

Guide to FCC/Canada Regulations for Low Power Modular Wireless Transmitters For North America



Provided by

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Complete EMC & Environmental Stress Testing



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Confirm the particular requirements for your application.

1 Modular Transmitters Overview

What is a modular transmitter?

A wireless radio frequency (RF) module is a self-contained electronic device that includes all the circuitry and software necessary to transmit and receive data or control signals through the air between one or more other transceivers. The ease of integration and relatively quick time-to-market makes these devices very desirable for manufacturers that want to enable wireless connectivity in their products.

Modular radios can be purchased with regulatory certifications in place or as non-certified devices. Non-certified modular radios are typically used for more customized applications, but even though they don't have a complete certification they're designed and often pre-screened to meet the regulatory requirements when properly installed into a end use host device.

Radios which are sold having a single modular certification can be integrated into a host without having to retest the transmitter functions or to re-certify the final radio enabled product.

But even though a single modular approved radio is certified, the host device must still be designed with the radio properly installed and in a manner that the radio will remain in compliance. In addition, the host electronics may also have to comply with a separate set of regulations and these steps could require compliance testing and other equipment authorization procedures.



1 Modular Transmitters Overview

What is a modular transmitter?

RF Modules come in a variety of configurations including those which are just the radio transceiver while others come as a system-on-a-chip (SoC) with the transceiver and a microcontroller packaged on a single printed circuit board.

Some can be purchased as “plug-and-play” units that connect to a host through an interface like a USB port, while others require a higher level of host integration through a socketed connection interface or by directly soldering the module on to the host PCB.

Modular radios are developed for both licensed and unlicensed frequency bands. An example of a licensed band radio is one that uses cellular frequencies like that of a cell phone handset. Though a licensed band certified modular cellular radio will not require any additional FCC or Industry Canada certification when properly implemented in the host, it will require coordination with the license holder to operate on the cellular network. This will likely involve testing and approvals through a “PTCRB” and possibly with the network operator.

This guide and the information which follows will summarize the FCC and Industry Canada regulations for integrating modular certified radios into host products that are themselves digital devices. The focus of this information will be on host devices incorporating an unlicensed band radio such as Bluetooth and Zigbee which are typically used in the 2400-2483MHz band, and WiFi transmitting at 2.4GHz and 5GHz.

The next section of this guide will review the rules that apply to the module for certification as a single modular device. Finally, the compliance steps are outlined for integrating a certified module into a host device.



2 Radio Module Requirements

What are the regulations for modular radios and where are they maintained?

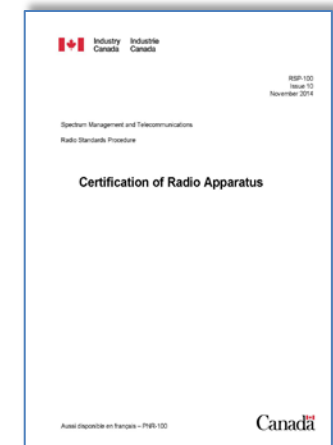
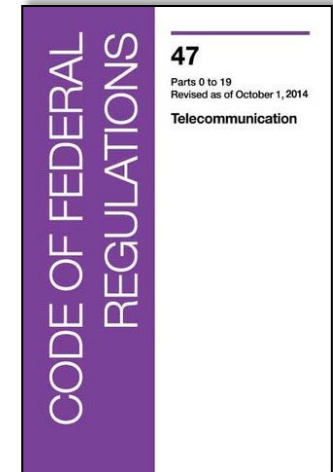
The FCC and Industry Canada regulations for modular certification of radio transmitter are closely harmonized between the two agencies. Both FCC and Canada regulations cover the design, operation, test, and labelling rules for the radio module itself. The agencies' rules are also closely aligned for the end use product when the radio module is integrated into a digitally operating host.

FCC Requirements for Certification as a Module

The requirements for certifying a radio as a module are listed in Title 47 of the FCC Code of Federal Regulations Part 15, and specifically rule part 15.212 for low power devices. In addition, there are guidance documents posted on the FCC's Knowledge Data Base (KDB) which provide supplemental information and clarification of the rules. Both the FCC regulations and the KDB guidance documents are freely accessible on the website www.FCC.gov. The information contained in the KDB- Transmitter Module Equipment Authorization Guide "[996369 D01 Module Equip Auth Guide v01r04](#)" provides further information and addresses unique integration issues.

