EVM User's Guide: TLC6983EVM

TLC6983 48x16 Common Cathode Matrix LED Display Driver Evaluation Module

Description

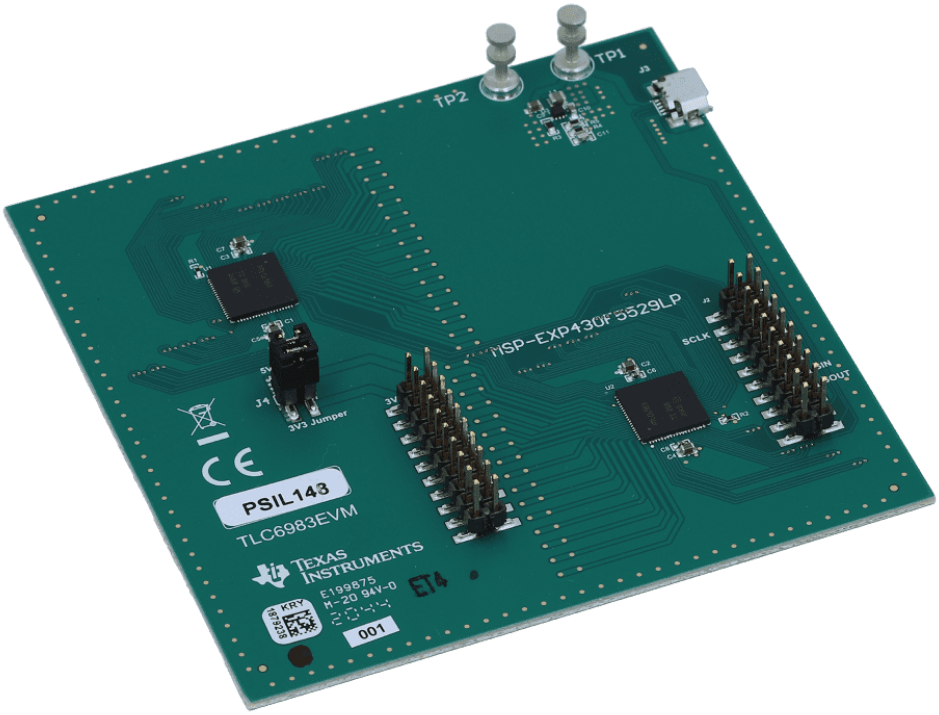
The TLC6983 evaluation module used as a reference for engineering demonstration and evaluation. Included in the user's guide are setup instructions, a schematic diagram, printed board (PCB) layout and a bill of materials (BOM).

Features

- 48 current source channels from 0.2mA to 20mA
- 16 scan line switches with 190mΩ $R_{DS(ON)}$
- Ultra low power consumption
- High speed and low EMI continuous clock series interface (CCSI)

Applications

- Narrow Pixel Pitch (NPP) LED display
- Mini and micro-LED products



1 Evaluation Module Overview

1.1 Introduction

The TLC6983 is a highly integrated common cathode matrix LED display driver with 48 constant current sources and 16 scanning FETs. A single TLC6983 is capable of driving 16 x16 RGB LED pixels while stacking two TLC6983s can drive 32 x 32 RGB LED pixels. To achieve low power consumption, the device supports separated power supplies for the red, green, and blue LEDs by the common cathode structure. Furthermore, the operation power of the TLC6983 is significantly reduced by ultra-low operation voltage range (Vcc down to 2.5V) and ultra-low operation current (Icc down to 3.9mA).

This user's guide describes the TLC6983 evaluation module used as a reference for engineering demonstration and evaluation. Included in this user's guide are setup instructions, a schematic diagram, printed board (PCB) layout and a bill of materials (BOM).

1.2 Kit Contents

- One TLC6983EVM board

Note that this EVM requires a controller (for example, MCU), which is not included.

