User's Guide
SLVU956B–December 2013–Revised April 2018

TPS6128xEVM-586 Evaluation Module

This User's Guide describes the characteristics, operation, and use of the TPS6128x evaluation module (EVM). This EVM enables test and evaluation of Texas Instruments' TPS61281 and TPS61282 devices, each a 2.3-MHz (typ.), up to 4.8-V, step-up dc-dc converter with integrated Pass-Through Mode. This User's Guide includes EVM specifications, user software description, the schematic diagram, bill of materials, and board layout. After the release of the A-version device in the summer of 2014, the EVM is assembled with the TPS6128xA (supports PWM mode during startup which is not available for TPS6128x). In 2018, the EVM is assembled with D-version device TPS6128xD.

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Trademarks

1 Introduction

The TPS61281 and TPS61282 devices each provide a power-supply solution for products powered by either a three-cell alkaline, NiCd or NiMH battery, or a single-cell Li-Ion or Li-polymer battery. The wide input voltage range is ideal for portable power applications such as mobile phones or computer peripherals. In addition, the TPS61281 and TPS61282 can also maintain output biased at the input voltage level. In this mode, the synchronous rectifier is current-limited, and allows external loads (for example, an audio amplifier) to be powered with a restricted supply. In this mode, quiescent current is reduced to 18 μA. Input current in shutdown mode is less than 5 μA in order to maximize battery life.

1.1 Requirements

The TPS6128xEVM is designed to operate over the full input voltage range and produces a fixed, predefined output voltage.

In order to operate this EVM, only a dc power supply able to deliver between 2.3 V and 4.8 V is required.

1.2 Applications

- Single-Cell Ni-Rich, Si-Anode, Li-Ion, LiFePO4 smart-phones or tablet PCs
- 2.5G, 3G, 4G mini-module data cards
- Current-limited applications featuring high peak power loads

1.3 Features

- 95% efficiency at 2.3-MHz operation
- V_{IN} range from 2.3 V to 4.8 V
- 2-μA quiescent current in low IQ pass-through mode
- Integrated pass-through mode (35 mΩ)
- Programmable valley inductor current limit and output voltage via I²C interface
- True pass-through mode during shutdown
- Thermal shutdown and overload protection
- Total Solution Size <20 mm², sub 1-mm Profil

2 TPS6128xEVM Schematic

Figure 1 illustrates the TPS6128xEVM schematic.

