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User's Guide
SLLU243–March 2017

# ISOW784x Quad-Channel Digital Isolator With Integrated DC-DC Converter Evaluation Module

This user's guide describes the evaluation module (EVM) for the ISOW784x quad-channel digital isolators with integrated DC-DC converter. This EVM allows designers to evaluate device performance for fast development and analysis of isolated systems. The EVM supports evaluation of any of the TI triple- or quad-channel digital isolators in a 16DW or 16DWE package.

**CAUTION**

This evaluation module is made available for isolator parameter performance evaluation only and is not intended for isolation voltage testing. To prevent damage to the EVM, any voltage applied as a supply or digital input/output must be maintained within the 0 V to 5.5 V recommended operating range.

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## 1 Introduction

This user's guide describes EVM operation with respect to the ISOW784x quad-channel digital isolators. However, the EVM may be reconfigured for evaluation of any of TI's triple- or quad-channel digital isolators in a 16DW or 16DWE package. This guide also describes the available channel configurations within the ISOW784x family, the EVM schematic, and typical laboratory setup. An efficiency plot and typical input and output waveforms are also provided.

## 2 Overview

The ISOW784x is a family of high-performance, quad-channel reinforced digital isolators with an integrated high-efficiency power converter. The integrated DC-DC converter provides up to 650 mW of isolated power at high efficiency and can be configured for various input and output voltage configurations. Therefore these devices eliminate the need for a separate isolated power supply in space-constrained isolated designs. The ISOW784x family of devices provide high electromagnetic immunity and low emissions while isolating CMOS or LVCMOS digital I/Os. The signal-isolation channel has a logic input and output buffer separated by a silicon dioxide ($SiO_2$) insulation barrier, whereas, power isolation uses on-chip transformers separated by thin film polymer as insulating material. Various configurations of forward and reverse channels are available. If the input signal is lost, the default output is high for the ISOW784x devices and low for the devices with the F suffix. These devices help prevent noise currents on a data bus or other circuits from entering the local ground and interfering with or damaging sensitive circuitry. Through innovative chip design and layout techniques, electromagnetic compatibility of the ISOW784x family of devices has been significantly enhanced to ease system-level ESD, EFT, surge and emissions compliance. The high-efficiency of the power converter allows operation at a higher ambient temperature.

## 3 Pin Configurations of ISOW784x Quad-Channel Isolators

Figure 1 shows the ISOW784x quad-channel digital isolator pin configurations.

