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AIR B-Smart BoosterPack User's Manual

A2541R24A-ADB1
A2541E24A-ADB1

Release Date 11/04/13

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USER'S MANUAL

AIR B-Smart BoosterPack

Contents

1. AIR B-Smart BoosterPack Overview 5
   1.1. Overview 5
   1.2. Kit Contents 6
2. Getting Started with the AIR B-Smart BoosterPack 7
   2.1. Hardware Installation 8
      2.1.1. MSP-EXP430G2 LaunchPad Only 8
      2.1.2. All LaunchPads 9
      2.1.3. Optional Hardware Components 10
   2.2. Emmoco Em-Ware Wiki 11
3. AIR B-Smart BoosterPack Hardware 12
   3.1. Electrical Characteristics 12
      3.1.1. Absolute Maximum Ratings 12
      3.1.2. Recommended Operating Conditions 12
   3.2. Functional Description 13
      3.2.1. A2541 Radio Module (U2) 14
      3.2.2. USB-UART (U3) 14
      3.2.3. Current Sense Amplifier (U4) 14
      3.2.4. MCU Socket (X1) 14
      3.2.5. LED Indicators 15
      3.2.6. Switches 15
      3.2.7. Jumpers 18
      3.2.8. Connectors 20
   3.3. Schematics 24
   3.4. PCB Layout 26
   3.5. Bill of Materials (BOM) 30

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1. AIR B-Smart BoosterPack Overview

1.1. Overview

The AIR B-Smart BoosterPack is a low-power wireless transceiver extension module compliant with the Texas Instruments BoosterPack Pinout Standard and compatible with 20-pin and 40-pin LaunchPad development kits. Refer to the Emmoco Em-Ware Wiki (see section 2.2) for more information regarding firmware availability for the various LaunchPad kits. The BoosterPack is available in two configurations, each of which contains an AIR radio module with integrated antenna. See Table 1 for a listing of the supported BoosterPacks and their operating bands.

Table 1 - AIR B-Smart BoosterPack Models

Model	Module	Operating Band	Range Extender
A2541R24A-ADB1	A2541R24A20	2402-2480MHz ISM Band	No
A2541E24A-ADB1	A2541E24A20	2402-2480MHz ISM Band	Yes

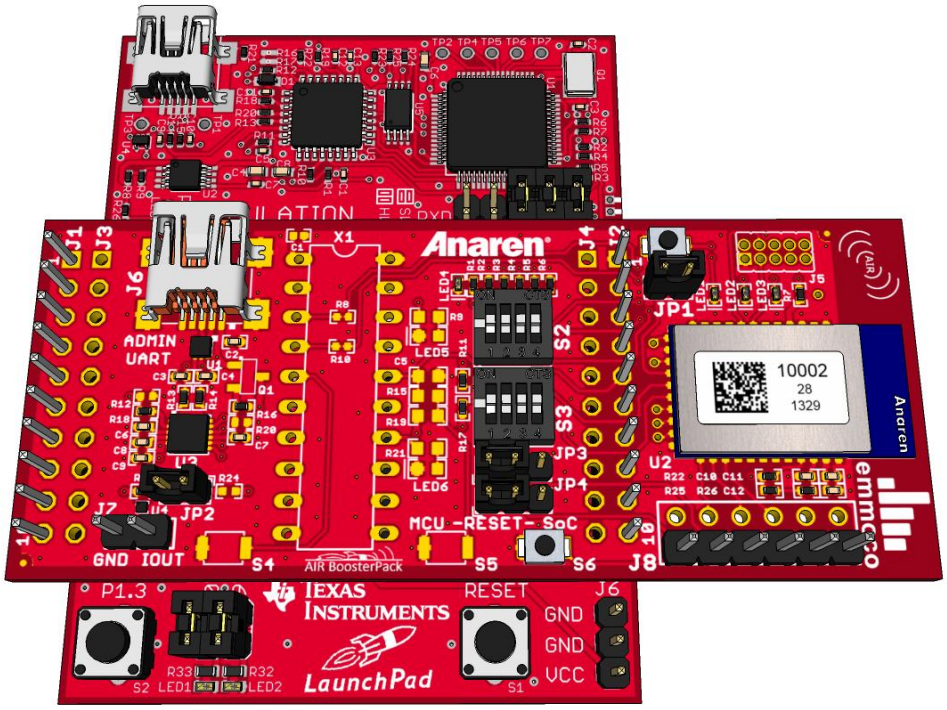


Figure 1 - AIR B-Smart BoosterPack with MSP-EXP430G2 LaunchPad

AIR B-Smart BoosterPack Hardware Features:

- 2.4GHz radio incorporating *Bluetooth*® Smart technology
- 2.0V to 3.6 V operation
- Low power consumption
- UART interface to Radio Module
- Analog Current Monitor
- Accessible Test Points for many of the Radio Module port pins
- 8 DIP Switches for isolating nonessential circuitry during low-power operation
- Option for installing 20-pin DIP socket + MSP430 microcontroller for standalone operation
- ROHS compliant
- See AIR Module Users Manual for radio specific features

1.2. Kit Contents

The AIR B-Smart BoosterPack kit includes the following:

- One AIR B-Smart BoosterPack
- One USB 2.0 cable (A to Mini-B)
- One 6-wire B-Smart cable for connecting an external MCU
- Quick Start Guide
- Regulatory Guide

2. Getting Started with the AIR B-Smart BoosterPack

The following sections describe the necessary steps to get the AIR B-Smart BoosterPack hardware and software up and running with the LaunchPad.

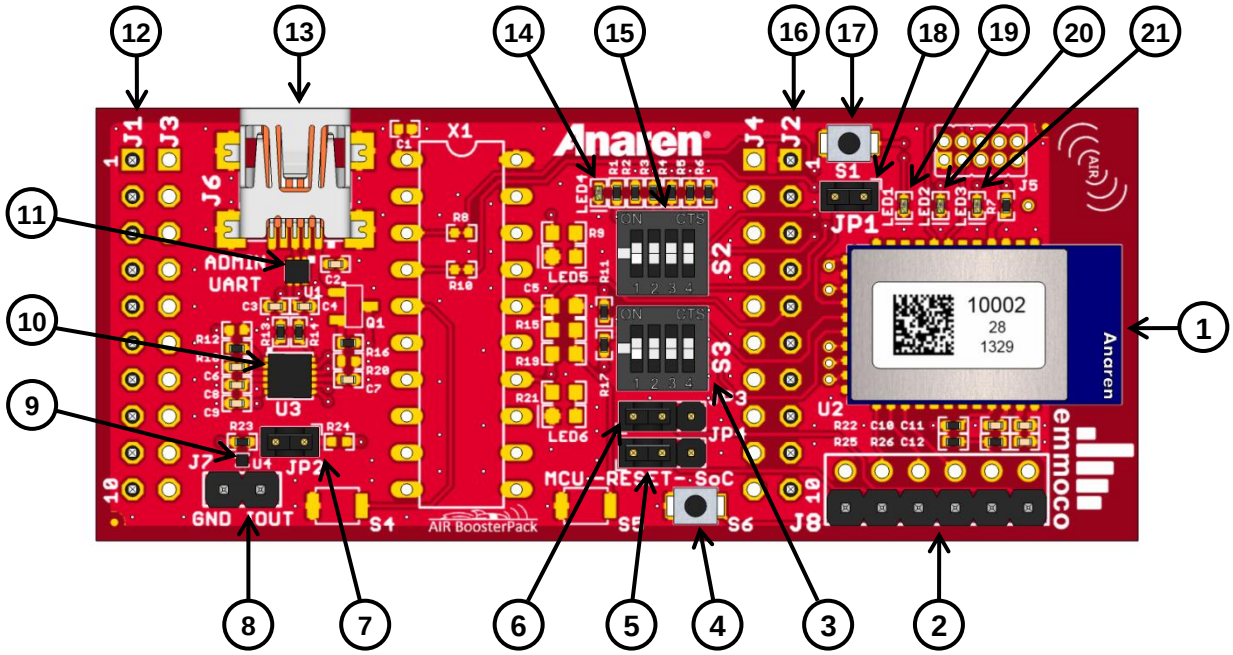


Figure 2 – AIR B-Smart BoosterPack Overview

1. **AIR Radio Module (U2)**
2. **External MCU Connector (J8)**
3. **USB UART Disconnect DIP Switch (S3)**
4. **Radio Module Reset Pushbutton Switch (S6)**
5. **MCU UART RTS Selection Jumper (JP4)**
6. **MCU UART CTS Selection Jumper (JP3)**
7. **Current Monitor Jumper (JP2)**
8. **Current Sense Amplifier Connector (J7)**
9. **Current Sense Amplifier (U4)**
10. **USB-UART Device (U3)**
11. **USB ESD Protection Device (U1)**
12. **LaunchPad Interface Connector (J1)**
13. **Mini-B USB Connector (J6)**
14. **Power LED (LED4)**
15. **LED Disconnect DIP Switch (S2)**
16. **LaunchPad Interface Connector (J2)**
17. **Radio Module User Pushbutton Switch (S1)**
18. **DC-DC Conv ON/BYP Override Jumper (JP1)**
19. **Red Status LED (LED1)**
20. **Green Status LED (LED2)**
21. **Blue Status LED (LED3)**

2.1. Hardware Installation

2.1.1. MSP-EXP430G2 LaunchPad Only

The following steps need to be performed on the MSP-EXP430G2 LaunchPad:

1) Remove the TXD and RXD jumpers from J3.
2) Ensure the VCC jumper is populated on J3. Jumpers RST and TEST also need to be installed when programming the microcontroller or when debugging firmware.
3) Continue installation by following the steps provided in Section 2.1.2.

