



GEMDEV2

Hardware Manual

Version 1.0

January 22, 2018

WAHOO FITNESS INTELLECTUAL PROPERTY

THIS DOCUMENT IS INTENDED FOR USE BY APPLICATION DEVELOPERS TO CREATE APPLICATIONS COMPATIBLE WITH THE WAHOO FITNESS GEM MODULE. USE OF THE TECHNICAL INFORMATION CONTAINED IN THIS DOCUMENT TO CREATE COMPETING HARDWARE TO THE WAHOO GEM MODULE IS STRICTLY PROHIBITED.

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Revision History

Version	Revision Date	Change History
1.0	November 24, 2017	Version 1.0

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Wahoo GEMDEV2 Hardware Manual

Overview and Key Features

The GEMDEV2 module has been designed to allow OEMs to easily add Bluetooth and ANT+ wireless connectivity in their product offering. The GEMDEV2 module incorporates GEMHCI protocol software specifically designed to enable fitness machines such as treadmills, exercise bikes, ellipticals, rowers, stair climbers and step machines to wirelessly communicate exercise data with smart phones, tablets, and leaderboard software systems.

The GEMDEV2 module is based on Nordic Semiconductor's nRF52832 multiprotocol Bluetooth and ANT+ chipset. The GEMDEV2 module offers a USB host interface and has a maximum transmit power of +4dBm, and a sensitivity of -96dBm. This manual is intended to assist hardware integration of the GEMDEV2 module into a given design. Details on Wahoo's GEMHCI software can be found www.wahoogym.com.

Features

- -96 dBm sensitivity
- TX Power -20 to +4dBm in 4dB steps
- 100m line of sight range
- 5.3 mA peak TX @ 0dB
- 5.4 mA peak RX
- 1dB dB RSSI resolution
- ARM® Cortex™M4F 32 bit processor running at 64MHz
- 512 kB embedded flash memory and 64 kB RAM
- USB Host Interface
- AES HW encryption
- FCC, CE, IC certified
- Integrated Antenna
- RoHS compliant
- Bluetooth End Product Listed
- Integrated GEMHCI software
- ANT+ FE profile
- ANT+ HRM scanning and connection

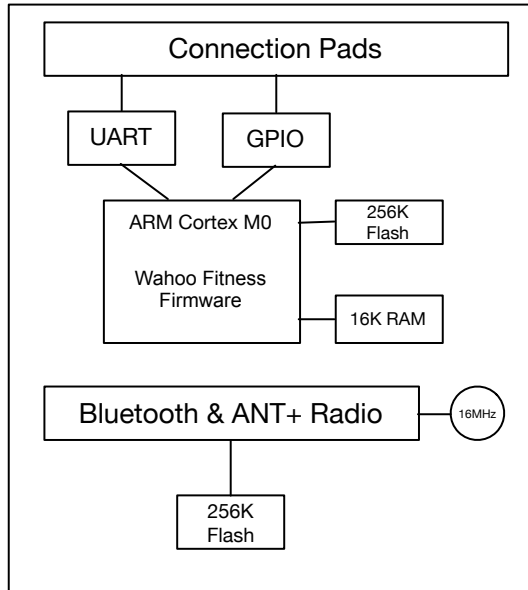
Specification

Specification Summary

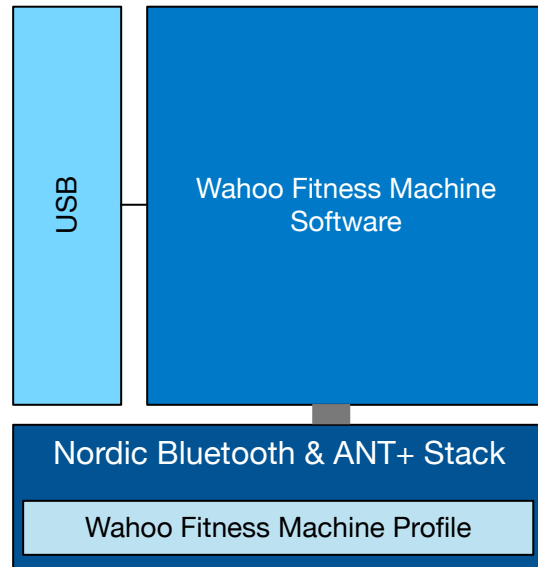
Category	Feature	Implementation
RF	Bluetooth	4.1 Single Mode Peripheral
	ANT+	Broadcast
	Frequency	2.402-2.480 GHz
	Maximum Transmit Power	+4dBm
	Minimum Transmit Power	-20dBm
	Receive Sensitivity	-96dBm
	Range	up to 100m line of sight
Peripherals	USB Host Interface	TX, RX 115.2kbps n,8,1
	GPIO	Link Indicator
FW Upgrade	Wahoo Firmware	Over the air Via JTAG interface
Control Protocol	GEMHCI	GEM HCI binary command interface
Supply Voltage	Min	1.7V
	Max	3.6V
	Recommended	3.0V
Power Consumption		Less than 50mA peak
Physical		30.48mm x 43.56mm
Environmental		-40 to +85C
Approvals		FCC, IC, CE, Bluetooth EPL

