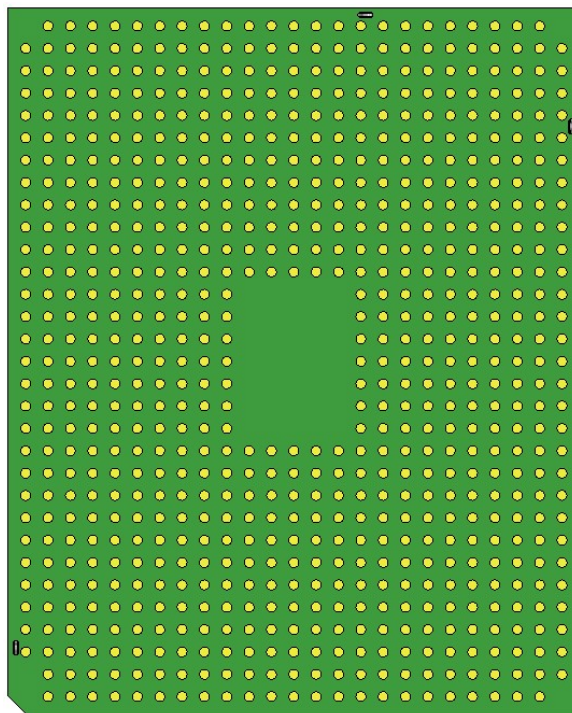




## User Manual

**Product Name:** IMQC

**Author:** Wistron NeWeb Corporation

**Revision:** 1.0

**Revision Date:** 2022/03/08

## Contact Information

|                           |                                                                           |
|---------------------------|---------------------------------------------------------------------------|
| Technical Support website | <a href="https://SupportIoT.wnc.com.tw">https://SupportIoT.wnc.com.tw</a> |
| Company Website           | <a href="http://www.wnc.com.tw">www.wnc.com.tw</a>                        |

## Revision History

| Rev. # | Author | Summary of Changes                                                                                               | Date       |
|--------|--------|------------------------------------------------------------------------------------------------------------------|------------|
| 0.1    | WNC    | First release                                                                                                    | 2021/10/11 |
| 0.2    | WNC    | Added SMT recommendation                                                                                         | 2021/10/12 |
| 0.3    | WNC    | Added module test recommendation after reflow                                                                    | 2021/11/17 |
| 0.4    | WNC    | 1. Update module test recommendation after reflow<br>2. Add GPS external circuit<br>3. Antennas map table update | 2021/11/22 |
| 0.5    | WNC    | Update Steel Stencil Design                                                                                      | 2021/11/22 |
| 0.6    | WNC    | Update Module test---RF Function Check                                                                           | 2021/11/23 |
| 0.7    | WNC    | Add note for USB2.0 interface is recommended to bring out on main board to proceed with module test              | 2021/11/23 |
| 0.8    | WNC    | Update LTE/5G Conducted Sensitivity                                                                              | 2022/01/03 |
| 0.9    | WNC    | Update design guide chapter                                                                                      | 2022/02/25 |
| 1.0    | WNC    | Rearrange the Chapter order.<br>Update Antenna Mapping                                                           | 2022/03/08 |
| 1.1    | WNC    | Add section 4.4.4 : Antenna gain limits                                                                          | 2022/03/28 |
|        |        |                                                                                                                  |            |
|        |        |                                                                                                                  |            |
|        |        |                                                                                                                  |            |
|        |        |                                                                                                                  |            |

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# Contents

|                                                            |           |
|------------------------------------------------------------|-----------|
| <b>Contact Information .....</b>                           | <b>2</b>  |
| <b>Revision History .....</b>                              | <b>2</b>  |
| <b>Contents .....</b>                                      | <b>4</b>  |
| <b>1. Introduction .....</b>                               | <b>6</b>  |
| 1.1. RF band support .....                                 | 7         |
| 1.2. Features .....                                        | 7         |
| 1.3. Connection Interface .....                            | 8         |
| 1.4. Environmental Specifications and Certifications ..... | 8         |
| 1.4.1 Environmental Specifications .....                   | 8         |
| <b>2. Pin Definitions .....</b>                            | <b>9</b>  |
| 2.1. LGA Module Pin Diagram .....                          | 9         |
| 2.2. LGA Module Pin Definitions .....                      | 10        |
| <b>3. Electrical Specifications .....</b>                  | <b>21</b> |
| 3.1. Power supply .....                                    | 21        |
| <b>4. RF Specifications .....</b>                          | <b>22</b> |
| 4.1. LTE Conducted Power .....                             | 22        |
| 4.2. 5G Conducted Power .....                              | 22        |
| 4.3. LTE/5G Conducted Sensitivity .....                    | 23        |
| 4.4. Antennas Map .....                                    | 23        |
| 4.4.1 LTE .....                                            | 23        |
| 4.4.2 5G .....                                             | 24        |
| 4.4.3 GPS .....                                            | 24        |
| 4.4.4 Antenna gain Limits .....                            | 25        |
| <b>5. Software Interface .....</b>                         | <b>25</b> |
| 5.1. USB Interface .....                                   | 25        |

6. Mechanical and Miscellaneous ..... 25

6.1. PCBA Form Factor ..... 26

7. Design Guide ..... 28

7.1. Power Supply ..... 28

7.2. RF Connector ..... 30

7.3. Reflow Profile ..... 33

8. Safety Recommendation ..... 33

Initialisms ..... 37

## **1. Introduction**

IMQC is a 5G NR BGA module support NSA and SA modes. It consists of processors with integrated LTE and 5G modems capable of supporting 5G Sub6-GHz radio. The key radio features of IMQC are the ULCA of LTE and Sub6-GHz, detail is described in the RF section. IMQC also supports dual-connectivity framework of the 3GPP standard Release 16.

IMQC is designed with flexibility and scalability in order to provide the unifying connectivity platform for three main categories of 5G services: enhanced mobile broadband, mission-critical control, and massive Internet of Things – each driving a very diverse set of requirements.

The module is able to support a variety of services including wide coverage, high throughput, enhanced capacity and low latency. It also support wide range of devices including low-data rate sensors at 10s of kbps to new immersive mobile experiences at multi-Gbps.

In addition to supporting a wide range of services, it supports a wide array of spectrum available across regulatory standards and spectrum including low-bands below 1 GHz, and mid-high/UHB bands between 1.7 GHz and 4.2 GHz, which will open up vast amount of bandwidths for extreme data rates and capacity that were previously not usable for wide-area mobile communications.

This document consists of several technical sections including, Electrical Specifications, RF Specifications, Power, SW Features and Tools, SW Guideline, Mechanical concept, Thermal considerations, Regulatory Compliance and Certification, Environmental Requirements, Packaging and Safety Recommendation.

## 1.1. RF band support

This section lists the main features and functions that the IMQC module supports in the table.

IMQC module overview

| Module | 5G | LTE | GNSS | Temperature Grade |
|--------|----|-----|------|-------------------|
| IMQC   | v  | v   | v    | Consumer          |

1. "√" indicates supporting. "×" indicates not supporting.

## 1.2. Features

Feature Lists:

- 5G bands/modes
  - 5G NR, NSA/SA, FR1
  - n77 (DL 4x4 MIMO, UL 2x2 MIMO, 8Rx, SRS)
  - n2, n30, n66 (DL 4x4 MIMO)
  - n5, n12 (DL 2x2 MIMO)
- LTE bands/modes:
  - LTE DL CAT 20, UL CAT 18
  - B2/30/66 (DL 4x4 MIMO)
  - B5/12/29 (DL 2x2 MIMO)
  - B14 (DL 2x2 MIMO)
- HPUE (PC2) for n77 (TDD)
- GNSS L1/L5
- Compliant with 3GPP release 16
- Application CPU: Quad ARM Cortex-A55 operating up to 2.0GHz
- Modem: Qualcomm SDX65 modem
- Linux OS
- Memory size: 4Gb LPDDR4X SDRAM and 4Gb NAND Flash ( can be extended to 8Gb+8Gb)
- Power management systems
- Interfaces
  - RESET\_N X1
  - PMIC ADC X 1
  - Clock\_32.768K X 1

- PCIE GEN3 2-Lane X 1
- USB 3.1 & USB 2.0 X1
- GPIO x 25
- I2S/PCM x 1
- SDIO x1
- Debug\_UART x1
- UARTx2
- RFFE X3
- I2C X1
- SPI x 1
- SIM x 1
- JTAG X 1
- GNSS L1 /L5

### 1.3. Connection Interface

The IMQC module is LGA device. All electrical connections are made though the 735 pads on the bottom side of a PCB.

### 1.4. Environmental Specifications and Certifications

#### 1.4.1 Environmental Specifications

The environmental specifications for both operating and storage conditions are defined in the Table below.

