
QUECTEL
Quectel
BC660K-GL NB-IoT Module
Introduction
Build a Smarter World

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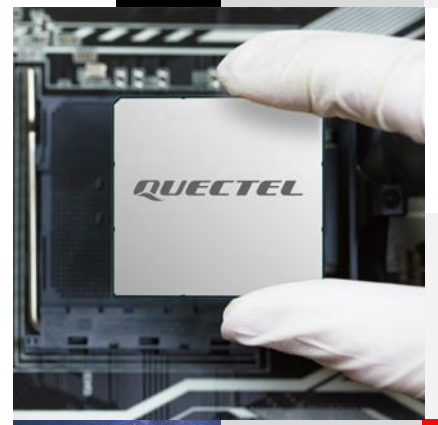

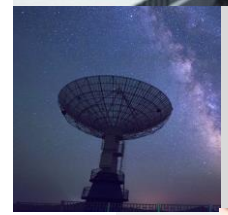

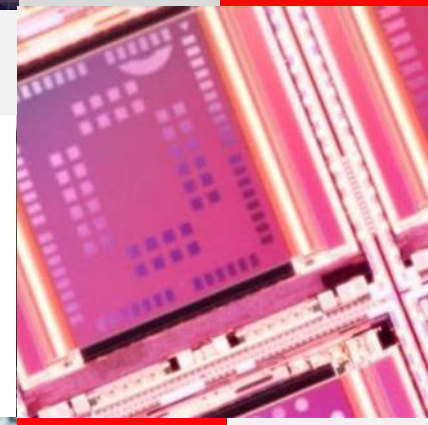

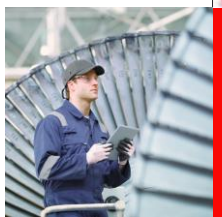

Technical Background

NB-IoT Roadmap

Highlights & Specifications

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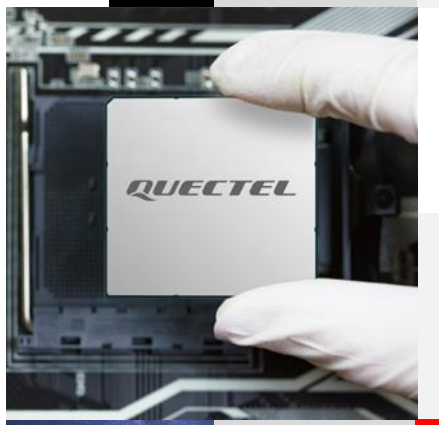

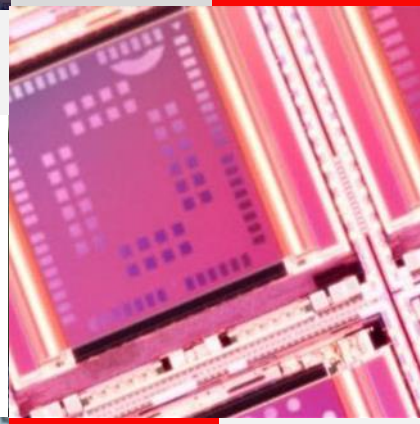

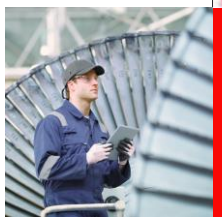

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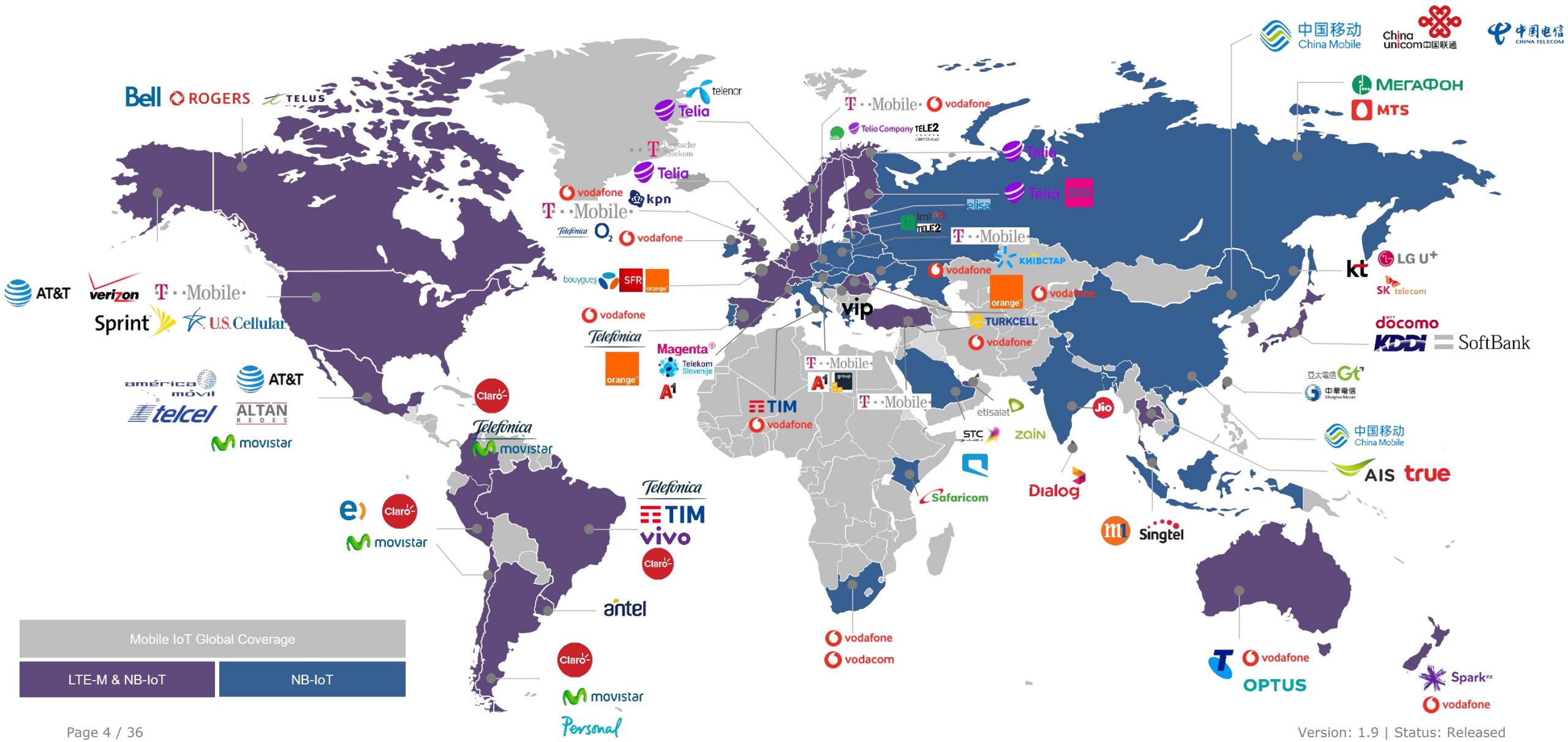
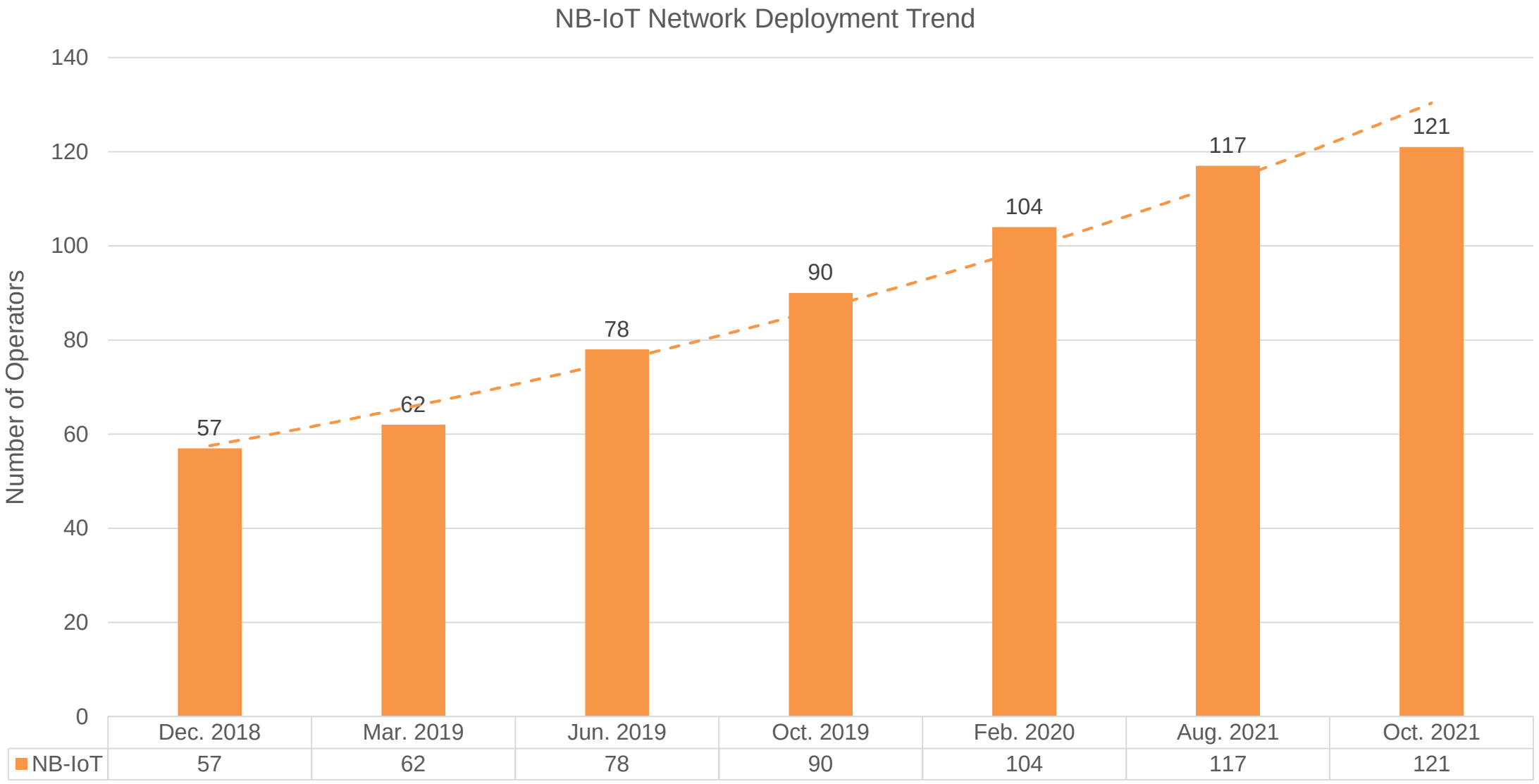
LPWA Network Deployment (Based on GSMA Data up to December 03, 2021)



