FN990 TLB

HW Design Guide

1VV0301753 Rev. 1 – 2022-04-22

Telit Technical Documentation

APPLICABILITY TABLE

PRODUCTS	Description
FN990A28	3G / 4G / Sub-6 cellular module
FN990A40	3G / 4G / Sub-6 cellular module

CONTENTS

1. INTRODUCTION

1.1. Scope

This document describes the FN990 TLB which is part of complete FN990 Development Kit (Dev-Kit)

1.2. Audience

This document is intended for system integrators that are using the Telit module in their product.

1.3. Contact Information, Support

For technical support please e-mail:

- *TS-EMEA@telit.com*
- *TS-AMERICAS@telit.com*
- *TS-APAC@telit.com*
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1.4. Symbol Conventions

Danger: This information MUST be followed or catastrophic equipment failure or personal injury may occur.

Warning: Alerts the user on important steps about the module integration.

	**Note/Tip:** Provides advice and suggestions that may be useful when integrating the module.
	**Electro-static Discharge:** Notifies the user to take proper grounding precautions before handling the product.

Table 1: Symbol Conventions

All dates are in ISO 8601 format, that is YYYY-MM-DD.

1.5. Related Documents

- FN990 HW User Guide, 1VV0301752
- Telit EVB 2.0 HW User Guide, 1VV0301732
- FN990 AT Commands Reference Guide, 80691ST11097A

2. GENERAL PRODUCT DESCRIPTION

2.1. Overview

The Translation Board (TLB) is custom designed to interface the variant of the Telit FN990 module with the Telit Generic Evaluation Board (EVB) thus forming the complete Development Kit of FN990.

The TLB provides the mapping of Telit module signals and functions into the generic EVB signals and functions.

The TLB design of the FN990 TLB includes the following items:

- FN990 module
- RF SMA connectors
- Board to Board connectors for interfacing to EVB main board
- Module specific circuitry which is not part of the generic circuitry of the EVB

The TLB also plans to assemble a custom designed module socket instead of assembling the module.

The Power supply and control interface for the RF module is provided by the EVB via the B2B connectors.

The bottom plane solder-mask is cutout under the RF module to optimally mount/connect a heatsink with the aim to cool the module via the many heat conducting GND via's.

The board is designed to accommodate new modules according to the updated pin mapping of the FN990 (52.0 x 30.0 x 2.25mm, +/- 0.15 mm tolerance and 75 pins).

Board	PCB Code
TLB	CS2146A-D
EVB 1.1	CS1984C
EVB 2.0	CS2125 or CS2148
Module	CS2170x

Table 2: Latest PCB reference numbers

2.2. TLB View

The below pictures show the TLB top and bottom view.

