

SN65LVPE512 EVM

The SN65LVPE512 is a dual-channel, single lane USB 3.0 redriver and signal conditioner that supports data rates of 5 Gbps. This document explains how to use the LVPE512 EVM to easily evaluate the functionality of this device in various applications.

This EVM acts as a modifiable reference design for the SN65LVPE512 that allows this device to be used in a wide variety of applications and configurations. [Table 1](#) explains how to modify these configuration settings by using the switches on the EVM. Example applications for this device include notebooks, desktops, docking stations, servers, and workstations. Schematics, printed-circuit-board (PCB) layout images, and a bill of materials (BOM) for this module are included in this user's guide.

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1 Introduction

The SN65LVPE512 is a dual-channel, single lane USB 3.0 redriver and signal conditioner supporting data rates of 5 Gbps. The device complies with USB 3.0 specification revision 1.0, supporting electrical idle condition and low-frequency periodic signals (LFPS) for USB 3.0 power management modes.

The SN65VLPE512 minimizes signal degradation effects such as crosstalk and inter-symbol interference (ISI) that limit interconnect distance between two devices. The input stage of each channel offers adjustable equalization that compensates for the distortion the USB 3.0 input signal experienced. The output stage offers adjustable de-emphasis that will compensate for distortion the output signal will experience. The optimal equalization and de-emphasis levels will depend on the length of the input and output interconnections. The SN65VLPE512 provides a unique way to tailor output de-emphasis on a per-channel basis with use of the DE and OS pins. All TX and RX equalization and de-emphasis settings are programmed by six 3-state pins as shown in [Table 1](#).

2 LVPE512 Evaluation Module

This sections contains the kit contents and operational description of the EVM as well as configuration instructions and suggested default settings.

3 Kit Contents

- 1 SN65LVPE512 Evaluation Module
- This user manual

3.1 Operational Description of EVM

This EVM facilitates the simple evaluation of the LVPE512 USB 3.0 redriver by providing an easy and efficient method for changing the configuration settings of the device. Physical switches on the EVM are used to modify these settings by altering the state of the programmable 3-state configuration pins. Further information on how to use these switches to configure the device is found in [Table 1](#).

The EVM board includes one USB 3.0 plug and one USB 3.0 receptacle to allow for device interconnections. The EVM board is powered by a 3.3-V supply voltage, which is derived from the internal VBUS power supply of the USB connection, therefore, no external power source is required for the EVM to operate.

Table 1. Configuration of EVM

Switch	Pin Description	Switch Position and Corresponding Setting
SW1	DE1 (De-emphasis channel 1)	1: –3.5 dB 2: 0 dB 3: –6.0 dB
SW2	EQ1 (Equalization channel 1)	1: 7 dB 2: 0 dB 3: 15 dB
SW3 ⁽¹⁾	OS1 (Output swing channel 1)	1: 1105 mVpp 2: 1241 mVpp 3: 1324 mVpp
SW4	DE2 (De-emphasis channel 2)	1: –3.5 dB 2: 0 dB 3: –6.0 dB
SW5	EQ2 (Equalization channel 2)	1: 7 dB 2: 0 dB 3: 15 dB
SW6 ⁽¹⁾	OS2 (Output swing channel 2)	1: 1105 mVpp 2: 1241 mVpp 3: 1324 mVpp
SW7	EN_RXD	1: Enabled 2: N/A (two position switch) 3: Sleep Mode

⁽¹⁾ SW3, SW6 have incorrectly labeled settings on their silkscreen.

