

User's Guide

AWR2944 Evaluation Module



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1 Getting Started

1.1 Introduction

The AWR2944EVM is an easy-to-use evaluation board for the AWR294x mmWave sensing device, with direct connectivity to the [DCA1000 EVM](#). This EVM kit contains everything needed to start developing software for the on-chip C66x DSP, ARM® Cortex®-R5F controller, and hardware accelerator (HWA 2.0). Also included is on-board emulation for programming and debugging as well as on-board buttons and LEDs for quick integration of a simple user interface.

1.2 Key Features

- Onboard antenna
- XDS110 based JTAG emulation with serial port for onboard 64-bit QSPI flash programming
- UART to USB Debug port for terminal access using FT4232H
- 60-pin, high-density (HD) connector for external JTAG/emulator interface with TRACE and CSI2 support
- 60-pin, high-density (HD) connector for debug, SPI, I2C and LVDS
- RJ45 connector to stream the captured data over the network to the host PC
- MATEnet Ethernet® interface to stream the captured data over the network to an automotive host
- Dual onboard CAN-FD transceiver
- One button and LED for basic user interface
- 12V power jack to power the board

1.3 What's Included

1.3.1 Kit Contents

- AWR2944EVM
- Micro USB cable
- Ethernet Cable
- Mounting brackets, screws, spacers and nuts, to allow placing the PCB vertical

Note

A 12V, > 2.5A supply brick with a 2.1mm barrel jack (center positive) is not included. TI recommends using an external power supply that complies with applicable regional safety standards, such as UL, CSA, VDE, CCC, PSE, and more. The length of the power cable needs to be < 3m.

The following power supply has been tested to work with the AWR2944EVM: SDI65-12-U-P5.

1.3.2 mmWave Out-of-Box (OOB) Demo

TI provides sample demo codes to easily get started with the AWR2944 evaluation module (EVM) and to experience the functionality of the AWR2944 radar sensor. For details on getting started with these demos, see www.ti.com/tool/mmwave-sdk.

2 Hardware



CAUTION HOT SURFACE
CONTACT MAY CAUSE BURN
DO NOT TOUCH

Note

During operation, a minimum separation distance of 20 centimeters must be maintained between the user and the EVM.

