

# **EG915U&EG9x&BG95&BG96 Series**

## **Compatible Design**

**LTE Standard/LPWA Module Series**

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# About the Document

## Revision History

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-	2021-10-26	Len CHEN/ Fanny CHEN/ Bayes YANG	Creation of the document
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# 1 Introduction

Quectel LTE Standard EG915U series and EG9x (EG91 series & EG95 series) modules are compatible with LPWA BG95 series and BG96 modules. This document briefly describes the compatible design among these modules.

## 1.1. Special Mark

Table 1: Special Mark

Mark	Definition
*	Unless otherwise specified, when an asterisk (*) is used after a function, feature, interface, pin name, AT command, or argument, it indicates that the function, feature, interface, pin, AT command, or argument is under development and currently not supported; and the asterisk (*) after a model indicates that the sample of such model is currently unavailable.



## 2 General Description

### 2.1. Product Description

EG915U series module is a series of LTE Standard wireless communication module. It provides data connectivity on LTE-FDD, LTE-TDD and GPRS networks. It also provides voice functionality, Bluetooth and Wi-Fi scan <sup>1</sup> for customer's specific applications.

EG91 and EG95 series modules are embedded 4G wireless communication module with receive diversity. It supports LTE-FDD/WCDMA/GSM wireless communication, and provides data connectivity on LTE-FDD, DC-HSDPA, HSPA+, HSDPA, HSUPA, WCDMA, EDGE and GPRS networks. It can also provide voice functionality <sup>2</sup> to meet your specific application demands.

BG95 series module is a series of embedded IoT (LTE Cat M1, LTE Cat NB2 <sup>3</sup> and EGPRS) wireless communication modules. It provides data connectivity on LTE-FDD and GPRS/EGPRS networks, and supports half-duplex operation in LTE networks. It also provides GNSS and voice functionality\* <sup>4</sup> to meet your specific application demands.

BG96 is an embedded LPWA (LTE Cat M1, LTE Cat NB1, EGPRS) wireless communication module. It provides data connectivity on LTE-TDD, LTE-FDD, GPRS/EGPRS networks, and supports half-duplex operation in LTE networks. It also provides GNSS <sup>5</sup> and voice functionality <sup>6</sup> to meet customers' specific application demands.

<sup>1</sup> EG915U series module supports Bluetooth and Wi-Fi scan functions. Due to Bluetooth and Wi-Fi scan share the same antenna interface, two functions cannot be used simultaneously.

<sup>2</sup> EG91 and EG95 series modules contain **Data + Voice** version and **Data-only** version. **Data + Voice** version supports voice and data functions, while **Data-only** version only supports data function.

<sup>3</sup> LTE Cat NB2 is backward compatible with LTE Cat NB1.

<sup>4</sup> BG95 series modules support VoLTE (Voice over LTE) under LTE Cat M1. Additionally, BG95-M3 and BG95-M5 support CS voice under GSM.

<sup>5</sup> GNSS function is optional.

<sup>6</sup> BG96 supports VoLTE (Voice over LTE) under LTE Cat M1 network.

## 2.1.1. Module General Information

Table 2: Module General Information





Module Name	Appearance	Packaging	Dimensions (mm)	Description
EG915U Series	 The image shows the top of an EG915U Series module. It is a rectangular silver-colored PCB. The text 'QUECTEL' is at the top. Below it is 'EG915U-XX' followed by 'Q1-XXXXX'. Further down, there are fields for 'XX', 'EG915UXXXX-XXX-XXXX', 'SN:XXXXXXXXXXXXXXXXXX', and 'IMEI:XXXXXXXXXXXXXXXXXX'. A QR code is located at the bottom right.	126 LGA pins	23.6 × 19.9 × 2.4	LTE Standard module
EG9x Series	 The image shows the top of an EG9x Series module. It is a rectangular silver-colored PCB. The text 'QUECTEL' is at the top. Below it is 'EG9X' followed by 'Q1-XXXXX'. Further down, there are fields for 'XX', 'EG9XXXXX-XXX-XXXX', 'SN:XXXXXXXXXXXXXXXXXX', and 'IMEI:XXXXXXXXXXXXXXXXXX'. A QR code is located at the bottom right.	106 LGA pins	29.0 × 25.0 × 2.3	LTE Standard module.
BG95 Series	 The image shows the top of a BG95 Series module. It is a rectangular silver-colored PCB. The text 'QUECTEL' is at the top. Below it is 'BG95-XX' followed by 'Q1-XXXXX'. Further down, there are fields for 'XX', 'BG95XXXX-XXX-XXXX', 'SN:XXXXXXXXXXXXXXXXXX', and 'IMEI:XXXXXXXXXXXXXXXXXX'. A QR code is located at the bottom right.	102 LGA pins	23.6 × 19.9 × 2.2	LTE Cat M1/Cat NB2 module
BG96	 The image shows the top of a BG96 module. It is a rectangular silver-colored PCB. The text 'QUECTEL' is at the top. Below it is 'BG96' followed by 'Q1-XXXXX'. Further down, there are fields for 'MA', 'BG96MA-128-SBNS', 'SN:XXXXXXXXXXXXXXXXXX', and 'IMEI:XXXXXXXXXXXXXXXXXX'. A QR code is located at the bottom right.	102 LGA pins	26.5 × 22.5 × 2.3	LTE Cat M1/Cat NB1 module

Table 3: Module Frequency Bands

Module	LTE	UMTS	GSM	Rx-diversity	GNSS	Wi-Fi/Bluetooth
EG915U Series						
EG915U-CN	LTE FDD: B1/B3/B5/B8 LTE TDD: B34/B38/B39/B40/B41	-	900/1800 MHz	-	-	2.4 GHz
EG915U-EU	LTE FDD: B1/B3/B5/B7/B8/B20/B28	-	850/900/1800/1900 MHz	-	-	2.4 GHz
EG915U-LA	LTE FDD: B2/B3/B4/B5/B7/B8/B28/B66	-	850/900/1800/1900 MHz	-	-	2.4 GHz
EG91 Series						
EG91-AUX <sup>7</sup>	LTE FDD: B1/B2/B3/B4/B5/B7/B8/B28/B66	B1/B2/B5/B8	850/900/1800/1900 MHz	-	GPS, GLONASS, BeiDou, Galileo, QZSS	-
EG91-E	LTE FDD: B1/B3/B7/B8/B20/B28A	B1/B8	900/1800 MHz	√	-	-
EG91-EX	LTE FDD: B1/B3/B7/B8/B20/B28	B1/B8	900/1800 MHz	√	GPS, GLONASS, BeiDou, Galileo, QZSS	-
EG91-NA	LTE FDD: B2/B4/B5/B12/B13	B2/B4/B5	-	√		-
EG91-NAL	LTE FDD: B2/B4/B5/B12/B13	-	-	√		-
EG91-NAX	LTE FDD: B2/B4/B5/B12/B13/B25/B26	B2/B4/B5	-	√		-
EG91-NAXD	LTE FDD: B2/B4/B5/B12/B13/B25/B26	B2/B4/B5	-	√		-
EG91-VX	LTE FDD: B4/B13	-	-	√		-
EG95 Series						
EG95-E	LTE FDD: B1/B3/B7/B8/B20/B28A	B1/B8	900/1800 MHz	√	-	-
EG95-NA	LTE FDD: B2/B4/B5/B12/B13	B2/B4/B5	-	√	GPS, GLONASS, BeiDou, Galileo, QZSS	-
EG95-EX	LTE FDD: B1/B3/B7/B8/B20/B28	B1/B8	900/1800 MHz	√		-
EG95-NAX	LTE FDD: B2/B4/B5/B12/B13/B25/B26	B2/B4/B5	-	√		-
EG95-NAXD	LTE FDD: B2/B4/B5/B12/B13/B25/B26	B2/B4/B5	-	√		-
EG95-AUX	LTE FDD: B1/B2/B3/B4/B5/B7/B8B28/B66	B1/B2/B5/B8	850/900/1800/1900 MHz	√		-
BG95 Series						
BG95-M1	Cat M1 Only: LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/	-	-	-	GPS, GLONASS, BeiDou, Galileo, QZSS.	-

<sup>7</sup> EG91-AUX does not support Rx-diversity.

	B26/B27/B28/B66/B85				
BG95-M2	<b>Cat M1:</b> LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/ B26/B27/B28/B66/B85 <b>Cat NB2:</b> LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/ B28/B66/B71/B85	-	-	-	-
BG95-M3	<b>Cat M1:</b> LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/ B26/B27/ B28/B66/B85 <b>Cat NB2:</b> LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/ B28/B66/B71/B85	-	850/900/1800/1900 MHz	-	-
BG95-M4	<b>Cat M1:</b> LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/ B26/B27/B28/B31/B66/B72/B73/B85 <b>Cat NB2:</b> LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/ B28/B31/B66/B72/B73/B85	-	-	-	-
BG95-M5	<b>Cat M1:</b> LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/ B26/B27/B28/B66/B85 <b>Cat NB2:</b> LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/ B28/B66/B71/B85	-	850/900/1800/1900 MHz	-	-
BG95-M6	<b>Cat M1:</b> LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/ B26/B27/B28/B66/B85 <b>Cat NB2:</b> LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/ B28/B66/B71/B85	-	-	-	-
BG95-MF	<b>Cat M1:</b> LTE-FDD:	-	-	-	Wi-Fi (For Positioning Only): 2.4 GHz

	B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/ B26/B27/ B28/B66/B85 <b>Cat NB2:</b> LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/ B28/B66/B71/B85				
BG96					
BG96	<b>Cat M1 &amp; NB1:</b>				
	LTE-FDD:				
	B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25 <sup>8</sup> /	-	850/900/1800/1900 MHz	-	GPS, GLONASS, BeiDou/COMPASS,
	B26*/B28				Galileo, QZSS
	LTE-TDD: B39 (for Cat M1 only)				

NOTE

The GNSS function of EG9x series (EG91 series and EG95 series) is optional.

2.2. Feature Overview

The following table compares the general features of EG915U series, EG9x series, BG95 series and BG96.

Table 4: Feature Overview

Feature	EG915U Series	EG9x Series	BG95 Series	BG96
Power Supply	Supply voltage: 3.3–4.3 V, Typ. 3.8 V	Supply voltage: 3.3-4.3 V, Typ. 3.8 V	Supply voltage: <b>BG95-M1/M2:</b> 2.6–4.8 V <sup>9</sup> , Typ. 3.3 V <b>BG95-M3/-M5/-M6/-MF:</b> 3.3–4.3 V, Typ. 3.8 V <b>BG95-M4:</b> 3.2–4.2 V, Typ. 3.8 V	Supply voltage: 3.3–4.3 V, Typ. 3.8 V
Peak Current	<b>VBAT_BB:</b> Max 1.0 A <b>VBAT_RF:</b> Max 2.5 A	<b>VBAT_BB:</b> Max 0.8 A <b>VBAT_RF:</b> Max 1.8 A	<b>VBAT_BB:</b> Max 0.6 A <b>VBAT_RF:</b> Max 2.7 A	<b>VBAT_BB:</b> Max 0.8 A <b>VBAT_RF:</b> Max 1.8 A
Sleep Current	<b>EG915U-EU &amp; EG915U-LA:</b> <b>EGSM900:</b> 1.55 mA @ DRX = 5 (USB OFF) <b>DCS1800:</b> 1.5 mA @ DRX = 5 (USB OFF) <b>LTE-FDD (USB OFF):</b> 3.49 mA @ PF = 32 2.22 mA @ PF = 64	<b>WCDMA PF = 64 (USB disconnected)</b> 1.8 mA @ EG95-E/EG9x-EX/EG91-AUX 2.2 mA @ EG9x-NA 2.0 mA @ EG95-NAX/EG95-NAXD 2.1 mA @ EG91-NAX/EG91-NAXD 1.7 mA @ EG95-AUX/EG91-E	<b>LTE Cat M1 @ DRX = 1.28 s:</b> 1.7 mA @ BG95-M1 1.68 mA @ BG95-M2 1.89 mA @ BG95-M3 1.53 mA @ BG95-M4 1.56 mA @ BG95-M5	<b>LTE Cat M1 @ DRX = 1.28 s:</b> 1.54 mA <b>LTE Cat NB1 @ DRX = 1.28 s:</b> 2.03 mA

<sup>8</sup> LTE-FDD B25 is supported on BG96 of R1.2 hardware version.  
<sup>9</sup> For every VBAT transition/re-insertion from 0 V, the minimum power supply voltage should be higher than 2.7 V. After the module starts up normally, the minimum safety voltage is 2.6 V. In order to ensure full-function mode, the minimum power supply voltage should be higher than 2.8 V.

