

EVM User's Guide: AWRL6888EVM

AWRL6888 Evaluation Module

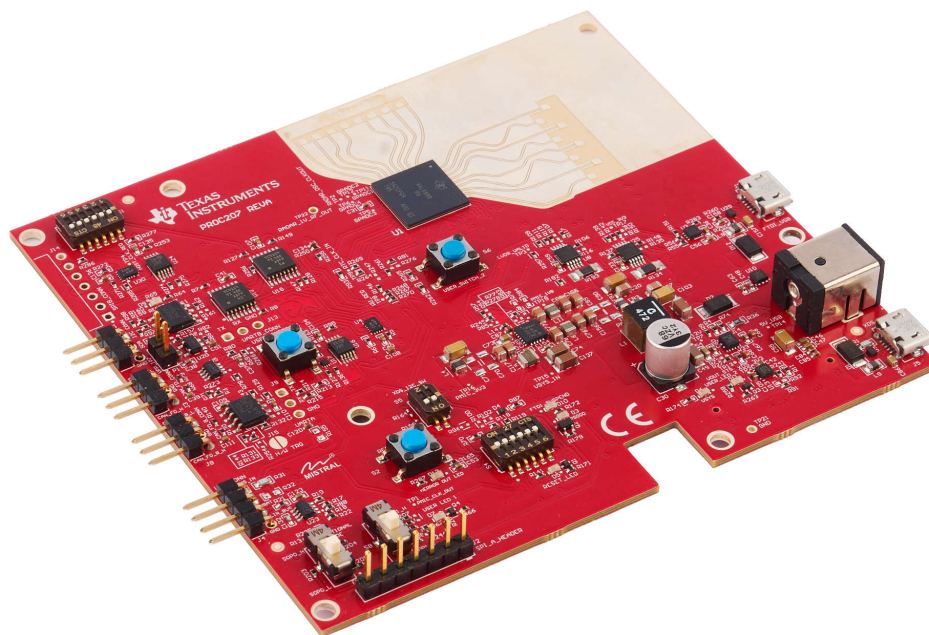


Description

The AWRL6888EVM from Texas Instruments is an easy-to-use evaluation module (EVM) for the AWRL6888 mmWave radar sensor. The AWRL6888EVM supports both standalone operation as well as direct connectivity to the DCA1000EVM for raw ADC capture and signal processing development. This EVM contains everything required to start developing software for on-chip DSP, Hardware accelerator and low power ARM® Cortex® - R5F controller. The EVM also includes on-board buttons, LEDs for quick integration of a simple user interface in addition to onboard emulation for programming and debugging.

Features

- 57GHz to 64GHz mmWave radar sensor
- On-Chip C66x DSP, ARM CORTEX-R5F controller and Hardware Accelerator (HWA 1.2)
- Onboard eight-transmit and eight-receive antennas (8TX/8RX) with High RF performance RO3003 PCB substrate
- TPS650365x based power management topology
- Direct interface with DCA1000 for debug and Raw ADC data capture.



AWRL6888EVM

1 Evaluation Module Overview

1.1 Introduction

The AWRL6888 mmWave radar sensor is an integrated single-chip mmWave sensor based on FMCW radar technology which operates in the 57GHz to 64GHz frequency band. The AWRL6888 is designed for low power, self-monitored, ultra-accurate radar systems in the automotive and industrial set of applications. The AWRL6888EVM enables access to point-cloud data over XDS110 USB interface, as well as Raw ADC Data when interfaced with DCA1000 development kit. The AWRL6888EVM is supported by mmWave tools, demos and software including [MMWAVE-L-SDK](#) and TI's Code Composer Studio™ (using the on-board XDS110 emulator). The AWRL6888EVM can also interface with the MCU LaunchPad™ development kit ecosystem by mounting LaunchPad BoosterPack™ connectors.

1.2 Key Features

- Wide 7GHz bandwidth (57GHz to 64GHz) on board etched antennas(8TX,8RX) with high RF performance ROGERS RO3003 PCB substrate
- XDS110 based JTAG emulation with serial port for onboard 64-bit QSPI flash programming
- UART to USB Debug port for terminal access using FTDI FT4232H
- 60-pin, high-density (HD) connector for debug, SPI, I2C and LVDS with direct mating to DCA1000 development kit
- Onboard 2 × CAN-FD and 1 × LIN PHY transceivers
- EVM supports input voltage range (5V to 12V) using DC Jack to power the board
- 5V USB Powered standalone mode of operation
- On-board INA228A Current sensors to measure per rail power consumption of the Radar device

1.3 Kit Contents

AWRL6888EVM Kit includes the following:

- AWRL6888EVM Evaluation board
- Micro USB cable
- Quick Start Guide
- Screws, spacers and nuts to allow mounting of EVM

1.4 Specification

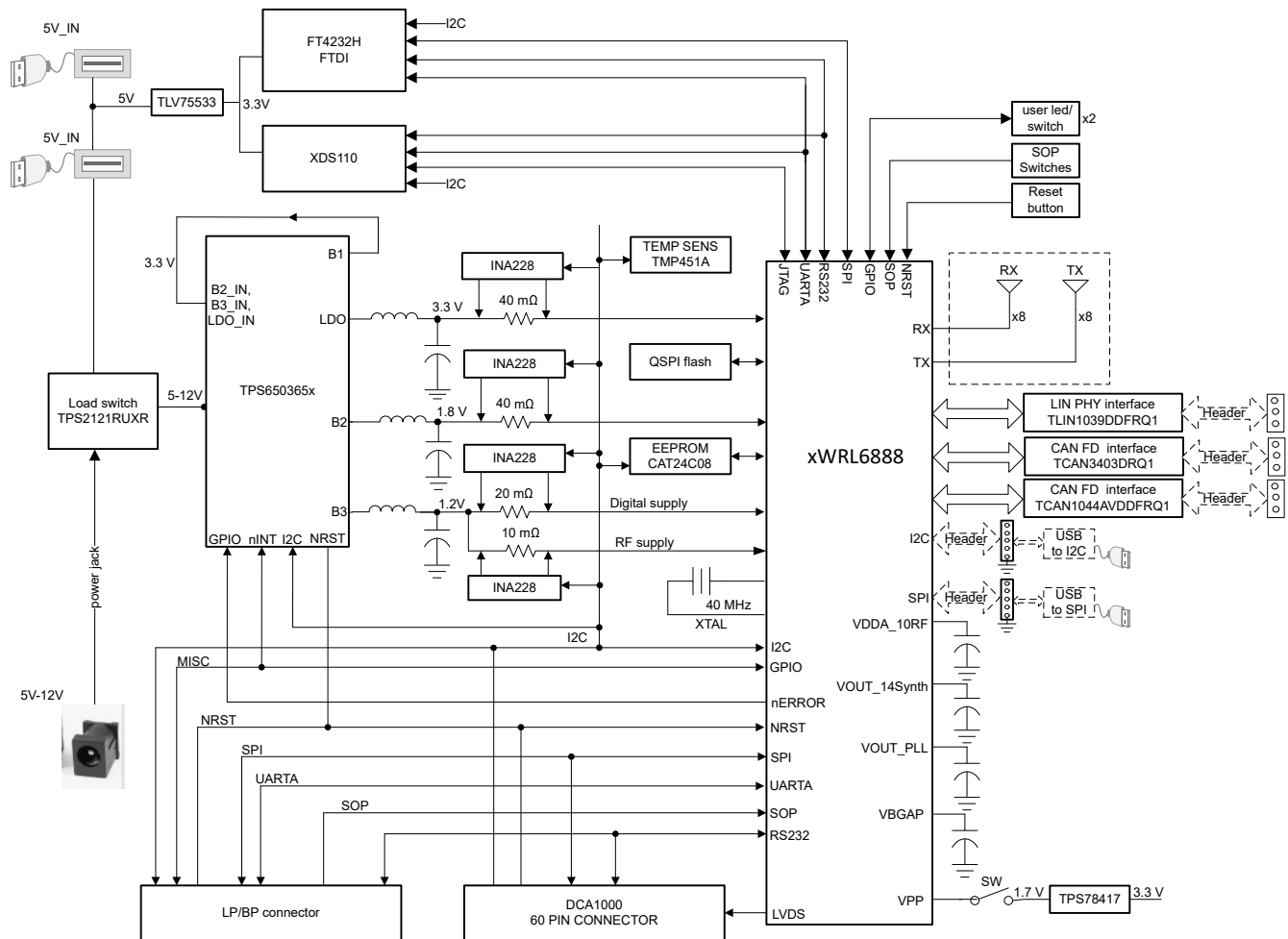


Figure 1-1. Functional Block Diagram

Figure 1-1 shows the functional block diagram of the AWRL6888EVM. The EVM contains all essential components for the TI mmWave radar system: PMIC, SFLASH, SOP configuration, Filter, mmWave Radar Sensor, USB to UART converter, and a 60-pin Samtec® connector for interfacing with DCA1000. The AWRL6888EVM has a provision to mount a launchpad boosterpack connector which can be connected to TI's LaunchPad boards.