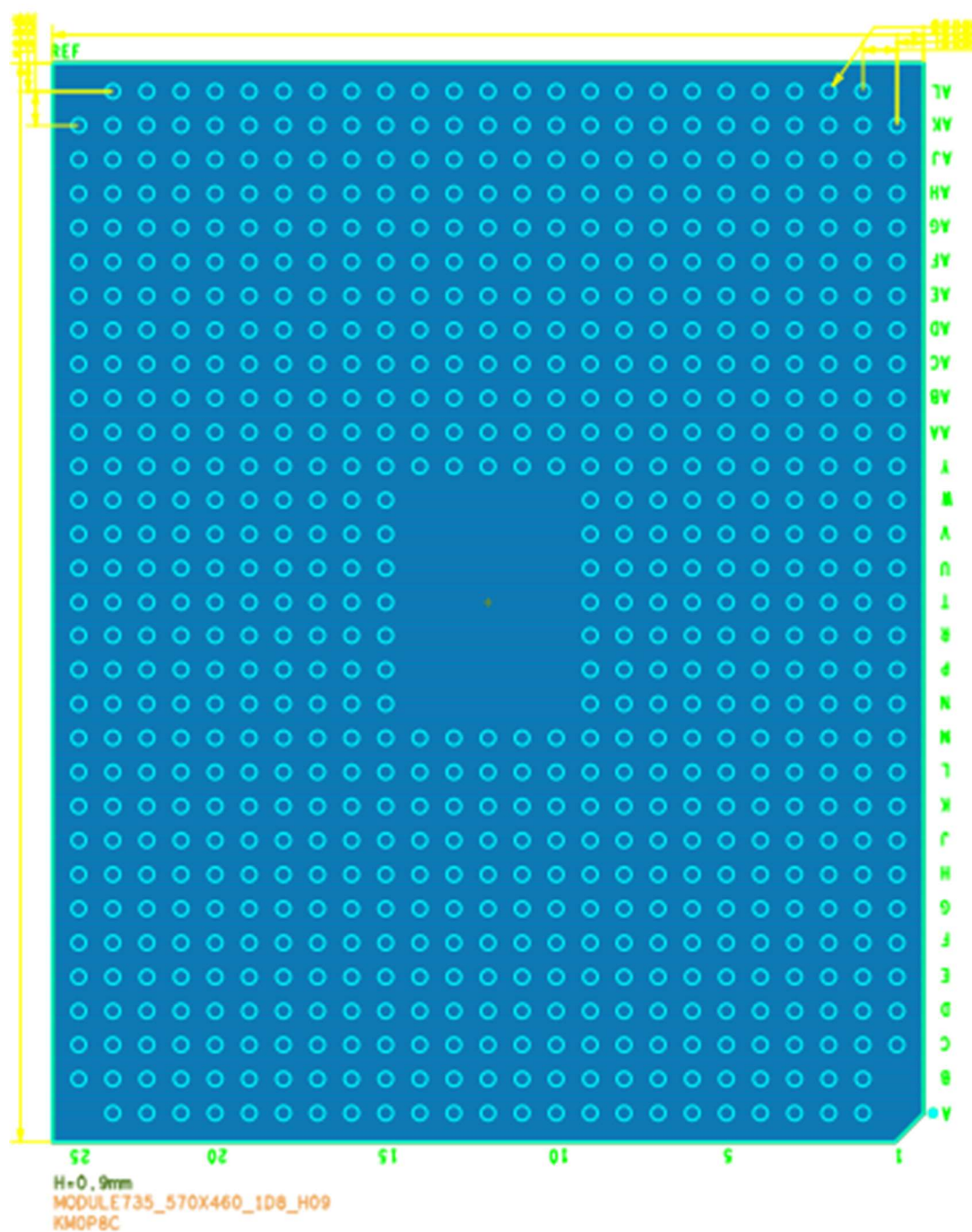
| Condition                            | Temperature Range | Remark                                                                                       |
|--------------------------------------|-------------------|----------------------------------------------------------------------------------------------|
| Normal operating temperature range   | −15 °C to 55°C    | Fully functional and in compliance with 3GPP specifications                                  |
| Extended operating temperature range | −40 °C to 85°C    | RF performance may be affected outside the normal range, but the module will still function. |
| Storage                              | −40 °C to 85 °C   |                                                                                              |

Note: All temperatures above refer to ambient temperatures.

## 2. Pin Definitions

### 2.1. LGA Module Pin Diagram

The IMQC LGA module pin layout is illustrated below.



LGA pad diagram (top view)

## 2.2. LGA Module Pin Definitions

I/O type description:

- AO: Analog Output
- AI: Analog Input
- AIO: Analog bi-direction
- DO: Digital Output
- DI: Digital Input
- DIO: Digital bi-direction
- P: Power
- PI: Power input
- PO: Power output
- GND
- NC

Table 2-1 Pin Interface Family

| Signal                                   |            |                        |                |      |                   |       |      |
|------------------------------------------|------------|------------------------|----------------|------|-------------------|-------|------|
| Power On Trigger , Reset, Force Download |            |                        |                |      | Voltage Level (V) |       |      |
| Pin Count                                | Pin Number | Pin Name               | Function       | Type | Min.              | Typ.  | Max. |
| 1                                        | G5         | CBL_PWR_N(PMX65_GPIO3) | Power On       | DI   | 1.7               | 1.8   | 1.95 |
| 2                                        | A6         | KPD_PWR_N              | Power On       | DI   | 1.7               | 1.8   | 1.95 |
| 3                                        | F2         | RESET_N                | Reset input    | DI   | 1.7               | 1.8   | 1.95 |
| 4                                        | J19        | FORCED_USB_BOOT        | Force Download | DI   | 1.7               | 1.8   | 1.95 |
| 5                                        | D3         | FAULT_N                | PMIC_Fault     | DIO  | 1.7               | 1.8   | 1.95 |
| PCIE and Control Signal                  |            |                        |                |      | Voltage Level (V) |       |      |
| Pin Count                                | Pin Number | Pin Name               | Function       | Type | Min.              | Typ.  | Max. |
| 6                                        | N25        | PCIE_WAKE_N            | PCIE           | DIO  | 1.62              | 1.8   | 1.98 |
| 7                                        | M25        | PCIE_CLK_REQ_N         | PCIE           | DIO  | 1.62              | 1.8   | 1.98 |
| 8                                        | L25        | PCIE_RST_N             | PCIE           | DIO  | 1.62              | 1.8   | 1.98 |
| 9                                        | C11        | PCIE_REFCLK_M          | PCIE           | AIO  |                   | Note1 |      |

| 10              | C10        | PCIE_REFCLK_P              | PCIE       | AIO  |                   | Note1 |      |
|-----------------|------------|----------------------------|------------|------|-------------------|-------|------|
| 11              | B9         | PCIE_RX0_M                 | PCIE       | AIO  |                   | Note1 |      |
| 12              | B8         | PCIE_RX0_P                 | PCIE       | AIO  |                   | Note1 |      |
| 13              | A9         | PCIE_RX1_M                 | PCIE       | AIO  |                   | Note1 |      |
| 14              | A8         | PCIE_RX1_P                 | PCIE       | AIO  |                   | Note1 |      |
| 15              | A13        | PCIE_TX0_M                 | PCIE       | AIO  |                   | Note1 |      |
| 16              | A12        | PCIE_TX0_P                 | PCIE       | AIO  |                   | Note1 |      |
| 17              | B13        | PCIE_TX1_M                 | PCIE       | AIO  |                   | Note1 |      |
| 18              | B12        | PCIE_TX1_P                 | PCIE       | AIO  |                   | Note1 |      |
| USB3.1 & USB2.0 |            |                            |            |      | Voltage Level (V) |       |      |
| Pin Count       | Pin Number | Pin Name                   | Function   | Type | Min.              | Typ.  | Max. |
| 19              | B17        | USB_SS_RX_M                | USB 3.1    | AIO  |                   | Note2 |      |
| 20              | B16        | USB_SS_RX_P                | USB 3.1    | AIO  |                   | Note2 |      |
| 21              | A19        | USB_SS_TX_M                | USB 3.1    | AIO  |                   | Note2 |      |
| 22              | A18        | USB_SS_TX_P                | USB 3.1    | AIO  |                   | Note2 |      |
| 23              | B21        | USBC_HS_D_M                | USB 2.0    | AIO  |                   | Note2 |      |
| 24              | B20        | USBC_HS_D_P                | USB 2.0    | AIO  |                   | Note2 |      |
| UART and I2C    |            |                            |            |      | Voltage Level (V) |       |      |
| Pin Count       | Pin Number | Pin Name                   | Function   | Type | Min.              | Typ.  | Max. |
| 25              | E25        | I2C_SDA(GPIO_10)           | I2C0       | DIO  | 1.62              | 1.8   | 1.98 |
| 26              | D25        | I2C_SCL(GPIO_11)           | I2C0       | DIO  | 1.62              | 1.8   | 1.98 |
| 27              | K19        | UART1_TX(GPIO_48)          | UART1      | DIO  | 1.62              | 1.8   | 1.98 |
| 28              | K20        | UART1_RX(GPIO_49)          | UART1      | DIO  | 1.62              | 1.8   | 1.98 |
| 29              | G7         | UART0_TX(GPIO_63)          | UART0      | DIO  | 1.62              | 1.8   | 1.98 |
| 30              | F8         | UART0_RX(GPIO_64)          | UART0      | DIO  | 1.62              | 1.8   | 1.98 |
| 31              | F7         | UART0_CTS/I2C_SDA(GPIO_65) | UART0/I2C1 | DIO  | 1.62              | 1.8   | 1.98 |
| 32              | E8         | UART0_RFR/I2C_SCL(GPIO_66) | UART0/I2C1 | DIO  | 1.62              | 1.8   | 1.98 |
| SPI             |            |                            |            |      | Voltage Level (V) |       |      |

| Pin Count  | Pin Number | Pin Name                      | Function | Type | Min.              | Typ. | Max. |
|------------|------------|-------------------------------|----------|------|-------------------|------|------|
| 33         | J10        | SPI_MOSI(GPIO_04)             | SPI0     | DIO  | 1.62              | 1.8  | 1.98 |
| 34         | J9         | SPI_MISO(GPIO_05)             | SPI0     | DIO  | 1.62              | 1.8  | 1.98 |
| 35         | J8         | SPI_CS_N(GPIO_06)             | SPI0     | DIO  | 1.62              | 1.8  | 1.98 |
| 36         | J7         | SPI_CLK(GPIO_07)              | SPI0     | DIO  | 1.62              | 1.8  | 1.98 |
| 37         | J25        | SLIC_SPI_MOSI(GPIO_16)        | SPI1     | DIO  | 1.62              | 1.8  | 1.98 |
| 38         | H25        | SLIC_SPI_MISO(GPIO_17)        | SPI1     | DIO  | 1.62              | 1.8  | 1.98 |
| 39         | K25        | SLIC_SPI_CS(GPIO_18)          | SPI1     | DIO  | 1.62              | 1.8  | 1.98 |
| 40         | G25        | SLIC_SPI_CLK(GPIO_19)         | SPI1     | DIO  | 1.62              | 1.8  | 1.98 |
| I2S or PCM |            |                               |          |      | Voltage Level (V) |      |      |
| Pin Count  | Pin Number | Pin Name                      | Function | Type | Min.              | Typ. | Max. |
| 41         | H22        | I2S_MCLK(GPIO_62)             | I2S      | DIO  | 1.62              | 1.8  | 1.98 |
| 42         | H23        | PCM_SYNC/I2S_WS(GPIO_12)      | I2S/PCM  | DIO  | 1.62              | 1.8  | 1.98 |
| 43         | J23        | PCM_RX_IN/I2S_Data0(GPIO_13)  | I2S/PCM  | DIO  | 1.62              | 1.8  | 1.98 |
| 44         | K23        | PCM_TX_OUT/I2S_Data1(GPIO_14) | I2S/PCM  | DIO  | 1.62              | 1.8  | 1.98 |
| 45         | G23        | PCM_PCLK/I2S_SCK(GPIO_15)     | I2S/PCM  | DIO  | 1.62              | 1.8  | 1.98 |
| RFFE       |            |                               |          |      | Voltage Level (V) |      |      |
| Pin Count  | Pin Number | Pin Name                      | Function | Type | Min.              | Typ. | Max. |
| 46         | G12        | RFFE0_DATA(GPIO_36)           | REFE0    | DIO  | 1.62              | 1.8  | 1.98 |
| 47         | G11        | RFFE0_CLK(GPIO_37)            | REFE0    | DIO  | 1.62              | 1.8  | 1.98 |
| 48         | H12        | RFFE1_DATA(GPIO_38)           | REFE1    | DIO  | 1.62              | 1.8  | 1.98 |
| 49         | H11        | RFFE1_CLK(GPIO_39)            | REFE1    | DIO  | 1.62              | 1.8  | 1.98 |
| 50         | E11        | RFFE3_DATA(GPIO_27)           | REFE3    | DIO  | 1.62              | 1.8  | 1.98 |
| 51         | F11        | RFFE3_CLK(GPIO_26)            | REFE3    | DIO  | 1.62              | 1.8  | 1.98 |
| SIM        |            |                               |          |      | Voltage Level (V) |      |      |
| Pin Count  | Pin Number | Pin Name                      | Function | Type | Min.              | Typ. | Max. |

