MCU Embedded Wireless LAN 802.11ax + Bluetooth® Low Energy 5.4 + 802.15.4 Module

WKR612AA1

User Manual

By purchase of any products described in this document, the customer is deemed to understand and accept contents of this document.

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Notes :

a. Limitation of Warranty

i) KAGA FEI provide warranties only if the product is operated under the condition set forth in this specification. Please note that KAGA FEI shall not be liable for any defect and/or malfunction arising from use of the product under the terms and conditions other than the operating conditions hereof. In addition, when this product is used under environmental conditions such as over voltage which is not guaranteed, it may be destroyed in short mode. To ensure the security of customer's product, please add an extra fuse or/and a protection circuit for over voltage.

ii) In some cases, KAGA FEI may use replacements as component parts of products. Such replacement shall apply only to component part of products, which KAGA FEI deems it possible to replace or substitute according to (i) scope of warranty provided in this specification (e.g. electric characteristics, outline, dimension, conditions of use, reliability tests, official standard (type approvals etc.)) and (ii) quality of products. KAGA FEI also ensures traceability of such replacement on production lot basis.

b. Instruction for Use (CAUTION)

i) Because product is not designed for radiation durability, please refrain from exposing product to radiation in the use.

ii) Communication between this product and other might not be established nor maintained depending upon radio environment or operating condition of this product and other products with wireless technology.

iii) This product operates in the unlicensed ISM band at 2.4GHz/5GHz. In case this product is used around the other wireless devices which operate in same frequency band of this product, there is a possibility that interference occurs between this product and such other devices. If such interference occurs, please stop the operation of other devices or relocate this product before using this product or do not use this product around the other wireless devices.

c. Term of Support

i) In the case that customer requests KAGA FEI to customize the hardware of this Product to meet such customer's specific needs, KAGA FEI will make commercially reasonable effort to modify such hardware or software at customer's expense; provide however, the customer is kindly requested to agrees it doesn't mean that KAGA FEI has obligations to do so even in the case it is technically difficult for KAGA FEI.

ii) Any failure arising out of this Product will be examined by KAGA FEI regardless of before or after mass production. Customer agrees that once such failure is turned out not to be responsible for KAGA FEI after aforesaid examination, some of the technical support shall be conducted by KAGA FEI at customer's expense; provided however, exact cost of this technical support can be agreed through the negotiation by the parties.

iii) Do not alter hardware and/or software of this Product. Please note that KAGA FEI shall not be liable for any problem if it is caused by customer's alteration of Hardware without KAGA FEI 's prior approvals.

iv) KAGA FEI does not guarantee functions and performances which depend on the customer's firmware. KAGA FEI does not assume liabilities for defects and failures.

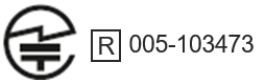
d. Term of Warranty
   i) KAGA FEI warrants only that this Product is in conformity with this Specification for one year after purchase and shall in no event give any other warranty.

e. Items of the Specification
   i) Any question arising from the Specification shall be solved in good faith through mutual discussion by the parties hereof.

f. Caution for Export Control
   i) This Product may be subject to governmental approvals, consents, licenses, authorizations, declarations, filings, and registrations for export or re-export as required by Japanese Foreign Exchange and Foreign Trade Law (including related laws and regulations) and/or any other country's applicable laws or regulations related to export control.
   ii) If this Product will be exported or re-exported, it is strongly recommended that customers check and confirm the necessary procedures to export or re-export this Product as required by applicable laws and regulations, and if necessary, customers must obtain the necessary and appropriate approvals or licenses from governmental authority at their own risk and expense.

Japan Regulatory Information

a) This module is approved with the specific antenna on this module. Please ensure that your product can also bear a label with the following information. If the product is so small that it is not practicable to place the label, you can also place it in the instruction manual and package. The mark diameter shall be easily legible without using a device such as light microscopes.



b) It is recommended to include the following sentence in the user manual of your product: This product installs a radio system which has been approved as a radio station in a low power data communication system based on the Radio Law.