Hardware Specifications

Block Diagrams



Hardware Block Diagram

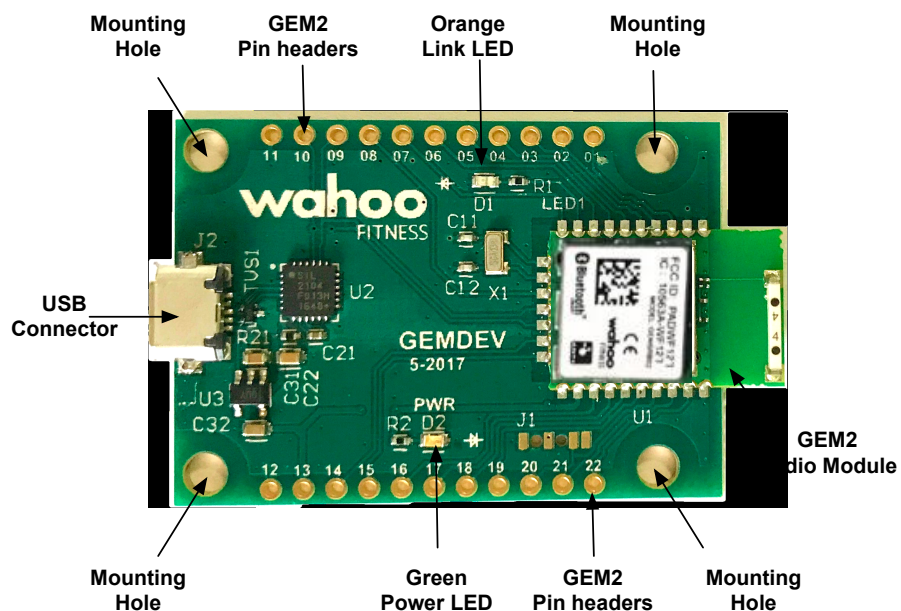


Software Diagram

GEMDEV Layout

Overview

The following picture provides an overview of the various hardware elements of GEMDEV board.



USB Host Connection

The USB Host Connection is used to provide power to the GEMDEV2 board as well as provide a means for communicating with the GEMDEV2 board using Wahoo's GEMHCI protocol.

Power LED

The green power LED indicates when the GEMDEV2 is powered.

Link LED

The orange link LED indicates when the GEMDEV2 is advertising and has established a Bluetooth link.

GEM2 pin headers

The GEM2 pin headers allow the GEM2 Module connections to be easily connected to an external circuit board as an alternative connection mechanism to the USB host connection.

Mounting holes

The GEMDEV2 mounting holes provide a convenient method of mounting the GEMDEV2 within fitness equipment.

Header Pin Definitions

Pin number	Pin Name	Function	Comment
1	Programmable I/O		For future use
2	Programmable I/O		For future use
3	Programmable I/O		For future use
4	Programmable I/O		For future use
5	Programmable I/O		For future use
6	Programmable I/O		For future use
7	Programmable I/O		For future use
8	Programmable I/O		For future use
9	UART TX	Host interface	
10	UART RX	Host interface	
11	GND		
12	GND		
13	VCC		3.3V
14	NFC1	NFC antenna input 1	
15	NFC2	NFC antenna input 2	
16	SCK		For future use
17	MISO		For future use
18	MOSI		For future use
19	SWDIO/nRST	Debug Interface	
20	SWDCLK	Debug Interface	
21	Programmable I/O		For future use
22	GPIO/RESET	Module Reset	