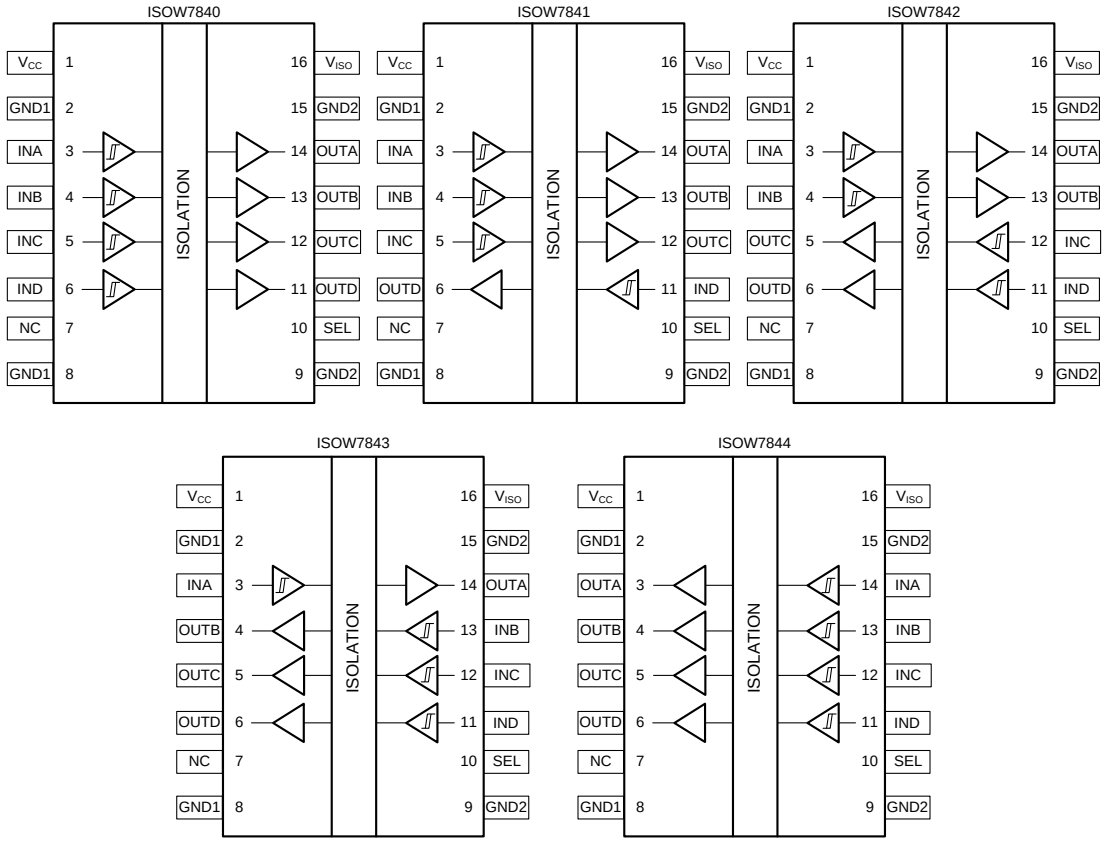



**Figure 1. ISOW784x Quad-Channel Digital Isolator Pin Configurations**


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## 4 ISOW7841EVM Board Block Diagram and Image

Figure 2 shows the board configuration for evaluation of the ISOW7841 quad-channel isolator.

