TLK2711 Serdes EVM Kit Setup and Usage

User's Guide

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Introduction

The Texas Instruments TLK2711 serdes evaluation module (EVM) board is used to evaluate the TLK2711 device for point-to-point data transmission applications.

The board enables the designer to connect 50-Ω parallel buses to both transmitter and receiver connectors. The TLK2711, using high speed PLL technology, serializes, encodes (8b/10b), and transmits data along one differential pair. The receiver part of the device deserializes, decodes, and presents data on the parallel bus. The high-speed (up to 2.5 Gbps) data lines interface to four 50-Ω controlled-impedance Subminiature Version A (SMA) connectors.

1.1 Introduction

The TLK2711 EVM board can be used to evaluate device parameters while acting as a guide for high-speed board layout. The evaluation board can be used as a daughter board that is plugged into new or existing designs. Because the TLK2711 operates over a wide range of frequencies, designers need to optimize designs for the frequency of interest. Additionally, designers may wish to use buried transmission lines and provide additional noise attenuation and EMI suppression to optimize their end product.

As the frequency of operation increases, the board designer must take special care to ensure that the highest signal integrity is maintained. To achieve this, the board's impedance is controlled to 50 Ω for both the high-speed differential serial and parallel data connections. In addition, impedance mismatches are reduced by designing the component pad size to be as close as possible to the width of the connecting transmission lines. Vias are minimized and, when necessary, placed as close as possible to the device drivers. Because the board contains both serial and parallel transmission lines, care was taken to control both impedance and trace length mismatch (board skew).

Overall, the board layout is designed and optimized to support high-speed operation. Thus, understanding impedance control and transmission line effects is crucial when designing high-speed boards.

Some of the advanced features offered by this board include:

- Printed-circuit board (PCB) is designed for high-speed signal integrity.
- SMA and parallel fixtures are easily connected to test equipment.
- All input/output signals are accessible for rapid prototyping.
- Analog and digital power planes can be supplied through separate banana jacks for isolation or can be combined using ferrite bridging networks
- Onboard capacitors provide ac coupling of high-speed signals.

1.2 TLK2711 EVM Kit Contents

❑ TLK2711 EVM board

TLK2711 EVM Board Configuration

The TLK2711 EVM board gives the developer various options for operation, many of which are jumper selectable. Other options can be either soldered into the EVM or connected through input connectors.

The TX and RX parallel connectors provide a connection for both transmitted and received data. The reference clock is supplied through SMA connector J8, and jumper J5 must be installed between pins 1 and 2. A direct clock connection also can be made to J5 pins 1 and 3. The high-speed serial data is transmitted through J13 and J14 SMA connectors. The received recovered clock (RX_CLK) is output through J15 header. Received data connects through SMA connectors J17 and J23 on the RX side of the board. Header J7 provides static signals (normally pulled high) to configure the device for different modes of operation.

The power planes are split two ways to provide power for different parts of the board. This minimizes coupling of switching noise between the analog and digital sections of the TLK2711. The VDD and VDDA connectors require 2.5 V and are joined together by a removable ferrite bead L3 that is installed in the default configuration. Thus, only the VDD connection is necessary to energize the TLK2711 device in the default configuration. In all sections of the board, the ground planes are common, and each ground plane is tied together at every component ground connection.

The board is normally delivered in a default configuration that requires external clock and data inputs. The TLK2711 is shipped with jumpers for default operation. Table 2-1 shows the default configuration for sending data.

Table 2-1. Default Transceiver Board Configuration as Shipped

Designator	Function	Condition
J5	GTX CLK SEL	Jumper installed: J5 provides a method of supplying a input clock to the board.
J7	TESTEN	Jumper installed (Logic 0) Disables the TLK2711 test mode
J7	PRBSEN	Jumper installed (Logic 0) Disables the TLK2711 PRBS internal production test mode
J7	LCKREFN	Jumper not installed (Logical 1) Locks to received clock
J7	ENABLE	Jumper not installed (Logical 1) Enables the device for normal operation
J7	LOOPEN	Jumper installed (Logic 0) Disables the TLK2711 internal loop back mode
J31	PRE-EMPHASIS	Jumper not installed (Logical 1) 20% pre-emphasis enabled. Jumper to enable 5% pre-emphasis.
L3	VDD- bridge -VDDA	Joins VDD and VDDA power planes
C24, C25	TX ac coupling capacitors	These capacitors (normally installed) are provided to ac-couple the transmitted signal.
C22, C23	RX ac coupling capacitors	These capacitors (normally installed) are provided to ac-couple the received signal.