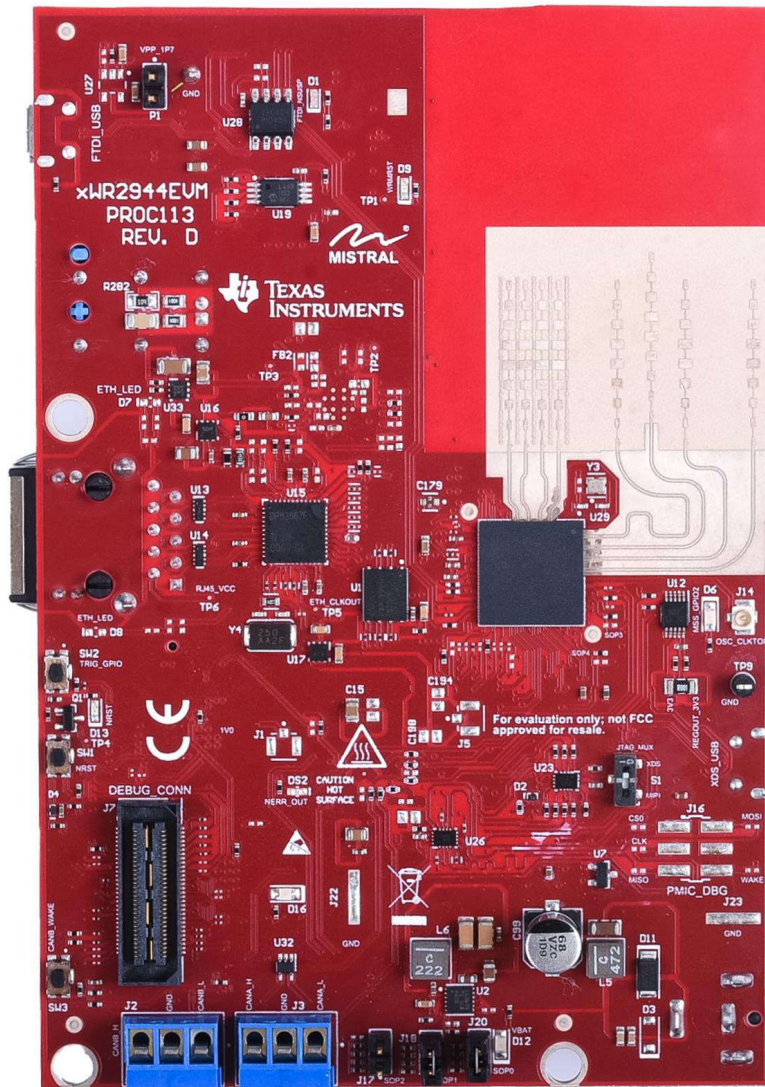


Figure 2-1. AWR2944EVM Front View

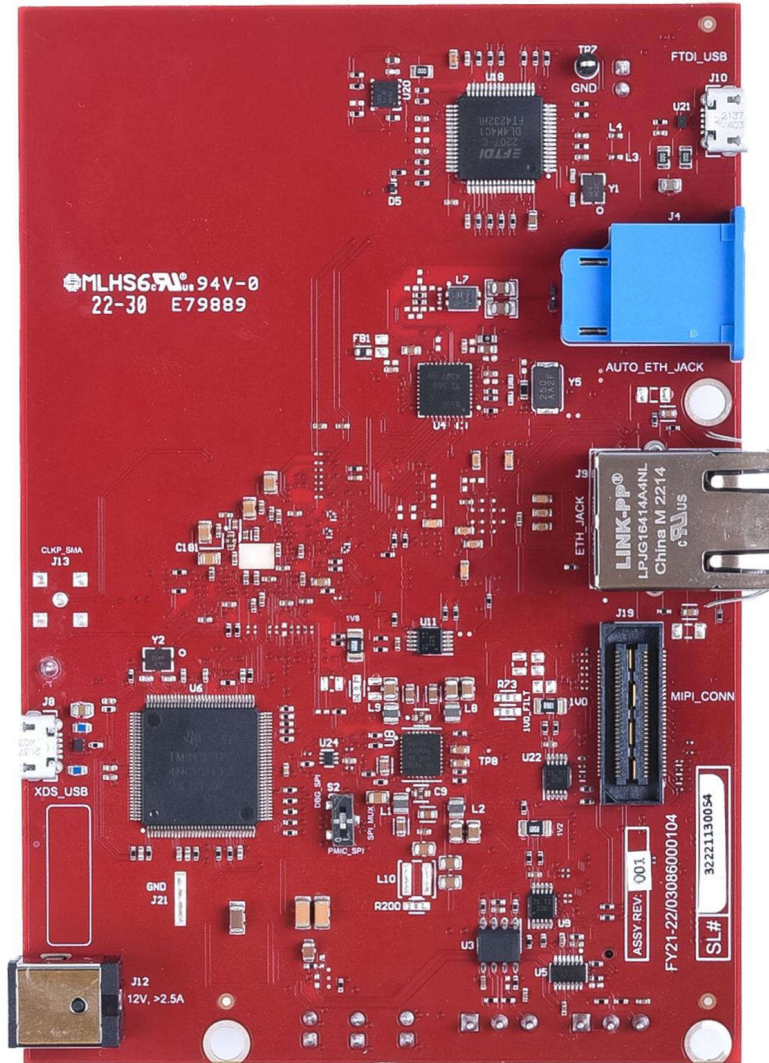


Figure 2-2. AWR2944EVM Back View

2.1 Block Diagram

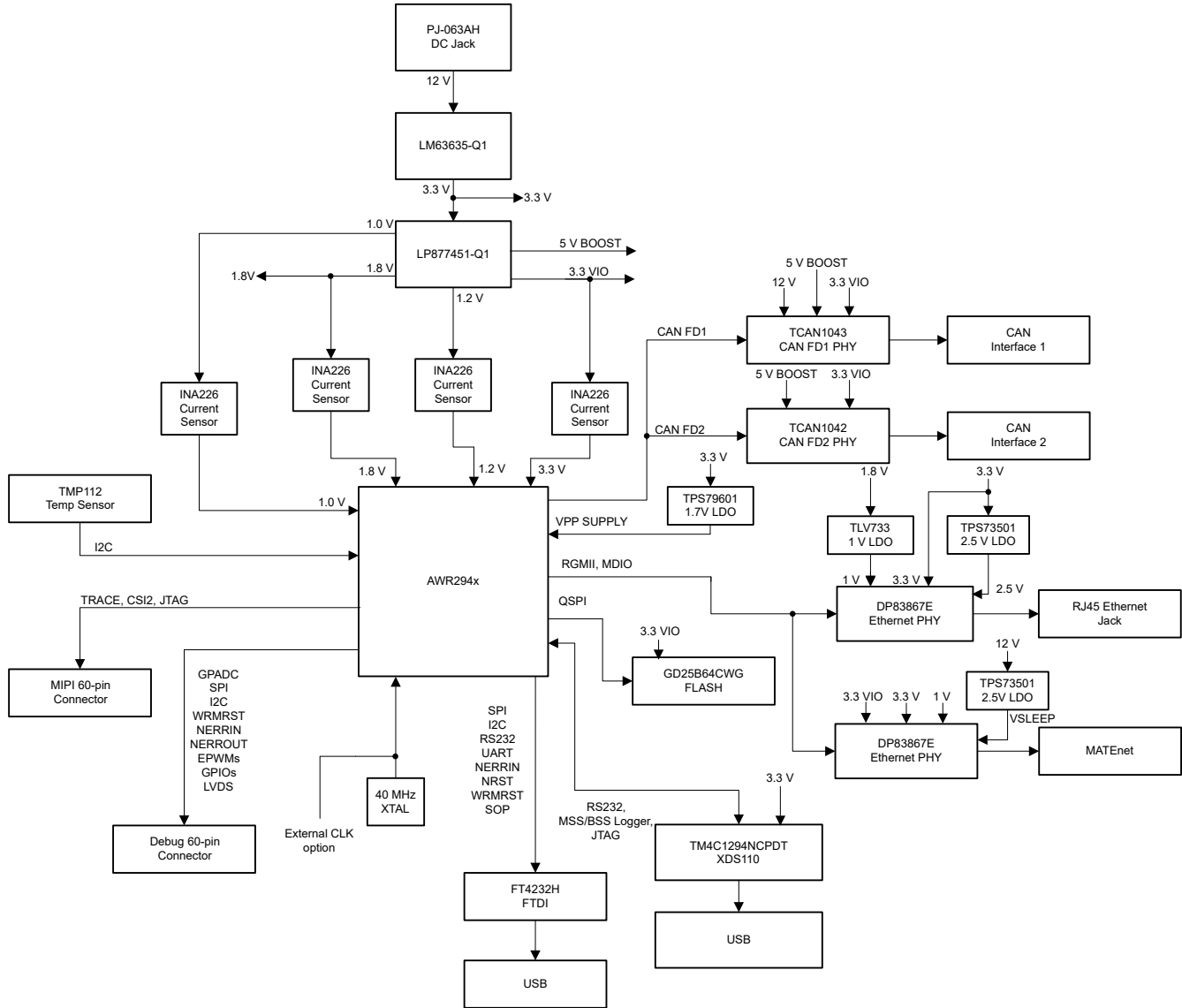


Figure 2-3. AWR2944EVM Block Diagram

2.2 PCB 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. Operate on an antistatic work surface. For more information on proper handling, refer to [SSYA010A](#).

2.3 Power Connections

The AWR2944EVM is powered by the 12V power jack (>2.5A current capability). When power is provided the AR_NRST, VBAT_INT, and 5V0 LEDs glow, indicating that the board is powered up.

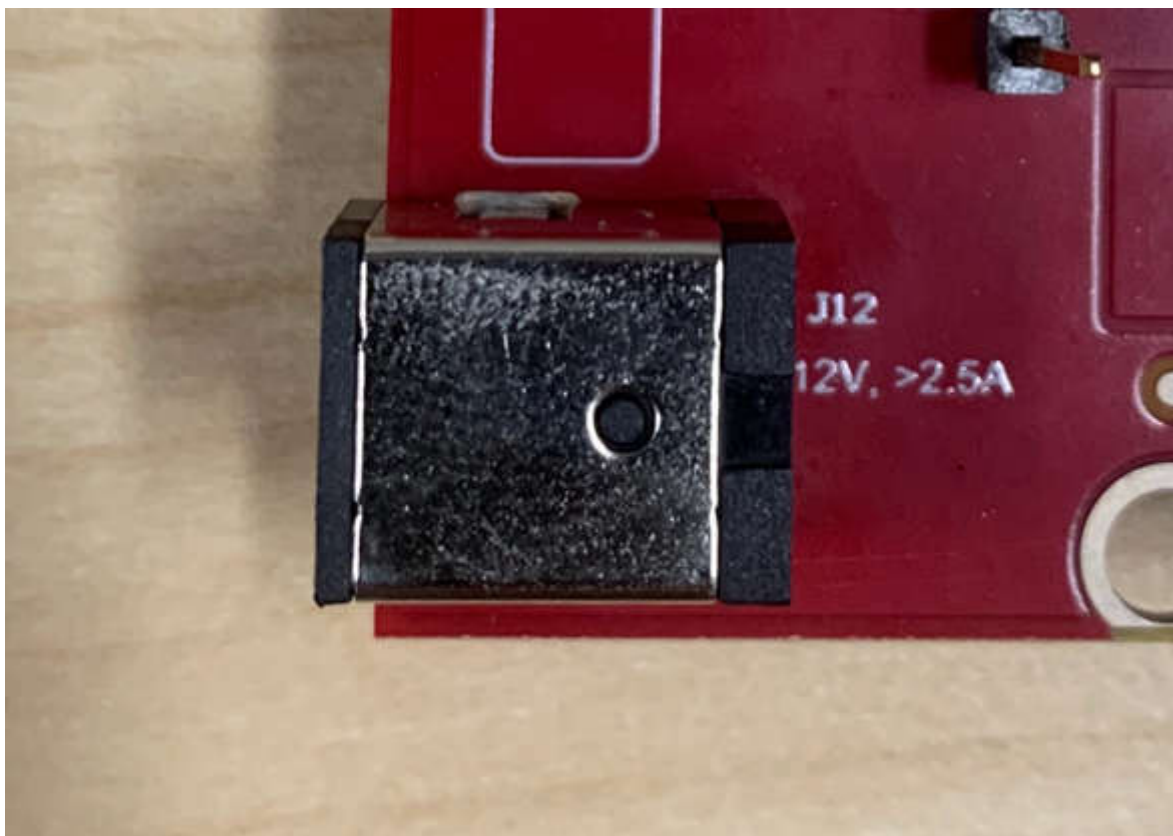


Figure 2-4. 12V Power Connector

Note

After the 12V power supply is provided to the EVM, TI recommends to press the NRST switch (SW1) one time to provide for a reliable boot-up state.