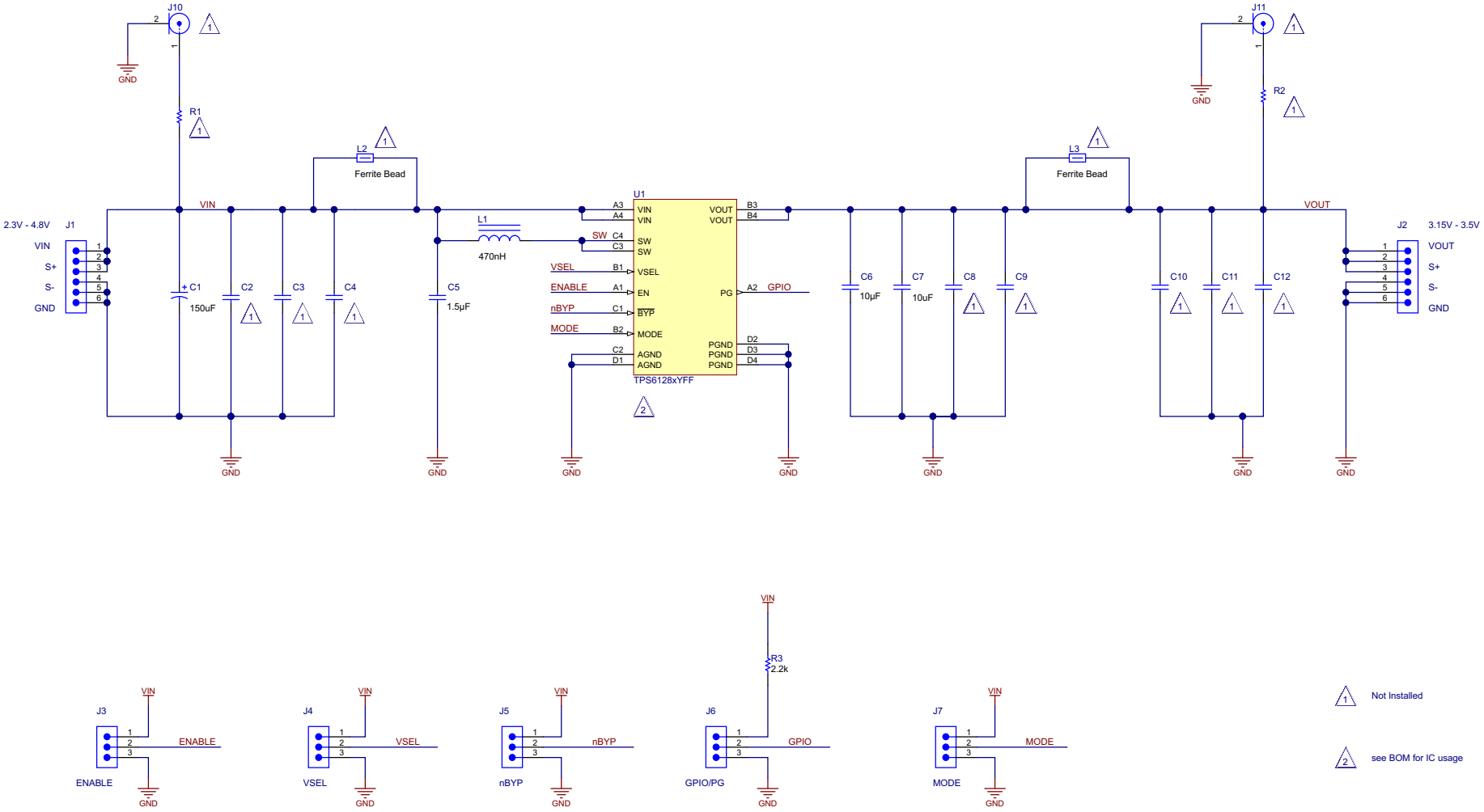

Figure 1. TPS6128xEVM-586 Schematic

3 Connector and Test Point Descriptions

3.1 J1 Input Connectors

3.1.1 Pin 1 and 2:VIN

This header is the positive connection to the input power supply. The power supply must be connected between these pins and pins 5 and 6 (GND). Twist the leads to the input supply and keep them as short as possible. The input voltage must be between 2.3 V and 4.8 V.

3.1.2 Pin 3: Input Sense VIN

This header is intended to measure the input voltage directly on the input capacitor close to the device. Therefore, a four-wire power and sense supply can be connected. Twist the leads to the sensing connector.

3.1.3 Pin 4: Input Sense GND

This header is intended to measure the GND close to the input of the device. Therefore, a four-wire power and sense supply can be connected. Twist the leads to the sensing connector.

3.1.4 Pin 5 and 6: GND

This header is the return connection to the input power supply. Connect the power supply between these pins and pins 1 and 2 (VIN). Twist the leads to the input supply and keep them as short as possible. The input voltage must be between 2.3 V and 4.8 V.

3.2 J2 Output Connector

3.2.1 Pin 1 and 2: VOUT

This header is the positive connection of the output voltage. Connect the load between these pins and pins 5 and 6 (GND).

3.2.2 Pin 3: Output Sense VOUT

This header is intended to measure the output voltage directly on the output capacitors.

3.2.3 Pin 4: Output Sense GND

This header is intended to measure the GND close to the output of the device.

3.2.4 Pin 5 and 6: GND

This is the return connection of the output voltage. Connect the load between these pins and pin 1 and 2 (VOUT).

3.3 Other Connectors

3.3.1 J10: SMA Input Connector

This SMA connector is connected to the input voltage of the converter. It can be used to easily analyze the noise spectrum of the input voltage with a spectrum analyzer. By default, J10 is not assembled on the EVM.

3.3.2 J11: SMA Output Connector

This SMA connector is connected to the output voltage of the converter. It can be used to easily analyze the noise spectrum of the output voltage with a spectrum analyzer. By default, J11 is not assembled on the EVM.

3.4 Jumpers

3.4.1 J3: Enable Jumper

Placing a jumper across pins EN and ON ties the EN pin to VIN, and enables the device. Placing a jumper across pins EN and OFF ties the EN pin to GND, which disables the device.

3.4.2 J4: VSEL, Output Voltage Selection

Placing a jumper across pins HIGH and VSEL ties the VSEL pin to VIN, and selects the default output roof voltage. Placing a jumper across pins LOW and VSEL ties the VSEL pin to GND, and selects the default output floor voltage.

