PRODUCT DATASHEET

Notecard Datasheet

NOTE-LORA v2.1

An affordable, embeddable module for low-power LoRa/LoRaWAN connectivity.

Last Revised August 18, 2026

Blues Developer Center

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Blues Notecard® Datasheet: NOTE-LORA v2.1

An affordable, embeddable module for low-power LoRa/LoRaWAN connectivity.

Notecard for LoRa is a version of the Blues Notecard that allows for connecting to LoRaWAN gateways. The device follows the same M.2 pinout as the cellular and WiFi Notecards. What's more, Notecard for LoRa uses the same powerful JSON-based programming interface, meaning that developers can easily add LoRa as a deployment option for their IoT solutions, with minimal impact to their existing host applications.

Functional Description

Notecard is an embeddable device-to-cloud data pump designed to remove the complexity and friction inherent in traditional IoT solutions. The Notecard family includes models supporting secure cellular, WiFi, LoRa, or satellite connectivity, enabling rapid development and iteration at a predictable, low cost. With as little as two lines of code on your host MCU, and no external libraries or dependencies, any Notecard model can securely move data from device to cloud.

Specifically, the Notecard NOTE-LORA v2.1 is:

- A drop-in embeddable data storage and transport module for LoRa IoT products, pumping JSON-formatted or binary data ("Notes") bi-directionally between device and cloud:
  - JSON from/to MCU application using I2C, Serial, or USB.
  - JSON to/from your cloud app using HTTPS or MQTT.
  - JSON is auto-tagged with date/time.
- A removable and field-upgradable 30mm x 35mm system-on-a-module (SOM).

Features

- **Low-power.** Designed to operate on battery power, be "always-on", maintain time & location, while typically drawing less than ~8µA when idle.
- **MCU-agnostic.** Will support any MCU or single-board computer as your app processor - even low-memory, 8-bit microcontrollers.
- **Simple.** Uses a JSON command interface over I2C, UART, or USB. Allows you to connect your 3.3V MCU.
- **Power-conscious.** Mostly-offline data sync mode for low power.

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- **Efficient.** Battery-powered LoRa without the complexity of managing connections, queues, or storage.
- **Integrated.** Utilizes an extremely thin cloud infrastructure that directly routes your data to where it belongs: AWS, Azure, GCP, or your own cloud.
- **Built for data.** Data routing and simple "no code/low code" visual data stream analysis through Notehub.io (SaaS), or host and integrate Notehub functionality into your own app (OSS).
- **Embeddable.** Castellated edges enable product builder to embed the Notecard for LoRa directly onto a PCB for volume production.

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Package Configuration

NOTE-LORA

- Product Name: Notecard for LoRa
- Module: STM32WLE5
- LoRa Frequency: Either 868 MHz (Europe) or 915 MHz (United States). Set by Blues during provisioning.

View in Store

Module Datasheet

- STM32WLE5

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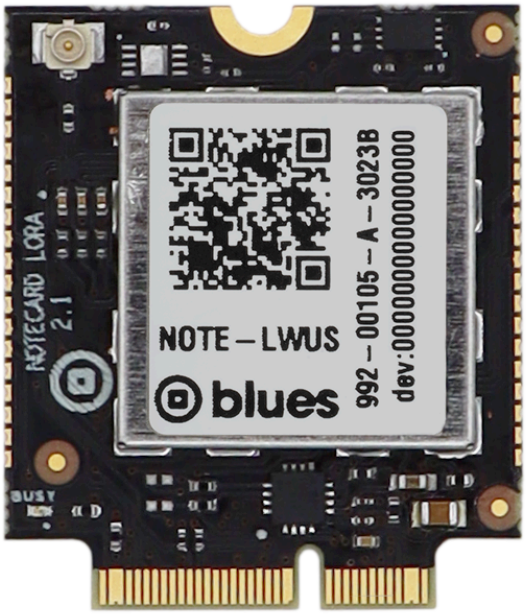
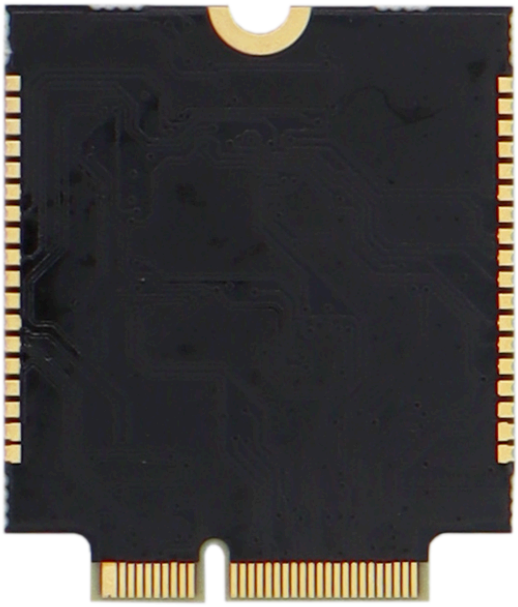
Block Diagram

