

Quectel BG95&BG77&BG600L Series Module

Introduction

August, 2020

Technical Background

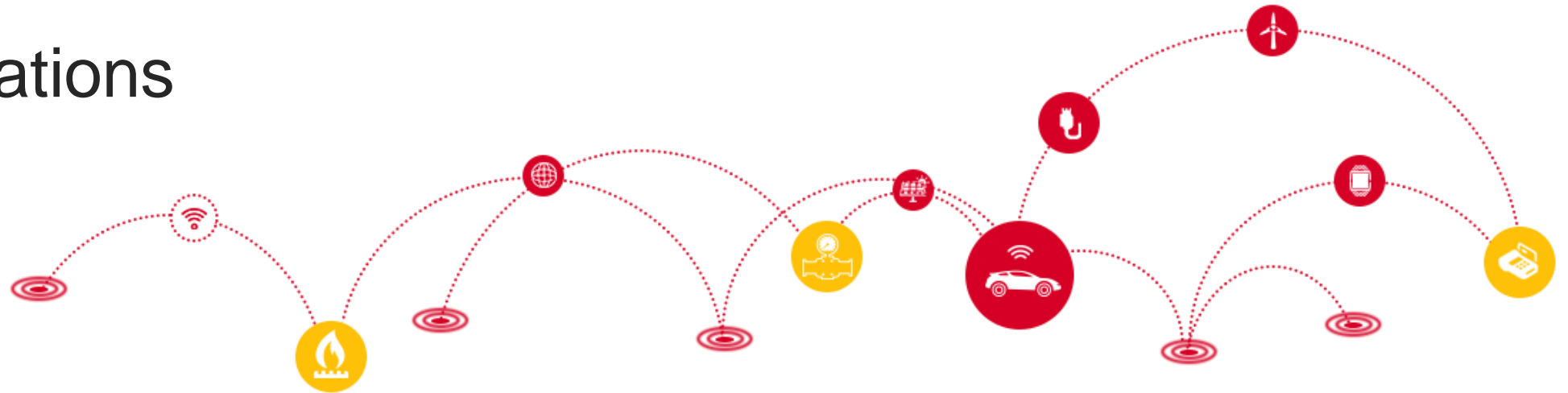
LPWA Roadmap

Highlights & Specifications

Development Timeline

