CAVLI wireless

Re-imagining Cellular IoT Solutions

C-Series DDK Start-up Guide

Release Version 1.0

www.cavliwireless.com

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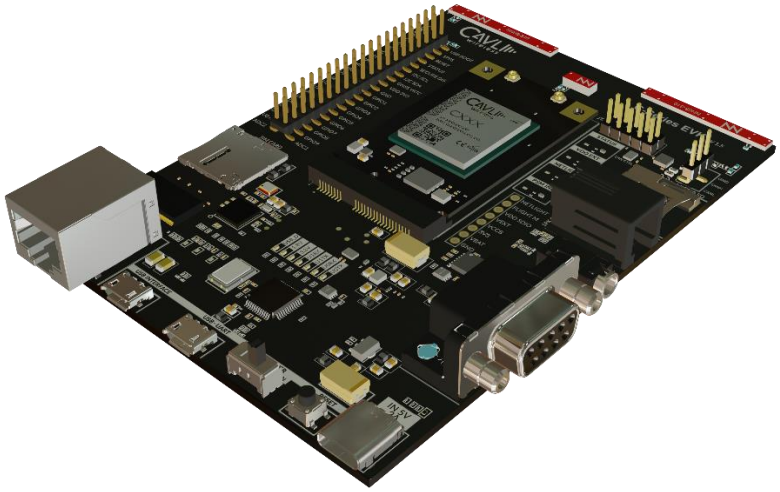
Chapter 1. Introduction

This document is intended as a user manual to Cavli's C-Series DDK.



1.1 Overview

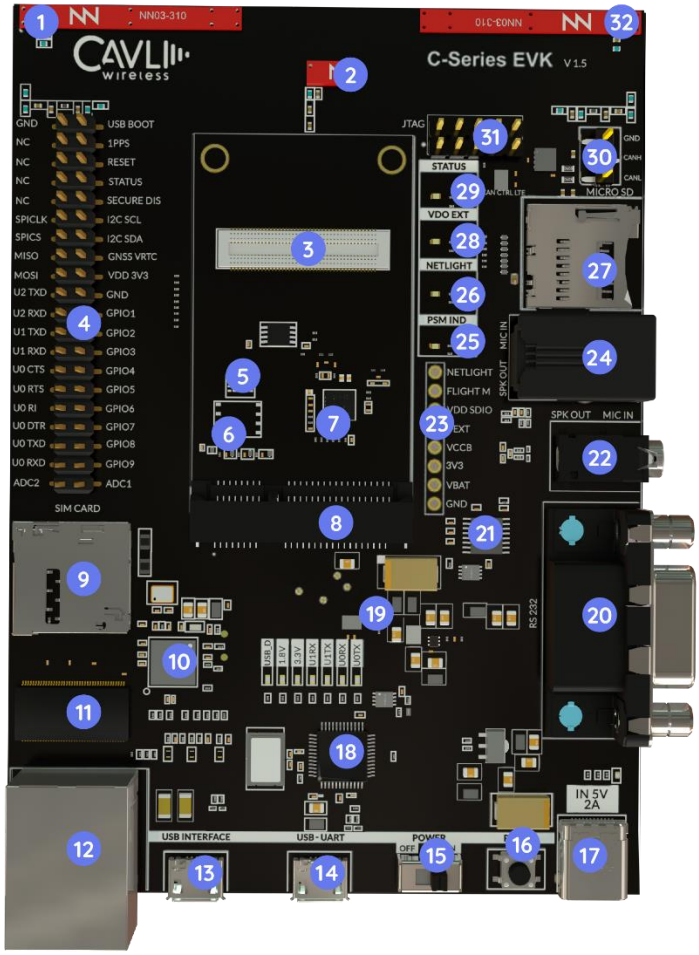
Cavli C-Series Smart modules are connectivity modules integrated with eSIM preloaded with global LTE connectivity subscriptions. We provide a wide range of options in terms of footprint, power consumption and network capabilities, which makes Cavli Smart Modules an apt choice for any application. Cavli C-Series are available in both module and plug and play – modem and mPCIe variants.

Cavli Device Development Kit (DDK) is a hardware platform tool designed for developers and engineers looking to work with Cavli Modules for:

- Developing prototype of proof-of-concept device for any new or improved design and or application.
- Programing, updating and debugging firmware and application code on Cavli Modules
- Running sample applications and scripts that are part of the end application
- Using the complete Cavli Open-CPU access and SDK functionality

Chapter 2. DDK Layout

- NN03-310 LTE Antenna 1
- NN03-320 GNSS Antenna 2
- 80 Pin Connector 3
- 40 Pin Connector 4
- eSIM MFF2 DFN6 Pads 5
- eSIM MFF2 DFN8 Pads 6
- NAU8810YG Audio Codec 7
- Mini PCIe Female Connector 8
- SIM Card Socket 9
- Ethernet Chip 10
- Ethernet Magnetic Chip 11
- RJ45 Jack 12
- USB Interface 13
- UART Interface 14
- Power Switch 15
- Reset Button 16



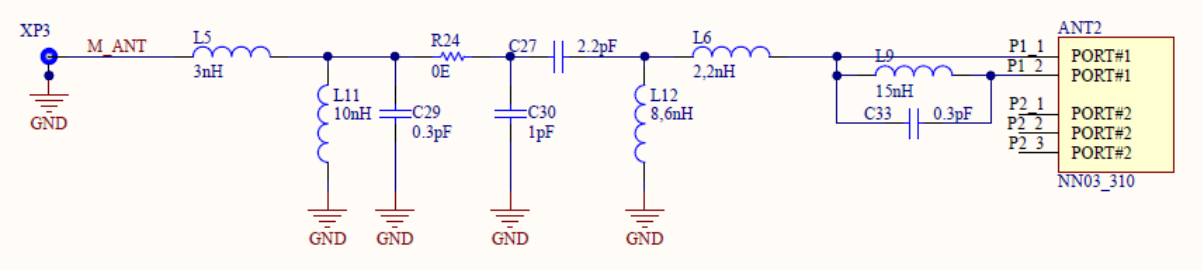
- 32 NN03-310 Diversity Antenna
- 31 JTAG Interface
- 30 CAN Bus Interface
- 29 Status Indicator
- 28 VREF Indicator
- 27 Micro SD Card Socket
- 26 Network Indicator
- 25 PSM Indicator
- 24 J22 Jack
- 23 8 Pin Connector
- 22 3.5mm Audio Jack
- 21 MAX3232 RS232 Transceiver
- 20 DB9 Female Connector
- 19 UART Voltage Transceiver
- 18 FTDI USB-UART Converter
- 17 Power Input (Type-C)

