# OPA857EVM Evaluation Module

This user's guide describes the characteristics, operation, and use of the OPA857 evaluation module (EVM). This user's guide also discusses how to set up and configure the hardware. Throughout this document, the terms *evaluation board*, *evaluation module*, and *EVM* are synonymous with the OPA857EVM. This user's guide also includes information regarding operating procedures, input and output connections, an electrical schematic, printed circuit board (PCB) layout drawings, and a parts list for the EVM.

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## Trademarks

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## 1 Overview

The OPA857EVM is an evaluation module for the OPA857 amplifier in a QFN-16 (RGT) package. This evaluation module is designed to quickly and easily demonstrate the functionality and versatility of the amplifier. The EVM is ready to connect to power, signal source, and test instruments through the use of onboard connectors. The EVM comes configured for easy connection with common 50-Ω laboratory equipment on its inputs and outputs. The amplifier is configured for a single-ended input with a selectable transimpedance gain (5 kΩ or 20 kΩ). The pseudo-differential output at the device pins is then converted to a single-ended signal through an RF transformer.


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## 2 Features

This EVM includes several key features.

- The EVM is configured for single-supply operation to a pseudo-differential output.
- The transimpedance gain can be easily configured for either the 5-kΩ or the 20-kΩ gain option.
- The EVM is designed for easy connection to standard 50-Ω input and output impedance test equipment.
- The inputs and outputs include SMA connectors.

## 3 EVM Specifications

Table 1 lists the EVM specifications.

**Table 1. EVM Specifications**

| Parameter | Description | Value |
|---|---|---|
| $V_S$ | Split-supply voltage range | 2.6 V to 3.6 V |
| GND | Ground pin | 0 V |
| $I_S$ | Supply current | 25 mA |
| CTRL Pin | Transimpedance gain select | Logic 0 = 5 kΩ; logic 1 = 20 kΩ |
| Test_SD | Test mode shutdown pin | $+V_S$ = enable test mode; GND = disable test mode |
| Test_In | Input for voltage-to-input (V-to-I) conversion | $V_{DC}$ is approximately 2.1 V for test mode operation. Set $V_{DC} = +V_S$ to disable test mode. |

## 4 Power Connections

The OPA857EVM is equipped with banana jacks for connecting the power supply and GND. These jacks are labeled *VCC* and *GND*, respectively. Appropriate power-supply bypassing is installed. To power-up the OPA857EVM, connect jumper J7 to GND, and apply the positive supply voltage to $V_{S+}$ through J6. For proper operation, the inputs and outputs must be biased per the data sheet specifications.

## 5 Transimpedance Control

Transimpedance gain can be controlled in multiple ways. This gain can be manually controlled through a 3-position jumper (JP2), which is connected to either VCC or GND. Alternatively, gain can be programmed through the SMA connector J10. Remember to remove the JP2 jumper shunt when controlling gain through programming.

## 6 Test_SD

This pin can be controlled manually through jumper JP1.

## 7 Test_In

This pin can be driven through the SMA connector J1. In test mode, set the dc bias of the input signal to approximately 2.1 V. The output test current, $I_{OUT}$ is approximately $V_{Test_In(AC)}$ / 2 kΩ.

## 8 Input and Output Connections

The input to the OPA857 is applied through the SMA connector J2. The OPA857 can be configured as a traditional TIA by installing a 0-Ω resistor in place of R4. Alternatively, the device can be configured in an inverting op amp configuration by installing a resistor of the desired size at R4. The pseudo-differential output of the OPA857 can be measured through jumpers J4 and J5. Alternatively, the output can be converted to a single-ended signal by the RF transformer T1, and measured at the SMA connector J3. Note that the OUT and OUTN pins have internal 25-Ω resistors on each pin; take these resistors into account during gain calculations when loading the amplifier.


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# 9 Schematic, Layout, and Bill of Materials

## 9.1 Schematic

Figure 1 illustrates the EVM schematic.