	1.63 mA @ PF = 128 1.34 mA @ PF = 256 <b>EG915U-CN:</b> TBD	<b>LTE PF = 64 (USB disconnected)</b> 2.3 mA @ EG95-E/EG9x-EX/EG91-AUX 2.6 mA @ EG9x-NA/EG9x-NAX/EG9x-NAXD 2.2 mA @ EG95-AUX 2.1 mA @ EG91-E 2.47 mA @ EG91-NAL	1.42 mA @ BG95-M6 1.59 mA @ BG95-MF <b>LTE Cat NB1 @ DRX = 1.28 s:</b> 1.55 mA @ BG95-M2 1.49 mA @ BG95-M3 1.31 mA @ BG95-M4 1.43 mA @ BG95-M5 1.41 mA @ BG95-M6 1.43 mA @ BG95-MF	
LTE Features	<ul style="list-style-type: none"> <li>Supports up to Cat 1 FDD/TDD <sup>10</sup></li> <li>Supports 1.4/3/5/10/15/20 MHz RF bandwidth</li> <li>Supports uplink QPSK, 16QAM</li> <li>Supports downlink QPSK, 16QAM and 64QAM</li> <li>LTE-FDD: Max 10 Mbps (DL)/5 Mbps (UL)</li> </ul>	EG91 series: <ul style="list-style-type: none"> <li>Support up to non-CA Cat 1 FDD</li> <li>Support 1.4/3/5/10/15/20 MHz RF bandwidth</li> <li>LTE-FDD: Max. 10 Mbps (DL), Max. 5 Mbps (UL)</li> </ul> EG95 series: <ul style="list-style-type: none"> <li>Support up to non-CA Cat 4 FDD</li> <li>Support 1.4/3/5/10/15/20 MHz RF bandwidth</li> <li>Support MIMO in DL direction</li> <li>FDD: Max. 150 Mbps (DL)/Max. 50 Mbps (UL)</li> </ul>	<ul style="list-style-type: none"> <li>Support 3 GPP Rel-14</li> <li>Support LTE Cat M1 and LTE Cat NB2</li> <li>Support 1.4 MHz RF bandwidth for LTE Cat M1</li> <li>Support 200 kHz RF bandwidth for LTE Cat NB2</li> <li>Cat M1: Max. 588 kbps (DL)/1119 kbps (UL)</li> <li>Cat NB2: Max. 127 kbps (DL)/158.5 kbps (UL)</li> </ul>	Support LTE Cat M1 and LTE Cat NB1 Support 1.4 MHz RF bandwidth for LTE Cat M1 Support 200 kHz RF bandwidth for LTE Cat NB1 Support SISO in DL direction LTE Cat M1: Max. 375 kbps (DL)/375 kbps (UL) LTE Cat NB1: Max. 32 kbps (DL)/70 kbps (UL)
Temperature Range	Operating temperature range: -35 °C ~ +75 °C <sup>11</sup> Extended temperature range: -40 °C ~ +85 °C <sup>12</sup> Storage temperature range: -40 °C ~ +90 °C	Operating temperature range: -35 °C to +75 °C <sup>11</sup> Extended temperature range: -40 °C to +85 °C <sup>12</sup> Storage temperature range: -40 °C to +90 °C	Operation temperature range: -35 ~ +75 °C <sup>11</sup> Extended temperature range: -40 ~ +85 °C <sup>12</sup> Storage temperature range: -40 ~ +90 °C	Operation temperature range: -35 ~ +75 °C <sup>11</sup> Extended temperature range: -40 ~ +85 °C <sup>12</sup> Storage temperature range: -40 ~ +90 °C
UART Interfaces	<b>Main UART:</b> <ul style="list-style-type: none"> <li>Used for AT command communication and data transmission.</li> <li>Baud rate: 115200 bps by default.</li> <li>Supports RTS and CTS hardware flow control.</li> </ul> <b>Debug UART:</b> <ul style="list-style-type: none"> <li>Used for tBaud rate: 921600 bps.</li> <li>Used for debug UART only, cannot be used as universal UART.</li> </ul> <b>Auxiliary UART</b>	<b>Main UART:</b> <ul style="list-style-type: none"> <li>Used for AT command communication and data transmission.</li> <li>Baud rates reach up to 921600 bps, 115200 bps by default.</li> <li>Supports RTS and CTS hardware flow control.</li> </ul> <b>Debug UART:</b> <ul style="list-style-type: none"> <li>Used for Linux console and log out.</li> <li>115200 bps baud rate.</li> </ul>	<b>Main UART:</b> <ul style="list-style-type: none"> <li>Used for data transmission and AT command communication</li> <li>115200 bps baud rate by default</li> <li>The default frame format is 8N1 (8 data bits, no parity, 1 stop bit)</li> <li>Support RTS and CTS hardware flow control</li> </ul> <b>Debug UART:</b> <ul style="list-style-type: none"> <li>Used for software debugging and log output</li> <li>Support 115200 bps baud rate</li> </ul> <b>GNSS UART:</b> <ul style="list-style-type: none"> <li>Used for GNSS data and NMEA sentences output</li> <li>115200 bps baud rate by default</li> </ul>	<b>UART1:</b> <ul style="list-style-type: none"> <li>Used for data transmission and AT command communication</li> <li>115200 bps by default</li> <li>The default frame format is 8N1 (8 data bits, no parity, 1 stop bit)</li> <li>Support RTS and CTS hardware flow control</li> </ul> <b>UART2:</b> <ul style="list-style-type: none"> <li>Used for module debugging and log output</li> <li>115200 bps baud rate</li> </ul> <b>UART3:</b> <ul style="list-style-type: none"> <li>Used for outputting GNSS data or NMEA sentences</li> <li>115200 bps baud rate</li> </ul>
USB Interface	<ul style="list-style-type: none"> <li>Compliant with USB 2.0 specification (slave only), with transmission rates up to 480 Mbps</li> <li>Used for AT command communication, data transmission, software debugging, firmware upgrade.</li> </ul>	<ul style="list-style-type: none"> <li>Compliant with USB 2.0 specification (slave only); the data transfer rate can reach up to 480 Mbps</li> <li>Used for AT command communication, data transmission, GNSS NMEA sentences output,</li> </ul>	<ul style="list-style-type: none"> <li>Compliant with USB 2.0 specification (slave only)</li> <li>Support operations at high-speed, low speed and full speed</li> <li>Used for AT command communication, data transmission, GNSS NMEA sentences output,</li> </ul>	<ul style="list-style-type: none"> <li>Compliant with USB 2.0 specification (slave only) and the data transfer rate can reach up to 480 Mbps</li> <li>Used for AT command communication, data transmission, GNSS NMEA output, software</li> </ul>

<sup>10</sup> Only EG915U-CN supports LTE-TDD.

<sup>11</sup> Within the operating temperature range, the module meets 3GPP specifications.

<sup>12</sup> Within the extended temperature range, the module remains the ability to establish and maintain functions such as voice, SMS, data transmission, emergency call, etc., without any unrecoverable malfunction. Radio spectrum and radio network are not influenced, while one or more specifications, such as P<sub>out</sub>, may exceed the specified tolerances of 3GPP. When the temperature returns to the operating temperature range, the module meets 3GPP specifications again.

	<ul style="list-style-type: none"><li>Support USB serial drivers for Windows 7/8/8.1/10, Linux 2.6–5.12, Android 4.x–11.x</li></ul>	<p>software debugging, firmware upgrade and voice over USB</p> <ul style="list-style-type: none"><li>Support USB serial drivers for Windows 7/8/8.1/10, Linux 2.6–5.12, Android 4.x–11.x, etc.</li></ul>	<p>software debugging and firmware upgrade</p> <ul style="list-style-type: none"><li>Support USB serial drivers for Windows 7/8/8.1/10, Linux 2.6–5.12, Android 4.x–11.x</li></ul>	<p>debugging and firmware upgrade</p> <ul style="list-style-type: none"><li>Supports USB serial drivers for Windows 7/8/8.1/10, Linux 2.6–5.12, Android 4.x–11.x</li></ul>
Digital Audio Interface	PCM interface (slave mode only)	PCM interface	PCM interface* for VoLTE or GSM CS voice only	PCM interface*
I2C Interface	Supported	Supported	Supported*	Supported*
(U)SIM Interface	Supported	Supported	Supported	Supported
Wi-Fi/Bluetooth	Bluetooth/Wi-Fi scan <sup>13</sup>	-	2.4 GHz (BG95-MF Only)	-
Firmware Upgrade	USB interface and DFOTA	USB interface and DFOTA	USB interface and DFOTA	USB interface and DFOTA

<sup>13</sup> EG915U series module supports Bluetooth and Wi-Fi scan functions. Due to Bluetooth and Wi-Fi scan share the same antenna interface, two functions cannot be used simultaneously.

## 2.3. Pin Assignment

The following figures show the pin assignment of EG915U series, EG9x series, BG95 series and BG96.

