DRV8850EVM User's Guide

This document is provided with the DRV8850 customer evaluation module (EVM) as a supplement to the DRV8850 (SLVSCC0) datasheet. It details the hardware implementation of the EVM.

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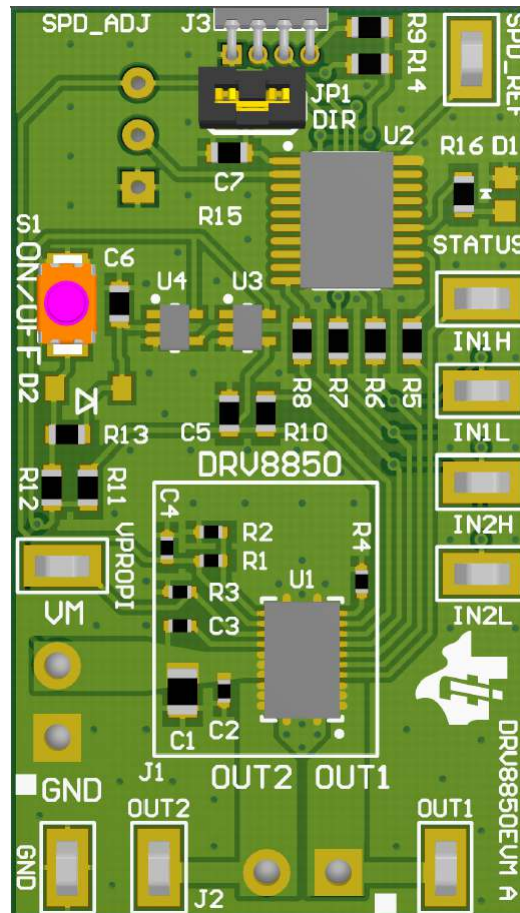Figure 1 shows the top 3-D view of the DRV8850EVM.

Figure 1. PCB Top 3-D View

2   Introduction

The DRV8850EVM is a complete solution for evaluating the DRV8850 low voltage brushed DC motor driver. It includes a MSP430 microcontroller that is pre-programmed to take input from an analog potentiometer for PWM speed control, and a direction jumper to change motor direction. Power can be provided through the 2-pin terminal block header. To expand beyond the included firmware capability, the MSP430 can easily be re-programmed via the MSP430 LaunchPad Development tool (MSP-EXP430G2) available at www.ti.com/tool/msp-exp430g2.

2.1   Power Connectors

The DRV8850EVM provides system power through the terminal block header (**J1**). The terminals are labeled **VM** and **GND** and supports 2–5.5 V. Please observe the correct polarity when connecting the power supply. The DRV8850's onboard LDO provides the regulated 3.3 V for the onboard MSP430G2553. The DRV8850's LDO is enabled and disabled through the push button switch (**S1**). This will disable the MSP430G2553 when the 3.3-V power rail is disabled.

As previously mentioned, the MSP430 comes pre-programmed to control basic DC motor operation. If changing the firmware via the external **MSP-EXP430G2** development tool is desired, it is not necessary or recommended to provide any input power to the DRV8850EVM. Power is provided from the **MSP-EXP430G2** board.