1.5 Device Information

The documents in [Table 1-1](#) provide information regarding devices from Texas Instruments used in the assembly of AWRL6888 EVM. Any letter appended to literature number corresponds to the current document revision that is current at the time of the writing of this document.

Table 1-1. Related Device Documentation

Devices Used on the EVM	Data Sheet
TMP451-Q1	TMP451AQDQFRQ1
TPDE004D	TPDE004DRYR
TPS2121	TPS2121
TPS65036501	TPS650365-Q1
TLV75533PDRV	TLV755P
TPS78417QDBVRQ1	TPS784-Q1
INA228A	INA228AIDGST
TS3A5018RSVR	TS3A5018
TS3A44159PWR	TS3A44159
TS3A24157DGSR	TS3A24157
TS3A27518EPWR	TS3A27518E
TM4C1294NCPDTT3	TM4C1294NCPDT
TCAN3403DRQ1	TCAN3403-Q1
TCAN1044AVDDFRQ1	TCAN1044A-Q1
TLIN1039DDFRQ1	TLIN1039-Q1
SN74LVC1G11DSFR	SN74LVC1G11D

2 Hardware

CAUTION



Hot surface. Contact can cause burns. Do not touch.

The AWRL6888EVM includes eight receivers and eight transmitters with a wide field of view antenna on a High RF Performance ROGERS3003 PCB substrate.

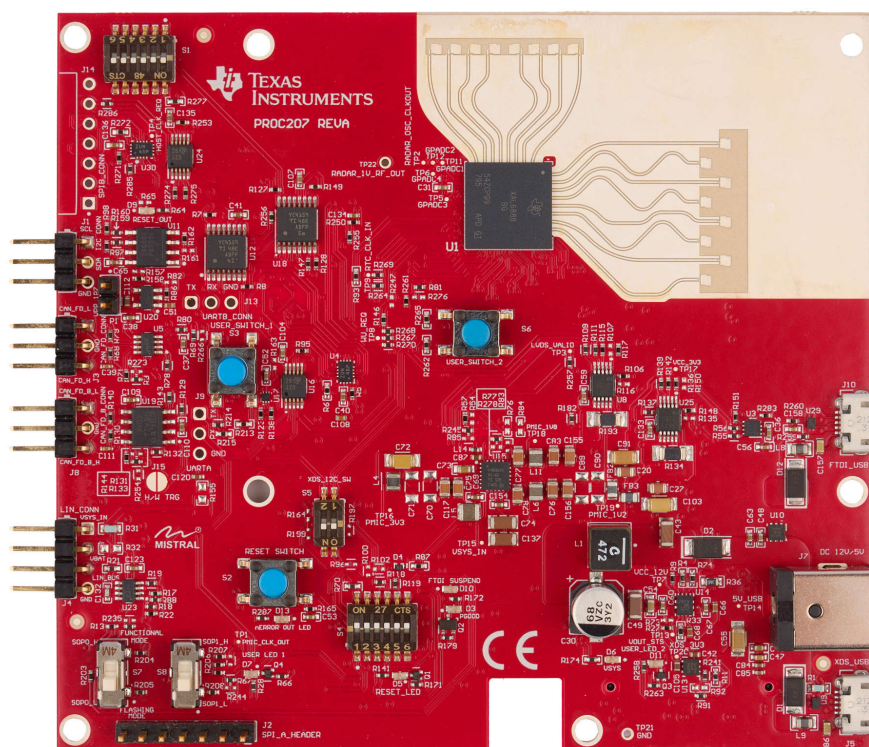


Figure 2-1. AWRL6888EVM (Top View)

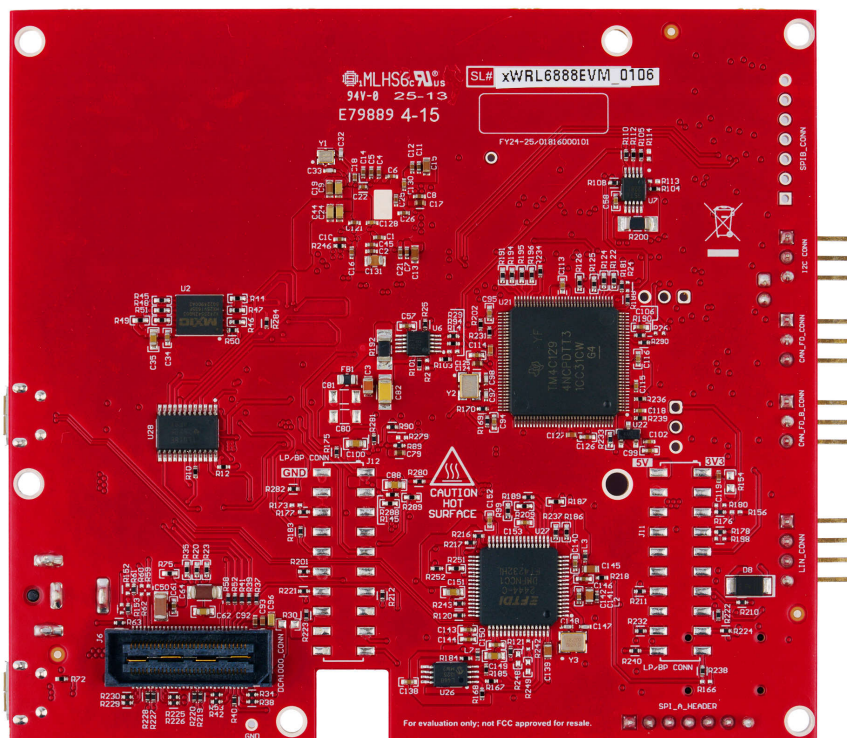


Figure 2-2. AWRL6888EVM (Bottom View)

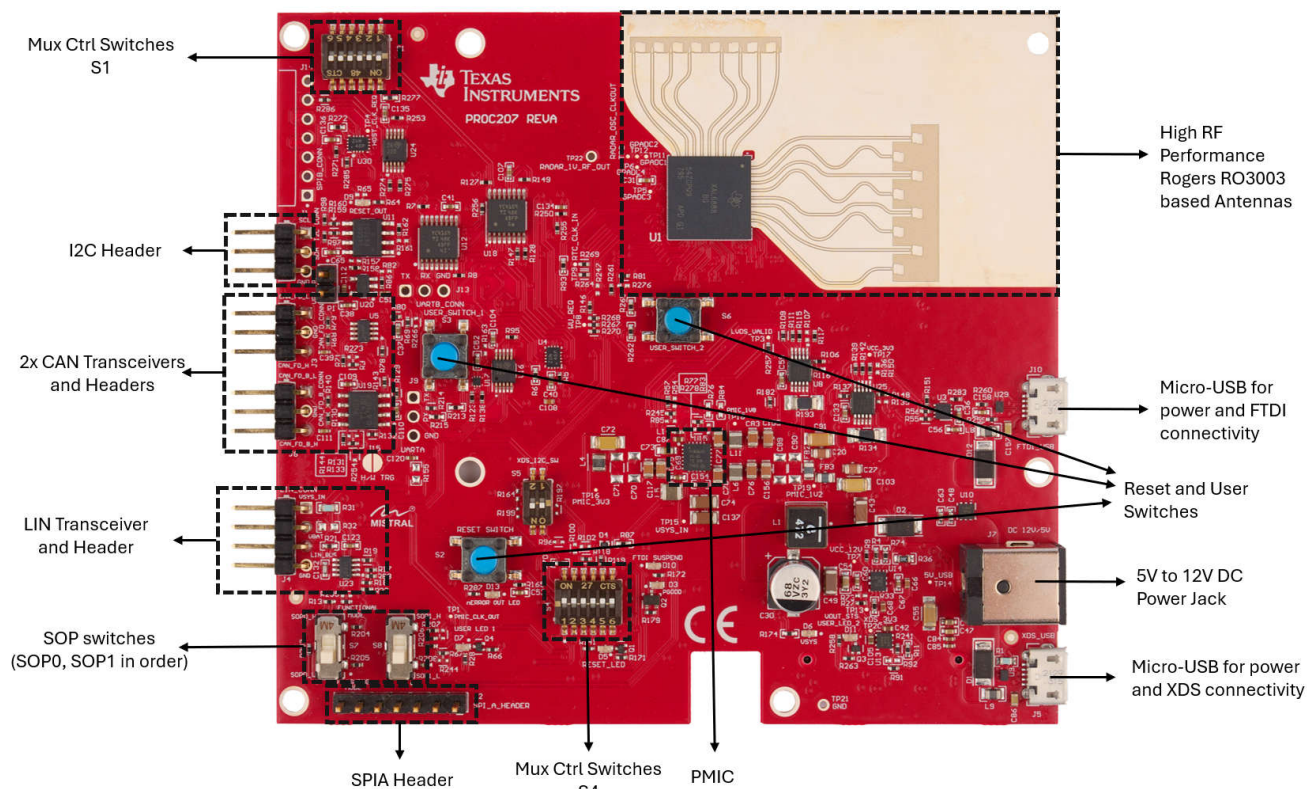


Figure 2-3. Salient Features of EVM (Top Side)

