User's Guide

CC256xCQFN-EM

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Trademarks

1 Introduction to the CC256xCQFN-EM Board

This user's guide is intended for use with TI's *Bluetooth*® development platform, the CC256xCQFN-EM board (see Figure 1-1). This guide helps users quickly get started integrating the board with TI's evaluation platforms and software SDKs. In addition, this user's guide describes the components and configurations of the board so that users can quickly get started using it for various Bluetooth applications.

This guide provides information about the module so that developers can use the board specifics to apply it to their applications. Module information and capabilities, including pin descriptions as well as available software and tools, enhance the user's out-of-box experience.

Figure 1-1. CC256xCQFN-EM Board

1.1 Key Features

- Bluetooth specification 5.1
- Fast time to market
- Easy PCB layout using cadence tools
- 4-layer PCB design
- Bluetooth and Bluetooth Low Energy
- TI's Bluetooth royalty-free stack with profiles
- FCC, IC, and Bluetooth SIG compliant
- High sensitivity (–93 dBm typical)
- Shield enabled for immunity
- H4 UART and PCM/I2S interface

1.2 QFN EM Board Applications

The following are example embedded wireless applications:

- Wireless Audio Solutions
- mPOS
- Medical Devices
- Set-Top Boxes (STBs)
- Wearable Devices
- Sensor Hub, Sensor Gateway
  - Home and Factory Automation

2 Module Description

The CC256xC QFN EM board is the development environment for the CC256x family and plugs into TI's MSP432™ LaunchPad™ through the BOOST-CCEMADAPTER board.

This family is based on TI's CC256xC integrated circuit and uses a host controller interface (HCI), a cost-effective and flexible means for implementing a Bluetooth network. The HCI reduces BOM cost by eliminating redundant processing capacity and gives designers the flexibility to work with a controller of their choice, because the Bluetooth stack resides and executes on the host processor of the application. Figure 2-1 highlights various aspects of the CC256xCQFN-EM board.

