SN65HVD101 and SN65HVD102 EVM User's Guide

This user's guide describes the SN65HVD101 and SN65HVD102 evaluation module (EVM). Hereafter in this document, SN65HVD101 and SN65HVD102 will be referred to as SN65HVD10x. This EVM helps designers evaluate the device performance, supporting the fast development and analysis of IO-Link transmission systems using the SN65HVD10x IO-Link physical layer devices.

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1 Features

The features of this EVM are listed below:

- Configurable CQ Output: push-pull, high-side, or low-side for SIO mode
- 3.3-V and 5-V configurable integrated LDO (SN65HVD101 only)
- Remote wake-up indicator
- Current-limit indicator
- Configurable current limits
- 9-V to 36-V supply range
- Power Good indicator
- Over-temperature protection
- Reverse polarity protection
- Tolerant to 50-V peak line voltage
- 20-pin QFN package, 3.5 mm × 4 mm

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2 EVM Overview

2.1 Evaluating the SN65HVD10x

The SN65HVD10x IO-LINK PHYs implement the IO-LINK interface for industrial point-to-point communication. When the device is connected to an IO-Link master through a 3-wire interface, the device will respond to communication initiated by the master. These PHY devices will exchange data with the Master node, acting as a complete physical layer for bi-directional communication. The SN65HVD101 device integrates a linear regulator that generates either 3.3 V or 5 V from the 24-V-nominal IO-Link L+ voltage for supplying power to the PHY as well as a local controller and additional circuits. The SN65HVD102 operates from an external 3.3-V or 5-V local supply connected to VCC_IN and GND on TB2 (see Figure 1 and Figure 2 for location).