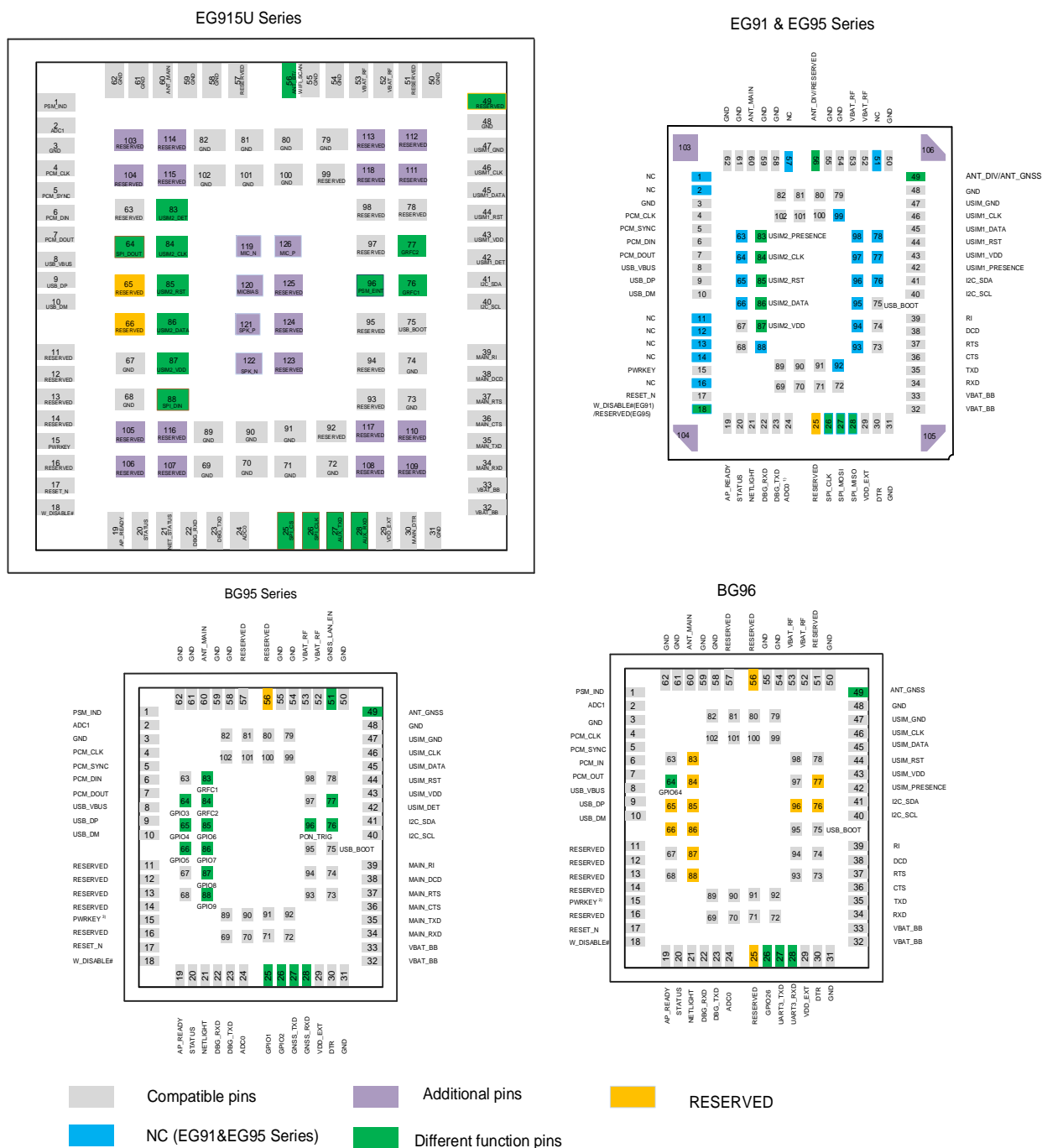


Figure 1: Pin Assignment (Top View)



## NOTE

1. For EG915U series, USB\_BOOT cannot be pulled up before the module startup.
2. EG915U series module supports dual card single standby function. For more details, please contact Quectel Technical Support.
3. For EG915U series, the PSM function is under development. For more details, please contact Quectel Technical Support.
4. For EG91 series, pin 49 is defined as ANT\_GNSS on EG91-AUX/-EX/-NA/-NAL/-NAX/-NAXD/-VX, while it is defined as ANT\_DIV on EG91-E.
5. For EG91 series, pin 56 is RESERVED on EG91-E, while it is defined as ANT\_DIV on EG91-EX/-NA/-NAL/-NAX/-NAXD/-VX. Rx-diversity antenna is not supported on EG91-AUX.
6. For EG95 series, pin 49 is defined as ANT\_GNSS on EG95-NA/-EX/-NAX/-NAXD/-AUX, while it is defined as ANT\_DIV on EG95-E.
7. For EG95 series, pin 56 is RESERVED on EG95-E, while it is defined as ANT\_DIV on EG95-NA/-EX/-NAX/-NAXD/-AUX).
8. For EG9x series and BG96, PWRKEY output voltage is 0.8 V because of the diode drop inside the chipset.
9. For BG95 series, the output voltage of PWRKEY is 1.5 V because of the voltage drop inside the chipset. Due to platform limitations, the chipset has integrated the reset function into PWRKEY. Therefore, never pull down PWRKEY to GND permanently.
10. BG95 series supports ADC0 and ADC1. Do not use ADC0 and ADC1 simultaneously, as ADC1 connects directly to ADC0 inside the module. BG95 series supports use of only one ADC interface at a time: either ADC0 or ADC1. If the two ADC interfaces are intended to be used at the same time, please add an external analog switch.
11. Only BG95-MF supports ANT\_WIFI (pin 56).
12. BG95-MF does not support GPIO3 and GPIO4 interfaces (pin 64 and pin 65)
13. BG95-M4 does not support GRFC interfaces (pin 83 and pin 84).
14. For BG95 series, RESET\_N connects directly to PWRKEY inside the module.
15. For BG95 series, GNSS\_TXD (pin 27) and GRFC2 (pin 84) are BOOT\_CONFIG pins. Never pull them up before startup, otherwise the module cannot power on normally.
16. For BG95 series, GPIO1 (pin 25) supports fast shutdown function. This function is disabled by default. See **document [4]** for more details.
17. For BG95 series, PCM and I2C interfaces are used for VoLTE or GSM CS voice only.
18. Keep all RESERVED pins and unused pins unconnected.
19. Connect GND pins to the ground in the design.

## 3 Pin Description

This chapter describes the pin definition of EG915U series, EG9x series, BG95 series and BG96.

**Table 5: I/O Parameters Definition**

Type	Description
AI	Analog Input
AO	Analog Output
AIO	Analog Input/Output
DI	Digital Input
DO	Digital Output
DIO	Digital Input/Output
OD	Open Drain
PI	Power Input
PO	Power Output

### 3.1. Pin Description

The following table describes the pin functions, I/O and DC characteristics of EG915U series, EG9x series, BG95 series and BG96 module.

Table 6: Pin Comparison

EG915U Series					EG91 & EG95 Series				BG95 Series				BG96			
Pin No	Pin Name	I/O	Power domain	Description	Pin Name	I/O	Power domain	Description	Pin Name	I/O	Power domain	Description	Pin Name	I/O	Power damin	Description
1	PSM_IND*	DO	1.8 V	Indicate the module's power saving mode	NC	-	-	-	PSM_IND	DO	1.8 V	Indicate the module's power saving mode	PSM_IND	DO	1.8 V	Indicate the module's power saving mode
2	ADC1	AI	0.1–VBAT	General-purpose ADC interface	NC	-	-	-	ADC1	AI	0.1–1.8 V	General-purpose ADC interface	ADC1	AI	0.3–1.8 V	General-purpose ADC interface
3	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	-	GND	-	-	-
4	PCM_CLK	DI	1.8 V	PCM clock	PCM_CLK	DIO	1.8 V	PCM clock	PCM_CLK*	DO	1.8 V	PCM clock	PCM_CLK*	DO	1.8 V	PCM clock
5	PCM_SYNC	DI	1.8 V	PCM data frame sync	PCM_SYNC	DIO	1.8 V	PCM data frame sync	PCM_SYNC*	DO	1.8 V	PCM data frame sync	PCM_SYNC*	DO	1.8 V	PCM data frame sync
6	PCM_DIN	DI	1.8 V	PCM data input	PCM_DIN	DI	1.8 V	PCM data input	PCM_DIN*	DI	1.8 V	PCM data input	PCM_IN*	DI	1.8 V	PCM data input
7	PCM_DOUT	DO	1.8 V	PCM data output	PCM_DOUT	DO	1.8 V	PCM data output	PCM_DOUT*	DO	1.8 V	PCM data output	PCM_OUT*	DO	1.8 V	PCM data output
8	USB_VBUS	AI	3.5–5.25 V	USB connection detect	USB_VBUS	PI	3.0–5.25 V	USB insertion detection	USB_VBUS	PI	Typ. 5.0 V	USB connection detect	USB_VBUS	PI	3.0–5.25 V	USB connection detect
9	USB_DP	AIO	-	USB differential data (+)	USB_DP	AIO	-	USB 2.0 differential data (+)	USB_DP	AIO	-	USB differential data (+)	USB_DP	AIO	-	USB differential data (+)
10	USB_DM	AIO	-	USB differential data (-)	USB_DM	AIO	-	USB 2.0 differential data (-)	USB_DM	AIO	-	USB differential data (-)	USB_DM	AIO	-	USB differential data (-)
11	RESERVED	-	-	Reserved	NC	-	-	-	RESERVED	-	-	Reserved	RESERVED	-	-	Reserved
12	RESERVED	-	-	Reserved	NC	-	-	-	RESERVED	-	-	Reserved	RESERVED	-	-	Reserved
13	RESERVED	-	-	Reserved	NC	-	-	-	RESERVED	-	-	Reserved	RESERVED	-	-	Reserved
14	RESERVED	-	-	Reserved	NC	-	-	-	RESERVED	-	-	Reserved	RESERVED	-	-	Reserved
15	PWRKEY	DI	VBAT power domain.	Turn on/off the module	PWRKEY	DI	-	Turn on/off the module	PWRKEY <sup>14</sup>	DI	-	Turn on/off the module	PWRKEY <sup>15</sup>	DI	-	Turn on/off the module

<sup>14</sup> For BG95 series, PWRKEY output voltage is 1.5 V because of the voltage drop inside the chipset. Due to platform limitations, the chipset has integrated the reset function into PWRKEY. Therefore, never pull down PWRKEY to GND permanently.

<sup>15</sup> For BG96, the output voltage is 0.8 V because of the diode drop inside the chipset.

16	RESERVED	-	-	Reserved	NC	-	-	-	RESERVED	-	-	Reserved	RESERVED	-	-	Reserved
17	RESET_N	DI	VBAT	Reset the module	RESET_N	DI	1.8 V	Reset the module	RESET_N	DI	1.5 V	Reset the module	RESET_N	DI	1.8 V	Reset the module
18	W_DISABLE#	DI	1.8 V	Airplane mode control	W_DISABLE# (EG91)/RESERVED (EG95)	DI	1.8 V	Airplane mode control	W_DISABLE#	DI	1.8 V	Airplane mode control	W_DISABLE#	DI	1.8 V	Airplane mode control
19	AP_READY	DI	1.8 V	Application processor ready	AP_READY	DI	1.8 V	Application processor ready	AP_READY	DI	1.8 V	Application processor ready	AP_READY	DI	1.8 V	Application processor ready
20	STATUS	DO	1.8 V	Indicate the module's operation status	STATUS	DO	1.8 V	Indicate the module's operation status	STATUS	DO	1.8 V	Indicate the module's operation status	STATUS	DO	1.8 V	Indicate the module's operation status
21	NET_STATUS	DO	1.8 V	Indicate the module's network activity status	NETLIGHT	DO	1.8 V	Indicate the module's network activity status	NET_STATUS	DO	1.8 V	Indicate the module's network activity	NET_STATUS	DO	1.8 V	Indicate the module's network activity
22	DBG_RXD	DI	1.8 V	Debug UART receive	DBG_RXD	DI	1.8 V	Debug UART receive	DBG_RXD	DI	1.8 V	Debug UART receive	DBG_RXD	DI	1.8 V	Debug UART receive
23	DBG_TXD	DO	1.8 V	Debug UART transmit	DBG_TXD	DO	1.8 V	Debug UART transmit	DBG_TXD	DO	1.8 V	Debug UART transmit	DBG_TXD	DO	1.8 V	Debug UART transmit
24	ADC0	AI	0.1–VBAT	General-purpose ADC interface	ADC0	AI	0.3 V–VBAT_BB	General-purpose ADC interface	ADC0	AI	0.1–1.8 V	General-purpose ADC interface	ADC0	AI	0.3–1.8 V	General-purpose ADC interface
25	SPI_CS	DO	1.8 V	SPI chip select	RESERVED	-	-	-	GPIO1	DIO	1.8 V	General-purpose input/output	RESERVED	-	-	-
26	SPI_CLK	DO	1.8 V	SPI clock	SPI_CLK	DO	1.8 V	SPI clock	GPIO2	DIO	1.8 V	General-purpose input/output	GPIO26	DO	1.8 V	General-purpose input/output
27	AUX_TXD	DO	1.8 V	Auxiliary UART transmit	SPI_MOSI	DO	1.8 V	SPI master-out slave-in	GNSS_TXD <sup>16</sup>	DO	1.8 V	GNSS UART transmit	UART3_TXD <sup>16</sup>	DO	1.8 V	UART3 transmit
28	AUX_RXD	DI	1.8 V	Auxiliary UART receive	SPI_MISO	DI	1.8 V	SPI master-in slave-out	GNSS_RXD	DI	1.8 V	GNSS UART receive	UART3_RXD	DI	1.8 V	UART3 receive
29	VDD_EXT	PO	1.8 V	Provide 1.8 V for external circuit	VDD_EXT	PO	1.8 V	Provide 1.8 V for external circuit	VDD_EXT	PO	1.8 V	Provide 1.8 V for external circuit	VDD_EXT	PO	1.8 V	Provide 1.8 V for external circuit
30	MAIN_DTR	DI	1.8 V	Main UART data terminal ready	DTR	DI	1.8 V	Data terminal ready sleep mode control	MAIN_DTR	DI	1.8 V	Main UART data terminal ready	DTR	DI	1.8 V	Data terminal ready sleep mode control
31	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	Ground
32, 33	VBAT_BB	PI	3.3–4.3 V	Power supply for the module's baseband part	VBAT_BB	PI	3.3-4.3 V	Power supply for the module's baseband part	VBAT_BB	PI	-	Power supply for the module's baseband part	VBAT_BB	PI	3.3–4.3 V	Power supply for the module's baseband part
34	MAIN_RXD	DI	1.8 V	Main UART receive	RXD	DI	1.8 V	Receive	MAIN_RXD	DI	1.8 V	Main UART receive	RXD	DI	1.8 V	Receive
35	MAIN_TXD	DO	1.8 V	Main UART transmit	TXD	DO	1.8 V	Transmit	MAIN_TXD	DO	1.8 V	Main UART transmit	TXD	DO	1.8 V	Transmit

<sup>16</sup> BOOT\_CONFIG. Do not pull it up before startup.