FN990 TLB Top View

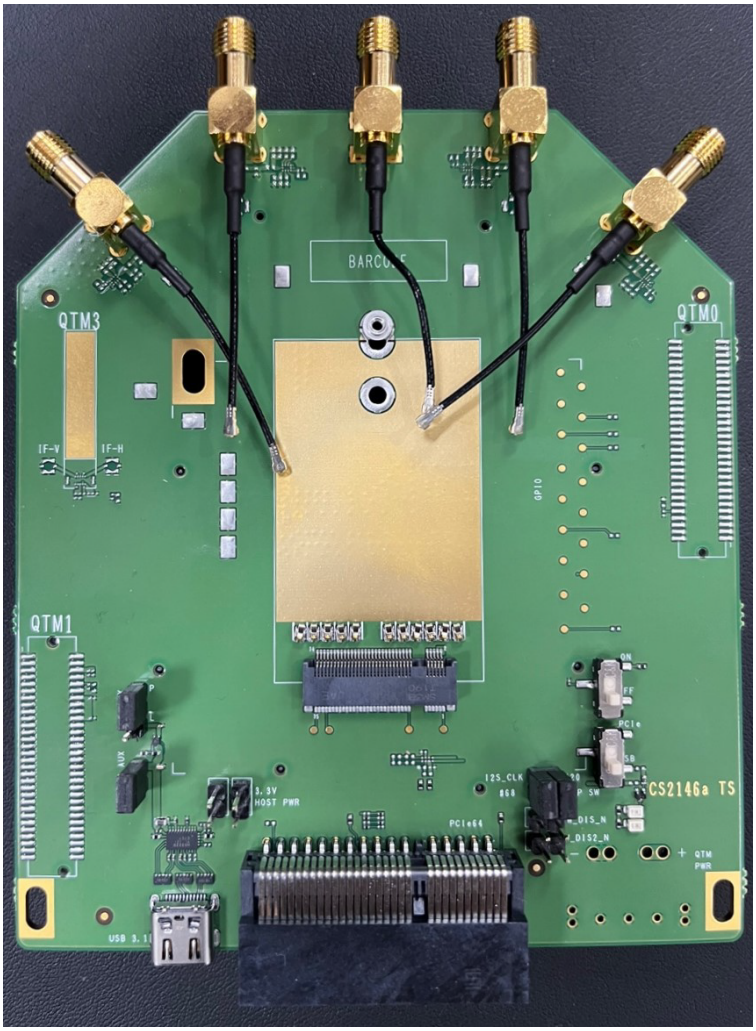

Figure 1: TLB Top View

FN990 TLB Bottom View

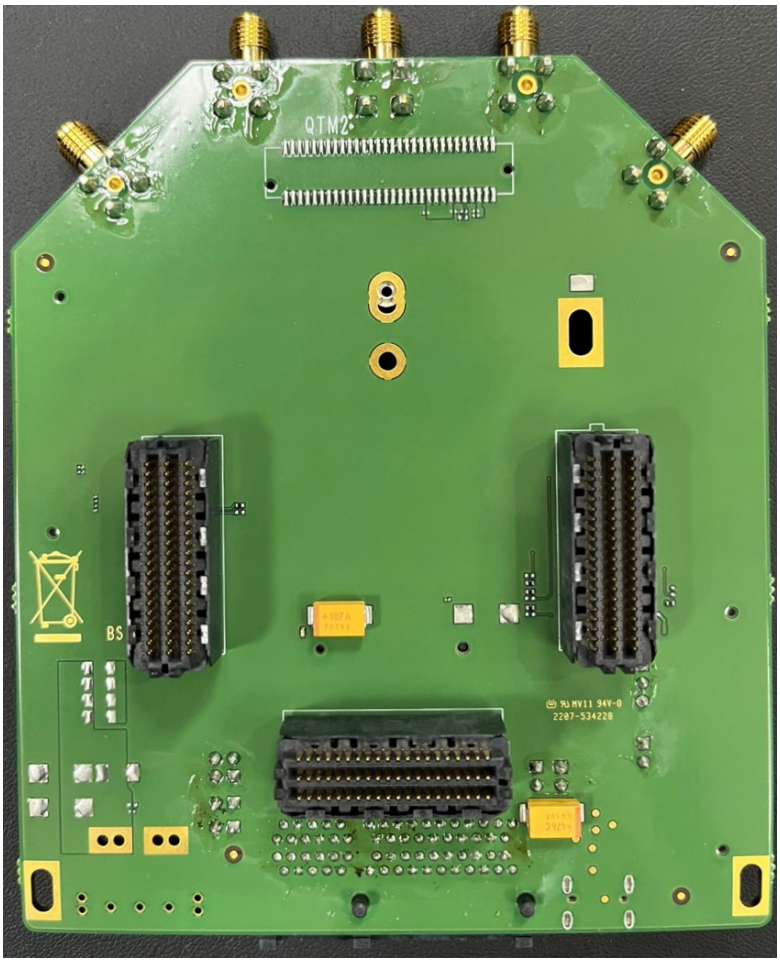

Figure 2: TLB Bottom View

2.3. TLB Description

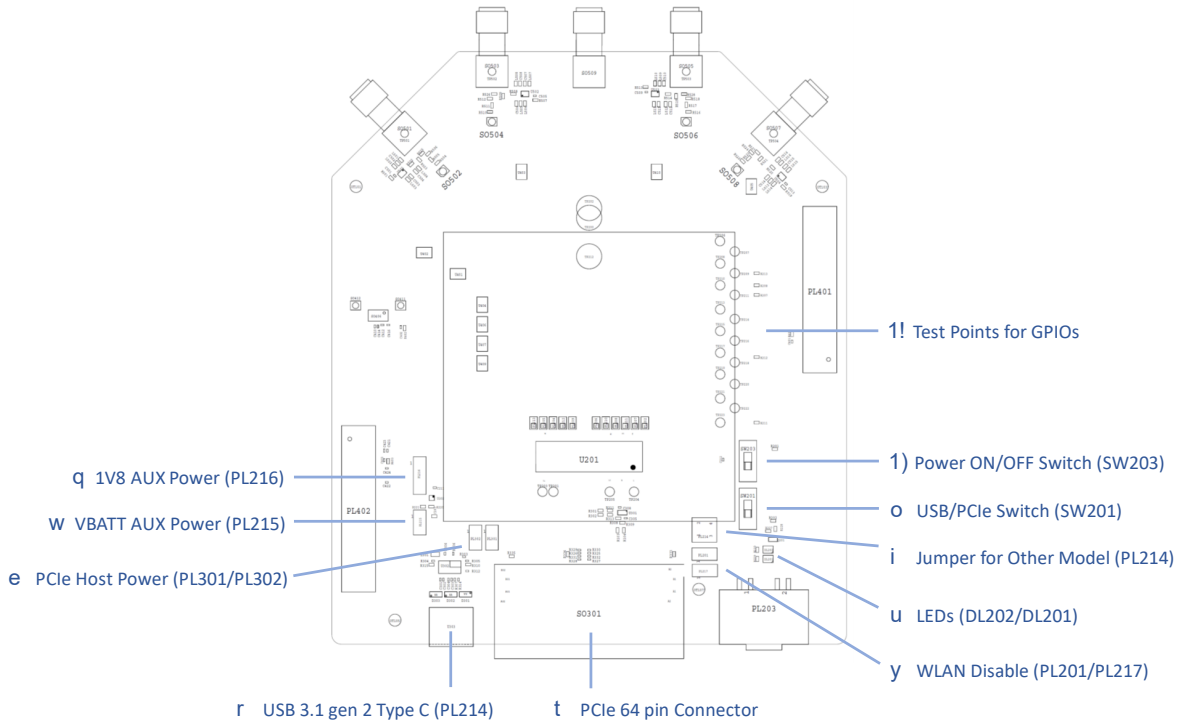

Figure 3: TLB Description

(1) 1V8 AUX Power (PL216)

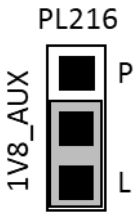

Figure 4: 1V8 AUX Power Default Jumper

The Jumper PL216 provides 1.8V I/O power for TLB circuit through external LDO.
Place jumpers on PL216 2-3(L) as shown Figure 5.
If PL216 1(P)-2 connected, FN990 internal power VREG_L6M_1P8 will be supplied to TLB circuit.

(2) VBATT AUX Power (PL215)
The Jumper PL215 provides VBATT power for TLB circuit
Place jumpers on PL215 as default.

(3) PCIe Host Power (PL301/PL302)

By placing jumpers on PL301/PL302, VBATT main power will be supplied from/to host/device as FN990 PCIe mode.

- Basically VBATT is supplied to FN990 from EVB.
- When FN990 operates as PCIe EP, VBATT can be supplied from host through SO301. However, in that case, be sure to remove the VBATT connection via EVB to prevent multiple power source is connecting.
- When FN990 operates as PCIe RC, VBATT can be supplied to device through SO301.