1.3 Device Information

The TLC6983 implements a high speed dual-edge transmission interface to support high device count daisy-chained and high refresh rate while minimizing electrical-magnetic interference (EMI). The device supports up to 25MHz SCLK (external) and up to 160MHz GCLK(internal). Meanwhile, the device integrates enhanced circuits and intelligent algorithms to solve the various display challenges in Narrow Pixel Pitch(NPP) LED display applications and Mini / Micro-LED products: Dim at the fist scan line, Upper and downside ghosting, Non-uniformity in low gray scale, Coupling, Caterpillar caused by open or short LEDs, which make the TLC6983 an excellent choice in such applications.

The TLC6983 also implements LED open/weak short/short detections and removals during operations and can also report those information out to the accompanying digital processor.

2 Hardware

2.1 TLC6983 EVM Board

Figure 2-1 shows the image of driver IC side of TLC6983EVM board.

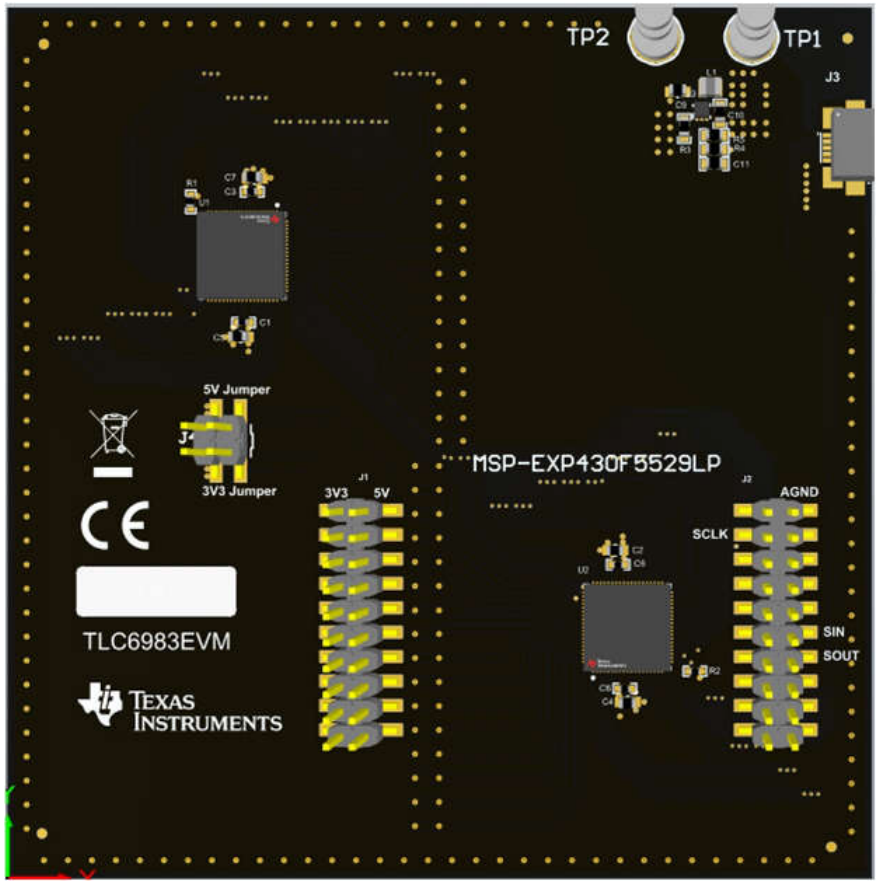


Figure 2-1. Driver IC Side of TLC6983EVM Board

2.2 Connectors

The TLC6983EVM has the following connectors:

- TP1 (+5 V): Input power supply for VLEDG/VLEDB and DCDC
- TP2 (GND): Supply ground
- J1, J2: Boosterpack connectors for connecting with the TMS320F280039C LaunchPad™ for C2000™ real-time MCU.
- J3: Mini-USB connector for 5V power input

2.3 Jumpers

The TLC6983EVM has the following jumpers:

- J4 (5V Jumper): Input 5V power supply from J3 or J1/J2
- J4 (3 V3 Jumper): Input 3 V3 power supply from J3 (DCDC) or J1/J2

3 Software

3.1 Software Setup

To set up the software for the TMS320F280039C LaunchPad, please follow the steps documented in the sample code user's guide which can be downloaded from *LP589x(-Q1)/TLC698x Sample Code User's Guide*. This user's guide also provides guidance on software setup for LED fault diagnostics, multiple CCSI buses, cascading devices, and animation control.