WKR612 : 005-103473

c) Region is set to US as default, and 12ch(2467MHz) and 13ch(2472MHz) are disabled. Please change the region setting to Japan, if it is needed to use these channels on the final product.

Canada Regulatory Information

a) This device contains license exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license exempt RSS(s). Operation is subject to the following two conditions:
1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicable s aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:
1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

b) The antenna used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

L'antenne utilize e pour cet émetteur ne doit pas être co localisée ou fonctionner conjointement avec une autre antenne ou un autre émetteur.

c) Please use the specified supply voltage in "Recommendation operating range" when installing this product. The final products must contain a power supply regulator and must ensure the applied voltage to this product is adjusted to always be within the operating voltage range.

Veuillez utiliser la tension d'alimentation précisée dans "Recommandation gamme opératoire" lorsque vous i nstallez ce produit. Les produits finaux doivent contenir un régulateur de la source de courant et doivent garantir que le voltage appliqué à ce produit soit ajusté de sorte à être toujours à l'intérieur de la gamme de voltage en opération.

d) Please ensure and control your host product not to transmit on channels 12 and 13.

S'il vous plaît assure et contrôle ton produit de l'hôte pour ne pas transmettre sur les canaux 12 et 13.

e) This product for operation in the band 5150-5250MHz and 5250-5350MHz are intended for indoor use only to reduce the potential for harmful interference to co-channel mobile satellite systems.

Ce produit dont la fréquence de fonctionnement se situe entre 5150-5250MHz et 5250-5350MHz est conçu uniquement pour une utilisation en intérieur afin de réduire les risques d'interférences nuisibles avec les systèmes mobiles par satellite à deux cannaux.

f) Please inform your users that under Innovation, Science and Economic Development Canada (ISED) regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by the ISED. 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.

Veuillez informer vos utilisateurs que En vertu des règlements d' Innovation, Sciences et Développement économique Canada, cet émetteur radio ne peut fonctionner qu'avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Innovation, Sciences et Développement économique Canada. Pour réduire la probabilité d'interférence avec d'autres utilisateurs, le type d'antenne et son gain doivent être choisis pour que la puissance isotrope rayonnée équivalente (e.i.r.p.) soit supérieure à celle nécessaire pour une communication réussie.

g) Please inform your users that high power radars are allocated as primary users (i.e. priority users) of the bands 5250-5350MHz and 5650-5850MHz and that these radars could cause interference and/or damage to the product.

Veuillez informer vos utilisateurs que les radars à haute puissance sont désignés comme utilisateurs principaux (c-à-d des utilisateurs prioritaires) des fréquences 5250-5350MHz et 5650-5850MHz et que ces radars pourraient provoquer des interférences et/ou endommager les appareils.

h) This product shall not be capable of transmitting in the band 5600-5650MHz.

Ce produit ne doit pas être capable de transmettre entre les fréquences 5600-5650MHz.

i) The device driver/firmware for this product is downloaded from a limited access web site provided by the device manufacturer and is implemented specifically for this product. The ID/password required to access the web site can be obtained after the conclusion of a contract with the device manufacturer.

Le pilote/micrologiciel du dispositif pour ce produit est téléchargé à partir d'un site internet à accès limité fourni par le fabricant de l'appareil et est mis en oeuvre spécifiquement pour ce produit. L'identifiant/mot de passe requis pour accéder au site internet peut être obtenu après la conclusion d'un contrat avec le fabricant du périphérique.

j) Product Information
HVIN: WKR612
PMN: WKR612
FVIN: N/A

k) Data transmission is always initiated by software, which is the passed down through the MAC, through the digital and analog baseband, and finally to the RF chip. Several special packets are initiated by the MAC. These are the only ways the digital baseband portion will turn on the RF transmitter, which it then turns off at the end of the packet. Therefore, the transmitter will be on only while one of the aforementioned packets is being transmitted. In other words, this device automatically discontinue transmission in case of either absence of information to transmit or operational failure.

