

User Manual for

# WisLink Cellular BG96 Arduino Shield RAK2011

Version 2.0 | November 2018



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## 1 Overview

### 1.1 Introduction

WisLink Cellular BG96 Arduino Shield RAK2011 is a compact cellular communications module that supports Low-Power Wide-Area (LPWA) technology for networking Internet-of-Things (IoT) devices. It can simultaneously support 2G, 4G/LTE, NB-IoT and GPS, with an additional feature of Voice-over-LTE (VoLTE) for high definition (HD) and uninterrupted voice calls.

This multitude of features allow users the flexibility of migrating from 2G to 4G/LTE without requiring any hardware change, improve power consumption, system capacity and spectrum efficiency by utilizing the Narrow Band Internet-of-Things, tracking units through GPS and location base services (LBS), stay on the 4G/LTE network even when making or receiving calls and other networking features.

The RAK2011 is based on the Quectel BG96 module and comes with drivers for Windows, Linux and Android support via AT commands. It supports networking protocols such as PPP, TCP, UDP, SSL, TLS, FTP(S), HTTP(S), NITZ, PING and MQTT. This is useful for facilitating software development and system integration into any IoT applications.

RAK2011 can be used as a development platform in tandem with external microcontrollers/microprocessors based platforms for IoT applications or it can be used as standalone device. It is in full compliance with FCC, CE, RoHS and Japan TELEC/JATE.

## 1.2 Package Content

WisLink Cellular BG96 Arduino Shield RAK2011 retail package includes:



Image 1 | Package Content



## 2 WisLink Cellular BG96 Arduino Shield RAK2011

### 2.1 **Overview**

The picture below shows part identification on top view of WisLink Cellular BG96 Arduino Shield RAK2011.



Image 2 | Top View of Board

The underside and dimension of the RAK2011 is shown below:



Image 3 | Bottom View of Board



## 2.2 Functional Diagram

The block diagram below shows internal architecture and external interfaces:



Image 4 | Functional Diagram

### 2.3 Interfaces

The RAK2011 is built around the Quectel BG96 LPWA IoT cellular module and provides the following interfaces, headers, jumpers, buttons and connectors:

- Micro-B USB
- Micro SIM Card Slot
- Arduino Headers (UART1, UART3, RESET, PWRKEY, STATUS, AP\_READY, DTR, RI, PSM\_IDC, W\_DISABLE, 5V, 3.3V)
- 2x4 PCM Voice Headers (I2C, I2S)
- 2x3 Digital/Analog I/O Headers (ADC0, ADC1, GPIO0, GPIO1)
- 1x4 Debug UART Header (UART2)
- 1x2 USB BOOT Jumper

It has two push buttons to allow the user to power on/off and reset the board:

- POWER\_KEY Power on/off the BG96 module
- RESET Reset the BG96 module

It has two SMA antenna connectors:

- Cellular (LTE/GSM) Antenna (3GPP Bands) UART1
- GPS Antenna (1575.42±1.023 MHz) UART3



## 2.4 **Operating Modes**

The WisLink Cellular BG96 Arduino Shield RAK2011 can operate in the following modes:

#### 1.4.1 Normal Operation

**Idle** - Software is active. The BG96 module has registered to the network, and is ready to send and receive data.

**Talk/Data** - Network connection is ongoing; the power consumption is determined by the network settings and data transfer rate.

#### 1.4.2 Extended Idle Mode DRX (e-I-DRX)

BG96 module may negotiate with the network, via non-access stratum signaling, the use of e-I-DRX for reducing power consumption while being available for mobile terminating data and/or network originated functions within a certain period dependent on the DRX cycle value.

#### 1.4.3 Airplane Mode

AT+CFUN command or  $W_DISABLE#$  pin can set the module into airplane mode. In this case, RF functions are disabled.

#### 1.4.4 Minimum Functionality Mode

AT+CFUN command can set the BG96 module into a minimum functionality mode without removing the power supply. In this case, both RF function and (U)SIM card will be disabled.

#### 1.4.5 Sleep Mode

In this mode, the current consumption of the BG96 module will be reduced to a lower level. During this mode, the BG96 module can still receive paging message, SMS and TCP/UDP data from the network.

#### 1.4.6 Power Saving Mode (PSM)

The BG96 module may enter into Power Saving Mode for reducing its power consumption. PSM is similar to power-off, except the BG96 module remains registered on the network and there is no need to reestablish PDN connections.

#### 1.4.7 Power OFF Mode

In this mode, the power management unit shuts down the power supply. The software is not active, the serial interfaces are not accessible, but operating voltage remains applied.



3GPP Band	Transmit (MHz)	Receive (MHz)
B1	1920 ~ 1980	2110 ~ 2170
B2 (PCS1900)	1850 ~ 1910	1930 ~ 1990
B3 (DCS1800)	1710 ~ 1785	1805 ~ 1880
B4	1710 ~ 1755	2110 ~ 2155
B5 (GSM850)	824 ~ 849	869 ~ 894
B8 (GSM900)	880 ~ 915	925 ~ 960
B12	699 ~ 716	728 ~ 746
B13	777 ~ 787	746 ~ 757
B18	815 ~ 829.9	860 ~ 874.9
B19	830 ~ 844.9	875 ~ 889.9
B20	832 ~ 862	791 ~ 821
B26	814 ~ 848.9	859 ~ 893.9
B28	703 ~ 748	758 ~ 803
B39	1880 ~ 1920	1880 ~ 1920

The table below lists all the supported cellular (LTE/GSM) operating frequencies:

Table 1 | Cellular Operating Frequency



Image 5 | LTE and GNSS Antenna

RAK2011



### 2.6 Arduino Header

The mapping of Arduino headers on the WisLink Cellular BG96 Arduino Shield RAK2011 is shown below:



Image 6 | Pin Configurations for Arduino headers

Name	Pin	I/O	Description
UART1_TXD	D0	D0	UART1_TXD
UART1_RXD	D1	D1	Receive cellular (LTE/GSM) data
R1	D2	D0	Ring indicator
DTR	D3	D1	Data Terminal Ready (sleep mode control)
AP_READY	D4	D1	Application processor sleep state detection
RESET	D5	D1	Reset signal of the BG96 module
PWRKEY	D6	D1	Turn on/off the BG96 module
STATUS	D7	D0	Indicate the BG96 module's operation status
W_DISABLE	D8	D1	Airplane mode control
PSM_IND	D9	D0	Power saving mode indicator
UART3_RXD	D11	D0	Transmit GPS data
UART3_TXD	D12	D1	Receive GPS data

The Arduino header signal definition is shown below:

 Table 2 | Pin Configurations foir Arduino Headers

UART1 interface supports 9600, 19200, 38400, 57600, 115200, 230400, 460800 and 921600 baud rates, and the default is 115200bps. It is used for cellular (LTE/GSM) data transmission and AT command communication.

UART3 interface supports 115200bps baud rate. It is used for outputting GPS data and NEMA sentences.





