

# Performance Evaluation of Long Range (LoRa) Wireless RF Technology for the Internet of Things (IoT) Using Dragino LoRa at 915 MHz

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## WHAT IS INTERNET OF THINGS

Internet of Things (IoT) is a developing concept that introduces the network of physical sensors which are interconnected to each other. Within this smart environment, the smart objects use the inter-connectivity to process, communicate, and exchange data among themselves without any human interaction.

## INTRODUCTION - LoRa

There is no single wireless standard that would predominate the IoT. However, one relevant wireless radio solution to IoT is known as Long Range Wide Area Network (LoRaWAN), which is one of the Low Power Wide Area Network (LPWAN) technologies [1]. LPWAN has appeared as a significant solution to offer advantages such as long-range coverage connectivity with low power consumption, an unlicensed spectrum, and affordability. Most likely LoRa with the inherent long-range coverage and low power consumption features will become the “go-to” technology for IoT applications [2].

## KEY FEATURES OF LoRa [4]

- 1 Long-range coverage (roughly 10 km depending on line-of-sight) with *low power*.
- 2 The best *link budget* of any other standardized wireless communication technologies.
- 3 Operates under unlicensed frequency ISM bands.
- 4 Security (end-to-end AES 128 encryption).
- 5 Geo-location (GPS tracking applications).
- 6 Mobility (communication with devices in motion).

## OBJECTIVE AND METRICS

- 1 Practical end-to-end IoT application. This application will involve connecting to different IoT servers in the cloud The Things Network (TTN) integrated with Cayenne.
- The following are a performance metrics:
- 2 Uplink Power [dBm]
  - 3 Downlink Power (RSSI) [dBm]
  - 4 Downlink Quality (SNR) [dB]
  - 5 Packet Error Rate [
  - 6 Airtime [ms]

## CAYENNE MOBILE APP

Remotely monitor and control the IoT sensors.



Figura 5: Cayenne Mobile App view

## REFERENCES

- [1] Xiong Xiong, Kan Zheng, Rongtao Xu, Wei Xiang, and Periklis Chatzimisios. Low power wide area machine-to-machine networks: key techniques and prototype. *IEEE Communications Magazine*, 53(9):64–71, 2015.
- [2] LoRa Alliance® FAQs is there really a need for lpwan. <https://lora-alliance.org/about-lora-alliance>. Accessed on: Jan. 29, 2020.
- [3] Dragino lora iot development kit. <https://www.dragino.com/products/lora/item/120-lora-iot-kit.html>. Accessed: 2019-11-14.
- [4] Semtech what is lora? <https://www.semtech.com/lora/what-is-lora>. Accessed: 2019-11-12.

