



**COMPAL**

# 5G CMC-N3 Module

## User Manual

Version : AA

Update date : May 08, 2025



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## Notice

The document is subject to update from time to time owing to the product version upgrade or other reasons.

Unless otherwise specified, the document only serves as the user guide. All the statements, information and suggestions contained in the document do not constitute any explicit or implicit guarantee.



### Revision History

| Version | Date         | Name   | Major Changes                     |
|---------|--------------|--------|-----------------------------------|
| AA      | May 08, 2025 | HW V01 | ● First release for draft version |
|         |              |        |                                   |
|         |              |        |                                   |
|         |              |        |                                   |

### Applicability Table

| No. | Product model | Description                                                                                                                    |
|-----|---------------|--------------------------------------------------------------------------------------------------------------------------------|
| 1   | CMC-N3        | <u>All relevant LCC HW spec 、figures and design guidelines in this document are common specification for All 5G LCC model.</u> |
|     |               |                                                                                                                                |

#### Noted: Sample testing Scope and intended audience

When module version is Engineering samples (ES) and used in the early stages of development. The means these devices undergo limited testing and sometimes have significant feature limitations. They are suitable to assist with printed circuit board development, to conduct board-level electrical evaluation tests, and to explore manufacturing considerations.

Engineering samples should not be used for product-level & reliability qualification, power consumption optimize, and we also do not provide RMA analysis services on this version samples.



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## 1. Foreword

### 1.1 Introduction

This document describes the hardware of the COMPAL® 5G LCC Module product. It helps you quickly retrieve interface specifications, electrical and mechanical details, and information on the requirements to be considered for integrating further components. **All relevant LCC HW spec、figures and design guidelines in this document are common specification for All 5G LCC mode.**

### 1.2 Safety Information

The following safety precautions must be observed during all phases of operation, such as usage, service or repair of any cellular terminal or mobile incorporating with 5G LCC module. Manufacturers of the cellular terminal should send the following safety information to users and operating personnel, and incorporate these guidelines into all manuals supplied with the product. If not so, we assume no liability for customers' failure to comply with these precautions.



Full attention must be given to driving at all times in order to reduce the risk of an accident. Using a mobile while driving (even with a handsfree kit) causes distraction and can lead to an accident. Please comply with laws and regulations restricting the use of wireless devices while driving.



Switch off the cellular terminal or mobile before boarding an aircraft. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. If the device offers an Airplane Mode, then it should be enabled prior to boarding an aircraft. Please consult the airline staff for more restrictions on the use of wireless devices on boarding the aircraft.



Wireless devices may cause interference on sensitive medical equipment, so please be aware of the restrictions on the use of wireless devices when in hospitals, clinics or other healthcare facilities.



Cellular terminals or mobiles operating over radio signals and cellular network cannot be guaranteed to connect in all possible conditions (for example, with unpaid bills or with an invalid SIM card). When emergent help is needed in such conditions, please remember using emergency call. In order to make or receive a call, the cellular terminal or mobile must be switched on in a service area with adequate cellular signal strength.



The cellular terminal or mobile contains a transmitter and receiver. When it is ON, it receives and transmits radio frequency signals. RF interference can occur if it is used close to TV set, radio, computer or other electric- equipment.



In locations with potentially explosive atmospheres, obey all posted signs to turn off wireless devices such as your phone or other cellular terminals. Areas with potentially explosive atmospheres include fueling areas, below decks on boats, fuel or chemical transfer or storage facilities, areas where the air contains chemicals or particles such as grain, dust or metal powders, etc.



## Safety of Children

Do not allow children to use the wireless device without guidance. Small and sharp components of the wireless device may cause danger to children or cause suffocation if children swallow the components.

## Environment Protection

Observe the local regulations regarding the disposal of your packaging materials, used wireless device and accessories, and promote their recycling.

## WEEE Approval

The wireless device is in compliance with the essential requirements and other relevant provisions of the Waste Electrical and Electronic Equipment Directive 2012/19/EU (WEEE Directive).

## RoHS Approval

The wireless device is in compliance with the restriction of the use of certain hazardous substances in electrical and electronic equipment Directive 2011/65/EU (RoHS Directive).



### 1.3 Reference Standard (Under testing)

The design of the product complies with the following standards:

Table1-1 3GPP Standards

| 3GPP TS specification reference | Title                                                                                 | 3GPP Release used as the basis for this declaration |
|---------------------------------|---------------------------------------------------------------------------------------|-----------------------------------------------------|
| 23.122                          | Non-Access-Stratum functions related to Mobile Station (MS) in idle mode              | 11.4.0                                              |
| 24.008                          | Mobile radio interface Layer 3 specification; Core network protocols; Stage 3         | 11.5.0                                              |
| 25.331                          | Radio Resource Control (RRC); protocol specification                                  | 9.0.0                                               |
| 25.133                          | Requirements for Support of Radio Resource Management (FDD)                           | 13.2.0                                              |
| 25.101                          | Radio Transmission and Reception (FDD)                                                | 14.0.0                                              |
| 24.301                          | (NAS) protocol for Evolved Packet System (EPS); Stage 3                               | 11.7.0                                              |
| 36.101                          | (E-UTRA); User Equipment (UE) radio transmission and reception                        | 12.14.1                                             |
| 36.133                          | (E-UTRA); Requirements for support of radio resource management                       | 14.14.0                                             |
| 36.213                          | (E-UTRA) Physical layer procedures                                                    | 12.11.0                                             |
| 36.214                          | (E-UTRA) Physical layer measurements                                                  | 12.3.0                                              |
| 36.304                          | (E-UTRA); User Equipment (UE) procedures in idle mode                                 | 12.8.0                                              |
| 36.321                          | (E-UTRA); Medium Access Control (MAC) protocol specification                          | 12.9.0                                              |
| 36.322                          | (E-UTRA); Radio Link Control (RLC) protocol specification                             | 12.4.0                                              |
| 36.323                          | (E-UTRA); Packet Data Convergence Protocol (PDCP) specification                       | 12.6.0                                              |
| 36.331                          | (E-UTRA); Radio Resource Control (RRC); Protocol specification                        | 15.3.0                                              |
| 24.501                          | Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3                        | 15.1.0                                              |
| 38.331                          | NR;Radio Resource Control (RRC) protocol specification                                | 15.3.0                                              |
| 38.133                          | NR; Requirements for support of radio resource management                             | 15.3.0                                              |
| 38.213                          | NR; Physical layer procedures for control                                             | 15.3.0                                              |
| 38.323                          | NR; Packet Data Convergence Protocol (PDCP) protocol specification                    | 15.3.0                                              |
| 37.324                          | Service Data Adaptation Protocol (SDAP) specification                                 | 15.1.0                                              |
| 11.11/51.011                    | Specification of the Subscriber Identity Module - Mobile Equipment (SIM-ME) Interface | 4.15.0                                              |
| 31.102                          | Characteristics of the Universal Subscriber Identity Module (USIM) application        | 12.11.0                                             |
| 31.103                          | Characteristics of the IP Multimedia Services Identity Module (ISIM) application      | 12.2.0                                              |
| 31.101                          | UICC-terminal interface; Physical and logical characteristics                         | 12.2.0                                              |
| 27.007                          | AT command set for 3GPP User Equipment (UE)                                           | 9.9.0                                               |
| 36.355                          | (E-UTRA); LTE Positioning Protocol (LPP)                                              | 14.2.0                                              |
| 44.031                          | Location Services (LCS)– MS-SMLC Radio Resource LCS Protocol (RRLP)                   | 14.3.0                                              |