|                       |            |                       |              |      |                   |              |              |
|-----------------------|------------|-----------------------|--------------|------|-------------------|--------------|--------------|
| 52                    | C6         | UIM1_DATA(GPIO_67)    | SIM1         | DIO  | 1.7               | 1.8          | 1.98         |
| 53                    | C5         | UIM1_PRESENT(GPIO_68) | SIM1         | DIO  | 1.7               | 1.8          | 1.98         |
| 54                    | C4         | UIM1_RESET(GPIO_69)   | SIM1         | DIO  | 1.7               | 1.8          | 1.98         |
| 55                    | C3         | UIM1_CLK(GPIO_70)     | SIM1         | DIO  | 1.7               | 1.8          | 1.98         |
| 56                    | B4         | NC40                  |              |      |                   |              |              |
| 57                    | A5         | NC41                  |              |      |                   |              |              |
| 58                    | A4         | NC42                  |              |      |                   |              |              |
| 59                    | A3         | NC43                  |              |      |                   |              |              |
| SDIO Interface(Note5) |            |                       |              |      | Voltage Level (V) |              |              |
| Pin Count             | Pin Number | Pin Name              | Function     | Type | Min.              | Typ.         | Max.         |
| 60                    | F25        | RESOUT_N              | Reset Output | DO   | 1.62              | 1.8          | 1.98         |
| 61                    | A22        | SDC_CLK               | SDIO         | DO   | 1.7/<br>2.7       | 1.8/<br>2.95 | 1.95/<br>3.6 |
| 62                    | C24        | SDC_CMD               | SDIO         | DO   | 1.7/<br>2.7       | 1.8/<br>2.95 | 1.95/<br>3.6 |
| 63                    | D22        | SDC_DATA_0            | SDIO         | DIO  | 1.7/<br>2.7       | 1.8/<br>2.95 | 1.95/<br>3.6 |
| 64                    | C22        | SDC_DATA_1            | SDIO         | DIO  | 1.7/<br>2.7       | 1.8/<br>2.95 | 1.95/<br>3.6 |
| 65                    | C23        | SDC_DATA_2            | SDIO         | DIO  | 1.7/<br>2.7       | 1.8/<br>2.95 | 1.95/<br>3.6 |
| 66                    | D23        | SDC_DATA_3            | SDIO         | DIO  | 1.7/<br>2.7       | 1.8/<br>2.95 | 1.95/<br>3.6 |
| 67                    | C25        | SDC_DATA_4(GPIO_98)   | SDIO         | DIO  | 1.7/<br>2.7       | 1.8/<br>2.95 | 1.95/<br>3.6 |
| 68                    | A23        | SDC_DATA_5(GPIO_99)   | SDIO         | DIO  | 1.7/<br>2.7       | 1.8/<br>2.95 | 1.95/<br>3.6 |

| 69                               | B23        | SDC_DATA_6(GPIO_100) | SDIO     | DIO  | 1.7/<br>2.7       | 1.8/<br>2.95 | 1.95/<br>3.6 |
|----------------------------------|------------|----------------------|----------|------|-------------------|--------------|--------------|
| 70                               | B24        | SDC_DATA_7(GPIO_101) | SDIO     | DIO  | 1.7/<br>2.7       | 1.8/<br>2.95 | 1.95/<br>3.6 |
| JTAG                             |            |                      |          |      | Voltage Level (V) |              |              |
| Pin Count                        | Pin Number | Pin Name             | Function | Type | Min.              | Typ.         | Max.         |
| 71                               | G8         | JTAG_SRST_N          | JTAG     | DI   | 1.62              | 1.8          | 1.98         |
| 72                               | E10        | JTAG_TCK             | JTAG     | DI   | 1.62              | 1.8          | 1.98         |
| 73                               | E9         | JTAG_TDI             | JTAG     | DI   | 1.62              | 1.8          | 1.98         |
| 74                               | F9         | JTAG_TDO             | JTAG     | DO   | 1.62              | 1.8          | 1.98         |
| 75                               | G9         | JTAG_TMS             | JTAG     | DI   | 1.62              | 1.8          | 1.98         |
| 76                               | F10        | JTAG_TRST_N          | JTAG     | DI   | 1.62              | 1.8          | 1.98         |
| DBI interface and Control Signal |            |                      |          |      | Voltage Level (V) |              |              |
| Pin Count                        | Pin Number | Pin Name             | Function | Type | Min.              | Typ.         | Max.         |
| 77                               | E21        | NC19                 |          |      |                   |              |              |
| 78                               | F22        | NC20                 |          |      |                   |              |              |
| 79                               | E22        | NC21                 |          |      |                   |              |              |
| 80                               | F20        | NC22                 |          |      |                   |              |              |
| 81                               | F21        | NC23                 |          |      |                   |              |              |
| 82                               | D21        | NC24                 |          |      |                   |              |              |
| 83                               | G20        | NC25                 |          |      |                   |              |              |
| 84                               | E20        | NC26                 |          |      |                   |              |              |
| 85                               | F24        | NC27                 |          |      |                   |              |              |
| 86                               | G21        | NC28                 |          |      |                   |              |              |
| 87                               | D24        | NC29                 |          |      |                   |              |              |
| 88                               | G22        | NC30                 |          |      |                   |              |              |
| 89                               | F23        | NC31                 |          |      |                   |              |              |

| 90         | E23        | NC32                |            |      |                   |      |      |
|------------|------------|---------------------|------------|------|-------------------|------|------|
| 91         | E24        | NC33                |            |      |                   |      |      |
| Debug UART |            |                     |            |      | Voltage Level (V) |      |      |
| Pin Count  | Pin Number | Pin Name            | Function   | Type | Min.              | Typ. | Max. |
| 92         | D15        | DBG_UART_TX(GPIO_8) | DB UART    | DO   | 1.62              | 1.8  | 1.98 |
| 93         | C15        | DBG_UART_RX(GPIO_9) | DB UART    | DI   | 1.62              | 1.8  | 1.98 |
| GPIO       |            |                     |            |      | Voltage Level (V) |      |      |
| Pin Count  | Pin Number | Pin Name            | Function   | Type | Min.              | Typ. | Max. |
| 94         | L4         | NC1                 |            |      |                   |      |      |
| 95         | H7         | NC2                 |            |      |                   |      |      |
| 96         | F4         | NC3                 |            |      |                   |      |      |
| 97         | E3         | NC4                 |            |      |                   |      |      |
| 98         | H5         | NC5                 |            |      |                   |      |      |
| 99         | H6         | NC6                 |            |      |                   |      |      |
| 100        | K4         | NC7                 |            |      |                   |      |      |
| 101        | K5         | NC8                 |            |      |                   |      |      |
| 102        | F1         | NC9                 |            |      |                   |      |      |
| 103        | C7         | NC10                |            |      |                   |      |      |
| 104        | G4         | NC11                |            |      |                   |      |      |
| 105        | E4         | NC12                |            |      |                   |      |      |
| 106        | F3         | NC13                |            |      |                   |      |      |
| 107        | E1         | NC14                |            |      |                   |      |      |
| 108        | J6         | NC15                |            |      |                   |      |      |
| 109        | G3         | NC16                |            |      |                   |      |      |
| 110        | G2         | NC17                |            |      |                   |      |      |
| 111        | G1         | NC18                |            |      |                   |      |      |
| 112        | G13        | GPIO_31             | SDX65_GPIO | DIO  | 1.62              | 1.8  | 1.98 |

|     |     |          |            |     |      |     |      |
|-----|-----|----------|------------|-----|------|-----|------|
| 113 | J13 | GPIO_32  | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 114 | H9  | NC34     |            |     |      |     |      |
| 115 | F12 | NC35     |            |     |      |     |      |
| 116 | H10 | NC36     |            |     |      |     |      |
| 117 | D13 | GPIO_44  | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 118 | D14 | GPIO_45  | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 119 | J22 | GPIO_47  | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 120 | H21 | NC37     |            |     |      |     |      |
| 121 | H20 | NC38     |            |     |      |     |      |
| 122 | H19 | NC39     |            |     |      |     |      |
| 123 | J5  | GPIO_80  | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 124 | L5  | GPIO_81  | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 125 | J4  | GPIO_82  | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 126 | H4  | GPIO_83  | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 127 | P24 | GPIO_86  | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 128 | K18 | GPIO_87  | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 129 | D12 | GPIO_88  | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 130 | E12 | GPIO_91  | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 131 | H13 | GPIO_92  | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 132 | J14 | GPIO_93  | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 133 | J21 | GPIO_94  | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 134 | K21 | GPIO_95  | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 135 | H14 | GPIO_96  | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 136 | J15 | GPIO_97  | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 137 | K24 | GPIO_102 | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 138 | J20 | GPIO_104 | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 139 | R24 | GPIO_103 | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |
| 140 | K22 | GPIO_105 | SDX65_GPIO | DIO | 1.62 | 1.8 | 1.98 |

