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Model MR60I13I6 Datasheet

60 GHz radar sensor Module

[BGT60TR13C]

Version: 1.0

<Specification may be changed without prior notice>

Sichuan AI-Link Technology Co., Ltd

四川爱联科技股份有限公司

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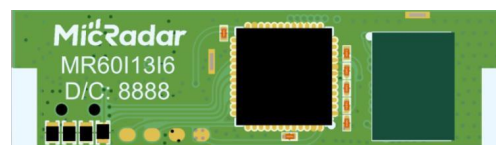
Below Space Intentionally Left Blank for Customer Confirmation or Comments

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Please sign and return this page and the front page to our company by email or fax, or by courier to the following address: Address: Anzhou Industrial Park, Mianyang, Sichuan, P.R.C Company: Sichuan AI-Link Technology Co., Ltd.			
Module Name		MR60I13I6	
	Designed by	Reviewed by	Approved by
Signature	TANG,wei	FAN,xijun	DING, ShuangPeng
Date	2025/5/22	2025/5/22	2025/5/22

Model MR60I13I6

➤ Compatible Standards

60 GHz radar sensor for FMCW operation



➤ SoC

BGT60TR13C

➤ Product Size

30.0mmx8.5mmx4.2mm

➤ Product Weight

1.3g

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Features

Radar sensor

- ✚ 60 GHz radar sensor for FMCW operation
- ✚ Digital interface for chip configuration and radar data acquisition
- ✚ Optimized power modes for low-power operation
- ✚ Integrated state machine for independent operation

Revision Record

Revision	Date	Description	Edited by
V1.0	2025/5/27	Premier Release	TANG,wei
* Private Preview Only			

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1 General Description

1.1 System Overview

This radar module utilizes 60GHz millimeter-wave radar technology to achieve motion sensing and trajectory simulation, thereby enabling gesture recognition. Based on the FMCW (Frequency-Modulated Continuous Wave) radar system, it wirelessly detects human movements in specific environments.

The module features the following operational characteristics::

- ✚ Real-time Personnel Positioning Detection;
- ✚ Supports Custom Development for Versatile Applications;
- ✚ Universal UART Interface with Open Protocol;
- ✚ Low Power Output, Safe for Human Use;
- ✚ Unaffected by temperature, light, or dust, the module ensures reliable performance and is widely applicable across industries..

1.2 System Properties

Dimension	Typically, 30.0mmx8.5mmx4.2mm
Chipset	BGT60TR13C
Operating Frequency	60 – 61 GHz 61 – 64 GHz
Antenna	AIP Antenna
Operating Voltage	5.0V±5%
PCB Information	4-layers design (1.2+/-0.15mm)
Peripheral Interface	UART
Rate	NA
Operating Temperature	-20°C to +70°C
Storage Temperature	-40°C to +85°C
ESD Protection	NA

1.3 Diagram

- ✚ Baseband chain consisting of high pass filter, low noise voltage gain amplifier (VGA), and antialiasing filters
- ✚ Three ADC channels with 12 bits resolution and up to 4 MSps sampling rate to sample the RX-IF channels
- ✚ Integrated RF-PLL, timers, counters, and FSM to run set of frames in standalone mode (no communication with AP required except first trigger and raw data transfer)
- ✚ Full duplex FIFO structure as data buffer (196 kbit = 8192 words x 24 bits)
- ✚ Linear Feedback Shift Register (LFSR) test pattern generator on chip for data transfer check
- ✚ 8 to 10 bits sensor ADC for power and temperature measurement
- ✚ Standard SPI mode for configuration and status register read accesses
- ✚ Dedicated power modes for power reduction

