This user's guide describes the characteristics, operation, and use of the TMP112EVM evaluation board. This guide discusses how to set up and configure the software and hardware and reviews various aspects of the program operation. Throughout this document, the terms evaluation board, evaluation module, and EVM are synonymous with the TMP112EVM. This user's guide also includes information regarding operating procedures and input/output connections, an electrical schematic, printed circuit board (PCB) layout drawings, and a parts list for the EVM.

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1 Overview

The TMP112 is a digital output temperature sensor capable of reading temperatures to 12 bits of resolution. The TMP112 uses a two-wire, I²C™ and SMBus™ interface that allows up to four devices on one bus. The TMP112 is ideal for extended temperature measurement, and is also specified to operate between –40°C and 125°C. The TMP112EVM is a platform for evaluating the performance of the TMP112 under various signal, reference, and supply conditions.

This document gives a general overview of the TMP112EVM and provides a general description of the features and functions to be considered while using this evaluation module.

1.1 TMP112EVM Kit Contents

Table 1 summarizes the contents of the TMP112EVM kit. Figure 1 illustrates all of the included hardware. Contact the Texas Instruments Product Information Center nearest you if any component is missing. TI highly recommends that you also check the TMP112 product folder on the TI web site at www.ti.com to verify that you have the latest versions of the related software.

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMP112EVM PCB test board</td>
<td>1</td>
</tr>
<tr>
<td>SM-USB-DIG platform PCB</td>
<td>1</td>
</tr>
<tr>
<td>USB extender cable</td>
<td>1</td>
</tr>
<tr>
<td>10-pin connector ribbon cable</td>
<td>1</td>
</tr>
</tbody>
</table>
Figure 1. Hardware Included with TMP112EVM Kit
1.2 Related Documentation from Texas Instruments

The following documents provide information regarding Texas Instruments’ integrated circuits used in the assembly of the TMP112EVM. This user’s guide is available from the TI web site under literature number SBOU114. Any letter appended to the literature number corresponds to the document revision that is current at the time of the writing of this document. Newer revisions may be available from www.ti.com, or call the Texas Instruments’ Literature Response Center at (800) 477-8924 or the Product Information Center at (972) 644-5580. When ordering, identify the document by both title and literature number.

<table>
<thead>
<tr>
<th>Document</th>
<th>Literature Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMP112 product data sheet</td>
<td>SBOS397</td>
</tr>
<tr>
<td>SM-USB-DIG platform user guide</td>
<td>SBOU098</td>
</tr>
</tbody>
</table>

2 TMP112EVM Hardware Setup

Figure 2 shows the overall system setup for the TMP112EVM. The computer runs software that communicates with the SM-USB-DIG platform. The SM-USB-DIG platform generates the digital signals used to communicate with the TMP112 test board. The SM-USB-DIG and TMP112EVM are easily connectable through a 10-pin, board-to-board connector attached to the SM-USB-DIG platform and the TMP112EVM PCBs. When these two boards are connected, simply plug the USB device from the SM-USB-DIG into the computer, as shown in Figure 2.
2.1 Theory of Operation for TMP112 Hardware

The TMP112EVM only requires the two-wire I^2C lines (SDA and SCLK) and V\textsubscript{DUT}/GND to supply a constant 3.3 V and power return, as shown in Figure 3. The TMP112EVM also has test points to monitor these signal lines and ground, in case users may want to use their own signals or verify successful I^2C communications.

![Figure 3. TMP112EVM Board Block Diagram](image)

2.2 Signal Definitions of H1 (10-Pin Male Connector Socket)

Table 3 shows the pin out for the 10-pin connector socket used to communicate between the TMP112EVM and the SM-USB-DIG. Note that the TMP112EVM uses only the necessary I^2C communication lines (pins 1 and 3) and the V\textsubscript{DUT} and GND (pins 6 and 8, respectively) to issue commands to the TMP112 sensors.

