

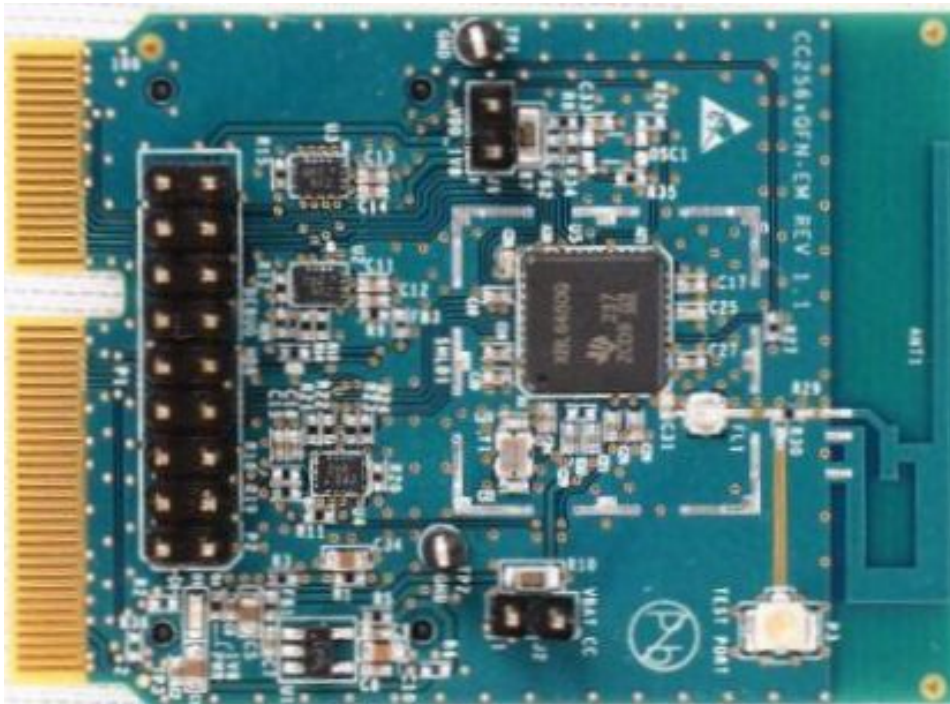
# CC256x QFN EM User Guide

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This User Guide is intended for use with TI's Bluetooth development platform, the CC256x QFN EM board. This guide will help you quickly get started with this board to integrate with TI's evaluation platforms and software SDK's. In addition, this user guide describes the components/configurations of this board to quickly get started with using this board for various Bluetooth applications.

## Introduction to CC256x QFN EM Board

This guide will provide information about the module so you can utilize the board specifics to apply it to your application. Module information and capabilities including pin descriptions and available software and tools will enhance your out of box experience.



## Key Features

- Bluetooth Specification v4.0
  - Fast Time to Market
  - Easy PCB Layout Using Cadence Tools
  - 4 Layer PCB design
  - *Bluetooth* & *Bluetooth* Low Energy or ANT
  - StoneStreet One Bluetopia Stack with many profiles
  - Other Profiles Available on Request i.e. Audio Profiles
  - FCC, IC, BT SIG Compliant
  - High sensitivity (-93 dBm typ.)
  - Shield enabled for immunity
  - H4 UART and PCM/I2S Interface
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## QFN EM Board Applications