Chapter 3. Component Description

3.1 Antenna

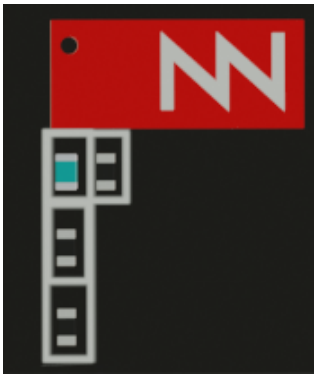
3.1.1 LTE Antenna

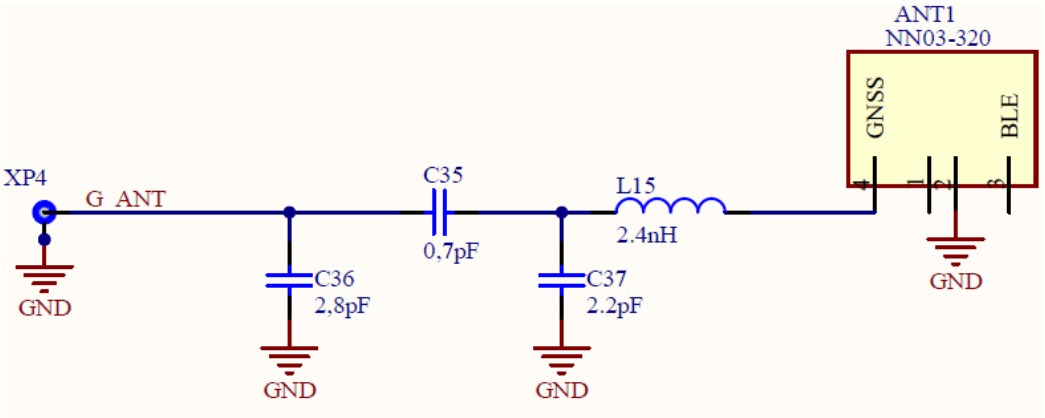
C-Series DDK comes with an integrated LTE antenna from Ignion. This part appears on the top left corner labelled as NN03_310. It offers worldwide coverage and works in multiple frequency regions. The frequency bands covered are Low (698-960 MHz), Mid (1710-2170 MHz) and High bands (2300-2690 MHz).



3.1.2 GNSS Antenna

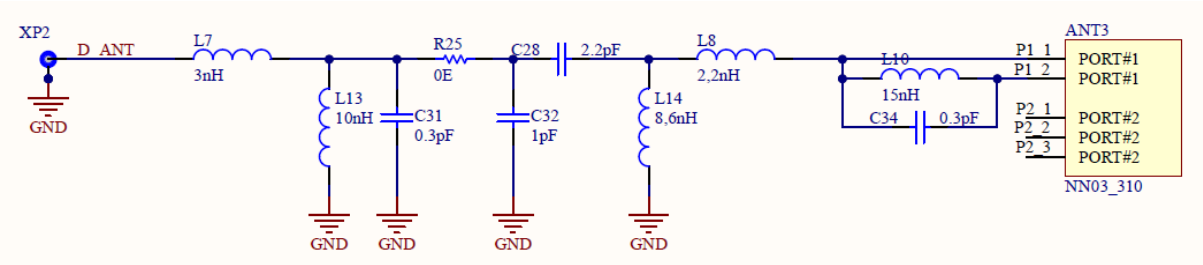
C-Series DDK comes with another integrated LTE antenna from Ignion for GNSS communication services. NN03-320 is the component used. It can be used to operate all common UWB frequency bands, here the frequency band covered is L1.





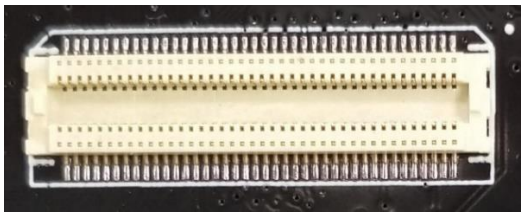
3.1.3 Diversity Antenna

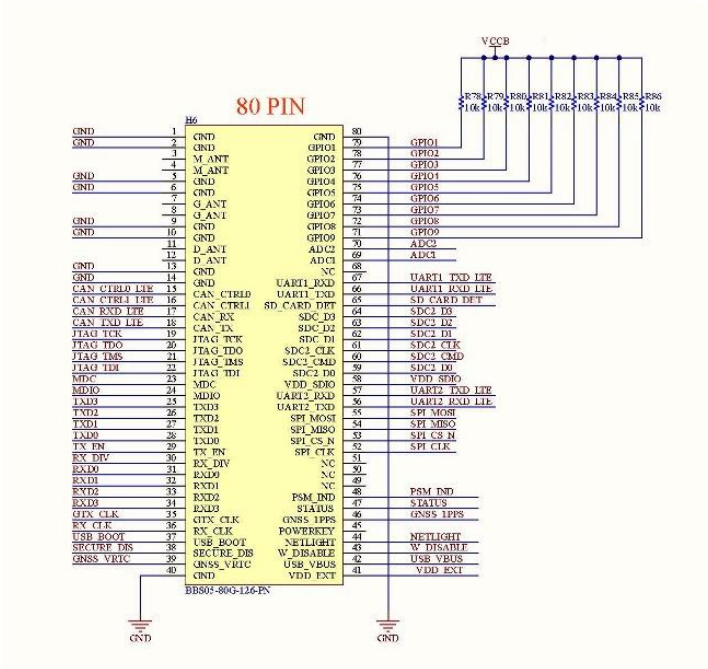
C-Series DDK comes with an integrated chip antenna (NN03_310) for diversity. Also, in every mini PCIe cards, SMA connectors are provided to connect an external antenna if the user wants to.



3.2 80-Pin Mating Connector

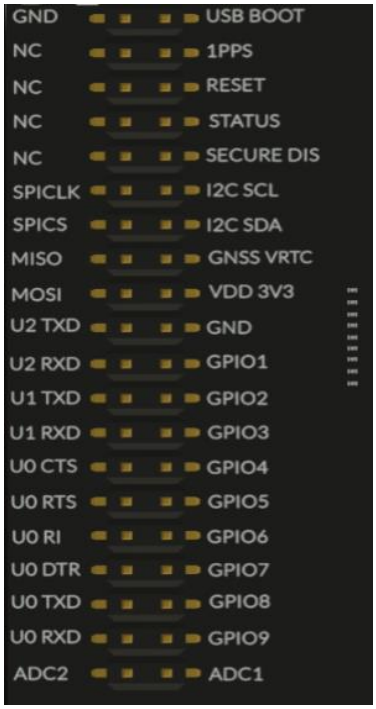
The 80-pin connector act as a mating connector between the mini PCIe card and DDK. This connector is equipped with all the available interfaces of the module.

