SD3GDAEVK

User's Guide

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SD3GDAEVK

The Texas Instruments SD3GDAEVK evaluation kit (EVK) helps designers evaluate the operation and performance of the LMH0344 3 Gbps HD/SD SDI Adaptive Cable Equalizer, LMH0346 3 Gbps HD/SD SDI Reclocker, and LMH0302 3 Gbps HD/SD SDI Cable Driver in a distribution amplifier configuration.

1 Introduction

The Texas Instruments SD3GDAEVK evaluation kit (EVK) helps designers evaluate the operation and performance of the LMH0344 3 Gbps HD/SD SDI Adaptive Cable Equalizer, LMH0346 3 Gbps HD/SD SDI Reclocker, and LMH0302 3 Gbps HD/SD SDI Cable Driver in a distribution amplifier configuration.

2 Setup

This section describes the connectors and jumpers on the board as well as how to properly connect, set up, and use the SD3GDAEVK.

2.1 Connector Descriptions

Conn6, Conn7 – VCC, GND are the DC power connectors. Conn6 and Conn7 should be powered with a DC voltage of 3.3V ± 5%.

Conn5 – SDI is the 75Ω BNC input connector for the LMH0344 data input. This input is intended to receive a single-ended input signal via a 75Ω coaxial cable (SMPTE 424M, SMPTE 292M, or SMPTE 259M standard levels and impedances).

Conn1, Conn2 – SDO, $\overline{\text{SDO}}$ are the 75Ω BNC output connectors for the LMH0302 data outputs. These outputs have onboard 4.7 µF AC-coupling capacitors (C3 and C4), and are SMPTE 424M, SMPTE 292M, or SMPTE 259M standard levels and impedances. The LMH0302 has a differential output driver, and when using only one output (one half of the differential pair), the unused output should be terminated with a 75Ω BNC termination.

Conn3, Conn4 – SCO/SDO2, $\overline{\text{SCO/SDO2}}$ are the 50Ω SMA output connectors for the LMH0346 secondary clock/data outputs. These outputs have onboard 4.7 µF AC-coupling capacitors (C15 and C16). The LMH0346 has a differential 50Ω CML output driver, and when using only one output (one half of the differential pair), the unused output should be terminated with a 50Ω SMA termination.

2.1.1 LMH0344 Cable Equalizer Controls and Indicators

J2 – $\overline{\text{CD}}$, MUTE is the jumper for monitoring $\overline{\text{CD}}$ and controlling MUTE. $\overline{\text{CD}}$ is asserted high when no signal is present at the LMH0344 input. MUTE may be used to force the LMH0344 outputs on or off, or tied to $\overline{\text{CD}}$ to allow automatic mute operation. To force the outputs off, set the jumper to tie MUTE to VCC. To force the outputs to be always on, set the jumper to tie MUTE to GND. For normal operation, set the jumper to tie $\overline{\text{CD}}$ to MUTE for automatic mute control.

J6 – BYPASS is the jumper for controlling the equalization bypass function. To put the equalizer into bypass mode, set this jumper to tie BYPASS to VCC. For normal operation (bypass turned off), leave J6 open.

D1 – $\overline{\text{CD}}$ is the LED for the $\overline{\text{CD}}$ status. This LED is GREEN when an input signal has been detected at the LMH0344 input, and OFF when no input signal is detected.

2.1.2 LMH0346 Reclocker Controls and Indicators

J1 – RATE0, RATE1 are the jumpers for controlling the reclocker serial data rate. These (two) jumpers may be set in any of the following three configurations:

1. RATE0=RATE1=GND for auto-rate mode (default mode if jumper is not set).
2. RATE0=VCC, RATE1=GND for 270 Mbps (SD) mode.
3. RATE0=GND, RATE1=VCC for 2967/2970 Mbps or 1483/1485 Mbps (HD/3G) mode.

J3 – SCO_EN is the jumper for selecting the function for the secondary output of the reclocker (SCO/SDO2). To select the serial clock, set the jumper to tie SCO_EN to VCC. To select the serial data output, set the jumper to tie SCO_EN to GND. The default selection (if jumper is not set) is for a second data output.