Industry Canada Requirements for Certification as a Module

In Canada, the requirements for modular transmitter certification are listed in Section 7 of Radio Standards Procedure, RSP-100. In addition to the design and administrative rules, the technical requirements for the transmitter such as those in RSS-210 or RSS-247 must also be met. Modular RSP-100 radio rules for Canada certification can be retrieved from the Industry Canada website at <http://www.ic.gc.ca/eic/site/smt-gst.nsf/en/sf01130.html>



2 Radio Module Requirements

In order to certify a radio module as a single modular approved device it must meet all eight requirements listed in Part 15.212 and/or RSP-100 Sec 7 for Canadian certification.

The requirements include the radio module having a self contained regulated power to ensure stability in the transmitter power when installed in different types of hosts. The transmitter module must contain a buffered input/output channel to prevent overflow and modulation distortion. The power supply and buffered I/O along with all the radio signal generating elements must be fully contained within a shielded housing. In this configuration a modular radio becomes a stand alone device which must be capable of meeting the technical requirements on its own and remain a compliant wireless transmitter when integrated in any host.

The radio module must have a dedicated or permanently mounted antenna or have a unique connector so only the antennas included in the modular approval certification are used. It also must be compliant with RF hazards requirements when integrated in a host.

The modular radio must be labeled properly. Plus the module OEM must provide instructions for the end user or integrator to properly install the device so it remains compliant with the regulations.

A radio that can't be designed to meet all modular conditions may be certified as a limited modular transmitter. The grant holder of a limited modular certification must retain control over the final installation of the device to ensure compliance of the end product. This typically restricts limited modular approval for devices produced by a specific manufacturer for their own end use integration.

What's required to make a radio modular certified?

Modular Radio Certification Requirements

FCC 15.212(a)(1) & RSP-100 Sec 7.

- (i) Radio elements must have their own shielding**
- (ii) Buffered I/O**
- (iii) Self Contained Regulated Power Supply**
- (iv) Permanent antenna or unique coupler**
- (v) Compliant in a stand alone configuration**
- (vi) Permanently labeled or e-label displayed**
- (vii) User instructions for compliant integration**
- (viii) Compliance with RF exposure requirements**

Modular Certification Types

Single Modular

Fully self contained module that meets all criteria

Limited Modular

Radio module that does not meet all modular criteria

Split Modular

Module having RF section separate from device controls

Limited Split Modular

A split design that does not meet all modular criteria

3 Host Device Requirements

What are the compliance rules for a host device with a modular transmitter?

RF modules are a cost effective communications link for low to medium volume wireless applications. Manufacturers that integrate a radio module into a host product benefit from the convenience of having the communications link already designed, compliance tested, and ready for integration. However, the following steps are required to ensure continued compliance of the integrated transmitter as well as the final host product.

- Step 1-** Review the module certification and comply with applicable grant notes.
- Step 2-** Configure the radio with the appropriate antenna and support items
- Step 3-** Perform SAR or MPE evaluation if necessary
- Step 4-** Perform host device testing as required.
- Step 5-** Apply labeling and update host device user instructions and documents



The type of host product and end use application may affect the authorization and conformity assessment testing required for the end product. A host may be a digital device that is subject to the equipment authorization requirements of verification or declaration of conformity. The rule parts in FCC Part 15.101 and ICES-003 list the authorization process to be followed depending on the type of host device. Certain digital device hosts are exempt from equipment authorization and integrators should review FCC 15.103 to determine if an exemption may apply. If an exemption does not exist the host will likely need digital device testing.

FCC 15.103 Exempted Devices- Devices used exclusively in

- Transportation vehicles (motor vehicles or aircraft),
- Utilities and industrial plants,
- Industrial, commercial, or medical test equipment,
- An appliance, i.e microwave oven, dishwasher, A/C
- Specialized medical digital devices,
- Joystick controllers, mouse,
- Devices having power consumption < 6nW
- Devices operating less than 1.705Mhz without a mains connection

3 Host Device Requirements

What information on the transmitter grant should be reviewed?

