BOOST-DAC7551Q1 Evaluation Module (EVM)

1 DAC7551-Q1 BoosterPack Components

The Texas Instruments DAC7551-Q1 BoosterPack™ Evaluation Module (EVM) allows designers to evaluate the operation and performance of the DAC7551-Q1 single-channel, voltage-output digital-to-analog converter (DAC). The BoosterPack layout of this EVM is compatible with the readily available microcontroller-based LaunchPad™ series for rapid prototype deployment. An optional wide-swing voltage generator for precision industrial control loop applications is available for ±5-V, ±10-V, and ±12-V ranges of operation.

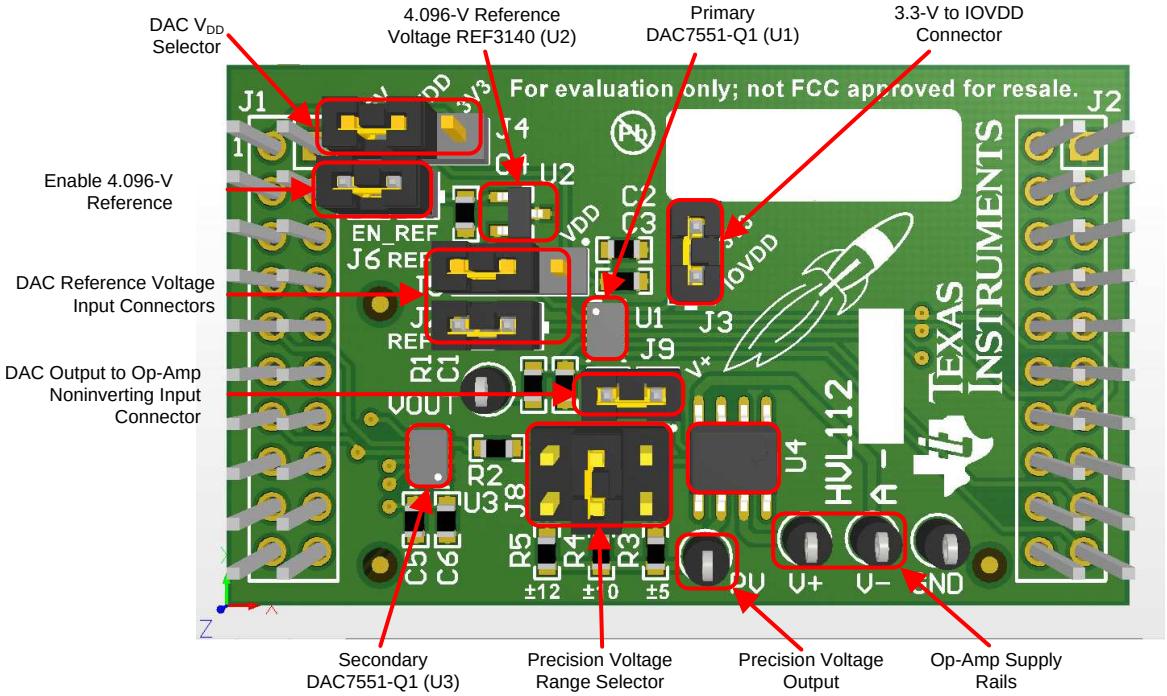

Figure 1. BOOST-DAC7551Q1EVM

Table 1. Device and Package Configurations

Device	IC	Package
U1, U3	DAC7551TDRNRQ1	USON (DRN)
U2	REF3140AIDBZT	SOT-23 (DBZ)
U4	OPA180IDR	SOIC (D)

2 Software Installation

The LaunchPad development kit is an optional platform to use with the BOOST-DAC7551Q1EVM device. However, the LaunchPad development kit is the targeted platform of choice for the majority of BoosterPack plug-in modules. To program the LaunchPad, select a software development tool based on either the software-skill level of the user or the BOOST-DAC7551Q1EVM evaluation complexity. For quick evaluation, the Energia open source integrated development environment (IDE) is recommended. For advanced programming and debugging features, the full-featured IDE, Code Composer Studio™ software is recommended.

To install Energia on your Windows, Mac OS X, or Linux computer, go to http://energia.nu/.

To install Code Composer Studio on your Windows or Linux computer, go to http://www.ti.com/tool/ccstudio.