### 2.7 PCM Voice Header

A standard 2x4 (2.54mm) male header is used to provide one Pulse Code Modulation (PCM) digital interface and one I2C interface to external CODEC extension board. PCM voice header pin definition is shown below:

		MURANCE CONTRACTOR CON	BO96 grants	
I2S_SCL PCM_SYNC	1 3	B	2 4	I2S_SDA PCM_CLK
PCM_IN GND	5	B	6 8	PCM_OUT VCC_5V
Imac	e 7   P	CM Voi	ce H	eader

The PCM voice header pin definition is shown below:

Name	Pin	I/O	Description	Comments
I2C_SCL	1	OD	I2C serial clock	External pull-up resistor is
I2C_SDA	2	OD	I2C serial data	open if unused.
PCM_SYNC	3	DO	PCM frame sync output	
PCM_CLK	4	DO	PCM clock output	1.8V power domain. Keep this
PCM_IN	5	DI	PCM data input	open if unused.
PCM_OUT	6	DO	PCM data output	

Table 3 | PCM Voice Header

#### The reference design for external CODEC extension board is shown below:





## 2.8 Analog Input / Digital I/O Header

A standard 2x3 (2.54mm) male header is used to provide 2 analog input (ADC0 and ADC1) and 2 digital input and output port pins (GPIO0 and GPIO1) to an optional external extension board for additional features that may utilize these analog Input and digital I/O port pins. The analog input and digital I/O header pin layout is shown below:



Image 9 | Analog Input / Digital I/O Header

6

VCC\_5V

The analog Input/Digital I/O header signal definition is shown below:

5

Name	Pin	I/O	Description	DC Characteristics	Comments
GPIO0	1	ю	V <sub>oL</sub> max = 0 V <sub>oH</sub> min = 1 General Purpose V <sub>IL</sub> min = 0 Input / Output	V <sub>OL</sub> max = 0.45V V <sub>OH</sub> min = 1.35V V <sub>IL</sub> min = 0.3V	1.8V power domain. Keep this open if
GPIO1	2		input / Output	V <sub>IH</sub> min = 1.2V V <sub>IH</sub> max = 2.0V	unused.
ADC0	3	AI	General Purpose Analog to Digital	Voltage range: 0.3V to 1.8V	Keep this open
ADC1	4		Converter	15-bit resolution	when unused.

Table 4 | Analog Input / Digital I/O Header



## 2.9 **Debug Header**

A standard 1x4 (2.54mm) male header is used to provide a serial port (UART2) interface for debug and log output at 115200bps baud rate. The debug header pin definition is shown below:





Image 10 | Debug Header

The analog Input/Digital I/O header signal definition is shown below:

Name	Pin	I/O	Description	DC Characteristics	Comments
DB_G_RXD	2	DI	Receive data	$V_{IL}$ min = 0.3V $V_{IL}$ max = 0.6V $V_{IH}$ max = 1.2V $V_{IH}$ max = 2.0V	1.8V power domain. Keep this open if unused.
DBG_TXD	3	DO	Transmit data	$V_{OL}$ min = 0V $V_{OL}$ max = 0.45V $V_{OH}$ min = 1.35V $V_{OH}$ max = 1.8V	1.8V power domain. Keep this open if unused.

Table 5 | Debug Header



## 2.10 Micro-B USB Interface

A Standard Micro-B USB compliant with the USB 2.0 standard specification is used to provide an interface to connect to a PC for control of BG96 cellular modem and firmware upgrade.



Image 11 | Micro-USB Interface

The Micro-B USB pin definition is shown below:

Pin	Description
1	USB_VBUS (+5V)
2	USB_DM
3	USB_DP
4	N/C
5	GND

Table 6 | Micro-USB Interface

## 2.11 USB Boot Jumper

A Standard 2 pin USB Boot header (when closed) is used to force the RAK2011 to boot from USB port for performing a firmware upgrade.



Image 12 | USB Boot Jumper



### 2.12 PWRKEY Push Button

PWRKEY push button is used to turn on/off the BG96 module. To turn on the BG96 module, push PWRKEY button for at least 100ms. The STATUS pin from Arduino header will output HIGH.

To turn off the BG96 module, push PWRKEY button for at least 650ms. STATUS pin from Arduino header will output LOW.

### 2.13 RESET Push Button

The RESET push button is used to reset the BG96 module. To reset the BG96 module, push the RESET button between 150ms and 460ms.



Image 13 | PWRKEY and RESET Push Button

### 2.14 LED Indicators

Here is the list of functions for LEDs indicators:

- 1.14.1 Green
  - STATUS indicates module operation status.
- 1.14.2 **Blue** 
  - NETLIGHT indicates network activity status.
- 1.14.3 **Red** 
  - Power ON indicates power status.





### 2.15 Power Requirements

The RAK2011 can be powered by +5V from a MCU baseboard via Arduino header (POWER) if used as an Arduino Shield.

It can also be powered by +5V out of Micro-B USB if used as a standalone modem.

Parameter	Min.	Max.
Power Supply Voltage	3.7V	5.5V
Current Consumption		500mA
Digital Input Voltage	0V	IOREF
Digital Output Voltage	0V	IOREF

Table 7 | Power Requirements

## 2.16 Environmental Requirements

The table below lists the operation and storage temperature requirements:

Parameter	Min.	Typical	Max.
Operation Temp. Range	-35°C	+25 °C	+75 °C
Extended Temp. Range	-40 °C		+85 °C
Storage Temp. Range	-40 °C		+90 °C

Table 8 | Environmental Requirements

## 2.17 Mechanical Dimensions

The mechanical dimension of the WisLink Cellular BG96 Arduino Shield RAK2011 can be found here:





## 3 Antenna

## 3.1 Cellular (LTE/GSM) Antenna

#### 3.1.1 Overview

The cellular (LTE/GSM) antenna for the RAK2011 covers working frequency band from 824MHz to 2690MHz.



Image 16 | Cellular Antenna

#### 3.1.2 Cellular (LTE/GSM) Antenna Dimension



Image 17 | Cellular Antenna Dimension



#### 3.1.3 Cellular (LTE/GSM) Antenna Parameter

The Voltage Standard Wave Radio (VSWR) plot is shown below:



Screenshot 1 | Cellular (LTE/GSM) Antenna Parameter

The VSWR data is shown in the table below:

Freq. (MHz)	VSWR
700	9.3
800	4.6
880	3.6
960	4.9
1710	9.3
1880	4.4
2170	15

Table 9 | Cellular Antenna Parameter

The Smith plot is shown here:



Image 18 | Smith Plot





#### 3.1.4 Radiation Pattern on H-Plane



Image 19 | Radiation Pattern on H-Plane

#### 3.1.5 Radiation Pattern on E1-Plane



Image 20 | Radiation Pattern on E1-Plane

#### 3.1.6 Radiation Pattern on E2-Plane







Image 21 | Radiation Pattern on E2-Plane



#### 3.1.7 UGain and Efficiency Table

Freq. (Hz)	Efficiency	Gain (dBi)	Freq. (Hz)	Efficiency	Gain (dBi)
7.00E+08	49%	1.632948	1.71E+09	35%	0.02584
7.10E+08	51%	1.826395	1.72E+09	35%	0.0088
7.20E+08	49%	1.833288	d1.73E+09	36%	0.647356
7.30E+08	44%	1.600659	1.74E+09	44%	0.806863
7.40E+08	46%	1.896142	1.75E+09	35%	0.03676
7.50E+08	50%	1.936788	1.76E+09	46%	0.549059
7.60E+08	50%	1.721112	1.78E+09	34%	0.14522
7.70E+08	46%	1.406281	1.79E+09	35%	0.41562
7.80E+08	45%	1.491829	1.81E+09	36%	0.35094
7.90E+08	47%	1.8309	1.83E+09	34%	0.30882
8.00E+08	45%	1.843967	1.85E+09	38%	0.430313
8.06E+08	41%	1.714366	1.86E+09	35%	0.33059
8.10E+08	45%	2.215538	1.88E+09	37%	0.008792
8.24E+08	42%	1.97312	1.90E+09	43%	0.479122
8.34E+08	44%	1.890023	1.92E+09	40%	0.111459
8.44E+08	42%	1.407188	1.94E+09	46%	0.407999
8.54E+08	42%	1.453714	1.96E+09	44%	0.037526
8.64E+08	47%	2.111646	1.98E+09	48%	0.405617
8.74E+08	46%	1.93289	1.99E+09	48%	0.112167
8.80E+08	48%	1.960958	2.00E+09	47%	0.144104
8.84E+08	46%	1.930333	2.02E+09	46%	0.14634
8.94E+08	52%	2.347337	2.04E+09	47%	0.033818
9.00E+08	50%	2.192946	2.06E+09	45%	0.112366
9.10E+08	50%	2.265394	2.08E+09	51%	0.672779
9.20E+08	49%	2.081987	2.10E+09	48%	0.291807
9.30E+08	48%	2.005751	2.12E+09	54%	0.939911
9.40E+08	49%	2.128994	2.14E+09	54%	1.161325
9.50E+08	49%	2.305449	2.16E+09	59%	1.631935
9.60E+08	48%	2.233022	2.17E+09	59%	1.967355

