EM91 Series Development Kit

User Guide

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Rev 2

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1.0	June 5, 2020	Creation
1.1	July 3, 2020	Added Section 2.2.4 Kit Components List Updated Figure 41. Heatsink Assembly
2	July 28, 2021	Added Section 1.2 Development Kit Components and Setup Updated all Chapter 2 General Description topics/tables Removed Section 2.1 RoHS Compliance Updated Section 3.1 Power Tree Replaced Section 3.2 Power Source with 3.2 Power Supply; added 3.2.1 Selecting the Power Supply and 3.2.2 Connecting the Power Supply Updated all Chapter 5 Host Interface topics Updated all Chapter 6 SIM Interface topics Removed Debug chapter Renamed Chapter 7 System I/O to Control Signals and Indicators, updated all topics Updated Section 8.1 5G NR Sub-6/LTE/3G/GNSS, removed mmWave topic, added Section 8.2 RF Performance Split Appendix topics into separate appendices: Appendix A Abbreviations, Appendix B References (updated B.1 Sierra Documents), Appendix C Schematics and PCA Drawing.

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1: Introduction

1.1 Overview

This document describes the EM91 Series Development Kit (Part #6001349) and how to use it with EM91 series embedded modules (EM9190, EM9191 and EM7690) for application development and testing.

1.2 Development Kit Components and Setup

Figure 1-1: Development Kit Contents

1.2.1 Components List

For a detailed list of EM91 Development Kit components, refer to the printed quick reference included with the kit ([3] EM919x/EM7690 Development Kit Quick Reference (Doc# 5306360), also available for download at source.sierrawireless.com).

Note that the kit includes a custom, orientation-independent USB Type-C cable (cable type AX2).

Figure 1-2: Custom USB Type-C Cable

1.2.2 Setup

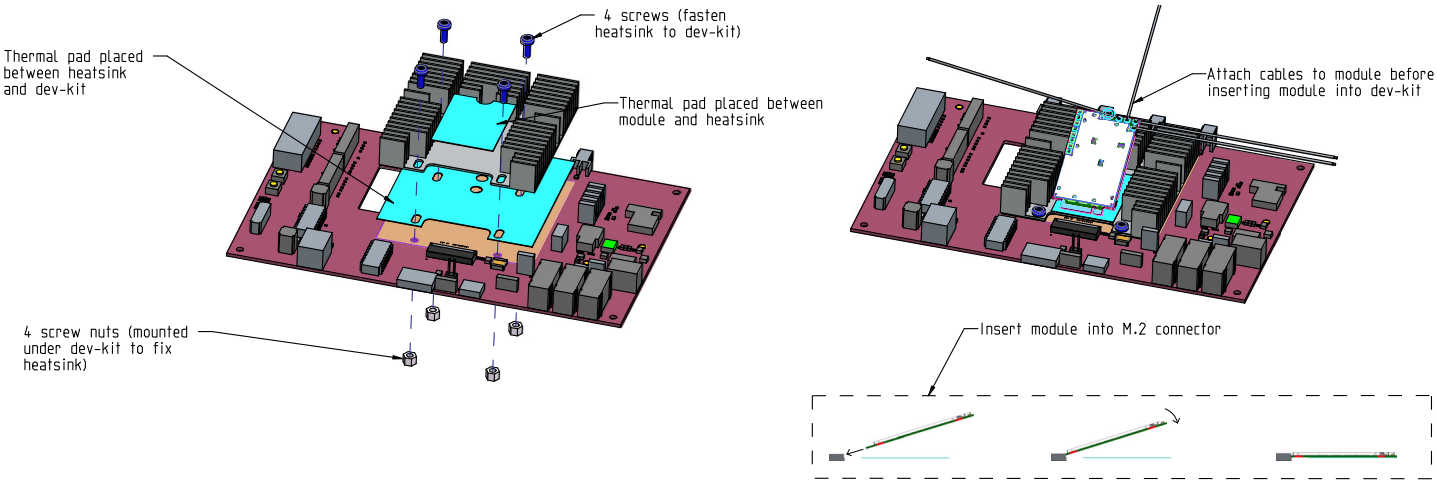
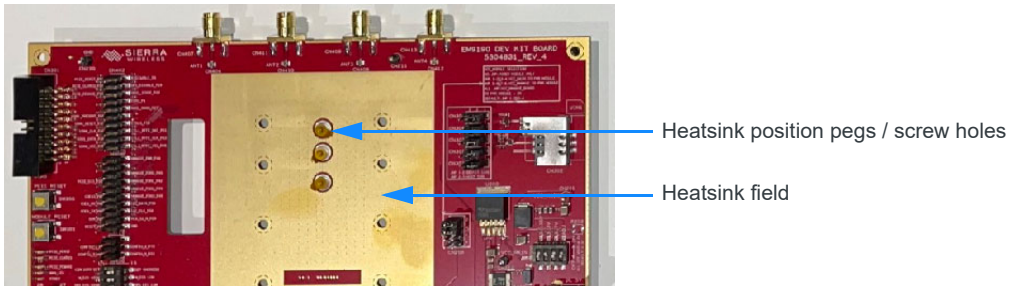


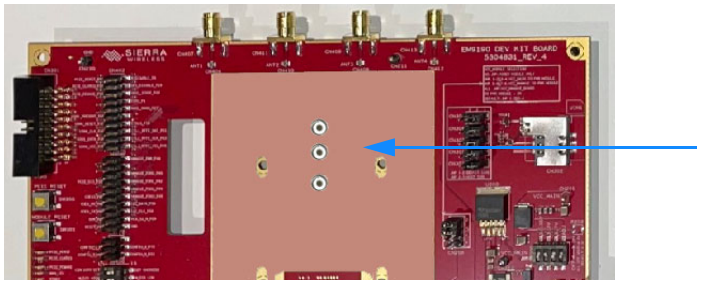
Figure 1-3: DevKit Assembly—Overview

To assemble the DevKit:

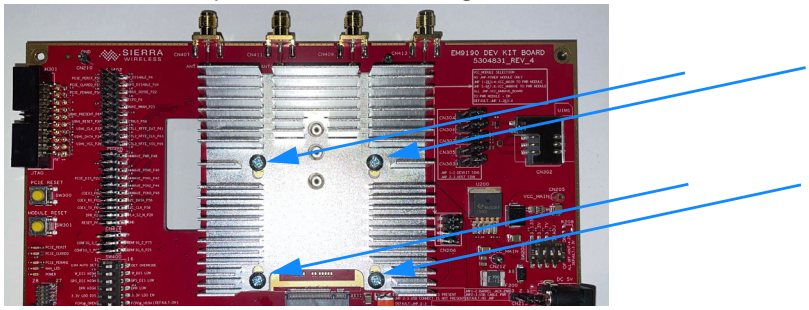
1. Remove the protective orange film from the heatsink position pegs.



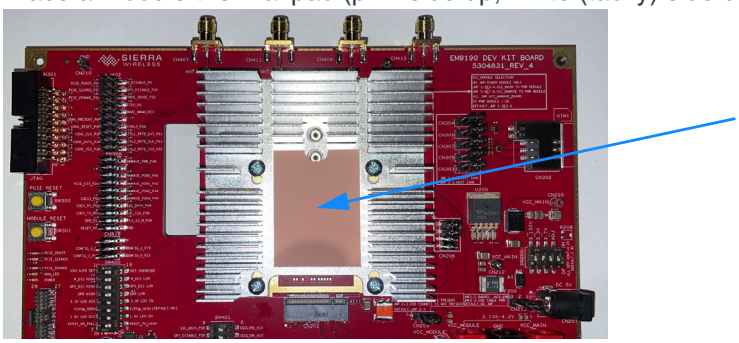
2. Remove the backing from the heatsink thermal pad and position the pad (pink side up, white (tacky) side down) on the DevKit's heatsink field.



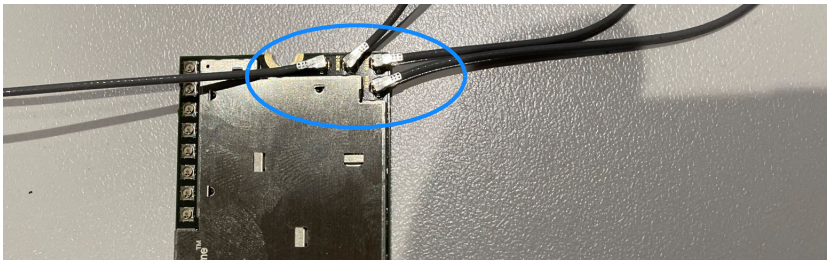
3. Place the heatsink on the thermal pad.
4. Use the four Phillips screws and locking nuts to secure the heatsink on the DevKit.



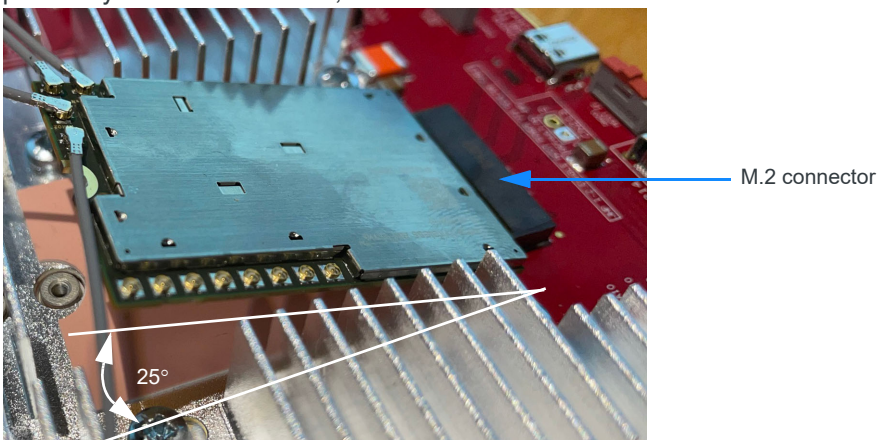
5. Place a module thermal pad (pink side up, white (tacky) side down) on the heatsink.



6. Attach MHF4 cables to the module's AUX, MIMO2, MIMO1, and MAIN RF connectors.

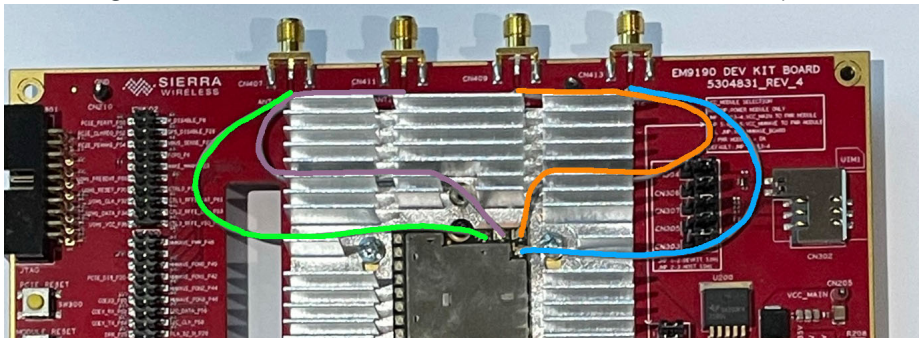


7. Insert the module at a 25° angle into the DevKit's M.2 connector, rotate down, and push fully into the connector, then secure the module with an M2 screw.



8. Connect the MHF4 cables to the DevKit's RF connectors. See 5G NR Sub-6/LTE/3G/GNSS on page 29.

   (Note—Cables are colored for illustrative purposes. Cable routing will depend on cable length—minimize tension to avoid accidental disconnection.)



9. Select the appropriate host interface—see USB Interface Selection on page 23/PCIe Interface Selection on page 24.
10. Make sure the appropriate SIM source is selected—see DevKit SIM Selection on page 26/Host Device SIM Selection (PCIe only) on page 26.
11. Connect the four paddle antennas to the DevKit's SMA connectors—see RF Performance on page 29.
12. Download and install the USB drivers, available from the module page at source.sierrawireless.com, in the "Software download" section:
    - Windows—Click the Windows drivers link to go to the latest drivers page.
    - Linux—Click the MBPL link to go to the latest package page.
13. Select and connect an appropriate power supply—see Power Supply on page 20.
14. If not already connected to supply power, use the custom USB Type-C to C cable (included with the DevKit) to connect the DevKit to the computer.