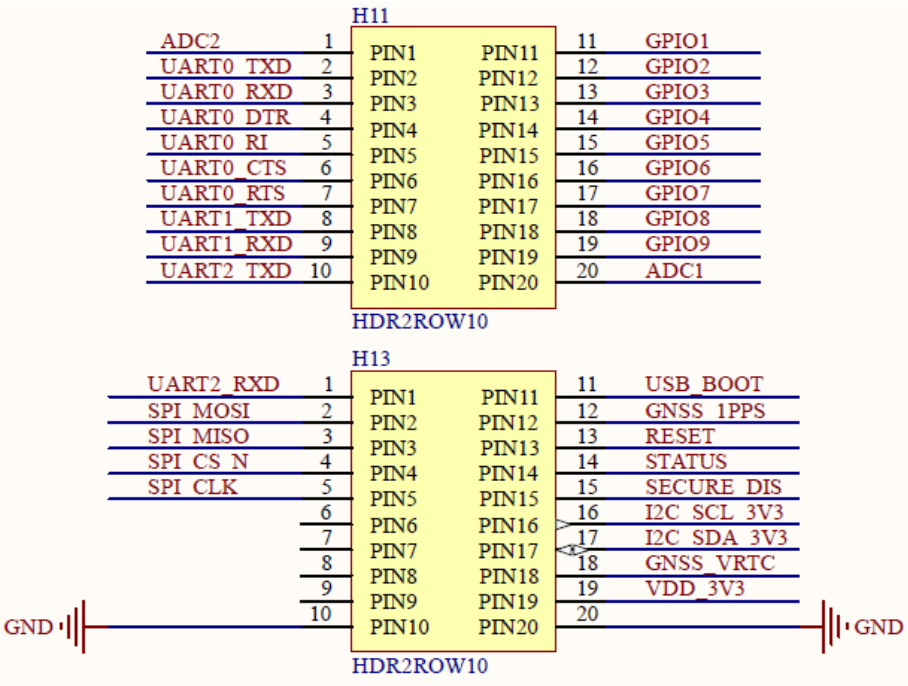




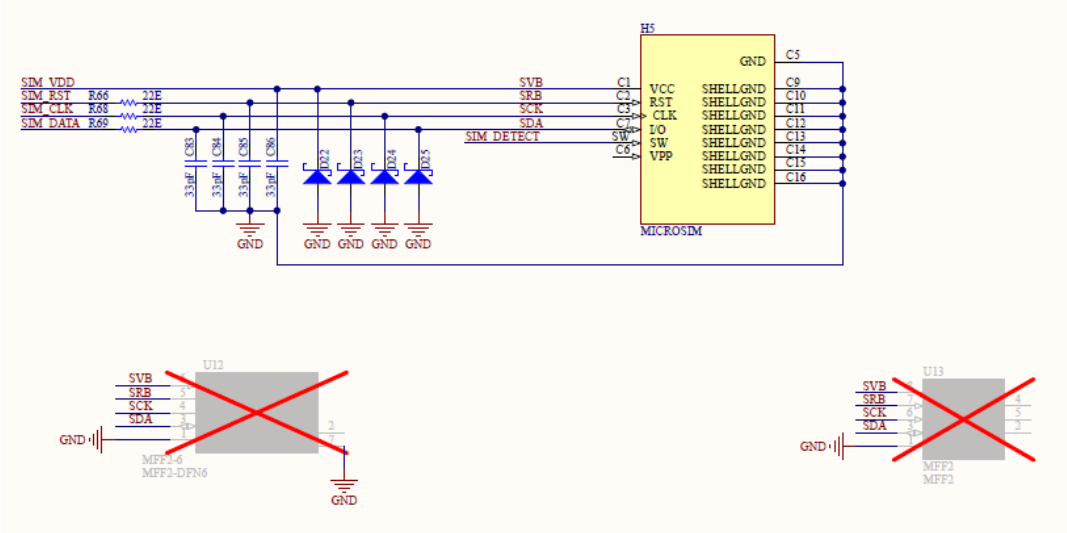
3.3 40-Pin Connector

The 40-pin connector enables the user to access all the available interfaces. The signals from the 80-pin connector are available in this 40-pin connector.



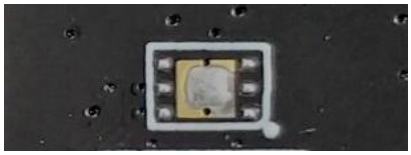


3.4 eSIM Pad



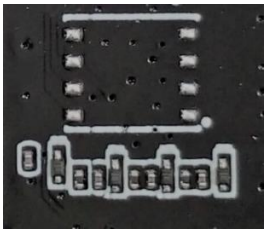
3.4.1 DFN6

C-Series DDK has a dedicated DFN6 eSIM pad embedded onto it and if the user wants to test an external eSIM, they can simply solder it in the position and use it accordingly.



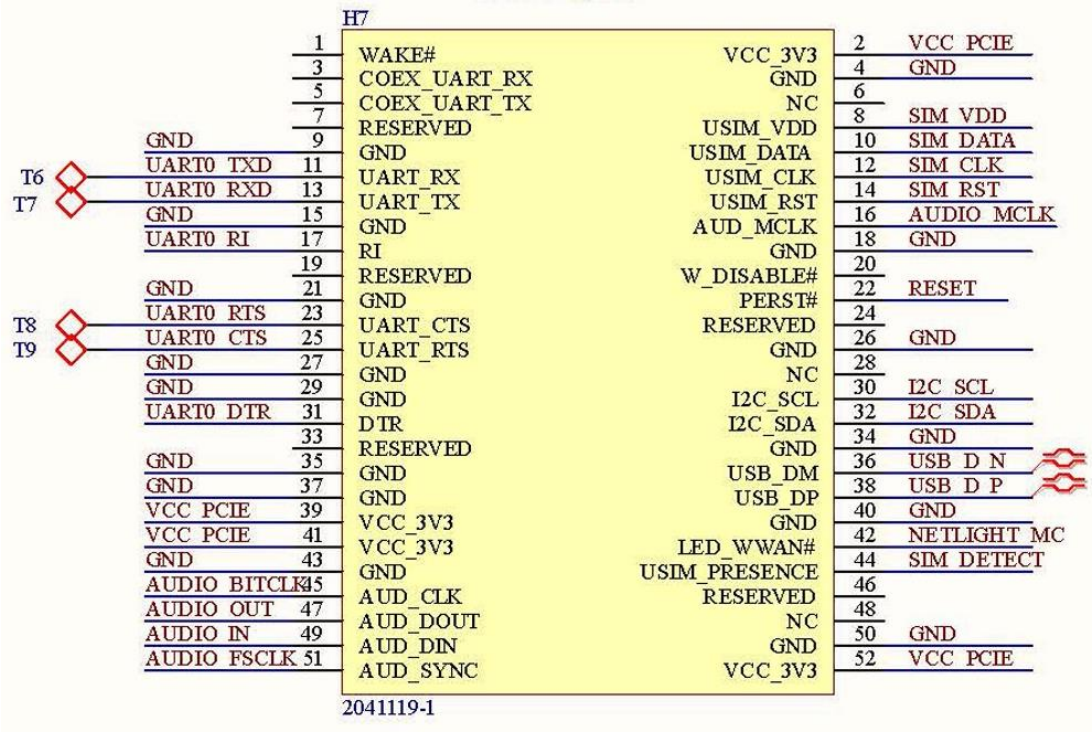
3.4.2 DFN8/MFF2

C-Series DDK has another dedicated DFN8/MFF2 eSIM pad. If the user wants to test an external eSIM they can solder it in position and use it.