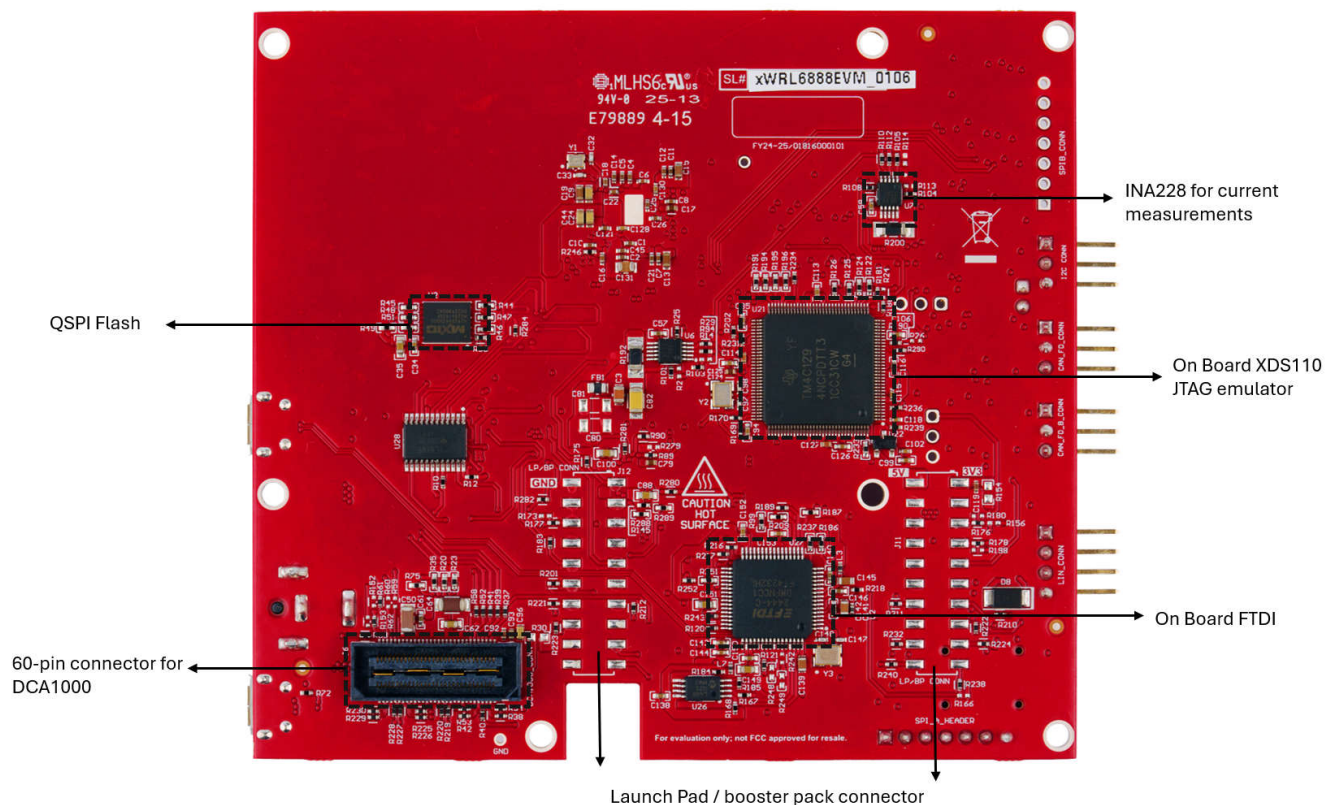


Figure 2-4. Salient Features of EVM (Bottom Side)

2.1 AWRL6888EVM Antenna

The AWRL6888EVM includes eight transmitter and eight receiver ROGERS RO3003-based antennas on the PCB. Figure 2-5 shows the antenna configuration.

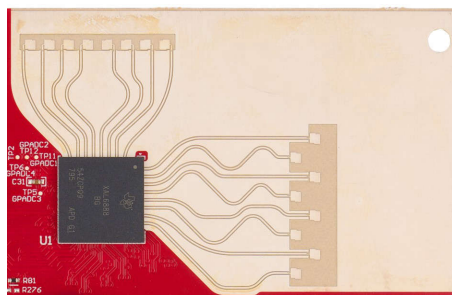


Figure 2-5. TX and Rx Antennas of the EVM

Note

The AWRL6888EVM has an antenna gain of approximately 5dBi to 6dBi across each antenna element.

2.1.1 PCB Material

The dielectric material used for this PCB is ROGERS RO3003 of 5mil thickness with rolled copper for the Antenna and transmission lines while 370HR is used for the rest of the layers.

Type	Layer	Total Cu Thickness		Final Thickness		Construction
		μm	mils	μm	mils	
Solder Mask				20	0,8	IMM SILVER
	1	40	1,6	23	0,9	Plating Cu (Total Cu final minimum = 34μm)
				17	0,7	Copper RA
	2	35	1,4	127	5,0	Core Rogers RO3003 RA
				35	1,4	Copper RA
				140	5,5	Prepreg 370HR
	3	35	1,4	35	1,4	Copper
				254	10,0	Core 370HR
	4	35	1,4	35	1,4	Copper
				140	5,5	Prepreg 370HR
	5	35	1,4	35	1,4	Copper
				254	10,0	Core 370HR
	6	35	1,4	35	1,4	Copper
				140	5,5	Prepreg 370HR
	7	35	1,4	35	1,4	Copper
				127	5,0	Core 370HR
	8	40	1,6	17	0,7	Copper
				23	0,9	Plating Cu (Total Cu final minimum = 34μm)
Solder Mask				20	0,8	IMM SILVER
Total Thickness :				1,512	mm	± 10%
				0,0595	(inch)	

2.1.1.1 Transmitter and Receiver Virtual Array

The transmitter and receiver antenna positions shown in [Figure 2-6](#) form a virtual array of sixteen transmitter and receiver pairs. This allows finer object detections in both azimuth and Elevation planes with an angular resolution of around 15° . Receiver antennas are spaced at distance D ($\lambda/2$) apart in azimuth plane. The transmitter antennas are spaced at distance D ($\lambda/2$) apart in both azimuth and elevation plane.

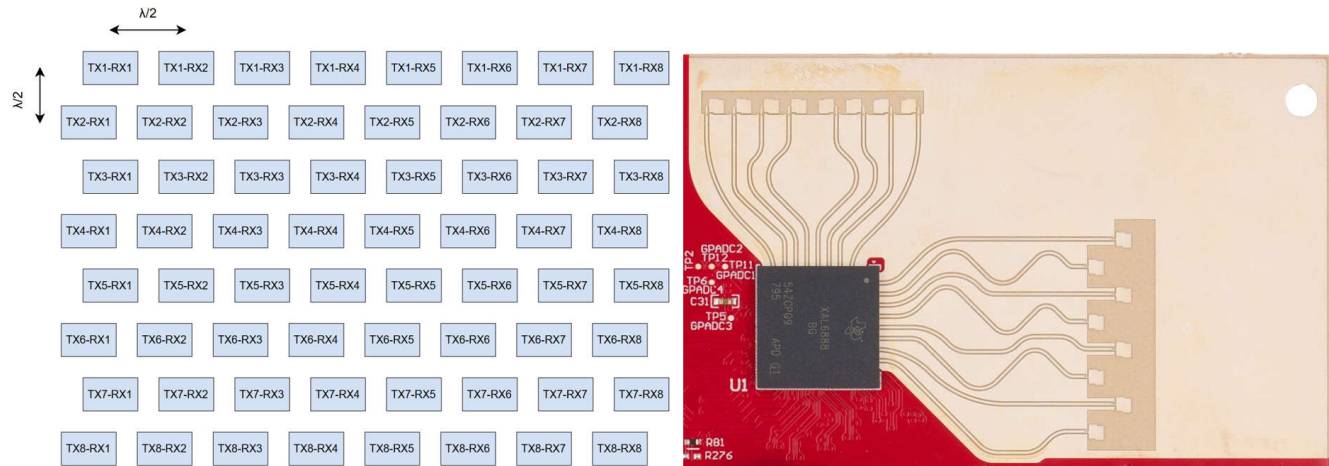


Figure 2-6. Antenna Virtual array with respect to TXs and RXs

[Figure 2-7](#) and [Figure 2-8](#) below show the antenna radiation pattern with regard to azimuth and elevation planes. Both figures show the radiation pattern for TX1, TX2, TX3, TX4, TX5, TX6, TX7, TX8 and RX1, RX2, RX3, RX4, RX5, RX6, RX7, RX8 together. All of the measurements were done with a Tx and Rx combination together. Thus, for the -6dB beam width, the user must see a 12dB drop (6dB from Tx and 6dB from Rx)

Note

Wavelength (λ) is computed based on a frequency of 60.5GHz. Antenna placements were made according to this frequency.

