User's Guide

TPS631010EVM User's Guide

ABSTRACT

This user's guide describes the operation and use of the TPS631010EVM evaluation module (EVM). The TPS631010EVM is designed to help users easily evaluate and test the operation and functionality of the TPS631010 buck-boost converter. The TPS631010EVM has the output voltage set to 3.3 V. The EVM operates from a 1.6-V to 5.5-V input voltage range. Output current can go up to 2 A when Vin is higher than 3V and 1.5 A when Vin is higher than 2.7V. This document includes the following:

- Setup instructions for the hardware
- Schematic diagram
- Bill of materials (BOM)
- Printed-circuit board (PCB) layout drawings for the evaluation module

Throughout this document, the abbreviations EVM, TPS631010EVM, and the term evaluation module are synonymous with the TPS631010, unless otherwise noted.

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Trademarks

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1 Introduction

The Texas Instruments TPS631010 is a highly efficient, single-inductor, internally compensated, buck-boost converter in a 8-pin, 1.8-mm × 0.9-mm WCSP package.

1.1 Background

The TPS631010EVM uses the TPS631010 integrated circuit (IC), is set to a 3.3-V output, and operates with an input voltage between 1.6 V and 5.5 V.

1.2 Performance Specification

Table 1-1 provides a summary of the TPS631010EVM performance specifications. All specifications are given for an ambient temperature of 25°C.

Table 1-1. Performance Specification Summary

SPECIFICATION	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input voltage		1.5		5.5	V
Start-up input voltage		1.6		5.5	V
Output voltage		1.2		5.3	V
Output current	VIN ≥ 3 V, VOUT = 3.3 V	0		2000	mA

1.3 Modifications

The printed-circuit board (PCB) for this EVM is designed to accommodate the TPS631010. Extra positions are available for additional input and output capacitors and a feedforward capacitor.

1.3.1 IC U1 Operation

U1 is configured for the evaluation of the adjustable-output version. This EVM is set to 3.3 V. Resistors R4 and R5 can be used to set the output voltage between 1.0 V and 5.5 V. See the data sheet for recommended values.

1.3.2 Device Enable Evaluation

Components JP2 can be populated to evaluate the device enable feature of this IC. For further details, please refer to the data sheet.

2 Setup

This section describes how to properly use the TPS631010EVM.

2.1 Input/Output Connector and Header Descriptions

J1, Pin 1 and 2 – VIN	Positive input connection from the input supply for the EVM
J1, Pin 3 and 4 – S+/S– Input	Voltage sense connections. Measure the input voltage at this point.
J1, Pin 5 and 6 – GND	VIN GND return connection from the input supply for the EVM, common with J2, pin 5 and 6
J2, Pin 1 and 2 – VOUT	Output voltage connection
J2, Pin 3 and 4 – S+/S– VOUT	Output voltage connection
J2, Pin 5 and 6 – GND	VOUT GND return connection for the output voltage, common with J1 pin 5 and 6
JP1 – Enable	Shorting the jumper between the center pin EN and HIGH turns on the unit. Shorting the jumper between the center EN and LOW turns the unit off.
JP2 – MODE	Shorting the jumper between the center pin MODE and LOW enables automatic transition to power-saving mode at light-load currents as described in the data sheet. Shorting the jumper between the center pin MODE and HIGH enables forced PWM mode.

2.2 Setup

To operate the EVM, connect an input supply with the positive lead to J1, pins 1 and 2 and negative lead to J1, pins 5 and 6. Connect a load with the positive lead to J2, pins 1 and 2 and the negative lead to J2, pins 5 and 6. Short EN and HIGH (pins 1 and 2) of JP1 with a shorting jumper.

3 Board Layout

This section provides the TPS631010EVM board layout and illustrations.

3.1 Layout

Figure 3-1 and Figure 3-2 show the board layout for the TPS631010EVM PCB.