Mobile IoT Global Coverage

LTE-M & NB-IoT	NB-IoT

NB-IoT Network Deployment Trend



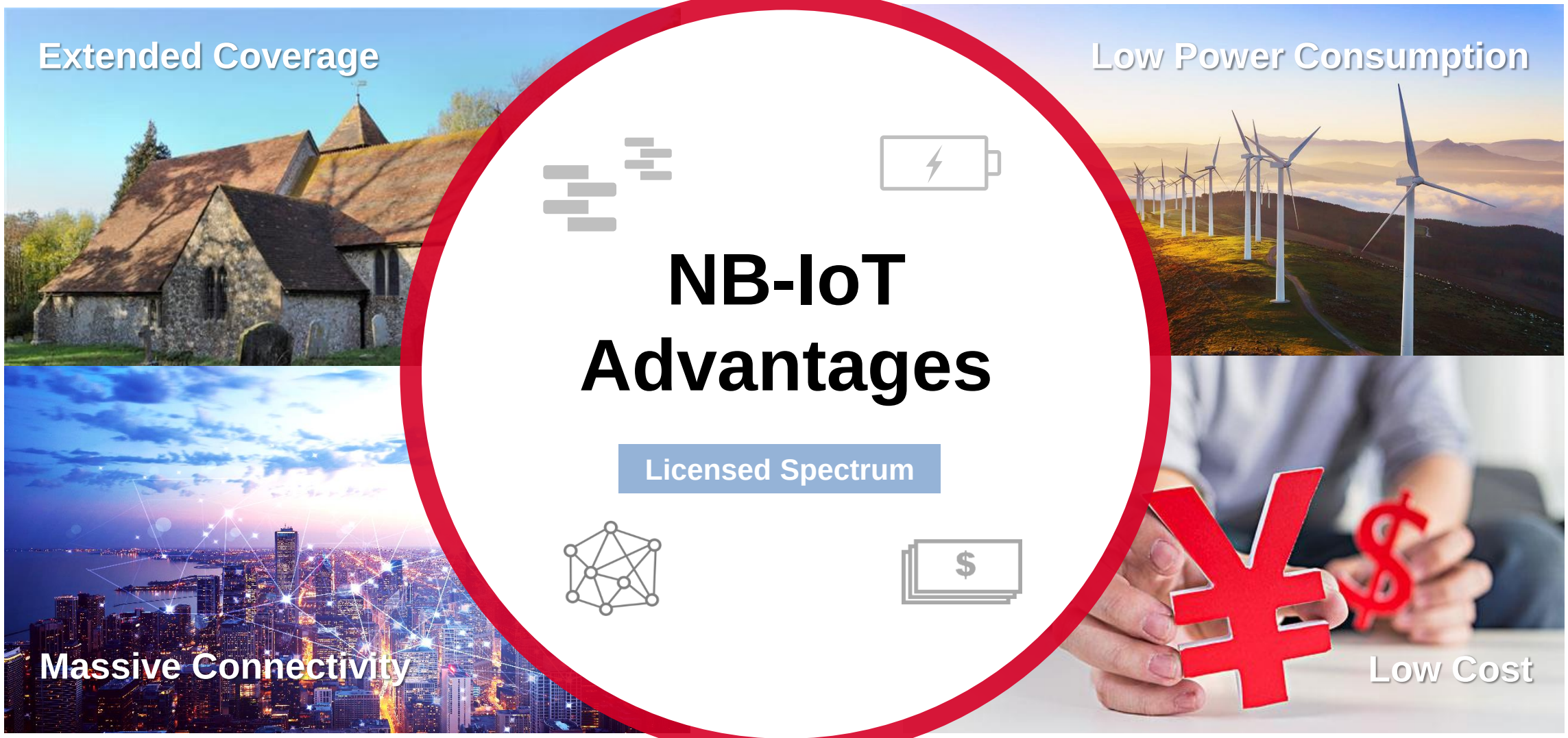
NB-IoT Deployment (1) (Based on GSMA Data up to December 03, 2021)

NB-IoT = 121								
Country/Region	**Operator**	**Bands**	**Country/Region**	**Operator**	**Bands**	**Country/Region**	**Operator**	**Bands**
Argentina	Claro	4, 28	China	China Telecom	5	France	SFR	20
Argentina	MNO Personal	28	China	China Unicom	3, 8	Germany	Telefónica	8, 20
Argentina	Movistar	4, 28	China(Hong Kong)	3	8	Germany	Vodafone	20
Australia	Telstra	28	China(Hong Kong)	China Mobile	3	Germany	Deutsche Telekom	8, 20
Australia	Vodafone	8	China(Hong Kong)	SmarTone	8	Greece	Vodafone	20
Australia	Optus	28	China(Taiwan)	APTG	8	Greece	T-Mobile (Cosmote)	20
Austria	A1	20	China(Taiwan)	Chunghwa	8	Hungary	T-Mobile	20
Austria	T-Mobile (Magenta)	8	China(Taiwan)	FarEasTone	28	Hungary	Vodafone	20
Bangladesh	Grameenphone	3, 8 (TBC)	China(Taiwan)	Taiwan Mobile	28	India	Reliance Jio	3, 5
Belarus	A1	/	Colombia	Claro	5	Indonesia	Telkomsel	8
Belarus	Velcom	8	Colombia	Movistar	5	Indonesia	XL Axiata	8
Belgium	BASE (Telenet)	3, 20	Croatia	A1	20	Ireland	Vodafone	20
Belgium	Proximus	20	Croatia	T-Mobile (DT)	8, 20	Italy	Vodafone	20
Belgium	Orange	3,20	Czech	Vodafone	8, 20	Italy	Telecom Italia/TIM	20
Brazil	Claro	3, 28	Denmark	Telenor	20	Japan	SoftBank	1, 8
Brazil	Vivo	3, 28	Denmark	Telia	20, 8	Kazakstan	KCELL	/
Brazil	Telecom Italia/TIM	28	Denmark	TDC	20	Kenya	SafariCom	8
Canada	Rogers	4, 5, 12	Estonia	Telia	20	Latvia	Bite	20
Chile	Claro	28	Estonia	Elisa	20	Latvia	LMT	20
Chile	Movistar	28	Finland	Telia	20	Latvia	Tele2	20
Chile	Entel	28	Finland	DNA	20, 3	Lithuania	Bite	28
China	China Mobile	8	Finland	Elisa	20, 3	Lithuania	Telia	28

NB-IoT Deployment (2) (Based on GSMA Data up to December 03, 2021)

NB-IoT = 121								
Country/Region	**Operator**	**Bands**	**Country/Region**	**Operator**	**Bands**	**Country/Region**	**Operator**	**Bands**
Lithuania	Tele2	28	Saudi Arabia	STC	12	Turkey	Turkcell	1, 8, 20
Malaysia (6 Cities)	Maxis	3	Serbia	Vip Mobile (A1)	20, 8	Turkey	Vodafone	8, 20
Malta	Vodafone	/	Singapore	M1	8	UAE	DU	20
Mexico	ALTAN	28	Singapore	StarHub	3, 8	UAE	Etisalat	20
Mexico	AT&T	5	Singapore	Singtel	8	Ukraine	Kyivstar	3
Mexico	Telcel	5	Slovakia	T-Mobile (Slovakia Telecom)	20	Ukraine	Vodafone	3
Netherlands	T-Mobile (DT)	20	Slovenia	A1	20	United Kingdom	Vodafone	20
Netherlands	Vodafone	20	Slovenia	Telekom Slovenije	20	Uruguay	Antel	3,28
New Zealand	Vodafone	28	South Africa	Vodafone	8	USA	AT&T	2, 4, 12
Norway	Telenor	8, 20	South Africa	Vodacom	3, 8, 28	USA	T-Mobile	2, 4, 12, 66, 71, 85
Norway	Telia	20	South Korea	KT	3	USA	Verizon	13
Peru	Claro	28	South Korea	LGU+	5			
Peru	Movistar	28	Spain	Telefónica	20			
Poland	T-Mobile (DT)	20	Spain	Vodafone	8, 20			
Portugal	Altice	20	Spain	Orange	20			
Portugal	Vodafone	8, 20	Sri Lanka	Dialog Axiata	3, 8			
Portugal	NOS	3,20	Sri Lanka	Mobitel	3,8			
Romania	Vodafone	20	Sweden	Telia	20			
Russia	MegaFon	20, 8, 3	Switzerland	Swisscom	20			
Russia	MTS	3	Thailand	AIS	8			
Saudi Arabia	Zain	3	Thailand	TRUE	8			
Saudi Arabia	Mobily	20	Thailand	DTAC	28			

