AN-1204 LM3478/LM3488 Evaluation Board

User's Guide

Literature Number: SNVA656A
June 2012–Revised October 2013

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The LM3478 and LM3488 are current mode, low side N-channel FET controllers. They can be utilized in numerous configurations including a Boost, Flyback or SEPIC. This evaluation board demonstrates the flexibility of the LM3478 in a boost topology.

1 Introduction

The LM3478 and LM3488 are current mode, low side N-channel FET controllers. They can be utilized in numerous configurations including a Boost, Flyback or SEPIC. This evaluation board demonstrates the flexibility of the LM3478 in a boost topology.

2 Features

- 5V Input Voltage Range
- 12V Output Voltage (default setting)
- Up to 1500 mA Output Current
- 1 MHz switching frequency
- PCB size: 43.18 mm x 52.07 mm

3 Adjusting the Output Voltage

The output voltage can be changed from 12V to another voltage by adjusting the feedback resistors using the following equation:

$$V_{OUT} = V_{FB}(1+(R_{FBT}/R_{FBB})) \quad (1)$$

Where V_{FB} is 1.26V.

For more information on components selection and features, see the LM3478 data sheet.

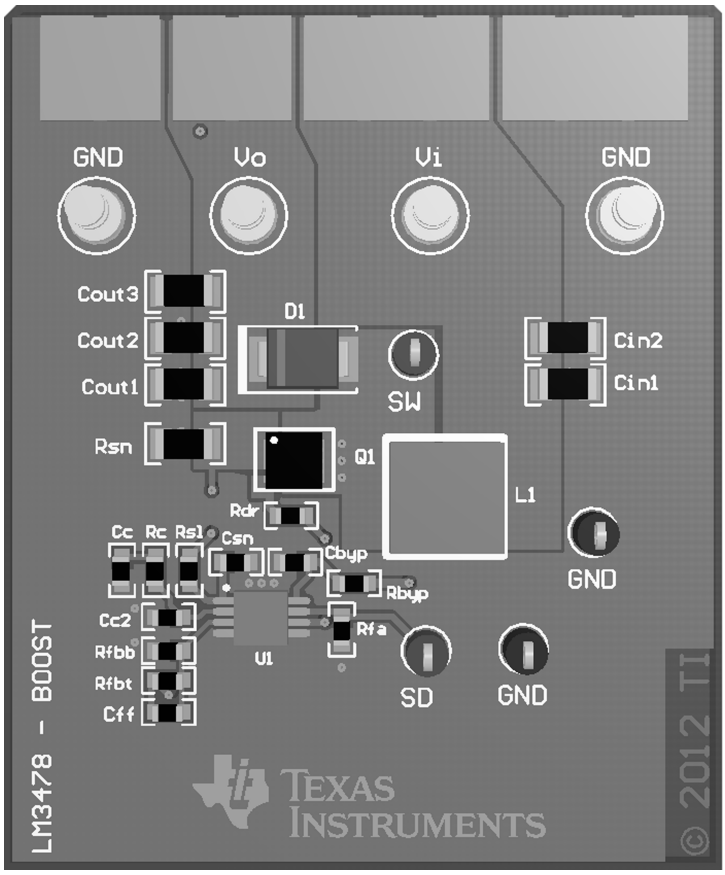
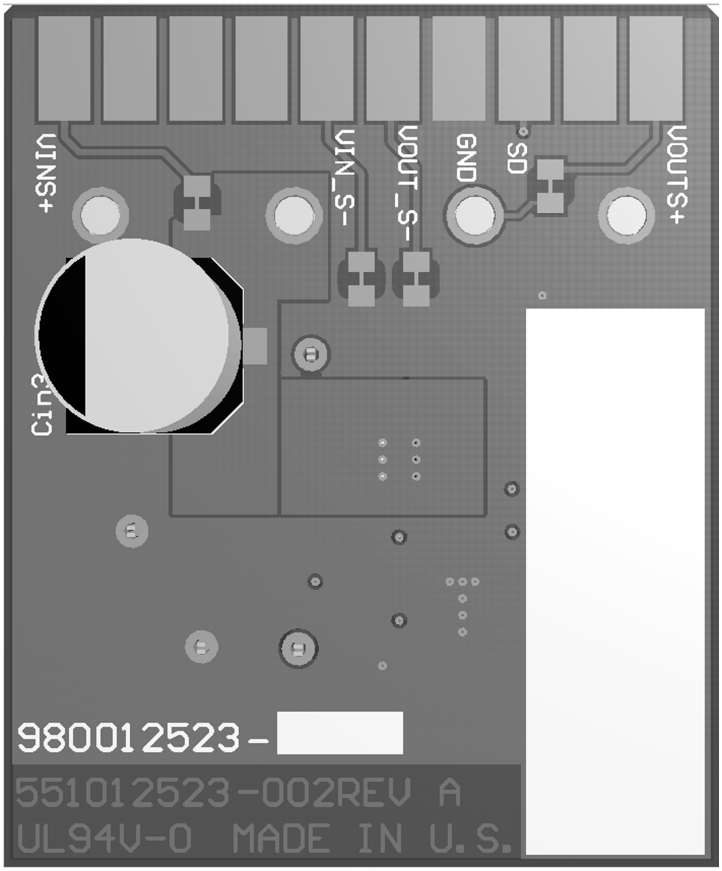