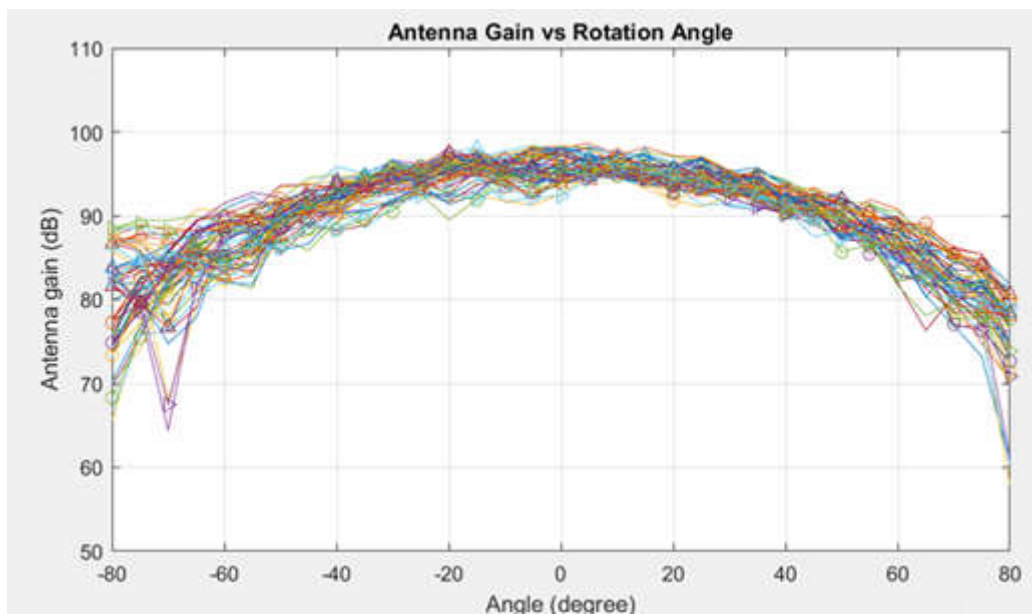


Figure 2-7. AWRL6888EVM Azimuth Antenna Radiation Pattern

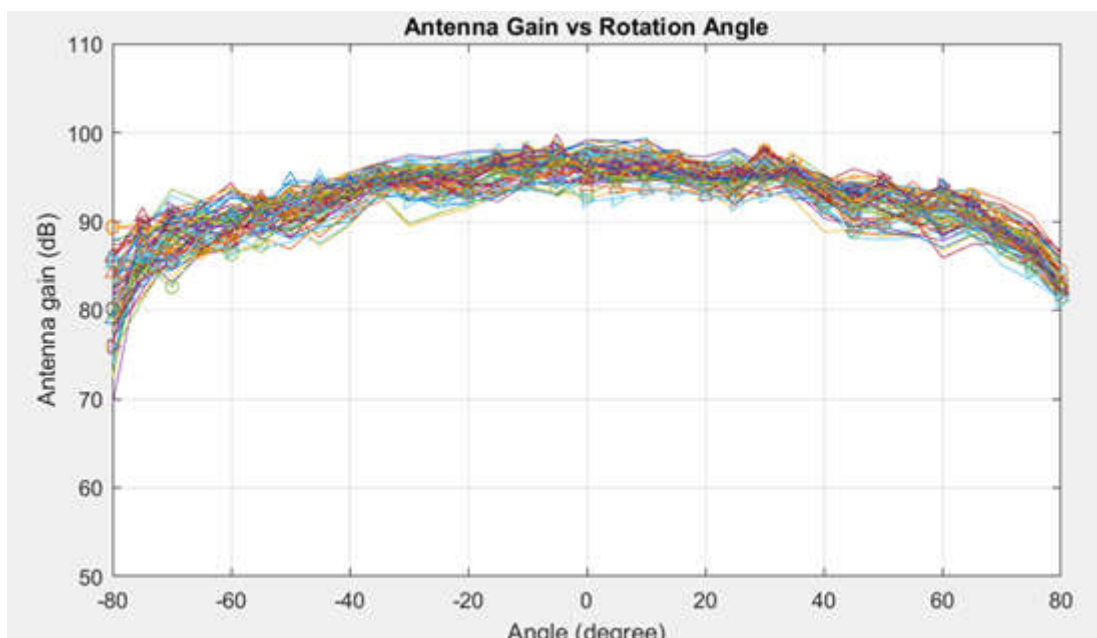


Figure 2-8. AWRL6888EVM Elevation Antenna Radiation Pattern

Note

In accordance with the EN 62311 RF exposure test, a minimum separation distance of 20 centimeters must be maintained between the user and the EVM during operation.

2.2 EVM Mux Block Diagram

Figure 2-9 shows different functionality muxing options for digital signals. The AWRL6888 contains multiple internal IPs and features. The EVM provides de-muxing options using various analog muxes and switches to improve the user experience. [Switch Settings](#) section shows different switch and mux configurations to enable connection to different peripherals.

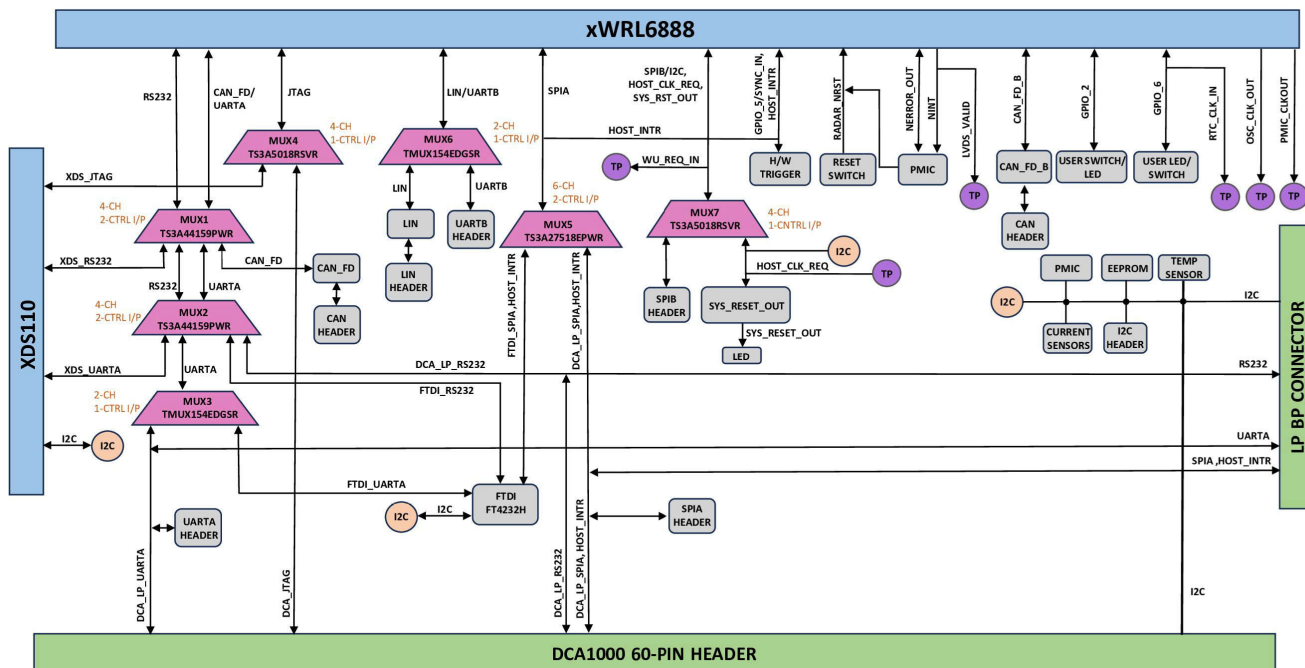


Figure 2-9. Functionality Muxing Options in the EVM

2.3 Switch Settings

The [Figure 2-10](#) shows the part designators and positions of the switches on AWRL6888EVM for different SOP mode settings. [Table 2-1](#) shows the different boot mode configurations for the device. AWRL6888 supports Application mode/Functional mode, Device management mode/QSPI flashing mode, and Debug modes. The mode (SOP) configurations shown below [Table 2-1](#) must be exercised first. After the correct SOP mode is set, an nRESET must be issued to register the SOP setting. In the [Figure 2-10](#) the current SOP mode shown is Debug mode.

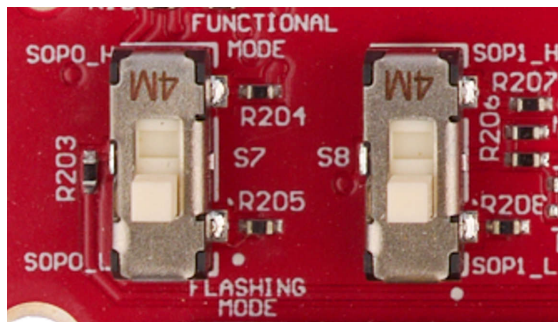


Figure 2-10. SOP switches (S7, S8)

Table 2-1. SOP settings

SOP Mode	PMIC_CLK_OUT, TDO	Combinations SOP1(S8), SOP0(S7)
SOP_MODE1	Device Management Mode/ QSPI Flashing Mode	00
SOP_MODE2	Application mode/ Functional Mode	01
SOP_MODE4	Debug Mode/ Development Mode	11

The S1 and S4 slide switches allows user connect to the digital interfaces from different peripherals.