Electrical Specifications

Operating Parameters

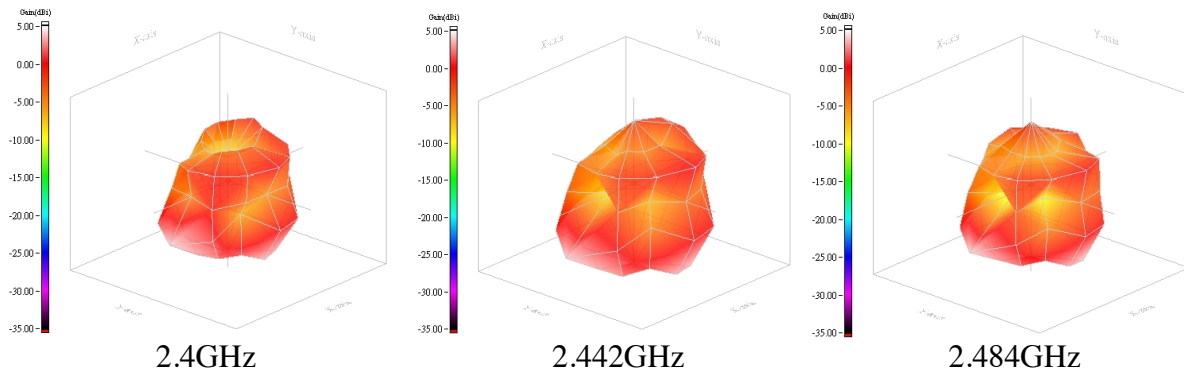
Parameter	Min	Typical	Max
USB Bus Power	-0.3V	3.45V	+5.8V
VCC	1.7V	3.0V	3.6V
Operating Temperature @ 3.3V	-40C		+85C

GEMDEV2 Considerations

Mechanical items (especially metal) should be kept as far as possible from the module antenna in all directions, including above and below the board surface. If possible, move mechanical items out and away from a keepout area of 53mm x 20mm from the GEMDEV2 module edge.

Antenna Characteristics

The GEM 2 module includes an integrated monopole chip antenna. Antenna performance will depend on host PCB layout. The following plots show antenna radiation pattern of the GEM 2 antenna.

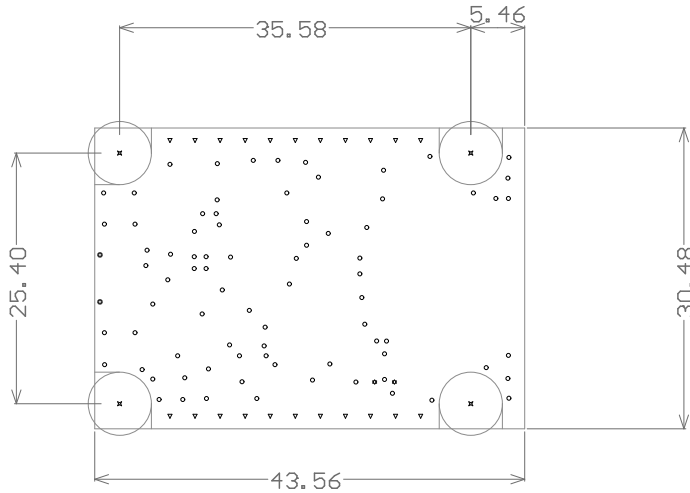


Antenna Performance

	Efficiency	Peak Gain	S11
2400MHz	65.72%	4.08 dBi	-16.0 dB
2442MHz	62.72%	3.95 dBi	-14.8 dB
2484MHz	59.73%	4.17dBi	-13.3 dB

Mechanical Information

Dimensions (in mm)



Connecting GEMDEV to Console MCU

The GEMDEV2 is designed for connection to fitness equipment console MCUs through its USB interface.

The GEMDEV2 has a Silicon Labs CP2104 USB to UART Bridge IC allowing the GEM module UART to communicate properly over a USB interface as a virtual communication port (VCP). Drivers are available for Windows, Linux, and Android.

<https://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>

GEMDEV2 Host Protocol

The GEMDEV2 uses Wahoo's GEMHCI protocol for communications between the GEMDEV2 board and the console MCU using the USB connection. The GEMHCI protocol is designed to operate through the virtual communications port with a port speed of 115.2Kbps.

The GEMHCI protocol is a binary protocol and is used to configure the GEMDEV2 operation as well as pass fitness equipment related data to the GEMDEV2 for broadcasting to connection applications using its Bluetooth/ANT+ radio.

Details of the GEMHCI protocol are provided in the GEMHCI reference manual. Please contact Wahoo for the latest version of the GEMHCI reference manual.

Regulatory & Standards Information

FCC & Industry Canada

The GEMDEV2 module has modular approval for the United States and Canada. To ensure compliance when using the GEM 2 module in a design, the OEM is required to adhere to the implementation considerations supplied in this hardware integration guide.

Federal Communication Commission (FCC) Radiation Exposure Statement:

This device is in compliance with SAR for general population/uncontrolled exposure limits in ANSI/IEEE C95.1-1999 and had been tested in accordance with the measurement methods and procedures specified in OET Bulletin 65 Supplement C.

This transceiver must not be co-located or operating in conjunction with any other antenna, transmitter, or external amplifiers. Further testing / evaluation of the end product will be required if the OEM's device violates any of these requirements.