36	MAIN_CTS	DO	1.8 V	DTE clear to send signal to DCE (connect to DTE's CTS)	CTS	DO	1.8 V	DTE clear to send signal to DCE (connect to DTE's CTS)	MAIN_CTS	DO	1.8 V	DTE clear to send signal to DCE (connect to DTE's CTS)	CTS	DO	1.8 V	DTE clear to send signal to DCE (connect to DTE's CTS)
37	MAIN_RTS	DI	1.8 V	DTE request to send signal to DCE (connect to DTE's RTS)	RTS	DI	1.8 V	DTE request to send signal to DCE (connect to DTE's RTS)	MAIN_RTS	DI	1.8 V	DTE request to send signal to DCE (connect to DTE's RTS)	RTS	DI	1.8 V	DTE request to send signal to DCE (connect to DTE's RTS)
38	MAIN_DCD	DO	1.8 V	Main UART data carrier detect	DCD	DO	1.8 V	Data carrier detect	MAIN_DCD	DO	1.8 V	Main UART data carrier detect	DCD	DO	1.8 V	Data carrier detect
39	MAIN_RI	DO	1.8 V	Main UART ring indication	RI	DO	1.8 V	Ring indication	MAIN_RI	DO	1.8 V	Main UART ring indication	RI	DO	1.8 V	Ring indication
40	I2C_SCL	OD	-	I2 C serial clock (for external codec) Pull up to 1.8 V only.	I2C_SCL	OD	-	I2C serial clock (for external codec). An external pull-up to 1.8 V is required.	I2C_SCL <sup>*</sup>	OD	-	I2C serial clock (for external codec) Pull up to 1.8 V only.	I2C_SCL	OD	-	I2C serial clock (for external codec) Pull up to 1.8 V only.
41	I2C_SDA	OD	-	I2 C serial data (for external codec) Pull up to 1.8 V only.	I2C_SDA	OD	-	I2C serial data (for external codec). An external pull-up to 1.8 V is required.	I2 C_SDA <sup>*</sup>	OD	-	I2C serial data (for external codec) Pull up to 1.8 V only.	I2C_SDA	OD	-	I2C serial data (for external codec) Pull up to 1.8 V only.
42	USIM1_DET	DI	1.8 V	(U)SIM1 card hot-plug detect	USIM1_PRESENCE	DI	1.8 V	(U)SIM card insertion detection	USIM_DET	DI	1.8 V	(U)SIM card hot-plug detect	USIM_PRESENCE	DI	1.8 V	(U)SIM card hot-plug detect
43	USIM1_VDD	PO	1.8/3.0 V	(U)SIM1 card power supply	USIM1_VDD	PO	1.8/3.0 V	Power supply for (U)SIM1 card	USIM_VDD	PO	1.8 V	(U)SIM card power supply	USIM_VDD	PO	1.8/3.0 V	(U)SIM card power supply
44	USIM1_RST	DO	1.8/3.0 V	(U)SIM1 card reset	USIM1_RST	DO	1.8/3.0 V	(U)SIM1 card reset	USIM_RST	DO	1.8 V	(U)SIM card reset	USIM_RST	DO	1.8/3.0 V	(U)SIM card reset
45	USIM1_DATA	DIO	1.8/3.0 V	(U)SIM1 card data	USIM1_DATA	DIO	1.8/3.0 V	(U)SIM1 card data	USIM_DATA	DIO	1.8 V	(U)SIM card data	USIM_DATA	DIO	1.8/3.0 V	(U)SIM card data
46	USIM1_CLK	DO	1.8/3.0 V	(U)SIM1 card clock	USIM1_CLK	DO	1.8/3.0 V	(U)SIM1 card clock	USIM_CLK	DO	1.8 V	(U)SIM card clock	USIM_CLK	DO	1.8/3.0 V	(U)SIM card clock
47	USIM1_GND	-	-	Specified ground for (U)SIM1 card	USIM_GND	-	-	Specified ground for (U)SIM1 card	USIM_GND	-	-	Specified ground for (U)SIM card.	USIM_GND	-	-	Specified ground for (U)SIM card.
48	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	Ground
49	RESERVED	-	-	Reserved	ANT_GNSS/ ANT_DIV <sup>17</sup>	AI	-	GNSS antenna interface/Diversity receive antenna interface	ANT_GNSS	AI	-	GNSS antenna interface	ANT_GNSS	AI	-	GNSS antenna interface
50	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	Ground

<sup>17</sup> For EG91 series, pin 49 is defined as ANT\_GNSS on EG91-AUX/-EX/-NA/-NAL/-NAX/-NAXD/-VX, while it is defined as ANT\_DIV on EG91-E.  
For EG95 series, pin 49 is defined as ANT\_GNSS on EG95-NA/-EX/-NAX/-NAXD/-AUX, while it is defined as ANT\_DIV on EG95-E.

51	RESERVED	-	-	Reserved	NC	-	-	-	GNSS_LAN_EN	-		External LNA enable control	RESERVED	-	-	-
52, 53	VBAT_RF	PI	3.3–4.3 V	Power supply for the module's RF part	VBAT_RF	PI	3.3–4.3 V	Power supply for the module's RF part	VBAT_RF	PI	-	Power supply for the module's RF part	VBAT_RF	PI	3.3–4.3 V	Power supply for the module's RF part
54, 54	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	Ground
56	ANT_BT/ WIFI_SCAN <sup>18</sup>	AIO	-	Wi-Fi Scan/ Bluetooth antenna interface	ANT_DIV/ RESERVED <sup>19</sup>	AI	-	Diversity receive antenna interface/ Reserved	ANT_WIFI*	AI	-	Wi-Fi antenna interface for BG95-MF only.	RESERVED	-	-	-
57	RESERVED	-	-	Reserved	NC	-	-	-	RESERVED	-	-	-	RESERVED	-	-	-
58, 59	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	Ground
60	ANT_MAIN	AIO		Main antenna interface	ANT_MAIN	AIO	-	Main antenna interface	ANT_MAIN	AIO	-	Main antenna interface	ANT_MAIN	AIO	-	Main antenna interface
61, 62	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	Ground
63	RESERVED	-	-	-	NC	-	-	-	RESERVED	-	-	-	RESERVED	-	-	-
64	SPI_DOUT	DO	-	SPI data output	NC	-	-	-	GPIO3	DIO	1.8 V	General-purpose input/output	GPIO64	DIO	1.8 V	General-purpose input/output
65, 66	RESERVED	-	-	Reserved	NC	-	-	-	RESERVED	-	-	RESERVED	RESERVED	-	-	RESERVED
67– 74	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	GND	GND	-	-	GND
75	USB_BOOT	DI	1.8 V	Force the module into emergency download mode	USB_BOOT	DI	1.8 V	Force the module into emergency download mode.	USB_BOOT	DI	1.8 V	Force the module into emergency download mode	USB_BOOT	DI	1.8 V	Force the module into emergency download mode
76	GRFC1*	DO	-	Generic RF Controller	NC	-	-	-	RESERVED	-	-	RESERVED	RESERVED	-	-	RESERVED
77	GRFC2*	DO	-	Generic RF Controller	NC	-	-	-	RESERVED	-	-	RESERVED	RESERVED	-	-	RESERVED
78	RESERVED	-	-	Reserved	NC	-	-	-	RESERVED	-	-	RESERVED	RESERVED	-	-	RESERVED
79–82	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	Ground
83	USIM2_DET	DI	1.8 V	(U)SIM2 card hot-plug detect	USIM2_PRESENCE	DI	1.8 V	(U)SIM2 card insertion detect	GRFC1 <sup>20</sup>	DO	1.8 V	Generic RF Controller	RESERVED	-	-	-
84	USIM2_CLK	DO	-	(U)SIM2 card clock	USIM2_CLK	DO	1.8/3.0 V	(U)SIM2 card clock	GRFC2 <sup>20</sup>	DO	1.8 V	Generic RF Controller	RESERVED	-	-	-
85	USIM2_RST	DO	-	(U)SIM2 card reset	USIM2_RST	DO	1.8/3.0 V	(U)SIM2 card reset	GPIO6	DIO	1.8 V	General-purpose input/output	RESERVED	-	-	-

<sup>18</sup> This RF interface contains both Bluetooth and Wi-Fi Scan function, which cannot be used simultaneously. And Wi-Fi scan supports receive only.<sup>19</sup> For EG91 series, pin 56 is RESERVED on EG91-E, while it is defined as ANT\_DIV on EG91-EX/-NA/-NAL/-NAX/-NAXD/-VX. Rx-diversity antenna is not supported on EG91-AUX.

For EG95 series, pin 56 is RESERVED on EG95-E, while it is defined as ANT\_DIV on EG95-NA/-EX/-NAX/-NAXD/-AUX).

<sup>20</sup> BG95-M4 does not support GRFC interfaces (pin 83 and pin 84).

86	USIM2_DATA	DIO	-	(U)SIM2 card data	USIM2_DATA	DIO	1.8/3.0 V	(U)SIM2 card data	GPIO7	DIO	1.8 V	General-purpose input/output	RESERVED	-	-	-
87	USIM2_VDD	PO	-	(U)SIM2 card power supply	USIM2_VDD	PO	1.8/3.0 V	(U)SIM2 card power supply	GPIO8	DIO	1.8 V	General-purpose input/output	RESERVED	-	-	-
88	SPI_DIN	DI	-	SPI data input	NC	-	-	-	GPIO9	DIO	1.8 V	General-purpose input/output	RESERVED	-	-	-
89–91	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	Ground
92–95	RESERVED	-	-	Reserved	NC	-	-	-	RESERVED	-	-	Reserved	RESERVED	-	-	Reserved
96	PSM_EINT*	-	-	External interrupt pin; Wake up the module from PSM	NC	-	-	-	PON_TRIG	DI	1.8 V	Wake up the module from PSM	RESERVED	-	-	RESERVED
97–99	RESERVED	-	-	Reserved	NC	-	-	-	RESERVED	-	-	Reserved	RESERVED	-	-	Reserved
100–102	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	Ground	GND	-	-	Ground
103–106	RESERVED	-	-	Reserved	GND	-	-	Ground	-	-	-	-	-	-	-	-
107–118	RESERVED	-	-	Reserved	-	-	-	-	-	-	-	-	-	-	-	-
119	MIC_N	AI	-	Microphone analog input (-)	-	-	-	-	-	-	-	-	-	-	-	-
120	MICBIAS	PO	-	Bias voltage output for microphone	-	-	-	-	-	-	-	-	-	-	-	-
121	SPK_P	AO	-	Analog audio differential output (+)	-	-	-	-	-	-	-	-	-	-	-	-
122	SPK_N	AO	-	Analog audio differential output (-)	-	-	-	-	-	-	-	-	-	-	-	-
123–125	RESERVED	-	-	Reserved	-	-	-	-	-	-	-	-	-	-	-	-
126	MIC_P	AI	-	Microphone analog input (+)	-	-	-	-	-	-	-	-	-	-	-	-

## NOTE

1. Pins in **purple** (pin 107–126) are additional pins on EG915U series that do not exist on EG9x series, BG95 series and BG96 modules, but pins in **purple** (pin 103–106) are additional pins on EG915U series and EG9x series that do not exist on BG95 series and BG96 modules.
2. Pins in **blue** are pins with different functionalities on EG915U series, EG9x series, BG95 series and BG96 modules.
3. Pins in **black** are compatible pins on EG915U series, EG9x series, BG95 series and BG96 modules with the same functionality.
4. Keep all RESERVED and unused pins unconnected.
5. All GND pins should be connected to ground.
6. For EG91 series, BOOT\_CONFIG pins (SPI\_CLK, USB\_BOOT, PCM\_CLK, PCM\_SYNC) cannot be pulled up before startup.