| 141                         | H24        | GPIO_106         | SDX65_GPIO            | DIO  | 1.62              | 1.8  | 1.98  |
|-----------------------------|------------|------------------|-----------------------|------|-------------------|------|-------|
| 142                         | J24        | GPIO_107         | SDX65_GPIO            | DIO  | 1.62              | 1.8  | 1.98  |
| Clock and charger configure |            |                  |                       |      | Voltage Level (V) |      |       |
| Pin Count                   | Pin Number | Pin Name         | Function              | Type | Min.              | Typ. | Max.  |
| 143                         | B3         | RFCLK3           | WLAN Clock            | AO   | 1.02              | 1.05 | 1.08  |
| 144                         | E2         | PMK_Sleep_Clk    | 32.768KHz Clock       | AO   | 1.62              | 1.8  | 1.98  |
| 145                         | D1         | SPMI_CLK(Note4)  | SPMI_CLK              | DIO  | 1.62              | 1.8  | 1.98  |
| 146                         | D2         | SPMI_DATA(Note4) | SPMI_Data             | DIO  | 1.62              | 1.8  | 1.98  |
| 147                         | D8         | PMX_AMUX5(Note3) | Set Charger configure | AI   | 0                 | -    | 1.875 |
| PMX65_ADC                   |            |                  |                       |      | Voltage Level (V) |      |       |
| Pin Count                   | Pin Number | Pin Name         | Function              | Type | Min.              | Typ. | Max.  |
| 148                         | D7         | PMX_AMUX6        | PMIC_ADC              | AI   | 0                 | -    | 1.875 |
| RF (Antenna Port)           |            |                  |                       |      | Voltage Level (V) |      |       |
| Pin Count                   | Pin Number | Pin Name         | Function              | Type | Min.              | Typ. | Max.  |
| 149                         | AL11       | ANT0             | RF                    | AIO  |                   |      |       |
| 150                         | AL13       | ANT1             | RF                    | AIO  |                   |      |       |
| 151                         | AL17       | ANT2             | RF                    | AIO  |                   |      |       |
| 152                         | AL15       | ANT3             | RF                    | AIO  |                   |      |       |
| 153                         | AL19       | ANT4             | RF                    | AIO  |                   |      |       |
| 154                         | AJ25       | ANT5             | RF                    | AIO  |                   |      |       |
| 155                         | AL23       | ANT6             | RF                    | AIO  |                   |      |       |
| 156                         | AL21       | ANT7             | RF                    | AIO  |                   |      |       |
| 157                         | W25        | ANT12            | RF                    | AIO  |                   |      |       |
| 158                         | U25        | ANT13            | RF                    | AIO  |                   |      |       |
| GPS_L1/L5 EN                |            |                  |                       |      | Voltage Level (V) |      |       |
| Pin Count                   | Pin Number | Pin Name         | Function              | Type | Min.              | Typ. | Max.  |

|     |     |                                        |           |    |      |     |      |
|-----|-----|----------------------------------------|-----------|----|------|-----|------|
| 159 | P25 | GNSS_ELNA_L1_EN/UART1_CTS<br>(GPIO_22) | GPS_L1_En | DO | 1.62 | 1.8 | 1.98 |
| 160 | R25 | GNSS_ELNA_L5_EN/UART1_RFR<br>(GPIO_23) | GPS_L5_En | DO | 1.62 | 1.8 | 1.98 |

Note1: Refer to section 2.5 PCIE standard for more electronic characteristics.

Note2: Refer to section 2.4 USB standard for more electronic characteristics.

Note3: PMX\_AMUX5 pin is used for external charge configuration, there is a default 26.7kohm pull down resistor connected to PMX\_AMUX5 pin in the module and configure to no charger function, so PMX\_AMUX5 is recommend to keep floating.

Note4: SPMI\_CLK/ SPMI\_DATA pin are interface between the Module and external charger chip, the module configure to no charger function, so SPMI\_CLK/ SPMI\_DATA is recommend to keep floating.

Note5: SDIO IO Interface (exception RESOUT\_N pin) can provide two types of voltages (1.8V/2.95V), refer to JESD84-B51---Embedded Multi-Media Card (eMMC) Electrical Standard (5.1).

| Power<br>(Please refer to Sec2.2) |            |          |              |      |                   |      |      |
|-----------------------------------|------------|----------|--------------|------|-------------------|------|------|
| System Power                      |            |          |              |      | Voltage Level (V) |      |      |
| Pin Count                         | Pin Number | Pin Name | Function     | Type | Min.              | Typ. | Max. |
| 161                               | L3         | VPH_PWR  | System Power | P    | 3.3               | 3.8  | 4.3  |
| 162                               | L2         | VPH_PWR  | System Power | P    | 3.3               | 3.8  | 4.3  |
| 163                               | L1         | VPH_PWR  | System Power | P    | 3.3               | 3.8  | 4.3  |
| 164                               | K3         | VPH_PWR  | System Power | P    | 3.3               | 3.8  | 4.3  |
| 165                               | K2         | VPH_PWR  | System Power | P    | 3.3               | 3.8  | 4.3  |
| 166                               | K1         | VPH_PWR  | System Power | P    | 3.3               | 3.8  | 4.3  |
| 167                               | J3         | VPH_PWR  | System Power | P    | 3.3               | 3.8  | 4.3  |
| 168                               | J2         | VPH_PWR  | System Power | P    | 3.3               | 3.8  | 4.3  |
| 169                               | J1         | VPH_PWR  | System Power | P    | 3.3               | 3.8  | 4.3  |
| 170                               | H3         | VPH_PWR  | System Power | P    | 3.3               | 3.8  | 4.3  |
| 171                               | H2         | VPH_PWR  | System Power | P    | 3.3               | 3.8  | 4.3  |

|                |            |                       |                 |      |                      |              |              |
|----------------|------------|-----------------------|-----------------|------|----------------------|--------------|--------------|
| 172            | H1         | VPH_PWR               | System Power    | P    | 3.3                  | 3.8          | 4.3          |
| 173            | M1         | VREG_DBB1_3P3         | System Voltage  | P    | VPH_PWR /<br>EXT_3V3 |              |              |
| 174            | M2         | VREG_DBB1_3P3         | System Voltage  | P    | VPH_PWR /<br>EXT_3V3 |              |              |
| 175            | N5         | VPH_PWRS              | RF Power        | P    | 3.3                  | 3.8          | 4.3          |
| 176            | M5         | VPH_PWRS              | RF Power        | P    | 3.3                  | 3.8          | 4.3          |
| 177            | P6         | VPH_PWRS              | RF Power        | P    | 3.3                  | 3.8          | 4.3          |
| 178            | N6         | VPH_PWRS              | RF Power        | P    | 3.3                  | 3.8          | 4.3          |
| 179            | M6         | VPH_PWRS              | RF Power        | P    | 3.3                  | 3.8          | 4.3          |
| 180            | L6         | VPH_PWRS              | RF Power        | P    | 3.3                  | 3.8          | 4.3          |
| 181            | P7         | VPH_PWRS              | RF Power        | P    | 3.3                  | 3.8          | 4.3          |
| 182            | N7         | VPH_PWRS              | RF Power        | P    | 3.3                  | 3.8          | 4.3          |
| 183            | M7         | VPH_PWRS              | RF Power        | P    | 3.3                  | 3.8          | 4.3          |
| 184            | L7         | VPH_PWRS              | RF Power        | P    | 3.3                  | 3.8          | 4.3          |
| VBUS           |            |                       |                 |      | Voltage Level (V)    |              |              |
| Pin Count      | Pin Number | Pin Name              | Function        | Type | Min.                 | Typ.         | Max.         |
| 185            | H8         | VBUS_DET              | USB_VBUS        | P    | 4.75                 | 5            | 5.25         |
| SDIO_IO Power  |            |                       |                 |      | Voltage Level (V)    |              |              |
| Pin Count      | Pin Number | Pin Name              | Function        | Type | Min.                 | Typ.         | Max.         |
| 186            | C18        | VREG_LDO_SDC(Note6)   | SDIO IO Voltage | P    | 1.7/<br>2.7          | 1.8/<br>2.95 | 1.95/<br>3.6 |
| SIMVCC1        |            |                       |                 |      | Voltage Level (V)    |              |              |
| Pin Count      | Pin Number | Pin Name              | Function        | Type | Min.                 | Typ.         | Max.         |
| 187            | B6         | SIMVCC1(VREG_L11_1P8) | SIM1 Power      | P    | 1.7                  | 1.8          | 1.98         |
| 188            | B5         | NC44                  |                 |      |                      |              |              |
| Output Voltage |            |                       |                 |      | Voltage Level (V)    |              |              |

| Pin Count | Pin Number | Pin Name     | Function              | Type | Min.  | Typ.  | Max. |
|-----------|------------|--------------|-----------------------|------|-------|-------|------|
| 189       | D5         | VREG_S4_1P9  | Output Voltage<br>1V9 | P    | 1.824 | 1.88  | 2    |
| 190       | D4         | VREG_S4_1P9  | Output Voltage<br>1V9 | P    | 1.824 | 1.88  | 2    |
| 191       | K7         | VREG_L6_1P8  | Output Voltage<br>1V8 | P    | 1.62  | 1.8   | 1.98 |
| 192       | C2         | VREG_1P8_SYS | Output Voltage<br>1V8 | P    | 1.7   | 1.8   | 1.95 |
| 193       | E7         | VREG_L10_3P1 | Output Voltage<br>3V1 | P    | 3     | 3.088 | 3.1  |

Note6: VREG\_LDO\_SDC is for SDIO Supply IO voltage, it can provide two types of voltages (1.8V/2.95V), refer to JESD84-B51---Embedded Multi-Media Card (eMMC) Electrical Standard (5.1).

