Datasheet

LT1110-200 (PRM240) Wireless Module

Version 4.2

Revision History

Version	Date	Notes	Contributors	Approver
3.0	13 Jan 2014	Separated into two separate docs: Hardware Integration Guide and User Guide. Marked as Rev 3.0 to match User Guide.		Sue White
3.1	6 April 2017	Updated to remove PRM210/211/220/221 and PRM241		Jennifer Gibbs
4.0	25 Apr 2024	Ezurio rebranding	Sue White	Dave Drogowski
4.1	16 May 2024	Changed Antenna (part numbers YS8963 and FG9026) manufacturer name from Laird Technologies to TE Connectivity Laird in section 8.3 Approved Antenna List	Raj Khatri	Dave Drogowski
4.2	08 Apr 2025	• Changed mode name to PRM240 from LT1110 • Updated the EIRP to 347mW in the Table 1 • Fixed the channels to 53 in the Table 2	Jacky Kuo	

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1   Overview

The PRM240 Frequency Hopping Spread Spectrum Transceiver Module from Ezurio is the latest in robust and easy to use radio modules. Supporting both high data rates and long ranges, the PRM240 is a great fit for any number of machine-to-machine applications. The PRM240 features an easy-to-use serial UART with hardware flow control for fast integration into an existing serial infrastructure.

This document contains information about the hardware and software interface between an PRM240 transceiver and an OEM Host. It is designed to explain how to integrate the PRM240 module into a host device.

For reference, this document also includes a list of Related Documents.

Note: Unless mentioned specifically by name, the PRM240 modules are referred to as *radio* or *transceiver*. Individual naming is used to differentiate product specific features. The host (PC/Microcontroller/Any device to which the PRM240 module is connected) are referred to as *OEM host* or *host*.

2   Key Features

- High power (200 mW) and low power (10mW) versions available
- Retries and acknowledgements
- Configurable network parameters
- Multiple generic I/O
- 280 kbps or 500kbps RF data stream
- Idle current draw of 8mA, sleep current of 0.3uA
- Software selectable interface baud rates from 1200 bps to 460.8 kbps
- Upgradable FW through serial port
- Low cost, low power and small size ideal for high volume, portable and battery powered applications
- All modules are qualified for Industrial temperatures (-40°C to 85°C)
- Advanced configuration available using AT commands
- Easy to use Configuration & Test Utility software

3   Specifications

Table 1: General specifications

Parameter	PRM240
Interface	UART
Frequency	902-928 MHz
RF Data Rate	230 kbps
Serial Interface Options	Logic Level (matches supply voltage)
Serial Interface Data Rate	Up to 460,800 baud
Variable Conducted Output Power	+13 to +23 dBm (200 mW)
Maximum Radiated Power (EIRP)	+25.4 dBm (347 mW) with a 2.4 dBi antenna

Table 2: Current consumption specifications

Parameter	PRM240
Peak Tx	230 mA
Peak Rx	30 mA
Average Idle	8 mA
Sleep	0.3 µA
Channels	53 channels
Sensitivity (BER 10-6)	230 kbps RF rate: -89 dBm
Voltage	2.0 - 3.6 VDC
Approximate Range (Indoor/Outdoor)	800 feet/3.2 miles (with 2 dBi dipole)
Temperature	-40° to +85° C
Dimensions	25 mm x 30 mm x 4 mm (Pluggable U.FL)
Approvals	U.FL connector (PRM240)

Table 3: Pin definitions for the PRM240 transceiver

Pin Number	Type	Signal Name	Functions
1	PWR	VCC	3.3 - 3.6 V ±50mV ripple (must be connected)
2	O	TXD	Asynchronous serial data output from transceiver
3	I	RXD	Asynchronous serial data input to transceiver
4	-	-	Reserved for future use. Do not connect.
5	I	$\overline{uP\_Reset}$	RESET – Controlled by the PRM240 for power-on reset if left unconnected. After a stable power-on reset, a logic low pulse resets the transceiver.
6	O	GIO_1	Generic Output
7	O	GIO_0	Generic Output/Hop_Frame
8		DNC	Do not connect.
9	I	$\overline{Force\_9600}$	Force 9600 – When pulled logic low and then applying power or resetting, the transceiver's serial interface is forced to a 9600, 8-N-1 rate. **Note:** Because this mode disables some modes of operation, it should not be permanently pulled low during normal operation.
10	GND	GND	Signal Ground
11	I	$\overline{CMD}$/DATA	When logic low, the transceiver interprets incoming OEM Host data as command data. When logic high, the transceiver interprets OEM Host data as transmit data.
12	O	$\overline{CTS}$	Clear to Send - CTS is used for hardware flow control. CTS toggles high when the input buffer reaches the CTS On threshold until the buffer recedes below CTS Off.
13	-	-	Reserved for future use. Do not connect.
14	I	$\overline{CS}$	Generic Input
15	O	$\overline{In\_Range}$	When logic low, the client is in range and synchronized with a server. This is always low on a server.
16	I	$\overline{RTS}$	Request to Send. Floats high if left unconnected. When enabled in EEPROM, the module does not transmit data out the serial UART unless the pin is low
17	O	DE/$\overline{RE}$	RS-485 Driver Enable
18		MISO	Generic Input
19	O	DA_OUT	PWM Output
20	I	AD_IN	Analog and digital Input