## CONTACT INFORMATION

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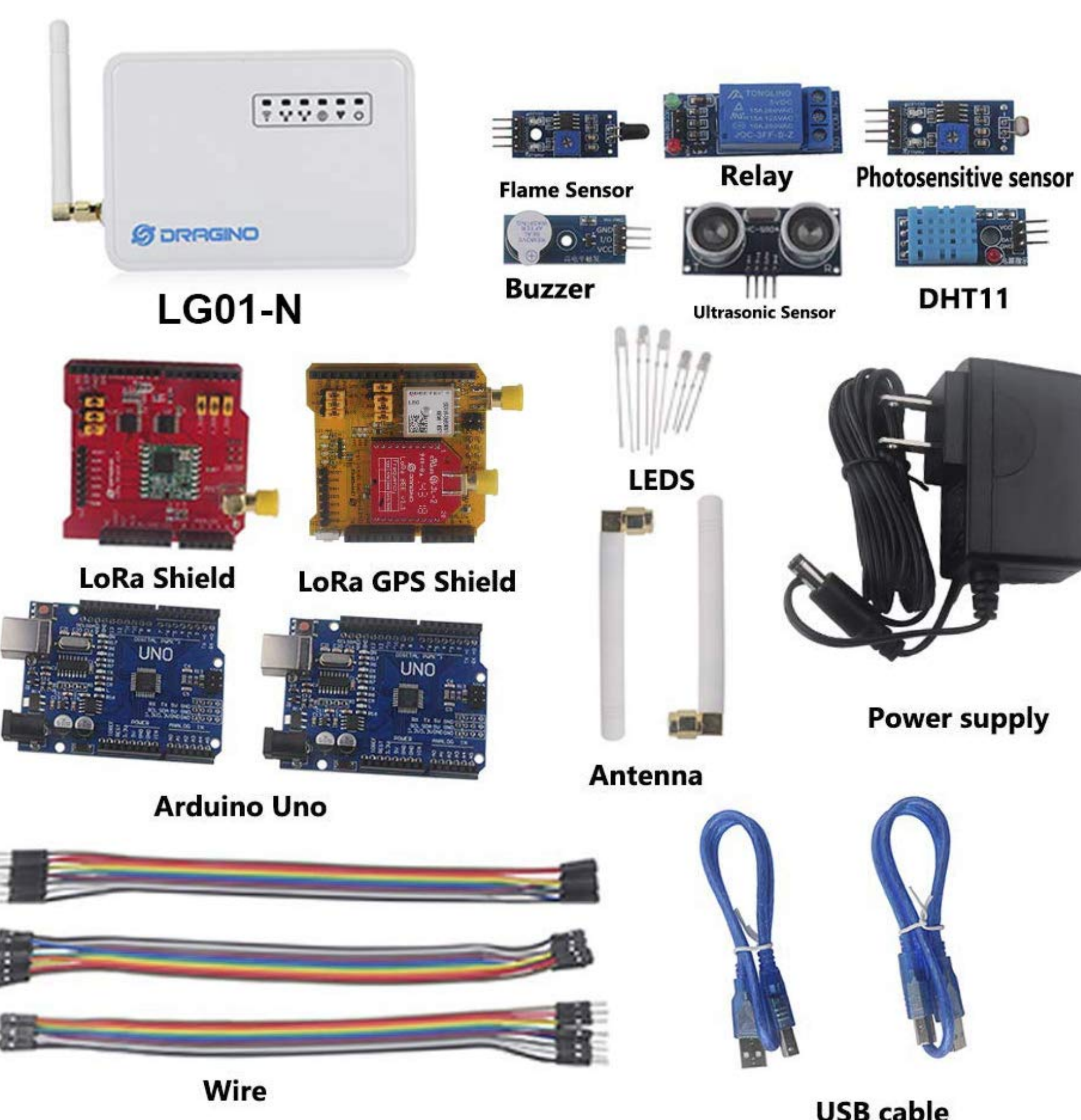


Figura 1: Dragino LoRa IoT Development Kit [3]