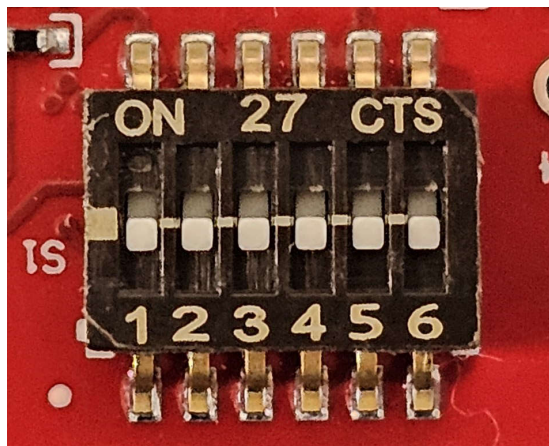


Figure 2-11. Slide Switch (S1)

Table 2-2. S1 Switch Settings

Reference Designator	Switch OFF	Switch ON
S1.1	CAN PHY B: Stand by Mode Disable	CAN PHY B: Stand by Mode Enable
S1.2	XDS_RS232	FTDI_DCA_LP/BP_RS232
S1.3	FTDI_RS232	DCA_LP/BP_RS232
S1.4	CAN_FD_A	XDS_DCA_LP/BP_FTDI_UARTA
S1.5	DCA_LP/BP_FTDI_UARTA	XDS_UARTA
S1.6	FTDI_UARTA	DCA_LP/BP_UARTA

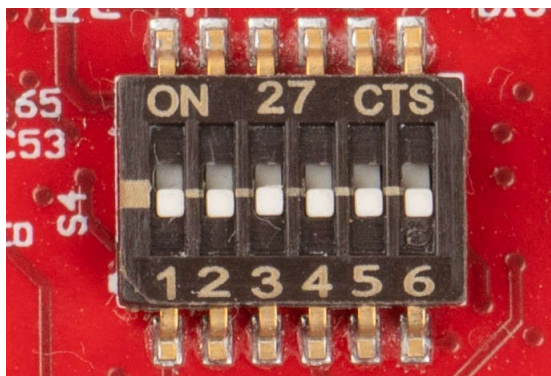


Figure 2-12. Slide Switch (S4)

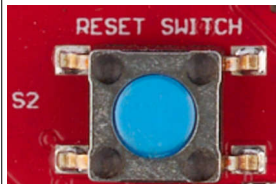
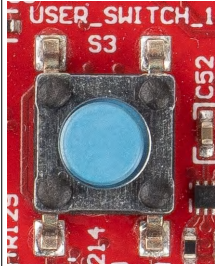
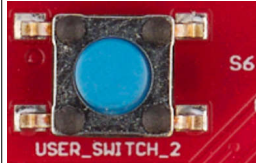
Table 2-3. S4 Switch Settings

Reference Designator	Switch OFF	Switch ON
S4.1	CAN PHY A: Stand by Mode Disable	CAN PHY A: Stand by Mode Enable
S4.2	LIN PHY: Enable	LIN PHY: Disable
S4.3	FTDI_SPI	DCA_SPI
S4.4	XDS_JTAG	DCA_JTAG
S4.5	UARTB	LIN
S4.6	SPIB	I2C/HOST_CLK_REQ/SYS_RST_OUT

2.4 Push Button Switches

Table 2-4 contains list of Push Button Switches on the AWRL6888EVM. The User switches are connected to GPIO and can be used for quick integration of a simple interface.

Table 2-4. List of Push Button Switches

Switch Reference Designators	Usage	Comments	Image
S2	Reset Switch	This Switch can be used to reset the AWRL6888 device	
S3	User Switch 1	When pushed, GPIO_2 logic is pulled high	
S6	User Switch 2	When pushed, GPIO_6 logic is pulled high	

2.5 LEDs

Table 2-5 contains list of LEDs present on the AWRL6888EVM. The User LEDs are provided for integration and can be controlled using the GPIOs of AWRL6888.

Table 2-5. List of LEDs

LED reference designators	Usage	Comments	Image
D3	PGOOD LED	Glow once all the power supplies are stable from PMIC	
D6	Power ON LED	5V or 12V Power indication	
D5	Reset LED	This LED Indicates the state of Reset pin on AWRL6888 device. LED glowing indicates the device is out of reset.	
D7	User LED: Customer programmable	Glow when GPIO_2 is logic-1	
D9	SYS_RST_OUT LED	Glow in presence of any System reset from AWRL6888 device	
D10	FTDI suspend LED	Glow when FTDI is in suspend state	
D11	User LED: Customer programmable	Glow when GPIO_6 is logic-1	
D13	nERROR LED	Glow in presence of any HW error in AWRL6888 device	

2.6 DC Input Jack

The AWRL6888EVM can be powered up using the 5V to 12V DC Jack. When DC Jack is connected, the Priority switchover is given to the Voltage of DC-jack at the power mux(TPS2121).

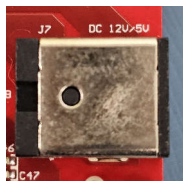


Figure 2-13.

Note

After the 5V-12V power supply is provided to the EVM, TI recommends pressing the NRST switch one time to verify for a reliable boot-up state.

Note

All digital IO pins of the device (except NRESET) are not fail safe. Therefore, care needs to be taken that the digital IO pins are not driven externally without the VIO supply being present to the device.

2.7 USB Connector

The AWRL6888EVM has two micro USB connectors. These connectors are for xds110 and FTDI interface connectivity. These connectors can also be used to provide 5V power supply input to the EVM.

FTDI Interface: Micro USB Connector J10 provides access to the UART-A, SPI, I2C, RS232/UART-B, SOP, and Reset signals of the AWRL6888 device.



Figure 2-14. FTDI USB (J10)

XDS Interface: Micro USB connector J5 provides access to the I2C, JTAG, UART_A, and RS232/UART-B signals of the AWRL6888 device. This is the UART interface used to flash the binary to the onboard serial flash and for running Out-of-box (OOB) demo.

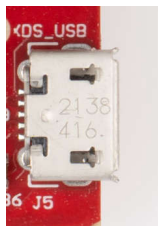


Figure 2-15. XDS USB (J5)

2.8 DCA1000 HD Connector

The 60-pin HD connector shown in [Figure 2-16](#) provides access to the high-speed data and controls signals (I2C, LVDS, NRST, RS232/UART-B, SPI, UART-A) of the AWRL6888 device through the DCA1000.

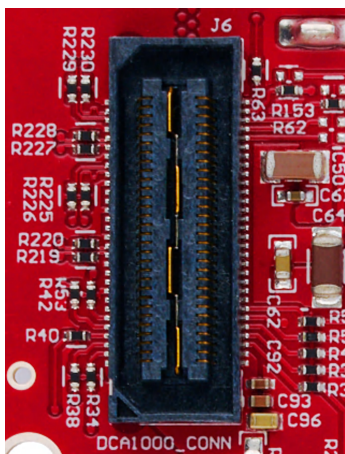


Figure 2-16. DCA1000 HD Connector

The [Figure 2-17](#) further details on the signals of the AWRL688 device being brought out at the DCA1000 direct mating connector.

60-PIN HD CONNECTOR FOR DCA1000

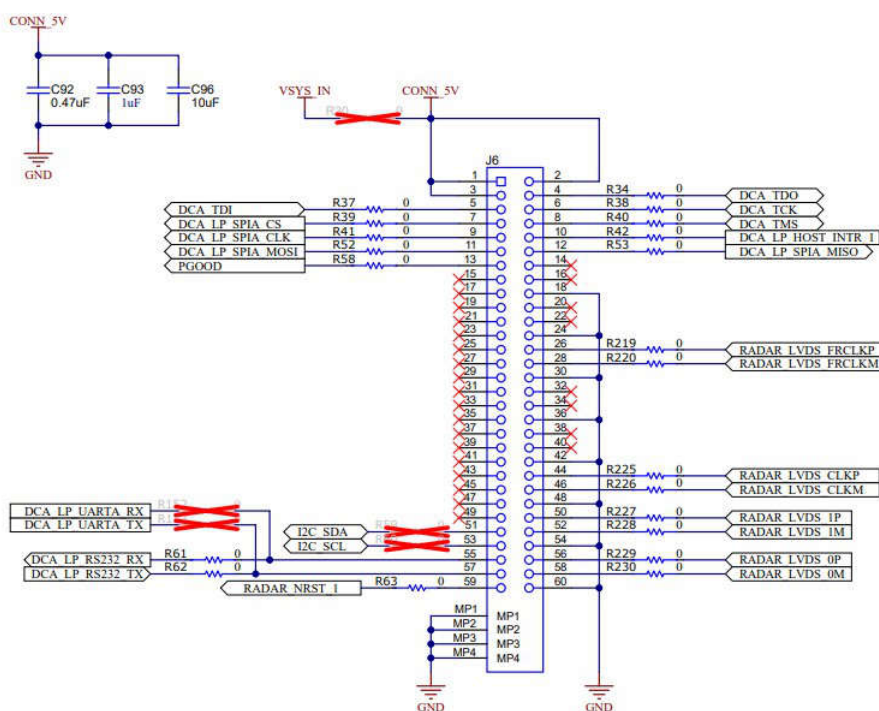


Figure 2-17. DCA1000 HD Connector Pins

2.9 BoosterPack Connector for LaunchPad Connectivity

J11/J12 are the booster pack connectors provided on the EVM. The user can populate the LP-BP connector to connect with other TI launchpad kits.