Notecard for LoRa is packaged using a compact removable form factor, 30mm x 35mm.

Open hardware schematics for both the Notecard and Notecarrier boards are available on GitHub, making it a straightforward task to embed the Notecard into a broad variety of host device designs.

The Notecard can interface with the host MCU at 3.3v levels.

Front	Back
	

Typical Application

As shown below, Notecard is not an application processor and hosts no customer application code. It can be used as a data pump peripheral that is focused on bidirectional, asynchronous, secure data staging and transfer of JSON Notes.

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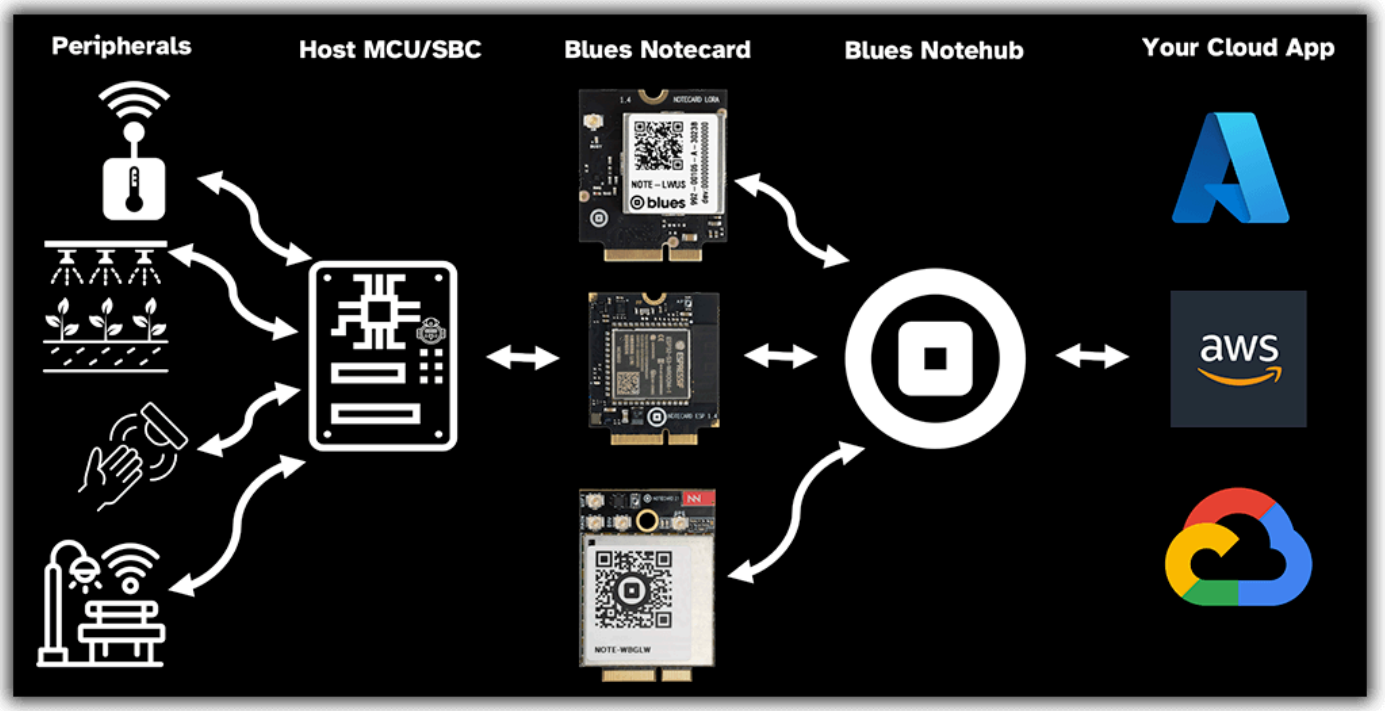

