Quectel
BC660K-GL & BC950K-GL
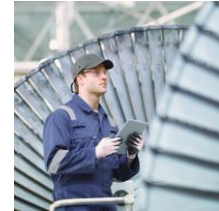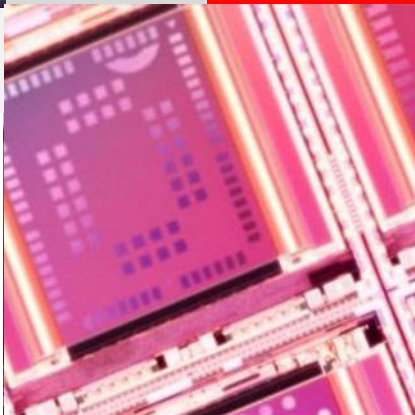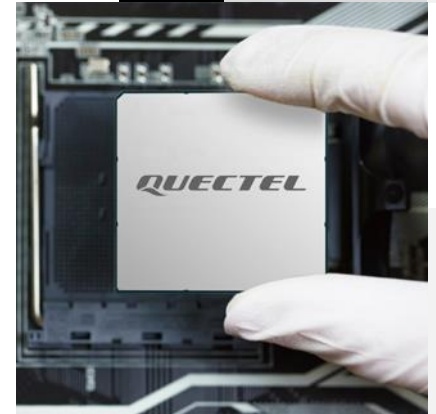# NB-IoT Module

Introduction

Build a Smarter World

Duty of Confidentiality

The Receiving Party shall keep confidential all documentation and information provided by Quectel, except when the specific permission has been granted by Quectel. The Receiving Party shall not access or use Quectel's documentation and information for any purpose except as expressly provided herein. Furthermore, the Receiving Party shall not disclose any of the Quectel's documentation and information to any third party without the prior written consent by Quectel. For any noncompliance to the above requirements, unauthorized use, or other illegal or malicious use of the documentation and information, Quectel will reserve the right to take legal action.
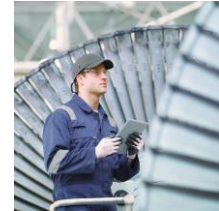
Build a Smarter World

LPWA Introduction & Portfolio

Specifications & Timelines
Technical Details
Applications
Appendix

Build a Smarter World
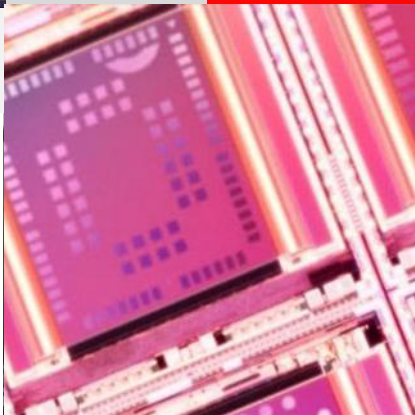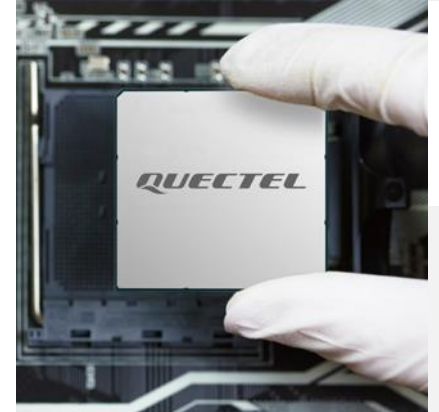
NB-IoT Technical Advantages

QUECTEL

Low Power Consumption

- NB: 0.8 µA (Typ.) @ PSM
- Cat M: 1.4 µA (Typ.) @ PSM
- eDRX technology

Massive Connection

- Max. 50000 terminal connections per cell
- Optimized spectral efficiency

Cost Effective

- The simplest hardware cellular technology
- Low data charge fees

Extended Network Coverage

- 20 dB link budget improvement over LTE/ GPRS
- Repetition/ retransmission mechanism
- Deep indoor coverage via high penetration capability

NB-IoT Connectivity Growth Trend

QUECTEL

Unit: Mpcs

NB

Year	NB
2021	82
2022	110
2023	145
2024	198
2025	272

■ NB

LPWA Network Deployment

Note:
1. Information sourced from GSMA and revised by Quectel, updated on Mar, 2022
2. For more operator deployment details, please refer to Appendix
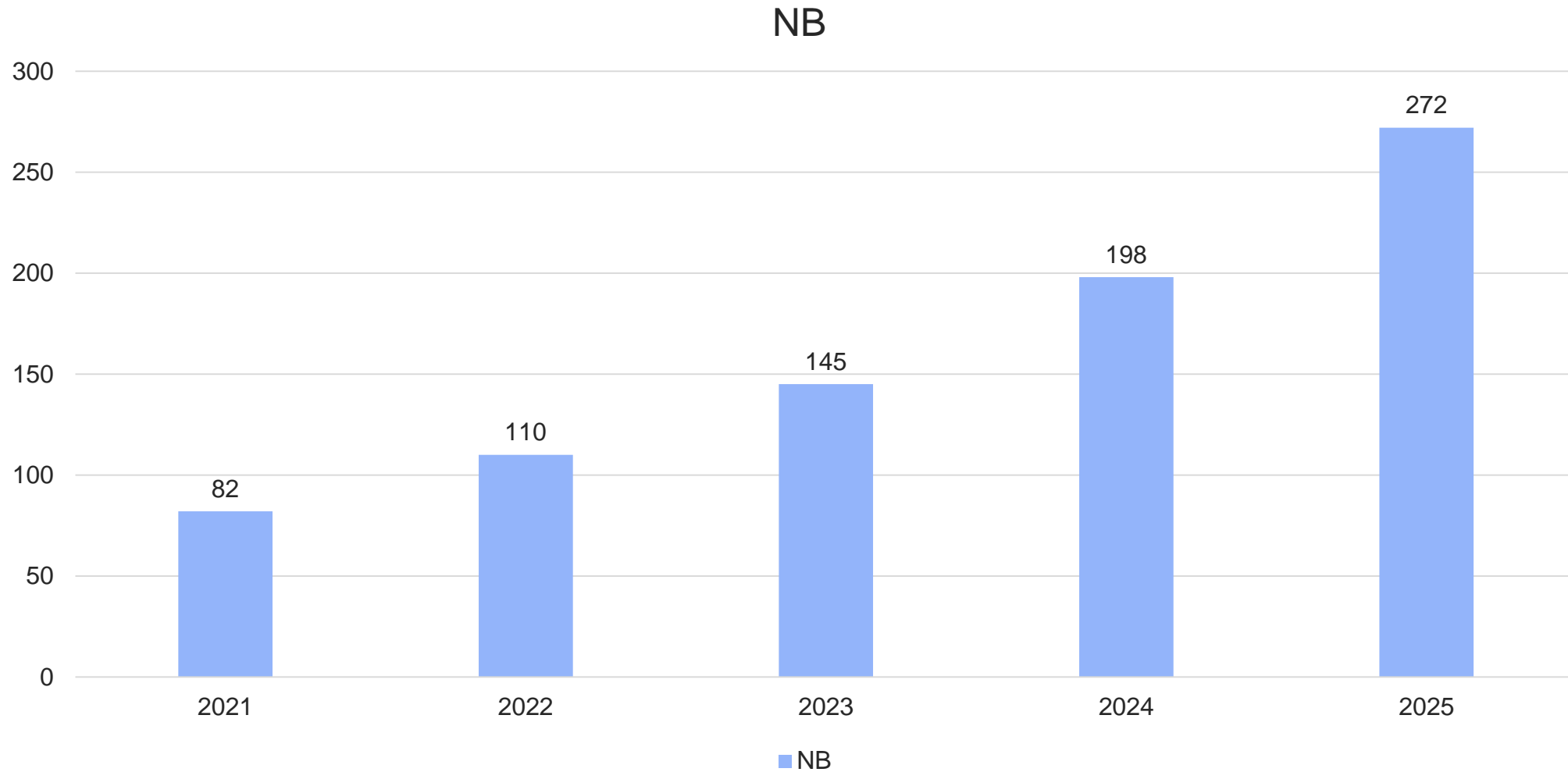
NB Modules Portfolio