Step 1- Review the module certification to confirm the transmitter can be used without restrictions. Comply with applicable grant notes.

The initial review of the certification should be to confirm that the grant is indeed a single modular certification. A Module Type designation that includes the terms “limited” implies there are restrictions on the which host devices may be used for the transmitter.

Review the Grant Notes to identify any restrictions on the use of the transmitter.

Common grant note issues include:

- *Approved for use with antenna(s) as listed in this filing.*
- *The antenna(s) must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antennas or transmitters.*
- *Final host installations incorporating multiple transmitters must comply with collocation and RF exposure requirements in accordance with FCC multi-transmitter product procedures; collocated transmitters operating in portable RF Exposure conditions may require separate approval.*

TCB **GRANT OF EQUIPMENT AUTHORIZATION** **TCB**

Certification
Issued Under the Authority of the
Federal Communications Commission
By:

Eurofins Product Service GmbH Date of Grant: 10/01/2010
Storkower Strasse 38c Application Dated: 10/01/2010
D-15526 Reichenwalde,
Germany

Panasonic Industrial Devices Europe GmbH
Zeppelinstrasse 19
Lueneburg, 21337
Germany

Attention: Heino Kaehler , Manager

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: T7V1315
Name of Grantee: Panasonic Industrial Devices Europe GmbH
Equipment Class: Part 15 Spread Spectrum Transmitter
Notes: Bluetooth Module
Modular Type: Single Modular

<u>Grant Notes</u>	<u>FCC Rule Parts</u>	<u>Frequency Range (MHz)</u>	<u>Output Watts</u>	<u>Frequency Tolerance</u>	<u>Emission Designator</u>
	15C	2402.0 - 2480.0	0.011		

Single Modular Approval. Output power listed is conducted. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. Installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

3 Host Device Requirements

What are the rules for antenna types?

Step 2- Only use an antenna approved for use with the transmitter

A modular approved radio is tested and certified with a specific type (or types) of antenna. The antenna characteristics directly affect the radiated output power and ultimately its continued compliance with the regulations. Only an approved antenna can be used with a modular certified radio.

Some radio modules are designed with a permanent antenna mounted directly on the module's printed circuit board. Other radios are fitted with an antenna connector port which can connect directly to an antenna or to a cable which connects to a remote antenna.

In certain instances a detachable or remote antenna type may be specified directly on the grant. In other cases the permitted antennas are listed in the OEM installation instructions or in the compliance test report. The transmitter reports can be retrieved from the grant filing on the FCC or Industry Canada website data base.

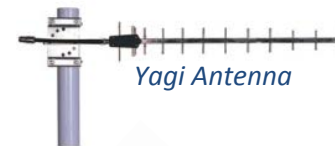
The radio module manufacturer is required to clearly state in the user instructions the type and gain of the antenna allowed. No antenna should be used that has a higher gain than that listed in the module grant.



Panel Antenna



Omni Directional



Yagi Antenna



Grid Antenna



Patch Antenna



Dish Antenna

3 Host Device Requirements

What are the RF hazards requirements?

Step 3- Perform SAR or MPE evaluation if necessary.

If the host application is handheld or body worn, or normally used within 20cm of a person, determine if the certification will permit the use of the radio for a portable application. First, determine if the transmitter power level is low enough to be categorically excluded from an RF hazards evaluation. If not excluded, then the radio and host configuration will require Specific Absorption Rate (SAR) testing. Review the details on RF exposure in the FCC KDB 447498.

A mobile application is one where the transmitter will be maintained at distances greater than 20cm. Determine if the transmitter power level for the mobile or fixed device is such that it is below the maximum permissible exposure (MPE) limit of $1\text{mW}/\text{cm}^2$. If not, then it will be necessary to extend the separation distance between the radio and the user until the RF levels are below the MPE limit.

For co-located transmitters having antennas on the same host device and transmit simultaneously the sum total of the transmitted RF energy is required to be less than the MPE limit of $1\text{mW}/\text{cm}^2$.