# 4 Hardware Interfaces Design

## 4.1. Power Supply

Table 7: Pin Difference of VBAT\_BB & VBAT\_RF

Pin Name	Pin No.	I/O	DC Characteristics			
			EG915U Series	EG9x Series	BG95 Series	BG96
VBAT_BB	32, 33	PI			<b>BG95-M1/-M2:</b> Vmax = 4.8 V Vmin = 2.6 V Vnom = 3.3 V	
					<b>BG95-M3/-M5/-M6/-MF:</b> Vmax = 4.3 V Vmin = 3.3 V Vnom = 3.8 V	
			Vmax = 4.3 V Vmin = 3.3 V Vnom = 3.8 V	Vmax = 4.3 V Vmin = 3.3 V Vnom = 3.8 V	Vmax = 4.3 V Vmin = 3.3 V Vnom = 3.8 V	Vmax = 4.3 V Vmin = 3.3 V Vnom = 3.8 V
			VBAT_BB: Imax = 1.0 A	VBAT_BB: Imax = 0.8 A	<b>BG95-M4:</b> Vmax = 4.2 V Vmin = 3.2 V Vnom = 3.8 V	VBAT_BB: Imax = TBD A
			VBAT_RF: Imax = 2.5 A	VBAT_RF: Imax = 1.8 A		VBAT_RF: Imax = TBD A
VBAT_RF	52, 53	PI			VBAT_BB: Imax = TBD A VBAT_RF: Imax = TBD A	

### NOTE

- Power design for a module is critical to its performance. The power supply of EG915U series should be able to provide sufficient current at least 3.0 A, the power supply of EG9x series should be able to provide sufficient current at least 2.0 A, while BG95 series and BG96 are LPWA modules requiring low quiescent and leakage current. For more information about sufficient current of BG95 series &

BG96, see **document [4] & [5]**.

2. Please refer to the corresponding reference design of the module for more details about power supply design.

## 4.2. Turn-on/off

The turn-on/off methods of EG915U series are the same as EG9x series, BG95 series and BG96. The modules can be turned on or turned off after pressing PWRKEY for a certain time.

It is also a safe way to use **AT+QPOWD** to turn off the module, which is similar to turning off the module via PWRKEY pin. See **document [6] & [7] & [8] & [9]** for details about **AT+QPOWD**.

**Table 8: Pin Difference of PWRKEY**

Moule Name	Pin Name	Pin No.	DC Characteristics	Turn-on: Pull-down time	Turn-off: Pull-down time
EG915U Series	PWRKEY	15	VBAT power domain. $V_{ILmax} = 0.5\text{ V}$	$\geq 2\text{ s}$	$\geq 3\text{ s}$
EG9x Series			0.8 V power domain. $V_{ILmax} = 0.5\text{ V}$	$\geq 500\text{ ms}$	$\geq 650\text{ ms}$
BG95 Series			1.5 V power domain. $V_{ILmax} = 0.45\text{ V}$	500–1000 ms	650–1500 ms
BG96			0.8 V power domain. $V_{ILmax} = 0.5\text{ V}$	$\geq 500\text{ ms}$	$\geq 650\text{ ms}$

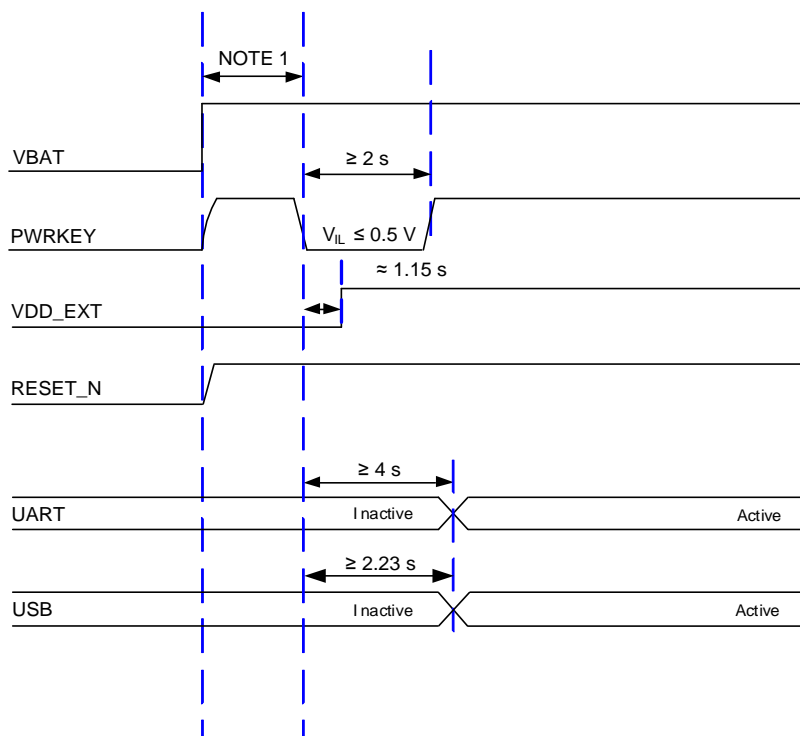


Figure 2: Power-up Timing (EG915U Series)

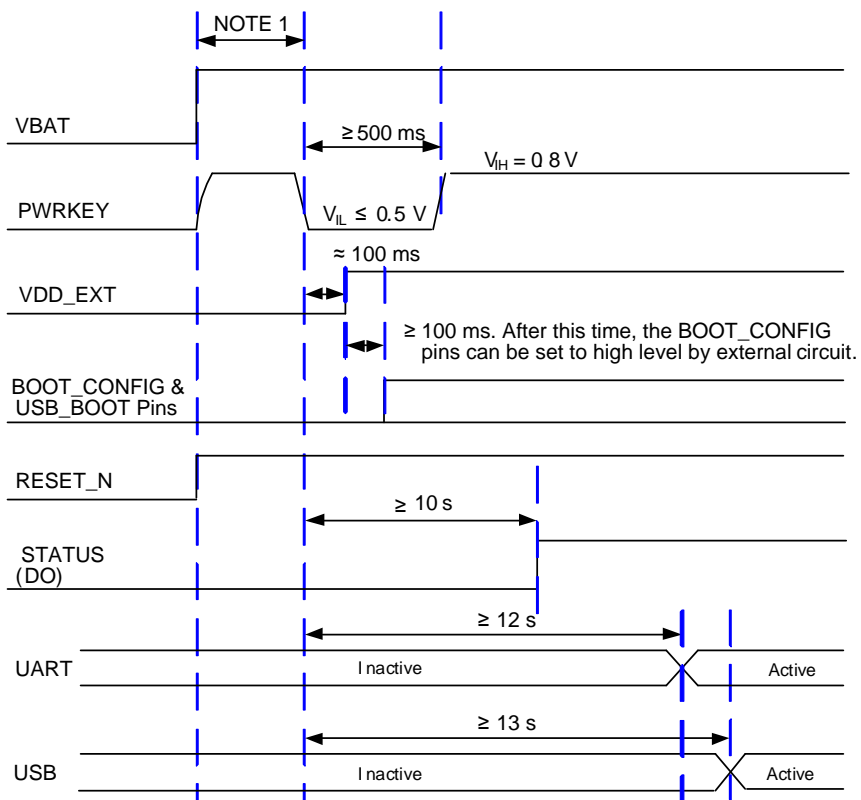


Figure 3: Power-up Timing (EG9x Series)

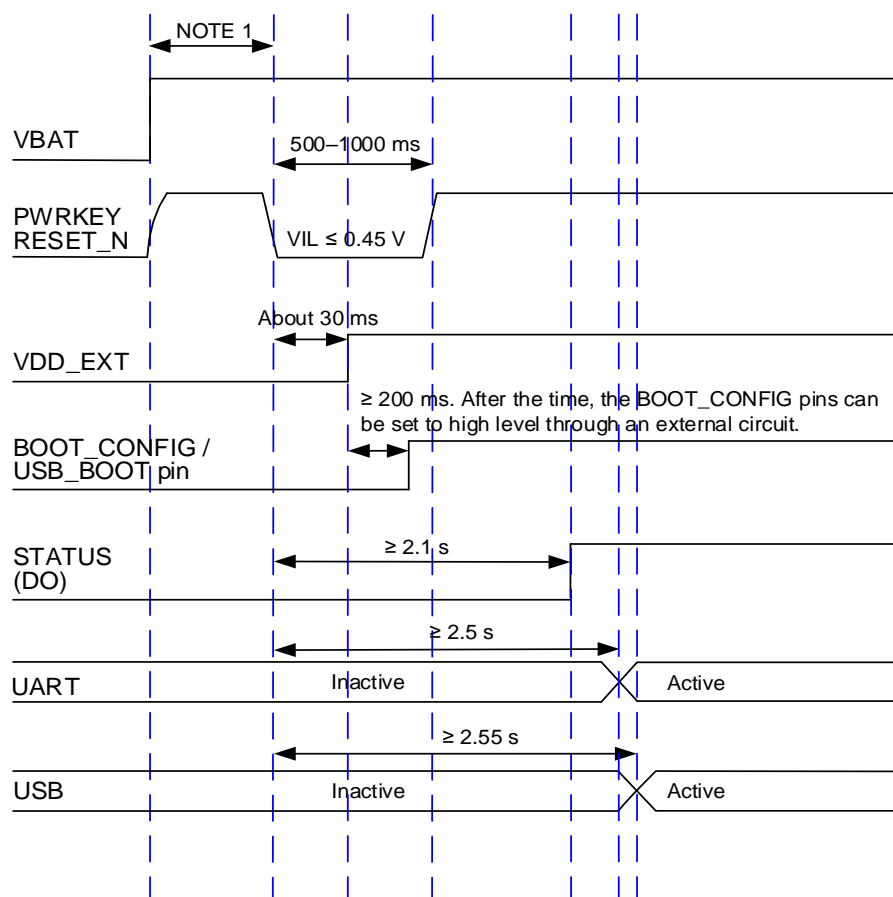


Figure 4: Power-up Timing (BG95 Series)