La transmission des données est toujours initiée par le logiciel, puis les données sont transmises par l'intermédiaire du MAC, par la bande d e base numérique et analogique et, enfin, à la puce RF. Plusieurs paquets spéciaux sont initiés par le MAC. Ce sont les seuls moyens pour qu'une partie de la bande de base numérique active l'émetteur RF, puis désac tive celui-ci à la fin du paquet. En con sé quence l'émetteur reste uniquement activé lors de la transmission d'un des paquets susmentionnés. En d'autres termes, ce dispositif interrompt automatiquement toute transmission en cas d'absence d'information à transmettre ou de défaillance.

l) This radio transmitter (28568-WKR612) has been approved by Innovation, Science and Economic Development Canada to operate with the antenna model listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.
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.

Model No.	Antenna Type	Frequency	Antenna Gain (Max.)	Impedance
AW-001	Monopole	2400-2500 MHz 5150-5850 MHz	-0.4dBi 3.2dBi	50Ω 50Ω
1461870100 1461870150 1461870200 1461870300	Dipole	2400-2500 MHz 5150-5850 MHz	3.2dBi 4.5dBi	50Ω 50Ω
2344657-1 2344657-2 2344657-3 2344657-4 2344657-9	Dipole	2400-2500 MHz 5150-5875 MHz	1.1dBi 4.9dBi	50Ω 50Ω

Le présent émetteur radio (28568-WKR612) a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les modèle d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les mod è le d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout modèle figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.
De réduire les interférences potentielles avec les autres utilisateurs, il est nécessaire de choisir le type d'antenne et le gain ne dépassant pas (e.i.r.p.) accepté pour une communication normale.

Modèle Non	Type d'antenne	Fréquenc es	Gain de l'antenne (Max.)	l'impédance
AW-001	Monopole	2400-2500 MHz 5150-5850 MHz	-0.4dBi 3.2dBi	50Ω 50Ω
1461807100 1461870150 1461870200 1461870300	Dipole	2400-2500 MHz 5150-5850 MHz	3.2dBi 4.5dBi	50Ω 50Ω

2344657-1 2344657-2 2344657-3 2344657-4 2344657-9	Dipole	2400-2500 MHz 5150-5875 MHz	1.1dBi 4.9dBi	50Ω 50Ω

m) This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the ISED radio frequency (RF) Exposure rules. This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body.

Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques (RF) RSS-102 de l'ISED. Cet équipement doit être installé et utilisé en gardant une distance de 20cm ou plus entre le radiateur et le corps humain.

n) Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

o) This product is authorized under the following conditions in Canada. Please do not use this equipment outside the approval range.

Ce produit est autorisé dans les conditions suivantes au Canada. S'il vous plaît ne pas utiliser en dehors de la plage d'approbation.

Channel center frequency[MHz]	Chanel number	Master Device	Client Device	Remarks
2402 – 2480	1 – 79	Yes	Yes	Bluetooth BDR/EDR
2402 – 2480	0 – 39	Yes	Yes	Bluetooth LE
2405 – 2480	11 – 26	Yes	Yes	802.15.4
2412 – 2462	1 – 11	Yes	Yes	
5180 – 5240	36- 48	Yes	Yes	Devices are restricted to indoor operation only and the end product must be labelled accordingly
5260 – 5320	52 – 64	No	Yes	Devices are restricted to indoor operation only and the end product must be labelled accordingly
5500 – 5580	100 – 116	No	Yes	excluding ch114
5600 – 5640	120 – 128	N/A	N/A	Prohibited band (TDWR)
5660 – 5720	132 – 144	No	Yes	
5745 – 5825	149 – 165	Yes	Yes	excluding ch163
5845 – 5885	169 – 177	N/A	N/A	

p) Please label ISED certification number and Host Marketing Name (HMN) at any location on the exterior of your product. Please indicate ISED certification number by either one of the following method:

Veuillez étiqueter le numéro de certification ISED et le nom commercial de l'hôte à tout emplacement sur l'extérieur de votre produit. Veuillez indiquer le numéro de certification ISED par l'une des méthodes suivantes.