The FCC provides an Excel spreadsheet calculator that maps the radio antennas on the host board and calculates the summed total of the transmitted power. The spreadsheet can be obtained from the FCC, or contact Elite for a copy.

> 20CM

Definition: Mobile Device.

For purposes of RF exposure evaluation, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to be generally used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structures and the body of the user or nearby persons.

< 20CM

Definition: Portable Device.

For purposes of RF exposure evaluation, a portable device is defined as a transmitting device designed to be used with any part of its radiating structure in direct contact with the user's body or within 20 centimeters of the body of a user or bystanders under normal operating conditions.

Definition: Specific Absorption Rate (SAR)

A measure of the rate at which energy is absorbed by the human body when exposed to a radio frequency (RF) electromagnetic field. SAR applies to portable devices.

Definition: Maximum Permissible Exposure (MPE)

Threshold level at which harmful biological effects may occur. The MPE limits apply to mobile or fixed devices.

3 Host Device Requirements

What tests are required for the integrated host product?

Step 4- Perform Part 15B/ICES-003 or other testing as necessary.

Once the modular transmitter is configured in the host device, the host product still needs to comply with all the equipment authorization procedures applicable to functions not associated with the transmitter module. Host products may have digital circuitry, a receiver, or be a computer peripheral and these elements are subject to the unintentional radiator rules under Part 15B or ICES-003.

If a host was previously tested for compliance as an unintentional radiator, i.e. verification or DoC without the transmitter, the host manufacturer is still responsible for compliance of the final integrated transmitter/host system. Since the module/host end product compliance may depend on the details of how the design and integration is completed, the grantee (party responsible for the module grant) is required to provide guidance to the host manufacture to ensure continued compliance with transmitter requirements.

Once the verification testing or Declaration of Conformity testing is completed, it is not necessary to notify the FCC or Canada of the host compliance. There are no requirements to file any additional documentation with the agencies. However, there are labeling and documentation steps required for the host compliance.

Verification Equipment Authorization

- *TV & FM broadcast receivers*
- *Stand-alone cable input selector switch*
- *Class B external switching power supplies*
- *Class B digital devices and peripherals*
- *All other devices not otherwise noted.*

DoC Equipment Authorization

- *CB, Superregenerative receiver*
- *All other receivers not otherwise noted*
- *TV interface*
- *Cable system terminal*
- *Class B personal computers & peripherals*
- *CPU boards, internal PS for Class B PCs*
- *Class B PCs assembled using authorized CPU boards and PS.*

3 Host Device Requirements

What information is required to include on the label and users manual?

Step 5- Label the host product and prepare documentation

With the radio module configured in the host device, the module's FCC and Industry Canada identifiers will need to be in a location that can be easily seen by the end user of the host device. For Industry Canada rules on transmitters, the model number of the transmitter must also be viewable.

If the module is embedded within the host so that it's not easily seen by a user then the host device will need an additional permanent label referring to the enclosed module and including the FCC 15.19 compliance statement. In addition, the host user manual must include the FCC and Industry Canada number or they must include instructions on how to access the module ID information.

The labeling requirements for a modular certified transmitter are similar to those covering a individual host certification with the exceptions that the words "Contains" must be included when referencing the FCC ID and Canada numbers.

Certified modular transmitters embedded in host devices also have the option for an electronically displayed module identification. E-Labeling rules are described in the KDB documents.

Host Device Labeling (Verification)

Model Number: TX5000
Contains FCC ID: XYZ12-ABC8888888
IC: 2222A-ABC8888888
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.

Two part compliance statement for host devices that are subject to **verification** equipment authorization.

Host Device Labeling (DoC)

Model Number: TX5000
Contains FCC ID: XYZ12-ABC8888888
IC: 2222A-ABC8888888

FCC Trade name
Model number

FCC logo for host devices subject to **Declaration of Conformity** equipment authorization.

3 Host Device Requirements

What information is required in the users manual?

Step 5- Include information to users in the manuals/documentation

The following information (as a minimum) is required to be included in the users guides or instruction manuals.