3.5 Mini-PCIe Female connector

Mini-PCIe female connector is used to mate the mPCIe card and the DDK.

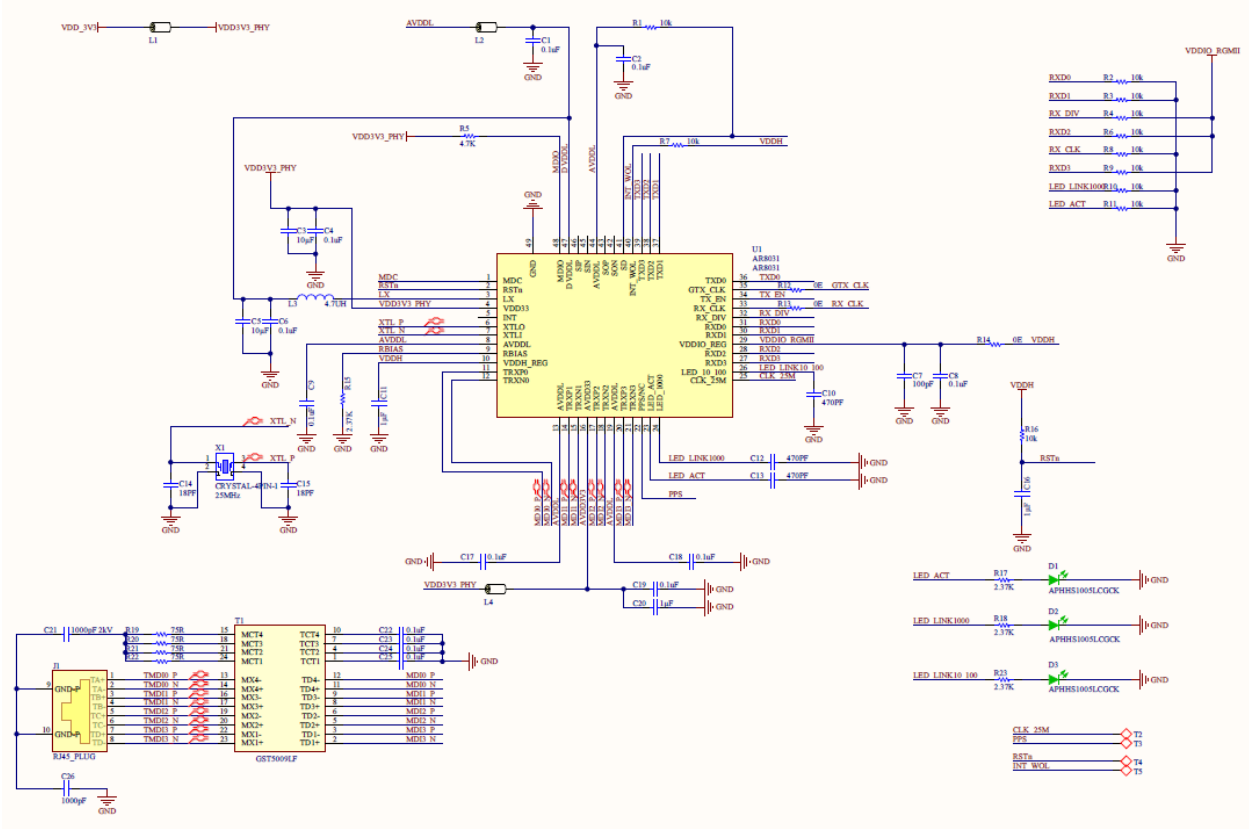


3.6 Sim Card Socket

You can insert your SIM card to the micro-SIM card push-push socket.

3.6 Ethernet

- Ethernet IC - AR8031
- Magnetics IC - GST5009LF
- Connector - RJ45_PLUG



The user can connect the LAN cable to the connector and access the ethernet interface.

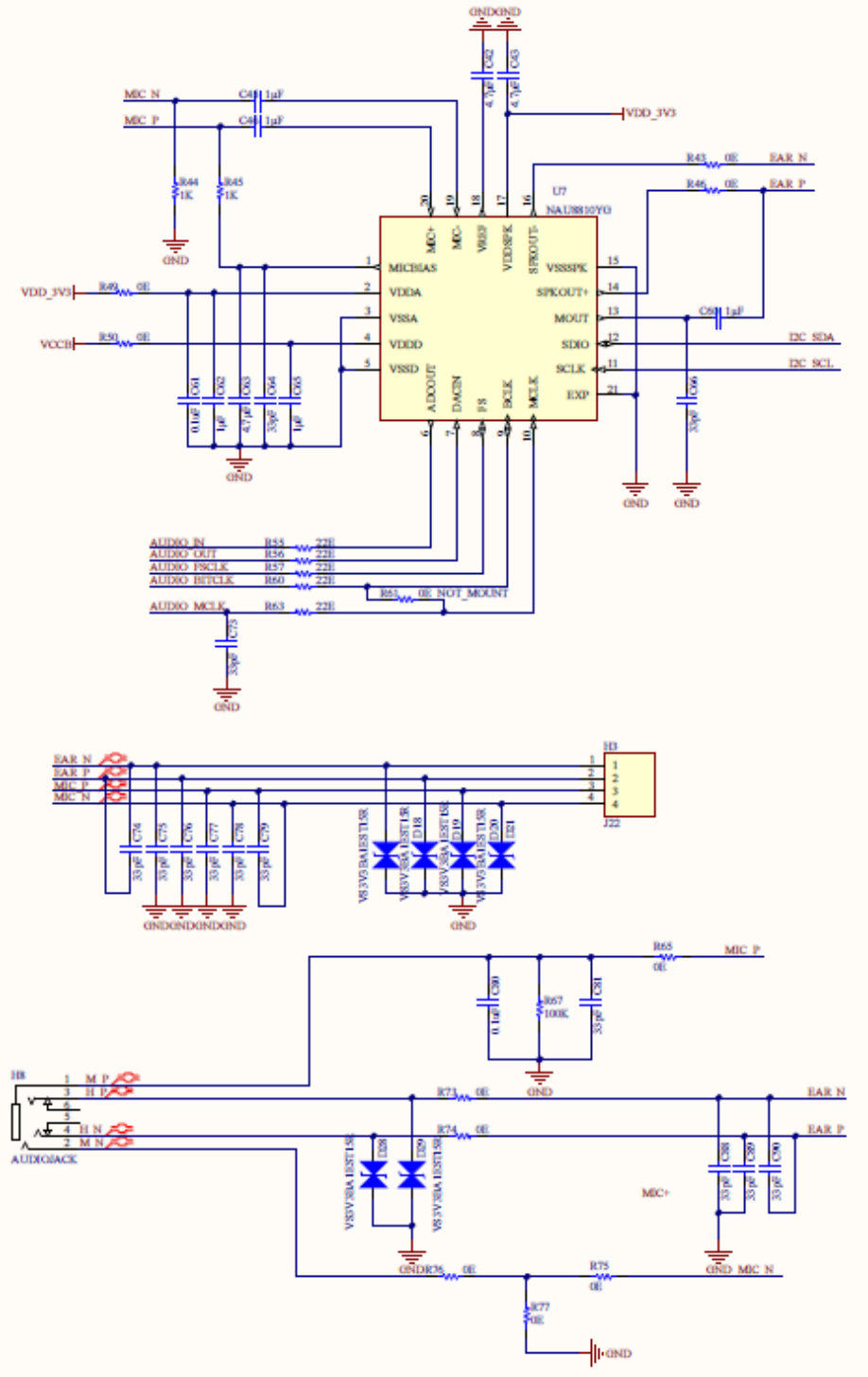
3.6.1 Ethernet chip

C-series DDK has an ethernet interface. AR8031 is an integrated 10/100/1000 ethernet transceiver. A magnetic chipset is used in between to interface RJ45 plug and the ethernet chip. The magnetic chip is GST5009LF.

