AM437x StarterKit EVM Hardware User's Guide

Verified Design

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1 Introduction

This document describes the hardware architecture of the AM437x StarterKit (part number TMDXSK437X), which is based on the Texas Instruments (TI) AM437x processor. This EVM is also commonly known as the AM437x StarterKit EVM.

1.1 Description

The AM437x StarterKit can be used as an evaluation and development platform for AM437x-based solutions and networking platforms. The embedded emulation logic allows emulation and debug-using standard development tools such as TI's Code Composer Studio by using the supplied USB cable. The embedded emulation logic is not intended for use in end products. All of the design information is freely available and can be used as the basis for the development of an AM437x-based product.

The following sections give more details regarding the StarterKit EVM.

1.2 System View

The top and bottom views of the system are provided in Figure 1 and Figure 2.

Figure 1. AM437x StarterKit EVM Top View

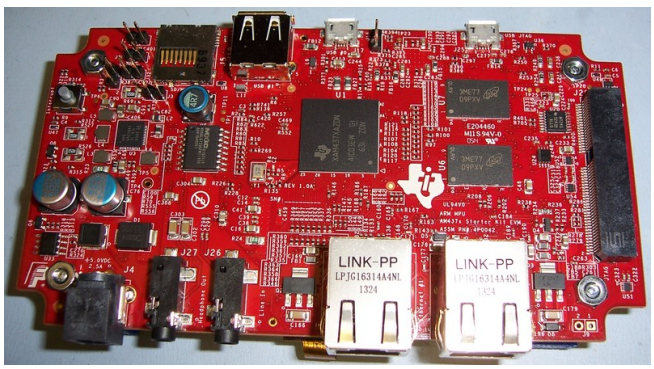

Figure 2. AM437x StarterKit EVM Bottom View

2 Functional Blocks Description

The complete AM437x StarterKit EVM is contained mostly within a single board.