| GND       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GND       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Pin Count | Pin Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 194~735   | AH25,AG25,AF25,AE25,AD25,AC25,AB25,AA25,Y25,V25,T25,B25,AK14,AJ14,AH14,AG14,AF14,AE14,AD14,AC14,AB14,AA14,Y14,L14,K14,G14,F14,E14,B14,AK19,AJ19,AH19,AG19,AF19,AE19,AD19,AC19,AB19,AA19,Y19,W19,V19,U19,T19,R19,P19,N19,M19,L19,M24,N24,N23,G19,F19,E19,D19,C19,B19,AK8,AJ8,AH8,AG8,AF8,AE8,AD8,AC8,AB8,AA8,Y8,W8,V8,U8,T8,R8,P8,N8,M8,L8,C8,B2,AK22,AJ22,AH22,AG22,AF22,AE22,AD22,AC22,AB22,AA22,Y22,W22,V22,U22,T22,R22,P22,N22,G24,B22,D20,AK11,AJ11,AH11,AG11,AF11,AE11,AD11,AC11,AB11,AA11,Y11,L11,K11,J11,N1,P1,A15,B11,AK16,AJ16,AH16,AG16,AF16,AE16,AD16,AC16,AB16,AA16,Y16,W16,V16,U16,T16,R16,P16,N16,M16,L16,K16,J16,H16,G16,F16,E16,D16,C16,A16,AK5,AJ5,AH5,AG5,AF5,AE5,AD5,AC5,AB5,AA5,Y5,W5,V5,U5,T5,R5,P5,R2,P2,F5,E5,AK24,AJ24,AH24,AG24,AF24,AE24,AD24,AC24,AB24,AA24,Y24,W24,V24,U24,T24,A24,AK13,AJ13,AH13,AG13,AF13,AE13,AD13,AC13,AB13,AA13,Y13,L13,K13,T2,F13,E13,C13,A11,AK18,AJ18,AH18,AG18,AF18,AE18,AD18,AC18,AB18,AA18,Y18,W18,V18,U18,T18,R18,P18,N18,M18,L18,M23,J18,H18,G18,F18,E18,D18,B18,AK7,AJ7,AH7,AG7,AF7,AE7,AD7,AC7,AB7,AA7,Y7,W7,V7,U7,T7,R7,N3,K6,K8,K9,B7,AK21,AJ21,AH21,AG21,AF21,AE21,AD21,AC21,AB21,AA21,Y21,W21,V21,U21,T21,R21,P21,N21,M21,L21,M22,L23,R23,C21,A21,AK10,AJ10,AH10,AG10,AF10,AE10,AD10,AC10,AB10,AA10,Y10,L10,K10,G10,D10,B10,AK15,AJ15,AH15,AG15,AF15,AE15,AD15,AC15,AB15,AA15,Y15,W10,V10,U10,T10,R10,P10,N10,M10,L15,K15,H15,G15,F15,E15,B15,AK4,AJ4,AH4,AG4,AF4,AE4,AD4,AC4,AB4,AA4,Y4,W4,V4,U4,T4,R4,P4,N4,M4,AJ1,AH1,AG1,AF1,AE1,AD1,AC1,AB1,AA1,Y1,W1,V1,U1,T1,D11,C1,AK2,AJ2,AH2,AG2,AF2,AE2,AD2,AC2,AB2,AA2,Y2,W2,V2,U2,C14,A2,AK3,AJ3,AH3,AG3,AF3,AE3,AD3,AC3,AB3,AA3,Y3,W3,V3,U3,T3,M3,AK23,AJ2 |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | 3,AH23,AG23,AF23,AE23,AD23,AC23,AB23,AA23,Y23,W23,V23,U23,T23,AK12,AJ12,AH12,AG12,AF12,AE12,AD12,AC12,AB12,AA12,Y12,L12,K12,J12,R1,A14,C12,A10,AK17,AJ17,AH17,AG17,AF17,AE17,AD17,AC17,AB17,AA17,Y17,W17,V17,U17,T17,R17,P17,N17,M17,L17,K17,J17,H17,G17,F17,E17,D17,C17,A17,AK6,AJ6,AH6,AG6,AF6,AE6,AD6,AC6,AB6,AA6,Y6,W6,V6,U6,T6,R6,N2,R3,P3,G6,F6,E6,D6,AK20,AJ20,AH20,AG20,AF20,AE20,AD20,AC20,AB20,AA20,Y20,W20,V20,U20,T20,R20,P20,N20,M20,L20,L24,L22,P23,C20,A20,AK9,AJ9,AH9,AG9,AF9,AE9,AD9,AC9,AB9,AA9,Y9,W9,V9,U9,T9,R9,P9,N9,M9,L9,D9,C9,A7,M11,M12,M13,M14,M15,AK1,AK25,AL2,AL3,AL4,AL5,AL6,AL7,AL8,AL9,AL10,AL12,AL14,AL16,AL18,AL20,AL22,AL24 |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### 3. Electrical Specifications

#### 3.1. Power supply

The IMQC module receives and supplies power with the following potentials:

| Pin name      | Pin Number                          | Description           | Type | Input range(V) |       |      |
|---------------|-------------------------------------|-----------------------|------|----------------|-------|------|
|               |                                     |                       |      | Min.           | Typ.  | Max. |
| VPH_PWR       | L3,L2,L1,K3,K2,K1,J3,J2,J1,H3,H2,H1 | System Power          | PI   | 3.3            | 3.8   | 4.3  |
| VPH_PWRS      | N5,M5,P6,N6,M6,L6,P7,N7,M7,L7       | RF Power              | PI   | 3.3            | 3.8   | 4.3  |
| VREG_DBB1_3P3 | M1,M2                               | System Voltage        | PI   | 3.3            | 3.8   | 4.3  |
| VREG_LDO_SDC  | C18                                 | SDIO IO Voltage       | PI   | 1.7            | 1.8   | 1.95 |
| VBUS_DET      | H8                                  | VUSB Detection        | PI   | 4.75           | 5     | 5.25 |
| VREG_S4_1P9   | D5,D4                               | Output Voltage<br>1V9 | PO   | 1.824          | 1.88  | 2    |
| VREG_1P8_SYS  | C2                                  | Output Voltage<br>1V8 | PO   | 1.7            | 1.8   | 1.95 |
| VREG_L10_3P1  | E7                                  | Output Voltage 3V1    | PO   | 3              | 3.088 | 3.1  |
| VREG_L6_1P8   | K7                                  | IO Voltage            | PO   | 1.62           | 1.8   | 1.98 |

|         |    |            |    |     |     |      |
|---------|----|------------|----|-----|-----|------|
| SIMVCC1 | B6 | SIM1 Power | PO | 1.7 | 1.8 | 1.98 |
|---------|----|------------|----|-----|-----|------|

## 4. RF Specifications

### 4.1. LTE Conducted Power

LTE Conducted Power

| Band    | Items         | Parameter      | Unit | Design Target |
|---------|---------------|----------------|------|---------------|
| Band 2  | Max. TX Power | 20MHz 1RB/QPSK | dBm  | 23            |
| Band 5  | Max. TX Power | 20MHz 1RB/QPSK | dBm  | 23            |
| Band 12 | Max. TX Power | 20MHz 1RB/QPSK | dBm  | 23            |
| Band 14 | Max. TX Power | 20MHz 1RB/QPSK | dBm  | 23            |
| Band 30 | Max. TX Power | 20MHz 1RB/QPSK | dBm  | 22            |
| Band 66 | Max. TX Power | 20MHz 1RB/QPSK | dBm  | 23            |

LTE B2,5,12,14,66 Tolerance: +/- 2.7 dB

LTE B30 Tolerance: +/- 1.5 dB

### 4.2. 5G Conducted Power

5G Conducted Power

| Band | Items         | Parameter       | Unit | Design Target |
|------|---------------|-----------------|------|---------------|
| n2   | Max. TX Power | DFT-s-OFDM QPSK | dBm  | 23            |
| n5   | Max. TX Power | DFT-s-OFDM QPSK | dBm  | 23            |
| n12  | Max. TX Power | DFT-s-OFDM QPSK | dBm  | 23            |
| n30  | Max. TX Power | DFT-s-OFDM QPSK | dBm  | 22            |
| n66  | Max. TX Power | DFT-s-OFDM QPSK | dBm  | 23            |
| n77  | Max. TX Power | DFT-s-OFDM QPSK | dBm  | 25            |

n2, n5, n12, n66 Tolerance: +/- 2.7 dB

n30, n77 Tolerance: +/- 1.5 dB

### 4.3. LTE/5G Conducted Sensitivity

Minimum Conductive Sensitivity

| Band       | RX0   | RX1   | RX2   | RX3   | RX4   | RX5   | RX6   | RX7   |
|------------|-------|-------|-------|-------|-------|-------|-------|-------|
| LTE B2     | -93.3 | -93.3 | -93.3 | -93.3 | -93.3 |       |       |       |
| LTE B5     | -91.3 | -91.3 |       |       |       |       |       |       |
| LTE B12    | -90.3 | -90.3 |       |       |       |       |       |       |
| LTE B14    | -90.3 | -90.3 |       |       |       |       |       |       |
| LTE B29    | -91   | -91   |       |       |       |       |       |       |
| LTE B30    | -92.3 |       | -92.3 | -92.3 | -92.3 |       |       |       |
| LTE B66    | -92.8 | -92.8 | -92.8 | -92.8 | -92.8 |       |       |       |
| Sub 6G n77 | -92.6 | -92.6 | -92.6 | -92.6 | -92.6 | -92.6 | -92.6 | -92.6 |

Condition:

LTE: QPSK/BW 10MHz with Full RBs

Sub 6G: QPSK/BW 10MHz/SCS 30kHz

### 4.4. Antennas Map

#### 4.4.1 LTE

| Band | Uplink (UL)<br>MHz | Downlink (DL)<br>MHz | ANT0           |                | ANT1     |     | ANT2     | ANT3     | ANT4           | ANT5     | ANT6     | ANT7     | ANT12   | ANT13   |
|------|--------------------|----------------------|----------------|----------------|----------|-----|----------|----------|----------------|----------|----------|----------|---------|---------|
|      |                    |                      | Pin AL11       |                | Pin AL13 |     | Pin AL17 | Pin AL15 | Pin AL19       | Pin AJ25 | Pin AL23 | Pin AL21 | Pin W25 | Pin U25 |
|      |                    |                      | TX0            | RX0            | TX1      | RX1 | RX2      | RX3      | RX4            | RX5      | RX6      | RX7      | GPS RX  | GPS RX  |
| B29  | N/A                | 717-728              |                | V              |          | V   |          |          |                |          |          |          |         |         |
| B12  | 699-716            | 729-746              | V              | V              |          | V   |          |          |                |          |          |          |         |         |
| B14  | 788-798            | 758-768              | V              | V              |          | V   |          |          |                |          |          |          |         |         |
| B5   | 824-849            | 869-894              | V              | V              |          | V   |          |          |                |          |          |          |         |         |
| B66  | 1710-1780          | 2110-2200            | V <sup>1</sup> | V <sup>1</sup> | V        | V   | V        | V        | V <sup>1</sup> |          |          |          |         |         |
| B2   | 1850-1910          | 1930-1990            | V <sup>2</sup> | V <sup>2</sup> | V        | V   | V        | V        | V <sup>2</sup> |          |          |          |         |         |
| B30  | 2305-2315          | 2350-2360            |                |                | V        | V   | V        | V        | V              |          |          |          |         |         |

## 4.4.2 5G

| Band | Uplink (UL)<br>MHz | Downlink (DL)<br>MHz | ANT0             |                | ANT1             |     | ANT2           | ANT3           | ANT4           | ANT5           | ANT6           | ANT7           | ANT12   | ANT13   |
|------|--------------------|----------------------|------------------|----------------|------------------|-----|----------------|----------------|----------------|----------------|----------------|----------------|---------|---------|
|      |                    |                      | Pin AL11         |                | Pin AL13         |     | Pin AL17       | Pin AL15       | Pin AL19       | Pin AJ25       | Pin AL23       | Pin AL21       | Pin W25 | Pin U25 |
|      |                    |                      | TX0              | RX0            | TX1              | RX1 | RX2            | RX3            | RX4            | RX5            | RX6            | RX7            | GPS RX  | GPS RX  |
| n12  | 699-716            | 729-746              | V                | V              |                  | V   |                |                |                |                |                |                |         |         |
| n5   | 824-849            | 869-894              | V                | V              |                  | V   |                |                |                |                |                |                |         |         |
| n66  | 1710-1780          | 2110-2200            | V <sup>3</sup>   | V <sup>3</sup> | V                | V   | V              | V              | V <sup>3</sup> |                |                |                |         |         |
| n2   | 1850-1910          | 1930-1990            | V <sup>4</sup>   | V <sup>4</sup> | V                | V   | V              | V              | V <sup>4</sup> |                |                |                |         |         |
| n30  | 2305-2315          | 2350-2360            |                  |                | V                | V   | V              | V              | V              |                |                |                |         |         |
| n77  | 3300-4200          |                      | V <sup>5,6</sup> | V              | V <sup>5,6</sup> | V   | V <sup>6</sup> | V <sup>6</sup> | V <sup>6</sup> | V <sup>6</sup> | V <sup>6</sup> | V <sup>6</sup> |         |         |

## 4.4.3 GPS

| Band   | Downlink (DL)<br>MHz | ANT12   | ANT13   |
|--------|----------------------|---------|---------|
|        |                      | Pin W25 | Pin U25 |
|        |                      | GPS RX  | GPS RX  |
| GPS L1 | 1575.42              | V       |         |
| GPS L5 | 1176.45              |         | V       |

Note1: LTE B66 Tx/Rx works on ANT0 instead of ANT4 as the CA ENDC combos include

LTE B66/LTE B2 transmit simultaneously or

LTE B66/LTE B30 transmit simultaneously or

LTE B66/5G n2 transmit simultaneously or

LTE B66/5G n30 transmit simultaneously.

Note2: LTE B2 Tx/Rx works on ANT0 instead of ANT4 as the CA ENDC combos include

LTE B2/LTE B30 transmit simultaneously or

LTE B2/5G n30 transmit simultaneously or

LTE B2/LTE B66 transmit simultaneously or

LTE B2/ 5G n66 transmit simultaneously.

Note3: 5G n66 Tx/Rx works on ANT0 instead of ANT4 as the CA ENDC combos include

5G n66/LTE B2 transmit simultaneously or

5G n66/LTE B30 transmit simultaneously or

5G n66/5G n30 transmit simultaneously.

Note4: 5G n2 Tx/Rx works on ANT0 instead of ANT4 as the CA ENDC combos include

5G n2/LTE B30 transmit simultaneously.

Note5: Uplink MIMO is supported for 5G n77 and its combined power can be up to PC1.5.

Note6: n77 SRS function work on ANT0~ANT7.

Note7: The cells highlighted with color are single band default antenna.

#### 4.4.4 Antenna gain Limits

To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss is a mobile-only exposure condition must not exceed the limits below.

| Band           | Frequency (MHz)        | Max Antenna Gain(dBi) |
|----------------|------------------------|-----------------------|
| LTE Band 2     | 1850~1910              | 7.3                   |
| LTE Band 5     | 824~849                | 8.7                   |
| LTE Band 12    | 699~716                | 7.9                   |
| LTE Band 14    | 788~798                | 8.5                   |
| LTE Band 30    | 2305~2315              | 0.5                   |
| LTE Band 66    | 1710~1780              | 4.3                   |
| LTE CA Band 5B | 824~849                | 8.7                   |
| 5G NR n2       | 1850~1910              | 7.3                   |
| 5G NR n5       | 824~849                | 8.7                   |
| 5G NR n12      | 699~716                | 7.9                   |
| 5G NR n30      | 2305~2315              | 0.5                   |
| 5G NR n66      | 1710~1780              | 4.3                   |
| 5G NR n77      | 3450~3550<br>3700~3980 | 3.5                   |

## 5. Software Interface

### 5.1. USB Interface

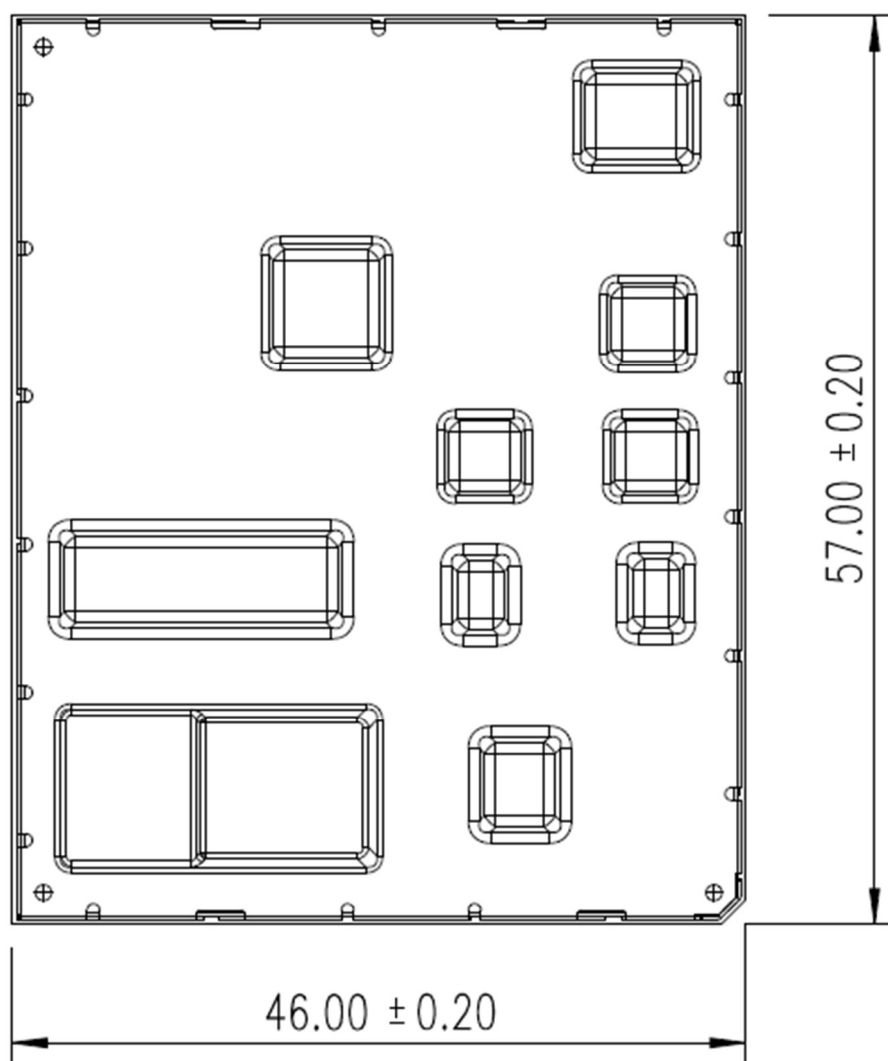
The IMQC module supports 3GPP's standard AT commands and proprietary AT commands.