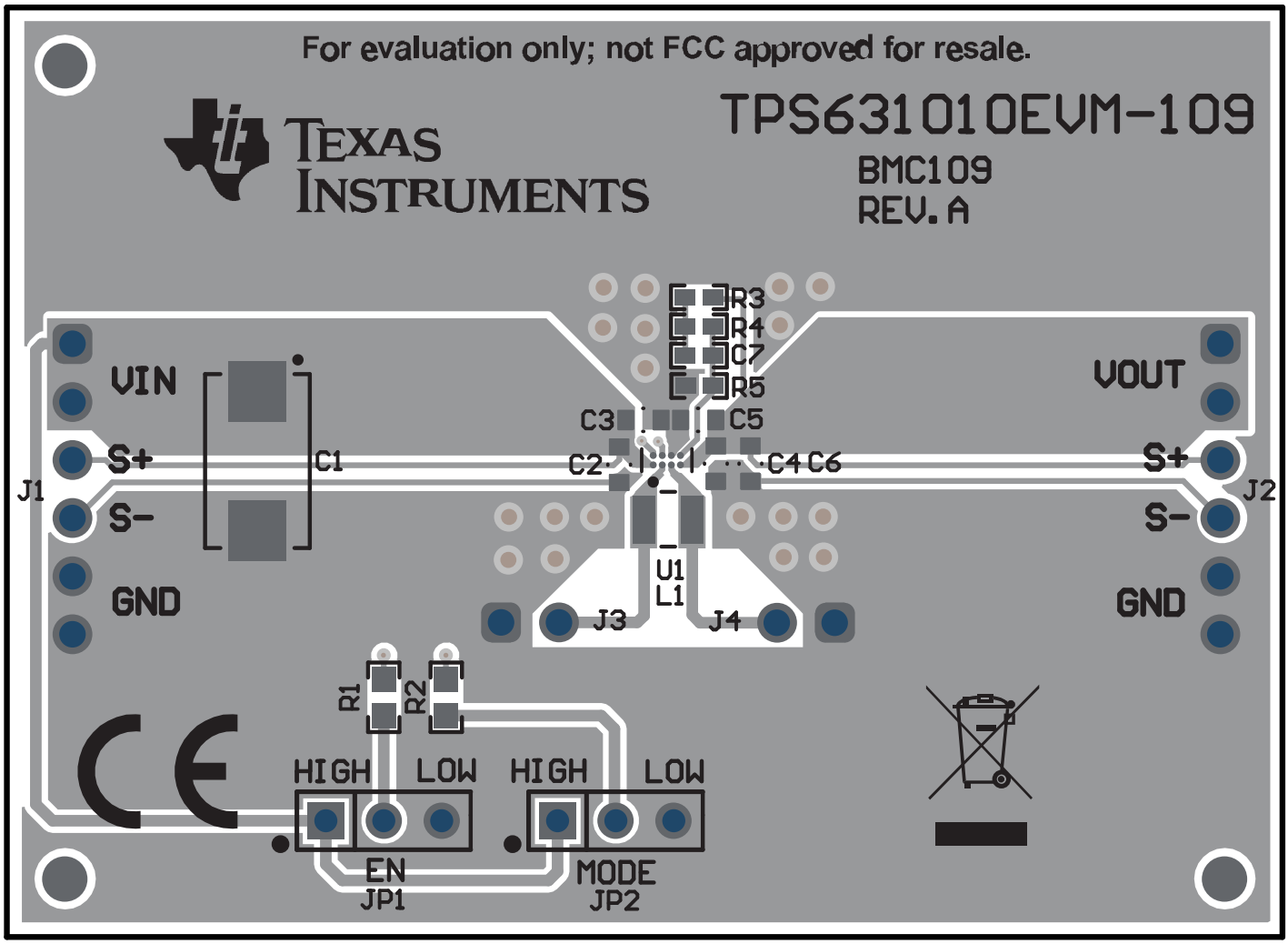

Figure 3-1. Top Layer Routing

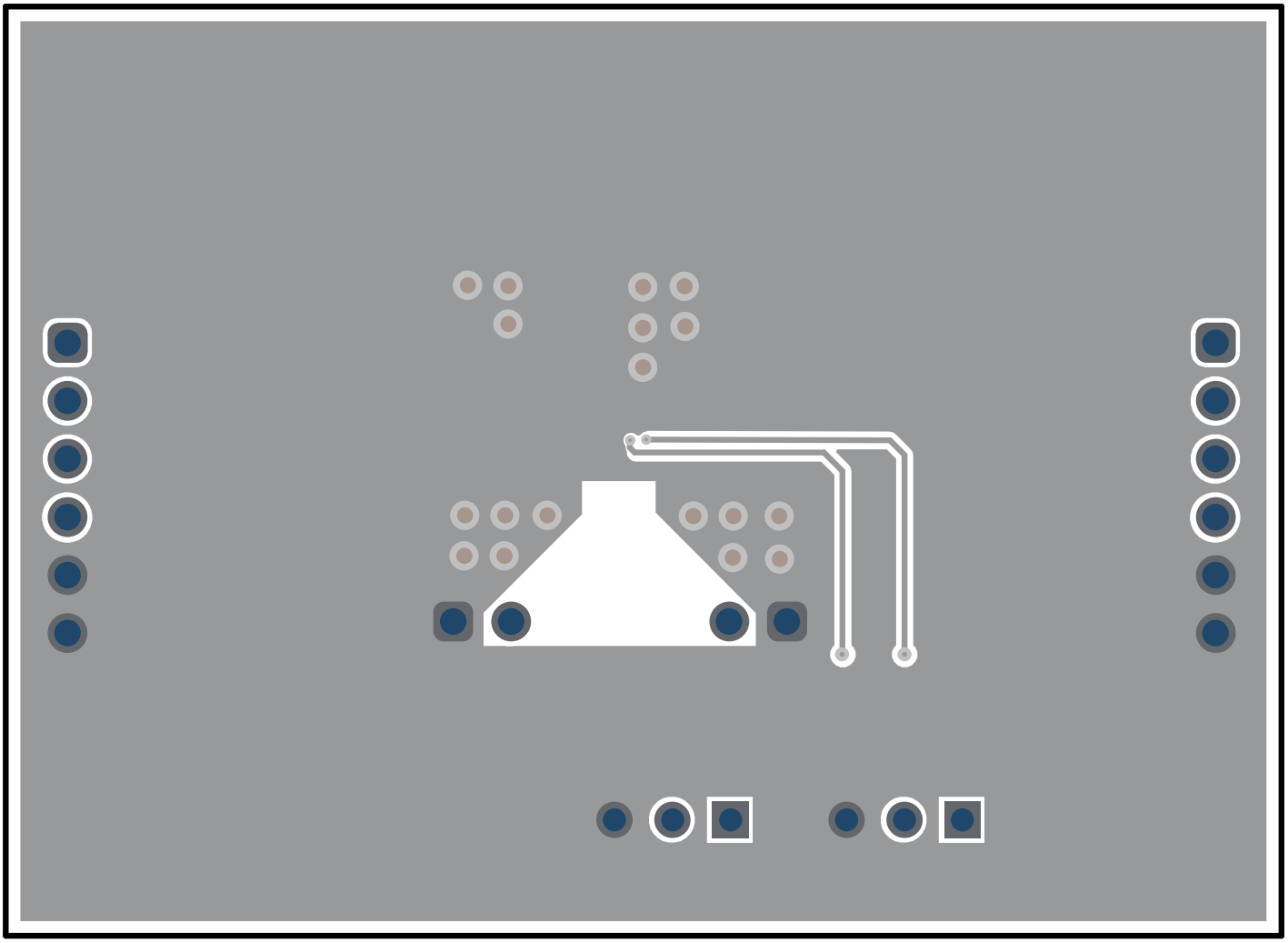

Figure 3-2. Bottom Layer Routing

4 Schematic and Bill of Materials

This section provides the TPS631010EVM schematic and bill of materials.