### Non-3GPP documentation:

Table1-2 ETSI

| Document Source | Title                                                                        | Version |
|-----------------|------------------------------------------------------------------------------|---------|
| ETSI            | TS 102 221: "UICC-Terminal interface; Physical and logical characteristics". | 12.1.0  |
| ETSI            | TS 102 223: "Smart Cards; Card Application Toolkit".                         | 12.3.0  |

Table1-3 GSMA

| Document Source | Title                                              | Version |
|-----------------|----------------------------------------------------|---------|
| GSMA            | IR.92 IMS Profile for Voice and SMS                | 8.0.0   |
| GSMA            | IR.94 IMS Profile for Conversational Video Service | 7.0.0   |



Table1-4 OMA

| Document Source | Title          | Version |
|-----------------|----------------|---------|
| OMA             | OMA-AD-SUPL-V1 |         |
| OMA             | OMA-AD-SUPL-V2 |         |

#### 1.4 Related Documents

- RF Antenna Application Design Specification
- 5G LCC Module System Driver Integration and Application Guidance
- 5G LCC Module AT Commands Manual



## 2. Overview

### 2.1 Introduction

CMC-N3 MODULE is a highly integrated 5G NR wireless communication module that adopts LCC pin with standard USB interface and backward supports with LTE system. It is applicable to most broadband communication networks of the mobile operator across the world. **All relevant LCC HW spec、figures and design guidelines in this document are common specification for All 5G LCC mode.**

### 2.2 Specification

Table 2-1 LCC module features

| Specification  |                                                                             |                             |
|----------------|-----------------------------------------------------------------------------|-----------------------------|
| Platform       | MTK MT6813                                                                  |                             |
| Memory         | 4Gb NAND Flash with 4Gb LPDDR MCP                                           |                             |
| Operating Band | 5G:<br>n2,n5,n7,n12,n13,n14,n25,n26,n30,n38,n41,n48,n66,n71,n77,n78         |                             |
|                | LTE:<br>B2,B4,B5,B7,B12,B13,B14,B17,B25,B26,B30,B38,B41,B42,B43,B48,B66,B71 |                             |
|                | Simultaneous GPS:<br>L1/L5, GPS, GLONASS, Galileo,SBAS and BeiDou           |                             |
| Downlink       | LTE                                                                         | LTE CAT.4                   |
|                | 5G sub-6                                                                    | 1CC; Max BW 20MHz; MIMO 2x2 |
| Uplink         | LTE                                                                         | LTE CAT.5                   |
|                | 5G sub-6                                                                    | 1CC; Max BW 20MHz; SISO     |
| HPUE           | Power Class 2: B41                                                          |                             |
| Power Supply   | DC 3.8V (typical) (3.4~4.4V)                                                |                             |
| Temperature    | Operating temperature <sup>[1]</sup> : -30°C ~+70°C                         |                             |
|                | Extended temperature <sup>[2]</sup> : -40°C ~+85°C                          |                             |
|                | Storage temperature: -40°C ~+85°C                                           |                             |
| Physical       | Dimension:32x29mm, Thickness=2.45mm(Typ.)                                   |                             |



|                    |                                                                                                                       |
|--------------------|-----------------------------------------------------------------------------------------------------------------------|
| characteristics    | Weight: 4.9g                                                                                                          |
| <b>Interface</b>   |                                                                                                                       |
| Antenna Port       | MAIN/DIV/GPS Antenna x 3                                                                                              |
|                    | Support 2x2 MIMO                                                                                                      |
| Function Interface | Option 1 : Single USIM 1.8/ 3V *1 and e-Sim design internally<br>Option 2 : Single USIM 1.8/ 3V * 2                   |
|                    | PCM(I2S) interface for Audio x 1                                                                                      |
|                    | PCI Gen 1, Single lane                                                                                                |
|                    | USB 2.0 HS                                                                                                            |
|                    | 2-wire UART for Debug<br>2-wire Coex_ UART for LTE/WLAN & coexistence                                                 |
|                    | Power on/off switch key pin                                                                                           |
|                    | Hardware reset pin x1<br>WLAN Disable pin x1                                                                          |
|                    | LED SINK control pin x1 (Support up to 12 mA)                                                                         |
|                    | I2C Interface x1                                                                                                      |
|                    | SPI Interface x1                                                                                                      |
|                    | GPIO (General-Purpose I/O) x 10                                                                                       |
|                    | Others Interface: (The trigger and read control de-pend on SW)<br>AUXADC (PMIC) x 2pin<br>MIPIx1 for Tunable ANT CTRL |
| <b>Software</b>    |                                                                                                                       |
| Protocol Stack     | IPV4/IPV6                                                                                                             |
| AT commands        | 3GPP TS 27.007 and 27.005                                                                                             |
| Firmware update    | FOTA                                                                                                                  |
| Management tool    | WebUI for user (Monitor data usage, manage device & network settings),                                                |



**NOTE:**

[1] When temperature goes beyond normal operating temperature range of  $-30^{\circ}\text{C} \sim +70^{\circ}\text{C}$ , RF performance of module may be slightly off 3GPP specifications.

