Wireless High-Power RF Module

User's Manual

Revision 4

1. Usage

This Wireless High-Power RF Module is one component in the Runwise Heat Management System. These modules are installed in multiple Runwise devices, in various locations throughout a climate controlled space to relay real-time, wireless data between the Runwise Management System and other devices within the Runwise Wireless Network.

2. Integration Instructions

When integrating a Wireless High-Power RF Module into a host design, the following must be considered:

- This module is limited to installation in fixed or mobile applications
- Separate approval is required for all other operating configurations, such as portable configurations or different antenna configurations
- This module is authorized for stand-alone host configurations; any configuration which includes multiple radios within 20 cm and which transmit simultaneously with the Runwise module may require additional testing and certification requirements. In cases where other transmitters must be co-located with the Runwise RF Module, contact Runwise via phone at 833-264-5371 or via email at support@runwise.com for further assistance.
- Enclosure should have a maximum dielectric constant of 3.7, otherwise the antenna should be mounted externally on the enclosure
- For internal antennas, there is not an explicit restriction but for best performance a ground plane keepout area is recommended for any region of the host device PCB that is near the module antenna or RP-SMA connector
- For external antennas, it is recommended that the antenna be positioned such that it is 20cm or greater away from any metallic or conductive objects
- The module is limited to OEM installation only
- OEM integrators must ensure that the end-user has no manual or instructions to remove or install the module
- The host manufacturer is responsible for additional testing to verify compliance as a composite system
- The antenna(s) used for this transmitter must not operate in conjunction with any other antenna or transmitter and must be installed to provide a separation distance

of at least 20 cm from all persons
- Only approved antennas with RP-SMA connectors are allowed to be used on this module
- Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the device

Contact Runwise via phone at 833-264-5371 or via email at support@runwise.com if there are any questions regarding integration or for other information.

3. Installing the Module

Before installing the module, note the serial number listed on the shield. This will be needed later to verify the operation of the unit and complete system configuration. Align the two connectors on the bottom of the module with the mating connectors on the host device. Press the module until the connectors are fully mated. If applicable, replace the host device housing. Ensure that the FCC label is on the outside of the device housing indicating that the RF module is installed.

4. Required Documentation

4.1. Module Label

This device complies with Part 15 of 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.

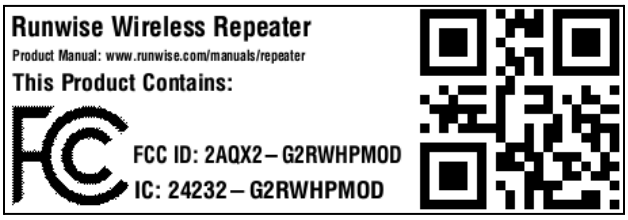
The module label must be affixed to the module before installation in the host device. If the module label is not present, contact Runwise via phone at 833-264-5371 or via email at support@runwise.com and do not install or otherwise use the module.

4.2. Host Device Label

The FCC and IC IDs must be displayed on the host device in a permanent fashion which is visible at the time of purchase, and is reasonably legible without magnification. The information can be displayed on a permanently-affixed label, etched or embossed on the exterior of the device housing, or displayed electronically. If the host is 4" x 4" or larger, the information must also include a statement for compliance with Part 15 of the FCC Rules. If the host is smaller than 4"x4", the FCC Rules Part 15 compliance statement may be included

in the manual. For reference, see example host labels below.

Small Host (less than 4”x4”):



NOTE: In the example shown, the host label does not contain the required FCC statements, and the following must be included in the host User’s Manual:

> **This device complies with Part 15 of 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.

Large Host (greater than or equal to 4”x4”):

	Contains FCC ID: 2AQX2-G2RWHPMOD **Contains IC: 2432-G2RWHPMOD** **This device complies with Part 15 of 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.

4.3. Host Device User’s Manual

The User’s Manual for the host device shall include the full contents found in sections 7, 8, and 9 of this Module User’s Manual.

5. Operation

The Module is capable of accepting power from the host device. Operation can be verified when configuring the host device. Refer to its User's Manual for details.

The ISM band transmission of the Module has a duty cycle range of 0.27% to 30.5% with the max duty cycle possible being 30.5%.

6. Regulation Reference

FCC 15.247
ISED RSS-247

7. FCC ID: 2AQX2-G2RWHPMOD

WARNING: The Federal Communications Commission warns that changes or modifications of the radio module within this device not expressly approved by Runwise could void the user's authority to operate the equipment.

