

# RAK8213 Data Sheet

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# 1. Introduction

The RAK8213 is a LTE Cat M1/Cat NB1 module based on the Quectel BG96 with a standard PCI Express® MiniCard form factor (Mini PCIe). Supports EGPRS network at the same time, can offer the highest data rate of 300Kbps downlink and 375Kbps uplink.

RAK8213 built-in GNSS module can support GPS, GLONASS, BeiDou/Compass, Galileo, QZSS, integrated GNSS greatly simplifies product design and provides faster, more accurate and more reliable positioning.

The module has a variety of power modes that can meet most of the application scenarios. And provides pin-to-pin compatibility with the Quectel LTE module EG91/EG95, Cat NB1 (NB-IoT) module BC95, UMTS/HSPA module UG95/UG96 and GSM/GPRS module M95.

Rich Internet protocol, industry-standard interfaces (USB/UART/I2C/Status indicators) and rich features (applicable to Windows XP, Windows Vista, Windows 7/8/8.1/10, Linux drivers for Linux and Android) Modules that extend applicability are suitable for a wide range of M2M applications such as wireless POS, smart metering, and tracking.

## 2. Feature

### 2.1 Key Benefits

- LTE Cat. M1/Cat.NB1/EGPRS module with Mini PCIe form factor, optimized for M2M and IoT applications.
- Ultra-low power consumption.
- USB Drivers and support 2.0 high speed interface.
- Quectel Enhanced AT commands.
- Robust mounting and interfaces

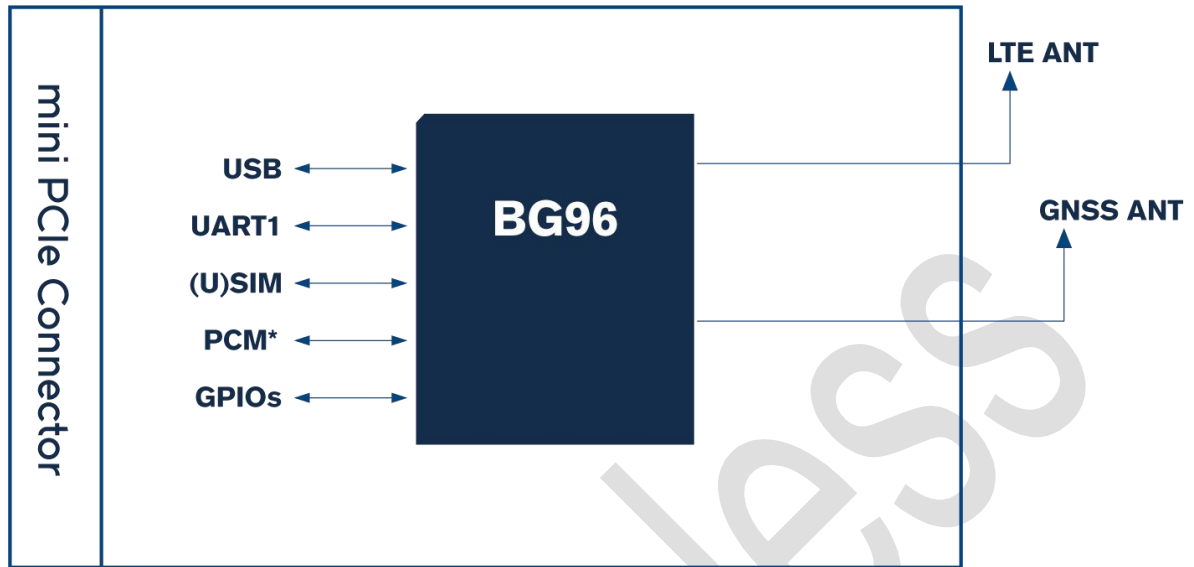
### 2.2 Interface

- ◆ USB 2.0 with High Speed up to 480Mbps
- ◆ UART × 1
- ◆ PCM\* × 1
- ◆ (U)SIM Interface × 1(One Micro SIM on board by default)
- ◆ NETLIGHT for Network Status Indication
- ◆ STATUS for Power ON/OFF Indication
- ◆ Main and GNSS Antenna Interfaces