[2] When the CMC-N3 module works at this temperature. NOT all its RF specifications comply with the 3GPP RF specifications

## 2.3 Circuit Block Diagram

Figure 2-1~2-2 shows the circuit block diagram of the LCC module. The major functional units of the LCC module contain the following parts:

- Power Management
- Baseband Controller
- Multi-chip Package (MCP) Memory
- RF Circuit

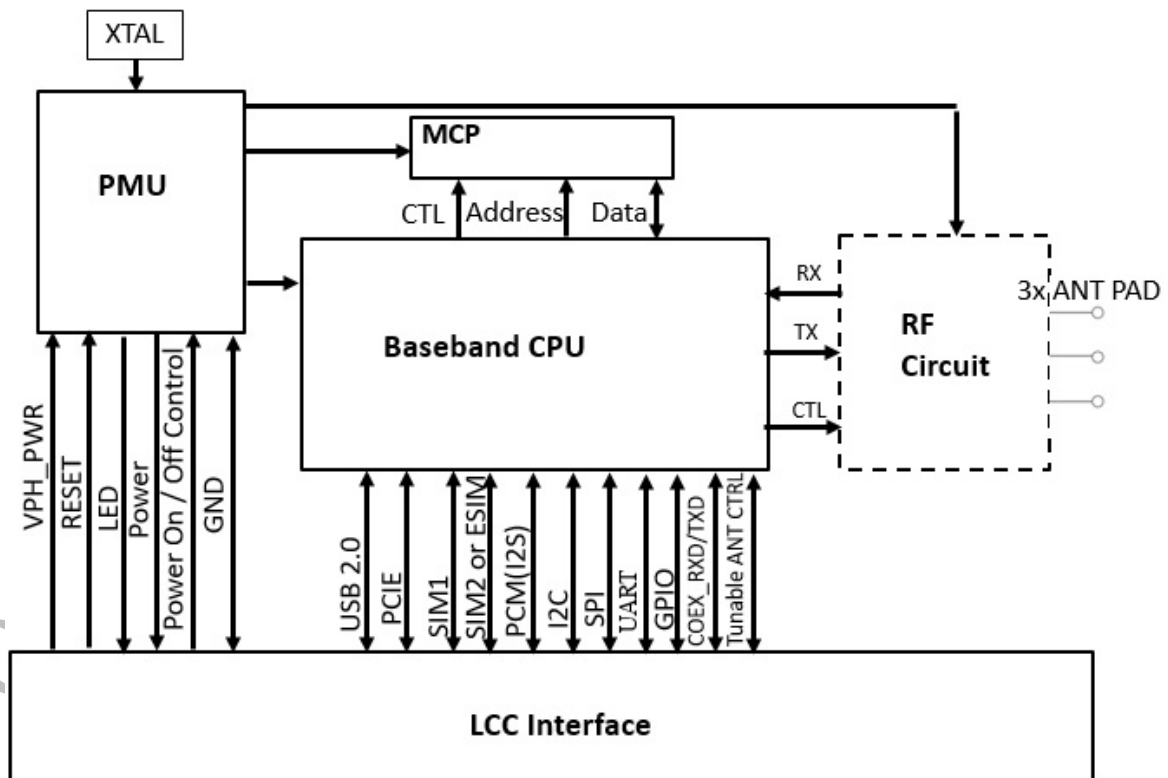


Figure 2-1 Circuit block diagram of the LCC module

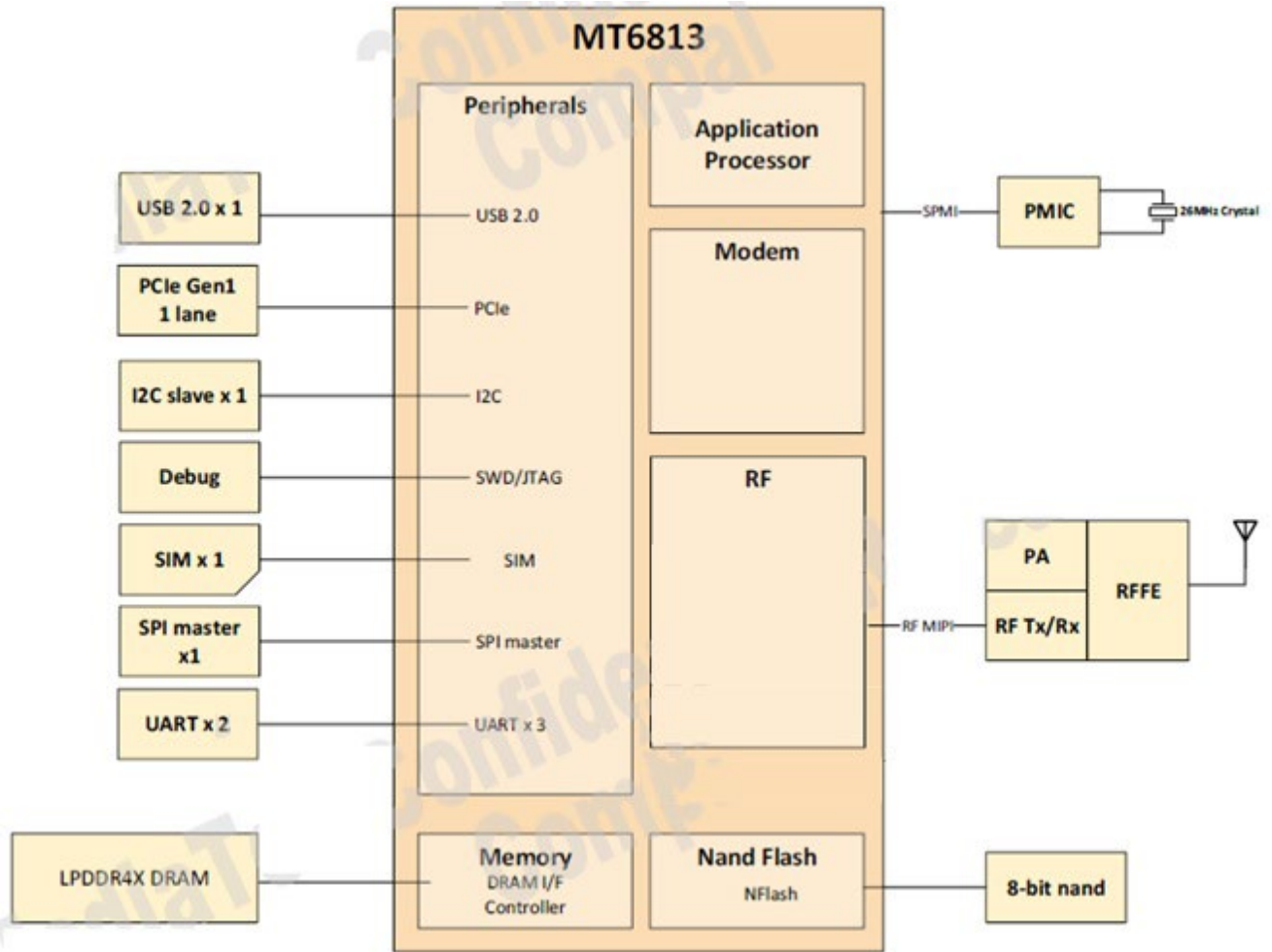


Figure 2-2 Example Overview Block Diagram of the LCC interfaces with other ICs

## 2.4 Application Block Diagram

### Peripherals Interface Description:

#### PCIe Interface:

The PCIe interface supports PCI Gen 1, Single lane.