Key Features

- **Low Power Consumption**

  The Notecard has sophisticated power control and makes heavy use of variable clock speeds. This enables the Notecard to have a typical idle current consumption of ~8µA, while still supporting active UART and I2C communication.

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Power Information

Notecard for LoRa is powered by the logic voltage supply (`VIO_P`), provided by the Notecarrier or host system; it must be 3.3V. Because this supply powers the STM32WL module and the LoRa radio, it should be designed with a 150mA budget allocated to the Notecard, and PCB traces for `VIO_P` and `GND` should be designed to handle that current.

Unlike cellular and WiFi Notecards, the `VMODEM_P` pins on Notecard for LoRa do not power the radio. `VMODEM_P` is used only to monitor the supply/battery voltage (for example, in response to a `card.voltage` request). It presents a negligible (sub-µA) load, and any voltage in the range of 2.5V to 5.5V may be provided.

Notecard for LoRa typically draws ~8µA on `VIO_P` when sitting idle waiting for a request from the host MCU, however the Notecard current draw increases when the LoRa radio is active (consult the STM32WLE5 datasheet for details). The module also draws tens of mA when the CPU is performing session encryption.

Pin Name	Direction	Pin Numbers	Usage
GND	--	3,5,6,11,18,33,39,45,51,57,71,73	Ground
VIO_P	IN	2,4	3.3V @ 150mA (powers the module and LoRa radio)
VUSB	IN	13	USB Serial proxy for "line power", with respect to dynamic line voltage detection
VMODEM_P	IN	70,72,74	2.5V to 5.5V, battery-voltage monitoring only (negligible draw)

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Reset and Loss of Power

Warning

A power-loss event occurs whenever the Notecard loses power on `VIO_P`, or the Notecard's `NRST` pin is pulled low. (On Notecard for LoRa, `VMODEM_P` is a battery-monitoring input only and does not power the Notecard.)

Upon recovering from any power-loss event, the Notecard initiates a procedure to ensure filesystem integrity. The Notecard also conducts a procedure upon first connection to Notehub after power loss to ensure consistency between Notecard's file system and Notehub's replica copy of those files. This verification procedure is done to protect and ensure the integrity of your product, and you should expect additional use of network bandwidth when these rare events occur.

It is the responsibility of every product designer to ensure that designs utilizing Notecard provide constant power to `VIO_P`, at the cost of as little as 8 µA, so as to ensure that power-loss events do not occur as a matter of course from the perspective of the Notecard.

If repeated power failures are expected and unavoidable in a product's use, designs must incorporate a small battery or lithium ion capacitor to provide backup power, and the Notecard firmware should be configured to enter a quiescent state when operating on its backup supply.

Frequent power-loss events will result in the voiding of the Notecard warranty. In addition, since repeated Notecard resets can be indistinguishable from "denial of service" attacks on the Notehub, Blues also reserves the right to deny access to devices that exhibit such behavior.

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Antenna Requirements

Notecard for LoRa requires usage of an external antenna attached to its u.FL connector. The external antenna must support a frequency band appropriate for the region-specific LoRa frequency in use.

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Cellular Service

This section does not apply to Notecard for LoRa.