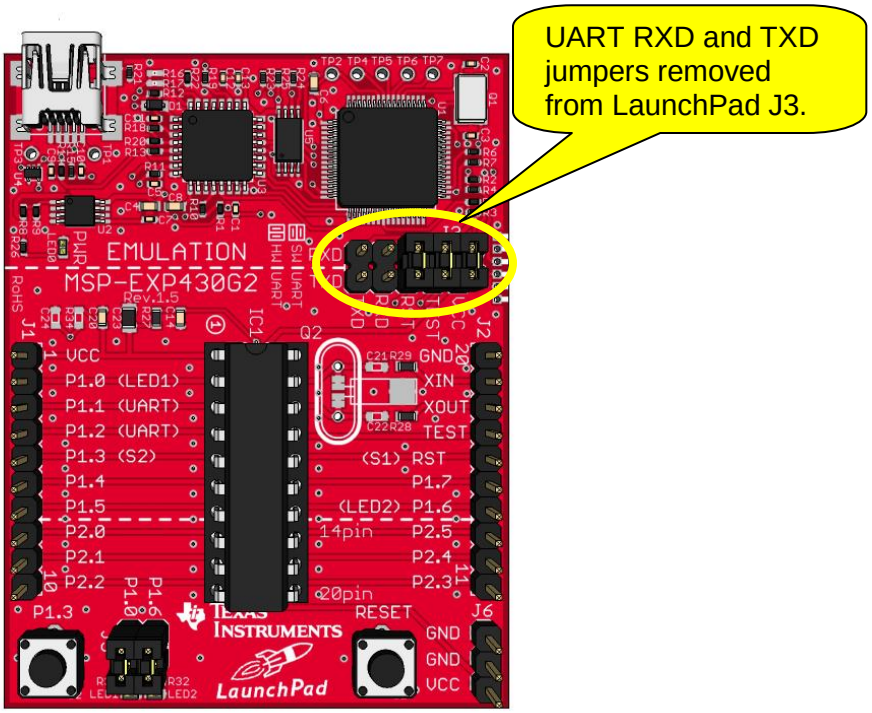


Figure 3 –MSP-EXP430G2 LaunchPad

2.1.2. All LaunchPads

The following steps need to be performed on the LaunchPad/BoosterPack:

1) Install the AIR B-Smart BoosterPack onto the LaunchPad board. Ensure the BoosterPack is oriented correctly. With the LaunchPad emulator section at the top, the BoosterPack radio module should overhang at the right. Figure 4 shows an example of a BoosterPack installed on a MSP-EXP430G2 LaunchPad, but the orientation is the same for all LaunchPads.
2) Ensure the jumper is installed on BoosterPack JP1. See section 3.2.7 and Table 6 for more information regarding this jumper.
3) Ensure the jumper is installed on BoosterPack JP2, unless an ammeter is connected for taking current measurements. See section 3.2.7 and Table 7 for more information regarding this jumper.
4) Install jumpers on BoosterPack JP3 and JP4 to select the desired UART CTS/RTS pin mapping. See section 3.2.7, Table 8, and Table 9 for details. Also refer to the Emmoco Em-Ware Wiki (see section 2.2) for information regarding the required jumper settings when the BoosterPack is used with a specific LaunchPad.

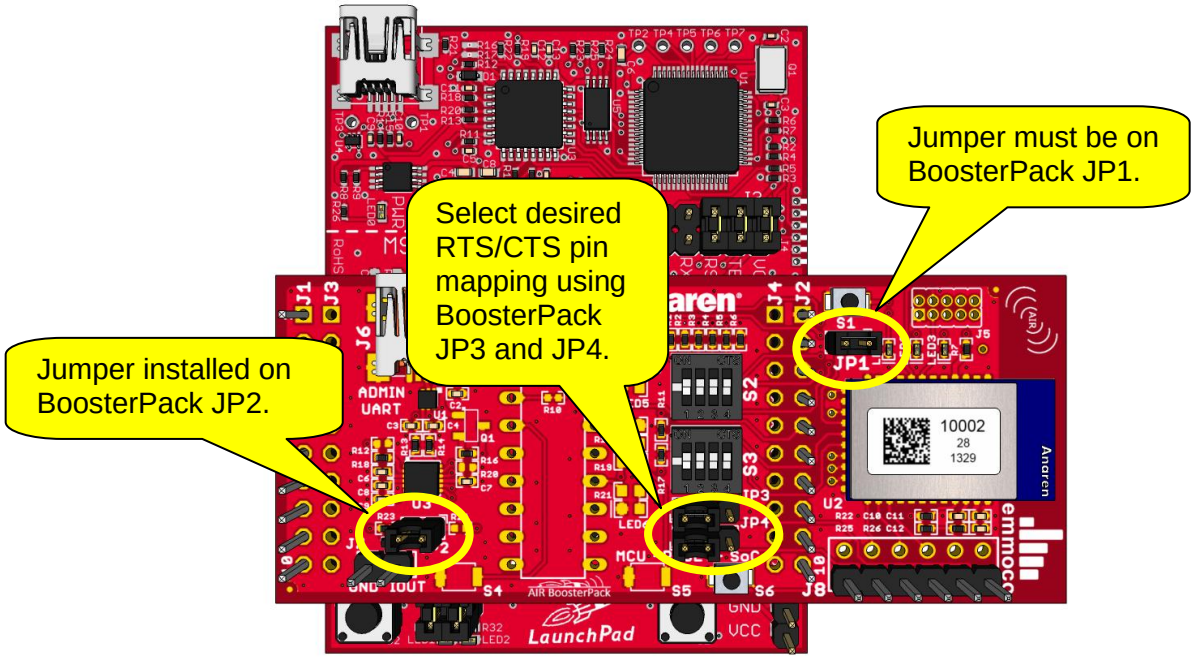


Figure 4 – AIR B-Smart BoosterPack Installed On MSP-EXP430G2 LaunchPad

2.1.3. Optional Hardware Components

The AIR B-Smart BoosterPack supports additional hardware features which are not populated by default. Refer to section 3.2 and its sub-sections for more information regarding these optional hardware components.