When the DevKit is connected to the computer by the USB cable, the EM91 series module enumerates two ports—for example, in Windows Device Manager, the ports enumerate under as a COM port (Sierra Wireless DM Port) and Modem (Sierra Wireless WWAN Modem). The Modem is used to access the module to enter AT commands.

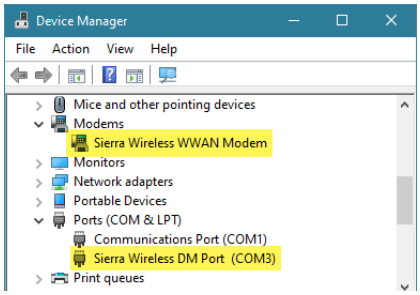


Figure 1-4: Device Manager—Enumerated Ports

Table 1-1: USB Cable Types—Effect on Transfer Rate

Type	Correct Orientation	Incorrect Orientation
Standard USB Type-A to C	USB3.1 (Superspeed+)	USB2.0 (High speed)
Standard USB Type-C to C	USB3.1 (Superspeed+)	Does not enumerate
Custom USB Type-C to C	USB3.1 (Superspeed+)	

Important: *The USB interface supports USB3.1 Superspeed+ transfer rate when an appropriate cable is correctly oriented.*
The custom USB Type-C to C cable included with the DevKit is recommended—this cable works regardless of the cable orientation.

If a standard USB Type-C to C or USB Type-A to C cable is used (not included with the DevKit), make sure it is correctly oriented:
• Standard USB Type-C to C—If the USB COM port does not enumerate, unplug the connector from the DevKit, change the orientation (turn over), and re-insert.
• Standard USB Type-A to C—If the USB COM port is limited to USB2.0 speeds, unplug the connector from the DevKit, change the orientation (turn over), and re-insert. (To check the port speed, use a test application like USBtreeview or similar.)

2: General Description

This chapter describes the DevKit, identifying interfaces, jumpers, switches, and test points.

The default jumper and switch settings described in this chapter illustrate the quick setup of the DevKit for the following 'normal' use case:

- DevKit and EM91 series module powered by the supplied AC adapter
- USB host interface (connected to a computer via the supplied custom USB Type-C to C cable)
- SIM installed in the DevKit SIM holder

2.1 DevKit

The DevKit exposes the EM91 series embedded module's many interfaces, available on the M.2 connector, enabling users to accelerate development and integration of the module into host platforms.

2.1.1 Block Diagram

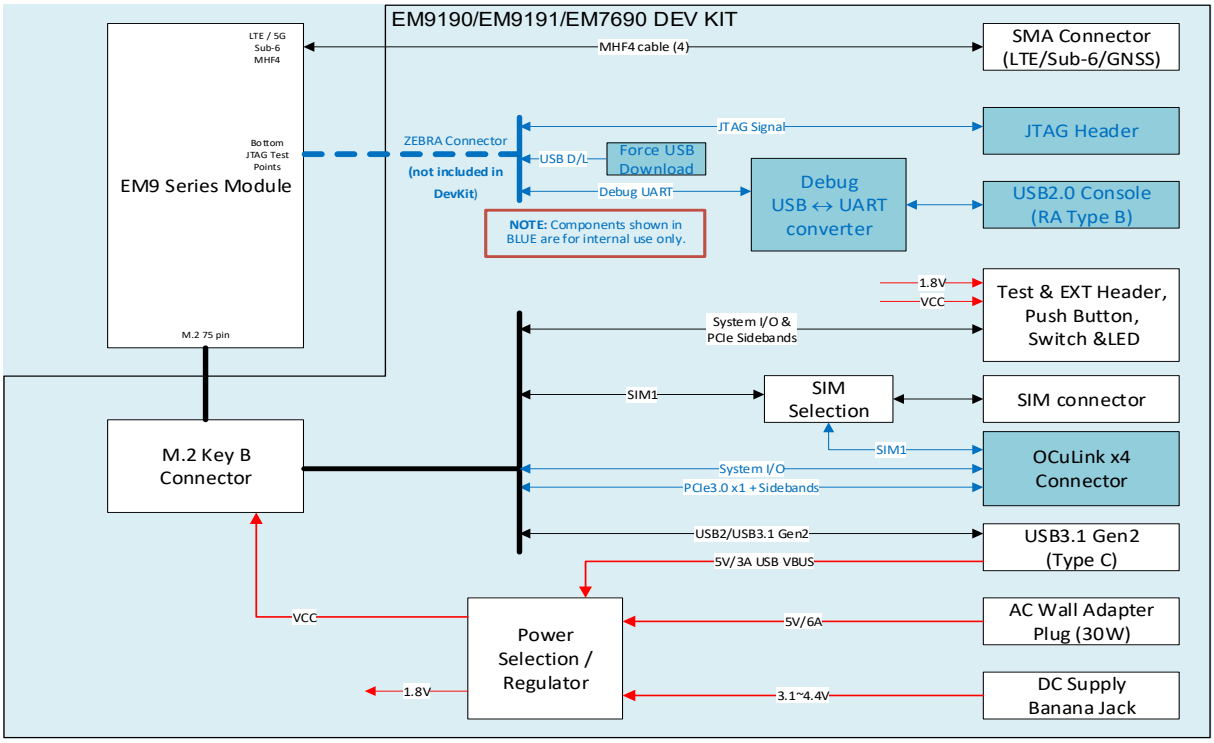


Figure 2-1: Block Diagram

2.1.2 Board Overview

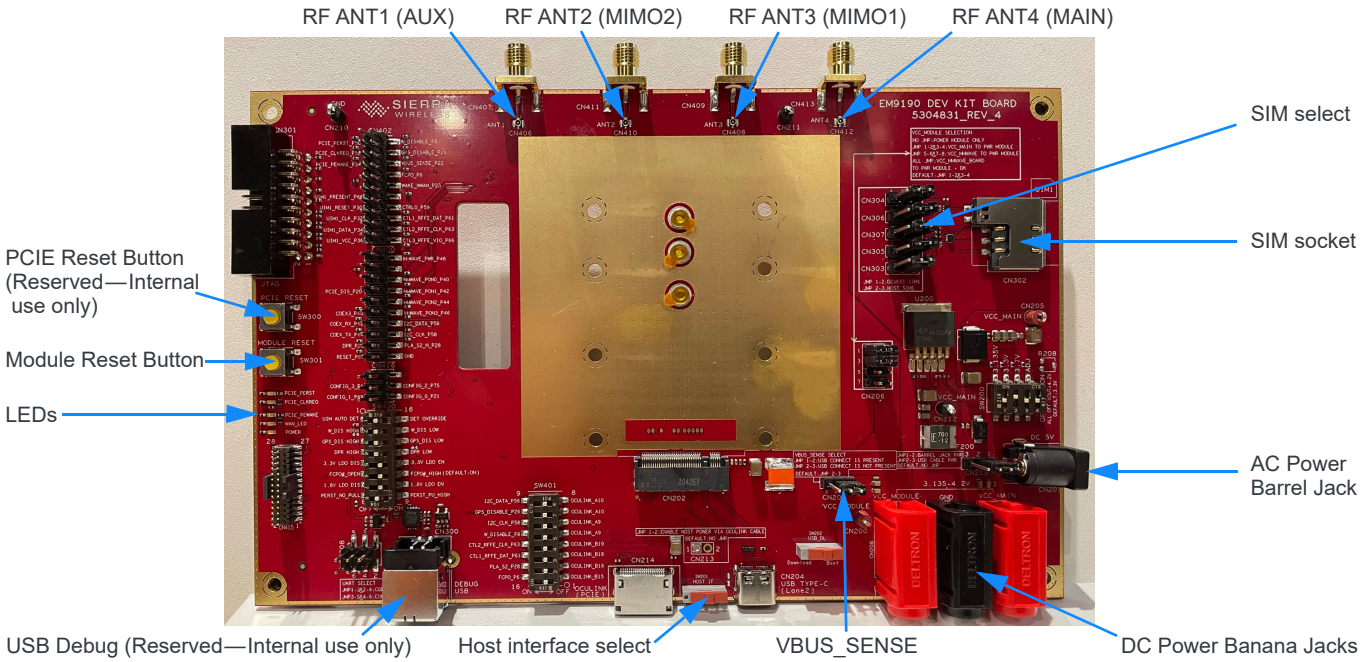


Figure 2-2: DevKit (Top View)

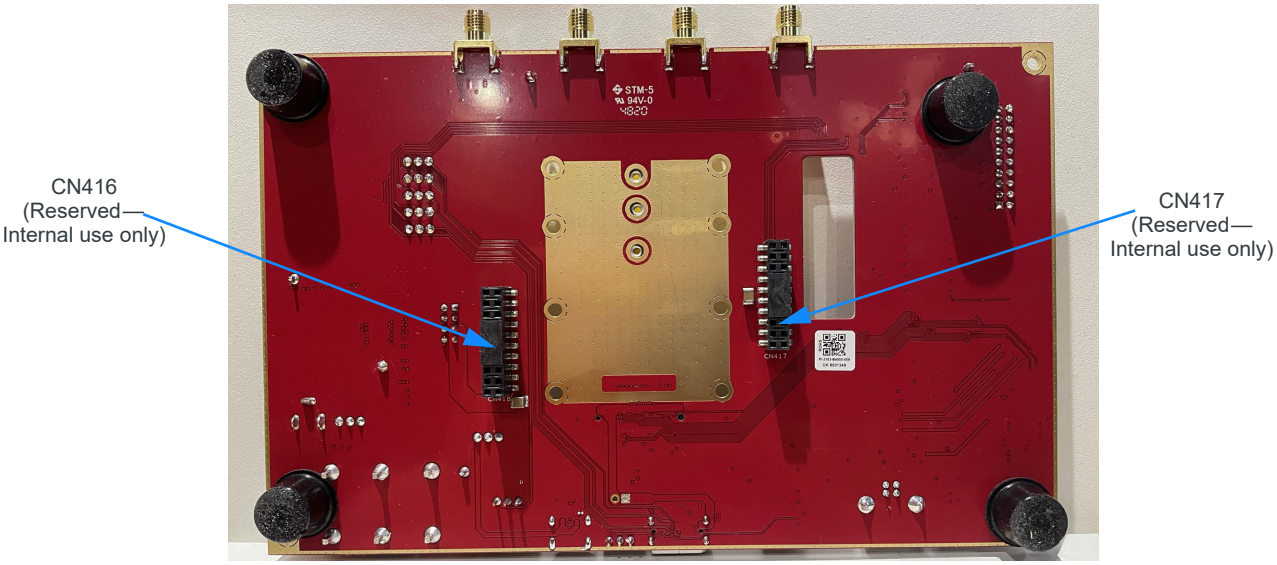


Figure 2-3: DevKit (Bottom View)

2.1.3 Jumpers

The DevKit includes the following jumpers:

Table 2-1: Jumpers

Connector	Jump	Description	Connector(s) used for selected function	Default Configuration
CN203	Pins 1–2	VBUS provided by USB connection	CN204 (USB TYPE-C)	Pins 1–2
	Pins 2–3	VBUS provided by VCC_Module	Depends on VCC_Module source	
CN206 (PWR IN SELECT)	No jump	VCC_MAIN (selected using C215) powers the DevKit only, and VCC_MODULE powers the module only.	• VCC_MAIN depends on CN215 selection. • VCC_MODULE: CN208 & CN209	Pins 1–2 & 3–4
	Pins 1–2 & 3–4	VCC_MAIN (selected using C215) powers the DevKit and module.	Depends on CN215 selection.	
	Note: Do not put jumpers on pins 5–6 or 7–8. These pins are reserved for internal use.			
CN215	No jump	DevKit power provided by banana plugs (e.g. bench power supply)	CN207 (VCC_MAIN)	Pins 1–2
	Pins 1–2	DevKit power provided by AC adapter	CN201 (DC_5V)	
	Pins 2–3	DevKit power provided by USB	CN204 (USB_TYPE-C)	
CN303~CN307	Pins 1–2	DevKit SIM	CN302 (SIM socket)	Pins 1–2
	Pins 2–3	Host SIM	CN214 (OCULINK (PCIE))	
CN308	Pins 1–3 & 2–4	Debug USB used for COEX	Reserved for internal use	Not jumpered
	Pins 3–5 & 4–6	Debug USB used for Console		