4 Implementation Results

4.1 Test Setup

The typical parameters for TLC6983 EVM is listed in Table 4-1.

Table 4-1. TLC6983EVM Parameters

Parameter	Value
VCC Device supply voltage	2.5-5.5 V
VLEDR/G/B supply voltage	2.5-5.5 V
ICH Constant output source current	0.2-20mA

The TLC6983EVM can be setup and tested by following the steps below:

1. USB power supply
   a. Download the code to TMS320F280039C LaunchPad with TI Code Composer Studio software. Figure 4-1 shows the connection method.
   b. Connect boosterpack connectors (J1, J2 on EVM board) with the TMS320F280039C LaunchPad, the connection method is shown as below figure.
   c. Disconnect J4 jumpers (5V/ 3V3) block and connect J3 with the mini-USB cable (the same cable with the TMS320F280039C LaunchPad).
2. External power supply
   a. Download the code to TMS320F280039C LaunchPad with TI Code Composer Studio software.
   b. Connect boosterpack connectors (J1, J2 on EVM board) with the TMS320F280039C LaunchPad, the connection method is shown in Figure 4-1.
   c. Disconnect J4 jumpers (5V/ 3V3) and connect TP1 and TP2 to 5V/GND power source.
   d. Power on 5V/GND power supply.