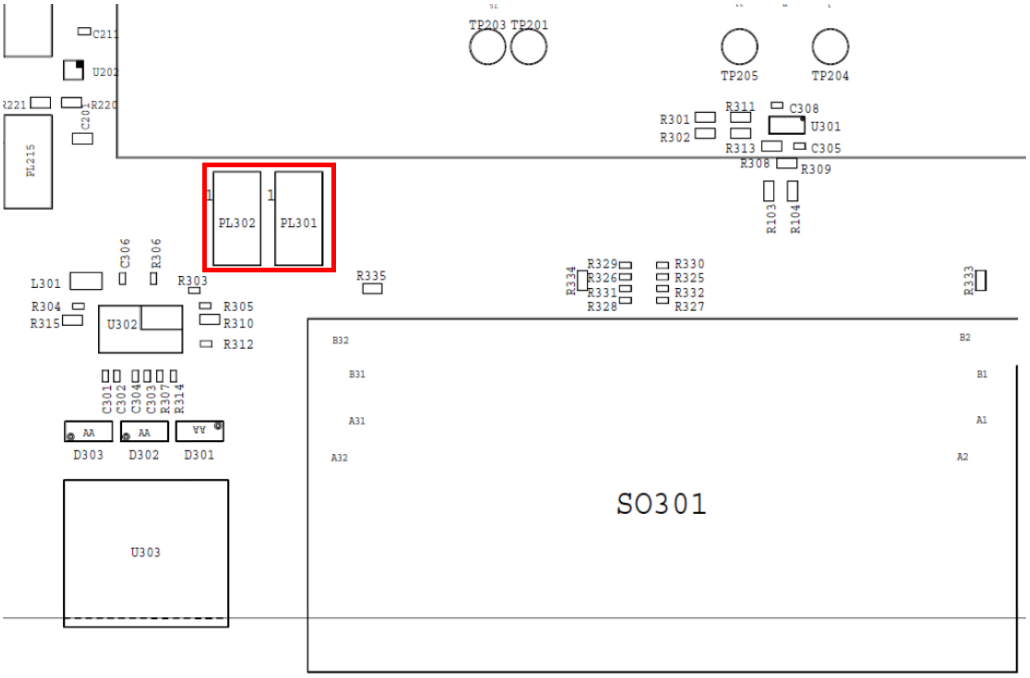

Figure 5: PCIe Host Power

(4) USB 3.1 gen 2 Type C Connector (PL214)

FN990 M.2 Card supports USB 3.1 gen 2 by USB type C connector mounted on TLB.

(5) WLAN Disable (PL201/PL217)

Figure 6: WLAN Disable Jumper

FN990 can control RF status by W_DISABLE_N pin.

Place a jumper on PL201 (W_DISABLE_N): 4G/5G disable

Place a jumper on PL217 (W_DISABLE2_N): GNSS disable – To be implemented. Please refer to the AT commands guide for setting. (AT#PSMWDISACFG)

(6) LEDs (DL202/DL201)

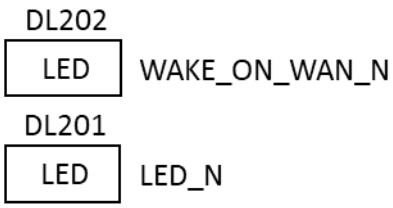

Figure 7: Two LEDs for WAKE_ON_WAN_N and LED_N

- WAKE_ON_WAN_N

LED is ON (DL202): Normal

LED is OFF (DL202): Wake up event is occurred

Please refer to the AT commands guide for setting. (AT#PSMEVTCFG)

- LED_N

FN990 M.2 #10 pin is LED_N and it is connected to DL201 LED.

And LED_N is supported current sink.

(7) Jumper for Other Model (PL214)

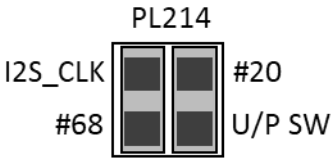

Figure 8: Default Jumper for PL214

Change the jumper connection state only when connect FN980 HW1.0 instead of FN990. Leave it as the default jumper.

(8) USB/PCIe Switch (SW201)

FN990 M.2 Card determines the host interface by checking the status of USB/PCIE SWITCH pin at the beginning of power on sequences.

- USB(Default): USB 3.1 or USB 2.0
- PCIe: PCIe 3.0 + (USB 3.1 or USB 2.0)*

**USB interface is only used as debugging purposes when USB/PCIe Switch pin is set to PCIe.*

Switch SW201 USB as default.

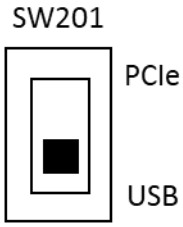

Figure 9: USB/PCIe Switch

(9) Power ON/OFF Switch (SW203)

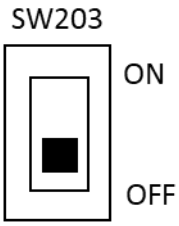

Figure 10: Power ON/OFF Switch

- FULL_CARD_POWER_OFF_N

If SW203 switch on, the FN990 will turn on automatically when VBATT is supplied.

If SW203 switch off, FN990 will be turned off.

