

OPT8241 CDK Evaluation Module

Quick Start Guide



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OPT8241 Evaluation Module



In collaboration with
D3 Engineering



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1 Overview

The OPT8241-CDK-EVM is the official evaluation module for the second-generation 3D Time-of-Flight (3D-ToF) sensor from Texas Instruments. This document describes the kit contents and the basic setup of the EVM hardware and software. The EVM showcases the high-performance QVGA resolution 3D Time-of-Flight sensor OPT8241 with its companion Time-of-Flight Controller OPT9221. [Figure 1](#) highlights the important components of the EVM.

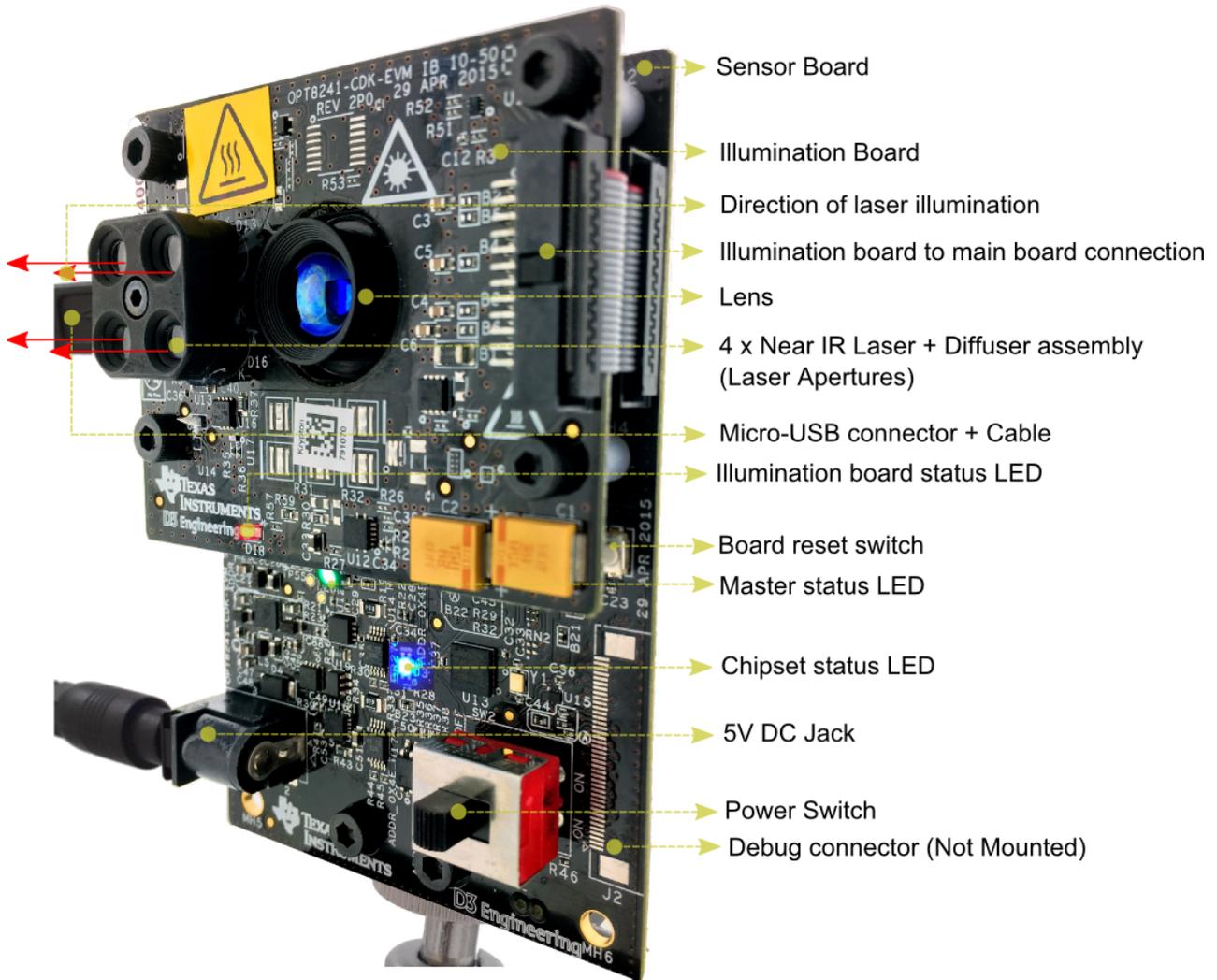


Figure 1. Components of EVM

2 CDK Contents

[Table 1](#) lists the CDK contents.