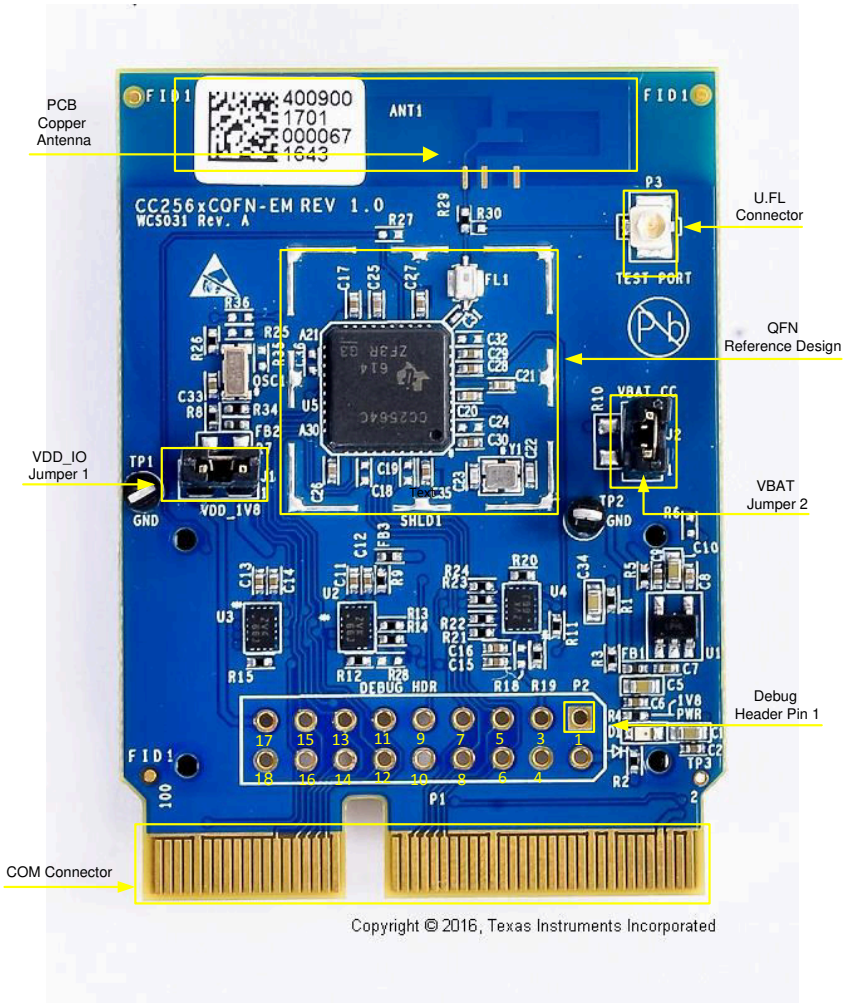

Figure 2-1. CC2564xCQFN-EM Highlights

The CC256xCQFN-EM board is intended for evaluation purposes and works with TI's Hardware Development Kit. For more information, see Section 6.

To help implement this reference design, schematics and layout files are available in the *CC256XCQFN-EM Design Files*.

3 Module Detailed Description

The reference files including schematics, layout, and BOM for the CC256xCQFN-EM board can be found in the *CC256XCQFN-EM Design Files*.

Figure 3-1 shows a block diagram depicting the I/Os of the QFN board that are required for interfacing to the host controller. These I/Os can be interfaced to the host controller through either the COM connector or the RF1 and RF2 sockets.

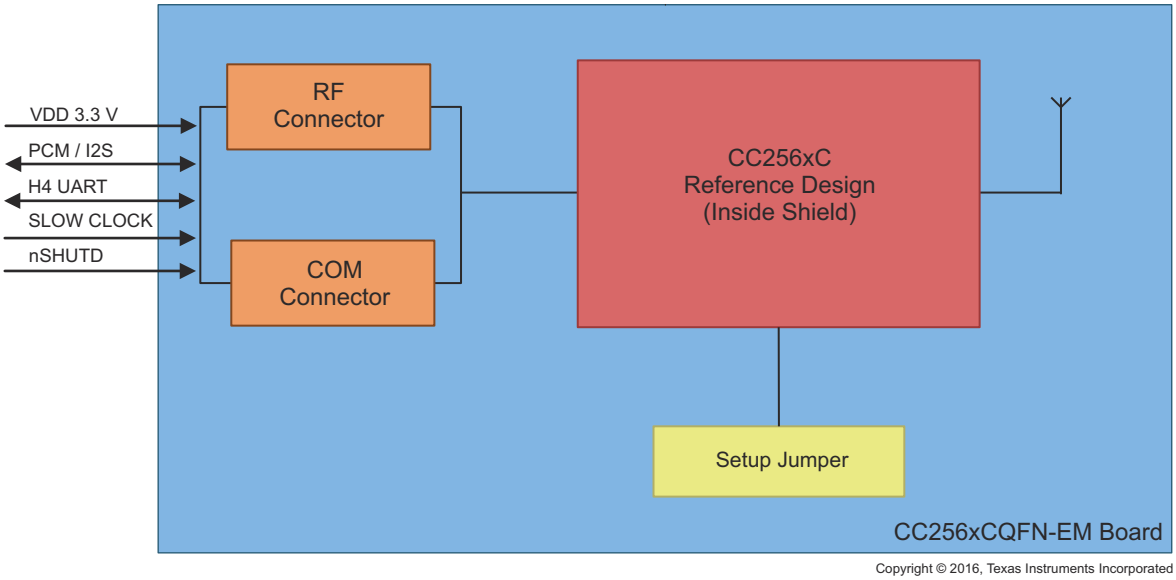

Figure 3-1. CC256xCQFN-EM Block Diagram

3.1 Pin Description

3.1.1 Board Jumpers

For correct operation, ensure both jumpers are placed for connecting power to the device as follows in Table 3-1.