Table 1. Configuration of EVM (continued)

Switch	Pin Description	Switch Position and Corresponding Setting
SW9	Power source selection	1: 3.3 V from Regulator 2: N/A (two position switch) 3: VCC from external source on JMP1
SW10	NC	N/A

Table 2. Suggested Default Settings

Switch	Pin Description	Switch Position and Corresponding Setting
SW1	DE1 (De-emphasis channel 1)	2: 0 dB
SW2	EQ1 (Equalization channel 1)	2: 0 dB
SW3	OS1 (Output swing channel 1)	2: 1241 mVpp
SW4	DE2 (De-emphasis channel 2)	2: 0 dB
SW5	EQ2 (Equalization channel 2)	2: 0 dB
SW6	OS2 (Output swing channel 2)	2: 1241 mVpp
SW7	EN_RXD	1: Enabled
SW9	Power source selection	1: 3.3 V from USB VBUS
SW10	NC	N/A

4 PCB Construction

This section contains the EVM board schematics and the PCB board layouts.

4.1 EVM Board Schematics

Figure 1 through Figure 4 illustrate the SN65LVPE512 EVM schematics.

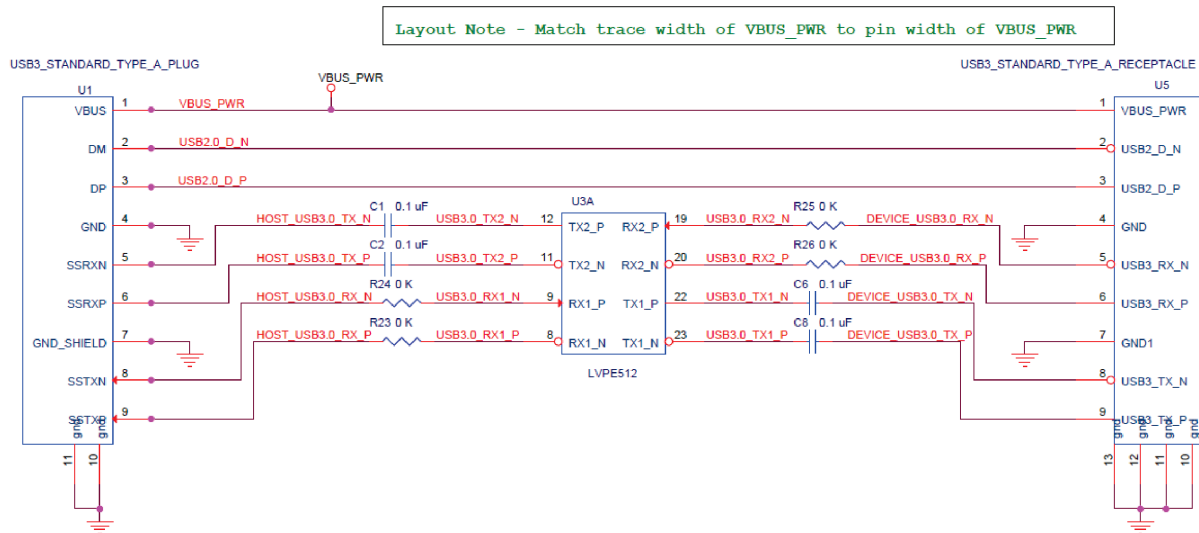


Figure 1. Schematic of High Speed Pins

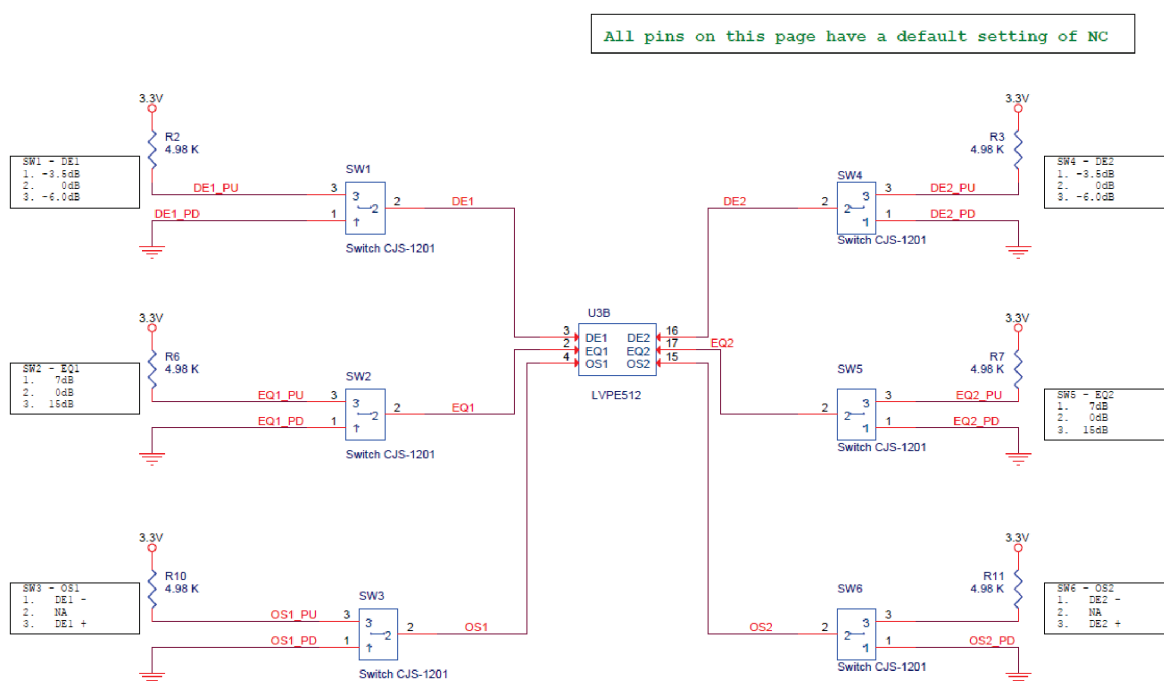
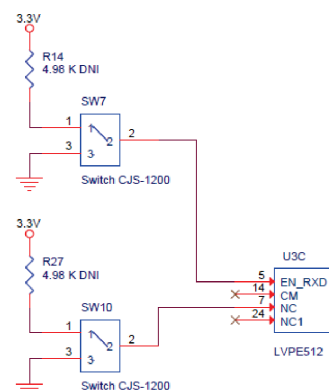


Figure 2. Schematic of EQ Control Pins



EN_RXD default value = 3.3 V (internally pulled up by LVPE512)
Switch on pin 7 added for 502B compatibility