#### USB Interface:

The USB interface supports USB 2.0 high speed standard.

#### SPI Interface:

Reserved for intelligent module in future.



### **USIM Interface:**

The USIM interface provides. There is support two SIM interface. DSSA (Dual SIM, Signal Active).

Option 1 : Single USIM 1.8/ 3V \*1 and e-Sim design internally

Option 2 : Single USIM 1.8/ 3V \* 2

### **Audio Interface:**

The module supports I2S/PCM interface (can be configured as either I2S or PCM interface)

### **I2C Interface:**

Reserved for intelligent module in future.

### **UART Interface:**

The module supports 2-wire UART x2 interfaces. One is only for debugging.

### **External Power Supply:**

Output Power Supply from LCC module:

A. Dual Voltage Support LV 1.8V/HV 3V IF for SIM Card Power.

B. VDD\_EXT: Voltage Support 1.8V for PU/PD level.

### **Extra Power Supply Require for LCC module:**

A. DC 3.8 V (4A) is recommended for module VPH\_PWR

### **RF Pad:**

RF antenna interface.

### **Tunable ANT CTRL:**

Since LTE bands cover wide frequency, tunable ANT CTRL helps customers for tunable antenna design. The firmware with this feature is in plan.

### 3. Application Interface

### 3.1 LCC Interface

The CMC-N3 module uses a 144-pin LCC as its external interface. For details about the module and dimensions, see 5.4 Dimensions and Interfaces.

### 3.2 Pin Map

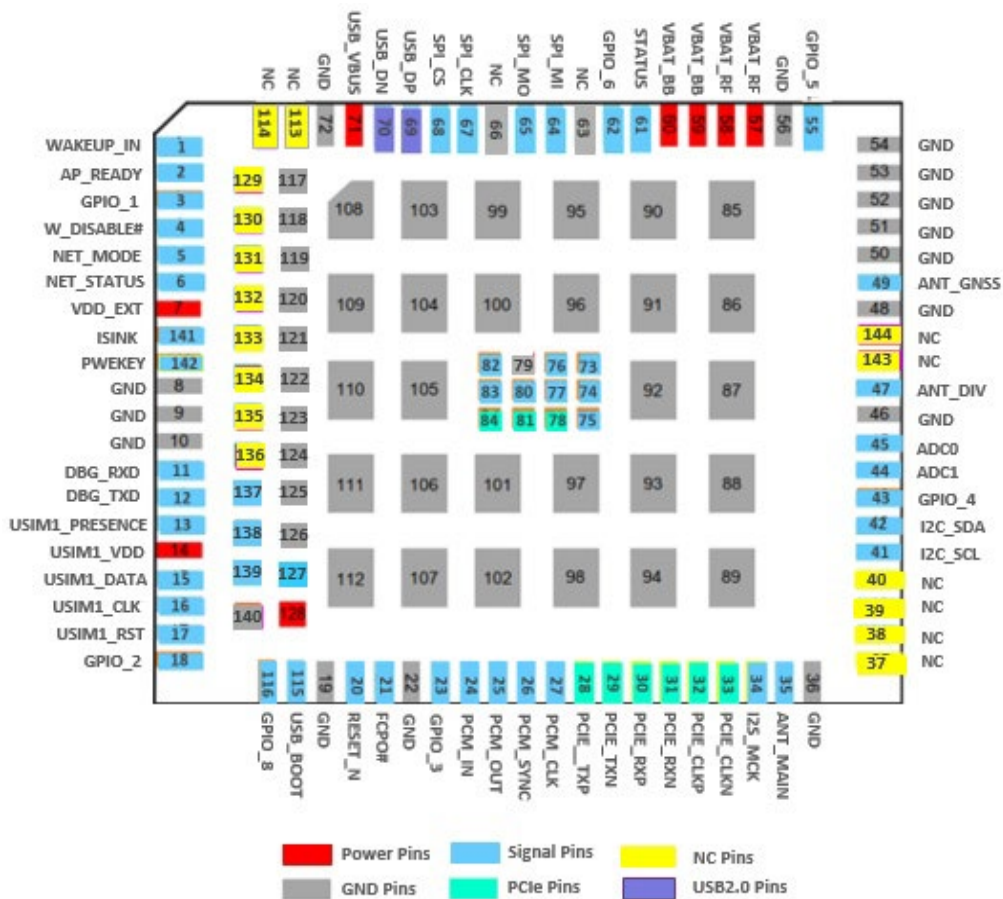


Figure 3-1 PAD Sequence of LCC module (Perspective View from TOP Side)

### 3.2.1 Pin Definition

The pin definition is as follows Table 3-1:

| 5G LCC Module |           |     |                                             |         |
|---------------|-----------|-----|---------------------------------------------|---------|
| Pin NO.       | Pin Name  | I/O | Pin Description                             | Type(V) |
| 1             | WAKEUP_IN | DI  | Sleep mode control                          | 1.8V    |
| 2             | AP_READY  | DI  | Application processor sleep state detection | 1.8V    |
| 3             | GPIO_1    | DIO | General-purpose IO(External Interrupt Mode) | 1.8V    |



