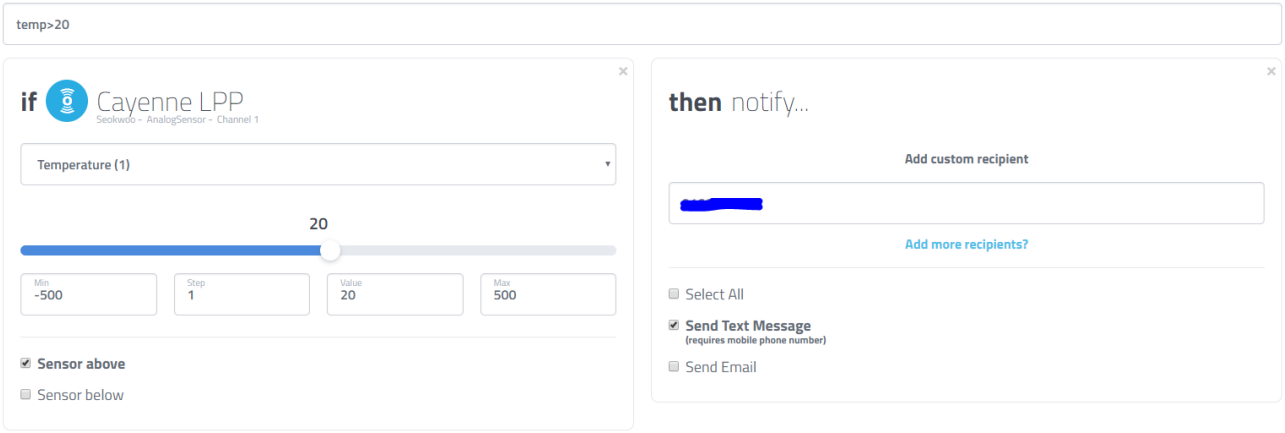
To see data on Cayenne, go back to overview page on https://cayenne.mydevices.com. It will display information for RSSI, SNR, Temperature, wind speed (shown as Analog Input (3) yet) and wind direction (shown as Analog Input (4) yet)



The reason Cayenne shows wind speed and direction as Analog Input is because Cayenne does not know what kind of data (e.g. wind speed) it receives but it just knows what type (e.g. analog input) of data comes in based on the predefined format. (refer to Table 2 for details)

The title and icon for the widget can be changed in the cogwheel icon at the upper right corner of widget. After changing name and icon, it will look like this.

You can set notification on "trigger" which is located on right corner of each widget and get an email or text message when certain condition is met. The below is a setup for text notification when temperature is above 20°C.



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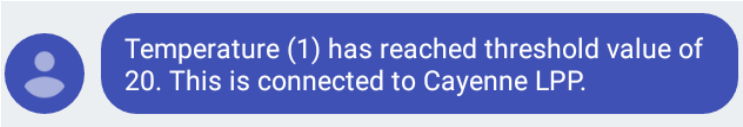
When condition is met, a phone receives text message.



CAYENNE DATA FORMAT

In scan.RM1xx.cayenne.sb, LoraTxCayenne function explains how data should be formatted before it is sent to Cayenne server. Data for each entity (e.g. for sensor) consists of three parts like following.

```
220     // Cayenne data : channel (frist byte) + data type (second byte) + data
221     //dim idType$ : idType$="\01\02"          // sensor ID as "Analog Input"("\02")
222     dim tempType$ : tempType$="\02\67"  // temperature type as "Temperature Sensor"("\67")
223     dim speedType$ : speedType$="\03\02"    // wind speed type as "Analog Input"("\02")
224     dim dirType$ : dirType$="\04\02"    // wind direction type as "Analog Input"("\02")
```

- First byte: data channel – individually classifies each sensor in a frame
- Second byte: data type (e.g. temperature)
- N bytes after second byte: data value where N (the size of data) varies across different data type

For example, the temperature sensor data is comprised of tempType (“\01\67”) and tempVal (in hex) in the application. Here, 0x01 means that 01 of data channel is used. 0x67 means that temperature sensor is the type of data to be used and the following data is the value for tempVal as formatted in the required Cayenne data-type, as seen in Table 2.

Table 2 Cayenne Data Type

Type	Data type (Hex)	Data size(Bytes)
Digital Input	0	1
Digital Output	1	1
Analog Input	2	2
Analog Output	3	2
Illuminance Sensor	65	2
Presence Sensor	66	1
Temperature Sensor	67	2
Humidity Sensor	68	1
Accelerometer	71	6
Barometer	73	2
Gyrometer	86	6
GPS Location	88	9

Cayenne Payload Structure reveals a full table for data format of each type.

RESOURCES

Cayenne Payload Structure - https://mydevices.com/cayenne/docs/lora/#lora-cayenne-low-power-payload
RM1xx Setup Guides – http://www.lairdtech.com/products/rm1xx-lora-modules#documentation-tab
RM1xx Sample Applications – https://github.com/LairdCP/RM1xx-Applications

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