Table 3-1. Jumper Configuration

Jumper	Description
VBAT_CC	Main power supply for CC256xC
VDD_1V8	Supplies power to CC256xC I/Os

3.1.1.1 Measuring Current Consumption

These jumpers can also be used to measure the current consumption by placing current sense resistors on R10 for VBAT_CC and on R7 for VDD_1V8. Both these resistors are 0.10 Ω, 1/4 W. The VBAT_CC jumper can be used to to measure the voltage and power consumed by the CC256xC, including RF TX and RX while the VDD_IO jumper can be used to measure voltage and power consumed by the digital I/Os.

3.1.2 Antenna and U.FL Selector

The board can be configured to route the RF output from the CC256xC to the onboard copper antenna or the onboard U.FL connector. This configuration is done by placing the resistor in either the R29 or R30 position which has negligible resistance of 0 Ω. R30 connects the RF to the U.FL while R29 connects to the copper antenna. The U.FL connector is used for conducted testing of the RF. The *HCI Tester Tool* can be used to test basic RF functionality on this board.

3.1.3 RF Connectors

The RF1 and RF2 connectors can be sued to mount the TI MSP432 platform using the BOOST-CCEMADAPTER board. The RF I/Os are all at 3.3-V levels; this enables seamless integration of the host using TI's platforms that comes preinstalled with EM headers. Table 3-2 and Table 3-3 describe the standard pinout.

Table 3-2. RF1

Pin No.	EM Adapter Pin Assignment	Pin No.	EM Adapter Pin Assignment
1	GND	2	NC
3	MODULE_UART_CTS	4	NC
5	SLOW_CLK	6	NC
7	MODULE_UART_RX	8	NC
9	MODULE_UART_TX	10	NC
11	NC (not connected)	12	NC
13	NC	14	NC
15	NC	16	NC
17	NC	18	NC
19	GND	20	NC

Table 3-3. RF2

Pin No.	EM Adapter Pin Assignment	Pin No.	EM Adapter Pin Assignment
1	NC	2	GND
3	NC	4	NC
5	NC	6	NC
7	3.3V	8	MODULE_AUDIO_DATA_OUT
9	3.3V	10	MODULE_AUDIO_DATA_IN
11	MODULE_AUDIO_FSYNC	12	NC
13	NC	14	NC
15	NC	16	NC
17	MODULE_AUDIO_CLK	18	MODULE_UART_RTS
19	WCS_NSHUTD	20	NC

For complete evaluation of the audio applications while using the RF connectors (a.k.a. EM connectors), the level shifter U4 must be properly configured in order to ensure proper direction of PCM signals.

- When using CC256XC as PCM master role:
  - R19 must be populated with 10K Ω resistor.
  - R18 and R11 must be unpopulated (removed).
- When using CC256XC as PCM slave:
  - R18 must be populated with 0Ω resistor.
  - R19 and R11 must be unpopulated (removed).

More information on the hardware changes required for PCM signals on EM connectors can be found in the CC256XCQFN-EM board design files (schematics and bill of materials).