NB-IoT Advantages



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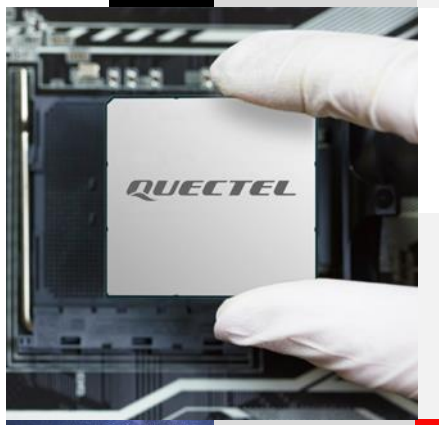

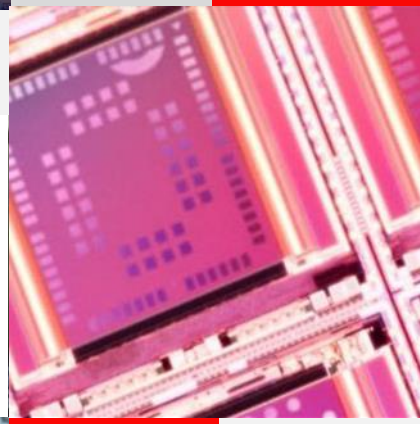

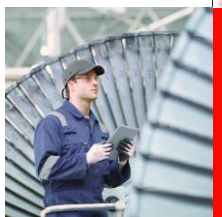

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NB-IoT Modules (Qualcomm) Roadmap

QCX212

BC660K-GL
- Cat NB2
- 127 kbps DL/ 158.5 kbps UL
- Global Version

2020 | **2021**

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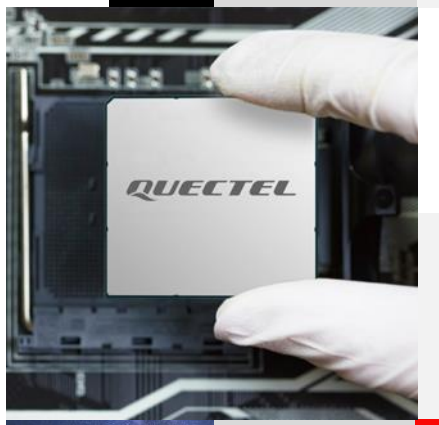

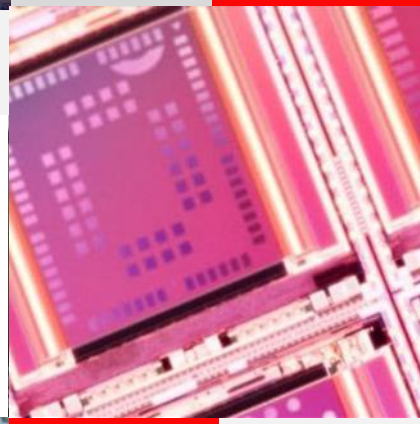

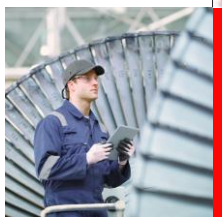

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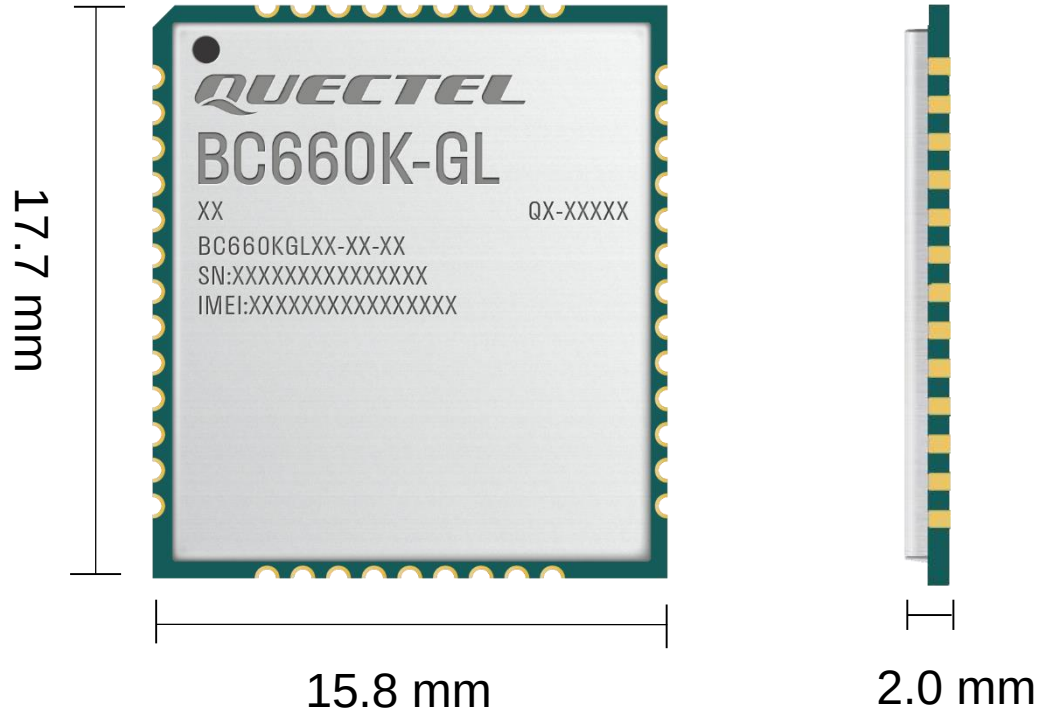
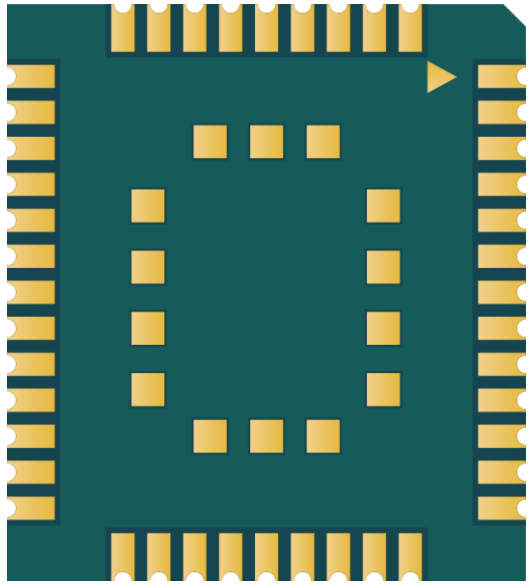
BC660K-GL Mechanical Dimensions

Multi-Band Cat NB2 Module (Qualcomm QCX212)





Length: 17.7 mm (±0.15 mm)
Width: 15.8 mm (±0.15 mm)
Height: 2.0 mm (±0.2 mm)
Weight: Approx. 1.2 g

BC660K-GL Highlights

LTE Cat NB2
DL: Max. 127 kbps / UL: Max. 158.5 kbps

Highlights	Description
Global Bands	LTE Cat NB2: B1/B2/B3/B4/B5/B8/B12/B13/B17/B18/B19/B20/B25/B28/B66/B70/B85
Rich Hardware Interfaces	UART/RI/USIM/ADC/NETLIGHT/PSM_EINT/BOOT/RESET_N/Antenna/GPIO/I2C①/PWM①/SPI①
Abundant Protocols	UDP/TCP/PING/SNTP/LwM2M/MQTT/MQTTS/SSL/TLS
eSIM②	eSIM reserved for customization
Power Supply	Supply voltage range: 2.2–4.3 V, typical 3.3 V Low voltage supply allows the battery to be powered by Lithium manganese/Lithium zinc cells.
Wakeup	• After the T3412 timer expires, the module will exit from Deep Sleep automatically. • Send an AT command to the module (this AT command will be lost), pull down MAIN_RXD, and on a falling edge, the module will exit from Deep Sleep. • Dedicated PSM_EINT interface(s) to wake up the module from Deep Sleep.
Power Consumption③	• 800 nA @ PSM • 0.11 mA @ Idle (DRX = 2.56 s) • 0.038 mA @ Idle (eDRX = 40.96 s, PTW = 10.24 s)
Advanced Features	• Battery voltage detection* • QuecOpen® • DFOTA
Memory	• 4 MB Nor flash (integrated) + 272 KB SRAM (integrated) • 200 KB Nor flash (integrated) + 30 KB SRAM (integrated)①
Compatibility	Compatible with Quectel GSM/GPRS M66, NB-IoT BC66/BC66-NA, BC65 and BC68-GV modules, easy for migration and future upgrades.

** means under development. ① means supported only on QuecOpen® version.*
② eSIM is reserved and not included by default. ③ sourced from the chipset spec.

BC660K-GL Main Interfaces

Interface	Description
USIM	1
UART	2 (for QuecOpen® version, × 3)
RI	1
PSM_EINT	1 (for QuecOpen® version, × 2)
ADC	1 (for QuecOpen® version, × 2)
RESET_N	1
BOOT	1
NETLIGHT	1
GRFC*	2
Antenna	1
GPIO	4 (for QuecOpen® version, × 13)
I2C	1 (for QuecOpen® version only)
PWM	1 (for QuecOpen® version only)
SPI	1 (for QuecOpen® version only)

BC660K-GL Main Functions

Function	Description
Protocols	UDP/TCP/PING/SNTP/LwM2M/MQTT/MQTTS/SSL/TLS
SMS*	Text mode and PDU mode
DFOTA	Delta firmware upgrade over-the-air
eSIM	Supported ①
QuecOpen®	Support the second development of embedded applications

** means under development.*
① eSIM is reserved and not included by default. If it is needed, a different OC will be provided.