## 6. Mechanical and Miscellaneous

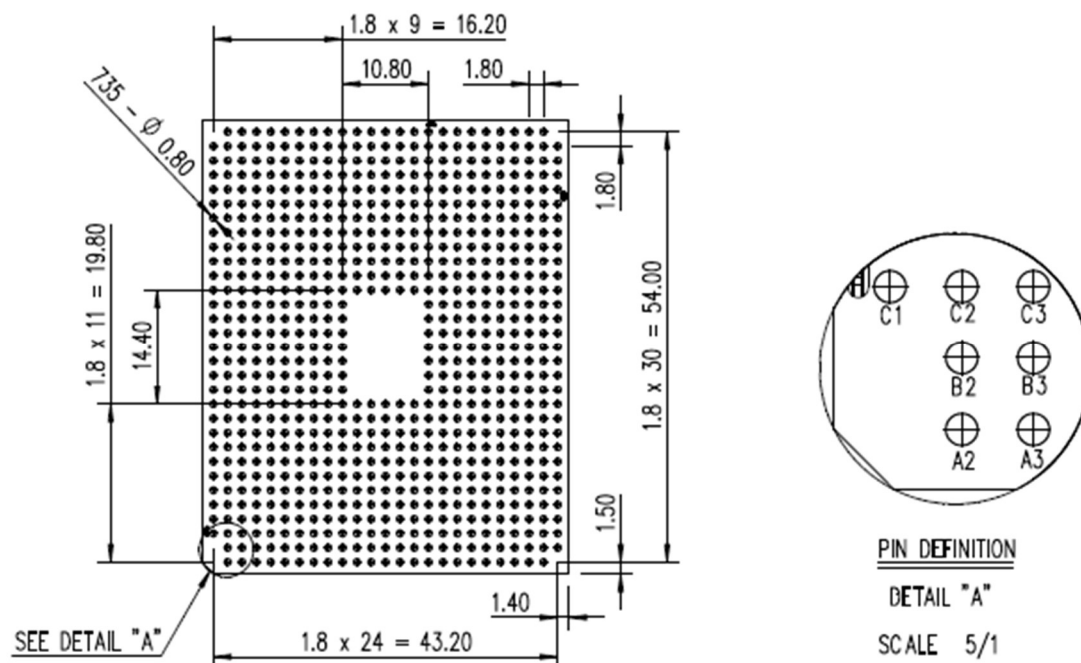
### 6.1. PCBA Form Factor

The dimensions of IMQC module as below:

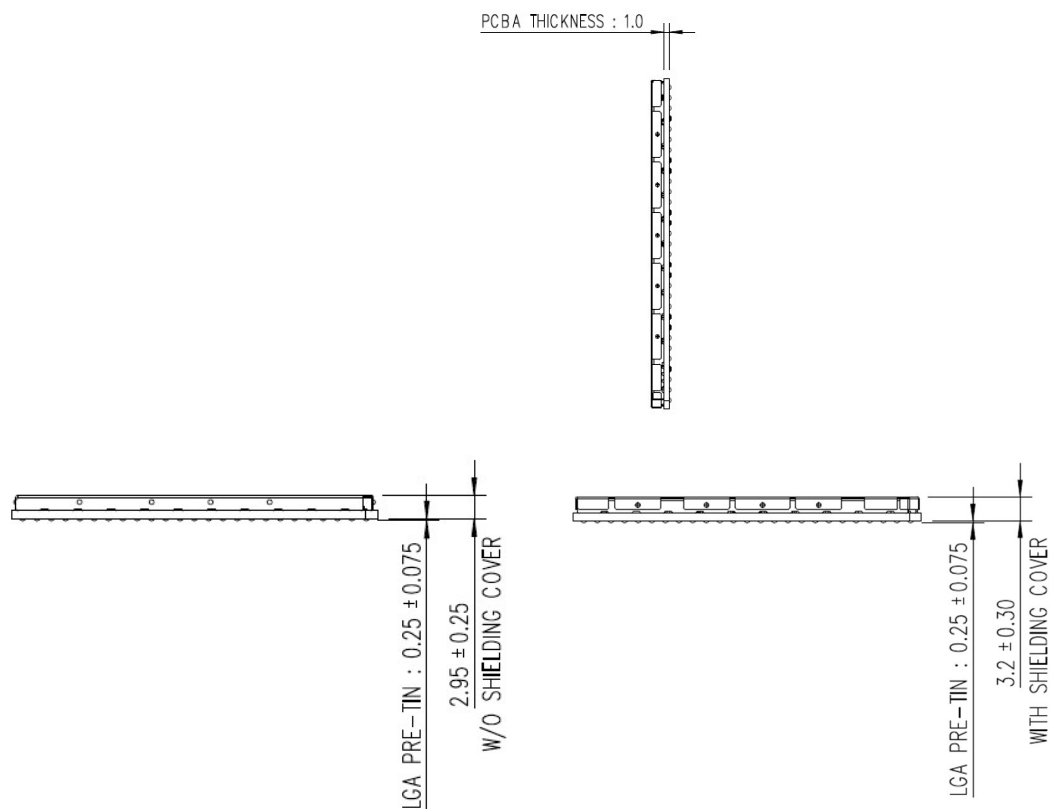
57mm (typ.) x 46 mm (typ.) x 3.2mm (typ.)



Module with shielding cover (Top side)



### Module LGA (Bottom side)



## Module Thickness

## 7. Design Guide

### 7.1. Power Supply

| Pin name | Pin Number                              | Description  | Type | Input range(V) |      |      |
|----------|-----------------------------------------|--------------|------|----------------|------|------|
|          |                                         |              |      | Min.           | Typ. | Max. |
| VPH_PWR  | L3,L2,L1,K3,K2,K1,J3,J2<br>,J1,H3,H2,H1 | System Power | PI   | 3.3            | 3.8  | 4.3  |

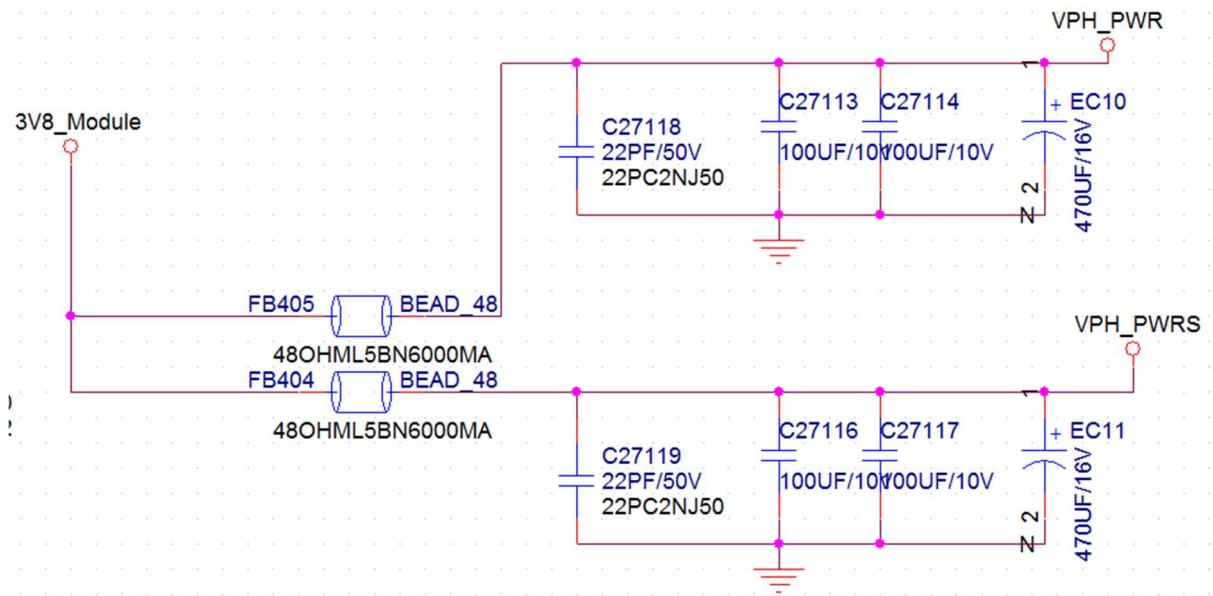
The Main Power input for this 5G module is VPH\_PWR which supplies the PMIC inside the module. The PMIC converts different power rails for different functions, respectively.

| Pin name | Pin Number                        | Description | Type | Input range(V) |      |      |
|----------|-----------------------------------|-------------|------|----------------|------|------|
|          |                                   |             |      | Min.           | Typ. | Max. |
| VPH_PWRS | N5,M5,P6,N6,M6,L6,P7<br>,N7,M7,L7 | RF Power    | PI   | 3.3            | 3.8  | 4.3  |

The Main RF Power input for this 5G module is VPH\_PWRS which supplies the ET chip inside the module.

Schematic suggestion:

To ensure that the voltage drop of VPH\_PWR/ VPH\_PWRS will not affect system performance, it's recommended to follow the capacitance that's a total of more than 400uF. These capacitors are required to place near VPH\_PWR/ VPH\_PWRS pins as close as possible.



| Net name              | Current Value |
|-----------------------|---------------|
| VPH_PWR               | 1.5A          |
| VPH_PWRS              | 1.5A          |
| VREG_DBB1_3P3         | 1600mA        |
| VREG_LDO_SDC          | 200mA         |
| VBUS_DET              | 500mA         |
| VREG_L6_1P8           | 600mA         |
| SIMVCC1(VREG_L11_1P8) | 150mA         |

## 7.2. RF Connector

IMQC provides 10 RF pads; developers can connect them via 50  $\Omega$  traces to the main board.

