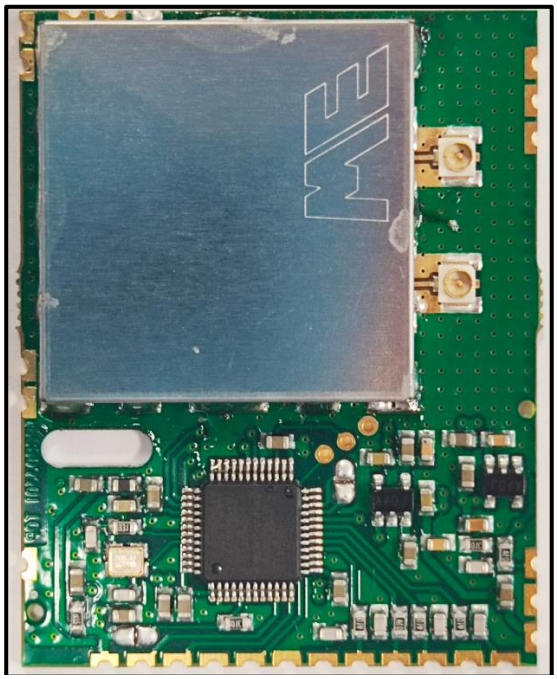
RF TRANSCEIVER MODULE 2.4 GHz FOR IMET RADIO REMOTE CONTROL SYSTEMS MODEL B033



(M880 WAVE2; M880 MODIN; M880 SAC; M880 SDC; M880 MAC)

TECHNICAL MANUAL

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Conventions used in this document

This symbol indicates instructions to be strictly followed for the RF B033 module to work properly

This symbol indicates useful suggestions for the proper use of the B033 module

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1.0 Device Overview and Description

The B033 RF 2.4GHz module has been designed to extend wireless communication in IMET radio control systems in the 2.4GHz to 2.4835GHz band, making 38 channels available in the assigned band. The device is integrated into the logic units of the IMET industrial remote control systems, to allow greater coverage and reliability in the communication between the remote unit (radio control or transmitter unit M880 WAVE2) and the base station (receiver unit M880 SAC; M880 SDC).
The B033 module mounts two antennas with U.FL 50Ω connectors to ensure greater coverage and stability in radio communication.
The B033 is assembled by welding and has its own internal voltage regulators one for the RF part and one for the microcontroller logic part and its own oscillators.

The module can it be easily integrated (surface mount) with M880 systems, freeing up the design dedicated to the RF communication part and from the compliance tests with the reference standards listed in the section 6.0 *"Approval and Certification"* allowing more faster construction times for the new M880 products.

The B033 module is approved for modular devices in the United States (FCC) and Canada (IC). Modular approval removes the need for expensive RF and antenna design, and allows the end user to place the B033 module inside a finished product and does not require regulatory testing for an intentional radiator (RF transmitter).
To maintain conformance, refer to module settings in Annex A.1 for the United States and Annex A.2 for Canada.
The B033 module is an RED Directive assessed radio module for operation in Europe. The module tests can be applied toward final product certification and Declaration of Conformity (DoC). To maintain conformance for Europe, refer to module settings in Section ANNEX A.3. Additional testing may be required depending on the end application.

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1.1 Main technical Characteristics and Features

B033 RF module is a Long Range 2.4GHz transceiver ideal for robust and reliable wireless solution and in particular for IMET radio remote control systems M880 series listed in the section 1.0 “Device overview”;

The main technical characteristics are listed in the following table

B033 MAIN CHARACTERISTICS
• High receiver sensitive up to -117 dBm;
• Size: 36,2 x 45,09 x 4,20 mm (L x W x H with shield)
• Wight: 8.00 g (with Shield)
• Integrated crystal oscillator for RF and logic unit
• 2.4Ghz ISM band transceiver
• Up to 38 channels available and selectable
• Wide band transceiver at 812kHz per channel
• Spread spectrum modulation with forward error correction (FEC) technique to increase the range and robustness of the radio communication. It is superior immunity to interference
• Internal voltage Regulator at 3.3 V with LDO (low Drop Out)
• Two External 50Ω Antenna Connector: Ultra Miniature Coaxial (U.FL), 50Ω
• Surface mountable in the IMET Remote control unit
• UART communication interface available

Table 1

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1.2 Main Application

B033 is designed for industrial automation application and in particular for IMET radio REMOTE control listed in section 1.0 “Device Overview”.