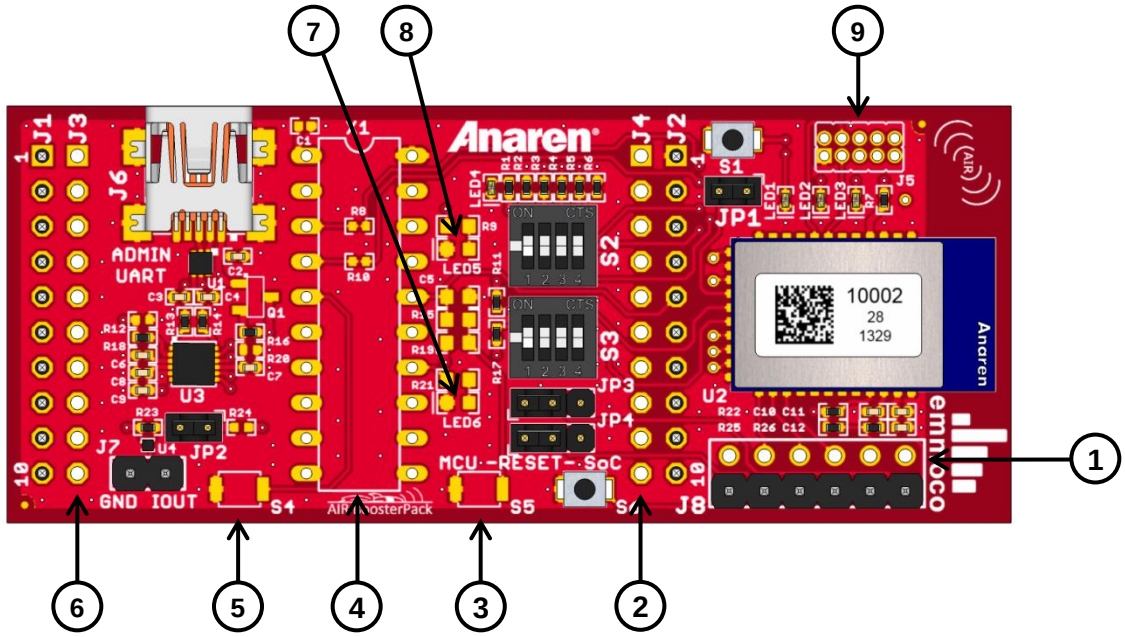


Figure 5 - Optional Hardware Components

1. **Radio Module Test Points (J8)**
2. **LaunchPad Interface Connector (J4)**
3. **MCU Reset Pushbutton Switch (S5)**
4. **MCU Socket (X1)**
5. **MCU User Pushbutton Switch (S4)**
6. **LaunchPad Interface Connector (J3)**
7. **MCU Green Status LED (LED6)**
8. **MCU Red Status LED (LED5)**
9. **Radio Module Programming Header (J5)**

2.2. Emmoco Em-Ware Wiki

Please visit the Emmoco Em-Ware Wiki (wiki.em-hub.com) for information regarding how to get started developing applications for the AIR B-Smart BoosterPack and your mobile device. In order to download the firmware examples or develop your own applications, an account will need to be created on Emmoco's Em-Hub (www.em-hub.com). Follow the instructions provided in the Wiki, and when prompted enter the Access Code found on the label located on the side of J1 (see Figure 6).

When trying to establish a connection between your handheld device and the AIR B-Smart BoosterPack, the list of available devices displayed on the handheld device should include the Board ID which is also identified on the label.

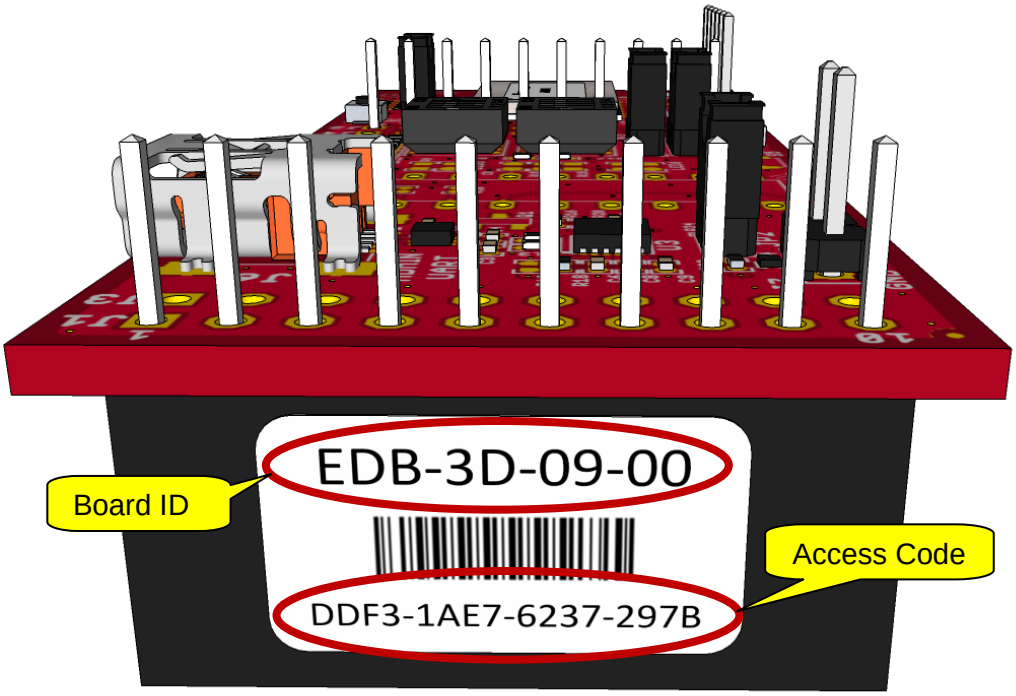


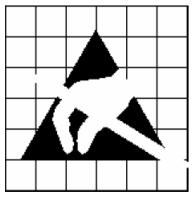
Figure 6 – AIR B-Smart BoosterPack ID Label

3. AIR B-Smart BoosterPack Hardware

3.1. Electrical Characteristics

3.1.1. Absolute Maximum Ratings

Under no circumstances shall the absolute maximum ratings given in Table 2 be violated. Stress exceeding one or more of the limiting values may cause permanent damage to the device.



Caution!
ESD sensitive device. Precaution should be used when handling the device in order to prevent permanent damage.

Table 2 - Absolute Maximum Ratings

Parameter	Min	Max	Unit	Condition
Supply Voltage	-0.3	3.9	V	
Voltage On Any Digital Pin	-0.3	VDD + 0.3 max 3.9	V	
Input RF Level		+10	dBm	
Storage Temperature Range	-40	125	°C	
ESD		2000	V	According to JEDEC STD 22, method A114, Human Body Model (HBM)
		500	V	According to JEDEC STD 22, C101C,Charged Device Model (CDM)

3.1.2. Recommended Operating Conditions

Table 3 – Recommended Operating Conditions

Parameter	Min	Max	Unit	Condition
Operating Supply Voltage	2.0	3.6	V	
Operating Temperature	-40	+85	°C	

3.2. Functional Description

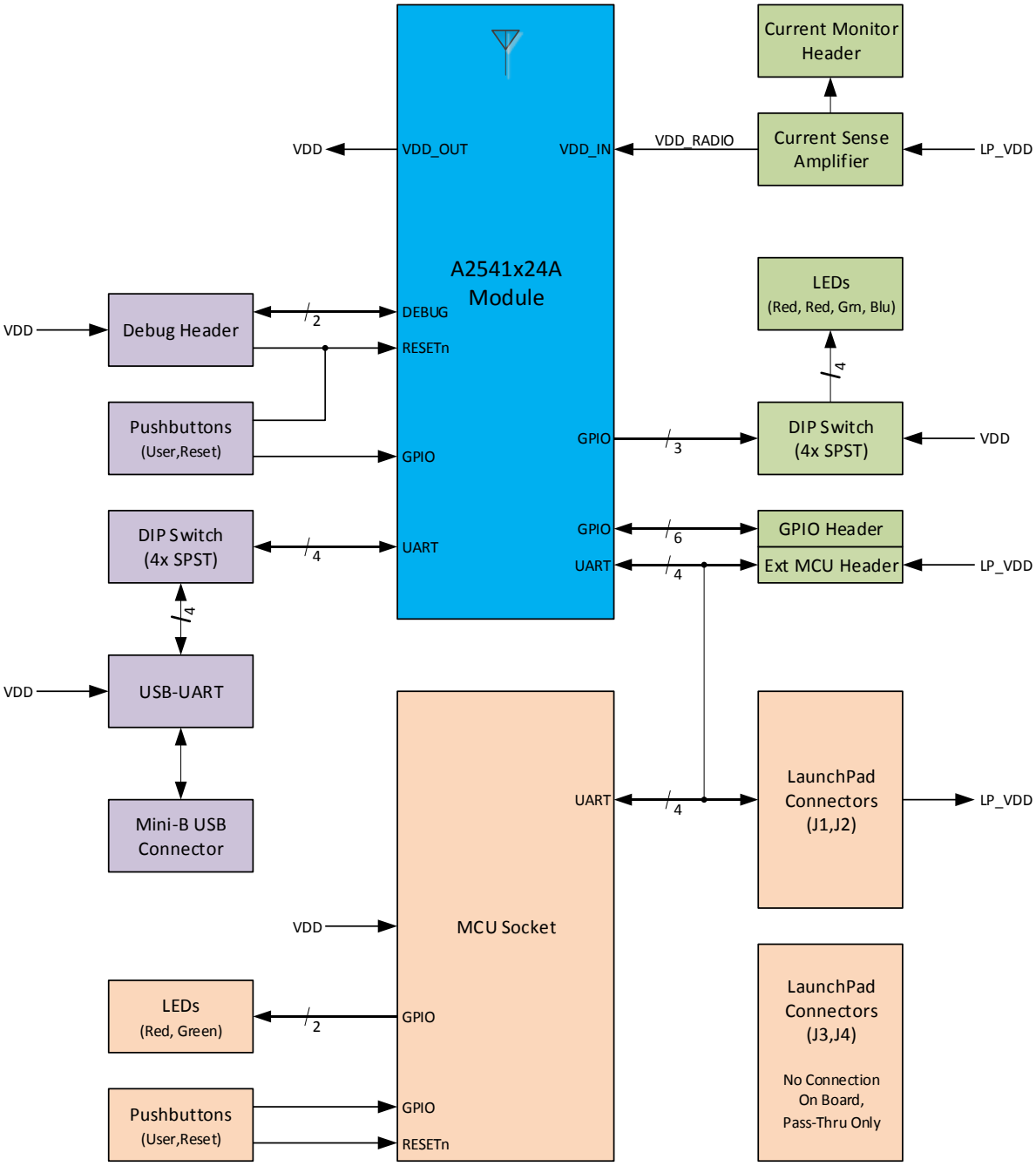


Figure 7 – Hardware Block Diagram

3.2.1. A2541 Radio Module (U2)

The Anaren A2541 module is a 2.4GHz *Bluetooth* low energy compliant radio preloaded with Em-Ware from Emmoco (based on the Texas Instruments BLE-STACK). For details regarding the radio module, refer to the A2541E24x and A2541R24x User's Manuals located on the Anaren website (www.anaren.com/air). For details regarding Em-Ware, refer to the Emmoco Em-Ware Wiki (see section 2.2).