Table 2-2. Configuration Changes Necessary for DC-Coupling of the High Speed Signals

Designator	Function	Condition or Changes Necessary for DC Coupling
C24, C25	TX ac-coupling capacitors	Install 0-Ω resistors
C22, C23	RX ac-coupling capacitors	Install 0-Ω resistors

2.1 Typical Test and Setup Configurations

The following configurations are used to evaluate and test the TLK2711 transceiver. The first configuration is a serial loopback of the high-speed signals shown in Figure 2-1. The serial loopback allows the designer to evaluate most of the functions of both transmitter and receiver sections of the TLK2711 device. To test a system, a parallel bit error rate tester (BERT) generates a predefined parallel bit pattern. The pattern is connected to the transmitter through parallel connectors TD0–TD15. Additionally, two control pins, TKLSB and TKMSB, must configured by the BERT for valid data transmission. For proper data transmission, TKLSB, and TKMSB must be programmed in the pattern to provide the necessary comma character to allow byte alignment to occur. See the TLK2711M data sheet for more information on the use of the TKMSB and TKLSB signals for providing syncronization. The TLK2711 device encodes, serializes, and presents the data on the high-speed serial pair. The serial TX data is then looped back to the receiver side, and the device deserializes, decodes, and presents the data on the receive side RD0-RD15. The data and controll bits (RKLSB and RKMSB) are received by the BERT and compared against the transmitted pattern and monitored for valid data and errors. If any bit errors are received, a bit error rate is evaluated at the parallel receive BERT.