-Contains Transmitter module IC: 28568-WKR612
-Contains IC: 28568-WKR612

Host Marketing Name (HMN)
-The HMN is the name or model number of a final product, which contains a certified radio module.
-The Host Marketing Name (HMN) shall be displayed according to the e-labelling requirements of RSS-Gen, section 4.4 or indicated on the exterior of the host product or on the product packaging, or in the product literature, which shall be supplied with the host product or readily available online.

q) Please include the following statements in the user manual of the host device of this module both in English and French:

(i) This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:
1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux RSS d'Innovation, Sciences et Développement économique 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;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

(ii) The device for operation in the bands 5150-5250 MHz and 5250-5350MHz are only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems.

Ce produit dont la fréquence de fonctionnement se situe entre 5150-5250MHz et 5250-5350MHz est conçue uniquement pour une utilisation en intérieur afin de réduire les risques d' interferences nuisibles avec les systèmes mobiles par satellite à deux cannaux.

(iii) Data transmission is always initiated by software, which is the passed down through the MAC, through the digital and analog baseband, and finally to the RF chip. Several special packets are initiated by the MAC. These are the only ways the digital baseband portion will turn on the RF transmitter, which it then turns off at the end of the packet. Therefore, the transmitter will be on only while one of the aforementioned packets is being transmitted. In other words, this device automatically discontinue transmission in case of either absence of information to transmit or operation al failure.

La transmission des données est toujours initiée par le logiciel, puis les données sont transmises par l'intermédiaire du MAC, par la bande de base numérique et analogique et, enfin, à la puce RF.
Plusieurs paque ts spéciaux sont initiés par le MAC. Ce sont les seuls moyens pour qu'une partie de la bande de base numérique active l'émetteur RF, puis désactive celui-ci à la fin du paquet. En conséquence, l'émetteur reste uniquement activé lors de la transmission d'un des paquets susmentionnés. En d'autres termes, ce dispositif interrompt automatiquement toute transmission en cas d'absence d'information à transmettre ou de défaillance.

(iv) This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the ISED radio frequency (RF) Exposure rules. This equipment should be installed and operated keeping the radiator at least 20cm or more away from human body.

Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques (RF) RSS-102 de l'ISDE. Cet équipement doit être installé et utilisé en gardant une distance de 20 cm ou plus entre le radiateur et le corps humain.

U.S. Regulatory Information

a) 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.

b) Please use the specified supply voltage in "Recommendation operating range" when installing this product. Please use the specified supply voltage in "Recommendation operating range" when installing this product. The final products must contain a power supply regulator and must ensure the applied voltage to this product is adjusted to always be within the operating voltage range.

c) Please ensure and control your host product not to transmit on channels 12 and 13.

d) Data transmission is inevitably initiated by software of host devices with the exception that several special packets are transmitted by the MAC. However, data transmission is terminated by end of packets in any cases. Therefore, it is RF transmitted only while packets are being transmitted. This modular transmitter automatically discontinues transmission in case of either absence of information to transmit or operational failure because RF parts will not be ON in neither case.

e) The device driver/firmware for this product is downloaded from a limited access web site provided by the device manufacturer and is implemented specifically for this product. The ID/password required to access the web site can be obtained after the conclusion of a contract with the device manufacturer.

f) The antenna used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

g) Frequency Tolerance: 2.4GHz Band ±20 ppm, 5GHz Band ±20 ppm

h) The device is designed to use the antennas listed below. Do not modify the antenna or any other part of the module. Any modifications will invalidate the modular certifications and require new approvals for the host system.

Model No.	Antenna Type	Frequency	Antenna Gain (Max.)	Impedance
AW-001	Monopole	2400-2500 MHz 5150-5850 MHz	-0.4dBi 3.2dBi	50Ω 50Ω
1461870100 1461870150 1461870200 1461870300	Dipole	2400-2500 MHz 5150-5850 MHz	3.2dBi 4.5dBi	50Ω 50Ω

2344657-1 2344657-2 2344657-3 2344657-4 2344657-9	Dipole	2400-2500 MHz 4900-5875 MHz	1.1dBi 4.9dBi	50Ω 50Ω

i) CAUTION:

- Changes or modifications not expressly approved by the party responsible for compliance could void the use's authority to operate the equipment.