Technical Details

Applications

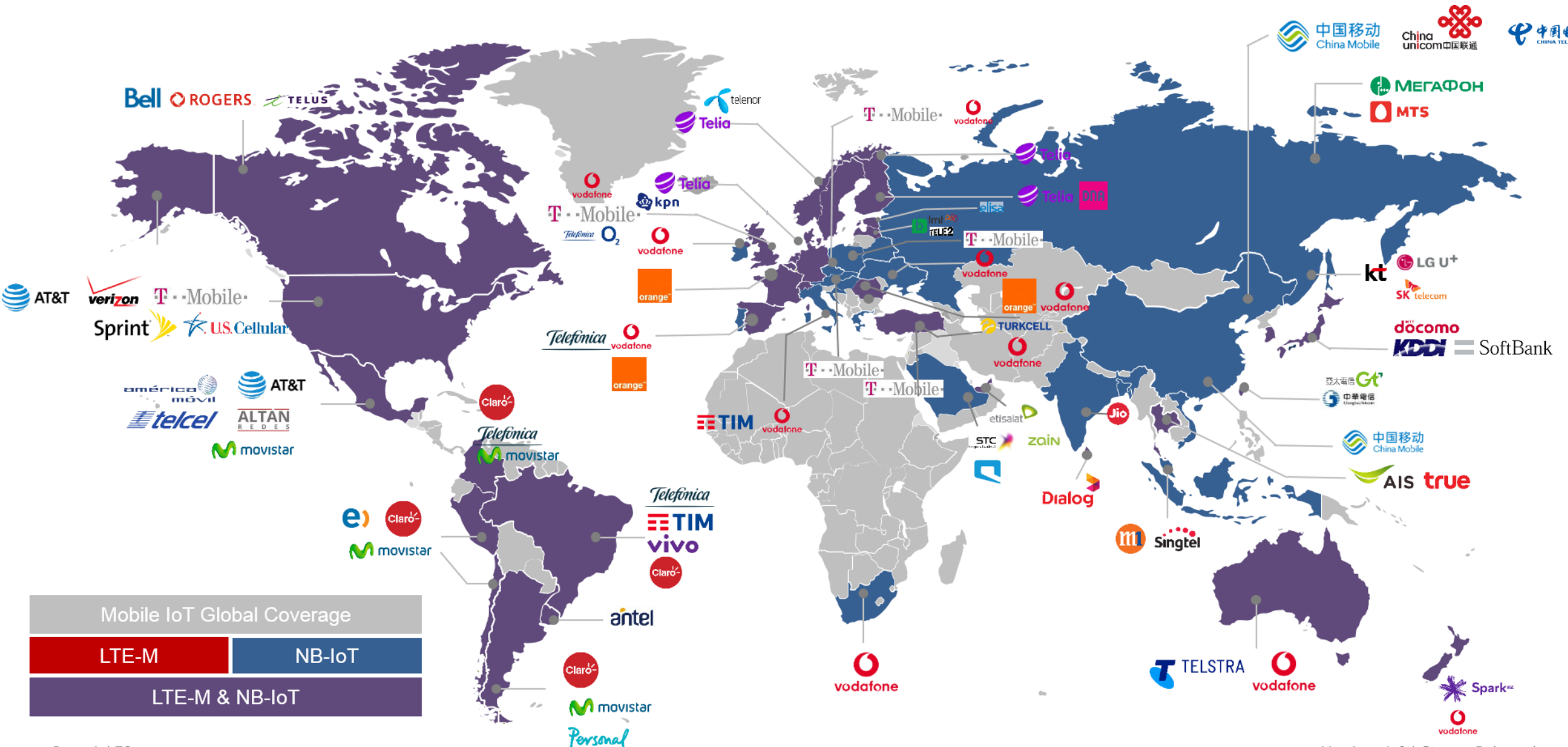


LPWA Advantages



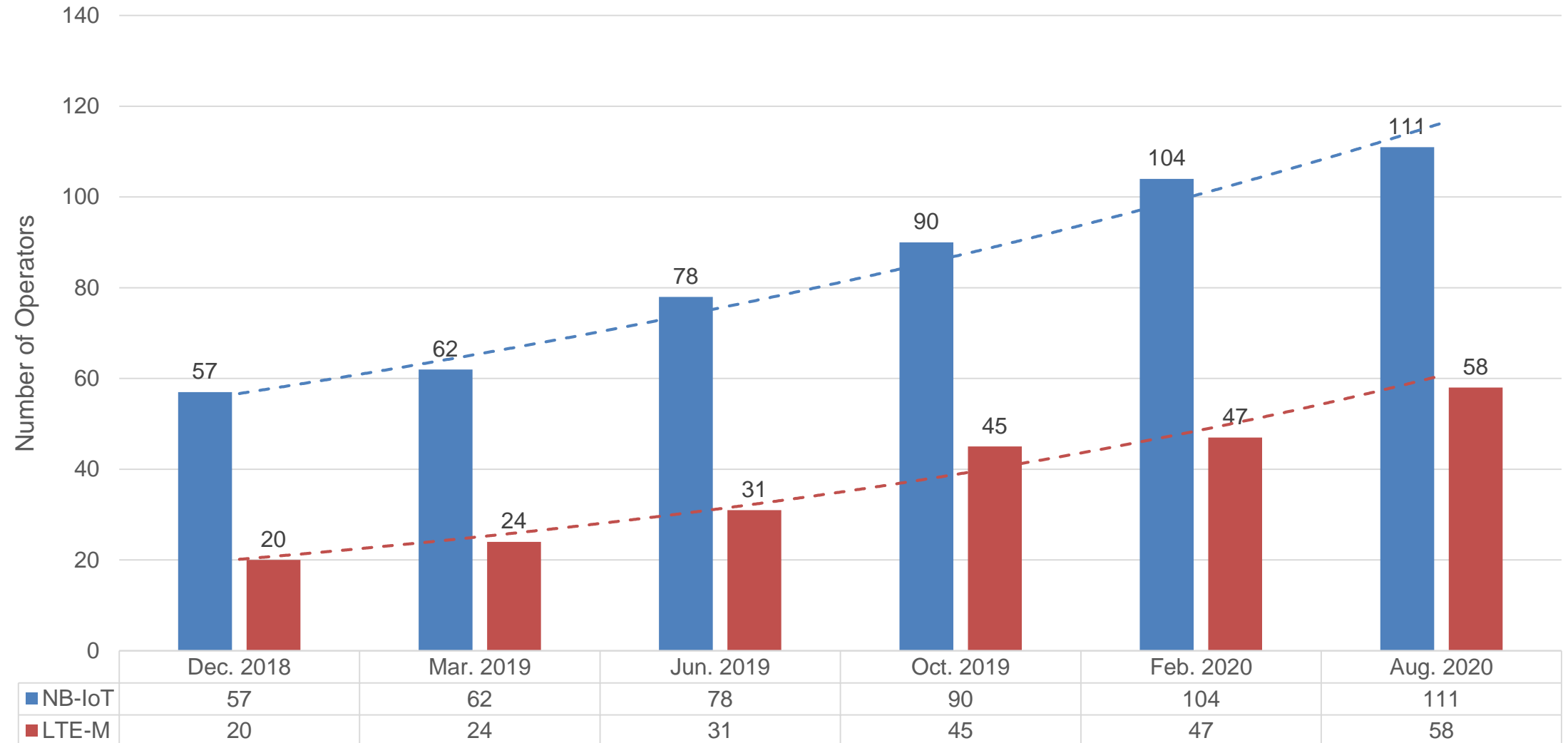
Note: VoLTE is supported on LTE Cat M1 only.