The GEMDEV2 Module is fully approved for mobile and portable applications.

FCC Labeling Requirements

WARNING: The OEM must ensure that FCC labeling requirements are met. This includes a clearly visible label on the outside of the OEM enclosure specifying the appropriate FCC identifier is visible.

Contains FCC ID: PADWF127
 IC: 10563A-WF127

If OEM device is larger than 8x10cm, the following FCC part 15.19 statement has to be visible on outside of device:

The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

Label and text information type should be large enough to be legible and consistent with the dimensions of the equipment and the label. The type size is not required to be larger than eight points.

Comments

The OEM should have their device tested by a qualified test house to verify compliance with FCC Part 15 Subpart B limits for unintentional radiators.

Any modifications to the GEMDEV2 module could void the OEM's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does not cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to correct the interference by one or more of the following measures:

- Re-orient or relocate the receiving antenna
- Increase the separation between the equipment and the receiver
- Connect the equipment to an outlet on a circuit that is different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Warning:

“THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES AND INDUSTRY CANADA LICENSE-EXEMPT RSS STANDARD(S). OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRE OPERATION.

Industry Canada (IC) Warning:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

French equivalent:

Le présent appareil est conforme aux CNR d'Industrie Canada applicable aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

IC Radiation Exposure Statement

This device is in compliance with SAR for general population/uncontrolled exposure limits in IC RSS-102 and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528.

REMARQUE IMPORTANTE

Déclaration IC d'exposition aux radiations Ce EUT est conforme avec SAR pour la population générale / limites d'exposition non contrôlée à IC RSS-102 et a été testé en conformité avec les méthodes de mesure et procédures spécifiées dans la norme IEEE 1528.

Modular Approval

OEM is still responsible for testing their product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

Approbation modulaire

OEM intégrateur est toujours responsable de tester leur produit final pour les exigences de conformité supplémentaires nécessaires à ce module installé (par exemple, les émissions de périphériques numériques, les exigences de périphériques PC, etc.)

IMPORTANT NOTE:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the IC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canadian authorization.

NOTE IMPORTANTE:

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "GEMDEV2 Module Contient des IC: 10563A-WF127"

CE

The GEMDEV2 Module has been tested against the appropriate regulatory standards for European market. OEMs should consult a qualified test house to ensure their product meets all regulatory requirements.

The GEM Module Declaration of Conformities is below. Test reports are available upon request.

Health and Safety – EN60950-1: 2006+A11:2009+A1:2010+A12:2011

Electromagnetic compatibility – EN301489-17 V2.2.1 in accordance with EN 301 489-1 V1.9.2

Radio Frequency Radiated Emissions: EN300 328 V1.9.1

Wahoo Fitness declares under our sole responsibility that the essential radio tests have been carried out and that the GEM Module to which this declaration relates is in conformity with all applicable essential requirements of Article 3 of the EU Directive 1999/5/EC when used for its intended purpose.

Place of Issue: Wahoo Fitness LLC
 90 W. Wieuca Road Suite 110
 Atlanta, GA 30342
 +1(877) 978-1112

Date: October 14, 2017

Authorized Person: James Halter

Signature:

Bluetooth Qualification

The GEMDEV2 module has been listed with the Bluetooth Special Interest Group (SIG) as a qualified an End Product. The Wahoo Fitness Declaration ID is: DID D037855

The Bluetooth SIG requires every product implementing Bluetooth technology to have a Declaration ID even though the end product references a Bluetooth design with its own Declaration ID.

An over of the Bluetooth SIG Qualification Process is as follows:

1. Register as a member of the Bluetooth SIG – www.bluetooth.org
2. Go to product listing page <https://www.bluetooth.org/en-us/test-qualification/qualification-overview>
3. Go to Create a Listing: https://www.bluetooth.org/tpg/QLI_SDoc.cfm
4. In the area “Reference a Qualified Design, Enter End Product ID: 77930
5. Select your Declaration ID or Purchase a Declaration ID. Fees for Declaration IDs vary based on Bluetooth SIG membership level.
6. Once you have completed your listing and paid your declaration fee, your design will be listed on the Bluetooth SIG website.

You can find more details on the Bluetooth SIG listing process at the following webpage: <https://www.bluetooth.org/en-us/test-qualification/qualification-overview>

Ordering Details

Part Number	Trays	Shipping Weight	MOQ	Multiple
GEMDEV205	100 pieces	TBD	100	100

Further Assistance

Please contact Wahoo Fitness at 1-877-978-1112 or via email at info@wahoofitness.com if additional help is needed.

Wahoo

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