A magnetic chipset is used in between to interface RJ45 plug and the ethernet chip. The magnetic chip is GST5009LF.

3.7 PCM

- CODEC IC - NAU8810
- Headphone connector - H3 J22
- Handset connector - H8 CONN JACK 4COND 3.5MM SMD R/A 54-00177



3.7.1 Audio Codec Chip

C-Series DDK has a dedicated audio codec chipset. The manufacturer's part number is NAU8810. It is a low power wideband Monophonic audio CODEC and is suitable for a wide range of audio applications, including voice telephony.

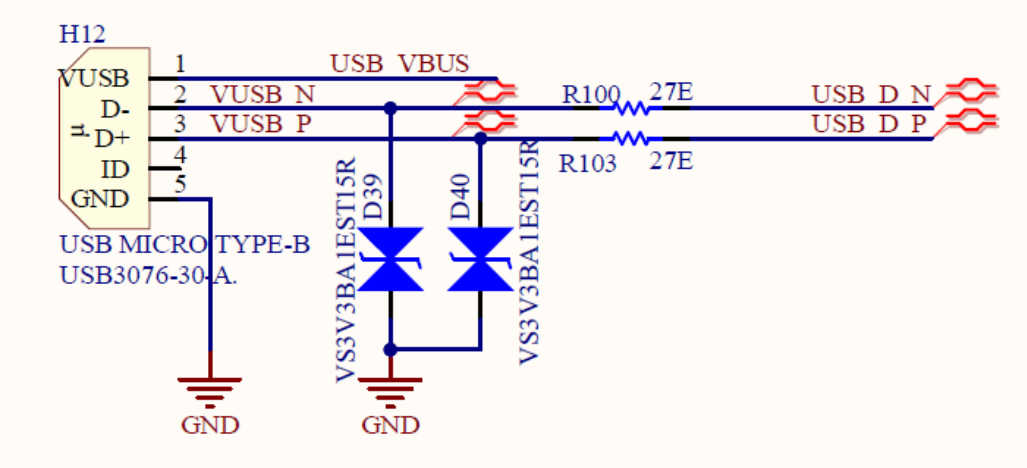
3.7.2 Audio Jack 3.5mm

The user can connect an earphone to make or attend calls. For more details refer CALL commands in the AT command manual.

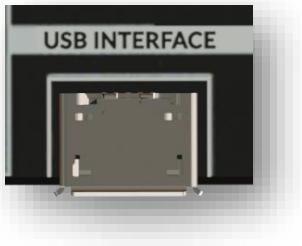
3.7.3 Stereo Jack (j22)

Similar to Audio Jack, there is a stereo jack provided in the DDK to make and attend calls.

3.8 USB Interface

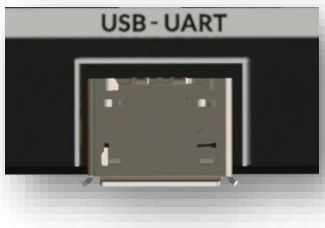


The Cavli module has a dedicated micro-USB interface for sending AT commands, debug and firmware updates.



3.9 UART Interface

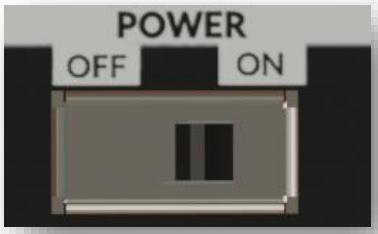
When the user connects a USB cable to the UART micro-USB port, two ports will be displayed in the serial terminal. One is for sending AT commands and the other one is for firmware update or debug.



UART	Description	Baud Rate	Data	Parity
COM - (#1)	AT Interface	115200	8 bit	none
COM - (#2)	Debug	921600	8 bit	none

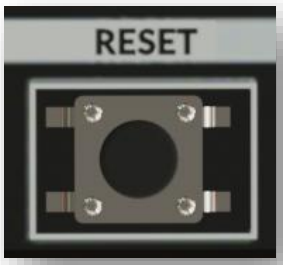
3.10 Power Switch

The power switch is used to power on and off the DDK board.

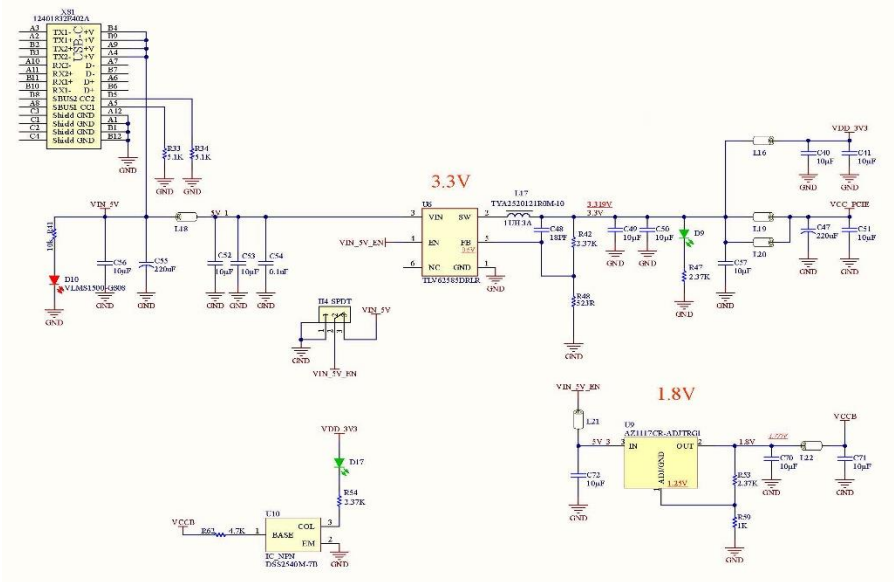


3.11 Reset Button

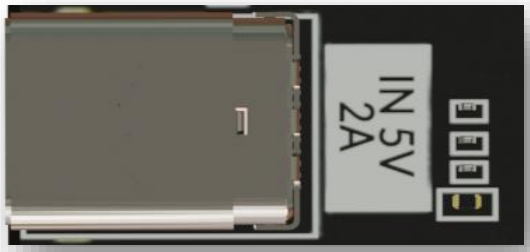
This button is used to reset the module.