LPWA Network Deployment (Based on GSMA Data up to Aug. 1, 2020)



LPWA Network Deployment Trend

LPWA Network Deployment Trend



NB-IoT Deployment (1) (Based on GSMA Data up to Aug. 1, 2020)



NB-IoT = 111								
Operator	Country/Region	Bands	Operator	Country/Region	Bands	Operator	Country/Region	Bands
3	Hong Kong, China	8	Claro	Argentina	4, 28	Movistar	Colombia	5
A1	Austria	20	Dialog Axiata	Sri Lanka	3, 8	Movistar	Argentina	4, 28
A1	Croatia	20	DNA	Finland	20, 3	MTS	Russia	3
A1	Belarus	/	DU	UAE	20	NOS	Portugal	3,20
AIS	Thailand	8	Elisa	Finland	20, 3	Orange	Belgium	3,20
ALTAN	Mexico	28	Elisa	Estonia	20	Orange	Spain	20
Altice	Portugal	20	Entel	Chile	28	Proximus	Belgium	20
Antel	Uruguay	3,28	Etisalat	UAE	20	Reliance Jio	India	3, 5
APTG	Taiwan, China	8	FarEasTone	Taiwan, China	28	Rogers	Canada	4, 5, 12
AT&T	USA	2, 4, 12	Grameenphone	Bangladesh	3, 8 (TBC)	SFR	France	20
AT&T	Mexico	5	KCELL	Kazakstan	/	Singtel	Singapore	8
BASE (Telenet)	Belgium	3, 20	KT	South Korea	3	SmarTone	Hong Kong, China	8
Bite	Latvia	20	Kyvistar	Ukraine	3	SoftBank	Japan	1, 8
China Mobile	China	8	LGU+	South Korea	5	StarHub	Singapore	3, 8
China Mobile	Hong Kong, China	3	LMT	Latvia	20	STC	Saudi Arabia	28
China Telecom	China	5	M1	Singapore	8	Swisscom	Switzerland	20
China Unicom	China	3, 8	Maxis	Malaysia (6 Cities)	3	Taiwan Mobile	Taiwan, China	3, 28
Chunghwa	Taiwan, China	8	MegaFon	Russia	20, 8, 3	TDC	Denmark	20
Claro	Brazil	3, 28	Mobily	Saudi Arabia	20	Telcel	Mexico	5
Claro	Colombia	5	Mobitel	Sri Lanka	3,8	Tele2	Latvia	20
Claro	Peru	28	Movistar	Peru	28	Telecom Italia/TIM	Brazil	28
Claro	Chile	28	Movistar	Chile	28	Telecom Italia/TIM	Italy	20

NB-IoT Deployment (2) (Based on GSMA Data up to Aug. 1, 2020)



NB-IoT = 111								
Operator	Country/Region	Bands	Operator	Country/Region	Bands	Operator	Country/Region	Bands
Telefónica	Spain	20	Verizon	USA	13	TRUE	Thailand	8
Telefónica	Germany	8, 20	Viettel	Vietnam	3			
Telenor	Denmark	20	Vivo	Brazil	3, 28			
Telenor	Norway	8, 20	Vodafone	Australia	5, 8, 28			
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	20	Vodafone/ Vodacom	South Africa	8			
Turkcell	Turkey	20	XL Axiata	Indonesia	8			
Velcom	Belarus	8	Zain	Saudi Arabia	3			

LTE-M Deployment (Based on GSMA Data up to Aug. 1, 2020)