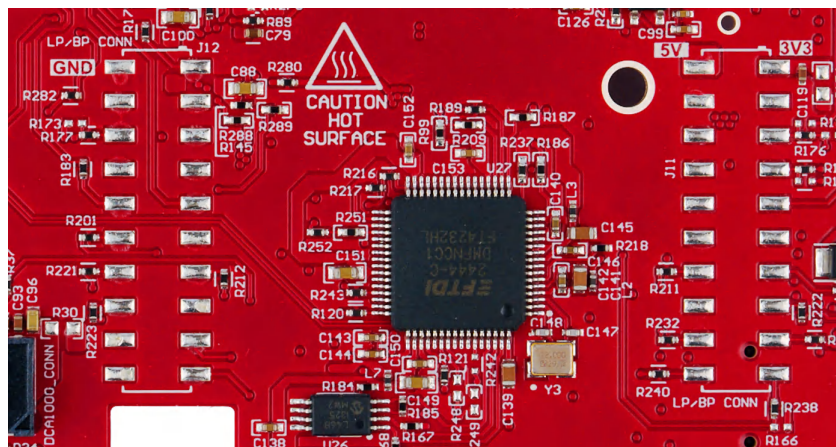


Figure 2-18. BoosterPack Connector

The Figure 2-19 shows the various signals that have been brought-out on the LP-BP connector.

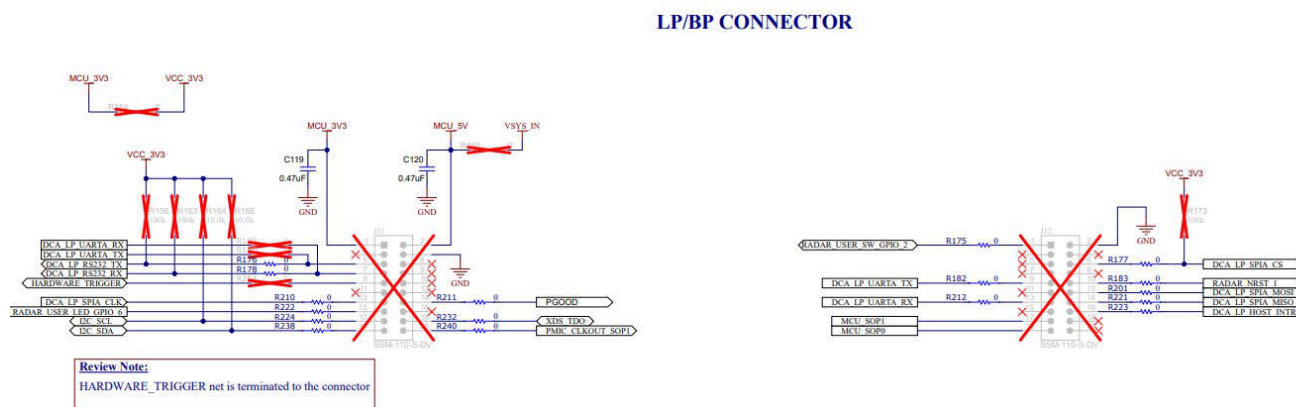


Figure 2-19. LP-BP Connector Pins

2.10 CAN-FD_A Connector

The J3 connector shown in [Figure 2-20](#) provides the CAN_L and CAN_H signals from the onboard CAN-FD transceiver (TCAN1044AVDDFRQ1). These signals are wired to the CAN bus after muxing with the UART-A signals; one of the two paths must be selected. CAN signal paths get connected to PHY by changing the switch S1.4 to off position. CAN standby input can be controlled by toggling S4.1 switch.

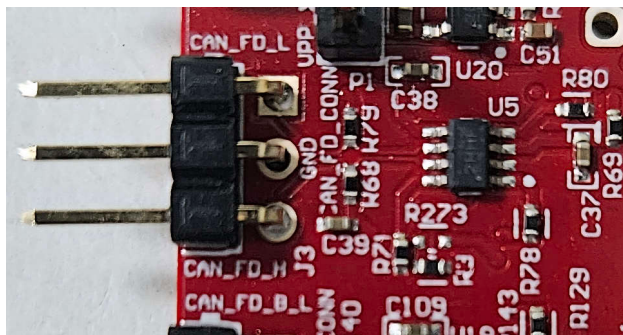


Figure 2-20. CAN-FD A Connector

ANALOG MUX -XDS /FTDI, DCA RS232, CAN_FD / UART A

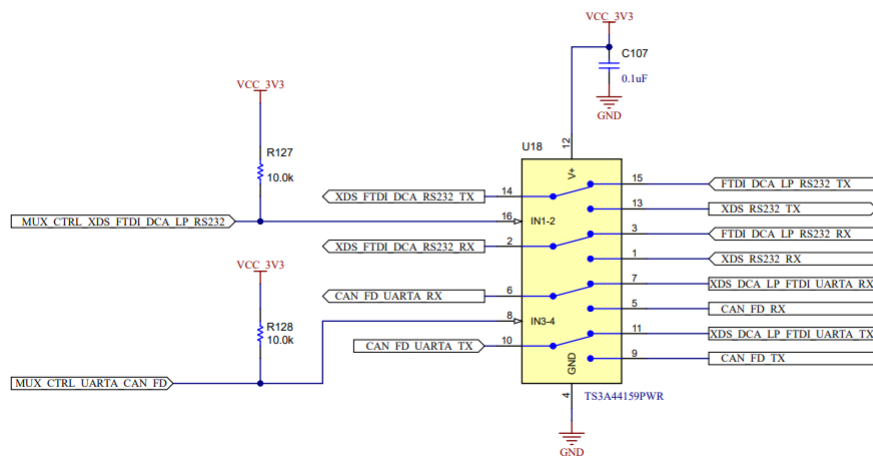


Figure 2-21. Analog Mux for the CAN PHY Switch

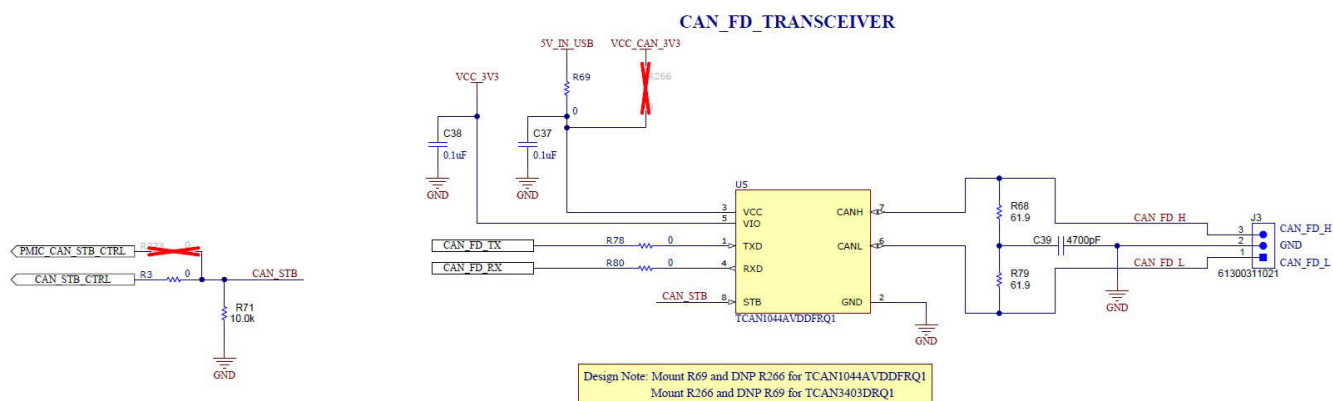


Figure 2-22. CAN-FD PHY Used in the EVM

2.11 CAN-FD_B Connector

The CAN connector provides access to the CAN_FD_B interface (CAN_L and CAN_H signals) from the onboard CAN-FD transceiver. These signals can be directly wired to the CAN bus.