2.4. Jumper Setting Guidelines

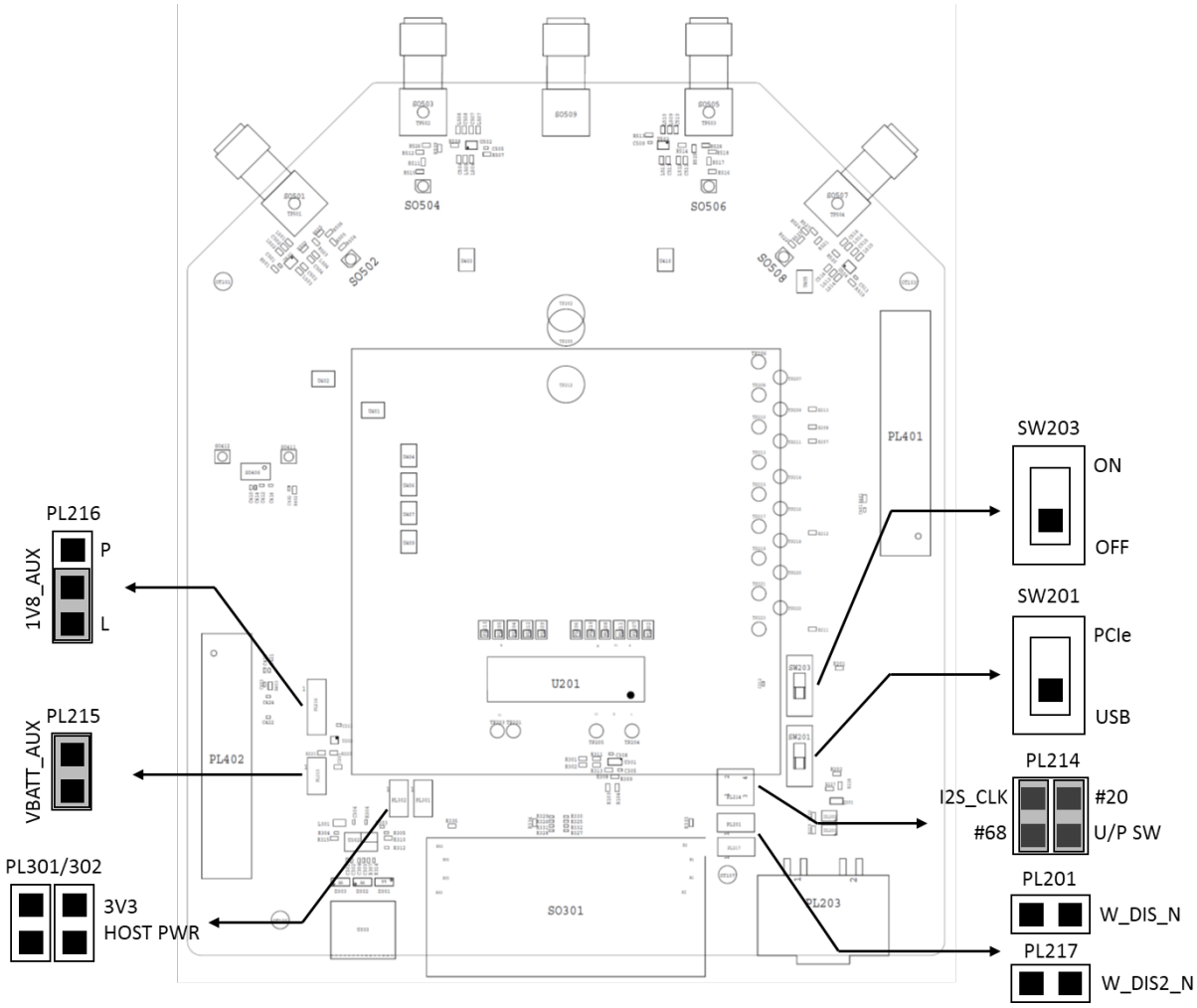

Figure 11: Default Jumper and Switch Setting of TLB with Silk

Jumper	Jumper Type	Set Position	Description
SW203	Switch	OFF	Power ON/OFF
PL301/PL302	2.54 mm	NC	PCIe Host Power
PL215	2.54 mm	1-2	VBATT Aux Power
PL216	2.54 mm	2-3(L)	1V8 AUX Power
PL214	2.54 mm	1-2, 3-4	Jumper for Other Model
SW201	Switch	USB	USB or PCIe mode

Table 3: Default Jumper and Switch Setting of TLB and Description

2.5. Antenna Ports

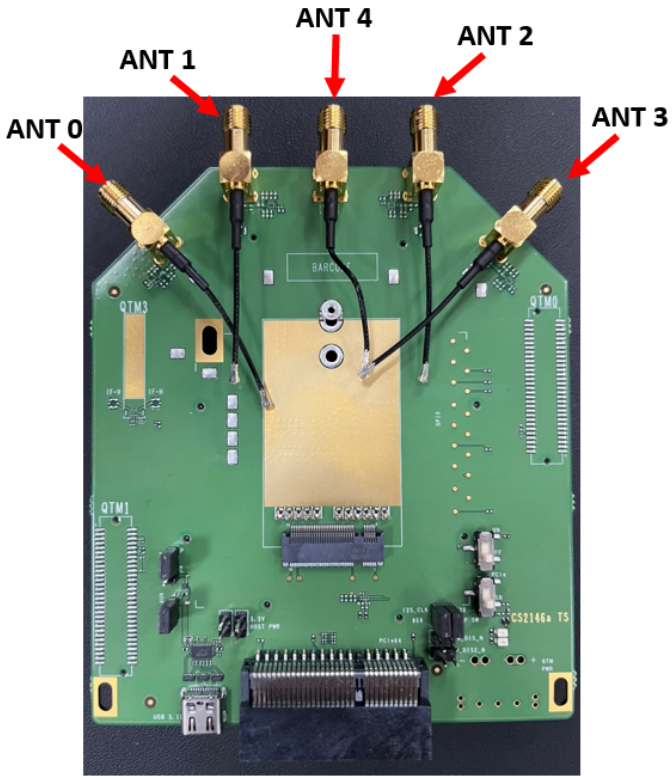

Figure 12: Antenna Ports

Note: For more detail information on Antenna ports, please refer to FN990 HW User Guide, 1VV0301752, Chapter 7.1 Antenna Interface.

Warning: Be careful not to damage cables and RF connectors assembly when connecting the Antenna cables.

2.6. PCIe

2.6.1. End Point

Set the switch (SW201) to PCIe as shown below.

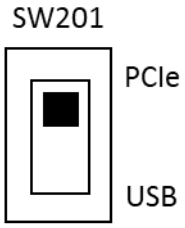

Figure 13: PCIe mode

Now FN990 will operated as PCIe EP by connecting it to the host using an extension cable.

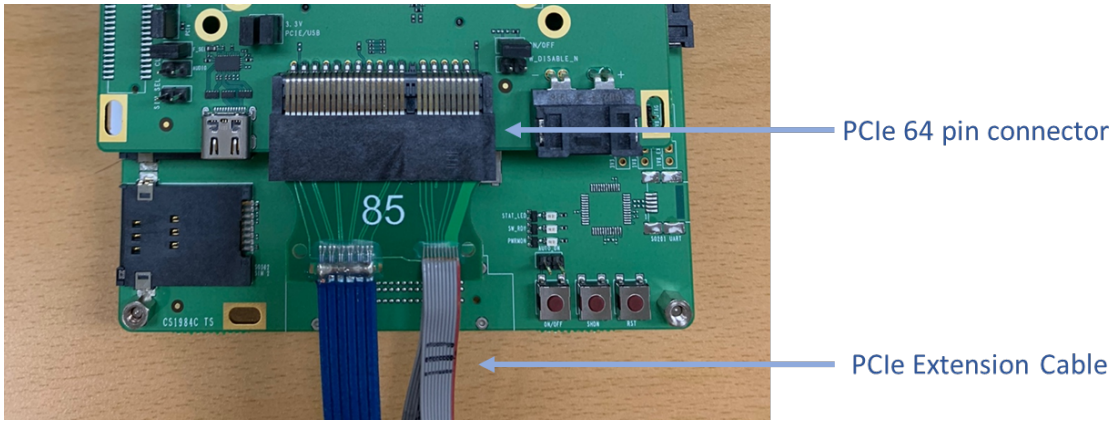

Figure 14: PCIe extension

If you want to use USB as a network interface again, just set the switch to USB as shown below and reboot the module.