Table 1. TPS6128x VSEL Settings

Value	Description	Default Output Voltage	
		TPS61281	TPS61282
HIGH	Selects the Output Roof Voltage as stored in register 0x03	3.15 V	3.30 V
LOW	Selects the Output Floor Voltage as stored in register 0x02	3.35 V	3.50 V

3.4.3 J5: nBYP, Forced Bypass Selection

Placing a jumper across pins nBYP and ON ties the nBYP pin to GND and enables the pass-through mode. Placing a jumper across pins nBYP and OFF ties the nBYP pin to VIN and enables Auto DC/DC boost mode.

Table 2. TPS6128x Mode of Operations

EN Input	nBYP Input	Device Status
LOW	LOW	The device is shut down in pass-through mode featuring a shutdown current down to ca. 2 μA typ. The load current capability is limited (up to ca. 250 mA).
LOW	HIGH	The device is shut down and the output voltage is reduced to a minimum value (VIN – VOUT ≤ 3.6 V). The device shutdown current is approximately 8.5μA typ.
HIGH	LOW	The device is active in forced pass-through mode. The device supply current is approximately 15 μA typ. from the battery. The device is short circuit protected by a current limit of ca. 7300 mA.
HIGH	HIGH	The device is active in auto mode (dc/dc boost, pass-through). The device supply current is approximately 50 μA typ. from the battery.

3.4.4 J6: GPIO/PG, General Purpose In/Out and Power Good

This pin can either be configured as a input (mode selection) or as dual role input/open-drain output (nRST/nFAULT) pin. Per default, the pin is configured as nRST/nFAULT input/output.

Pin GPIO/PG is connected to HIGH, per default. This pin is tied to VIN via pull-up resistor R5.

3.4.5 J7: MODE: Device Mode Selection

Placing a jumper across pins MODE and PWM ties the MODE pin to VIN and sets the device in Forced PWM mode. Placing a jumper across pins MODE and PFM ties the MODE pin to GND and enables Auto PFM/PWM mode.

4 TPS6128xEVM Assembly Drawings and Layout

Figure 2 through Figure 6 show the design of the TPS6128xEVM-586 PCBs. The EVM has been designed using a four-layer, 1-ounce copper-clad PCB with all components in an active area on the top side of the board. Moving components to both sides of the PCB can offer additional size reduction for space-constrained systems.

All layers are viewed from the top-side.