QCX212

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

BC950K-GL
- Cat NB2
- 127 kbps DL/ 158.5 kbps UL
- Global Version

2020	2021	2022	2023

LPWA Introduction & Portfolio
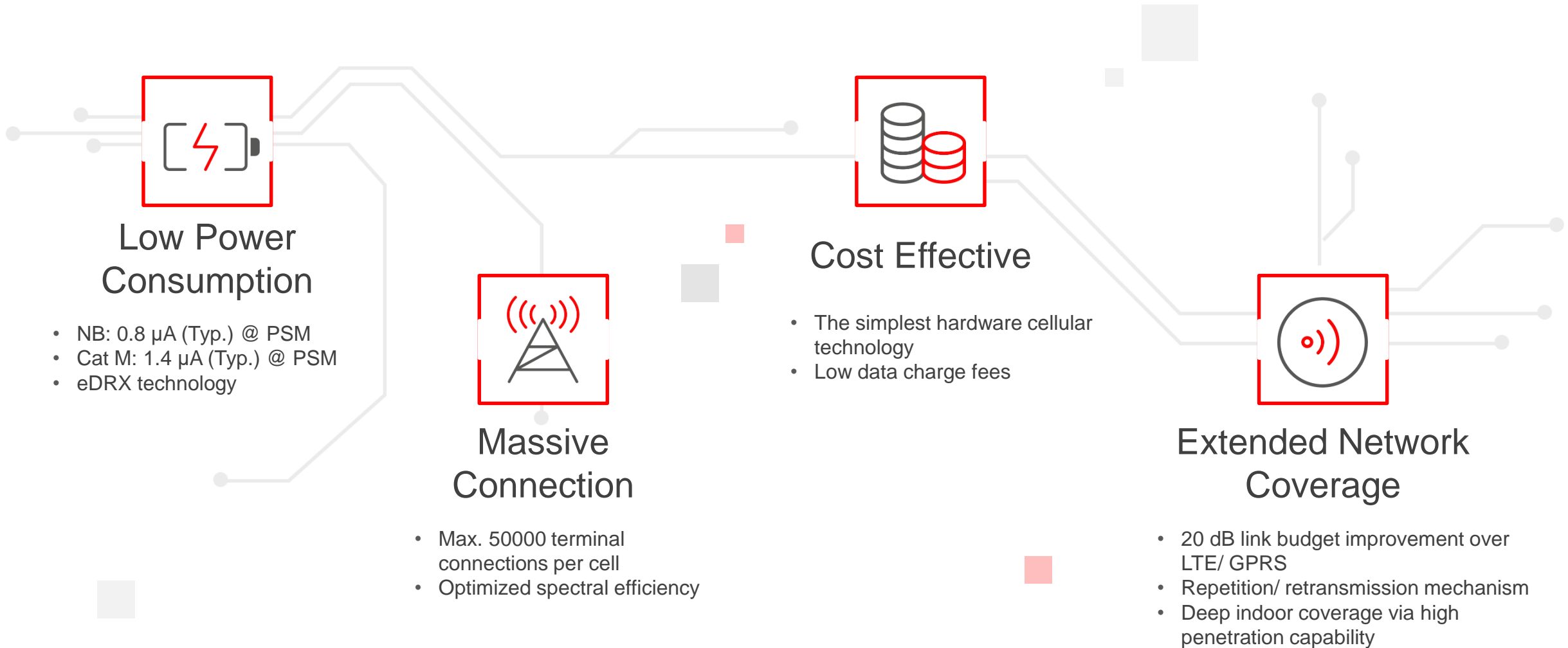# Specifications & Timelines
Technical Details
Applications
Appendix

Build a Smarter World

BC660K-GL Mechanical Dimensions

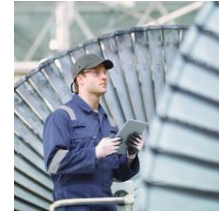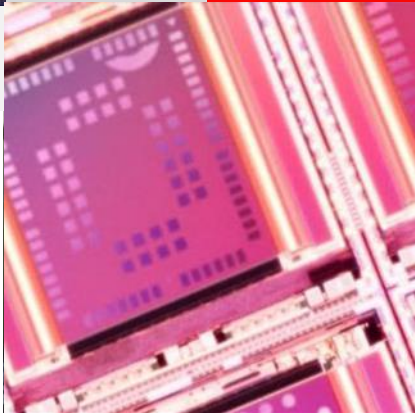## Multi-Band Cat NB2 Module (Qualcomm QCX212)

17.7 mm

QUECTEL

BC660K-GL Q1-XXXXX

XX
BC660KGLXXXX-XX-XXX
SN:XXXXXXXXXXXXXX
IMEI:XXXXXXXXXXXXXXX
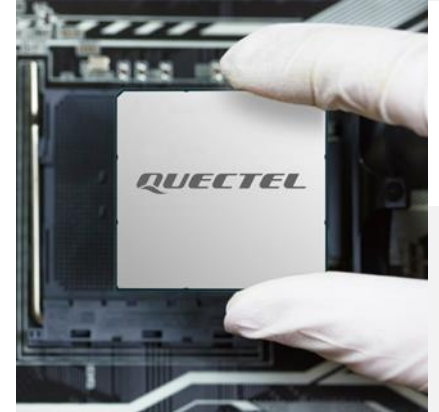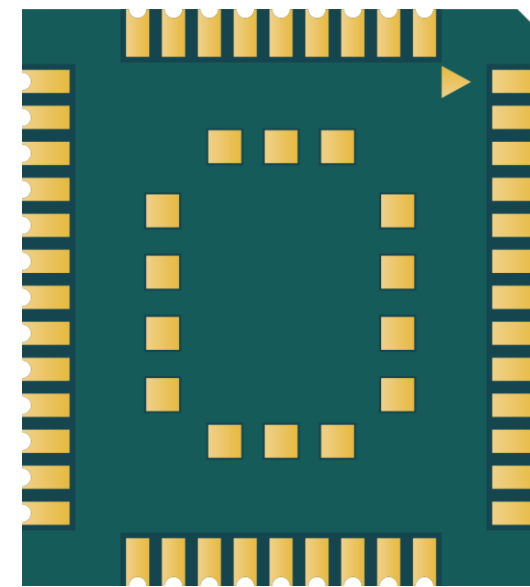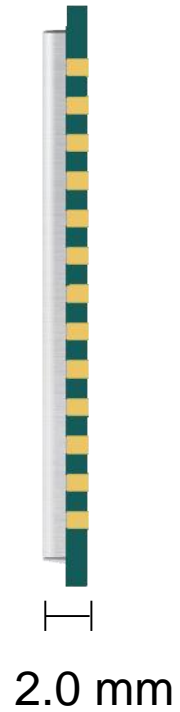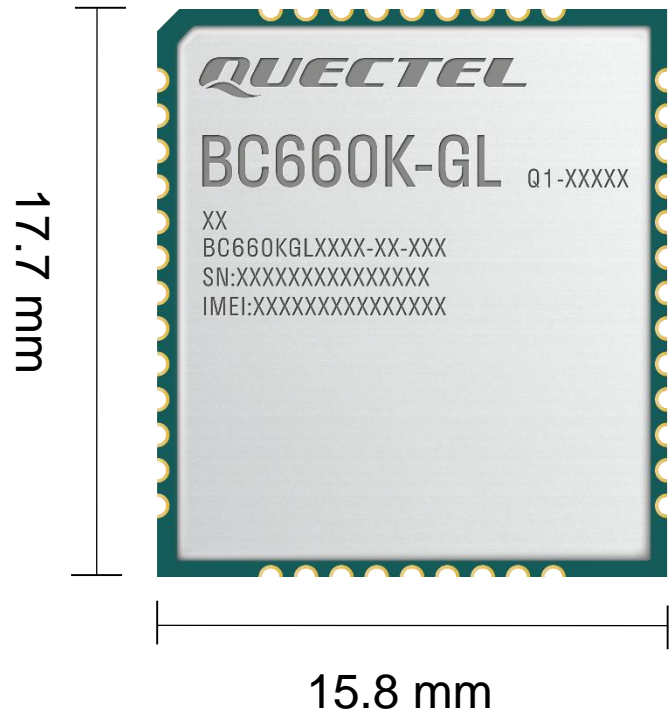
15.8 mm

2.0 mm

Length: 17.7 mm (±0.15 mm)
Width: 15.8 mm (±0.15 mm)
Height: 2.0 mm (±0.2 mm)
Weight: 1.0 g (±0.2 g)

BC950K-GL Mechanical Dimensions

Multi-Band Cat NB2 Module (Qualcomm QCX212)

23.6 mm

QUECTEL

BC950K-GL Q1-XXXXX

XX
BC950KGLXX-XXX-XXXXX
SN:XXXXXXXXXXXXXX
IMEI:XXXXXXXXXXXXXX
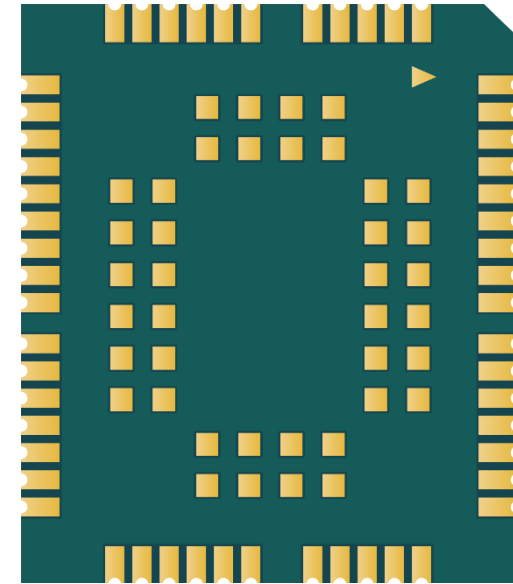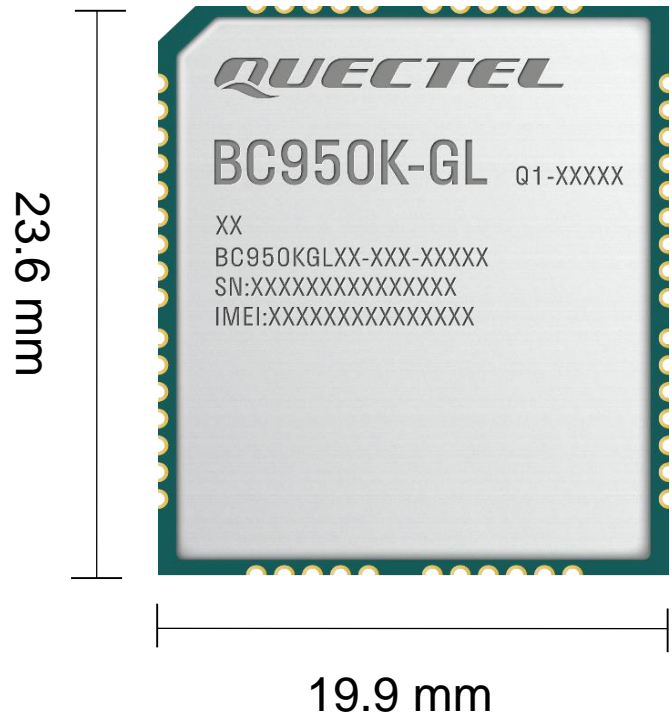
19.9 mm

