BLE-0101 Module
Datasheet

Version 1.0

1. Description

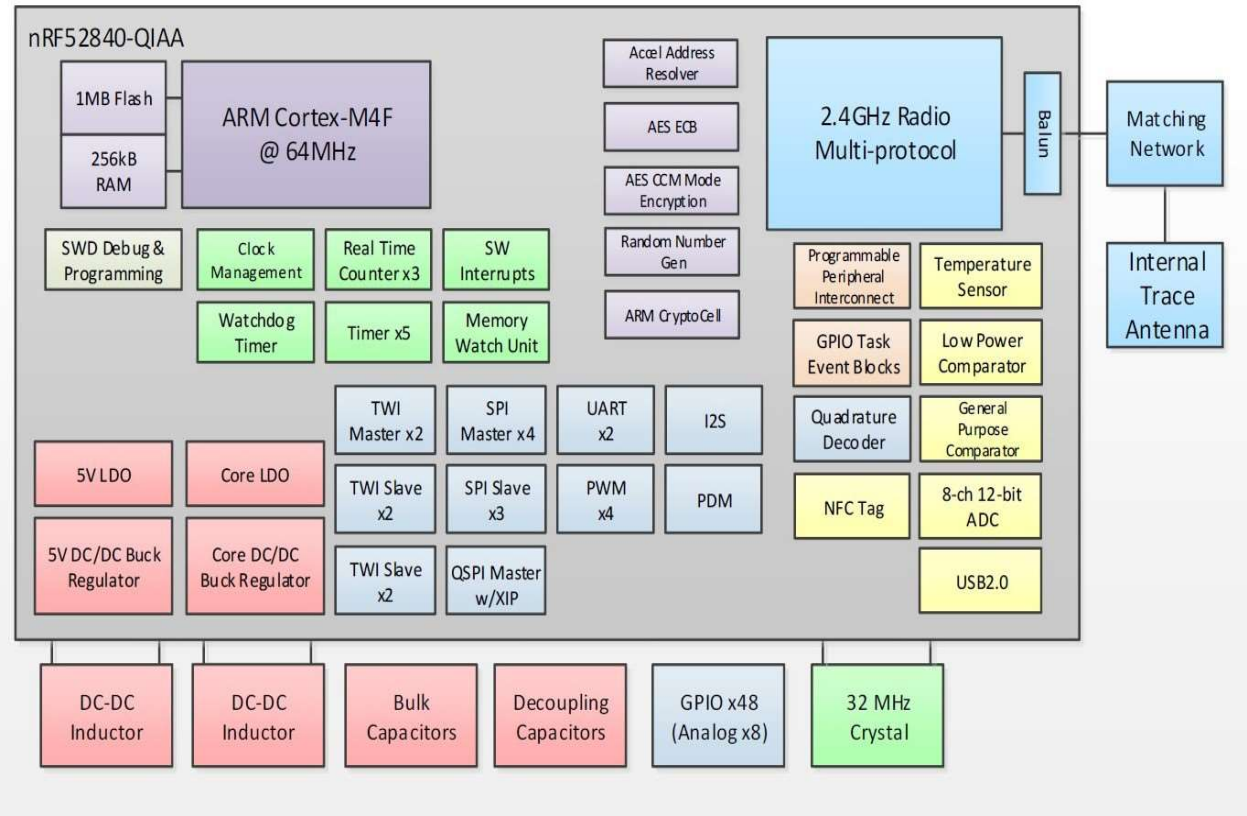
The RYSE BLE-0101 is an advanced, highly flexible, ultra-low power multiprotocol System on Module (SoM) that enables Bluetooth 5 low energy connectivity for portable, and extremely low power embedded systems. With an Arm® Cortex®-M4 with FPU processor, integrated 2.4G Hz transceiver, and an integrated trace antenna, the BLE-0101 provides a complete RF solution allowing faster time to market with reduced development costs. Providing full use of the Nordic Semiconductor nRF52840's capabilities and peripherals, the BLE-0101 can power the most demanding applications, all while simplifying designs and reducing BOM costs. The BLE-0101 is an ideal solution for designs that require Bluetooth 5 features. Increased integration with built in USB and 5.5 V compatible DC/DC supply reduces design complexity and BOM cost, while expanding possible applications. BLE-0101 designs are footprint compatible with the BMD-300/301/330/360, providing low-cost flexibility for tiered product lineups.