Figure 1. Top View



A Bottom View

Figure 2. LM3478 Evaluation Board

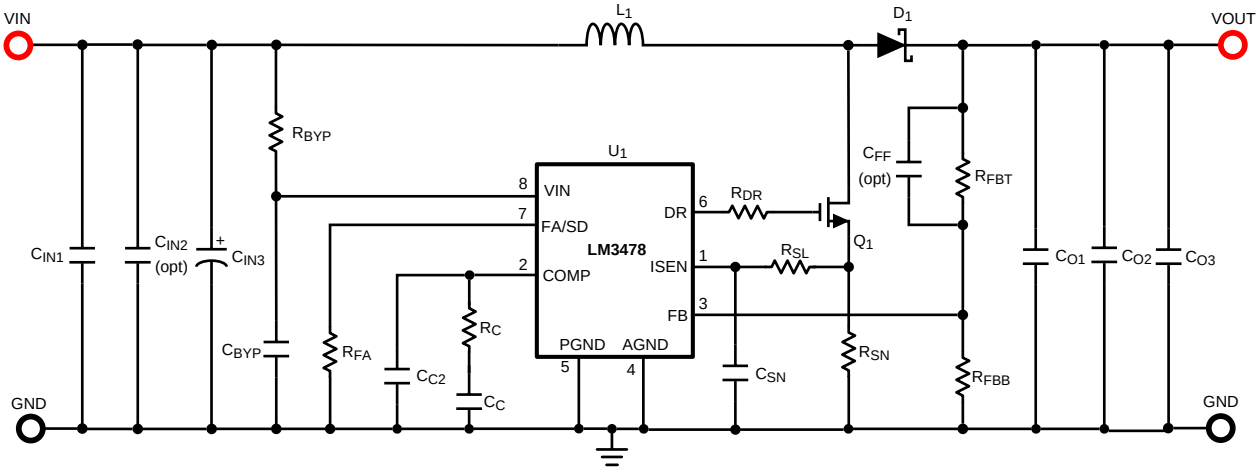


Figure 3. LM3478 Evaluation Board Schematic

Table 1. Bill of Materials (BOM) LM3478

Designation	Description	Size	Manufacturer Part #	Vendor
C_{IN1}	CAP, 47µF, 20%, 25V, X5R	1206	C3216X5R1E476M	TDK
C_{IN2}	optional			

Table 1. Bill of Materials (BOM) LM3478 (continued)

Designation	Description	Size	Manufacturer Part #	Vendor
C_{IN3}	CAP, 150µF, 20%, 8V 15mΩ, Aluminum	7.3mm L x 4.3mm W x 4.2mm H	EEF-UE0K151R	Panasonic
C_{O1},C_{O2}, C_{O3}	CAP, 47µF, 20%, 25V, X5R	1206	C3216X5R1E476M	TDK
C_C	CAP, 0.1µF, 10%, 16V, X7R	0603	GRM188R71C104KA01D	Murata
C_{C2}	CAP, 100pF, 5%, 50V, NP0	0603	GRM1885C1H101JA01D	Murata
C_{BYP}	CAP, 0.1µF, 10%, 16V, X7R	0603	GRM188R71C104KA01D	Murata
C_{FF}	optional			
C_{SN}	CAP, 0.01µF, 10%, 50V, X7R	0603	C0603C103K5RACTU	Kemet
R_C	RES, 1kΩ, 1%, 0.1W	0603	CRCW06031K00FKEA	Vishay
R_{BYP}	RES, 10.0 ohm, 1%, 0.1W	0603	CRCW060310R0FKEA	Vishay
R_{FBT}	RES, 86.6kΩ, 1%, 0.1W	0603	CRCW060386K6FKEA	Vishay
R_{FBB}	RES, 10.2kΩ, 1%, 0.1W	0603	CRCW060310K2FKEA	Vishay
R_{DR}	RES, 0Ω, 1%, 0.1W	0603	CRCW06030000Z0EA	Vishay
R_{SL}	RES, 0Ω, 1%, 0.1W	0603	CRCW06030000Z0EA	Vishay
R_{SN}	RES, 0.015Ω, 1%, 1W	1206	CSR1206FK15L0	Stackpole Electronics
Q_1	NexFET™ N-CH, 25V, 60A, $R_{DS(on)}$= 4.4mΩ	8-SON	CSD16323Q3	TI
D_1	Diode Schottky, 30V, 3A	SOD128	PMEG3030EP	Vishay
L_1	Shielded Inductor, 1.8µH, 10A	6.36mm L x 6.56mm W x 3.1mm H	XAL6030-182ME	Coilcraft
U_1	LM3478MM			TI
	EDGE CONNECTOR		307-020-500-202	EDAC