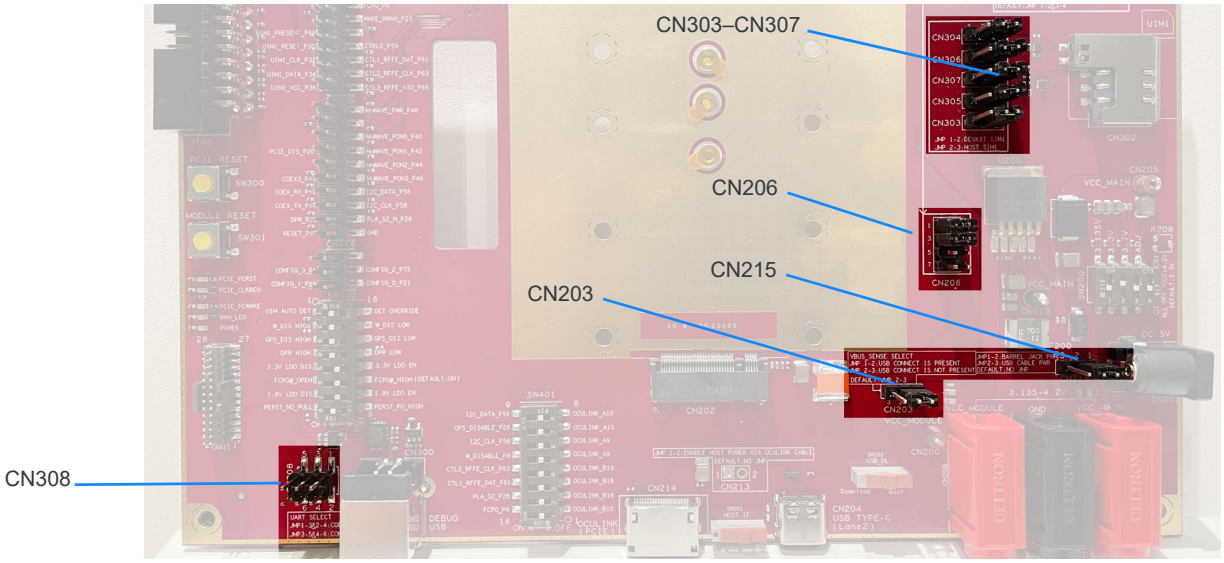


Figure 2-4: Jumper Locations

2.1.4 Switches

The DevKit includes the following switches:

Table 2-2: Switch Settings

Component	Switch	Default	Operation	Description
SW200	1	Off	3.135 V	Select voltage for EM module (if the selected power supply is the AC adapter or USB cable). If all dipswitches are OFF, voltage is 4.4 V. **Important:** *Do not set more than one dipswitch ON.*
	2	On	3.3 V	
	3	Off	3.7 V	
	4	Off	ADJ (Adjustable)	
SW201	Host interface switch			Select the host interface. Slide switch toward PCIe connector (CN214) or USB connector (CN204).
SW202	Boot mode switch			Reserved for internal use. Do not use.
SW300	Button switch			Reserved for internal use. Do not use.
SW301	Button switch			Reset module
SW400	1	Off	SIM1_DETECT	On—Ignore SIM1; Off—Normal mode
	2	Off	W_DISABLE_N	On—RF off; Off—RF active
	3	Off	GPS_DISABLE_N	On—GPS disabled; Off—GPS enabled
	4	Off	DPR	On—Logic low; Off—Logic high For details, refer to [1] EM919X/EM7690 Product Technical Specification (Doc# 41113174).
	5	On	3.3V LDO Enable	On—Enable 3.3V LDO; Off—Disable 3.3V LDO
	6	On	FCPO_N	On—Power on module; Off—Power off module
	7	On	1.8V LDO Enable	On—Enable 1.8V; Off—Disable 1.8V
	8	Off	PCIE_PERST_N	On—Pulls PCIE_PERST_N (PCIe Reset) signal high; Off—No pull (host controls PCI_PERST_N) *Note: If measuring sleep power consumption, set SW400 dipswitch 8 to OFF ("PERST_NO_PULL").*

Table 2-2: Switch Settings (Continued)

Component	Switch	Default	Operation	Description
SW401	1	Off	OCuLink B15 selection	On—Connect to FCPO_N; Off—NC
	2	Off	OCuLink B16 selection	On—Connect to PLA_S2; Off—NC
	3	Off	OCuLink B18 selection	On—Connect to ANT_CTL1/RFFE_DAT; Off—NC
	4	Off	OCuLink B19 selection	On—Connect to ANT_CTL2/RFFE_CLK; Off—NC
	5	Off	OCuLink A9 selection	On—Connect to W_DISABLE_N; Off—NC *Note: Switches 5 and 6 are mutually exclusive. Only one can be ON at any time.*
	6	Off		On—Connect to I2C_CLK; Off—NC *Note: Switches 5 and 6 are mutually exclusive. Only one can be ON at any time.*
	7	Off	OCuLink A10 selection	On—Connect to GPS_DISABLE_N; Off—NC *Note: Switches 7 and 8 are mutually exclusive. Only one can be ON at any time.*
	8	Off		On—Connect to I2C_DATA; Off—Off—NC *Note: Switches 7 and 8 are mutually exclusive. Only one can be ON at any time.*

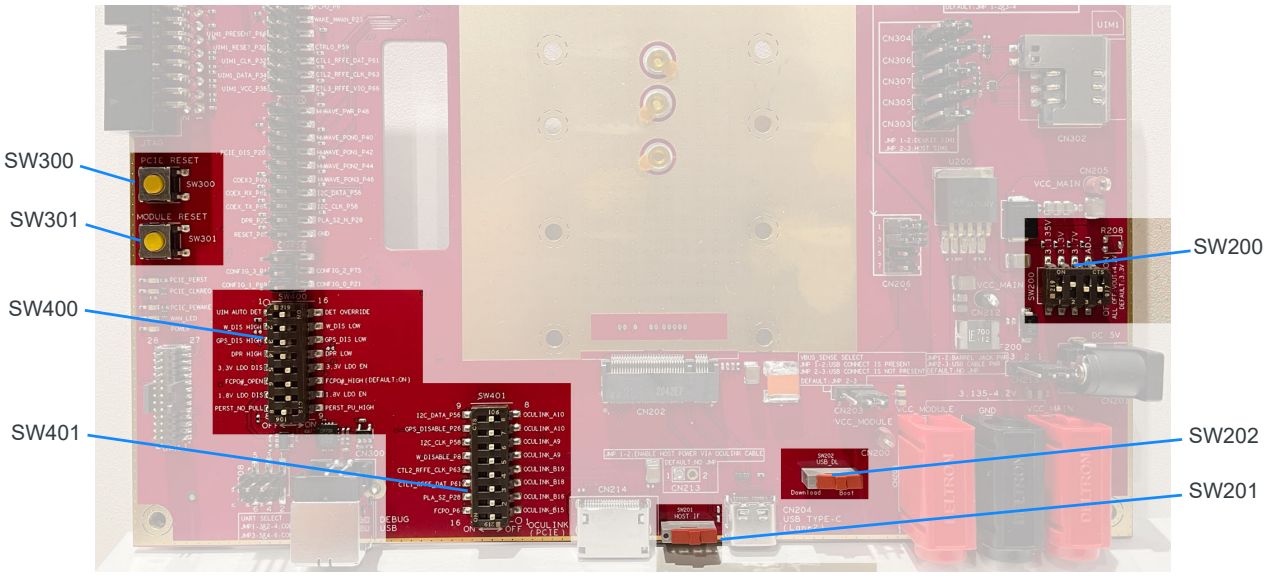


Figure 2-5: Switch Locations

2.1.5 Test Points

The DevKit provides the following test points:

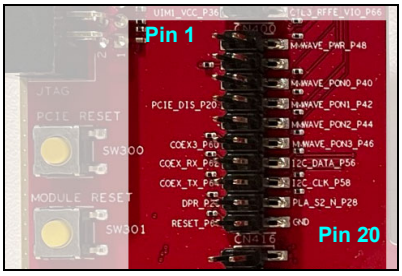


Figure 2-6: Test Points—CN400

Table 2-3: CN400

Description	Pin #	Pin #	Description
NC	1	2	MMWAVE_PWR_P48
VCC_1V8	3	4	NC
NC	5	6	MMWAVE_PON0_P40
PCIE_DIS_P20	7	8	MMWAVE_PON1_P42
NC	9	10	MMWAVE_PON2_P44
COEX3_P60	11	12	MMWAVE_PON3_P46
COEX_RX_P62	13	14	I2C_DATA_P56
COEX_TX_P64	15	16	I2C_CLK_P58
DPR_P25	17	18	PLA_S2_N_P28
RESET_N_P67	19	20	GND

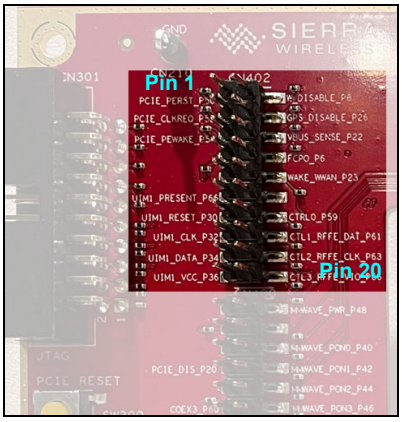


Figure 2-7: Test Points—CN402

Table 2-4: CN402

Description	Pin #	Pin #	Description
PCIE_PERST_N_P50	1	2	W_DISABLE_N_P8
PCIE_CLKREQ_N_P52	3	4	GPS_DISABLE_N_P26
PCIE_PEWAKE_N_P54	5	6	VBUS_SENSE_P22
VCC_MODULE	7	8	FCPO_N_P6
NC	9	10	WAKE_ON_WWAN_P23
UIM1_PRESENT_P66	11	12	NC
UIM1_RESET_P30	13	14	ANT_CTL0_P59
UIM1_CLK_P32	15	16	ANT_CTL1/RFFE_DAT_P61
UIM1_DATA_P34	17	18	ANT_CTL2/RFFE_CLK_P63
UIM1_VCC_P36	19	20	ANT_CTL3/RFFE_VIO_P65

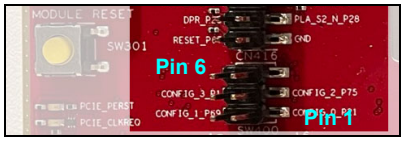


Figure 2-8: Test Points—CN416

Table 2-5: CN416

Description	Pin #	Pin #	Description
PORT_CONFIG_0_P1	1	2	PORT_CONFIG_1_P75
PORT_CONFIG_2_P69	3	4	PORT_CONFIG_3_P21
NC	5	6	NC

3: Power

The DevKit provides multiple power inputs. This section presents guidelines for implementing different power inputs to EM91 series embedded modules.

3.1 Power Tree

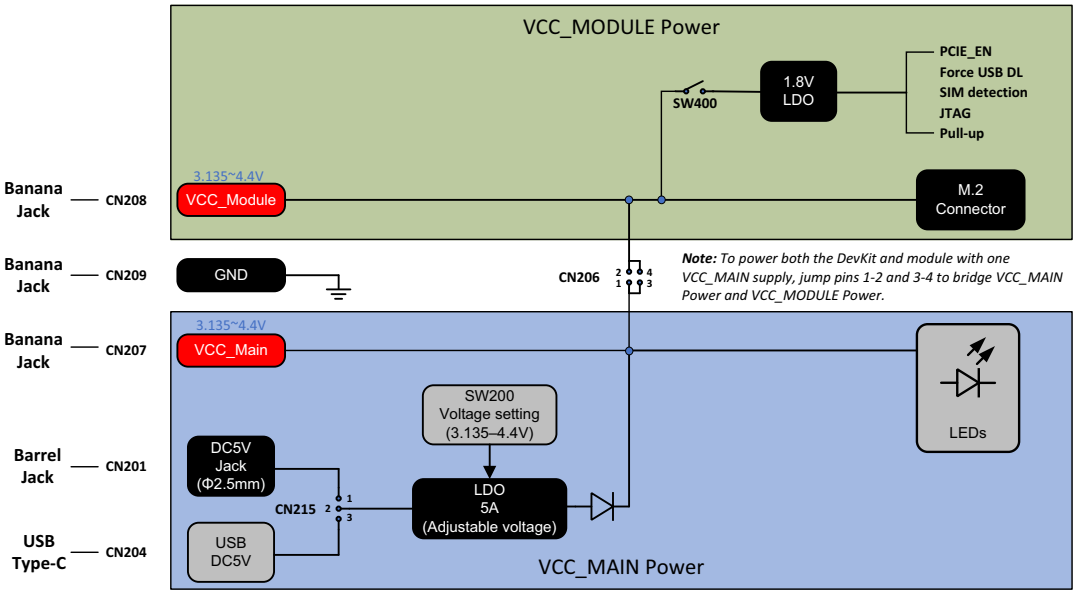


Figure 3-1: DevKit Power Supplies Tree

The DevKit supports several power supply options:

- VCC_MAIN power:
  - Barrel Jack (CN201), AC wall adapter, 5 V
  - USB (CN204), USB Type-C, 5 V
  - Banana Jack (CN207/CN209), 3.135–4.4 V
- VCC_MODULE power:
  - Banana Jack (CN208/CN209), 3.135–4.4 V

Note: The DevKit board rev. 4 and earlier incorrectly indicates 4.2 V as the maximum voltage on the banana jacks. Newer boards indicate the correct maximum voltage—4.4 V.