<table>
<thead>
<tr>
<th>Pin on U1</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I2C_SCL</td>
<td>I^2C clock signal (SCL)</td>
</tr>
<tr>
<td>2</td>
<td>CTRL/MEAS4</td>
<td>GPIO: control output or measure input</td>
</tr>
<tr>
<td>3</td>
<td>I2C_SDA1</td>
<td>I^2C data signal (SDA)</td>
</tr>
<tr>
<td>4</td>
<td>CTRL/MEAS5</td>
<td>GPIO: control output or measure input</td>
</tr>
<tr>
<td>5</td>
<td>SPI_DOUT1</td>
<td>SPI data output (MOSI)</td>
</tr>
<tr>
<td>6</td>
<td>V\textsubscript{DUT}</td>
<td>Switchable DUT power supply: 3.3 V, 5 V, Hi-Z (disconnected)(^{(1)})</td>
</tr>
<tr>
<td>7</td>
<td>SPI_CLK</td>
<td>SPI clock signal (SCLK)</td>
</tr>
<tr>
<td>8</td>
<td>GND</td>
<td>Power Return (GND)</td>
</tr>
<tr>
<td>9</td>
<td>SPI_CS1</td>
<td>SPI chip-select signal (CS)</td>
</tr>
<tr>
<td>10</td>
<td>SPI_DIN1</td>
<td>SPI data input (MISO)</td>
</tr>
</tbody>
</table>

\(^{(1)}\) When V\textsubscript{DUT} is Hi-Z, all digital I/O are Hi-Z as well.
2.2.1 Theory of Operation for SM-USB-DIG Platform

Figure 4 shows the block diagram for the SM-USB-DIG platform. This platform is a general-purpose data acquisition system that is used on several different Texas Instruments evaluation modules. The details of its operation are included in a separate document, SBOU098 (available for download at www.ti.com). The block diagram shown in Figure 4 gives a brief overview of the platform. The primary control device on the SM-USB-DIG platform is the TUSB3210.

![Block Diagram of SM-USB-DIG Platform](image)

3 TMP112EVM Hardware

The TMP112EVM hardware overview involves connecting the two PCBs of the EVM together, connecting the USB cable, applying power, and setting the jumpers. This section presents the details of this procedure.

3.1 Electrostatic Discharge Warning

**CAUTION**

Many of the components on the TMP112EVM are susceptible to damage by electrostatic discharge (ESD). Customers are advised to observe proper ESD handling precautions when unpacking and handling the EVM, including the use of a grounded wrist strap at an approved ESD workstation.
3.2 Typical Hardware Connections

To connect the TMP112 test board and the SM-USB-DIG platform together, gently slide the male and female ends of the 10-pin connectors together. Make sure that the two connectors are completely pushed together; loose connections may cause intermittent operation.

3.3 Connecting the USB Cable to the DIG

Figure 5 shows the typical response to connecting the SM-USB-DIG platform board to a computer USB port for the first time. Typically, the computer responds with a *Found New Hardware, USB Device* pop-up dialog. The pop-up window then changes to *Found New Hardware, USB Human Interface Device*. This pop-up indicates that the device is ready to be used. The SM-USB-DIG platform uses the human interface device drivers that are part of the Microsoft® Windows® operating system.

In some cases, the Windows *Add Hardware Wizard* appears. If this prompt pops up, allow the system device manager to install the human interface drivers by clicking *Yes* when requested to install drivers. Windows confirms installation of the drivers with the message shown in Figure 6.
3.4 **TMP112EVM Features**

This section describes some of the hardware features present on the TMP112EVM test board.

3.4.1 **I²C Test Points**

I²C test points are included on the TMP112 test board for user convenience. These test points can be used to monitor the two-wire lines of the I²C interface or to run the TMP112 test board externally without the use of the SM-USB-DIG.

3.4.2 **10-Pin Connector Ribbon Extender (Optional)**

The TMP112EVM kit ships with an optional ribbon cable for extending the connection between the SM-USB-DIG and the PCB. This extension cable can be useful if high temperature tests must be run on the test board because the SM-USB-DIG is not rated for high temperatures. To connect the ribbon cable, attach the cable to the EVM and SM-USB-DIG as shown in Figure 7.

![Image of 10-Pin Ribbon Cable Extender](image-url)

*Figure 7. 10-Pin Ribbon Cable Extender*
4 TMP112EVM Software

This section discusses how to install the TMP112EVM software.

4.1 Hardware Requirements

The TMP112EVM software is tested on Microsoft Windows XP and 7 operating systems (OS) with United States and European regional settings. The software also functions on other Windows OS platforms.

4.2 Software Installation

The TMP112EVM software is available through the TMP112EVM product folder on the TI web site. To install the software to a computer, locate the compressed file (TMP112EVM.zip) and open it using WinZIP® or a similar file compression program; extract the TMP112EVM files into a specific TMP112EVM folder (for example, C:\TMP112EVM) on your hard drive.

When the files are extracted, navigate to the TMP112EVM folder you created on the hard drive. Locate the setup.exe file and execute it to start the installation. The TMP112 software installer file then begins the installation process, as shown in Figure 8.