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Pin Information

Pin Definitions

Pin Name	Pin Description
ATTN_P	Attention pin (requires protection)
AUX_RX	Auxiliary UART receive (requires protection)
AUX_TX	Auxiliary UART transmit (requires protection)
AUX1	Auxiliary GPIO pin 1
AUX2	Auxiliary GPIO pin 2
AUX3	Auxiliary GPIO pin 3
AUX4	Auxiliary GPIO pin 4
BOOT	Test/debug pin used to force Notecard into its bootloader
GND	Ground
NC	No connection (must be left open)
NRST	Active-low (not) reset*
RSVD	Reserved for internal use (electrically connected and must be left open)
RX_P	UART receive (requires protection)
SCL_P	I2C clock (requires protection)
SDA_P	I2C data (requires protection)

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Pin Name	Pin Description
TX_P	UART transmit (requires protection)
USB_DN	USB data negative
USB_DP	USB data positive
VIO_P	I/O Voltage (requires protection)*
VMODEM_P	Voltage supply/battery monitoring input*
VUSB	USB Active indicator from 3V3 to 5V

* See the power information section for important product design considerations related to reset and loss of power conditions.

Pin Description

Notecard M.2 Key E, Edge Connector Pinout

Pin #	Pin Name	Func. Interface	Func. Interface	Pin Name	Pin #
1	NC		Power	VIO_P	**2**
3	GND	Power	Power	VIO_P	**4**
5	GND	Power	Power	GND	**6**
7	USB_DP	USB Serial		NC	**8**
9	USB_DN	USB Serial		NC	**10**
11	GND	Power		NC	**12**

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Pin #	Pin Name	Func. Interface	Func. Interface	Pin Name	Pin #
13	VUSB	USB Serial		NC	**14**
15	NC			NC	**16**
17	NC		Power	GND	**18**
19	NC			NC	**20**
21	NC			NC	**22**
23	NC			NC	**24**
25	NC			NC	**26**
27	NC			NC	**28**
29	NC			NC	**30**
31	NC			NC	**32**
33	GND	Power		NC	**34**
35	NC			NC	**36**
37	NC			NC	**38**
39	GND	Power	I2C Serial	SCL_P	**40**
41	NC		I2C Serial	SDA_P	**42**
43	NC			NC	**44**
45	GND	Power	Auxiliary Ports	AUX1	**46**

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Pin #	Pin Name	Func. Interface	Func. Interface	Pin Name	Pin #
47	NC		Auxiliary Ports	AUX2	**48**
49	NC		Auxiliary Ports	AUX3	**50**
51	GND	Power	Auxiliary Ports	AUX4	**52**
53	RSVD		Attention	ATTN_P	**54**
55	RSVD			NC	**56**
57	GND	Power	Auxiliary Ports	AUX_RX	**58**
59	NC		Auxiliary Ports	AUX_TX	**60**
61	NC		UART Serial	RX_P	**62**
63	RSVD		UART Serial	TX_P	**64**
65	BOOT	Bootloader		NC	**66**
67	NRST	Reset		NC	**68**
69	NC		Power	VMODEM_P	**70**
71	GND	Power	Power	VMODEM_P	**72**
73	GND	Power	Power	VMODEM_P	**74**
75	NC				

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Notecard for LoRa v2.1 Castellated Edge Pinout

Pin #	Pin Name	Func. Interface	Func. Interface	Pin Name	Pin #
1	NC			NC	**19**
2	AUX_TX	Auxiliary Ports		NC	**20**
3	AUX_RX	Auxiliary Ports		NC	**21**
4	NC			NC	**22**
5	AUX1	Auxiliary Ports		NC	**23**
6	AUX2	Auxiliary Ports	I2C Serial	SCL	**24**
7	AUX3	Auxiliary Ports	I2C Serial	SDA	**25**
8	AUX4	Auxiliary Ports		NC	**26**
9	RX	UART Serial	Attention	ATTN	**27**
10	TX	UART Serial		NC	**28**
11	SWDIO			NC	**29**
12	SWCLK		USB Serial	VUSB	**30**
13	LED_BUSY		USB Serial	USB_DP	**31**
14	NRST	Reset	USB Serial	USB_DN	**32**
15	VIN	Power	Power	VIO	**33**
16	VIN	Power	Power	VIO	**34**