3.2.2. USB-UART (U3)

The FTDI FT234XD USB to Basic UART device provides virtual COM port (VCP) access to the radio module. Please refer to the FT234XD datasheet on the FTDI website (www.ftdichip.com) for further info regarding this device.

3.2.3. Current Sense Amplifier (U4)

The Texas Instruments INA216A2 provides a method for monitoring current in near real-time using an oscilloscope. The device amplifies the voltage across shunt resistor R23 with a gain of 50 and provides a single-ended analog output referenced to GND. This circuit is not calibrated and should not be used for taking accurate measurements. Please refer to the INA216A2 datasheet on the TI website (www.ti.com) for further info regarding this device.

3.2.4. MCU Socket (X1)

The BoosterPack has a footprint for a 20-pin DIP socket which allows the board to be operated standalone. In this configuration, the MSP430G2553 is installed directly on the BoosterPack and therefore only power and ground connections are required (i.e. there is no need to plug the BoosterPack into the LaunchPad other than for programming the MCU). Please refer to the MSP430G2x53 datasheet and MSP430x2xx Family User's Guide on the TI website (www.ti.com) for further info regarding this device. Not populated (default).

3.2.5. LED Indicators

- **A2541 Red LED (LED1)**
  Controlled by A2541 P0_6 – active high. Can be electrically isolated using position 2 of DIP switch S2.

- **A2541 Green LED (LED2)**
  Controlled by A2541 P1_0 – active high. Can be electrically isolated using position 3 of DIP switch S2.

- **A2541 Blue LED (LED3)**
  Controlled by A2541 P2_0 – active high. Can be electrically isolated using position 4 of DIP switch S2.

- **PWR Red LED (LED4)**
  On when power is applied – active high. Can be electrically isolated using position 1 of DIP switch S2.

- **MCU Red LED (LED5)**
  Controlled by J1-2 – active high. Duplicate of Red LED on MSP-EXP430G2 LaunchPad. Not populated (default).

- **MCU Green LED (LED6)**
  Controlled by J2-4 – active high. Duplicate of Green LED on MSP-EXP430G2 LaunchPad. Not populated (default).

3.2.6. Switches

- **A2541 User Pushbutton (S1)**
  Radio Module user pushbutton – active low. Connected to P0_0.

- **LED Disconnect DIP Switch (S2)**
  These DIP switches are used to electrically isolate the LEDs from the A2541 GPIO signals for applications that require low-power operation. Position 1 also controls power to the USB-UART Vccio pin. The default state of all DIP switches is ON (closed).

Table 4 – LED DIP Switch Settings (S2)

Switch	Position	Signal Name	Description
S2	1	VDD	PWR Red LED & USB-UART Vccio connect/disconnect. ON (closed): Red LED is ON when power is applied to the BoosterPack. Power is applied to the USB-UART device's Vccio pin. OFF (open): Red LED is disabled and cannot be turned on, regardless of the voltage level supplied to the BoosterPack. The USB-UART device I/O is powered down. Note that a USB cable should not be plugged into J6 while this switch is OFF and the S3 switches are ON.
	2	P0_6	A2541 Red LED connect/disconnect. ON (closed): Red LED is enabled and may be turned on by driving its control signal high. OFF (open): Red LED is disabled and cannot be turned on, regardless of the state of its control signal.
	3	P1_0	A2541 Green LED connect/disconnect. ON (closed): Green LED is enabled and may be turned on by driving its control signal high. OFF (open): Green LED is disabled and cannot be turned on, regardless of the state of its control signal.
	4	P2_0	A2541 Blue LED connect/disconnect. ON (closed): Blue LED is enabled and may be turned on by driving its control signal high. OFF (open): Blue LED is disabled and cannot be turned on, regardless of the state of its control signal.

- **USB UART Disconnect DIP Switch (S3)**
  These DIP switches are used to electrically isolate the USB-UART signals from the A2541 for applications that require low-power operation. All switch positions should be set to the same setting (i.e. all ON or all OFF). The default state of all DIP switches is ON (closed).

Table 5 – UART DIP Switch Settings (S3)

Switch	Position	Signal Name	Description
S3	1	P1_7/RXD	RXD connect/disconnect. ON (closed): The radio module RXD pin is connected to the USB-UART device TXD pin. OFF (open): The radio module RXD pin is isolated from the USB-UART device.
	2	P1_4/CTS	CTS connect/disconnect. ON (closed): The radio module CTS pin is connected to the USB-UART device RTS pin. OFF (open): The radio module CTS pin is isolated from the USB-UART device.
	3	P1_6/TXD	TXD connect/disconnect. ON (closed): The radio module TXD pin is connected to the USB-UART device RXD pin. OFF (open): The radio module TXD pin is isolated from the USB-UART device.
	4	P1_5/RTS	RTS connect/disconnect. ON (closed): The radio module RTS pin is connected to the USB-UART device CTS pin. OFF (open): The radio module RTS pin is isolated from the USB-UART device.

- **MCU User Pushbutton (S4)**
  Onboard MCU user pushbutton – active low. Duplicate of S2 user pushbutton on MSP-EXP430G2 LaunchPad. Not populated (default).

- **MCU Reset (S5)**
  Onboard MCU hardware reset – active low. Duplicate of S1 reset pushbutton on MSP-EXP430G2 LaunchPad. Not populated (default).

- **A2541 Reset (S6)**
  Radio Module hardware reset – active low.

3.2.7. Jumpers

- **Radio Module DC-DC Converter ON/BYP Control**
  The A2541R24A's internal TPS62730 DC-DC Converter can be controlled via firmware or by an external signal on module pin 16. When controlled by firmware the converter is placed into Bypass mode whenever the CC2541 is in a low-power state, otherwise the converter is ON (i.e. switching). This helps reduce overall power consumption for systems operating above 2.1V since the CC2541 device is powered by the output of the TPS62730 instead of the radio module's supply pin. That equates to about 30% reduction in current draw while the radio is in a higher power active state when operating at 3.0V and about 40% reduction in current when operating at 3.6V (current reduction is at module input).

  When the converter is ON the radio module's I/O signals will be at 2.1V logic levels, whereas in Bypass mode the I/O will be at logic levels equal to the module's supply voltage. This is an important consideration when deciding whether to force the DC-DC converter into Bypass mode or allow firmware to cycle between ON and Bypass. In the latter scenario, all devices that interface to the A2541R24A must be compatible with the changing logic levels. When the BoosterPack is plugged into a MSP-EXP430G2 LaunchPad, for example, the radio module supply voltage is near 3.6 Volts. Likewise, the MSP430 on the LaunchPad is also powered by 3.6V but its supply is fixed (i.e. it doesn't change when the DC-DC converter mode is changed). Therefore in this example the converter must be forced into Bypass mode to maintain logic level compatibility between the two devices. For applications where all devices interfacing to the A2541R24A are powered by the radio module's VDD_OUT pin (i.e. pin 4), the converter is allowed to change modes under firmware control since in this case all devices share the same supply.

  When using the BoosterPack on a LaunchPad, the DC-DC Converter MUST be forced into Bypass mode by placing a shunt on JP1.

Table 6 - JP1 Jumper Settings (DC-DC Converter ON/BYP Override)

Jumper	Position	Description
JP1	Closed	DC-DC Converter is forced to Bypass mode (default)
	Open	DC-DC Converter mode is controlled by firmware

- **Current Measurement**
  JP2 allows for measuring radio module current draw using an ammeter. This jumper is in series between J1-1 (LP_VDD) and U2.33 (VDD_RADIO).