LTE-M = 58								
Operator	Country/Region	Bands	Operator	Country/Region	Bands	Operator	Country/Region	Bands
AIS	Thailand	3, 8	KPN	Netherlands	20	Sprint	USA	25
ALTAN	Mexico	28	KT	South Korea	3	Swisscom	Switzerland	20
América Móvil	Mexico	4	LGU+	South Korea	5	T-Mobile (DT)	Netherlands	8
Antel	Uruguay	3, 28	LMT	Latvia	20	Telcel	Mexico	4
APTG	Taiwan, China	8, 28	Movistar	Mexico	2	Telefonia	Spain	20
AT&T	Mexico	4	Movistar	Peru	4	Telefonica	Colombia	2
AT&T	USA	2, 4, 12	Movistar	Colombia	4	Telefónica	Germany	20
Bell	Canada	12	Movistar	Argentina	4,28	Telenor	Denmark	20
Chunghwa	Taiwan, China	3	NTT DOCOMO	Japan	1, 19	Telenor	Norway	20
Claro	Brazil	3, 28	O2 Telefonica	UK	20	Telenor	Sweden	20
Claro	Colombia	5	Orange	Belgium	20	Telstra	Australia	28
Claro	Chile	28	Orange	France	20	Telus	Canada	2, 4, 5, 12
Claro	Argentina	28	Orange	Romania	3	Turkcell	Turkey	3, 20
Claro	Peru	28	Orange	Spain	3, 20	USCC	US	2, 4, 5, 12
Dialog Axiata	Sri Lanka	8	Personal	Argentina	4,28	Verizon	USA	4, 13
DNA	Finland	20, 3	Rogers	Canada	4, 5, 12	Vivo	Brazil	3,28
Elisa	Estonia	/	SingTel	Singapore	3, 8	Vodafone	New Zealand	28
Entel	Peru	28	SKT	South Korea	3, 5	Vodafone	Netherlands	20
Etisalat	UAE	5	SoftBank	Japan	1, 3, 8			
KDDI	Japan	18, 26	Spark	New Zealand	3, 28			

Technical Background

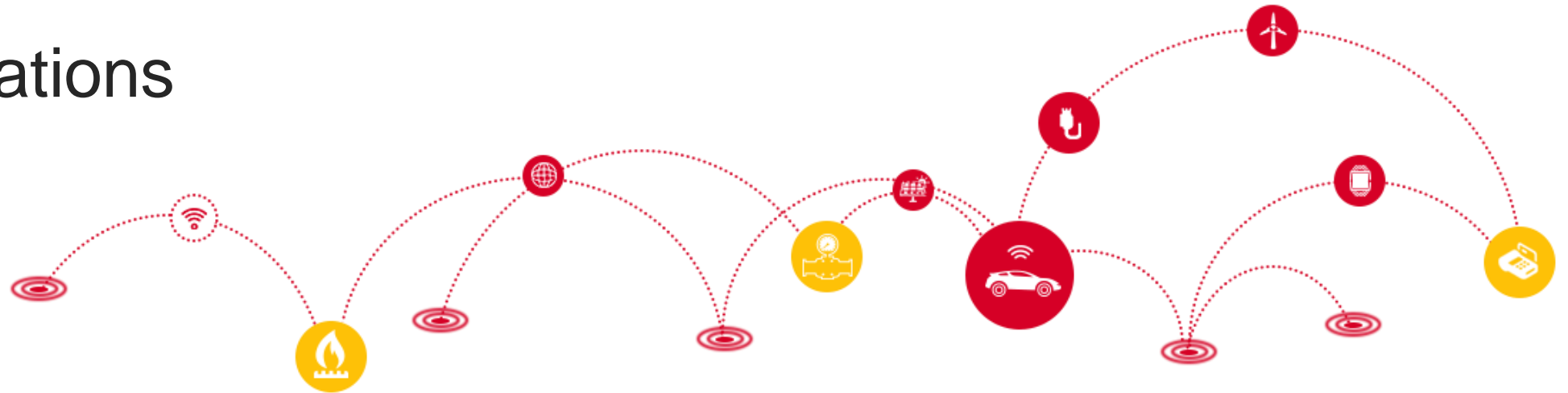
LPWA Roadmap

Highlights & Specifications

Development Timeline


Technical Details

Applications




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-M6

- Cat M1/ NB2
- Power Class 3
- Global Version




BG95-M3

- Cat M1/ NB2/ EGPRS
- Global Version



BG95-N1


- Cat NB2
- Global Version



BG95-MF

- Cat M1/ NB2
- Wi-Fi Positioning
- Global Version

MDM9206



BG96

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



BG77

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



BG600L-M3

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



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
	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