CN206 can bridge VCC_MAIN and VCC_MODULE power, allowing a VCC_MAIN source to power all DevKit components and the module. (Only one power source can be connected—CN207, CN201, or CN204.)

Warning: To avoid damage to the DevKit or module:

• DO NOT exceed the maximum voltage (4.4 V) when providing power via either banana jack (CN207, CN208).

• DO NOT connect two or more power sources to VCC_MAIN power (when unbridged), or to the combined VCC_MAIN and VCC_MODULE power (when bridged).

For detailed power supply voltage requirements, refer to [1] EM919X/EM7690 Product Technical Specification (Doc# 41113174).

3.2 Power Supply

3.2.1 Selecting the Power Supply

The DevKit and module can be powered by the same supply or by separate supplies. To configure the DevKit's power supplies, use the settings shown in Table 3-1.

Table 3-1: Power Supply Configurations

Power Supply → / Powered component(s) ↓	USB (CN204)	AC Adapter (CN201)	Banana Jacks: VCC_MAIN (CN207) +GND (CN209)	Banana Jacks: VCC_MODULE(CN208) +GND (CN209)
DevKit + Module	CN215: Jump pins 2–3 CN206: Jump pins 1–2 & 3–4	CN215: Jump pins 1–2 CN206: Jump pins 1–2 & 3–4	CN215: No jumpers CN206: Jump pins 1–2 & 3–4	N/A
DevKit only	CN215: Jump pins 2–3 CN206: No jumpers	CN215: Jump pins 1–2 CN206: No jumpers	CN215: No jumpers CN206: No jumpers	N/A
Module only	N/A	N/A	N/A	CN206: No jumpers *Note: If measuring sleep power consumption, set SW400 dipswitch 8 to OFF ("PERST_NO_PULL").*
Typical use cases	Firmware development, or functional test scenarios that do not require high current.	Certification/field tests where current consumption measurement is not required.	Current consumption measurement	

Important: *SW400 dipswitches 5 (3.3V LDO Enable), 6 (FCPO_N), and 7 (1.8V LDO Enable) must all be ON for full functionality. For details, see Table 2-2 on page 16, and Figure 3-1 on page 19.*

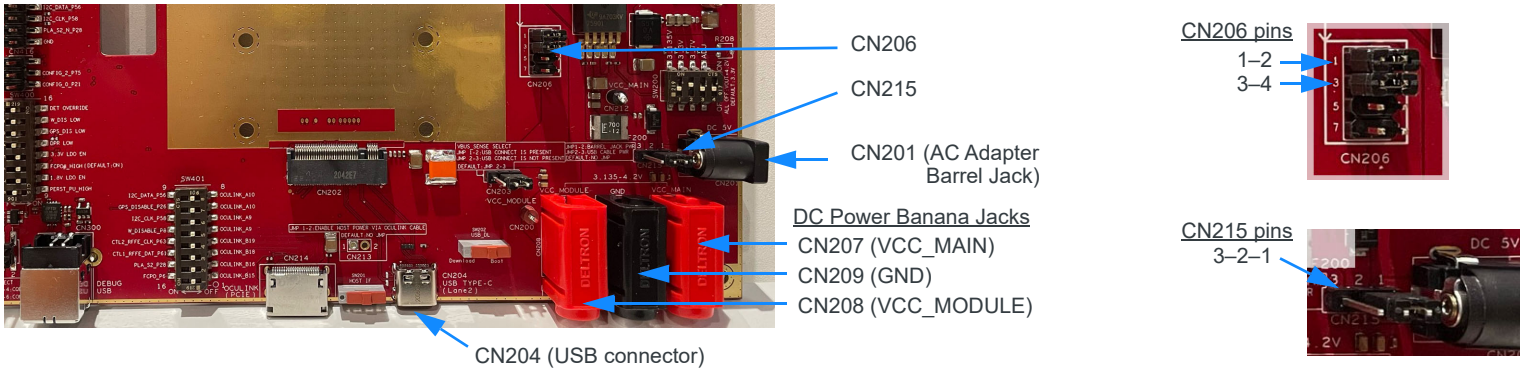


Figure 3-2: Power Supply Configuration

3.2.2 Connecting the Power Supply

When ready to power up the board and/or module:

1. If the module is powered separately, connect the module power supply's banana plugs to CN208 (VCC_MODULE) and CN209 (GND).
2. Connect the DevKit power supply to the appropriate connector:
   - Banana plugs—Connect the supply to CN207 (VCC_MAIN) and CN209 (GND).
   - USB—Use the custom USB Type-C to C cable (included with the DevKit) to connect the computer to CN204 (USB TYPE-C).
   - AC adapter—Connect the supply to the barrel jack CN201 (DC 5V).

4: M.2 Connector

The DevKit includes a 75-pin M.2 Key B socket (CN202) that supports Sierra Wireless EM91 series modules.

For M.2 pin definitions, refer to [1] EM919X/EM7690 Product Technical Specification (Doc# 41113174).

5: Host Interface

This section describes how to select the host interface (either USB or PCIe) to use on the DevKit.

Note: Only one interface (USB or PCIe) can be enabled at any time. Selecting one interface automatically disables the other interface.

5.1 USB Interface Selection

To use USB as the host interface:

1. Select USB as the host interface—slide SW201 toward the USB Type-C connector (CN204). (Note—This connector supports USB2 and USB3.)

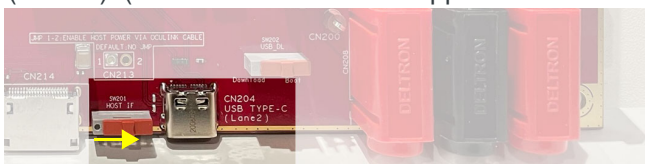


Figure 5-1: Connect Host via USB

Important: *The USB interface supports USB3.1 Superspeed+ transfer rate when an appropriate cable is correctly oriented.*
The custom USB Type-C to C cable included with the DevKit is recommended—this cable works regardless of the cable orientation. For details, see Table 1-1 on page 12.

If a standard USB Type-C to C or USB Type-A to C cable is used (not included with the DevKit), make sure it is correctly oriented:

- *Standard USB Type-C to C—If the USB COM port does not enumerate, unplug the connector from the DevKit, change the orientation (turn over), and re-insert.*
- *Standard USB Type-A to C—If the USB COM port is limited to USB2.0 speeds, unplug the connector from the DevKit, change the orientation (turn over), and re-insert. (To check the port speed, use a test application like USBtreeview or similar.)*

Note: The PCIe interface is disabled when USB is selected.

2. Jump CN203 pins 1–2 to connect VBUS_SENSE to the USB_VBUS. (Note—This must be done to enable USB detection.)

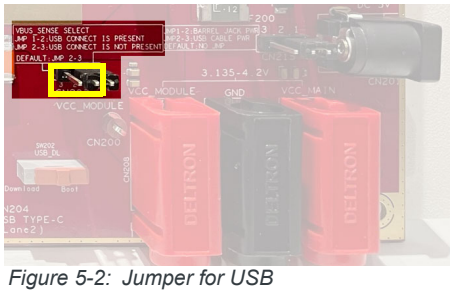


Figure 5-2: Jumper for USB

3. Set all dipswitches on SW401 to OFF.

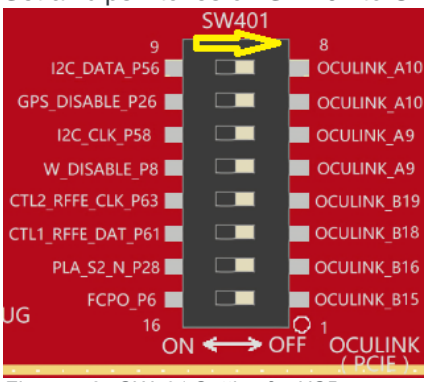


Figure 5-3: SW401 Setting for USB

4. Make sure the DevKit is configured to use the DevKit's SIM socket—see DevKit SIM Selection on page 26.

5.2 PCIe Interface Selection

Note: Information in this section is provided for completeness. Sierra Wireless is not providing the cabling or interface hardware for this interface.

To use PCIe as the host interface:

1. Select PCIe as the host interface—slide SW201 toward the PCIe connector (CN214).

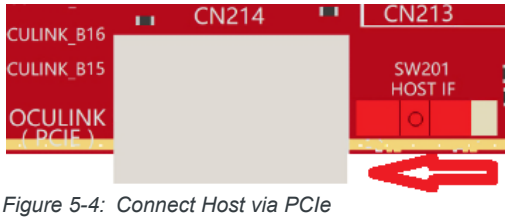


Figure 5-4: Connect Host via PCIe

2. Set SW401 dipswitches for your host device configuration.
   - Desktop configuration—Set all dipswitches to Off.
   - Laptop (W_Disable) configuration—Set dipswitches 1, 2, 3, 4, 5, 7 to On, and dipswitches 6 and 8 to Off.

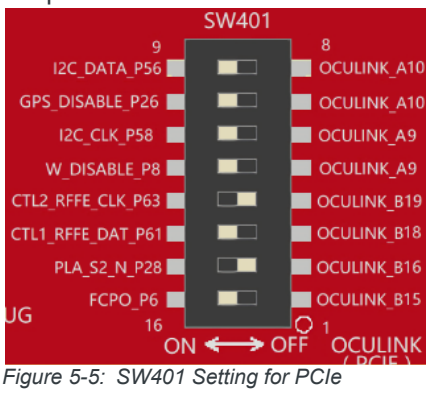


Figure 5-5: SW401 Setting for PCIe

3. Make sure the DevKit is configured to use the appropriate SIM (either the DevKit's SIM socket or, if supported, the Host's SIM)—see SIM Interface on page 26.
4. The DevKit includes a selectable 10K external pull-up to PCIE_PERST_N. To enable this pull-up, set SW400 dipswitch 8 to ON (PERST_PU_HIGH).

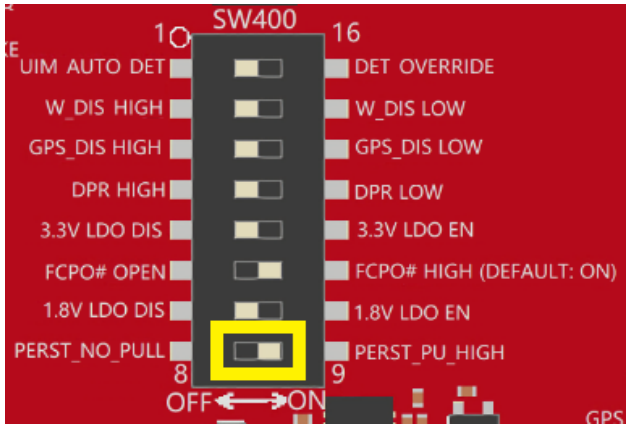


Figure 5-6: External Pull-up for PCIE_PERST_N

Note: As shown in Figure 5-7, the PCIE_PERST_N, PCIE_CLKREQ_N, and PCIE_WAKE_N signals are connected to the DevKit's LED driver, which incorporates a 47k pull-down on these 3 signals. Depopulate Q300 and Q301 to remove the pull-down. Please contact your Sierra Wireless account representative if you have any signal or timing issues on the PCIe host.