1.3 Main Operational characteristics and storage

RF transceiver B033 is designed to operated in the following environmental condition

- Operating Voltage range: 3,7Vd.c. to 5V d.c.;
- Operating Temperature Range: -25°C to + 55°C (-13°F to +131°F);
- Storage Temperature Range: -40°C to +85°C (-40°F to +185°F);

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1.4 List of available RF channel from 2.404GHz to 2.479 GHz

In the following table is reported the list of available channels than can be used by the B033 RF module

List of Available Channels	
Channel Number	Channel Frequency (GHz)
1	2.404
2	2.406
3	2.408
4	2.410
5	2.412
6	2.414
7	2.416
8	2.418
9	2.420
10	2.422
11	2.424
12	2.426
13	2.428
14	2.430
15	2.432
16	2.434
17	2.436
18	2.438
19	2.440
20	2.442
21	2.445
22	2.447
23	2.449
24	2.451
25	2.453
26	2.455

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List of Available Channels	
Channel Number	Channel Frequency (GHz)
27	2.457
28	2.459
29	2.461
30	2.463
31	2.465
32	2.467
33	2.469
34	2.471
35	2.473
36	2.475
37	2.477
38	2.479

Table 2 – List of available channels

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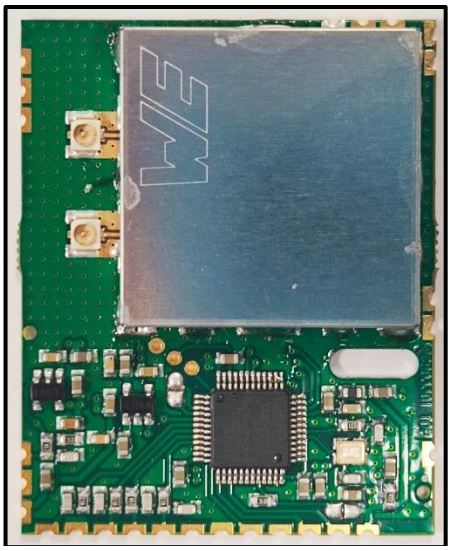
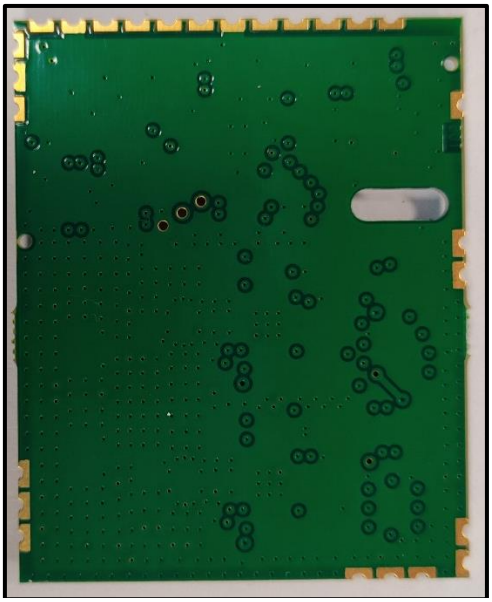
2.0 Foto of the Device

2.1 Top side with Shield



2.1 Bottom side



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3.0 Device Marking plate

B033 is marking with FCC ID: for Unite State as modular approval in accordance with Part 15.212 Modular Transmitter approval

B033 is marking with IC ID: for Canada as modular approval according to Radio Standards Specification (RSS) RSS-210 and RSSGen.

B033 is CE marking according to EUROPEAN RED directive 2014/53/EU Essential Requirements for Health and Safety (Article (3.1(a)), Electromagnetic Compatibility (EMC) (Article 3.1(b)), and Radio (Article 3.2) and are summarized in Section 6.0 *"Approvals and Certification"* European Compliance Testing.