Table 7 – JP2 Jumper Settings (Current Measurement)

Jumper	Position	Description
JP2	Closed	Current measurement not available (default)
	Open	Connect ammeter across pins to establish power connection and measure current

- **MCU UART Pin Mapping**
  The BoosterPack board provides the ability to remap the MCU UART hardware flow control signals to support different LaunchPads. JP3 selects whether the P0_4/CTS signal is connected to J1-8 or J2-8. Similarly, JP4 selects whether the P0_5/RTS signal is connected to J1-9 or J2-9. Refer to the Emmoco Em-Ware Wiki (see section 2.2) for details regarding the required jumper settings for the specific LaunchPad used.

Table 8 – JP3 Jumper Settings (CTS Select)

Jumper	Position	Description
JP3	1-2	P0_4/CTS is connected to J1-8 (default)
	2-3	P0_4/CTS is connected to J2-8

Table 9 – JP4 Jumper Settings (RTS Select)

Jumper	Position	Description
JP4	1-2	P0_5/RTS is connected to J1-9 (default)
	2-3	P0_5/RTS is connected to J2-9

3.2.8. Connectors

- **J1 – LaunchPad Interface**

Table 10 – J1 BoosterPack Connector Pinout

Pin	Signal Name	I/O	Description
J1-1	LP_VDD	I	Supply voltage
J1-2	LP_J1.2	-	Not Used
J1-3	LP_J1.3/RXD	I	UART Receive Data (LaunchPad MCU)
		-	Not Used (onboard MSP430 or ext MCU connected to J8)
J1-4	LP_J1.4/TXD	O	UART Transmit Data (LaunchPad MCU)
		-	Not Used (onboard MSP430 or ext MCU connected to J8)
J1-5	LP_J1.5	-	Not Used
J1-6	LP_J1.6	-	Not Used
J1-7	LP_J1.7	-	Not Used
J1-8	LP_J1.8/RTS_A	O	UART Request To Send (LaunchPad MCU)
		-	Not Used (onboard MSP430 or ext MCU connected to J8)
J1-9	LP_J1.9/CTS_A	I	UART Clear To Send (LaunchPad MCU)
		-	Not Used (onboard MSP430 or ext MCU connected to J8)
J1-10	LP_J1.10	-	Not Used

- **J2 – LaunchPad Interface**

Table 11 - J2 BoosterPack Connector Pinout

Pin	Signal Name	I/O	Description
J2-1	GND	-	Ground reference
J2-2	LP_J2.2	-	Not Used
J2-3	LP_J2.3	-	Not Used
J2-4	LP_J2.4	-	Not Used
J2-5	LP_J2.5	-	Not Used
J2-6	LP_J2.6	-	Not Used
J2-7	LP_J2.7	-	Not Used
J2-8	LP_J2.8/RTS_B	O	UART Request To Send (LaunchPad MCU)
		-	Not Used (onboard MSP430 or ext MCU connected to J8)
J2-9	LP_J2.9/CTS_B	I	UART Clear To Send (LaunchPad MCU)
		-	Not Used (onboard MSP430 or ext MCU connected to J8)
J2-10	LP_J2.10	-	Not Used

- **J3 – LaunchPad Interface**
  0.1" pitch thru-hole footprint for adding 10-pin socket. The signals on this connector are not used by the BoosterPack and the connector is therefore intended to be used as a pass-thru only. Not populated (default).

- **J4 – LaunchPad Interface**
  0.1" pitch thru-hole footprint for adding 10-pin socket. The signals on this connector are not used by the BoosterPack and the connector is therefore intended to be used as a pass-thru only. Not populated (default).

- **J5 – Radio Module Programming/Debugging Interface**
  0.05" pitch footprint for A2541 programming/debugging using a CC Debugger. Not populated (default). Please note that if a header is added and the radio module is erased/reprogrammed, there is no way to reload the factory firmware image (i.e. the factory image will not be provided).

Table 12 – J5 A2541 Program/Debug Connector Pinout

Pin	Signal Name	I/O	Description
J5-1	GND	-	Ground reference
J5-2	VDD	O	Supply voltage to debugger
J5-3	DEBUG_DC	I	Radio Module Debug Clock
J5-4	DEBUG_DD	I/O	Radio Module Debug Data
J5-5	-	-	
J5-6	-	-	
J5-7	RESET	I	Radio Module Hardware Reset – active low
J5-8	-	-	
J5-9	-	-	
J5-10	-	-	

- **J6 – USB Interface**
  Mini-B USB connector. Provides Virtual COM Port access to the radio module.

Table 13 – J6 Mini-B USB Connector Pinout

Pin	Signal Name	I/O	Description
J6-1	+VBUS	I	+5V USB supply
J6-2	USB_D-	I/O	USB D- data signal
J6-3	USB_D+	I/O	USB D+ data signal
J6-4	-	-	
J6-5	GND	-	Ground reference

- **J7 – Current Sense Amplifier Interface**
  0.1" pitch header for measuring current via the current sense amplifier.

Table 14 – J7 Current Sense Amplifier Connector Pinout

Pin	Signal Name	I/O	Description
J7-1	GND	-	Ground reference
J7-2	ISENSE	O	Analog current measurement I = V/(50 * R23) = V/50

- **J8 – Radio Module Test Points/External MCU Interface**
  0.1" pitch header for connecting an external MCU to the BoosterPack via UART and or GPIO interface. Power may be provided to the external device by the BoosterPack assuming J1-1 is connected to a suitable power supply. Alternatively, an external power source may be used to provide power to the BoosterPack via this interface. Even row not populated (default).

Table 15 – J8 A2541 Test Points & External MCU Connector Pinout

Pin	Signal Name	I/O	Description
J8-1	GND	-	Ground reference
J8-2	P2_0	-	Test point
J8-3	P0_5/RTS	O	UART Request To Send
		-	Not Used (LaunchPad MCU or onboard MSP430)
J8-4	P1_0	-	Test point
J8-5	LP_VDD	I	Supply input from external source. External supply powers BoosterPack and external MCU. A2541 DC-DC converter must be in Bypass mode.
		O	Supply output to external MCU. BoosterPack powered by J1-1 and provides supply voltage to external MCU. A2541 DC-DC converter must be in Bypass mode.
		-	Not Used (LaunchPad MCU or onboard MSP430)
J8-6	P0_7	-	Test point
J8-7	P0_2/RXD	I	UART Receive Data
		-	Not Used (LaunchPad MCU or onboard MSP430)
J8-8	P0_6	-	Test point
J8-9	P0_3/TXD	O	UART Transmit Data
		-	Not Used (LaunchPad MCU or onboard MSP430)
J8-10	P0_1	-	Test point
J8-11	P0_4/CTS	I	UART Clear To Send
		-	Not Used (LaunchPad MCU or onboard MSP430)
J8-12	P0_0	-	Test point