Figure 3. Schematic of Device Control Pins

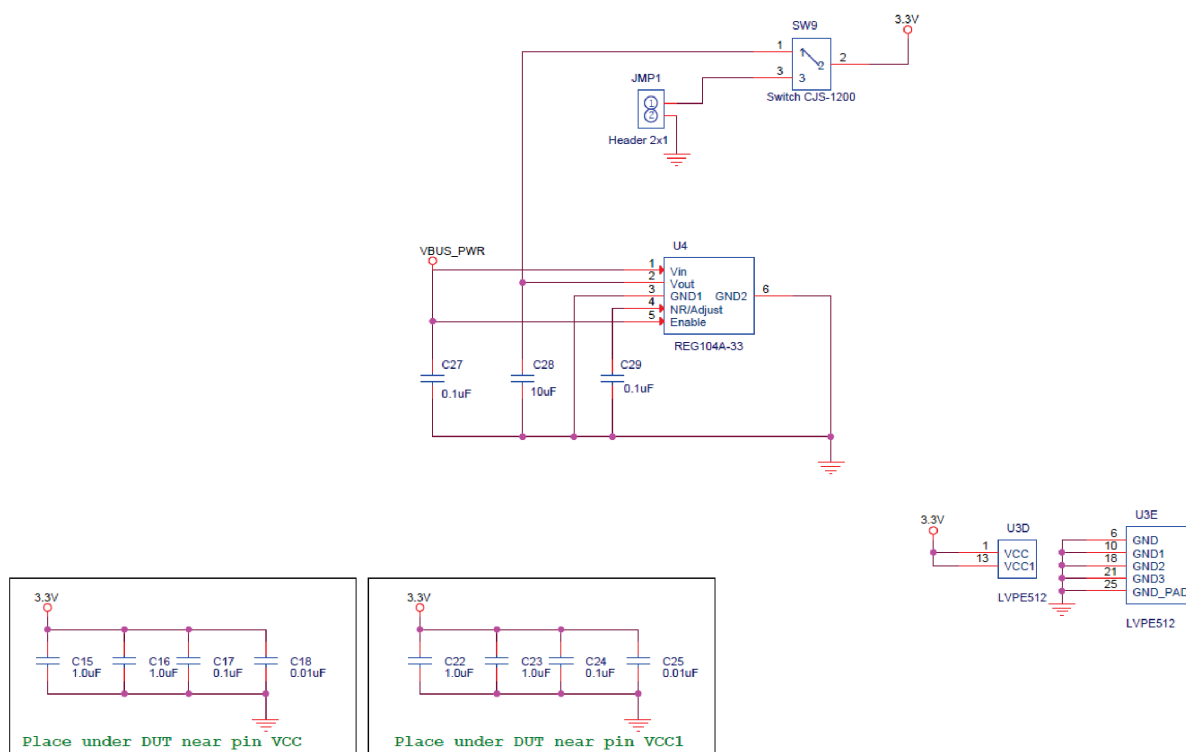


Figure 4. Schematic of Power Pins

4.2 EVM PCB Layout

Figure 5 through Figure 8 illustrate the SN65LVPE512 PCB layouts.