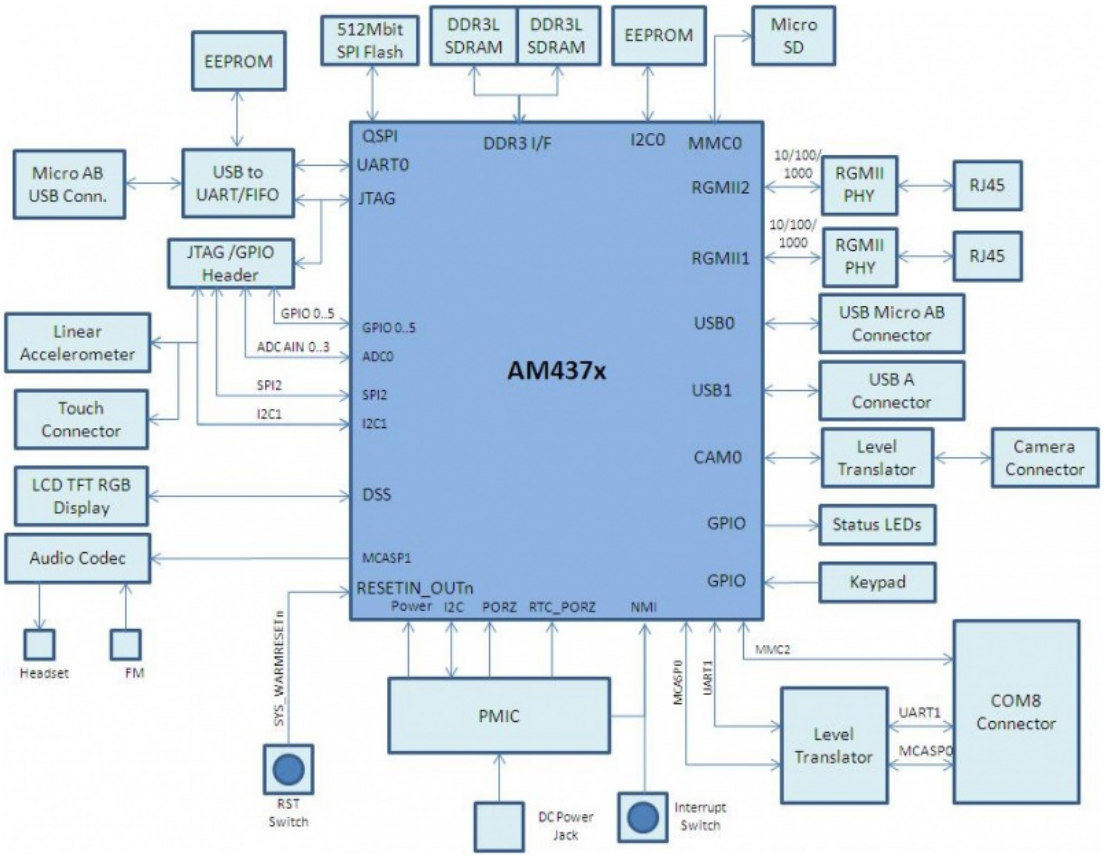

Figure 3. AM437x StarterKit EVM Block Diagram

2.1 Processor

The AM437x is the central processor for this EVM. All the resources on the board surround the AM437x processor to provide development capabilities for hardware and software. See the AM437x data sheet and TRM for the details about the processor.

System configuration signals (sysboot0 to 18) can be set on the EVM, using resistors to define some startup parameters on the AM437x processor. See Section 4 for more details.

2.2 Clocks

The StarterKit EVM has several clocks to support the AM437x processor. The main clock for the processor is derived from a 24-MHz crystal. The AM437x generates the base clock and subsequent module clocks. A 32-kHz clock for the RTC is derived from a 32.768-kHz crystal on the board.

2.3 Reset Signals

SYS_RESETn is a reset signal running to several peripherals and AM437x, which performs a reset. SYS_RESETn signal is asserted by the push-button and is used to force a reset of the AM437x and the other peripherals. AM437x can also pull down on the RESET_INOUTn signal to cause the SYS_RESETn line to go active. The power-on reset to the processor is driven from the power good signal of the power manager.

2.4 DDR3 SDRAM

The AM437x StarterKit EVM contains two 4-Gb (256 Mb × 16) of DDR3L SDRAM memory from Micron. The part number for the DDR3L SDRAM memory used is MT41K256M16HA. The package used is an 96-ball FBGA. See the AM437x TRM for memory locations for this memory.

2.5 NOR Flash

The StarterKit EVM has a NOR type of flash. The part number of the memory used is MX66L51235FMI, which is a 512-Mb serial flash memory. The QSPI interface of AM437x is used to communicate with this memory.

2.6 Board Identity Memory

Each board contains a serial EEPROM that contains board-specific data that allows the processor to automatically detect which version of the board is connected. Other hardware-specific data can be stored on this memory device as well. The part number of the memory device is CAT24C256WI-G. See Section 4 for details on the data in this memory.

2.7 SDMMC0

The SDMMC0 connector on the StarterKit EVM is a microSD socket with part number SCHA5B0200. This connector is a standard SD/MMC card type. The connector links to the MMC0 port of the AM437x processor. Check the AM437x data sheet and TRM for supported card types and densities.

2.8 10/100/1000 Ethernet

The AM437x StarterKit EVM has two 10/100/1000 Ethernet transceivers from Micrel (KSZ9031RN) that are connected to RJ45 (J6 and J8) connectors.

The reset on the transceiver is driven by the warm reset signal SYS_RESETn. A 25-MHz crystal drives the clock input of the KSZ9031RN Ethernet physical layer (PHY).

The PHY address is set to 0x00h.

2.9 USB

The AM437x StarterKit EVM supports two USB ports. The USB ports are connected to a micro-USB AB connector and a standard A-type connector. The ESD device TPD4S012 and common choke filter ACM2012 (TDK) are used on the USB signals before they are connected to the AM437x pins.