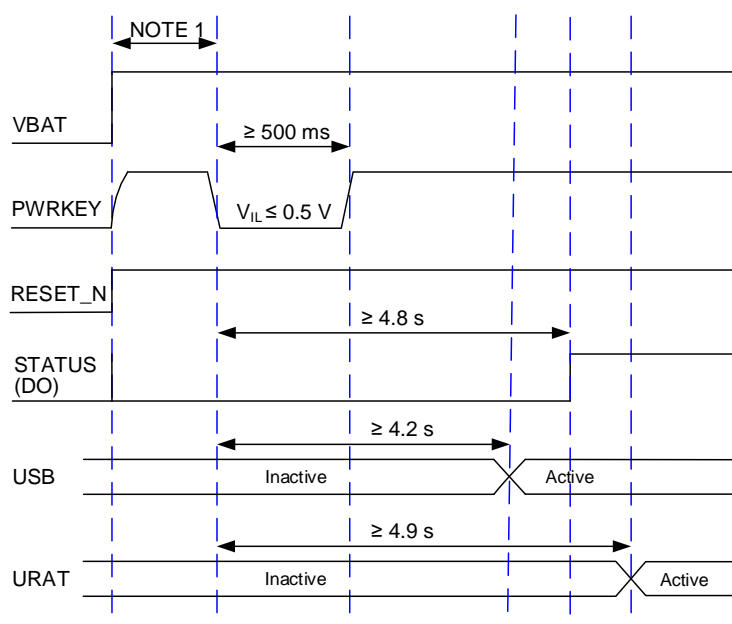
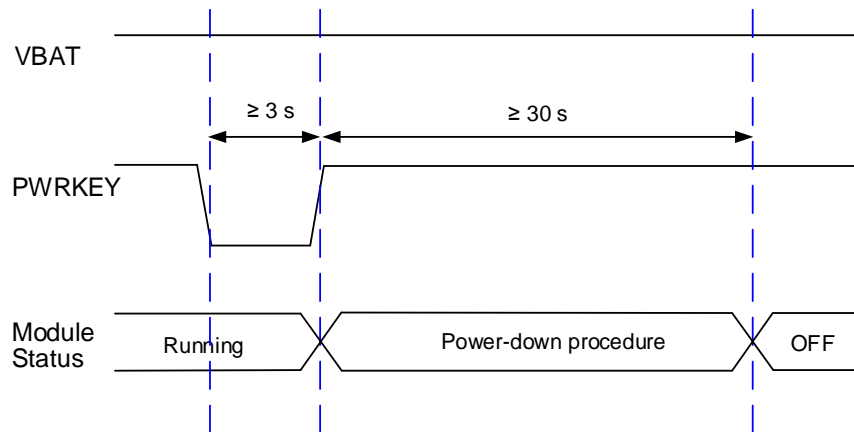


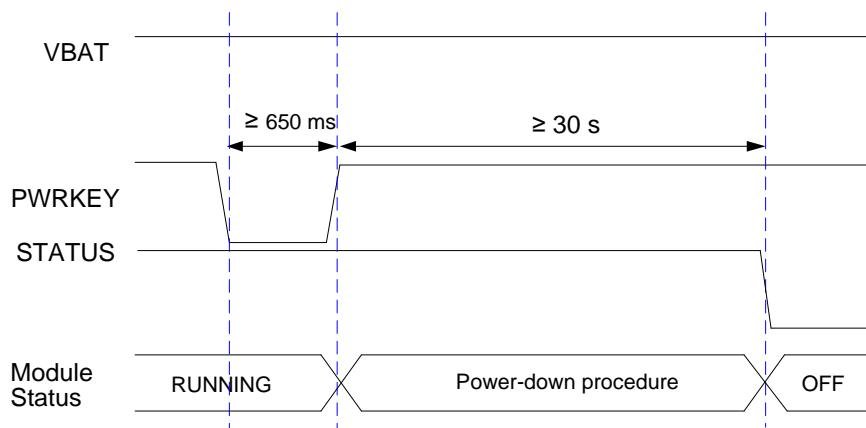
Figure 5: Power-up Timing (BG96)

**NOTE**

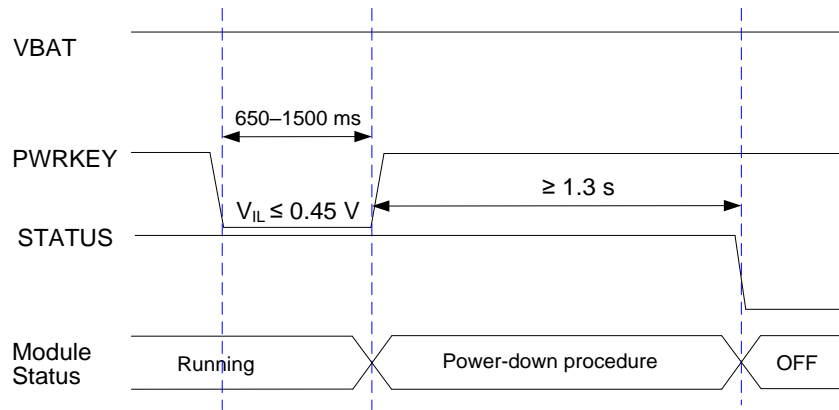
1. Make sure that the VBAT is stable before pulling down PWRKEY pin. It is recommended that the time difference between powering up VBAT and pulling down PWRKEY pin is no less than 30 ms.
2. For EG9x series, PWRKEY can be pulled down directly to GND with a recommended 10 kΩ resistor if the module needs to be powered on automatically and shutdown is not needed.
3. For EG91 series, BOOT\_CONFIG pins (SPI\_CLK, USB\_BOOT, PCM\_CLK, PCM\_SYNC) cannot be pulled up before startup.



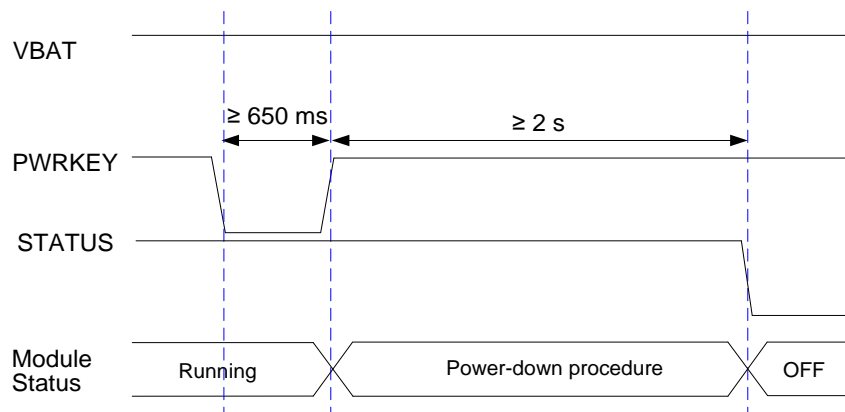
**Figure 6: Power-down Timing (EG915U Series)**



**Figure 7: Power-down Timing (EG9x Series)**



**Figure 8: Power-down Timing (BG95 Series)**



**Figure 9: Power-down Timing (BG96)**

**NOTE**

1. For BG95 series, the output voltage of PWRKEY is 1.5 V because of the voltage drop inside the chipset. Due to platform limitations, the chipset has integrated the reset function into PWRKEY. Therefore, never pull down PWRKEY to GND permanently.
2. For EG915U series, when keeping the PWRKEY to the ground and the AT command cannot be used to turn off, the module can only be forced to turn off by cutting off the VBAT power supply. Therefore, it is recommended to turn on or turn off the module by pulling up and pulling down the PWEKEY instead of keeping the PWRKEY to the ground.
3. For EG9x series, in order to avoid damaging internal flash, do not switch off the power supply when the module works normally. Only after the module is shut down by PWRKEY or AT command, the power supply can be cut off.
4. For EG915U and EG9x series, when turned off the module with the AT command, keep PWRKEY at high level after the execution of the command. Otherwise, the module will be turned on again after being shut down.

### 4.3. Reset

EG915U series, EG9x series, BG95 series and BG96 modules can be reset by driving RESET\_N pin to a low level voltage for a certain time.

**Table 9: Pin Difference of RESET\_N**

Moule Name	Pin Name	Pin No.	DC Characteristics	Reset: Pull-down time
EG915U Series	RESET_N	17	VBAT power domain. $V_{ILmax} = 0.5\text{ V}$	$\geq 100\text{ s}$
EG9x Series			1.8 V power domain. $V_{ILmax} = 0.5\text{ V}$	150–460 ms
BG95 Series			1.5 V power domain. $V_{ILmax} = 0.45\text{ V}$	2–3.8 ms
BG96			1.8 V power domain. $V_{ILmax} = 0.5\text{ V}$	150–460 ms

#### NOTE

- RESET\_N should not be pulled down to GND permanently.
- For BG95 series, due to platform limitations, the chipset has integrated the reset function into PWRKEY, and RESET\_N connects directly to PWRKEY inside the module.
- Using RESET\_N to turn off the module only when **AT+QPOWD** and PWRKEY pin are failed.
- Ensure that there is no large capacitance on PWRKEY and RESET\_N pins.

### 4.4. (U)SIM Interfaces

**Table 10: Pin Difference of (U)SIM1 & (U)SIM2 Interfaces**

Pin No.	EG915U Series	EG9x Series	BG95 Series	BG96	Comment
42	USIM1_DET	USIM1_PRESENCE	USIM_DET	USIM_PRESENCE	1.8 V power domain.
43	USIM1_VDD	USIM1_VDD	USIM_VDD	USIM_VDD	<b>EG915U series /EG9x series/BG96:</b> 1.8 V or 3.0 V (U)SIM card is supported.
44	USIM1_RST	USIM1_RST	USIM_RST	USIM_RST	

45	USIM1_DATA	USIM1_DATA	USIM_DATA	USIM_DATA	<b>BG95 series:</b> supports 1.8 V (U)SIM card only.
46	USIM1_CLK	USIM1_CLK	USIM_CLK	USIM_CLK	
47	USIM1_GND	USIM_GND	USIM_GND	USIM_GND	
83	USIM2_DET	USIM2_PRESENCE	GRFC1	REERVED	1.8 V power domain.
84	USIM2_CLK	USIM2_CLK	GRFC2	REERVED	<b>EG915U series/EG9x series:</b> 1.8 V or 3.0 V (U)SIM2 card is supported.
85	USIM2_RST	USIM2_RST	GPIO6	REERVED	
86	USIM2_DATA	USIM2_DATA	GPIO7	REERVED	<b>BG95 series/BG96:</b> (U)SIM2 interfaces do not support.
87	USIM2_VDD	USIM2_VDD	GPIO8	REERVED	

## 4.5. USB Interface

EG915U series, EG9x series, BG95 series and BG96 modules contain one integrated Universal Serial Bus (USB) interface which complies with USB 2.0 specification. It supports USB slave mode only.

**Table 11: Pin Difference of USB\_VBUS**

Pin Name	Pin No.	I/O	DC Characteristics			
			EG915U Series	EG9x Series	BG95 Series	BG96
USB_VBUS	8	PI	Vmax = 5.25 V	Vmax = 5.25 V	Vmax = 5.25 V	Vmax = 5.25 V
			Vmin = 3.5 V	Vmin = 3.0 V	Vmin = 4.0 V	Vmin = 3.0 V
			Vnom = 5.0 V	Vnom = 5.0 V	Vnom = 5.0 V	Vnom = 5.0 V

### NOTE

1. BG95 series supports low speed (1.5 Mbps), full speed (12 Mbps) and high speed (480 Mbps) modes.
2. EG915U series, EG9x series and BG96 supports high speed (480 Mbps) and full speed (12 Mbps) modes.

