Quectel BG95&BG77&BG600L Series Module

Introduction

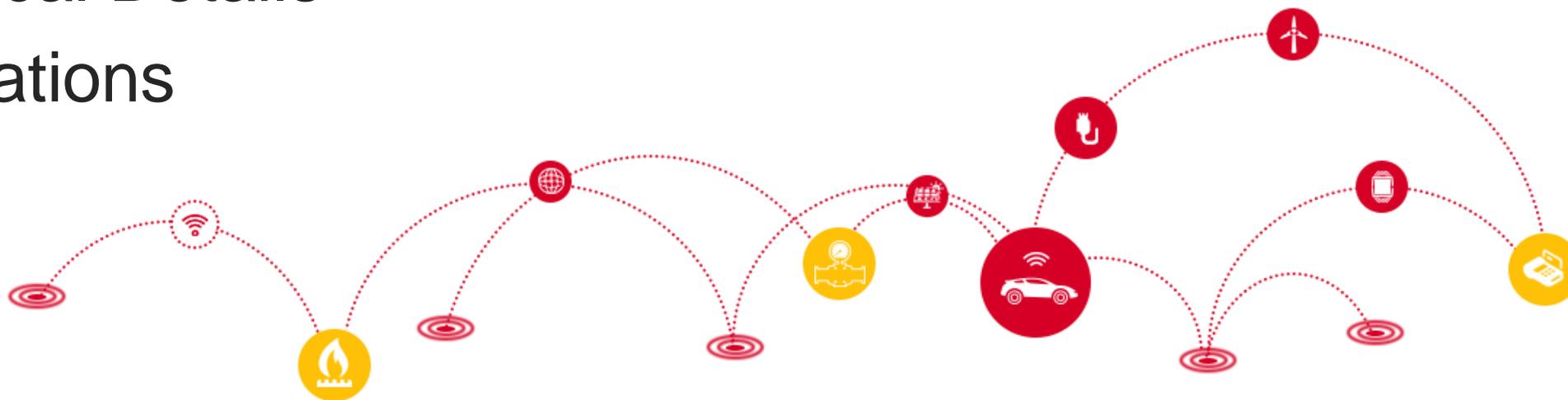April, 2020

Technical Background

LPWA Roadmap

Highlights & Specifications
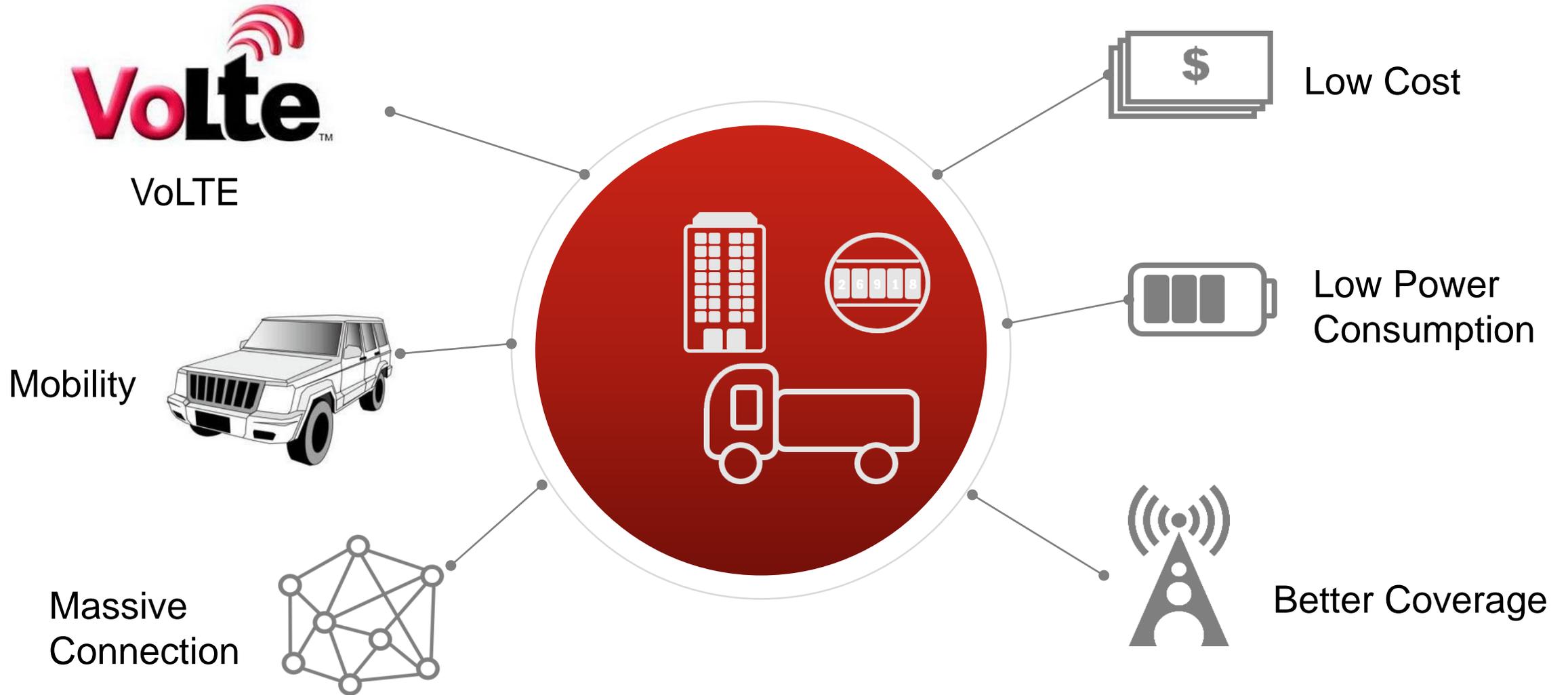
Development Timeline

Technical Details

Applications

LPWA Advantages

VoLTE

Mobility

Massive Connection

Low Cost

Low Power Consumption

Better Coverage

LPWA Network Deployment (Based on GSMA Data up to Apr. 15, 2020)

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Mobile IoT Global Coverage

LTE-M | NB-IoT

LTE-M & NB-IoT

LPWA Network Deployment Trend

LPWA Network Deployment Trend

	Dec-18	Mar-19	Jun-19	Oct-19	Feb-20
NB-IoT	57	62	78	90	104
LTE-M	20	24	31	45	47
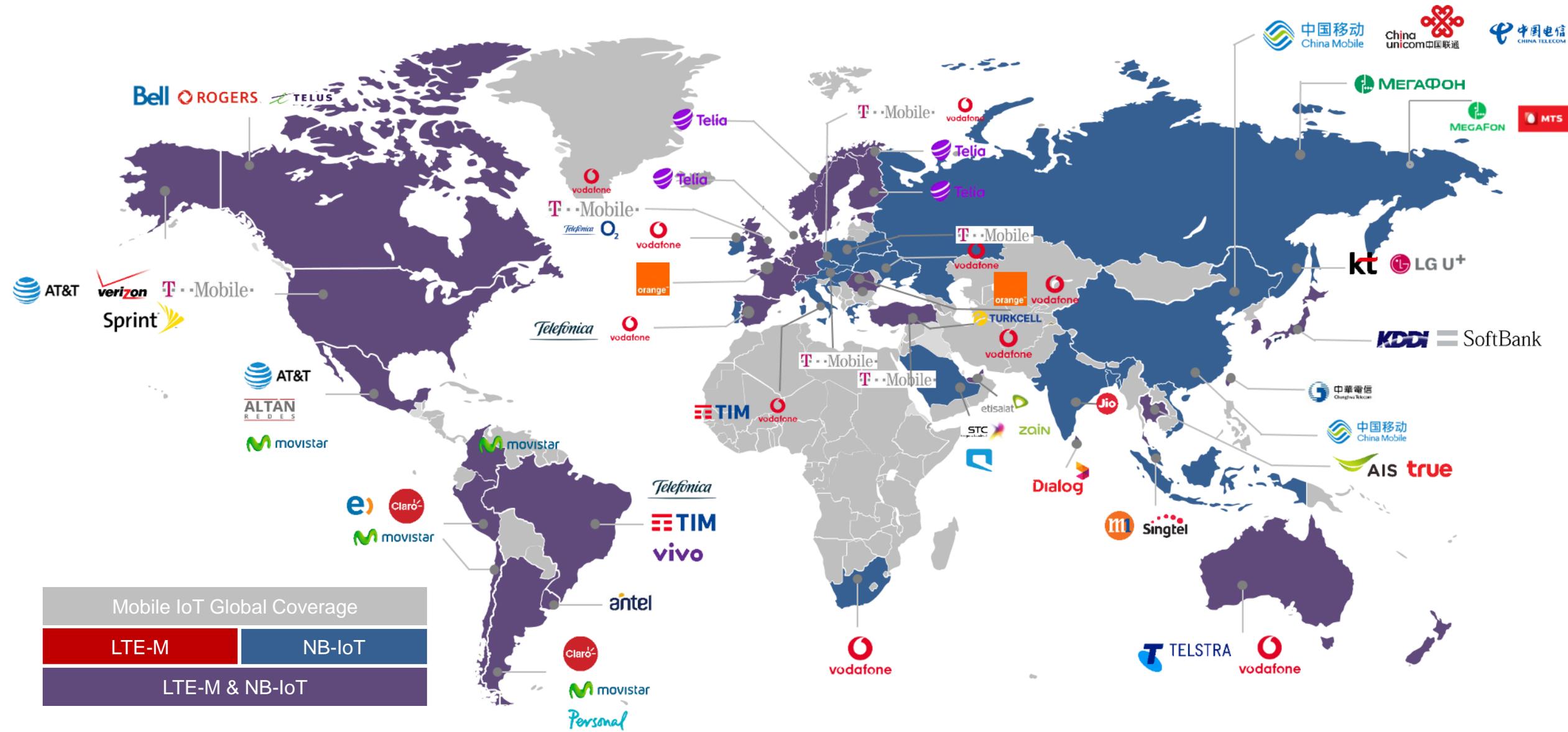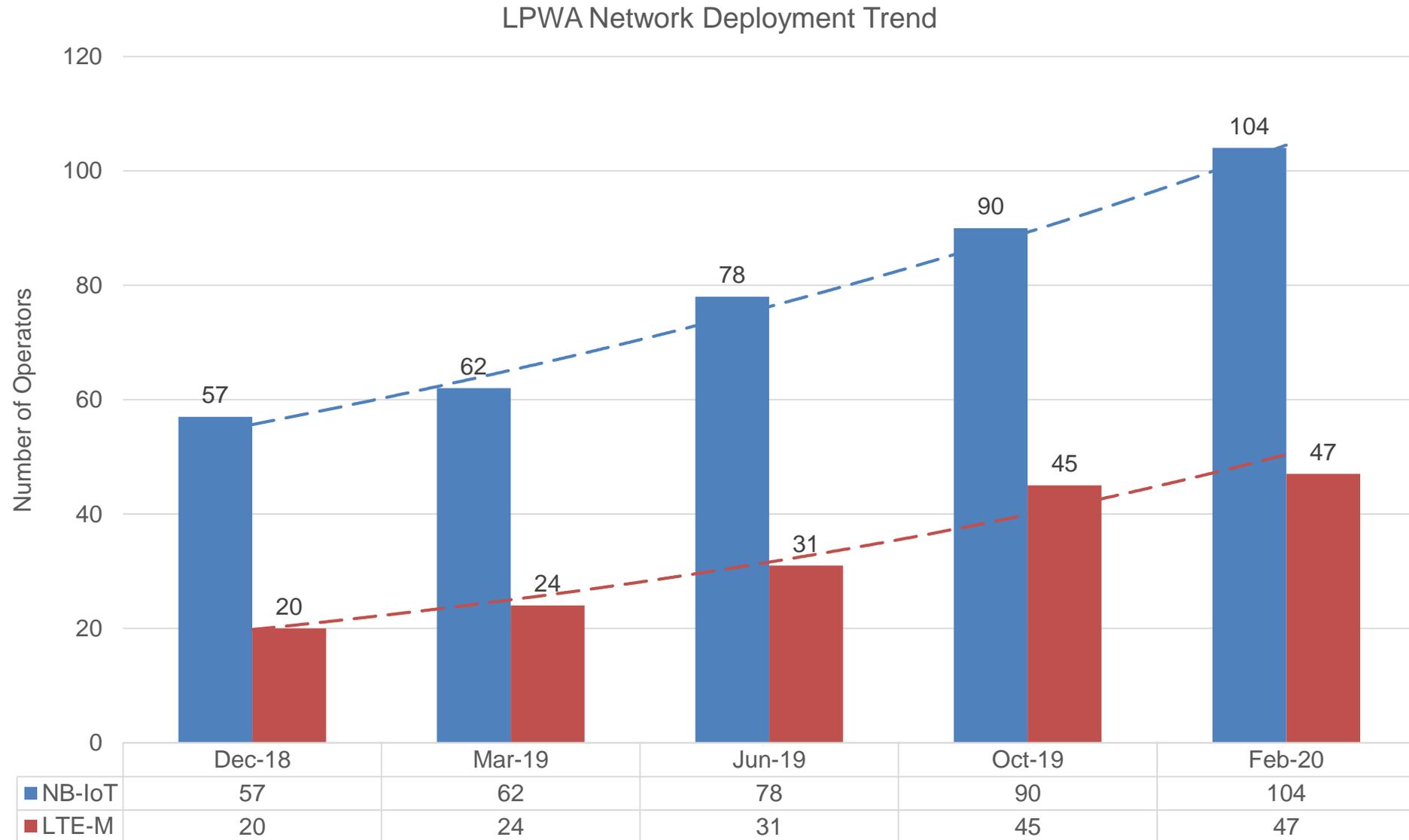
NB-IoT Deployment (1) (Based on GSMA Data up to Apr. 15, 2020)

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NB-IoT = 110								
Operator	**Country/Region**	**Bands**	**Operator**	**Country/Region**	**Bands**	**Operator**	**Country/Region**	**Bands**
3	Hong Kong, China	8	Dialog Axiata	Sri Lanka	3, 8	Movistar	Argentina	4, 28
A1	Austria	20	DNA	Finland	20, 3	MTS	Russia	3
A1	Croatia	20	DU	UAE	20	NOS	Portugal	3, 20
A1	Belarus	/	Elisa	Finland	20, 3	NTT Docomo	Japan	1, 19
AIS	Thailand	8	Elisa	Estonia	20	Orange	Belgium	3, 20
ALTAN	Mexico	28	Entel	Chile	28	Orange	Spain	20
Altice	Portugal	20	Etisalat	UAE	20	Proximus	Belgium	20
Antel	Uruguay	3, 28	FarEasTone	Taiwan, China	28	Reliance Jio	India	3, 5
APTG	Taiwan, China	8	Grameenphone	Bangladesh	3, 8 (TBC)	Rogers	Canada	4, 5, 12
AT&T	USA	2, 4, 12	KCELL	Kazakstan	/	SFR	France	20
AT&T	Mexico	5	KT	South Korea	3	Singtel	Singapore	8
BASE (Telenet)	Belgium	3, 20	Kyvistar	Ukraine	3	SmarTone	Hong Kong, China	8
China Mobile	China	8	LGU+	South Korea	5	SoftBank	Japan	1, 8
China Mobile	Hong Kong, China	3	LMT	Latvia	/	StarHub	Singapore	3, 8
China Telecom	China	5	M1	Singapore	8	STC	Saudi Arabia	28
China Unicom	China	3, 8	Maxis	Malaysia (6 Cities)	3	Swisscom	Switzerland	20
Chunghwa	Taiwan, China	8	MegaFon	Russia	20, 8, 3	Taiwan Mobile	Taiwan, China	3, 28
Claro	Brazil	3, 28	Mobily	Saudi Arabia	20	TDC	Denmark	20
Claro	Colombia	5	Mobitel	Sri Lanka	3,8	Telcel	Mexico	5
Claro	Peru	28	Movistar	Peru	28	Telecom Italia/TIM	Brazil	28
Claro	Chile	28	Movistar	Chile	28	Telecom Italia/TIM	Italy	20
Claro	Argentina	4, 28	Movistar	Colombia	5	Telefónica	Spain	20

NB-IoT Deployment (2) (Based on GSMA Data up to Apr. 15, 2020)

NB-IoT = 110								
Operator	**Country/Region**	**Bands**	**Operator**	**Country/Region**	**Bands**	**Operator**	**Country/Region**	**Bands**
Telefónica	Germany	8, 20	Viettel	Vietnam	3			
Telenor	Denmark	20	Vivo	Brazil	3, 28			
Telenor	Norway	8, 20	Vodafone	Australia	8			
Telia	Finland	20	Vodafone	Czech	8, 20			
Telia	Norway	20	Vodafone	Germany	20			
Telia	Sweden	20	Vodafone	Greece	20			
Telia	Denmark	20, 8	Vodafone	Hungary	20			
Telia	Estonia	20	Vodafone	Ireland	20			
Telkomsel	Indonesia	8	Vodafone	Italy	20			
Telstra	Australia	28	Vodafone	Malta	/			
T-Mobile	Austria	8	Vodafone	New Zealand	28			
T-Mobile	Germany	8, 20	Vodafone	Portugal	8, 20			
T-Mobile	Hungary	20	Vodafone	Spain	8, 20			
T-Mobile	USA	2, 4, 12, 66, 71, 85	Vodafone	Netherlands	20			
T-Mobile (Cosmote)	Greece	20	Vodafone	Turkey	8, 20			
T-Mobile (DT)	Poland	20	Vodafone	United Kingdom	20			
T-Mobile (Slovakia Telecom)	Slovakia	20	Vodafone	Ukraine	3			
T-Mobile (DT)	Croatia	8, 20	Vodafone	Romania	20			
T-Mobile (DT)	Netherlands	8, 20	Vodafone/ Vodacom	South Africa	8			
Turkcell	Turkey	20	XL Axiata	Indonesia	8			
Velcom	Belarus	8	Zain	Saudi Arabia	3			
Verizon	USA	13	TRUE	Thailand	8			