Table 10 | UGain and Efficiency



## 3.2 GPS Antenna

#### 3.2.1 Overview

The GPS antenna for RAK2011 is shown below:



Image 22 | GPS Antenna

#### 3.2.2 GPS Antenna Dimensions



Image 23 | GPS Antenna Dimensions

#### 3.2.3 GPS Environmental Requirements

The antenna environmental requirements are listed in the table below:

Conditions	Temperature	Humidity
Working	-35°C ~ +80°C	0% ~ 95%
Storage	-40°C ~ +85°C	0% ~ 95%

Table 11 | GPS Environmental Requirements



#### 3.2.4 GPS Antenna Parameter

The GPS Antenna specifications and Post Environmental Tolerance (PET) are listed in the table below:

Item	Specifications	PET
Range of Receiving Frequency	1575.42±1.1	±2.5
Center Frequency (MHz) w/ 30mm2 GND plane	1575.42	±3.0
Bandwidth (MHz) (Return Loss ≤ -10dB)	≥10	±0.5
VSWR (in Center Frequency)	≤2.0	±0.5
Gain (Zenith) (dBi Typ) w/ 70mm2 GND Plane	4.5	±0.5
Axial Ratio (dB) w/ 70mm2 GND Plane	3.0	±0.2
Polarization	Righ-Handed Circular	-
Impedance (Ω)	50	-
Frequency/Temperature Coefficient (ppm/°C)	0±10	-

Table 12 | GPS Antenna Parameter

Amplifier Specifications are listed in the table below:

Item	Specifications
Frequency Range	1575.42 MHz
Gain	27 dB
VSWR	≤ 2.0 V
Noise Coefficient	≤ 2.0 dBm
DC Voltage	3 ~ 5 V
DC Current	5 ± 2 mA

Table 13 | Amplifier Specifications

Environmental test performance specifications are listed below:

1.

Item	Normal Temp.	High Temp. <sup>1</sup>	Low Temp. <sup>2</sup>
Amplifier Gain	27dB ± 2.0	27dB ± 2.0	27dB ± 2.0
VSWR	≤ 2.0	≤ 2.0	≤ 2.0
Noise Coefficient	≤ 2.0	≤ 2.0	≤ 2.0

High temperature test: soak in temperature (85° C) and humidity (95%) chamber for 24-hour and return to normal temperature (at least for 1hour) without visual shape change.

 Low temperature test: soak in temperature (-40° C) chamber for 24hour and return to normal temperature (at least for 1-hour) without visual shape change.

Table 14 | Environmental Test Performance



## 4 Usage Model by Interface

### 4.1 Use USB Interface

Note: Please push the PWRKEY once in order to turn on the module after connecting the USB cable.

#### 4.1.1 Install USB Driver

Prior to connecting the RAK2011 to a Windows PC for the first time, the BG96 USB driver must first be installed on the PC. The driver (Quectel BG96 Windows USB Driver V1.0.rar) can be downloaded

from: https://www.rakwireless.com/en/download/Cellular/WisLink-Cellular#Tools

After the Windows USB drive installation is complete, connect RAK2011 to a PC via a Type A to Micro B USB cable. Open the Windows' Device Manager and it will show the following under Ports (COM & LPT):



Screenshot 2 | Windows Device Manager

#### 4.1.2 Send AT Commands

Select Quectel USB AT Port corresponding to the COM port, then open the serial port tool as shown on the screenshot. The tool (QCOM\_V1.6.zip) can be downloaded at:

https://www.rakwireless.com/en/download/Cellular/WisLink-Cellular#Tools

After sending  $AT\r\n$ , the module will return  $AT\r\n K$ , indicating the BG96 module is working normally.

You can send additional AT commands to control the module. For more AT commands, please refer to the document BG96 AT Commands Manual. It can be downloaded at:

www.quectel.com/support/downloadb/TechnicalDocuments.htm



and the second se					
COM Fort Satting	Consud List				
CON Part III	T Chevre All Commands	HEX	Г	Inter	Jelay(al)
and a manufact a manufact a	V 1: AT+QCFG="WYSCARERQ", 03	Г.	R	1	
ByteSize: 5 - Flaw Central: Bo Cirl Flow - Close Port	2 AT+9CH9="IOTOPHORS", I	Έ.	V	2	
hereasone in the second	₩ 3: AT+9CFG="BAND", 0, 10, 10	-	V	3	
2018-05-24 13:50:30:533347	A (AT+QCFG+ "HESTECCEARELE", 0	· _	$\overline{\mathbf{v}}$	4	10000
2018-05-24 13 50 39 533308	IØ 5: A1+CSQ		$\overline{\mathbf{v}}$	5	
2010-05-24_13:50:43:397]AT	W 6 AT+QICSOPEL 1, "helegras", ", ", 1	Έ.	V	. 6	
2018-05-24_13:50:43:39730K	T: AT+QLACT=1	<b></b>	V	7	
	T 0: AT+QLACT?	F	7	5	
	I-BELATECOTATED-1	Γ.	P	9	
	T 10: AT+Q5PSCP0+7	1	V	10	
	[ 11: [AT+Q3/5+1	Ξ.	P	11	
	T 12: AT+Q:PSLOCP	1	$\overline{\mathbf{v}}$	12	
	T 13 AT+QUISEBD	Γ.	¥	13	
	T 14: AT+REARE?	1	$\overline{\mathbf{v}}$	14	
	T 15: AT+OMET?	Γ.	V	15	
	T 16: [AT+CRE07	· E	V	16	
	T 17: AT+038809	Έ.	¥	17	
	T 18: AT+QUILOSE=0	· []	V	18	
	19 AT+C075×7	Ē.	¥	19	
	T 20: AT+QLOPER-1, 0, "TCP", "116.247.104.27	-	P	20	
2010-05-24_13:50:30:405] Open COM Fort Success	T 21: [AT+QD0FEH-1, 0, "TOP", "23.253.146.203	-	R	21	
	T 22: AT+QESTATE+0, 1	Ξ.	V	22	
	T 23 ATHONYINO	1	V	23	
	T 24: [AT+QE1HBEE=0, "db0011f=0000587f0009	E	W	24	
Operation	1" 25: AT+925210=0, 48	-	$\overline{\mathbf{v}}$	15	
Clear Information   ITE   HIS   View File   Show Time	T 26: AT+QEED+11, 1500	Γ.	V	26	
Tunnel Staring T Show In MER Send With Eater	T 27: [AT+QUIPEN=1, 1, "TCP LISTENER", "127 0		V	27	
The state of the second s	T 28: [AT+QPIRO-1, "117.60.157.30"	1	¥	28	
AT Seed Crossed	[" 29: [AT+COFS=1, 0, "CH9-CT", 9	Γ.	R	29	
-			-	Timer	1
Select File Send File	Load Test Script Clear All Commands		1		Part of the local data
		Tele	17 T	:(2a) pa	12000

Screenshot 3 | Send AT Commands

#### 4.1.3 NB-IoT UDP Communication Test

Here are the steps for testing NB-IoT UDP Communication:

- 1. Plug in NB-IoT SIM card.
- 2. Connect WisLink Cellular RAK2011 to a Windows PC.
- 3. Select Quectel USB AT Port corresponding to the COM port.
- 4. Open the serial port tool.
- Send the AT commands listed below to have the BG96 module find a NB-IoT network.