3.12 Power Input- (Type C)



It is recommended to use a 5V/2A adapter for the input power supply. The user can also use laptop USB power for LPWAN modules.

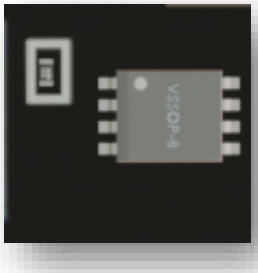


3.13 USB- UART Converter

A 48 pin FT2232 converter is used in the DDK. For more details refer UART interface section.

3.14 UART Voltage Level Transceiver

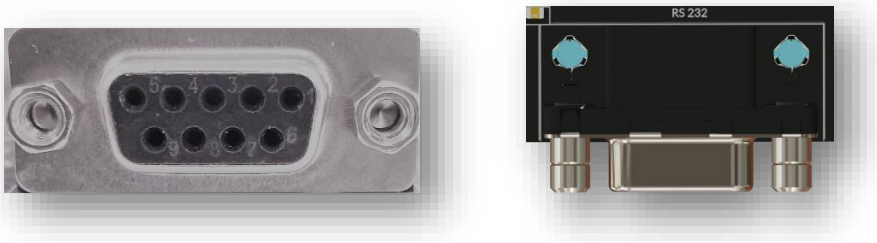
Voltage level translators are required when the user needs to interface with a MCU as the modem IO voltage domain is 1.8V. The voltage level can be 3.3V or 5V depending on the MCU. C-Series DDK uses SN74AVC4T245, A 4-bit noninverting bus transceiver.



3.15 RS232 Communication

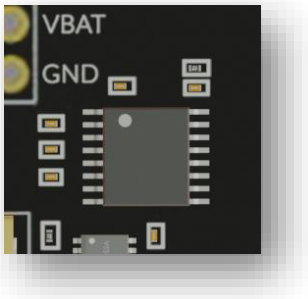
3.15.1 DB9 Female Connector

DB9F is a 9-hole female connector used to connect the sensor and the RS232 interface.



3.15.2 RS232 Transceiver Chip

The RS232 transceiver chip used in the DDK is MAX3232CPWR. It provides electrical interface between an asynchronous communication controller and the serial-port connector. A DB9F connector is used to connect the sensor.



3.16 8 Pin Connector

All the reference voltages and signals are given to the 8-pin connector. The user can use this connector for the reference voltage.

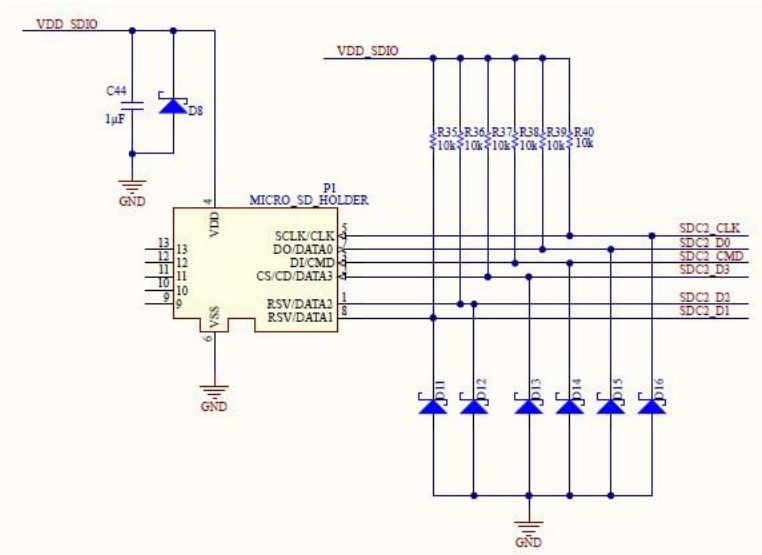
3.17 PSM Indicator

This is an LED to indicate the Power Saving Mode (PSM) status of the module.

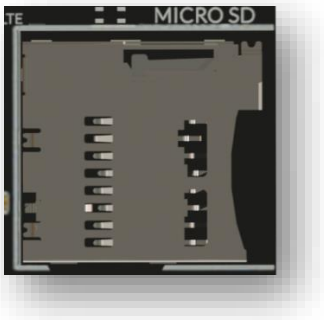
3.18 Network Indicator

This is an LED to indicate the network registration status of the module.

3.19 Micro SD Card Socket



The C-Series DDK provides a micro-SD card socket. Please refer the AT command manual for more information about how to read and write the data into the SDK. The user can insert a micro-SD card to the connector and access the files using the module.

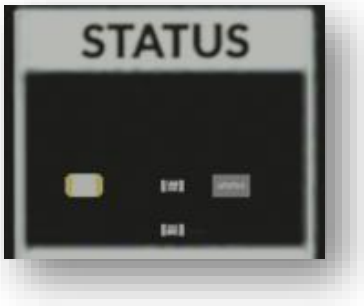


3.20 Reference Voltage Indicator

This is an LED to indicate the IO domain and module ON/OFF status of the module.

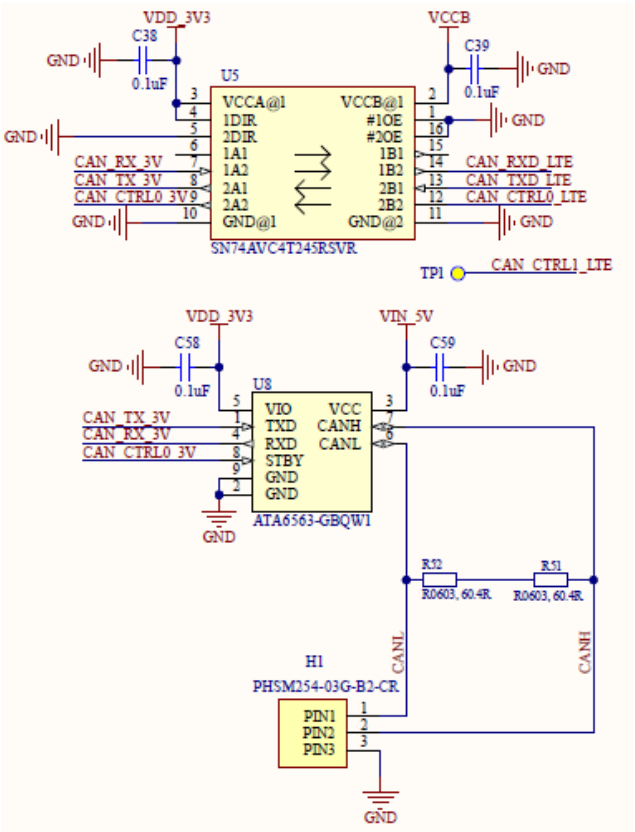
3.21 Module Status Indicator

This is an LED used to indicate module ON/OFF status.