### 2.3 Application

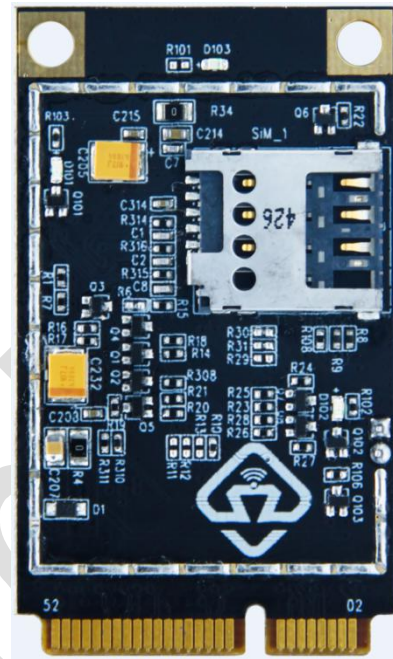
- Netbooks, notebooks
- Remote monitoring
- Onboard
- Wireless POS
- Smart meter reading
- Wireless routers, switches

### 3. System Diagram



## 4. Hardware introduction

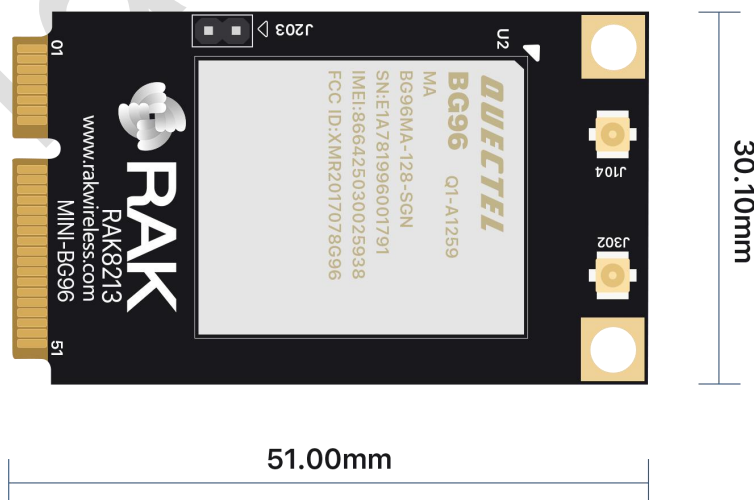
### 4.1 Module photo



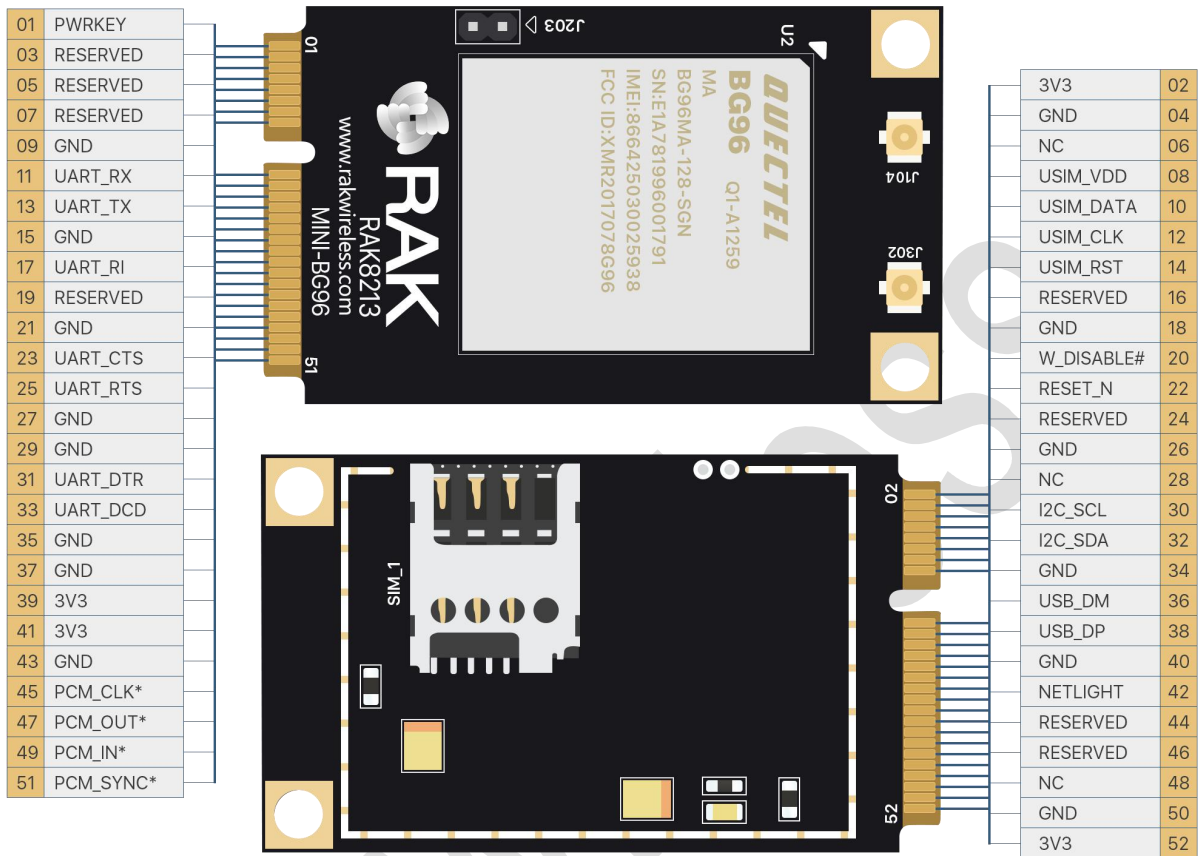
height : 5.9mm ± 0.1mm  
max height(wihtout J203) : 2.5mm ± 0.1mm  
J203 total height : 8.8mm ± 0.1mm  
PCB height : 1.1mm ± 0.01mm

height : 1.8mm ± 0.1mm.  
max height(wihtout J203) : 2.2mm ± 0.1mm.

### 4.2 Size information



### 4.3 Pin definition



Pin.NO	Pin Name	Description
1	PWRKEY	Turn on/off the module
2	3V3	3.3V supply voltage
3	RESERVED	Reserved pins
4	GND	Ground
5	RESERVED	Reserved pins
6	NC	NULL
7	RESERVED	Reserved pins
8	USIM_VDD	Power supply for (U)SIM card
9	GND	Ground
10	USIM_DATA	Data signal for (U)SIM card
11	UART_RX	Receive data, support 3.3V

12	USIM_CLK	Clock signal of (U)SIM card
13	UART_TX	Transmit data, support 3.3V
14	USIM_RST	Reset signal of (U)SIM card
15	GND	Ground
16	RESERVED	Reserved pins
17	UART_RI	Ring indicator, support 3.3V
18	GND	Ground
19	RESERVED	Reserved pins
20	W_DISABLE#	Airplane mode control
21	GND	Ground
22	RESET_N	Module reset pin, active low
23	UART_CTS	Clear to send, support 3.3V
24	RESERVED	Reserved pins
25	UART_RTS	Request to send, support 3.3V
26	GND	Ground
27	GND	Ground
28	NC	NULL
29	GND	Ground
30	I2C_SCL	Temporarily unavailable
31	UART_DTR	Data terminal ready. Sleep mode control
32	I2C_SDA	Temporarily unavailable
33	UART_DCD	Data carrier detection
34	GND	Ground
35	GND	Ground
36	USB_DM	USB differential data bus (-)
37	GND	Ground
38	USB_DP	USB differential data bus (+)
39	3V3	3.3V supply voltage
40	GND	Ground
41	3V3	3.3V supply voltage
42	NETLIGHT	Indicate the module's network activity status