(China Telecom's NB-IoT SIM card is used in this example. Please modify the AT commands as required according to the NBIoT network being used to provide your service. For more information on AT commands, please refer to: Quectel BG96 Network Searching Scheme Introduction.)

```
AT+QCFG="NWSCANSEQ",03 // Set the scanning network to NB-IoT network
AT+QCFG="IOTOPMODE",1
AT+QCFG="BAND",0,10,10 // Set the scan channel to BAND5
AT+QCFG="NBSIBSCRAMBLE",0
```

You can also manually search the current network to connect. Use the following commands to do manual search and connection:

AT+COPS=? // Manually search the current network AT+COPS=1,0,"CHN-CT",9 // Manually connect NB-IoT network



These commands can be found in the: Quectel BG96 AT Commands Manual.

COR Burn Control	Constitution (Constitution)		
LOW POPU Setting	Concert All Concerts	197 E Batar	Balley (eff)
COM Fort: [16 - Bendrets [115200 - Stephits: [1 - Furity: [fene	T I ATABCED: "BRCCARDO" 00	E	1
hetefine [1	et G + Grander Transmitt	F 17 0	
date p		F 17 3	
	- R 4. ATHORYOF "IRSTROTANDLE" 0	FRITT	1 10000
	V S: 47+030	E P S	-
AT +QCFGn "WYSCARSEQ", 03	P 6: Attatcoret 1 "Ctat"	F F B	1-
x	T ATHEFACTUL	F F 7	
T+9CFG="IDTOF#008", 1	P 0: ATHEACT?	F F 8	1
m	T 9: AT+CIPATOE=1	F F 9	-
K.	T 10: AT+QCPG+"INSCARSEQ"	F 10 10	1
I+QCFG="WESIESCRAMELE", 0	T 11: AT+QCPG="20707800E"	□□ 11	
X	T 12: [AT+QCFO+"EAB"	F 12 12	
	T 13: AT+QCPG+"HESTESCHAMBLE"	F 🖓 13	
	T 14: AT+COATT?	□ 14	
	L 12	F 🖓 15	
	15: AT+CE207	FF 16	
	T 17: AT+DIRE/?	F P 17	
	18: AT+CE8207?	F 🖓 18	
	F 19:	F F 19	
	20: [AT+420928-1, 0, "WDP", "200. 120. 2. 101",	F 🖓 20	
	T 21: AT+QESTATE?	□ P _ 21	
	C 22:	C 12 22	
	F 23.	P T 23	_
Overation	24: AT+QESENDEE+0, "4500111 40000587 (0009)	F F 24	
	1 25  AT+613580-0,0	T M 25	-
clear internation   and   and   and   and   and	75: [AT+QI3D=0, 1500	F P 28	
Input String IF MIL String I Show In MIL Frid With East	er [ 27: [ATI	1 17 <u>27</u>	-
	1 co. (A1*487.189/F1, "117.60.157.30"	F F 70	
- Send Cor	eard 1 (22a)	1 14 _ 29	1
	I Just Test Series   Char All Commits	Ban Tines	1
Select File Send F	le titer kit contacts	Delay Time (aS)	2000

Screenshot 4 | NB-IoT UDP Communication Test

6. After setting the configuration, send AT + CSQ to check network signal strength. If there is a signal strength value, it indicates the module has connected to NB-IoT network. You can also send AT + CGREG? to check the connection status of the network to determine whether or not to connect to the network:

eour .		_	
COM Fort Setting	Comuni List	101100 mar 1011	
008 Port: 31 - Basdrate: 115200 - StepBits: 1 + Parity: Hone -	Choose All Comeands	MEX   Eat	er Delay(eS)
	I AT+QCFG="MYSCAMEEQ", 03		1
Bytelize: 0 - Flow Control: No Ctol Flow - Close Port	₽ 2: [AT+QCF6="IOTOPMODE", 1	FP	2
	Ø 3 AT+QCFG="BAND", 0, 10, 10		3
	✓ 4: AT+QCFG="MBSIESCEAMBLE",0		4 20000
pT	₩ 5: AT+CD0	FF	5
IT+QCFG+"MNSCAMERQ", 03	₩ 6 ATHOROSOP=1, 1, "CTNO", "", ", 1	FP-	8
x	T ATHELACT=1	FF	7
1+OChe=_TOLOGMCOR_1	P 8 ATHOLIGT?	FF	8
B	- 9 [AT+CIFAI08-1	FF	9
E	T 10 ATHOLYSE "WEICARDED"	EP-	10
AT+QCFG="MESTESCRAMELE", 0	T 11: AT+0CFG:"20T0P8008"	C m	11
x	T 12: [ATHO/PO/TO/TANE"	- P -	12
47+C59	T 13- ATHORNE TRUTKORARI #*	E P	13
C34 16, 99	T 14: 071054772	F 17	
r .	C IN	E .	15
(T+CGBB07	- 15: ATACARDO	E #	16
+CG889: 0,1	E IT STORES	E R C	17
	T 10 (1710)	In	Aland Inc.
OK			10
	T as [ATTEDP201, 0, VAP , 202, 120, 2, 101 ]		20
[2017-11-03_12:03:21:229] Open COW Fort Surgers			
	1 22		
		W 1	
Disration	24: pt+q12ENEE+0, *660011E40000587E0009	1 19 -	24
Destruction Carlos Charles	1 25: [AT+QI3END=0, 0	1.0 -	
CARE INTOTABLICE   AND   MADE   MADE   2000 1184	1 28: [AT+GIND=0, 1500	P	26
Tapat String: 17 MEI String T Shos In MEI 17 Seal With Inter	114 112		21
	1 29: [AT+GPI#G=1, "117 60 157 30"	FP -	28
Send Connund	F 29.1	ER 1	29
	1	Ban Tie	nes: 1
Select File Send File	Loud Test Script Clear All Comeands	Balay Tinel	
			- Party
「 Save Log D: MARTy=ductFil+\207機決文档\WisLTE\3096\T=sls\QCOM_N1 6\QCOM_LDS to	Save An Script	ba	

Screenshot 5 | Check Network Signal Strength

7. After connecting to the network, you need to set up the APN and activate the APN network. You can set the APN by sending the following commands:

AT+QICSGP=1,1,"CTNB","",1// Set APN parametersAT+QIACT=1// Activate APNAT+QIACT?// Query the APN assigned IP address



For command details, please refer to Quectel BG96 TCP (IP) AT Commands Manual.

