TPS7A8300EVM-579 Evaluation Module

This user's guide describes the operational use of the TPS7A8300EVM-579 evaluation module (EVM) as a reference design for engineering demonstration and evaluation of the TPS7A8300RGR, low-dropout linear regulator (LDO). Included in this user's guide are setup and operating instructions, thermal and layout guidelines, printed circuit board (PCB) layout, a schematic diagram, and bill of materials (BOM).

Throughout this document, the terms demonstration kit, evaluation board, evaluation module are synonymous with the TPS7A8300EVM-579.

The following related documents are available through the Texas Instruments web site at http://www.ti.com.

Related Documentation

Device	Literature Number
TPS7A8300	SBVS197

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1 Introduction

The Texas Instruments TPS7A8300EVM-579 EVM helps design engineers to evaluate the operation and performance of the TPS7A8300 family of linear regulators for possible use in their own circuit application. This particular EVM configuration contains a single low-noise, high-PSRR linear regulator for high-speed communication systems. The regulator is capable of delivering up to 2 A to the load with ultralow VIN to VOUT dropout voltage. For stability, use a 10 µF (effective minimum) output capacitor for the TPS7A8300.

2 EVM Setup

This section describes how to properly connect and setup the TPS7A8300EVM-579, including the jumpers and connectors on the EVM board.

2.1 Input/Output Connectors and Jumper Descriptions

2.1.1 J1 – VIN

Input power-supply voltage connector. Twist together the positive input lead and ground return lead from the input power supply, and keep them as short as possible to minimize input inductance. Add additional bulk capacitance between J1 and J2 (use the C8 footprint) if the supply leads are greater than six inches. For example, an additional 47-µF electrolytic capacitor connected from J1 to ground can improve the transient response of the TPS7A8300, while eliminating unwanted ringing on the input because of long wire connections.

2.1.2 J2 – GND

Return connector for the input power supply.

2.1.3 J3 – VOUT

Regulated output voltage connector.

2.1.4 J4 – GND

Output ground return connector.

2.1.5 J5 – Input Connector

For output currents greater than 1 A, use the higher current rated J5 connector for the input power connection. Pin 1 connects to the input power supply. Pin 2 connects to the ground plane for the EVM.

2.1.6 J6 – Output Connector

For output currents greater than 1 A, use the higher current rated J6 connector for the load connection. Pin 1 connects to the output load. Pin 2 connects to the ground plane for the EVM.

2.1.7 J7 – VBIAS

If the input supply (VIN) voltage is less than 1.4 V but greater than 1.1 V, use a VBIAS voltage of 3.0 V to 6.5 V to provide power to the TPS7A8300. If the input voltage is greater than 1.4 V, it is not necessary to connect the VBIAS pin. The VBIAS supply pin typically consumes 2.3 mA.

2.1.8 JP1 – EN

Output enable. To enable the output, connect a jumper to short VIN (pin 1) or VBIAS (pin 3) to EN (pin 2). To disable the output, leave JP1 floating. When JP1 is not connected, R5 pulls down EN to GND.

2.1.9 JP2 – AnyOut

The output voltage of the TPS7A8300 is selectable in accordance with the names given to the output voltage setting pins: 50 mV, 100 mV, 200 mV, 400 mV, 800 mV, and 1.6 V. For each pin connected to the ground, the output voltage setting increases by the value associated with that pin name, starting from the value of the reference voltage of 0.8 V; floating the pin(s) has no effect on the output voltage.

2.2 Soldering Guidelines

To avoid damaging the integrated circuit (IC), use a hot-air system for any solder rework to modify the EVM for the purpose of repair or other application reasons.

2.3 Equipment Connection

1. Set the input and bias power supplies to 6.5 V (max), and turn the power supplies off.
2. Connect the positive voltage lead from the input power supply to VIN, at the J1 connector of the EVM.
3. Connect the ground lead from the input power supply to GND at the J2 connector of the EVM.
4. Connect a 0-A to 2-A load between OUT and GND. The connector used depends on the desired output current.
5. Disable the output by floating JP1.