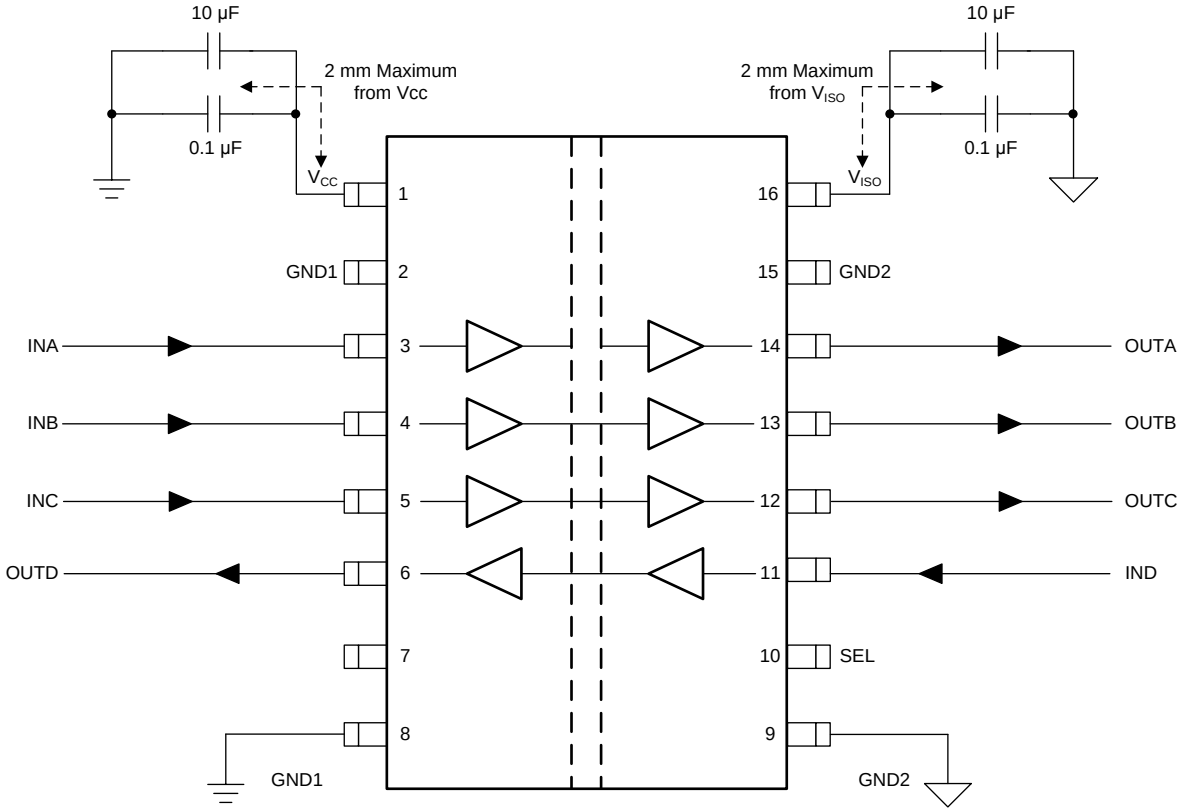



**Figure 2. ISOW7841EVM Configuration**

Figure 3 shows the photograph of the EVM.

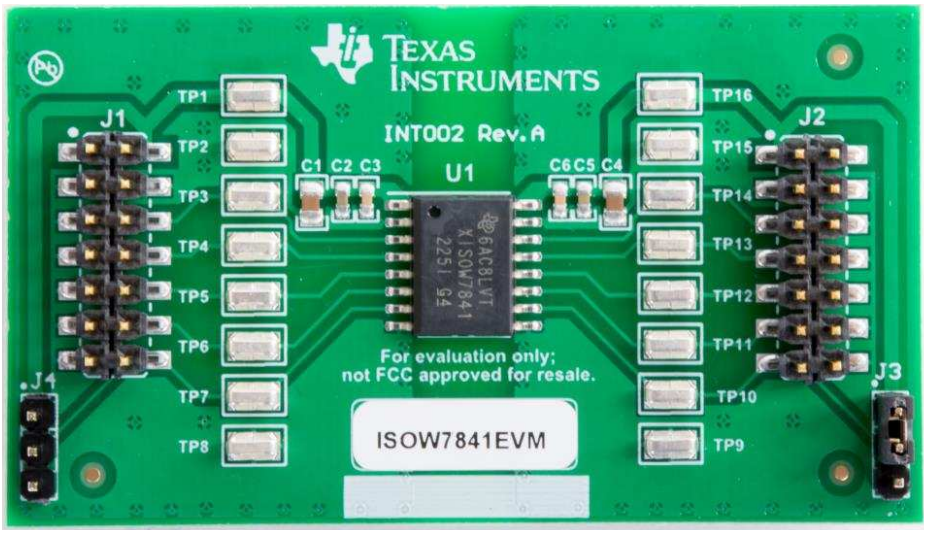



**Figure 3. ISOW7841EVM Photograph**


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# 5 EVM Setup and Operation

This section describes the setup and operation of the EVM for parameter performance evaluation. Figure 4 shows the configuration for operating the ISOW784x quad-channel isolator EVM using an integrated DC-DC converter to generate output power supply.