LTE-M Deployment (Based on GSMA Data up to Apr. 15, 2020)

LTE-M = 56								
Operator	Country/Region	Bands	Operator	Country/Region	Bands	Operator	Country/Region	Bands
AIS	Thailand	3, 8	KPN	Netherlands	20	Swisscom	Switzerland	20
ALTAN	Mexico	28	KT	South Korea	3	Telcel	Mexico	4
América Móvil	Mexico	4	LGU+	South Korea	5	Telefonia	Spain	20
Antel	Uruguay	3, 28	Movistar	Mexico	2	Telefonica	Colombia	2
APTG	Taiwan, China	8, 28	Movistar	Peru	4	Telefónica	Germany	20
AT&T	Mexico	4	Movistar	Colombia	4	Telenor	Denmark	20
AT&T	USA	2, 4, 12	Movistar	Argentina	4, 28	Telenor	Norway	20
Bell	Canada	12	NTT DOCOMO	Japan	1, 19	Telenor	Sweden	20
Chunghwa	Taiwan, China	3	O2 Telefonica	UK	20	Telstra	Australia	28
Claro	Brazil	3, 28	Orange	Belgium	20	Telus	Canada	2, 4, 5, 12
Claro	Colombia	5	Orange	France	20	Turkcell	Turkey	3, 20
Claro	Chile	28	Orange	Romania	3	USCC	US	2, 4, 5, 12
Claro	Argentina	28	Orange	Spain	3, 20	Verizon	USA	4, 13
Claro	Peru	28	Personal	Argentina	4, 28	Vivo	Brazil	3, 28
Dialog Axiata	Sri Lanka	8	Rogers	Canada	4, 5, 12	Vodafone	New Zealand	3, 28
DNA	Finland	20, 3	SingTel	Singapore	3, 8	Vodafone	Netherlands	20
Elisa	Estonia	/	SKT	South Korea	3, 5			
Entel	Peru	28	SoftBank	Japan	1, 3, 8			
Etisalat	UAE	5	Spark	New Zealand	3, 28			
KDDI	Japan	18, 26	Sprint	USA	25			

Technical Background

LPWA Roadmap

Highlights & Specifications

Development Timeline

Technical Details

Applications

LPWA Roadmap

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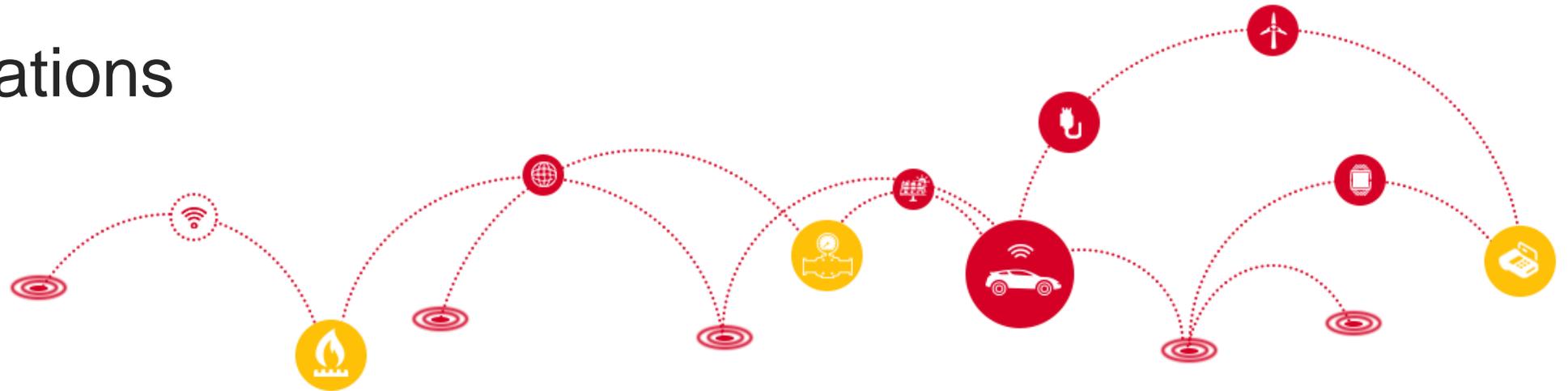
MDM9205

BG95 Series are Pin-to-Pin Compatible with BG96

BG95-M1
- Cat M1
- Global Version

BG95-M4
- Cat M1/ NB2
- **B31/B72/B73 (450 MHz)**
- Global Version

BG95-M2
- Cat M1/ NB2
- Global Version

BG95-M5
- Cat M1/ NB2/ EGPRS
- **Power Class 3**
- Global Version

BG95-M3
- Cat M1/ NB2/ EGPRS
- Global Version

BG95-N1
- Cat NB2
- Global Version

May 2020

BG95-MF
- Cat M1/ NB2
- **Wi-Fi Positioning**
- Global Version

BG77
- Cat M1/ NB2
- **Super Compact Size**
- Global Version

BG600L-M3
- Cat M1/ NB2/ EGPRS
- LGA Package
- Compatible With MC60
- Global Version

MDM9206

BG96
- Cat M1/NB1/EGPRS
- MDM9206-0
- 375 kbps DL/ UL
- Global Version

MM/YYYY *Estimated Engineering Sample Dates*

2017	2018	2019	2020

BG95/BG77/BG600L-M3 Summary

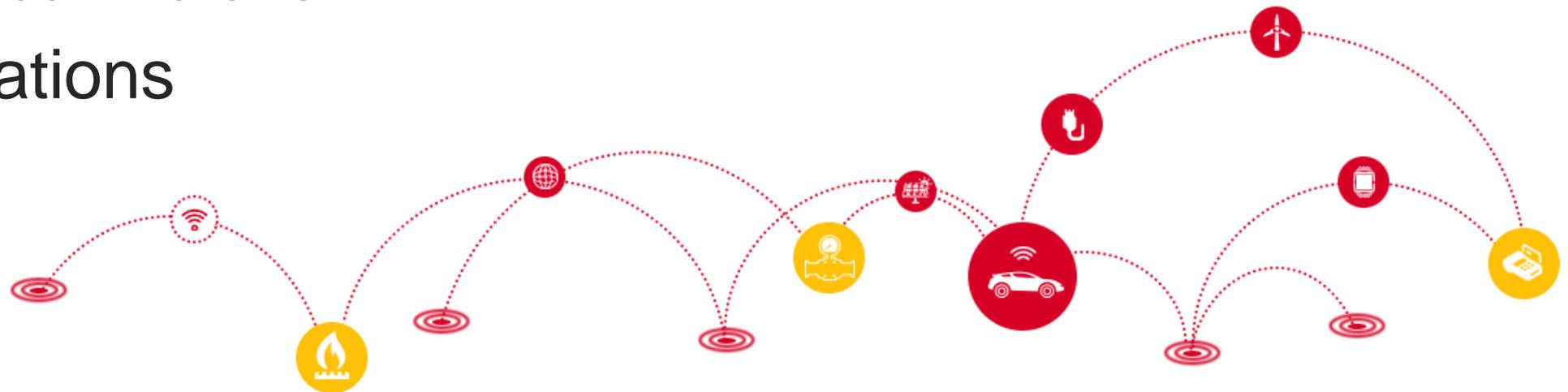| Module	Models	Bands	Package	Dimensions (mm)	eSIM	Compatibility	Target Carrier Certifications
BG95	BG95-M1 (Cat M1 Only) BG95-M2 (Cat M1/Cat NB2) BG95-M3 (Cat M1/Cat NB2/EGPRS) BG95-N1 (Cat NB2 Only) BG95-M4 (Cat M1/Cat NB2, 450 MHz Supported) BG95-MF (Cat M1/Cat NB2, Wi-Fi Positioning)	Global	LGA	23.6 × 19.9 × 2.2	Embedded/ On-board	BG96/ BC95-G/ BC92/ EG9x/ UG9x/ M95	All major global carriers/ depend on customers' requirements
	BG95-M5 (Cat M1/Cat NB2/EGPRS, Power Class 3)				On-board		
BG77	BG77 (Cat M1/Cat NB2)	Global	LGA	14.9 × 12.9 × 1.7	On-board	/	All major global carriers/ depend on customers' requirements
BG600L-M3	BG600L-M3 (Cat M1/Cat NB2/EGPRS)	Global	LGA	18.7 × 16.0 × 2.1	On-board	MC60	All major global carriers/ depend on customers' requirements

Technical Background

LPWA Roadmap

Highlights & Specifications
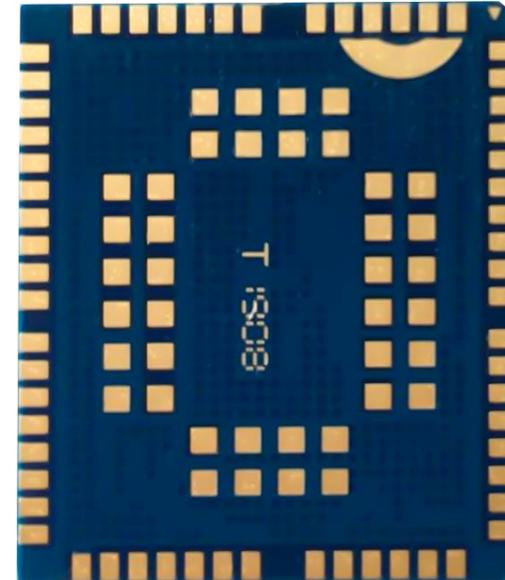
Development Timeline

Technical Details

Applications

BG95 Series Mechanical Dimensions

Multi-Mode LPWA Module (MDM9205)

23.6 mm

QUECTEL

BG95   Q1-XXXXX

XX
BG95XX-XX-XXXX
SN:XXXXXXXXXXXXXX
IMEI:XXXXXXXXXXXXXX
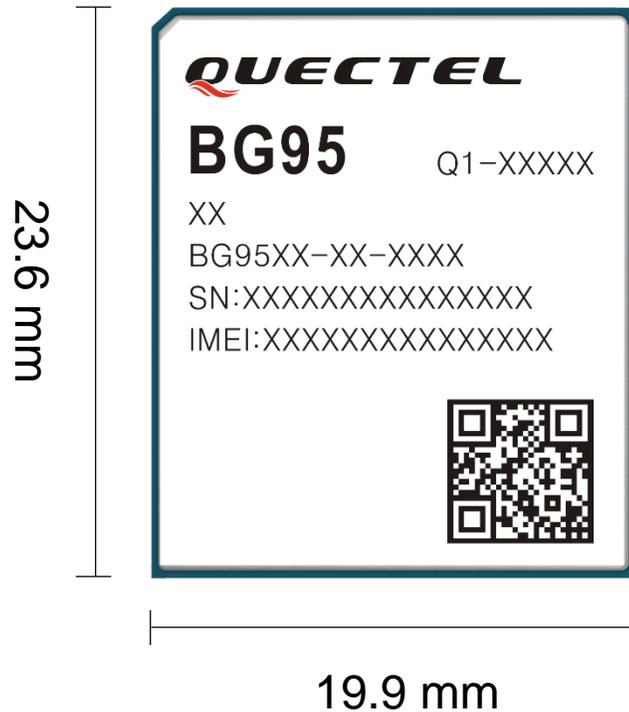
19.9 mm

2.2 mm

Length: 23.6 mm ($\pm$ 0.15 mm)
Width: 19.9 mm ($\pm$ 0.15 mm)
Height: 2.2 mm ($\pm$ 0.2 mm)
Weight: Approx. 2.15 g

BG95 Series Overview

Model	Mode	Bands	Target Carrier Certifications	Status
BG95-M1	Cat M1 Only	**LTE-FDD:** B1/B2/B3/B4/B5/B8/B12/B13/B18/ B19/B20/B25/B26/B27/B28/B66/B85	All major global carriers	CS
BG95-M2	Cat M1/ Cat NB2	**LTE-FDD:** B1/B2/B3/B4/B5/B8/B12/B13/B18/ B19/B20/B25/B26①/B27①/B28/B66/B71②/B85	All major global carriers	CS
BG95-M3	Cat M1/ Cat NB2/ EGPRS	**LTE-FDD:** B1/B2/B3/B4/B5/B8/B12/B13/B18/ B19/B20/B25/B26①/B27①/B28/B66/B71②/B85 **EGPRS:** 850/900/1800/1900 MHz	All major global carriers	MP
BG95-N1	Cat NB2 Only	**LTE-FDD:** B1/B2/B3/B4/B5/B8/B12/B13/B18/ B19/B20/B25/B28/B66/B71/B85	All major global carriers	ES
BG95-M4	Cat M1/ Cat NB2 **(450 MHz Supported)**	**LTE-FDD:** B1/B2/B3/B4/B5/B8/B12/B13/B18/ B19/B20/B25/B26①/B27①/B28/**B31**/B66/**B72**/**B73**/B85	Major carriers in Europe and Latin America	ES
BG95-M5	Cat M1/ Cat NB2/ EGPRS **(Power Class 3)**	**LTE-FDD:** B1/B2/B3/B4/B5/B8/B12/B13/B18/ B19/B20/B25/B26①/B27①/B28/B66/B71/B85 **EGPRS:** 850/900/1800/1900 MHz	All major global carriers	ES
BG95-MF	Cat M1/ Cat NB2 **(Wi-Fi Positioning)**	**LTE-FDD:** B1/B2/B3/B4/B5/B8/B12/B13/B18/ B19/B20/B25/B26①/B27①/B28/B66/B71②/B85 **Wi-Fi (Positioning Only):** 2.4 GHz	Based on market demand	Pre-ES

① Cat M1 bands only   *② Cat NB2 bands only*

BG95 Series Highlights

Highlight	Description
Multi Modes	Cat M1/ Cat NB2/ EGPRS
Rich Product Variants	Support Power Class 3/ Power Class 5 (21 dBm)/ 450 MHz/ Wi-Fi Positioning/ Mini PCIe
Global Bands	• **LTE-FDD:** B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B26[1]/B27[1]/B28/B31/B66/B71[2]/B72/B73/B85 • **EGPRS:** 850/900/1800/1900 MHz
Low Power Consumption	BG95-M3: Approx. 3.9 µA in PSM mode (USB and UART disconnected)
Mobility	Movable application with handover support (Cat M1 only)
PSM Wake-up	Support T3412 expiration and real-time hardware pin wake-up
Extended Power Supply Range [3]	2.6–4.8 V, typ. 3.3 V (BG95-M1/-M2/-N1) 3.3–4.3 V, typ. 3.8 V (BG95-M3/-M5) 3.2–4.2 V, typ. 3.8 V (BG95-M4) Typ. 3.8 V (BG95-MF)
GNSS	GPS, GLONASS, BeiDou, Galileo, QZSS
Voice*	• VoLTE for Cat M1 • CS voice for GSM
QuecOpen®	Integrated ARM Cortex A7 processor supporting ThreadX
Security*	Comprehensive set of hardware-based security features
Compatibility	Soldering footprint compatible with Quectel BG96/M95
Special Features	SoftSIM/ nuSIM; AWS/ Azure

means under development
LTE-FDD B31/B72/B73 for BG95-M4 supports Power Class 2.
① Cat M1 bands only   ② Cat NB2 Bands Only
③ please refer to the hardware design manual for more specific requirements on power supply voltage

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Cat M1/Cat NB2/EGPRS

BG95 Q1-XXXXX
XX
BG95XX-XX-XXXX
SN:XXXXXXXXXXXXXX
IMEI:XXXXXXXXXXXXXX

23.6 mm × 19.9 mm × 2.2 mm

Package: 102-pin LGA

Supply Voltage[①] **: 2.6–4.8 V, typ. 3.3 V (BG95-M1/-M2/-N1)**

3.3–4.3 V, typ. 3.8 V (BG95-M3/-M5)

3.2–4.2 V, typ. 3.8 V (BG95-M4)

Typ. 3.8 V (BG95-MF)

Data Rate:

- LTE Cat M1: Max. 588 kbps (DL), Max. 1119 kbps (UL) (Half Duplex)

- LTE Cat NB2: Max. 127 kbps (DL), Max. 158.5 kbps (UL)

- EGPRS: Max. 296 kbps (DL), Max. 236.8 kbps(UL)

- GPRS: Max. 107 kbps (DL), Max. 85.6 kbps (UL)

Protocols: PPP/ TCP/ UDP/ SSL/ TLS/ FTP(S)/ HTTP(S)/ MQTT/ LwM2M/ CoAP/ IPv6

Functions: Data/ VoLTE* / GNSS/ DFOTA/ NITZ/ PING/ Jamming Detection/ Triangle Location

Interfaces: (U)SIM/ eSIM[②] **/ UART/ USB/ I2C*/ PCM*/ ADC/ GPIO/ GRFC/ Antenna**

Power Consumption (Typical): 3.9 µA @ PSM (USB and UART disconnected), BG95-M3

means under development
[①] *please refer to the hardware design manual for more specific requirements on power supply voltage.*
[②] *eSIM is reserved and not included by default.*