2.2   Test Points

Test points are provided and labeled for the inputs to the DRV8850 motor driver (**IN1H**, **IN1L**, **IN2H**, and **IN2L**), the outputs of the motor driver (**VPROPI**, **OUT1**, and **OUT2**), and the onboard potentiometer reference signal (**SPD_REF**). One **GND** test point is also provided. Figure 2 highlights these test points.
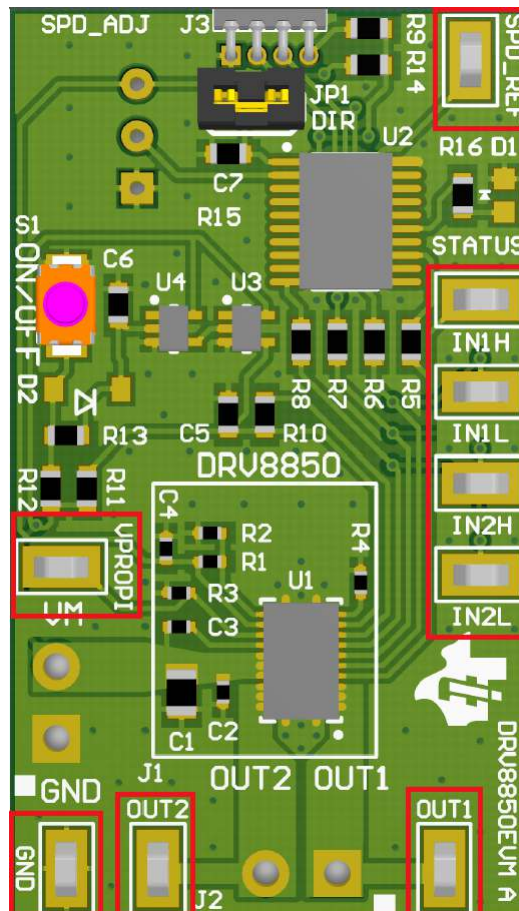

Figure 2. DRV8850 Test Points

2.3   *Jumpers and Switches*

There is one jumper (**JP1**) located on the DRV8850EVM. This jumper controls the direction of the DC motor.

There is one switch (**S1**) on the DRV8850EVM. This switch enables and disables the DRV8850EVM by sending the DRV8850EVM into a low power sleep mode and removing power from the onboard MSP430G2553.

2.3.1   Direction Select (JP1) Jumper

JP1 is found in Figure 3. Installing the jumper provides a logic HIGH signal to a GPIO on the micro-controller. Depending on the motor connections across J4, the motor will spin either counter-clockwise or clockwise. Removing the jumper provides a logic LOW to the micro-controller and the input polarity of the signals to the DRV8850 is flipped. This will rotate the motor in the opposite direction.
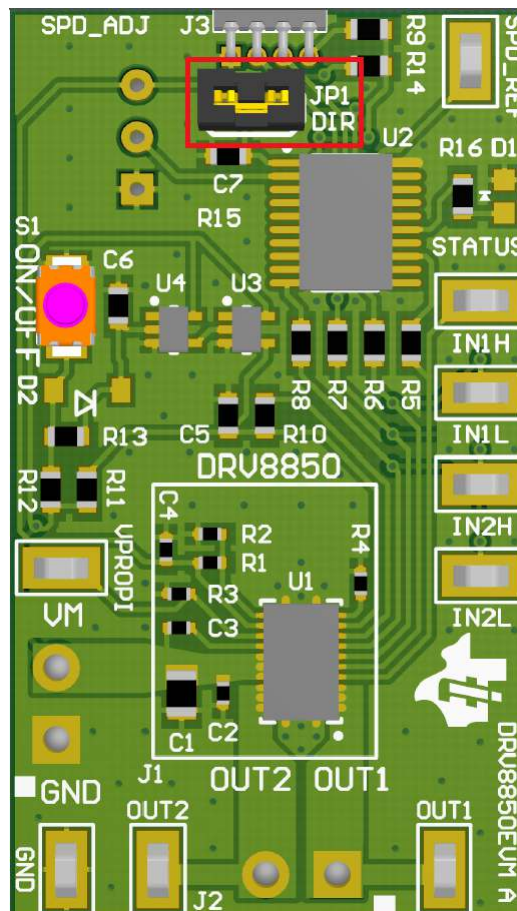

Figure 3. Direction Select Jumper (JP1)