The J8 connector shown in [Figure 2-23](#) provides the CAN_L and CAN_H signals from the onboard CAN-FD transceiver (TCAN3403DRQ1). CAN standby input can be controlled by toggling S1.1 switch

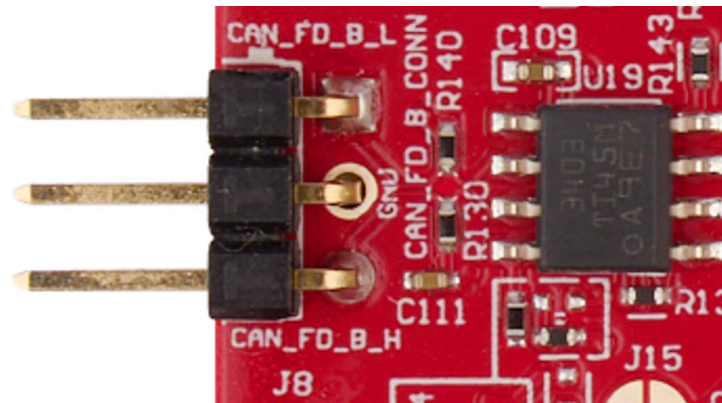


Figure 2-23. CAN-FD B Connector

CAN_FD_B_TRANSCEIVER

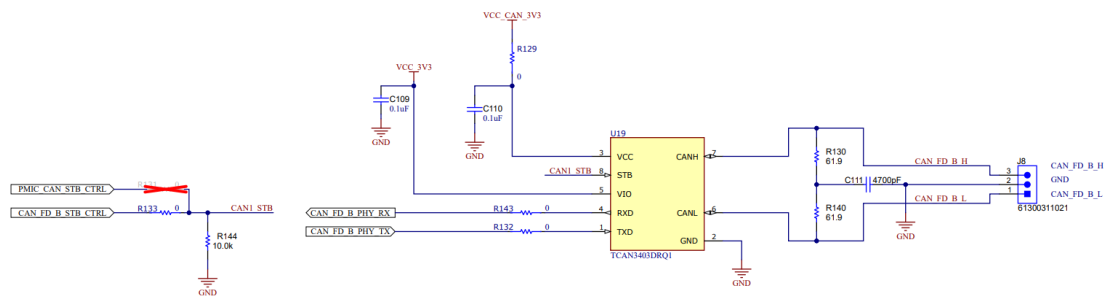


Figure 2-24. CAN-FD PHY Used in the EVM

2.12 LIN-PHY Connector

Figure 2-25 shows the LIN PHY (TLIN1039DDFRQ1) interface to the device. LIN PHY can operate with a different supply voltage than the mmWave sensor, an external VBAT option is provided for the LIN VDD supply, by default VSYS_IN supply is provided for J4 connector.

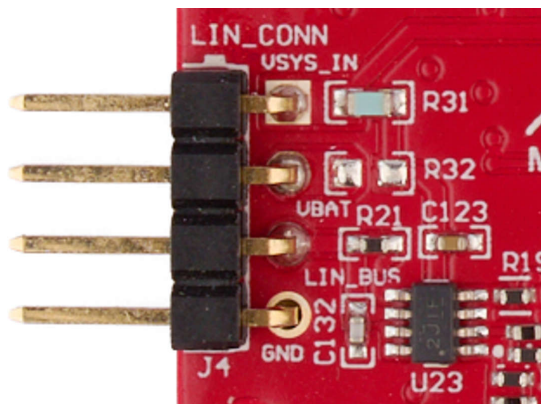


Figure 2-25. LIN Connector

ANALOG MUX - LIN/UARTB

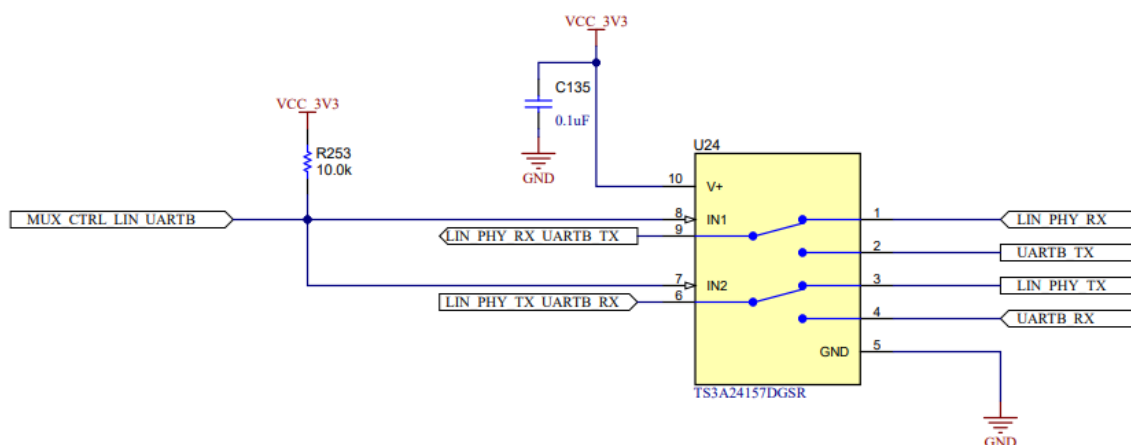


Figure 2-26. Analog Mux for the LIN PHY Switch

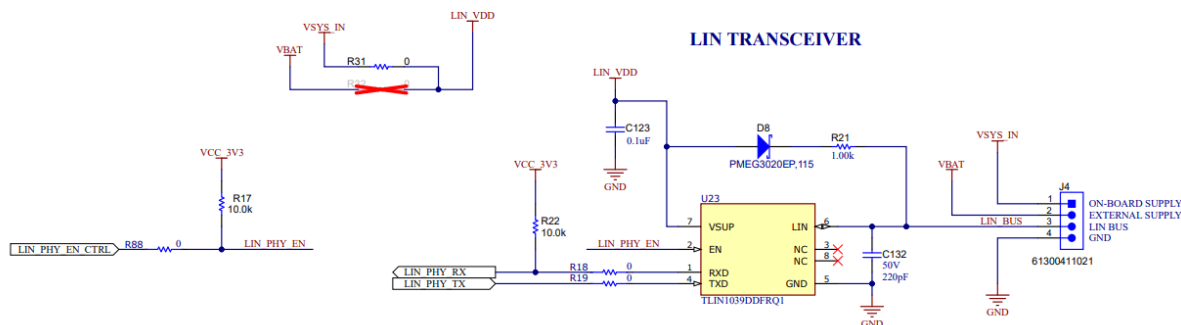


Figure 2-27. LIN PHY Interface

To enable the external VBAT supply, resistor R32 needs to be mounted and resistor R31 needs to be removed.

2.13 I2C Connections

The AWRL6888EVM board features a temperature sensor for measuring on-board temperature, current sensors for current measurement on 3.3V, 1.8V, 1.2V Digital, 1.2VRF power supply rails for AWRL6888 device and EEPROM for storing board ID. These are connected to TPS65036501 and AWRL6888 through I2C bus. In addition to this, header J1 is also provided for easy interface to I2C bus. Please refer to the schematics of the AWRL6888EVM for the I2C addresses.

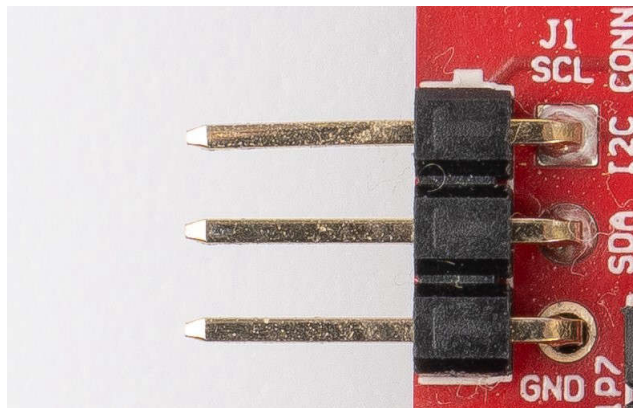


Figure 2-28. I2C Connector

2.13.1 EEPROM

The board features an EEPROM for storing the board specific IDs (for the identification of the EVM through the XDS110 interface).

2.14 XDS110 Interface

J5 connector provides access to the onboard XDS110 (TM4C1294NCPDT) emulator. This connection provides the following interfaces to the PC:

- JTAG for CCS connectivity
- Application/user UART (Configuration and data communication to PC)

When used in standalone mode of operation, the power is supplied through a single USB connector. Connector J5 is also used for configuration and data transfer through the user UART mounted on PC by XDS110 interface. When enumerated correctly, the two UART ports from the XDS110 are displayed on the device manager as a virtual COM Port, similar to that shown in [Figure 2-29](#).

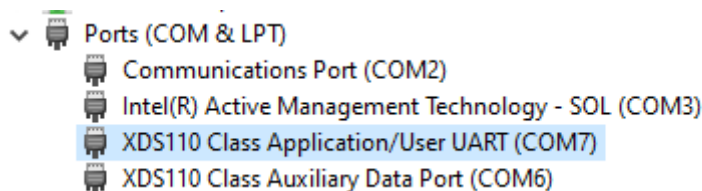


Figure 2-29. Virtual COM Port

If the PC is unable to recognize the above COM ports, install the latest [EMUpack](#).

2.15 FTDI Interface

J10 connector provides access to the onboard FTDI ports. This provides the following interfaces to PC:

- FTDI Port A : SPI
- FTDI Port B : I2C, HOST_INTERRUPT
- FTDI Port C : UARTA, nRESET
- FTDI Port D : RS232, SOP control

When AWRL6888EVM's FTDI USB is connected for the first time to PC, Windows® can be unable to recognize the device. This is indicated and confirmed in the device manager with yellow exclamation marks, as shown in [Figure 2-30](#).

