User's Guide

TPS62745 Buck Converter Evaluation Module User's Guide

ABSTRACT

This user's guide describes the characteristics, operation, and use of the Texas Instruments TPS62745 evaluation module (EVM). This EVM is designed to help the user easily evaluate and test the operation and functionality of the TPS62745. The EVM converts a 2.2-V to 5.5-V input voltage to a regulated output voltage that is set between 1.8 V and 3.3 V at up to 300 mA. The TPS62745 also includes a load switch and power good output, while having an ultra-low quiescent current of 400 nA. This user's guide includes setup instructions for the hardware, a printed-circuit board (PCB) layout for the EVM, a schematic diagram, a bill of materials (BOM), and test results for the EVM.

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Trademarks

1 Introduction

The TPS62745 is a 300-mA, synchronous, step-down converter in a 2 x 3-mm, 10-pin SON package. The output voltage is fixed inside the device by the connection of the four VSELx pins.

1.1 Background

The TPS62745EVM-622 uses the TPS62745 device. The EVM operates with full-rated performance with an input voltage between 3.3 V and 10 V.

2 Setup

This section describes how to properly use the TPS62745EVM-622.

2.1 Input/Output Connector Descriptions

J1 – VIN	Positive input connection from the input supply for the EVM (3.3 V to 10 V)
J2 – S+/S-	Input voltage sense connections. Measure the input voltage at this point.
J3 – GND	Return connection from the input supply for the EVM.
J4 – VOUT	Output voltage connection.
J5 – S+/S-	Output voltage sense connections. Measure the output voltage at this point.
J6 – GND	Output return connection.
J7 – PG/GND	The PG output appears on pin 1 of this header with a convenient ground on pin 2.
J8 – VIN_SW	VIN switch output connection.
J9 – SW/GND	Switch Node sense connection.
JP1 – EN	EN pin input jumper. Place the supplied jumper across ON and EN to turn on the IC. Place the jumper across OFF and EN to turn off the IC.
JP2 – EN_VIN_SW	Enable VIN switch jumper. Place the supplied jumper across VIN_SW_ON and EN_VIN_SW to activate (close) the internal VIN switch. Place the jumper across VIN_SW_OFF and EN_VIN_SW to de-activate (open) the internal VIN switch.
JP3 through JP6 – VSELx	These four inputs set the output voltage. By connecting each pin high or low, the output voltage is programmed per Table 2-1. Do not leave any jumper open for proper operation.

Table 2-1 provides the output voltage settings for the TPS62745EVM-622. A 0 refers to logic low, while 1 refers to logic high.

Table 2-1. Output Voltage Settings

VOUT	VSEL 4	VSEL 3	VSEL 2	VSEL 1
1.8	0	0	0	0
1.9	0	0	0	1
2.0	0	0	1	0
2.1	0	0	1	1
2.2	0	1	0	0
2.3	0	1	0	1
2.4	0	1	1	0
2.5	0	1	1	1
2.6	1	0	0	0
2.7	1	0	0	1
2.8	1	0	1	0
2.9	1	0	1	1
3.0	1	1	0	0
3.1	1	1	0	1
3.2	1	1	1	0
3.3	1	1	1	1

2.2 Operation

To operate the EVM, set jumpers JP1 through JP6 to the desired positions per Section 2.1. Connect the input supply to J1 and J3 and connect the load to J4 and J6.

3 Common Efficiency Measurement Errors with Ultra-Low Iq Devices

Efficiency is a common measurement for a power supply. With an ultra-low quiescent current device, such as the TPS62745, measurement errors can have a large impact on the measured efficiency, especially at very low load currents (< 100 µA).

3.1 Efficiency Measurement Setup

To accurately measure the efficiency of the TPS62745EVM-622, use the setup described in SLVA236 Figure 6. The 'Additional Input Capacitor' referred to in that application note is not needed as C5 is already included on the TPS62745EVM-622. Any additional input capacitance is not recommended as it incurs increased leakage on the input which lowers the measured efficiency.

When measuring efficiency through the setup in SLVA236, special care must be taken to remove the current consumed by the measurement instruments from the efficiency calculations. Such measurement instruments typically include the input voltage and output voltage multimeters as well as the input power supply's remote sense lines (if it has this capability). The current into these points affects the measured efficiency at very light loads. Two possible methods to overcome this are: measuring the current into these points (measure the current into the multimeters and/or remote sense lines) and then subtracting this current from the efficiency calculation or simply removing these instruments from the test setup. At very light load currents, it is typically best to remove the remote sense lines of the input power supply and then measure the current into the input and output voltage multimeters to get the most accurate efficiency measurement.