2. Key features

- Based on the Nordic Semiconductor nRF52840 SoC
- Bluetooth PHYs: LE 1M
- Bluetooth 5 features: Advertising Extensions, Channel Selection Algorithm #2
- Bluetooth mesh
- Complete RF solution with an integrated trace antenna
- Integrated DC-DC converter
- No external components required
- Arm® Cortex®-M4 with FPU 32-bit processor
- Arm® TrustZone® Cryptocell 310 security
- True random number generator
- Serial Wire Debug (SWD)
- Nordic Semiconductor SoftDevice ready
- 1 MB embedded flash memory
- 256 KB RAM
- 48 General Purpose I/O Pins
- 12-bit/200 KSPS ADC
- One Full-Speed USB (12 Mbps)

- Four SPI Master/Slave (8 Mbps)
- Quad SPI with Execute in Place (XIP)
- PWM 4 blocks x 4-channels each
- General Purpose and Low power comparators
- Temperature sensor
- Two 2-wire Master/Slave (I2C compatible)
- I2S audio interface
- Two UARTs (w/ CTS/RTS and DMA)
- 20-channel CPU independent Programmable Peripheral Interconnect (PPI)
- Quadrature Demodulator (QDEC)
- 5 x 32 bit timer/counters
- 3 x 24 bit Real Timer Counters (RTC)
- **Dimensions: 15.0 x 10.2 x 1.9 mm**

3. Block Diagram



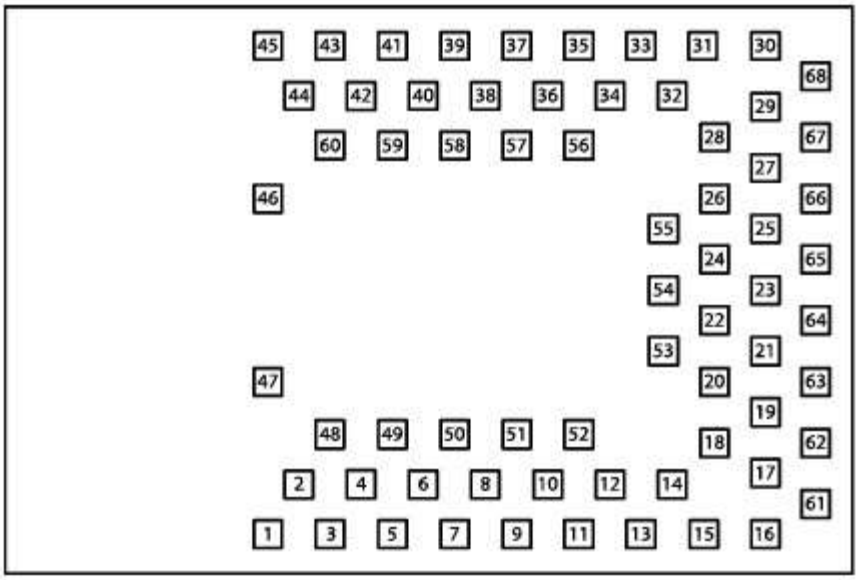
4. Sepcifications

Bluetooth		
Version	Bluetooth 5 Low Energy, Concurrent Central & Peripheral (S140) Coded PHY (Long Range), 2Mbps & 1Mbps PHY, Advertising Extensions, Improved Coexistence	
Security	AES-128	
LE connections	Concurrent central, observer, peripheral, and broadcaster roles with up to twenty concurrent connections along with one Observer and one Broadcaster (S140)	
Radio		
Frequency	2.402GHz to 2.485GHz	
Modulations	GFSK at 1 Mbps and 2Mbps, QPSK at 250kbps	
Transmit power	+8 dBm maximum	
Receiver sensitivity	-96 dBm (BLE mode)	
Antenna	Trace antenna (0.62dBi max gain)	
Current Consumption		
TX only @ +8 dBm, 0 dBm @ 3V, DCDC enabled		14.8 mA, 4.8 mA
TX only @ +8 dBm, 0 dBm		32.7 mA, 10.6 mA
RX only @ 1 Mbps @ 3V, DCDC enabled		4.6 mA
RX only @ 1 Mbps		9.9 mA
CPU @ 64MHz from flash, from RAM		6.3 mA, 5.2mA
CPU @ 64MHz from flash, from RAM @ 3V, DCDC enabled		3.3 mA, 2.8mA
System Off, On (Supply on VDD), no RAM retention		0.4 µA, 0.97 µA
System Off, On (Supply on VDD), full 256kB RAM retention		1.86 µA, 2.35µA
Dimensions		
Length	15.0 mm ± 0.3 mm	
Width	10.2 mm ± 0.3 mm	
Height	1.9 mm ± 0.1 mm	
Hardware		
Interfaces	SPI Master/Slave x4 Quad SPI x1 UART x2 Two-Wire Master/Slave (I2C) x2 GPIO x48	I2S x1 PWM x12 PDM x1 USB 2.0 x1 Analog input x8
Power supply	VDD: 1.7V to 3.6V, 1.75V required to start DCDC	