3.3. Schematics

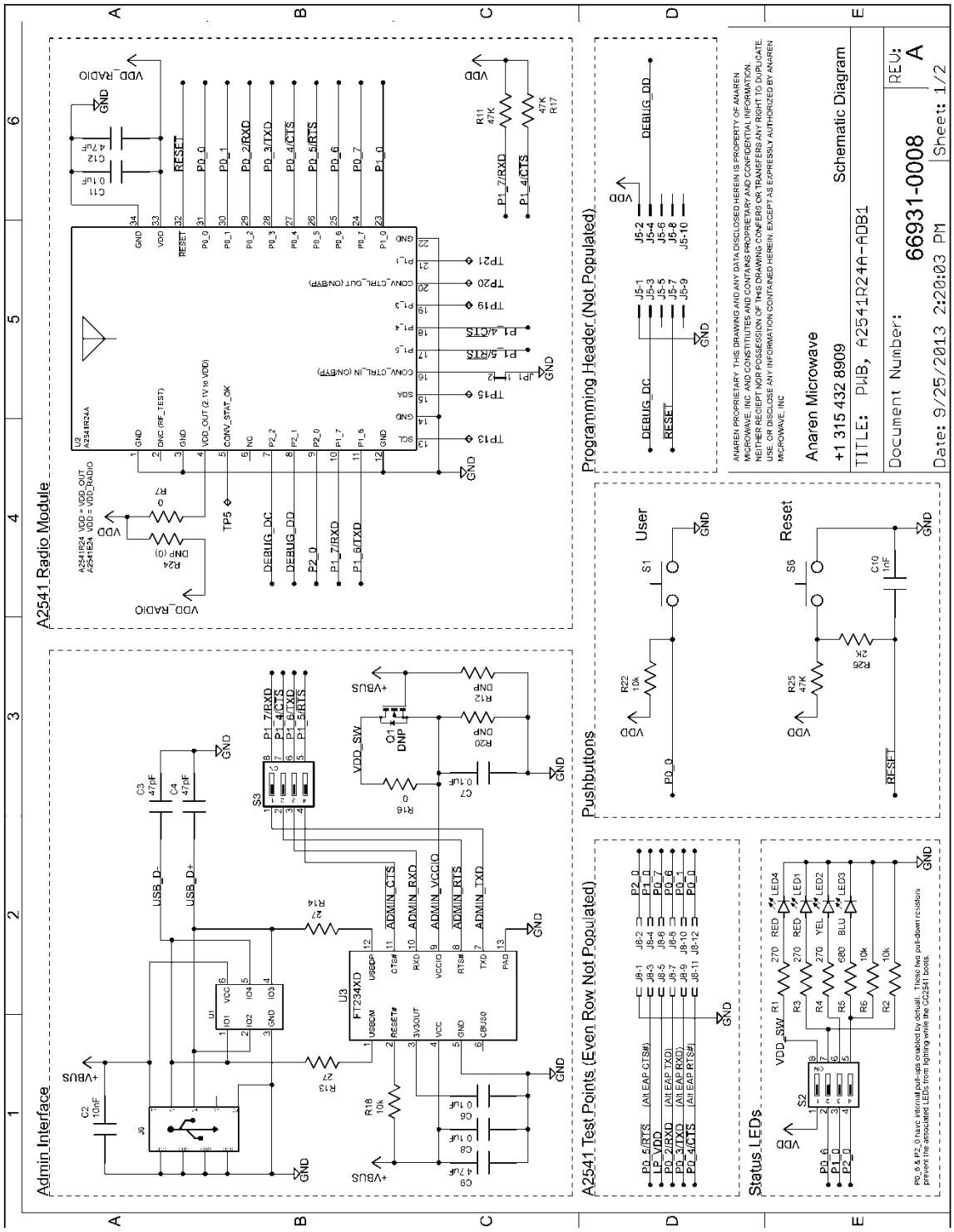


Figure 8 – Schematic Sheet 1

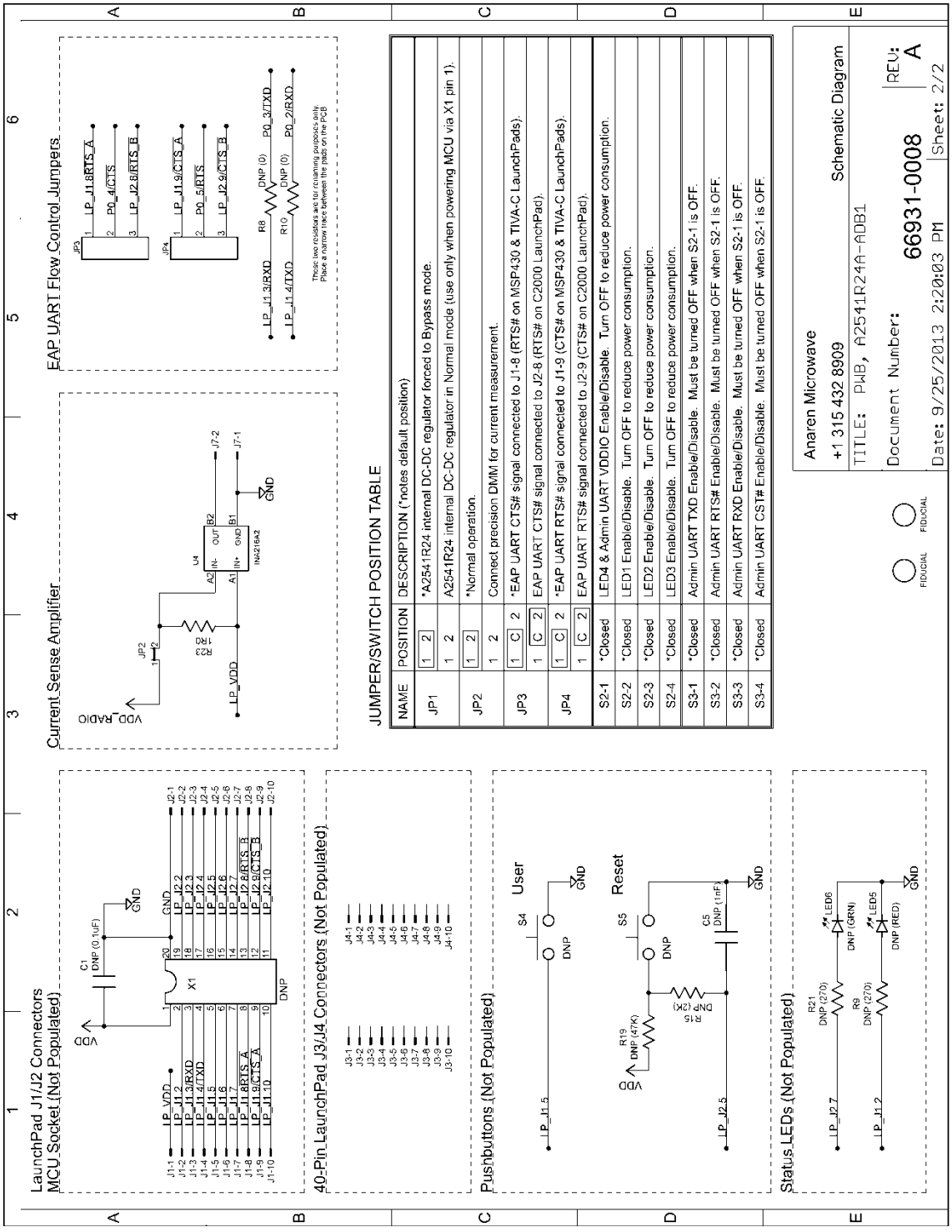


Figure 9 – Schematic Sheet 2

3.4. PCB Layout

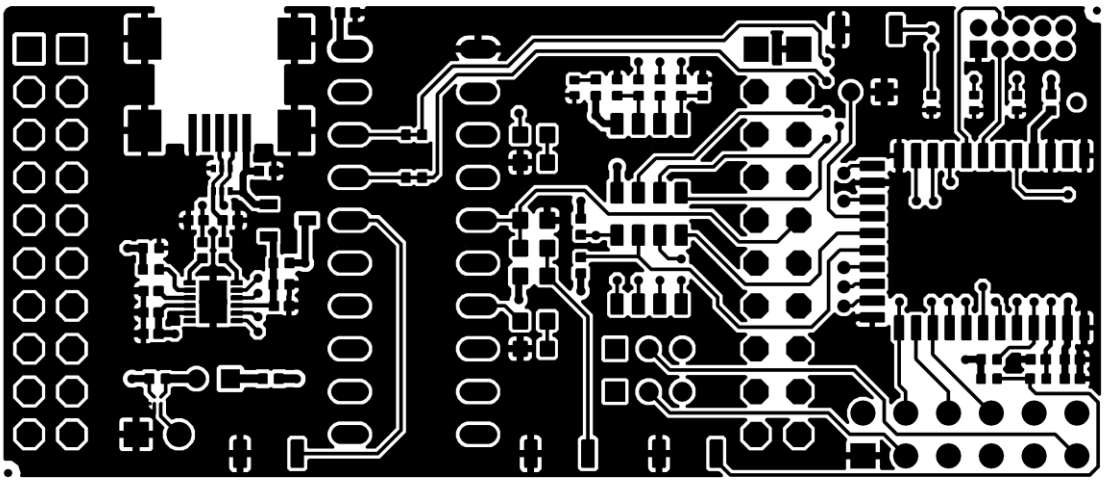


Figure 10 - PCB Layout Top Layer

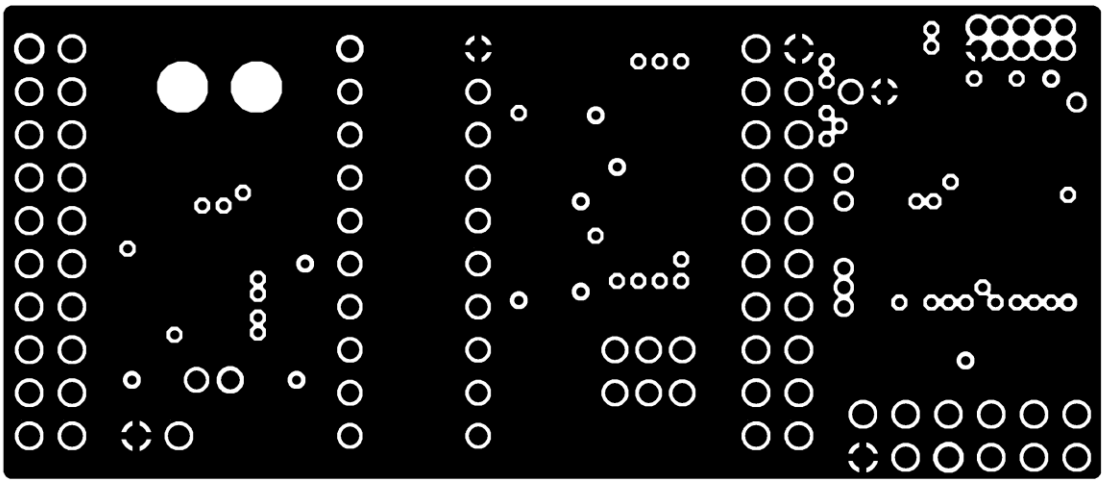


Figure 11 - PCB Layout Inner Layer (GND Plane)