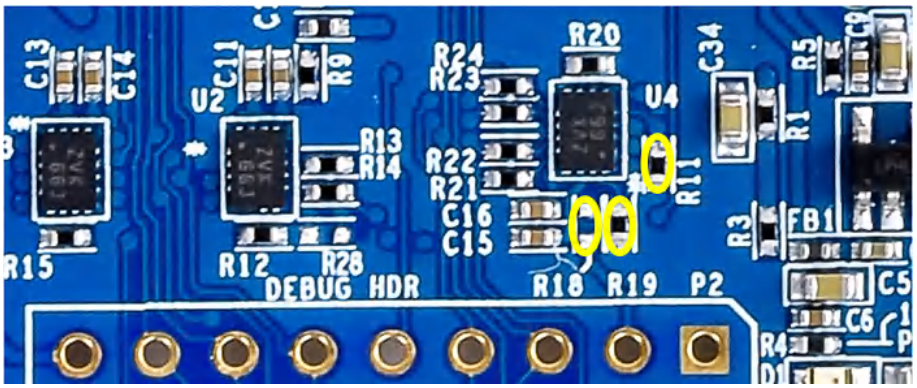

Figure 3-2. CC256XCQFN-EM PCM Role Selection for RF Connectors

3.1.4 Debug Header

The debug header is provided for testing and debugging purposes. The debug header exposes important signals used in the design such as power, ground, debug, UART, and audio signals. All I/Os are at 1.8V. Table 3-4 shows the pinout.

Table 3-4. DEBUG HDR

Pin No.	EM Adapter Pin Assignment	Pin No.	EM Adapter Pin Assignment
1	GND	2	VBAT
3	VIO_HOST	4	GND
5	AUD_FSYNC_1V8	6	AUD_CLK_1V8
7	AUD_OUT_1V8	8	AUD_IN_1V8
9	CLK_REQ_OUT_1V8	10	SLOW_CLK_EDGE
11	HCI_TX_1V8	12	HCI_RX_1V8
13	HCI_CTS_1V8	14	HCI_RTS_1V8
15	TX_DEBUG_1V8	16	nSHUTDOWN_1V8
17	VDD_1V8	18	GND

3.1.5 COM Connector

The COM connector, or edge card, is used to interface with TI's MPUs such as the AM437x and AM335x EVMs. As shown in Figure 3-3, the COM connector provides HCI, audio, slow clock, shutdown, and debug interfaces to the host connected through the edge card. All I/Os for the COM connector are at 1.8V. Some components must be DNI to use the COM connector. For more details, see the BOM.

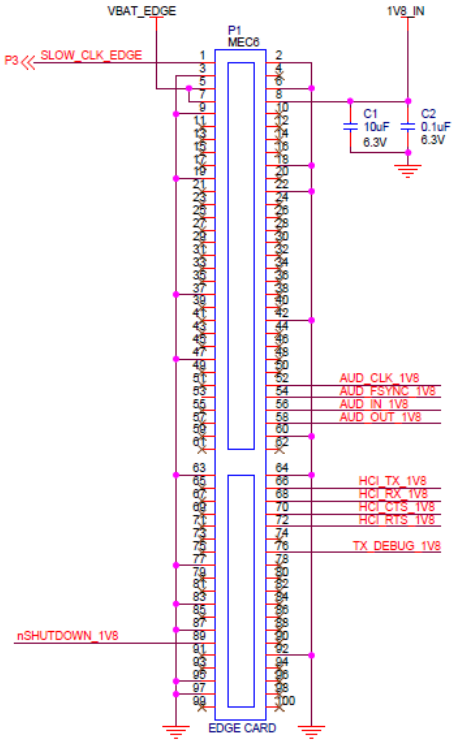

Figure 3-3. COM Connector Pinout

Table 3-5 lists the COM card pinout.

Table 3-5. COM CARD

Pin No.	Relevant COM Connector Pin Assignment
1	SLOW_CLK_EDGE
8	1V8_IN
52	AUD_CLK_1V8
54	AUD_FSYNC_1V8
56	AUD_IN_1V8
58	AUD_OUT_1V8
66	HCI_TX_1V8
68	HCI_RX_1V8
70	HCI_CTS_1V8
72	HCI_RTS_1V8
76	TX_DEBUG_1V8
89	nSHUTDOWN_1V8

Pins 3, 9, 19, 37, 47, 63, 77, 83, 87, 95, and 97, as well as 2, 6, 18, 22, 42, 60, 64, and 92 are connected to ground.

All other pins are NC.

Some components must be removed (DNI) and R2 must be populated on the CC256XCQFN-EM to use the COM connector with the AM335x evaluation module (TMDXEVM3358) or similar Sitara EVM.

- EM1, EM2, U2, U3, and U4 must be unpopulated (removed).
- R2 (0 Ω) must be populated.