2.10 Connectivity

The AM437x StarterKit EVM supports MCS COM8 form-factor wireless boards from TI through the J20 COM connector, which is a Samtec card edge type connector MEC6-150-02-S-D-RA1. This connector supports COM8-type of boards. More details about this connector can be found in the MCS COM8 board documents. The COM connector requires 3.6 V, 442 mA on the power supply. Thus, a TPS79501 LDO regulator is used to provide this voltage supply from the base 5.0-V supply. The signals on the COM board are all 1.8-V voltage level. Thus, voltage translators are placed to convert to and from 3.3 V of the AM437x rail for a particular signal, which is running at 3.3 V.

2.11 Camera

Camera interface from the AM437x processor is terminated on the 12×2 header J15. The custom-made camera module from TI must interface with this header. This camera module is on a separate camera board that attaches at a right angle so the camera can face horizontally when the StarterKit EVM is lying on a test bench.

2.12 Audio

The headphone output and line input signals from the two 3.5-mm SJ3524 jacks are connected to the audio codec with part number TLV320AIC3106. This audio codec is connected through the McASP1 and I2C interfaces to the AM437x.

2.13 Accelerometer

The AM437x StarterKit EVM has an accelerometer sensor from ST Microelectronics (LIS331DLH). This accelerometer is interfaced with the processor using I2C bus1.

3 Power Supplies

This section describes how the required power supplies for the design are generated.

3.1 Power Source

An external AC to 5-V-DC (rated 2.5 A minimum) power adapter is connected to the AM437x Starter Kit EVM through the DC Jack, J4.

3.2 Power Sequencing

The power sequencing requirements of the AM437X processor (see the AM437x data sheet) are handled automatically by the TPS65218 PMIC.

3.3 Power Management IC Power Supplies

The AM437x StarterKit EVM uses the TPS65218 power management IC.

The I2C0 on AM437x is used to control the smart reflex port and control port on the TPS65218.

Table 1 and Table 2 provide the following power supplies used for AM437x.

Table 1. AM437x Power Supplies from TPS65218

TPS65218 POWER SUPPLY	AM437X POWER RAIL	VOLTAGE
VDCDC1	VDD_CORE, VDD_TPM	1.1 V
VDCDC2	VDD_MPU	1.1 V
VDCDC3	VDDS_DDR	1.35 V
VLS1	VDD_DDR	1.35 V
V1_8D_AM437X	VDDS_CLKOUT, VDDS_OSC , VDDS_SRAM_CORE_BG , VDDS_SRAM_MPU_BB, VDDS_PLL_CORE_LCD, VDDS_PLL_DDR , VDDS_PLL_MPU , VDDA1P8V_USB0 , VDDA1P8V_USB1 , VDDS_CTM, VDDS_TPM, VDDA_MC_ADC, VDDA_TS_ADC, VDDS, COM8, VDDSHV2, tamper , ADC input sections	1.8 V
V1_0BAT	CAP_VDD_RTC	1.0 V
V1_8BAT	VDDS_RTC	1.8 V
V3_3D_AM438X	VDDA_3P3V_USB0, VDDA_3P3V_USB1, VDDSHV1, 3, 5, 6, 7, 8, 9, 10, and 11	3.3 V
V5_0D	HDMI circuitry, USB0 power	5.0 V

NOTE: The TPS65218 power management IC that is used on the earlier revisions had several issues that can affect operation. See the errata for the TPS65218 for more details.

3.3.1 Other Power Supplies Used

Table 2. Other Power Supplies

POWER SUPPLY	POWER RAIL	VOLTAGE
V1_8LPDDR2 from TPS78101	VDD1 of LPDDR2	1.8 V
V3_3D	NAND memory, QPSI flash, Ethernet PHY, SDMMC0, board ID memory, ARM JTAG, buffers of FTDI section, LCD buffer, touch screen, camera module, HDMI buffer, audio codec, RS-232 sections, COM8 sections, smart card sections, tamper header, platform test section, GPIO header, printer	3.3 V
V3_3FTDI	FT2232 Section from TPS79333	3.3 V
VBAT	LCD power generation, camera module, VCOM_BAT generation for COM8 module, USB1 power generation, platform test section, LEDs, GPIO header, buzzer, printer	5.0 V
V1_2D	HDMI section power	1.2 V

3.4 APM Sense Resistors

The AM437x StarterKit EVM has the following subsystems with current sense resistors. These resistors allow the power to be measured on each power rail to check AM437x power requirements during real time software execution. The value of the resistors is selected to provide the best dynamic range when using a TI INA226 converter. An INA226 converter is installed on the EVM for both the VDD_CORE and VDD_MPU power supply rails of the AM437x. The other power rails have sense resistors, but have their measurement connections attached to 2pin standard headers so they can be read easily by a multimeter or connected to an INA226 converter EVM.