Engineer's Tips:

- All I/O is 3.3V TTL.
- All inputs are weakly pulled high via a 20k Ohm pull-up resistor and may be left floating during normal operation.
- Minimum connections: VCC, GND, TXD, and RXD.
- Signal direction is with respect to the transceiver.
- Unused pins should be left disconnected.

Table 4: Input characteristics

Signal name	Min. High	Max. High	Min. Low	Max. Low
uP_Reset	.8 V	VCC	0 V	.6 V
RTS	2.31 V	VCC	0 V	.99 V
AD_IN	n/a	VCC	0 V	n/a
All other inputs	70% VCC	VCC	0 V	30% VCC

Table 5: Output characteristics

Signal name	Min. High	Max. High	Min. Low	Max. Low	Sink Current
GIO_0	2.5 V	3.3 V	0 V	.4 V	20 mA
GIO_1	2.5 V	3.3 V	0 V	.4 V	20 mA
DA_OUT	N/A	3.3 V	0 V	N/A	4 mA
All other inputs	2.5 V	3.3 V	0 V	.4 V	4 mA

Table 6: Timing Specifications

Parameter	Server/Client	Min.	Typ.	Max.	Notes
Power on to CTS Low		5 ms	10 ms	N/A	The first boot after a FW upgrade requires more than the typical amount of time for CTS to toggle low.
EEPROM Read		800 µs	1 ms	2 ms	Measured from last byte of command to first byte of response: 870 us for 1 byte 1.1 ms for 80 bytes 1.4 ms for 256 bytes
EEPROM Write		20 ms	30 ms	40 ms	Measured. EEPROM writes cause the radio to resynchronize
Power on to In Range	Client only; server goes in range in <13 ms	13 ms	600 ms	1700 ms*	*Maximum time assuming all beacons are heard; RF interference could extend the maximum time indefinitely
Hop Period In Range			13.19 ms		
Hop Period Out of Range	Client only		38.4 ms		
Reset Pulse		250 ms			
PWM Output Period			315.077 µs		
Restore Default EEPROM Command		10 ms	38 ms		The Restore command initiates a soft reset; monitoring CTS is the best indication of a completed command
Non-Specific AT Command		1 ms	10 ms		Some AT commands could wait indefinitely for a response
Write Flash					For FW upgrade
Read Flash					
Decrypt Image					

3.1   RF Hop Frame

The PRM240 hops every 13.19 milliseconds and can be configured for two different RF data rates to provide options for range or throughput. During each hop, the PRM240 reserves a certain amount of time for overhead, such as the synchronization beacon, internal messaging, and user data transmission. Figure 1 outlines the various transmissions that occur during a hop. These transmissions are transparent to the user sending data, but may be useful for applications that require critical timing. User data is only transmitted during the data slots and after the Interface Timeout or RF Packet Size criteria has been met. Data transmission only begins at the beginning of a data slot. When configured for Full Duplex, data slot 1 is reserved for the server and data slot 2 is shared by all clients for transmissions.