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4.0 Device PIN Diagram and Layout

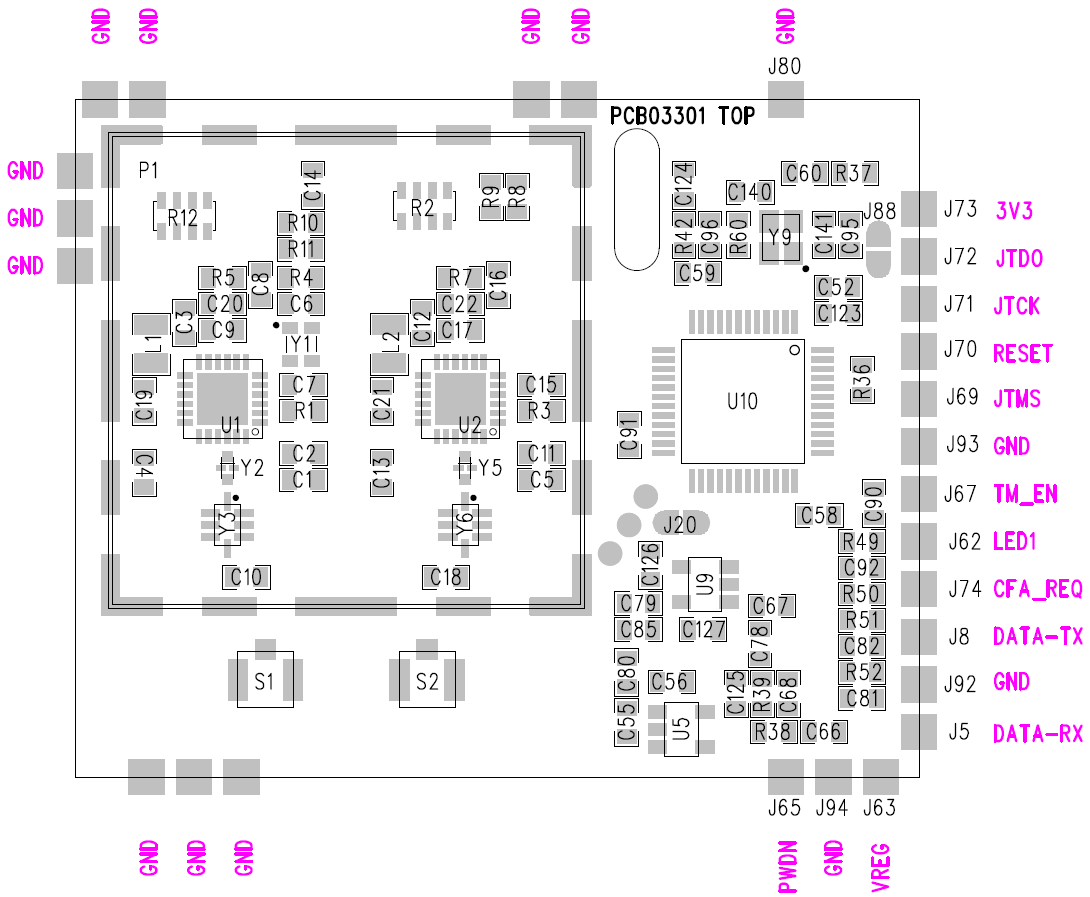

Figure 1 – Pin Layout

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4.1 PIN Description table

PIN		Symbol	Type	Description
J65		PWDN	LDO	*Power enable; Power ON / Power OFF the RF module*
J94		GND	Ground	*Ground*
J92		GND	Ground	*Ground*
J93		GND	Ground	*Ground*
J80		GND	Ground	*Ground*
J63		VREG	Power	*Power supply input*
J62		LED1	GPIO	*General porpouse digital input /output use only for debug*
J5		DATA -RX	DI	*UART Serial communication data input*
J8		DATA-TX	DO	*UART Serial communication data output*
J74		CFA-REQ	DI	*Digital input for frequency change request*
J67		TM_EN	GPIO	*Reserved for internal used*
J64		GND	Ground	*Ground*
J69		JTMS	JTAG	*Test mode select*
J70		RESET	Reset	*Microcontroller Reset PIN*
J71		JTCK	JTAG	*JTAG signal*
J72		JTDO	JTAG	*JTAG signal*
J73		3.3V	3.3V	*Power supply for microcontroller during programming phase*
DO = Digital Output ; DI = Digital Input; GPIO = general porpouse input output				

Table 3

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5.0 Mounting Details

The B033 2.4GHz module is a surface mountable module and module dimension are shown in figure 3. The module B033 is 1,0mm (0,038”) thick with castellated mounting point on the edge.
In the host PCB of the B033 module it is recommended to extend the ground plane at least 5mm (0,2”) around the module.
The module was assembled using standard lead free reflow profile The module is compatible with standard lead-free solder reflow profiles. To avoid damaging the module, the following recommendations are given:

- Refer to the solder paste data sheet for specific reflow profile recommendations;
- Use no-clean flux solder paste;
- Do not wash as moisture can be trapped under the shield;
- Use only one flow. If the PCB requires multiple flows, apply the module on the last flow;

The B033 has 50Ω ultra miniature coaxial (U.FL) connector.