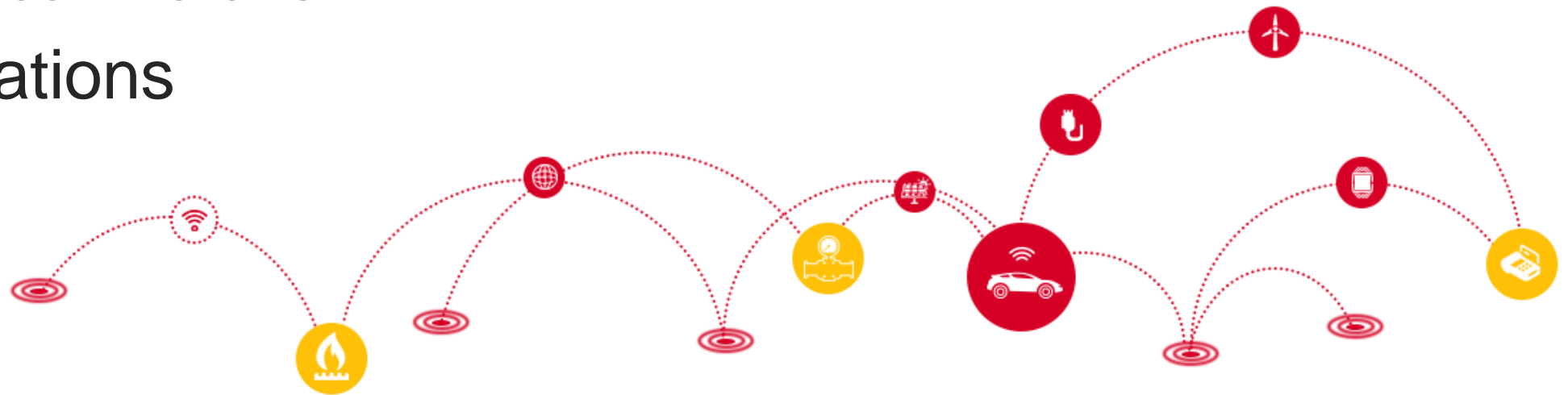
LPWA Roadmap

Highlights & Specifications

Development Timeline

Technical Details

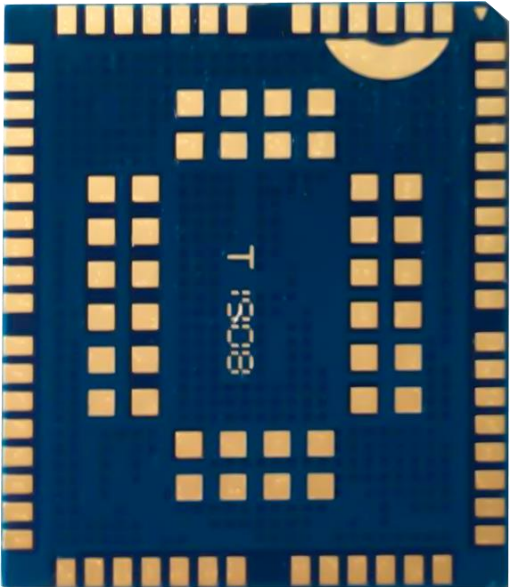
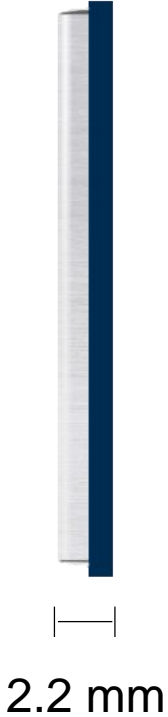
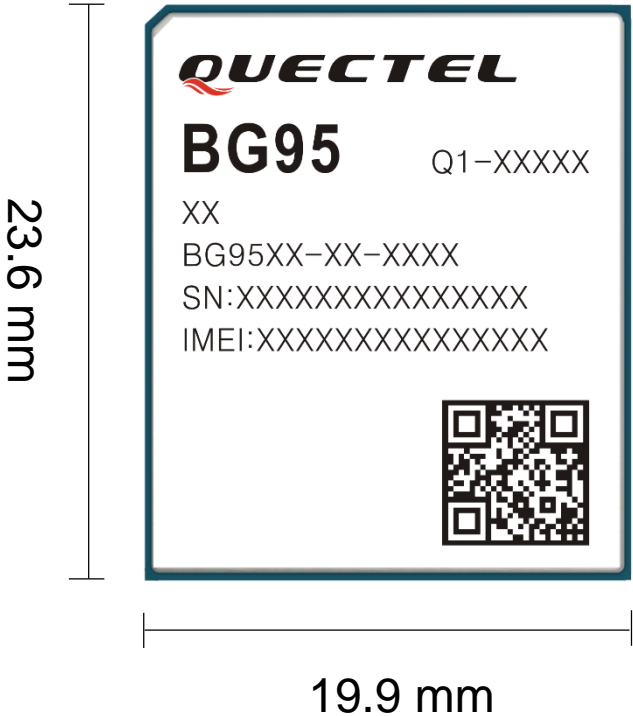
Applications



BG95 Series Mechanical Dimensions



Multi-Mode LPWA Module (MDM9205)