COM Port Setting			
	Contrad List		
	Choose All Comeands	HET T EAL	er Delaying
en sacht T senser brein T seiner b T sach hers T	T 1 ATHONY WYCANTRO "	L R	1.1.
BytaSize 0 - Flow Control: By Cirl Flow - Conse Port	P 2: AT+9CFG+"TOTOPROB" 1	ER-	2
	2 1 AT+0CFG-"BAND" 0.10.10	F F	2
	- P 4 AT+9CN="HISTINCHAMILE".0	FP-	4 [10000
CHOCKON "NECTROCHANDLE" 0	F 5: AT+C39	F F	5
£	P 6: [ATHEICSOF=1, 1, "CTNF", "", 1	FP-	8
1+C3Q	T: AT+QIACT=1	FF	7
CSQ: 16, 99	P 0 ATHERTY	FPE	8
	1=801450+1A 9 T	L M	9
*+C(88)27	T 10: AT HOLTIGH "WYSCARSEG"	F P	10
00829: 0,1	T 11: AT+QCFG="INTOPMOR"	FF	11
	T 12: ATHOCH-"\$A80"	FP -	12
CONTROL 1 CITARI C. C. 1	T" 13: ATHOCKS="MESTERCEAMBLE"	F F	13
t	E T 14: ATHOSATT?	F F	14
r+qIACT=1	F 15:	TP .	15
E	[" 16: [AT+CR207	FF	16
THQUACTY	T 17: AT+038207	F P	17
100-1 1, 1, 1, 1, 10 40 200 00	□ 18: [AT+CELEO?		18
£	F 19:	F P	19
	* [ 20: [AT+GEOPER-1, 0, "UDP", "202. 120. 2. 101"	L M I	20
2017-11-03_12:03:21 229] Open COM Fort Success	T 21: [AT+QISTATE?	TP :	11
	F 22:	TP 1	12
	F 23: F	PES	13
	T 24: [AT+GISENDEL=0, "45:001114000058740009	FF	24
Operation.	T 25: [AT+QISEND=0, 0	FP :	8
Clear Information   128   MIS   View File   Show Time	T 28: [AT+QTE3=0, 1500	FP :	16
Trans String I they In MEL String I they In MEL IF Send With Dates		CP :	27
	1 28: AT+GPIRG=1, "117.60.157.30"	FF :	26
Sand Company	I T 29: [	FF :	19
*	-	Ess Tir	est II
Select File Send File	Loud Text Script Clear All Commands		(c) [0000
		PRINT THE R	ex hogo

Screenshot 6 | Setup and Activate APN

 After activating the APN, you can establish a UDP connection; (In China Telecom's NB-IoT network, you must first inform the operator of your server's IP address. The operator will make binding before the connection is successful. The behavior of other networks might be different).

AT+QIOPEN=1,0,"UDP","202.120.2.101",123,0,0 //Est AT+QISTATE? // Query connection is succe	ablish UDP connection
Q QCOM_VL8	- 0 <b>- X</b> -
About	
Off Part Setting	Canad List
CON Part 201 w   Backate (UCD) - Stability (I w) Participation	T Chorse All Commands MEX [ Enter Selayind)
contacts - managements - restarts	₩ 1: [AT+QCF6+"W9CANERQ", 00
Bytafine 8 - Flow Central: So Cul Flow - Close	Port P 2 (A1+0CH+*10T0PH008*,1 F P 2
	₩ 3. (AT+QC79+"BA30", 0, 10, 10
+coast: 0,1	A 10000
ICK STORAGE I TOMAN AND A STORAGE AND A STOR	Ø 6: [AT+QLCSQP+1, 1, "CTH9", "", ", 1 Ø 6
xT+QIxCT+1	
CR SHATTERS	
*24XT: 1.1.1, "30.40.205.56"	
	T 12: [47+9C70+"5480"
10 A CONTRACTOR AND A CONTRACT AND A	T 13: AT+0CH+="HISTISCIANILI" T 7 13
84 "1841 184" 1, 20 , 1941 ; 1, 1841 ; 1, 194 ; 1, 1841 ; 1, 194 ; 1, 1847 ; 1, 194 ; 1, 1847 ; 1, 194 ; 1, 194	T 14: AZ+CGATT? T 7 14
	E T 15
*220758 0,0	□ 16: [AT+CRD17 □ □ 16
4253447E: 0, "109", "202.120.2.101", 123, 0, 2, 1, 0, 0, "new ti"	T 17: [AT+CHE97 T 17
	T 18 (AT+CEN2O7 T V 10
(6,	
20017411402111-00211-0031 Guar 200 Read Susana	
LOSI AN ON_AL OF ALL OF ALL AND OPEN CONTAINS STATEMENT	
	Fa PF a
1	T 24: AT+GISERBEE-0, *660011640000687400094 T 🖓 24
Operation	□ 25: [A11QISEND=0, 0 □ □ P 25
Clear Information   178   275   Vice File   Show Time	T 28 (47+6330=0, 1500 T 17 26
Input String: F MEI String T Show In MEI F Send Title	
	28: JAT+07280+1, "117 60 157 30"
	anan 1 a.1
	Loud Test Script Clear All Commands Run Times: 1
Select File Sen	File Pelay Time (aS) (2000
Save Log D: MMDredectFile(1010)使这支档(#15433710000/7.eols/0000_97.6/000)	LLOG D Save As Script Res Story
U	1

Screenshot 7 | Establish UDP Connection

9. If sending data to the server, there will be a prompt to receive data "recv". If there is no prompt, you can send the following commands to check if there is data reception.



AT+QISENDEX=0,"db0011fa0000587f0009031d0000000dd99732a8e147ae1000000 00000000000000000000000dd997618cb851eb8" // send data AT+QISEND=0,0 // Query data is sent successfully AT+QIRD=0,1500 // Check if there is data received, if there is, print it out directly

bout					
CON Fort Setting	Consud List				
COR Party Dir. w. Bandrata: [110000 v.] Standita: [1 v.] Parity: [New v.]	Choose All Commands	xer	Γ2	ater	Delay (a)
and the second s	₽ 1: AT+QCPG="BMSCARSEQ", 03	Г	F	1	
ByteSize: 8 - Flow Central: So Ctrl Flow - Close Port	2: AT*QCFG*"IDTOPHODE", 1	Г.	<b>F</b>	2	1
	₩ 3: AT+QCPG="BARD", 0, 10, 10	Г	F	3	li—
	₩ 4: AT+QCFG="BESTESCRAMBLE", 0	F	<b>F</b>	4	10000
	IF 5: AT+CSQ	F	₽.	5	
HQIOPER: 0,0	I 6: [AT+QICS/F=1, 1, "CTH9", "", ", 1	Г	<b>F</b>	6	
AT+QISTATE?	T: AT+QIACT=1	Г	₹.	T	
NEISTATE: 0, "UDP", "202. 120. 2. 101", 123, 0, 2, 1, 0, 0, "www.tl"	B: AT+QIACT?	Г	₽	8	
18 C	T 9: AT+COPADER=1	Г	₽.	9	
AT+QISENDEC=	T 10: AT+QCPG="MYSCARSEQ"	Г	1	10	
0, *460011£40000597£000903140000000489973248+1474+1000000000000000000000000000000000	T 11: AT+QCFG="IOTOPHODE"	Г	R.	11	
68997618-5651+58°	T 12: AT+0CFO+"EARD"	Г.	<b>F</b>	12	1
5230 OX	T 13: AT+QCFO+"MESTRSCRAMBLE"	Г	7	13	li —
HEDIRC: "recy". 0	T 14: AT+COATT?	E	F	14	1 i
KT+QISEND=0,0	F 15:	E	7	15	1
HQISEND: 48, 48, 0	T 16: AT+(80)?	Г	<b>F</b>	16	
	T 17: AT+CR80?	Г	7	17	
05 ATHOTESHID 1900	T 18: AT+CERE??	Г	<b>F</b>	18	
HQTRD: 48	F 19:	Г	<b>F</b>	19	1 <u></u>
	20: AT+QIOPEN=1, 0. "UDP", "202, 120, 2, 101".	E	F .	20	
	T 21: AT+QISTATE?	Г	1	21	
	F 22:	Г	<b>F</b>	22	1
	C 23:	F	Г.	23	li
	24: 000000000000000000000000000000000000	E	<b>F</b>	24	1i
Operation	T 25: AT+QISESI=0, 0	E	7	25	li —
Clear Information   DTR   HIS   View File   Show Time	T 26: AT+QIRD=0, 1500	E	7	25	i —
Turne Galler F MEE String T Shew In MEE F Send With Enter	T 27: ATI	Г	F	27	1
Tubut outside	T 28: AT+QPIN0+1, "117.60.157.30"	E	F	28	1
Send Consud	F 29:	Г	F	29	1
*					
Salari Bila	Lead Test Script Clear All Commands		RedA.	sames:	P
		Dela	r Tie	He (HS) :	15000
Same Los D. \BallProductFile\T079814/785/81417F/B096\Tax24/0008 VI 6\0008 105 15	Same As Series			1.1	