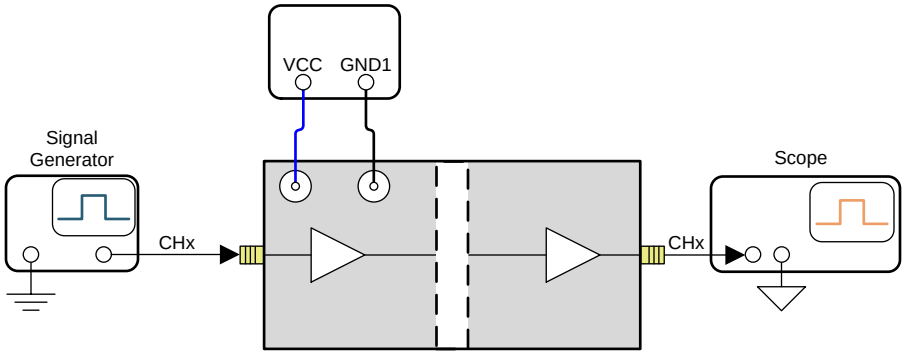



**Figure 4. Basic EVM Operation**

Figure 5 shows typical input and output waveforms of the EVM for a 1-MHz clock. The input is shown as channel 1, and the output is shown as channel 2.




**Figure 5. Typical Input and Output Waveforms**

Figure 6 shows typical efficiency vs load current plot of ISOW7841EVM for 3.3-V and 5-V output voltage configurations with input at 3.3-V and 5-V input voltages.

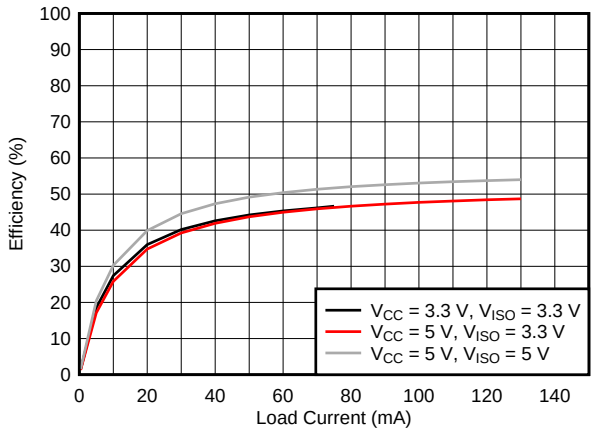



**Figure 6. ISOW7841EVM Efficiency vs Load Current ($I_{ISO}$)**


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## 6 Bill of Materials

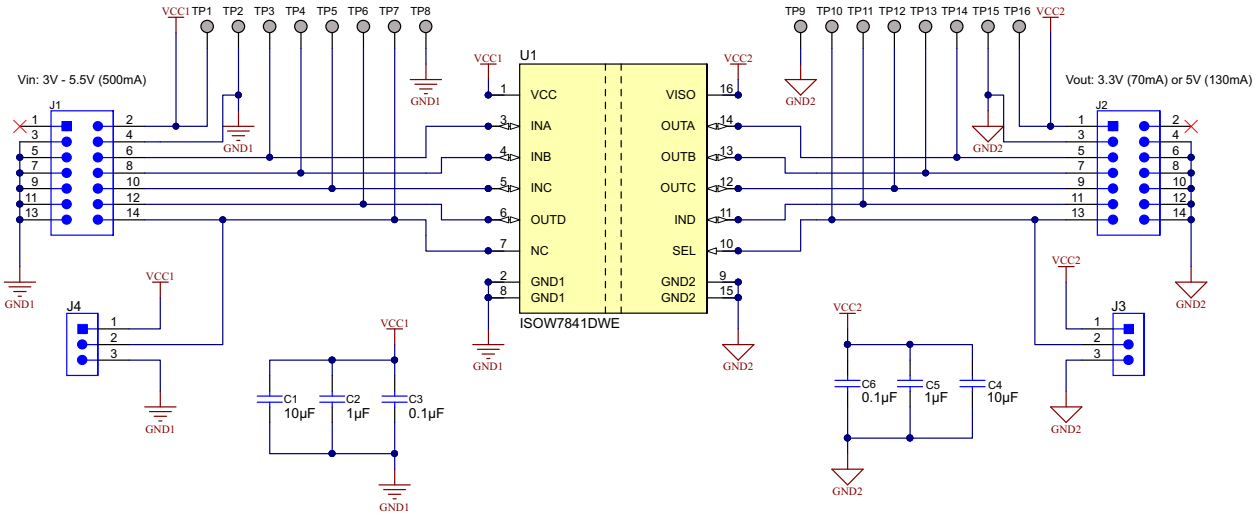
Table 1 shows the bill of materials (BOM) for this EVM.