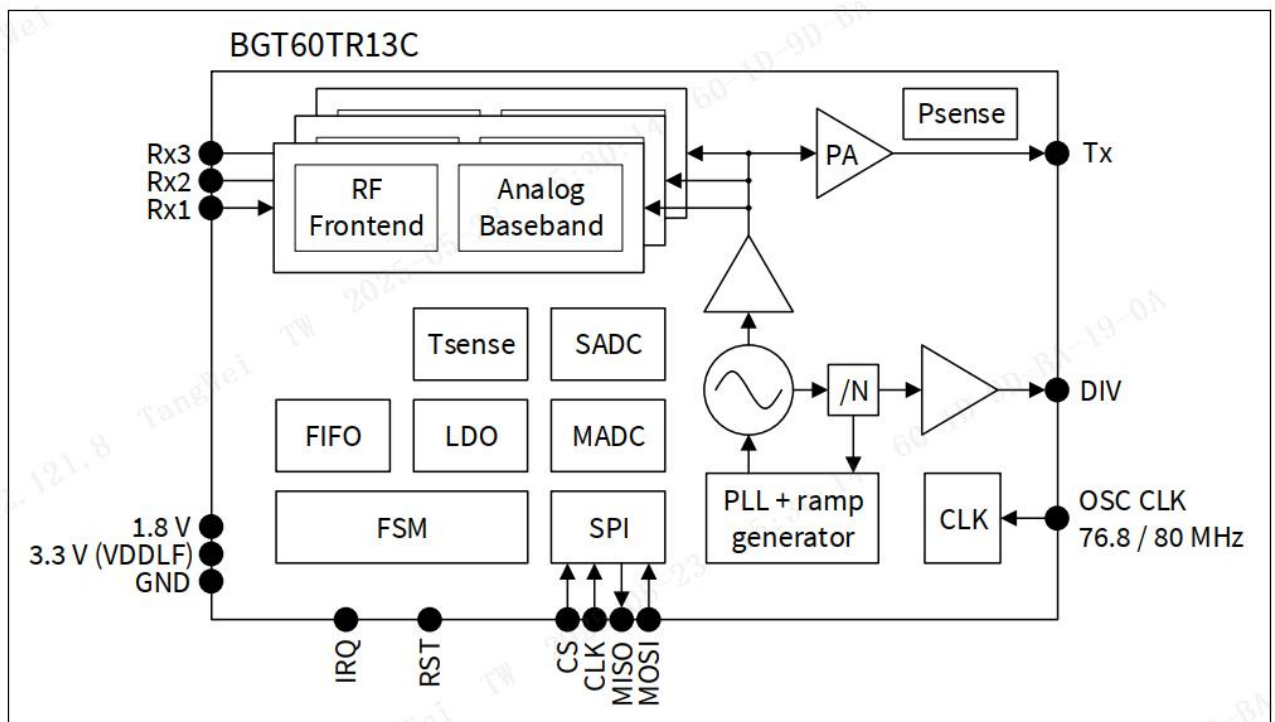


Figure 1: MR60I13I6 Block Diagram

2 Mechanical Dimensions

2.1 Mechanical Outline Drawing

Typical Dimension (W x L x T): 30.0mmx8.5mmx4.2mm

General tolerance:

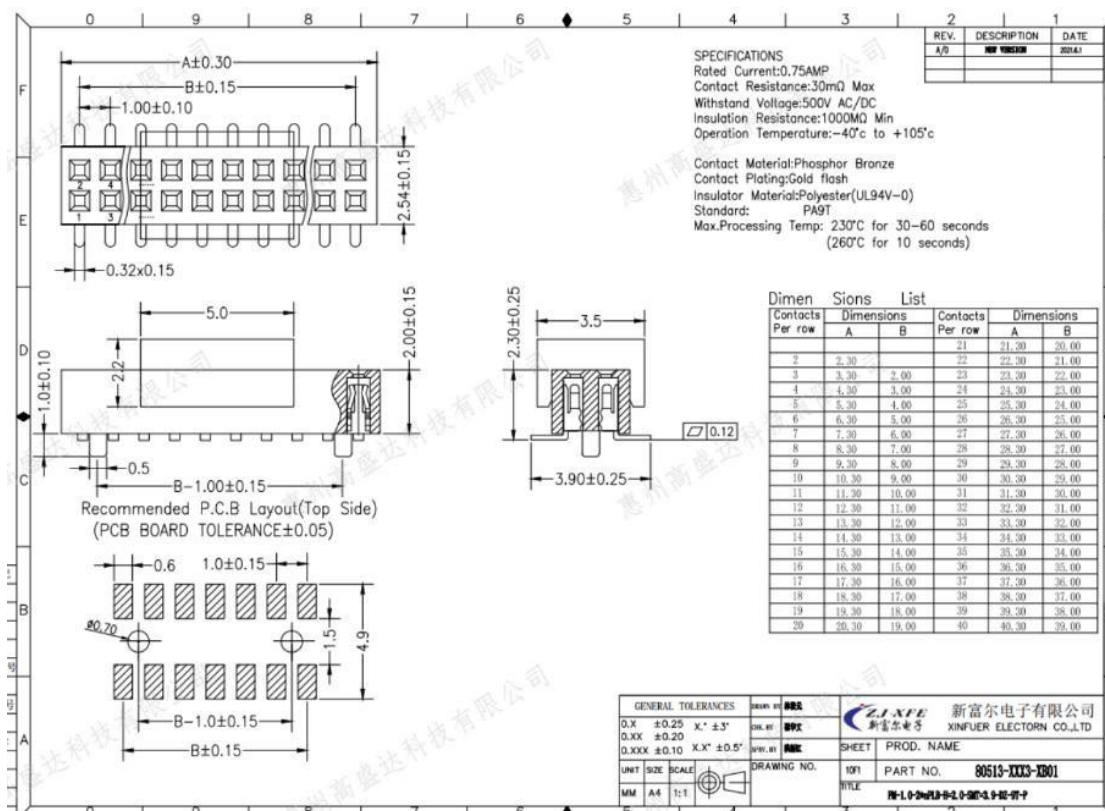
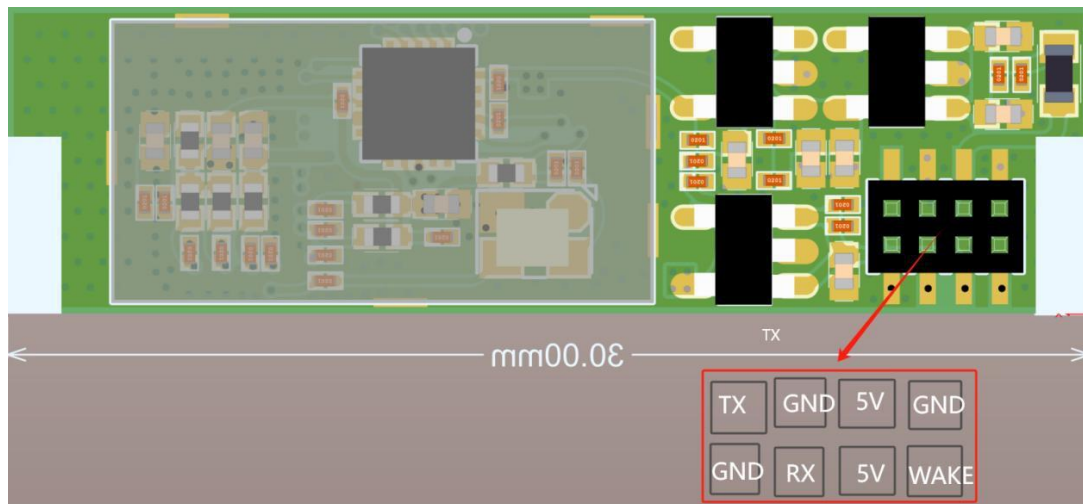
DIM (mm)	Tolerance (mm)
0-5	±0.15
5-10	±0.2
10-200	±0.3

PCB Thickness: 1.2mm (+/-0.15mm)