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Pin #	Pin Name	Func. Interface	Func. Interface	Pin Name	Pin #
17	GND	Power	Power	GND	**35**
18	GND	Power	Power	GND	**36**

> *Link: Digi-Key part number of the connector - Both Digi-Key and Mouser have pictures for this part number that show a component with a different key, but both have links to datasheet/drawing/CAD models.*

Note

All pins whose **Functional Interface** is marked "Power" must be connected.

All pins named `NC` have no connection on the Notecard and must be left open.

All pins named `RSVD` are reserved for internal use. These pins are electrically connected on the Notecard and MUST be left open. Furthermore, any pin not used in a design MUST also be left open.

`BOOT` (pin 65) is a test/debug pin, not a functional interface. It is not required for normal operation and should be left open, but routing it to a test point on your carrier board makes it possible to recover a Notecard whose firmware update was interrupted. See Bootloader for details.

Those pins ending with `_P` may be optionally protected from anomalous external conditions on some Notecarrier designs, depending upon use-case specific requirements.

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Technical Details

Host Microcontroller API

Notecard supports a rich, simple API whose syntax is standard JSON. The developer can communicate requests to Notecard, generally by using little more than `printf` functions available in most programming languages.

Serial Communication

JSON requests and responses (the Notecard's Application Programming Interface "API") may be sent over any of the following interfaces:

- USB Serial Interface
- UART Serial Interface
- I2C Interface

API Reference

For API usage, names, and parameters, please refer to the Notecard API Reference.

USB Serial Interface

The USB Serial Interface appears to the host as a USB 2.0 Full Speed CDC device. You can access it from Linux, Windows, or macOS without a device driver using terminal emulation software. Newline-delimited JSON requests may be sent directly as UTF-8 text over this port, or you may use the open-source Blues libraries for C, Python, Go, and Arduino.

Pin Name	Direction	Pin Number	Usage
USB_DN	I/O	9	USB D- data signal
USB_DP	I/O	7	USB D+ data signal
VUSB	IN	13	+5V from USB

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Pin Name	Direction	Pin Number	Usage
GND	I/O	11	Ground from USB

UART Serial Interface

The UART Serial Interface operates at `VIO_P` at a fixed baud rate of 9600 using eight data bits, no parity bit, and one stop bit. Newline-delimited JSON requests may be sent directly as UTF-8 text over this port, or you may use the open-source Blues libraries for C, Python, Go, and Arduino.

Pin Name	Direction	Pin Number	Usage
RX_P	IN	62	Receive data signal
TX_P	OUT	64	Transmit data signal

I2C Interface

The Notecard acts as an I2C secondary device operating at `VIO_P`, and it implements a simple Serial-over-I2C protocol. You can access it from an embedded host using open-source Blues libraries for C, Python, Go, and Arduino.

Pin Name	Direction	Pin Number	Usage
SCL_P	IN	40	I2C clock
SDA_P	I/O	42	I2C data

Host Microcontroller Hardware Interface

Attention Interrupt

Using software, you can optionally configure Notecard to use the `ATTN` output pin to:

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- Inform the host MCU of certain asynchronous events (such as incoming data availability) in an interrupt-driven manner rather than just polling.
- Place the host MCU into a power-off sleep state and wake it back up again.

Pin Name	Direction	Pin Number	Usage
ATTN_P	OUT	54	Attention pin

Note

This pin operates at `VIO_P`. If it is unused it can be left disconnected.

Auxiliary Ports

The AUX1-4 pins operate at `VIO_P` and can be configured in software to operate in several optional modes, such as GPIO mode, monitor mode, and LED/NeoPixel mode. See `card.aux` for the full list of modes and which Notecards support them, and Working with the Notecard AUX Pins for usage examples. If these pins are unused, they can be left disconnected.