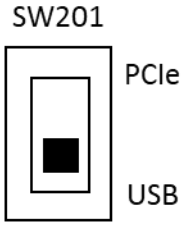

Figure 15: USB mode

For technical supports and questions about PCIe interface, contact Telit Technical Support at:

- *TS-EMEA@telit.com*
- *TS-AMERICAS@telit.com*
- *TS-APAC@telit.com*
- *TS-SRD@telit.com*

2.6.2. Root Complex

Since FN990 is made according to the m.2 card standard, it basically operates as EP.

If you want to run FN990 as RC using PCIe 64pin connector, you need to move 4 optional resistors referring to the figure below.

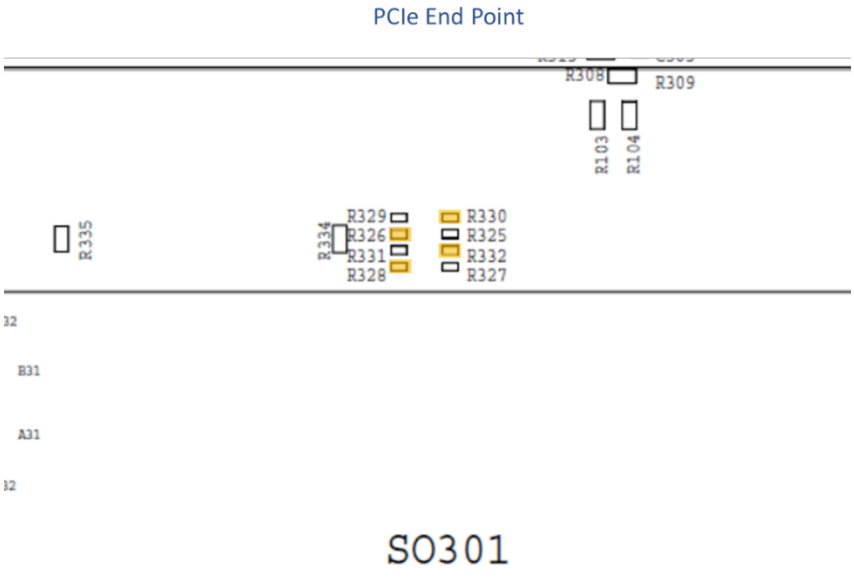

Figure 16: PCIe End Point

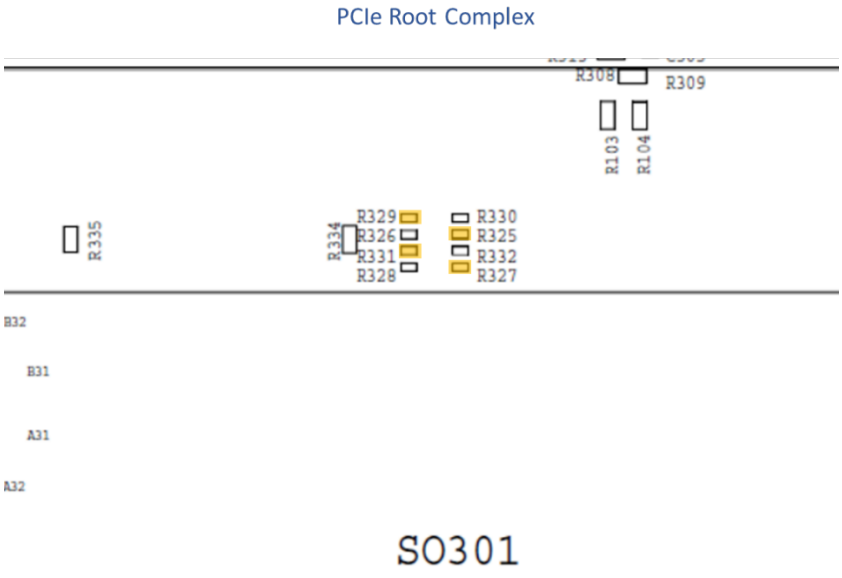

Figure 17: PCIe Root Complex

2.7. Guidance for Evaluation Board

The EVB can be configured for different power supply sources depending on the required use case.

2.7.1. Direct Supply Mode (Bypass)

Direct supply mode is for advanced users (typically, hardware designers) who need to provide supply voltage directly to the module.

Note: For more details, please refer to the 1VV301732 Telit EVB 2.0 User Guide, Chapter 4.5. 4-Wires Connection for DIRECT SUPPLY.

2.7.2. DC-DC Mode (5-12V)

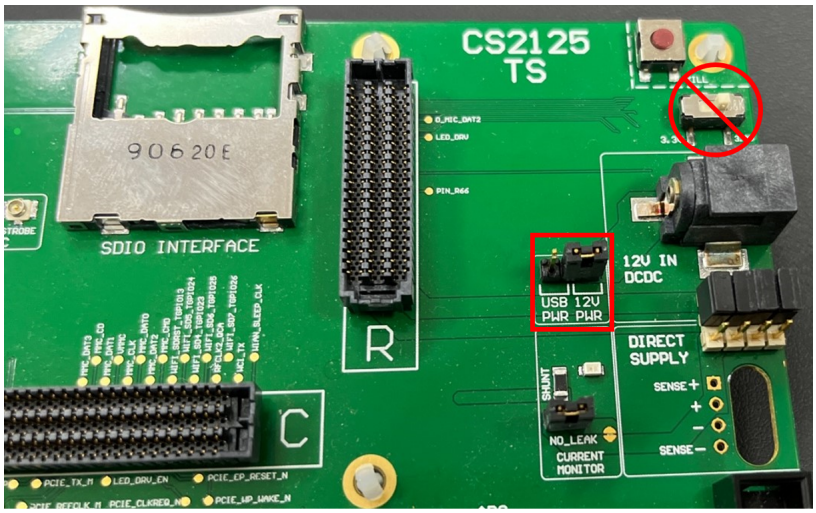

Figure 18: EVB 2.0 Jumper Setting for DC-DC mode

Note: In order to use DC-DC mode, please place a jumper '12V PWR'.

Don't need to switch 3.3 V / 3.8 V on EVB 2.0 because FN990 TLB is SMART TLB. The voltage is automatically set (that is AVS, Automatic Voltage Selection is implemented).

In via DC-DC mode, the wall adaptor connected to the jack can supply a voltage in the 5-12V range. The regulator can accept up to 36V (42V absolute maximum) but, in this case, the output voltage (VBATT) will not be properly regulated. For more details, please refer to the 1VV301732 Telit EVB 2.0 User Guide, Chapter 4.4. Power Supply Requirements.