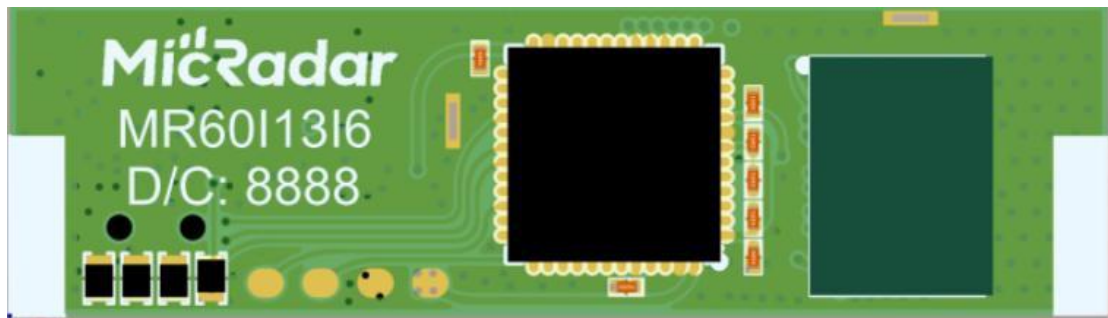


2.3 Pin definitions

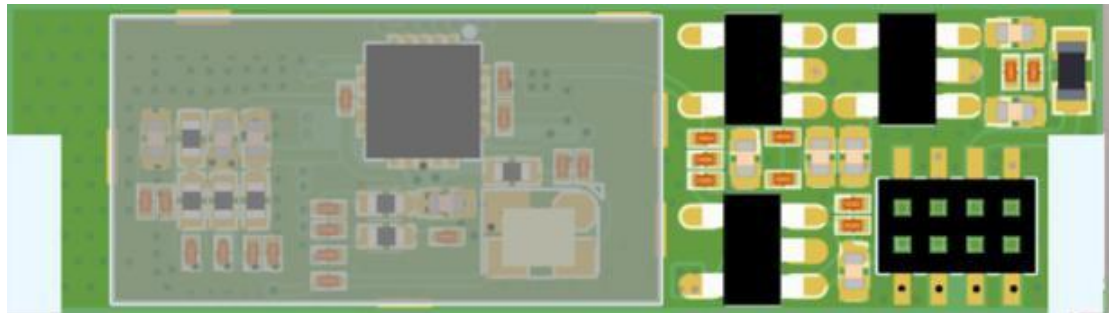
Pin	Define	Description	Pin	Define	Description
1	TX	Data Transmission	5	GND	Ground
2	GND	Ground	6	RX	Data Reception
3	5V	5V Power Input	7	5V	5V Power Input
4	GND	Ground	8	WAKE	Sleep Wake-up



2.3 Product Photos



TOP View



BOT View

3 RF Characteristics

3.1 Electrical parameters

Parameter	Min	Typ	Max	Unit
Radar Operating Parameters				
Operating Voltage (VCC)	4.5	5.0	5.5	V
Operating Current (ICC)		100	220	mA
Operating Temperature (TOP)	-20		+70	°C
Storage Temperature (TST)	-40		+85	°C
Transmitter Parameters-1				
Operating Frequency (fTX)	60		61	GHz
Output Power (Pout)		3		dBm
Transmitter Parameters-2				
Operating Frequency (fTX)	61		64	GHz
Output Power (Pout)		9		dBm
Antenna Parameters				
Antenna Gain (GANT)		5		dBi
Horizontal Beamwidth (3dB)		100		°
Vertical Beamwidth (3dB)		80		°

3.2 Radar detection performance parameters

No.	Parameter	Requirement
1	Detection Range	≥5 m (moving target), ≥5 m (static target)
2	Range Accuracy	≤0.2 m
3	Horizontal Detection Angle	≤100°
4	Vertical Detection Angle	≤80°
5	OTA Function	Supported
6	Response Time	≤2s
7	Presence Detection Time	≤60s

* Note: [1] Typical RF Output Power are tested at room temp.25°C

4 Electrical Current Consumption

Description	Value	Unit
Radar Average Current	100	mA
RF On Current	200	mA
Input Voltage	+5±0.5	V

Power Supply Ripple	≤50	mA
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5 Package, Storage & Disposal

5.1 Package

TBD

5.2 Storage

All electronic components must be stored in a clean, well-ventilated place free of corrosive gas. Unless otherwise specified, the temperature and humidity of the storage place must meet below requirements:

- ✚ Temperature: -40~85°C;
- ✚ Humidity: 20%~75%;
- ✚ Humidity sensitivity grade: MSL 3
- ✚ Container Requirement: products shall be placed in a container well-functioning as an electrostatic shielding.

5.3 Disposal

The waste disposal of this product and the package should comply with the applicable local/regional /state/ international regulations.

6 Installation and User Guide

Installation and Application Guidelines for Radar Module

This radar module requires proper installation and integration for optimal performance.

Please note the following operational considerations:

Due to the limitations of the radar antenna beam pattern, the effective detection range decreases when targets deviate from the radar's boresight (normal) direction.

Millimeter-wave signals can penetrate certain non-metallic materials, such as common glass, wooden panels, screens, and thin partitions, enabling detection of moving objects behind such obstructions. However, they cannot penetrate thicker load-bearing walls or metal doors.

Important Notes:

- For all installation methods, the radar's main beam must cover the primary activity area, ideally aligned perpendicular (boresight) to the target zone.
- When installed at a downward tilt, the horizontal detection range will proportionally

decrease due to changes in the coverage area's projection.

C. During operation, ensure no metal objects obstruct the module's surface.

D. The radar's effective range varies depending on the target's Radar Cross Section (RCS), obstruction material/thickness, and electromagnetic wave propagation properties.

E. For static human detection, different body postures may affect the detection range. The radar does not guarantee maximum range coverage for all possible states.

7 Appendix

Key Components List

NO.	Name	Model	Specification	Manufacturer
1	IC	BGT60TR13C		Infineon
2	IC	AT32F403ACGU7		artery

8 FCCwarning

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.