- 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	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	MP
BG95-M2	Cat M1/ Cat NB2	LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/ B19/B20/B25/B26 ^① /B27 ^① /B28/B66/B71 ^② /B85	All major global carriers	MP
BG95-M3	Cat M1/ Cat NB2/ EGPRS	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	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/B26 ^① /B27 ^① /B28/ B31/B66/B72/B73 /B85	Major certifications 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/B26 ^① /B27 ^① /B28/B66/B71/B85 EGPRS: 850/900/1800/1900 MHz	All major global carriers	CS
BG95-M6	Cat M1/ Cat NB2 (Power Class 3)	LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/ B19/B20/B25/B26 ^① /B27 ^① /B28/B66/B71/B85	All major global carriers	CS
BG95-MF	Cat M1/ Cat NB2 (Wi-Fi Positioning)	LTE-FDD: B1/B2/B3/B4/B5/B8/B12/B13/B18/ B19/B20/B25/B26 ^① /B27 ^① /B28/B66/B71 ^② /B85 Wi-Fi (Positioning Only): 2.4 GHz	Based on market demand	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	<ul style="list-style-type: none"> 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 μ A 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/-M6) 3.2–4.2 V, typ. 3.8 V (BG95-M4) Typ. 3.8 V (BG95-MF)
GNSS	GPS, GLONASS, BeiDou, Galileo, QZSS
Voice*	<ul style="list-style-type: none"> 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	SIM service: eSIM/ SoftSIM/ nuSIM* Cloud service: AWS/ Azure

^① Cat M1 bands only ^② Cat NB2 Bands Only

^③ refer to the hardware design manual for more specific requirements on power supply voltage
 LTE-FDD B31/B72/B73 for BG95-M4 supports Power Class 2* (26 dBm) and Power Class 3 (23 dBm).

* means under development

BG95 Series Specifications 1

Cat M1/Cat NB2/EGPRS



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/-M6)

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 μ A @ 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-M6	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	B1/B2/B3/B4/B5/B8/ B12/B13/B18/B19/ B20/B25/B26/B27/ B28/B66/B85
	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	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	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 certifications in Europe and Latin America	All major global carriers/ depend on customers' requirements	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* (26 dBm) and Power Class 3 (23 dBm).

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	0.63	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	0.67	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)	Searching (Cold start)	71	mA
	Tracking (Instrument, GPS only)	55	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

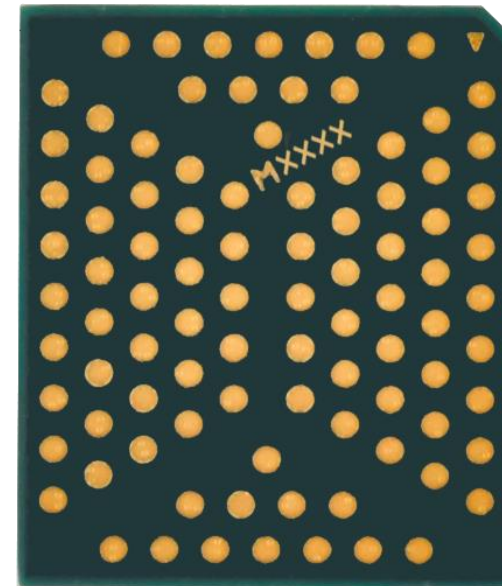
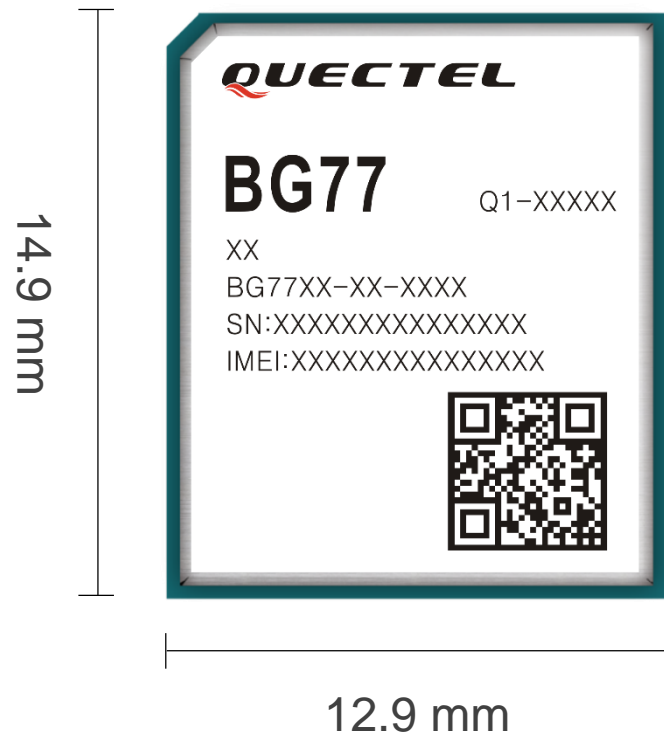
BG95 Series Main Functions