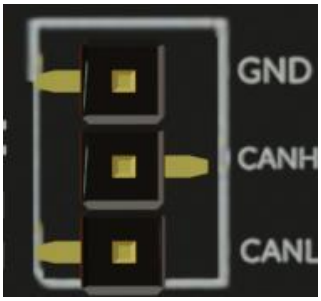


3.22 CAN Bus Interface

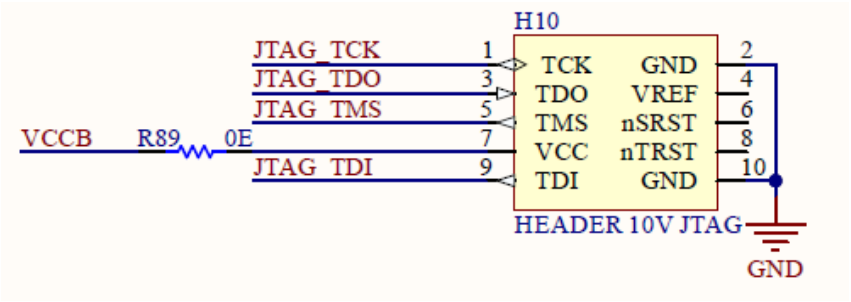
- CAN FD ready
- Communication speed upto 5mbps
- Differential Receiver with Wide common mode range
- Transceiver is fully ISO 11898-2, ISO11898-2:2016 and SAE J2962-2 complaint.
- Transceiver qualified according to AEC-Q100 and AEC-Q006



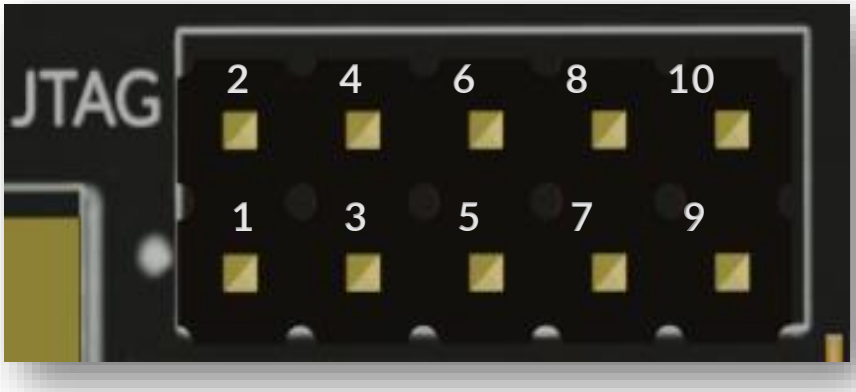
Three pins CANH, CANL, GND are used to interface the CAN devices. A dedicated CAN Bus transceiver is used in the DDK(ATA6563-GBQW1).



3.23 JTAG Interface



The user can program the module using JTAG.



Pin	Description
1	JTAG_TCK
2	GND
3	JTAG_TDO
4	NC
5	JTAG_TMS
6	NC
7	1.8V
8	GND
9	JTAG_TDI
10	GND

Chapter 4. Getting Started

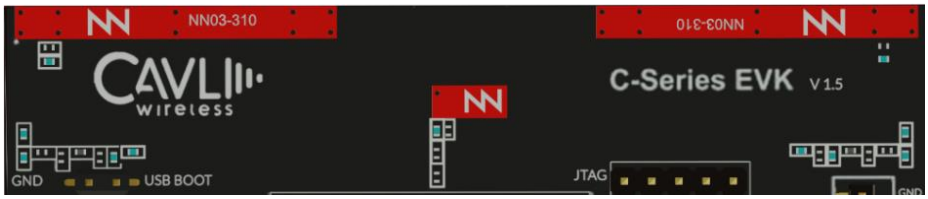
4.1 How to start

The C-series DDK supports mini PCIe cards and the user can use the same DDK for all Cavli Mini-PCIe cards.

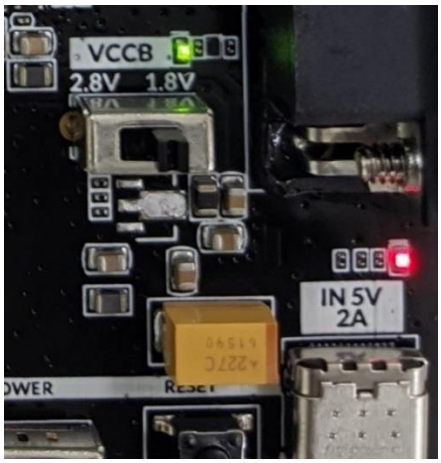
1. Ensure POWER switch is OFF
2. Connect USB type-C cable to POWER slot(5V/2A) – Power indication lights turn on (Red light)
3. Connect Micro-USB to USB-UART (To access AT ports)

4. Connect the mini-PCIe card to mini-PCIe connector

5. Ensure the antenna is connected to the module which is onboarded onto the DDK (If external antenna is used)
6. The C-series DDK comes with an integrated chip antenna for LTE, diversity and GNSS.

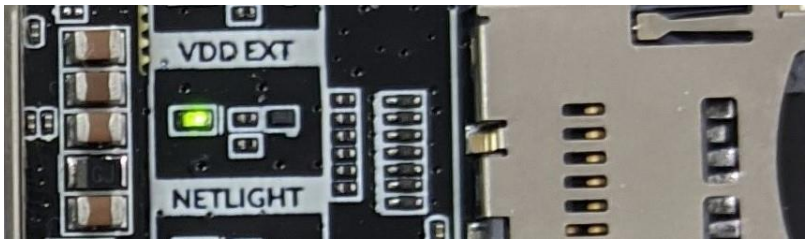


7. VCCB toggle switch is used to select the needed board voltage (Depends on the module used)



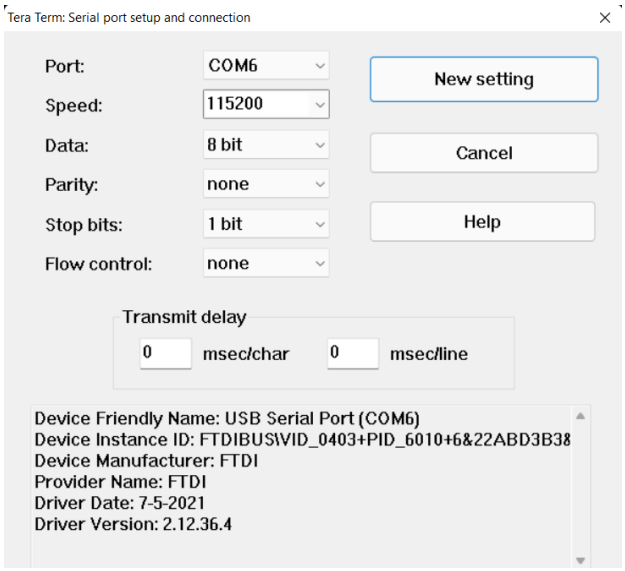
8. If external SIM is to be used, the mini-SIM Card slot can be used. It's a push-push type slot