To comply with FCC's RF radiation exposure requirements, the antenna(s) used for this transmitter must be installed such that a minimum separation distance of 20 cm is maintained between the radiating element (antenna) & any user's or bystander at all times and must not be co-located or operating in conjunction with any other antenna or transmitter.

Note: 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 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 or 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.

8. IC Notice:

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.

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, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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 isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

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.

This radio transmitter IC: 24232-G2RWHPMOD has been approved by Industry Canada to operate with the antenna types listed below 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.

Le présent émetteur radio IC: 24232-G2RWHPMOD a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous 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.

9. List of Approved Antennas:

9.1. 915 MHz Antennas:

Manufacturer	***Antenna***	***Description***	***Type***	***Peak Gain (dBi)***	***Ω***	***Connector Type***	***Notes***
Taiwancast	ANT-SMA-5CM	SMA antenna, quarter wave helical, 50mm long, for 902-928 MHz band	Monopole	+0	50	SMA	3
Taiwancast	ANT-SMA22-915-109.5	912 MHz to 918 MHz Omnidirectional Antenna	Omni / Monopole	+1.3	50	RP-SMA	
TE Connectivity Linx	ANT-915-NUB-SMA	RF ANT 915MHZ SHORT WHIP SMA	Monopole	+3.9	50	SMA	3
Taiwancast	TWCAST-915ROD	902 MHz to 928 MHz Omnidirectional Antenna	Omni / Monopole	+5.8	50	N	2
L-COM	HGV-906U-NM	824 MHz to 960 MHz 6 dBi Omnidirectional Antenna	Omni / Monopole	+6	50	N	2
Taoglas Limited	IS.05.B.301111	Low Profile ISM Antenna	Dome / Omni	+3.14	50	SMA	3
Taoglas Limited	TI.19.2113	RF ANT 915 MHZ WHIP TILT SMA MALE	Dipole	+2.5	50	SMA	1
PCTEL	MYA9153	Aluminum Yagi Antenna, 3 element	Yagi	+8.1	50	N	2

NOTES:

1 - *Antenna tested for compliance using SMA RF connector which is not applicable in production hardware. Any equivalent antenna with RP-SMA connector type, same or lower gain, same physical arrangement, and generates the same in-band and out-of-band characteristics in all spatial directions is considered approved by equivalency.*

2 - *Antenna tested for compliance using RP-SMA to N adapter, which will be permanently glued to the antenna in production.*

3 - *Antenna will not be used with SMA connector. Any equivalent antenna with RP-SMA connector type, same or lower gain, same physical arrangement, and generates the same in-band and out-of-band characteristics in all spatial directions is considered approved by equivalency.*

9.2. 2.4 GHz Antennas:

Manufacturer	*Antenna*	*Description*	*Type*	*Peak Gain (dBi)*	*Ω*	*Connector Type*
Johanson	2450AT42A100	2.4GHz Ceramic Chip RF Antenna 2.4GHz ~ 2.5GHz 0dBi Solder Surface Mount	Dielectric Resonator	+0	50	PCB Surface Mount

10. Additional Testing

Manufacturers are required to ensure that their end device containing this module meets all requirements for FCC Part 15 Subpart B compliance testing with the modular transmitter installed. For use in Canada, IC compliance testing is also required.

This module is authorized for stand-alone host configurations; any configuration which includes multiple radios within 20 cm and which transmit simultaneously with the Runwise module may require additional testing and certification requirements. In cases where other transmitters must be co-located with the Runwise RF Module, contact Runwise via phone at 833-264-5371 or via email at support@runwise.com for further assistance.

10.1. High Transmit Mode

The module may need to be placed into high transmit mode for compliance testing by the host device OEM. Refer to the following information to facilitate this.

- The UART RX and TX lines are pins 2 and 3 respectively, on the 20-pin connector.
- The UART settings are as follows:
    - Baud Rate: 230400
    - Data: 8-bit
    - Parity: none
    - Stop Bits: 1
    - Flow Control: none
- Send the command `rf-test` to place the firmware in RF test mode.
- To change the RF channel, send the command `chan-set x`, where x is a value 0-59, inclusive
- To initiate transmission send the command `tx-cont -m`
- To change the transmit power send the command `tx-power x`, where x is a number in the following set: {-20, -15, -10, -7, -5, -3, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13}
- To stop transmission send the escape (0x1B) character
- Send the command `rf-stat` to prompt the module to return its settings for the test mode