Pin Name	Direction	Pin Number	Usage
AUX_RX	IN	58	Auxiliary UART receive
AUX_TX	OUT	60	Auxiliary UART transmit
AUX1	I/O	46	General Purpose IO
AUX2	I/O	48	General Purpose IO
AUX3	I/O	50	General Purpose IO
AUX4	I/O	52	General Purpose IO

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Reset

Use of this pin is optional. If the host system has a global reset line, caution should be used when connecting this pin to the host system's reset because the Notecard may independently pull the line low in software. Restrictions on this pin are:

- If this pin is not used, it must remain not connected (`NC`).
- The pin is active-low. It must be held low for at least 350 ns for a clean reset.
- This pin must never be pulled-up. A pull-up would interfere with the Notecard's own internal watchdog timer and thus will prevent reliable operations.
- Some Notecarriers may invert this signal to be active-high.

Pin Name	Direction	Pin Number	Usage
NRST	I/O	67	Active-low reset

Bootloader

`BOOT` (pin 65) is a test/debug pin that forces Notecard into its bootloader instead of running its firmware. Its primary use is recovering a Notecard whose firmware update was interrupted, leaving it unable to boot normally. This pin plays no part in normal operation and use of it is optional.

To enter the bootloader, hold `BOOT` at `VIO_P` while resetting the Notecard, then release `NRST` (pin 67) before releasing `BOOT`. Notecard will stay in its bootloader, ready to accept firmware over the USB serial interface.

Restrictions on this pin are:

- If this pin is not used, it must remain not connected (`NC`).
- Never apply a voltage above `VIO_P` to this pin.
- Never hold this pin `HIGH` in normal operation, or Notecard will enter its bootloader on every reset rather than running its firmware.

Pin Name	Direction	Pin Number	Usage
BOOT	IN	65	Force Notecard into its bootloader on reset

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Tip

For the step-by-step procedure on using a Notecarrier to recover a Notecard, see Recovering a Bricked Notecard.

Network Communication Behavior

The Notecard includes a built-in connection to Notehub.io and communicates through any available (and in-range) LoRaWAN gateway and LoRaWAN Network Server (LNS) with a secure connection to Notehub.io. Outbound connections communicate with Notehub via the LNS for provisioning and device authentication. By default, the connection is unidirectional, but can operate bi-directionally, if needed.

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Specifications

General Characteristics

Description	Value
Dimensions	30mm x 35mm
Weight	3 grams

Electrical Characteristics

Absolute Maximum Ratings

Description	Minimum	Maximum	Unit
Storage temperature	-40	90	°C
Ambient operating temperature	-40	85	°C

DC Characteristics

Description	Minimum	Typical	Maximum	Unit
VIO Supply Voltage		3.3		V
VIO Operating Current			150	mA
VMODEM Monitoring Voltage	2.5		5.5	V

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Ordering Information

Blues Shop

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Certifications

CE

For the EU variant of Notecard for LoRa.

CE certification indicates that a product complies with the essential requirements of relevant European health, safety, and environmental protection legislation. It is a mandatory conformity mark for products sold within the European Economic Area (EEA).

Certification	Date
EN 301 489-1 V2.2.3	August 2024
EN 301 489-3 V2.3.2	August 2024
EN 55032: 2015+A11: 2020, Class B	August 2024
EN 55035: 2017+A11: 2020	August 2024
EN IEC 62311: 2020	August 2024
EN 300 220-1 V3.1.1	August 2024
EN 300 220-2 V3.2.1	August 2024

FCC

For the US variant of Notecard for LoRa.

FCC certification indicates that a product complies with the regulations set forth by the Federal Communications Commission (FCC) in the United States. This certification ensures that electronic devices do not emit electromagnetic interference that could disrupt other electronic devices and communication systems.