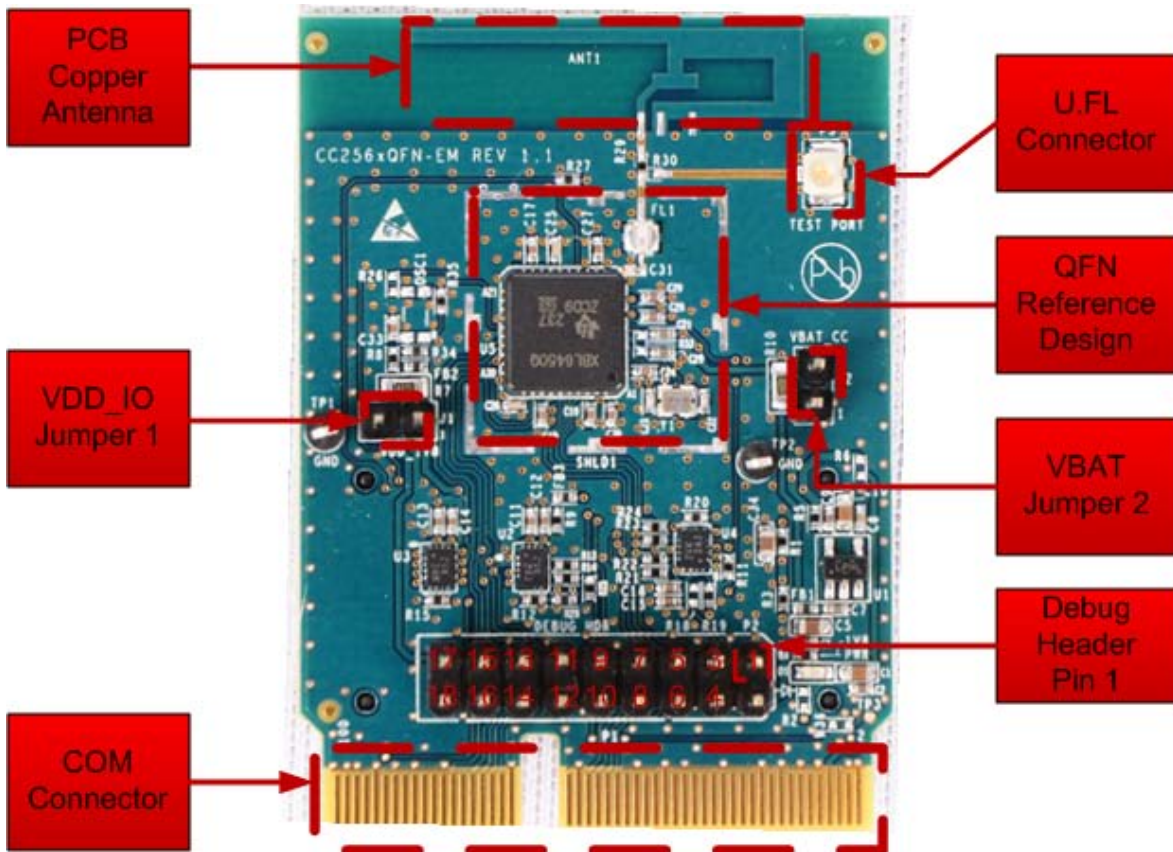
Example Embedded Wireless Applications:

- Cable Replacement
- Printer Adapters
- Personal Digital Assistants (PDAs)
- Printers/Scanners
- Computers and Peripherals
- Wireless Sensors
- Industrial Control Applications
- Low Power Medical

## Module Description

The CC256x QFN EM board is the development environment for the CC256x family and plugs directly into Texas Instruments MSP430 and Stellaris experimenter boards with the added benefit of header connectors that simplify prototype wiring and field trials.

This family is based upon Texas Instrument’s CC256x integrated circuits and uses a Host Controller Interface (HCI), a cost effective and flexible means to implement a Bluetooth network. HCI reduces BOM cost by eliminating redundant processing capacity and giving designers the flexibility to work with a controller of their choosing, as the Bluetooth stack resides and executes on the application’s host processor.



The CC256x QFN EM board is intended for evaluation purpose and works with Texas Instrument’s Hardware Development Kit. Please refer to Tools and Software Section.