The value of the sense resistors for the VDD_CORE and VDD_MPU were selected to give better dynamic range for active power modes rather than sleep or low power modes. If power is to be measured for VDD_CORE or VDD_MPU for sleep or low power modes, then this sense resistor value must be changed to give better shunt voltage values.

Table 3. AM437x StarterKit EVM APM Sense Resistors

VOLTAGE NET	SENSE RESISTOR VALUE
VDD_CORE	0.05 ohm
VDD_MPU	0.05 ohm
VAM437X_DDR	0.05 ohm
VDDS_DDR	0.05 ohm
V1_8D_AM437X	0.1 ohm
V3_3D_AM437X	0.1 ohm

4 Configuration and Setup

4.1 Boot Configuration

The AM437x sysboot pins are hard wired for the supported boot mode using resistors on the EVM. See the AM437x TRM and data sheet for the actual definitions of each sysboot signal. Also, see the StarterKit EVM schematics for more details.

4.2 I2C Address Assignments

In the AM437x StarterKit EVM boards, each separate board has an I2C ID memory that contains the details of the identity of that board, such as its configuration (see the following sections for more details on the memories' contents).

Table 4. AM437x I2C Bus Addresses

AM437X FUNCTION	AM437X I2C PORT	ADDRESS
Board ID memory	I2C0	0x50
PMIC control	I2C0	0x2D
Touch screen control	I2C1	0x5C
Camera module 0	I2C0	0xxx
Audio codec	I2C0	0x18
HDMI transmitter	I2C2	0x76
HDMI companion chip	I2C2	0xxx
Multiple smart card slot interface IC	I2C2	0xxx

4.3 I2C ID Memory

The StarterKit EVM has a dedicated I2C EEPROM, which contains specific identity and configuration information for that board. In addition, the dedicated I2C EEPROM has available space in each memory for user-specific configuration information.

The part number of the memory device is CAT24C256WI-G.

Table 5. AM437x StarterKit EVM EEPROM Data

NAME	SIZE (BYTES)	CONTENTS
Header	4	MSB 0xEE3355AA LSB
Board name	8	Name for board in ASCII "XXXXXXX" = AM437x Starter Kit EVM
Version	4	Hardware version code for board in ASCII "1.0A" = rev. 01.0A
Serial number	12	Serial number of the board. This is a 12 character string: WWYY4P16nnnn where • WW = 2 digit week of the year of production • YY = 2 digit year of production • nnnn = incrementing board number
Configuration	32	Codes to show the configuration setup on this board. For the available EVM's supported, the following codes are used: • ASCII "SKU#01" = base board for general purpose EVM • ASCII "SKU#02" = base board for industrial motor control EVM • Remaining 26 bytes are reserved
Ethernet MAC address 0	6	MAC address for AM437x Ethernet MAC 1
Ethernet MAC address 1	6	MAC address for AM437x Ethernet MAC 2 or PRU 0
Ethernet MAC address 2	6	MAC address for AM437x PRU 1 (if used)
Available	32702	Available space for other non-volatile codes and data

4.4 JTAG

The AM437x StarterKit EVM supports embedded XDS100V2 USB emulation through the micro-USB AB connector. The EVM also has an optional 20-pin TI CJTAG connector to support the emulation. This CJTAG connector is not installed by default. Other JTAG adaptors are available on TI's e-store.

5 User Interfaces

5.1 Keypad

The keypad has four push-button switches with Omron B3SL-1022P on the component side of the board. This keypad uses two power and two scan lines to enable four buttons to be monitored.

5.2 LEDs

There are four status LEDs (two blue LEDs, one green LED, and one red LED) on the top side of the EVM. The EVM also has a green LED (D3) to indicate power-on available.