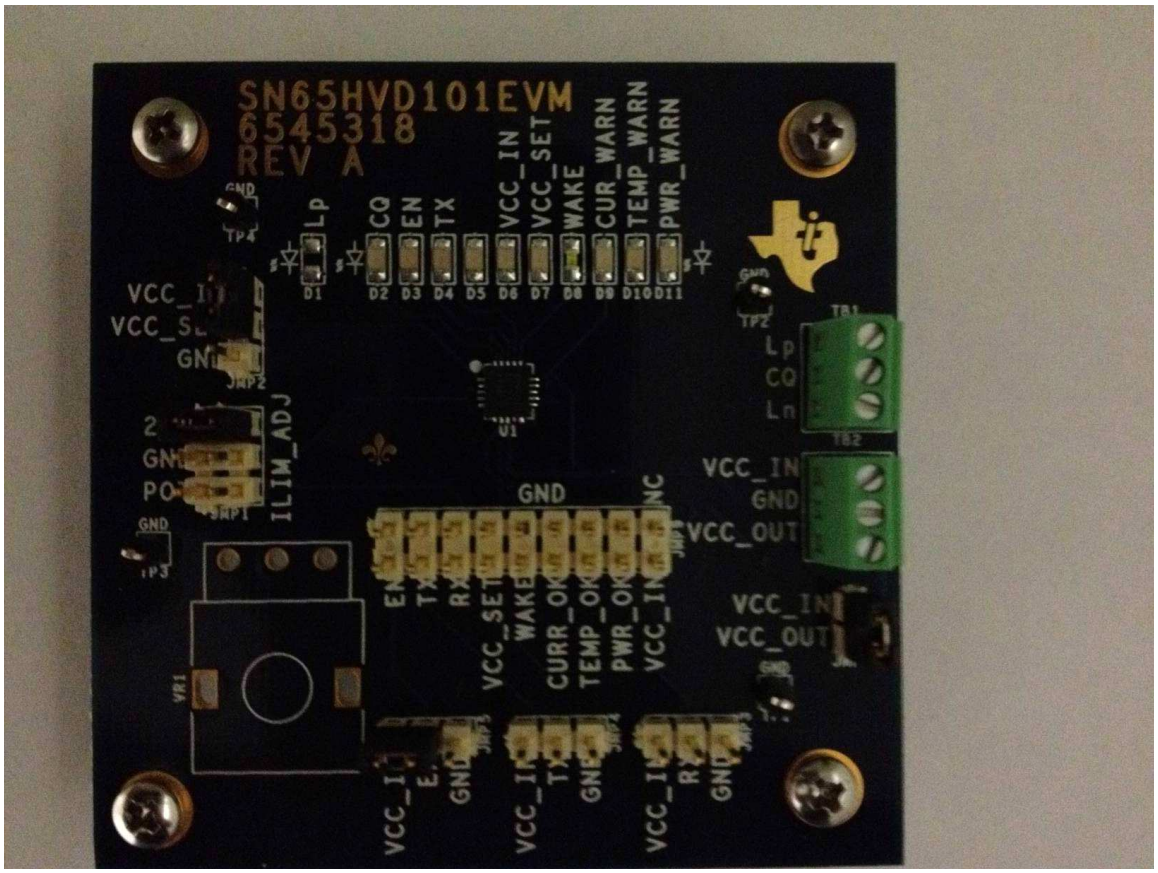


Figure 1. SN65HVD101 EVM Board

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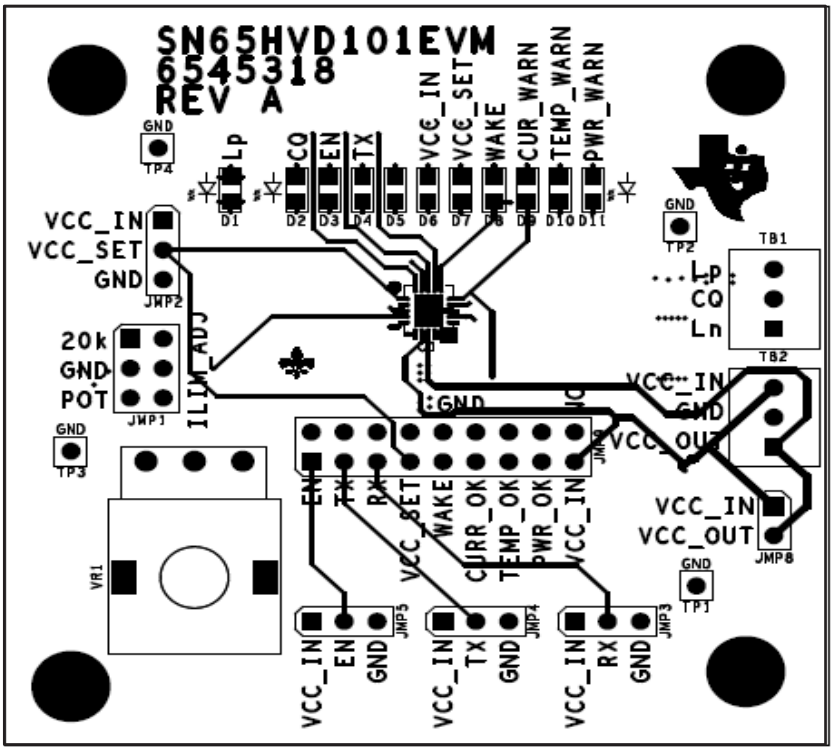


Figure 2. SN65HVD101 EVM Board Layout

3 EVM Setup and Precautions

To evaluate the performance of the SN65HVD101 you need the following equipment:

1. Power supply capable of supplying 3.3 V. 5 V if using the SN65HVD102 device.

2. Power supply capable of supplying 24 V across Lp (supply) and Ln (GND), if using the SN65HVD101 device.

3. Oscilloscope note: The IO-Link uses industrial 24-V signaling; oscilloscope probes should be chosen which will not be damaged by voltage levels up to 30 V.

4. IO-Link Master Node with appropriate 3-wire cable with Lp, Ln and CQ signals.

5. Local microcontroller, or equivalent, to communicate with the SN65HVD10x IO-Link PHY via the controller interface pins.

3.1 SN65HVD101 EVM Setup

With an appropriate IO-Link cable, connect the Lp, Ln, and CQ pins from TB1 on the EVM board to an IO-Link Master node.

3.3-V or 5-V supply operation

On JMP2 if a shunt is placed on VCC_SET to GND, the internal voltage regulator will supply 3.3 V. If no shunt is placed on JMP2, the VCC_SET input will float and the internal regulator will supply 5 V.