|    |                 |     |                                                 |        |
|----|-----------------|-----|-------------------------------------------------|--------|
| 4  | W_DISABLE#      | DI  | Airplane mode control                           | 1.8V   |
| 5  | NET_MODE        | DO  | Indicate the module's network registration mode | 1.8V   |
| 6  | NET_STATUS      | DO  | Indicate the module's network activity status   | 1.8V   |
| 7  | VDD_EXT         | PO  | Voltage Support 1.8V for PU/PD level.           | 1.8V   |
| 11 | DBG_RXD         | DI  | Debug UART receive                              | 1.8V   |
| 12 | DBG_TXD         | DO  | Debug UART transmit                             | 1.8V   |
| 13 | USIM1_PRESENCE  | DI  | (U)SIM card hot plug detect                     | 1.8/3V |
| 14 | USIM1_VDD       | PO  | (U)SIM card power supply                        | 1.8/3V |
| 15 | USIM1_DATA      | DIO | (U)SIM card data                                | 1.8/3V |
| 16 | USIM1_CLK       | DO  | (U)SIM card clock                               | 1.8/3V |
| 17 | USIM1_RST       | DO  | (U)SIM card reset                               | 1.8/3V |
| 18 | GPIO_2          | DIO | General-purpose IO(External Interrupt Mode)     | 1.8V   |
| 20 | RESET_N         | DI  | PMIC RESET (Act_Low)                            | 1.8V   |
| 21 | FCPO#           | DI  | Turn on/off the module for M.2 module design    | VSYS   |
| 23 | GPIO_3          | DIO | General-purpose IO(External Interrupt Mode)     | 1.8V   |
| 24 | PCM_IN/I2S_DI   | DI  | PCM data input/I2S data input                   | 1.8V   |
| 25 | PCM_OUT/I2S_DO  | DO  | PCM data output/I2S data output                 | 1.8V   |
| 26 | PCM_SYNC/I2S_WS | DIO | PCM frame sync/I2S word select                  | 1.8V   |
| 27 | PCM_CLK/I2S_CLK | DIO | PCM clock/I2S Clock                             | 1.8V   |
| 28 | PCIE_TX_P       | O   | PCle TX Differential signals Positive           |        |
| 29 | PCIE_TX_M       | O   | PCle TX Differential signals Negative           |        |
| 30 | PCIE_RX_P       | I   | PCle RX Differential signals Positive           |        |
| 31 | PCIE_RX_M       | I   | PCle RX Differential signals Negative           |        |
| 32 | PCIE_REFCLK_P   | I   | PCle Reference Clock signal Positive            |        |
| 33 | PCIE_REFCLK_N   | I   | PCle Reference Clock signal Negative            |        |
| 34 | I2S_MCK         | DO  | I2S Master clock                                | 1.8V   |
| 35 | ANT_MAIN        | AIO | Main antenna interface                          | -      |
| 41 | I2C_SCL         | DIO | I2C serial clock. (for external codec)          | 1.8V   |
| 42 | I2C_SDA         | DIO | I2C serial data. (for external codec)           | 1.8V   |
| 43 | GPIO_4          | DIO | General-purpose IO(External Interrupt Mode)     | 1.8V   |
| 44 | ADC1            | AI  | General-purpose ADC interface                   | 1.8V   |
| 45 | ADC0            | AI  | General-purpose ADC interface                   | 1.8V   |
| 47 | ANT_DIV         | AI  | Diversity antenna interface                     | -      |
| 49 | ANT_GNSS        | AI  | GNSS antenna interface                          | -      |



|    |                |     |                                                                                        |         |
|----|----------------|-----|----------------------------------------------------------------------------------------|---------|
| 55 | GPIO_5         | DIO | General-purpose IO(External Interrupt Mode)                                            | 1.8V    |
| 57 | VBAT_RF        | PI  | Power supply for module's RF part                                                      | 3.8V    |
| 58 | VBAT_RF        | PI  | Power supply for module's RF part                                                      | 3.8V    |
| 59 | VBAT_BB        | PI  | Power supply for module's baseband part                                                | 3.8V    |
| 60 | VBAT_BB        | PI  | Power supply for module's baseband part                                                | 3.8V    |
| 61 | STATUS         | DO  | Indicate the module's operation status                                                 | 1.8V    |
| 62 | GPIO_6         | DIO | General-purpose IO                                                                     | 1.8V    |
| 64 | SPI_MI         | DI  | Master input                                                                           | 1.8V    |
| 65 | SPI_MO         | DO  | Master output                                                                          | 1.8V    |
| 67 | SPI_CLK        | DO  | Serial Clock                                                                           | 1.8V    |
| 68 | SPI_CS         | DO  | Slave Select                                                                           | 1.8V    |
| 69 | USB_DP         | AIO | USB differential data (+)                                                              |         |
| 70 | USB_DM         | AIO | USB differential data (-)                                                              |         |
| 71 | USB_VBUS       | DIO | USB connection detection                                                               | 5V      |
| 73 | GPIO_7         | DIO | General-purpose IO                                                                     | 1.8V    |
| 74 | RESERVED       | AO  | DCXO26M, 26MHz clock output                                                            | 1.2V    |
| 75 | MIPI_CLK       | O   | MIPI Interface for Tunable ANT,<br>RFFE clock, Open Drain output.                      | 1.8V    |
| 76 | MIPI_DATA      | O   | MIPI Interface for Tunable ANT,<br>RFFE data, Open Drain output.                       | 1.8V    |
| 77 | USIM2_PRESENCE | DI  | Enter USB force download mode (High: enter<br>normal boot ; Low: enter force download) | 1.8V/3V |
| 78 | PCIE_PEWAKEN   | DI  | PCIE WAKE                                                                              | 1.8V    |
| 80 | USIM2_CLK      | DO  | SIM2 Clock                                                                             | 1.8/3V  |
| 81 | PCIE_PERSTN    | DI  | PCIE Reset                                                                             | 1.8V    |
| 82 | USIM2_RST      | DO  | SIM2 reset                                                                             | 1.8/3V  |
| 83 | USIM2_DATA     | DIO | SIM2 data                                                                              | 1.8/3V  |
| 84 | PCIE_CLKREQN   | DO  | PCIE Clock request                                                                     | 1.8V    |