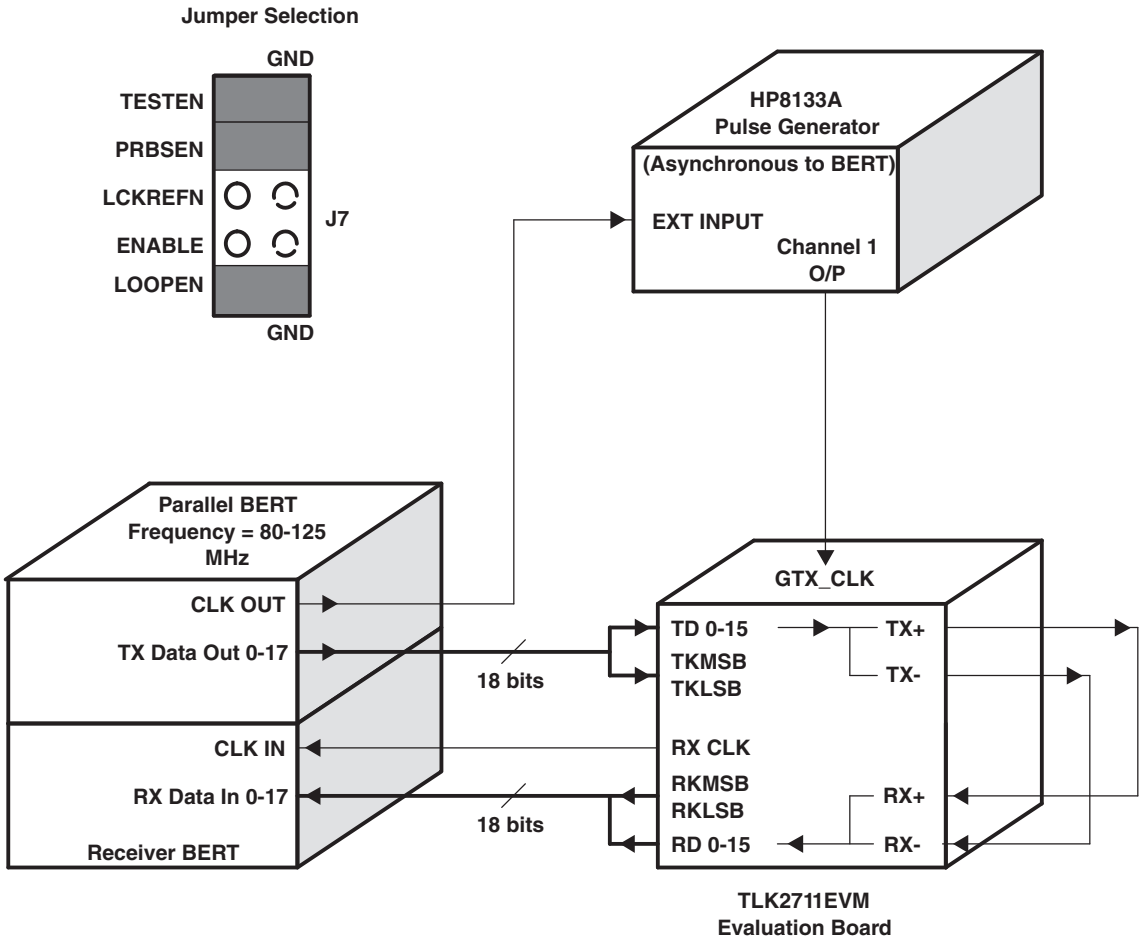

Figure 2-1. TLK2711 Serial Loop-Back Test Configuration

If a parallel BERT is not available, the designer can take advantage of the built-in test mode of the device (see Figure 2-2). If the designer asserts the PRBSEN pin high, this results in a pseudo random bit pattern to be transmitted. This pin also puts the receiver in a mode to detect a valid PRBS pattern. A valid pattern is indicated by the PRBSPASS(RKLSB) pin indicating high. This test validates only the high-speed serial portion of the device and system interconnects. The PRBS pattern is 2^7-1 and is compatible with most serial BERT test equipment. This function allows the operator to isolate and test the transmitter and receiver independently. A typical configuration is shown in Figure 2-3. The dashed lines represent optional connections that can be made monitoring eye patterns and measuring jitter. This same test can be performed without the external serial connections with LOOPEN jumper removed. Removing LOOPEN, causes the transmitted data to be internally looped to the receiver with the transmitter disabled.