3 Operation

1. Turn on the power supplies.
2. Enable the output by jumping JP1, the EN pin, to VIN or VBIAS.
3. Vary the respective load and input voltage as necessary for test purposes.

4 Thermal Guidelines and Layout Recommendations

Thermal management is a key component of design of any power converter. Proper thermal design dictates the necessity of substantial copper area for thermal dissipation, and thermal vias to allow the conduction of heat away from the device. Use the following formulas to approximate the maximum power dissipation for the particular ambient temperature:

$$T_J = T_A + P_D \times \theta_{JA} \quad (1)$$

$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT}$$

where

- T_J is the junction temperature (°C)
- T_A is the ambient temperature (°C)
- P_D is the power dissipation in the device (W)
- θ_{JA} is the thermal resistance from junction to ambient (°C/W) (2)

Do not allow the maximum operating junction temperature, T_J, to exceed 125°C under all temperature conditions and voltage conditions across the device.

Table 1 shows the thermal resistance, θ_{JA}, and power dissipation for High-K JEDEC standard boards. The High-K θ_{JA} value represents the worst-case thermal increase for the device junction at a given power dissipation. Calculate the maximum input voltage for full loads at different ambient temperatures from this value. The input voltage must be sufficiently low so that the power dissipation of the device still allows for a safe junction temperature. The θ_{JA} dissipation for the TPS7A8300EVM-579 board is approximately 25°C/W, depending on the board configuration and airflow.

Table 1. Thermal Resistance, θ_{JA}, and Maximum Power Dissipation

IC	Board	Package	θ_{JA}	Max Dissipation (T_A = 25°C)	Max Dissipation (T_A = 70°C)
TPS7A8300	High-K	RGR	35.4°C/W	2.82 W	1.55 W

5 PCB Layout

Figure 1 to Figure 3 illustrate the PCB layout for this EVM.