2.2 mm

Length: 23.6 mm (±0.15 mm)
Width: 19.9 mm (±0.15 mm)
Height: 2.2 mm (±0.2 mm)
Weight: 1.6 g (±0.2 g)

BC660K-GL Highlights

Highlights	Description
Global Bands	LTE Cat NB2: B1/ 2/ 3/ 4/ 5/ 8/ 12/ 13/ 17/ 18/ 19/ 20/ 25/ 28/ 66/ 70/ 85
Rich Hardware Interfaces	UART/ RI/ USIM/ ADC/ NETLIGHT/ PSM_EINT/ BOOT/ RESET_N/ Antenna/ GPIO/ I2C[①]/ PWM[①]/ SPI[①]
Abundant Protocols	UDP/ TCP/ PING/ SNTP/ LwM2M/ MQTT/ MQTTS/ SSL/ TLS
eSIM[②]	eSIM reserved with 2.552 x 2.722 mm package
Power Supply	Supply voltage range: 2.2–4.3 V, typical 3.3 V[③] 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 the 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 Consumption[④]	• 800 nA @ PSM[⑤] • 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
Compatibility	Compatible with Quectel GSM/GPRS M66, NB-IoT BC66/BC66-NA, BC65 and BC68 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: 3GPP performance for QCX212 chipset is guaranteed from VBAT supply 3.0–4.3 V.   ④: sourced from the chipset spec.   ⑤: Reference data provided by baseband chip.

BC950K-GL Highlights

Highlights	Description
Global Bands	LTE Cat NB2: B1/ 2/ 3/ 4/ 5/ 8/ 12/ 13/ 17/ 18/ 19/ 20/ 25/ 28/ 66/ 70/ 85
Rich Hardware Interfaces	UART/ RI/ USIM/ ADC/ NETLIGHT/ PSM_EINT/ BOOT/ RESET_N/ Antenna/ GPIO/ I2C[①]/ PWM[①]/ SPI[①]
Abundant Protocols	UDP/ TCP /PING/ SNTP/ LwM2M/ MQTT/ MQTTS/ SSL/ TLS
eSIM [②]	eSIM reserved with customization 5 x 6 mm Package
Power Supply	Supply voltage range: 2.2–4.3 V, typical 3.6 V[③] 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 the 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 Consumption[④]	• 800 nA @ PSM[⑤] • 0.11 mA @ Idle (DRX = 2.56 s)
Advanced Features	• Battery voltage detection* • QuecOpen® • DFOTA
Compatibility	Package compatible with Quectel GSM/ GPRS M95 R2.0 and NB-IoT BC95-G modules which can be replaceable only with slight modifications, easy for product migration.

* means under development. ① means supported only on QuecOpen® version.   ②: eSIM is reserved and not included by default.   ③: 3GPP performance for QCX212 chipset is guaranteed from VBAT supply 3.0–4.3 V.   ④: sourced from the chipset spec.   ⑤: Reference data provided by baseband chip.

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, × 16)
I2C	× 1 (for QuecOpen® version only)
PWM	× 1 (for QuecOpen® version only)
SPI	× 1 (for QuecOpen® version only)

* means under development.

BC950K-GL Main Interfaces

Interface	Description
USIM	× 1
UART	× 2 (for QuecOpen® version, × 3)
RI	× 1
PSM_EINT	× 1 (for QuecOpen® version, × 5)
ADC	× 1 (for QuecOpen® version, × 4)
RESET_N	× 1
BOOT	× 1
NETLIGHT	× 1
GRFC*	× 2
Antenna	× 1
GPIO*	Configurable (for QuecOpen® version only, Multiplexed with other pins)
I2C*	× 1 (for QuecOpen® version only, Multiplexed with other pins)
PWM*	× 1 (for QuecOpen® version only, Multiplexed with other pins)
SPI*	× 1 (for QuecOpen® version only, Multiplexed with other pins)

* means under development.

BC660K-GL & BC950K-GL Main Functions

Function	Description
Protocols	UDP/ TCP/ PING/ SNTP/ LwM2M/ MQTT/ MQTTS/ SSL/ TLS
SMS*	Text mode
DFOTA	Delta firmware upgrade over-the-air
eSIM	Supported [1]
QuecOpen®	200 KB flash (integrated) + 300 KB SRAM (integrated)

* 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

BC950K-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	75	mA
	@ Connected Tx 23 dBm	355	mA

BC950K-GL Timeline

QUECTEL

2022			2023											2024		
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.

Project Stage

ES   CS

Certification

Carrier
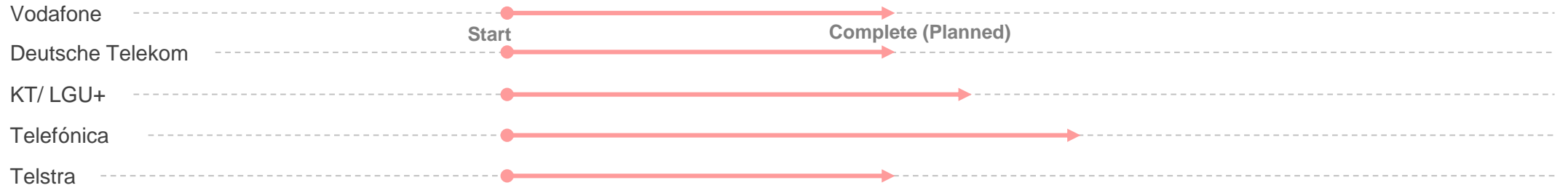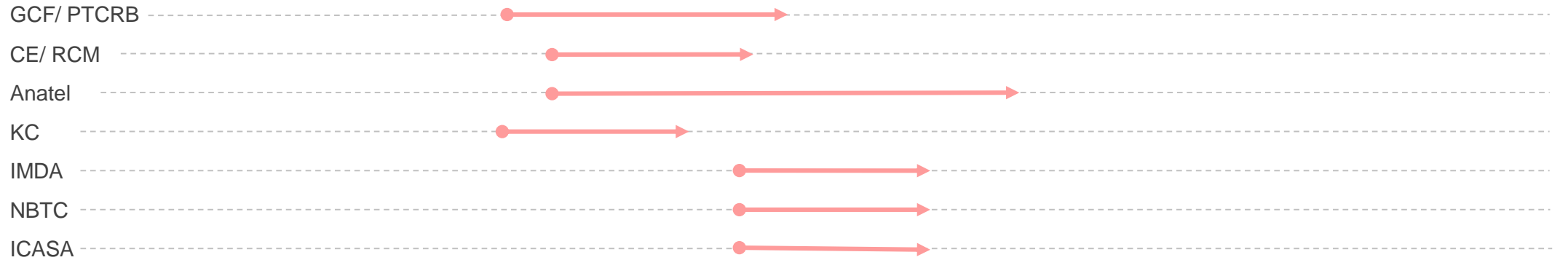
- Vodafone — Start .... Complete (Planned)
- Deutsche Telekom
- KT/ LGU+
- Telefónica
- Telstra

Regulatory

- GCF/ PTCRB
- CE/ RCM
- Anatel
- KC
- IMDA
- NBTC
- ICASA

The timeline may be adjusted according to the actual development status

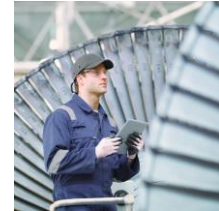Version: 2.1 | Status: Released
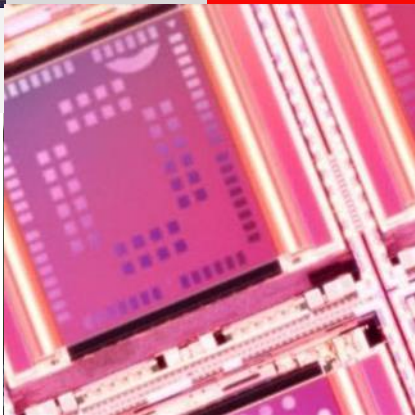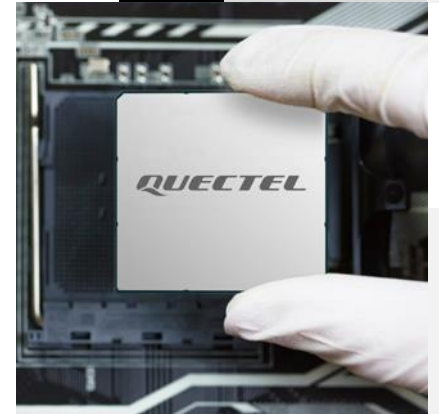
LPWA Introduction & Portfolio