More information on the hardware changes required for the COM connector are in the CC256XCQFN-EM board design files (schematics and bill of materials).

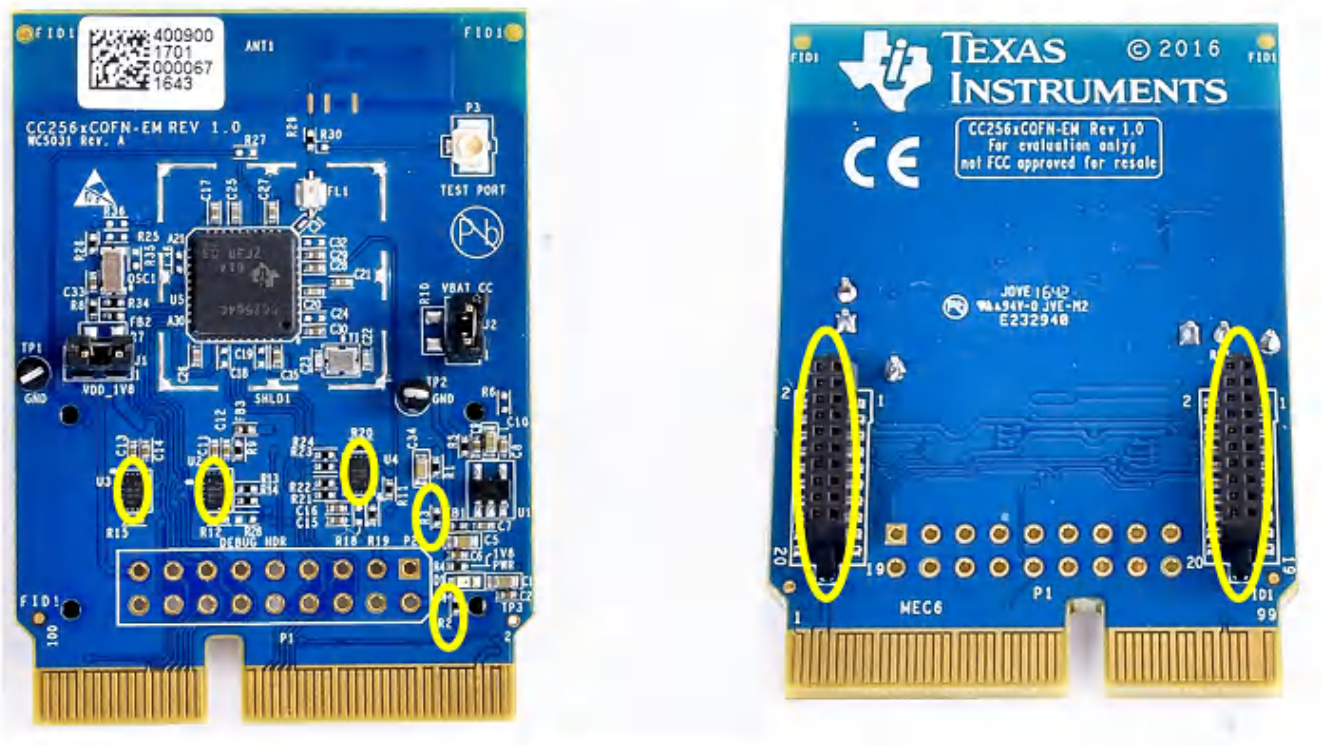

Figure 3-4. CC256XCQFN-EM Hardware Modifications for COM Connector

3.2 Clock Inputs

The slow clock can come from two sources, internal and external to the board. The CC256xCQFN-EM has the option to place the slow clock on the board or source it from an external source. The source is connected to the SLOW_CLK_IN (see Figure 3-5) and can be a digital signal in the range of 0 to 1.8V.

The frequency accuracy of the slow clock must be 32.768kHz and ±250ppm for Bluetooth use (according to the Bluetooth specification).