2.4 Connectors

2.4.1 MIPI 60-Pin Connector (J19)

This connector provides the standard MIPI 60-pin interface, as shown in Figure 5, for JTAG, CSI2 and trace capability through emulators such as the XDS560pro. Further information on the emulation and trace header can be found in the [Emulation and Trace Headers Technical Reference Manual](#). This connector also provides access to the CSI_RX lanes which allow for playback or feeding external data and bypassing the RF front end, which enables testing and algorithm development on a known dataset.

To use this interface, the JTAG lines from the AWR2944EVM needs to be muxed to MIPI 60-pin connector. Refer to [Section 2.8.1](#) for more details.

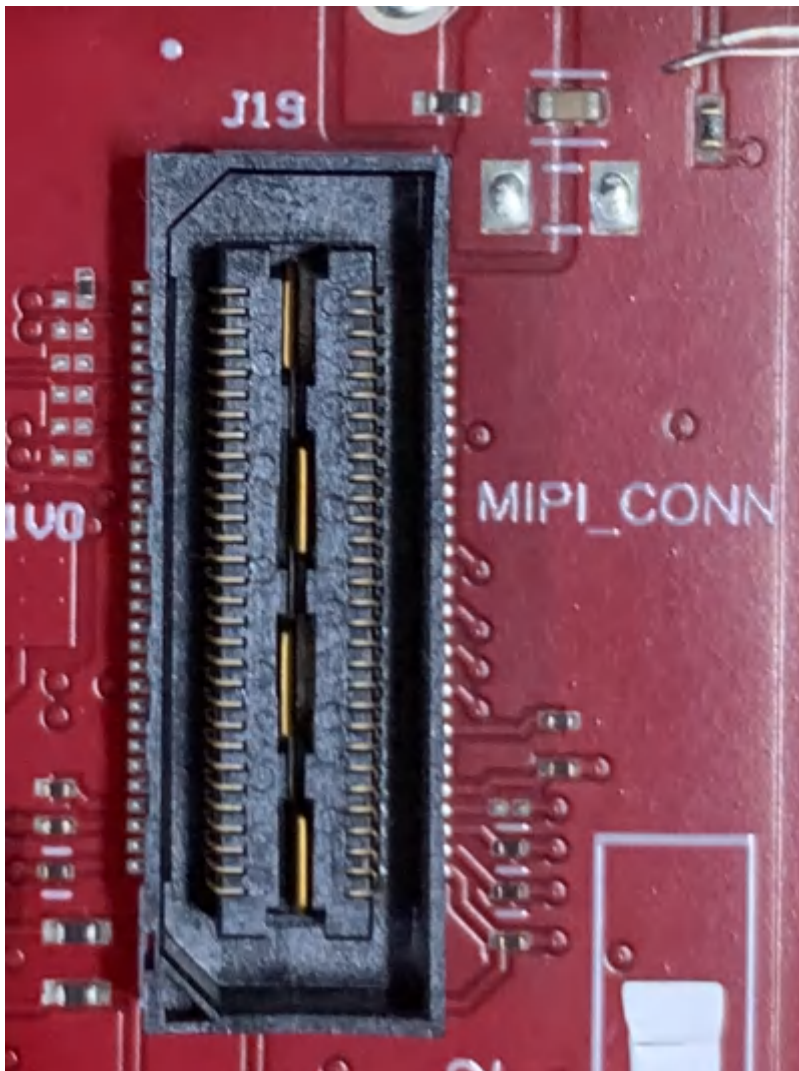


Figure 2-5. 60-pin MIPI Connector

Table 2-1 provides the pin assignment details for the MIPI 60-pin connector.

Table 2-1. J19 Pin Assignment

Pin Number	Description	Pin Number	Description
1	MIPI_VREF_DEBUG	2	MIPI_TMS
3	MIPI_TCK	4	MIPI_TDO
5	MIPI_TDI	6	MIPI_NRST
7	MIPI_RTCK	8	MIPI_TRSTPD
9	MIPI_JTAG_NRST	10	NC
11	NC	12	MIPI_VREF_DEBUG
13	TRACE_CLK	14	NC
15	MIPI_DBG_DETECT	16	GND
17	TRACE_CTL	18	NC
19	TRACE_DATA0	20	NC
21	TRACE_DATA1	22	NC
23	TRACE_DATA2	24	NC
25	TRACE_DATA3	26	NC
27	TRACE_DATA4	28	NC

Table 2-1. J19 Pin Assignment (continued)

Pin Number	Description	Pin Number	Description
29	TRACE_DATA5	30	NC
31	TRACE_DATA6	32	NC
33	TRACE_DATA7	34	NC
35	NC	36	NC
37	NC	38	NC
39	NC	40	NC
41	NC	42	GND
43	NC	44	CSI2_CLK_P
45	NC	46	CSI2_CLK_N
47	NC	48	GND
49	NC	50	CSI2_1_P
51	NC	52	CSI2_1_N
53	NC	54	GND
55	NC	56	CSI2_0_P
57	GND	58	CSI2_0_N
59	NC	60	GND

2.4.2 Debug Connector-60 pin (J7)

This connector enables interfacing of LVDS signals to the DCA1000 EVM for data capturing purposes.

Also, the connector has SPI, I2C, JTAG, GPADC, WRMRST, NRROUT, EPWM, and other control signals from AWR2944EVM for debug purpose.

The SPI is multiplexed to the Debug Connector. For more details refer to [Section 2.8.1](#).

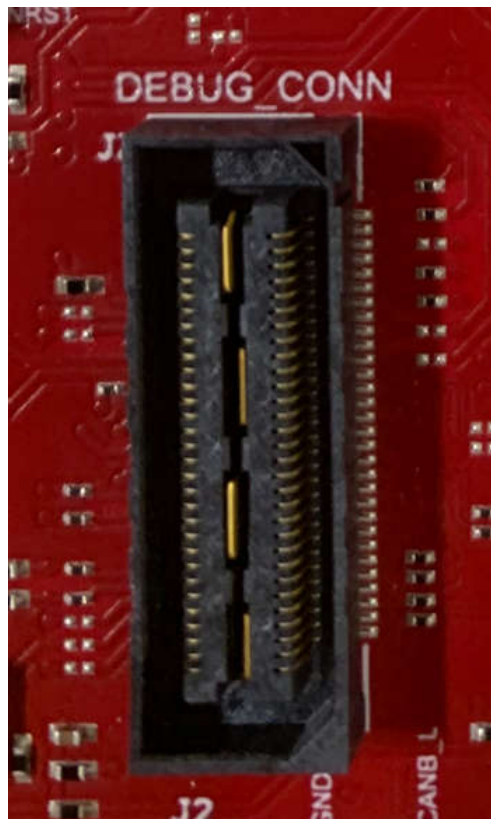


Figure 2-6. 60-pin Debug Connector

Table 2-2 provides the pin assignment details for the Debug 60-pin connector.