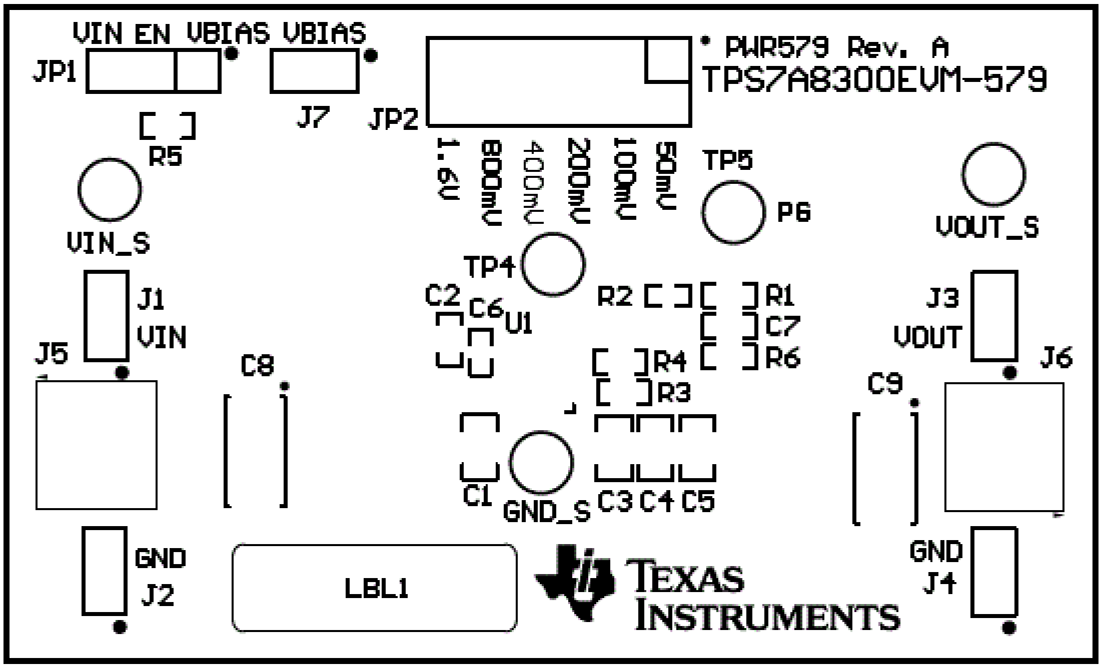

Figure 1. Assembly Layer

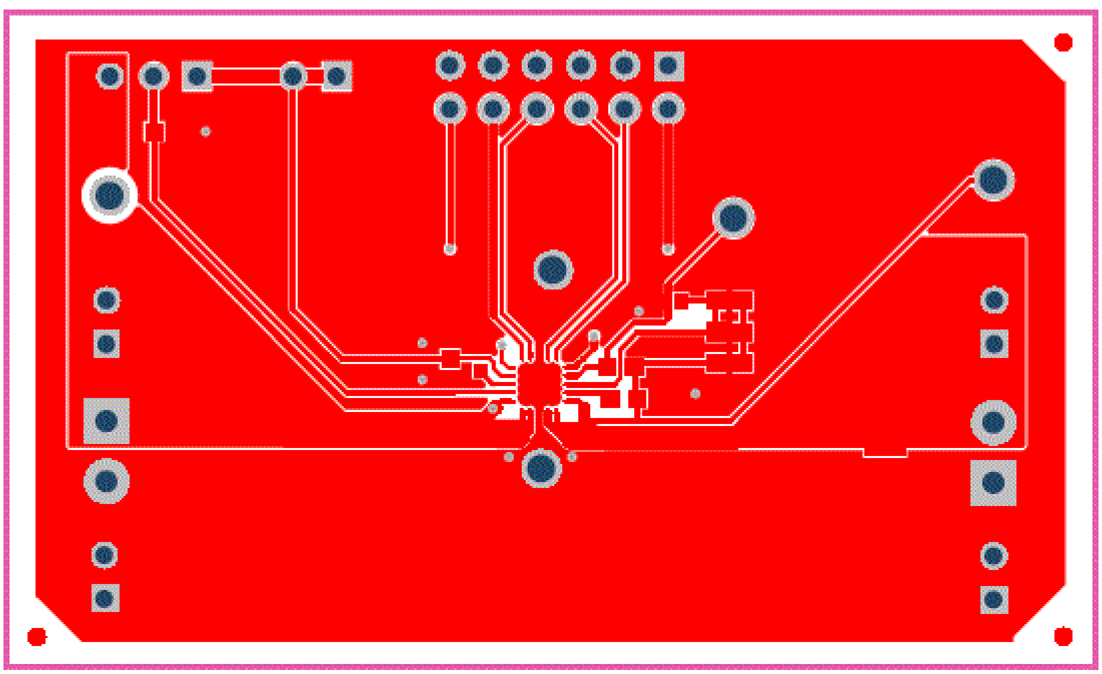

Figure 2. Top Layer Routing