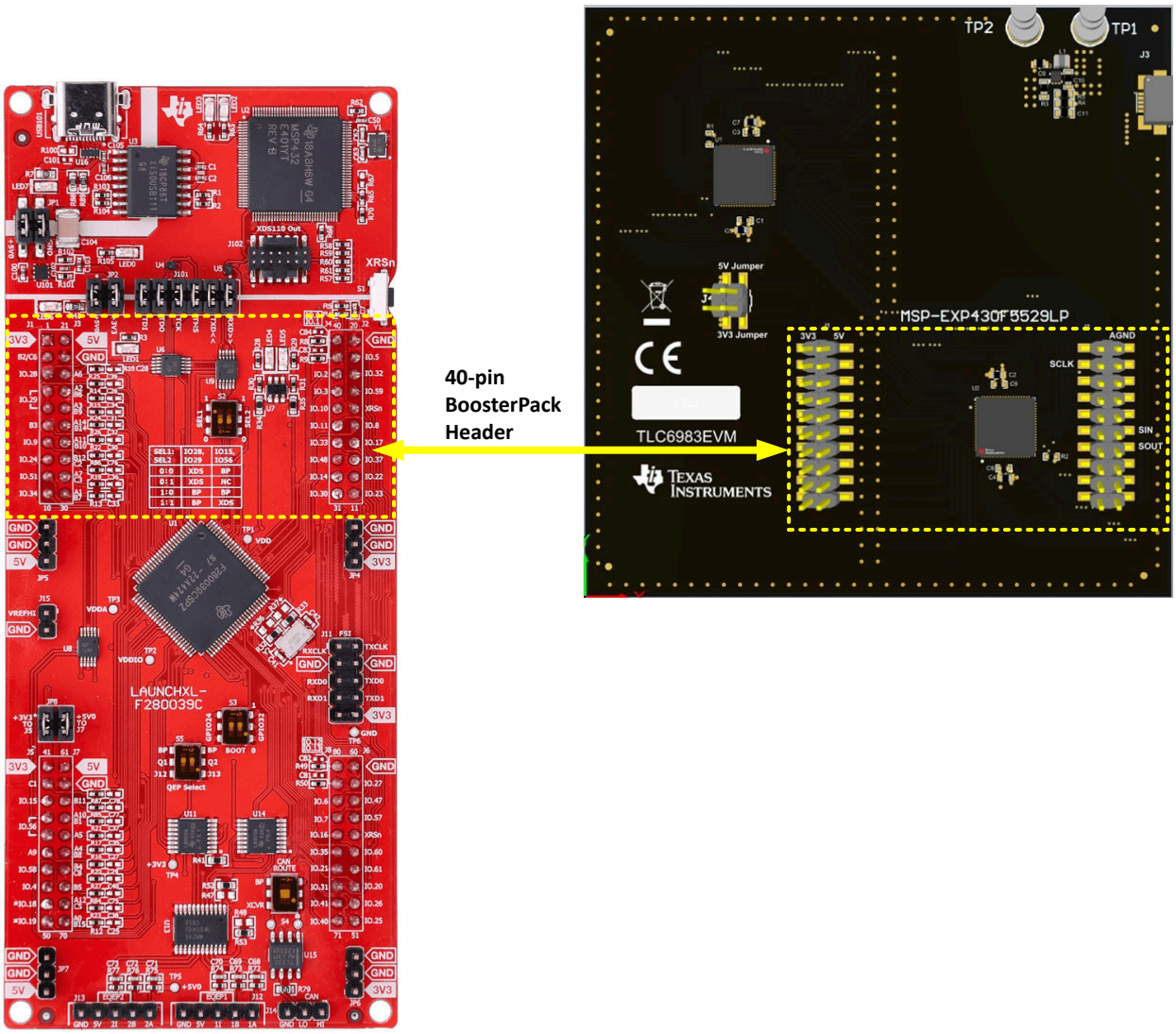


Figure 4-1. TLC6983EVM and TMS320F280039C LaunchPad

5 Hardware Design Files

5.1 Schematic

The EVM schematic is shown in Figure 5-1.