Specifications & Timelines

Technical Details
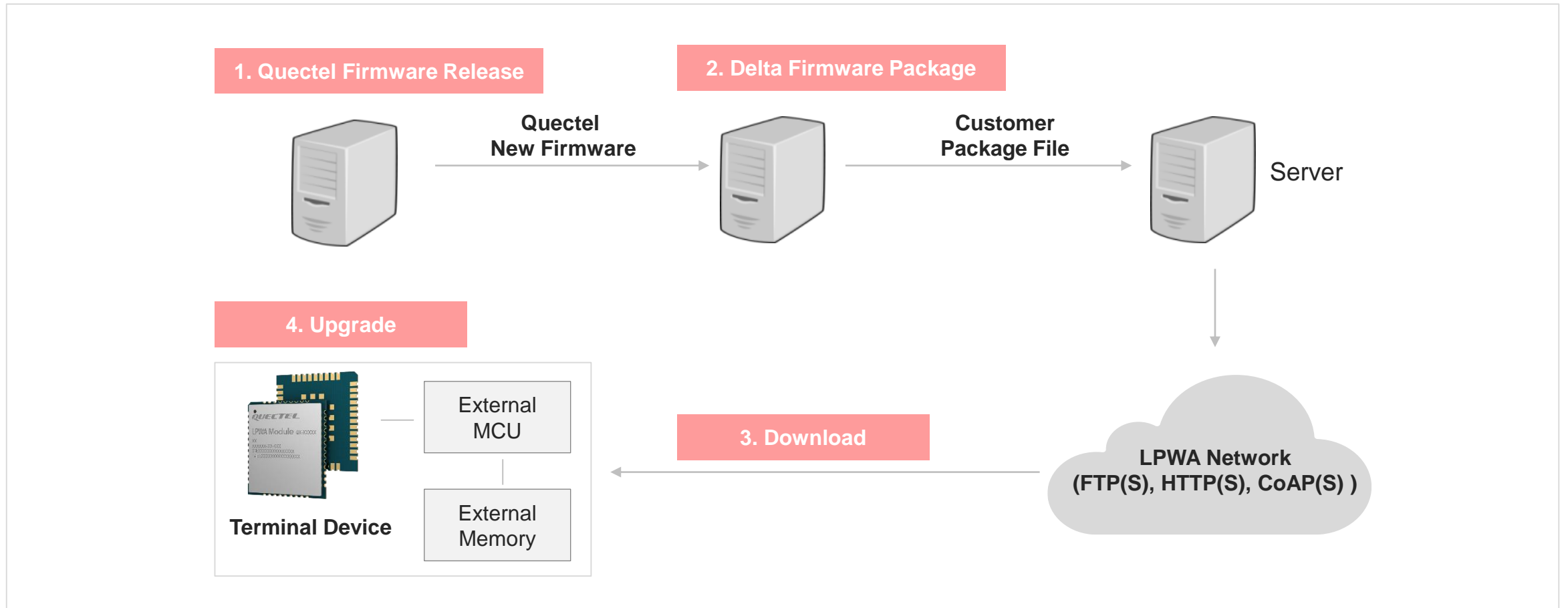
Applications
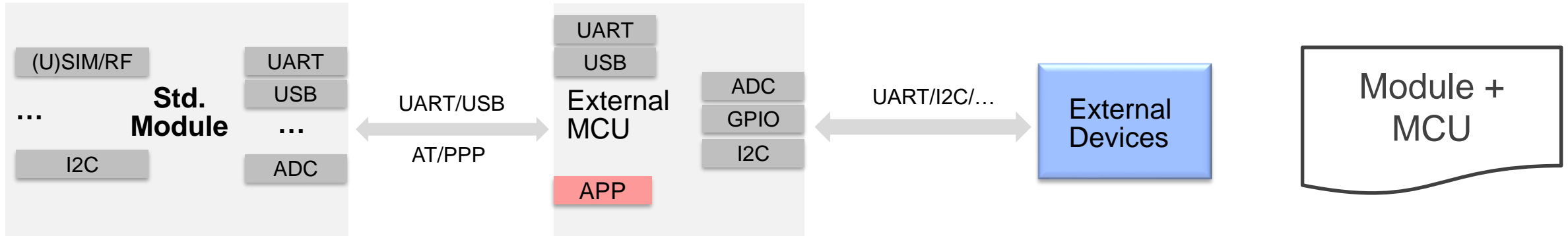
Appendix

Build a Smarter World

DFOTA

DFOTA (Delta Firmware Upgrade Over-The-Air)

Quick firmware upgrade through cellular networks owing to differential upgrade, delta firmware package, and fast download speed.

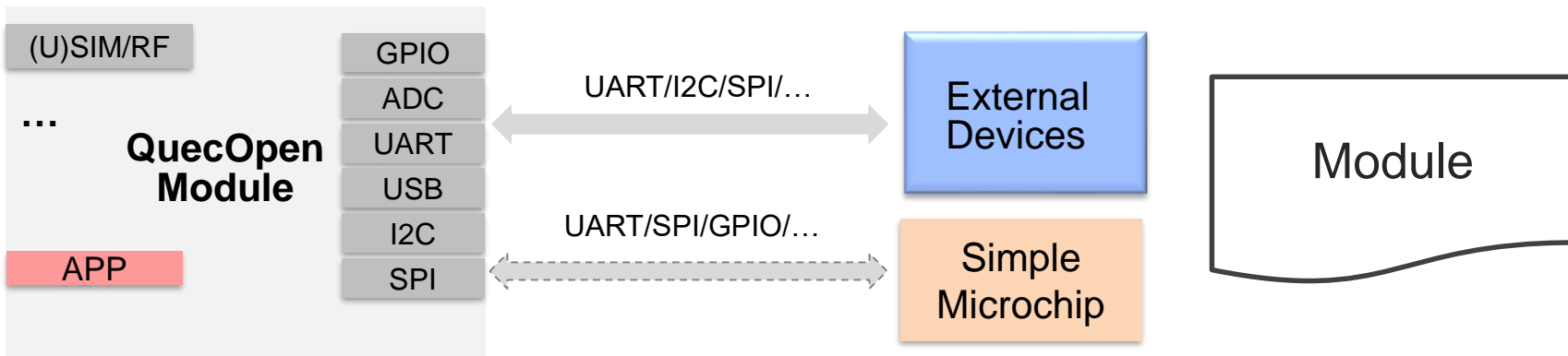**1. Quectel Firmware Release**

2. Delta Firmware Package

Quectel New Firmware

Customer Package File

Server

4. Upgrade

External MCU

3. Download

External Memory

Terminal Device

LPWA Network (FTP(S), HTTP(S), CoAP(S))

QuecOpen® vs. Standard Mode

QUECTEL

Standard Module Mode

(U)SIM/RF	UART				
	USB				
... **Std. Module** ...		UART/USB	UART		
		AT/PPP	USB		
I2C	ADC			ADC	
				GPIO	

External MCU

APP

ADC
GPIO
I2C

UART/I2C/...

External Devices

Module + MCU

QuecOpen® Mode

(U)SIM/RF

... **QuecOpen Module**

GPIO
ADC
UART
USB
I2C
SPI

APP

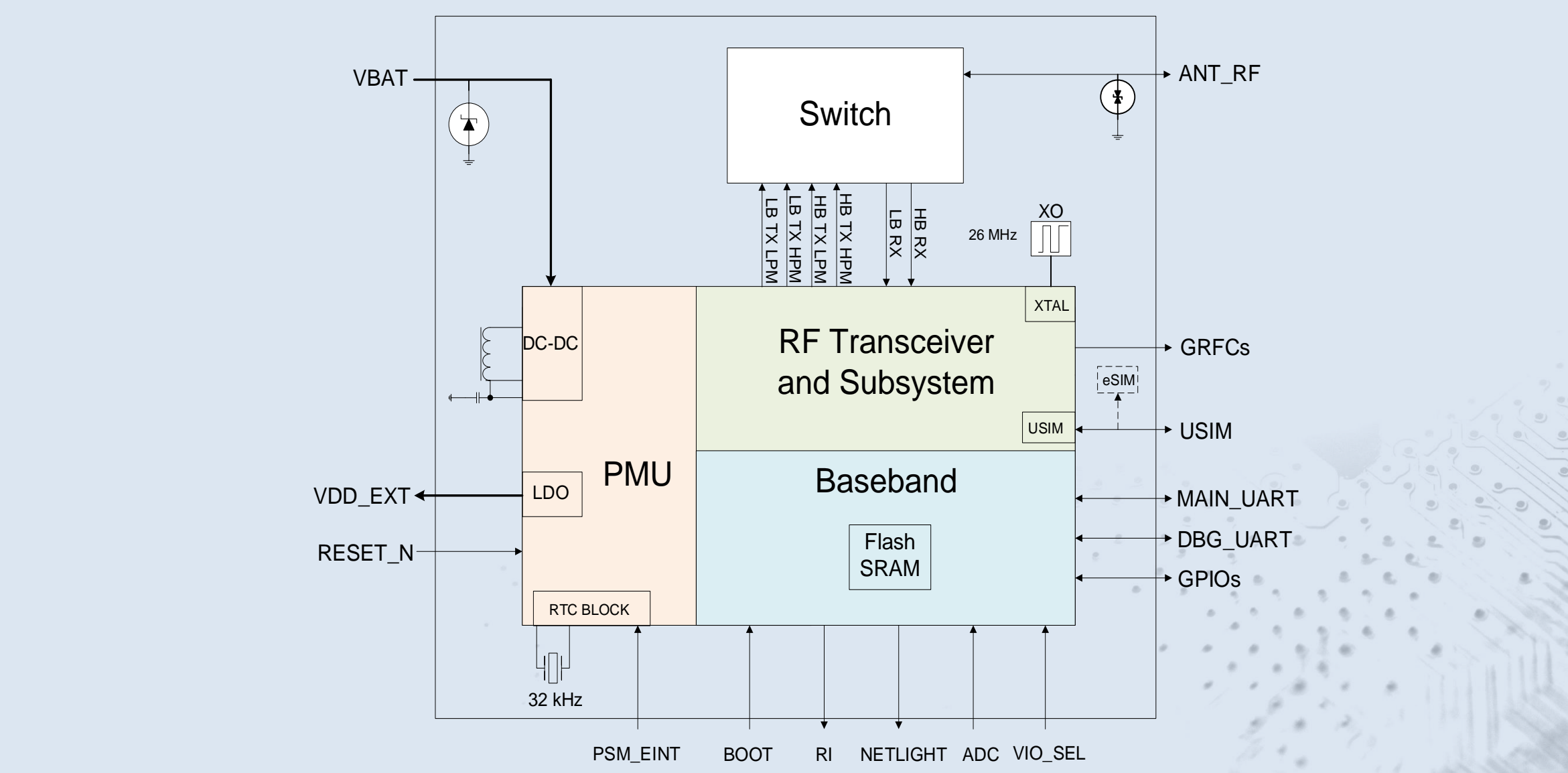UART/I2C/SPI/...