5.3 LCD

The LCD is a 4.3-inch TFT type, 480×272, 24-bit RGB panel with part number NHD-4.3-480272EF-ATXL#-CTP from New Haven Display. The LCD has white LEDs for backlight (controlled by power regulator TPS61081). The connector is a FPC-type 40 pin with part number 54132-4097. The LCD has an inbuilt capacitive touch screen, which is connected to the I2C0 port of the processor.

6 Pin Use Description

6.1 Functional Interface Mapping

Some signals of the AM437x are connected to a fixed device on the EVM where the signals cannot be changed. However, some of the signals of the AM437x are connected to devices on the EVM based on the profile setting.

6.2 GPIO Definitions

The developer can select and enable pins based on the selective peripheral pins as output or input.

7 Board Connectors

The pinout details of all the connectors used in the StarterKit EVM are provided in Table 6 through Table 15.

7.1 HEADPHONE OUT - J27

Table 6. Audio Out Connector

PIN NUMBER	SIGNAL NAME
1	AGND_AUD
2	AUD_HPLOUT_JCK
3	AUD_HPROUT_JCK
10	NC

7.2 LINE IN - J26

Table 7. Audio Line-in Connector

PIN NUMBER	SIGNAL NAME
1	AGND_AUD
2	AUD_LINEINL_JCK
3	AUD_LINEINR_JCK
10	NC

7.3 SDMMC0 - J5

Table 8. SDMMC0 Connector

PIN NUMBER	MEMORY CARD PIN NUMBER
1	MMC_D2
2	MMC_D3
3	MMC_CMD
4	VDD
5	MMC_CLK
6	DGND
7	MMC_D0
8	MMC_D1
9	DGND
10	MMC_CD
11	DGND
12	DGND
13	DGND
14	DGND
15	DGND
16	DGND

7.4 LCD Connector - J1

Table 9. LCD Connector

PIN NUMBER	SIGNAL NAME	DESCRIPTION
1	VLED–	Backlight power –
2	VLED+	Backlight power +
3	DGND	Digital ground
4	V3_3D	3.3-V power rail
5	LCD_RED0	LCD red data 0
6	LCD_RED1	LCD red data 1
7	LCD_RED2	LCD red data 2
8	LCD_RED3	LCD red data 3
9	LCD_RED4	LCD red data 4
10	LCD_RED5	LCD red data 5
11	LCD_RED6	LCD red data 6
12	LCD_RED7	LCD red data 7
13	LCD_GREEN0	LCD green data 0
14	LCD_GREEN1	LCD green data 1
15	LCD_GREEN2	LCD green data 2
16	LCD_GREEN3	LCD green data 3
17	LCD_GREEN4	LCD green data 4
18	LCD_GREEN5	LCD green data 5
19	LCD_GREEN6	LCD green data 6
20	LCD_GREEN7	LCD green data 7
21	LCD_BLUE0	LCD blue data 0
22	LCD_BLUE1	LCD blue data 1
23	LCD_BLUE2	LCD blue data 2
24	LCD_BLUE3	LCD blue data 3
25	LCD_BLUE4	LCD blue data 4
26	LCD_BLUE5	LCD blue data 5
27	LCD_BLUE6	LCD blue data 6
28	LCD_BLUE7	LCD blue data 7
29	DGND	Digital ground
30	LCD_PCLK	LCD P clock
31	LCD_DISEN	LCD DISEN
32	LCD_HSYNC	LCD HSYNC
33	LCD_VSYNC	LCD VSYNC

7.5 Touch Screen Connector - J2

Table 10. LCD Capacitive Touch Screen Pin Details

PIN NUMBER	DIRECTION	DESCRIPTION
1	V3_3D	3.3-V power rail
2	DGND	Digital ground
3	GP_I2C_SCL	I2C clock
4	GP_I2C_SDA	I2C data
5	TOUCH_INT	Touch interrupt
6	TOUCH_WAKE	Touch wake
7	NC	No connect
8	NC	No connect

