

Humidity Sensing Datasheet

Overview

Common Name	Sensing Families	Application Surfaces	Range	Harvesting Band	Size
Humidity Sensing IoT Pixels	Humidity, Temperature, Location	Cardboard, Plastic	8 - 12 meters	2.4 GHz 918 MHz	3.5 cm x 4.4 cm

Wiliot offers reference designs for its IoT Pixels, which third-party Works with Wiliot OEMs manufacture and sell to end users. The final product's features and performance may vary based on the choices made by these OEMs. This datasheet describes a standard embodiment.



Humidity IoT Pixels

Wiliot's Humidity Sensing technology is an ambient IoT solution designed for humidity measurement. It operates through cloud-based sensing-as-a-service and battery-free ambient IoT tags called Humidity IoT Pixels.

The Humidity Sensing IoT Pixels are designed to work with Wiliot's Visibility Platform. Using temperature, humidity, location, and further environmental and neighboring pixels' data, the Visibility Platform delivers humidity aware alerts, insights, and real-time environment monitoring.



Wiliot is an ambient IoT data carrier platform company. Our Visibility Platform connects the digital and physical worlds using IoT Pixels, battery-free smart tags that push data to the cloud in real-time without human intervention. Our platform exists within a fast-growing ambient IoT ecosystem. We have partners in that ecosystem that provide applications, tags, and edge devices.

Specifications

	Parameter	Description	
Functionality	Sensing Families	Humidity, Temperature, Location	
	Humidity Sensing	30 to 85 ± 10 Relative Humidity (RH), tested at 25,35,45 °C	
	Temperature Sensing	-20 to 50 °C, ± 0.5 C	
	Location	Geolocation, Bridge Zone	
	Security	AES-128, encryption and authentication	
	Application Surfaces	Plastic (Polypropylene), Paper	
	Operable Temperature Range	-30 to 80 °C	
Radio	Energizing	Sub 1 Ghz Energizing Range	10 - 15 meters (pixels to bridge distance)
		2.4 GHz Energizing Range	3-5 meters (pixels to bridge distance)
		Harvesting Polarization	Linear, parallel to wide edge
		Harvesting Band	-2483.5 MHz, 902-928 MHz US / 915-921 MHz EU
		Calibration	3 BLE advertisements (CH 37, 38, 39) every 90ms (default)
	Broadcast	Broadcast Signal Protocol	Bluetooth® Low Energy (LE) 5.2 (2.402 GHz)
		Broadcast Signal Strength	EIRP -32dBm @2.402 GHz
		Broadcast Packet	Standard Bluetooth Low Energy Packet (PDU), payload: Wiliot Ephemeral ID (WEID)
		Security	AES-128, encryption and authentication
		Broadcast Polarization	Linear, parallel to wide edge
		Broadcast Range	10 - 15 meters
		Broadcast Frequency	1 - 90 seconds (depending on energy harvesting)
	Construction	Chip	V2.1
Face Sheet		Varies	
Size		3.5 cm x 4.4 cm	
Delivery	Serialization Method	Unique GS1 ID in data packet. Support more over API	
	Roll Core	76.2 mm (3 inch) Diameter Cardboard Core	

Applications

Food and Grocery	Storage environment compliance, Freshness and Shelf Life prediction and monitoring, Packaging monitoring
Agriculture	Environment monitoring
Pharma	Storage environment compliance
Health and Safety	Environment monitoring
Manufacturing	Environment monitoring

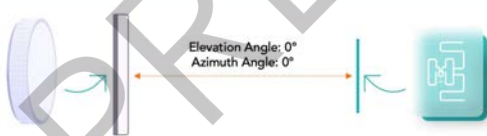
Operational Range

The Operational Range of IoT Pixels is dependent on its ability to harvest enough energy and broadcast to a gateway or bridge within range thereafter. We define these as its *Energizing Range* and *Broadcasting Range*, respectively. Optimal conditions and performance are reported below.

Energizing Range

IoT Pixels can be powered by a Works with Wiliot bridge over a certain distance. At the edge of that distance, the broadcast latency will be significantly higher. They can be energized by a sub 1 GHz bridge and a 2.4 GHz bridge.

Application Surface	Plastic
Polarization	Linear
Optimal Orientation	



Sub 1 GHz

Frequency	918 MHz
Energizing Range	10-15 meters
Polarization	Linear

Broadcasting Range

Wiliot IoT Pixels broadcast data in an encrypted standard Bluetooth non-connected advertising packet. It can be read by any Bluetooth 4.0+ device within the broadcast range.

Frequency	2.4 GHz
Broadcast Range	10-15 meters
Application Surface	Plastic
Polarization	Linear
RF Protocol	Bluetooth® Low Energy (LE)

*in optimal conditions

Application Surfaces

The material of the surface that IoT Pixels are applied to directly affects the efficiency of the harvesting antenna. Pixels are optimized for cardboard and plastic applications; any other surface material applications will likely adversely affect performance.

Specifically, the dielectric constant of the material shifts the peak harvesting frequency of pixels away from the bridge energizing bands. With weaker harvesting efficiency, the energizing distance decreases, and the broadcast latency increases.

There are two solutions for applying pixels to different surfaces:

- **Bridge:** shift the bridge energizing frequency bands to optimize for the material
- **Pixels:** build pixels with an antenna optimized for the surface it will be applied to

Please visit the support pages to learn more at support.wiliot.com

Bluetooth Packet & Payload

Wiliot Pixels broadcast standard Bluetooth beacons.

Specifically, Wiliot Pixels transmit non-connectable, unidirectional advertising Bluetooth Low Energy Protocol Data Units (PDU). The PDU payload is called the Wiliot Ephemeral IDentity (WEID); encrypted data that can only be interpreted in the Wiliot Cloud.

Since the pixels are compliant with the latest version of the Bluetooth Core Specification, any Bluetooth device that is configured to listen for Wiliot beacons can send the information to the cloud, effectively working as a gateway to the Wiliot Cloud.

For more information on the Bluetooth Packet & payload, please consult the technical documentation about the Wiliot Ephemeral IDentity (WEID)

Appendix

RF Certification Details

Certification	Region	ID
FCC	USA	2AXVQ-WILIOT2SB
CE / RED	EU	222140140/AA/00
RCM / ACMA	Australia / NZ	ACMA20700
IC / ISED	Canada	26623-WILIOT2SB
ARIB	Japan	022-220027

Bluetooth SIG

Declaration ID	QDID
D055501	166091