**Table 1. Bill of Materials**

| Item | Designator | Description | Manufacturer | Part Number | Quantity |
|---|---|---|---|---|---|
| 1 | C1, C4 | CAP, CERM, 10 µF, 35 V, ±10%, X5R, 0805 | MuRata | GRM21BR6YA106KE43L | 2 |
| 2 | C2, C5 | CAP, CERM, 1 µF, 50 V, ±10%, X5R, 0603 | MuRata | GRM188R61H105KAALD | 2 |
| 3 | C3, C6 | CAP, CERM, 0.1 µF, 25 V, ±5%, X7R, 0603 | AVX | 06033C104JAT2A | 2 |
| 4 | H1, H2, H3, H4 | Bumpon, Hemisphere, 0.44 X 0.20, Clear | 3M | SJ-5303 (CLEAR) | 4 |
| 5 | J1, J2 | Header, 100mil, 7x2, SMT | Molex | 0015912140 | 2 |
| 6 | J3, J4 | Header, 100mil, 3x1, Gold, TH | Samtec | HTSW-103-07-G-S | 2 |
| 7 | SH-J1 | Shunt, 100mil, Gold plated, Black | Samtec | SNT-100-BK-G | 1 |
| 8 | TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16 | Test Point, Miniature, SMT | Keystone | 5019 | 16 |
| 9 | U1 | ISOW7841DWE | Texas Instruments | ISOW7841DWER | 1 |

## 7 EVM Schematics and Layout

The ISOW7841EVM is designed to accommodate any of the ISO784x quad-channel devices in a 16-pin DWE package. To evaluate any of the ISOW784x quad-channel devices in a 16-pin DWE package, replace ISOW7841DW with the device of interest on the ISOW7841EVM PCB. No other component requires any modification. Figure 7 shows the ISOW784x EVM schematic and Figure 8 shows the printed-circuit board (PCB) layout.




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**Figure 7. ISOW7841EVM Schematic**


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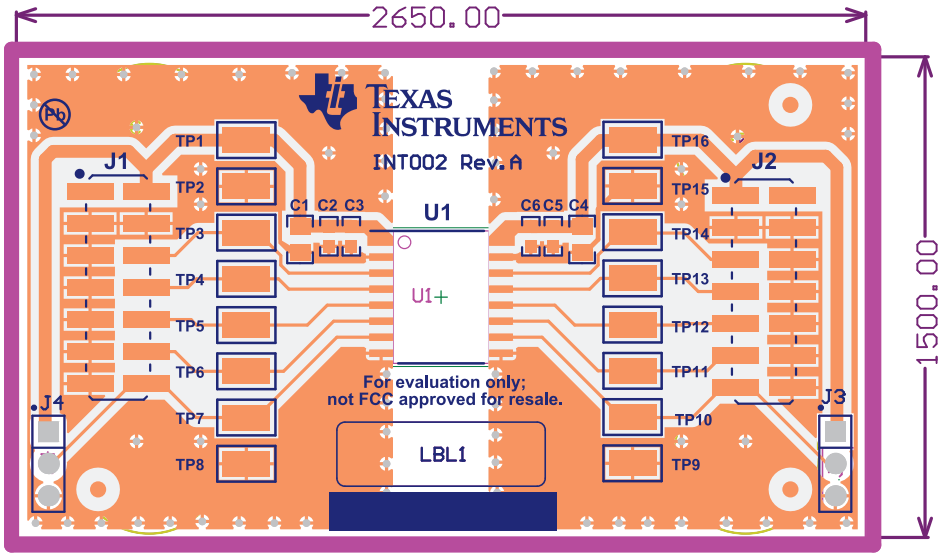



**Figure 8. ISOW7841EVM PCB Layout**


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      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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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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