Table 2-2. J7 Pin Assignment

Pin Number	Description	Pin Number	Description
1	NC	2	NC
3	NC	4	XREF_CLK0
5	GND	6	MSS_EPWMA0
7	DBG_SPI_CS0	8	GND
9	DBG_SPI_CLK	10	MSS_SPIA_HOSTIRQ
11	DBG_SPI_PICO	12	DBG_SPI_POCI
13	3.3V PULL_UP	14	XREF_CLK1
15	EMU_TCK	16	MCU_CLKOUT
17	EMU_TDI	18	GND
19	GPADC1	20	EMU_TMS
21	GPADC2	22	EMU_TDO
23	GPADC3	24	GND
25	GPADC4	26	LVDS_TX3_FRCLK_P
27	GPADC5	28	LVDS_TX3_FRCLK_N
29	GPADC6	30	GND
31	GPADC7	32	NC
33	GPADC8	34	NC
35	GPADC9	36	GND
37	MSS_SPIB_CS1	38	NC
39	SOP1_MSS_SPIB_CS2	40	NC
41	MSS_GPIO_0	42	GND
43	MSS_GPIO_1	44	LVDS_TX2_CLK_P
45	AR_WRMIRST	46	LVDS_TX2_CLK_N
47	NC	48	GND
49	AR_NERROUT	50	LVDS_TX1_P
51	MSS_I2CA_SCL	52	LVDS_TX1_N
53	MSS_I2CA_SDA	54	
55	MSS_EPWMB0	56	LVDS_TX0_P
57	MSS_EPWMA1	58	LVDS_TX0_N
59	MSS_GPIO_3	60	GND

2.4.3 CAN-A Interface Connector (J3)

The J3 connector provides the CANA_L and CANA_H signals from the onboard can CAN-FD transceiver (TCAN1042HGVDQR1). These can be directly wired to the CAN bus.



Figure 2-7. CAN_A Connector

Table 2-3 provides the pin assignment details for the CAN_A connector.

Table 2-3. J3 Pin Assignment

Pin Number	Description
1	CAN_L
2	GND
3	CAN_H

2.4.4 CAN-B Interface Connector (J2)

The J2 connector provides the CANB_L and CANB_H signals from the onboard can CAN-FD transceiver (TCAN1043ADYRQ1). These can be directly wired to the CAN bus.

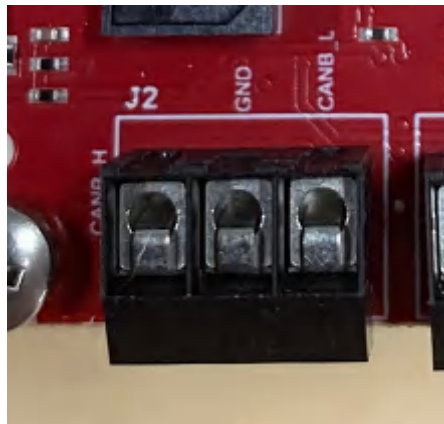


Figure 2-8. CAN_B Connector

Table 2-4 provides the pin assignment details for the CAN_B connector.

Table 2-4. J2 Pin Assignment

Pin Number	Description
1	CAN_L
2	GND
3	CAN_H

2.4.5 Ethernet Ports (J4 and J9)

The AWR2944EVM supports two RGMII Ethernet ports to provide the connection to the network. The J4 connector provides access over a MATEnet port (9-2304372-9 connector) via a DP83TC812R-Q1 PHY. The J9 port provides access over an RJ45 port via a DP83867ERGZR PHY. By default, the RGMII interfaces are connected to the J9 port only. To access the RGMII interface, over the J4 connector several resistors must be populated. For more details please see [Section 2.4.5.1](#) and refer to the Schematic, BOM, and Assembly and Database and Layout sections.

This RGMII interface is intended to operate primarily as a 100Mbps ECU interface and can also be used as an Instrumentation Interface.

The RGMII interface supports following features:

- Full Duplex 10Mbps/100Mbps wire rate Interface to Ethernet PHY over RGMII, parallel interface
- MDIO Clause 22 and 45 PHY management interface
- IEEE 1588 Synchronous Ethernet support

The Ethernet port is interfaced to the AWR2944 through the Ethernet PHY and is used to stream the captured data over the network to the host PC.

[Figure 2-9](#) shows the Ethernet RJ45 Mag-Jack connector, and [Table 2-5](#) provides the connector pin details.

Table 2-5. J9 Pin Assignment

Pin Number	Description	Pin Number	Description
1	GND	2	Test point
3	ETH_D4P	4	ETH_D4N
5	ETH_D3P	6	ETH_D3N
7	ETH_D2P	8	ETH_D2N
9	ETH_D1P	10	ETH_D1N
11	LED_ACTn	12	GND
13	GND	14	LED_LINKn
15	ETH_GND	16	ETH_GND



Figure 2-9. RJ45 Connector

[Figure 2-10](#) shows the Ethernet MATEnet connector, and [Table 2-6](#) provides the connector pin details.

Table 2-6. J4 Pin Assignment

Pin Number	Description	Pin Number	Description
1	TRD_P	2	TRD_M
S1	GND	S2	GND
S3	GND	S4	GND
S5	GND	S6	GND

**Figure 2-10. MATEnet Connector**

2.4.5.1 ECOs to Enable the DP83TC812R PHY

By default, the board is designed to be used with the DP83867E PHY with the RJ45 connector. To enable the DP83TC812R PHY with the MATEnet connector, the following hardware changes must be made. For help with locating these components on the PCB, refer to the provided Schematic, BOM, and assembly files.

1. Remove R98 and populate on R74
2. Remove R101 and populate on R230
3. Remove R103 and populate on R96
4. Remove R105 and populate on R100
5. Remove R121 and populate on R178
6. Remove R122 and populate on R225
7. Remove R195 and populate on R245
8. Remove R290 and populate on R234
9. Remove R325 and populate on R237
10. Remove R336 and populate on R238
11. Remove R338 and populate on R239
12. Remove R339 and populate on R240
13. Remove R413 and populate on R247
14. Remove R369 and populate on R249
15. Populate D18 and D19 ESD diodes
16. Populate C55
17. The bootstrap configuration pins can be populated/removed as needed depending on the use case

Note

The automotive Ethernet PHY (U4) and port (J4) on the AWR2944EVM have not been tested by Texas Instruments to be compliant with any regional standards such as Radio Equipment Directive 2014/53/EU. If the user wishes to populate the components necessary to utilize this port, then users can do any necessary testing to verify that the port is compliant with all applicable regional standards before use. Any modifications done to enable the J4 port invalidates the existing RED 2014/53/EU certification of the AWR2944EVM.

2.4.6 USB Connectors (J8, J10)

Note

The EVM must be powered on before the USB cables are connected. Plugging in the USB cables before powering on the board can cause the board to get stuck in a permanent reset state. In the event that this occurs, just unplug the USB cables, power cycle the EVM, and plug in the USB cables to resolve the issue.

The AWR2944EVM has two standard micro USB connectors.

Micro USB Connector J10 provides access to the AWR2944 UART, SPI, I2C, RS232, and SOP interfaces through the FTDI chip.

Table 2-7. J10 Pin Assignment

Pin Number	Description	Pin Number	Description
1	FTDI_VBUS	2	FTDI_USBD_N
3	FTDI_USBD_P	4	FTDI_USBDID
5	GND	6	GND
7	GND	8	GND
9	GND	10	GND
11	GND		



Figure 2-11. FTDI USB Port

Micro USB connector J8 provides access to the JTAG, MSS_UARTA, and MSS_UARTB interfaces of the AWR2944 via the XDS110 emulator.

This is the UART interface used to flash the binary to the onboard serial flash and for Out-of-box (OOB) demo.

Note

The OOB demo requires only J8 to be connected to the PC. J10 is not used for the OOB demo.

Table 2-8. J8 Pin Assignment

Pin Number	Description	Pin Number	Description
1	XDSET_VBUS	2	XDSET_D_N
3	XDSET_D_P	4	XDSET_ID
5	GND	6	GND
7	NC	8	NC
9	GND	10	GND
11	GND		

**Figure 2-12. XDS USB Port**

2.4.7 OSC_CLKOUT Connector (J14)

Connector J14 provides access to measure oscillator clock out signal from the AWR2944 device.