Table 1. Contents of CDK

Content	Description	Number of Pieces
Board Assembly (Sensor Board + Illumination Board + Tripod Mount)	The sensor board houses the sensor and the TFC. Illumination boards with Lasers and mounted diffusers for IR illumination	1
USB cable	Micro-USB cable for connecting the EVM to the PCM	1
Quick Start Guide	This document	1

Table 1. Contents of CDK (continued)

Content	Description	Number of Pieces
Third-party brochure	Metrilus calibration suite brochure	1

Complies with US FDA performance standards for laser products except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

3 Safety

This Laser Device is designed at Class 1 during normal operation. While the OPT8241-CDK-EVM development boards meet the Class 1 classification requirements under EN/IEC60825-1 2007, users are advised to take the necessary safety caution when using the OPT8241-CDK-EVM. First, examine the board for any damage before the board is powered. Check that the diffusers and diffuser mounts are properly secured on the laser diodes. If there is any damage, stop operating by removing power from the CDK immediately. Opening the laser diffuser assembly may lead to hazardous radiation exposure. Any kind of circuit modification to the board or use of software or firmware other than the recommended EVM tools and firmware provided by TI may lead to violation of class 1 safety limits. Due to the small size and unsuitability for labeling, laser safety related labels are included herein, rather than on the product.

WARNING

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

This is a class A product as defined by standard EN 61326-1:2013. This product is not intended to be used in domestic establishments and also in establishments that are directly 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.

There is no scheduled maintenance required for the OPT8241-CDK-EVM; any servicing and maintenance of this EVM shall be performed only by trained Texas Instruments or TI-appointed trained personnel. Any modification or significant damage to the CDK could potentially cause the CDK to operate outside of the EN/IEC60825 2007 Class 1 classification limits.



Figure 2. Explanatory Label

For reference and future support, user should keep a record of the revision and serial number by entering the information in the following location:



Figure 3. Manufacturer Label

The revision and the serial numbers are located on the boards here:

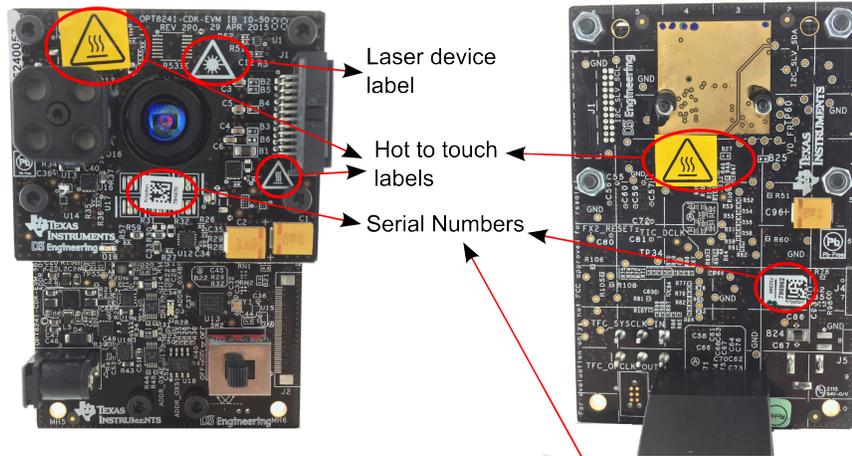


Figure 4. Serial Numbers

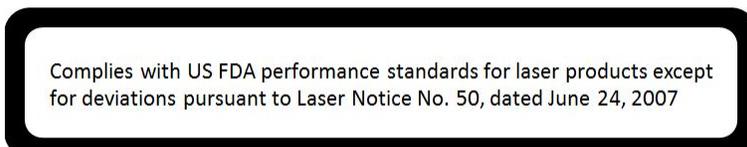


Figure 5. Certification Label

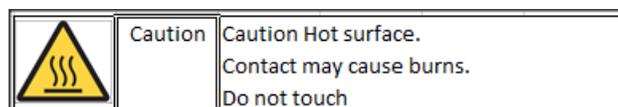


Figure 6. Hot To Touch

4 Power Supply

The recommended power adapter is [EMSA050300-P5RP-SZ](#). Note that the recommended power adapter is not included in the kit. The power adapter must be bought separately or an equivalent adapter should be used.