![Figure 8. TMP112EVM Software Installation](image)
After the installation process initializes, the user is given the choice of selecting the directory in which to install the program; the default location is `C:\Program Files\TMP112\` and `C:\Program Files\National Instruments\`. Following this option, two license agreements are presented that must be accepted, as shown in Figure 9. After accepting the Texas Instruments and National Instruments license agreements, the progress bar opens and shows the installation of the software. When the installation process is completed, click **Finish**.

![License Agreement](image)

**Figure 9. TMP112EVM License Agreements**
5 TMP112EVM Software Overview

This section discusses how to use the TMP112EVM software.

5.1 Starting the TMP112EVM Software

The TMP112 software can be operated through the Windows Start menu. From Start, select All Programs; then select the TMP112EVM program.

Figure 10 shows how the software appears if the TMP112EVM is functioning properly.

![Figure 10. TMP112EVM Software Interface](image)

Figure 11 shows an error message that is displayed if the computer cannot communicate with the SM-USB-DIG platform. If you receive this error message, first check that the USB extension cable is properly connected to both the computer USB port and to the SM-USB-DIG platform. Another possible source for this error is a problem with the computer USB human interface device driver. Make sure that the device is recognized when the USB cable is plugged in; recognition is indicated by a Windows-generated confirmation sound.

![Figure 11. TMP112EVM Software: Communication Error with the SM-USB-DIG Platform](image)
5.2 Using the TMP112Software

5.2.1 Reading from Registers

When first starting the TMP112EVM software, the user must confirm stable connections to the test board by toggling the Read All Reg button (shown in Figure 12). If all devices are communicating correctly, the user then sees the temperature change over time in the TMP112 Temperature box. By toggling the Auto-Read button, the temperature is automatically refreshed at the rate specified in the Conversion Rate pull-down menu. The conversion rate can only be changed when Auto-Read is turned off.

Figure 12. TMP112 Reading from Registers
5.2.2 Writing to Registers

The TMP112EVM software contains two different methods for writing data: Write All Reg and Auto-Write Reg. Writing the registers individually without auto-write can be useful when adjusting large numbers of the configuration registers on the left side of the panel. The auto-write feature automatically makes changes to the configuration register whenever one of the configuration settings on the left changes, as shown in Figure 13.

![Figure 13. TMP112 Writing to Registers](image-url)
5.2.3 Reading the Temperature Gauge

The *Temperature* box on the TMP112EVM software window displays the measured values of the TMP112 registers in a graphical format, as Figure 14 shows. This value can be toggled to either (degrees) Fahrenheit or Celsius by toggling the checkbox at the bottom of the window. Note that changing to extended mode on the TMP112EVM software also changes the full-scale value of the TMP112 thermometer.

![Temperature Gauge](image)

**Figure 14. Reading the Temperature Gauge**

5.2.4 Polarity (Alert Pin)

The polarity drop-down selection box in the *Configuration* section allows the user to toggle how the Alert pin behaves when triggered. When the polarity box is set to active low, as shown in Figure 15, the LED on the TMP112EVM board lights up when triggered and functions as a ground source. When the polarity box is set to active high, the LED on the TMP112EVM board does not function, and the Alert pin on the TMP112 is set to DVDD when triggered.

![Configuration](image)

**Figure 15. Configuring the Polarity**
5.2.5 Shutdown Mode

The TMP112 has a built-in shutdown mode that allows the device to stop consuming power. The shutdown mode selection box (shown in Figure 16) can also be used to clear the Alert pin when the interrupt mode (refer to Section 5.2.7) is selected. Note that the TMP112EVM cannot perform temperature conversions while in shutdown mode.

![Figure 16. Active and Shutdown Mode](image)

5.2.6 Extended Mode

The TMP112EVM has two modes for storing converted temperature data (extended mode and normal mode), as shown in Figure 17. Normal mode provides the temperature, \( T_{\text{LOW}} \) and \( T_{\text{HIGH}} \) registers 12 bits of accuracy. By changing to extended mode, the user increases to 13 bits of accuracy and adjusts the full-scale value of the three registers from 120°C to 150°C. Note that adding an additional bit of accuracy also changes the current \( T_{\text{HIGH}} \) and \( T_{\text{LOW}} \) values; these values must then be reset to the user's original, intended values after adjusting the extended mode drop-down box.