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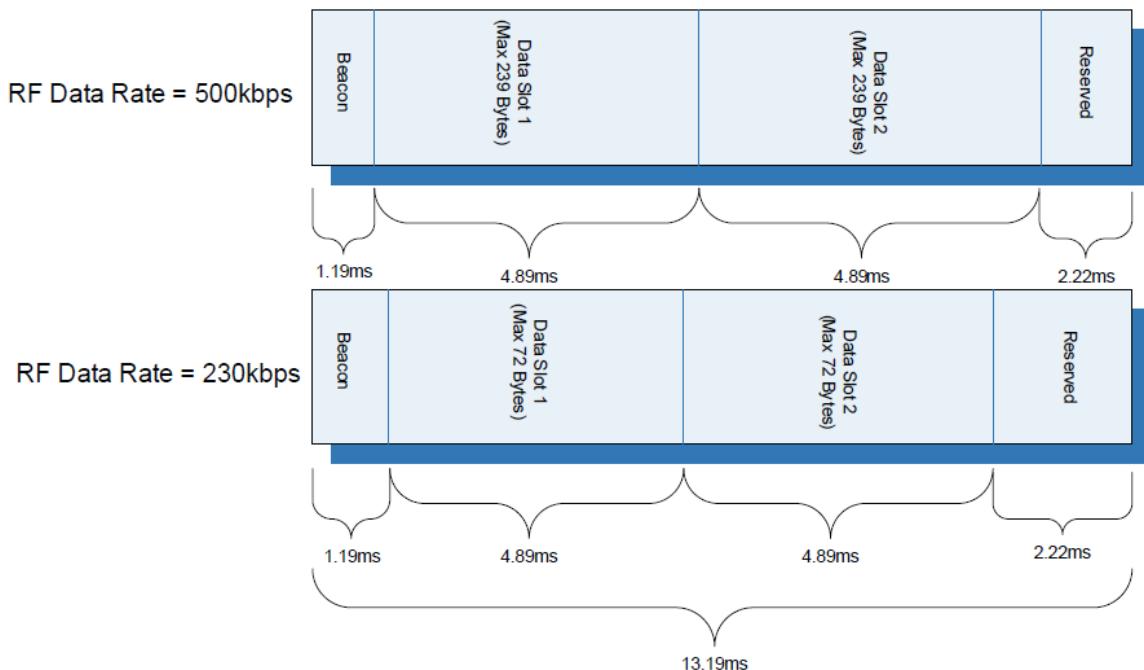
Figure 1: RF hop frame diagram