BG95 Series Specifications 2

23.6 mm × 19.9 mm × 2.2 mm
Cat M1: 588 kbps DL/1119 kbps UL
Cat NB2: 127 kbps DL/158.5 kbps UL

■ LTE Cat M1/Cat NB2/EGPRS Module

Items		BG95-M1	BG95-M2	BG95-M3	BG95-N1	BG95-M4	BG95-M5	BG95-MF*
Cat M1	LTE-FDD	B1/B2/B3/B4/B5/B8/ B12/B13/B18/B19/ B20/B25/B26/B27/ B28/B66/B85	B1/B2/B3/B4/B5/B8/ B12/B13/B18/B19/ B20/B25/B26/B27/ B28/B66/B85	B1/B2/B3/B4/B5/B8/ B12/B13/B18/B19/ B20/B25/B26/B27/ B28/B66/B85	/	B1/B2/B3/B4/B5/B8/ B12/B13/B18/B19/B20/ B25/B26/B27/B28/B31/ B66/B72/B73/B85	B1/B2/B3/B4/B5/B8/ B12/B13/B18/B19/B20/ B25/B26/B27/B28/B66/ B85	B1/B2/B3/B4/B5/B8/ B12/B13/B18/B19/B20/ B25/B26/B27/B28/B66/ B85
Cat NB2	LTE-FDD	/	B1/B2/B3/B4/B5/B8/ B12/B13/B18/B19/ B20/B25/B28/B66/ B71/B85	B1/B2/B3/B4/B5/B8/ B12/B13/B18/B19/ B20/B25/B28/B66/ B71/B85	B1/B2/B3/B4/B5/B8/ B12/B13/B18/B19/ B20/B25/B28/B66/ B71/B85	B1/B2/B3/B4/B5/B8/ B12/B13/B18/B19/ B20/B25/B28/B31[1]/ B66/B72[1]/B73[1]/B85	B1/B2/B3/B4/B5/B8/ B12/B13/B18/B19/ B20/B25/B28/B66/ B71/B85	B1/B2/B3/B4/B5/B8/ B12/B13/B18/B19/ B20/B25/B28/B66/B71/ B85
EGPRS		/	/	850/900/1800/1900 MHz	/	/	850/900/1800/1900 MHz	/
Wi-Fi (For Positioning Only)		/	/	/	/	/	/	2.4 GHz
GNSS		Supported	Supported	Supported	Supported	Supported	Supported	Supported
Certification		All major global carriers/ depend on customers' requirements	All major global carriers/ depend on customers' requirements	All major global carriers/ depend on customers' requirements	All major global carriers/ depend on customers' requirements	Major carriers in Europe and Latin America	All major global carriers/ depend on customers' requirements	Based on market demands

means under development
[1] *LTE-FDD B31/B72/B73 for BG95-M4 supports Power Class 2.*

BG95-M3 Power Consumption

Description	Conditions		Typ.	Unit
Leakage	Power off mode		14.5 NOTE	μA
Power Saving Mode	PSM @ Real Network (USB and UART disconnected)		3.9	μA
Sleep State (Under Cat M1 network)	DRX = 1.28 s		1.65	mA
	e-I-DRX = 81.92 s @ PTW = 20.48 s, DRX = 2.56 s		0.85	mA
Sleep State (Under Cat NB1 network)	DRX = 1.28 s		1.56	mA
	e-I-DRX = 81.92 s @ PTW = 20.48 s, DRX = 2.56 s		0.81	mA
Active State (GNSS OFF) (Under Cat M1 network)	21 dBm @ Instrument		199	mA
	Data Transfer @ Real Network (TCP 200B)		48	mA
Active State (GNSS OFF) (Under Cat NB1 network)	21 dBm @ Instrument		172	mA
	Data Transfer @ Real Network (TCP 200B)		40	mA
Active State (GNSS ON, LTE OFF)	Acquisition		71	mA
	Tracking	Instrument, GPS only, DPO on	21	mA
		Instrument, GPS only, DPO off	56	mA

NOTE: More internal power supplies are powered off and also the internal clock frequency is reduced in PSM, therefore the power consumption in PSM is much lower than that in power-off mode.

BG95 Series Main Interfaces

Interface	Description
(U)SIM	1 (Support 1.8 V only)
UART	3 (Main UART, Debug UART, GNSS UART)
USB 2.0	1
PCM*	1 (For VoLTE only)
I2C*	1 (For VoLTE only)
ADC	1
PWRKEY	1
GPIO	9
GRFC	2
Antenna Interface	2 (for Main Antenna and GNSS Antenna, respectively)

"" means under development*

BG95 Series Main Functions

Function	Description
Protocols	PPP/ TCP/ UDP/ SSL/ TLS/ FTP(S)/ HTTP(S)/ MQTT/ LwM2M/ CoAP/ IPv6
USB Serial Driver*	Windows 7/8/8.1/10, Linux 2.6–5.4, Android 4.x/5.x/6.x/7.x/8.x/9.x
GNSS/ RIL Driver*	Android 4.x/5.x/6.x/7.x/8.x/9.x
SMS	Point-to-point MO and MT; SMS Cell Broadcast; Text and PDU Mode
Voice*	• VoLTE for Cat M1 • CS voice for GSM
DFOTA	Delta Firmware Upgrade Over-The-Air
LwM2M	Supported
GNSS	GPS, GLONASS, BeiDou, Galileo, QZSS

"" means under development*

BG77 Mechanical Dimensions

Ultra Compact LTE Cat M1/ Cat NB2 Module (MDM9205)
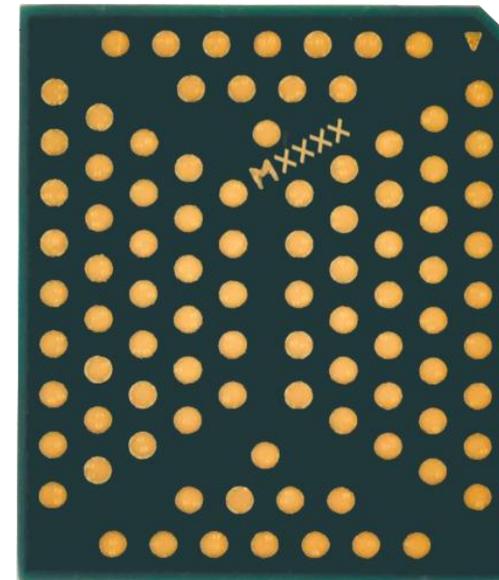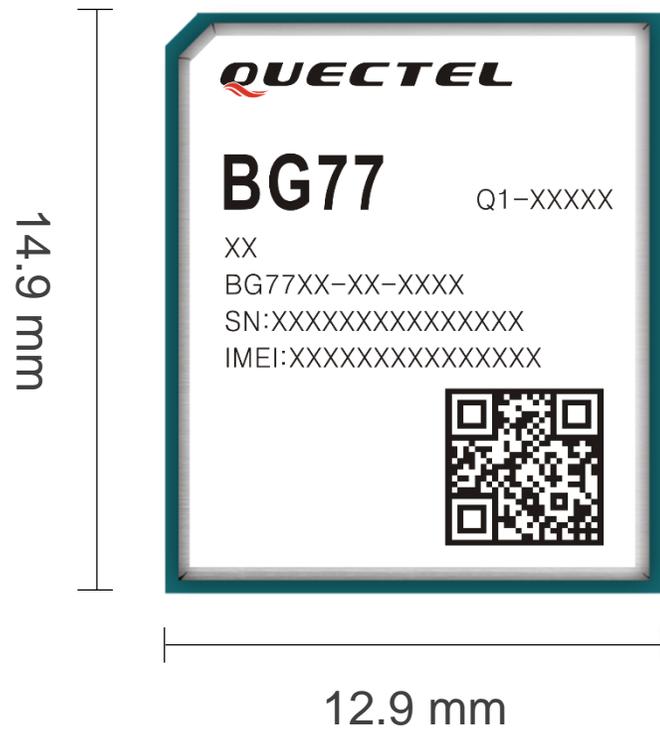
14.9 mm

12.9 mm

1.7 mm

Length: 14.9 mm ($\pm$ 0.15 mm)
Width: 12.9 mm ($\pm$ 0.15 mm)
Height: 1.7 mm ($\pm$ 0.2 mm)
Weight: Approx. 0.73 g

BG77 Highlights

Highlight	Description
Super Compact Size	14.9 mm $\times$ 12.9 mm $\times$ 1.7 mm
Dual-Mode	LTE Cat M1/ Cat NB2
Power Class	Support Power Class 5 (21 dBm)
Global Bands	LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B26[1]/B27[1]/B28/B66/B71[2]/B85*
Low Power Consumption	Approx. 3.2 µA in PSM mode (USB and UART disconnected)
Mobility	Movable application with handover support (Cat M1 only)
PSM Wake-up	Support T3412 expiration and real-time hardware pin wake-up
Extended Power Supply Range [3]	2.6–4.8 V, typ. 3.3 V
GNSS	GPS, GLONASS, BeiDou, Galileo, QZSS
Voice*	VoLTE (For Cat M1 Only)
QuecOpen®	Integrated ARM Cortex A7 processor supporting ThreadX
Security*	Comprehensive set of hardware-based security features
Special Features	SoftSIM

means under development
[1] Cat M1 bands only   [2] Cat NB2 bands only
[3] please refer to the hardware design manual for more specific requirements on power supply voltage

Cat M1/Cat NB2

Super Compact Size: 14.9 mm $\times$ 12.9 mm $\times$ 1.7 mm

Package: 94-pin LGA

Supply Voltage [1] : 2.6–4.8 V, 3.3 V Typ.

Data Rate:

- LTE Cat M1: Max. 588 kbps (DL), Max. 1119 kbps (UL) (Half Duplex)

- LTE Cat NB2: Max. 127 kbps (DL), Max. 158.5 kbps (UL)

Protocols: PPP/ TCP/ UDP/ SSL/ TLS/ FTP(S)/ HTTP(S)/ MQTT/ LwM2M/ CoAP/ IPv6*

Functions: Data/ VoLTE*/ GNSS/ DFOTA/ NITZ/ PING/ Jamming Detection/ Triangle Location

Interfaces: (U)SIM/ UART/ USB/ I2C*/ PCM*/ ADC/ GPIO/ GRFC/ Antenna

Power Consumption (Typical): 3.2 µA @ PSM (USB and UART disconnected)

14.9 mm $\times$ 12.9 mm $\times$ 1.7 mm

* means under development
[1] please refer to the hardware design manual for
  more specific requirements on power supply voltage.

BG77 Specifications 2

14.9 mm × 12.9 mm × 1.7 mm
Cat M1: 588 kbps DL/1119 kbps UL
Cat NB2: 127 kbps DL/158.5 kbps UL

■ LTE Cat M1/Cat NB2 Module

Items	BG77
Cat M1	LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B26/B27/B28/B66/B85*
Cat NB2	LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B28/B66/B71/B85*
EGPRS	/
GNSS	Supported
Certification	All major global carriers

"" means under development*

BG77 Power Consumption

Description	Conditions	Typ.	Unit
Leakage	Power off mode	13 NOTE	µA
Power Saving Mode	PSM @ Real Network (USB and UART disconnected)	3.2	µA
Sleep State (Under Cat M1 network)	DRX = 1.28 s	1.63	mA
	e-I-DRX = 81.92 s @ PTW = 20.48 s, DRX = 2.56 s	0.76	mA
Sleep State (Under Cat NB1 network)	DRX = 1.28 s	1.5	mA
	e-I-DRX = 81.92 s @ PTW = 20.48 s, DRX = 2.56 s	0.79	mA
Active State (GNSS OFF) (Under Cat M1 network)	21 dBm @ Instrument	228	mA
	Data Transfer @ Real Network (TCP 200B)	55	mA
Active State (GNSS OFF) (Under Cat NB1 network)	21 dBm @ Instrument	165	mA
	Data Transfer @ Real Network (TCP 200B)	45	mA
Active State (GNSS ON, LTE OFF)	Acquisition	72	mA
	Tracking	62	mA

NOTE: More internal power supplies are powered off and also the internal clock frequency is reduced in PSM, therefore the power consumption in PSM is much lower than that in power-off mode.

BG77 Main Interfaces

Interface	Description
(U)SIM	1 (Support 1.8 V only)
UART	3 (Main UART, Debug UART, GNSS UART)
USB	1
PCM*	1 (For VoLTE only)
I2C*	1 (For VoLTE only)
RESET_N	1
ADC	2
GPIO	7
GRFC	2
Antenna Interface	2 (for Main Antenna and GNSS Antenna, respectively)

"" means under development*

BG77 Main Functions

Function	Description
Protocols	PPP/ TCP/ UDP/ SSL/ TLS/ FTP(S)/ HTTP(S)/ MQTT/ LwM2M/ CoAP/ IPv6*
USB Serial Driver*	Windows 7/8/8.1/10, Linux 2.6–5.4, Android 4.x/5.x/6.x/7.x/8.x/9.x
GNSS/ RIL Driver*	Android 4.x/5.x/6.x/7.x/8.x/9.x
SMS	Point-to-point MO and MT; SMS Cell Broadcast; Text and PDU Mode
Voice*	VoLTE (For Cat M1 Only)
DFOTA	Delta Firmware Upgrade Over-The-Air
LwM2M	Supported
GNSS	GPS, GLONASS, BeiDou, Galileo, QZSS

"" means under development*

BG600L-M3 Mechanical Dimensions

Multi-Band LTE Cat M1/ Cat NB2 / EGPRS Module (MDM9205)
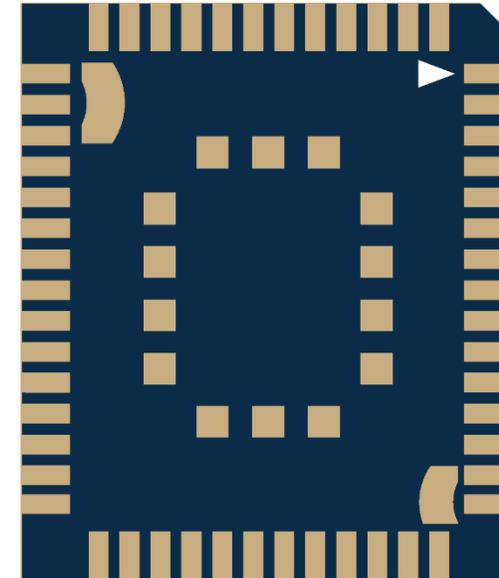
18.7 mm

16.0 mm

2.1 mm

Length: 18.7 mm ($\pm$ 0.15 mm)
Width: 16.0 mm ($\pm$ 0.15 mm)
Height: 2.1 mm ($\pm$ 0.2 mm)

BG600L-M3 Highlights

Highlight	Description
Multi Modes	Cat M1/ Cat NB2/ EGPRS
Global Bands	• **LTE-FDD:** B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B26[1]/B27[1]/B28/B66/B71[2]/B85 • **EGPRS:** 850/900/1800/1900 MHz
Power Class	Support Power Class 5 (21 dBm)
Low Power Consumption	4.0 µA @ PSM (USB and UART disconnected)
Mobility	Movable application with handover support (Cat M1 only)
PSM Wake-up	Support T3412 expiration and real-time hardware pin wake-up
Extended Power Supply Range	3.3–4.3 V, typ. 3.8 V
GNSS*	GPS, GLONASS, BeiDou, Galileo, QZSS
Voice*	VoLTE (For Cat M1 Only), CS voice for GSM
QuecOpen®*	Integrated ARM Cortex A7 processor supporting ThreadX
Security*	Comprehensive set of hardware-based security features
Compatibility	Compatible with Quectel MC60

means under development

[1] *Cat M1 bands only*   [2] *Cat NB2 bands only*

Rev.: V1.4 | Status: Released

QUECTEL
Build a Smarter World

Cat M1/Cat NB2/EGPRS

Small Size: 18.7 mm ✕ 16.0 mm ✕ 2.1 mm

Package: 68-pin LGA

Supply Voltage: 3.3–4.3 V, 3.8 V Typ.