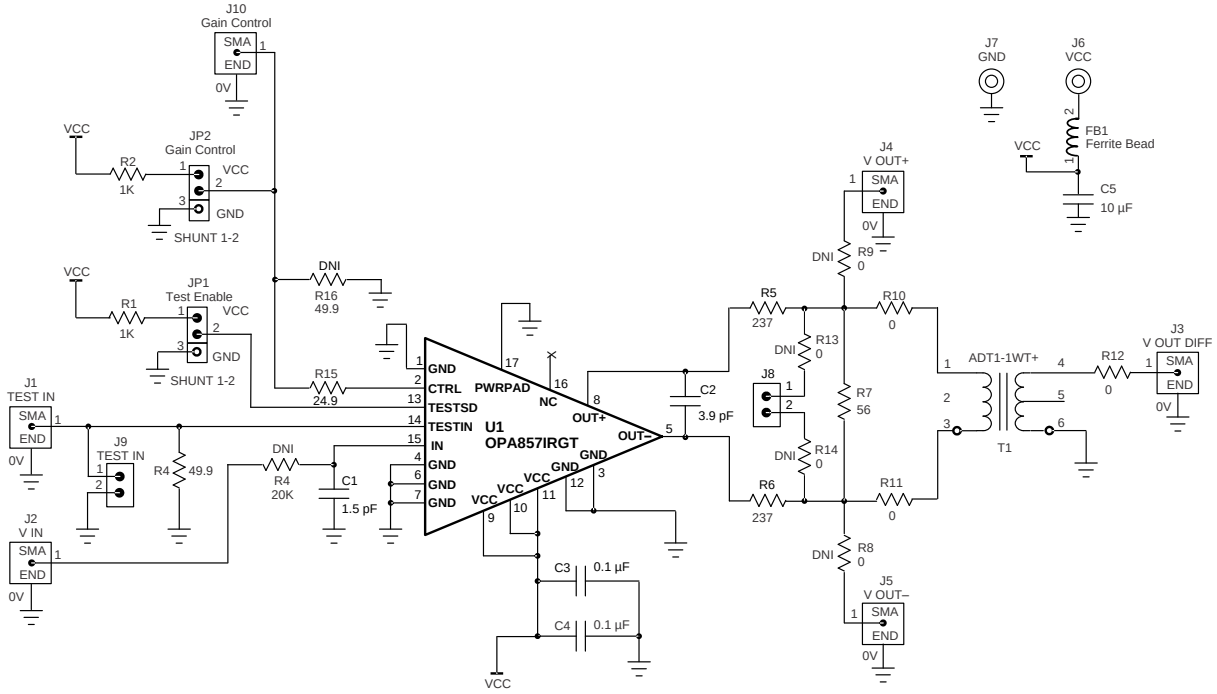



**Figure 1. Schematic**



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## 9.2 PCB Layers

Figure 2 through Figure 5 illustrate the PCB layers of the EVM.