Caution: The U.FL connector is fragile and can oly tollerate very limited number of insertions and disinsertions

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5.1 Module Dimension Details

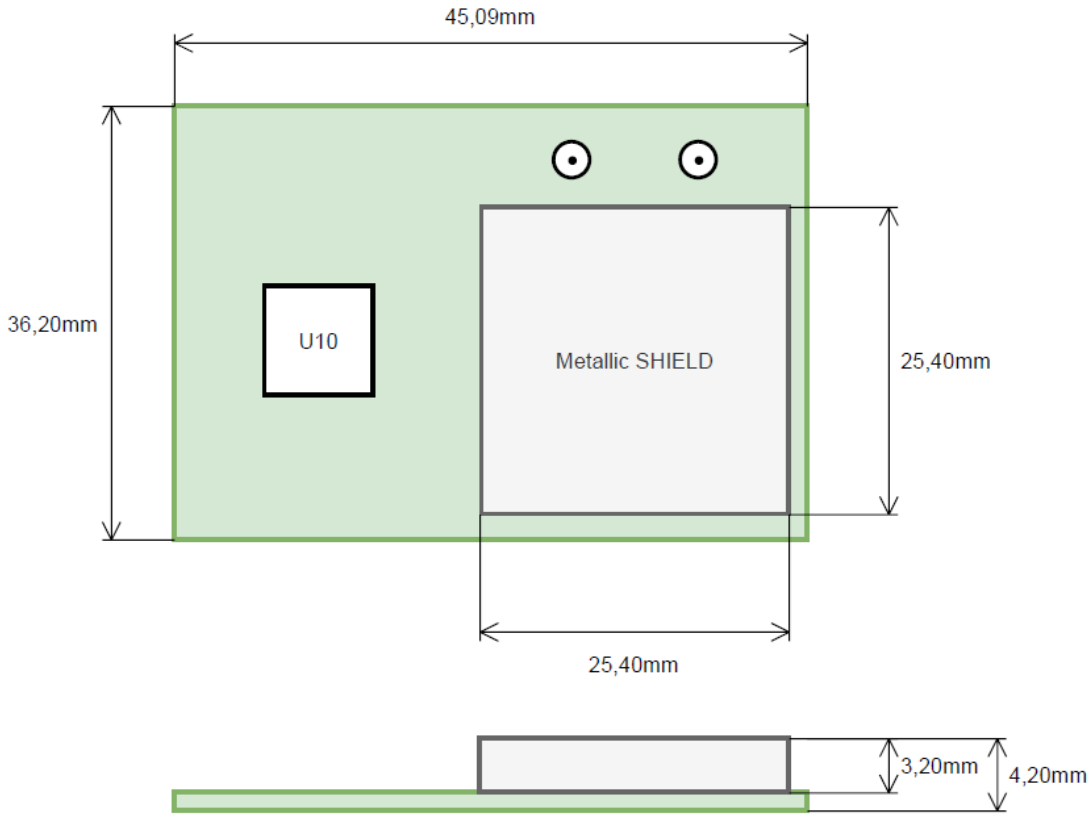

Figure 3 – Dimension Details

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5.2 External Antenna for B033

The B033 module has a 50Ω ultra-miniature coaxial (U.FL) connector to connect to an external 2.4GHz antenna. Modular certification of the B033 module is performed with the external antenna types listed in the following table:

TESTED EXTERNAL ANTENNA TYPES			
IMET CODE	TYPE	Nominal Gain	Description
AN110	RFA-02-P05-70B-150	2 dBi (Peak)	Internal Antenna with U.FL connector 2,4GHz PEAK GAIN 2 dBi with CABLE 250mm
AN110/A	RFA-02-P05-70B-150	2 dBi (Peak)	Internal Antenna with U.FL connector 2,4GHz PEAK GAIN 2 dBi with CABLE 100mm

Table 4

An antenna type comprises antennas having similar in-band and out-of-band radiation patterns.
Refer to Section *Regulatory Approval* for specific regulatory requirements by country.