7.6 Ethernet Connectors

7.6.1 RJ45 Connector1 - J6

Table 11. 10/100/1000 Ethernet Connector 1

PIN NUMBER	SIGNAL NAME	DESCRIPTION
1	DGND	Ground
2	NC	No connect
3	ETHER1_D3P	Data 3 ve
4	ETHER1_D3N	Data 3 –ve
5	ETHER1_D2P	Data 2 ve
6	ETHER1_D2N	Data 2 –ve
7	ETHER1_D1P	Data 1 ve
8	ETHER1_D1N	Data 1 –ve
9	ETHER1_D0P	Data 0 ve
10	ETHER1_D0N	Data 0 –ve
11	ACT LED ANODE	Anode of ACT LED
12	ACT LED CATHODE	Cathode of ACT LED
13	LINK LED CATHODE	Cathode of LINK LED
14	LINK LED ANODE	Anode of LINK LED
SHLD1	DGND	Ground
SHLD2	DGND	Ground

7.6.2 RJ45 Connector2 - J8

Table 12. 10/100/1000 Ethernet Connector 2

PIN NUMBER	SIGNAL NAME	DESCRIPTION
1	DGND	Ground
2	NC	No connect
3	ETHER2_D3P	Data 3 ve
4	ETHER2_D3N	Data 3 –ve
5	ETHER2_D2P	Data 2 ve
6	ETHER2_D2N	Data 2 –ve
7	ETHER2_D1P	Data 1 ve
8	ETHER2_D1N	Data 1 –ve
9	ETHER2_D0P	Data 0 ve
10	ETHER2_D0N	Data 0 –ve
11	ACT LED ANODE	Anode of ACT LED
12	ACT LED CATHODE	Cathode of ACT LED
13	LINK LED CATHODE	Cathode of LINK LED
14	LINK LED ANODE	Anode of LINK LED
SHLD1	DGND	Ground
SHLD2	DGND	Ground

7.7 USB - J17

Table 13. Micro-AB Connector - USB Port 0

PIN NUMBER	SIGNAL NAME	DESCRIPTION
1	VUSB_VBUS0	USB0 bus voltage
2	USB0_CONN_DM	USB0 data –
3	USB0_CONN_DP	USB0 data +
4	USB0_ID	USB0 identification
5	DGND	Ground

7.8 USB - J19

Table 14. Type A - USB Port 1

PIN NUMBER	SIGNAL NAME	DESCRIPTION
1	VUSB_VBUS1	USB1 bus voltage
2	USB1_CONN_DM	USB1 data –
3	USB1_CONN_DP	USB1 data +
4	DGND	Ground

7.9 Camera Interface Header - J15

Table 15. Camera Header

PIN NUMBER	SIGNAL NAME	DESCRIPTION
1	AGND	Analog ground
2	SENSOR_SIO_D	Sensor serial I/O data
3	V2_8A	2.8-V supply
4	SENSOR_SIO_C	Sensor serial I/O clock
5	DGND	Ground
6	SENSOR_VSYNC	Sensor VSYNC
7	DGND	Ground
8	SENSOR_HREF	Sensor HREF
9	V1_5D	1.5-V Supply
10	SENSOR_XCLK	Sensor clock
11	SENSOR_PWRDN	Sensor power down
12	V2_8D	2.8-V supply
13	SENSOR_PCLK	Sensor clock
14	SENSOR_Y0	Sensor data 0
15	SENSOR_RESET	Sensor reset
16	SENSOR_Y1	Sensor data 1
17	SENSOR_Y9	Sensor data 9
18	SENSOR_Y8	Sensor data 8
19	SENSOR_Y7	Sensor data 7
20	SENSOR_Y6	Sensor data 6
21	SENSOR_Y5	Sensor data 5
22	SENSOR_Y4	Sensor data 4
23	SENSOR_Y3	Sensor data 3
24	SENSOR_Y2	Sensor data 2

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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. 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.

Industry Canada Compliance (English)

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.

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.

8.3 Important Notice for Users of EVMs Considered "Radio Frequency Products" in Japan

NOTE: These EVM terms and conditions can be downloaded in PDF format.

EVMs entering Japan are NOT certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If user uses EVMs in Japan, user is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

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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