On the SN65HVD101 device, VCC_IN is a voltage-sense feedback signal. When using the SN65HVD101 EVM, place a shunt over VCC_IN and VCC_OUT on JMP8.

ILIM_ADJ – Current Limit Adjust

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JMP1 sets the current limit. Placing a shunt across 20K (pins 1-2) on JMP1 limits the current at the CQ pin to 100 mA. Placing a shunt across GND (pins 3-4) on JMP1 limits the current to 400 mA. When working with the SN65HVDHVD102 EVM, leave the shunt off and provide the 3.3-V or 5-V supply to the VCC_IN terminal.

Microcontroller / IO-LINK Interface Signals

From the microcontroller, connect the EN (enable) signal to the EN post on JMP5, the microcontroller TX signal to the EVM TX post on JMP4, the RX signal to the RX post on JMP3. Connect the master's WAKE signal to the WAKE post on JMP9, and the master CUR_OK signal to the CURR_OK post on JMP9. An example is shown below in Figure 3.

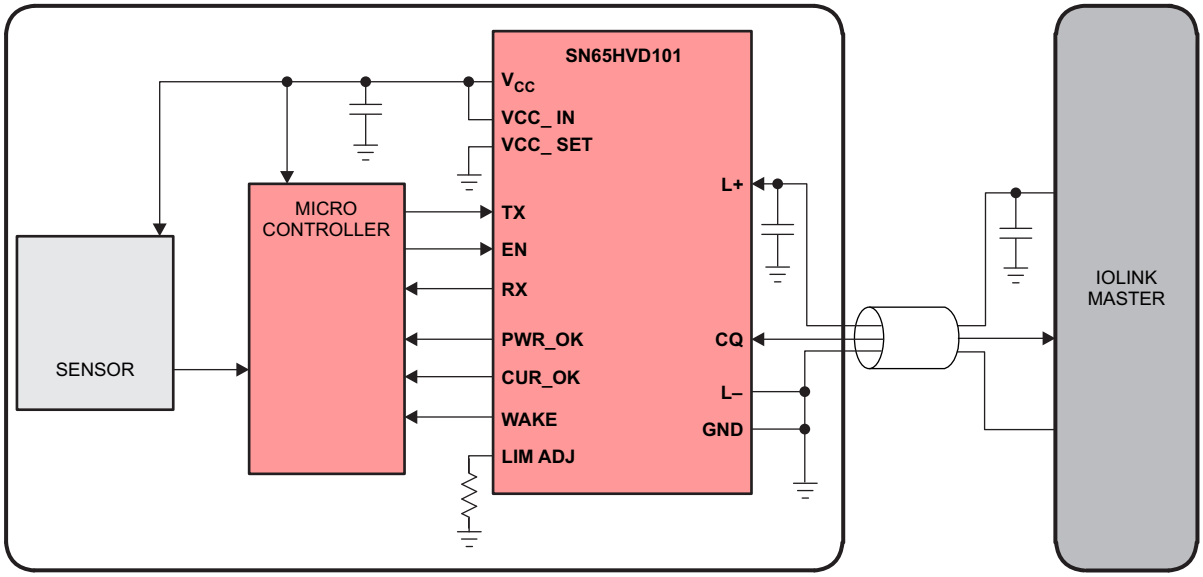


Figure 3. IO-Link Application Example

3.2 EVM Jumper Settings

Table 1. EVM Jumper Settings

Jumper	Description	Setting	Result
JMP1	CQ current limit adjust	OPEN	NA
		20K – GND	100mA (Default)
		POT-GND	400mA
JMP2	Power Supply Selection	OPEN	5V Supply
		VCC_SET – GND	3.3V Supply (Default)
		VCC_SET – VCC_IN	5V Supply (internal pull-up on VCC_SET)
JMP3	RX Input	OPEN	RX signal to microcontroller
JMP4	TX Input	OPEN	TX signal to microcontroller
JMP5	Driver Enable/Disable	VCC_IN – EN	Driver is enabled
		EN – GND	Driver is disabled
JMP8	HVD101 - Voltage Sense Feedback	VCC_IN – VCC_OUT	Voltage Sense Feedback for the HVD101 internal voltage regulator
	HVD102 - Input Voltage Supply	OPEN	VCC_IN = Supplied Vcc
JMP9	Microcontroller interface		Contact pins for interfacing with a microcontroller