**Figure 2-13. OSC Clock Port**

2.4.8 PMIC SPI Connector (J16) (DNP)

Connector J16 provides access to the SPI and enable pins on the PMIC (U8). This part is not populated by default. To populate this connector with the appropriate part, please refer to the Schematic, BOM, and assembly files.

Table 2-9. J8 Pin Assignment

Pin Number	Description	Pin Number	Description
1	PMIC SPI_CS	2	PMIC SPI_PICO
3	PMIC SPI_CLK	4	NC
5	PMIC SPI_POCI	6	PMIC ENABLE

2.4.9 Voltage Rails Ripple Measurement Connectors (J1, J5) (DNP)

J1 provides access to measure ripple on 1V0_FILTERED (1.0 analog RF supply for AWR2944) voltage rail.

J5 provides access to measure ripple on 1V8_FILTERED (1.8V analog supply for AWR2944) voltage rail.

These connectors are not populated on the board by default. To populate these connectors with the appropriate part, please refer to the schematic, BOM, and assembly files.

2.5 Antenna

The AWR2944EVM includes etched antennas onboard for the four receivers and four transmitters, which enables tracking multiple objects with the distance and angle information. This antenna design enables estimation of both azimuth and elevation angles, which enables object detection in a 3D plane (see [Figure 2-14](#)).

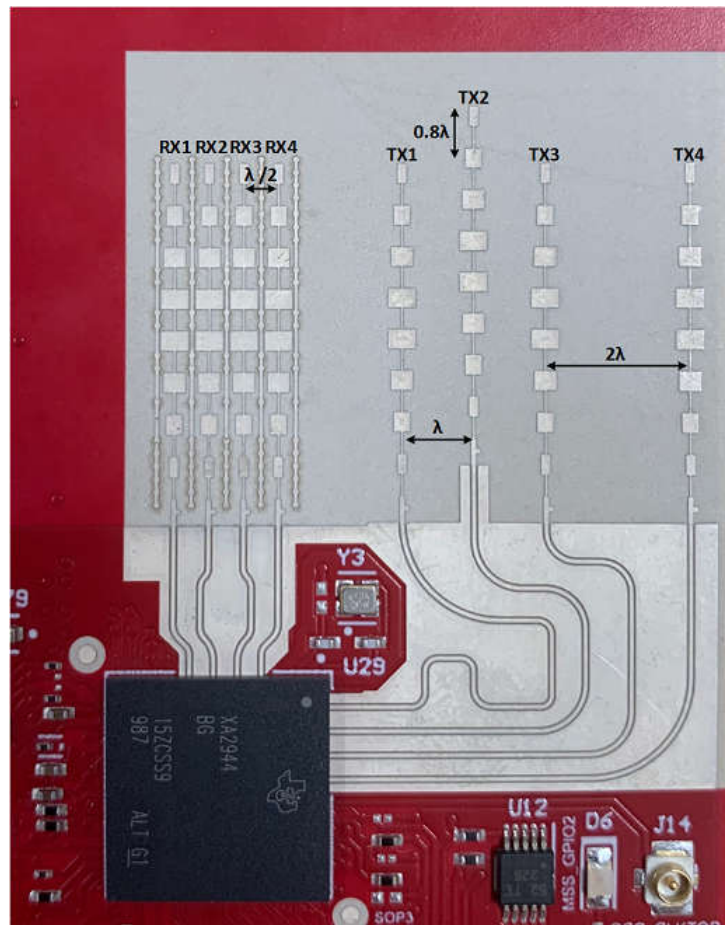


Figure 2-14. AWR2944EVM Antenna Design

The antenna placement shown in Figure 2-14 results in the virtual antenna array shown in Figure 2-15.

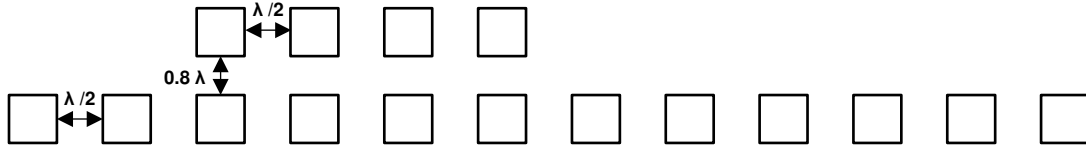


Figure 2-15. Virtual Antenna Array

The antenna peak gain is 13dBi across the frequency band of 76 to 81GHz. The radiation pattern of the antenna in the horizontal plan (H-plane) and elevation plan (E-plane) is as shown in Figure 2-16 and Figure 2-17, respectively.

The beamwidth of the antenna design can be determined from the radiation patterns provided below. For example, based on 3dB drop in the gain as compared to bore sight, the horizontal 3dB-beamwidth is approximately ± 30 degrees (see Figure 2-16), and elevation 3dB-beamwidth is approximately ± 3 degrees (see Figure 2-17). Similarly, the horizontal 6dB beamwidth is approximately ± 45 degrees (see Figure 2-16) and the elevation 6dB-beamwidth is approximately ± 5 degrees (see Figure 2-17).