3 DAC7551-Q1 BoosterPack Setup and Operation

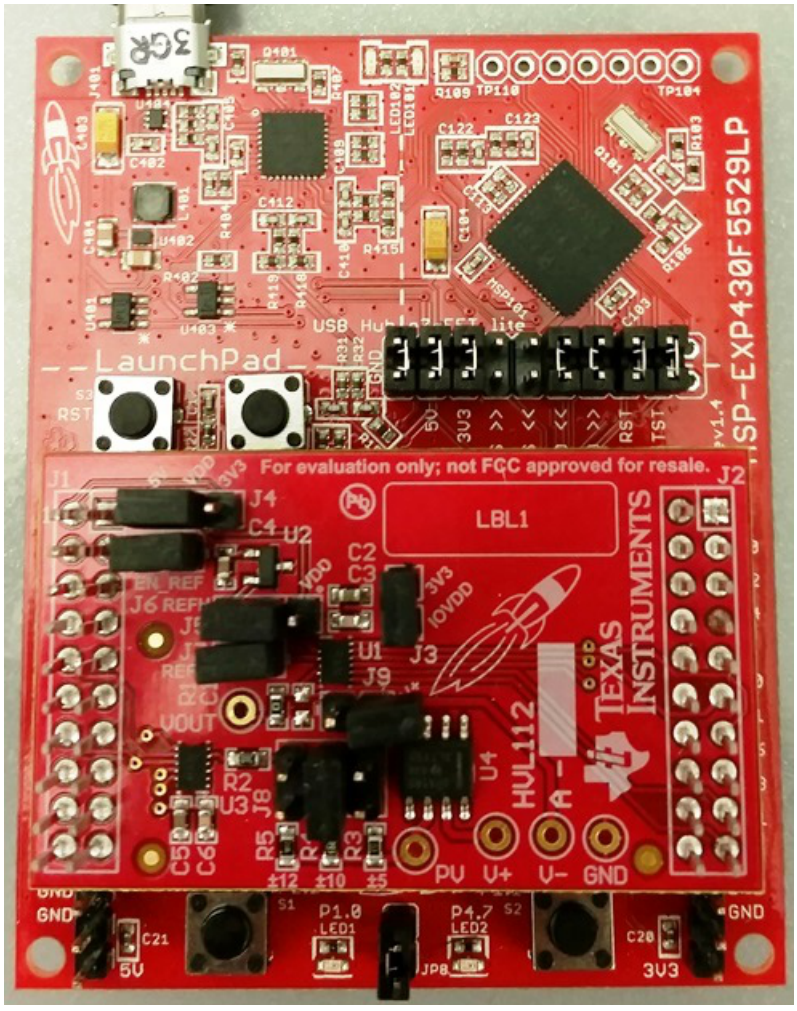

Figure 2. BOOST-DAC7551Q1EVM Attached to LaunchPad

The MSP430F5529 LaunchPad can be purchased at http://www.ti.com/tool/msp-exp430f5529lp. Stack the BoosterPack onto the LaunchPad. Ensure that the pin 1 connectors of the LaunchPad and the BoosterPack are aligned.

3.1 Standalone Operation

Table 2 lists the default BoosterPack jumper configuration which is defined for standalone operation of the primary DAC.

Table 2. Jumper Configurations for Standalone Operation

Jumper	Starting Configuration	Purpose
J3	Shorted	3.3 V to IOVDD
J4	Pin 1 and 2 shorted	5 V to VDD
J5	Pin 2 and 3 shorted	4.096 V to VREFH
J6	Shorted	Enable onboard voltage reference
J7	Shorted	GND to VREFL
J8	Pin 3 and 4 shorted	±10-V range operation
J9	Open	V_{OUT} disconnected from non-inverting op-amp input

3.2 Precision Industrial Control Operation

To operate in the Precision Industrial Control mode, configure the BoosterPack jumpers as listed in Table 3.

Table 3. Jumper Configurations for Precision Industrial Control Operation

Jumper	Starting Configuration	Purpose
J3	Shorted	3.3 V to IOVDD
J4	Pin 1 and 2 shorted	5 V to VDD
J5	Pin 2 and 3 shorted	4.096 V to VREFH
J6	Shorted	Enable onboard voltage reference
J7	Shorted	GND to VREFL
J8	Pin 3 and 4 shorted	±10-V range operation
J9	Shorted	V_{OUT} connected from non-inverting op-amp input

3.2.1 Rail-to-Rail Triangle Waveform Generator Example

To generate a triangle waveform, refer to the *BOOST-DAC7551Q1EVM Triangle Wave Generator* example source code for the Energia IDE (SLAC701). By default the code is configured for the ±10-V precision industrial control-range operation.