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Certification	Date
47 CFR FCC Part 15, Subpart B, Class B	August 2024
47 CFR Part 2, Section 2.1091	August 2024
47 CFR FCC Part 15, Subpart C (Section 15.249)	August 2024

ISED

For the US variant of Notecard for LoRa.

ISED/ISEDC certification is issued by Innovation, Science and Economic Development Canada (ISEDC), formerly known as Industry Canada (IC). This certification ensures that electronic devices comply with Canadian regulations regarding radio frequency (RF) emissions and electromagnetic interference (EMI).

Certification	Date
RSS-210 Issue 10	October 2024
RSS-Gen Issue 5 + Amendment 2	October 2024
RSS-102 Issue 5 + Amendment 1	October 2024

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Board Errata

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Security and Vulnerability Scanning

As a part of our regular audit and scanning process, Blues Inc. performs full vulnerability scanning every six months. Any identified vulnerabilities will be analyzed, reported, and patched in a timely fashion, where appropriate.

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Revision History

Author	Date	Summary
Ray Ozzie	2019-2020	Document drafted
John Wiedey	2020	Various improvements
Sean Taylor	2020	Various improvements
Zachary J. Fields	11 SEP 2020	Updated information and translated to markdown
Brandon Satrom	13 APR 2021	Updated Country list based on carrier audit
Carlton Henderson	12 JUL 2021	Update coverage information
Carlton Henderson	12 JUL 2021	Fix block diagram photo
Brandon Satrom	11 NOV 2021	Added Certification Dates
Brandon Satrom	07 JAN 2022	Added RoHS Certification Dates
Brandon Satrom	15 FEB 2022	Add WiFi Notecard Datasheet
Rob Lauer	25 AUG 2022	Added updated certification data
Rob Lauer	27 OCT 2022	Update country coverage information

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Author	Date	Summary
Rob Lauer	13 JAN 2023	Added RF performance information
Rob Lauer	2 FEB 2023	Warning re: STM32 light sensitivity
Kimball Johnson	21 SEP 2023	Updated for new Cell+WiFi, LoRa, and WiFi Notecards
Rob Lauer	23 OCT 2023	Update and clarify power consumption values
Rob Lauer	31 JAN 2024	Update Notecard for LoRa datasheet details
Rob Lauer	16 APR 2024	Updated for new Cellular (black PCB) Notecards, MB Cellular Notecards, and Notecard XP
Rob Lauer	6 JUN 2024	Added cell band support for Cellular Notecards
Rob Lauer	23 JUL 2024	Update pin definitions
TJ VanToll	24 SEP 2024	Adding Notecard for LoRa v2.1 information
Rob Lauer	01 NOV 2024	Adding Notecard for LoRa v2.1 castellated pin info
Rob Lauer	06 NOV 2024	Added errata for Notecard Cell+WiFi
Brandon Satrom	06 DEC 2024	Expanded reset and loss of power guidance

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Author	Date	Summary
Rob Lauer	20 DEC 2024	Added PTCRB certifications for WBNAN, NBNAN, NBGLN
Rob Lauer	5 MAR 2025	Update AUX5 to AUX_CHARGING
Rob Lauer	22 MAY 2025	Fix labelling of NC pins
Rob Lauer	13 JUN 2025	Update certifications
Rob Lauer	21 JUL 2025	Update certifications for WBNAN, NBNAN, NBGLN
Rob Lauer	28 JUL 2025	Update certifications for all Notecard SKUs
Rob Lauer	17 NOV 2025	Add FCC and IC IDs for all Notecard Cellular SKUs
TJ VanToll	21 JAN 2026	Added Notecard for Skylo
Rob Lauer	23 JUL 2026	Accuracy review vs. hardware design files
Rob Lauer	03 AUG 2026	Document the `BOOT` pin (65) on all Notecard SKUs
TJ VanToll	14 AUG 2026	Adding new Telit SKUs WBEXWT & WBNAWT
Rob Lauer	18 AUG 2026	Expand countries not included

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Author	Date	Summary
Rob Lauer	18 AUG 2026	Added manufacturer-reported GNSS accuracy figures

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