Data Rate:

- LTE Cat M1: Max. 588 kbps (DL), Max. 1119 kbps (UL) (Half Duplex)

- LTE Cat NB2: Max. 127 kbps (DL), Max. 158.5 kbps (UL)

Protocols: PPP/ TCP/ UDP/ SSL/ TLS/ FTP(S)/ HTTP(S)/ MQTT/ CoAP/ IPv6*

Functions*: Data/ VoLTE/ GNSS/ DFOTA/ NITZ/ PING/ Jamming Detection/ Triangle Location

Interfaces: (U)SIM/ UART/ USB/ I2C*/ PCM*/ ADC/ GPIO*/ GRFC*/ Antenna

Power Consumption (Typical): 4.0 µA @ PSM (USB and UART disconnected)

QUECTEL
BG600L-M3 XX
Q1–XXXXX
BG600LM3XX–XXX–XXXX
SN:XXXXXXXXXXXXXX
IMEI:XXXXXXXXXXXXXX

18.7 mm ✕ 16.0 mm ✕ 2.1 mm

* means under development

BG600L-M3 Specifications 2

QUECTEL

BG600L-M3 xx
Q1-XXXXX
BG600LM3XX-XXX-XXXX
SN:XXXXXXXXXXXXXX
IMEI:XXXXXXXXXXXXXX

18.7 mm ✕ 16.0 mm ✕ 2.1 mm
Cat M1: 588 kbps DL/1119 kbps UL
Cat NB2: 127 kbps DL/158.5 kbps UL

■ LTE Cat M1/Cat NB2/EGPRS Module

Items	BG600L-M3
Cat M1	LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B26/B27/B28/B66/B85
Cat NB2	LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B28/B66/B71/B85
EGPRS	850/900/1800/1900 MHz
GNSS*	Support
Certification	All major global carriers/ depend on customers' requirements

* means under development

BG600L-M3 Power Consumption

Description	Conditions		Typ.	Unit
Power Saving Mode	PSM @ Real Network (USB and UART disconnected)		4.0	μA
Sleep State (Under Cat M1 network)	DRX = 1.28 s		1.61	mA
	e-I-DRX = 81.92 s @ PTW = 20.48 s, DRX = 2.56 s		0.87	mA
Sleep State (Under Cat NB1 network)	DRX = 1.28 s		1.34	mA
	e-I-DRX = 81.92 s @ PTW = 20.48 s, DRX = 2.56 s		0.83	mA
Active State (GNSS OFF) (under Cat M1 network)	21 dBm @ Instrument		204	mA
	Data Transfer @ Real Network		TBD	mA
Active State (GNSS OFF) (under Cat NB1 network)	21 dBm @ Instrument		166	mA
	Data Transfer @ Real Network		TBD	mA
Active State (GNSS ON, LTE OFF)	Acquisition		TBD	mA
	Tracking	Instrument, GPS only, DPO on	TBD	mA
		Instrument, GPS only, DPO off	TBD	mA

BG600L-M3 Main Interfaces

Interface	Description
USB	1
(U)SIM	1 (Support 1.8 V only)
UART	3 (Main UART, Debug UART, GNSS UART)
ADC	1
PWRKEY	1
NET_STATUS	1
Antenna Interface	2
GRFC*	2
I2C*	1 (For VoLTE only)
PCM*	1 (For VoLTE only)
GPIO*	6

means under development

BG600L-M3 Main Functions

Function	Description
Protocols	PPP/ TCP/ UDP/ SSL/ TLS/ FTP(S)/ HTTP(S)/ MQTT/ CoAP/ IPv6*
USB Serial Driver*	Windows 7/8/8.1/10, Linux 2.6–5.4, Android 4.x/5.x/6.x/7.x/8.x/9.x
GNSS/ RIL Driver*	Android 4.x/5.x/6.x/7.x/8.x/9.x
SMS*	Point-to-point MO and MT; SMS Cell Broadcast; Text and PDU Mode
Voice*	• VoLTE for Cat M1 • CS voice for GSM
DFOTA*	Delta Firmware Upgrade Over-The-Air
LwM2M*	Supported
GNSS*	GPS, GLONASS, BeiDou, Galileo, QZSS

means under development

Technical Background

LPWA Roadmap

Highlights & Specifications

Development Timeline

Technical Details

Applications
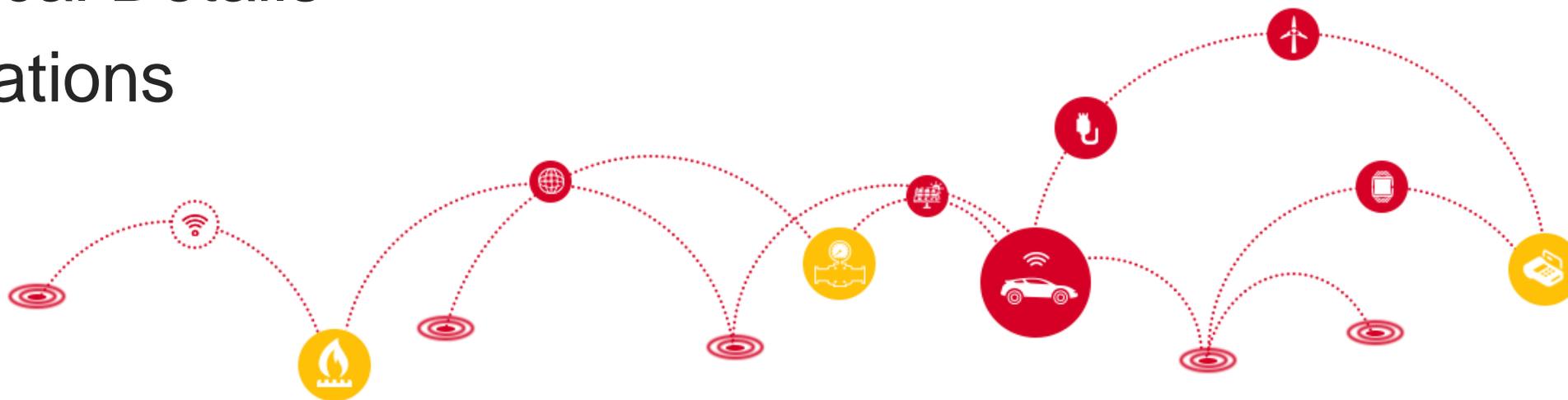
BG95-M1 Development Schedule

2019			2020			
Q2	Q3	Q4	Q1	Q2		Q3

ES — **CS (I)** — **CS (II)** — **MP (I)** — **MP (II)**

Version: BG95M1LAR02A01

- PPP/TCP/UDP/IP
- Basic AT commands
- SMS
- PING
- NITZ
- FTP(S)/HTTP(S)
- MQTT
- Handover
- FILE (UFS)
- SSL/TLS

Version: BG95M1LAR02A02 (Add new features)

- LwM2M
- DFOTA
- GNSS
- QuecOpen®

Version: BG95M1LAR02A03 (Add new features)

- RF TX/RX FTM
- QuecLocator®
- CMUX
- Jamming Detection
- LTE RF Antenna Tuner

- Completed: Sprint
- On-going: Verizon/ AT&T

Version: BG95M1LAR02Axx (Add new features)

- IPv6
- Triangle Location
- QuecThing®
- NIDD
- Add new features to meet certification demands

Version: BG95M1LAR02Axx (Add new features)

- CoAP
- VoLTE
- LwM2M AT
- Add new features to meet certification demands

Plan for: Verizon MR/ AT&T MR

The timeline may be adjusted according to the actual development status.
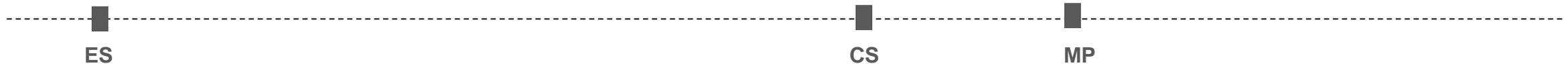*BG95-M3 is the main variant to be developed, and BG95-M1 will leverage the development functions of BG95-M3.*

BG95-M1 Timeline (1)

2019							2020									
Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.

Project Schedule

ES   CS   MP

ES: Engineering samples ready. Basic functions are available for customers' simple demo purpose.
CS: Commercial samples ready. Stable hardware design and quite stable software design. New software features can be added upon request.
MP: Hardware and software ready for mass production. For certification status, please refer to the "certification schedule".

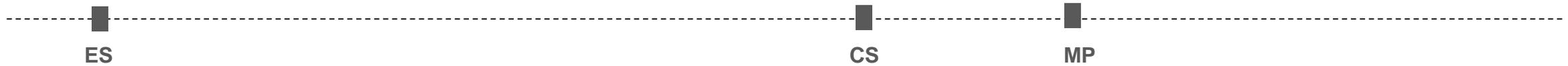## Carrier Certification Schedule

Sprint   **Completed**

Verizon

Start   Complete (Planned)

AT&T

The timeline may be adjusted according to the maturity of Qualcomm baseline.
BG95-M1 will leverage some test results of BG95-M3.

BG95-M1 Timeline (2)

2019							2020									
Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.

Project Schedule

ES   CS   MP

ES: Engineering samples ready. Basic functions are available for customers' simple demo purpose.
CS: Commercial samples ready. Stable hardware design and quite stable software design. New software features can be added upon request.
MP: Hardware and software ready for mass production. For certification status, please refer to the "certification schedule".

Regulatory Certification Schedule

CE/FCC   **Completed**
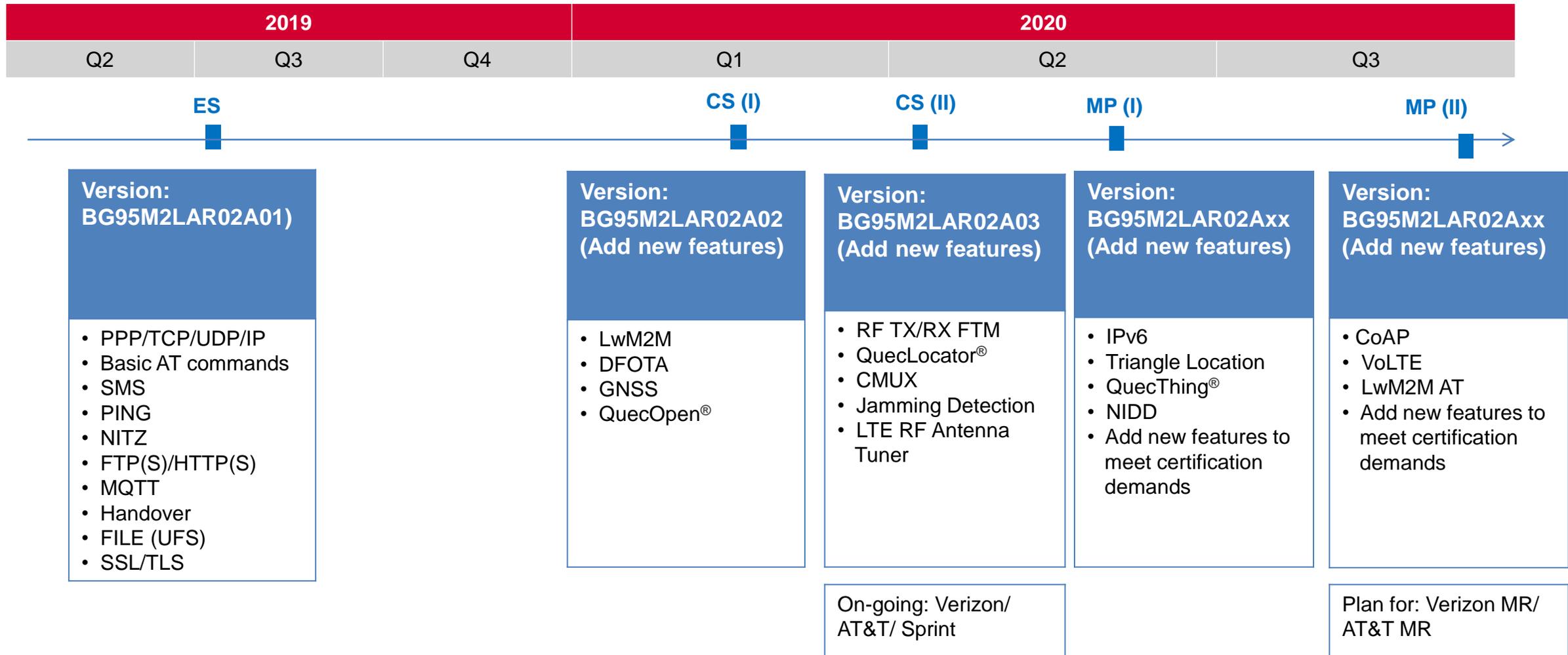
GCF/PTCRB

Start   Complete (Planned)

IC/RCM

The timeline may be adjusted according to the maturity of Qualcomm baseline.
BG95-M1 will leverage some test results of BG95-M3.

BG95-M2 Development Schedule

2019			2020		
Q2	Q3	Q4	Q1	Q2	Q3

ES

CS (I)

CS (II)

MP (I)

MP (II)

Version:
BG95M2LAR02A01)

- PPP/TCP/UDP/IP
- Basic AT commands
- SMS
- PING
- NITZ
- FTP(S)/HTTP(S)
- MQTT
- Handover
- FILE (UFS)
- SSL/TLS

Version:
BG95M2LAR02A02
(Add new features)

- LwM2M
- DFOTA
- GNSS
- QuecOpen®

Version:
BG95M2LAR02A03
(Add new features)

- RF TX/RX FTM
- QuecLocator®
- CMUX
- Jamming Detection
- LTE RF Antenna Tuner

On-going: Verizon/ AT&T/ Sprint

Version:
BG95M2LAR02Axx
(Add new features)

- IPv6
- Triangle Location
- QuecThing®
- NIDD
- Add new features to meet certification demands

Version:
BG95M2LAR02Axx
(Add new features)

- CoAP
- VoLTE
- LwM2M AT
- Add new features to meet certification demands

Plan for: Verizon MR/ AT&T MR

The timeline may be adjusted according to the actual development status.
BG95-M3 is the main variant to be developed, and BG95-M2 will leverage the development functions of BG95-M3.

BG95-M2 Timeline (1)

2019		2020												2021	
Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.

Project Schedule

CS   **MP**

ES: Engineering samples ready. Basic functions are available for customers' simple demo purpose.
CS: Commercial samples ready. Stable hardware design and quite stable software design. New software features can be added upon request.
MP: Hardware and software ready for mass production. For certification status, please refer to the "certification schedule".

Carrier Certification Schedule

Sprint   Completed

Deutsche Telekom

Start   Complete (Planned)

Verizon

AT&T

T-Mobile

The timeline may be adjusted according to the maturity of Qualcomm baseline.
BG95-M2 will leverage some test results of BG95-M3.

BG95-M2 Timeline (2)

2019		2020											2021	
Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.

Carrier Certification Schedule

NTT DOCOMO

Start   Complete (Planned)

SoftBank
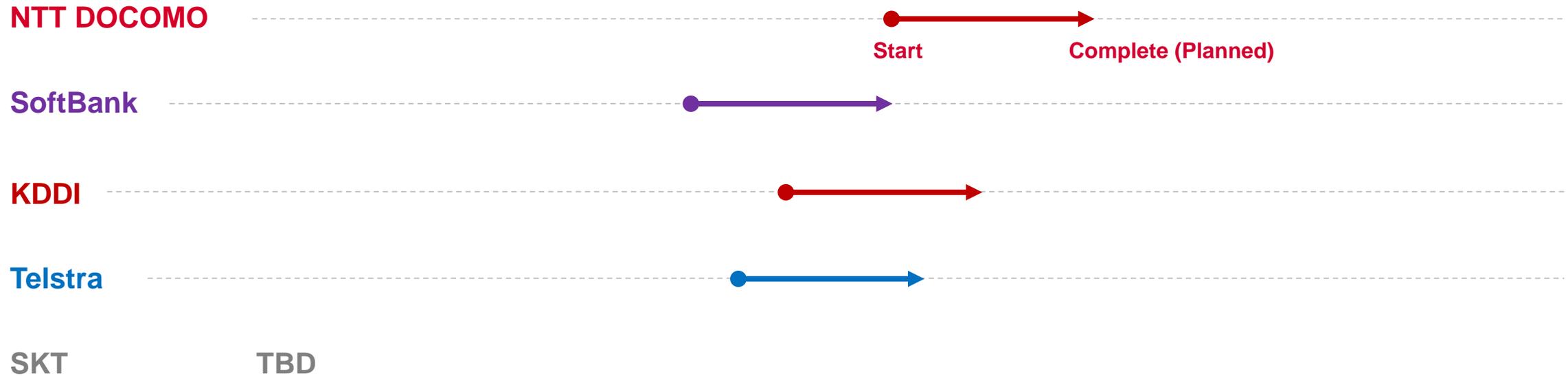
KDDI

Telstra

SKT   **TBD**

*The timeline may be adjusted according to the maturity of Qualcomm baseline.
BG95-M2 will leverage some test results of BG95-M3.*

BG95-M2 Timeline (3)

QUECTEL
Build a Smarter World

2019							2020									
Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.