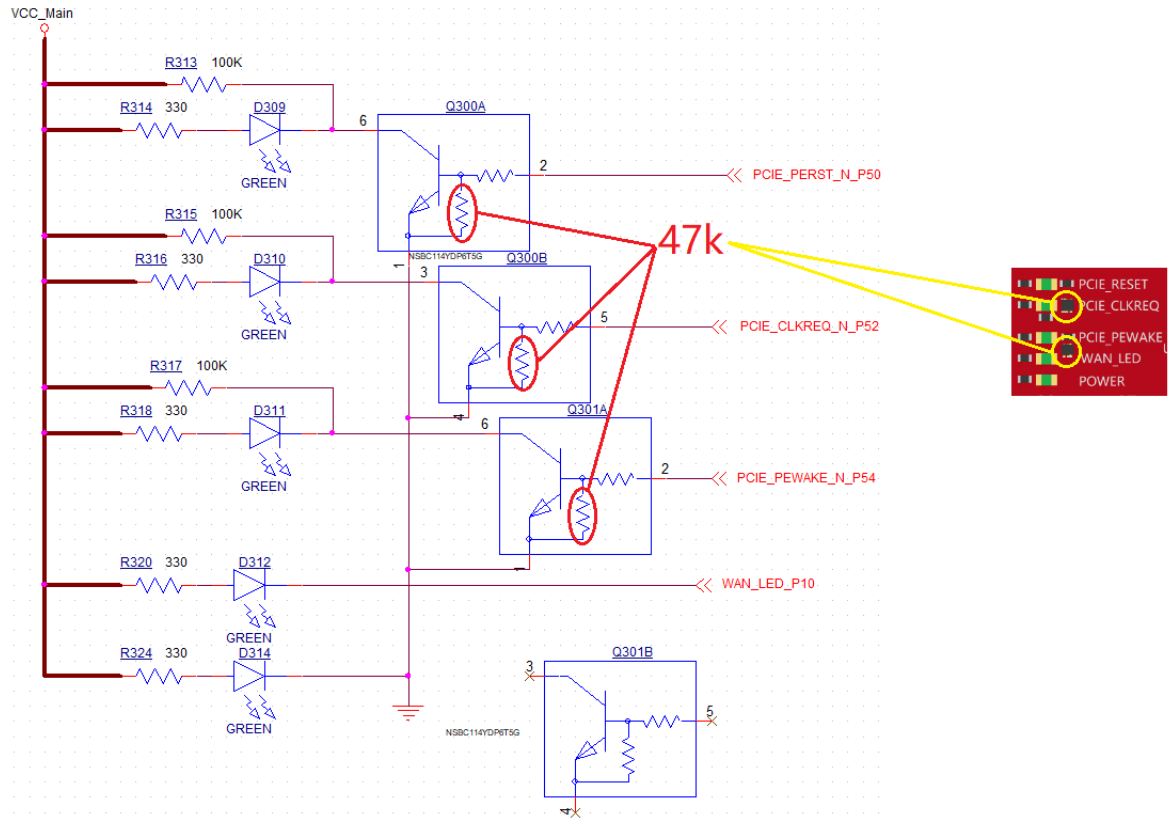


Figure 5-7: Side Effect of the LED Driver to PCIe Sideband Signals

6: SIM Interface

This section describes how to configure the SIM interface to connect to a SIM card on the DevKit or the host device, dependent on the configured Host Interface:

- USB—DevKit SIM socket only (DevKit SIM Selection). The DevKit's SIM interface cannot connect to the host device's SIM.
- PCIe—DevKit SIM socket, or host device's SIM (Host Device SIM Selection (PCIe only)) if the host uses custom hardware to carry the host SIM's signals (e.g. M.2 to OCuLink adapter board).

6.1 DevKit SIM Selection

To configure the SIM interface to use the DevKit's MFF SIM socket (CN302):

1. Select the SIM socket—Jump CN303~CN307 pins 1–2.

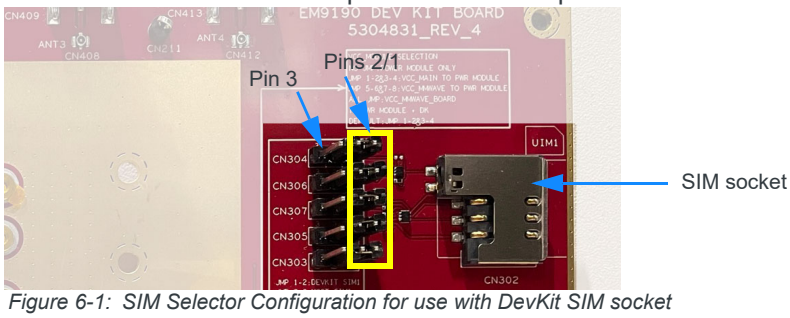


Figure 6-1: SIM Selector Configuration for use with DevKit SIM socket

2. Insert a SIM card in the SIM connector (CN302).

Note: The SIM chamfer (angled corner) faces the board edge when the SIM card is inserted.

6.2 Host Device SIM Selection (PCIe only)

Note: This option is for Sierra Wireless internal use only.

To enable the DevKit to use the host device's SIM, PCIe must be used for the host interface, and the host must use custom hardware (not supplied by Sierra Wireless) to carry its SIM signals to the DevKit.

To configure the SIM interface to use the host device's SIM:

1. Select the host device's SIM—Jump CN303~CN307 pins 2–3.

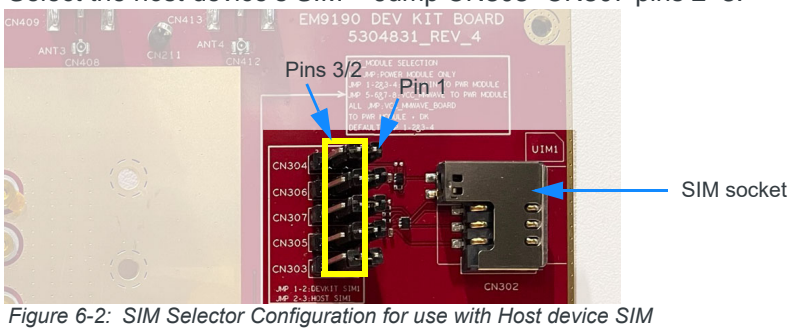


Figure 6-2: SIM Selector Configuration for use with Host device SIM

7: Control Signals and Indicators

This section describes the DevKit's control functionality (buttons, LEDs).

7.1 Buttons

The DevKit provides buttons to reset the module and reset the PCIe bus.

7.1.1 Module Reset

To hard reset the EM91 series embedded module, press (for ~0.5 s) and release the MODULE RESET button (SW301).

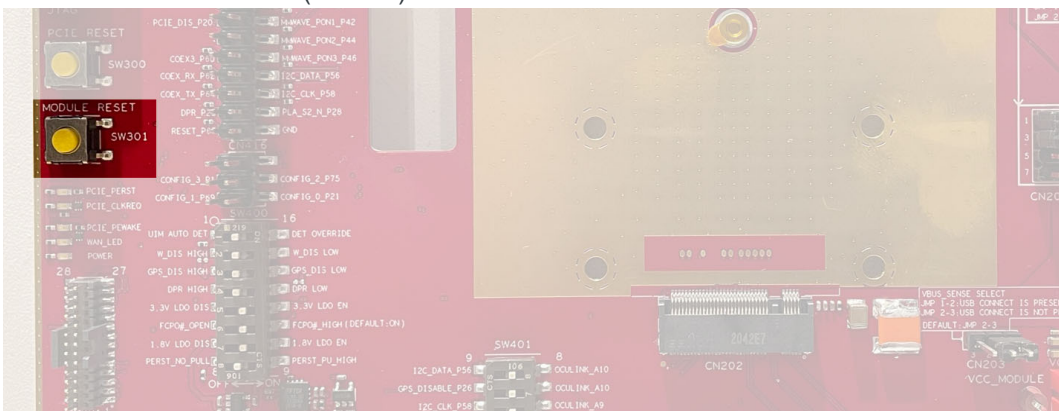


Figure 7-1: Module Reset Button

7.1.2 PCIe Reset

This button is reserved. Do not use.

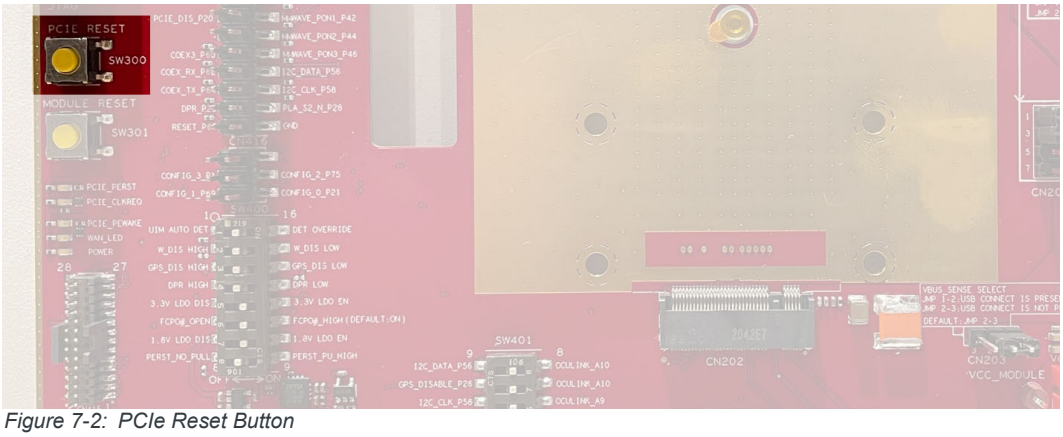


Figure 7-2: PCIe Reset Button

7.2 LEDs

The DevKit uses green LEDs to indicate the logic states of the signals listed in Table 7-1.

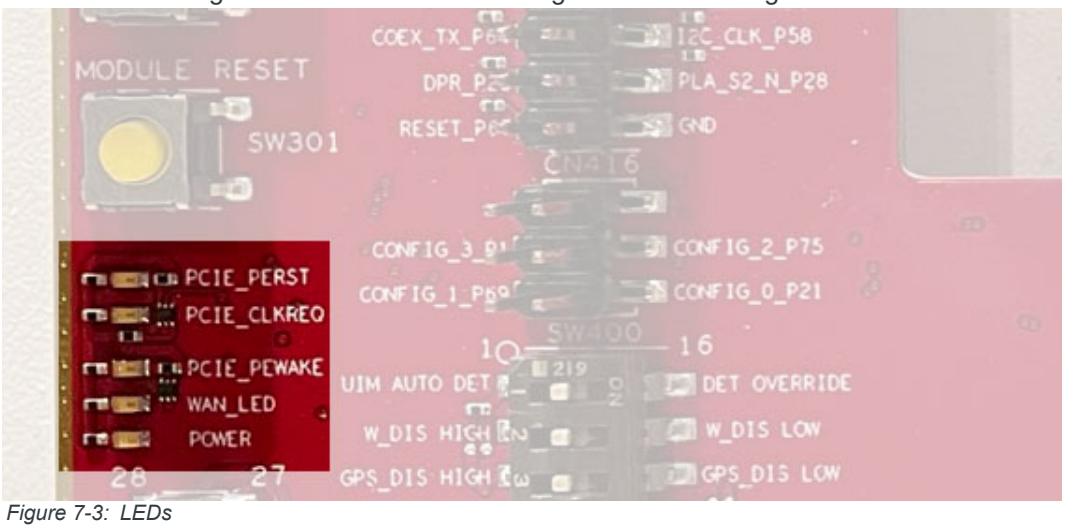


Figure 7-3: LEDs

Table 7-1: Logic State Indicator LEDs

LED Name	Module Signals	Logic state		Description
		LED On	LED Off	
PCIE_RESET	PCIE_PERST_N	High	Low	On—Signal is high (not active) Off—Signal is low (active)
PCIE_CLKREQ	PCIE_CLKREQ_N	High	Low	On—Signal is high (not active) Off—Signal is low (active)
PCIE_PEWAKE	PCIE_PEWAKE_N	High	Low	On—Signal is high (not active) Off—Signal is low (active)
WAN_LED	WWAN_LED#	Low	Hi-Z	On—Signal is low (active) Off—Signal is high (not active) *Note: To test this signal (toggle the LED on/off), use AT!LEDTEST=0,<state> (where <state>: 0=ON, 1=OFF).* *Note: Functionality for this LED is factory-configurable. Contact your Sierra Wireless account representative for details.*
POWER	VCC	High	Low	On—DevKit is powered on Off—DevKit is powered off

8: RF Ports

This section describes the DevKit's RF ports (5G NR Sub-6, 4G LTE, 3G and GNSS).