J4 – BYPASS/AUTO BYPASS is the jumper for selecting the bypass mode of the reclocker. Bypass mode (VCC) forces the device to output the data without reclocking it. Auto bypass (GND) is the default condition in which the device locks to and reclocks the data at supported data rates while automatically bypassing the reclocking function for unsupported data rates. The default selection (jumper is not set) is for auto bypass mode.

J8 – OUTPUT MUTE is the jumper for muting or enabling the reclocker outputs. To mute the outputs, set this jumper to tie OUTPUT MUTE to GND. To enable the outputs (normal operation), set the jumper to tie OUTPUT MUTE to VCC. The default selection (jumper is not set) is for the outputs to be enabled.

J10 – LOCK DETECT is the jumper for monitoring the reclocker lock detect status. This output provides an indication that the PLL is locked when high.

J9 – SD/HD is the jumper for monitoring the SD/HD output. This output indicates that the locked data rate is SD when high, and HD/3G when low. This output is only valid when the PLL is locked, and defaults to HD/3G (low) when the PLL is unlocked.

D2 – LOCK is the LED for the reclocker lock detect status. This LED is GREEN when the PLL is locked to the incoming data, and OFF when the PLL is not locked.

D3, D4 – SD/HD are the LEDs for the locked data rate. D4 is RED when the reclocker is locked to SD data. D3 is GREEN when the reclocker is locked to HD or 3G data.

2.1.3 LMH0302 Cable Driver Controls and Indicators

J5, J7 – SD/HD are the jumpers for controlling the slew rate of the cable driver output. The output complies with SMPTE 259M when high and SMPTE 424M / 292M when low. Two methods are provided to set the cable driver slew rate:

1. Auto Mode: Set J5 and leave J7 open. The LMH0346 will automatically detect the incoming data rate and control the LMH0302 slew rate. If the LMH0346 does not recognize the incoming data or is in Bypass mode, the slew rate will default to HD/3G.
2. Manual Mode: Pull J5 and set the J7 jumper to either SD or HD/3G to manually set the LMH0302 slew rate.

J11 – ENABLE is the jumper for controlling the cable driver power down function. Set this jumper to disable the cable driver. Leave this jumper open for normal operation.

2.2 Operation

Begin by applying 3.3V DC power to the Conn6 and Conn7 connectors on the board.

Set the control jumpers as desired. For default operation, set the following jumpers:

1. J2 set to tie CD to MUTE for automatic equalizer mute control.
2. J5 set to automatic LMH0346 control of the LMH0302 output slew rate.

All other jumpers may be left open if desired.

Apply a test signal via 75Ω coaxial cable to the Conn5 75Ω BNC input connector. The signal characteristics should be within the LMH0344 input specifications (typically the signal going into the cable will be a SMPTE 424M, SMPTE 292M, or SMPTE 259M compliant serial SDI signal). The LMH0344 equalizer will automatically adjust its gain to reverse the effects of the cable loss and restore the original signal.

The LMH0346 reclocker receives this signal and retimes it to reduce jitter. The primary reclocker output is sent to the LMH0302 cable driver, which drives SMPTE 424M, SMPTE 292M, or SMPTE 259M compliant serial SDI signals to the Conn1 and Conn2 75Ω BNC output connectors. Connect 75Ω coaxial cable to Conn1 and/or Conn2 to observe the single-ended output. If only one output is used, the other output should be terminated with a 75Ω BNC termination.

The secondary reclocker output may be observed via the Conn3 or Conn4 50Ω SMA output connector. Connect a matched pair of 50Ω SMA cables to Conn3 and Conn4 to observe the differential output, or connect the cable to either Conn3 or Conn4 to view the single-ended output. If only one output is used, the other output should be terminated with a 50Ω SMA termination.

To evaluate only the LMH0346 reclocker, set the J6 jumper to bypass equalization, and monitor the reclocker SCO/SDO2 outputs on Conn3 and Conn4.