Screenshot 8 | Check Data Reception

RAK2011

#### 4.1.4 GPS Function Test

Follow these steps in order to test GPS Function:

- 1. Plug in the module GPS antenna.
- 2. Select Quectel USB AT Port corresponding to the COM port.
- 3. Open the serial port tool.
- 4. Send the commands listed below to control the module's GPS capabilities:

AT+QGPS=1	// Turn on GNSS
AT+QGPSLOC?	<pre>// Acquire Positioning Information</pre>
AT+QGPSEND	// Turn off GNSS

For detailed GPS command description, please refer to: Quectel BG96 GNSS AT Commands Manual.

5. GPS Function Test complete!

### 4.2 Use Arduino Header Interface

The RAK2011 also supports Arduino headers as defined by Arduino UNO R3. Please refer to the RAK2011 Arduino Header pin definition in the previous section.

Here is a test communication program to verify communication between an Arduino MCU base board and RAK2011.



#### The Arduino library for RAK2011 can be downloaded from here:

https://github.com/RAKWireless/WisLTE Arduino

```
void setup()
{
      // put your setup code here, to run once:
      Serial.begin(115200);
      while (!Serial)
      {
              ; // wait for serial port to connect. For native USB port only
      }
}
void loop()
{
              // put your main code here to run repeatedly:
      if (Serial.available())
      {
              Serial.write(Serial.read());
      }
}
```

Die Foir Steinu Toole Beh	
	1
WaLTE_TEST 9	
1 wid setup 0 1	
2 // put your satup code here, to run once:	
3 Serial begin 0.15200);	
i shile (Serial)(	
5 ; // wait for serial port to connect. Reeded for native 358 port only	
6 1	
7 Serial write ("ATEO's's"): // Turn off the BO96 sche function	
6 dalay(100);	
9 Serial write ("AII's"); // Check the basic information of B096.	
10 }	
11	
12 weid Leep O	
13 // put your main code have, to run repeatedly:	
14 if Serial available()) (	
15 Serial write (Serial read 0);	
16 )	
17 }	

Screenshot 9 | Arduino and MCU Communication Test



Screenshot 10 | CommUART Assistant



## **5 Hologram SIM Card**

## 5.1 Creating an Hologram account

Hologram is the Connectivity Platform for the Internet of Things. You can connect devices, capture data, and manage your fleet through their complete IoT platform. Here is their official website: <u>https://hologram.io/</u>

Please access this link to create an Hologram account: https://dashboard.hologram.io/account/register?



Screenshot 11 | Creating an Hologram account

### 5.2 Activate the Hologram SIM

Log into your Hologram account and enter your Dashboard interface. Next you need to activate your purchased Hologram SIM card. Click on "Activate you first SIM" in the upper right of the page.



Screenshot 12 | Activate you first SIM

Enter the activation interface, according to the given prompts, fill in the information, you can complete the activation of the SIM card.







Screenshot 13 | Input your SIM information

Then enter the SIM card information interface. After waiting for a period of time, you will see the "Live" status, as the bellow screenshot shown.

S ·	All devices	A Manage 🖂 Usage				ME1 14 1 1-12	
	1403	Select all			+ Activate SIM	& Cre	ate organization Q Searct
	Add new tag	DEVICE	U	LAST AC	PLAN 1MB - Develope	COVERA Zone 1	PHONE #

Screenshot 14 | Manage your SIM card

⇒ C ∎ £	https://dashboard.hologram	a.lo/device/163454/message/inb	ound	아 태 ☆	M. m () ()
S ·	Unnamed D	evice (44247)	0 SIM NUMB 89445004	ER DEVICE 08176044247 ID 163454	LINK 10 403299
ROUTES	TADS None	• OB	THIS PERIOD STATE • Live ISPECT	15 A 19 DE	PN INFO + VICE KEY +
CONSOLS					100 JAN 1
	Messaging Send to device Simulate from device Configuration Plan & coverage Usage reports	Send a message via Cloud Di	ata	via SMS	
ACCOUNT	Routes	DATA			
STORE		PORT	4010		

Screenshot 15 | SIM card Status



## 5.3 Send Data

Insert the SIM card into the board's slot, and then connect the board to the computer through the connection cable.( Please note that the LTE antenna needs to be connected)

Find the port number of the AT Port and use the QCOM serial port tool to connect the board. Then send the following AT command.( For AT command details, see the AT command manual)

AT+COPS=? AT+COPS=1,0,"CHINA MOBILE",0	<pre>// Find nearby network information // Manually set up a connected network // Check whether the device is registered on the</pre>
network	// check whether the device is registered on the
AT+QNWINFO	<pre>// Query connected network information</pre>
AT+COPS?	<pre>// Query the connected web server information</pre>
AT+QICSGP=1,1,"hologram","",	",1 // Set APN network to hologram
AT+QIACT=1	// Activate the APN network
AT+QIACT?	<pre>// Query the APN assigned IP address</pre>
AT+QIOPEN=1,0,"TCP","23.253.1	46.203",9999,0,1 // Create a TCP, connection
hologram test server	
AT+QISEND=0,48	// Send data, send data length is 48
{"k":"bZmmdbAg","d":"Hello,Wo	<pre>rld!","t":"TOPIC1"} //Send Packets.The data format</pre>
is a hologram-defined format.	( For details, please see:
<pre>https://hologram.io/docs/refe</pre>	<pre>erence/cloud/embedded/ )</pre>
AT+QISEND=0,0	<pre>// Query data is sent successfully</pre>