External Power Supply Requirements:

- Nom Output Voltage — 5 VDC
- Max Output Current — 3 A
- Efficiency Level — V

NOTE: TI recommends using an external power supply that complies with applicable regional safety standards such as (by example) UL, CSA, VDE, CCC, PSE, and so forth.

5 Top-Level Specifications Of The EVM

The top-level specifications of the EVM are listed in [Table 2](#).

Table 2. EVM Specification

Item	Value (Typical)
External power supply requirements	3 A at 5 V
Pixel resolution	320 x 240
Field of View	87° Diagonal. 74 (H) x 59 (V)
Maximum average optical output power	1.5 W
Connectivity	USB 2.0
Operating Conditions	0°C to 40°C (Ambient)

The details of the laser illumination are listed in [Table 3](#).

Table 3. Laser Illumination Profile

Item	Value (Typical)
Wavelength	850 nm
Peak Optical Output	10 W
Pulse train width	18 μ s–28 ms
Pulse repetition frequency	12-MHz to 80-MHz square wave at 50% duty cycle.
Laser Beam Divergence	80° at 90% power relative to the center
Laser Beam Shape	Circular
Transverse Beam Mode	Diffused

6 System Requirements

The system requirements are as follows:

1. Microsoft® Windows® 7 / Ubuntu 14.04 64 bit PC
2. 2GB RAM
3. Minimum of 500MB free space

7 Software Setup

Implement the following steps to setup the software:

1. Download the software for the appropriate platform from the TI website here: <http://www.ti.com/tool/opt8241-cdk-evm>
2. Installation of the software:
 - Windows - Install the software by running the downloaded executable.
 - Ubuntu – The following dependencies must be installed before installing the Voxel Viewer software.
 - `libusb ≥ libusb-1.0`
 - `ibudev`
3. The default installation directory is “C:\Program Files\Texas Instruments\Voxel Viewer-0.x.y.z” on Windows. On Ubuntu, the name of the executable is `voxelviewer`.

8 Hardware Setup

The hardware setup is shown in the following steps:

1. Ensure that the software setup is complete.
2. Verify that the EVM is in a fully-assembled state, as shown in [Figure 1](#).
3. Ensure that the power switch on the board (SW2) is in the off position (to the left).
4. Verify that there is not apparent damage to the EVM and the laser diffuser assembly is in good shape. This step is important to avoid accidental exposure to hazardous radiation.
5. Connect the recommended power supply.
6. Connect the board to the PC using the micro-USB cable provided.
7. Throw the power switch on the board (SW2) to on position (to the right).
8. Check that the master LED is green and the chipset LED is blue in color.

9 Launching the Software

Launch the software using the following:

1. On Windows, click on the desktop shortcut created or navigate to <installation folder>/bin and click on VoxelViewer.exe to launch the software. On Linux®, execute the voxelviewer command.
2. Once the viewer is up, streaming should automatically start.
3. If the EVM is connected after the viewer has started, use the camera connection dialog box to refresh the list of cameras, choose the appropriate camera and click OK. The camera connection dialog box is also available through the File menu – **File** → **Connect Depth Camera (CTRL+C)**.
4. A sample screenshot with streaming enabled is shown in [Figure 7](#).
5. The streaming can be paused/started using the play/pause button near the top-left corner of the window.
6. The state of streaming can also be confirmed on the hardware by looking at the color of the Master LED. The Master LED is cyan while streaming and green when the streaming is stopped.