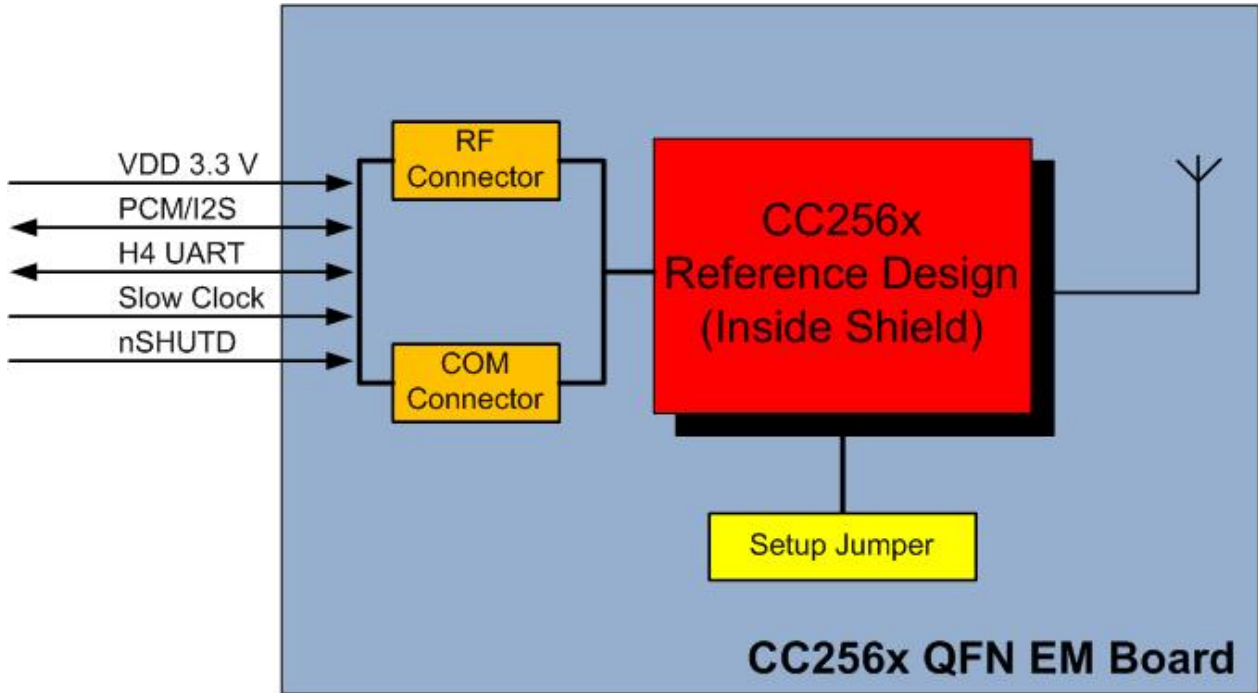
To aid in the implementation of this reference design, schematic and layout files are available on the CC256x Main Wiki page.

## Module Detailed Description

The reference files including schematic, layout, and BOM for the CC256x QFN EM board can be found at the following link:

CC256x QFN EM v1.2 Reference Design (swrr117) <sup>[1]</sup>

Below is a block diagram depicting the input/outputs of the QFN board that is required for interfacing to host controller. These I/O's can be interfaced to the host controller either through the COM connector or the RF1 & RF2 sockets.



## Pin Description

### Board Jumpers

For correct operation, please make sure both jumpers are placed for connecting power to the device:

### Jumper Configuration

Jumper	Description
VBAT_CC	Main power supply for CC256x
VDD_1V8	Supplies power to CC256x I/O's

### 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 R7 for VDD\_1V8. Both these resistors are 0.10 Ohm, 1/4 W. VBAT\_CC jumper can be used to measure the voltage/power consumed by the CC256x including RF TX/RX while VDD\_IO jumper can be used to measure voltage/power consumed by the digital I/O's.

### Antenna/U.FL Selector

The board can be configured to route the RF output from the CC256x to the on board copper antenna or the on board U.FL connector. This configuration is done by placing the resistor in either R29 or R30 position which has negligible resistance of a 0 Ohm. R30 will connect the RF to the U.FL while R29 will connect to the copper antenna. The U.FL connector is used for conducted testing of the RF. The Bluetooth Hardware Evaluation Tool (BHET) <sup>[2]</sup> can be used to test basic RF functionality on this board.

### RF Connectors

The RF1 and RF2 connectors can be used to mount on a wide variety of TI MCU platforms such as MSP430 and Stellaris. Note that the RF I/O's are all at 3.3V levels. This enables seamless integration of the host using TI's platforms that comes preinstalled with EM headers. The standard pinout is described in the following table:

#### RF1

Pin #	EM Adapter Pin Assignment	Pin #	EM Adapter Pin Assignment
1	GND	2	N/C
3	MODULE_UART_CTS	4	N/C
5	SLOW_CLK	6	N/C
7	MODULE_UART_RX	8	N/C
9	MODULE_UART_TX	10	N/C
11	N/C	12	N/C
13	N/C	14	N/C
15	N/C	16	N/C
17	N/C	18	N/C
19	GND	20	N/C

#### RF2

Pin #	EM Adapter Pin Assignment	Pin #	EM Adapter Pin Assignment
1	N/C	2	GND
3	N/C	4	N/C
5	N/C	6	N/C
7	+3.3V	8	MODULE_AUDIO_DATA_OUT
9	+3.3V	10	MODULE_AUDIO_DATA_IN
11	MODULE_AUDIO_FSYNC	12	N/C
13	N/C	14	N/C
15	N/C	16	N/C

17	MODULE_AUDIO_CLK	18	MODULE_UART_RTS
19	WCS_NSHUTD	20	N/C

## Debug Header

The debug header is provided for testing and debugging purposes. It exposes important signals used in the design such as power, ground, debug, UART, and Audio signals. Note that all I/O's are at 1.8V. Pinout is shown in the following table:

### DEBUG HDR

Pin #	EM Adapter Pin Assignment	Pin #	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

## COM Connector

The COM connector, aka Edge card, is used to interface with TI's MPUs such as OMAP and AM335x. As shown below, it provides HCI, Audio, Slow Clock, Shutdown, and Debug interfaces to the host connected through the edge card. Note that all I/O's for the COM connector are at 1.8V. Also note some components should be DNI to use the COM connector. See BOM for details.