![Figure 17. Extended and Normal Mode](image)

5.2.7 Thermostat Mode

Thermostat mode, in the Configuration box, allows the user to designate how the TMP112 Alert pin behaves when the temperature register exceeds the \( T_{\text{HIGH}} \) register. When the TMP112EVM software is in comparator mode, the Alert pin triggers if the temperature measured by the TMP112 exceeds the \( T_{\text{HIGH}} \) register for the set amount of faults, as described in the Fault Queue (see Section 5.2.9). When the Alert pin is triggered, it remains triggered until the temperature measured by the TMP112 falls below the \( T_{\text{LOW}} \) register value for the set amount of faults.

When the TMP112EVM software is in interrupt mode, the Alert pin does not automatically clear after falling below the \( T_{\text{LOW}} \) register limit. Instead, the user must either select the Read All Reg button or put the device into shutdown mode, as described in Section 5.2.5. After the Read All Reg button is selected, or after the device is put into shutdown mode, the Alert pin clears when the measured temperature drops down below the \( T_{\text{LOW}} \) register. Figure 18 shows the thermostat mode dialog.

![Figure 18. Comparator and Interrupt Mode](image)
5.2.8 Conversion Rate

The Conversion Rate selection box (shown in Figure 19) allows the user to change how long each temperature conversion takes the TMP112 to perform. The user may want to select a slower conversion time, as shown in Figure 19, to make the TMP112 consume less power.

![Figure 19. Conversion Rate](image)

5.2.9 Fault Queue

The fault queue drop-down box allows the user to configure how many faults must be triggered before the Alert pin is activated, as shown in Figure 20. A fault is generated whenever the TMP112 $T_{HIGH}$ register is exceeded by the temperature register. This feature can be useful to prevent the TMP112 from triggering on temperature spikes that the user may not want to trigger with the Alert pin.

![Figure 20. Setting the Fault Queue](image)

5.2.10 Logging

Specify the path and filename for logging data, as shown in Figure 21. The standard file format is .csv. Data are saved in four columns: Time, Temp, Tlow and Thigh. Time is in the format of hh:mm:ss.ms; the remaining columns are readouts from the TMP112 in Celsius.

![Figure 21. Setting the Path for the Log File](image)
5.2.11 Alert Configuration (T<sub>LOW</sub> and T<sub>HIGH</sub>)

The Alert Config box has three objects that make up the main functionality of the TMP112 Alert pin (the Alert bit, T<sub>LOW</sub> register, and T<sub>HIGH</sub> register), as Figure 22 shows. The green LED within the Alert Config box lights up when the T<sub>HIGH</sub> register is exceeded and the Alert pin is activated. This LED is denoted as an Alert because of the default configuration. The Alert pin can also be switched to an active high, as shown in Section 5.2.4, if so desired by the user.

![Figure 22. Alert Config Box](image)

The T<sub>LOW</sub> input box allows the user to set when the alert pin is cleared. When the measured value in the temperature register falls below the T<sub>LOW</sub> threshold, the Alert pin clears, depending on which thermostat mode is selected. For more information on the behavior of the thermostat mode, see Section 5.2.7.

The T<sub>HIGH</sub> input box allows the user to set when the Alert pin is triggered. When the measured value in the temperature register exceeds the T<sub>HIGH</sub> threshold, the Alert pin triggers until the temperature returns to a value below the T<sub>LOW</sub> threshold, depending on the thermostat mode selected.

5.2.12 Registers Tab

The registers tab displays the individual register setting for the TMP112 sensors. For more information on the individual registers and the bit meanings, simply highlight the desired register and hit the Help with Reg button shown in Figure 23.

![Figure 23. Register Tab](image)

The Registers tab also includes the Dig_Bits table. The Dig_Bits table allows the user to monitor and change individual bits by highlighting the desired register and toggling the bit controls beneath it.

**NOTE:** Only the bits that can be written within a given register can be toggled.
6 TMP112 Documentation

This section contains the complete bill of materials and PCB layout for the TMP112EVM.

**NOTE:** These board layouts are not to scale. These images are intended to show how the board is laid out and are not intended to be used for manufacturing TMP112EVM PCBs.

6.1 TMP112EVM Board Schematic

Figure 24 shows the schematic for the TMP112EVM board.

![TMP112EVM Board Schematic](image)

**Figure 24. TMP112EVM Board Schematic**
6.2 PCB Layout

Figure 25 and Figure 26 show the PCB layout of the TMP112EVM.

Figure 25. TMP112EVM PCB Top Layer (Component Side)

Figure 26. TMP112EVM PCB Bottom Layer
### 6.3 Bill of Materials

Table 4 lists the bill of materials for the TMP112EVM.