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5.3 Electrical Characteristics

Description	Technical Data				
	Condition	Min	Typical	Max	Unit
Ambient Operating Temperature	–	-25		+55	°C
Supply voltage Range	–	3.7	4.2	5.0	V
Current consumption	TX mode at maxmiun Output Power		55		mA
	RX mode		45		mA
	Sleep mode		40		mA
Receiver Characteristics					
Parameters	**Condition**	**Min**	**Typical**	**Max**	**Unit**
RF Input Frequency		2.404		2.479	GHz
RF sensitivity			-117		dBm
Max RF Input	50Ω			10	dbBm
Blocking immunity	@ +/- 1 MHz		60		dB
	@ +/- 2 MHz		63		dB
	@ +/- 10 MHz		81		dB
Adjacent channel rejection			37		dB
Maximum Tollerance frequency offset between transmiter and receiver without sensitive degradation,		-50		+50	ppm
Transmitter Characteristics					
Parameters	**Condition**	**Min**	**Typical**	**Max**	**Unit**
RF Carrier Frequency range		2.404		2.479	GHz
RF Output Power	50Ω	-18		+10	dbBm
Raw data rate			14.27		Kb/s
FSK frequency deviation		62.5		1000	kHz
Crystal oscillator frequency			52		MHz
Channels Number			38		
Channel Nomial Bandwith			812		KHz

Table 5 – Electrical Characteristics

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6.0 Approval and Certification

RF 2.4GHz module B033 is complying with the following Directive, Standards and Regulations

- CE marking according to European RED Directive 2014/53/EU and 2011/65/EU and Delegated Directive 2015/863/EU on the Restriction of Hazardous Substances (RoHS) with the following reference standard

  ESTI EN 301 489-1:2019 V2.2.3
  ETSI EN 301 489-17: 2020 V3.2.4
  ETSI EN 300 328:2019 V2.2.2
  EN 62368-1:2014 + A11:2017
  EN 62479:2010

- FCC (Federal Communications Commission) Part 15

  PART 15.207:2019
  PART 15.209:2019
  PART 15.247:2019

- IC (Industrial Canada) RSS-247 issue 2:2017

  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.

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

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ANNEX A - Regulatory Approval

This section outlines the regulatory information for the B033 module for the following countries:

- United State;
- Canada;
- Europe;

A.1 United State

The B033 module is received Federal Communications Commission (FCC) CFR47 Telecommunications, Part 15 Subpart C "Intentional Radiators" modular approval in accordance with Part 15.212 Modular Transmitter approval. Modular approval allows the end user to integrate the B033 module into a finished product without obtaining subsequent and separate FCC approvals for intentional radiation, provided no changes or modifications are made to the module circuitry. Changes or modifications could void the user's authority to operate the equipment. The end user must comply with all of the instructions provided by the Grantee, which indicate installation and/or operating conditions necessary for compliance.

The finished product is required to comply with all applicable FCC equipment authorizations regulations, requirements and equipment functions not associated with the transmitter module portion. For example, compliance must be demonstrated to regulations for other transmitter components within the host product; to requirements for unintentional radiators (Part 15 Subpart B "Unintentional Radiators"), such as digital devices, computer peripherals, radio receivers, etc.; and to additional authorization requirements for the non-transmitter functions on the transmitter module (i.e., Verification, or Declaration of Conformity) (e.g., transmitter modules may also contain digital logic functions) as appropriate.

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A.1.1 Labelling and User Information Requirements

The B033 module has been labelled with its own FCC ID number, and if the FCC ID is not visible when the module is installed inside another device, then the outside of the finished product into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording as follows:

Contains Transmitter Module FCC ID: 2AYRTB033 or Contains FCC ID:2AYRTB033 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

A user's manual for the product should include the following statement:

This equipment has been tested and found to complying 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.

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WARNING:

Changes or modifications made to this equipment not expressly approved by IMET may void the FCC authorization to operate this equipment.

A.1.2 RF Exposure

All transmitters regulated by FCC must comply with RF exposure requirements.