|                                                    |               |     |                                                                                     |           |
|----------------------------------------------------|---------------|-----|-------------------------------------------------------------------------------------|-----------|
| 115                                                | USB_BOOT      | DIO | Enter USB force download mode (High: enter normal boot ; Low: enter force download) | 1.8V      |
| 116                                                | GPIO_8        | DIO | General-purpose IO(External Interrupt Mode)                                         | 1.8V      |
| 127                                                | GPIO_9        | DIO | General-purpose IO(External Interrupt Mode)                                         | 1.8V      |
| 128                                                | USIM2_VDD     | PO  | SIM2 power supply                                                                   | 1.8/3V    |
| 137                                                | COEX_UART_RXD | DO  | Main UART receive                                                                   | 1.8V      |
| 138                                                | COEX_UART_TXD | DI  | Main UART transmit                                                                  | 1.8V      |
| 139                                                | GPIO_10       | DIO | General-purpose IO(External Interrupt Mode)                                         | 1.8V      |
| 141                                                | ISINK         | AO  | Current sink for LED                                                                | 12mA(max) |
| 142                                                | PWRKEY        | DI  | Normal power on key for MIFI/Dongle/CPE design                                      | 1.8V      |
| 85~112                                             | PAD GND       |     | PAD GND                                                                             | GND       |
| 8~10,19,22,36,46,48,50~54,56,72                    | D_GND         |     | GND                                                                                 | GND       |
| 37~40,63,66,79,113,114,117~126,129~136,140,143,144 | NC            |     | Not Connection                                                                      | NC        |

AI : Analog input

AO : Analog output

B : Bidirectional digital with CMOS input

PD: Pull-Down

PU: Pull-Up

T: Tristate

OD: Open Drain

PP: Push-Pull

PI: Power Input

PO: Power Output

Z: High-impedance (Hi-Z) output



**NOTE:**

The unused pins can be left floating.

- **P** indicates power pins; **I** indicate pins for digital signal input; **O** indicates pins for digital signal output; **PO** indicates power output pins; **PI** indicates power input pins.
- **VIL** indicates Low-level Input voltage; **VIH** indicates High-level Input voltage; **VOL** indicates Low-level Output voltage; **VOH** indicates High-level Output voltage.
- The **NC** pins are not connected, therefore, before you deal with these pins; please refer to the corresponding hardware guide.
- The **Reserved** pins are internally connected to the module. Therefore, these pins should not be used, otherwise they may cause problems. Please contact with us for more details about this information.



### 3.3 RF Antenna Interface

The LCC module provides three antenna pads (as shown below) for connecting the external antennas.

The RF pad difference is the most important difference between LCC modules; please refer to 29 mm x 32 mm LCC Module Hardware Migration Guide.

Route the antenna pad as close as possible to antenna connector. In addition, the impedance of RF signal traces must be 50  $\Omega$ .

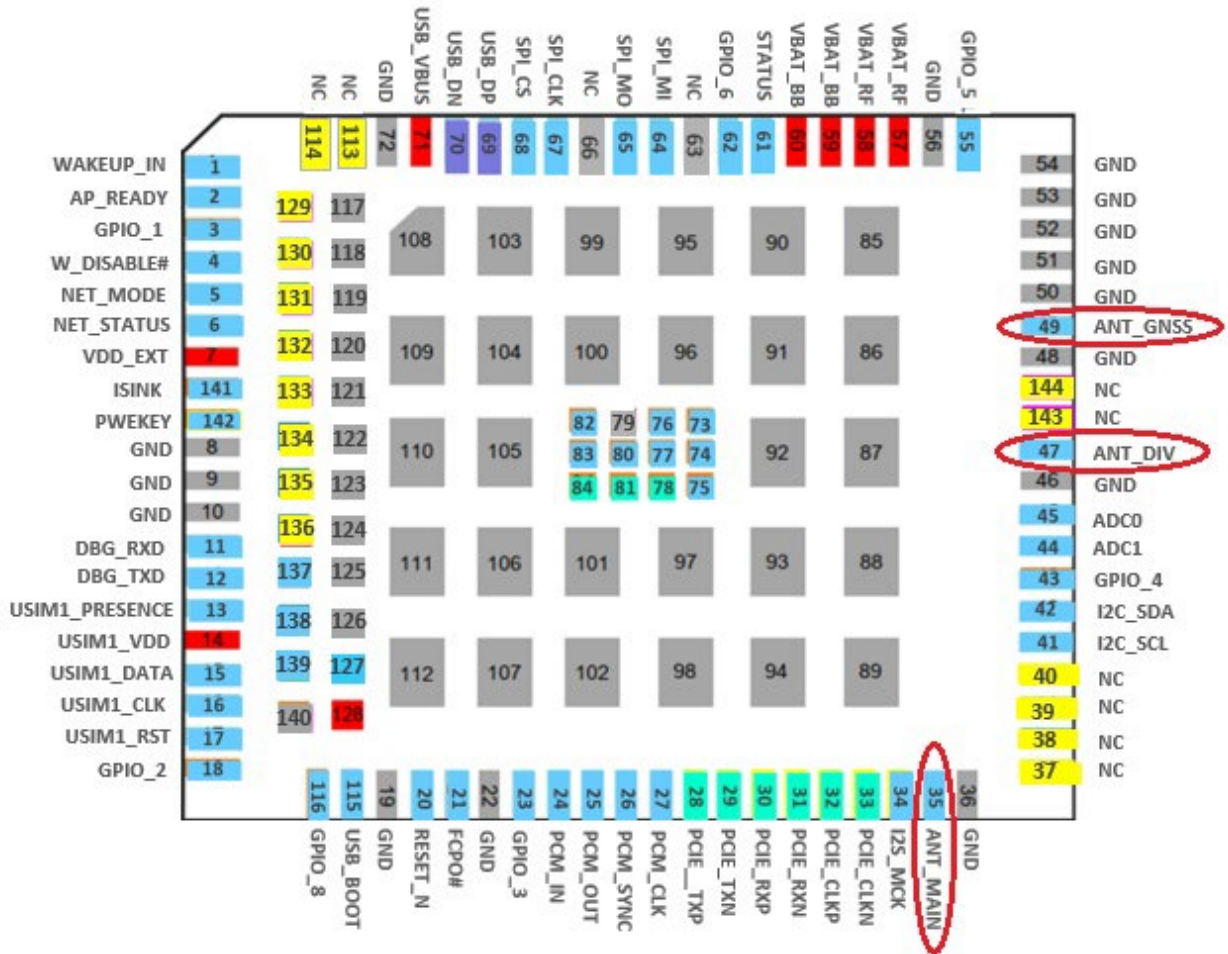


Table 3-18 Definition of the antenna port mapping

| Frequency | Ant GNSS(49) | Ant DIV(47) | Ant MAIN(35) |
|-----------|--------------|-------------|--------------|
| LB        | 600-960MHz   | Rx          | Tx/Rx        |
| MB/HB     | 1710-2690MHz | Rx          | Tx/Rx        |
| UHB       | 3300-5000MHz | Rx          | Tx/Rx        |
| GPS L1    | 1575-1610MHz | Rx          |              |
| GPS L5    | 1176MHz      | Rx          |              |



Supported air Interfaces for each of band groups are listed in the following table 3-19.