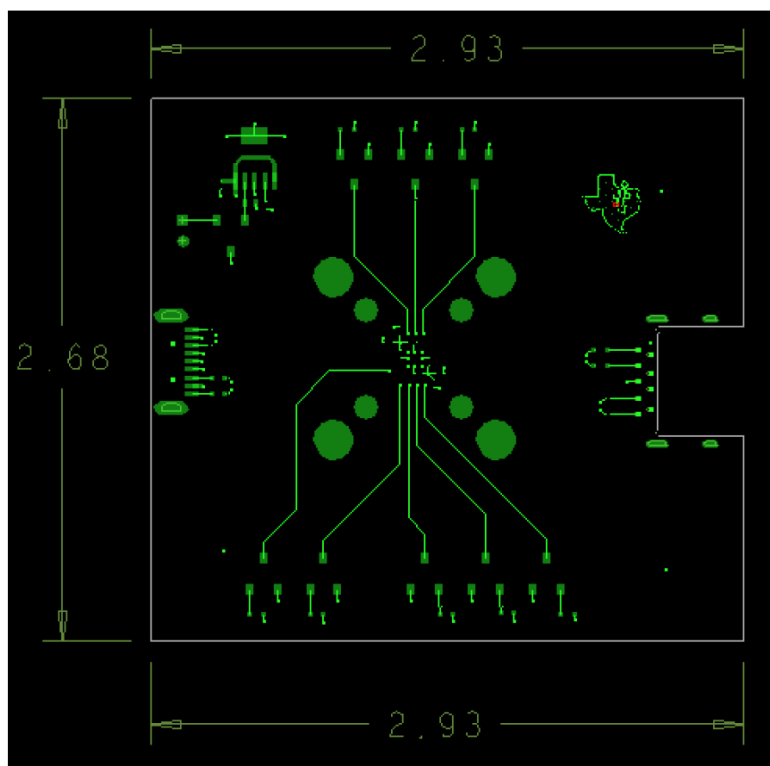


Figure 5. PCB Layout of Top Layer

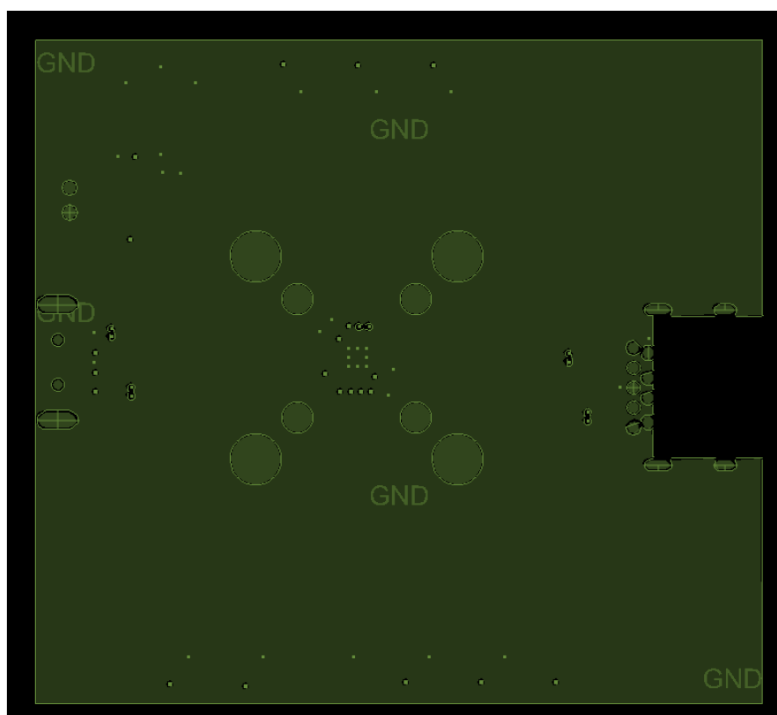


Figure 6. PCB Layout Second Layer

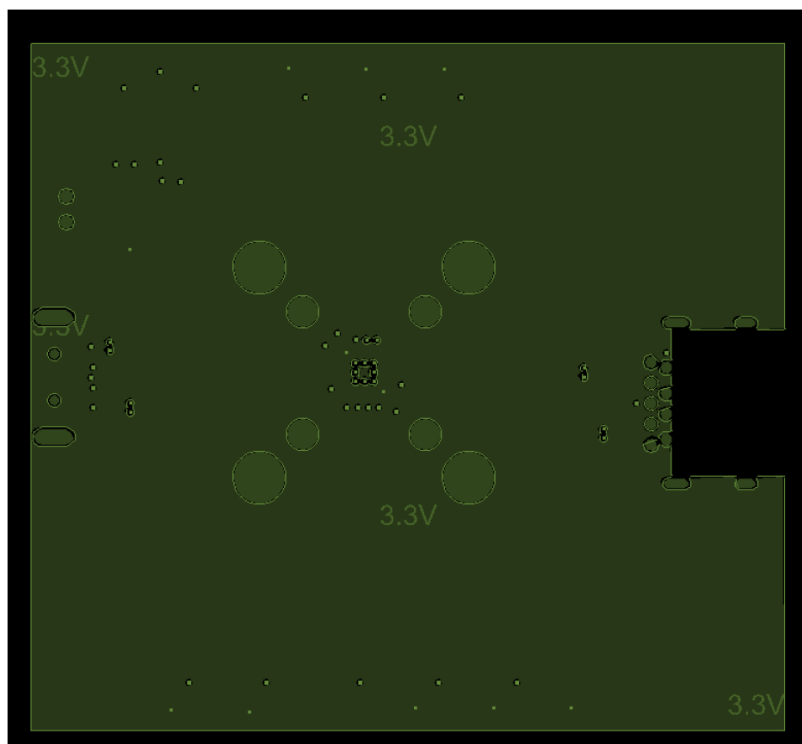


Figure 7. PCB Layout of Third Layer

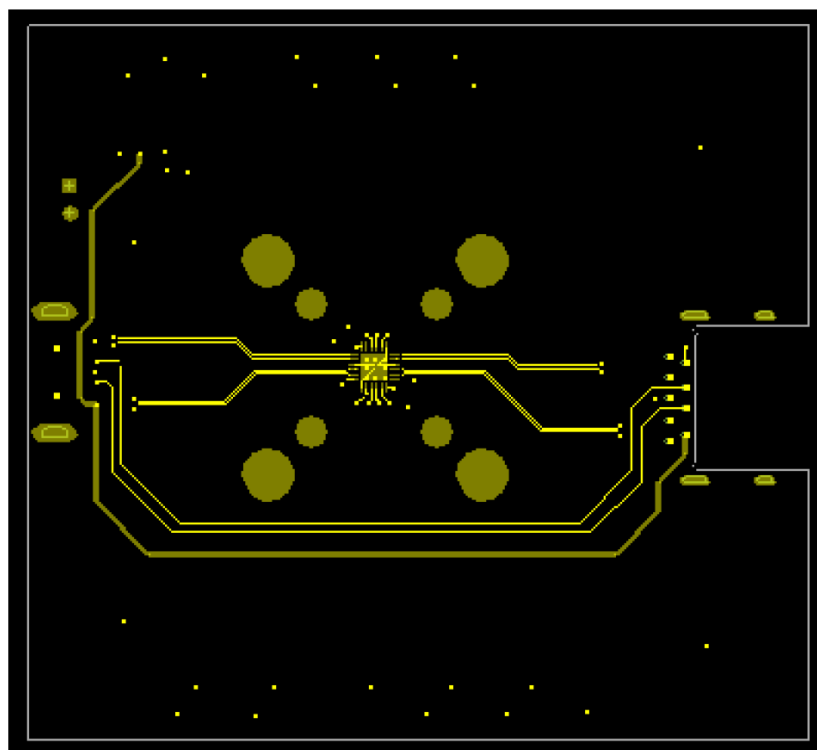


Figure 8. PCB Layout of Bottom Layer

4.3 EVM PCB Fabrication

The EVM board is a 4-layer board constructed of FR4-PolyClad 370 material. The board consists of a signal layer on top, a ground layer, a power layer, and another signal layer on the bottom. The impedance of the differential traces is 100 Ω . Other traces have an impedance of 50 Ω .

NOTE: In order to achieve the desired impedance, it is recommended that you consult your board manufacturer for their process and design requirements.

5 EVM Bill of Materials

Table 3 lists the SN65LVPE512 EVM BOM.