To modify the operating range, short the appropriate pin set on J8 and change the second variable of the *digitalDACWriteApp* function found in the setup routine to set the tail voltage provided by the secondary DAC. For example, to change the operating range to ±5 V in the software, replace the defined integer named *mRange* with *sRange* in the setup routine which will appear as follows: digitalDACWriteApp(ModeNormal, sRange);.

Copy the code example into a blank Energia workspace. On the Energia menu bar, navigate to Tools > Board > LaunchPad with MSP430f5529 (25 MHz) to configure the compiler for the correct microcontroller. Verify and compile the sketch by selecting the checkmark-labeled button. Connect the LaunchPad to the computer running the Energia software through a USB-to-microUSB cable. Next, upload the sketch to the LaunchPad by selecting the right-arrow labeled button.

With the external power supply turned-off, connect the –10-V (or appropriate negative voltage) output of the power supply to the –V test point (TP4). A +10-V (or appropriate positive voltage) output of the power supply to the +V test point (TP2). Establish a common ground between the LaunchPad and external power supply by using the GND test point (TP5).

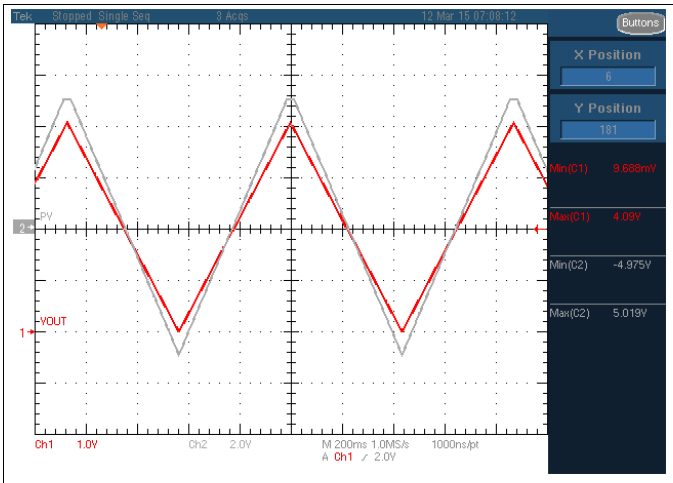

Figure 3. ±5-V PV Output Range at No Load

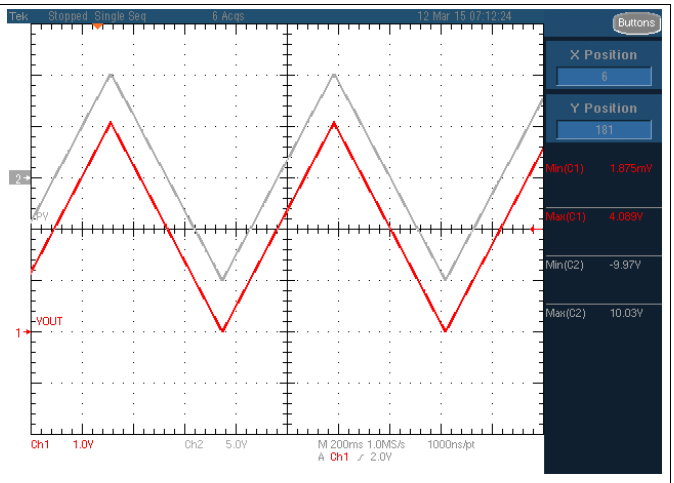