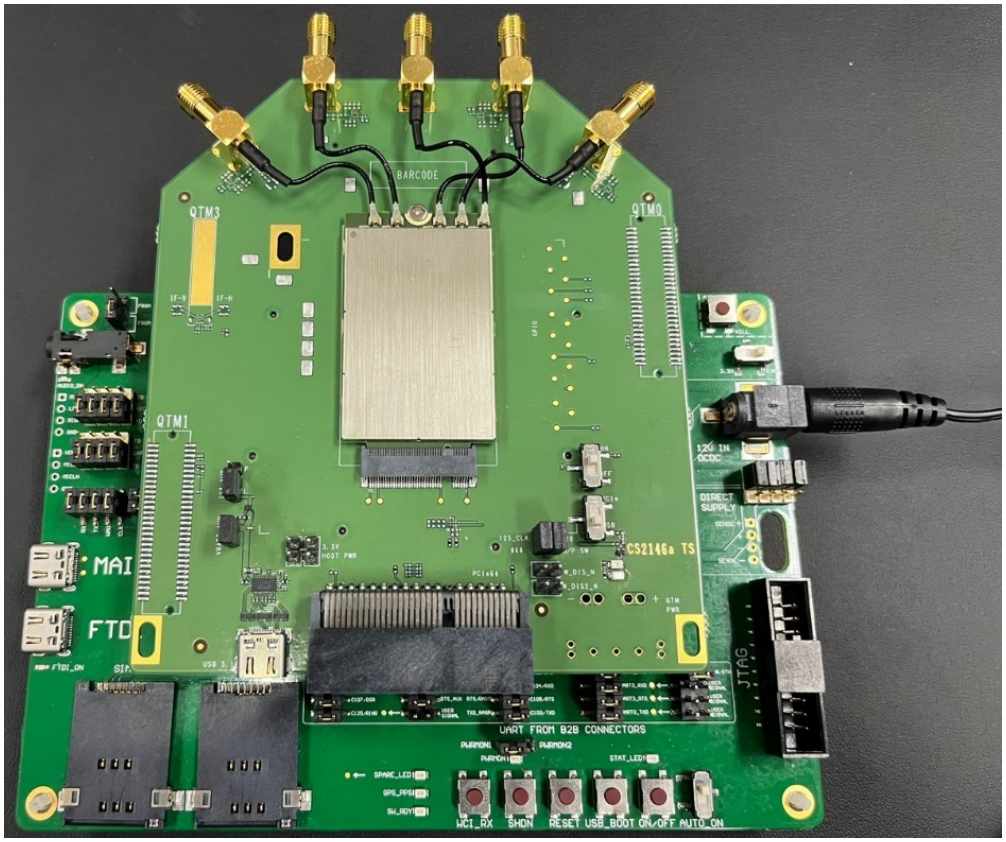

Figure 19: Connecting a wall adaptor and Telit EVB 2.0

2.7.3. Power Supply via USB

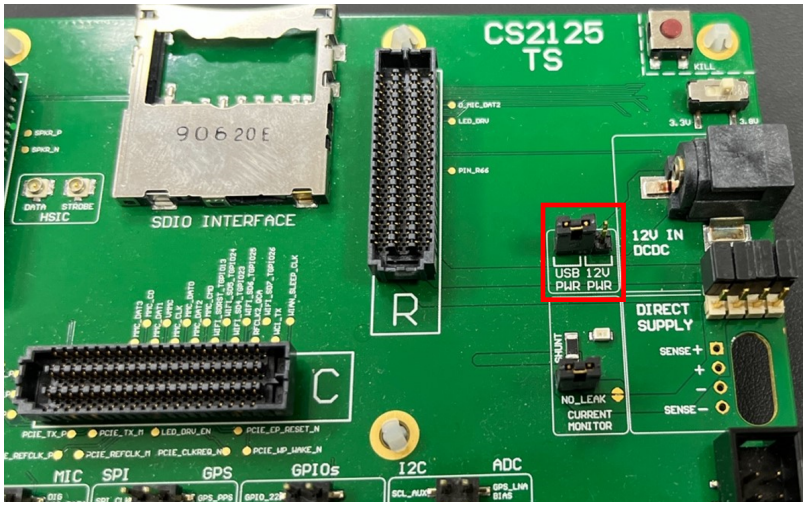

Figure 20: EVB 2.0 Jumper Setting for USB PWR mode

Note: Please note it should be placed USB PWR on EVB 2.0.