Regulatory Certification Schedule

CE/Anatel   **Completed**

GCF/PTCRB

Start   **Complete (Planned)**
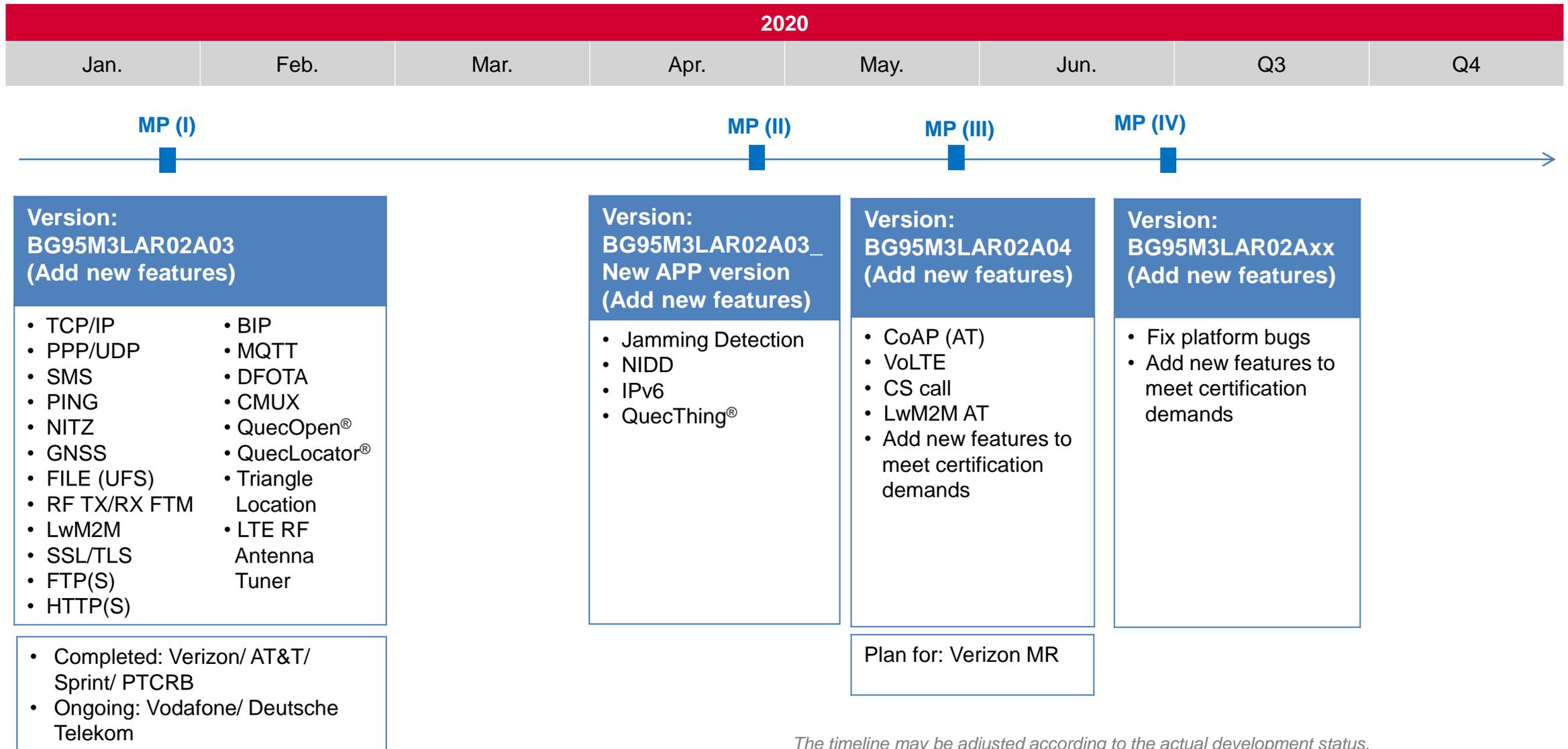
FCC/IC/RCM

IFETEL

JATE/TELEC

NBTC

KC/ NCC   **TBD**

The timeline may be adjusted according to the maturity of Qualcomm baseline.
BG95-M2 will leverage some test results of BG95-M3.

BG95-M3 Development Schedule

Quectel
Build a Smarter World

2020							
Jan.	Feb.	Mar.	Apr.	May.	Jun.	Q3	Q4

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

**Version:
BG95M3LAR02A03
(Add new features)**

- TCP/IP
- PPP/UDP
- SMS
- PING
- NITZ
- GNSS
- FILE (UFS)
- RF TX/RX FTM
- LwM2M
- SSL/TLS
- FTP(S)
- HTTP(S)
- BIP
- MQTT
- DFOTA
- CMUX
- QuecOpen®
- QuecLocator®
- Triangle Location
- LTE RF Antenna Tuner

- Completed: Verizon/ AT&T/ Sprint/ PTCRB
- Ongoing: Vodafone/ Deutsche Telekom

**Version:
BG95M3LAR02A03_
New APP version
(Add new features)**

- Jamming Detection
- NIDD
- IPv6
- QuecThing®

**Version:
BG95M3LAR02A04
(Add new features)**

- CoAP (AT)
- VoLTE
- CS call
- LwM2M AT
- Add new features to meet certification demands

Plan for: Verizon MR

**Version:
BG95M3LAR02Axx
(Add new features)**

- Fix platform bugs
- Add new features to meet certification demands

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

BG95-M3 Timeline (1)

2019			2020												2021	
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.

Project Stage

BG95-M3 MP

Carrier Certification Schedule

Verizon/ AT&T/ Sprint Completed

Vodafone
Start — Complete (Planned)

Deutsche Telekom

T-Mobile

NTT DOCOMO

SoftBank

KDDI

Telefónica/ China Telecom/ China Mobile/ China Unicom/ SKT/ Telstra TBD

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

BG95-M3 Timeline (2)

2019			2020												2021	
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.

Regulatory/Other Certification Schedule

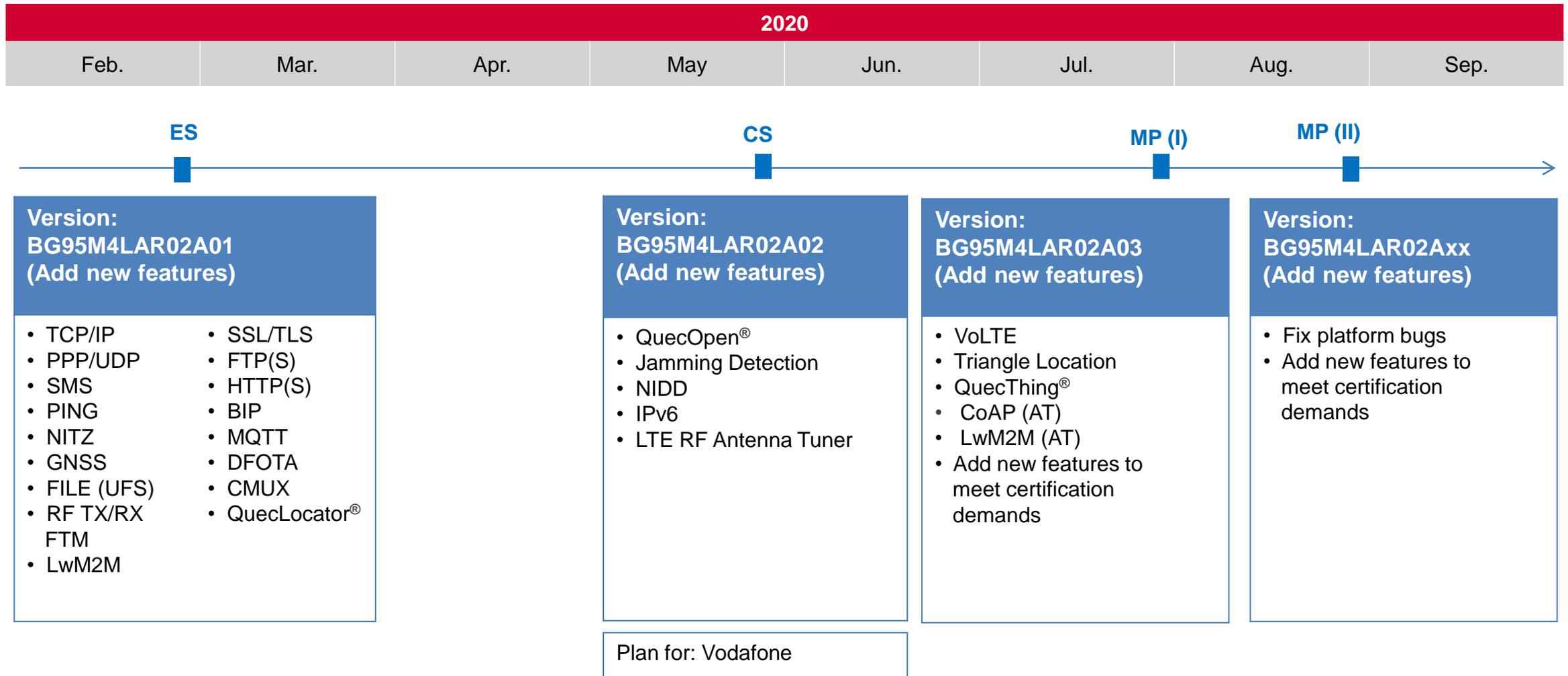**GCF/ CE/ FCC/ PTCRB/ IC/ Anatel/ RCM/ PEN**   **Completed**

IFETEL

Start (Planned)   Complete (Planned)

CCC

JATE/TELEC

SRRC/ NAL/ KC/ NCC/ NBTC/ IMDA/ ATEX   **TBD**

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

BG95-M4 Development Schedule

QUECTEL
Build a Smarter World

2020							
Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.

ES — **CS** — **MP (I)** — **MP (II)**

Version:
BG95M4LAR02A01
(Add new features)

- TCP/IP
- PPP/UDP
- SMS
- PING
- NITZ
- GNSS
- FILE (UFS)
- RF TX/RX FTM
- LwM2M
- SSL/TLS
- FTP(S)
- HTTP(S)
- BIP
- MQTT
- DFOTA
- CMUX
- QuecLocator®

Version:
BG95M4LAR02A02
(Add new features)

- QuecOpen®
- Jamming Detection
- NIDD
- IPv6
- LTE RF Antenna Tuner

Plan for: Vodafone

Version:
BG95M4LAR02A03
(Add new features)

- VoLTE
- Triangle Location
- QuecThing®
- CoAP (AT)
- LwM2M (AT)
- Add new features to meet certification demands

Version:
BG95M4LAR02Axx
(Add new features)

- Fix platform bugs
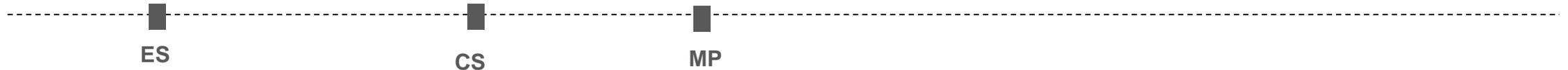- Add new features to meet certification demands

The timeline may be adjusted according to the actual development status.
BG95-M3 is the main variant to be developed, and BG95-M4 will leverage the development functions of BG95-M3.
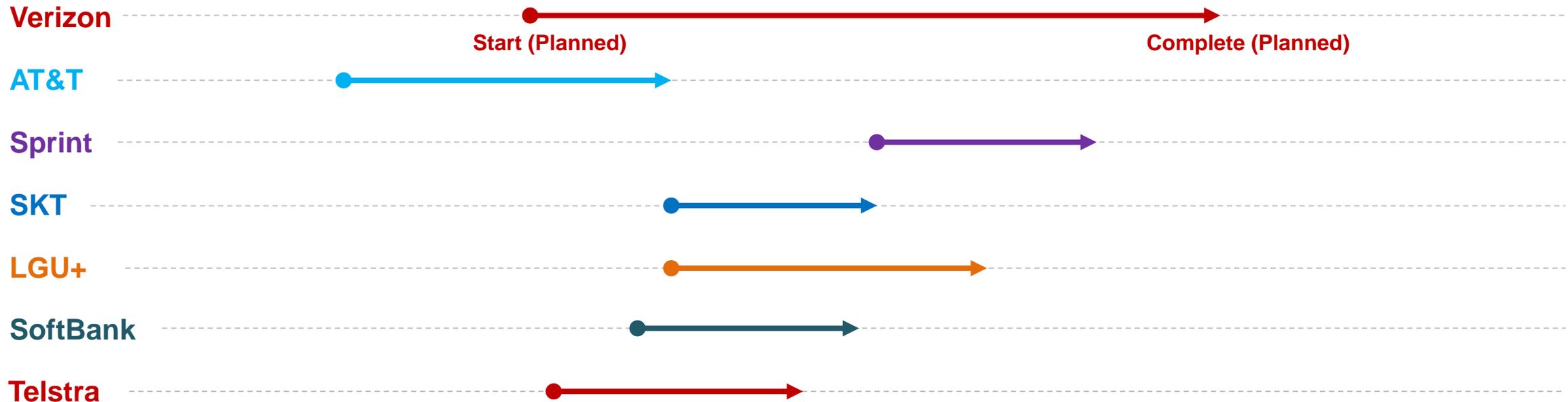
BG95-M4 Timeline

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

Project Schedule
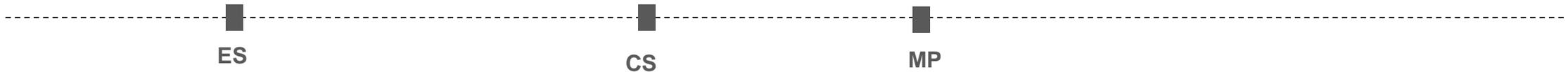
ES   CS   MP

ES: Engineering samples ready. Basic functions are available for customers' simple demo purpose.
CS: Commercial samples ready. Stable hardware design and quite stable software design. New software features can be added upon request.
MP: Hardware and software ready for mass production. For certification status, please refer to the "certification schedule".

Carrier Certification Schedule

Vodafone

Start (Planned)   **Complete (Planned)**

Regulatory Certification Schedule

GCF

CE/FCC

Anatel

IFETEL
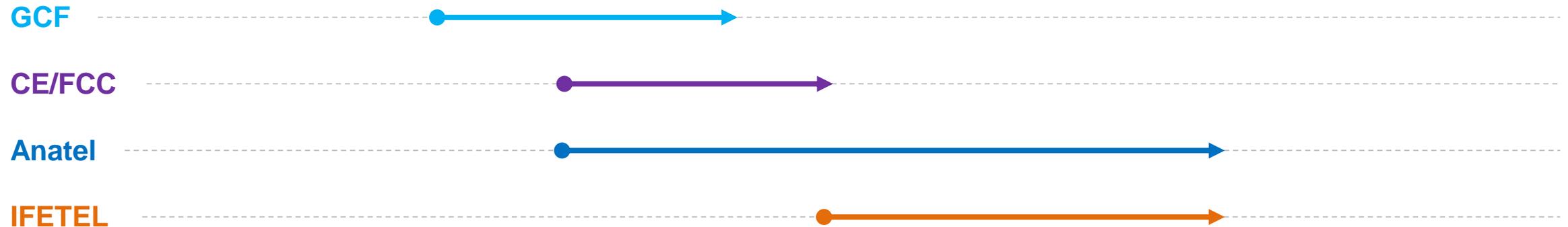
The timeline may be adjusted according to the maturity of Qualcomm baseline.
BG95-M4 will leverage some test results of BG95-M3.

BG95-M5 Development Schedule

2020							
Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.

ES **CS** **MP (I)** **MP (II)**

**Version:
BG95M5LAR02A01
(Add new features)**

- TCP/IP
- PPP/UDP
- SMS
- PING
- NITZ
- GNSS
- FILE (UFS)
- RF TX/RX FTM
- LwM2M
- SSL/TLS
- FTP(S)
- HTTP(S)
- BIP
- MQTT
- DFOTA
- CMUX
- QuecLocator®

**Version:
BG95M5LAR02A02
(Add new features)**

- QuecOpen®
- Jamming Detection
- NIDD
- IPv6
- CoAP
- LTE RF Antenna Tuner

Plan for: global carrier certifications

**Version:
BG95M5LAR02A03
(Add new features)**

- VoLTE
- CS call
- Triangle Location
- QuecThing®
- Add new features to meet certification demands

**Version:
BG95M5LAR02Axx
(Add new features)**

- Fix platform bugs
- Add new features to meet certification demands
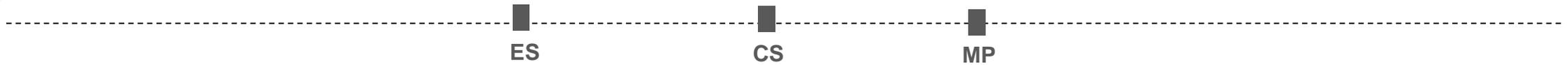
The timeline may be adjusted according to the actual development status.
BG95-M3 is the main variant to be developed, and BG95-M5 will leverage the development functions of BG95-M3.

BG95-M5 Timeline (1)

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2020												2021		
Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.

Project Schedule
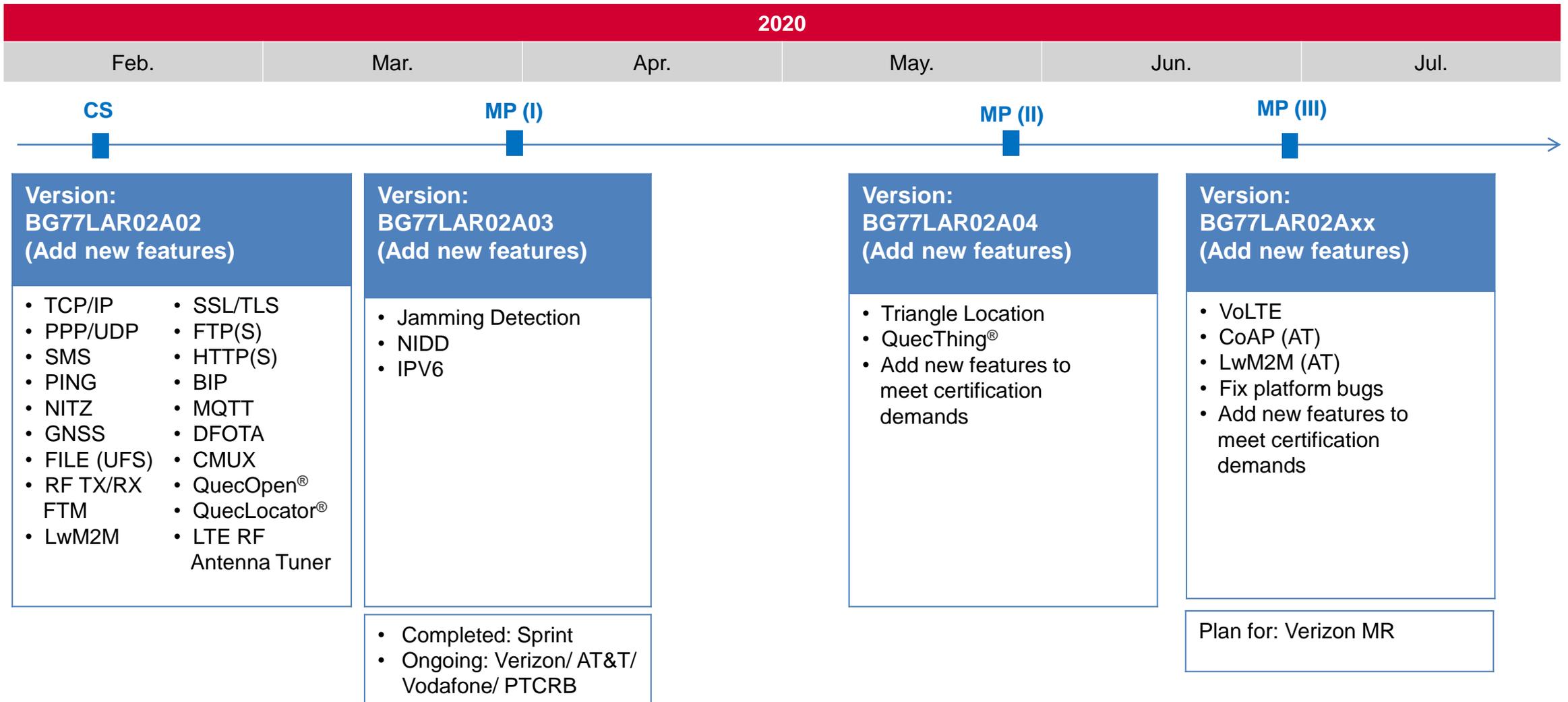
ES   CS   MP

ES: Engineering samples ready. Basic functions are available for customers' simple demo purpose.
CS: Commercial samples ready. Stable hardware design and quite stable software design. New software features can be added upon request.
MP: Hardware and software ready for mass production. For certification status, please refer to the "certification schedule".