	VDDH: 2.5V to 5.5V VBUS: 4.35V to 5.5V (For USB operation)
Temperature Range	-40°C to +85°C
Certifications	
USA(FCC)	FCC ID: 2BAAG-BLE0101
Canada(IC)	IC: 30116-BLE0101

5. Pinout

5.1. PinOut Diagram(Top view)



5.2. Pin Defanations

Pin	Name	Direction	Description
6	P0.25	In/Out	GPIO
7	P0.26	In/Out	GPIO
8	P0.27	In/Out	GPIO
9	P0.28	In/Out	GPIO/AIN4[2]
10	P0.29	In/Out	GPIO/AIN5[2]
11	P0.30	In/Out	GPIO/AIN6[2]
12	P0.31	In/Out	GPIO/AIN7[2]
13	P0.00	In/Out	GPIO/XTAL1 (32.768kHz)
14	P0.01	In/Out	GPIO/XTAL2 (32.768kHz)
15	P0.02	In/Out	GPIO/AIN0[2]
19	P0.03	In/Out	GPIO/AIN1[2]
20	P0.04	In/Out	GPIO/AIN2
21	P0.05	In/Out	GPIO/AIN3
22	P0.06	In/Out	GPIO
23	P0.07	In/Out	GPIO/TRACECLK
24	P0.08	In/Out	GPIO
25	P0.09	In/Out	GPIO/NFC1[2]
26	P0.10	In/Out	GPIO/NFC2[2]
27	P0.11	In/Out	GPIO/TRACEDATA[2]
28	P0.12	In/Out	GPIO/TRACEDATA[1]
31	P0.13	In/Out	GPIO
32	P0.14	In/Out	GPIO
33	P0.15	In/Out	GPIO
34	P0.16	In/Out	GPIO

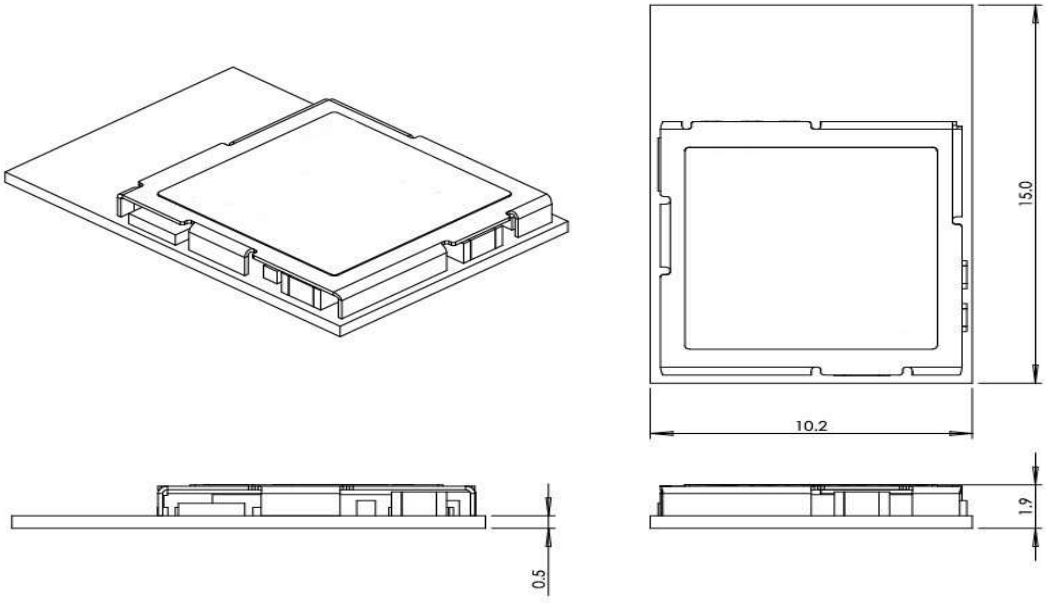
Pin	Name	Direction	Description
35	P0.17	In/Out	GPIO
36	P0.21	In/Out	GPIO
37	P0.19	In/Out	GPIO
38	P0.20	In/Out	GPIO
39	P0.18	In/Out	GPIO/$\overline{\text{RESET}}$
40	P0.22	In/Out	GPIO
41	P0.23	In/Out	GPIO
42	P0.24	In/Out	GPIO
43	SWCLK	In	SWD Clock
44	SWDIO	In/Out	SWD IO
48	P1.05	In/Out	GPIO[2]
49	P1.06	In/Out	GPIO[2]
50	P1.07	In/Out	GPIO[2]
51	P1.08	In/Out	GPIO
52	P1.09	In/Out	GPIO/TRACEDATA[3]
53	P1.10	In/Out	GPIO[2]
54	P1.11	In/Out	GPIO[2]
56	P1.00	In/Out	GPIO/TRACEDATA[0]/SWO
57	P1.01	In/Out	GPIO[2]
58	P1.02	In/Out	GPIO[2]
59	P1.03	In/Out	GPIO[2]
60	P1.04	In/Out	GPIO[2]
61	P1.12	In/Out	GPIO[2]
62	P1.13	In/Out	GPIO[2]
63	P1.14	In/Out	GPIO[2]
64	P1.15	In/Out	GPIO[2]
67	USB-D-	In/Out	USB Data -
68	USB-D+	In/Out	USB Data +
66	VBUS	Power	USB PHY supply: 4.35V to 5.5V in Connect to USB Host device 5V supply
17	VCC1	Power In/Out	LV Mode: 1.7V to 3.6V in HV Mode: 1.8V to 3.3V supply out3
65	VCCH1	Power	LV Mode: Connect to VCC HV Mode: 2.5V to 5.5V in
1, 2, 3, 4, 5, 16, 18, 29, 30, 45, 46, 47, 55	GND	Power	Electrical Ground

