Wireless Air Temp and Humidity Sensor User Guide

VERSION 1.0
APRIL 2018

TABLE OF CONTENTS

1. QUICK START

To start using your sensor, simply go to:

https://console.radiobridge.com

From here you can register your device and immediately start receiving messages from the sensor.

The sensor configuration, message monitoring, and setting up alerts is usually self-explanatory through the user interface. For further explanations of any sensor features, you may refer to this user guide.

2. OVERVIEW

2.1. Sensor Overview

The wireless sensors designed and manufactured by Radio Bridge provide full sensor to cloud solutions for Internet of Things (IoT) applications. The sensor uses air flow to measure temperature and humidity levels. If the temperature and/or humidity rises above or falls below the configured thresholds, an alert is sent over the wireless network. Versions of the sensor support the major LPWAN standards such as Sigfox, LoRa/LoRaWAN, and SubGig.

Temperature is sampled every 15 seconds and averaged over 1 minute. Thus, the sensor is not appropriate for applications that need to detect rapid changes in temperature within periods of less than a minute.

Features include:

- Built-in radio that talks directly with the wireless network. Standards include:
  - Sigfox
  - LoRa/LoRaWAN
  - SubGig®
- Two types of tamper detection: enclosure tamper and wall mount tamper
  - Enclosure tamper detects if the packaging of the sensor itself is opened or broken
  - Wall mount tamper detects if the sensor has been removed from the wall or mounting point
- 20,000-1M+ transmissions on a single battery and a 5-10 year battery life depending on usage (see Battery section)
- Fully integrated internal antenna
- Over the air sensor configuration in the field
- Automatic low battery reporting and supervisory messages

2.2. Revision History

Table 1 Revision History

Revision	Date	Description
1.0	April 2018	Initial release of the document

2.3. Document Conventions

Table 2 Document Conventions

Font / Icon	Meaning
	Important notes
	Warnings and cautions

2.4. Part Numbers

Table 3 Part Numbers

Part Number	Wireless Standard	Region
RBS105-ATH-RCZ2	Sigfox	North America
RBS205-ATH-315	SubGig	North America
RBS305-ATH-US	LoRa	North America

3. TECHNICAL SPECIFICATIONS

3.1. Absolute Maximum Ratings

Table 4 Absolute Maximum Ratings

Parameter	Rating	Units
Operating ambient temperature	-30 to +70	°C
Storage ambient temperature	-40 to +100	°C

4. BATTERY LIFE

The sensor uses a lithium non-rechargeable battery and is capable of 20,000 to 1,000,000+ total messages depending on the wireless standard and usage. For an accurate estimate of battery life, please refer to the "Sensor Battery Estimator.xlsx" spreadsheet on the Radio Bridge website. This spreadsheet combines usage information such as average number of messages per day and estimates the battery life for a particular sensor.

Refer to the spreadsheet "Sensor Battery Estimator.xlsx" on the Radio Bridge website for specific battery life estimates.

The power required for a message transmission is much greater than the "sleep current" (the power consumed when the sensor is inactive) for high power radio technologies such as Sigfox and LoRaWAN. This means that the battery life for most sensors is primarily dependent on the number of transmissions per day.

Different battery types will deplete over time with different voltage profiles. For instance, a lithium battery will maintain a relatively high voltage for the life of the battery and then experience a rapid drop near the end, whereas an alkaline battery will experience a more gradual reduction in voltage over time. Radio Bridge sensors are shipped with lithium batteries, and these are recommended when the battery needs to be eventually replaced.

Temperature also plays a role in battery life. The battery life estimates in the online spreadsheet assume room temperature, but temperatures close to the maximum and minimum ratings will have a negative impact on battery life. For example, battery voltage tends to be lower in cold temperatures and the internal circuitry needs a certain minimum voltage to operate properly before it will shut down. Thus, battery life will tend to be shorter when running the sensor in cold environments.

Battery voltage will be lower in cold temperatures and thus battery life will be reduced in cold environments.

The battery voltage is reported by the supervisory messages as well as a low battery indicator. See the section on Message Protocol for more detail.

5. MESSAGE PROTOCOL

This section defines the protocol and message definitions for the sensor.

Radio Bridge provides a web-based console at console.radiobridge.com to configure and monitor sensors. Usage of this console is highly recommended for most customers rather than implementing the protocols defined in this section.

If the standard Radio Bridge console (console.radiobridge.com) is not used, refer to this section to decode the sensor data and configure the sensor through downlink messages.

5.1. Common Messages

There are common messages across all wireless sensors that are defined in the document "Common Sensor Messages" which is available on the Radio Bridge website.

Refer to the document "Common Sensor Messages" for definitions of all common messages. Common messages are not defined in this document.

Common messages include basic error messages, tamper, supervisory, and downlink ack. It is important to refer to that document prior to decoding the messages defined in this section.