Table 3. SN65LVPE512 EVM Bill of Materials

QTY	Reference	Value	Digi-Key P/N	PCB Footprint	Manufacturer P/N
4	C1, C2, C6, C8	0.1 μ F	490-3167-2-ND	cc0201	GRM033R60J104KE19D
4	C15, C16, C22, C23	1.0 μ F	490-1320-2-ND	cc0402	GRM155R60J105KE19D
4	C17, C24, C27, C29	0.1 μ F	587-1227-2-ND	cc0402	LMK105BJ104KV-F
2	C18, C25	0.01 μ F	399-1011-2-ND	cc0402	C0402C100J5GACTU
1	C28	10 μ F	587-3383-2-ND	cc0603	JMK107ABJ106MAHT
1	JMP1	Header 2x1	10046483-202HLF-ND	berg2	10046483-202HLF
6	R2, R3, R6, R7, R10, R11	4.98 K	311-4.99KHRCT-ND	r0603	RC0603FR-074K99L
2	R14, R27	4.98 K DNI	311-4.99KHRCT-ND	r0603	RC0603FR-074K99L
4	R23, R24, R25, R26	0 K	311-0.0GRCT-ND	r0603	RC0603JR-070RL
6	SW1–SW6	Switch CJS-1201	563-1023-1-ND	CJS-1200B	CJS-1201TA
3	SW7, SW9, SW10	Switch CJS-1200	563-1022-1-ND	CJS-1200B	CJS-1200TB
1	U1	USB3_STANDARD_TYPE_A_PLUG	732-3157-ND	usb3_plug_wurth_elektronik	6.92112E+11
1	U3	LVPE512	SN65LVPE512RMQR-ND	24QFN04_0_50	SN65LVPE512RMQR
1	U4	REG104A-33	REG104GA-3.3-ND	DCQ_R-PDSO-G6	REG104GA-3.3
1	U5	USB3_STANDARD_TYPE_A_RECEPTACLE	732-3148-1-ND	usb3_recpt_wurth_elektronik	6.92121E+11

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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.

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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.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-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.

Concernant les EVMs avec appareils radio:

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.

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.

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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