External Devices

UART/SPI/GPIO/...

Simple Microchip

Module

- Simplify circuit design and reduce product size.

- Rich hardware interfaces, strong performance and easy development.

- Reduce costs by eliminating the need for external MCU.

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.

Version: 2.1 | Status: Released
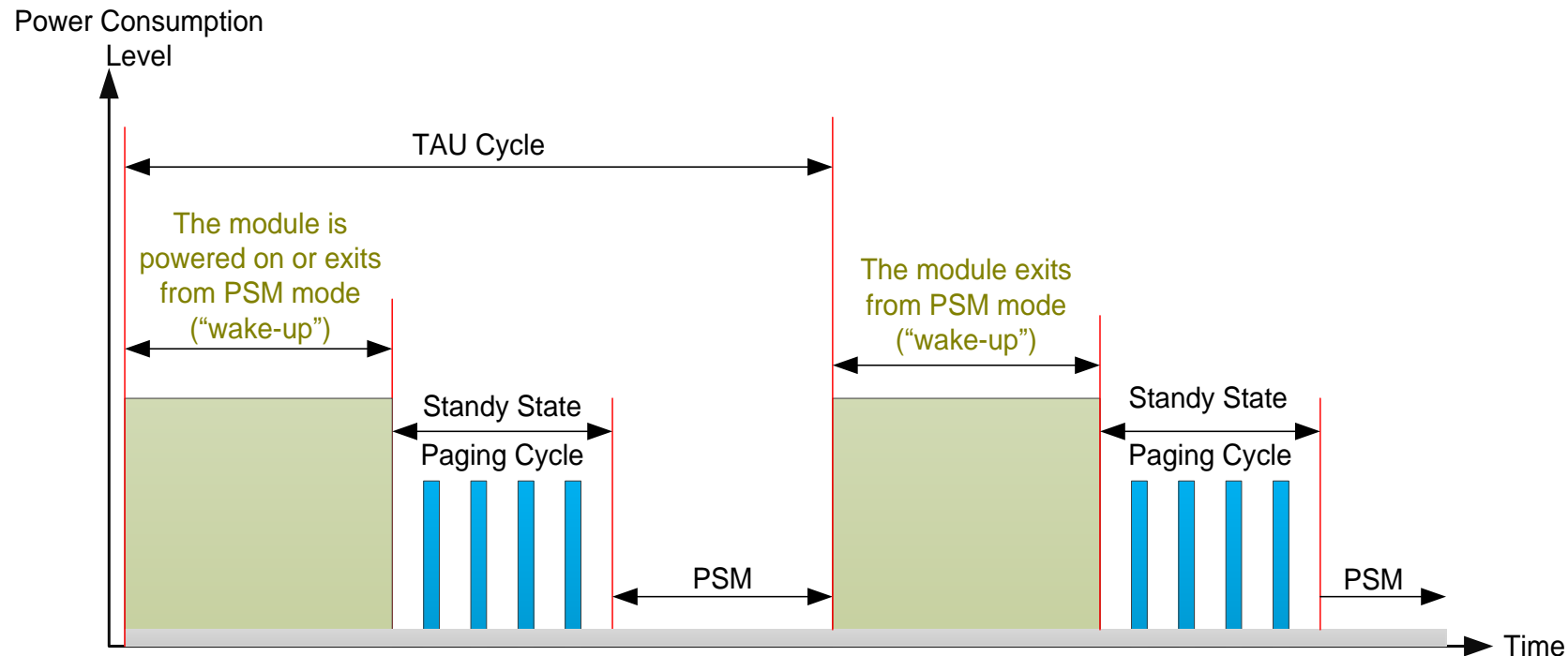
Key Technique – eDRX

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.
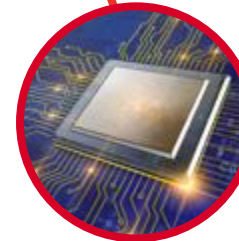
360 Degree Support

QUECTEL
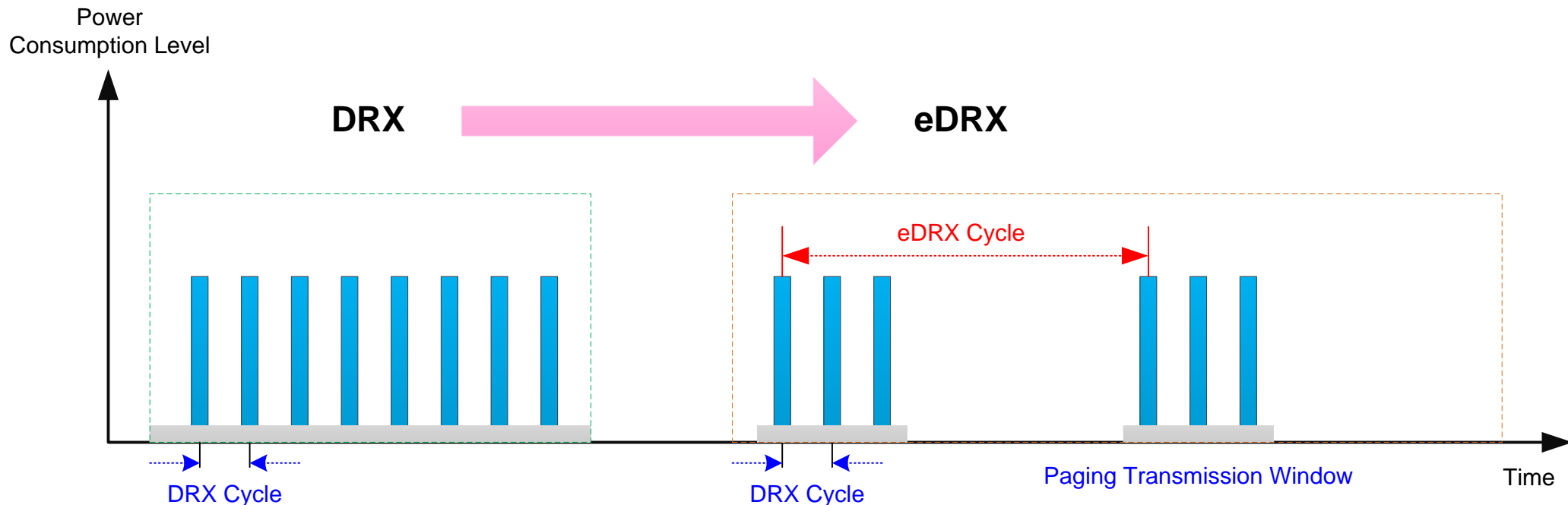
1. System Evaluation

- Analyzing customer requirements
- Recommending the right module for the customer
- Evaluating antenna placement
- Designing antennas
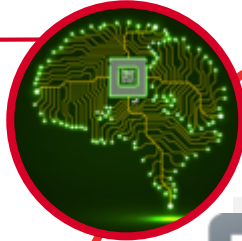
2. Design In

- Recommending referenced hardware designs
- Checking schematics and layouts
- Providing software design support

On-site Support
support@quectel.com
www.quectel.com

3. Prototype

- Providing design validation testing
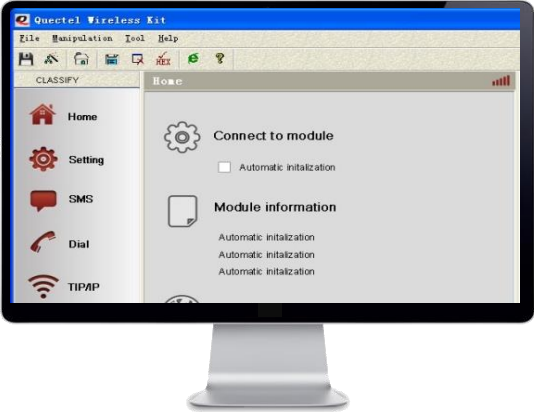- Recommending suppliers

5. Mass Production

- Providing assembly and testing guidelines
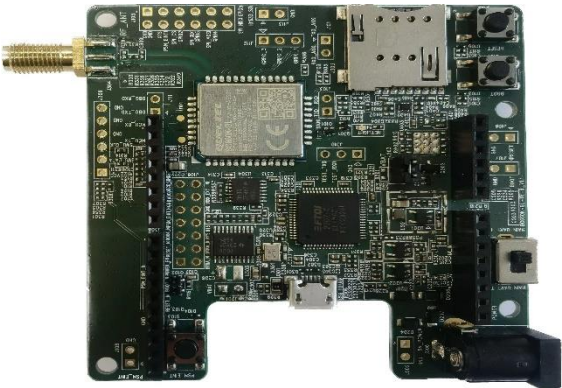- Providing after-sales services

4. Testing Service

- RF testing
- Power consumption testing
- Audio testing
- Reliability & environmental testing
- ESD testing
- Certification testing
- Antenna debugging