4   Block Diagram
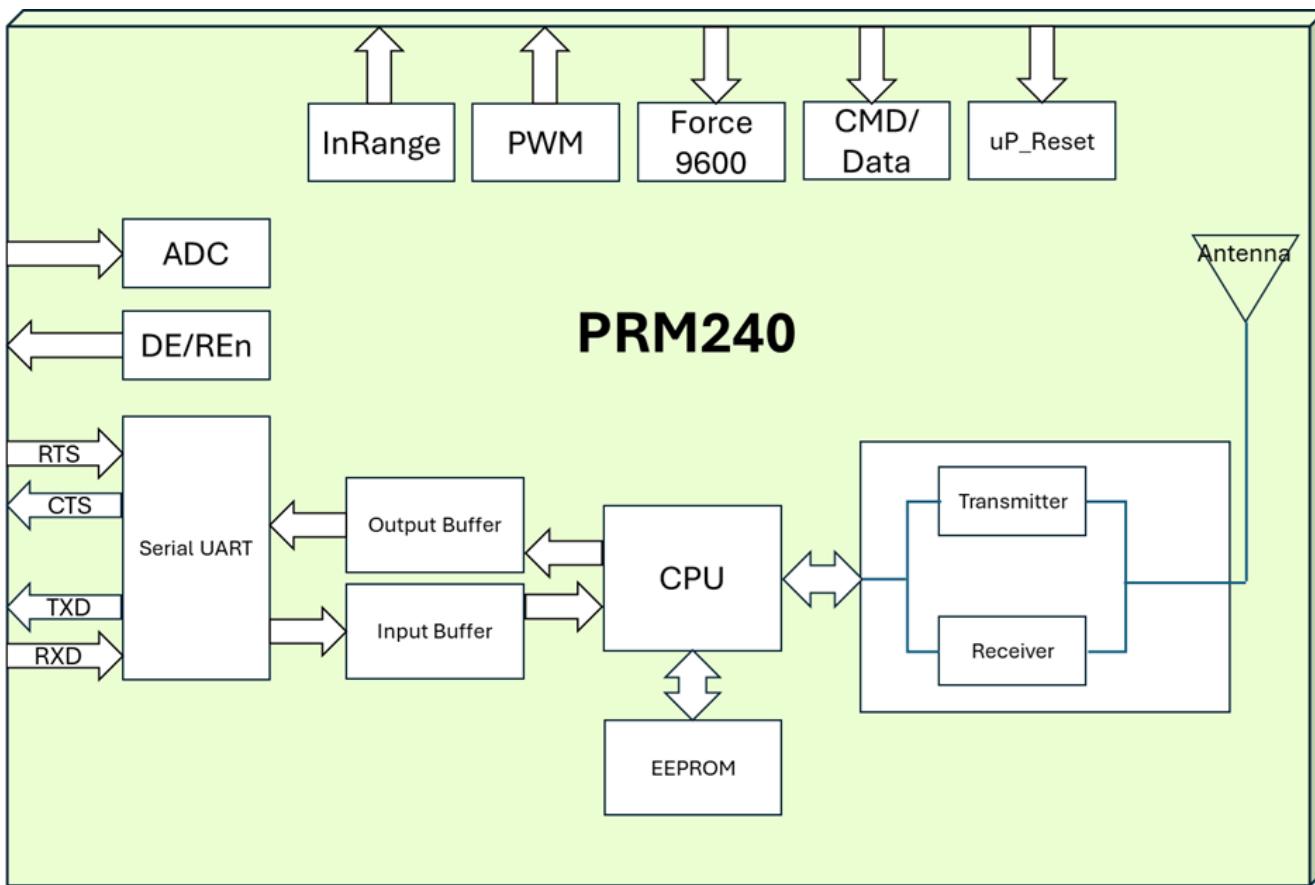
Figure 2: PRM240 functional block diagram

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5   Hardware Interface

5.1   Pin Descriptions

5.1.1   RXD and TXD

The PRM240 accepts 3.3 VDC TTL level asynchronous serial data from the OEM host via the RXD pin. Data is sent from the transceiver, at 3.3V levels, to the OEM host via the TXD pin. Pins should be left floating or high when not in use. Leaving the RXD tied low results in the radio transmitting garbage serial data across the RF.

5.1.2   Force_9600

When pulled logic low before applying power or resetting, the transceiver's serial interface is forced to 9600,
8-N-1 (8 data bits, No parity, 1 stop bit), regardless of actual EEPROM setting. The interface timeout is also set to 3 milliseconds, and the RF packet size is set to the default size for the selected RF data rate. To exit, the transceiver must be reset or power-cycled with Test pin logic high or disconnected.

When enabled in the EEPROM, 9600 Boot Option causes the 9600 pin to be ignored on cold boot (power-up), command boot (0xCC 0xFF), and brown-out conditions. Therefore, the 9600 pin is only observed on warm boots (reset pin toggled). This helps ensure that brown-out conditions don't cause the baud to change if the 9600 pin happens to be low at the time. When 9600 Boot Option is disabled, the 9600 pin is used for all boot conditions. 9600 Boot Option is enabled by default.

Force 9600 is also used to wake the radio from sleep. When the pin is taken Low, the radio wakes. The transceiver does not sleep if the pin is low when the sleep command is issued.

Note: Because this pin disables some modes of operation, it should not be permanently pulled low during normal operation.

5.1.3   uP_Reset

μP_Reset provides a direct connection to the reset pin on the PRM240 microprocessor and is used to force a hard reset. For a valid reset, reset must be asserted low for an absolute minimum of 250 ns.

5.1.4   CMD/DATA

When logic high, the transceiver interprets incoming serial data as transmit data to be sent to other transceivers. When logic low, the transceiver interprets incoming serial data as command data. When logic low, data packets from the radio are not transmitted over the RF interface. However, incoming packets from other radios are still received. Enabling CMD/Data RX Disable in the EEPROM causes incoming RF packets to be queued by the receiving radio while CMD/Data is Low. When CMD/Data goes High, the data is sent over the serial interface.

5.1.5   In_Range

The In Range pin is driven low when a client radio's frequency hopping is synchronized with that of a server. In Range is always driven low on a server. Following boot, In Range transitions Low in approximately 12 milliseconds on a server. For a client, the In Range takes an average of 500 milliseconds, depending on the signal strength of the received beacon, the presence and strength of interference, and randomness of the sync function. It can vary from 150 to over 1500 milliseconds.

5.1.6   GO_0/Hop_Frame

The Hop Frame indicator functionality is disabled by default and controlled by the Control 1, Bit-6 EEPROM setting. When enabled, this pin transitions logic Low at the start of a hop and transition logic High at the completion of a hop. The OEM host is not required to monitor Hop Frame.

5.1.7   RTS Handshaking

With RTS mode disabled, the transceiver sends any received data to the OEM host as soon as it is received. However, some OEM hosts are not always able to accept data from the transceiver. With RTS enabled in EEPROM, the OEM host can prevent the transceiver from sending it data by de-asserting RTS (High). Once RTS is re-asserted (Low), the transceiver sends packets to the OEM host as the packets are received.