BC660K-GL Power Consumption

Description	Conditions	Typ.	Unit
Deep Sleep	PSM	800	nA
Light Sleep	@ DRX = 1.28 s, ECL = 0	220	μA
	@ DRX = 2.56 s, ECL = 0	110	μA
	eDRX = 40.96 s, PTW = 10.24 s, ECL = 0	38	μA
Active State	@ Connected Tx 0 dBm	67	mA
	@ Connected Tx 23 dBm	330	mA

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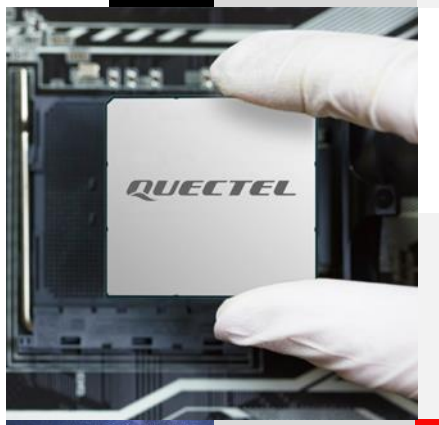

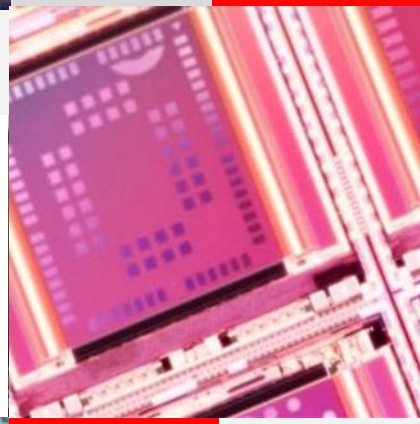

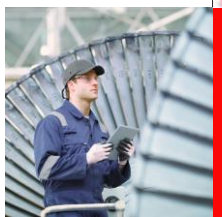

Build a Smarter World

BC660K-GL Development Schedule

2021									2022						
Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.

MP (I) — **MP (II)** — **MP (III)** — **MP (IV)**

Version: BC660KGLAAR01A03 (Add new features)

- MQTT
- TCP server
- Fix bugs
- Add new features to meet more certification demands

Version: BC660KGLAAR01A04 (Add new features)

- MQTTs
- SSL/TLS
- Fix bugs
- Add new features to meet more certification demands

Version: BC660KGLAAR01A04 (Add new features)

- LWM2M(DTLS)
- QuecOpen®
- Fix bugs and get certified
- Add new features to meet more certification demands

Version: BC660KGLAAR01A0x (Add new features)

- HTTP/HTTPS
- DFOTA via UART
- CoAP/CoAPS
- Fix bugs and get certified
- Add new features to meet more certification demands

The timeline will be adjusted according to the actual development status.

BC660K-GL Timeline

2020	2022											
Q4	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.

Project Stage

BC660K-GL MP

Carrier Certification

Deutsche Telekom/ Vodafone/ Verizon/ AT&T/ KT **Completed**

Regulatory Certification

GCF/ CE/ PTCRB/ FCC/ IC/ Anatel/ KC/ RCM/ IMDA **Completed**

The timeline may be adjusted according to the maturity of Qualcomm baseline.

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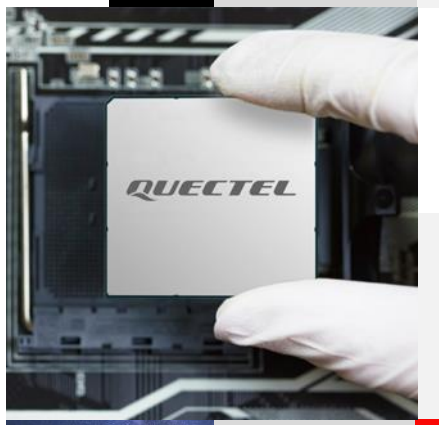

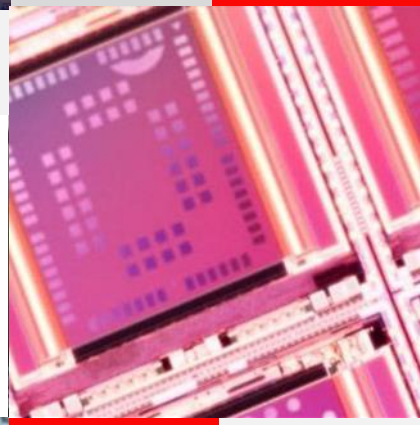

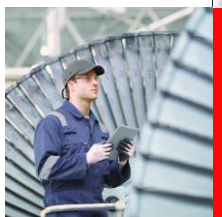

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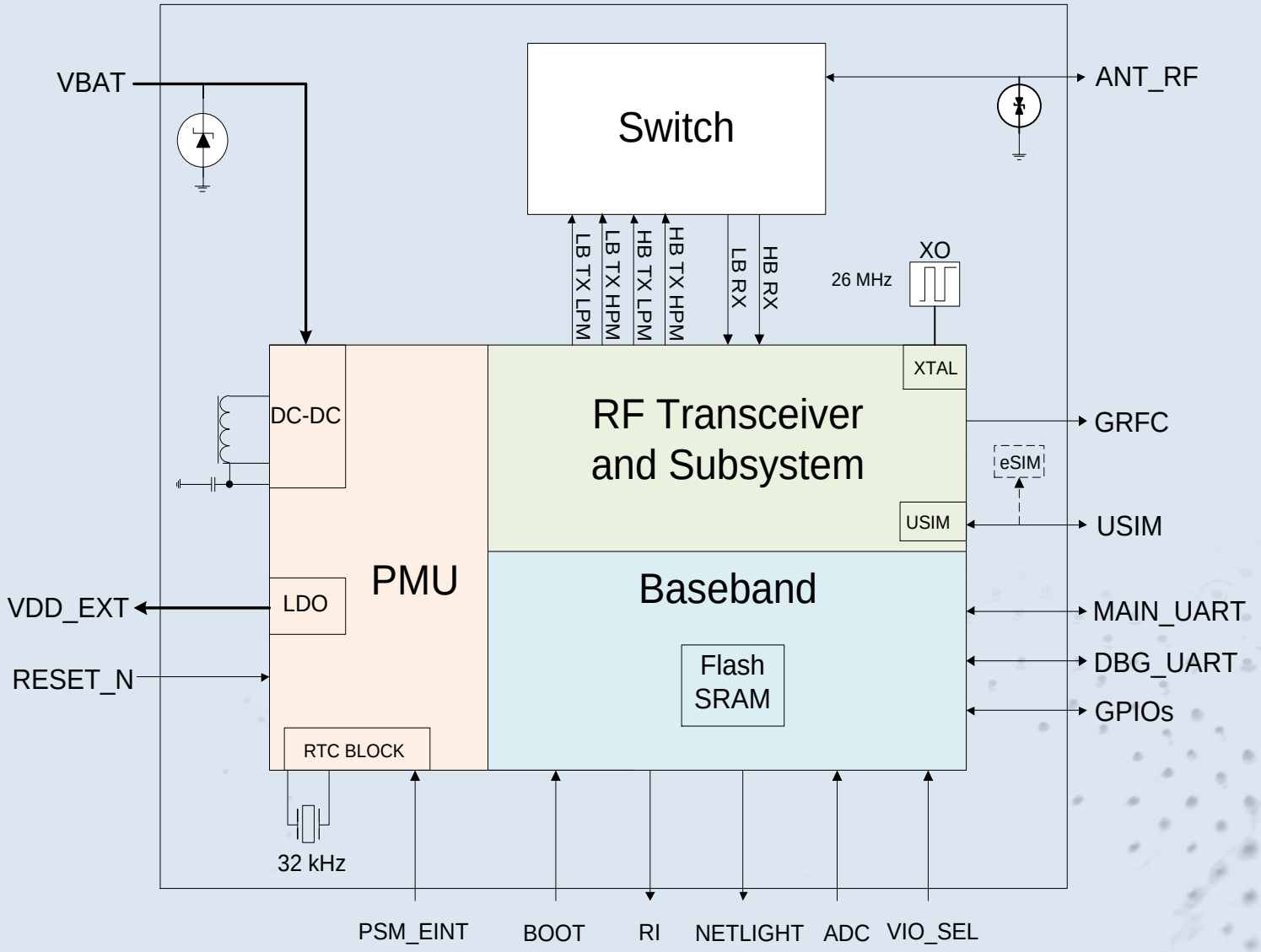
Hardware Architecture