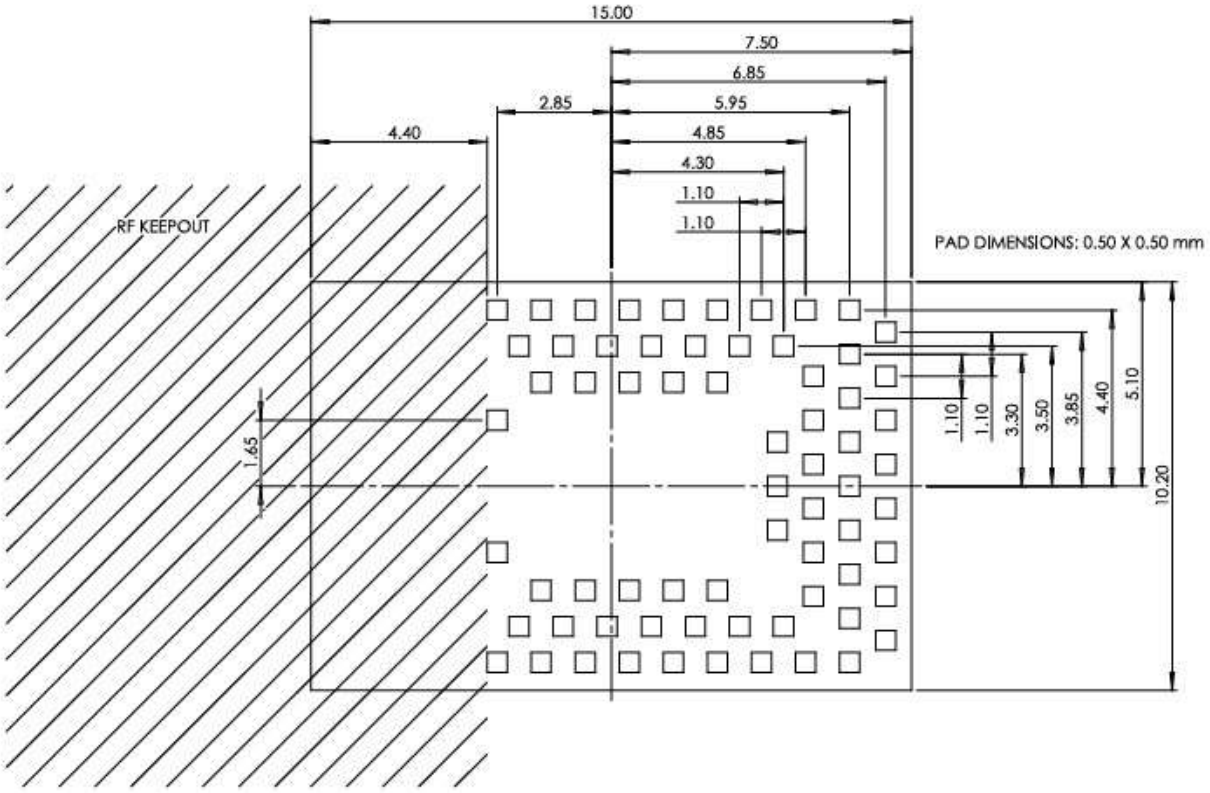
Note 1: An internal 4.7µF bulk capacitor is included on the module. However, it is good design practice to add additional bulk capacitance as required for your application, i.e. those with heavy GPIO usage and/or current draw.