When the MSP432 Launchpad is connected, the SLOW_CLK_IN signal, is sourced from the oscillator on the CC256xCQFN-EM board, therefore no additional clock source is needed.

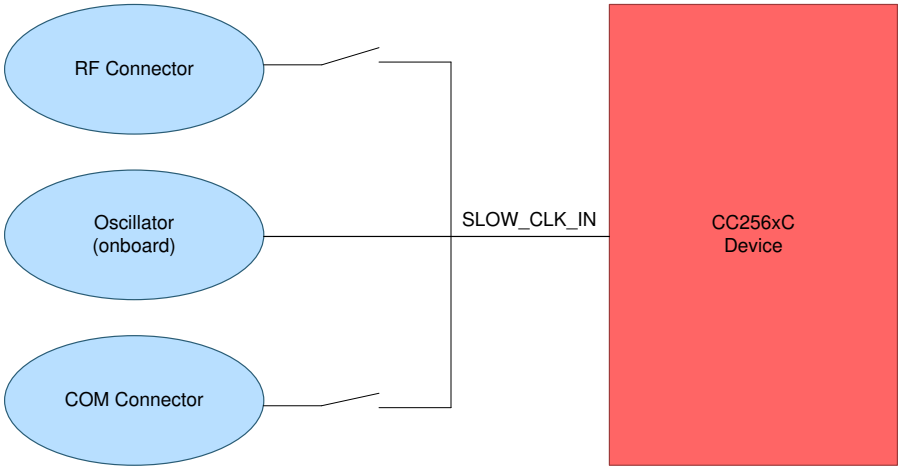

Figure 3-5. CC256xC Clocking Scheme

4 Module Dimensions

Table 4-1 lists the module dimensions.

Table 4-1. Module Dimensions

No.	Item	Dimension (in)	Tolerance	Remark
1	Width	1.550	± 0.001	Smaller at COM end
2	Length	2.125	± 0.001	—
3	Height	0.062	± 0.001	—

5 Tools and Software

5.1 TI's Bluetooth Software Solution

The Bluetooth software-based solution is based on TI's Bluetooth stack, such as the CC2564CMSP432BTBLESW. Detailed documentation is in the previous SDK.

5.2 Evaluation Platforms

TI supports the MSP432 LaunchPad (MSP-EXP432P401R).

In addition, a software development environment, for example Code Composer Studio™, is required. For a detailed description on use of these tools, see the *HCI Tester Tool*. Evaluation kits and modules are available through TI's network of authorized distributors.

Figure 5-1 shows the CC256xCQFN-EM board mounted to the MSP-EXP432P401R using the BOOST-CCEMADAPTER board, which uses the RF1 and RF2 interface board.

Figure 5-1. CC256xCQFN-EM Hardware Configuration

5.3 Bluetooth Hardware Evaluation Tool

The *HCI Tester Tool* can be downloaded as a complete package from TI. This program is an intuitive, user-friendly tool to test TI's Bluetooth chips including this CC256xCQFN-EM board. More specifically, the program is used to measure RF performance of TI's Bluetooth chips.

6 Certification

Certifications for the CC256xCQFN-EM board include the CE Mark - Conformité Européenne. The CC256xC is also in the process of being certified as a Bluetooth controller subsystem by Bluetooth SIG (Special Interest Group).

Note

This device is an engineering development board and cannot be used in an end product.

7 Life Support Policy

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8 References

- Texas Instruments: *CC2564C Dual-Mode Bluetooth® Controller Data Sheet*
- Texas Instruments: *CC256xQFN PCB Guidelines*
- Texas Instruments: *CC256XCQFN-EM Design Files*
- Texas Instruments: *HCI Tester Tool*

9 Revision History

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

Changes from Revision B (November 2016) to Revision C (January 2025)	Page
• Changed specification number for Bluetooth in Section 1.1	2

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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.

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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.

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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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https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html

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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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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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4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

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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