4 Optional components

C_{IN2} is an additional input capacitor.

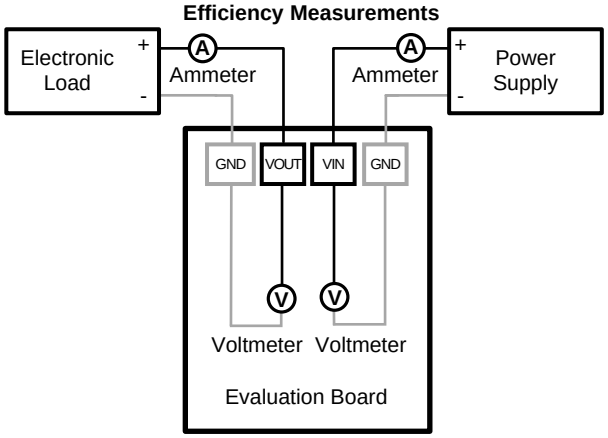
C_{FF} increases the gain of the dynamic loop during load transients.

5 Test Setup

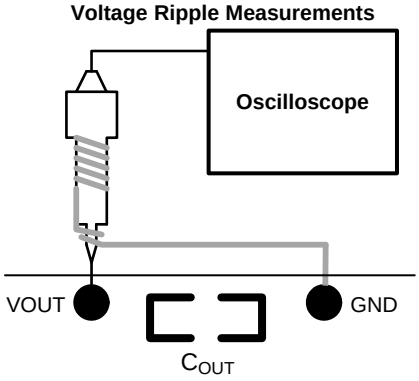
Table 2. Demonstration Board Quick Setup Procedures

Step	Description	Notes
1	Connect a power supply to V_{IN} and GND terminals	V_{IN} range: 4.5V to 5.5V
2	Turn on V_{IN} with 0A load applied, check V_{OUT}	V_{OUT} = 12V
3	Slowly increase the load from 0A to 1.5A, check V_{OUT}	V_{OUT} = 12V