4.1 Schematic

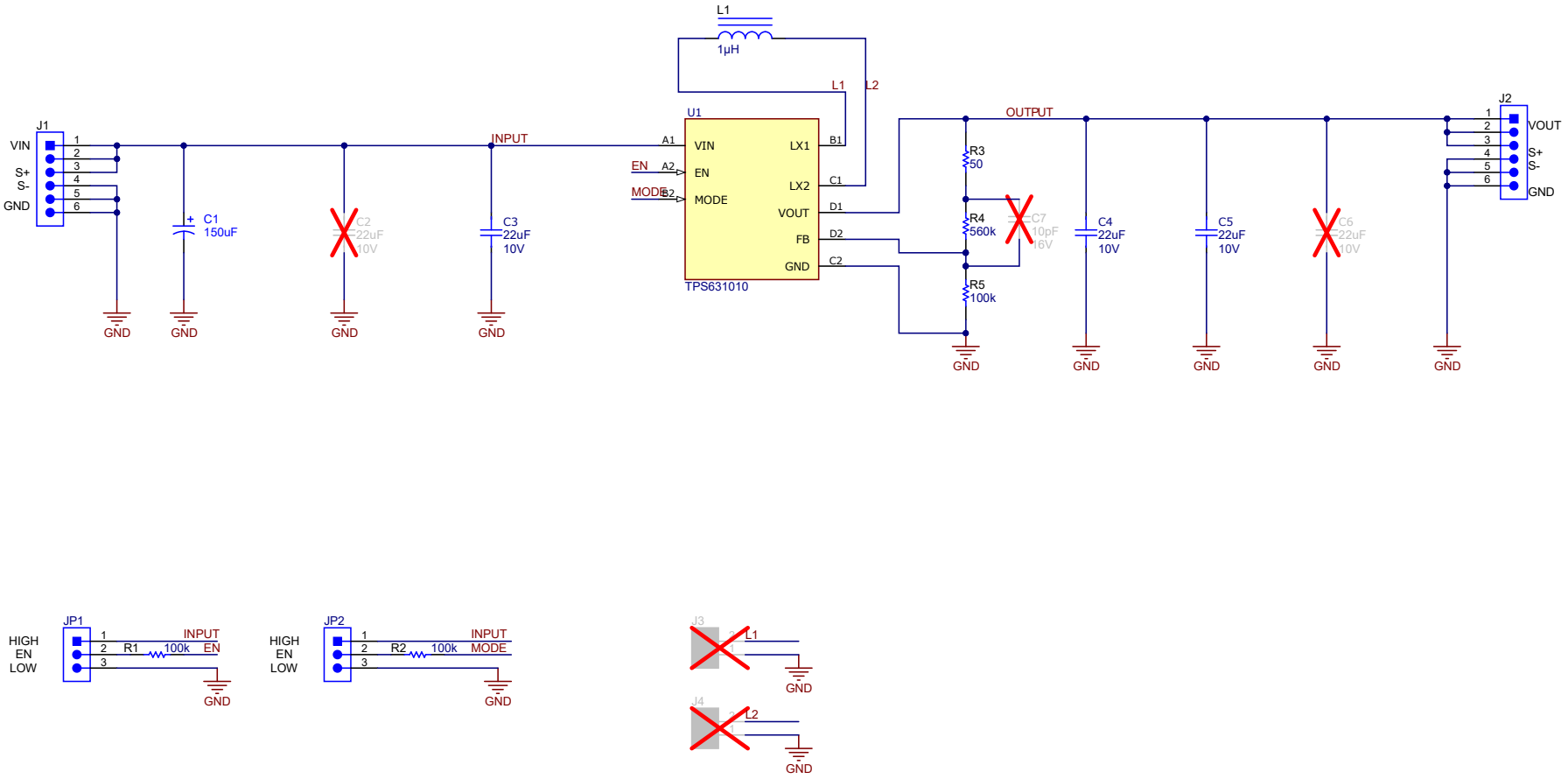

Figure 4-1. Schematic

5 Bill of Materials

Table 5-1. TPS631010EVM Bill of Materials

DESIGNATOR	QTY	VALUE	DESCRIPTION	PACKAGE REFERENCE	PART NUMBER	MANUFACTURER
C1	1	150uF	CAP, Tantalum Polymer, 150 uF, 10 V, +/- 20%, 0.005 ohm, 7343-31 SMD	7343-31	T530D157M010ATE005	Kemet
C3, C4, C5	3	22µF	Multi-Layer Ceramic Capacitor 22uF 10V X5R ±20% 0603 Paper T/R	0603	GRT188R61A226ME13D	Murata
J1, J2	2		Header, 2.54 mm, 6x1, Gold, TH	Header, 2.54mm, 6x1, TH	61300611121	Wurth Elektronik
JP1, JP2	2		Header, 100mil, 3x1, Tin, TH	Header, 3 PIN, 100mil, Tin	PEC03SAAN	Sullins Connector Solutions
L1	1	1uH	Inductor, Shielded, Metal Composite, 1 µH, 3.2 A, 0.042 ohm, SMD	1008	DFE252012P-1R0M=P2	MuRata
R1, R2	2	100k	RES, 100 k, 5%, 0.1 W, 0603	0603	CRCW0603100KJNEAC	Vishay-Dale
R3	1	50	RES, 50, 0.1%, 0.5 W, 0402	0402	FC0402E50R0BTBST1	Vishay Thin Film
R4	1	560k	RES, 560 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402560KJNED	Vishay-Dale
R5	1	100k	RES, 100 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402100KFKED	Vishay-Dale
SH-JP1, SH-JP2	2	1x2	Shunt, 100mil, Flash Gold, Black	Closed Top 100mil Shunt	SPC02SYAN	Sullins Connector Solutions
U1	1		1.5-A Output Current, High Power Density Buck-Boost Converter With FB	DSBGA8	TPS631010	Texas Instruments
C2, C6	0	22µF	Multi-Layer Ceramic Capacitor 22uF 10V X5R ±20% 0603 Paper T/R	0603	GRT188R61A226ME13D	Murata
C7	0	10pF	CAP, CERM, 10 pF, 16 V,+/- 10%, C0G, 0402	0402	C0402C100K4GACTU	Kemet
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A
J3, J4	0		Header, 2.54 mm, 2x1, Gold, TH	Header, 2.54mm, 2x1, TH	61300211121	Wurth Elektronik

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NOTE:

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FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

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CAUTION

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.

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

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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NOTE: 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.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. 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.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie 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.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

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1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
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