8.1 5G NR Sub-6/LTE/3G/GNSS

The DevKit includes four SMA (female) RF connectors bridged to MHF4 (female) connectors. MHF4 cables (included) are used to connect the RF ports to the module for 5G NR Sub-6/LTE/3G/GNSS connections:

- ANT1 (CN407)—Connect to EM module's AUX connector.
- ANT2 (CN411)—Connect to EM module's MIMO2 connector.
- ANT3 (CN409)—Connect to EM module's MIMO1 connector.
- ANT4 (CN413)—Connect to EM module's MAIN connector.

For cable descriptions and part numbers, refer to [3] EM919x/EM7690 Development Kit Quick Reference (Doc# 5306360).

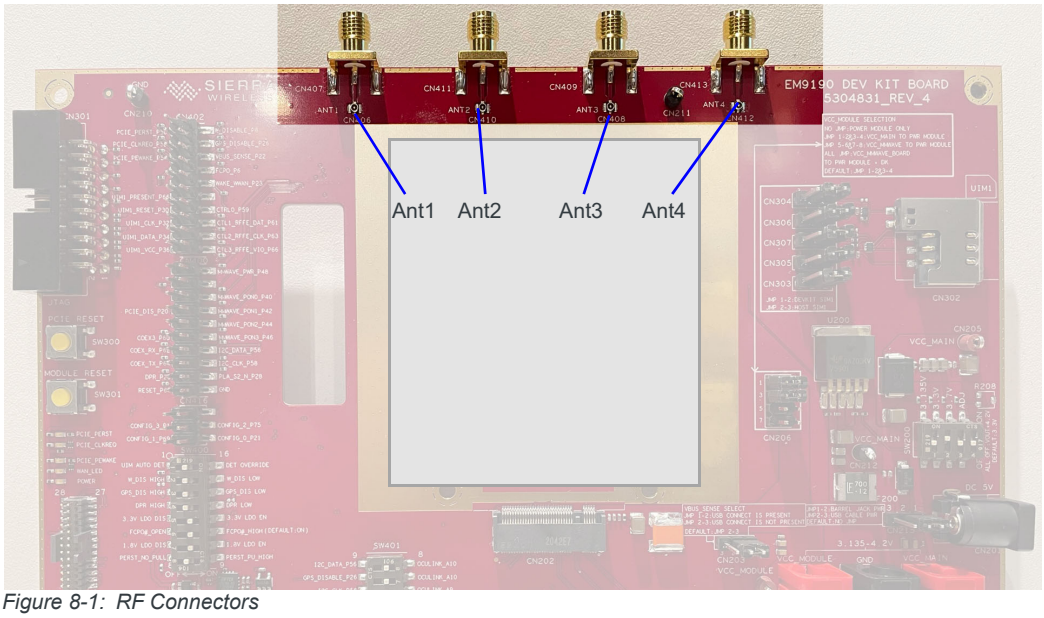


Figure 8-1: RF Connectors

8.2 RF Performance

The EM91 Development Kit includes four paddle antennas (Panorama PWB-6-60-RSMAP).

For optimal MIMO performance using these antennas, use the following orientations to achieve good antenna-to-antenna isolation:

- Best performance—Antennas oriented above and below the PCB

Separate all antennas by 90°. Position ANT1 (AUX) and ANT3 (MIMO1) facing up, and ANT2 (MIMO2) and ANT4 (MAIN) facing down.

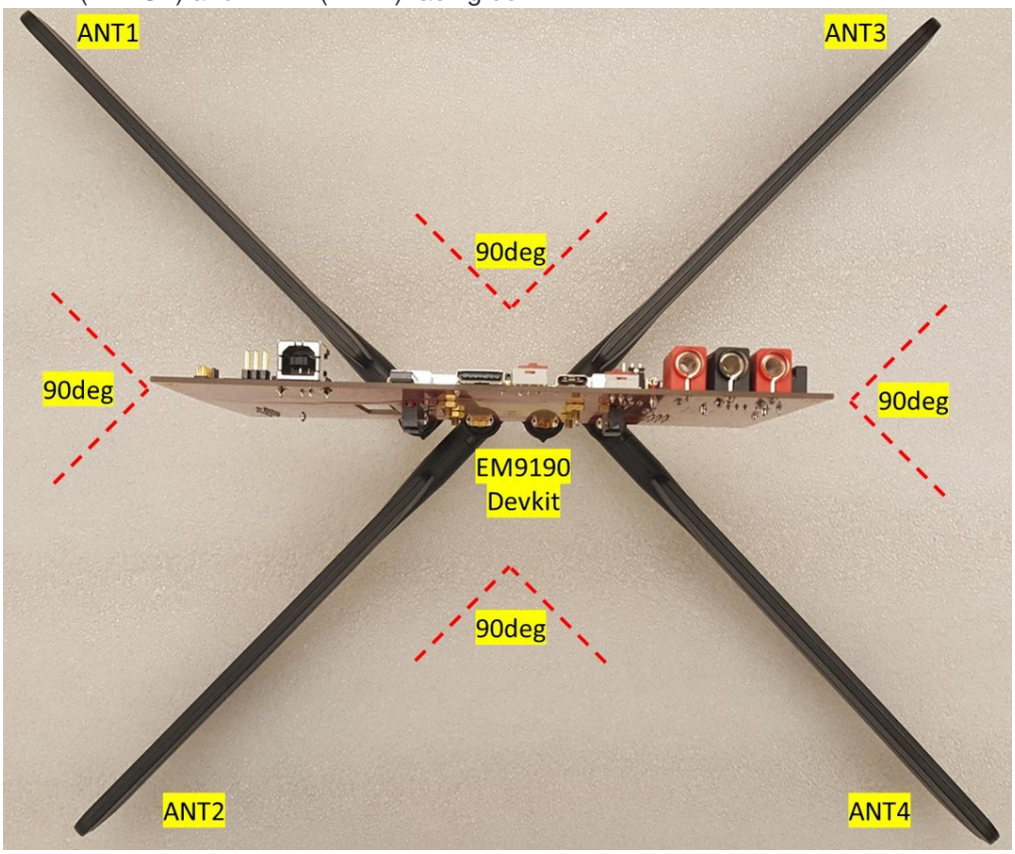


Figure 8-2: Antenna Positioning—Optimal Performance

- Good performance—All antennas oriented above the PCB

  Separate all antennas by 36°.

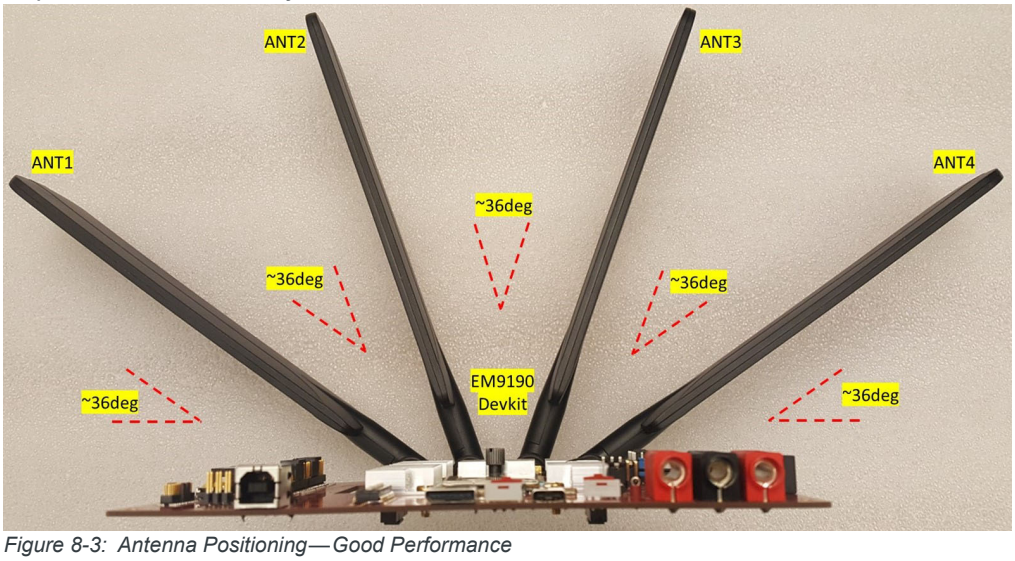


Figure 8-3: Antenna Positioning—Good Performance

9: Thermal

EM91 series embedded modules can generate significant amounts of heat, especially when transmitting large quantities of data. To mitigate thermal impact to the module, a heat sink is required, as shown in Figure 9-1 and Figure 9-2.

For additional information, refer to [2] EM9190 Thermal Application Note (Doc# 2174257).

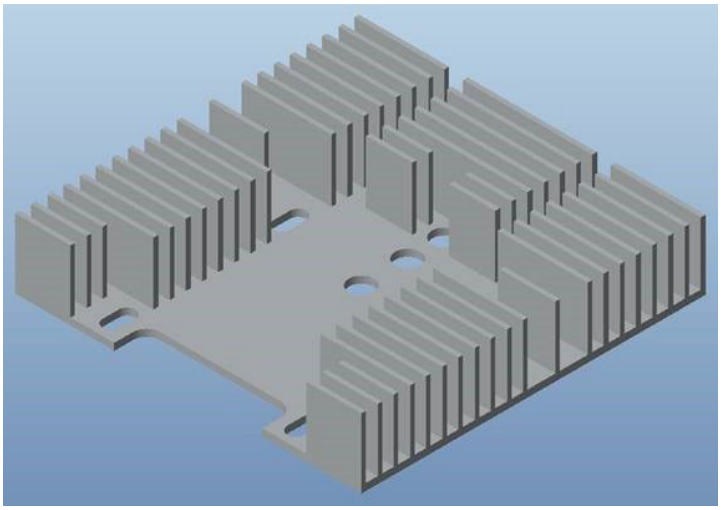


Figure 9-1: EM9190 Heatsink

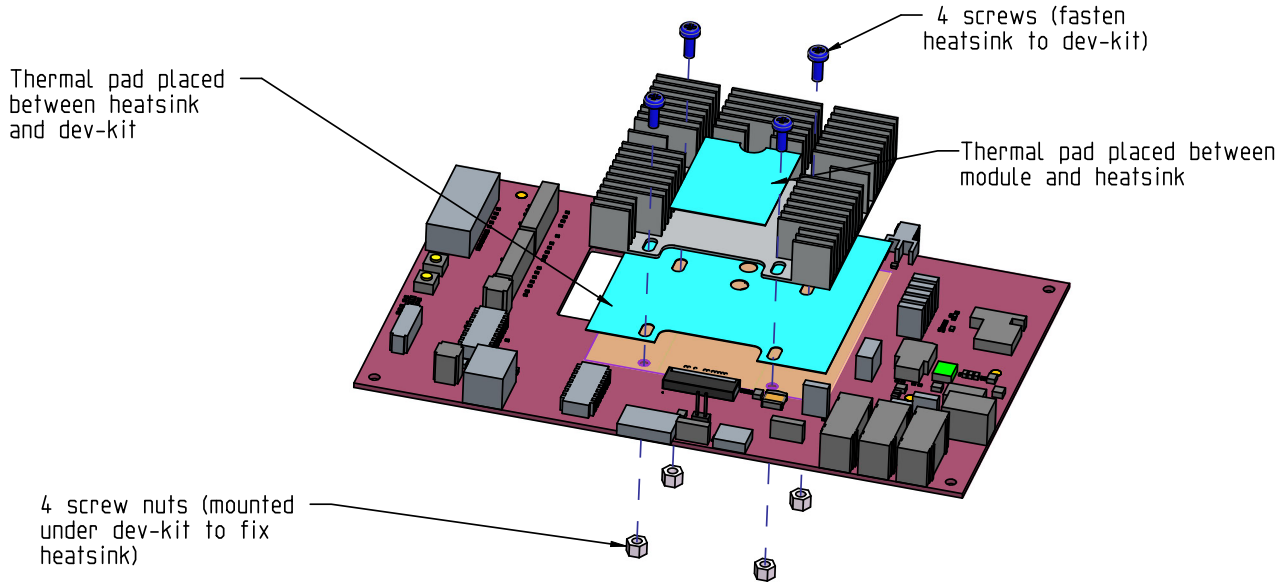


Figure 9-2: Heatsink Assembly

A: Abbreviations

Table A-1: Abbreviations and Definitions

Abbreviation or Term	Definition
5G NR	5G New Radio
ADC	Analog to Digital Converter
ADJ	Adjustable
CLK	Clock
DK	Development Kit
DPR	Dynamic Power Reduction
ESD	Electrostatic Discharge
GND	Ground
GNSS	Global Navigation Satellite Systems (GPS, GLONASS, BeiDou, and Galileo)
GPIO	General Purpose Input Output
Host	Typical refers to the electrical interface source/master
I2C	Inter IC Control bus
I/O	Input/output
LED	Light Emitting Diode
LTE	Long Term Evolution
M.2	Formerly called Next Generation Form Factor (NGFF)
NC	No connect
OCuLink	A small form factor Optical or Copper x4 PCI Express cable Link, targeting mobile and systems with small faceplate areas, for both external and internal cabling
PCIe	PCI Express®
PTS	Product Technical Specification
RXD	Receive Data
SIM	Subscriber Identity Module
Sub-6	Sub 6 GHz
TXD	Transmit Data
UART	Universal Asynchronous Receive Transmit
USB	Universal Serial Bus

B: References

This guide deals specifically with hardware integration issues that are unique to AirPrime embedded modules.