Support Package

Quectel provides a graphical user interface (GUI) tool QNavigator, which can help customers quickly test the functions of Quectel modules.
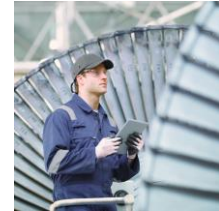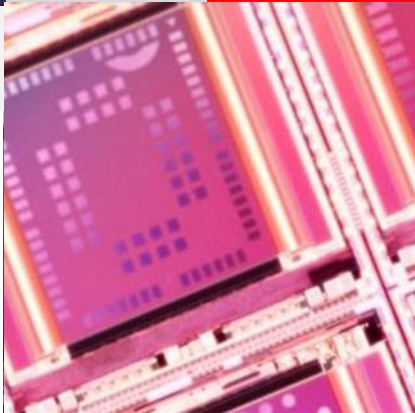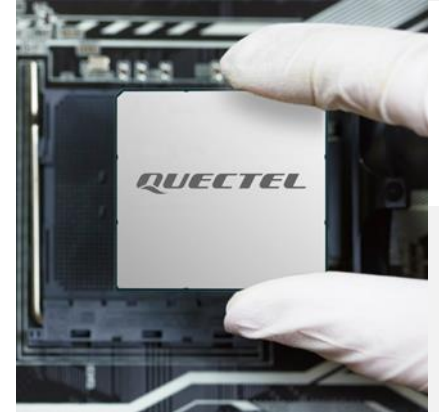

BC660K-GL TE-B

BC950K-GL TE-B

LPWA Introduction & Portfolio

Specifications & Timelines

Technical Details

Typical Applications

Appendix

Build a Smarter World

NB-IoT Application Scenarios

Public Utilities

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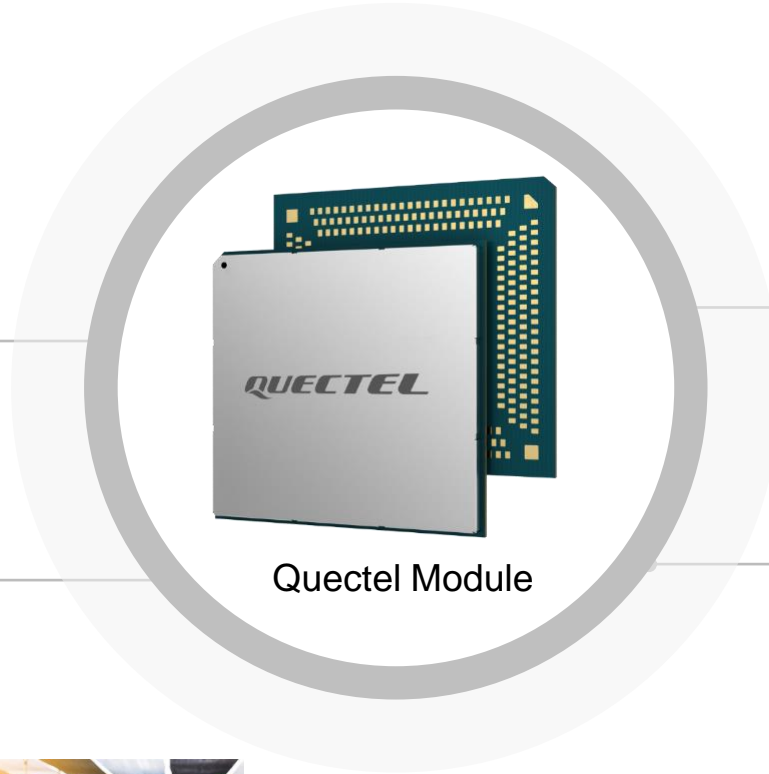
Smart Life

- Asset Tracking
- Wearable Devices
- Person/ Pet Tracking

Quectel Module

Industry & Agriculture

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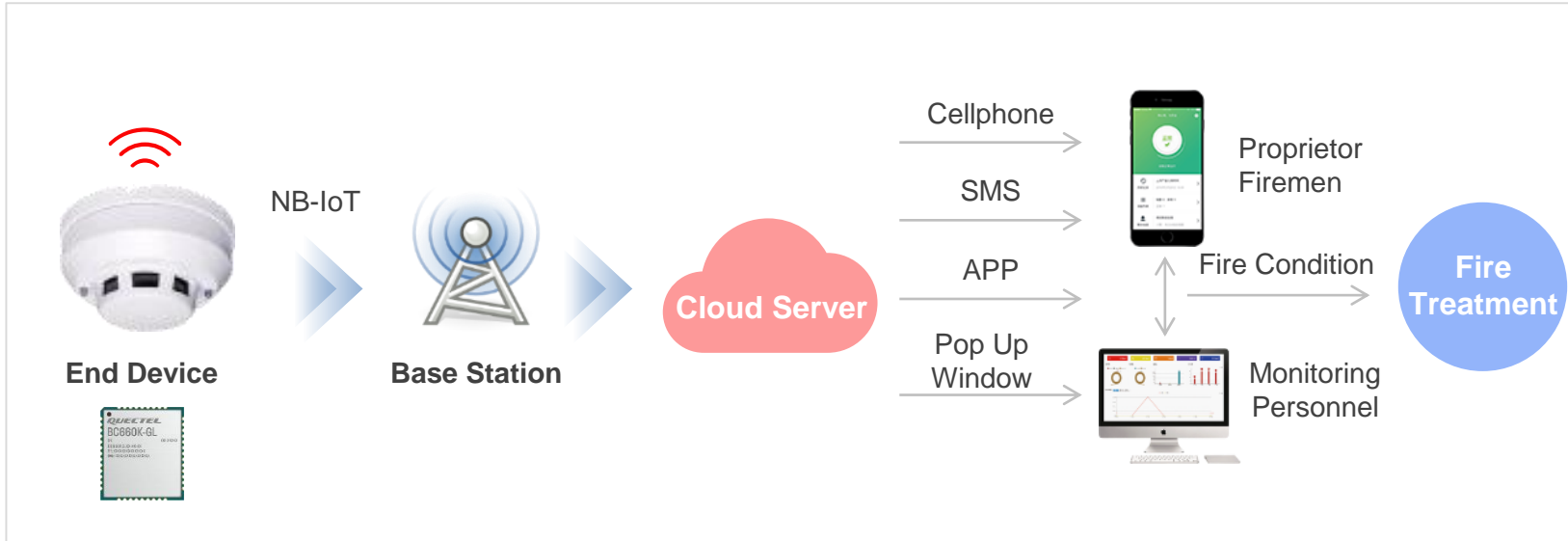- Soil PH/ Optical Sensor
- Machine Alarm
- Irrigation Controller

Smart Home

- Intelligent Door Lock
- Intelligent Control

PH: Potential of hydrogen.

Smart Sensor Detector

QUECTEL

NB-IoT

End Device

Base Station

Cloud Server

Cellphone

SMS

APP

Pop Up Window

Proprietor Firemen

Fire Condition

Monitoring Personnel

Fire Treatment

Features

- Long battery life
- Extended communication distance
- Battery-under-voltage reminder function
- Anti-disassembly, anti-theft and timely reminder functions
- The wireless communication adopts NB-IoT technology with strong transmission capability
- Hazardous gas monitoring, including VOCs, combustibles and toxics, etc.

Easy Connection to Sensors
Provide abundant hardware interfaces to connect to peripheral sensors

Quick Response
Audible and visual alarms, and remote alarms (notified through SMS, WeChat, telephone, etc.)

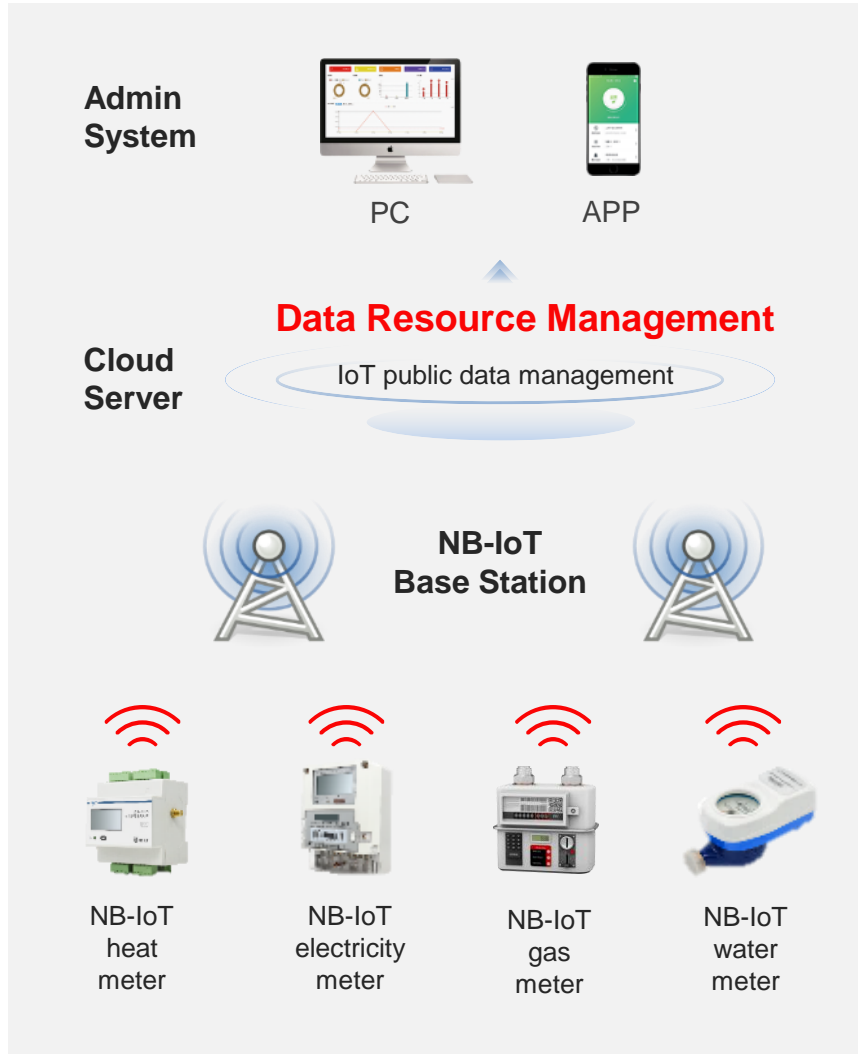## Easy Installation and Remote Maintenance
Wireless issue diagnosis implementation without physical damage