Note: Leaving RTS de-asserted for too long can cause data loss once the transceiver's transmit buffer reaches capacity.

5.1.8   CTS Handshaking

If the transceiver buffer fills up and more bytes are sent to it before the buffer can be emptied, data is lost. The transceiver prevents this loss by deasserting CTS High as the buffer fills and asserting CTS Low as the buffer is emptied. CTS should be monitored by the host device and data flow to the radio should be stopped when CTS is High.

5.1.9   DE/RE

When enabled, RS-485 Data Enable uses the DE/RE pin to control the DE pin on external RS-485 circuitry. When the transceiver has data to send to the host, it asserts DE/RE High, send the data to the host, and then take DE/RE Low.

5.1.10   PWM Output

PWM output can be configured to output on any of three pins (2, 3, or 19). The PWM Output can optionally produce a pulse width modulation for RSSI with a period of 315.077 uS.

6   Mechanical Considerations

6.1   Mechanical Drawing: PLUGGABLE U.FL
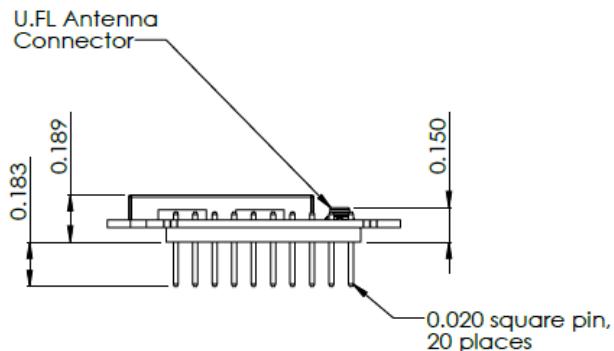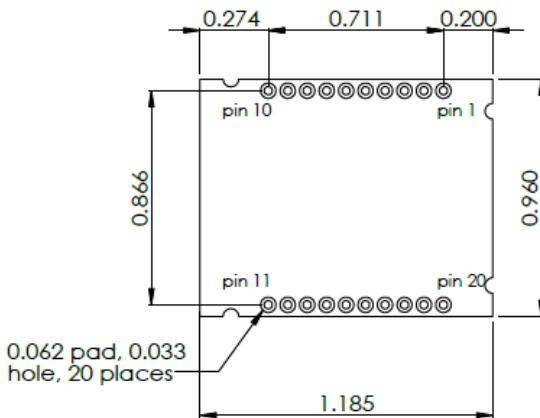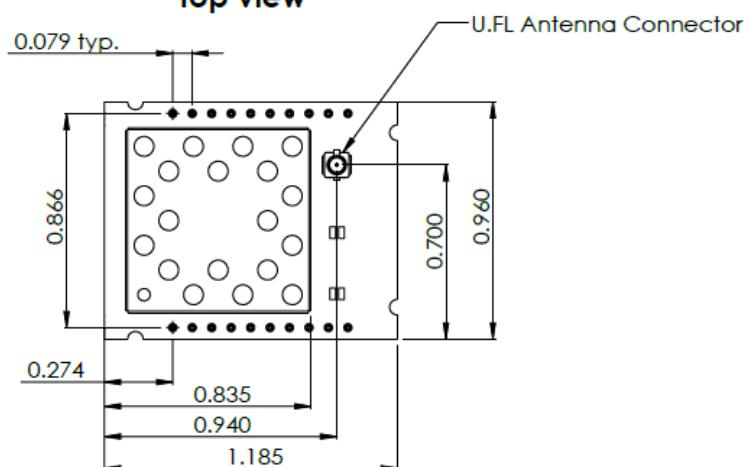
Figure 3: Form factor: pluggable U.FL

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6.2   Moisture Content Warning

CAUTION   Level

This bag contains
MOISTURE-SENSITIVE DEVICES

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1. Shelf life in sealed bag: 24 months at < 40°C
   and < 90% relative humidity.

2. Peak package body temperature: 245°C.

3. After this bag is opened, devices that will
   be subjected to reflow solder or another high
   temperature process must be;

   a) Mounted within 168 hours at factory
      conditions of ≤ 30°C @ 60% RH... or...
   b) Stored at < 10% RH
4. Devices require bake, before mounting, if;
   a) Humidity indicator card is >10% when read
      at 23 +/- 5°C ...or...
   b) 3a or 3b is not met.