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 Driver*	Android 4.x/5.x/6.x/7.x/8.x/9.x/10.x
RIL Driver*	Android 4.x/5.x/6.x/7.x/8.x/9.x/10.x
SMS	Point-to-point MO and MT; SMS Cell Broadcast; Text and PDU Mode
Voice*	<ul style="list-style-type: none">• 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)



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 × 12.9 mm × 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

BG77 Specifications 1



14.9 mm × 12.9 mm × 1.7 mm

Cat M1/Cat NB2

Super Compact Size: 14.9 mm × 12.9 mm × 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)

* 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	1.61	mA
	e-I-DRX = 81.92 s @ PTW = 20.48 s, DRX = 2.56 s	0.61	mA
Sleep State (Under Cat NB1 network)	DRX = 1.28 s	1.54	mA
	e-I-DRX = 81.92 s @ PTW = 20.48 s, DRX = 2.56 s	0.66	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)	Searching (Cold start)	77	mA
	Tracking (Instrument, GPS only)	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

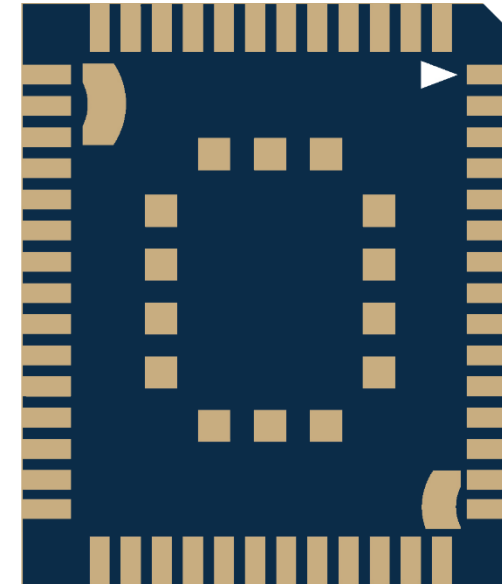
BG77 Main Functions

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 Driver*	Android 4.x/5.x/6.x/7.x/8.x/9.x/10.x
RIL Driver*	Android 4.x/5.x/6.x/7.x/8.x/9.x/10.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)



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	<ul style="list-style-type: none"> • 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 μ A @ 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

BG600L-M3 Specifications 1



18.7 mm × 16.0 mm × 2.1 mm

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)

** means under development*

BG600L-M3 Specifications 2



■ LTE Cat M1/Cat NB2/EGPRS Module

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

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)	3.97	μA
Sleep State (Under Cat M1 network)	DRX = 1.28 s	1.66	mA
	e-I-DRX = 81.92 s @ PTW = 20.48 s, DRX = 2.56 s	0.83	mA
Sleep State (Under Cat NB1 network)	DRX = 1.28 s	1.39	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	199	mA
	Data Transfer @ Real Network	59	mA
Active State (GNSS OFF) (under Cat NB1 network)	21 dBm @ Instrument	165	mA
	Data Transfer @ Real Network	47	mA
Active State (GNSS ON, LTE OFF)	Searching (Cold start)	68	mA
	Tracking (Instrument, GPS only)	54	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