Table 3-19

| Band Group | Fmin (MHz) | Fmax (MHz) | Air Interface                                                                                           |
|------------|------------|------------|---------------------------------------------------------------------------------------------------------|
| LB         | 600        | 960        | LTE FDD: B5/12/13/14/17/26/71<br>LTE TDD: N/A<br>5G NR FR1 FDD: n5/12/13/14/26/71<br>5G NR FR1 TDD: N/A |
| MB         | 1710       | 2170       | LTE FDD: B2/4/25/66<br>LTE TDD: N/A<br>5G NR FR1 FDD: n2/25/66<br>5G NR FR1 TDD: N/A                    |
| HB         | 2300       | 2690       | LTE FDD: B7/30<br>LTE TDD: B38/41<br>5G NR FR1 FDD: n7/30<br>5G NR FR1 TDD: n38/41                      |
| UHB        | 3300       | 4200       | LTE FDD: N/A<br>LTE TDD: B42/43/48<br>5G NR FR1 FDD: N/A<br>5G NR FR1 TDD: n48/77/78                    |



## 4. Overview

This chapter describes the RF specifications of the LCC module, including:

- Operating Frequencies
- Conducted Rx Sensitivity and Tx Power
- Antenna Design Requirements



### NOTE:

Keep the trace length between RF connector and LCC ANT pin as short as possible to secure test data close to EVB measurement result. (Suggest to limit the length within 6mm.)

### 4.1 Transmitting Power

The transmitting power for each band of the LCC module as shown in the following table:

Table 4-2 LTE FDD

| Mode    | Band    | Typical Value (dBm) | Tolerance |
|---------|---------|---------------------|-----------|
| LTE FDD | Band 2  | 23.5                | ±1        |
|         | Band 4  | 23.5                | ±1        |
|         | Band 5  | 23.5                | ±1        |
|         | Band 7  | 23.5                | ±1        |
|         | Band 12 | 23.5                | ±1        |
|         | Band 13 | 23.5                | ±1        |
|         | Band 14 | 23.5                | ±1        |
|         | Band 17 | 23.5                | ±1        |
|         | Band 25 | 23.5                | ±1        |
|         | Band 26 | 23.5                | ±1        |
|         | Band 30 | 23.0                | ±1        |
|         | Band 66 | 23.5                | ±1        |
|         | Band 71 | 23.5                | ±1        |

Table 4-3 LTE TDD

| Mode    | Band    | Typical Value (dBm) | Tolerance |
|---------|---------|---------------------|-----------|
| LTE TDD | Band 38 | 23.5                | ±1        |
|         | Band 41 | 26.0                | ±1        |



|  |         |      |    |
|--|---------|------|----|
|  | Band 42 | 22.0 | ±1 |
|  | Band 43 | 22.0 | ±1 |
|  | Band 48 | 22.0 | ±1 |

Table 4-4 NR-FR1 FDD

| Mode          | Band | Typical Value (dBm) | Tolerance |
|---------------|------|---------------------|-----------|
| NR-FR1<br>FDD | n2   | 23.5                | ±1        |
|               | n5   | 23.5                | ±1        |
|               | n7   | 23.5                | ±1        |
|               | n12  | 23.5                | ±1        |
|               | n13  | 23.5                | ±1        |
|               | n14  | 23.5                | ±1        |
|               | n25  | 23.5                | ±1        |
|               | n26  | 23.5                | ±1        |
|               | n30  | 23.0                | ±1        |
|               | n66  | 23.5                | ±1        |
|               | n71  | 23.5                | ±1        |

Table 4-5 NR-FR1 TDD

| Mode          | Band | Typical Value (dBm) | Tolerance |
|---------------|------|---------------------|-----------|
| NR-FR1<br>TDD | n38  | 23.5                | ±1        |
|               | n41  | 23.5                | ±1        |
|               | n48  | 22.0                | ±1        |
|               | n77  | 23.5                | ±1        |
|               | n78  | 23.5                | ±1        |



**NOTE:**

Tx Power is based on no maximum power reduction (MPR) configuration as 3GPP defined.  
For configurations that require MPR or additional MPR, refer to 3GPP for the power reduction.



## 4.2 Receiver Sensitivity

The receiver sensitivity for each band of the 5G LCC Module as shown in the following table:

Table 4-6 LTE band

|                    | Band | Single Port(dBm) |     | Combined Port(dBm) |           |
|--------------------|------|------------------|-----|--------------------|-----------|
|                    |      | PRx              | DRx | 2-RX               | 3GPP spec |
| Mode<br>10MHz, 15K | B2   | TBD              | TBD | TBD                | -95.0     |
|                    | B4   | TBD              | TBD | TBD                | -97.0     |
|                    | B5   | TBD              | TBD | TBD                | -95.0     |
|                    | B7   | TBD              | TBD | TBD                | -95.0     |
|                    | B12  | TBD              | TBD | TBD                | -94.0     |
|                    | B13  | TBD              | TBD | TBD                | -94.0     |
|                    | B14  | TBD              | TBD | TBD                | -94.0     |
|                    | B17  | TBD              | TBD | TBD                | -94.0     |
|                    | B25  | TBD              | TBD | TBD                | -93.5     |
|                    | B26  | TBD              | TBD | TBD                | -94.5     |
|                    | B30  | TBD              | TBD | TBD                | -96.0     |
|                    | B38  | TBD              | TBD | TBD                | -97.0     |
|                    | B41  | TBD              | TBD | TBD                | -95.0     |
|                    | B42  | TBD              | TBD | TBD                | -96.0     |
|                    | B43  | TBD              | TBD | TBD                | -96.0     |
|                    | B48  | TBD              | TBD | TBD                | -96.0     |
|                    | B66  | TBD              | TBD | TBD                | -96.5     |
|                    | B71  | TBD              | TBD | TBD                | -94.2     |