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

(1) List of applicable FCC rules

FCC Part 15 Subpart C 15.255

(2) Specific operational use conditions

The module is a mmWave Module with 60GHz function, this device is used indoors.

Modulation: FMCW

Antenna Type: AIP Antenna

Operation Frequency: 60-61GHz and 61-64GHz

(3) Limited module procedure

Not applicable

(4) Trace antenna designs

Not applicable The module has its own antenna, and doesn't need a host's printed board micro strip trace antenna etc.

(5) RF exposure considerations

The module must be installed in the host equipment such that at least 20cm is maintained between the antenna and users' body. and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

(6) Antenna used

Antenna Type: AIP Antenna

Gain: 5dBi for each antenna

Impedance: 50 Ohm

This device is intended only for host manufacturers under the following conditions:

- The transmitter module may not be co-located with any other transmitter or antenna.
- The module shall be only used with the Sleeve monopole antenna(s) that has been originally

tested and certified with this module.

- The antenna must be either permanently attached or employ a 'unique' antenna coupler

As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

(7) Labelling Instruction for Host Product Integrator

Host product manufacturers need to provide a physical or e-label stating "Contains FCC ID: 2AOKI-M6" with their finished product.

(8) Information on test modes and additional testing requirements

Host manufacturer must perform test of radiated & conducted emission and spurious emission, e.t.c according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product. Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

(9) Additional testing, Part 15 Subpart B disclaimer

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 Class A digital device 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:

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.

(10) Note EMI Considerations

Note EMI Considerations: D04 Module Integration Guide has been considered as “best practice” for RF design engineering testing and evaluation of non-linear interactions which can generate additional non-compliant limits due to module placement to host components or properties.

For standalone mode, D04 Module Integration Guide was referenced, and simultaneous mode considered for the host product to confirm compliance.

(11) How to make changes

Only the Grantee is permitted to make permissive changes.

OEM Integration Instructions

This device is intended only for OEM integrators under the following conditions:

- The module shall be only used with the external antenna(s) that has been originally tested and certified with this module.
- The antenna must be installed such that 20 cm is maintained between the antenna and users
- This device and its antenna(s) must not be co-located with any other transmitters except in accordance with FCC multi-transmitter product procedures.

As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

Restrictions

- 1.This equipment is prohibited to be used on satellite equipment.
- 2.This equipment is field disturbance sensor and fixed installation. It is prohibited to use it on the vehicle radar systems.
- 3.This equipment is prohibited to be used on the aircraft.
- 4.This equipment is used indoors.

RF Exposure evaluation for the simultaneous transmission of the co-located transmitters.

The host product shall be evaluation for ensuring the continuous compliance for the FCC rules that apply to the host product. Additional guidance for testing host products is provided in KDB Publication 996369 D02 and D04. This module was tested as a subsystem and it's certification does not cover the FCC Part 15 Subpart B (unintentional radiator) rule requirement applicable to final host. The host will still need to be reassessed for compliance to this portion of rule requirements. For the host product is not installed according to tis guide, the module certification will be invalid and a new grant certification will be required for the host product.

9 IC warning

This device complies with Innovation, Science and Economic Development 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.

Le onjunc areil est conforme aux CNR d' l'innovation, la science et le développement économique Canada licables aux areils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- (1) l'areil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, onj si le brouillage est susceptible d'en compromettre le fonctionnement.

ISED Radiation Exposure Statement:

This equipment complies with Canada radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Déclaration d'exposition aux radiations

Cet équipement est conforme Canada limites d'exposition aux radiations dans un environnement non contrôlé. Cet équipement doit être installé et utilisé à distance minimum de 20cm entre le radiateur et votre corps.

This device is intended only for OEM integrators under the following condition:

The transmitter module may not be co-located with any other transmitter or antenna. As long as the condition above is met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les condition suivantes:

Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne. Tant que les 1 condition ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformitésupplémentaires requis pour ce module installé

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 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 Canada 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' 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.

This radio transmitter (ISED certification number: 23460-M6) has been approved by Industry Canada to operate with the antenna types listed with the maximum permissible gain 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 (ISED certification number: 23460-M6) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Antenna Type: AIP Antenna

Gain: 5dBi for each antenna

Impedance: 50 Ohm

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as shown in this manual.

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module. Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

End Product Labeling

The final end product must be labeled in a visible area with the following:

Contains IC: 23460-M6.

Plaque signalétique du produit final

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante:

Contient des IC: 23460-M6.

CAN ICES-3 (B)/NMB-3(B)

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