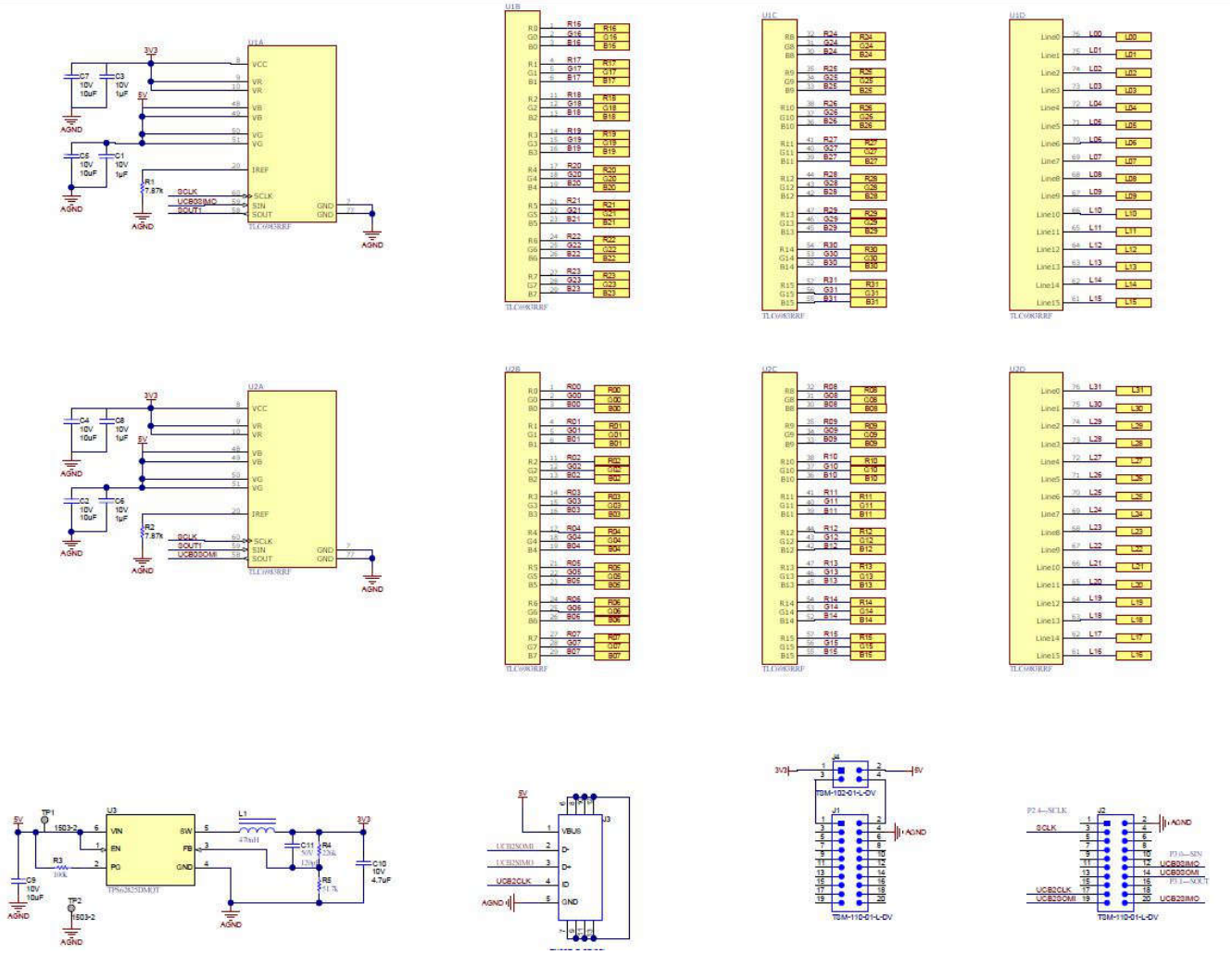


Figure 5-1. TLC6983 EVM Schematic

5.2 PCB Layout

The EVM board layout is illustrated in Figure 5-2.