Table 4-7 NR band

| Mode      | Band | Single Port(dBm) |     | Combined Port(dBm) |           |
|-----------|------|------------------|-----|--------------------|-----------|
|           |      | PRx              | DRx | 2-RX               | 3GPP spec |
| 10MHZ,15K | n2   | TBD              | TBD | TBD                | -94.8     |
|           | n5   | TBD              | TBD | TBD                | -94.8     |
|           | n7   | TBD              | TBD | TBD                | -94.8     |
|           | n12  | TBD              | TBD | TBD                | -93.8     |
|           | n13  | TBD              | TBD | TBD                | -93.8     |
|           | n14  | TBD              | TBD | TBD                | -93.8     |
|           | n25  | TBD              | TBD | TBD                | -93.3     |



|  |     |     |     |     |       |
|--|-----|-----|-----|-----|-------|
|  | n26 | TBD | TBD | TBD | -94.5 |
|  | n30 | TBD | TBD | TBD | -95.8 |
|  | n38 | TBD | TBD | TBD | -96.8 |
|  | n41 | TBD | TBD | TBD | -94.8 |
|  | n48 | TBD | TBD | TBD | -95.8 |
|  | n66 | TBD | TBD | TBD | -96.3 |
|  | n71 | TBD | TBD | TBD | -94.0 |
|  | n77 | TBD | TBD | TBD | -95.3 |
|  | n78 | TBD | TBD | TBD | -95.8 |



**NOTE:**

The typical result is at room temperature and based on Lab test result and Call box only at a shielded test environment.

Follow 3GPP specification

### 4.3 GNSS

5G LCC Module supports L1/L5, GPS, GLONASS, Galileo, SBAS and BeiDou

Table 4-8

|     | Condition              |             | Test Result(TBU) |
|-----|------------------------|-------------|------------------|
| GPS | TTFF(a)                | Cold start  | TBU              |
|     |                        | Hot Start   | TBU              |
|     | Receive Sensitivity(b) | Tracking    | TBU              |
|     |                        | Acquisition | TBU              |



**NOTE:**

a. Acquisition times measured with signal strength = -130dBm.

b. Performance is tested in conducted mode with a GNSS signal simulator under room temperature.



#### 4.4 Ordering information

**All relevant LCC HW spec、figures and design guidelines in this document are common specification for All 5G LCC model**

##### 4.4.1 Specification-compliant devices

This device can be ordered using the identification code shown in Table5-4.

Table 5-4 Device ordering information

| Character | 1st | 2nd             | 3rd            | 4th              | 5th     | 6th | 7th | 8th | 9th         | 10th        | 11 th       |
|-----------|-----|-----------------|----------------|------------------|---------|-----|-----|-----|-------------|-------------|-------------|
| Module    |     | Module Solution | Module Type    | SKU Region       | Version |     |     |     | Sample Type | RF Band SKU | Memory Size |
| Code      | C   | M (MTK)         | C (LCC Module) | N = US<br>E = EU | (1-9)   |     |     |     |             |             | TBD         |



**NOTE:**

Example 1: CMC-N3

Example 2: CMC-E3

#### 4. FCC Notice

Model: CMC-N3

##### Important Notice to OEM integrators

1. This module is limited to OEM installation ONLY.
2. List of applicable FCC rules: 47 CFR Part 22/24/27/90/96
3. This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b). 3. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations 4. For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with Part 15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should



confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions). The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are compliant with the transmitter(s) rule(s).

4. Note EMI Consideration: KDB 996369 D04 Module Integration Guide has been considered as “best practice” for RF design engineering testing and evaluation of non-linear interactions which can generate additional non-compliant limits due to module placement to host components or properties.

5. How to make changes: Only Grantees are permitted to make permissive changes. Please contact us if the host integrator expects the module to be used differently than as granted:

Compal Electronics Inc

Miranda Wu

Miranda\_wu@compal.com

## Antenna Installation

- (1) The antenna must be installed such that 20 cm is maintained between the antenna and users.
- (2) The transmitter module may not be co-located with any other transmitter or antenna.
- (3) To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile exposure condition must not exceed:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

## Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

## Module Warning statements

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



(1) This device may not cause harmful interference

(2) This device must accept any interference received, including interference that may cause undesired operation.

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

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the 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 does cause 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 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.

## RF Exposure

This device has been tested and meets applicable limits for Radio Frequency (RF) exposure. The antenna(s) used for this transmitter should be installed and operated with minimum distance 20 cm between the radiator & your body.

## Label requirements

Any device incorporating this module must include an external, visible, permanent marking or label which states:

“Contains FCC ID: GKRCMCN3”

## Radiation Exposure Statement



This equipment complies with FCC/IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

Cet équipement est conforme aux limites d'exposition aux rayonnements FCC/IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec une distance minimale de 20 cm entre le radiateur et votre corps.

OEM integrators must identify all possible combinations of simultaneous transmission configuration for all transmitters and antennas installed in the host platform. When there are multiple transmitting devices installed in a host platform, an RF exposure evaluation for the simultaneous transmission condition must be performed.

### Max. allowable antenna gain

| Bands         | Freq.       | Monopole  |
|---------------|-------------|-----------|
|               | Uplink(MHz) | Gain(dBi) |
| B71 / n71     | 663~698     | 8.9       |
| B12 / n12     | 698~716     | 9.1       |
| B13/n13       | 777~787     | 9.6       |
| B14/n14       | 788~798     | 9.7       |
| B17           | 704~716     | 9.1       |
| B30/n30       | 2305~2315   | 0         |
| B26/n26       | 814~849     | 9.9       |
| B5 / n5       | 824~849     | 9.9       |
| B4            | 1710~1755   | 5.5       |
| B66 / n66     | 1710~1780   | 5.5       |
| B2 / n2       | 1850~1910   | 8.5       |
| B25 / n25     | 1850~1915   | 8.5       |
| B41/n41(HPUE) | 2496~2690   | 6         |
| B7 / n7       | 2500~2570   | 8.5       |
| B38 / n38     | 2570~2620   | 6         |
| n78 Part 27O  | 3700~3800   | 5.5       |
| n78 Part 27Q  | 3450~3550   | 5.5       |
| n77 Part 27O  | 3700~3980   | 5.5       |
| n77 Part 27Q  | 3450~3550   | 5.5       |
| B42 CBRS      | 3550~ 3600  | 0         |
| B42           | 3400 ~ 3550 | 7         |
| B48 / n48     | 3550~3700   | 0         |



|                 |                  |          |
|-----------------|------------------|----------|
| <b>B43 CBRS</b> | <b>3600~3700</b> | <b>0</b> |
| <b>B43</b>      | <b>3700~3800</b> | <b>7</b> |

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