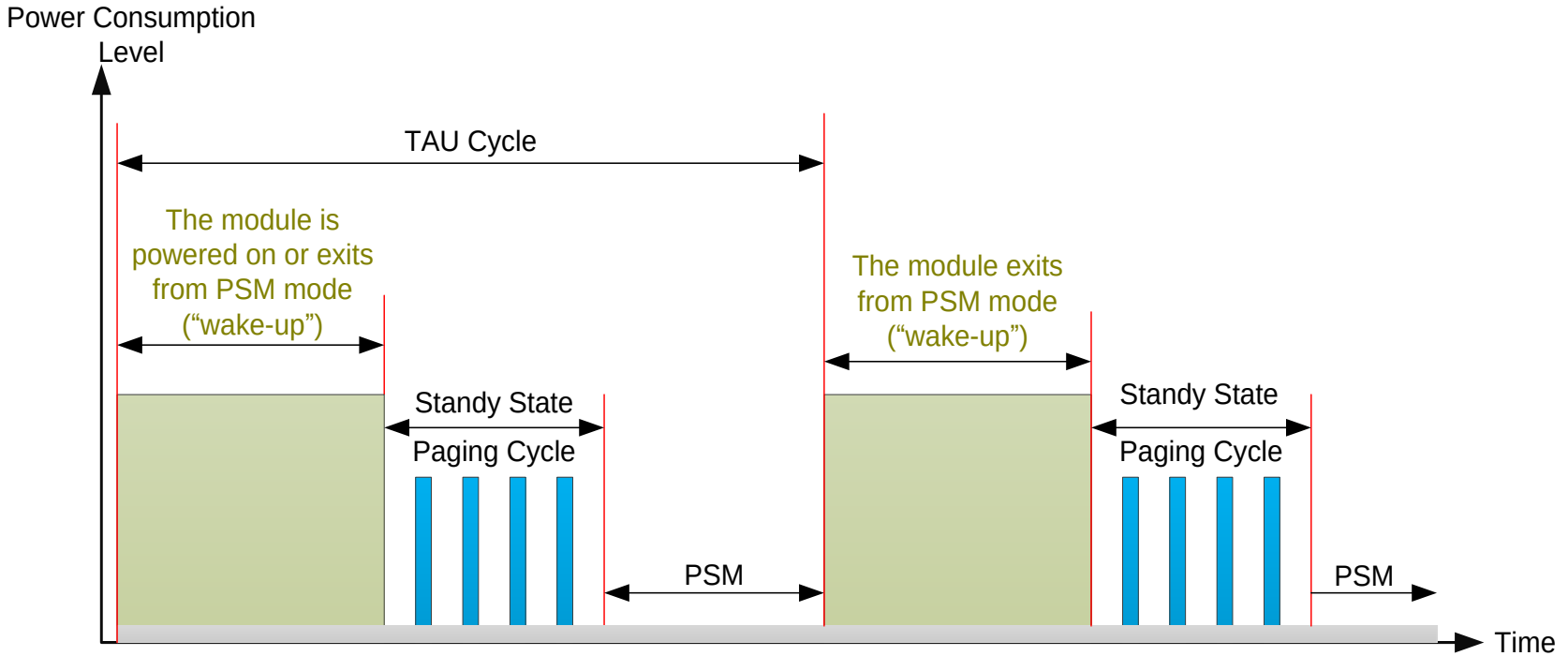


Key Technique – PSM

Power Saving Mode (PSM) is similar to power-off status, only the module remains registered on the network in PSM. Therefore, when the module is woken up from PSM, there is no need to re-attach to network. When the module is in PSM, it is not reachable for mobile terminating services. PSM is thus intended for applications that expect only infrequent mobile originating and terminating services and that can accept a corresponding latency in the mobile terminating communication.

If the module is to use PSM, it shall request an Active Time value during every Attach and TAU procedures. If the network supports PSM and allows the module to enter PSM, it would confirm the enablement of PSM by allocating an Active Time value to the module.

The following figure illustrates the power consumption cycle of the module.

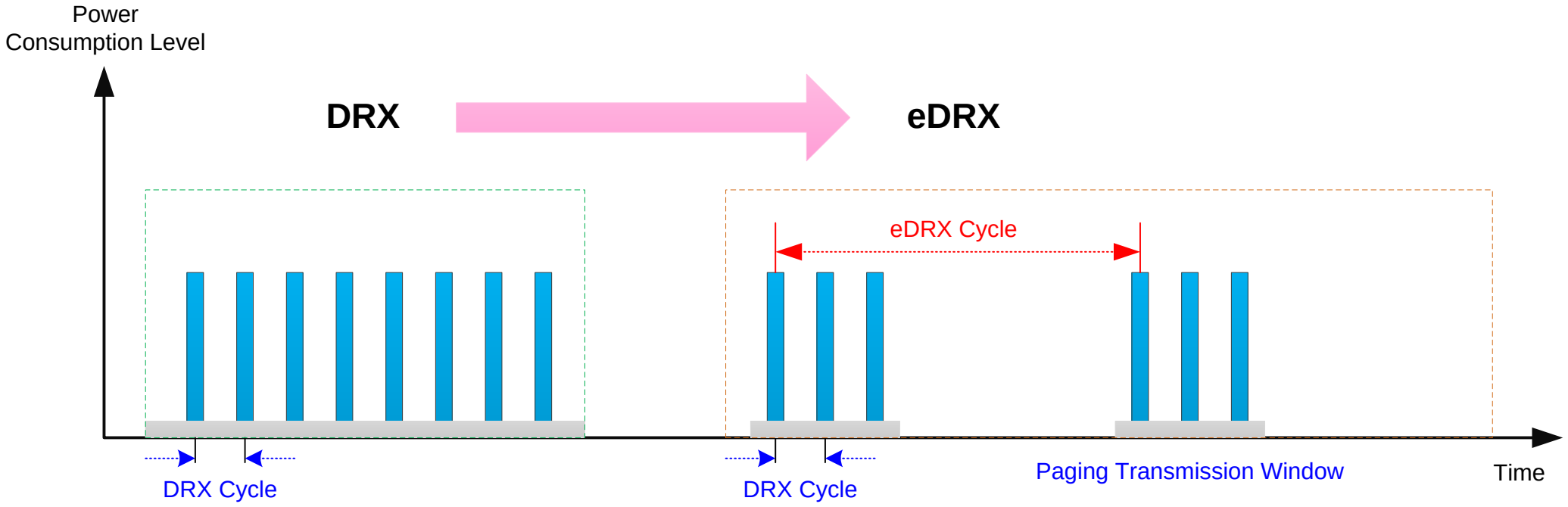


Key Technique – eDRX

The module (UE) may negotiate with the network in the non-access stratum over the use of eDRX to reduce its power consumption while remaining responsive to mobile terminated data and/or network originated procedures with a delay depending on the DRX cycle value.

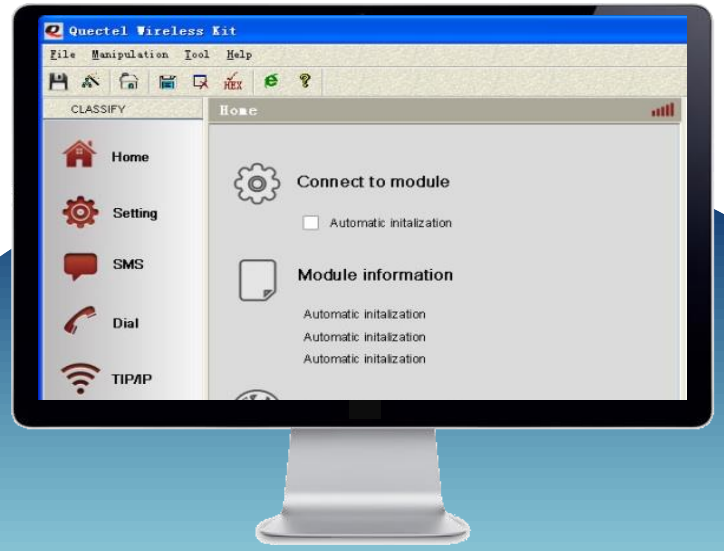
To use eDRX on applications, two things need consideration: its special handling of mobile terminating services or data transfers and, most importantly, the delay tolerance of mobile terminated data.

The following figure illustrates the DRX and eDRX cycle of the module.



Quectel Comprehensive Technical Support

Quick Start



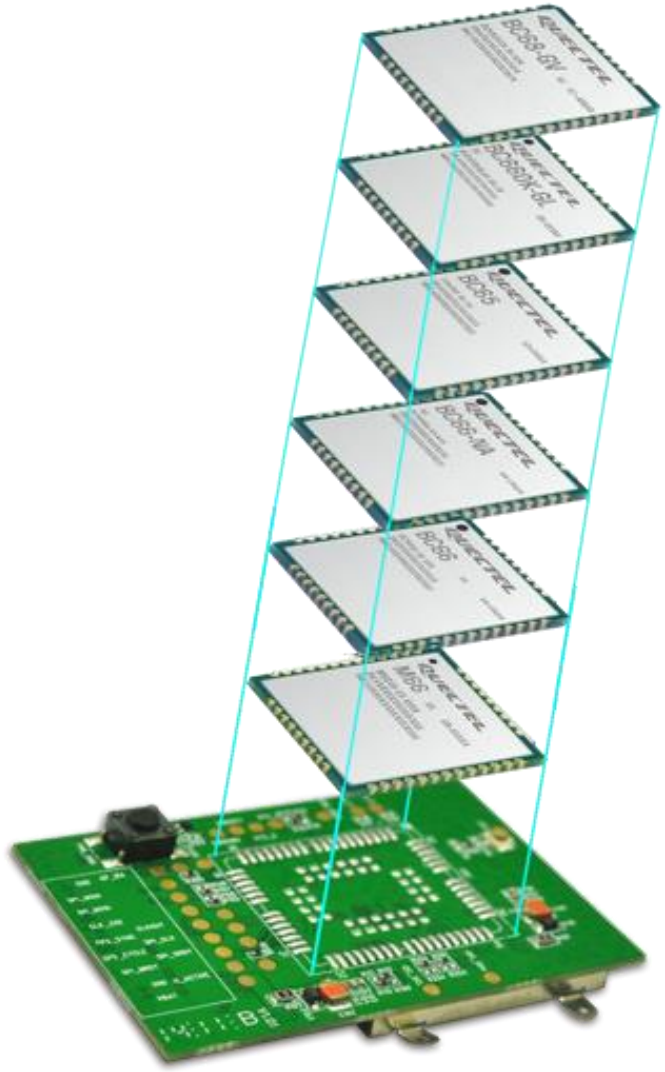
Quectel offers a GUI tool named **QNavigator**. It can help you quickly test Quectel module's functionality.