43	GND	Ground
44	RESERVED	Reserved pins
45	PCM_CLK*	PCM clock output, In development
46	RESERVED	Reserved pins
47	PCM_OUT*	PCM data output, In development
48	NC	NULL
49	PCM_IN*	PCM data input, In development
50	GND	Ground
51	PCM_SYNC*	PCM frame synchronization output. In development
52	3V3	3.3V supply voltage

## 5. Performance Parameters

Features	Details
Mini PCIe interface	Using the PCI Express Mini Card 1.2 standard interface
Power Supply	Supply voltage: 3.3V~4.3V, Typical supply voltage: 3.8V
Transmitting Power	Class 3 (23dBm±2.7dB) for LTE-FDD bands
	Class 3 (23dBm±2.7dB) for LTE-TDD bands
	Class 4 (33dBm±2dB) for GSM850
	Class 4 (33dBm±2dB) for GSM900
	Class 1 (30dBm±2dB) for DCS1800
	Class 1 (30dBm±2dB) for PCS1900
	Class E2 (27dBm±3dB) for GSM850 8-PSK
	Class E2 (27dBm±3dB) for GSM900 8-PSK
	Class E2 (26dBm±3dB) for GSM1800 8-PSK
Class E2 (26dBm±3dB) for GSM1900 8-PSK	
LTE Features	Support LTE Cat M1 LTE-FDD:B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B26/B28 LTE-TDD:B39
	Support LTE Cat NB1 LTE-FDD:B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B26/B28
	Support 1.08MHz RF bandwidth
	Support SISO in DL direction
	Cat M1:Max 375kbps(DL)/375kbps(UL)
	Cat NB1:Max 32kbps(DL)/70kbps(UL)
GSM Features	GPRS:Support GPRS multi-slot class 12(12 by default) Coding schemes:CS-1,CS-2,CS-3 and CS-4 Maximum of four Rx time slots per frame GPRS:Max 85.6kbps(DL)/85.6kbps(UL)
	EDGE:Support EDGE multi-slot class 12(12 by default) Support GMSK and 8-PSK for different MCS (Modulation and coding Scheme) Downlink coding schemes: CS 1-4 and MCS 1-9 Uplink coding schemes: CS 1-4 and MCS 1-9

	EDGE: Max. 236.8kbps (DL)/236.8kbps (UL)
Internet Protocol Features*	Support TCP/UDP/PPP protocols Support PAP (Password Authentication Protocol) and CHAP (Challenge Handshake Authentication Protocol) protocols which are usually used for PPP connections
SMS*	Text and PDU mode Point to point MO and MT SMS cell broadcast SMS storage: ME by default
(U)SIM Card Interface	Support USIM/SIM card: 1.8V, 3.0V
Audio Feature*	Support one digital audio interface: PCM interface
USB Interface	Compliant with USB 2.0 specification (slave only) and the data transfer rate can reach up to 480Mbps Used for AT command communication, data transmission, GNSS NEMA output, software debugging and firmware upgrade Support USB drivers for Windows XP, Windows Vista, Windows 7, Windows 8/8.1, Windows 10, Windows CE 5.0/6.0/7.0*, Linux 2.6/3.x/4.1, Android 4.x/5.x/6.0
UART Interfaces	UART1: Used for data transmission and AT command communication Baud rate reach up to 3000000bps; 115200bps by default Support RTS and CTS hardware flow control
AT Commands	3GPP TS 27.007 and 3GPP TS 27.005 AT commands, as well as Quectel enhanced AT commands
Network Indication	One NETLIGHT pin for network connectivity status indication
Antenna Interfaces	Including main antenna (ANT_MAIN) and GNSS antenna (ANT_GNSS) interfaces
Physical Characteristics	Size: (51.0±0.15)mm × (30.0±0.15)mm × (4.9±0.2)mm Weight: approx. 11.4g
Temperature Range	Operation temperature range: -35°C ~ +75°C Extended temperature range: -40°C ~ +85°C
Firmware Upgrade	USB interface and DFOTA*
RoHS	All hardware components are fully compliant with EU RoHS directive

**Note:**

1. "\*" means under development.