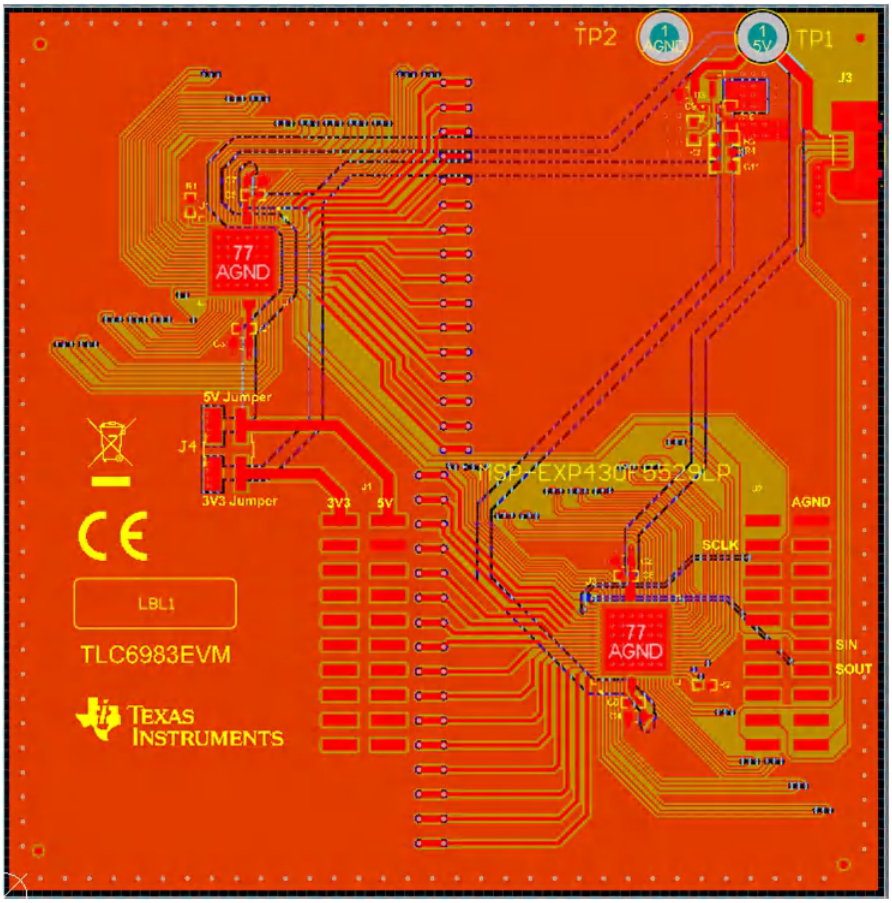


Figure 5-2. TLC6983EVM Layout

5.3 Bill of Materials

The TLC6983 EVM BOM is listed in Table 5-1.

Table 5-1. TLC6983 EVM Bill of Materials

Item No.	Designator	QTY	Value	Part Number	Manufacturer	Description	Package Reference
1	C1, C3, C6, C8	4	1uF	CL05A105MP5NNNC	Walsin	CAP, CERM, 1µF, 10V,+/- 20%, X5R, 0402	0402
2	C2, C4, C5, C7, C9	5	10uF	ZRB18AD71A106KE01L	MuRata	CAP, CERM, 10uF, 10V, +/- 10%, X7T, 0603	0603
3	C10	1	4.7uF	CGB3B1X5R1A475K055AC	TDK	CAP, CERM, 4.7uF, 10V, +/- 10%, X5R, 0603	0603
4	C11	1	120pF	VJ0603A121FXACW1BC	Vishay-Sprague	CAP, CERM, 120pF, 50V, +/- 1%, C0G/NP0, 0603	0603
5	D1_M0…D128_M7	1024	RGB	EAST1616RGBA8	Everlight	LED, RGB, SMD	1.6x1.6mm
6	J1, J2	2		TSM-110-01-L-DV	Samtec	Header, 2.54mm, 10x2, Gold, SMT	Header, 2.54mm, 10x2, SMT
7	J3	1		ZX62R-B-5P(30)	Hirose Electric Co. Ltd.	Connector, Receptacle, Micro-USB Type B, Top Mount SMT	Connector USB Mini B
8	J4	1		TSM-102-01-L-DV	Samtec	Header, 2.54mm, 2x2, Gold, SMT	Header, 2.54mm, 2x2, SMT
9	L1	1	470nH	DFE201610E-R47M=P2	MuRata	Inductor, Shielded, Metal Composite, 470nH, 3.6A, 0.032 ohm, SMD	1.6x2mm
10	LBL1	1		THT-14-423-10	Brady	Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650 x 0.200 inch
11	R1, R2	2	7.87k	CRCW04027K87FKED	Vishay-Dale	RES, 7.87 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402
12	R3	1	100k	CRCW0603100KFKEA	Vishay-Dale	RES, 100 k, 1%, 0.1 W, 0603	0603
13	R4	1	226k	CRCW0603226KFKEA	Vishay-Dale	RES, 226 k, 1%, 0.1 W, 0603	0603
14	R5	1	51.7k	RT0603BRD0751K7L	Yageo America	RES, 51.7 k, 0.1%, 0.1 W, 0603	0603
15	TP1, TP2	2		1503-2	Keystone	Terminal, Turret, TH, Double	Keystone1503-2
16	U1, U2	2		TLC6983RRF	Texas Instruments	48x16 Common Cathode Matrix LED Display Driver with Ultra Low Power	VQFN76
17	U3	1		TPS62825DMQT	Texas Instruments	2A High Efficiency Synchronous Buck Converter, DMQ0006A (VSON-HR-6)	DMQ0006A

6 Additional Information

6.1 Trademarks

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7 Revision History

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

Changes from Revision * (December 2020) to Revision A (September 2024)	Page
• Updated hardware setup figures to use TMS320F280039C	3
• Add *Software Setup* section with instructions in *Sample Code User's Guide*	4
• Changed instructions to use LAUNCHXL-F280039C instead of MSP430F5529 LaunchPad	4

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

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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

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- *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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(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.

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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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