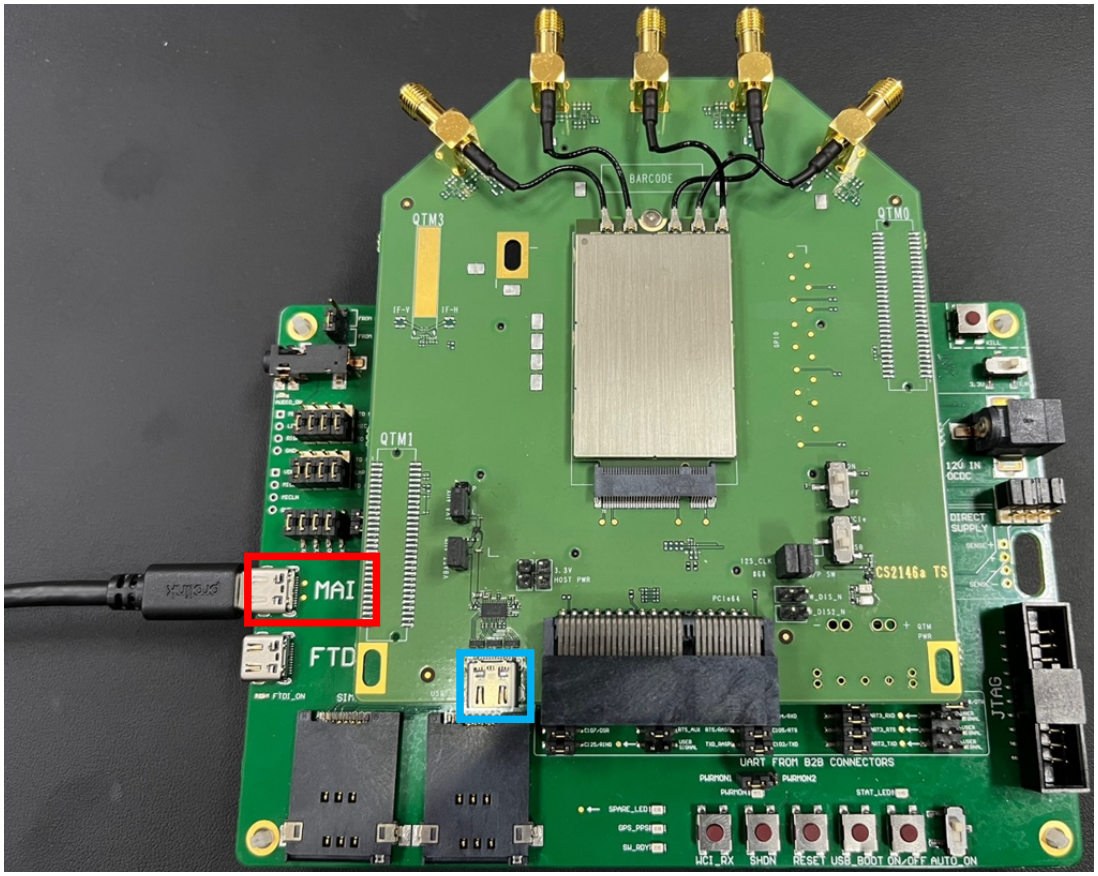

Figure 21: Connecting an USB cable and Telit EVB 2.0

Note: Please note EVB's MAIN USB connector (red box) only power supply to FN990 TLB. If you want to communicate with FN990 please use the FN990 TLB's USB connector. (blue box)