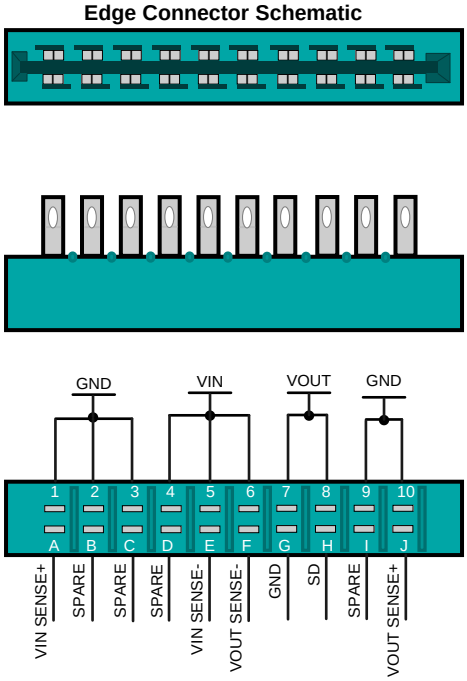
Efficiency Measurements



Voltage Ripple Measurements

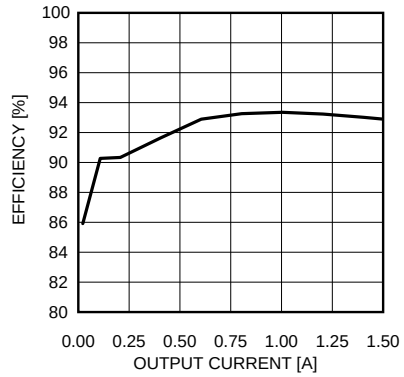


Edge Connector Schematic

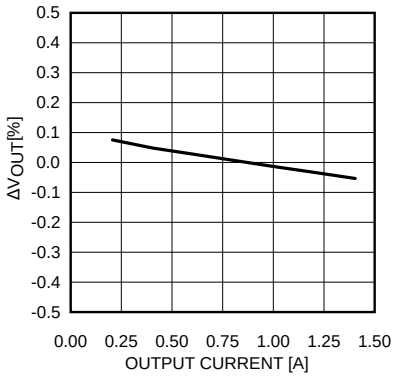


6 Typical Performance Characteristics for LM3478 Evaluation Board

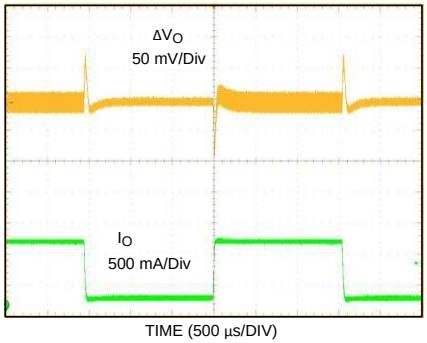
Efficiency vs. Load Current



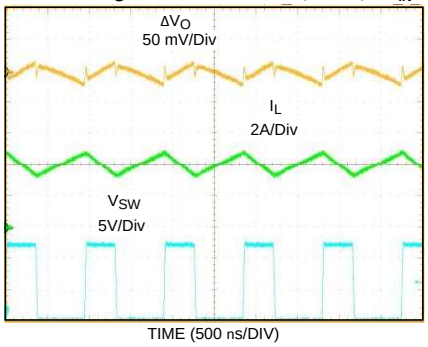
Load Regulation



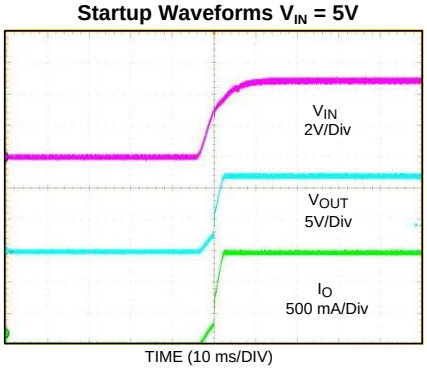
Load Transient Waveforms 500mA to 1500mA, $5V_{IN}$