ANT0 (Pin AL11): UHB\_ANT0, MHB\_TX1/RX1, LB\_TX0/RX0

ANT1 (Pin AL13): UHB\_ANT1, MHB\_TX0/RX0, LB\_TX1/RX1

ANT2 (Pin AL17): UHB\_ANT2, MHB\_RX2

ANT3 (Pin AL15): UHB\_ANT3, MHB\_RX3

ANT4 (Pin AL19): UHB\_RX4, MHB\_RX4

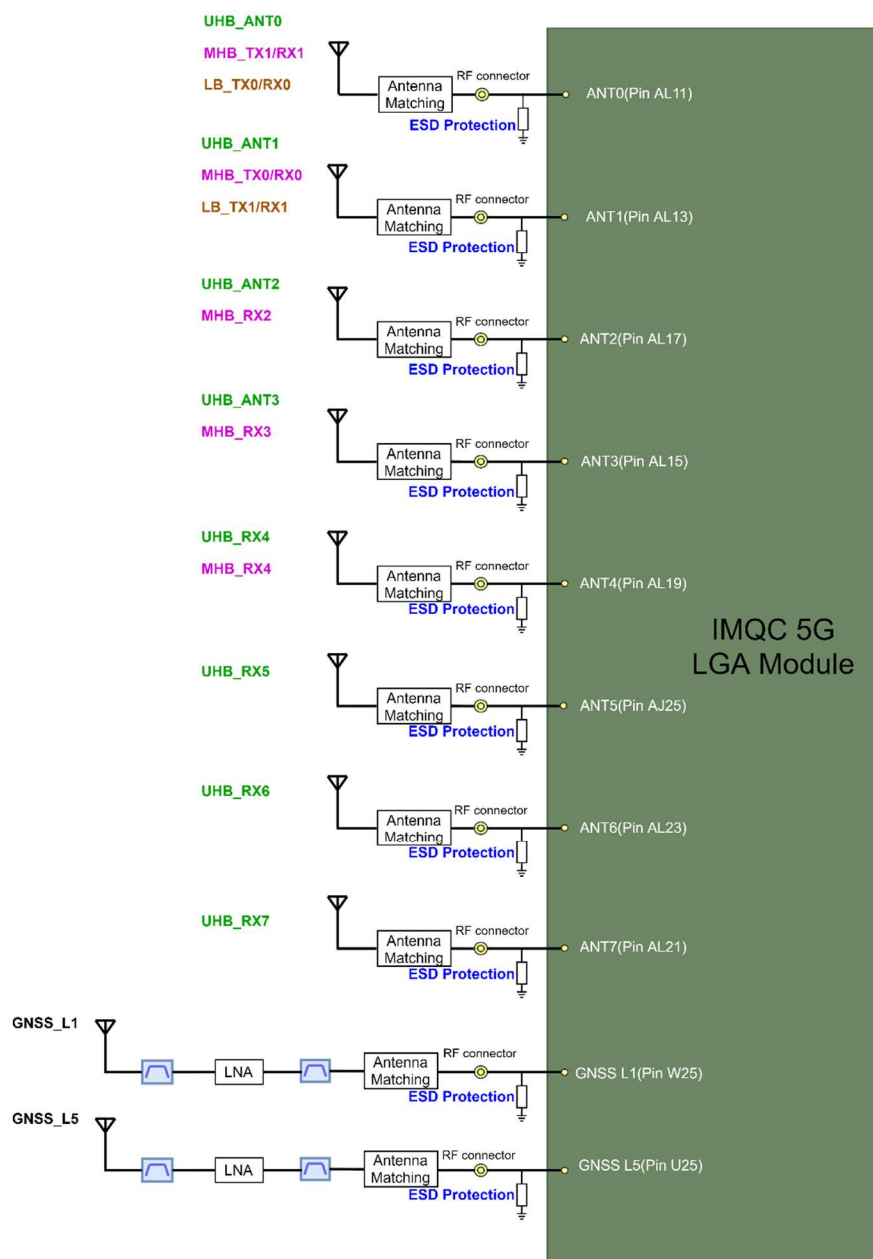
ANT5 (Pin AJ25): UHB\_RX5

ANT6 (Pin AL23): UHB\_RX6

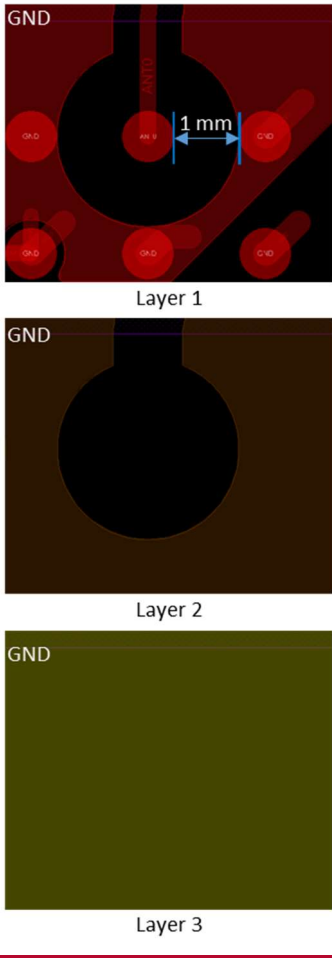
ANT7 (Pin AL21): UHB\_RX7

ANT12 (Pin W25): GNSS\_L1

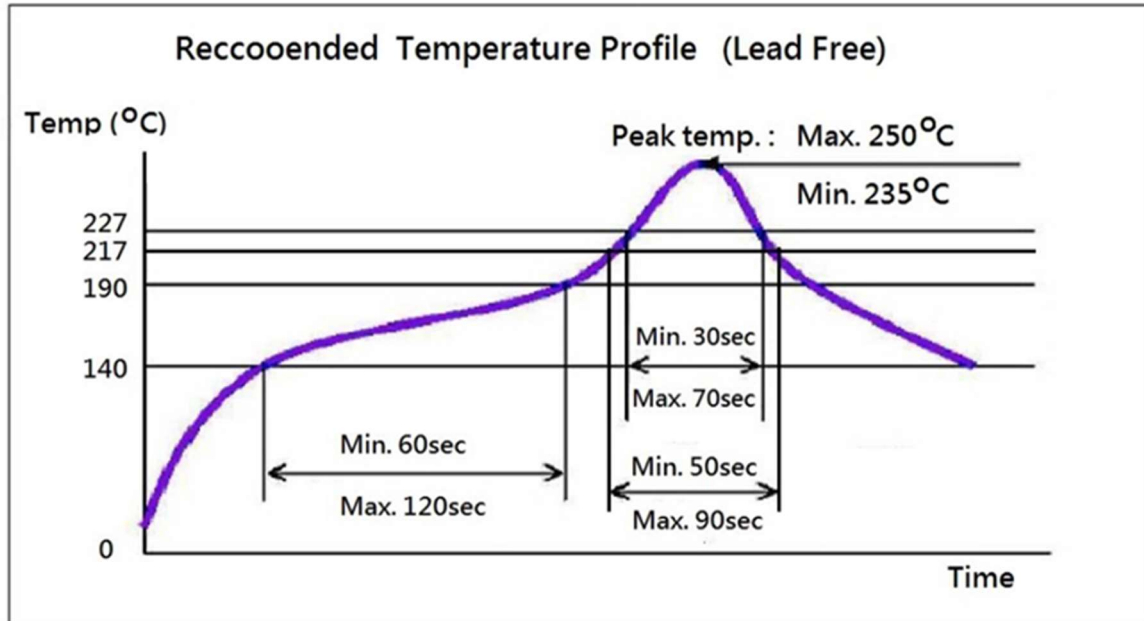
ANT13 (Pin U25): GNSS\_L5



We recommend that no grounds are present under the surface of IMQC's RF pads on Layer1. Details are shown in the below Figure. Layer2 has the same keep-out size as Layer1. Layer3 are as reference GND.



### 7.3. Reflow Profile



Peak Temperature : 235°C ~ 250°C

Reflow Zone (above 217°C) : 50 ~ 90 sec. (SAC305)

Preheat Zone (140°C ~ 190°C) : 60 ~ 120 sec.

Reflow Zone (above 227°C or 230°C) : 30 ~ 70 sec. (SN100C)



**Caution:** Do not reflow the module twice to avoid components to be short or damaged.

## 8. Safety Recommendation

Be sure the use of this product is allowed in the country and in the environment required.

The use of this product may be dangerous and must be avoided in the following areas:

- Where it can interfere with other electronic devices in environments such as hospitals, airports, and aircraft
- Where there is a risk of explosion such as gasoline stations and oil refineries

It is the responsibility of the user to comply with his or her country's regulations and any specific environmental regulations.

Do not disassemble the product; any mark of tampering will compromise the warranty's validity.

We recommend following the instructions of the hardware user guides to correctly wire the product. The product must be supplied with a stabilized voltage source, and the wiring must conform to all relevant security and fire-prevention regulations.

This product must be handled with care; avoid any contact with the pins because electrostatic discharge may damage the product. The same caution must be taken regarding the UIM card; carefully check the instructions for its use. Do not insert or remove the UIM when the product is in power-saving mode.

The system integrator is responsible for the functioning of the final product; therefore, care must be taken for external components of the module as well as for project or installation issues—there may be a risk of disturbing the GSM network or external devices or of having an impact on device security. If you have any doubts, please refer to the technical documentation and the relevant regulations in force.

Every module must be equipped with a proper antenna with specific characteristics. The antenna must be installed with care in order to avoid any interference with other electronic devices.

## FCC Statement:

### Federal Communications Commission Statement

This device complies with FCC Rules Part 15. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to Part 15 of the Federal Communications Commission (FCC) rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by doing one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

### FCC Caution

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

### Radiation Exposure Statement:

This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

This module is intended for OEM integrator. The OEM integrator is responsible for the compliance to all the rules that apply to the product into which this certified RF module is integrated. Additional testing and certification may be necessary when multiple modules are used.

**USERS MANUAL OF THE END PRODUCT**

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated.

The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied.

The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

**LABEL OF THE END PRODUCT**

The final end product must be labeled in a visible area with the following " Contains TX FCC ID: NKRIMQC ".

## Initialisms

Initialisms and definitions

| Abbreviation | Definition                                     |
|--------------|------------------------------------------------|
| 3GPP         | 3 <sup>rd</sup> Generation Partnership Project |
| AC           | Alternating Current                            |
| CDMA         | Code Division Multiple Access                  |
| DC           | Direct Current                                 |
| DBI          | Display Bus interface                          |
| FDMA         | Frequency Division Multi Access                |
| GND          | Ground                                         |
| GPIO         | General Purpose Input Output                   |
| I2C          | Inter-Integrated Circuit                       |
| LTE          | Long Term Evolution                            |
| AP           | Application Processor                          |
| MD           | Modem                                          |
| MIMO         | Multiple Input Multiple Output                 |
| MNO          | Mobile Network Operator                        |
| GRFC         | Generic RF control                             |
| BB           | Baseband                                       |
| RFFE         | RF Front End                                   |
| I2S          | Integrated Interchip Sound                     |
| SDIO         | Secure Digital Input/Output                    |
| PCIeG3       | PCI Express Generation 3                       |
| PCM          | Pulse-Code Modulation                          |
| PMIC         | Power Management Integrated Chip               |
| TDM          | Time-Division Multiplexing                     |
| SMA          | Subscriber Mount Antenna                       |

|       |                                             |
|-------|---------------------------------------------|
| SIM   | Subscriber Identity Module                  |
| SPI   | Serial Peripheral Interface                 |
| ADC   | Analog to Digital Converter                 |
| UART  | Universal Asynchronous Receiver-Transmitter |
| eMMc  | Embedded Multi Media Card                   |
| JTAG  | Joint Test Action Group                     |
| USB   | Universal Serial Bus                        |
| BGA   | Ball Grid Array                             |
| PMX65 | Qualcomm PMIC PMX65                         |
| PMK65 | Qualcomm PMIC PMK65                         |
| SDX65 | Qualcomm CPU SDX65                          |