## 6. Electrical Characteristics

### 6.1 Absolute Maximum Ratings

Parameter	Min	Typical	Max	Unit
3V3 pin	-0.3	3.3	4.3	V
Digital pins	-0.3	1.8	2.3	V

### 6.2 Power consumption

Parameter	Description	Condition	Typical	Unit
I <sub>PWR</sub>	Shutdown	Shutdown mode	8	uA
	Minimum function mode	AT+CFUN=0(Uart and USB are not connected)	0.8	mA
	Power saving mode(PSM)	PSM @LTE Cat M1	10.4	uA
		PSM @LTE Cat NB1	9.8	uA
	Standby mode	DRX=1.28s @LTE Cat.M1(Uart and USB are not connected)	1.99	mA
		e-I-DRX=20.48s @LTE Cat.NB1(Uart and USB are not connected)	2.77	mA
	LTE Cat M1 data transmission (GNSS closed)	23dBm (Instrument testing)	190	mA
		18dBm (Instrument testing)	155	mA
		12dBm (Instrument testing)	136	mA
		0dBm (Instrument testing)	124	mA
	LTE Cat NB1 data transmission (GNSS closed)	23dBm (Instrument testing)	TBD	mA
		18dBm (Instrument testing)	TBD	mA
		12dBm (Instrument testing)	TBD	mA
		0dBm (Instrument testing)	TBD	mA
	LTE Cat M1 Voice (GNSS closed)	Voice Call @LTE Cat.M1	108	mA

### 6.3 RF Output Power

Frequency	Max	Min
LTE-FDD B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B26/B28	23dBm±2.7dB	<-44dBm
LTE-TDD B39	23dBm±2.7dB	<-44dBm
GSM850/GSM900	33dBm±2dB	5dBm±5dB
DCS1800/PCS1900	30dBm±2dB	0dBm±5dB
GSM850/GSM900 (8-PSK)	27dBm±3dB	5dBm±5dB
DCS1800/PCS1900 (8-PSK)	26dBm±3dB	0dBm±5dB

### 6.4 RF Receiving Sensitivity

Standard	Frequency	Cat.M1 Sensitivity / 3GPP (dBm)	Cat.NB1 Sensitivity / 3GPP (dBm)
LTE	LTE-FDD B1	-107.0/-102.7	-117/-107.5
	LTE-FDD B2	-106.7/-100.3	-117/-107.5
	LTE-FDD B3	-106.8/-99.3	-117/-107.5
	LTE-FDD B4	-106.9/-102.3	-117/-107.5
	LTE-FDD B5	-107.0/-100.8	-117/-107.5
	LTE-FDD B8	-107.3/-99.8	-117/-107.5
	LTE-FDD B12	-107.7/-99.3	-117/-107.5
	LTE-FDD B13	-106.5/-99.3	TBD/-107.5
	LTE-FDD B18	-107.5/-102.3	-119/-107.5
	LTE-FDD B19	-107.1/-102.3	-119/-107.5
	LTE-FDD B20	-107.2/-99.8	-118/-107.5
	LTE-FDD B26	-107.1/-100.3	-118/-107.5
	LTE-FDD B28	-107.2/-100.8	-118/-107.5
	LTE-TDD B39	TBD/-103	Not support
Standard	Frequency	GSM sensitivity/3GPP (dBm)	
GSM	GSM850/GSM900	-109/-102.4	
	DCS1800/PCS1900	-108.5/-102.4	

## 7. Ordering Information

Product	Based module	Interface
RAK8213	Quectel BG96	Mini PCIe

## 8. Contact information

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## 9. Revision History

Version	Date	Change	Author
V1.0	2018-06-06	First release	Chace