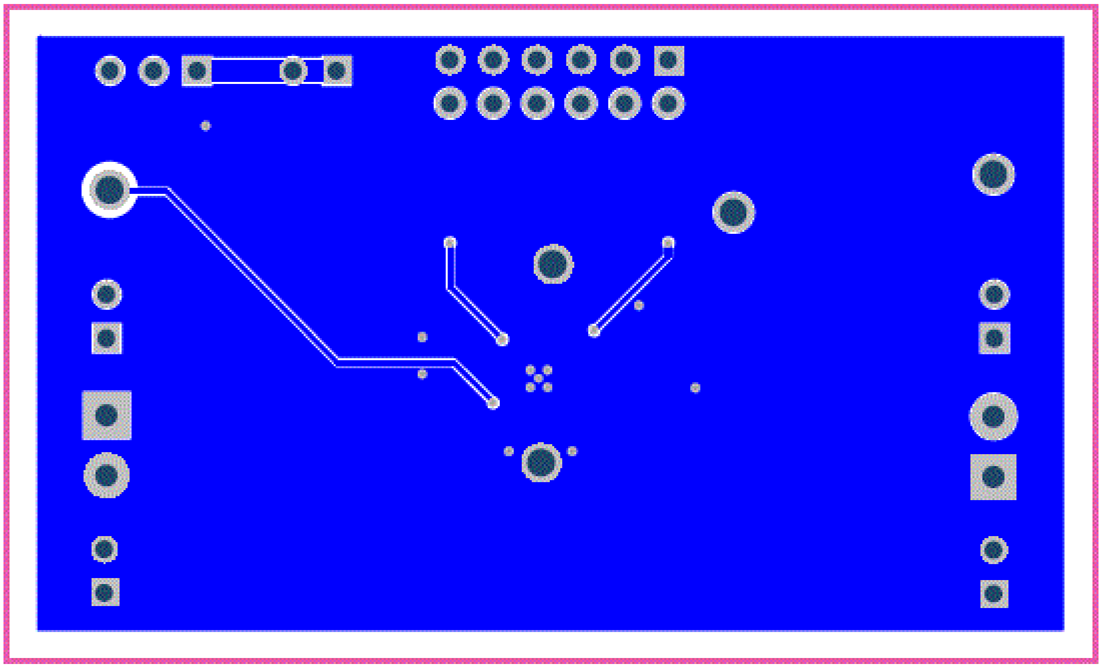

Figure 3. Bottom Layer Routing

6 Schematic

Figure 4 is the schematic for this EVM.