Figure 4. ±10-V PV Output Range at No Load

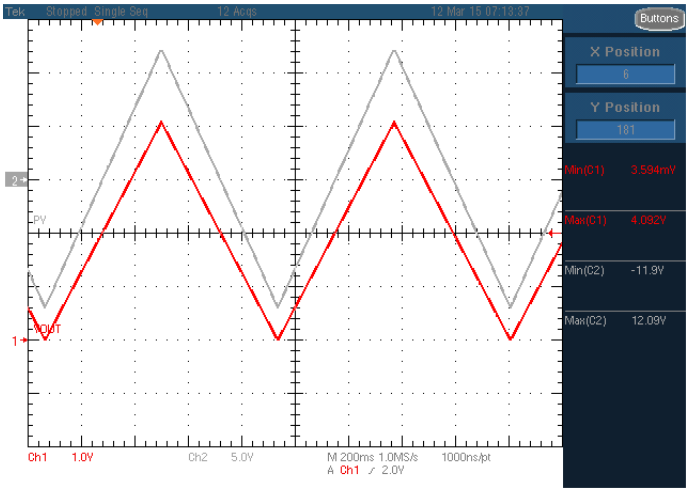

Figure 5. ±12-V PV Output Range at No Load

4 Board Layout

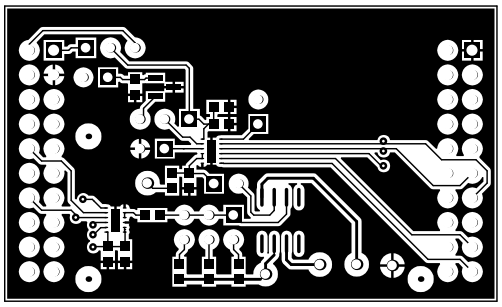

Figure 6. Top Assembly Layer

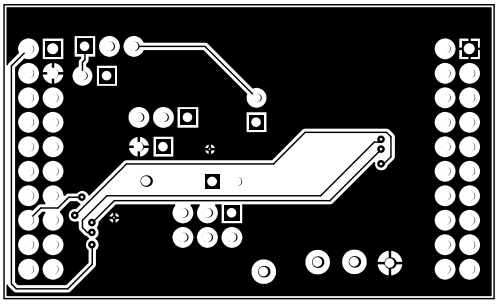

Figure 7. Bottom Assembly Layer

4.1 Schematic

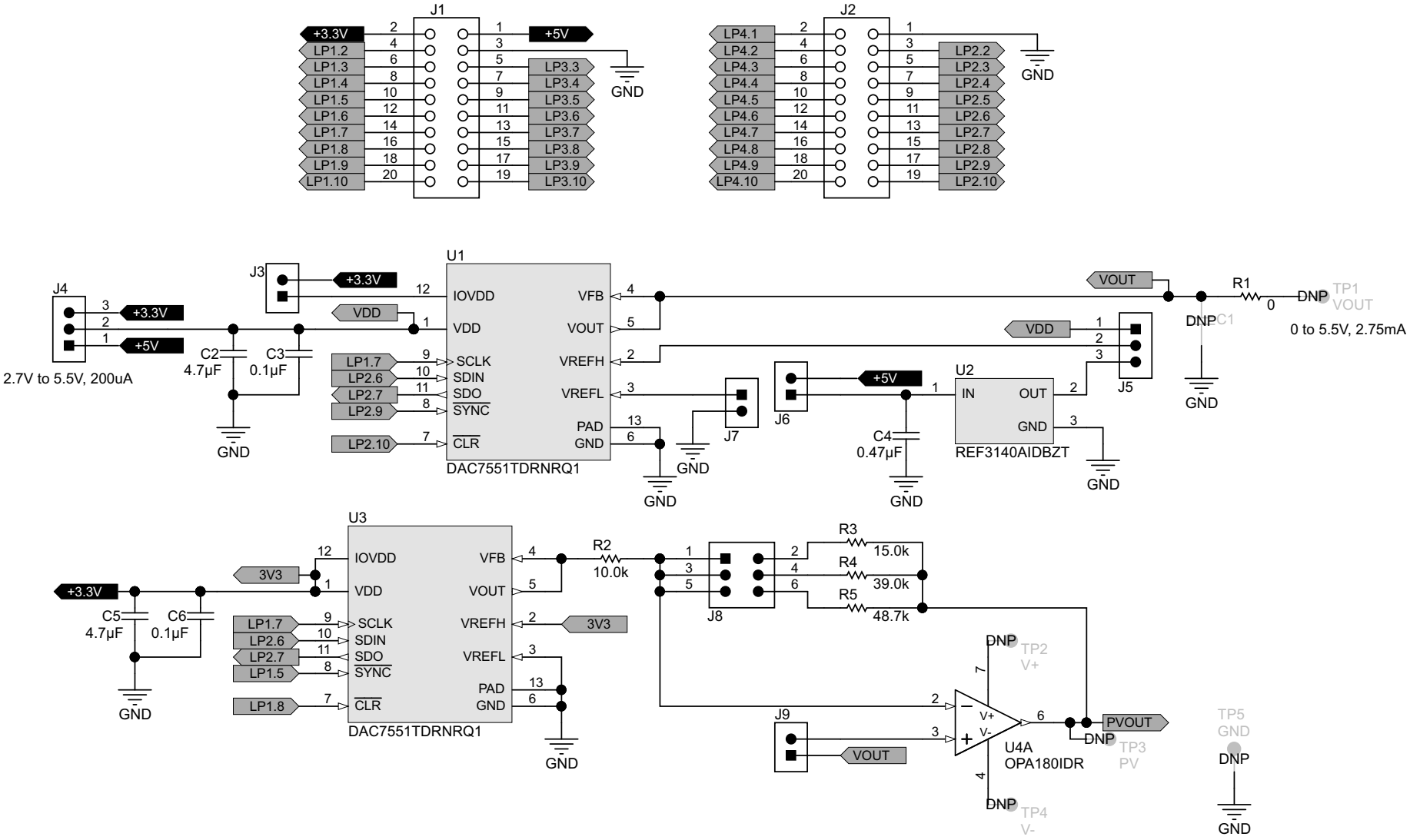

Figure 8. BOOST-DAC7551Q1EVM Schematic

5 Bill of Materials

Table 4 lists the bill of materials (BOM) for the BOOST-DAC7551Q1EVM.

Table 4. BOM

Item	Designator	Description	Manufacturer	PartNumber	Qty
2	C2, C5	CAP, CERM, 4.7 µF, 10 V, ± 10%, X5R, 0603	Kemet	C0603C475K8PACTU	2
3	C3, C6	CAP, CERM, 0.1 µF, 10 V, ± 10%, X7R, 0603	Kemet	C0603C104K8RACTU	2
4	C4	CAP, CERM, 0.47 µF, 10 V, ± 10%, X7R, 0603	Kemet	C0603C474K8RACTU	1
5	J1, J2	Connector, Receptacle, 100mil, 10x2, Gold plated, TH	Samtec, Inc.	SSW-110-23-F-D	2
6	J3, J6, J7, J9	Header, 2.54 mm, 2x1, Tin, TH	Samtec	TSW-102-07-T-S	4
7	J4, J5	Header, 100mil, 3x1, Gold, TH	Samtec	HTSW-103-07-G-S	2
8	J8	Header, 100mil, 3x2, Gold, TH	Samtec	TSW-103-07-G-D	1
9	LBL1	Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	Brady	THT-14-423-10	1
10	R1	RES, 0, 5%, 0.1 W, 0603	Vishay-Dale	CRCW06030000Z0EA	1
11	R2	RES, 10.0 k, 1%, 0.1 W, 0603	Yageo America	RC0603FR-0710KL	1
12	R3	RES, 15.0 k, 1%, 0.1 W, 0603	Yageo America	RC0603FR-0715KL	1
13	R4	RES, 39.0 k, 1%, 0.1 W, 0603	Yageo America	RC0603FR-0739KL	1