3. COMPONENT ASSEMBLY DIAGRAM

3.1. Layout

Component Diagram Top View

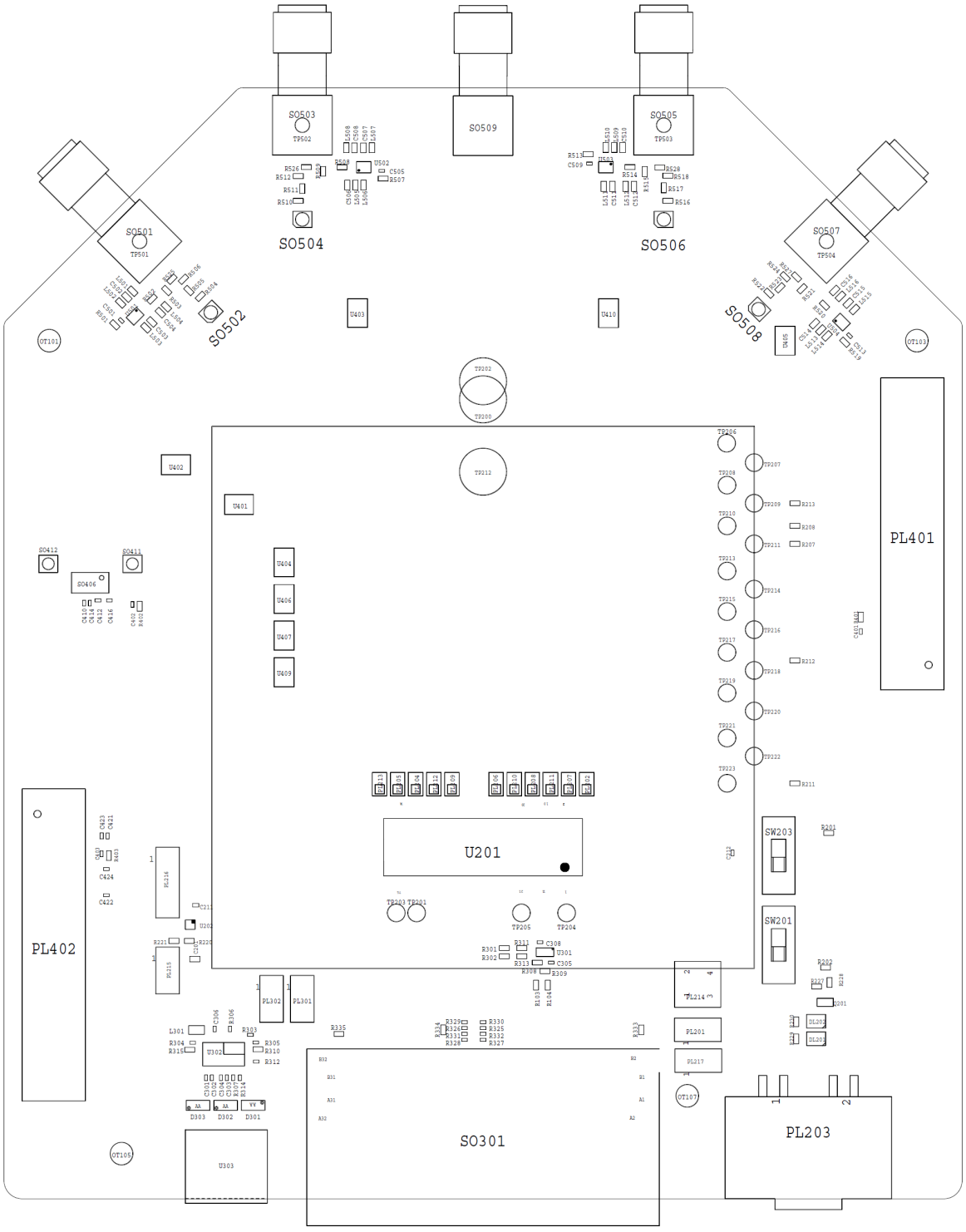

Figure 22: Component Diagram Top View

Component Diagram Bottom View

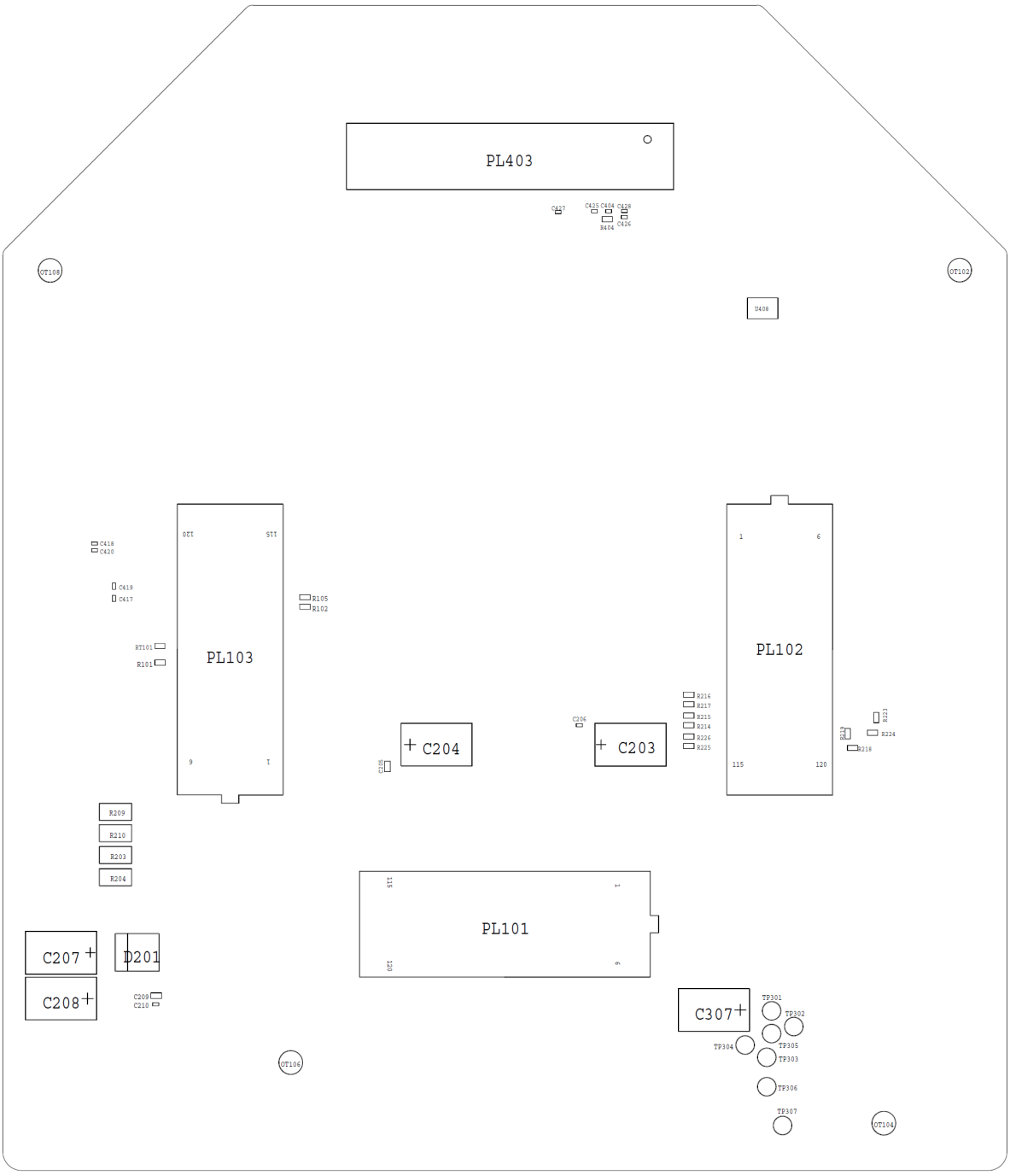

Figure 23: Component Diagram Bottom View

4. SCHEMATICS

Please e-mail:

- *TS-APAC@telit.com*

5. CHANGE LIST

This section will explain the changes from the previous TLB.

There are some differences which are described in the table below.

PCB Code	Change List
CS2146	Prototype.
CS2146A-D	Added AUX Power Jumper. Added W_DISABLE2 Jumper. Added LEDs for WAKE_ON_WAN_N and LED_N. Added USB/PCIe Switch. Added Power ON/OFF Switch. I2S Audio is supported through EVB.

Table 4: Changes from the Previous TLB

6. PRODUCT AND SAFETY INFORMATION

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6.3. Safety Recommendations

Make sure the use of this product is allowed in your country and in the environment required. The use of this product may be dangerous and has to be avoided in areas where:

- it can interfere with other electronic devices, particularly in environments such as hospitals, airports, aircrafts, etc.
- there is a risk of explosion such as gasoline stations, oil refineries, etc. It is the responsibility of the user to enforce the country regulation and the specific environment regulation.

Do not disassemble the product; any mark of tampering will compromise the warranty validity. We recommend following the instructions of the hardware user guides for correct wiring of the product. The product has to be supplied with a stabilized voltage source and the wiring has to be conformed to the security and fire prevention regulations. The product has to be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself. Same cautions have to be taken for the SIM, checking carefully the instruction for its use. Do not insert or remove the SIM when the product is in power saving mode.

The system integrator is responsible for the functioning of the final product. Therefore, the external components of the module, as well as any project or installation issue, have to be handled with care. Any interference may cause the risk of disturbing the GSM network or external devices or having an impact on the security system. Should there be any doubt, please refer to the technical documentation and the regulations in force. Every module has to be equipped with a proper antenna with specific characteristics. The antenna has to be installed carefully in order to avoid any interference with other electronic devices and has to guarantee a minimum distance from the body (20 cm). In case this requirement cannot be satisfied, the system integrator has to assess the final product against the SAR regulation.

The equipment is intended to be installed in a restricted area location.

The equipment must be supplied by an external specific limited power source in compliance with the standard EN 62368-1:2014.

The European Community provides some Directives for the electronic equipment introduced on the market. All of the relevant information is available on the European Community website:

https://ec.europa.eu/growth/sectors/electrical-engineering_en

7. GLOSSARY

ECO	Engineering Change Order
EVB	Evaluation Board
IFBD	Interface Board
PCB	Printed Circuit Board
SDK	Software Development Kit
SIM	Subscriber Identification Module
TIM	Thermal Interface Material
TLB	Translation Board
USB	Universal serial bus

8. DOCUMENT HISTORY

Revision	Date	Changes
0	2021-12-14	First draft
1	2022-04-22	Updated – Section 1.5 Related Documents Updated Table 2 – PCB reference numbers Updated – Section 2.2 TLB View Updated – Section 2.3 TLB Description Updated – Section 2.4 Jumper Setting Guidelines Updated – Section 2.5 Antenna Ports Updated – Section 2.6 PCIe Updated – Section 2.7 Guidance for Evaluation board Updated – Section 3 Compoent Assembly Diagram Updated – Section 4 Schematics Updated – Section 5 Change List

From Mod.0818 rev.4

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