## Architecture and Performance Study

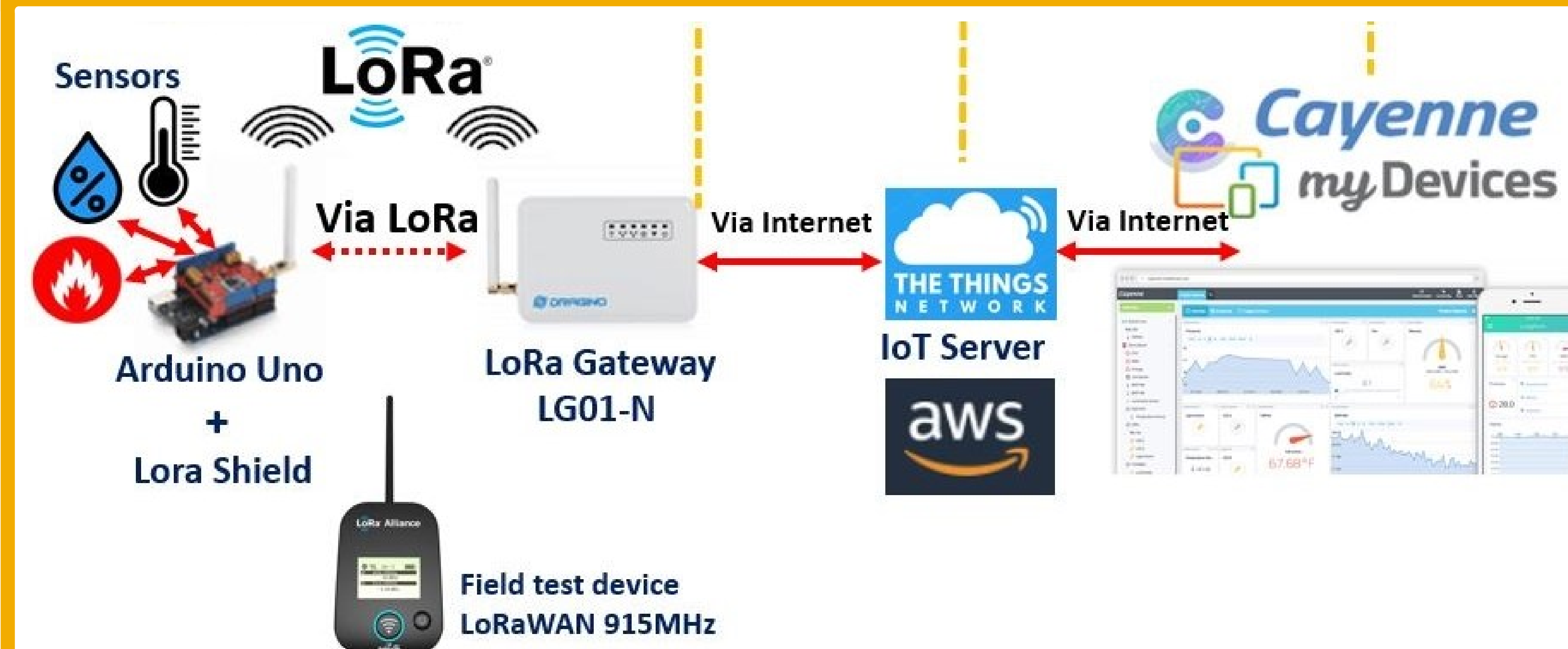


Figura 2: Architecture and Topology For The Things Network Server Connection and Integration with Cayenne App

## TEMPERATURE RESULTS

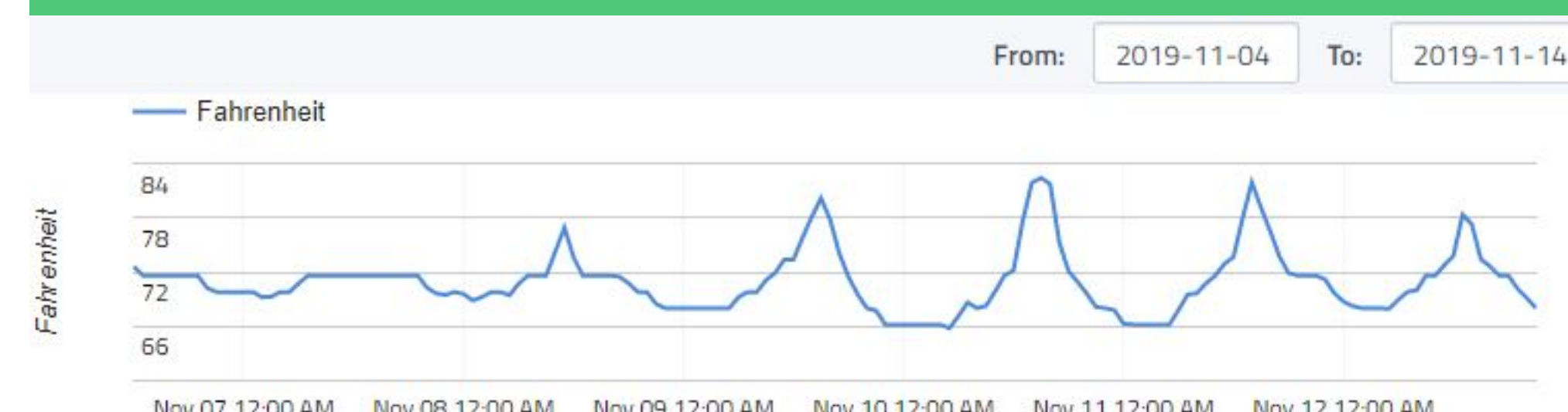


Figura 3: Temperature - Fahrenheit Degrees from Cayenne App

## HUMIDITY RESULTS



Figura 4: Humidity % from Cayenne App