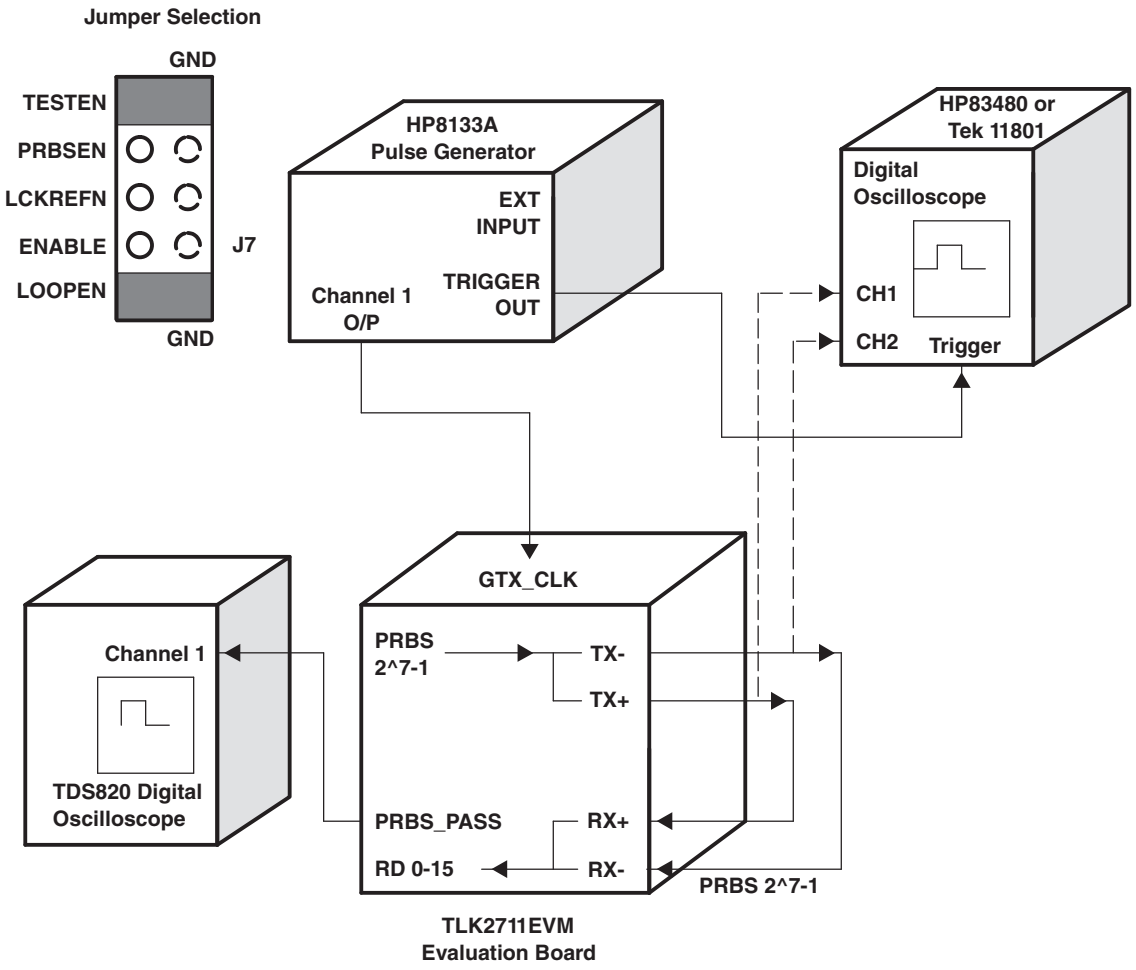

Figure 2-2. TLK2711 Serial Loop-Back Test Configuration

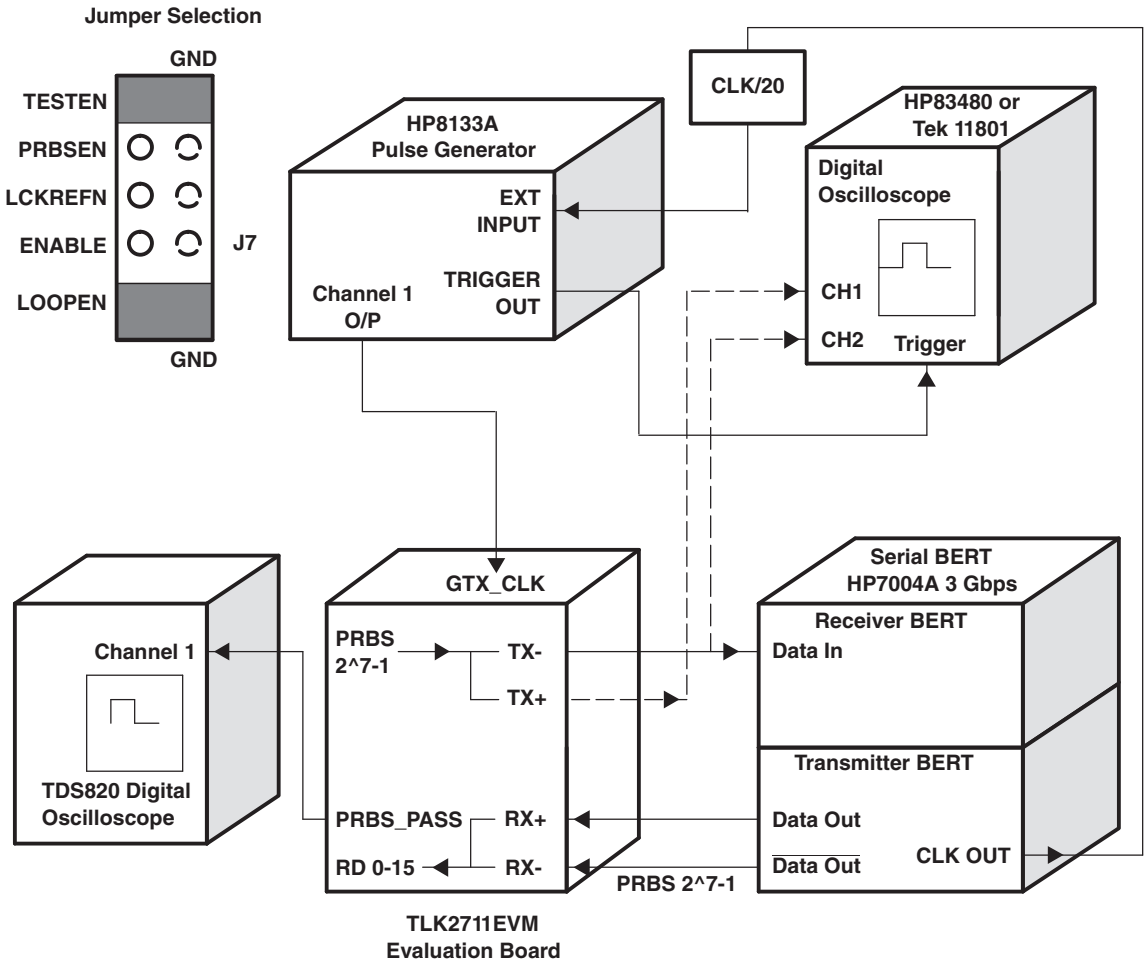

Figure 2-3. TLK2711 Serial PRBS BERT Test Configuration

A board-to-board communication link is a practical method of evaluating the TLK2711 in a system-like environment as shown in Figure 2-4. A Parallel BERT or a logic analyzer can be used to provide and monitor signals to and from the transceiver pairs. The BERT would need to configure the TKLSB and TKMSB signals for data transmission before any data is sent. On the receive side the RKMSB and RKLSB can monitor the device for errors. Both GTX_CLK sources must have the same frequency within 200 PPM for asynchronous operation. Synchronous operation can be achieved by using either the BERT or a synchronized pulse generator to supply both boards with GTX_CLK inputs.