If appropriate, compliance with exposure guidelines for mobile and unlicensed devices can be accomplished by the use of warning labels and by providing users with information concerning minimum separation distances from transmitting structures and proper installation of antennas. The following statement must be included as a CAUTION statement in manuals and OEM products to alert users of FCC RF exposure compliance:

To satisfy FCC RF Exposure requirements for mobile and base station transmission devices, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operation at closer than this distance is not recommended. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

If the B033 module is used in a portable application (i.e., the antenna is less than 20 cm from persons during operation), the integrator is responsible for performing Specific Absorption Rate (SAR) testing in accordance with FCC rules 2.1091.

A.1.3 Approved External Antenna Types

To maintain modular approval in the United States, only the antenna types that have been tested shall be used. It is permissible to use different antenna manufacturer provided the same antenna type and antenna gain (equal to or less than) is used.

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Testing of the B033 module was performed with the antenna types listed in Tested External Antenna Types on section 5.2.

A.2 Canada

The B033 module has been certified for use in Canada under Industry Canada (IC) Radio Standards Specification (RSS) RSS-210 and RSSGen. Modular approval permits the installation of a module in a host device without the need to recertify the device.

A.2.1 Labelling and User information Requirements

Labelling Requirements for the Host Device (see RSS-Gen , issue 5,Amendment 2 (February 2021), chapter 4): The host device shall be properly labelled to identify the module within the host device. The Industry Canada certification label of a module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labelled to display the Industry Canada certification number of the module, preceded by the words *"Contains transmitter module",* or the word *"Contains*", or similar wording expressing the same meaning, as follows:

Contains transmitter module IC:

User Manual Notice for License-Exempt Radio Apparatus (see RSS-Gen , issue 5, Amendment 2 (February 2021), chapter 8.4): User manuals for license-exempt radio apparatus shall contain the following or equivalent notice in a conspicuous location in the user manual or alternatively on the device or both:

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(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.

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Le présent appareil est conforme aux CNR 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, et

(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Transmitter Antenna (see RSS-Gen , issue 5, Amendment 2 (February 2021), chapter 6.8): User manuals for transmitters shall display the following notice in a conspicuous location:

This radio transmitter 26923-B033 has been approved by Innovation, Science and Economic Development Canada 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.

Cet émetteur radio 26923-B033 a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous, avec le gain maximal autorisé indiqué. Les types d'antenne 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.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi) and required impedance for each.

A.2.2 Approved External Antenna type

Transmitter Antenna (from RSS-Gen , issue 5,Amendment 2 (February 2021)chapter 6.8):
The B033 (26923-B033) module can only be operated with antennas with which it was approved. Transmitter may be approved with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest gain antenna of each combination of transmitter and antenna type for which approval is being sought, with the transmitter output power set at the maximum level. Any antenna of the

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same type having equal or lesser gain as an antenna that had been successfully tested with the transmitter, will also be considered approved with the transmitter, and may be used and marketed with the transmitter. When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. For transmitters of output power greater than 10 milliwatts, the total antenna gain shall be added to the measured RF output power to demonstrate compliance to the specified radiated power limits. Testing of the B033 module was performed with the antenna types listed in Section 5.2 “External Antenna for B033”.

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A.3 Europe

The B033 module is an RED Directive (2014/53/EU) assessed radio module that is CE marked and has been manufactured and tested with the intention of being integrated into a final product.
The B033 module has been tested to RED Directive 2014/53/EU Essential Requirements for Health and Safety (Article (3.1(a)), Electromagnetic Compatibility (EMC) (Article 3.1(b)), and Radio (Article 3.2) and are summarized in Section 6.0 *"Approvals and Certification"* European Compliance Testing.

To maintain conformance to the testing listed in Section 6.0 *"Approvals and Certification"*: European Compliance Testing, the module shall be installed in accordance with the installation instructions in this data sheet and shall not be modified. When integrating a radio module into a completed product the integrator becomes the manufacturer of the final product and is therefore responsible for demonstrating compliance of the final product with the essential requirements of the RED Directive.

A.3.1 Labelling and User Information Requirements

The label on the final product which contains the B033 module must follow CE marking requirements.

A.3.2 External Antenna Requirements

Provided the integrator installing an assessed radio module with an integral or specific antenna and installed in conformance with the radio module manufacturer's installation instructions requires no further evaluation under Article 3.2 of the RED Directive and does not require further involvement of an RED Directive Notified Body for the final product.
The European Compliance Testing listed in Section 6.0 *"Approval and Certification"* was performed using the antenna types listed in section 5.2 *"External Antenna Types".*

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