2.3.2 ON/OFF Switch (S1)

Pressing the S1 switch (see Figure 4) toggles the nSLEEP and LDOEN signals (tied together) to the DRV8850. When the system is OFF, the DRV8850 is in a low power consumption or sleep state, and the motor outputs along with the internal circuitry are turned OFF. By disabling the LDO on the DRV8850 this will, in turn, remove power from the MSP430G2553.
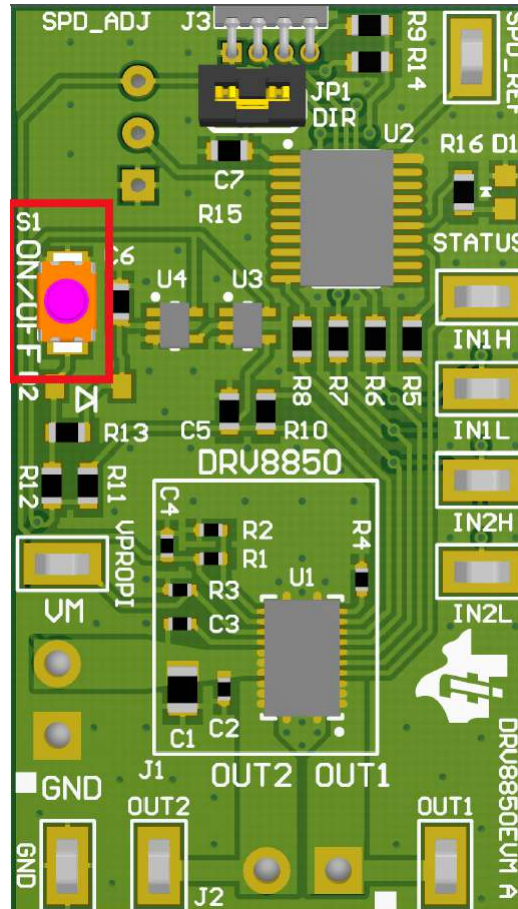

Figure 4. ON/OFF Switch (S1)

2.4   *Speed Adjust Potentiometer (R15)*

The speed adjust potentiometer is found in Figure 5. Turning the wheel towards the JP2 jumper reduces the input PWM duty cycle to the DRV8850 and the motor will turn slower until it stops. Turn the wheel towards the motor outputs and the motor will spin faster. You can also observe the STATUS LED highlighted in Figure 5. It will blink when the MSP430G2553 is enabled.
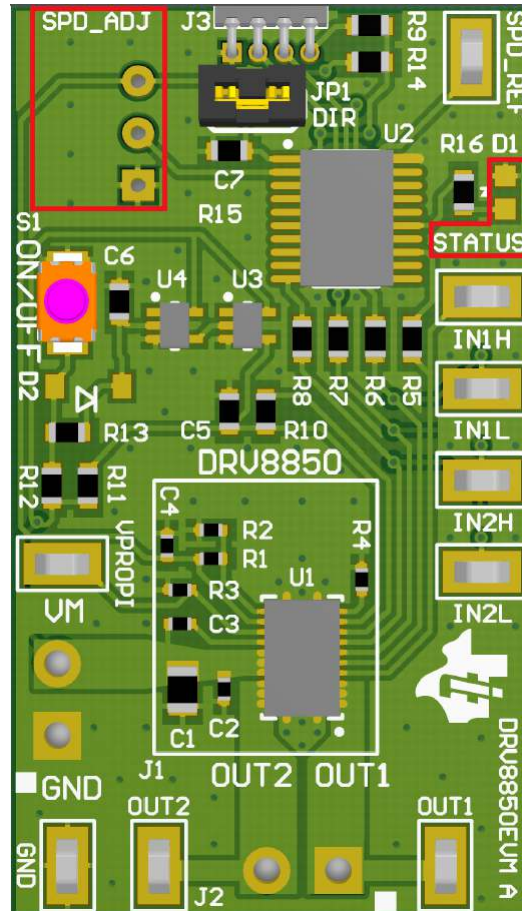

Figure 5. Speed Adjust Potentiometer (R2)

2.5   Motor Outputs

Connect a DC motor across OUT1 and OUT2. Polarity is not critical.

2.6   Operation of the EVM

1. Connect a DC motor across OUT1 and OUT2.
2. Adjust *SPD_ADJ* potentiometer to minimum voltage by turning it all the way counter-clockwise. This minimizes the motor speed.
3. Apply power to the terminal block header J1.
4. Adjust SPD_ADJ potentiometer clockwise and the motor will start to turn. Continue adjusting as desired.
5. To change direction, remove or install the JP1 jumper.

CAUTION

The motor will be hot when under excessive load or shaft lock. Be careful when handling the motor under these conditions.