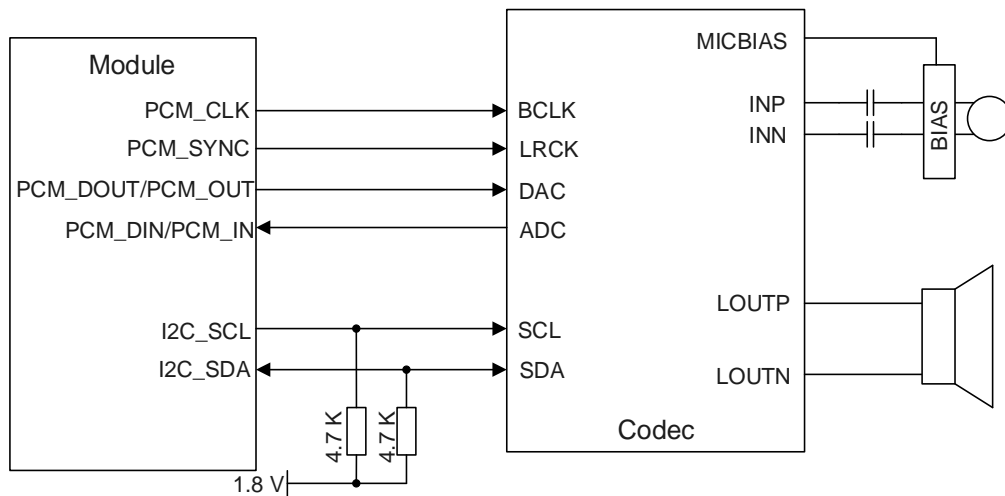


## 4.6. PCM Interface and I2C Interface

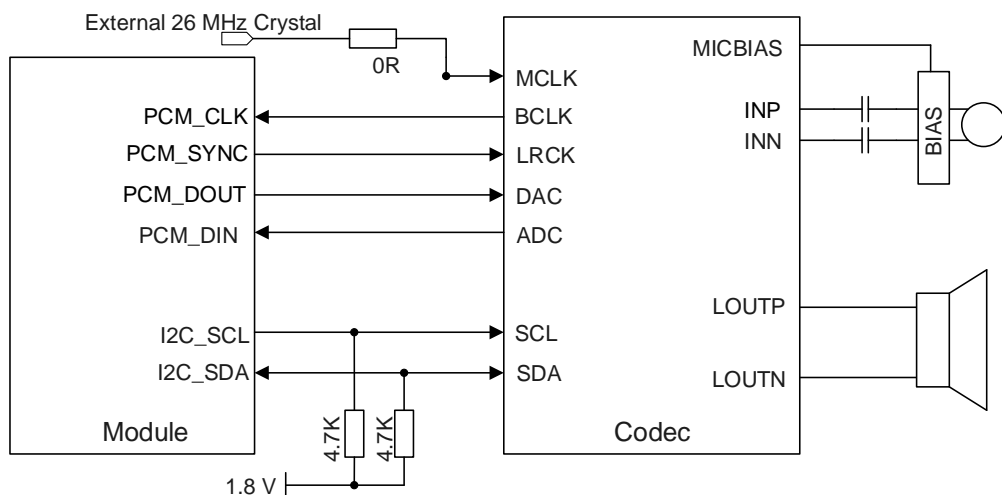
EG915U series, EG9x series, BG95 series and BG96 modules provide one PCM digital interface and one I2C interface.

The PCM interface of EG91U series only supports slave mode, does not support master mode. Therefore, an external clock should be provided for the codec.

The PCM interface of EG9x series, BG95 series and BG96 supports slave mode and master mode.



**Figure 10: PCM Application with Audio Codec (EG9x Series/BG95 Series/BG96)**



**Figure 11: PCM Application with Audio Codec(EG915U Series)**

**NOTE**

EG9x series works as a master device pertaining to I2C interface.

## 4.7. UART Interfaces

EG915U series, BG95 series and BG96 modules provide three UART interfaces: main UART, debug UART and GNSS UART/auxiliary UART.

EG9x series module provides two UART interfaces: main UART and debug UART.

**Table 12: Pin Difference of UART Interfaces**

Pin No.	EG915U Series	EG9x Series	BG95 Series	BG96	Comment
34	MAIN_RXD	RXD	MAIN_RXD	RXD	<b>EG9x series:</b> Baud rates reach up to 921600 bps, 115200 bps by default.
35	MAIN_TXD	TXD	MAIN_TXD	TXD	
22	DBG_RXD	DBG_RXD	DBG_RXD	DBG_RXD	<b>EG915U series:</b> Supports 921600 bps.
23	DBG_TXD	DBG_TXD	DBG_TXD	DBG_TXD	<b>EG9x series/BG95 series/BG96:</b> Supports 115200 bps.
27	AUX_TXD	SPI_MOSI	GNSS_TXD	UART3_TXD	<b>EG915U series/BG95 series/BG96:</b> Supports UART interface function.
28	AUX_RXD	SPI_MISO	GNSS_RXD	UART3_RXD	<b>EG9x series:</b> Does not support UART interface function.

**NOTE**

Transistor circuit solution is not suitable for applications with high baud rate exceeding 460 kbps. Therefore, the debug UART interface of EG915U series cannot be used in transistor circuit solution.

## 4.8. ADC Interfaces

EG915U series, BG95 series, and BG96 module provide two ADC interfaces: ADC0, ADC1.

EG9x series module provides one ADC interface: ADC0.

**Table 13: Pin Difference of ADC Interfaces**

Pin Name	Pin No.	I/O	DC Characteristics			
			EG915U Series	EG9x Series	BG95 Series	BG96
ADC0	24	AI	0.1–VBAT	0.3–VBAT_BB	0.1–1.8 V	0.3–1.8 V
ADC1	2	AI	0.1–VBAT	-	0.1–1.8 V	0.3–1.8 V

## 4.9. Pin 25/26/27/28

**Table 14: Pin Difference of Pin 25/26/27/28**

Pin No.	EG915U Series	EG9x Series	BG95 Series	BG96
25	SPI_CS	RESERVED	GPIO1	RESERVED
26	SPI_CLK	SPI_CLK	GPIO2	GPIO26
27	AUX_TXD	SPI_MOSI	GNSS_TXD	UART3_TXD
28	AUX_RXD	SPI_MISO	GNSS_RXD	UART3_RXD

### NOTE

1. Pin 27/28 of EG915U series/BG95 series/BG96 supports UART interface function. EG9x series does not support UART interface function.
2. BG95 series and BG96 do not support SPI interface.
3. The GNSS\_TXD (pin 27) pin of BG95 series is a BOOT\_CONFIG pin. Do not pull it up before startup.

## 4.10. Pin 63/64/88

Table 15: Pin Difference of Pin 63/64/88

Pin No.	EG915U Series	EG9x Series	BG95 Series	BG96	Comment
63	RESERVED	NC	RESERVED	RESERVED	If unused, keep them open.
64	SPI_DOUT	NC	GPIO3	GPIO64	
88	SPI_DIN	NC	GPIO9	RESERVED	

## 4.11. Pin 1

Table 16: Pin Difference of Pin1

Pin No.	EG915U Series	EG9x Series	BG95 Series	BG96	Comment
					<b>EG915U series:</b> The function of this pin is under development.
1	PSM_IND*	RESERVED	PSM_IND	PSM_IND	<b>EG9x series:</b> RESERVED
					<b>BG95 series/BG96:</b> If unused, keep this pin open.

## 4.12. Pin 96

Table 17: Pin Difference of Pin 96

Pin No.	EG915U Series	EG9x Series	BG95 Series	BG96	Comment
96	PSM_EINT*	NC	PON_TRIG	RESERVED	<p><b>EG915U series:</b> The function of this pin is under development.</p> <p><b>BG95 series:</b> If unused, keep this pin open.</p>

## 4.13. GRFC

Table 18: Pin Difference of GRFC

Pin No.	EG915U Series	EG9x Series	BG95 Series	BG96
76	GRFC1*	NC	RESERVED	RESERVED
77	GRFC2*	NC	RESERVED	RESERVED
83	USIM2_DET	USIM2_PRESENCE	GRFC1	RESERVED
84	USIM2_CLK	USIM2_CLK	GRFC2	RESERVED

### NOTE

- EG915U series and BG95 series support GRFC functions. For more details, please contact Quectel Technical Support.
- BG95-M4 does not support GRFC interfaces (pin 83 and pin 84).

## 4.14. Antenna Interfaces

ANT\_MAIN of EG915U series, EG9x series, BG95 series, and BG96 are compatible with each other. But diversity antenna, GNSS antenna, Wi-Fi/Bluetooth antenna of EG915U series, EG9x series, BG95 series, and BG96 are not compatible.

**Table 19: Pin Difference of ANT\_GNSS/ANT\_WIFI**

Pin No.	EG915U Series	EG9x Series	BG95 Series	BG96
49	RESERVED	ANT_GNSS/ANT_DIV	ANT_GNSS	ANT_GNSS
56	ANT_BT/WIFI_SCAN	ANT_DIV/RESERVED	ANT_WIFI*	RESERVED

### NOTE

- EG915U series support Bluetooth and Wi-Fi Scan functions. Due to the shared antenna interface, the two functions cannot be used simultaneously. And Wi-Fi scan supports receive only.
- For EG91 series, pin 49 is defined as ANT\_GNSS on EG91-AUX/-EX/-NA/-NAL/-NAX/-NAXD/-VX, while it is defined as ANT\_DIV on EG91-E.
- For EG95 series, pin 49 is defined as ANT\_GNSS on EG95-NA/-EX/-NAX/-NAXD/-AUX, while it is defined as ANT\_DIV on EG95-E.
- For BG95 series, Wi-Fi antenna interface for BG95-MF only.

# 5 Recommended Footprint

This chapter mainly introduces the recommended footprint and stencil design for EG915U series, EG9x series, BG95 series and BG96 modules. All dimensions are measured in mm, and the tolerances for dimensions without tolerance values are  $\pm 0.2$  mm.

## 5.1. Recommended Compatible Footprint

The following figure shows the bottom views of EG915U series, EG9x series, BG95 series and BG96.

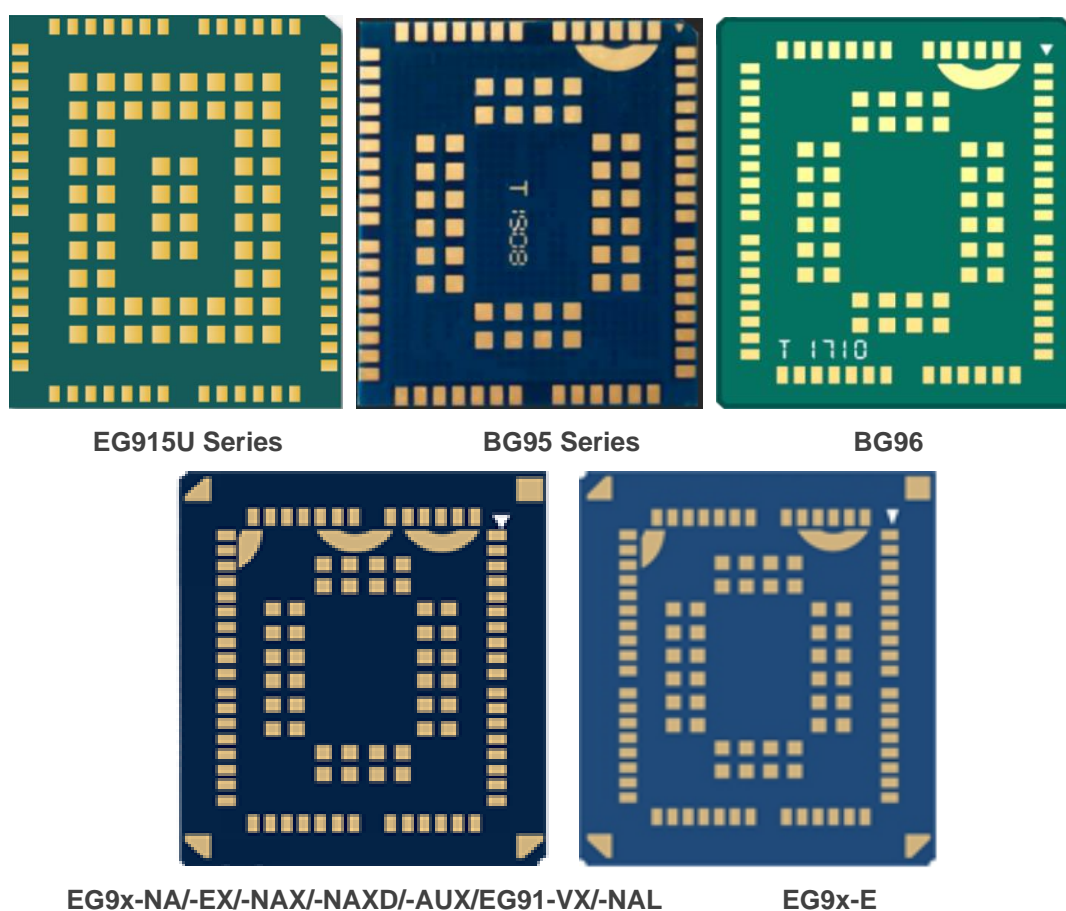


Figure 12: Bottom Views of EG915U Series/EG9x Series/BG95 Series/BG96

The following figure shows the recommended compatible footprint of EG915U series, EG9x series, BG95 series and BG96.