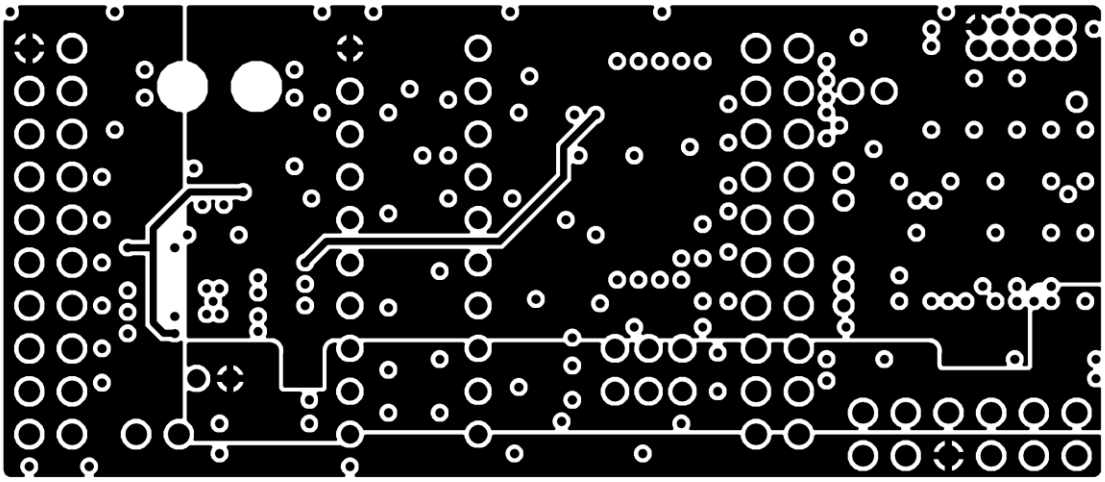


Figure 12 - PCB Layout Inner Layer (Split PWR Plane)