Carrier Certification Schedule

Verizon

Start (Planned)   **Complete (Planned)**

AT&T

Sprint

SKT

LGU+

SoftBank

Telstra

The timeline may be adjusted according to the maturity of Qualcomm baseline.
BG95-M5 will leverage some test results of BG95-M3.

Rev.: V1.4 | Status: Released

BG95-M5 Timeline (2)

QUECTEL
Build a Smarter World

					2020								2021	
Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.

Carrier Certification Schedule

Vodafone/ Deutsche Telekom/ T-Mobile/
China Telecom/ China Mobile/ China Unicom/ NTT DOCOMO/ KDDI   TBD

Regulatory/Other Certification Schedule
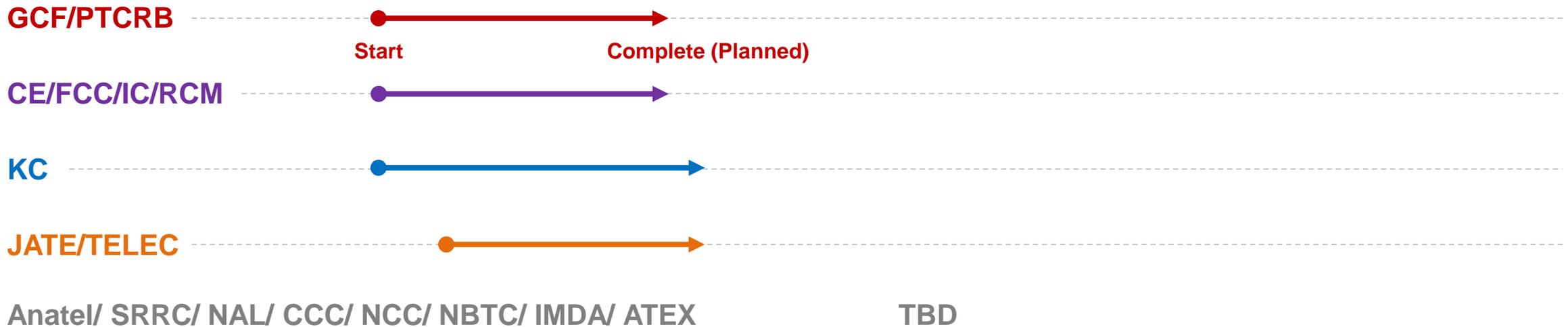
GCF/PTCRB

Start   Complete (Planned)

CE/FCC/IC/RCM

KC

JATE/TELEC

Anatel/ SRRC/ NAL/ CCC/ NCC/ NBTC/ IMDA/ ATEX   TBD

The timeline may be adjusted according to the maturity of Qualcomm baseline.
BG95-M5 will leverage some test results of BG95-M3. Rev.: V1.4 | Status: Released
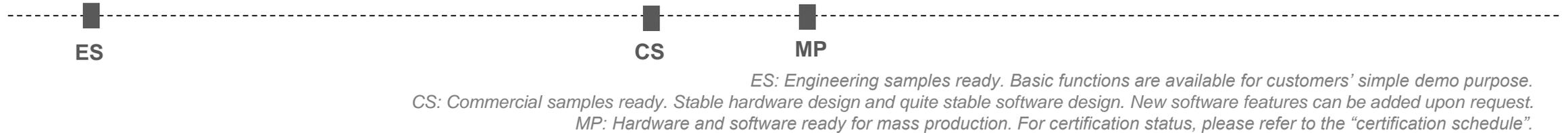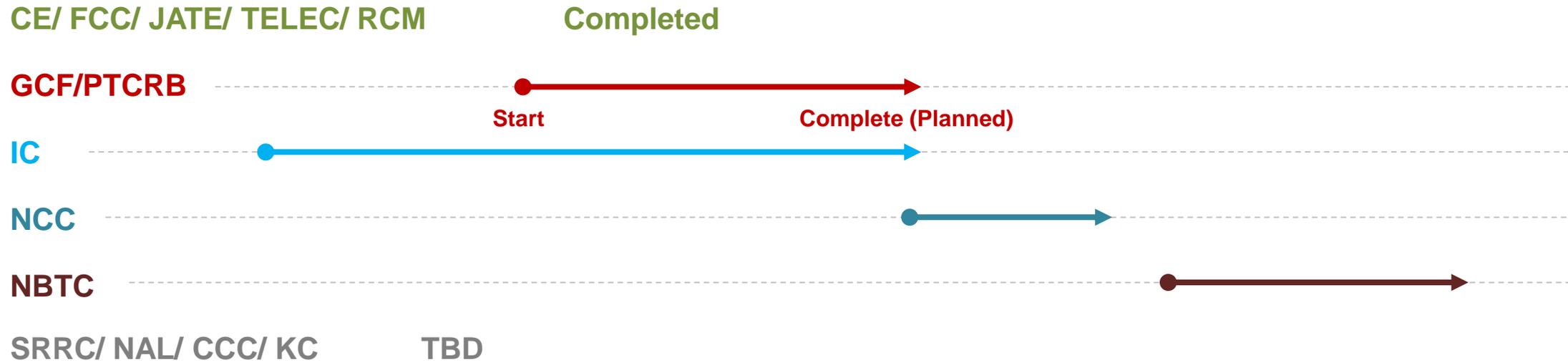
BG95-MF Development Schedule

QUECTEL
Build a Smarter World

2020							
Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.

ES1 **ES2** **CS (I)** **CS (II)** **MP**

Version:
BG95MFLAR02A01

- PPP/TCP/UDP/IP
- Basic AT commands
- QuecLocator®

Version:
BG95MFLAR02A01

- SMS
- PING
- NITZ
- FTP(S)/HTTP(S)
- MQTT
- Handover
- FILE (UFS)
- SSL/TLS

Version:
BG95MFLAR02A02
(Add new features)

- LwM2M
- DFOTA
- GNSS
- QuecOpen®

Version:
BG95MFLAR02A03
(Add new features)

- RF TX/RX FTM
- CMUX
- Jamming Detection
- LTE RF Antenna Tuner

Version:
BG95MFLAR02Axx
**(Add new features)**

- IPv6
- Triangle Location
- QuecThing®
- NIDD
- CoAP
- VoLTE
- Add new features to meet certification demands

The timeline may be adjusted according to the actual development status.
BG95-M3 is the main variant to be developed, and BG95-MF will leverage the development functions of BG95-M3.

BG95-MF Timeline (Planning)

QUECTEL
Build a Smarter World

2020											2021		
Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.

Project Schedule

ES   CS   MP

ES: Engineering samples ready. Basic functions are available for customers' simple demo purpose.
CS: Commercial samples ready. Stable hardware design and quite stable software design. New software features can be added upon request.
MP: Hardware and software ready for mass production. For certification status, please refer to the "certification schedule".

Regulatory Certification Schedule

GCF/PTCRB

Start (Planned)   **Complete (Planned)**

CE/FCC/IC/RCM

The timeline may be adjusted according to the maturity of Qualcomm baseline. BG95-MFwill leverage some test results of BG95-M3.

BG77 Development Schedule

2020

| Feb. | Mar. | Apr. | May. | Jun. | Jul. |

CS   **MP (I)**   **MP (II)**   **MP (III)**

Version:
BG77LAR02A02
(Add new features)

- TCP/IP
- PPP/UDP
- SMS
- PING
- NITZ
- GNSS
- FILE (UFS)
- RF TX/RX FTM
- LwM2M
- SSL/TLS
- FTP(S)
- HTTP(S)
- BIP
- MQTT
- DFOTA
- CMUX
- QuecOpen®
- QuecLocator®
- LTE RF Antenna Tuner

Version:
BG77LAR02A03
(Add new features)

- Jamming Detection
- NIDD
- IPV6

- Completed: Sprint
- Ongoing: Verizon/ AT&T/ Vodafone/ PTCRB

Version:
BG77LAR02A04
(Add new features)

- Triangle Location
- QuecThing®
- Add new features to meet certification demands

Version:
BG77LAR02Axx
(Add new features)

- VoLTE
- CoAP (AT)
- LwM2M (AT)
- Fix platform bugs
- Add new features to meet certification demands

Plan for: Verizon MR

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

BG77 Timeline (1)

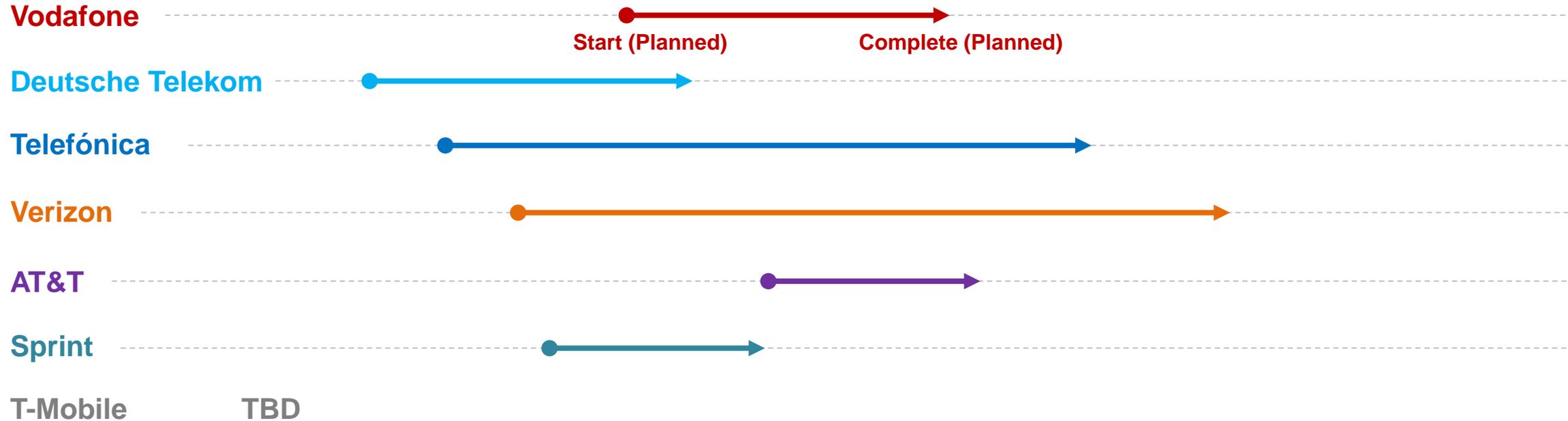| 2019						2020										
Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.

Project Schedule

ES   CS   MP

ES: Engineering samples ready. Basic functions are available for customers' simple demo purpose.
CS: Commercial samples ready. Stable hardware design and quite stable software design. New software features can be added upon request.
MP: Hardware and software ready for mass production. For certification status, please refer to the "certification schedule".

Carrier Certification Schedule

Sprint   **Completed**

Vodafone
Start   Complete (Planned)

Deutsche Telekom

Verizon

AT&T

NTT DOCOMO

SoftBank

KDDI

The timeline may be adjusted according to the maturity of Qualcomm baseline.
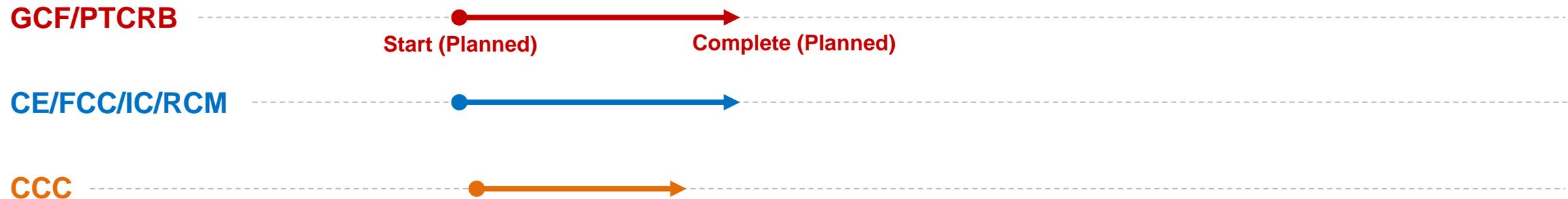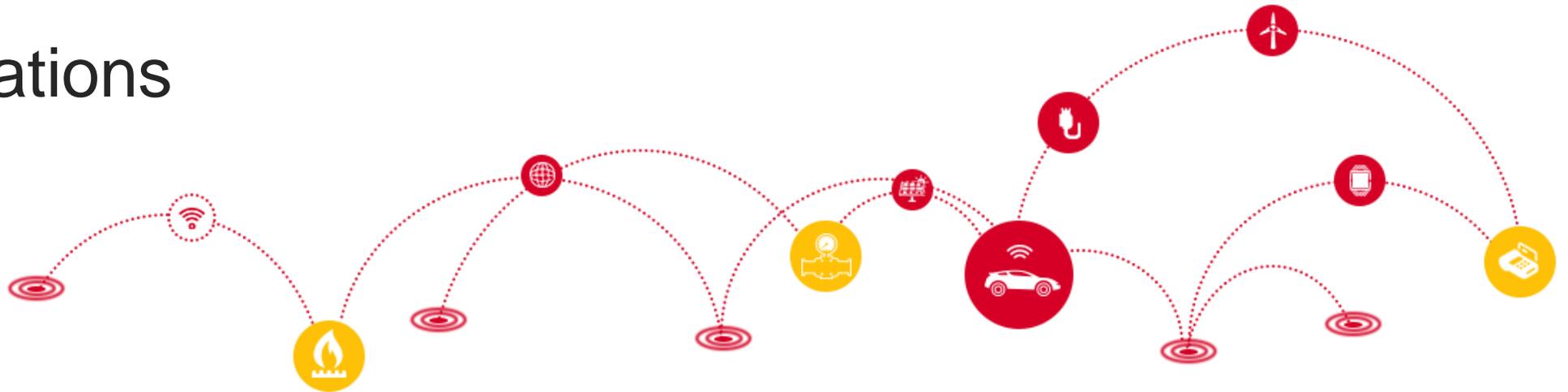*BG77 will leverage some test results of BG95-M3.*   Rev.: V1.4 | Status: Released

BG77 Timeline (2)

2019						2020										
Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.