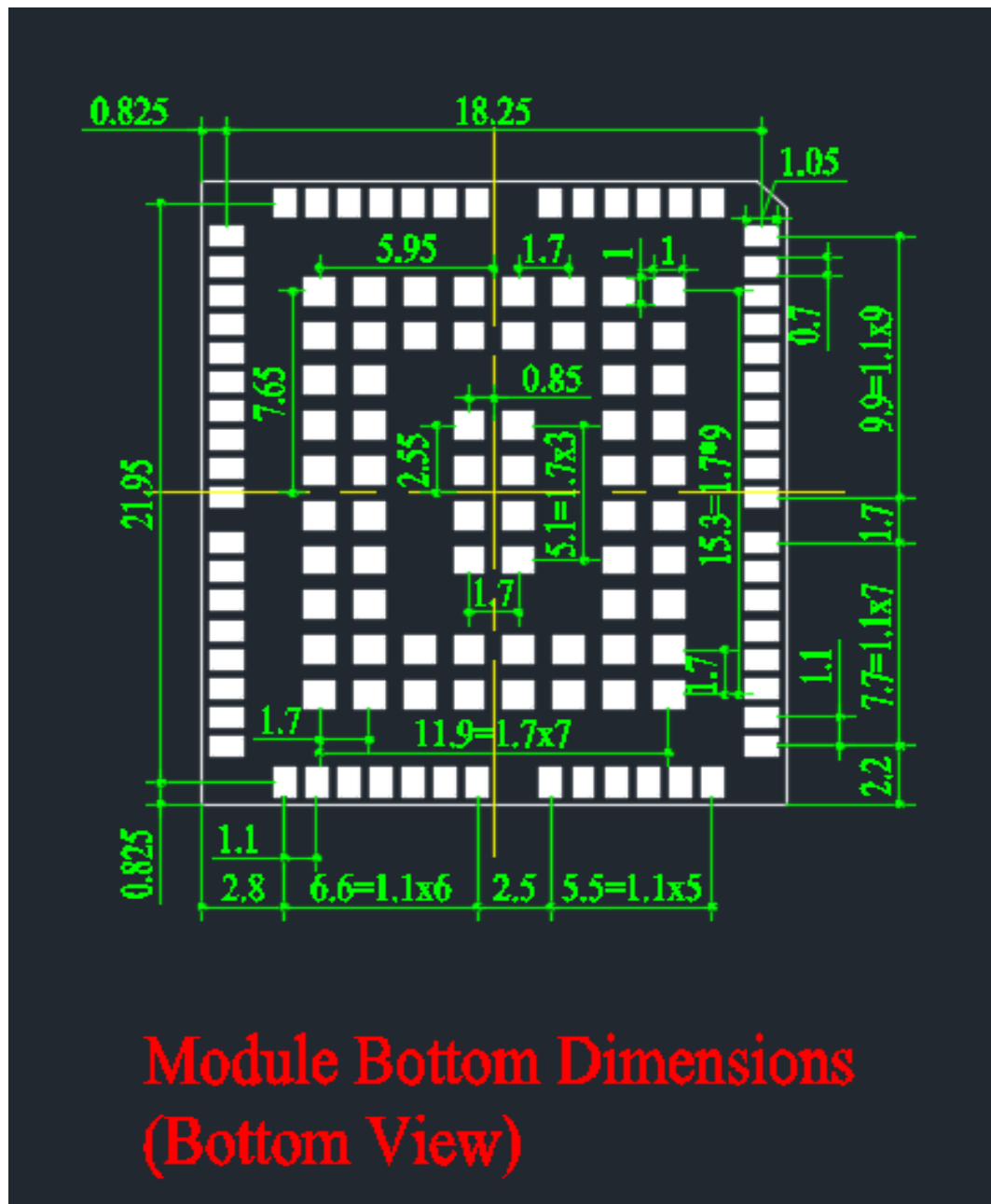


Figure 13: Recommended Footprint of EG915U Series/EG9x Series/BG95 Series

**NOTE**

Keep at least 3 mm between the module and other components on the motherboard to improve soldering quality and maintenance convenience.



## 5.2. Installation Sketch Map

The following figure shows the sketch map of installation among EG915U series, EG9x series, BG95 series and BG96.

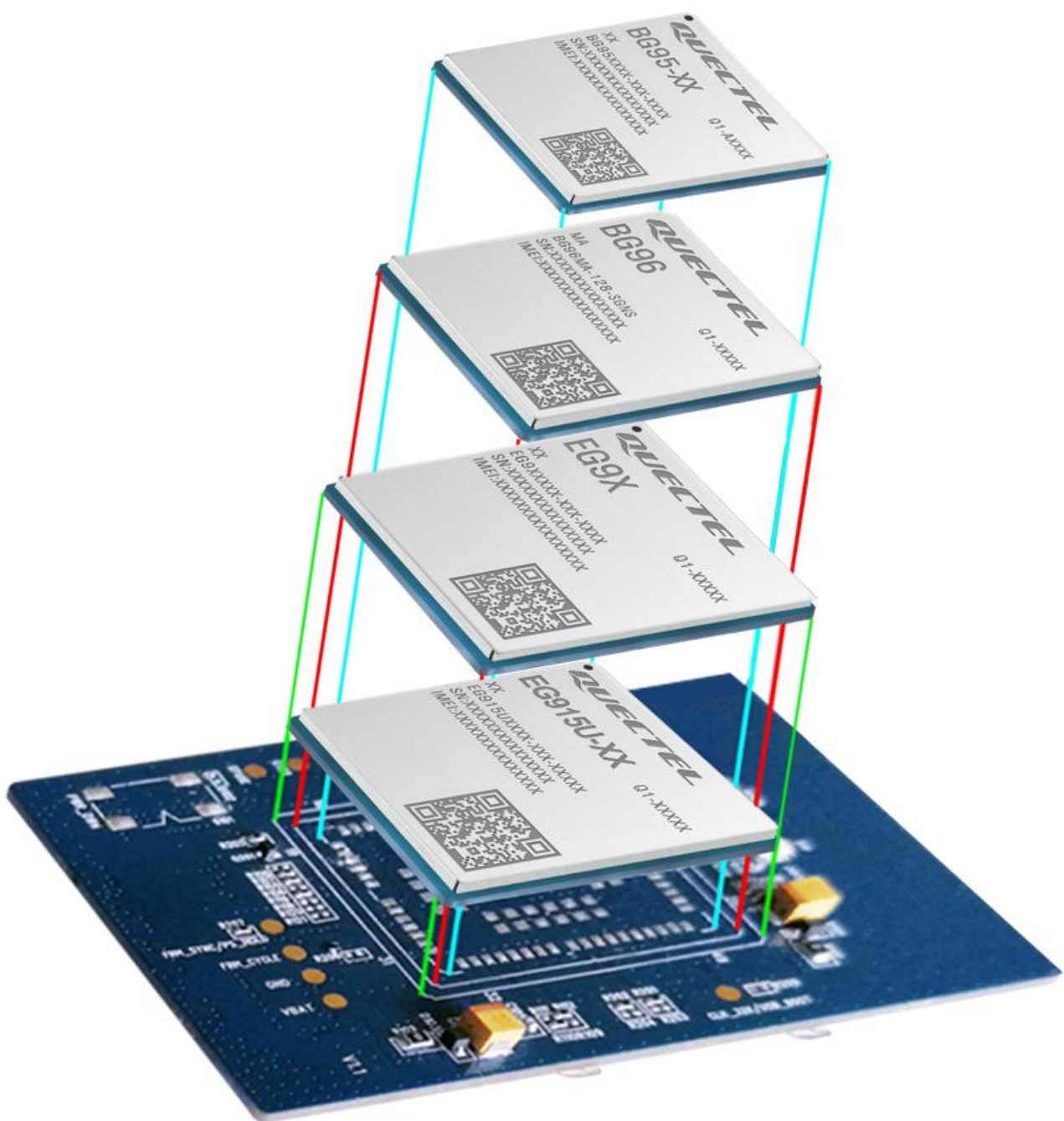


Figure 14: Installation Sketch Map for EG915U Series/EG9x Series/BG95 Series/BG96

# 6 Appendix References

**Table 20: Related Documents**

Document Name
[1] Quectel_EG915U_Series_Hardware_Design
[2] Quectel_EG91_Series_Hardware_Design
[3] Quectel_EG95_Series_Hardware_Design
[4] Quectel_BG95_Series_Hardware_Design
[5] Quectel_BG96_Hardware_Design
[6] Quectel_EG915U_Series_AT_Commands_Manual
[7] Quectel_EG9x_AT_Commands_Manual
[8] Quectel_BG95&BG77&BG600L_Series_AT_Commands_Manual
[9] Quectel_BG96_AT_Commands_Manual
[10] Quectel_EG915U_Series_Reference_Design
[11] Quectel_EG9x_Reference_Design
[12] Quectel_BG95_Series_Reference_Design
[13] Quectel_BG96_Reference_Design

**Table 21: Terms and Abbreviations**

Abbreviation	Description
bps	Bits Per Second
CS	Coding Scheme

CTS	Clear To Send
DC-HSDPA	Dual-carrier High Speed Downlink Packet Access
DFOTA	Delta Firmware Upgrade Over The Air
DL	Downlink
DRX	Discontinuous Reception
DTR	Data Terminal Ready
EDGE	Enhanced Data Rates for GSM Evolution
EGPRS	Enhanced General Packet Radio Service
FDD	Frequency Division Duplex
GNSS	Global Navigation Satellite System
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
HSDPA	High Speed Downlink Packet Access
HSUPA	High Speed Uplink Packet Access
I/O	Input/Output
IoT	Internet of Things
LGA	Land Grid Array
LPWA	Low-Power Wide-Area (Network)
LTE	Long Term Evolution
NMEA	NMEA (National Marine Electronics Association) 0183 Interface Standard
PCM	Pulse Code Modulation
PF	Paging Frame
PSM	Power Saving Mode
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying

RF	Radio Frequency
Rx	Receive
SISO	Single Input Single Output
SMS	Short Message Service
TDD	Time Division Duplexing
Tx	Transmitting Direction
UL	Uplink
UART	Universal Asynchronous Receiver/Transmitter.
USB	Universal Serial Bus
(U)SIM	(Universal) Subscriber Identity Module
V <sub>max</sub>	Maximum Voltage
V <sub>nom</sub>	Nominal Voltage
V <sub>min</sub>	Minimum Voltage
V <sub>ILmax</sub>	Maximum Low-level Input Voltage
VoLTE	Voice (voice calls) over LTE
WCDMA	Wideband Code Division Multiple Access
Wi-Fi	Wireless Fidelity