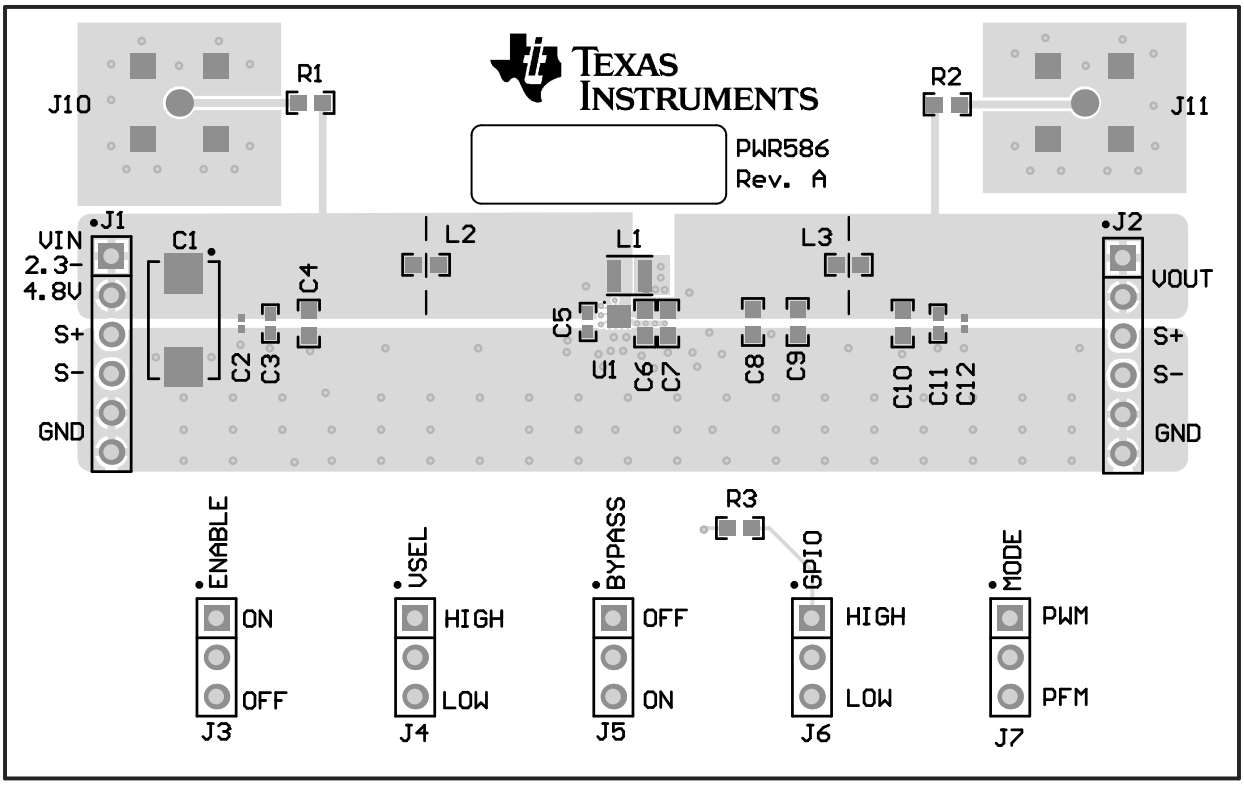

Figure 2. TPS6128xEVM-586 Component Placement

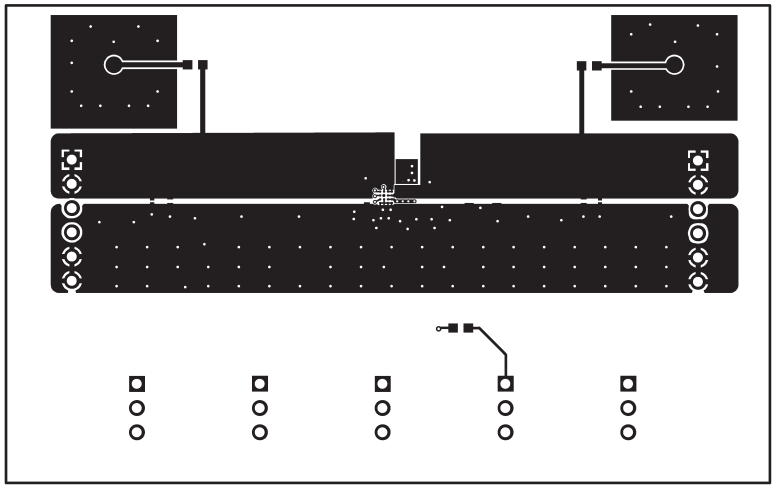

Figure 3. TPS6128xEVM-586 Top Copper

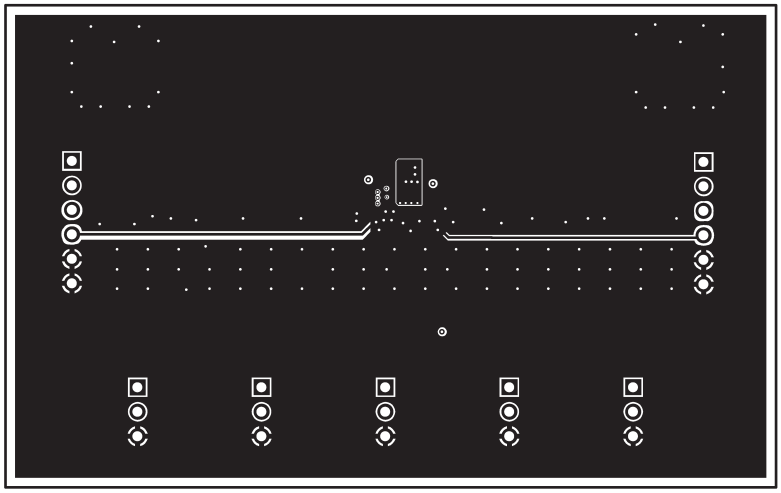

Figure 4. TPS6128xEVM-586 Inner Layer 1

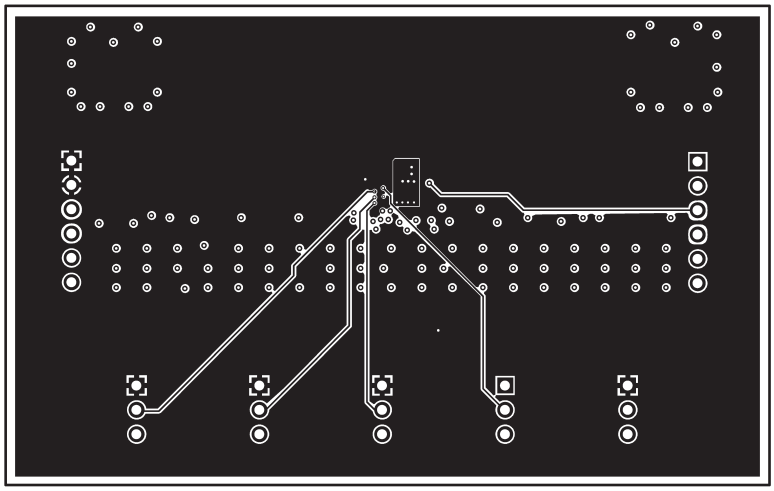

Figure 5. TPS6128xEVM-586 Inner Layer 2

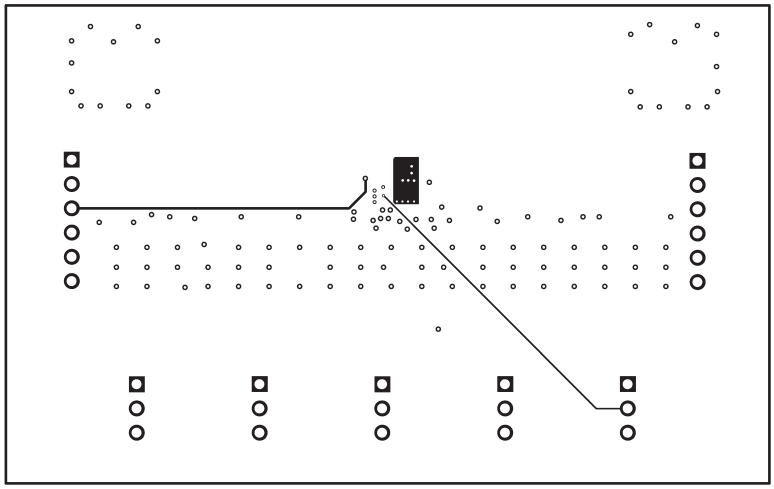

Figure 6. TPS6128xEVM-586 Bottom Copper

5 List of Materials

Table 3 lists the EVM components as configured according to the schematic shown in Figure 1.

Table 3. TPS6128x Bill of Materials

Count		RefDes	Value	Description	Size	Part Number	MFR
-001	- 002						
TPS6128xA Solution Required Components							
1	1	C5	1.5µF	Capacitor, Ceramic, 6.3V +/- 20%, X5R	0402	GRM155R60J155ME80D	MuRata
2	2	C6, C7	10µF	Capacitor, Ceramic, 6.3V, +/- 20%, X5R	0603	GRM188R60J106ME84D	MuRata
1	1	L1	470nH	Inductor, Ferrite, 3.7A, 29mΩ	2512	1239AS-H-R47M	Toko
1	0	U1	TPS61281D	IC, Step-Up DC/DC Converter with Pass-Through Mode	4x4 WCSP	TPS61281DYFF	Texas Instruments
0	1	U1	TPS61282D	IC, Step-Up DC/DC Converter with Pass-Through Mode	4x4 WCSP	TPS61282DYFF	Texas Instruments
TPS6128xEVM-586 Evaluation Components							
1		C1	150µF	Capacitor, Tantalum, 6.3V +/-10%, 70mΩ	7343-20	T495V157K006ATE070	Kemet
3		R3, R4, R5	2.2kΩ	Resistor, +/-5%, 100mW	0603	RC0603JR-072K2L	Yageo America
2		J1, J2		Header, 6x1, 100mil spacing		TSW-106-07-G-S	Samtec
5		J3, J4, J5, J6, J7		Header, 2x1, 100mil spacing		TSW-102-07-G-S	Samtec

Revision History

Changes from A Revision (June 2014) to B Revision **Page**

- Added support for TPS6128xD device. 1
- Changed TPS61281A to TPS61281D and TPS61282A to TPS61282D in the BOM. 9

Revision History

Changes from Original (December 2013) to A Revision **Page**

- Added support for TPS6128xA device..... 1
- Changed TPS61281 to TPS61281A and TPS61282 to TPS61282A in the BOM. 9

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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.

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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*

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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.

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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. 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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