3 Board Layout

Figure 1, Figure 2, Figure 3, Figure 4, and Figure 5 show the board layout for the SD3GDAEVK. The SD3GDAEVK is a 4-layer board (TOP / GND / VCC / BOTTOM).

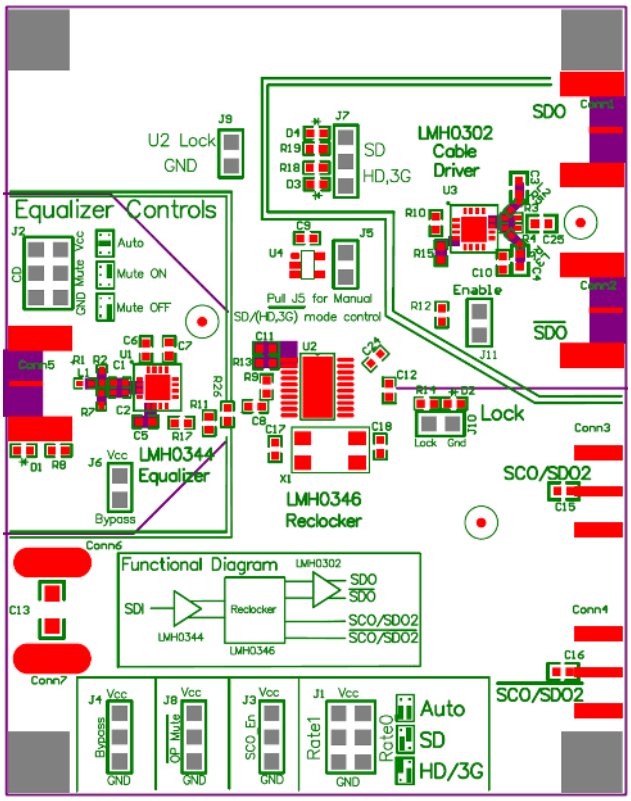

Figure 1. Top Assembly Layer

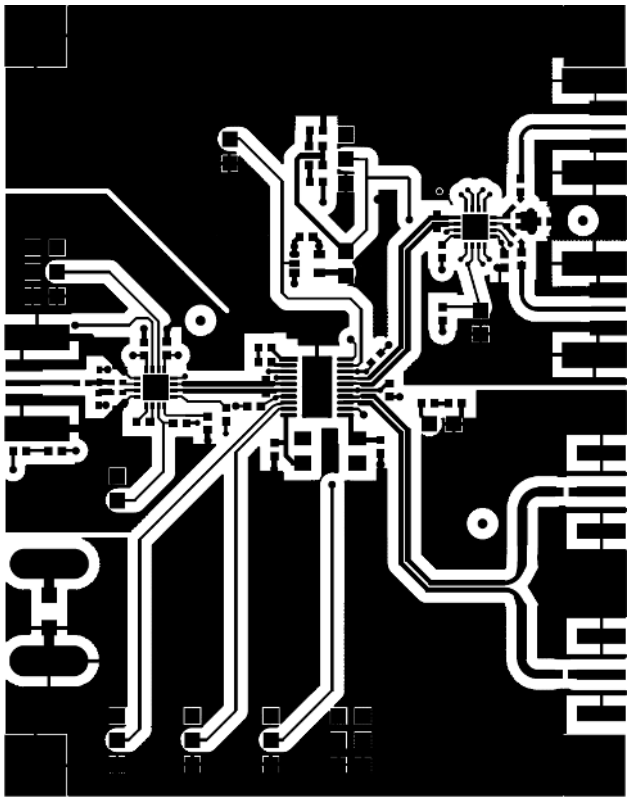

Figure 2. Top Layer

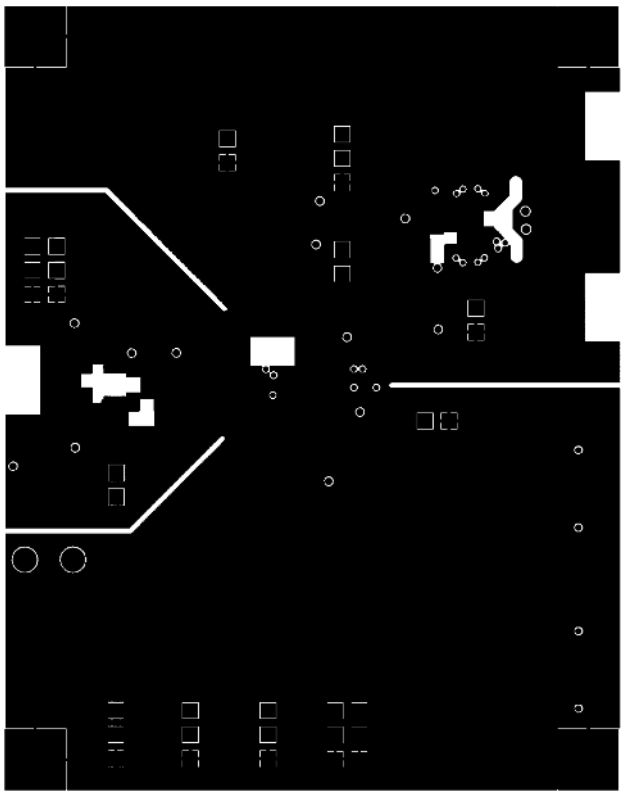

Figure 3. GND Layer

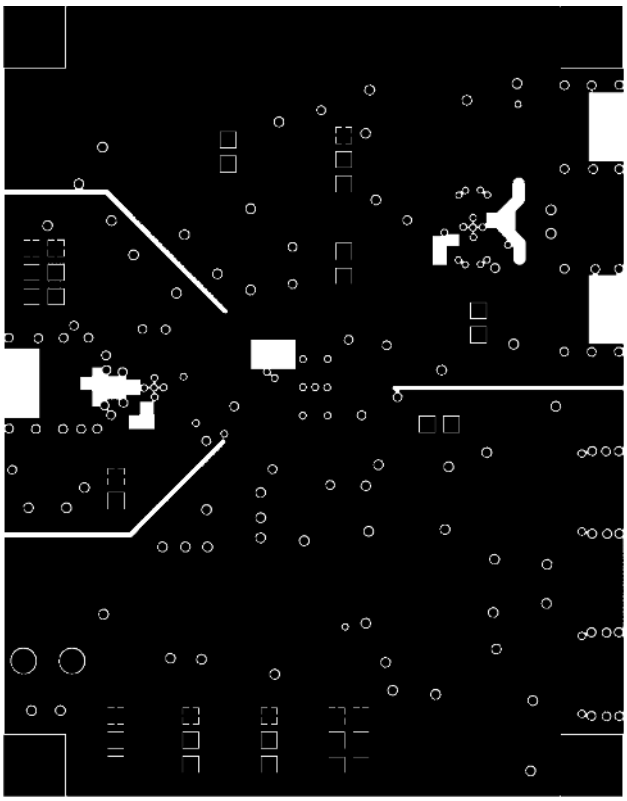

Figure 4. VCC Layer

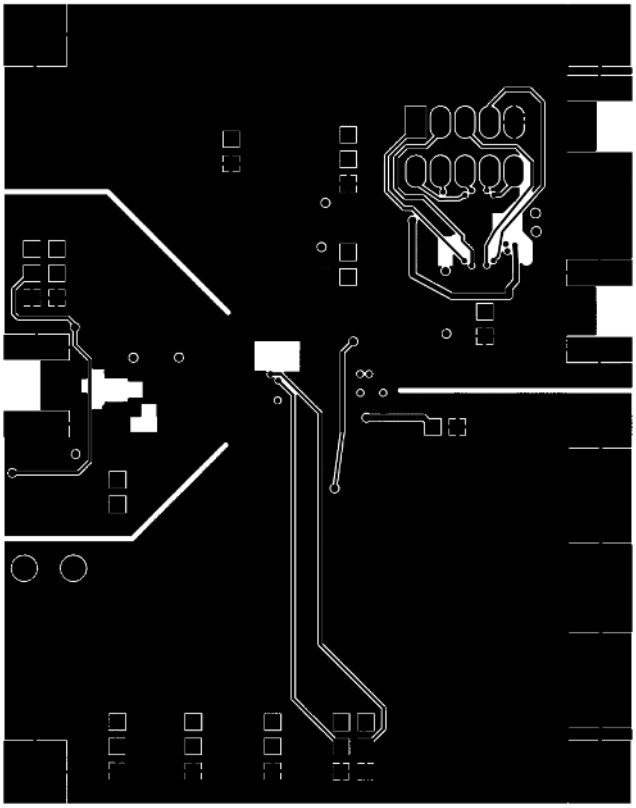

Figure 5. Bottom Layer

4 Schematic

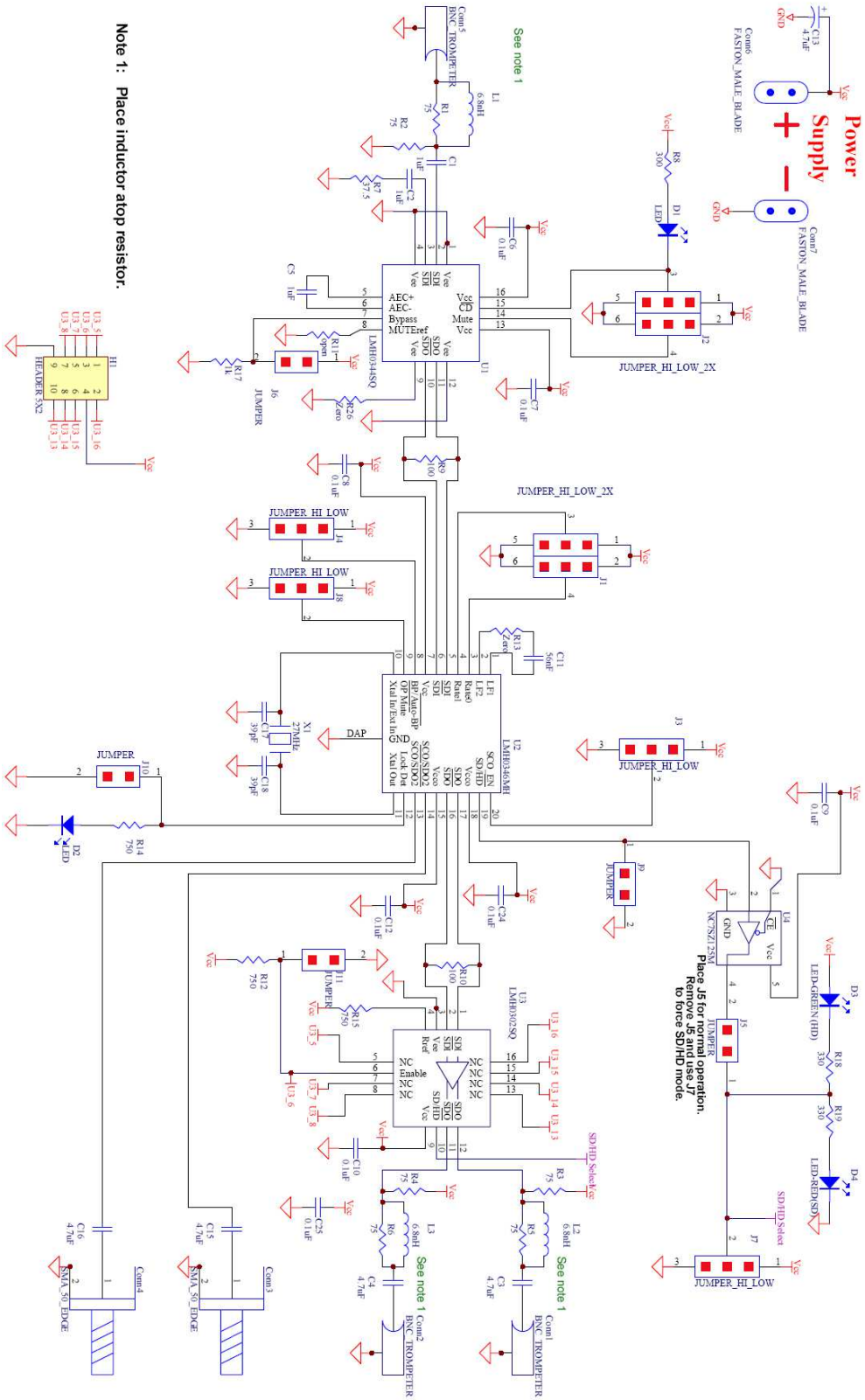

Figure 6. Schematic

5 Bill of Materials

Table 1. Bill of Materials

Reference Designator	Description	Manufacturer	Part Number
C1, C2	Capacitor, 1µF, 10V, X5R, 0402	Murata	GRM155R61A105KE15D