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3 Schematic and Bill of Materials

The following sections contain the DRV8850EVM schematic and bill of materials (BOM).

3.1 DRV8850EVM Schematic
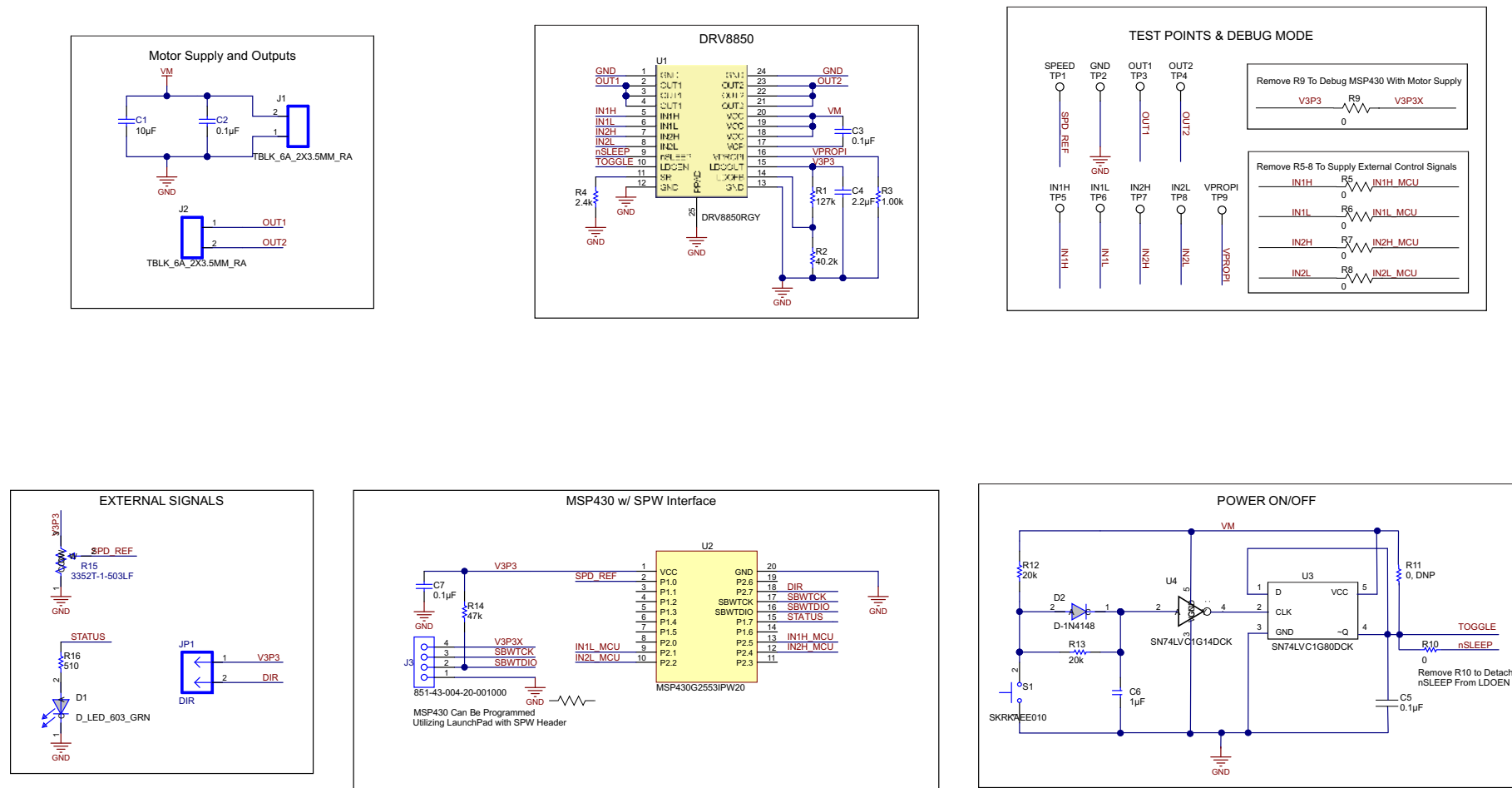
Figure 6 illustrates the DRV8850EVM schematic.

Figure 6. DRV8850EVM Schematic

3.2 DRV8850EVM Bill of Materials

Table 1 contains the BOM for the DRV8850EVM.