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Table 2. Status LEDs

LED	NAME	FUNCTION
D2	CQ	ON – CQ voltage present
		OFF – No CQ voltage present
D3	EN	ON – Transmitter enabled
		OFF – Transmitter disabled
D4	TX	ON - TX voltage greater than 2V
		OFF – TX voltage less than 2V
D5	RX	ON - RX voltage greater than 2V
		OFF – RX voltage less than 2V
D6	VCC_IN	ON – VCC_IN voltage greater than 2V
		OFF – VCC_IN voltage less than 2V
D7	VCC_SET	ON – Vcc =3.3V
		OFF – Vcc = 5V
D8	WAKE	ON – WAKE notification from the PHY to the local controller
		OFF – No WAKE event
D9	CUR_WARN	ON – CQ over-current fault
		OFF – CQ current OK
D10	TEMP_WARN	ON – Internal temperature approaching thermal shutdown
		OFF – Internal temperature OK
D11	PWR_WARN	ON – Power Fail. Lp and Vcc voltages are not at correct levels
		OFF – Power OK, Lp and Vcc voltages are at correct levels

Table 3. Bill Of Materials

Item	Qty	Reference	Part	Footprint	Mfr	Part Number	Notes
1	1	C1	10uF	805	Taiyo Yuden	EMK212BJ106KG-T	
2	1	C2	1uF		TDK	C1608X7R1C105K	
3	1	C3	0.1uF		Murata	GRM188R71H104KA93D	
4	1	C4	3.3uF		TDK	C3216X7R1H335K	
5	1	C5	DNI		DNI	NA	
6	6	D2,D3,D4,D5,D6,D7	GREEN		Lumex Opto	SML-LXT0805GW-TR	
7	1	D8	WHITE		Panasonic- SSG	LNJ037X8ARA	
8	3	D9,D10,D11	YELLOW		Lumex Opto	SML-LXT0805YW-TR	
9	1	JMP1	Header 2x3	HDR_THVT_2x3_100	Samtec	HTSW-103-07-G-D	Shunt pins 1-2
10	2	JMP2	Header 1x3	HDR_THVT_1X3_100	Samtec	HTSW-103-07-G-S	Shunt pins 1-2
11	4	JMP3, JMP4, JMP5	Header 1x3	HDR_THVT_1X3_100	Samtec	HTSW-103-07-G-S	
12	1	JMP8	Header 1x2	HDR_THVT_1X2_100	Samtec	HTSW-102-07-G-D	Shunt pins 1-2
13	1	JMP9	Header 2x9	HDR_THVT_2x9_100	Samtec	HTSW-109-07-G-D	
14	1	R1	10k ohm	603	Yageo	RC0603FR-0710KL	
15	9	R2,R3,R4,R5,R6,R7,R8, R9,R10	3.5k ohm	603	Panasonic-ECG	ERJ-3EKF3571V	
16	1	R11	20k ohm	1206	Panasonic-ECG	ERJ-8ENF2002V	
17	1	R12	0 ohm	1210	KOA Speer	RK73Z2ETTE	
18	2	TB1, TB2	Terminal Block 1x3	TB_THRTSCR_1x3_100	Phoenix Contact	1725669	

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Table 3. Bill Of Materials (continued)

19	4	TP1, TP2, TP3, TP4	Test Point		Keystone	5001	
20	1	U1	HVD101/102	HVD10X_VQFN_20RGB	Texas Instruments	SN65HVD101 or SN65HVD102	
21	1	VR1	DNI	THVT_VR_CTS_Series296	DNI	DNI	
22	4		Shunts	NA	Kobiconn	151-8000-E	
23	4		Standoffs	140mil Drill hole	Keystone Electronics	2027	
24	4		Screws	140mil Drill hole	Building Fasteners	PMSSS 440 0025 PH	
25	1	D1	DNI	C170	DNI	DNI	DNI

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3.3 SN65HVD101 Schematic

Figure 4 is the schematic for the SN65HVD101 EVM.