C11	Capacitor, 56nF, 16V, X7R, 0603	Murata	GRM188R71C563KA01D
C13	Capacitor, 4.7µF, 16V, X7R, 1206	TDK	C3216X7R1C475K160AB
C17, C18	Capacitor, 39pF, 50V, NP0, 0603	TDK	C1608C0G1H390J080AA
C3, C4, C15, C16	Capacitor, 4.7µF, 6.3V, X5R, 0603	Murata	GRM188R60J475KE19D
C5	Capacitor, 1µF, 16V, X5R, 0603	Murata	GRM188R61C105KA93D
C6, C7, C8, C9, C10, C12, C24, C25	Capacitor, 0.1µF, 25V, X7R, 0603	Kemet	C0603C104J3RACTU
Conn3, Conn4	SMA, 50Ω, Edge Launch	Johnson	142-0701-851
Conn1, Conn2, Conn5	BNC, 75Ω, Edge Launch	Trompeter	UCBJE20-1
Conn6, Conn7	Power Supply Terminal	Keystone	1287-ST
D1, D2, D3	LED, Green, 0603	Lite-On	LTST-C190GKT
D4	LED, Red, 0603	Lite-On	LTST-C190KRKT
J1, J2	Header, 2x3, 0.1"	3M	929836-02-36-RK
J3, J4, J7, J8	Header, 1x2, 0.1"	3M	929834-02-36-RK