9. Turn on the POWER switch
10. When modem is ready the VDD_EXT LED will glow



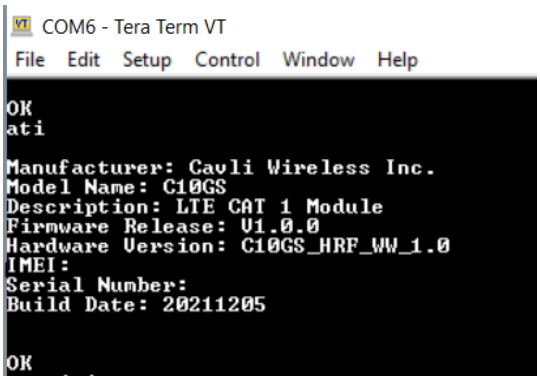
11. Connect the board to your device (Laptop/Desktop)
    You can use any serial tools (Tera term, docklight etc) to access the AT command interface (We are using Teraterm as an example here)

12. Ensure the correct COM port is selected once TeraTerm is booted up



13. Using the AT command interface:

- You can access the basic info of the module using the 'ATI' command



- Ensure the module has been connected to the needed service provider (Using the 'AT+COPS?' command)

```
OK
at+cops?

+COPS: 0,0,"IND-JIO",7

OK
```

- Ensure that the module has been registered to the Hubble platform (Module Onboarding Process)

```
OK
at+hubblereg=?

+HUBBLEREG: <account_id>,<plan_id>[,<group_id>]

OK
```

- Only after hubble registration can the internet connection be established

```
at+hubblereg?

+HUBBLEREG: REGISTERED

OK
at+cgpaddr

+CGPADDR: 1,"10.255.235.47"

OK
at+ping=www.youtube.com

OK

Reply from 209.85.203.91: bytes= 84 time = 270(ms), TTL = 48

Reply from 209.85.203.91: bytes= 84 time = 302(ms), TTL = 98

Reply from 209.85.203.91: bytes= 84 time = 323(ms), TTL = 46

Reply from 209.85.203.91: bytes= 84 time = 303(ms), TTL = 97

Reply from 209.85.203.91: bytes= 84 time = 313(ms), TTL = 48

Ping statistics for 209.85.203.91

Packets: Sent = 5, Received = 5, Loss = 0 (0%), Max = 323 ms, Min = 270 ms, Avg = 302 ms

at+csq

+CSQ: 19,99

OK
```

To know if the internet connection is established, 'AT+CGPADDR' command can be used.
If '10.xxx.xxx.xx' returned, internet is available
If '172.xxx.xxx.xx' returned, only intranet connection

- 'AT+CSQ' gives the signal strength of the module

14. This DDK provides interfaces such as UART, USB, Ethernet, JTAG, CAN, RS232, PCM, SD CARD, and SIM CARD.

15. Users can debug and Improve applications based on Cavli modules.

16. Now you are all set to use the board. Enjoy!!

4.2 Connections to ensure

- Connect USB type-C cable to POWER slot(5V/2A) – Power indication lights turn on
- Connect type-B cable for UART connection and USB connection.
- If firmware to be updated, Micro-USB is connected to USB INTERFACE

4.3 Ways of using header pins

- A 40 pin connector for general interface
- One 10 pin header pins for JTAG interface
- One 3 pin header pins for CAN interface
- The customer can use a jumper wire to connect the sensor or slave device to the respective interface

4.4 Antenna matching network topology

Please follow antenna Matching topology as per the datasheet of the selected antenna. Antenna topology may vary for matching network, we suggest to review the layout of antenna connection before going ahead with PCB

4.5 Voltage domains for header pins

SI NO	INTERFACE	Voltage domain	C10GS	C42GM
1	GND		Yes	Yes
2	NC			
3	NC			
4	NC			
5	NC			

6	SPICLK	1.8V	Yes	Yes
7	SPICS	1.8V	Yes	Yes
8	MISO	1.8V	Yes	Yes
9	MOSI	1.8V	Yes	Yes
10	U2TXD	3.3V	Yes	Yes
11	U2RXD	3.3V	Yes	Yes
12	U1TXD	3.3V	Yes	Yes
13	U1RXD	3.3V	Yes	Yes
14	U0CTS	3.3V	NO	Yes
15	U0RTS	3.3V	NO	Yes
16	U0RI		NO	NO
17	U0DTR		NO	NO
18	U0TXD	3.3V	Yes	Yes
19	U0RXD	3.3V	Yes	Yes
20	ADC2	1.8V	NO	Yes
21	ADC1	1.8V	NO	Yes
22	GPIO9	1.8V	Yes	NO
23	GPIO8	1.8V	Yes	Yes
24	GPIO7	1.8V	Yes	Yes
25	GPIO6	1.8V	Yes	Yes
26	GPIO5	1.8V	Yes	Yes
27	GPIO4	1.8V	Yes	Yes
28	GPIO3	1.8V	Yes	Yes
29	GPIO2	1.8V	Yes	Yes
30	GPIO1	1.8V	Yes	Yes
31	GND			
32	VDD_3V3	3.3V	Yes	Yes
33	GNSS VRTC		Yes	Yes
34	I2C SDA	1.8V	Yes	Yes
35	I2C SCL	1.8V	Yes	Yes
36	SECURE DIS	1.8V	NO	Yes
37	STATUS	1.8V	Yes	Yes
38	RESET	1.8V	Yes	Yes
39	1PPS	1.8V	Yes	Yes
40	USB BOOT	1.8V	NO	Yes

4.7 Module accessibility

Not all interfaces and connector are applicable for every module, the following table specifies what applies to which module.

SI NO	INTERFACE	C10GS	C42GM
1	GND	Yes	Yes
2	NC		
3	NC		
4	NC		
5	NC		
6	SPICLK	Yes	Yes
7	SPICS	Yes	Yes
8	MISO	Yes	Yes
9	MOSI	Yes	Yes
10	U2TXD	Yes	Yes
11	U2RXD	Yes	Yes
12	U1TXD	Yes	Yes
13	U1RXD	Yes	Yes
14	U0CTS	NO	Yes
15	U0RTS	NO	Yes
16	U0R1	NO	NO
17	U0DTR	NO	NO
18	U0TXD	Yes	Yes
19	U0RXD	Yes	Yes
20	ADC2	NO	Yes
21	ADC1	NO	Yes
22	GPIO9	Yes	NO
23	GPIO8	Yes	Yes
24	GPIO7	Yes	Yes
25	GPIO6	Yes	Yes
26	GPIO5	Yes	Yes
27	GPIO4	Yes	Yes

28	GPIO3	Yes	Yes
29	GPIO2	Yes	Yes
30	GPIO1	Yes	Yes
31	GND	Yes	Yes
32	VDD_3V3	Yes	Yes
33	GNSS VRTC	Yes	Yes
34	I2C SDA	Yes	Yes
35	I2C SCL	Yes	Yes
36	SECURE DIS	NO	Yes
37	STATUS	Yes	Yes
38	RESET	Yes	Yes
39	1PPS	Yes	Yes
40	USB BOOT	NO	Yes