- To maintain compliance with FCC's RF exposure guidelines, use only the supplied antenna. Unauthorized antenna, modification, or attachments could damage the transmitter and may violate FCC regulations.

- To maintain compliance with FCC's RF exposure guidelines, this equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

- This product is authorized under the following conditions in USA and Canada. Please do not use this equipment outside the approval range.

Channel center frequency[MHz]	Chanel number	Master Device	Client Device	Remarks
2402 – 2480	1 – 79	Yes	Yes	Bluetooth BDR/EDR
2402 – 2480	0 – 39	Yes	Yes	Bluetooth LE
2405 – 2480	11 – 26	Yes	Yes	802.15.4
2412 – 2462	1 – 11	Yes	Yes	
5180 – 5240	36- 48	Yes	Yes	Devices are restricted to indoor operation only and the end product must be labelled accordingly
5260 – 5320	52 – 64	No	Yes	Devices are restricted to indoor operation only and the end product must be labelled accordingly
5500 – 5580	100 – 116	No	Yes	excluding ch114
5600 – 5640	120 – 128	No	Yes	Client device operation allowed under KDB 905462
5660 – 5720	132 – 144	No	Yes	
5745 – 5825	149 – 165	Yes	Yes	excluding ch163
5845 – 5885	169 – 177	N/A	N/A	

j) This module can change the output power depending on the circumstances through the application software developed by the module installer. It is not allowed for end users to change the output power.

k) Please label the FCC ID at any location on the exterior of your product. Please indicate the FCC ID by either one of the following methods:
-Contains Transmitter Module FCC ID: 2A6NFWKR612
-Contains FCC ID: 2A6NFWKR612

l) Please include the following statements in the user manual of the host device of this module;

FCC CAUTION

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Compliance with FCC requirement 15.407(c)
Data transmission is always initiated by software, which is passed down through the MAC, through the digital and analog baseband, and finally to the RF chip. Several special packets are initiated by the MAC. These are the only ways the digital baseband portion will turn on the RF transmitter, which it then turns off at the end of the packet.
Therefore, the transmitter will be on only while one of the aforementioned packets is being transmitted. In other words, this device automatically discontinues transmission in case of either absence of information to transmit or operational failure.

Frequency Tolerance: ±20 ppm (2.4GHz)

Frequency Tolerance: ±20 ppm (5GHz)

This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

m) This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment should be installed and operated keeping the radiator at least 20cm or more away from human body.

n) This device complies with the following FCC Rules:
Part 15 Subpart C
Part 15 Subpart E

o) This modular transmitter is only FCC authorized for the specific rule parts listed on our grant, host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification.

Host manufacturer in any case shall ensure host product which is installed and operating with the module is in compliant with Part 15B requirements. Please note that for a Class B or A digital devices or peripheral, the instructions furnished the user manual of the end-user product shall include statement set out in §15.105 Information to the user or such similar statement and place it in a prominent location in the text of host product manual. Original texts as following:

<For Class B>
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.

<For Class A>
NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. 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. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

p) Co-location of this module with other transmitters that operate simultaneously are required to be evaluated using the FCC multi-transmitter procedures. When installing this module to your final devices, please make sure to carry out all the necessary evaluations according to the applicable guidelines like follows:
-for RF exposure: KDB 447498, KDB 996369 and any other relevant guidelines
-for EMC: KDB 996369 D04 and any other relevant guidelines

q) When you install this module to your final devices, please ensure that your final composite product complies with the applicable FCC rules in reference to a guidance in KDB 996369.

r) When you install this module to your final devices, please ensure to perform all the required equipment authorization and testing for the technical parameters which are not covered by the module grant (e.g., unintentional radiator Part 15 Subpart B requirements, or transmitters used in the host which are not previously approved as modules).

CE Regulatory Information

a) When your end product installs this module, it is required to proceed additional certification processes before placing on the market in EU member states to make your products fully comply with relative EU standards.

b) KAGA FEI can provide you the test reports of conducted measurement portion for the radio module. You can utilize the test reports for the certification processes of your end product as it requires radio testing.