Carrier Certification Schedule

Telstra

Start (Planned)　　　Complete (Planned)

T-Mobile/ Telus/ China Mobile/China Telecom/China Unicom/ SKT　　　TBD

Regulatory Certification Schedule

CE/ FCC/ JATE/ TELEC/ RCM　　　Completed

GCF/PTCRB

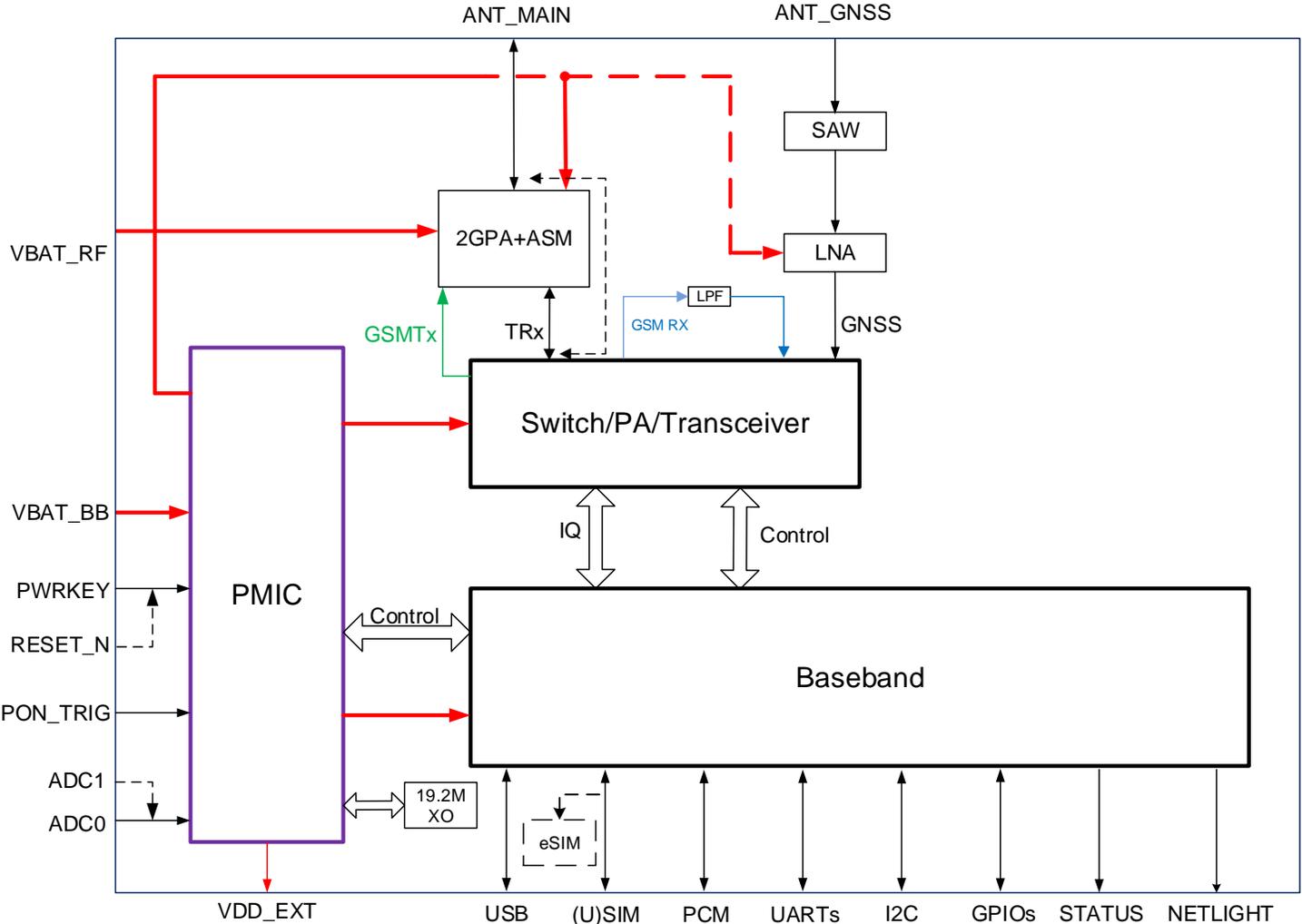Start　　　Complete (Planned)

IC

NCC

NBTC

SRRC/ NAL/ CCC/ KC　　　TBD

The timeline may be adjusted according to the maturity of Qualcomm baseline.
BG77 will leverage some test results of BG95-M3.

BG600L-M3 Development Schedule

2020							
Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.

ES   **CS**   **MP (I)**   **MP (II)**

Version:
BG600LM3LAR02A01
(Add new features)

- TCP/IP
- PPP/UDP
- SMS
- PING
- NITZ
- GNSS
- FILE (UFS)
- RF TX/RX FTM
- LwM2M
- SSL/TLS
- FTP(S)
- HTTP(S)
- BIP
- MQTT
- DFOTA
- CMUX
- QuecLocator®

Version:
BG600LM3LAR02A02
(Add new features)

- QuecOpen®
- Jamming Detection
- NIDD
- IPv6
- CoAP
- LTE RF Antenna Tuner

Plan for: Verizon/ AT&T

Version:
BG600LM3LAR02A03
(Add new features)

- VoLTE
- CS call
- Triangle Location
- QuecThing®
- Add new features to meet certification demands

Version:
BG600LM3LAR02Axx
(Add new features)

- Fix platform bugs
- Add new features to meet certification demands

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

BG600L-M3 Timeline (1)

Project Schedule
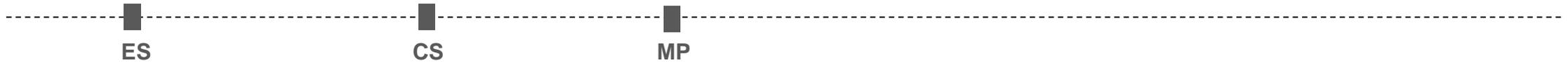
ES: Engineering samples ready. Basic functions are available for customers' simple demo purpose.
CS: Commercial samples ready. Stable hardware design and quite stable software design. New software features can be added upon request.
MP: Hardware and software ready for mass production. For certification status, please refer to the "certification schedule".

Carrier Certification Schedule

Vodafone — Start (Planned) ... Complete (Planned)

Deutsche Telekom

Telefónica

Verizon

AT&T

Sprint

T-Mobile   TBD

The timeline may be adjusted according to the maturity of Qualcomm baseline.
BG600L-M3 will leverage some test results of BG95-M3.

BG600L-M3 Timeline (2)

							2020							2021	
Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
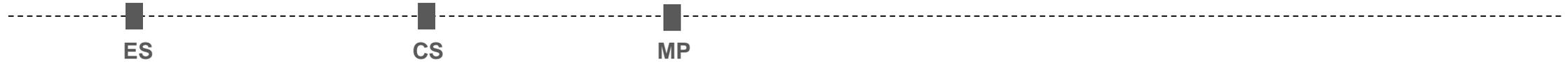
Project Schedule

ES   **CS**   **MP**

ES: Engineering samples ready. Basic functions are available for customers' simple demo purpose.
CS: Commercial samples ready. Stable hardware design and quite stable software design. New software features can be added upon request.
MP: Hardware and software ready for mass production. For certification status, please refer to the "certification schedule".

Regulatory Certification Schedule

GCF/PTCRB

Start (Planned)   **Complete (Planned)**

CE/FCC/IC/RCM

CCC

The timeline may be adjusted according to the maturity of Qualcomm baseline.
BG600L-M3 will leverage some test results of BG95-M3.

Technical Background

LPWA Roadmap

Highlights & Specifications

Development Timeline

Technical Details

Applications

Hardware Architecture

ANT_MAIN   ANT_GNSS

SAW

2GPA+ASM   LNA

VBAT_RF

GSMTx   TRx   LPF
                GSM RX   GNSS

Switch/PA/Transceiver

VBAT_BB

PMIC   IQ   Control

PWRKEY

RESET_N   Control   Baseband

PON_TRIG

ADC1   19.2M
              XO
ADC0
                    eSIM

VDD_EXT   USB   (U)SIM   PCM   UARTs   I2C   GPIOs   STATUS   NETLIGHT

Take BG95-M3 as an example.

Key Technologies 1 - PSM

Power Saving Mode (PSM) is similar to power-off, but the module remains registered on the network. When the module is woken up from PSM, there is no need to re-attach or re-establish PDN connection. When the module in PSM, it is not immediately reachable for mobile terminating services. PSM is therefore intended for applications that are expecting only infrequent mobile originating and terminating services and that can accept a corresponding latency in the mobile terminating communication.

When the module wants to use the PSM it shall request an Active Time value during every Attach and TAU/RAU procedures. If the network supports PSM and accepts that the module uses PSM, the network confirms usage of PSM by allocating an Active Time value to the module.

The following figure illustrates the power consumption cycle of the module.
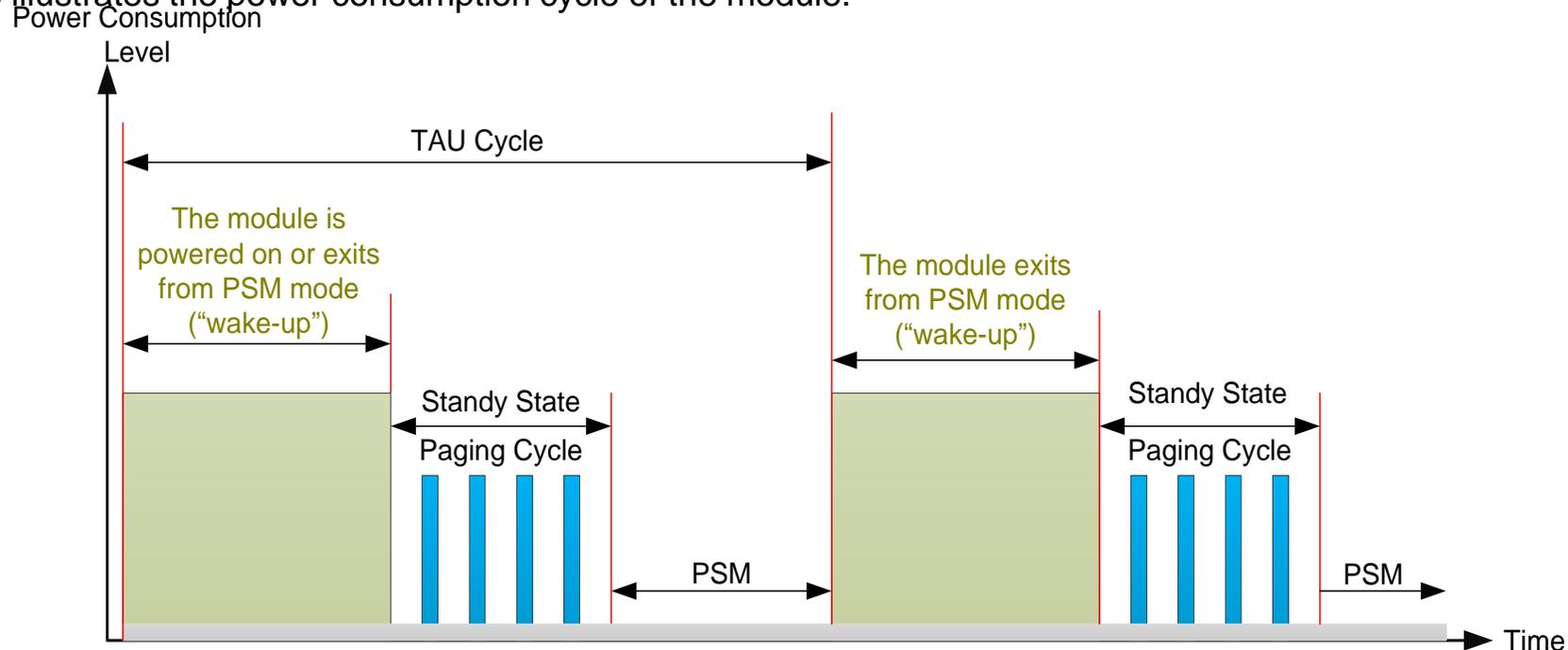
Key Technologies 2 - e-I-DRX

The module (UE) and the network may negotiate over non-access stratum signaling the use of Extended Idle Mode DRX (e-I-DRX) for reducing its power consumption, while being available for mobile terminating data and/or network originated procedures within a certain delay dependent on the DRX cycle value.

Applications that want to use e-I-DRX need to consider specific handling of mobile terminating services or data transfers, and in particular they need to consider the delay tolerance of mobile terminated data.

The following figure illustrates the DRX and e-I-DRX cycle of the module.
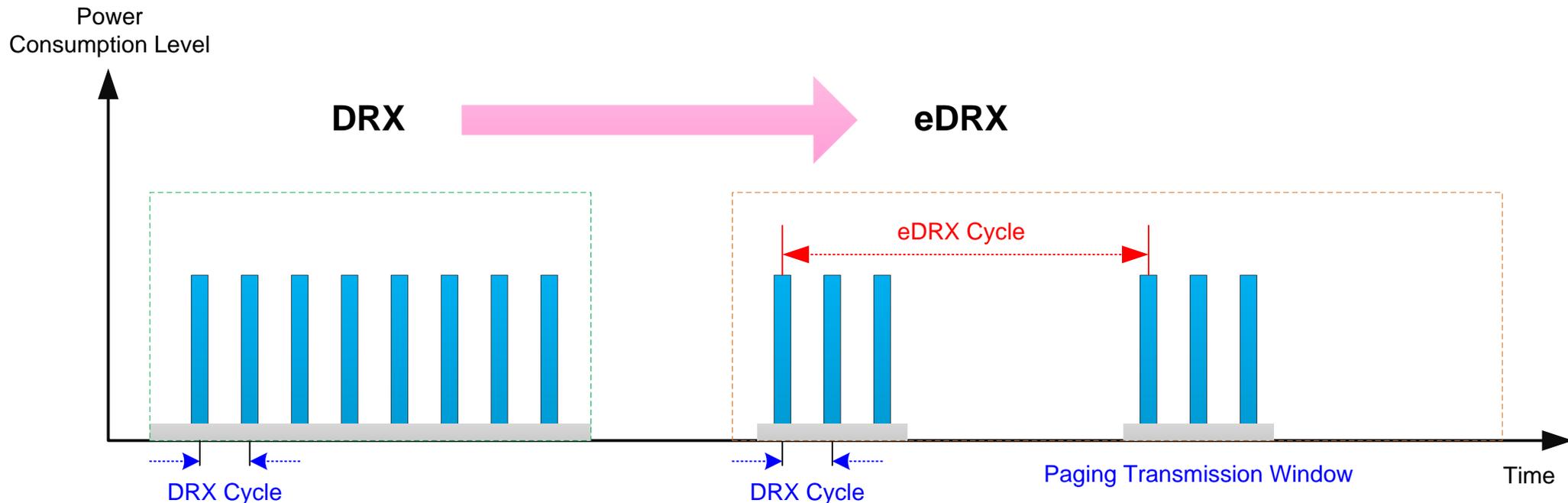
BG95 Series Layout Compatibility

BG95 series module is compatible with

the following Quectel modules:

- *GSM/GPRS module M95*

- *UMTS/HSPA modules UG96/UG95*

- *LTE Cat 4/Cat 1 module EG95/EG91*

- *LPWA module BG96/BC95-G/BC92*
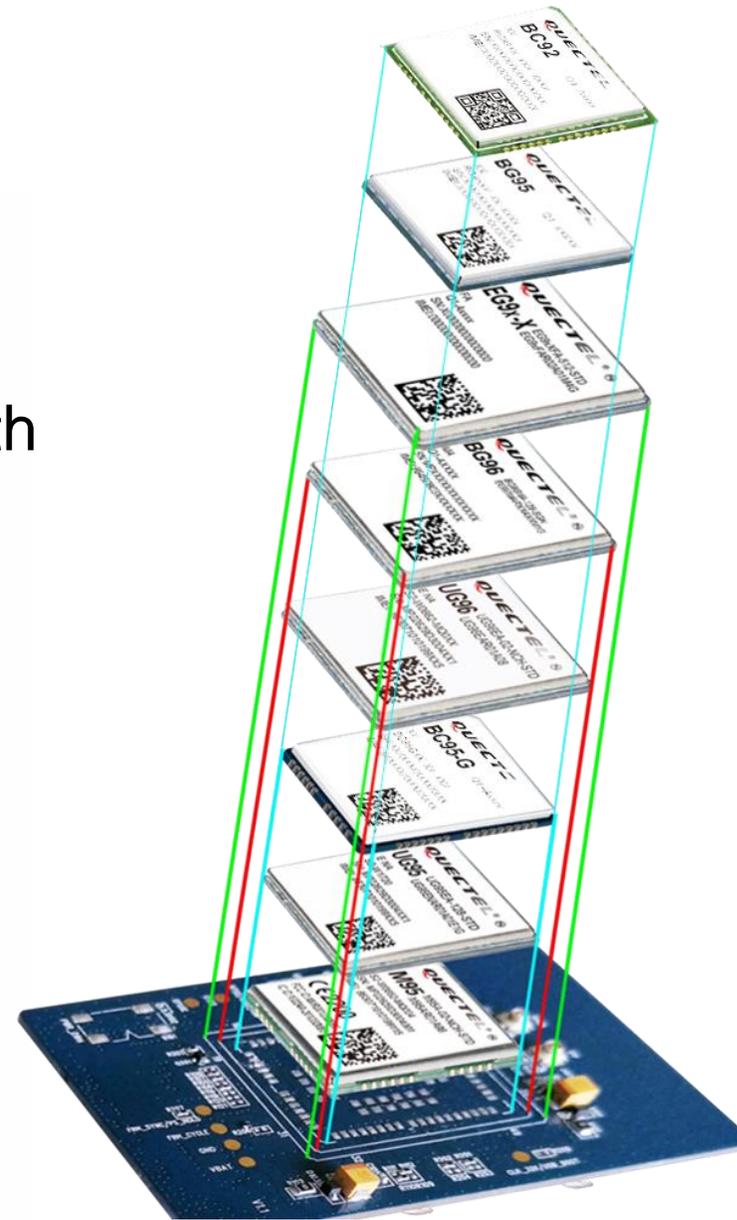
The compatibility diagram shown above is for illustration purpose only.
The actual label design of the modules may be different.