Public Cellular Network
No need for Wi-Fi configuration

SMS: Short message service
VOC: Volatile organic compound

Version: 2.1 | Status: Released

Smart Meter

Admin System

PC   APP

Data Resource Management

Cloud Server

IoT public data management

NB-IoT Base Station

NB-IoT heat meter   NB-IoT electricity meter   NB-IoT gas meter   NB-IoT water meter

Remote Meter Reading

- Solve the problems of low efficiency and high cost caused by manual reading
- Real-time information of power/ water/ gas consumption

Data Analysis

- Automatically generate statistical report
- Provide accurate calculation of production and sales difference
- Regional consumption statistics
- Annual, monthly and daily consumption statistics

Energy Conservation

- Report abnormal dosage immediately
- Save energy

Stable and Reliable Data Transmission

- Establish information management system
- Improve energy consumption management
- Meet the requirements of certain data encryption

IoT: Internet of Things

Smart City – Street Lighting

Admin System
PC   APP

Data Resource Management

Cloud Server

IoT public data management

NB-IoT Base Station

NB-IoT Street Lights

Remote Control

- Solve the problems of low efficiency and high cost caused by manual control
- Real-time information of power consumption and brightness
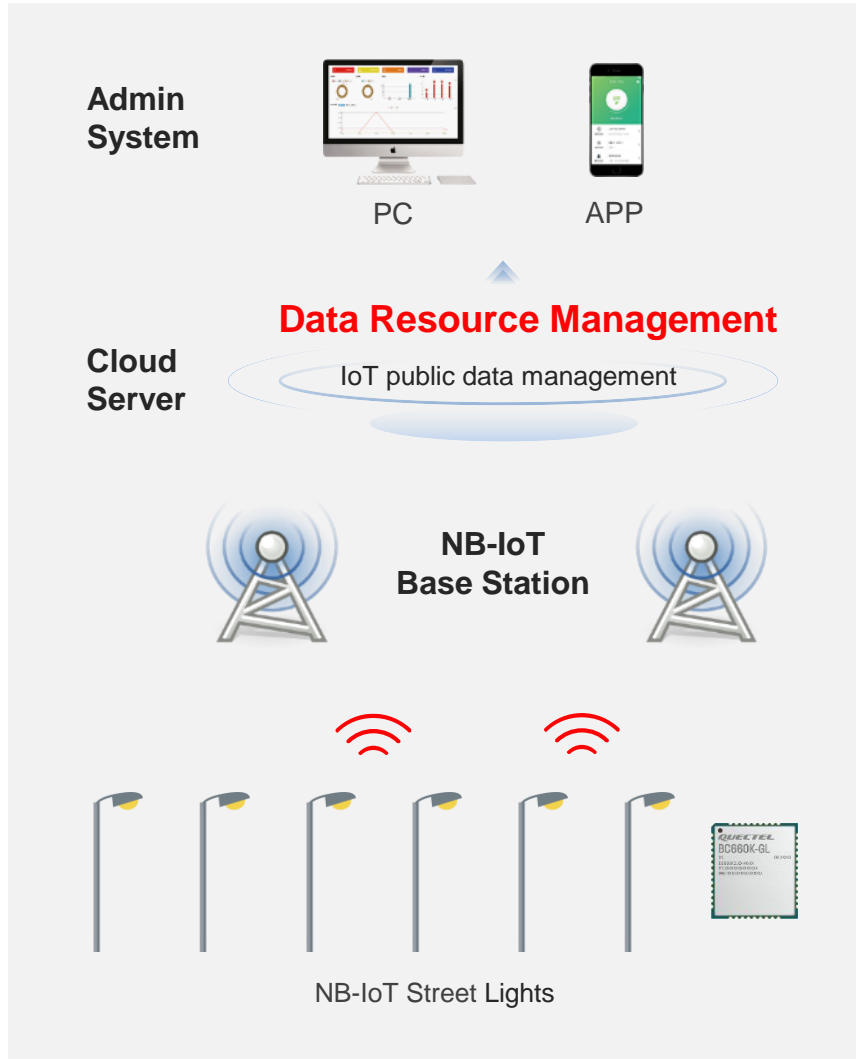- Adjust brightness of street lights

Data Analysis

- Automatically generate statistical report
- Real-time data feeds directly to the operation center
- Annual, monthly and daily consumption statistics
- Report abnormal lamp immediately

Energy Conservation

- Control street lights on both sides of the road to be turned on or off, or control street lights on either side of the road to be turned on with different time periods
- Save energy

Stable and Reliable Data Transmission

- Establish information management system
- Improve energy consumption management
- Reduce maintenance costs via NB network

Smart Traffic – Emergency Light

Alarm & Location

NB-IoT

Emergency Incident Site

Base Station

Traffic Center

Cloud Server

Warning message

Nearby Vehicles

Safe Driving
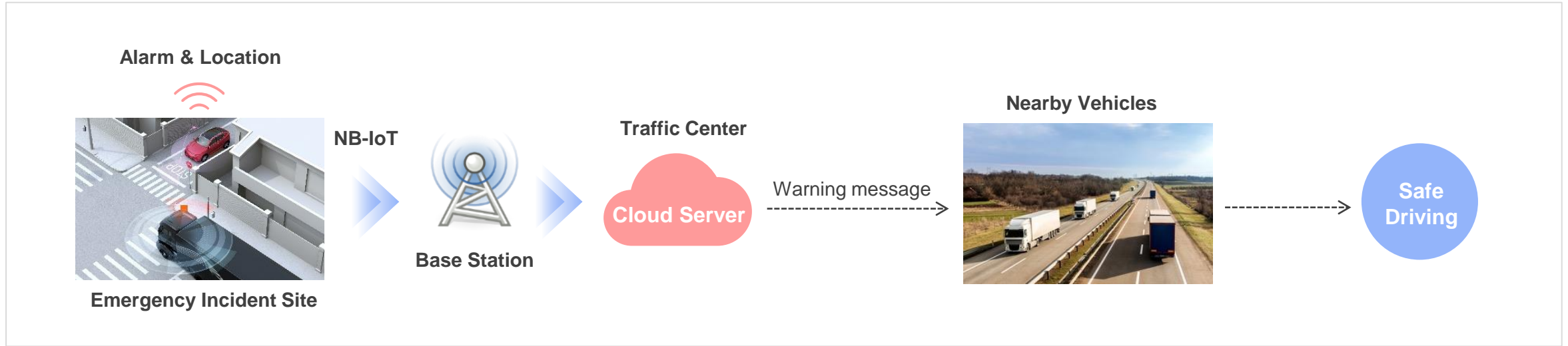
Quick Response

NB module sends location information to traffic center immediately after emergency incident happens.

Alarm Triger

Alarm will be trigged via NB modules control signal.

Management

Platform server send the location to other vehicles nearby with NB modules.

Warning Sign Substitute

Emergency lights will replace traditional emergency tripod in the future.

Smart EV Charging Stations

QUECTEL

Admin system

PC   APP

Data resource management

Cloud server

IoT public data management

BC950K-GL Q1-XXXXX
XX
BC950KGLXX-XXX-XXXXX
SN:XXXXXXXXXXXXX
IMEI:XXXXXXXXXXXXX

Charging Piles A | Charging Piles B | Charging Piles C | Charging Piles D
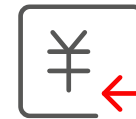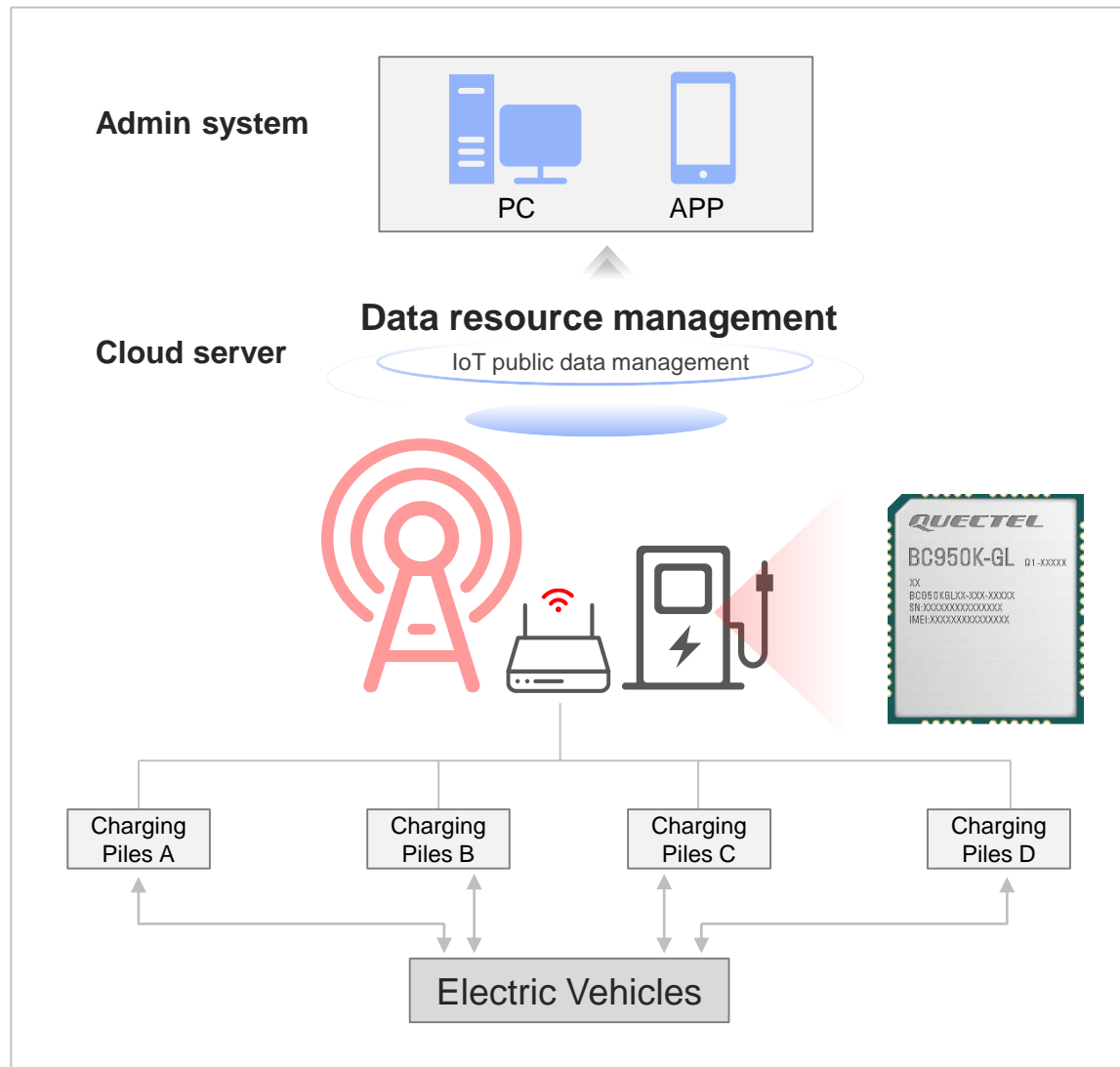
Electric Vehicles