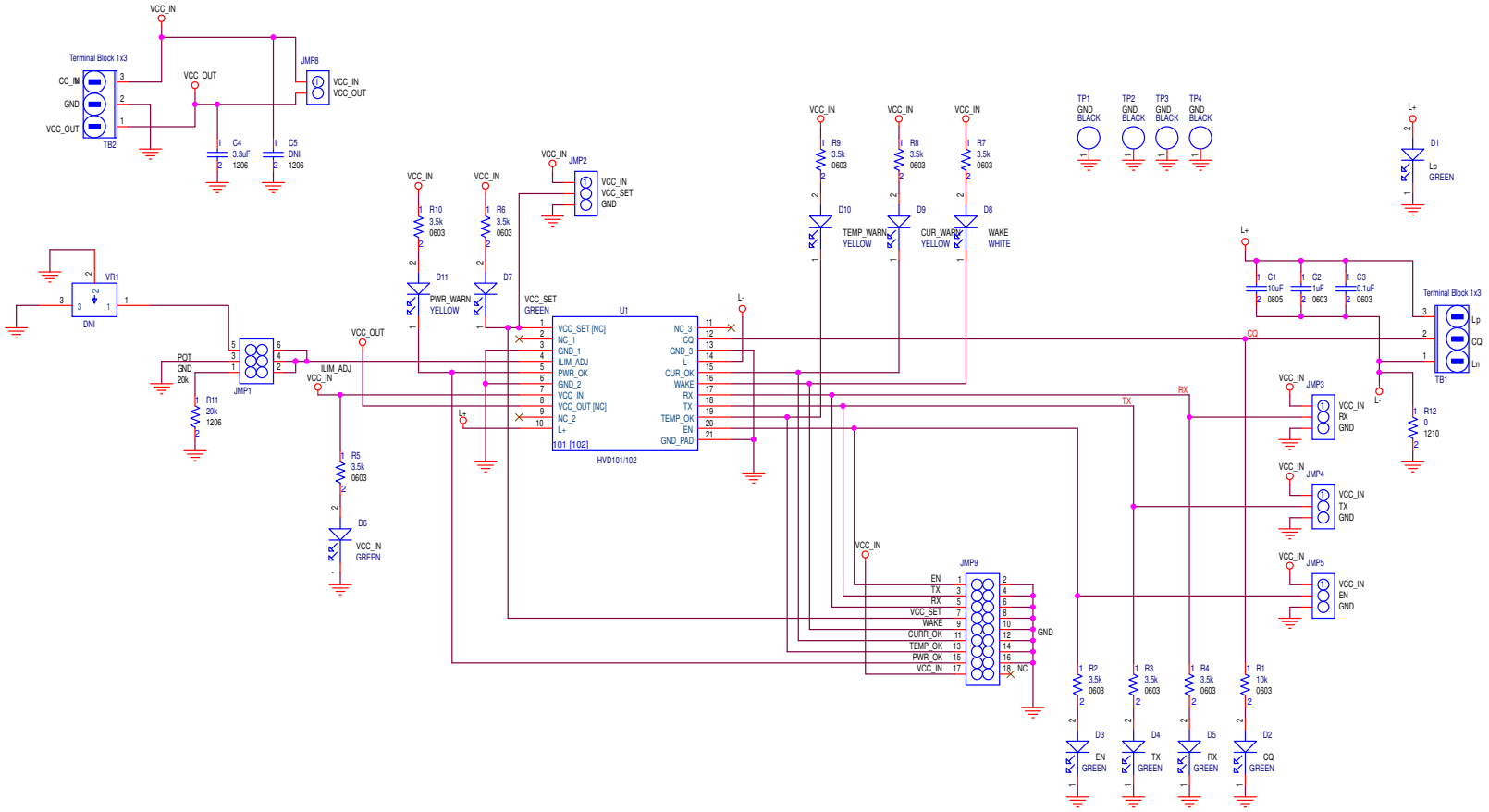


Figure 4. SN65HVD101 Schematic

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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.

For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant

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.

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 his 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.

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.

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.

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.

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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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