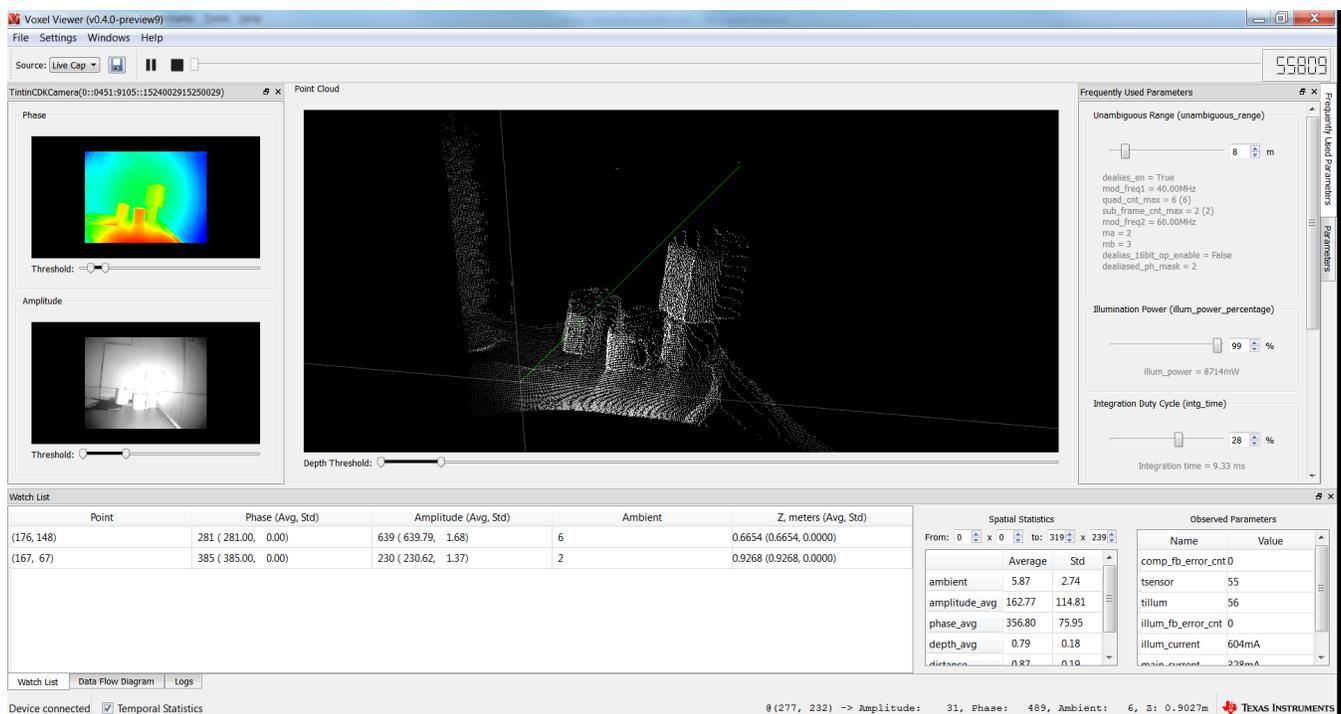


Figure 7. Streaming Enabled

10 Basic Troubleshooting

The sensor board has 2 LEDs for indicating various operating states of the board. The master LED indicates the overall status of the board and the chipset LED indicates the status of the ToF chipset. The various states of the board are listed in [Table 4](#).

Table 4. States of Board

State	Master LED	Chipset LED	Status Type
All OK, Streaming OFF	Bright Green	Blue	Info
All OK, Streaming On	Cyan	X	Info
TFC Test Mode Enabled	X	Off	Info
Firmware Upgrade in progress	Blink (Magenta)	X	Info
Firmware Upgrade done	Magenta	X	Info
DC Jack unplugged	Dimmed colors	X	Info
Over Temperature	X	Magenta	Warning
TFC booted, but status failed	X	Red	Error
TFC did not boot	Blink (Red)	Off	Error

In usual operating conditions, the master LED should be green/cyan and the chipset LED should be blue.

11 Related Documentation from Texas Instruments

Related documentation regarding the EVM is available here: <http://www.ti.com/tool/opt8241-cdk-evm>. The documentation related to the ToF chipset used in the EVM is available in the following:

- Sensor - <http://www.ti.com/product/OPT8241>
- Time-of-Flight Controller - <http://www.ti.com/product/OPT9221>

12 If You Need Assistance

If you have questions about the ToF evaluation module, post a question in the optical sensors forum at <http://e2e.ti.com> Include OPT8241-CDK-EVM in the subject heading.

For servicing and other technical issues related to the EVM, please contact TI at the address below:

Attn: Kelly Loney
 Texas Instruments
 12500 TI Boulevard Dallas,
 TX 75243
 Tel: (512) 750-2405
 Email: kloney@ti.com

Revision History

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

Changes from A Revision (February 2016) to B Revision	Page
• Added class A product statement pertaining to EN 61326-1:2013 in the <i>Safety</i> section.	7

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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 - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. *Limited Warranty and Related Remedies/Disclaimers:*
 - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
 - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
 - 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

Concerning EVMs Including Radio Transmitters:

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.

3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lstds/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/lstds/ti_ja/general/eStore/notice_01.page

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

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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3.4.1 *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.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

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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8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMNITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the component(s), excluding any postage or packaging costs.

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