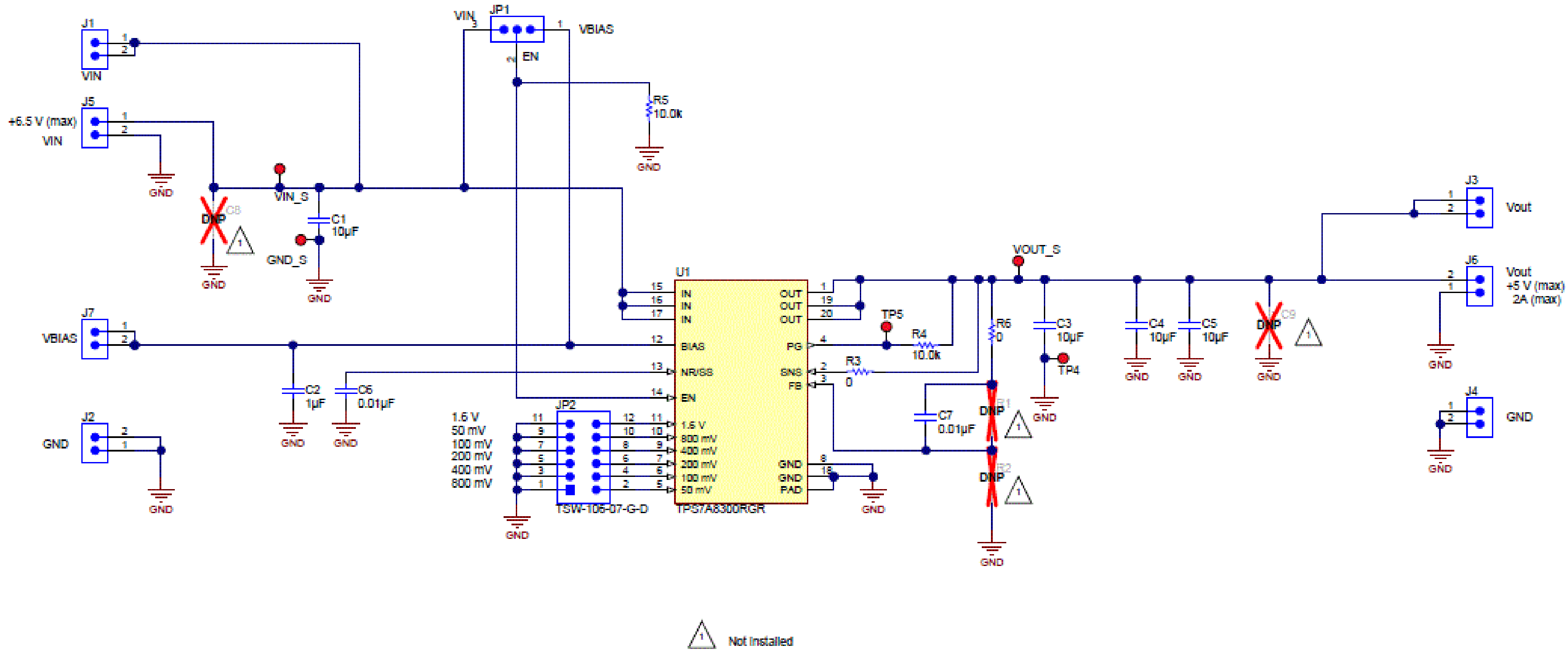

Figure 4. TPS7A8300EVM-579 Schematic

7 Bill of Materials

The BOM for this EVM is shown in Table 2

Table 2. TPS7A8300EVM-579 BOM(1)(2)(3)

RefDes	Value	Description	Size	Part Number	Manufacturer
C6, C7	0.01 uF	Capacitor, Ceramic Chip, 50V, ±10%, X7R	603	GRM188R71H103KA01D	Murata
C2	1.0 uF	Capacitor, Ceramic, Low Inductance, 16V,X7R,10%	603	GRM188R71C105KA12D	Murata
C1, C3, C4, C5	10 uF	Capacitor, Ceramic, 16V, [X5R], [10%l]	805	GRM21BR61C106KE15L	Murata
J5, J6	ED555/2DS	Connector, Male 2 Pole 3.5 mm, 6A, 150V	6.5x6.5 mm	ED555/2DS	On Shore Tech
J1, J2, J3, J4, J7	PEC02SAAN	Header, Male 2-pin, 100mil spacing, (36-pin strip)	0.100 inch x 2	PECO2SAAN	Sullins
JP2	TSW-106-07-G-D	Header, TH, 100mil, 6x2, Gold plated, 230 mil above insulator	0.100 inch x 2X6	TSW-106-07-G-D	Samtec
JP1	PEC03SAAN	Header, Male 3-pin, 100mil spacing,	0.100 inch x 3	PEC03SAAN	Sullins
R3, R6	0	Resistor, Chip, 1/10W, 1%	603	CRCW06030000Z0EA	Vishay
R4, R5	10 k	Resistor, Chip, 1/10W, 1%	603	CRCW060310K0FKEA	Vishay
GND_S, TP4, TP5, VIN_S, VOUT_S	5010	Test Point, Red, Thru Hole	0.125 x 0.125 inch	5010	Keystone
U1	TPS7A8300RGR	IC, 2 A, LDO Voltage Regulator for High Speed Communication Systems	QFN-20	TPS7A8300RGR	TI
PCB		PCB, 2.5 In x 1.5 In x 0.062 In		PWR579A	Any
SH-J1, SH-J2		Shunt, Black	100-mil	929950-00	3M

(1) These assemblies are ESD sensitive, observe ESD precautions.
(2) These assemblies must be clean and free from flux and all contaminants. Use of no-clean flux is not acceptable.
(3) These assemblies must comply with workmanship standards IPC-A-610 Class 2.

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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 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 its 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.

Industry Canada Compliance (English)

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.

Canada Industry Canada Compliance (French)

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.

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.

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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If user uses EVMs in Japan, user is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

1. Use EVMs 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 EVMs only after user obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after user obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless user gives the same notice above to the transferee. Please note that if user does not follow the instructions above, user will be subject to penalties of Radio Law of Japan.

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