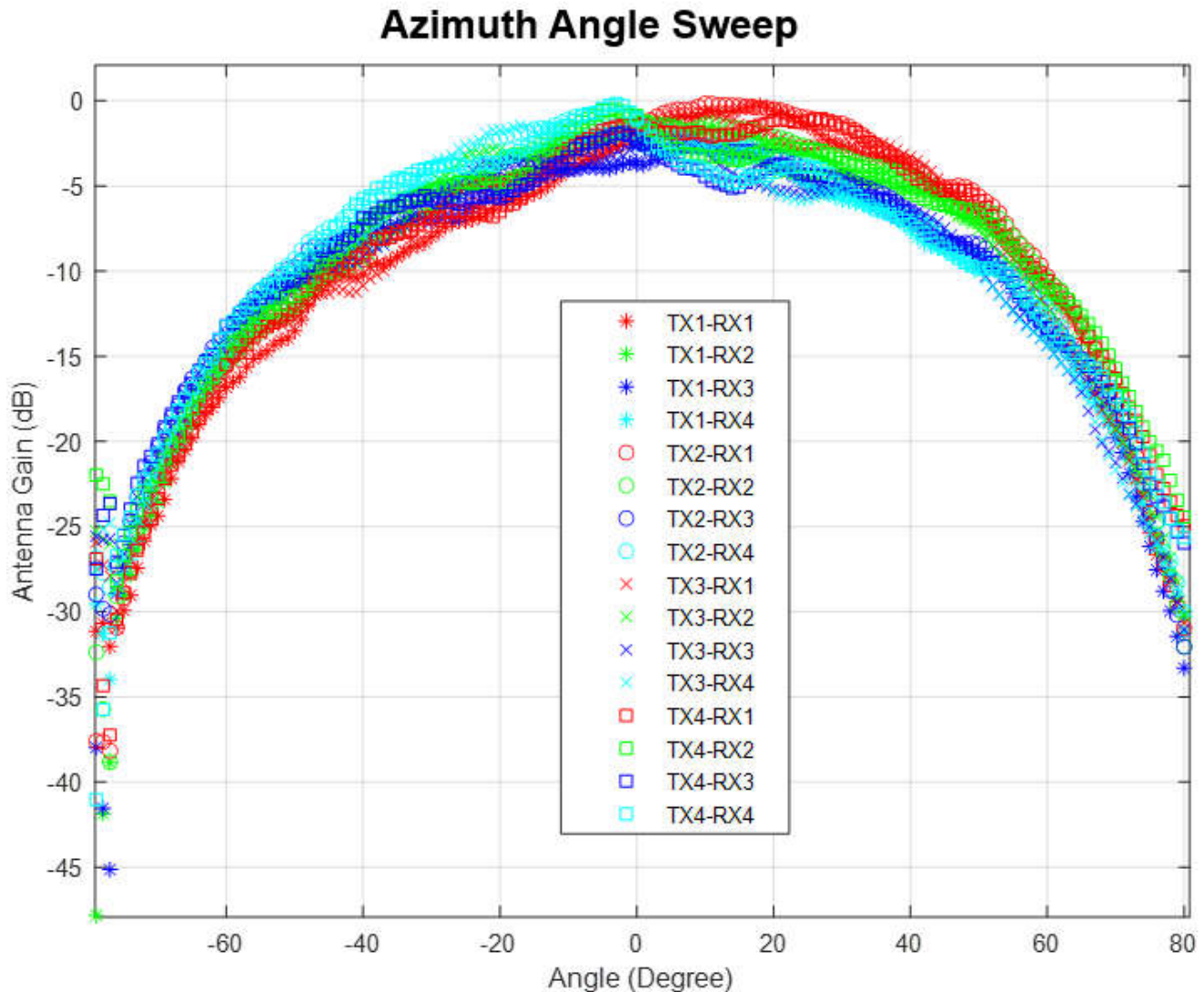


Figure 2-16. Azimuth Radiation Pattern

Elevation Angle Sweep

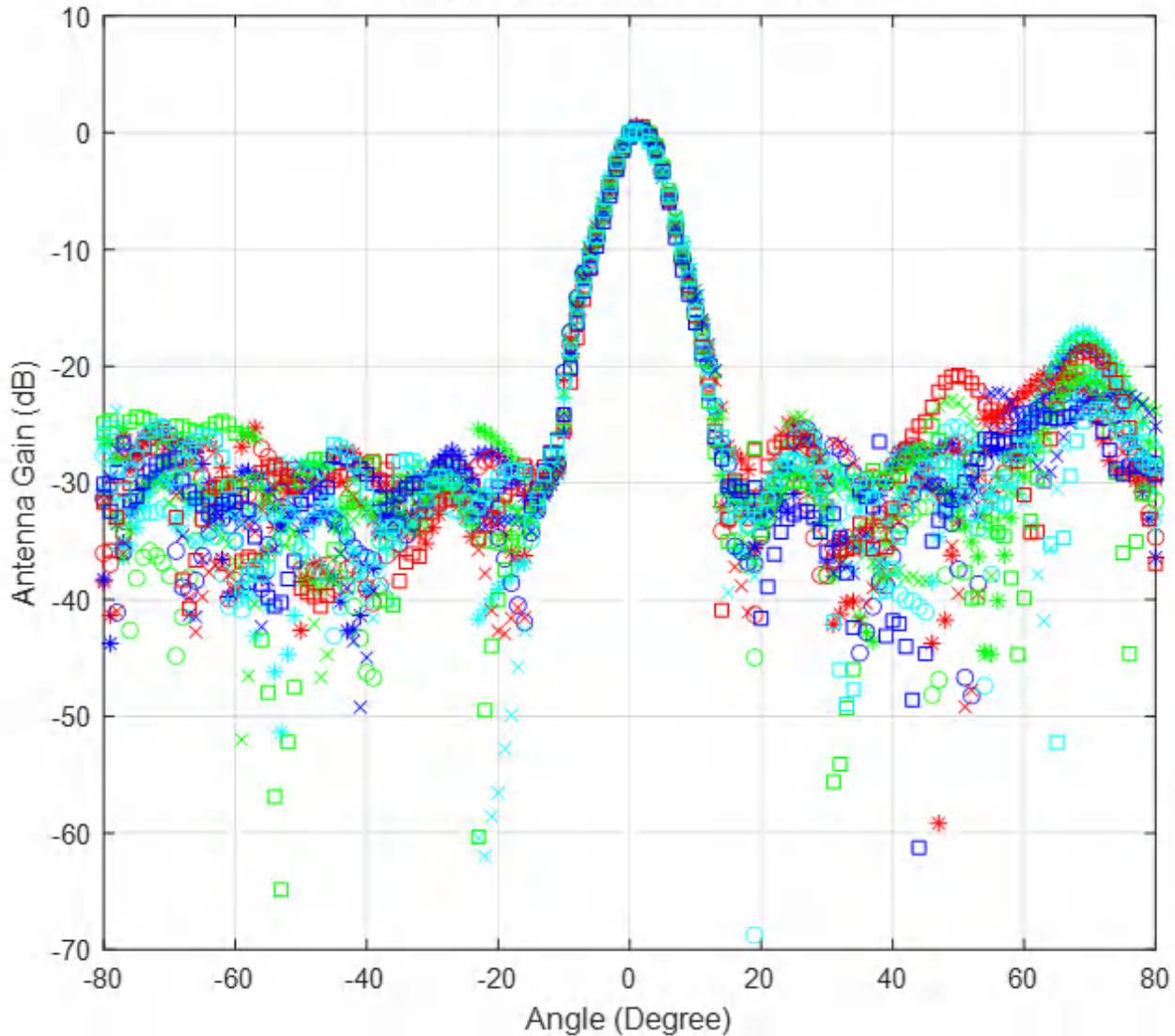


Figure 2-17. Elevation Radiation Pattern

2.6 PMIC

Power to the AWR2944 is provided by the LP877451-Q1 PMIC. This is a functional safety compliant PMIC that supports ASIL-C/SIL-2 applications. For more details, visit the LP87745-Q1 product page (<https://www.ti.com/product/LP87745-Q1>).

2.7 On-Board Sensors

The xWRL6432AOPEVM provides access to an on-board temperature sensor (TMP112AQDRLRQ1) and four on-board current sensors (INA228AIDGST). These sensors can be controlled by the radar via I2C.

The current sensors are designed to measure the current being supplied to the various power rails of the xWRL6432AOP device. For details on the supply rails that can be measured using the current sensors, refer to [Table 2-10](#).

Table 2-10. Current Sensor Supply Details

Reference Designator	Supply Node	PCB Net Name
U6	1.8V Supply	REG_1V8
U7	3.3V Supply	VCC_3V3
U8	1.2V Supply	REG_1V2
U25	1.2V RF Supply	REG_RF_1V2

2.8 PC Connection

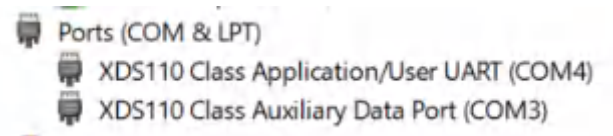
The PC connectivity is provided via two micro USB connectors, J8 and J10.

2.8.1 XDS110 Interface

J8 provides access to the onboard XDS110 (TM4C1294NCPDT) emulator. This connection provides the following interfaces to the PC:

- JTAG for CCS connectivity
- MSS logger UART (can be used to get MSS code logs on the PC)

When the J8 USB is connected to the PC, the device manager recognizes two XDS110 COM ports under Ports (COM and LPT).

**Figure 2-18. XDS110 COM Ports**

XDS110 debug probe and data port are detected under Texas Instruments Debug Probes.

**Figure 2-19. TI Debug Probes**

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

2.8.2 FTDI Interface

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

- FTDI Port A -> SPI.
- FTDI Port B-> Host INTR signal.
- FTDI Port C -> NRESET control signal.
- FTDI Port D -> SOP0, SOP1 control signals.

When the USB is connected for the first time to the PC, a possibility is that Windows® does not recognize the device. This is indicated in the device manager with yellow exclamation marks, as shown in [Figure 2-20](#).