3.2 Pullup and Pulldown Resistors

In addition to the input capacitor and remote sense lines noted in Section 3.1, any pullup or pulldown resistors can draw significant current and affect the measured efficiency. For example, if the VSEL2 pin were pulled up to the input voltage with a 1-MΩ resistor and the pin were tied low through JP4, this would draw an extra 3.6 µA from the input source at a 3.6-V input voltage. This would greatly affect the efficiency at very light loads. For this reason, no pullup or pulldown resistors have been used on the TPS62745EVM-622. The final application circuit should ensure that all digital inputs to the TPS62745 are terminated either high or low and not left floating, per the device data sheet.

4 Board Layout

This section provides the TPS62745EVM-622 board layout and illustrations. The gerbers are available on the EVM product page: TPS62745EVM-622.

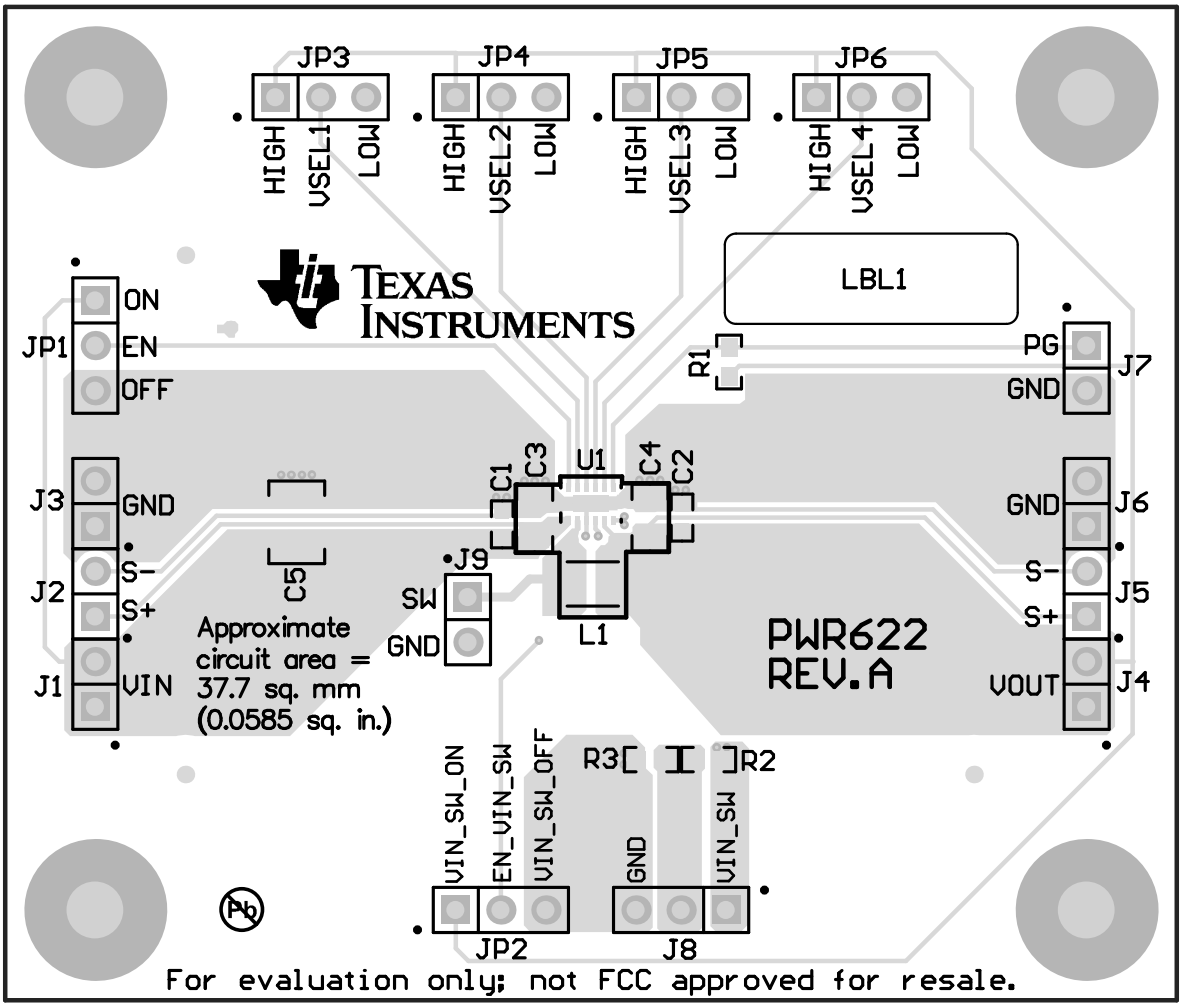

Figure 4-1. Assembly Layer

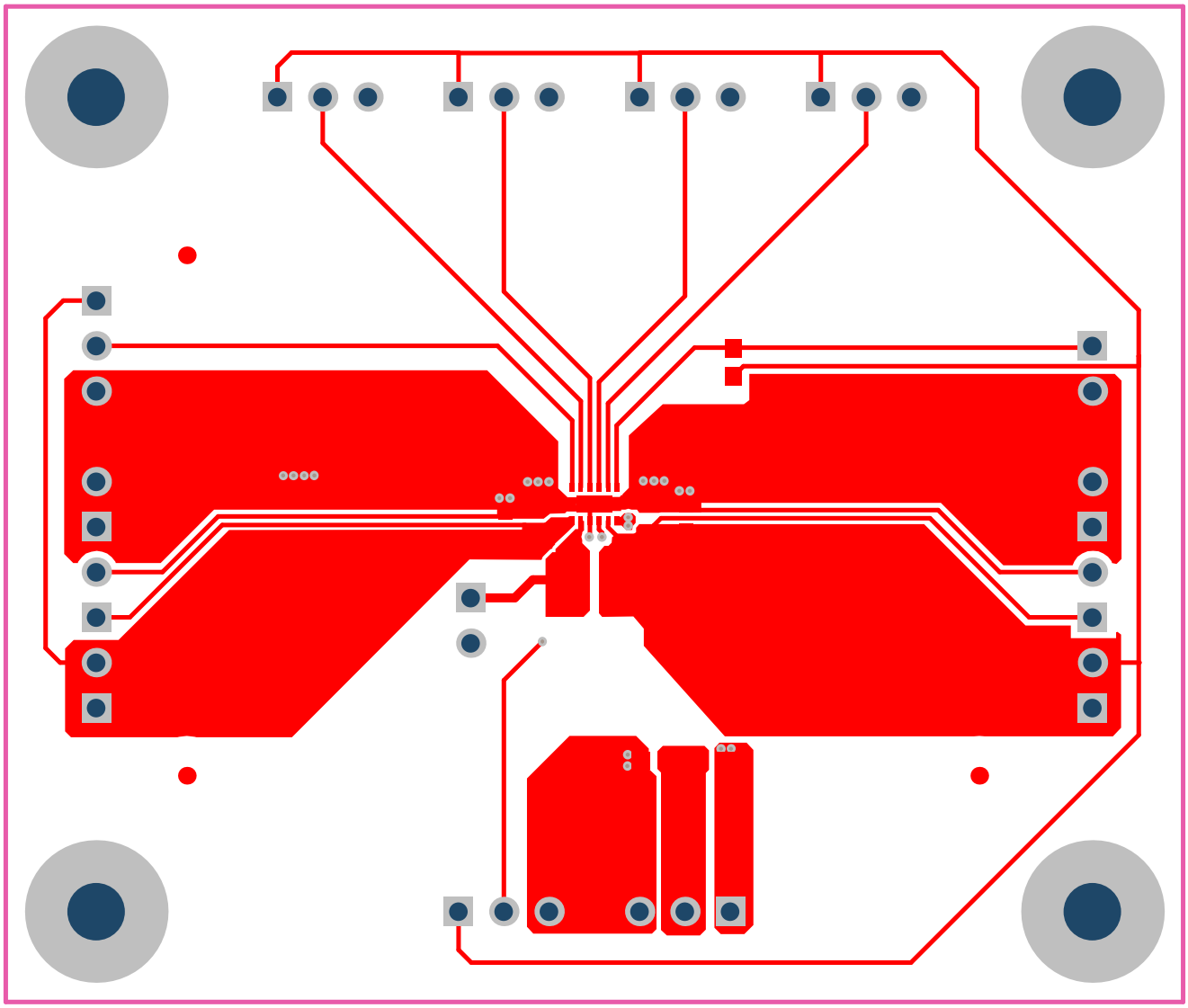

Figure 4-2. Top Layer

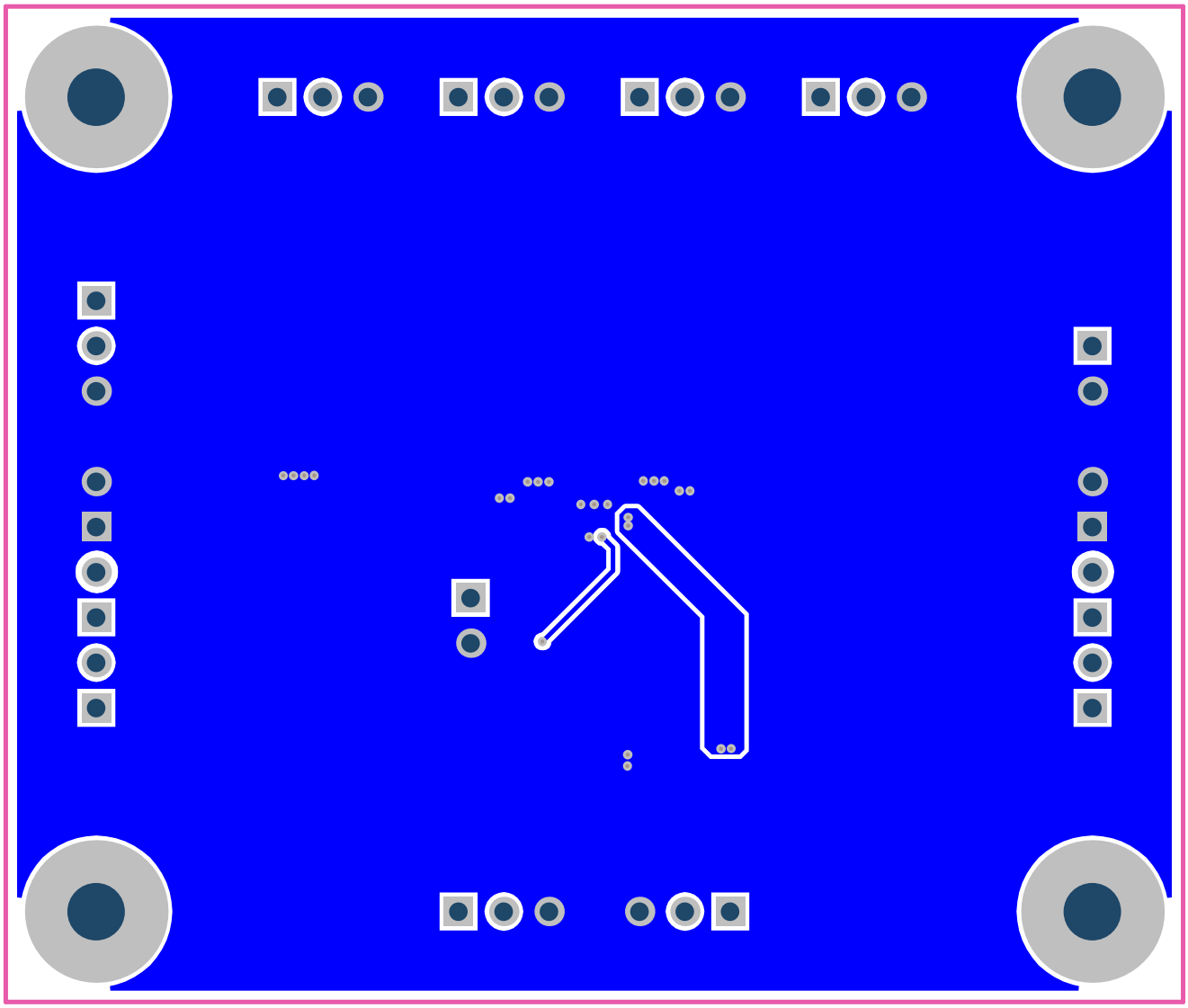

Figure 4-3. Bottom Layer

5 Schematic and Bill of Materials

This section provides the TPS62745EVM-622 schematic and bill of materials.

5.1 Schematic

Figure 5-1 illustrates the TPS62745EVM-622 schematic.