- Compliance statement per 15.19(3)
- Modifications to the device per 15.21
- RF Hazards (if applicable)
- Antenna separation distances
- Special instructions on use and assembly of equipment

Composite modes with digital devices may need the statement in FCC 15.105.

When applicable, the grantee must include information concerning minimum separation distances from radiating structures and how to properly install antennas.

Where special accessories such as shielded cables and/or special connectors are required for compliance, the manuals shall include accessory installation instructions on the first page.

If the certified transmitter can also operate in a mode as a Class A or B digital device then include the compliance statement as noted in FCC 15.105.

Other compliance statements may be required depending on the operating modes and applications. See list (right).

All user information can be provided in a printed manual, computer disk, or over the Internet. For Industry Canada the user information will need to be provided in English and French.

Rule Part 15.19(3) compliance statement:

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.

Rule Part 15.21 statement:

Any changes/modifications to this equipment not approved by (insert grantee name) could void the user's authority to operate the equipment.

Additional Specific User Manual Instructions

- ✓ Kits for TV interface & cable. 15.25(d);
- ✓ TV interface devices. 15.115 (c)(5);
- ✓ Digital cable ready products 15.123
- ✓ External power amplifiers 15.204(d)(2)
- ✓ Cordless phones. 15.214(c) & (d)(3)
15.233(b)(2)(ii), 15.233(h)
- ✓ Professionally installed systems. 15.247(c)
(1)(iii);
- ✓ Operations at 92-95GHz. 15.257(a)(4)
- ✓ Unlicensed PCS. 15.311

4 Final Comments and Resources

RF modules provide a quick solution for enabling a wireless communications link for low to medium volume wireless applications, but it's important to design and integrate the radio into the host to maintain the radio certification and host equipment authorization.

Each end use application has its own unique design considerations and constraints. The host device manufacturer is responsible for evaluating all aspects of the module integration and ensuring continued compliance of the module and the host.

Given the wide range of end use applications and modular radio certification, host device manufacturers are encouraged to read through the FCC and Canadian rules & regulations, guides and KDB's. In addition, it's recommended to contact an Elite applications engineer to review the steps noted in this document and to confirm no detail is overlooked.

Elite can also assist with CE marking and other global wireless certification. For more information on wireless transmitters, link to the following documents, or contact Elite.

Review of Host Device Compliance Steps

- Step 1- Review module grant & comply with grant notes.
- Step 2- Use appropriate antenna and support items
- Step 3- Perform SAR or MPE evaluation if necessary
- Step 4- Perform host device testing as required.
- Step 5- Label & update host instructions & documents



4 Final Comments and Resources

The following documents provide the most beneficial supplemental information to explain the modular certification for FCC and Industry Canada regulatory compliance. These documents can be found via Elite's Downloads page (links below) or searched for on the www.fcc.gov website and the Industry Canada website <http://www.ic.gc.ca/eic/site/smt-gst.nsf/en/home>

- [FCC Transmitter Module Equipment Authorization Guide Oct 31, 2013](#)
- [FCC Guidelines for Labeling and User Information for Devices Subject to Part 15 July 11, 2014](#)
- [FCC Electronic Labeling Guidance July 11, 2014](#)
- [FCC Quick Labeling Guide](#)
- [FCC Mobile and Portable Devices RF Exposure Procedures EA Policies Feb 7, 2014](#)
- [FCC OET Bulletin 65 Supplement C Cross Reference Jan 17, 2014](#)
- [FCC SAR Measurement Procedures For USB Dongle Transmitters Nov 13, 2009](#)
- [Industry Canada RSP-100 Nov 2014](#)
- [Industry Canada ICES-003 Issue5 Nov 2014](#)
- [Industry Canada RSS-102 Issue 5 RF Exposure Compliance March 2015](#)



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4 Final Comments and Resources

Elite technical sales engineers are available to assist with your modular radio transmitter compliance project. Contact one of the following experts for assistance with FCC, Canada, European Union or other global regulations.

Steve Laya, Sales & Marketing Manager, 630-495-9770 x 119, sglaya@elitetest.com

John Schmit, Inside Sales Manager, 630-495-9770 x 125, jbschmit@elitetest.com

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