# Monnit

## G2XL - Generation 2 eXreame Long Range Wireless Module Product Manual

## Technical Overview

### General Description

Monnit G2XL delivers transformative RF performance in a compact, nano-power module capable of delivering a 50+ mile range (LOS) performance while consuming 1.0uA between transmissions. Monnit has integrated this module with various sensor types to provide a long range wireless sensing solution. Additionally, the module supports flexible transmit power options, data rate manipulation, over-the-air upgradeability, data logging, robust link-level security encryption, and over 20 embedded digital and analog peripherals for end-application utilization.

Monnit integrates these modules into gateway and sensor products for both OEM and direct customers. Monnit's solutions target enterprise customers, enabling them to obtain the benefits of the IOT revolution and reach all corners of the globe.

### Principle of Operation

The module contains three different operation profiles to facilitate data links: PEER, BSN, and EDN. Additionally, the module can be loaded with standard application firmware with a UART AT interface or a more sophisticated API mode.

PEER devices are used to facilitate point to point streaming of information from one device to another.

BSN or EDN modes create point to multi-point ultra-low power networking topology for sensors and gateways.

### Module Specifications

- • Communication: RF 900 MHz FHSS
- Dimensions: 1.6" x 0.9" x 0.185"
- Antenna Ports: 2x U.FL or APEX
- Operating Temperature: -40° to 85°C (-40° to 185°F)

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*The Leader in Low Cost Wireless Sensors*

| Technical Specifications | |
|---|---|
| Supply Voltage | 2.4 - 3.8 VDC |
| Current Consumption | 0.7 µA (sleep mode)<br>1 mA   (radio idle/off mode)<br>4 mA   (measurement mode)<br>5 mA (radio RX mode)<br>650 mA @3.6V (radio TX mode max) |
| Operating Temperature Range (Board Circuitry and Coin Cell) | -40°C to +85°C ( -40°F to +185°F ) |
| Optimal Battery Temperature Range (AA) | +10°C to +50°C ( +50°F to +122°F ) |
| Antenna Ports | 2x U.FL or APEX |
| Wireless Range | Up to 50 miles line-of-sight |
| RF Symbol Rates, Sub-modulation, and Data Rates | 400 KSPS GFSK ➔ 400 Kbps<br>400 KSPS GFSK+DSSS1 ➔ 200 Kbps<br>400 KSPS GFSK+DSSS2 ➔ 100 Kbps<br>400 KSPS GFSK+DSSS4 ➔ 50 Kbps<br>400 KSPS GFSK+DSSS8 ➔ 25 Kbps<br>10 KSPS GFSK ➔ 10 Kbps<br>10 KSPS GFSK+DSSS1 ➔ 5 Kbps<br>10 KSPS GFSK+DSSS2 ➔ 2.5 Kbps<br>10 KSPS GFSK+DSSS4 ➔ 1.25 Kbps<br>10 KSPS GFSK+DSSS8 ➔ 625 bps |
| Channel Spacing | 10 KSPS : 50KHz, 400 KSPS : 500KHz |
| Channel Totals | 10 KSPS : 514 channels, 400 KSPS : 51 channels |
| RF Output Range | -13dBm to +30dBm |
| Receiver Sensitivity | -100 dBm (400Kbps) to -127 dBm (625 bps) |
| Receiver Saturation | +10dBm |
| Security | Diffie-Hellman Key Exchange + AES-128 CTR |
| Certifications | Industry Canada<br>FC [Canada flag] |

## Caution/Notice:

This module is designed for use in an ordinary environment (normal room temperature, humidity and atmospheric pressure). Do not use this sensor under the following conditions as these factors can deteriorate the product characteristics and cause failures and burn-out.

- Corrosive gas or deoxidizing gas - chlorine gas, hydrogen sulfide gas, ammonia gas, sulfuric acid gas, nitric oxides gas, etc.).
- Volatile or flammable gas.
- Dusty conditions.
- Under low or high pressure.
- Wet or excessively humid locations.
- Places with salt water, oils chemical liquids or organic solvents.
- Where there are excessively strong vibrations.
- Other places where similar hazardous conditions exist.

Use this module within the specified temperature range. Higher temperature may cause deterioration of the characteristics or the material quality of this product.

## RF Connectors

The module supports up to two U.FL/APEX connectors.  The end-customer must connect an antenna to all antenna ports used in a customer's application.   Using an antenna port without a 50 ohm termination constitutes misuse and may cause damage to module.   Special care must be taken to ensure this situation does not occur.

## Power Warning

Hardware cannot withstand negative voltage. Please take care when connecting power to module.

## Data Connections

The following signals pins are available for connection to host hardware.

| PIN | SIGNAL |
|-----|--------------|
| 1 | ACT |
| 2 | nCTS |
| 3 | TX |
| 4 | GROUND |
| 5 | RX |
| 6 | nRTS |
| 7 | nRST |
| 8 | AN0 |
| 9 | ACTL |
| 10 | 2.4 - 3.8 VDC |

## Communication Protocol

Information relating to the communication protocol for this module are contained in the following documents and can be obtained under NDA with Monnit corporation.