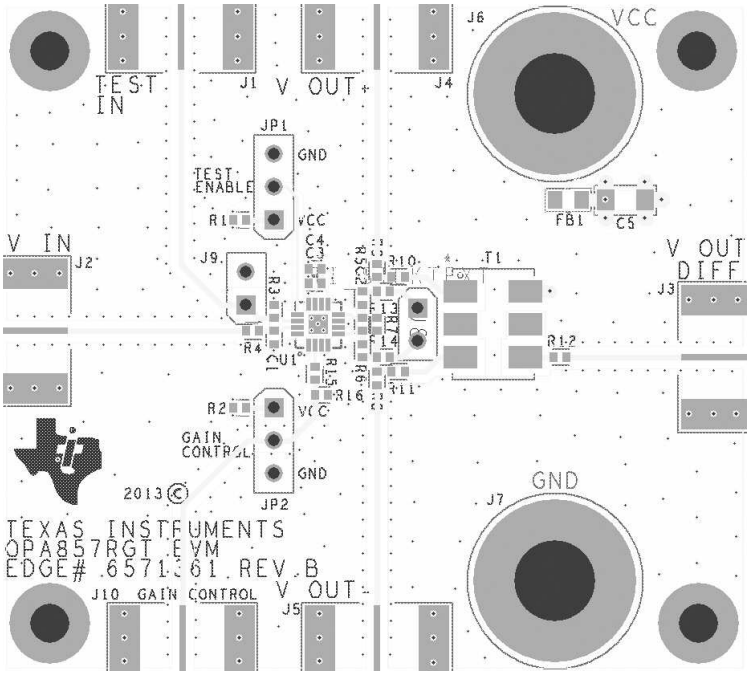



**Figure 2. Top View: Layer 1**

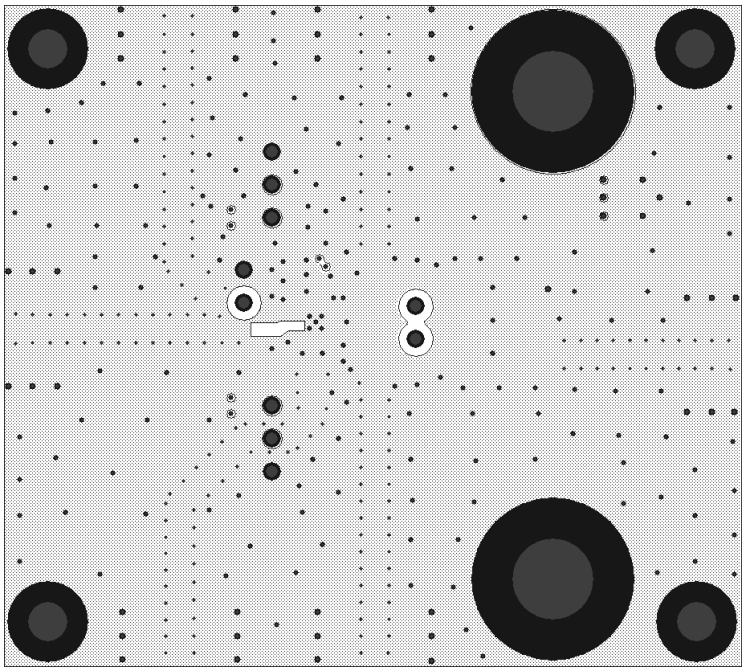


**Figure 3. Ground View: Layer 2**



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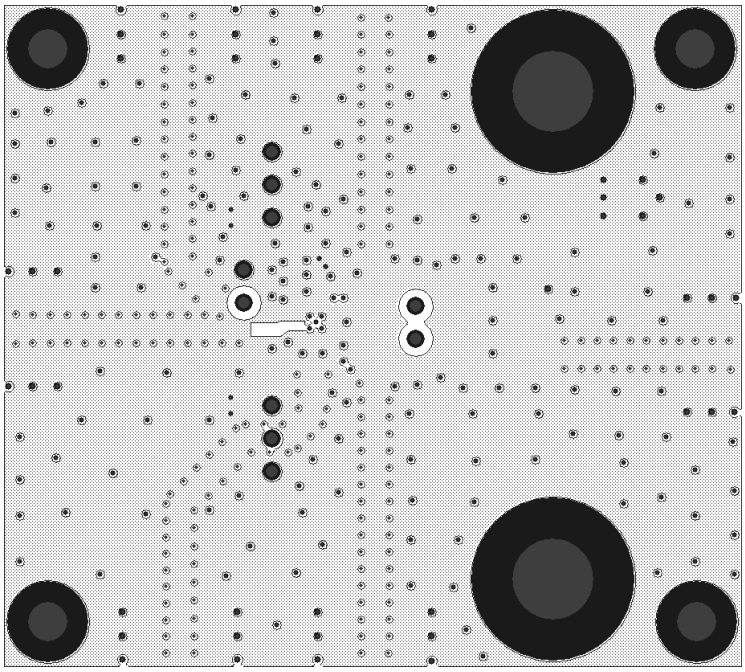


**Figure 4. VCC View: Layer 3**

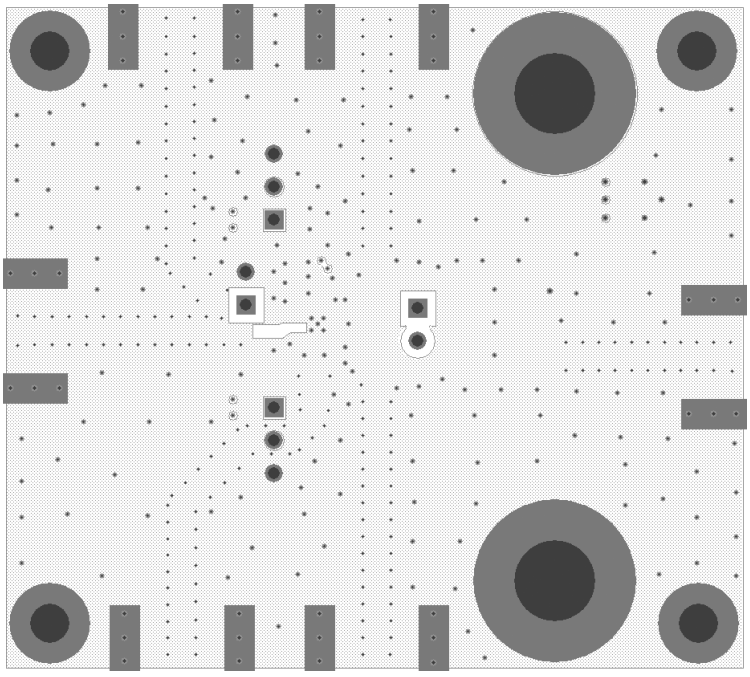


**Figure 5. Bottom View: Layer 4**


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## 10 Bill of Materials

Table 2 lists the bill of materials (BOM) for the OPA857EVM.