Low Cost
- Cat M solution cost is much lower than traditional 4G & 5G solutions in the past.
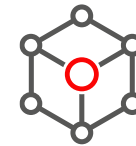
Massive Connectivity
- One module connected to multi devices
- Global certificates with one SKU
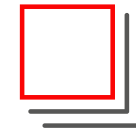
Wide Coverage
- Provide reliable solution for electric vehicle charging at any place under cellular coverage
- Easy migration to 5G network in the future
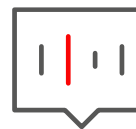
Easy Management
- Real-time information of date and energy usage
- Mature eco-system, together with QuecCloud® service, enables EV-charging clients to manage their all end devices from a single interface

Smart Tracker

OBD Tracking
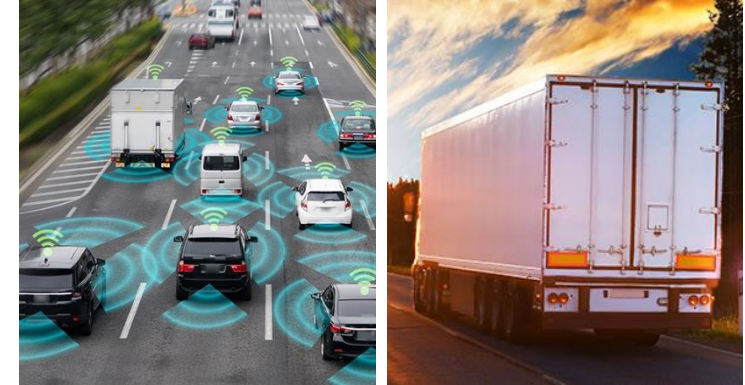
Logistic Tracking

NB-IoT Module

- Acquire positioning data
- Communication with center server
- Device management system
- Electronic fence

Scooter Tracking

Person/ Pet Tracking

OBD: On Board Diagnostics

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.
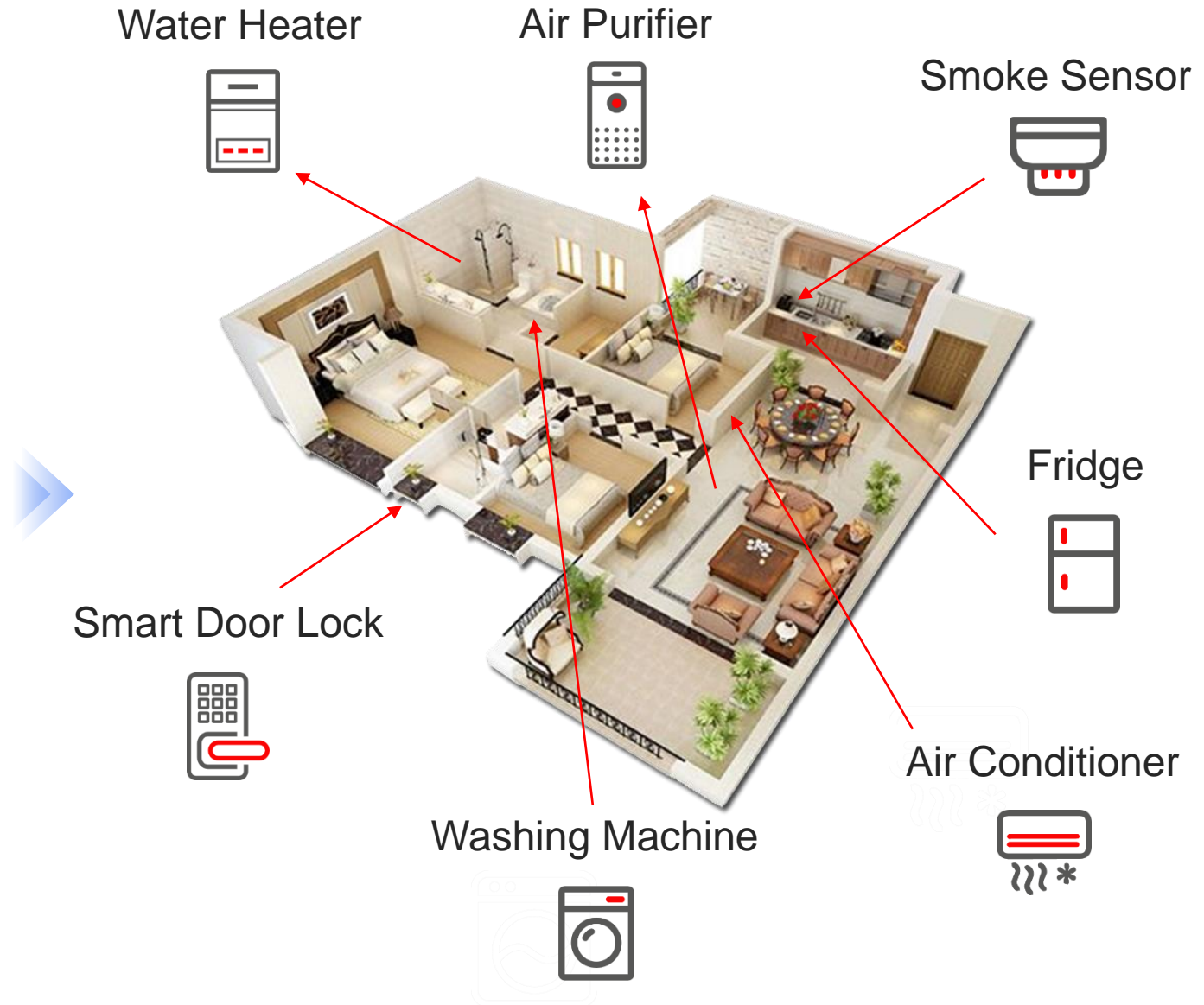
Water Heater

Air Purifier

Smoke Sensor

Fridge

Air Conditioner

Washing Machine

Smart Door Lock

LPWA Introduction & Portfolio

Specifications & Timelines

Technical Details

Applications

Appendix

Build a Smarter World

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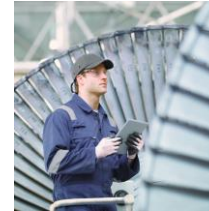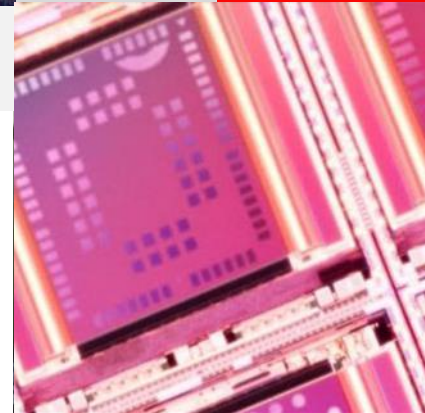| Country/ Region	Operator	Bands	Country/ Region	Operator	Bands	Country/ Region	Operator	Bands
			NB = 121					
Argentina	Claro	4, 28	China	China Telecom	5	France	SFR	20
Argentina	MNO Personal	28	China	China Unicom	3, 8	Germany	Telefónica	8, 20
Argentina	Movistar	4, 28	China(Hong Kong)	3	8	Germany	Vodafone	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

Back

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Country/ Region	Operator	Bands	Country/ Region	Operator	Bands	Country/ Region	Operator	Bands
				NB = 121				
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	New Zealand	Spark	28
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			

Back

QUECTEL

We are a global IoT solutions provider, backed by outstanding support and services, to deliver a smarter world.

- Unbeatable choice from the broadest module portfolio in the world
- High quality range of off-the-shelf and customized antennas
- Providing Connectivity-as-a-Service
- Superb support with the largest R&D team in the industry
- Continuous innovation – in 5G, LPWA, CV2X, Smart Modules
- A passionate, dedicated team of "Quectelers" ensure our customers always come first

ThankYou

Build a Smarter World

Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China
Tel: **+86 21 5108 6236**   Sales Support: **sales@quectel.com**
Technical Support: **support@quectel.com**   General: **info@quectel.com**