### COM CARD

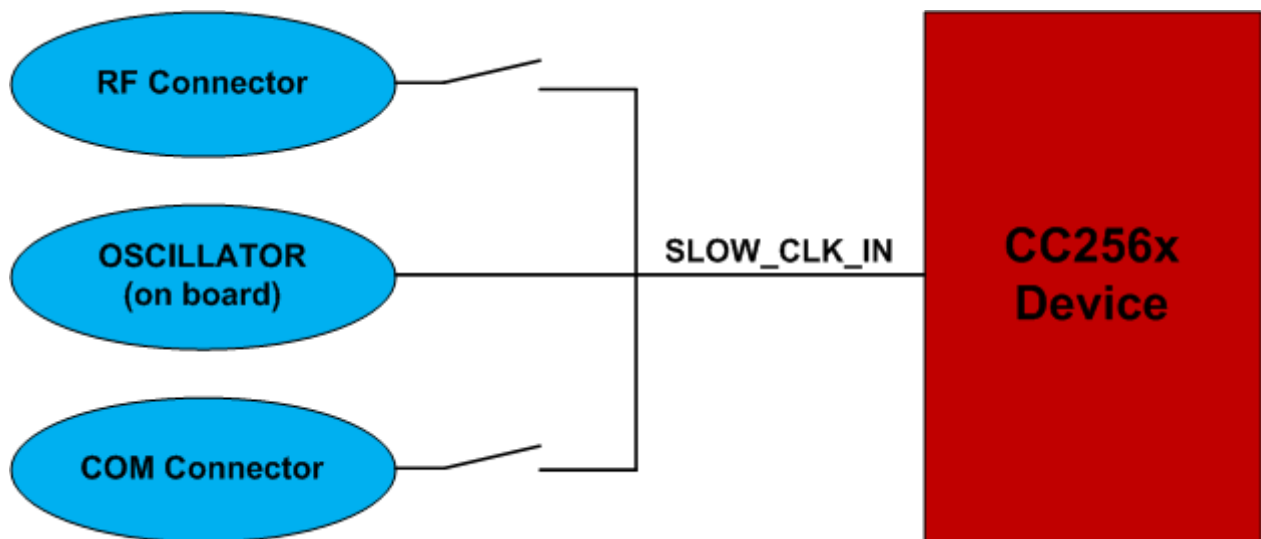
Pin #	Relevant COM Connector Pin Assignment
1	SLOW_CLK_EDGE
8	1V8_IN
52	AUD_CLK_1V8
54	AUD_FSYNC_1V8
56	AUD_IN_1V8
58	AUD_OUT_1V8
66	HCI_TX_1V8
68	HCI_RX_1V8
70	HCI_CTS_1V8
72	HCI_RTS_1V8
76	TX_DEBUG_1V8
89	nSHUTDOWN_1V8

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

All other pins are NC (Not Connected).

## Clock Inputs

- The slow clock can come from 2 sources, internal and external to the board. The CC256x QFN EM gives option to place the slow clock on the board itself or source it from an external source. It is connected to the SLOW\_CLK\_IN and can be a digital signal in the range of 0-1.8 V.
- The slow clock's frequency accuracy must be 32.768 kHz, 250 ppm for Bluetooth usage (according to the Bluetooth specification).
- When the MSP430 Experimenter board is connected, the signal is exposed from the  $\mu$ Controller. So within this application there is no additional clock needed.



## 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	

## Tools and Software

### Bluetopia Software Solution

Stone Street One has developed Bluetooth software based on their Bluetopia stack, including a few profiles, for many platforms including TI's MSP430 and Stellaris platforms. Detailed documentation is available in the Bluetooth Demo APPS page.<sup>[3]</sup>

### Evaluation Platforms

These are the evaluation platforms we support:

- MSP430F5438 Experimenter's Board<sup>[4]</sup>
- Stellaris LM3S9D96 kit
- Stellaris LM4F232 kit
- MSP430F5529 Experimenter's Board

In addition, a software development environment, e.g. Code Composer Studio, is required.