The Sierra Wireless documents listed below are available from www.sierrawireless.com. For additional documents describing embedded module design, usage, and integration issues, contact your Sierra Wireless account representative.

B.1 Sierra Documents

[1] EM919X/EM7690 Product Technical Specification (Doc# 41113174)

[2] EM9190 Thermal Application Note (Doc# 2174257)

[3] EM919x/EM7690 Development Kit Quick Reference (Doc# 5306360)

C: Schematics and PCA Drawing

This section contains DevKit schematics and PCA drawings.

Table C-1: ECAD Drawing

Project Name	SCH PN	PCB PN	PCA PN
EM9190 DEV.KIT	5304830	43048301	5304828

EM9190 Development Kit with PCIE Oculink

Project	Description	PCA #	PCB #	SCH #	REV	EDM VER
EM9190 Development Kit with PCIE Oculink	With PCIE 1 Lane, USB 3.0 and MMWAVE Board Connection	5304828	5304831	5304830	1	R1 Ver7
Note: This Dev Kit is designed for PCIE 1 Lane + USB 3.0, may not be fully capatible with previous modules.						

Table of Contents

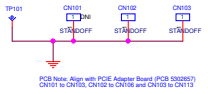
Page	Title
1	Table of Contents
2	Host Interface & PWR
3	UART, SIM, LED & JTAG
4	Switch & Header