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Qty</th>
<th>Value</th>
<th>Ref Des</th>
<th>Description</th>
<th>Vendor/Mfr</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>10 kΩ</td>
<td>R1, R2</td>
<td>Resistor, 10 kΩ 1/10W 5% 0603 SMD</td>
<td>Stackpole Electronics</td>
<td>RMCF0603JT10K0</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>300 Ω</td>
<td>R4, R5</td>
<td>Resistor, 300 Ω 1/10W 5% 0603 SMD</td>
<td>Panasonic</td>
<td>ERJ-3GEYJ301V</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0 Ω</td>
<td>R3</td>
<td>Resistor, 0.0 Ω 1/10W 0603 SMD</td>
<td>Stackpole Electronics</td>
<td>RMCF0603ZT0R00</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>0.1 μF</td>
<td>C1</td>
<td>Capacitor, Ceramic, 0.10-μF 25-V Y5V 0603</td>
<td>TDK Corporation</td>
<td>C1608Y5V1E104Z</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>2 V, 5 mA</td>
<td>D1, D2</td>
<td>LED Green Wide Angle 0603 SMD</td>
<td>Lite-On Inc</td>
<td>LTST-C193KGKT-5A</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>—</td>
<td>U1</td>
<td>TMP112</td>
<td>Texas Instruments</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>—</td>
<td>Jumpers, All</td>
<td>Connector, Header 50-Pos .100-in. SGL Gold</td>
<td>Samtec</td>
<td>TSW-150-07-G-S</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>—</td>
<td>J1</td>
<td>Connector, Socket 50-Pin .050 R/A Sngl</td>
<td>Mill-Max Manufacturing</td>
<td>851-43-050-20- 001000</td>
</tr>
</tbody>
</table>

Table 4. Bill of Materials
Texas Instruments Incorporated (TI) markets, sells, and loans all evaluation boards, kits, and/or modules (EVMs) pursuant to, and user expressly acknowledges, represents, and agrees, and takes sole responsibility and risk with respect to, the following:

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10. User has sole responsibility to ensure the safety of any activities to be conducted by it and its employees, affiliates, contractors or designees, with respect to handling and using EVMs. Further, user is responsible to ensure that any interfaces (electronic and/or mechanical) between EVMs 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.

11. User shall employ reasonable safeguards to ensure that user’s use of EVMs will not result in any property damage, injury or death, even if EVMs should fail to perform as described or expected.

12. User shall be solely responsible for proper disposal and recycling of EVMs consistent with all applicable federal, state, and local requirements.

Certain Instructions. User shall operate EVMs within TI’s recommended specifications and environmental considerations per the user’s guide, accompanying documentation, and any other applicable requirements. Exceeding the specified ratings (including but not limited to input and output voltage, current, power, and environmental ranges) for EVMs may cause property damage, personal injury or death. If there are questions concerning these ratings, 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 result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the applicable 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 EVM's schematics located in the applicable EVM user's guide. When placing measurement probes near EVMs during normal operation, please be aware that EVMs may become very warm. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use EVMs.

Agreement to Defend, Indemnify and Hold Harmless. User agrees to defend, indemnify, and hold TI, its directors, officers, employees, agents, representatives, affiliates, 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 handling and/or use of EVMs. User's indemnity shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if EVMs fail to perform as described or expected.

Safety-Critical or Life-Critical Applications. If user intends to use EVMs in evaluations of safety critical applications (such as life support), and a failure of a TI product considered for purchase by user for use in user’s 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 user must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.
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General Statement for EVMs Not Including a Radio

For EVMs not including a radio and not subject to the U.S. Federal Communications Commission (FCC) or Industry Canada (IC) regulations, TI intends EVMs to be used only for engineering development, demonstration, or evaluation purposes. EVMs are not finished products typically fit for general consumer use. EVMs may nonetheless generate, use, or radiate radio frequency energy, but have not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or the ICES-003 rules. Operation of such EVMs 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: For EVMs including a radio, the radio included in such EVMs is intended for development and/or professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability in such EVMs and their development application(s) must comply with local laws governing radio spectrum allocation and power limits for such EVMs. 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 are strictly prohibited and unauthorized by TI unless user has obtained appropriate experimental and/or development licenses from local regulatory authorities, which is the sole responsibility of the user, including its acceptable authorization.

U.S. Federal Communications Commission Compliance

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 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 its 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. 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.

Industry Canada Compliance (English)

For EVMs Annotated as IC – INDUSTRY CANADA Compliant:

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.

Canada Industry Canada Compliance (French)

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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