TE-B Kit

Compatibility

BC660K-GL are compatible with

- Quectel NB-IoT BC66/BC66-NA/BC68-GV/BC65 modules
- Quectel GSM/GPRS M66 module



NOTES: 1. The actual pin numbers of different modules that are compatible with each other may vary.
2. The modules shown on this page is for illustration purpose only. The actual appearance of the modules may be different.

Technical Background

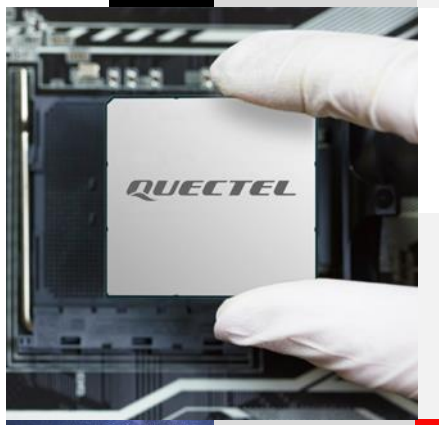
NB-IoT Roadmap

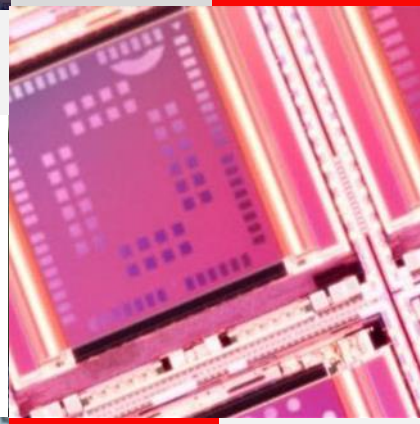
Highlights & Specifications

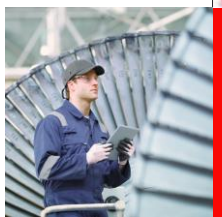
Development Timeline

Technical Details

Applications







Build a Smarter World

LPWA Application Scenarios

Public Utilities

- Water/Gas Metering
- Smart Parking
- Fire Hydrant
- Smoke Detector
- Street Lighting
- Smart Dustbin

Smart Life

- Asset Tracking
- Wearable Devices
- Person/Pet Tracking

Quectel Module

Industry & Agriculture

- Gas Detector
- Soil PH/Optical Sensor
- Machine Alarm
- Irrigation Controller

Smart Home

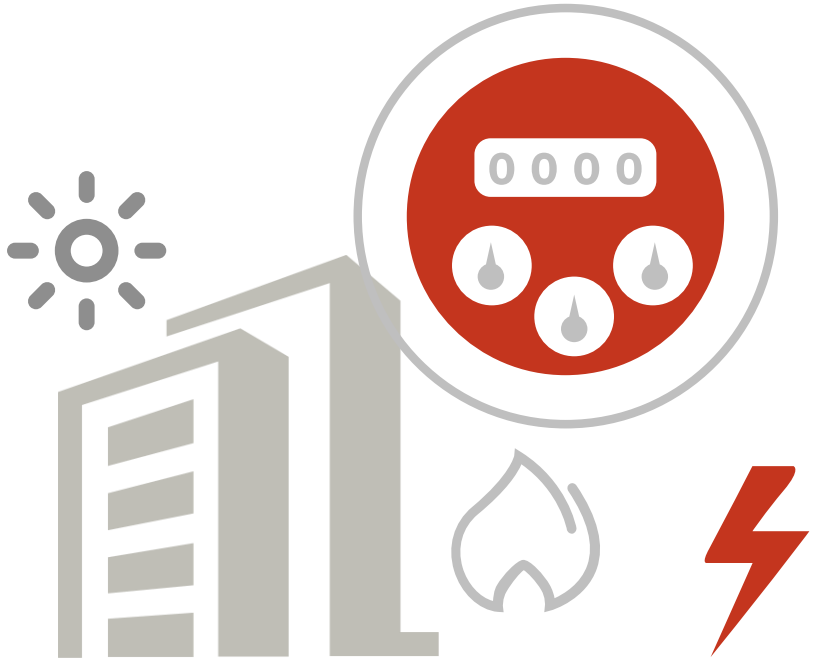
- Intelligent Door Lock
- Intelligent Control

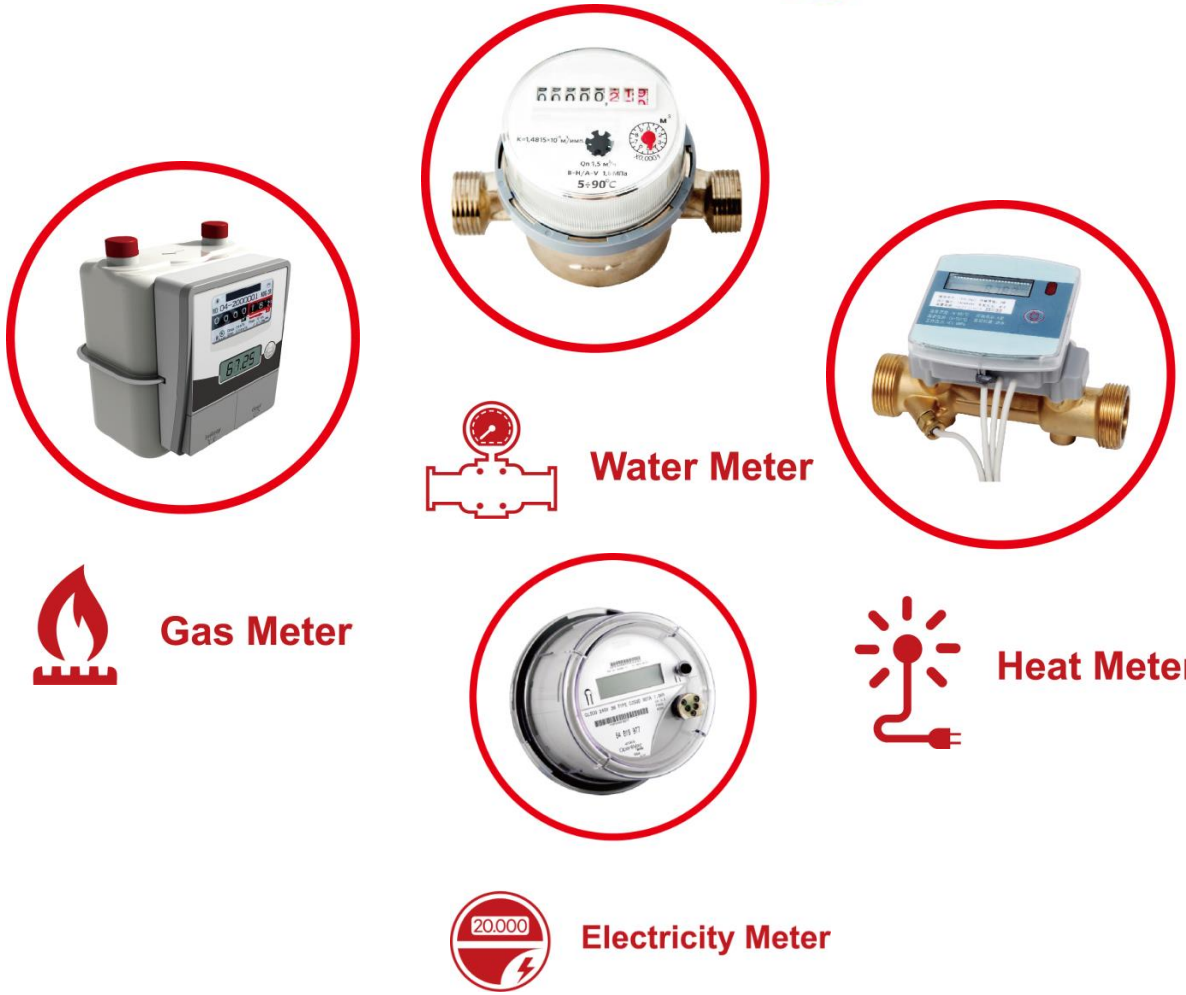
Public Utilities – Smart Metering

By 2024, there will be

1.9 billion

connected meters ①





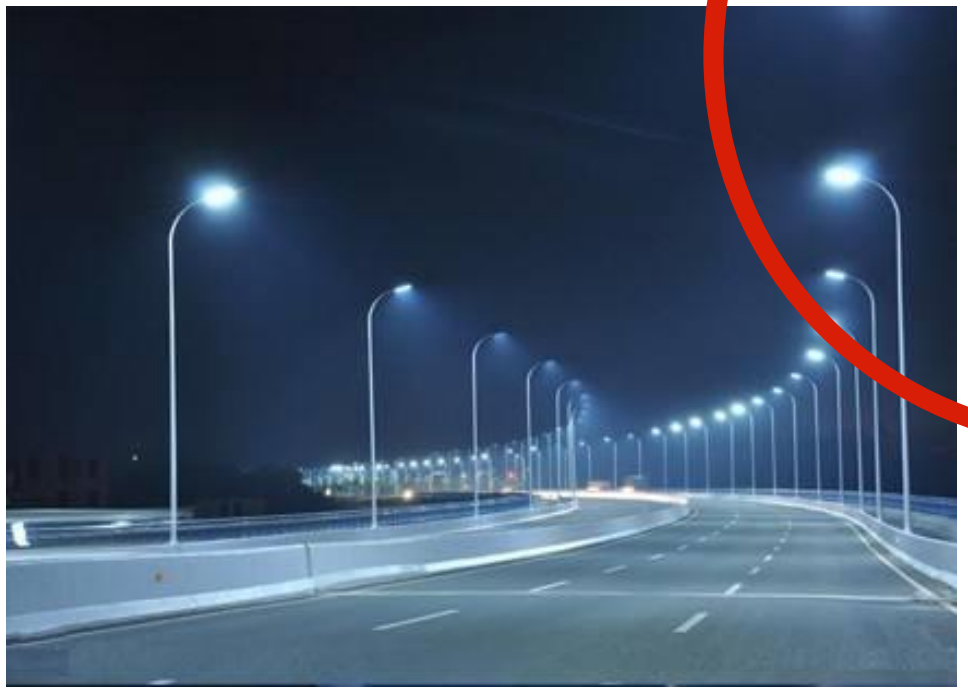
Domestic Meters | Wind Power Plant | Factory | Workplace