14	R5	RES, 48.7 k, 1%, 0.1 W, 0603	Yageo America	RC0603FR-0748K7L	1
15	SH-J1, SH-J2, SH-J3, SH-J4, SH-J5, SH-J6, SH-J7	Shunt, 100mil, Gold plated, Black	Samtec	SNT-100-BK-G	7
16	U1, U3	12-Bit, Ultra-Low Glitch, Voltage Output Digital-to-Analog Converter, DRN0012A	Texas Instruments	DAC7551TDRNRQ1	2
17	U2	20 ppm / degC Max, 100 uA Series Voltage Reference, –40°C to 125°C, 3-pin SOT-23 (DBZ), Green (RoHS & no Sb/Br)	Texas Instruments	REF3140AIDBZT	1
18	U4	0.1-uV/degC Drift, Low-Noise, Rail-to-Rail Output, 36-V, Zero-Drift Operational Amplifiers, D0008A	Texas Instruments	OPA180IDR	1

6 References

For related documentation see the following:

1. *DAC7551-Q1, 12-Bit, Ultra-Low Glitch, Voltage Output Digital-to-Analog Converter Datasheet* (SLAS767)
2. *REF3140, 15ppm/°C Max, 100µA, SOT23-3 Series Voltage Reference Datasheet* (SBVS046)
3. *OPA180, 0.1-µV/°C Drift, Low-Noise, Rail-to-Rail Output, 36-V, Zero-Drift Op Amps Datasheet* (SBOS584)

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3 *Regulatory Notices:*

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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.

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,
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
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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