5. If baking is required, devices may be baked for
   48 hrs. at 125 +/- 5°C
   Note: If device containers cannot be subjected
   to high temperature or shorter bake times are
   desired, reference IPC/JEDEC J-STD-033 for
   bake procedure.

Bag Seal Date _____

Figure 4: Moisture content warning

7   Ordering Information

7.1   Product Part Numbers

Table 7: PRM240 Part Numbers

Part #	Description	FCC ID*	IC
PRM240-0X	900 MHz OEM Transceiver, pluggable, 3.3V TTL, 200 mW, u.FL Jack	KQL-1110200	2268C-1110200

8   Compliancy Information

8.1   Agency Identification Numbers

Family	US/FCC	Canada/IC
PRM240	KQL-1110200	2268C-1110200

8.2   PRM240-200 Family

Part #	Description	Packaging
PRM240	(+23 dBm), Pluggable with U.FL connector	PLG-U.FL

8.3   PRM240-200 Family Approved Antenna List

Item	Part Number	Mfg.	Type	Gain (dBi)
1	EFH8631A3S-10MHF1	Ezurio	FlexDIPOLE	2.4
2	W3113	Pulse Electronics	Helical SMD-Antenna	0.8
3	S467FL-6-Px-915S	TE	Dipole	2
4	Nevco PCB Trace L Antenna	Laird	PCB Trace	0.9

8.4   Requirements for Modular Approval

Federal Communication Commission Interference Statement

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

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.

IMPORTANT NOTE:

FCC Radiation Exposure Statement:

The product comply with the US portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available.

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

Integration instructions for host product manufacturers

Applicable FCC rules to module: FCC Part 15.247

Summarize the specific operational use conditions

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

1)   The transmitter module may not be co-located with any other transmitter or antenna

As long as 1 condition above are 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.

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not 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 FCC authorization. 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.

Limited module procedures: Not applicable

Trace antenna designs: Not applicable

RF exposure considerations

Co-located issue shall be met as mentioned in "Summarize the specific operational use conditions".

Product manufacturer shall provide below text in end-product manual

"FCC Radiation Exposure Statement:

The product comply with the US portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available."

Label and Compliance Information

Product manufacturers need to provide a physical or e-label stating

"**Contains FCC ID: KQL-1110200**" with finished product

Information on Test Modes and Additional Testing Requirements

Test tool: Laird Technologies Config, Version: 6.1.0.0 shall be used to set the module to transmit continuously.

Additional Testing, Part 15 Subpart B Disclaimer

The module is only FCC authorized for the specific rule parts listed on the grant, and that the 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. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Industry Canada statement

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

(2) This device must accept any interference, including interference that may cause undesired operation of the device

L'émetteur/récepteur exempt de licence contenu dans 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;

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

Radiation Exposure Statement:

The product comply with the Canada portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available.

Déclaration d'exposition aux radiations:

Le produit est conforme aux limites d'exposition pour les appareils portables RF pour les Etats-Unis et le Canada établies pour un environnement non contrôlé. Le produit est sûr pour un fonctionnement tel que décrit dans ce manuel. La réduction aux expositions RF peut être augmentée si l'appareil peut être conservé aussi loin que possible du corps de l'utilisateur ou que le dispositif est réglé sur la puissance de sortie la plus faible si une telle fonction est disponible.

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

1) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 1 condition above are 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 conditions suivantes:

1) 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 conformité supplémentaires requis pour ce module installé.

IMPORTANT NOTE:

In the event that these conditions can not 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 ID can not 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'ID 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.

End Product Labeling

The final end product must be labeled in a visible area with the following: "Contains IC:2268C-1110200".

Plaque signalétique du produit final

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 2268C-1110200".

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 [IC: 2268C-1110200 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.

Le présent émetteur radio [IC: 2268C-1110200] a été approuvé par Innovation, Sciences et Développement économique 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 pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.

8.5   Antenna

Manufacture / Part Number	Type	Connector	Gain(dBi)
TE / S467FL-6-Px-915S	Dipole	U.FL plug	2
Ezurio / EFH8631A3S-10MHF1	**FlexDIPOLE**	**MHF1 (U.FL)**	**2.4**
Laird / Nevco PCB Trace L Antenna	PCB trace antenna	N/A	0.9
Pulse Electronics / W3113	Helical SMD-Antenna	N/A	0.8

9   Additional Information

Please contact your local sales representative or our support team for further assistance:

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