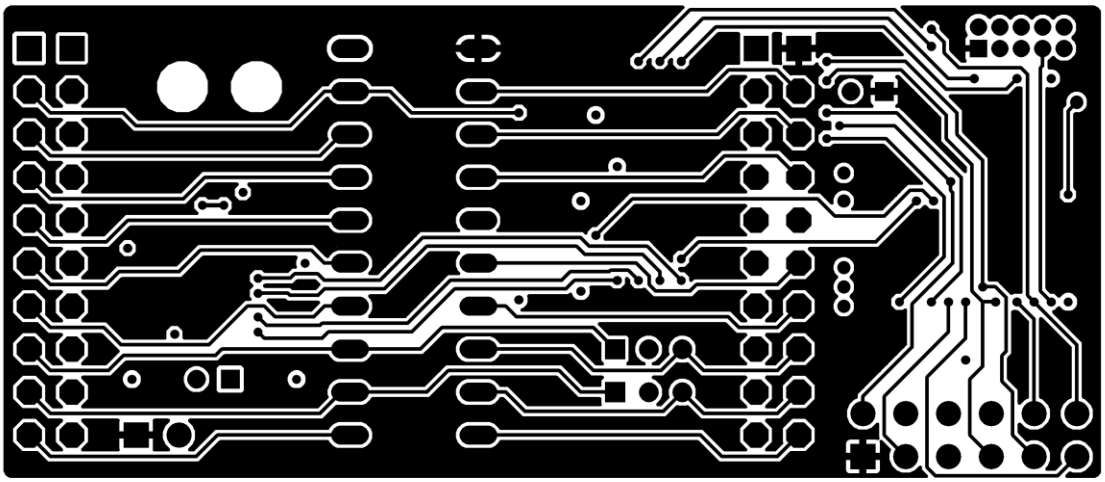


Figure 13 - PCB Layout Bottom Layer

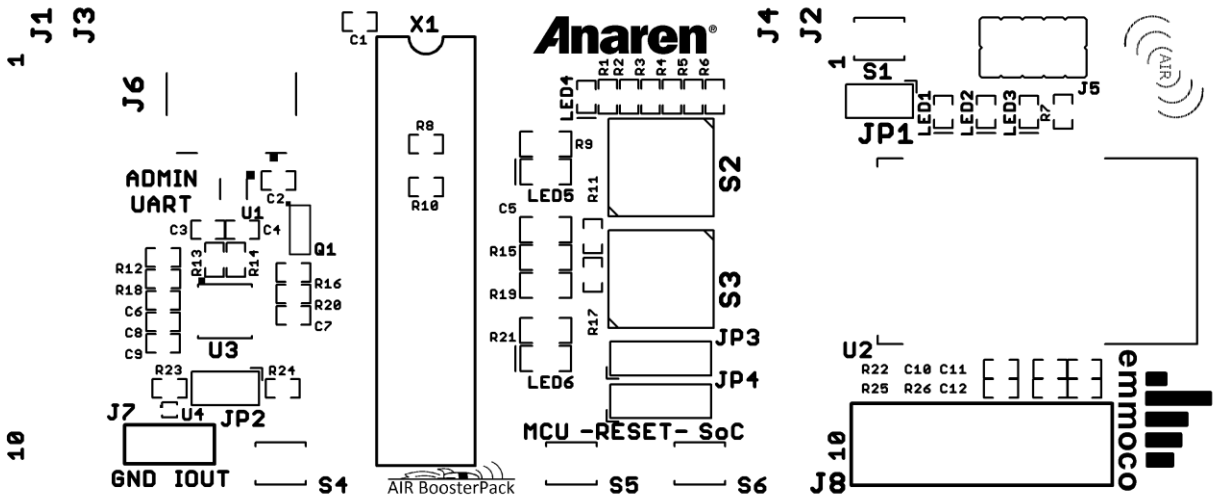


Figure 14 - PCB Layout Top Silkscreen

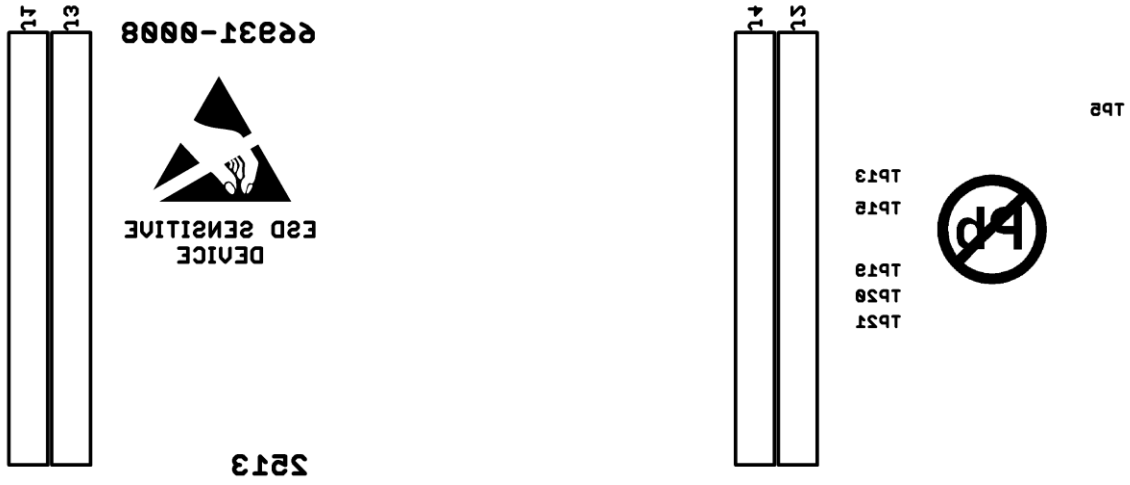


Figure 15 - PCB Layout Bottom Silkscreen

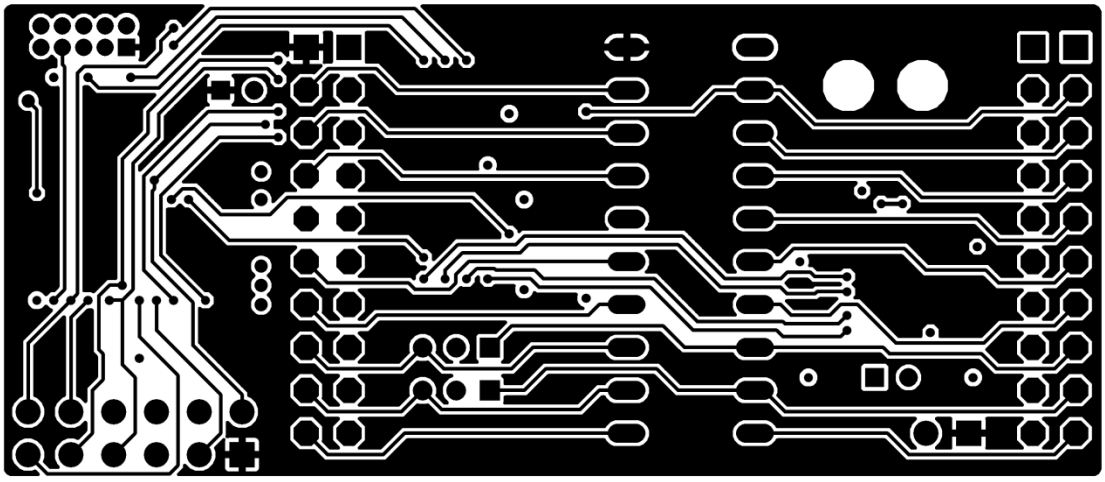


Figure 16 - PCB Layout Bottom Layer Mirror Image

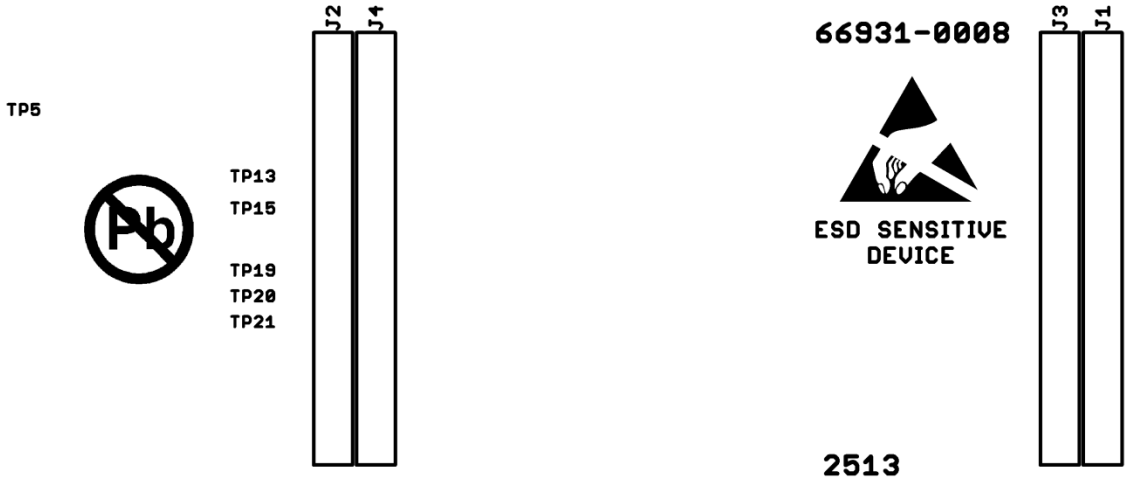


Figure 17 - PCB Layout Bottom Silkscreen Mirror Image

3.5. Bill of Materials (BOM)

Table 16 - Bill of Material

Item	Ref Des	Qty	Description	Comment
1	C1, C6, C7, C8, C11	4/1 NP	CAP CER 0.1UF 10V 10% X5R 0402	C1 not populated
2	C2	1	CAP CER 0.01UF 50V 10% X7R 0402	
3	C3, C4	2	CAP CER 47PF 50V 5% NPO 0402	
4	C5	1 NP	CAP CER 1000PF 50V 10% X7R 0603	Not populated
5	C9, C12	2	CAP CER 4.7UF 6.3V 10% X5R 0402	
6	C10	1	CAP CER 1000PF 50V 5% NP0 0402	
7	J1, J2, J3, J4	2/2 NP	CONN SOCKET 10POS 0.1" SNGL	J3, J4 not populated Samtec ESQ-110-13-S-S (or equivalent)
8	J5	1 NP	CONN HEADER 10POS 1.27MM DUAL ROW VERTICAL T/H SHROUDED	Not populated Samtec SHF-105-01-L-D-TH (or equivalent)
9	J6	1	CONN USB 2.0 MINI-B	Samtec MUSBR-05-S-O-B-SM-A (or equivalent)
10	J7	1	CONN HEADER 2POS 2.54MM SINGLE ROW VERTICAL T/H	Samtec MTLW-102-07-T-S-230 (or equivalent)
11	J8	1	CONN HEADER 6POS 2.54MM SINGLE ROW VERTICAL T/H	Even row not populated Samtec MTLW-106-07-T-S-230 (or equivalent)
12	JP1, JP2 (HDR)	2	CONN HEADER 2POS 2MM SINGLE ROW VERTICAL T/H	Harwin M22-2510205 (or equivalent)
13	JP3, JP4 (HDR)	2	CONN HEADER 3POS 2MM SINGLE ROW VERTICAL T/H	Harwin M22-2510305 (or equivalent)
14	JP1, JP2, JP3, JP4 (SHUNT)	4	CONN SHUNT 2MM 2POS GOLD	Samtec 2SN-BK-G (or equivalent)
15	LED1, LED4	2	LED 0402 RED SMD	Kingbright APHHS1005SURCK (or equivalent)
16	LED2	1	LED 0402 GREEN SMD	Kingbright APHHS1005CGCK (or equivalent)

Item	Ref Des	Qty	Description	Comment
17	LED3	1	LED 0402 BLUE SMD	Kingbright APHHS1005QBC/D (or equivalent)
18	LED5	1 NP	LED 0603 RED SMD	Not populated
19	LED6	1 NP	LED 0603 GREEN SMD	Not populated
20	Q1	1 NP		Not populated
21	R1, R3, R4	3	RES 270 OHM 1/10W 5% 0402 SMD	
22	R2, R6, R18, R22	4	RES 10K OHM 1/10W 5% 0402 SMD	
23	R5	1	RES 680 OHM 1/10W 5% 0402 SMD	
24	R7, R8, R10, R16, R24	2/3 NP	RES 0.0 OHM 1/10W 0402 SMD	R8, R10 not populated R24 not populated for A2541R24 version R7 not populated for A2541E24 version
25	R9, R21	2 NP	RES 270 OHM 1/10W 5% 0603 SMD	Not populated
26	R11, R17, R25	3	RES 47K OHM 1/10W 5% 0402 SMD	
27	R12, R20	2NP		Not populated
28	R13, R14	2	RES 27 OHM 1/10W 5% 0402 SMD	
29	R15	1 NP	RES 2K OHM 1/10W 5% 0603 SMD	Not populated
30	R19	1 NP	RES 47K OHM 1/10W 5% 0603 SMD	Not populated
31	R23	1	RES 1 OHM 1/10W 1% 0402 SMD	
32	R26	1	RES 2K OHM 1/10W 5% 0402 SMD	
33	S1, S4, S5, S6	2/2 NP	SWITCH TACT SPST NO SMD	S4, S5 not populated Omron B3U-1000P (or equivalent)
34	S2, S3	2	SWITCH DIP 4POS 1.27MM SMD	CTS 218-4LPSTJ (or equivalent)
35	U1	1	IC ESD-PROT ARRAY 4CH SOT563	Texas Instruments TPD4E001DRL
36	U2	1	RADIO MODULE A2541 11x19 SMD	Anaren A2541E24A20 or A2541R24A20
37	U3	1	IC USB SERIAL BASIC UART 12DFN	FTDI FT234XD-R
38	U4	1	IC CURRENT SHUNT MONITOR 4DSBGA	Texas Instruments INA216A2YFFR
39	X1	1 NP	IC SOCKET 20PIN	Not populated

HISTORY

Date	Author	Change Note No./Notes
10/11/13		Initial Draft
11/04/13		Initial Release

Attach distributor contact information here

If you have additional questions, need samples, or would like a quote – please email the AIR team at AIR@anaren.com .

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