COM Port Setting	Command List Choose All Commands	MEX	Г	Enter	Delay (a)
Lum rort: [50 V Decerate: [115200 V Stoppits: [1 V Ferity: [Hone	T 1: ATHOCKS="NVSCANSRO" 03	F		1	
ArtaSize: 0 y Flow Control: No Civi Flow y	2 AT+00PC="TOTOPHOTE" 1	E.		- 2	
	3 AT+907PG+"BAND" 0 10 10	È.		3	
	4 ATHONE "MESTROTRAMELE" 0	Ē	5	4	10000
118-03-19_18:00:40:556]> ("k": "bZnmdbAg", "d": "Hello, Yorld!", "t": "TOPIC1")	F 5: 4T+CS0	È.		5	
110-03-19_10-00:42:14918880K	6: ATHORNESSEN 1 The Lagran 1	E.		- 6	
D18-03-19_18:01:09:988]> {"k":"bZmmdbAg", "d":"Hello, Yorld!", "t":"TOPIC1"}	V T	E.		7	
018-03-19_18:01:11:383]EBBOR	R B: AT+OTACT?	È.		8	
018-03-19_18:01:36:015]AT+QICLOSE=0	C 9- ATHOGRADIE-1	E.		9	
018-03-19_18 01:38:01710K		-		10	
JIO-US-19_IO-UI-S9-S40JALT4LUFEM=1,U, ICF , 23.255.140.205 ,9999,U,I 118-03-19 18-01-39-346308		1	÷.	11	
018-03-19 18:01:40:195]		-	<u></u>		
018-03-19_18:01:40:195]+QIOPEN: 0,0		E.	-	12	
018-03-19_18:01:42:421]AT+QISEND=0,48		1	-	1.0	
018-03-19_18:01:42:421]> ("k":"bZemdbAg", "d":"Hello, World!", "t":"TOPIC1")		1	<u> </u>	18	
010-03-19_10.01.95.8561		-		10	
018-03-19 18:01:55:8561+QIUBC: "recv".0.5	1 16: AT+CRE37	-	M	15	
018-03-19_18:01:55:856][0,0]	T IT ALTOADAY	1	~	- 11	
1018-03-19_18:02:00:878]	1 10: AT+QICLUSE=0	5	~	18	
018-03-19_18:02:00:878]+QIUBC: "cloxed",0	19: JAT+COPS?	5	2	19	
	20: AT+QIOPEN=1, 0, "TCP", "116.247.104.2T"		2	20	
018-03-19_18:01:55:975] DCD:0 CTS:1 KI:0	21: AT+QIOPEN=1, 0, "TCP", "23.253.146.203"	E	₽	21	
018-03-19_18 02:00:8881 DCD 0 CTS:1 KI:1	22: AT+QISTATE=0, 1	E	P	22	
018-03-19_18:02:00:9991 DCD:0 CTS:1 KL:0	23: AT+QHVINFO	Г	$\mathbf{P}$	23	
- · · · · · · · · · · · · · · · · · · ·	24: 000000000000000000000000000000000000	E	$\mathbf{\nabla}$	24	
Uperation	☐ 25: AT+QISEXD=0, 48	E	$\overline{\mathbf{v}}$	25	
Clear Information 🛛 🗆 DIR 🗆 RIS 🔽 View File 🔽 Show Time	26: AT+QIRI=11, 1500	Г	$\overline{\mathbf{v}}$	26	1
THEX String T Show In HEX F Sand With Enter	T 27: AT+QIOPEN=1, 1, "TCP LISTENER", "127.0.	Г	₽	27	
apar strag.	. 28: AT+QPING=1, "117.60.157.30"	Г	F	28	1
<pre>{"k":"bZmmdbAg","d":"Hello,World!","t":"TOPIC1"} ^ Send Come</pre>	d 29: AT+COFS=1, 1, "UNICON", 0	Г	$\overline{\mathbf{v}}$	29	1
*	-		Rem	Tiner	1
Select File Send File	Load Test Script Clear All Commands	Delo	or Ti	ne(s):	2000

Screenshot 16 | Send data

If the data is sent successfully, you can see the sent information on your interface of the Hologram Dashboard.



C s	全 https://dashboa	ird.hologram.lo/device	1/163454/message/inbound?d	rawer=full		9 1 0
•	All activity Erro	ors			Y Filter	
) ces	Device 16345(	No tags selecter	d. Tage can be added on devices	Most recent logs	Q Search b	y topics publis
	÷	and from Honorowski	DATA	TOPICS	Mar 19	2018, 17:47:1
	BKEY Device (44)	247)	Hallo, Vorldf	) 🖞 Unnamed Devic 😚	SIMULATE	VIEW RAW
				2 more		
			All messages loaded	d for this filter.		
			All messages loaded	d for this filter.		
OUNT			All messages loaded	d for this filter.		
SUNT RE S INUNIT PORT			All messages loaded	5 for this filter.		

Screenshot 17 | Send data successfully

### 5.4 Receive Data

Receiving data is similar to sending data, except that the established socket is different. The receiving data is established as a TCP server. The AT commands sent are shown as below:

AT+COPS=?	// Find nearby network information
AT+COPS=1,0,"CHINA MOBILE",0	// Manually set up a connected network
AT+CREG? network	// Check whether the device is registered on the
AT+QNWINFO	<pre>// Query connected network information</pre>
AT+COPS?	// Query the connected web server information
AT+QICSGP=1,1,"hologram","","	",1 // Set APN network to hologram
AT+QIACT=1	// Activate the APN network
AT+QIACT?	// Query the APN assigned IP address
AT+QIOPEN=1,1,"TCP LISTENER", local IP, port 2020	"127.0.0.1",0,2020,0 // Create a TCP server, use
AT+QIRD=11,1500	// Read the received data, 11 is the returned



COM Port Setting	Connand List				
COM Port: 50 v Baudrate: 115200 v StopBits: 1 v Parity: None v	Choose All Commands	HEX	1 8	nter	Delay (mS)
	I: AT+QCFG="INVSCAIRSEQ", 03	E	₽.	1	
ByteSize: 8 v Flow Control: No Ctrl Flow v Close Port	I 2: AT+QCPG="IOTOPMODE", 1	Е	₽	2	
	I 3: AT+QCFG="BAND", 0, 10, 10	E	₽.	3	
2018-03-19_18:15:40:464]AT+CRD9?	I 4: AT+QCFG="HESIBSCRAMBLE", 0	Е	2	4	10000
2018+03-19_18:15:40:464]+CREG: 0,5	IV 5: AT+CSQ	E	R	5	
	I 6: AT+QICSGP=1, 1, "helogram", "", "", 1	E	₽	6	
2018-03-19_18:15:40:464 JOK	▼ 7: AT+QIACT=1	Е	₹	7	
2018-09-19 18 15 44 301108	I 8: AT+QIACT?	Г	F	8	
2018-03-19 18 15 48 6721AT+QIACT=1	9: AT+CGPADDE=1	Г	F	9	
2018-03-19_18:15:49:684]00	T 10: AT+QGPSCPG=?	E	F	10	
2018-03-19_18:15:51:029]AT+QIACT?	T 11: AT+QGPS=1	Г	$\mathbf{r}$	11	
2018-03-19_18:15:51:029J+QIACT: 1, 1, 1, 10. 52. 96. 150"	T 12: AT+9GPSLOC?	E	R	12	
2018-09-19 18 15 51 020108	T 13: AT+QGPSEND	E	$\overline{\mathbf{v}}$	13	
2018-03-19 18 16 23 2741AT+QIOPEN=1.1. "TCP LISTENER". "127.0.0.1".0.2020.0	T 14: AT+NBAND?	Е	F	14	
2018-03-19_18:16:23:274]0K	T 15: AT+CGATT?	Г	V	15	
2018-03-19_18:16:23:278]	16: AT+CREG?	Г	₹	16	
2018-03-19_18:16:23:278J+QI0P28: 1,0	T 17: AT+CGRE07	Г	₹	17	
	T 18: AT+QICLOSE=0	Г	₽.	18	
	T 19: AT+COFS?	Е	F	19	
	20: AT+QIOPEN=1, 0, "TCP", "116. 247. 104. 27"	E	₽	20	
2018-03-19 18:15:35:898] Open COM Fort Success	T 21: AT+QIOPEN=1, 0, "TCP", "23. 253. 146. 203"	Г	R	21	<u> </u>
2018-03-19 18:16:23:279] DCD:0 CTS:1 KI:1	22: AT+GISTATE=0, 1	E.	F	22	
2018-03-19_18:16:23:399] DCD:0 CTS:1 RI:0	23: AT+QHYINPO	E.	2	23	
	24: 000000000000000000000000000000000000	E.	<b>F</b>	24	
Operation	25: AT+QISEND=0, 48	E.	F	25	<u> </u>
Clear Information 🗌 DIR 🗌 HIS 🗌 View File 🔽 Show Time	28: AT+91KI=11.1500	E.	R	26	<u> </u>
- MEX String □ Show In MEX □ Send With Enter	27: AT+QIOPEN=1, 1, "TCP LISTENER", "127.0.	F	R	27	
Input String:	28: AT+QPING=1, "117.60.157.30"	E	F	28	<u> </u>
AT+COPS=1,0,"CHINA MOBILE",0 ^ Send Command	29: AT+COFS=1, 0, "CHINA MOBILE", 0	E	F	29	Ē
*				7	
	1 12 10 11 0 120 1		V/02/	rimez:	4