- GWAPI V1.9
- SensorAPI V1.3

## United States FCC Module Approval

The G2XL Module complies with Part 15 of the FCC rules and regulations. 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 instruction manual, 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 cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of more of the following measures:

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

**Warning:** Changes or modifications not expressly approved by Monnit could void the user's authority to operate the equipment.

This 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.

## Canada IC

English

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotopically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

The radio transmitter (IC: 9794A-G2XL1) has been approved by Industry Canada to operate with the antenna types listed with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

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

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut  fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio (IC: 9794A-G2XL1) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables 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, méme si le brouillage est susceptible d'en compromettre le fonctionnement.

## FCC/IC Approved Antennas

The G2XL Module can be installed utilizing antennas and cables constructed with standard connectors (Type-N, SMA, TNC, and so forth.) if the installation is performed professionally and according to FCC guidelines. For installations not performed by a professional, non-standard connectors (RPSMA, RPTNC, and so forth.) must be used.   The modules are FCC/IC approved for fixed base station and mobile applications. If the antenna is mounted at least 21.7cm (9 in) in the USA, or 32.1cm (12.6 in) in Canada from nearby persons, the application is considered a mobile application. Antennas not listed in the table must be tested to comply with FCC Section 15.203 (Unique Antenna Connectors) and Section 15.247 (Emissions).

G2XL modules have been tested and approved for use with all the antennas listed in the tables below. (Cable-loss **IS** required when using gain antennas as shown below.)

| Part Number | Manufacturer | Description | Required Cable Loss |
|---|---|---|---|
| XQZ-900E-2 | Xianzi | 3 dBi Dipole Omni | 0 dB |
| HG905RD-RSP | Hyperlink | 5 dBi Dipole Omni | 0.44 dB |
| HG908U-PRO | Hyperlink | 8dBi Fiberglass Omni | 3.48 dB |
| HG8909P | Hyperlink | 9dBi Flat Panel | 3.54 dB |
| HG914YE-NF | Hyperlink | 14dBi Yagi | 10.74 dB |

## OEM Labeling Requirements

The Original Equipment Manufacturer (OEM) must ensure that FCC and IC labeling requirements are met. This includes a clearly visible label on the outside of the final product enclosure that displays the contents shown in the figure below.

Required FCC/IC Label for OEM products containing the RFXL Module:

Contains FCC ID: ZTL-G2XL1

Contains Wireless Module IC: 9794A-G2XL1

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

# OEM Documentation Requirements

## RF Exposure for FCC

⚠️ **WARNING:** To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 21.7 cm or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operations at closer than this distance is not recommended. The antenna used for this transmitter must not be co-located in conjunction with any other antenna or transmitter.

The preceding statement must be included as a CAUTION statement in OEM product manuals in order to alert users of FCC RF Exposure compliance.

## RF Exposure for IC

⚠️ **WARNING:** To satisfy IC RF exposure requirements for mobile transmitting devices, a separation distance of 32.1 cm or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operations at closer than this distance is not recommended. The antenna used for this transmitter must not be co-located in conjunction with any other antenna or transmitter.

⚠️ **AVERTISSEMENT:** Pour satisfaire IC RF exigences d'exposition pour les appareils mobiles de transmission, une distance de séparation de 32,1 cm ou plus doit être maintenue entre l'antenne de cet appareil et des personnes pendant le fonctionnement de l'appareil. Pour assurer la conformité, les opérations au plus près que cette distance ne sont pas recommandés. L'antenne utilisée pour cet émetteur ne doit pas être situé en conjonction avec une autre antenne ou émetteur.

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The preceding statement must be included as a CAUTION statement in OEM product manuals in order to alert users of IC RF Exposure compliance.

## OEM Notices

**IMPORTANT**: The G2XL Module has been certified by the FCC for use with other products without any further certification (as per FCC section 2.1091). Modifications not expressly approved by Monnit Corporation could void the user's authority to operate the equipment.

**IMPORTANT:** OEM Integrators must test final product to comply with unintentional radiators (FCC section 15.107 & 15.109) before declaring compliance of their final product to Part 15 of the FCC Rules. Other compliance testing may also apply (for example, PC peripheral requirements, etc.).

**IMPORTANT:** The G2XL module has been certified for remote and base radio applications. If the module will be used for portable applications, the device must undergo SAR testing.

**IMPORTANT:** In the event that the minimum distance requirement or if the module is co-located with other transmitters, then current FCC and IC authorization is no longer valid and the FCC ID or IC number 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 FCC and IC authorization.