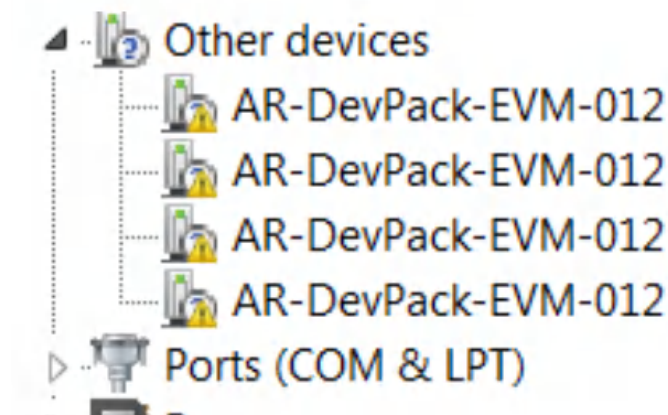


Figure 2-30. Uninstalled FTDI Drivers

To correctly detect these ports on the PC, please download and install the latest FTDI drivers available in the (C:\ti\mmwave_sdk_tools\ftdi). This must be done for all four COM ports. When all four COM ports are installed, the device manager recognizes these devices and indicates the COM port numbers, as shown in [Figure 2-31](#).

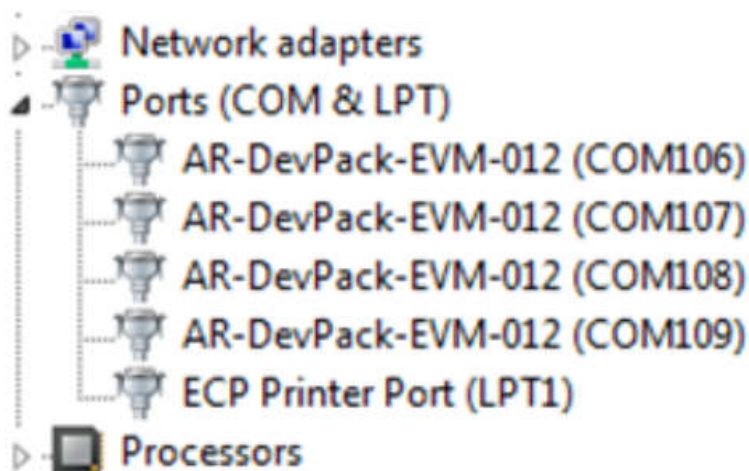


Figure 2-31. Installed FTDI Drivers

2.16 DCA1000EVM Mode

The setup for raw data capture using DCA1000EVM is shown in [Figure 2-32](#).

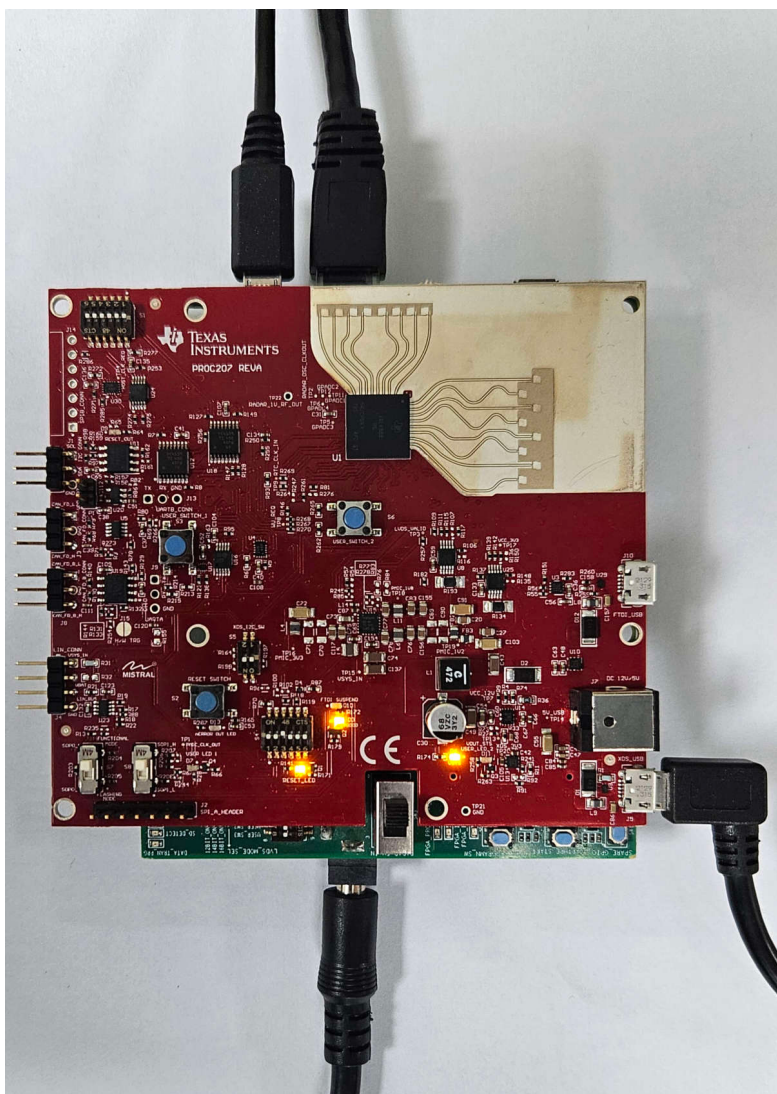
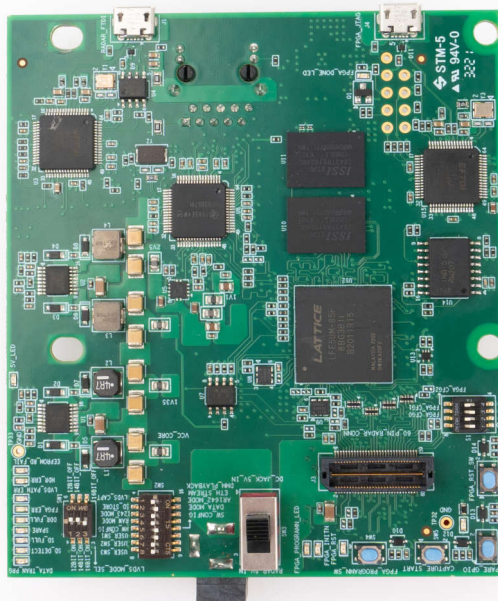


Figure 2-32. AWRL6888EVM for Raw Data Capture

The DCA Switch settings which needs to be followed for Raw Data capture are shown in [Figure 2-33](#).



Note
When EVM is directly mated with DCA1000 board, kindly use spacers which are included in the kit and make sure no physical contact happens between DCA1000 and the AWRL6888EVM as it can damage the boards.

When EVM is directly mated with DCA1000 board, kindly use spacers which are included in the kit and make sure no physical contact happens between DCA1000 and the AWRL6888EVM as it can damage the boards.

2.17 PCB Storage and Handling Recommendations

This EVM contains components that can potentially be damaged by electrostatic discharge. Always transport and store the EVM in the supplied ESD bag when not in use. Handle using an antistatic wristband and operate on an antistatic work surface. For more information on proper handling, refer to the [Electrostatic Discharge](#) application report.

2.17.1 PCB Storage and Handling Recommendations

The immersion silver finish of the PCB provides a better high-frequency performance, but is also prone to oxidation in open environment. This oxidation causes the surface around the antenna region to blacken, however mmWave Radar performance remains intact. To avoid oxidation, the PCB must be stored in an ESD cover and kept at a controlled room temperature with low humidity conditions. All ESD precautions must be taken while using and handling the EVM.

2.17.2 Higher Power Demanding Applications

Most of the EVM can be operated with a single 5V USB cable. For higher power consumption applications where a single 5V USB supply cannot provide the power needed, use an external 5V or 12V power adapter.

3 Software, Development Tools, and Example Code

To enable quick development of end applications on the ARM Cortex-R5F core in AWRL6888, TI provides a [MMWAVE-L-SDK](#) that includes demo codes, software drivers, emulation packages for debug, and more. For more information, please refer to [MMWAVE-L-SDK](#) user's guide .

4 Hardware Design Files

4.1 Schematics, PCB Layout and Bill of Materials (BOM)

AWRL6888EVM Schematic, Assembly, Bill of Materials can be found at [AWRL6888 EVM Schematic Drawing, Assembly Drawing, and Bill of Materials](#).

4.2 EVM Design Database

AWRL6888EVM Design Database containing Altium Project Source files can be found at [Altium AWRL6888 EVM Design Files](#).

4.3 Hardware Design Checklist

AWRL6888 Hardware Design Checklist containing schematic, layout recommendations can be found at [SPRADL0](#).

5 Additional Information

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- Code Composer Studio™ and LaunchPad™ are trademarks of Texas Instruments.
- Windows® is a registered trademark of Microsoft.

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6 References

1. Texas Instruments, [DCA1000EVM Data Capture Card](#), user's guide
2. Texas Instruments, [MMWAVE-L-SDK](#), tool page
3. Texas Instruments, [Code Composer Studio](#), tool page

6.1 TI E2E™ Community

Search the forums at e2e.ti.com. If you cannot find the answer, post your question to the community.

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WARNING

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NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 Regulatory Notices:

3.1 United States

3.1.1 Notice applicable to EVMs not FCC-Approved:

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

3.1.2 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

NOTE: 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 instructions, 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

NOTE: 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.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. 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.

3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/sds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

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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This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

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4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

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