BG600L-M3 Layout Compatibility

BG600L-M3 is compatible with

Quectel GSM/GPRS/GNSS module MC60
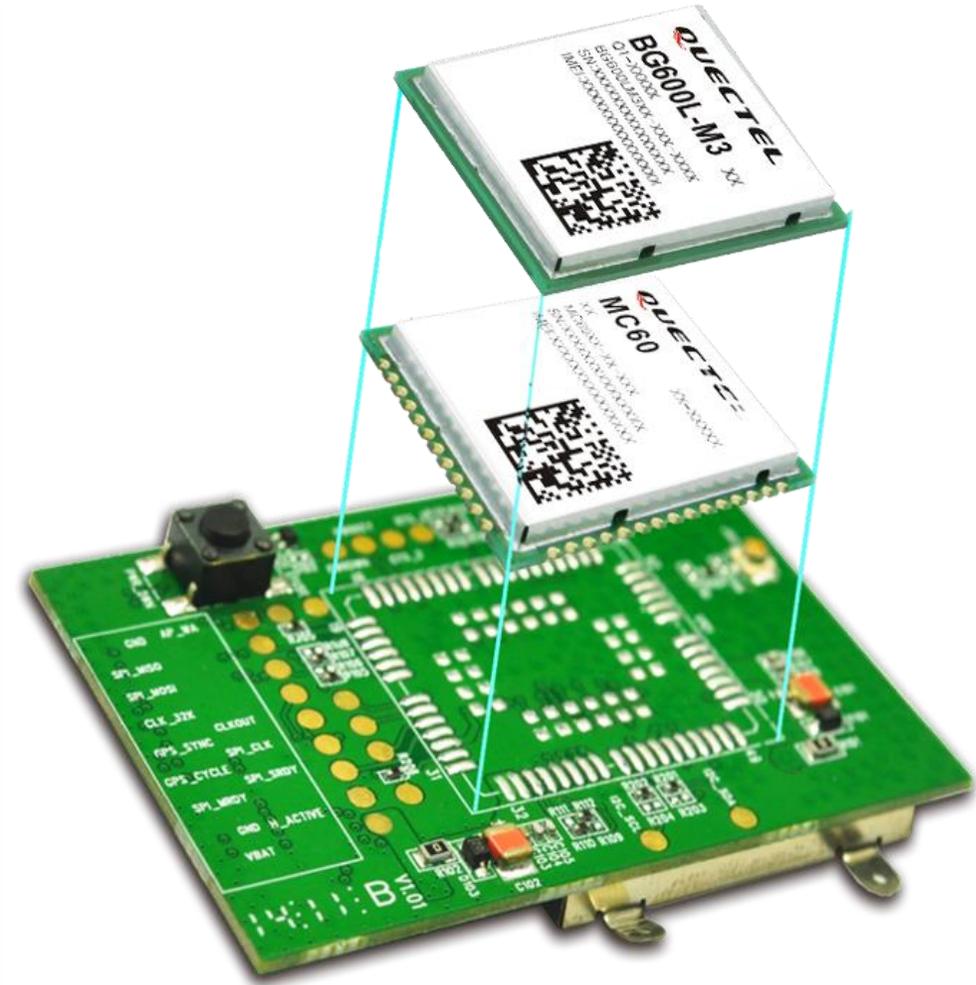
The compatibility diagram shown above is for illustration purpose only.
The actual label design of the modules may be different.

Quick Start (Planned)

UMTS & LTE EVB Kit
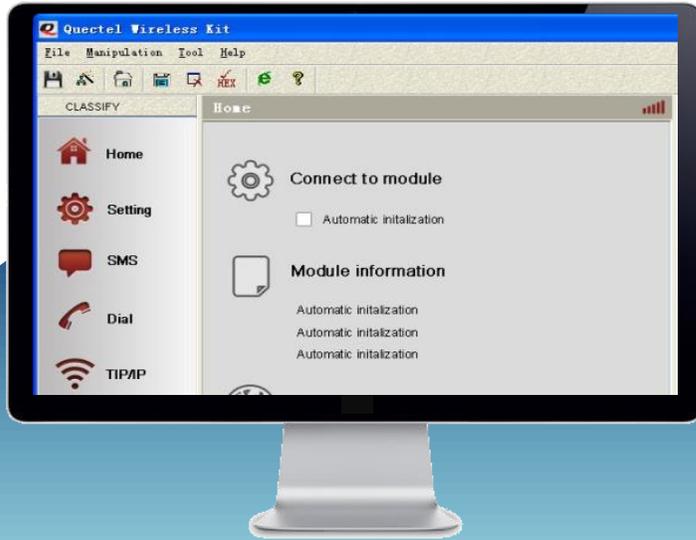
Quectel offers a GUI tool named **QNavigator**. It can help customers quickly test Quectel module's functionality.
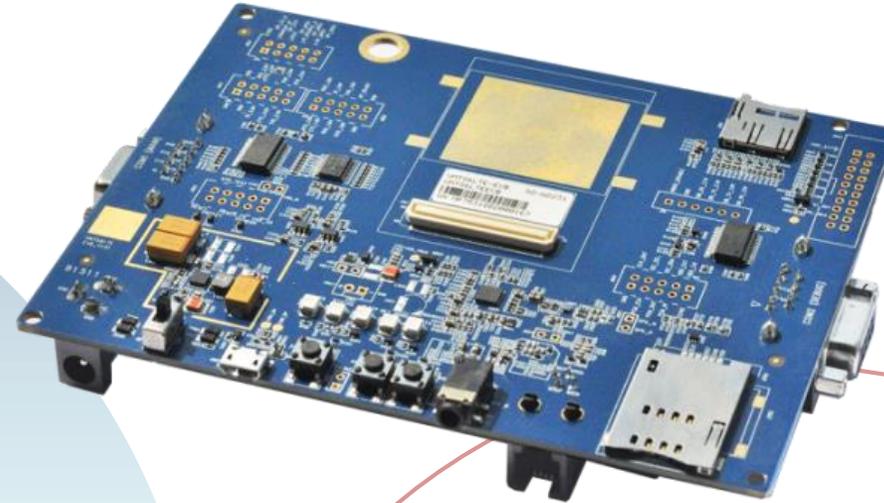
Technical Background

LPWA Roadmap

Highlights & Specifications

Development Timeline

Technical Details
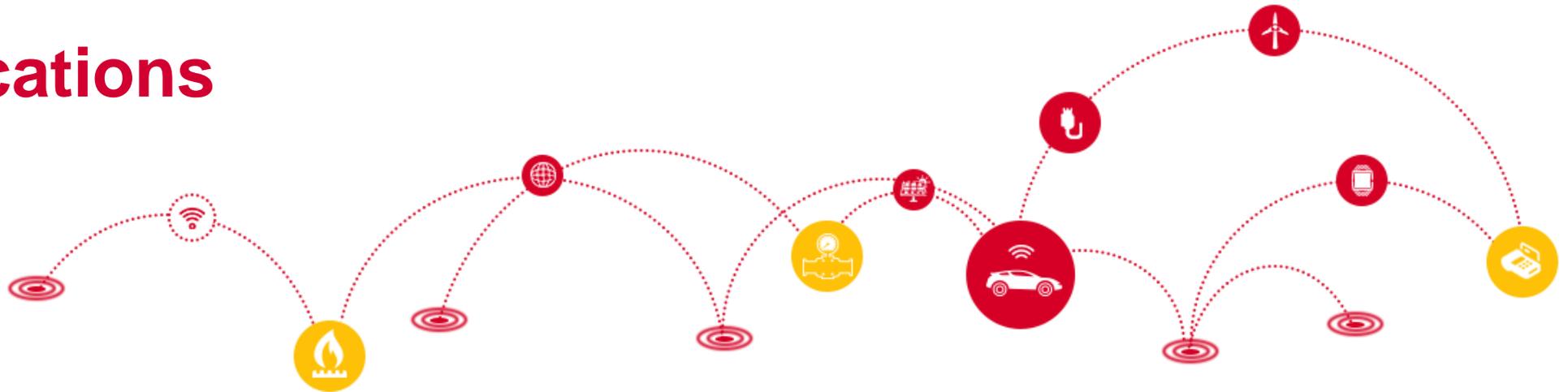
Applications

LPWA Application Scenarios

Public Utilities

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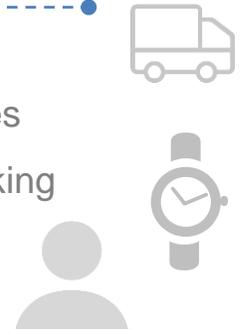- Fire Hydrant
- Smoke Detector
- Street Lighting
- Smart Dustbin

Quectel

Quectel Module

Smart Life

- Asset Tracking
- Wearable Devices
- Person/Pet Tracking

Industry & Agriculture

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

Smart Home

- Intelligent Door Lock
- Intelligent Control

Public Utilities – Smart Metering

QUECTEL
Build a Smarter World

By 2024, there will be

1.9 billion

connected meters [1]

Water Meter

Gas Meter

Heat Meter

Electricity Meter

Nuclear Power Plant	Thermal Power Plant	Hydraulic Power Plant

Domestic Meters	Wind Power Plant	Factory	Workplace	Renewable Energy	Ecological Vehicle	Photoelectricity

[1] 2016 Machina report on smart metering   Rev.: V1.4 | Status: Released

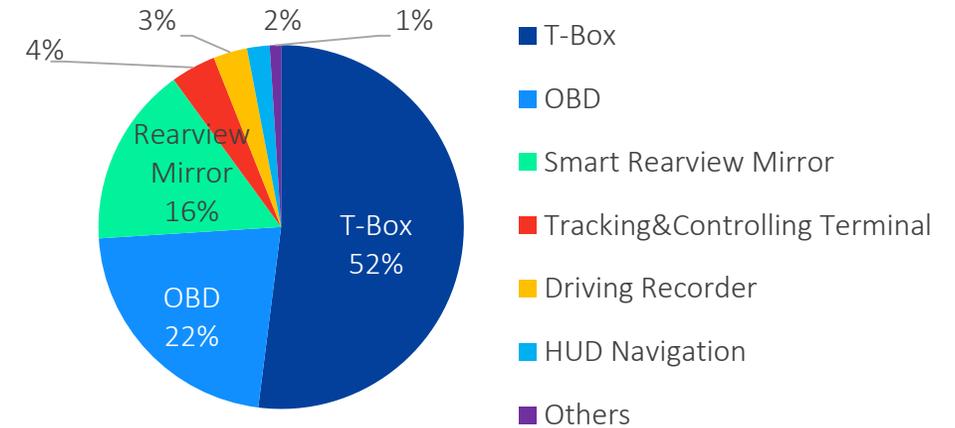# Public Utilities – Street Lighting

- Real time data feeds directly to the operation center

- Manual brightening of lighting when required

- Improved energy efficiency

Smart Life – LPWA Tracker

LPWA Tracking

- **Automotive Tracking (Connected to the Automotive System)**
  - T-box
  - OBD/UBI
- **Asset Tracking**
  - Vehicle financing (averagely 4–6 trackers are installed on each vehicle)
  - Logistics (container, pallet box, express box)
  - Anti-theft (motorbike, shared bike, equipment, other shared products)
- **Person/Pet Tracking**
  - Watch, wristband and other wearables
  - Person/animal tracking

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

Pie chart:
- T-Box 52%
- OBD 22%
- Rearview Mirror 16%
- 4%
- 3%
- 2%
- 1%

Legend:
- T-Box
- OBD
- Smart Rearview Mirror
- Tracking&Controlling Terminal
- Driving Recorder
- HUD Navigation
- Others

[1] China Academy of Information and Communication Technology   Rev.: V1.4 | Status: Released
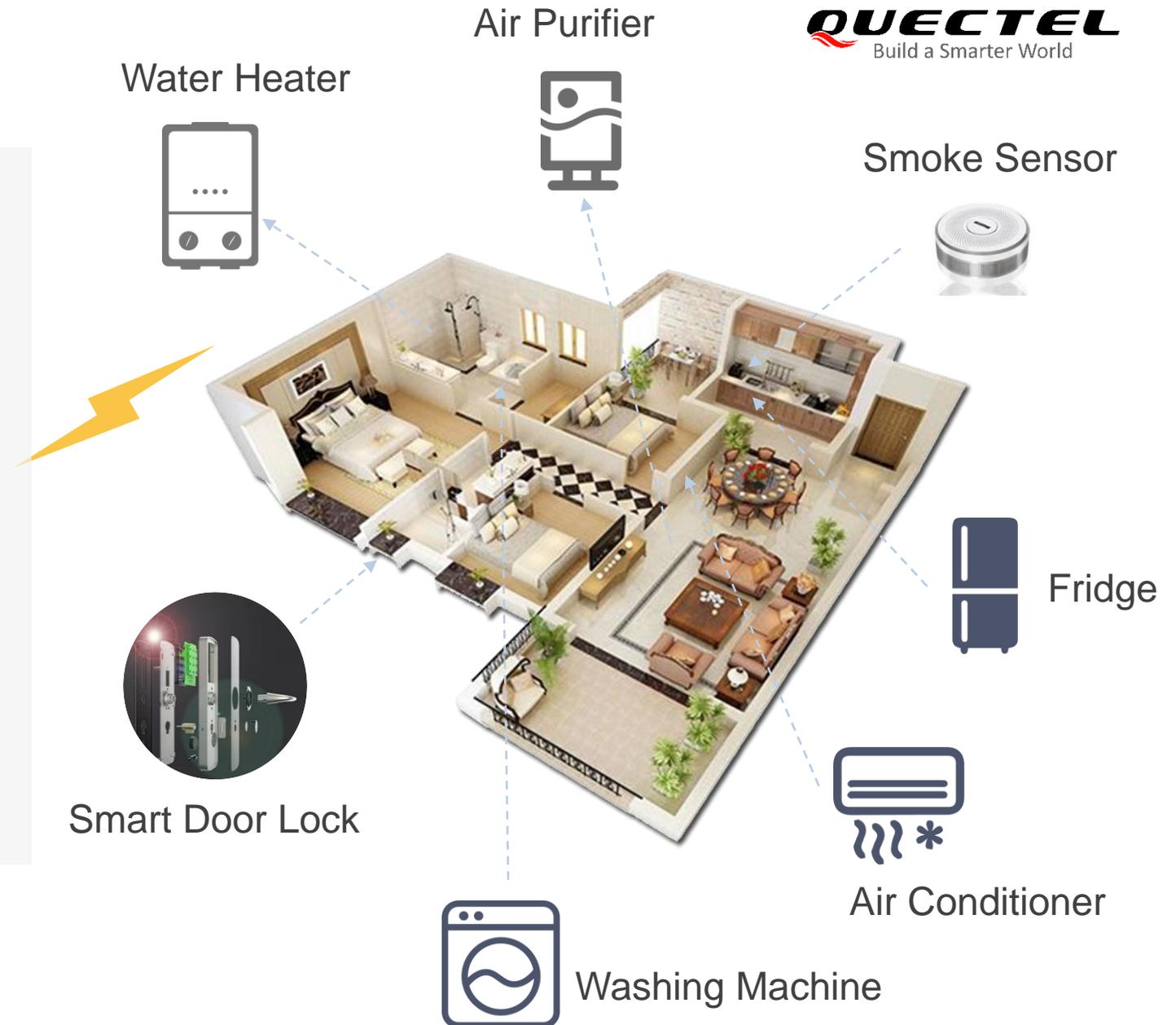
Smart Home

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

Smart Door Lock

Air Conditioner

Washing Machine

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

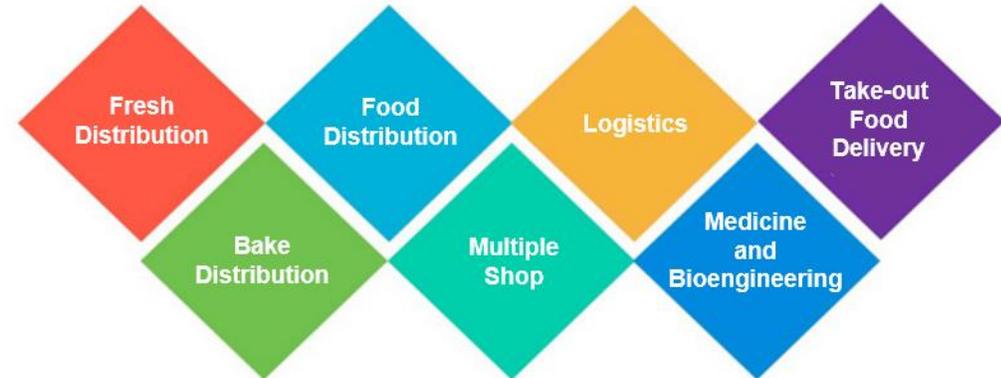**4** Safe & Eco-friendly
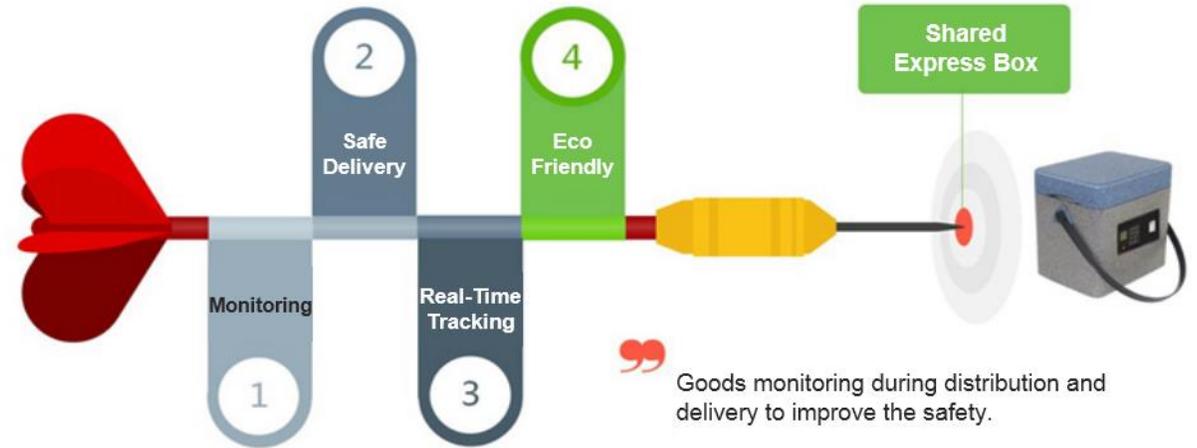Low Noise and Power Consumption

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

Thank you!

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f https://www.facebook.com/quectelwireless

🐦 https://twitter.com/Quectel_IoT