Switching Waveforms CCM, 1.5A, $5V_{IN}$



Startup Waveforms V_{IN} = 5V



7 Layout

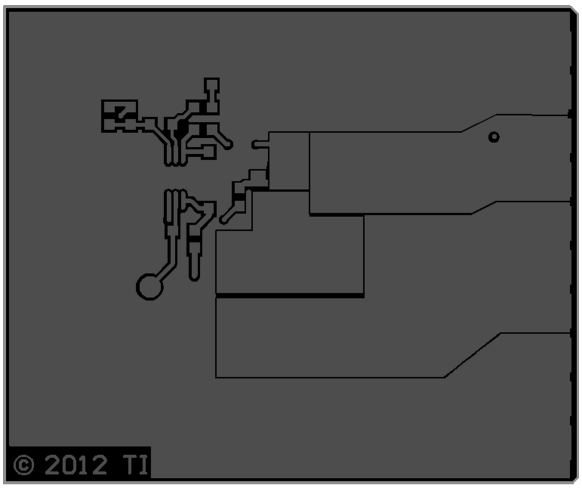


Figure 4. Top Layer

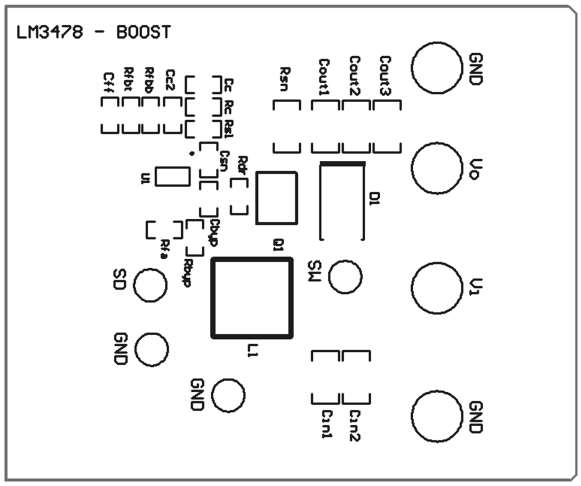


Figure 5. Top Silkscreen

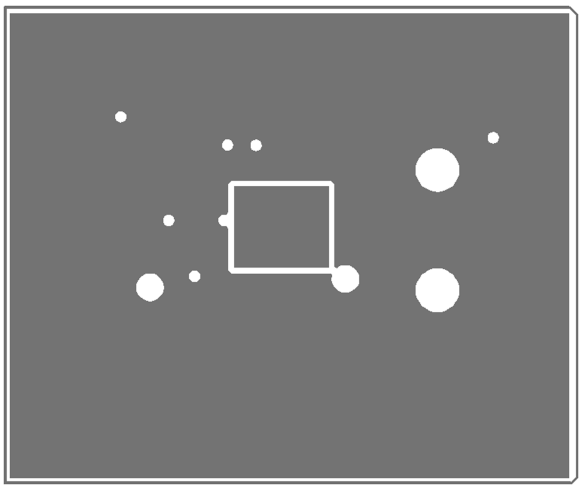


Figure 6. Mid Layer 1

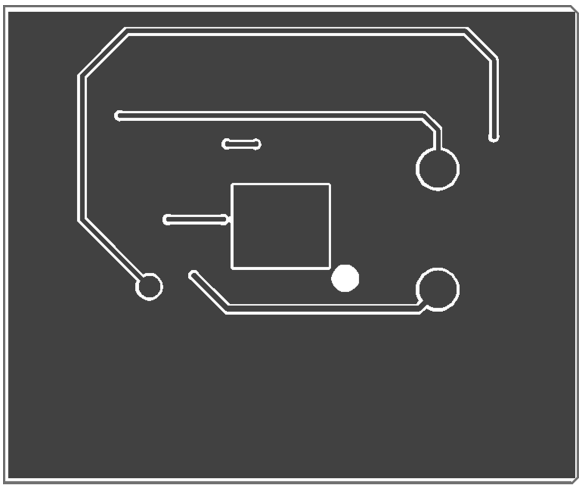


Figure 7. Mid Layer 2

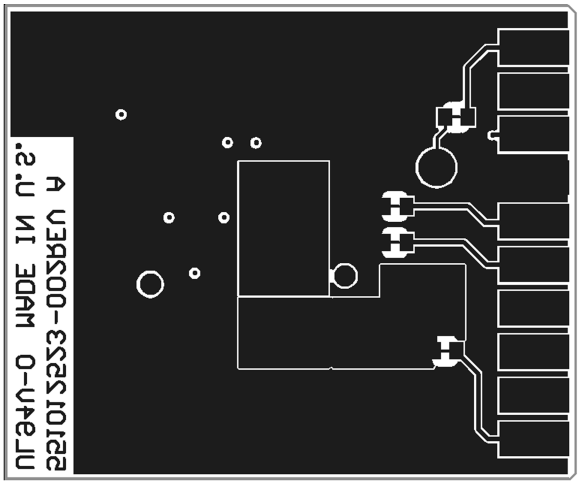


Figure 8. Bottom Layer

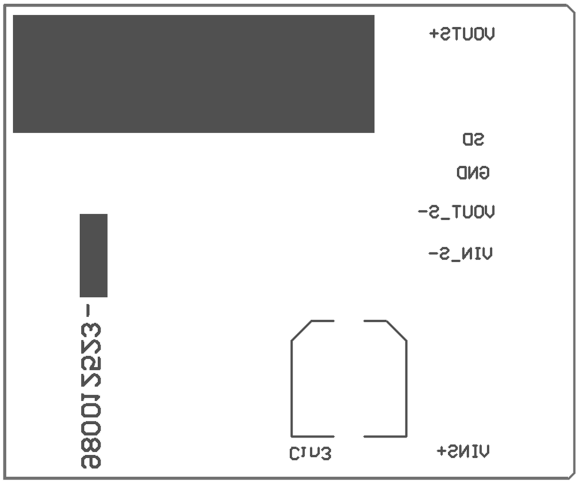


Figure 9. Bottom Silkscreen

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      3.1.1 *Notice applicable to EVMs not FCC-Approved:*

      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.

      3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

      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.

FCC Interference Statement for Class B EVM devices

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*

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This device complies with Industry Canada license-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.

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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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2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
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