5.1. Uplink Messages

The uplink message (sensor to web application) specific to the sensor is defined in following table. The common uplink messages are not included in this section (see common messages document).

Table 5 Uplink Message 0x09: Temperature Event

Byte	Description
0	Temperature/Humidity Event Payload (see Temperature/Humidity Event Payload Definitions)
1	Current temperature in degrees Celsius
2	Relative temperature measurement
3	Humidity in % relative humidity (0-100%)

The temperature/humidity event is defined in the following table.

Table 6 Temperature Event Payload Definitions

Event Payload	Description
0x00	Periodic report
0x01	Temperature has risen above upper threshold
0x02	Temperature has fallen below lower threshold
0x03	Temperature report on change increase
0x04	Temperature report on change decrease
0x05	Humidity has risen above upper threshold
0x06	Humidity has fallen below lower threshold
0x07	Humidity report on change increase
0x08	Humidity report on change decrease

The current temperature field in the uplink message is the current temperature in degrees Celsius. The temperature has been calibrated with controlled temperature chambers.

The relative temperature measurement is the raw (analog to digital) measurement and ranges on a scale from 0-255. This value can be used with different calibration tables defined by the user.

For either the current temperature or the relative temperature measurement, reported values of 0x00 or 0xff are considered out of range.

The humidity field in the uplink message is the air humidity percentage which can range from 0-100%.

5.2. Downlink Messages

The downlink message (web application to sensor) specific to the sensor configuration is defined in following table. The common downlink messages are not included in this section (see common messages document).

Table 7 Downlink Configuration Message 0x09

Byte	Description
0	Mode: 0x00 for Threshold, or 0x01 for Rate of Change
1-6	Defined by Mode (See Mode sections)

The mode byte selects one of two modes: threshold based alerts or rate-of-change alerts. The remainder of the payload (bytes 1-6) are determined by the mode selected and defined in the next two sections.

5.2.1. Threshold Mode

Threshold mode is set when byte 0 of the payload is set to 0x00. The remainder of the payload is defined in the following table.

Table 8 Downlink Configuration Message for Threshold Mode

Byte	Description
0	0x00 (Threshold mode)

1	Periodic reporting in 1 hour intervals. Default is 0 (disabled)
2	Restoral margin (bits 7:4 for humidity, bits 3:0 for temperature). Default 5 degrees C for temperature and 5% for humidity.
3	Lower temperature threshold. Default 10 degrees C.
4	Upper temperature threshold. Default 90 degrees C.
5	Lower humidity threshold. Default 40% relative humidity.
6	Upper humidity threshold. Default 60% relative humidity.

The upper and lower temperature thresholds are *signed* values with units of one degree Celsius (range is -40 to 100 degrees C). Note that if the configuration settings exceed the maximum ratings on the sensor, the sensor may not report an event.

The Restoral Margin is used for the upper and lower thresholds and requires the temperature or humidity values to cross back over the threshold a certain amount before a new event is reported. This prevents excessive event messages if the measurement is at or near the threshold.

For example, consider an upper temp threshold set at 30 degrees Celsius and the restoral margin set at 5 degrees. If the temperature initially exceeds 30 degrees then an event is generated and a message is sent to the network. The temperature must now drop to 25 degrees and then exceed 30 degrees before another event is reported.

The restoral margins are *unsigned* values with units of 1 degree Celsius (range is 1-15 degrees C) and 1% relative humidity (range is 1%-15%). If a restoral margin is set to 0, it is disabled.

Periodic reporting is described in the section Periodic Reports.

5.2.2. Report on Change Mode

Report on Change mode is set when byte 0 of the payload is set to 0x01. The remainder of the payload is defined in the following table.

Table 9 Downlink Configuration Message for Report on Change Mode

Byte	Description
0	0x01 (Report on Change mode)

1	Periodic reporting in 1 hour intervals. Default is 0 (disabled)
2	Temperature time window (bits 7:4 for humidity, bits 3:0 for temperature)
3	Temperature increase
4	Temperature decrease
5	Humidity increase
6	Humidity decrease

The report on change feature will send an alert if the temperature/humidity increases or decreases a specified amount in the time window that is defined. The temperature/humidity changes are unsigned values and have units of degrees C and % relative humidity. The time window is in units of minutes, so the range is 1-15 minutes and separately defined for humidity and temperature (bits 7:4 for humidity, bits 3:0 for temperature).

For example, if the temperature change is set to 5 degrees and the time window is set to 10 minutes, then if the temperature rises 6 degrees in a 10 minute window then the sensor sends an alert. If the temperature/humidity increase is set to zero then the feature is disabled.

If the time window is set to 0 but the temperature/humidity is non-zero, then the sensor will send an alert any time the temperature/humidity changes by the specified amount. For example, if the time window is set to 0 and both the temperature increase and decrease are set to 5 degrees, then an alert is sent every time the temperature changes 5 degrees from the last report. There is no time limit when the time window is set to 0.