J5, J6, J9, J10, J11	Header, 1x3, 0.1"	3M	929834-02-36-RK
L1, L2, L3	Inductor, 6.8nH, 0402	Murata	LQP15MN6N8B02D
R1, R2, R3, R4, R5, R6	Resistor, 75Ω, 1%, 0402	Yageo America	RC0402FR-0775RL
R13, R26	Resistor, 0.0Ω 5%, 0603	Panasonic ECG	ERJ-3GEY0R00V
R12, R14, R15	Resistor, 750Ω, 5%, 0603	Panasonic ECG	ERJ-3GEYJ751V
R17	Resistor, 1kΩ, 1%, 0603	Yageo America	RC0603FR-071KL
R18, R19	Resistor, 330Ω, 5%, 0603	Panasonic ECG	ERA-V15J331V
R7	Resistor, 37.4Ω, 1%, 0402	Panasonic ECG	ERJ-2RKF37R4X
R8	Resistor, 300Ω, 5%, 0603	Panasonic ECG	ERJ-3GEYJ301V
R9, R10	Resistor, 100Ω, 1%, 0603	Panasonic ECG	ERJ-3EKF1000V
U1	IC, SDI Cable Equalizer, LLP-16	TI	LMH0344SQ
U2	IC, SDI Reclocker, eTSSOP-20	TI	LMH0346MH
U3	IC, SDI Cable Driver, LLP-16	TI	LMH0302SQ
U4	IC, 3-state buffer, SOT-23	Fairchild Semi	NC7SZ125M
X1	Crystal, 27MHz	Abracon	ABMM-27.000MHZ-B2-T

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

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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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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

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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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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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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
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