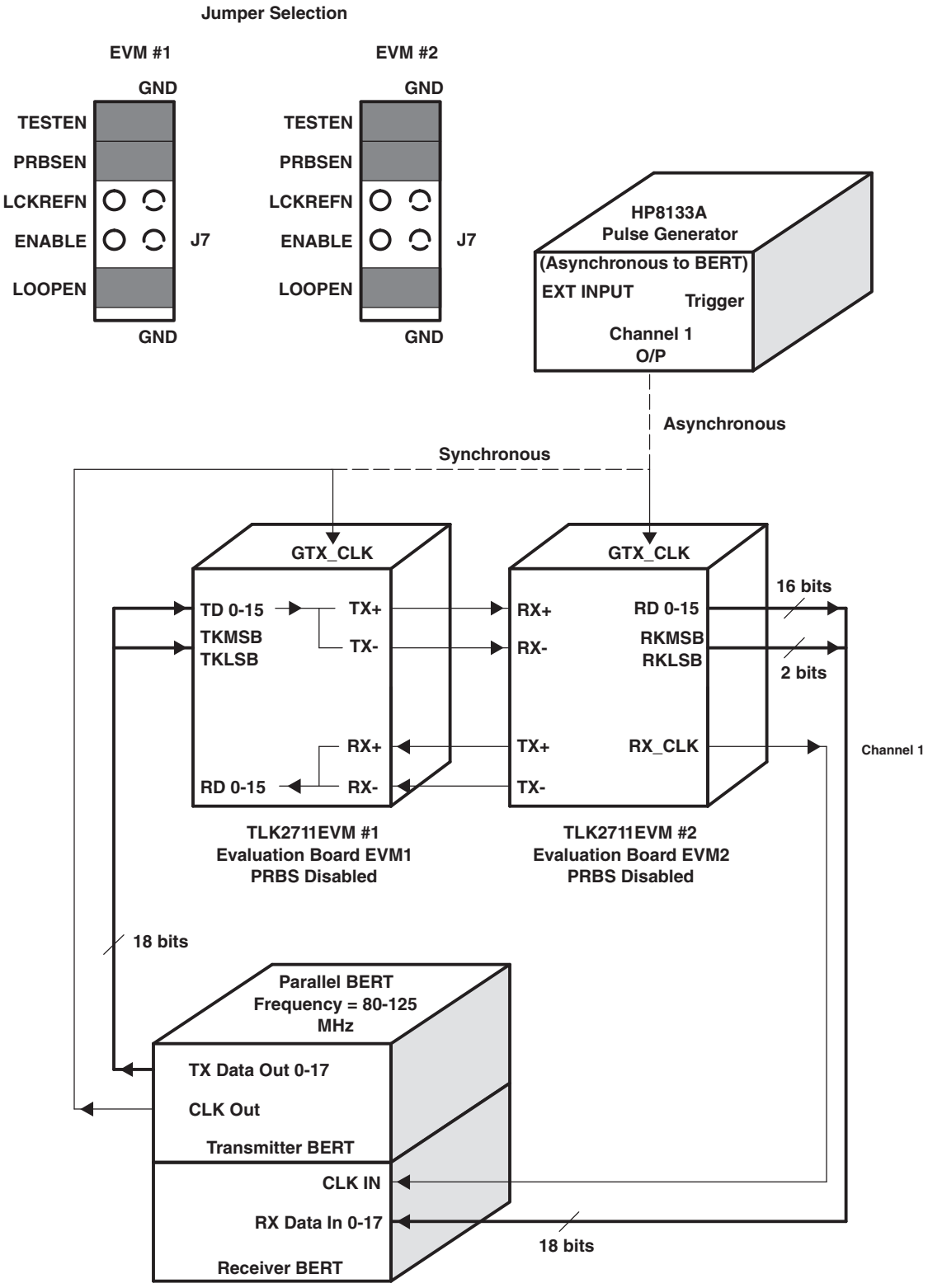

Figure 2-4. TLK2711 Serial PRBS BERT Test Configuration

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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 are 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.

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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.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

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

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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.

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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.

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.

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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.

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.

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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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