

User's Manual

ISA100 Wireless Module F9195KA

1. Description

F9195KA ISA100 wireless Module provides a high performance RF transceiver solution for ISA100.11a wireless networks based on 2.4GHz IEEE 802.15.4.



2. General Specification

Table1 General Specification

Item	Specification
System Clock	50MHz (Main CPU) 24MHz (Radio Part) 32.768kHz (RTC Part)
Operating Temperature	-40 to +65 deg. C.

3. Radio Specification

Table2 Radio Specification

Item	Specification
Equipment type	Transceiver
Frequency of operation	2405 to 2475MHz
Bandwidth / Channel spacing	2.65MHz / 5MHz
Type of modulation	O-QPSK, DSSS
Antenna type	Sleeve antenna(2dBi), Collinear antenna(6dBi, 9dBi), Patch antenna(15dBi)
Antenna connector type	Hirose H.FL unique connector. And the installation and replacement of antenna are done by professionals as directed in the user's manual.
Antenna gain with cable loss	+2.00dBi, +6.00dBi, +9.00dBi,+15.00dBi
ITU code	G1D
Operating Power supply	DC 5.0V, DC 3.3V (F9195KA is provided with stable power supply from the host device)

4. Block Diagram

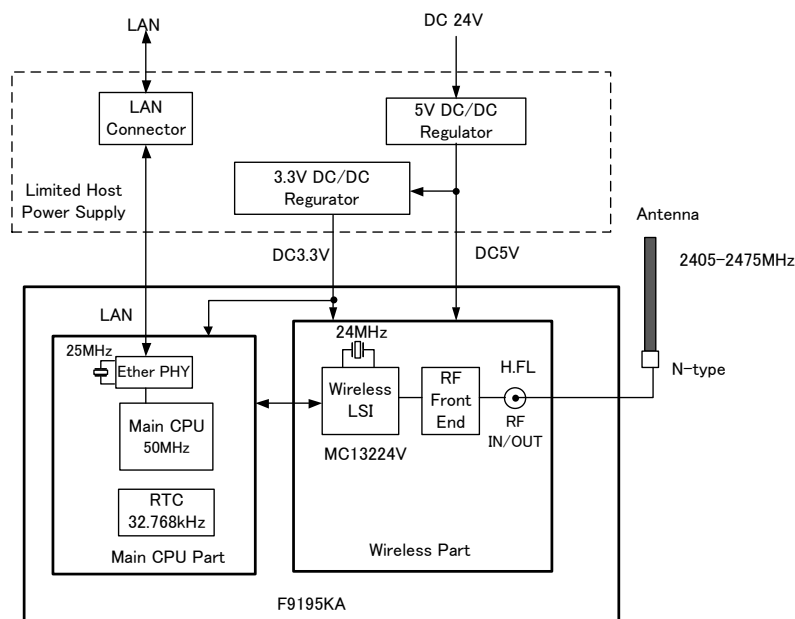


Figure1 System Block Diagram

5. Theory of operation

5.1. Power Circuitry

F9195KA do not have voltage regulator. However, this application limited the host equipment, and F9195KA's voltage is supplied from voltage regulator of the limited host power supply. (Figure1-broken line block)

The limited host power supply contains two regulators, i.e., 5V DC/DC and 3.3V DC/DC (in Figure1)

- 5V DC/DC supplies a regulated 5Vdc to the 3.3V DC/DC and the RF amplifier in the Wireless Part.
- 3.3V DC/DC supplies a regulated 3.3Vdc to the Wireless LSI and the other logic IC.

5.2. Clocks

F9195KA has four clock resources.

- Wireless LSI Reference oscillator - The default frequency for the reference oscillator is 24MHz and the mounted crystal is a 24MHz device that meets the wireless LSI specifications.
- 32.768kHz external Real Time Clock Module – High stability time base
- Main CPU operates at 50MHz using internal PLL.
- 25MHz crystal provides an accurate time base for the Ethernet PHY.