For a detailed description on usage of these tools please refer to: CC256x EVM Platform<sup>[5]</sup>

Evaluation kits and modules are available through TI's network of authorized distributors.

Below is a picture of the CC256x QFN EM board mounted to one of the platforms, the MSP430F5438 Experimenter's Board, using RF1 and RF2 interface:

### Bluetooth Hardware Evaluation Tool

The CC256x Bluetooth Hardware Evaluation Tool<sup>[2]</sup> is a program which can be downloaded as a complete package from Texas Instruments. It is a very intuitive, user-friendly tool to test TI's Bluetooth chips including this CC256x QFN EM board. More specifically, it is used to measure RF performance of our BT chips.

### Certification

The CC256x QFN EM board is currently undergoing FCC, CI, and ETSI certification. It is also in process of being certified as a Bluetooth controller subsystem by the Bluetooth SIG(Special Interest Group).

### Life Support Policy

This TI product is not designed for use in life support appliances, devices, or systems where malfunction can reasonably be expected to result in a significant personal injury to the user, or as a critical component in any life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness. TI customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify TI for any damages resulting.

## Related Documents

- CC256x QFN Data Manual (swrs121a) <sup>[6]</sup>
- CC256x System Design Guide <sup>[7]</sup>
- [Coming Soon: CC256x PCB design checklist]

## References

- [1] <http://www.ti.com/litv/zip/swrr117>
  - [2] [http://processors.wiki.ti.com/index.php/CC256x\\_Bluetooth\\_Hardware\\_Evaluation\\_Tool](http://processors.wiki.ti.com/index.php/CC256x_Bluetooth_Hardware_Evaluation_Tool)
  - [3] [http://processors.wiki.ti.com/index.php/CC256x\\_MSP430\\_Bluetopia\\_Basic\\_Demo\\_APPS](http://processors.wiki.ti.com/index.php/CC256x_MSP430_Bluetopia_Basic_Demo_APPS)
  - [4] [http://processors.wiki.ti.com/index.php/CC256X\\_MSP:EXP430F5438](http://processors.wiki.ti.com/index.php/CC256X_MSP:EXP430F5438)
  - [5] [http://processors.wiki.ti.com/index.php/CC256x\\_EVM\\_Platform](http://processors.wiki.ti.com/index.php/CC256x_EVM_Platform)
  - [6] <http://www.ti.com/litv/pdf/swrs121a>
  - [7] [http://processors.wiki.ti.com/index.php/CC256x\\_System\\_Design\\_Guide](http://processors.wiki.ti.com/index.php/CC256x_System_Design_Guide)
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Texas Instruments (TI) provides the enclosed Evaluation Board/Kit/Module (EVM) under the following conditions:

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/ kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please visit [www.ti.com/esh](http://www.ti.com/esh) or contact TI.

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### REGULATORY COMPLIANCE INFORMATION

As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

#### General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this is strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

**This development kit is subject to the export / import control regulations of the United States per the harmonization code: ECCN 5A002A1A TSPA. Please note that it may also be subject to export control policies of local authorities.**

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#### 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

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

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.
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## For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

### Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-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.

### 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.

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Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

### 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.

### 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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## 【Important Notice for Users of this Product in Japan】

### This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan!

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

(1) Use this product 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 this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or

(3) Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product.

Also, please do not transfer this product, unless you give the same notice above to the transferee.

Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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## 【ご使用にあたっての注意】

### 本開発キットは技術基準適合証明を受けておりません。

本製品のご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

(1) 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。

(2) 実験局の免許を取得後ご使用いただく。

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なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとしします。

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**EVALUATION BOARD/KIT/MODULE (EVM)  
WARNINGS, RESTRICTIONS AND DISCLAIMERS**

**For Feasibility Evaluation Only, in Laboratory/Development Environments.** Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

**Your Sole Responsibility and Risk.** You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure 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.
3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials

**Certain Instructions.** It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please 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 result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's 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, some circuit components may have case temperatures greater than 60 C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs

**Agreement to Defend, Indemnify and Hold Harmless.** You agree to defend, indemnify and hold TI, its licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, "Claims") arising out of or in connection with any use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

**Safety-Critical or Life-Critical Applications.** If you intend to evaluate the components for possible use in safety critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.