Table 1. DRV8850EVM Bill of Materials

Designator	Description	Manufacturer	Part Number	Qty
PCB1	Printed Circuit Board	Any	DRV8850EVM	1
C1	CAP, CERM, 10uF, 10V, +/-10%, X7R, 0805	MuRata	GRM21BR71A106KE51L	1
C2	CAP, CERM, 0.1uF, 16V, +/-10%, X7R, 0402	MuRata	GRM155R71C104KA88D	1
C3	CAP, CERM, 0.1uF, 16V, +/-10%, X5R, 0402	MuRata	GRM155R61C104KA88D	1
C4	CAP, CERM, 2.2uF, 10V, +/-10%, X5R, 0402	TDK	C1005X5R1A225K050BC	1
C5	CAP, CERM, 0.1uF, 16V, +/-10%, X7R, 0603	MuRata	GRM188R71C104KA01D	1
C6	CAP, CERM, 1uF, 16V, +/-10%, X5R, 0603	TDK	C1608X5R1C105K	1
C7	CAP, CERM, 0.1uF, 16V, +/-5%, X7R, 0603	Kemet	C0603C104J4RACTU	1
D1	Diode, LED, Green, 2.1-V, 20-mA, 6-mcd	Lite On	LTST-C190GKT	1
D2	Diode, Signal, 300-mA, 75-V, 350-mW	Diodes	1N4148W-7-F	1
J1, J2	TERM BLOCK 2POS SIDE ENT 3.5MM	TE Connectivity	1776275-2	2
J3	SOCKET .050" GRID SIP 4 POS R/A, TH	Mill-Max	851-43-004-20-001000	1
JP1	Header, Male 2-pin, 100mil spacing,	Sullins	PEC02SAAN	1
R1	RES, 127k ohm, 1%, 0.063W, 0402	Vishay-Dale	CRCW0402127KFKED	1
R2	RES, 40.2k ohm, 1%, 0.063W, 0402	Vishay-Dale	CRCW040240K2FKED	1
R3	RES, 1.00k ohm, 1%, 0.063W, 0402	Vishay-Dale	CRCW04021K00FKED	1
R4	RES, 2.4k ohm, 5%, 0.063W, 0402	Vishay-Dale	CRCW04022K40JNED	1
R5, R6, R7, R8, R9, R10	RES, 0 ohm, 5%, 0.1W, 0603	Vishay-Dale	CRCW06030000Z0EA	6
R11	RES, 0 ohm, 5%, 0.1W, 0603	DNP	DNP	1
R12, R13	RES, 20k ohm, 5%, 0.1W, 0603	Vishay-Dale	CRCW060320K0JNEA	2
R14	RES, 47k ohm, 5%, 0.1W, 0603	Vishay-Dale	CRCW060347K0JNEA	1
R15	Potentiometer, 3/8 Cermet, SingleTurn, Flat	Bourns	3352T-1-503LF	1
R16	RES, 510 ohm, 5%, 0.1W, 0603	Vishay-Dale	CRCW0603510RJNEA	1
S1	Switch, Push Button, SMD	Alps	SKRKAEE010	1
SH-JP1	Shunt, 100mil, Gold plated, Black	3M	969102-0000-DA	1
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9	PC Test Point, Miniature	Keystone	5019	9
U1	LOW VOLTAGE H-BRIDGE IC WITH LDO VOLTAGE REGULATOR	Texas Instruments	DRV8850RGY	1
U2	MIXED SIGNAL MICROCONTROLLER	Texas Instruments	MSP430G2553IPW20	1
U3	IC, Single Positive-Edge-Triggered D-Type Flip-Flop	TI	SN74LVC1G80DCK	1
U4	IC, Single Schmitt-Trigger Inverter	TI	SN74LVC1G14DCK	1

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For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

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

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

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.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

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

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-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.

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.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

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.

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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This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product 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,

2. Use this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or

3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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