Nuclear Power Plant | Thermal Power Plant | Hydraulic Power Plant

Renewable Energy | Ecological Vehicle | Photoelectricity

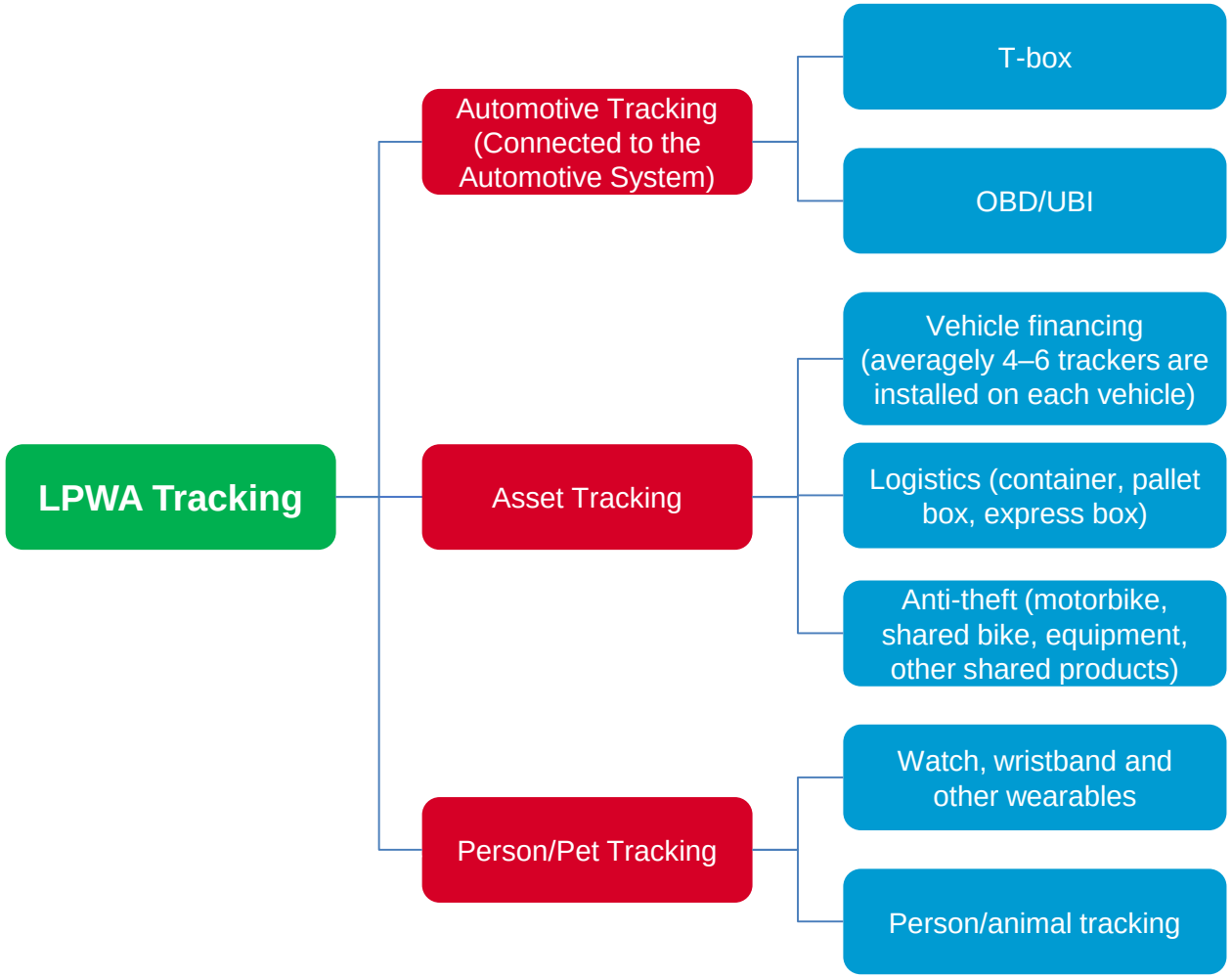
① *2016 Machina report on smart metering*

Public Utilities – Street Lighting

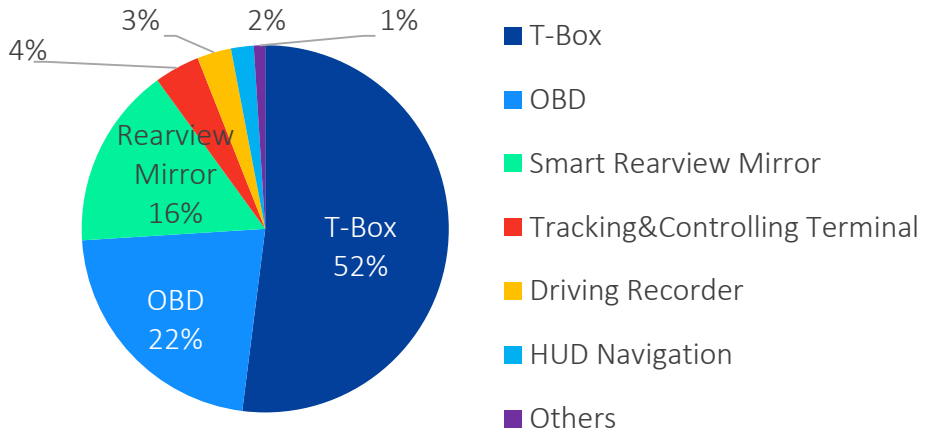


- Real time data feeds directly to the operation center
- Manual brightening of lighting when required
- Improved energy efficiency

Smart Life – LPWA Tracker



According to CAICT ①, 10 million automotive wireless terminals were sold in 2018 in China:



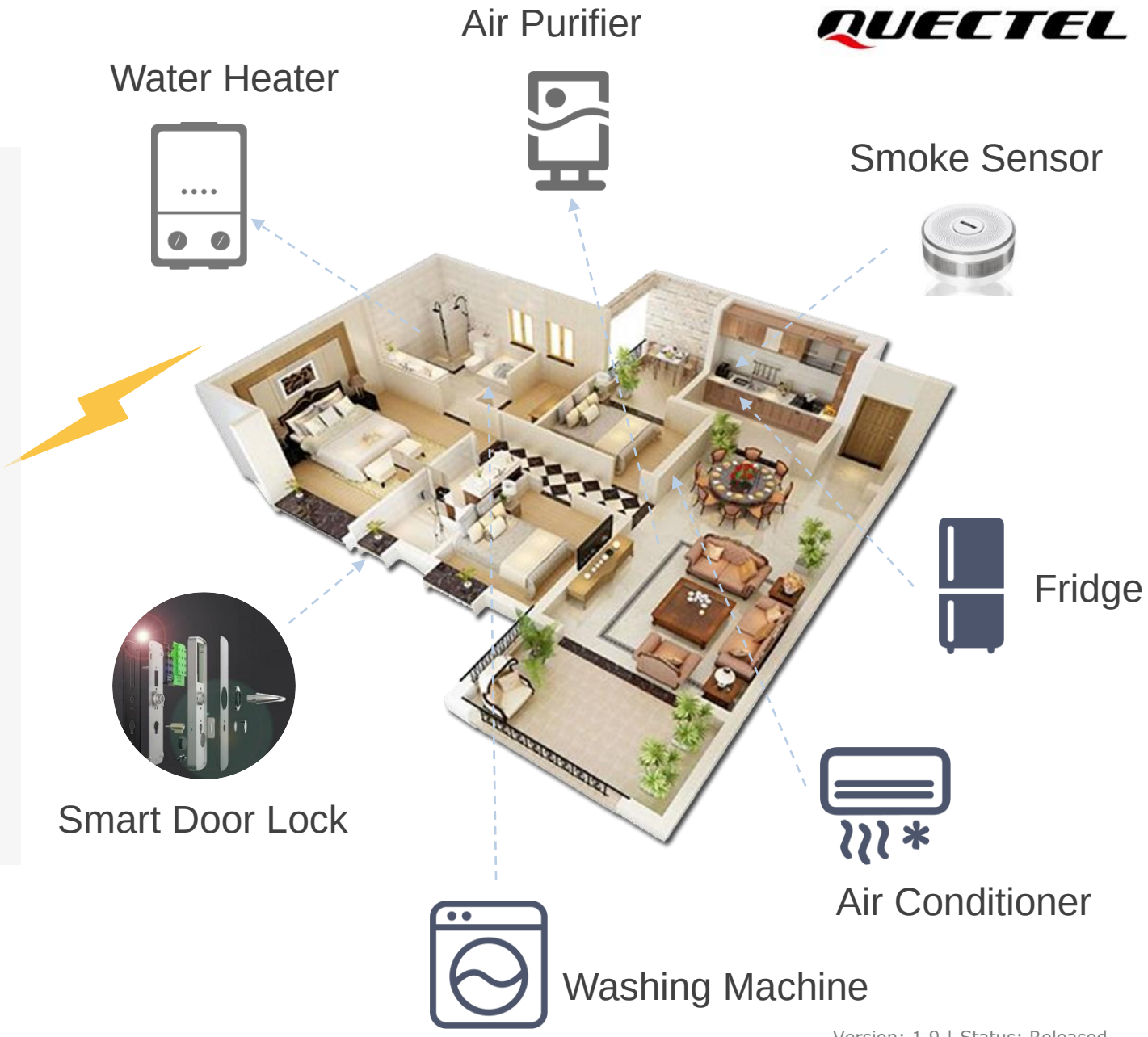
① China Academy of Information and Communication Technology

Smart Home

Feature: Non-inductive connection, automation, machine learning

Trend: Smarter, more convenient, safer, more energy-efficient

Including: White goods, black goods, security, monitors, medical treatment, healthcare, wearables, wireless controllers, etc.