5.3. Wireless LSI - MC13224V (Figure1)

The MC13224V is a single package device that contains an ARM7 MCU, SRAM, NVM, and IEEE 802.15.4 transceiver. All of the wireless part control is done through this part and it also provides the radio function and RF control. In this module:

- The operating voltage is 3.3Vdc supplied from the regulator of limited host power supply.
- The primary clock source is provided by the 24MHz crystal reference oscillator.

5.4. RF Front End Circuitry

F9195KA RF Front End circuitry is shown in Figure1. RF Front End contains the RF amplifier, the variable attenuator, the low-pass filter and the RF switches. The MC13224 uses the RF port as a bi-directional single-ended port for both transmit and receive. The RF Switch multiplexes TX port path and RX port path based on the control signal of MC13224.

For the transmit path, MC13224 RF port drives the RF switch. And RF switch is enabled TX port path by the control signal of MC14224. TX port of RF switch drives input of the variable attenuator. The variable attenuator is a digital step attenuator covering 31 dB attenuation. Setting value of the attenuation is provided by the Main CPU. Attenuator output drives the RF amplifier input. The RF amplifier output drives a low-pass filter. The low-pass filter is to eliminate out-of-band spurious and harmonic signals. The low-pass filter feeds the RF switch. RF switch is enabled TX port path by the control signal of MC13224. And then RF switch drives the antenna connector (RF IN/OUT)

For the receive path, the incoming signal is derived from the antenna connector, and it drives the RF switch. The RF switch is enabled RX port path by the control signal of MC13224, and the RF switch drives the RF port of the MC13224.

6. FCC Compliance

ISA100 Wireless Module F9195KA has been certified per FCC Part 15 rules for integration into products without further testing or certification. To fulfill the FCC certification requirements, the final product manufacture using F9195KA module must ensure that the information provided on the F9195KA module label is placed on the outside of the final product. F9195KA module is labeled with its own FCC ID Number. If the FCC ID is not visible when the module is installed inside another product, then the outside of the product into which the module is installed must also display a label referring to enclosed module. This exterior label can use wording such as the following:

Contains Transmitter Module FCC ID: SGJ-WFC006

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.

The final product manufacture using the F9195KA module must only use the approved antenna that has been certified with this module.

FCC approved Antenna

Model Name	Specification
ASCL-NP-00400	+2.14dBi Sleeve antenna
ASCL-NP-00200	+6.0dBi Collinear antenna
ASCL-NP-00300	+9.0dBi Collinear antenna
MTA-11PA15-Y0	+15dBi Patch antenna

Co-Located:

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

FCC CAUTION

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

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.

RF Exposure Compliance

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET65. This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body (excluding extremities: hands, wrists, feet and ankles).

7. Industry Canada (IC) Compliance

Labeling requirements for Industry Canada are similar to those of the FCC. A clearly visible label on the outside of the final product enclosure must display the following text:

Contains Transmitter Module IC: 8999A-WIC003

This Class A digital apparatus complies with Canadian ICES-003.

French: Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

This device complies with Industry Canada licence-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: 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.

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.

This radio transmitter IC Number 8999A-WIC003 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.

Antenna type:	Gain:
Sleeve	2.14dBi, 50Ω
Collinear	9dBi, 50Ω
Patch compound	15dBi, 50Ω

French: Le présent émetteur radio IC Number 8999A-WIC003 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.

Antenna type:	Gain:
Sleeve	2.14dBi, 50Ω
Collinear	9dBi, 50Ω
Patch compound	15dBi, 50Ω

RF Exposure Compliance:

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the IC 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 (excluding extremities: hands, wrists, feet and ankles).

French: 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) CNR-102 de l'IC. Cet équipement doit être installé et utilisé en gardant une distance de 20 cm ou plus entre le dispositif rayonnant et le corps (à l'exception des extrémités : mains, poignets, pieds et chevilles)