Variant Table

DNI	No

BOARD MOUNTING HOLE

MODULE SCREW BOSS

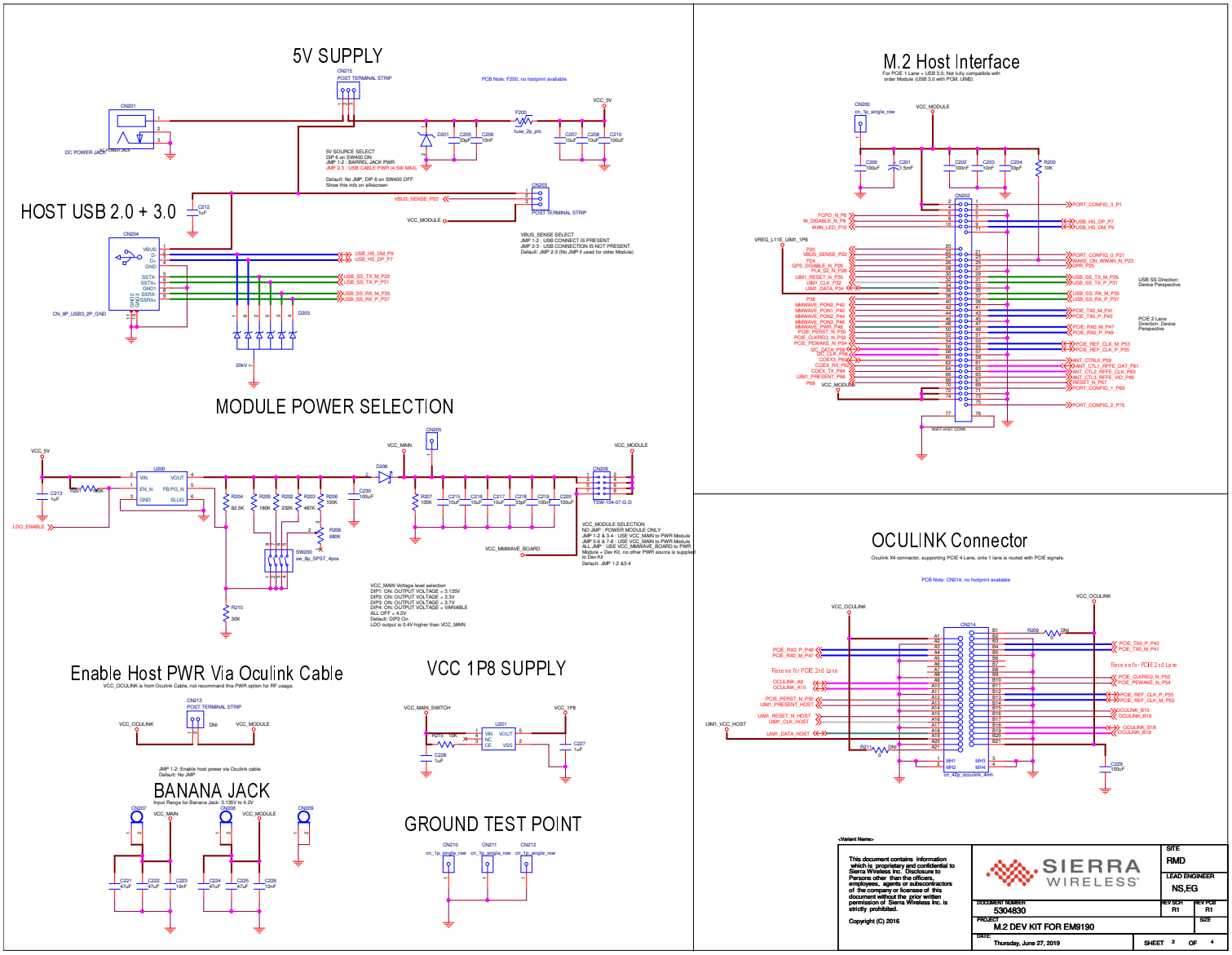


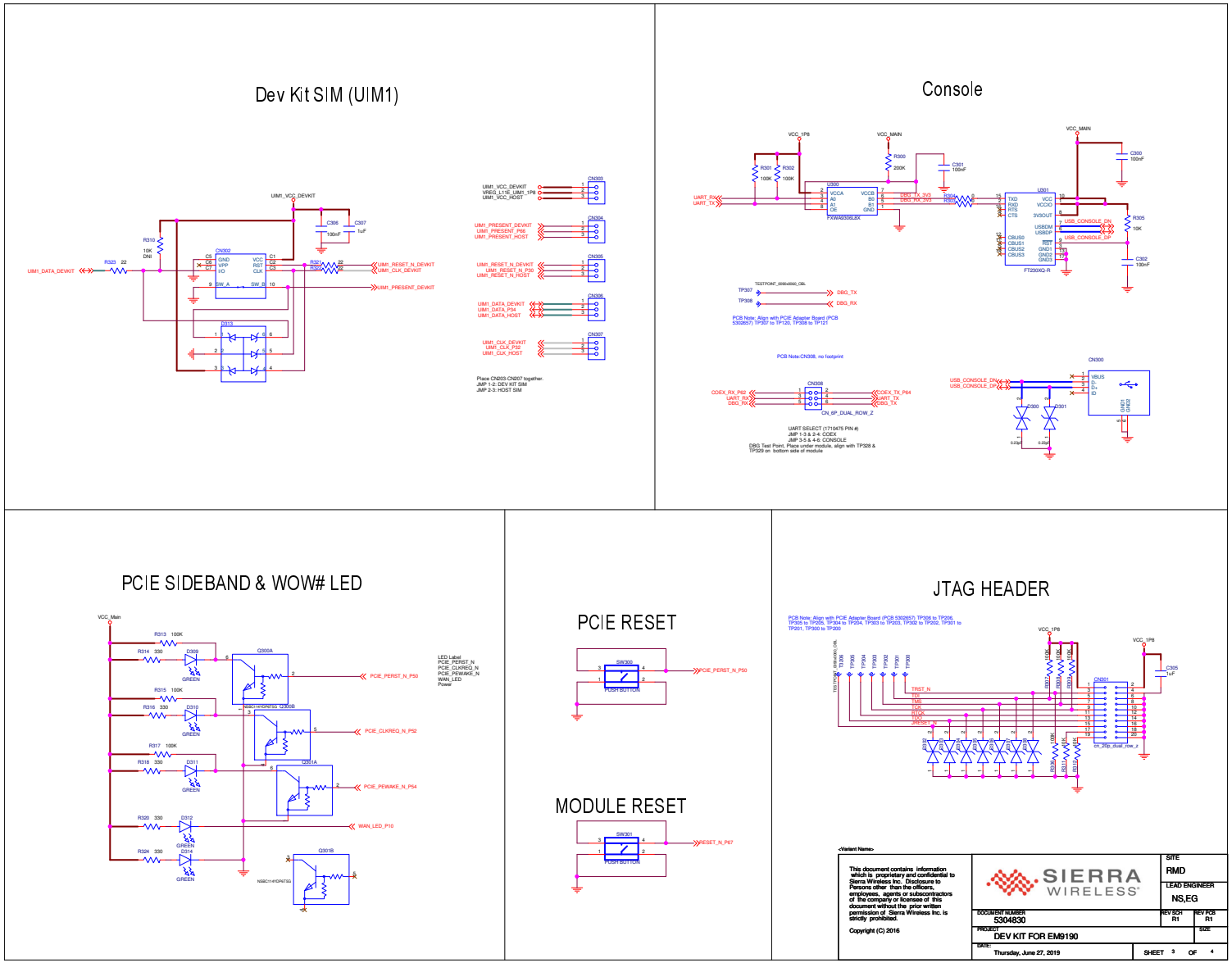
MOUNTING HOLE FOR HEATSINK

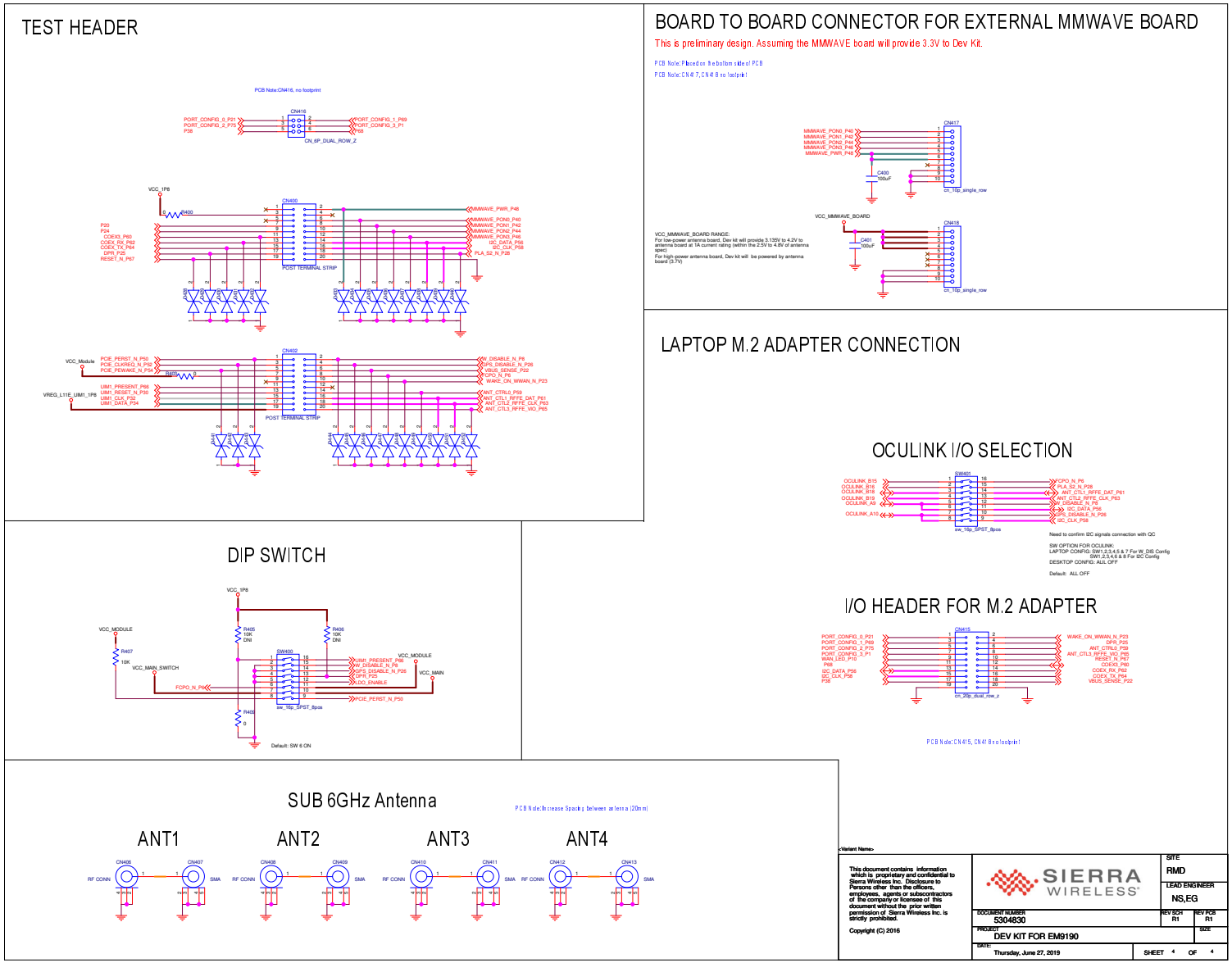
<Variant Name>

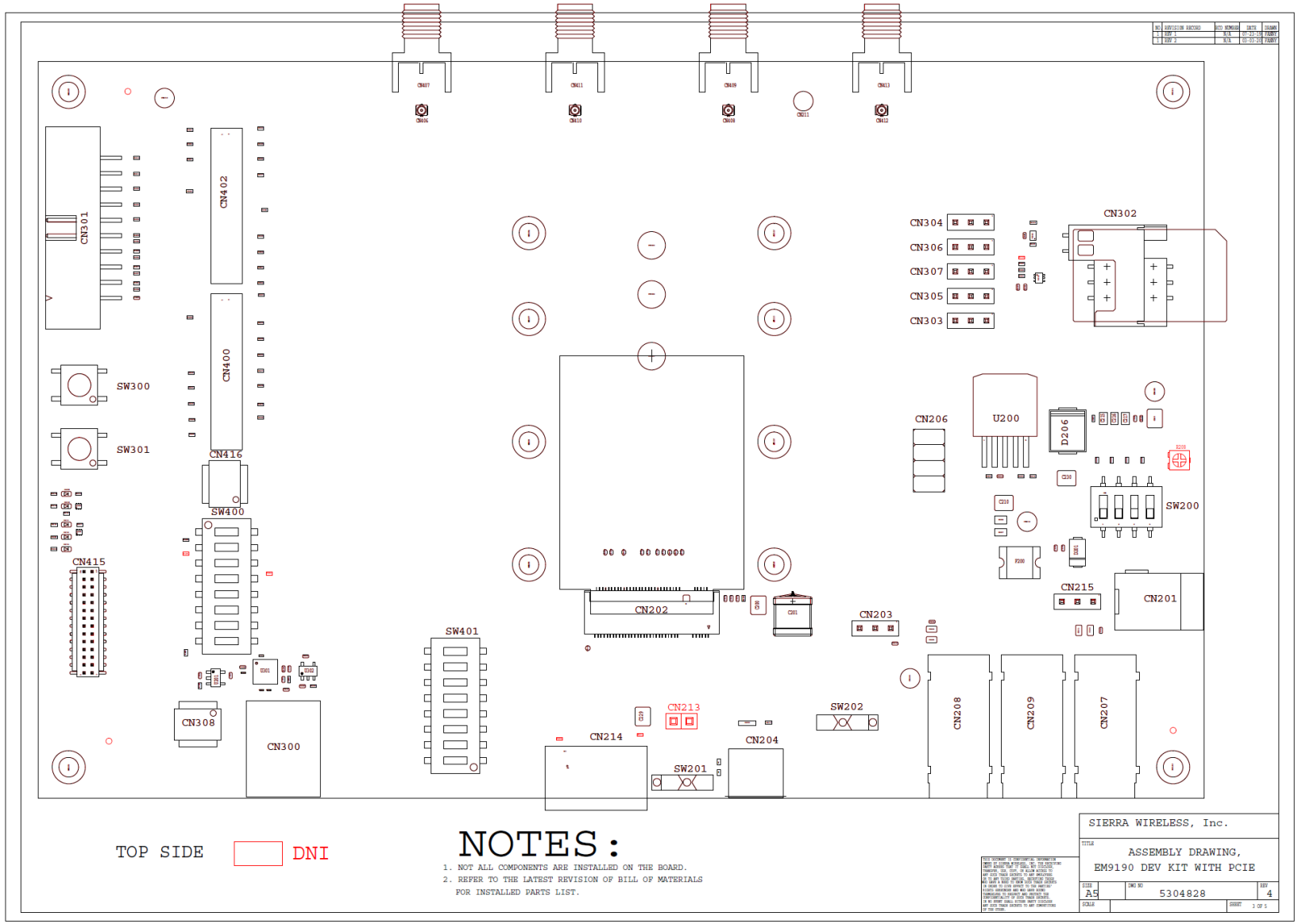
SIERRA WIRELESS

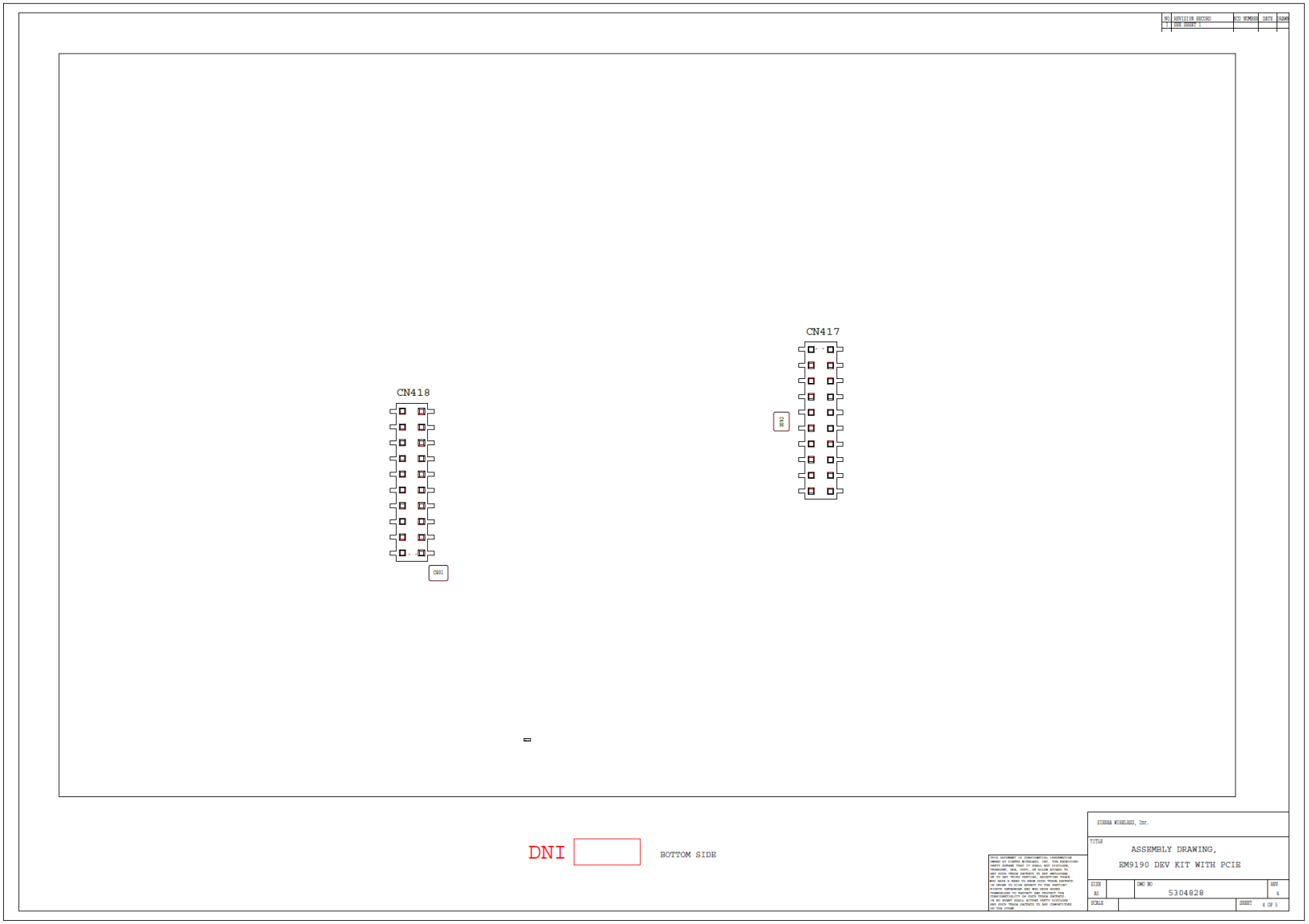
SITE: RMD
LEAD ENGINEER: NS,EG
DOCUMENT NUMBER: 5304830
REV SCH: R1
REV PCB: R1
PROJECT: DEV KIT FOR EM9190
SIZE:
DATE: Thursday, June 27, 2019
SHEET 1 OF 4


5V SUPPLY
HOST USB 2.0 + 3.0
MODULE POWER SELECTION
Enable Host PWR Via Oculink Cable
VCC 1P8 SUPPLY
BANANA JACK
GROUND TEST POINT
M.2 Host Interface
OCULINK Connector
SIERRA WIRELESS
RMD
NS,EG
5304830
M.2 DEV KIT FOR EM9190
Thursday, June 27, 2019
Copyright (C) 2016


Dev Kit SIM (UIM1)
Console
PCIE SIDEBAND & WOW# LED
PCIE RESET
MODULE RESET
JTAG HEADER
SIERRA WIRELESS
DEV KIT FOR EM9190
5304830
RMD
NS,EG
Thursday, June 27, 2019


TEST HEADER
BOARD TO BOARD CONNECTOR FOR EXTERNAL MMWAVE BOARD
This is preliminary design. Assuming the MMWAVE board will provide 3.3V to Dev Kit.
LAPTOP M.2 ADAPTER CONNECTION
OCULINK I/O SELECTION
I/O HEADER FOR M.2 ADAPTER
DIP SWITCH
SUB 6GHz Antenna
ANT1
ANT2
ANT3
ANT4
SIERRA WIRELESS
RMD
NS,EG
5304830
DEV KIT FOR EM9190
Thursday, June 27, 2019


CN301
CN402
CN400
SW300
SW301
CN416
SW400
CN415
CN308
CN300
SW401
CN214
CN213
SW201
CN204
SW202
CN202
CN203
CN304
CN306
CN307
CN305
CN303
CN302
CN206
U200
D206
SW200
CN215
CN201
CN208
CN209
CN207
TOP SIDE
DNI
NOTES:
1. NOT ALL COMPONENTS ARE INSTALLED ON THE BOARD.
2. REFER TO THE LATEST REVISION OF BILL OF MATERIALS FOR INSTALLED PARTS LIST.
SIERRA WIRELESS, Inc.
ASSEMBLY DRAWING,
EM9190 DEV KIT WITH PCIE
A5
5304828
4


CN417
CN418
DNI
BOTTOM SIDE
ASSEMBLY DRAWING,
EM9190 DEV KIT WITH PCIE
5304828