## Warranty Information

(a) Monnit warrants that Monnit-branded products will be free from defects in materials and workmanship for a period of one (1) year from the date of delivery with respect to hardware and will materially conform to their published specifications for a period of one (1) year with respect to software. Monnit may resell sensors manufactured by other entities and are subject to their individual warranties; Monnit will not enhance or extend those warranties.  Monnit does not warrant that the software or any portion thereof is error free. Monnit will have no warranty obligation with respect to Products subjected to abuse, misuse, negligence or accident. If any software or firmware incorporated in any Product fails to conform to the warranty set forth in this Section, Monnit shall provide a bug fix or software patch correcting such non-conformance within a reasonable period after Monnit receives from Customer (i) notice of such non-conformance, and (ii) sufficient information regarding such non-conformance so as to permit Monnit to create such bug fix or software patch. If any hardware component of any Product fails to conform to the warranty in this Section, Monnit shall, at its option, refund the purchase price less any discounts, or repair or replace non-conforming Products with conforming Products or Products having substantially identical form, fit, and function and deliver the repaired or replacement Product to a carrier for land shipment to customer within a reasonable period after Monnit receives from Customer (i) notice of such non-conformance, and (ii) the non-conforming Product provided; however, if, in its opinion, Monnit cannot repair or replace on commercially reasonable terms it may choose to refund the purchase price. Repair parts and replacement products may be reconditioned or new. All replacement products and parts become the property of Monnit. Repaired or replacement products shall be subject to the warranty, if any remains, originally applicable to the product repaired or replaced. Customer must obtain from Monnit a Return Material Authorization Number (RMA) prior to returning any Products to Monnit. Products returned under this Warranty must be unmodified.

Customer may return all Products for repair or replacement due to defects in original materials and workmanship if Mon- nit is notified within ninety (90) days of customer's receipt of the product. Monnit reserves the right to repair or replace products at its own and complete discretion. Customer must obtain from Monnit a Return Material Authorization Number (RMA) prior to returning any products to Monnit. Products returned under this Warranty must be unmodified and in original packaging. Monnit reserves the right to refuse warranty repairs or replacements for any products that are damaged or not in original form. For products outside the ninety-day warranty period repair services are available at Monnit at standard labor rates for a period of one year from the Customer's original date of receipt.

(b) As a condition to Monnit's obligations under the immediately preceding paragraphs, Customer shall return Products to be examined and replaced to Monnit's facilities, in shipping cartons which clearly display a valid RMA number provided by Monnit. Customer acknowledges that replacement products may be repaired, refurbished or tested and found to be complying. Customer shall bear the risk of loss for such return shipment and shall bear all shipping costs. Monnit shall deliver replacements for Products determined by Monnit to be properly returned, shall bear the risk of loss and such costs of shipment of repaired products or replacements, and shall credit Customer's reasonable costs of shipping such returned Products against future purchases.

(c) Monnit's sole obligation under the warranty described or set forth here shall be to repair or replace non-conforming products as set forth in the immediately preceding paragraph, or to refund the documented purchase price for non-conforming Products to Customer. Monnit's warranty obligations shall run solely to Customer, and Monnit shall have no obligation to customers of Customer or other users of the Products.

## Limitation of Warranty and Remedies.

THE WARRANTY SET FORTH HEREIN IS THE ONLY WARRANTY APPLICABLE TO PRODUCTS PURCHASED BY CUSTOMER. ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY DIS-CLAIMED. MONNIT'S LIABIITY WHETHER IN CONTRACT, IN TORT, UNDER ANY WARRANTY, IN NEGLIGENCE OR OTHERWISE SHALL NOT EXCEED THE PURCHASE PRICE PAID BY CUSTOMER FOR THE PRODUCT. UNDER NO CIRCUMSTANCES SHALL MONNIT BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES. THE PRICE STATED FOR THE PRODUCTS IS A CONSIDERATION IN LIMITING MONNIT'S LIABILITY. NO ACTION, RE-GARDLESS OF FORM, ARISING OUT OF THIS AGREEMENT MAY BE BROUGHT BY CUSTOMER MORE THAN ONE YEAR AFTER THE CAUSE OF ACTION HAS ACCRUED.

IN ADDITION TO THE WARRANTIES DISCLAIMED ABOVE, MONNIT SPECIFICALLY DISCLAIMS ANY AND ALL LI-ABILITY AND WARRANTIES, IMPLIED OR EXPRESSED, FOR USES REQUIRING FAIL-SAFE PERFORMANCE IN WHICH FAILURE OF A PRODUCT COULD LEAD TO DEATH, SERIOUS PERSONAL INJURY, OR SEVERE PHYSI- CAL OR ENVIRONMENTAL DAMAGE SUCH AS, BUT NOT LIMITED TO, LIFE SUPPORT OR MEDICAL DEVICES OR NUCLEAR APPLICATIONS. PRODUCTS ARE NOT DESIGNED FOR AND SHOULD NOT BE USED IN ANY OF THESE APPLICATIONS.

## Error Reporting, Troubleshooting and Support

For technical support and troubleshooting tips please visit our support library online at http://www.monnit.com/support/.  If you are unable to solve your issue using our online support, email Monnit support at support@monnit.com with your contact information and a description of the problem, and a support representative will call you within one business day.

For error reporting, please email a full description of the error to support@monnit.com.

For more information about our products or to place an order, please contact our sales department at 801-561-5555.

Visit us on the web at www.monnit.com.