Periodic reporting is described in the section Periodic Reports.

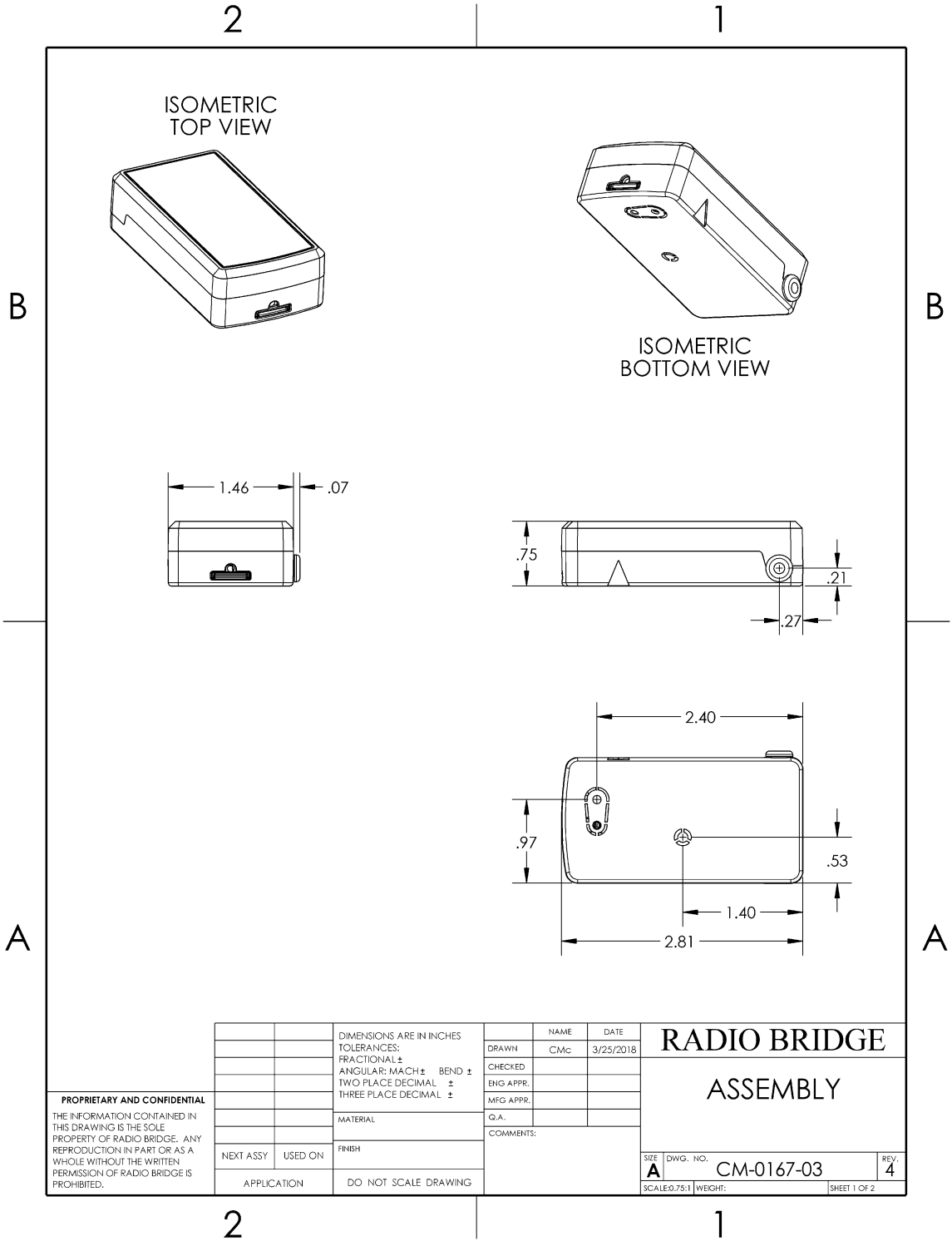
5.2.3. Periodic Reports

The temperature/humidity sensor can also send periodic updates of the temperature and humidity, and this is defined in byte 1 of both modes. The period is defined in 1 hour increments, and a setting of 0 will disable the periodic reports. For example, to receive a report every 4 hours, byte 1 would be set to 0x04.

Note that periodic reporting is not recommended as it will increase data service fees and significantly reduce battery life. Wherever possible, use thresholds or report-on-change only.

6. MECHANICAL DRAWINGS

The mechanical drawings provided in this section are for the main body of the sensor. All dimensions are inches unless otherwise noted.



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8.2. Warranty

To view product warranty information, go to the following website: www.radiobridge.com

8.3. Customer Support

Radio Bridge offers free technical support at:

www.radiobridge.com/forums

Radio Bridge also offers technical support plans and service packages to help our customers get the most out of their Radio Bridge products.

For information on Technical Support plans and pricing, visit us at www.radiobridge.com.