Screenshot 18 | Create a TCP server

RAK2011

After creating a successful TCP server, the user needs to return to the Hologram Dashboard interface, click on the "send to device" button, and then fill in the data to be sent. The PORT is the TCP server port of your board. Fill in and click "Send data message".

	<ul> <li>Insper/accordination/graining</li> </ul>	and a second	(moosing	H PAUSE DATA
5 *				
$\odot$		Cond a monorma		
DEVICES	Messaging	Send a message		
	Simulate from device	via Clo	ud Data	via SMS
ROUTES	Configuration			
	Plan & coverage		1 ages d	1
50 C	Usage reports		123456	
CONSOLE	Routes	DATA		
	C LOGS			
				1
			2000	
		PORT	2020	
		PROTOCOL	тср	•
ACCOUNT			Send data messag	pe 🖌
STORE				
COMMUNIT		BI Learn about device mes	seging	
SUPPORT				

Screenshot 19 | Send a message

After sending the data in the Hologram Dashboard, the board will receive a message of "recv, 11" indicating that the board have already received the data. At this time, sending the "AT+QIRD=11,1500" command to obtain the received data.



COM Port Satting	Compand List				
198 Post: DD w Bandwate (19200 w StanBite: 1 w Pavite: Mars w	Choose All Commands	HEX	Γs	Inter	Delay (n5
the rate ho is and the house is a produce h. I have house it	I: AT+9CFG="INVSCANSE9", 03	Г	R	1	
ByteSize: B - Flow Control: Ho Ctrl Flow - Close Port	Z: AT+9CFG="IOTOPMODE", 1	F	<b>P</b>	2	i—
	I 3: AT+9CFG="BAND", 0, 10, 10	E.		3	<u> </u>
010-02-10 18 15 51 0001474074070	. V 4: AT+QCFG="HESTBSCRAMBLE", 0	E	R	4	10000
010-03-19_10-13-31-0291+01401-1	▼ 5: AT+C3Q	E.	R	5	
		E	<b>V</b>	6	i —
018-03-19_18:15:51:029]0K	T: AT+9IACT=1	Ē	<b>P</b>	7	i —
018-03-19_18:16:23:274]AT+QIOPEN=1, 1, "TCP LISTENER", "127.0.0.1", 0, 2020, 0	8: AT+QIACT?	F	R	8	i
018-03-19_18 16:23:27410K	9 ATHOGRADIR=1	F		9	
010-03-19_10-10-23-2101 018-03-19_18-18-23-2101	T 10: AT+DGPSCPGe?	F		10	i
018-03-19 18:17:46:457]		E.	-	11	-
018-03-19_18:17:46:457]+QIUNC: "incoming", 11, 1, "10. 176. 100. 3", 39018	T 12 AT+00PS1002	Ē.	8	12	-
	13: AT+00PS800	È.		13	-
018-03-19_18:17:46:4571+QTURC: "recv",11		-		14	-
010-03-19_10.10.13.1001ALTQLAU=11,1500		-	8	15	-
Letter 65 19 10 10 10 100 100 10 10 10 10 10 10 10 1		-	÷.	10	
		-	<u>.</u>	10	
018-03-19_18:18:13:188]00	17: AT+LOKEOV	5	≝.	11	
statement of the second statement of the second statement of the second statement of the second statement of the	18: AT+QICLOSE=0	5	M	18	
(2018-03-19_18:18:13:188]+QTMSC: "closed", 11		5	Ξ.	19	
	20: AT+QIOPEN=1, 0, "TCP", "116.247.104.27"	5	2	20	
018-03-19_18:17:46:577] DCD:0 CTS:1 KI:0	<ul> <li>21: [AT+QIOPEN=1, 0, "TCP", "23. 253. 146. 203"</li> </ul>		Ρ.	21	
018-03-19_18:18:13:192] DCD:0 CTS:1 KI:1	22: AT+QISTATE=0, 1		2	22	
	23: AT+QWINPO	E	Μ.	23	
Onevetion	24: 000000000000000004997618eb851eb8*		F	24	
	25: AT+QISEND=0, 48		₹.	25	
Clear Information   DIR   RIS   View File   Show Time	28: AT+QIEI=11, 1500	Г	₽.	26	
aput String I Show In HEX Send With Enter	☐ 27: AT+QIOPEN=1, 1, 'TCP LISTENER', '127.0.	Г	V	27	
	28: AT+QPING=1, "117.60.157.30"	-	P	28	
Send Command	29: AT+COPS=1, 0, "CHINA MOBILE", 0	-	₽.	29	
e	Load Test Script Clear All Commands	B-1	Run	Tines:	1

Screenshot 20 | Receive the data



## 6 Certification

#### **BG96 Module Certification**

Cat-M1	Cat-NB1	EGPRS	GNSS	Chipset
LTE FDD: B1/B2/B3/B4/B5 B8/B12/B13/B18 B19/B20/B26/B28 LTE TDD: B39(For Cat-M1 Only)	LTE FDD: B1/B2/B3/B4/B5/B8/B 12/B 13/B18/B19/B20/B26/ B28	850/1900MHz 900/1800MHz	GPS GLONASS, BeiDou/Compass Galileo QZSS	Qualcomm (MDM9206)

Table 15 | BG96 Module Certification

#### **Regulatory Certification**



#### **Certification Body**



#### WisLink Cellular BG96 Arduino Shield Pass Certification



Table 16 | WisLink Cellular BG96 Arduino Shield Pass Certification



## 7 **Contact Information**

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## 8 Revision History

Revision	Description	Date
1.0	Initial Release	June 23, 2017
1.1	Improved content and layout	August 2018
1.2	Add certification information, update some words or phases in right context	October 2018
2.0	Add the Hologram SIM Card chapter	November 2018

Table 17 | Revision History

## **Document Summary**

Document Title:	WisLink Cellular BG96 Arduino Shield RAK2011 User Manual
Product Name:	RAK2011
Release Date:	November 2018
Revision Number:	V2.0

Prepared by	Checked by:	Approved by:



#### About RAKwireless:

Shenzhen Rakwireless Technology is a pioneer in providing innovated Lego-like IoT module solutions for the three critical elements of IoT edge devices – edge computing, cloud connectivity, and node sensing. It's patented, modularized, simplified design of combining one, two, or all the three elements to significantly help address diverse IoT applications and accelerate time-to-market.