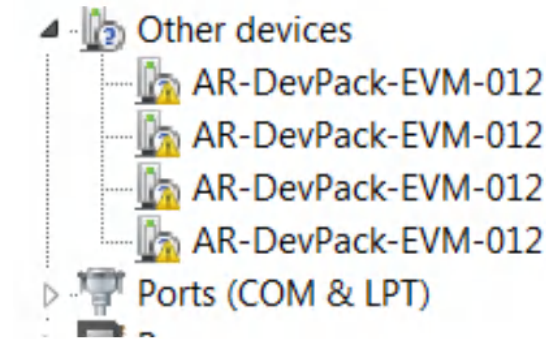


Figure 2-20. Uninstalled FTDI Drivers

To install the devices, download the latest FTDI drivers available in the [mmwave SDK package](#). Right click on these devices, and update the drivers by pointing to the location where the FTDI drivers were installed (C:\ti\mmwave_sdk_<version_number>\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 2-21](#).

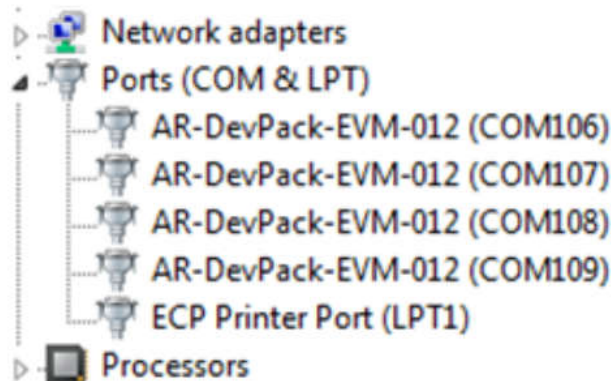


Figure 2-21. Installed FTDI Drivers

2.9 Connecting the AWR2944EVM to the DCA1000 EVM

The AWR2944EVM can be connected to the [DCA1000 EVM](#) platform to allow for LVDS data streaming. [Figure 2-22](#) shows the AWR2944EVM interfaced to the DCA1000 EVM.

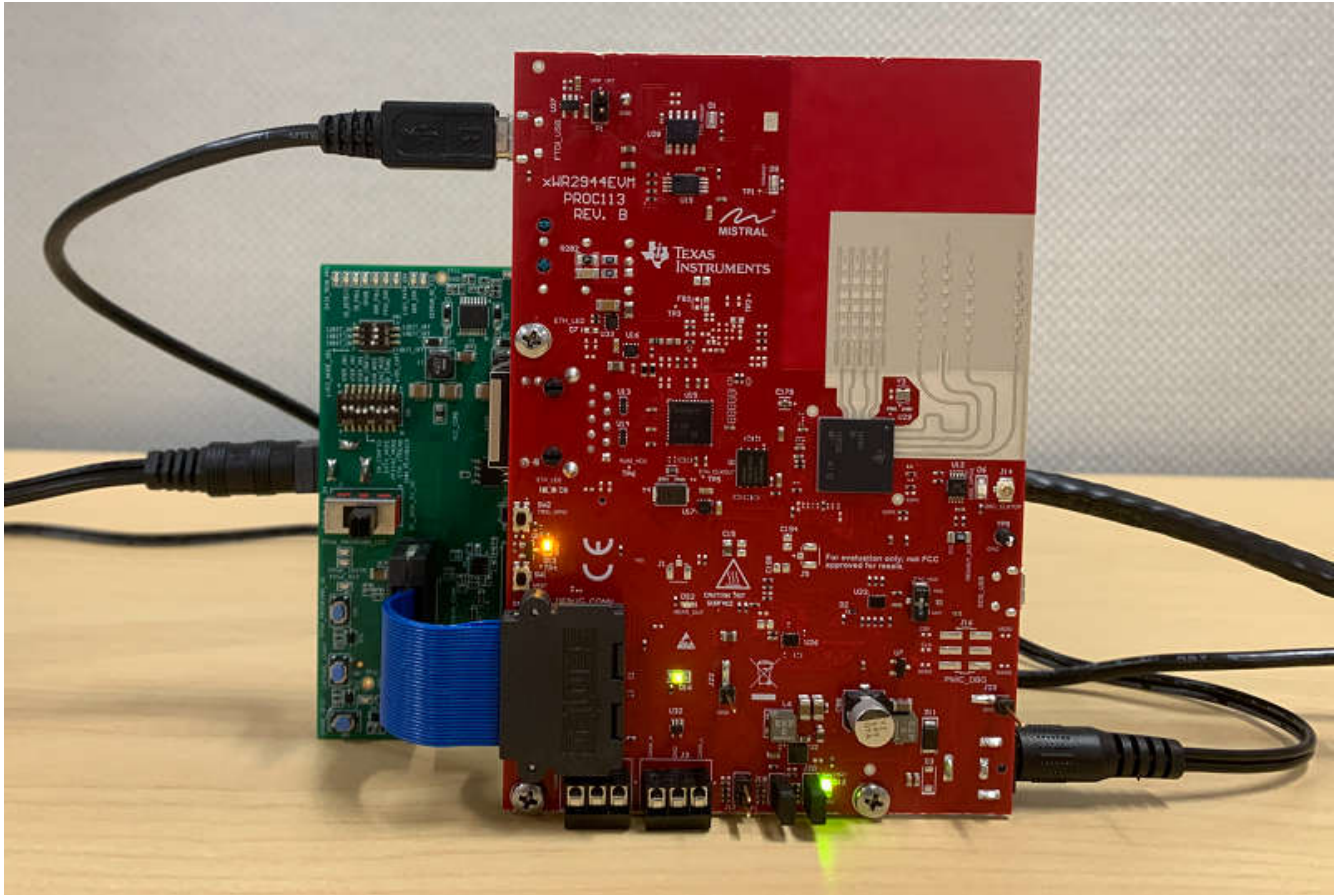


Figure 2-22. AWR2944EVM and DCA1000 EVM


When using the AWR2944EVM with the DCA1000 EVM, the following settings must be used.

1. Set the AWR2944EVM to SOP2 mode.



Figure 2-23. SOP2 Mode

Table 2-11. MUX Switches (continued)

Reference	Usage	Comments	Image
S2	SPI	When set to 'PMIC_SPI' position, the MSS_SPIB interface is routed to the PMIC and to the J16 header. 1 When set to 'DBG_SPI', the MSS_SPIB interface is routed to the 60-pin debug header (J7)	

1. DNP resistors R5, R61, R167, and R176 must be populated to bring the MSS_SPIB interface out to the J16 header.

2.10.2 Sense On Power (SOP) Jumpers (J17, J18, J20)

The AWR2944EVM can be set to operate in different modes based on the state of the SOP [2:0] lines. These lines are sensed ONLY during boot up of the AWR2944 device. The state of the device is described in [Table 2-12](#).

A closed jumper refers to a '1' and open the jumper refers to a '0' state of the SOP signal going to the AWR2944 device.

Note

The SOP[2:0] pins can also be controlled via the onboard FTDI. In this case, the FTDI settings override the jumper settings.