Note 2: These pins are in close proximity to the nRF52 radio power supply and antenna pins. Radio performance parameters, such as sensitivity, may be affected by high frequency digital I/O with large sink/source current on these pins. Nordic recommends using only low frequency, low-drive functions when possible.

Note 3: In HV mode, VCC acts as a regulated supply that can power other external devices. The voltage output of VCC can be configured in software but is limited to no more than VCCH-0.3V. In System Off mode VCC can supply no more than 1mA.

6. Mechanical Drawing and Specifications





7. Regulations

7.1. List of applicable FCC rules

CFR 47 FCC PART 15 SUBPART C/E has been investigated. It is applicable to the modular.

7.2. Specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

7.3. Limited module procedures

Not applicable

7.4. Trace antenna designs

Not applicable

7.5. RF exposure considerations

To maintain compliance with FCC's RF Exposure guidelines, this equipment should be installed and operated with minimum distance of 20cm from your body.

7.6. Antennas

This radio transmitter FCC ID: 2BAAG-BLE0101 has been approved by FederalCommunications Commission to operate with the antenna types 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.

Antenna type	Maximum Antenna gain
Trace antenna	0.62dBi

7.7. Label and compliance information

The final end product must be labeled in a visible area with the following " Contains FCCID: 2BAAG-BLE0101”

7.8. Information on test modes and additional testing requirements

Host manufacturer is strongly recommended to confirm compliance with FCC requirements for the transmitter when the module is installed in the host.

7.9. Additional testing, Part 15 Subpart B disclaimer

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B.

ISED 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 ISED 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.

Any company of the host device which install this modular with limit modular approval should perform the test of radiated emission and spurious emission according to RSS-247 and RSSGen requirement, only if the test result comply with RSS-247 and RSS-Gen requirement, then the host can be sold legally.

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' ISED 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. toute entreprise de l'hôte qui installent ce dispositif modulaire avec limite approbation devrait effectuer l'essai des modules et des rayonnements non essentiels des émissions rayonnées selon rss-247 et le cnr - gen, seulement si le résultat d'essai conforme rss-247 et le cnr - gen, puis l'hôte peut être vendu légalement.

End Product Labeling

The final end product must be labeled in a visible area with the following: Contains IC:30116-BLE0101.

Plaque signalétique du produit final

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: Contient des IC:30116-BLE0101.

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 show 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.

This radio transmitter [30116-BLE0101] has been approved by Innovation, Scienceand Economic Development Canada to operate with the antenna types listed below, It has an antenna with the maximum antenna gain is 0.62dBi

Antenna type	Maximum Antenna gain
Trace antenna	0.62dBi

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.

Cet émetteur radio [30116-BLE0101] a été approuvé par Innovation, Science et développement économique Canada pour fonctionner avec les types d’antenne énumérés ci-dessous.Il dispose d'une antenne avec une prise le gain maximum d'antenne est de0.62 dBi.

Antenna type	Maximum Antenna gain
Trace antenna	0.62dBi

Les types d'antennes non inclus dans cette liste qui ont un gain supérieur au gain maximum indiqué pour tout type répertorié sont strictement interdits pour l'utilisation avec cet appareil.

FCC Warning

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.

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.

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

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

This equipment should be installed and operated with minimum distance 20cm between the radiator&your body.

ISEDC 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.

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

Tous les changements ou modifications non expressément approuvée par le responsible de la conformité pourrait vider l'utilisateur est habilité à exploiter l'équipemen.

ISEDC Radiation Exposure Statement:

This equipment complies with ISEDC RF radiation exposure limits set forth for an uncontrolled environment.

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

Cet appareil est conforme aux limitesd'exposition de rayonnement RF ISEDC établiespour un environnement non contrôlé.

Cetémetteur ne doit pas être co-implanté oufonctionner en onjunction avec toute autreantenne ou transmetteur.

This equipment should be installed and operated with minimum distance 20cm between the radiator&your body.

La distance entre le radiateur et le corps doit être d'au moins 20 cm lors de l'installation et du fonctionnement de l'appareil.