Industry & Agriculture – Multi-gas Detector

- Hazardous gas monitoring, including VOCs, combustibles and toxics, etc.
- Real-time gas concentration reading, location, alarm and status indication

Industry & Agriculture – Robotic Lawn Mower

Smart Robotic Lawn Mower

(Based on Quectel LPWA module)

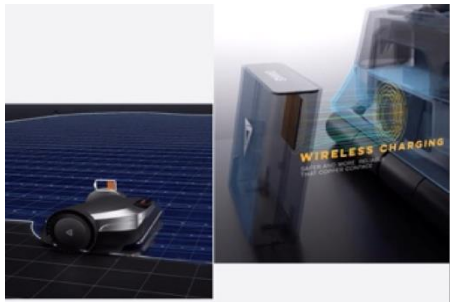
1 Wireless Communication
Easy Operation with APP

Positioning technology, easy installation

2 Intelligent Cutting
Smart Route

Smart algorithm

3 Wireless Charging
High-efficiency Cutting



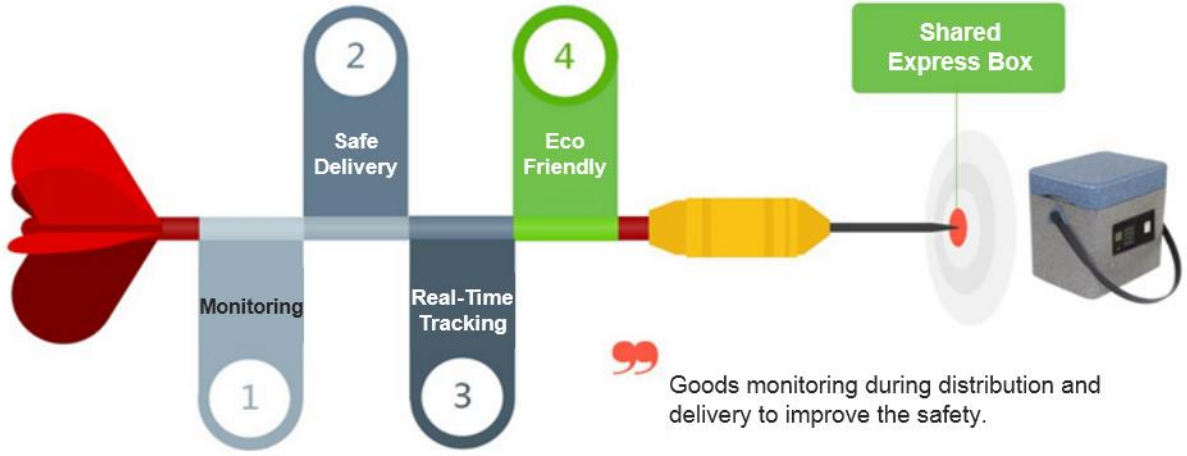
Self charging

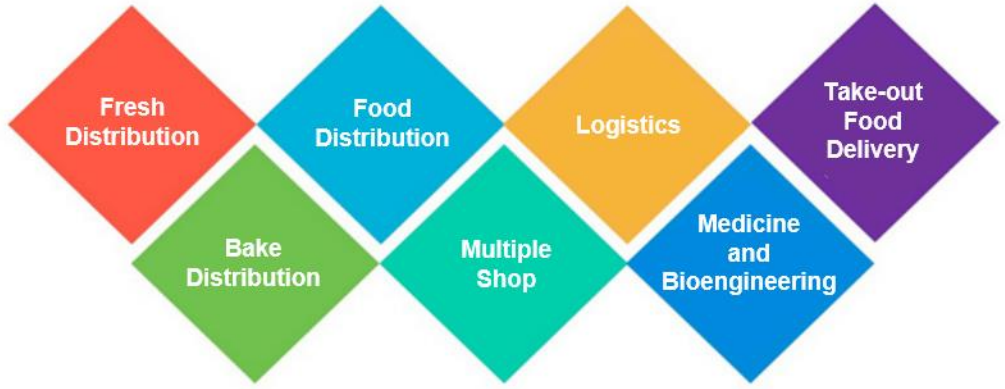
4 Safe & Eco-friendly
Low Noise and Power Consumption

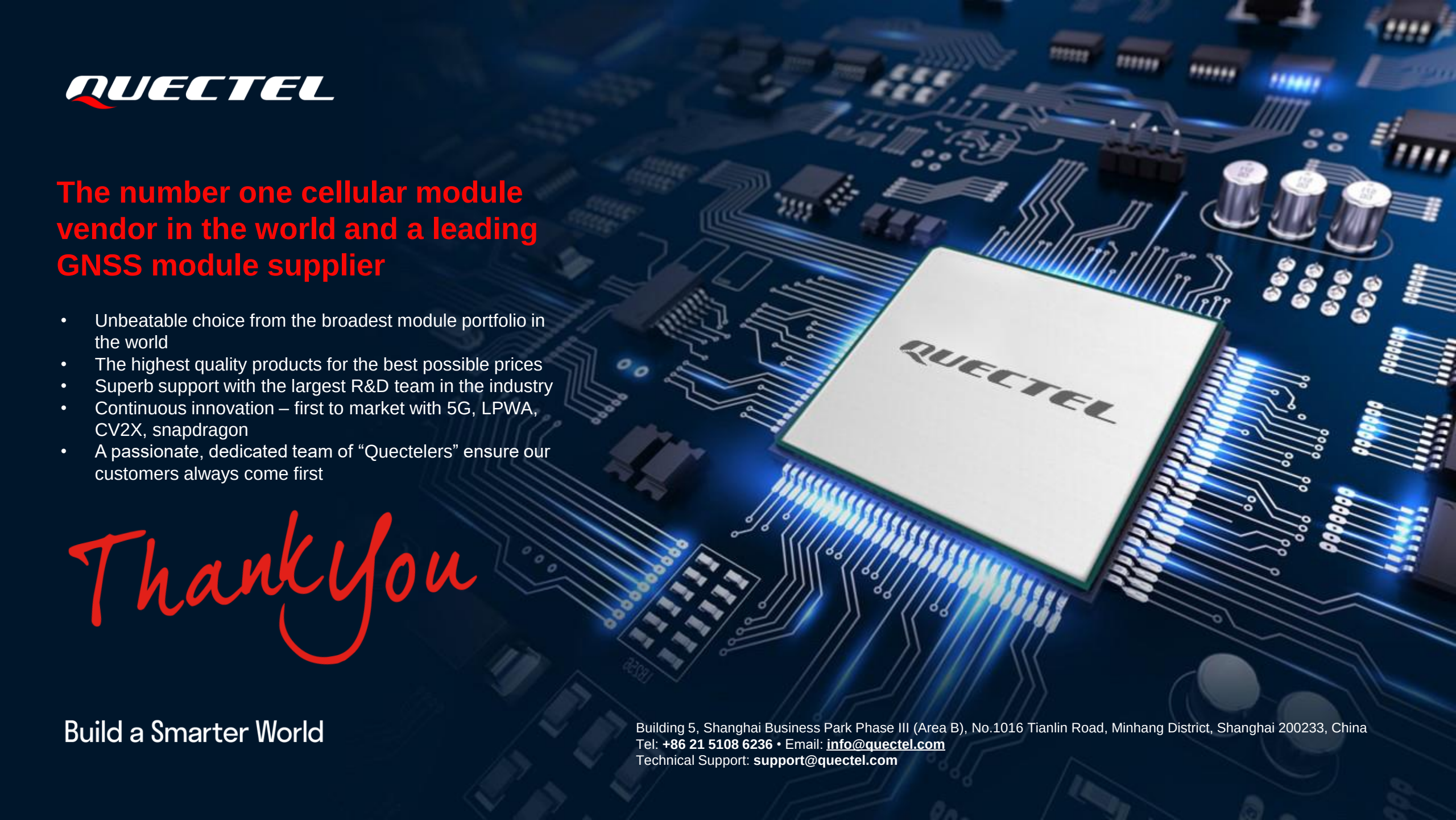
Lower noise

Smart Logistics – NB-IoT Shared Express Box

Smart IoT express box, featuring heat preservation, safe lock, real-time location, real-time temperature, integrates information technology and equipment IoT automation







The number one cellular module vendor in the world and a leading GNSS module supplier

- Unbeatable choice from the broadest module portfolio in the world
- The highest quality products for the best possible prices
- Superb support with the largest R&D team in the industry
- Continuous innovation – first to market with 5G, LPWA, CV2X, snapdragon
- A passionate, dedicated team of “Quectelers” ensure our customers always come first

Thank You

Build a Smarter World

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