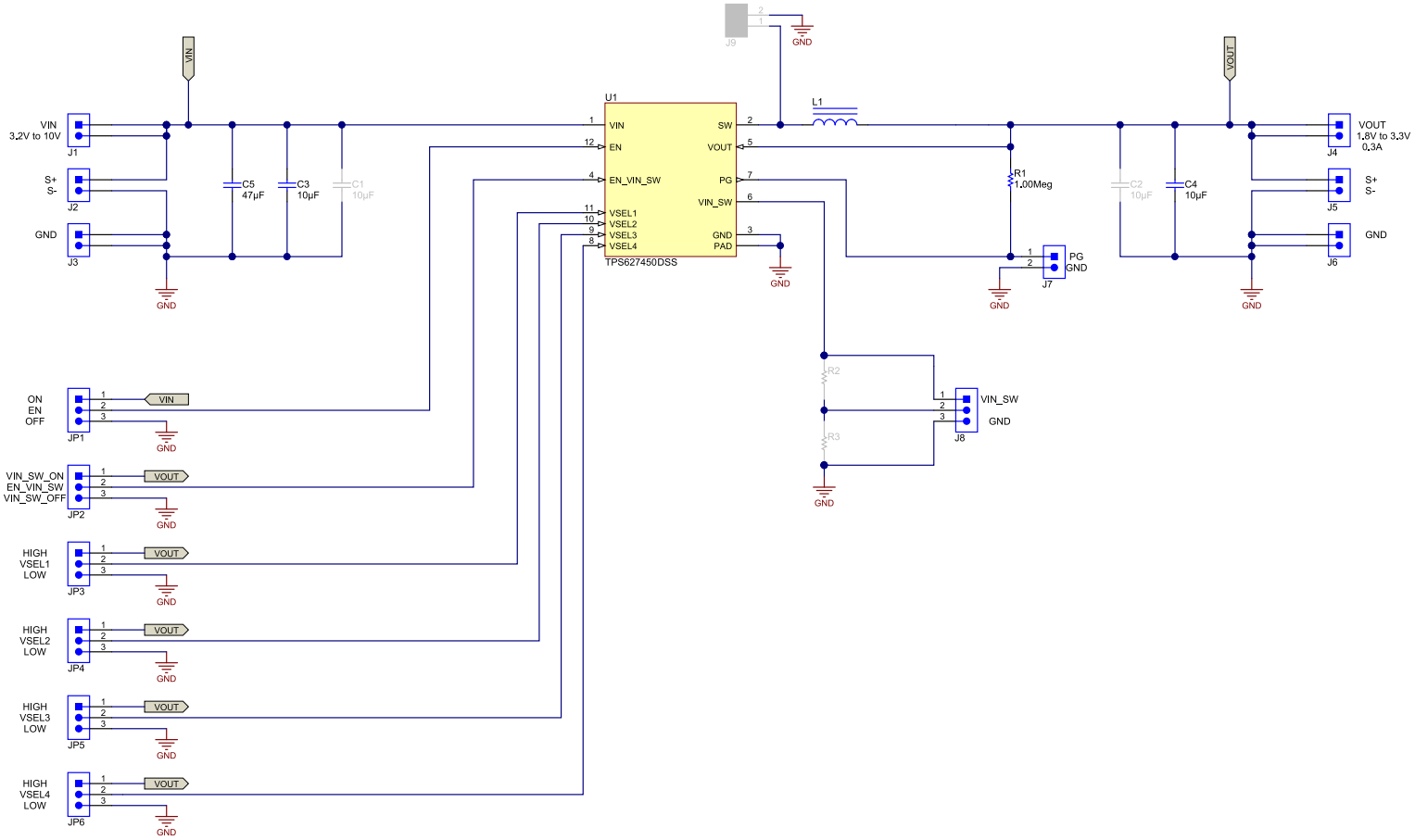

Figure 5-1. TPS62745EVM-622 Schematic

5.2 Bill of Materials

Table 5-1 lists the TPS62745EVM-622 bill of materials.

Table 5-1. TPS62745EVM-622 Bill of Materials

Count	RefDes	Value	Description	Size	Part Number	MFR
3	C1, C2	not Populated	Capacitor, Ceramic	0603		
2	C3, C4	10uF	Capacitor, Ceramic, X5R, 10V, 10%	0805	LMK212BJ106KG-T	Taiyo Yuden
1	C5	47uF	Capacitor, Ceramic, X5R, 16V, 20%	1210	GRM32ER61C476ME15L	Murata
1	L1	4.7uH	Inductor, Multilayer, 1.7A, 165-mΩ	1008	DFE252012P-4R7M	Toko
1	R1	1.00M	Resistor, Chip, 1/16W, 1%	0603	RC0603FR-071ML	Yageo
1	U1	TPS62745	IC, 400 nA I_Q Step Down Converter	2 mm x 3 mm WSON	TPS62745DSS	TI

6 Revision History

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

Changes from Revision * (June 2015) to Revision A (May 2021) **Page**

- Updated user's guide title..... 2
- Updated the numbering format for tables, figures, and cross-references throughout the document. 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 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.

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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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