**Table 2. Bill of Materials**

| Item | Reference Designator | Quantity | Description | Package/ Case | Manufacturer | Part Number |
|---|---|---|---|---|---|---|
| 1 | C1 | 1 | CAP CER 1.5pF 50V C0G, NP0 | 0402 | Murata | GRM1555C1H1R5CZ01D |
| 2 | C2 | 1 | CAP CER 3.9PF 50V NP0 0402 | 0402 | AVX Corporation | 04025A3R9BAT2A |
| 3 | C3, C4 | 2 | CAP CER 0.1UF 10V 10% X5R 0402 | 0402 | Murata | GRM155R61A104KA01D |
| 4 | C5 | 1 | CAP CER 10UF 10V 10% X5R 1206 | 1206 | TDK Corporation | C3216X5R1A106K |
| 5 | FB1 | 1 | FERRITE 4.5A 31 OHM 0805 SMD | 0805 | Laird-Signal Integrity Products | HI0805Q310R-00 |
| 6 | JP1 | 1 | MODIFIED .025 SQUARE POST TERMINAL | | Samtec | HMTSW-103-07-G-S-.240 |
| 7 | JP2 | 1 | MODIFIED .025 SQUARE POST TERMINAL | | Samtec | HMTSW-103-07-G-S-.240 |
| 8 | J1, J2, J3, J4, J5, J10 | 6 | CONN SMA JACK 50 OHM EDGE MNT | | Emerson Network Power Connectivity Johnson | 142-0701-801 |
| 9 | J6 | 1 | BANANA JACK, SOLDER LUG, RED | | SPC Technology | SPC15363 |
| 10 | J7 | 1 | BANANA JACK, SOLDER LUG, BLACK | | SPC Technology | SPC15354 |
| 11 | J8, J9 | 2 | CONN HEADER 2POS .100" T/H GOLD | | Samtec | HMTSW-102-07-G-S-.240 |
| 12 | R1, R2 | 2 | RES 1K OHM 1/10W 1% 0402 SMD | 0402 | Panasonic | ERJ-2RKF1001X |
| 13 | R3, R16 | 2 | RES 49.9 OHM 1/10W 1% 0402 SMD | 0402 | Panasonic | ERJ-2RKF49R9X |
| 14 | R4 | 1 | RES 20K OHM 1/10W 1% 0402 SMD | 0402 | Panasonic | ERJ-2RKF2002X |
| 15 | R5, R6 | 2 | RES 237 OHM 1/10W 1% 0402 SMD | 0402 | Panasonic | ERJ-2RKF2370X |
| 16 | R7 | 1 | RES 56 OHM 1/10W 1% 0402 SMD | 0402 | Panasonic | ERJ-2RKF56R0X |
| 17 | R8, R9 | 2 | RES 0.0 OHM 1/10W JUMP 0402 SMD | 0402 | Panasonic | ERJ-2GE0R00X |
| 18 | R10, R11, R12, R13, R14 | 3 | RES 0.0 OHM 1/10W JUMP 0402 SMD (Do Not Install) | 0402-DNI | Panasonic | ERJ-2GE0R00X -DNI |
| 20 | R15 | 1 | RES 24.9 OHM 1/10W 1% 0402 SMD | 0402 | Panasonic | ERJ-2RKF24R9X |
| 21 | T1 | 1 | RF TRANSFORMER 75 OHM 0.4 TO 800MHz | | Minicircuits | ADT1-1WT+ |
| 22 | U1 | 1 | Variable gain Transimpedance amplifier | RGT | Texas Instruments | OPA857IRGT |
| 23 | | 2 | Mini Jumper-2.54 for shunts | | KELTRON Connector Co. | MJ-5.97-G or equivalent |
| 24 | | 4 | MACHINE SCREW PAN PHILLIPS 4-40 | | B&F Fastener Supply | PMS 440 0038 PH |
| 25 | | 4 | HEX STANDOFF 4-40 ALUMINUM 5/8" | | Keystone Electronics | 1808 |


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## Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Original (December 2013) to A Revision | Page |
|---|---|
| • Changed Test_In value in Table 1 from "VDC is don't care in standard mode" to "Set $V_{DC}$ = $+V_S$ to disable test mode" | 2 |


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# STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an “EVM” or “EVMs”) to the User (“User”) in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.

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   2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

3 *Regulatory Notices:*

   3.1 *United States*

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

      **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.

      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 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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3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

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If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

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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3.4 *European Union*

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive)*:

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

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4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

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