Table 2-12. SOP[0:2] Modes

Reference	Usage	Comments
J17 (SOP 2), J18 (SOP 1), J20 (SOP 0)	SOP[2:0]	101 (SOP mode 5) = Flashing mode 001 (SOP mode 4) = Functional mode 000 (SOP mode 3) = Reserved 011 (SOP mode 2) = Development mode 010 (SOP mode 1) = Reserved

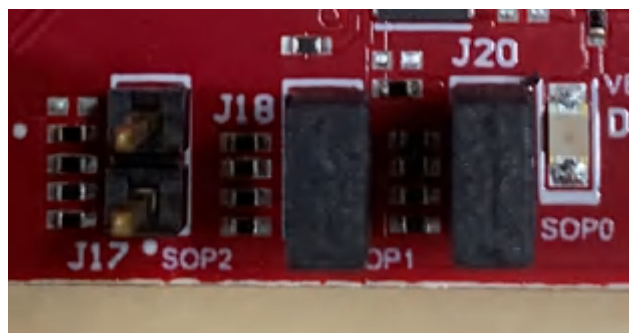


Figure 2-25. SOP Jumpers

Additionally, the SOP[4:3] signals defines the XTAL clock input as per the below configurations provided in [Table 2-13](#).

Table 2-13. SOP[4:3] Modes

Reference	Usage	Comments
R303, R312 Populated. R301, R309 unpopulated	SOP[4:3]	00 = 40MHz (Default state)
R301, R312 Populated. R303, R319 unpopulated		01 = 45.1584MHz
R303, R309 Populated. R301, R312 unpopulated		10 = 49.152MHz
R301, R309 Populated. R303, R312 unpopulated		11 = 50MHz

2.10.3 I2C Connections

The board features temperature sensor for measuring onboard temperature, current sensors for current measurement for 1.2V, 1.8V, 3.3V, 1V0_RF1, and 1V0_RF2 AWR2944 supply rails and EEPROM for storing board ID. These are connected to the AWR2944EVM through I2C bus.

[Table 2-14](#) shows the list of I2C devices available in AWR2944EVM board and the address.

Table 2-14. I2C Device Addresses

Sensor Type	Reference Designator	Part Number	Target Address
Temp sensor	U24	TMP112AIDRLR	0x49
Current sensor for 3.3V rail	U12	INA226AIDGSR	0x44
Current sensor for 1.8V rail	U11	INA226AIDGSR	0x41
Current sensor for 1.2V digital rail	U9	INA226AIDGSR	0x40
Current sensor for 1.0V RF1 rail	U22	INA226AIDGSR	0x42
Current sensor for 1.0V RF2 rail	U30	INA226AIDGSR	0x43
EEPROM	U28	CAV24C02WE-GT3	0x50

2.10.4 Push Buttons

Table 2-15. Push Button Switches




Reference	Usage	Comments	Image
SW1	RESET	This Switch is used to RESET the AWR2944, PMIC, XDS110 and FTDI device.	

Table 2-15. Push Button Switches (continued)

Reference	Usage	Comments	Image
SW2	GPIO_28	When pushed, the GPIO_28 shall be pulled to High.	
SW3	CANB_WAKE	Used to Wake up the CANB Transceiver	

2.10.5 LEDs**Table 2-16. On Board LEDs**






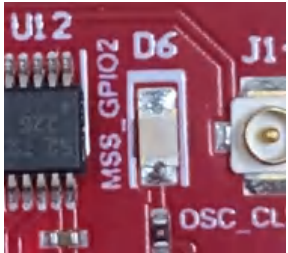

Ref	Color	Usage	Comments	Image
D12	Green	12V supply indication	This LED indicates the presence of 12V supply input.	
D16	Green	5V Supply	This LED indicates the presence of 5V supply output.	

Table 2-16. On Board LEDs (continued)

Ref	Color	Usage	Comments	Image
D13	Yellow	NRST	This LED is used to indicate the state of NRST pin. If this LED is glowing, then the device is out of reset.	
DS2	Red	NERROUT	Glowes if there is any HW error in the AWR2944 device.	
D9	Yellow	WRMRST	Open drain fail safe warm reset signal.	
D6	Green	GPIO_2	Glowes when the GPIO_2 is logic-1.	
D1	Yellow	FTDI_SUSPEND_N	Glowes when FTDI is in suspend state.	

3 Design Files and Software Tools

3.1 Design Files

To view the schematics, assembly drawings, and BOM, see [AWR2944EVM Schematic, Assembly Files, and BOM](#).

To view the design database and layout details, see [AWR2944EVM Database and Layout Files](#).

3.2 Software, Development Tools, and Example Code

To enable quick development of end applications on the on-chip C66x DSP, ARM® Cortex®-R5F controller, and hardware accelerator (HWA 2.0), TI provides a software development kit (SDK) that includes demo codes, software drivers, emulation packages for debug, and more. These can be found at [mmwave-sdk](#).

4 Requirements for Operating in the EU and UK regions

The following requirements must be met when operating the AWR2944EVM in the EU and UK.

- The tested operating bandwidths for Radio Equipment Directive 2014/53/EU and UKCA compliance are 900MHz (77.45GHz center frequency) and 3900MHz (78.95GHz center frequency). The maximum peak EIRP is approximately 37dBm for the 900MHz bandwidth and 34dBm for the 3900MHz bandwidth.
 1. If users choose to operate the EVM outside of the specified operating bandwidth and operating power as described above, then the EVM must be operated inside a shielded chamber.
- When operating in the 77GHz to 81GHz region, users must not enable more than one simultaneous TX for 0dB backoff or enable a minimum of 10dB TX backoff for multiple simultaneous TX to meet the -3 dBm limit for mean power spectral density.
- The automotive Ethernet PHY (U4) and port (J4) on the AWR2944EVM have not been tested by Texas Instruments to be compliant with any regional standards such as Radio Equipment Directive 2014/53/EU. If users wish to populate the components necessary to utilize this port, then users can do any necessary testing to verify that the port is compliant with all applicable regional standards before use. Any modifications done to enable the J4 port invalidate the existing RED 2014/53/EU certification of the AWR2944EVM.
- The RJ45 port (J9) has been tested to be compliant with the Radio Equipment Directive 2014/53/EU and UKCA requirements using an unshielded, symmetrical indoor CAT5 or higher Ethernet cable with a maximum length of 3 meters. If users wish to operate the AWR2944EVM with an Ethernet cable that does not meet these specifications, then users can do any necessary testing to verify that the AWR2944EVM and Ethernet cable is compliant with all applicable regional standards before use.
- The AWR2944EVM has been tested to be compliant with the Radio Equipment Directive 2014/53/EU and UKCA requirements using a DC power cable with a maximum length of 3 meters. If users wish to operate the AWR2944EVM with a longer DC power cable length, then users can do any necessary testing to verify that the AWR2944EVM and DC power cable is compliant with all applicable regional standards before use.
- The AWR2944EVM has been tested to be compliant with the Radio Equipment Directive 2014/53/EU and UKCA requirements using a USB cable with a maximum length of 3 meters. If users wish to operate the AWR2944EVM with a longer USB cable length, then users can do any necessary testing to verify that the AWR2944EVM and USB cable is compliant with all applicable regional standards before use.
- The AWR2944EVM has not been assessed for the interactive control of a vehicle and any such use requires an additional assessment of applicable functional safety of the vehicle’s control systems.

5 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision A (March 2023) to Revision B (August 2023)	Page
• Changed from 5 centimeters to 20 centimeters.....	3
• Changed minimum separation distance in note to 20 centimeters.....	3
• Added automotive Ethernet PHY (U4) note.....	12

Changes from Revision * (November 2021) to Revision A (March 2023)	Page
• Added 64-bit size to flash programming key feature.....	2
• Changed AWR2944EVM Front View image.....	3
• Changed AWR2944EVM Back View image.....	3
• Changed AWR2944EVM Block Diagram.....	5
• Changed all instances of legacy terminology to POCI and PICO where I ² C is mentioned.....	8
• Added PMIC section.....	17
• Changed all instances of legacy terminology to controller and target where I ² C is mentioned.....	23

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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 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

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/lstds/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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-
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