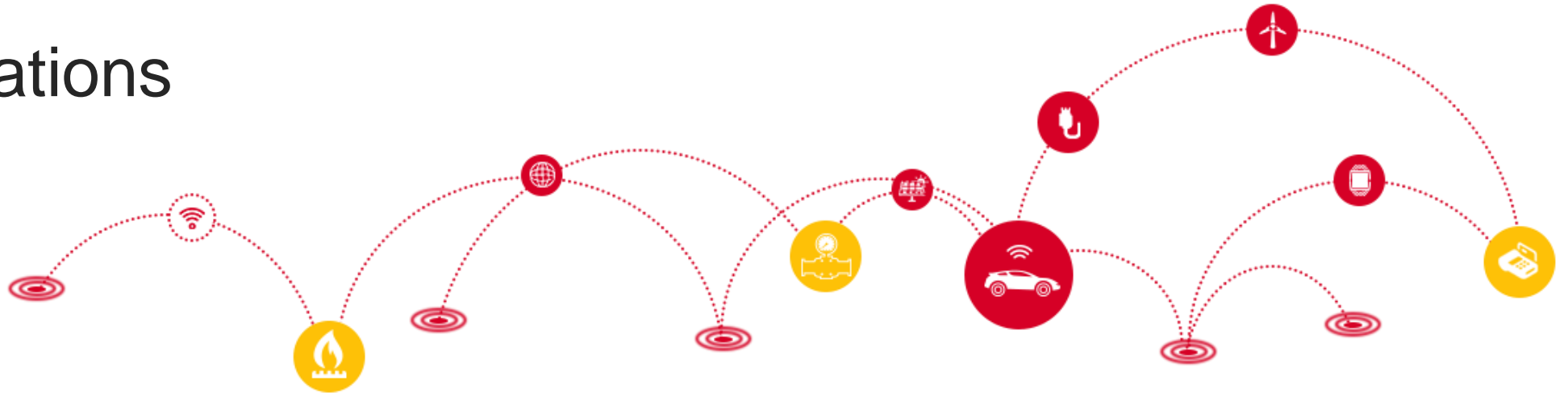
* means under development

BG600L-M3 Main Functions

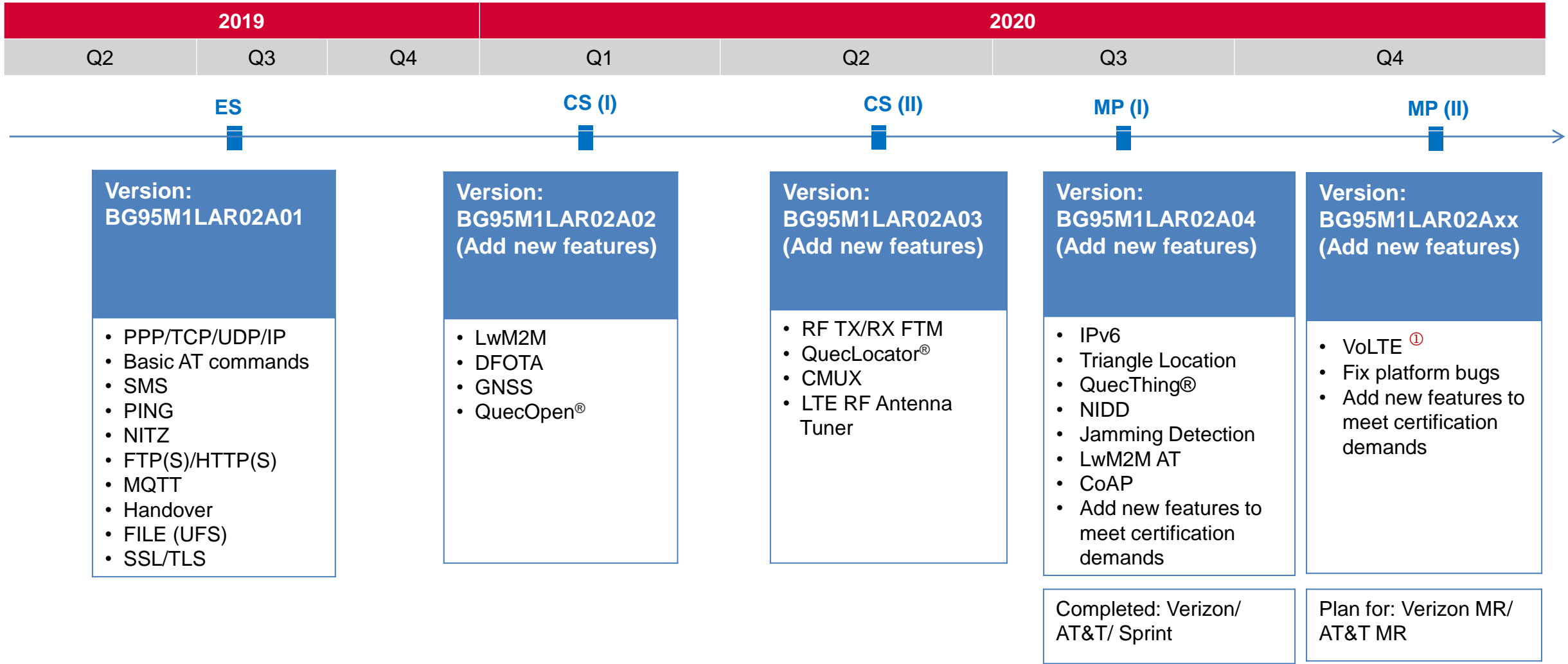
Function	Description
Protocols	PPP/ TCP/ UDP/ SSL/ TLS/ FTP(S)/ HTTP(S)/ MQTT/ CoAP/ IPv6
USB Serial Driver	Windows 7/8/8.1/10, Linux 2.6–5.4*, Android 4.x/5.x/6.x/7.x/8.x/9.x*
GNSS Driver*	Android 4.x/5.x/6.x/7.x/8.x/9.x/10.x
RIL Driver*	Android 4.x/5.x/6.x/7.x/8.x/9.x/10.x
SMS	Point-to-point MO and MT; SMS Cell Broadcast; Text and PDU Mode
Voice*	<ul style="list-style-type: none">• 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



① Based on market demands

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



Project Stage

BG95-M1 

Carrier Certifications

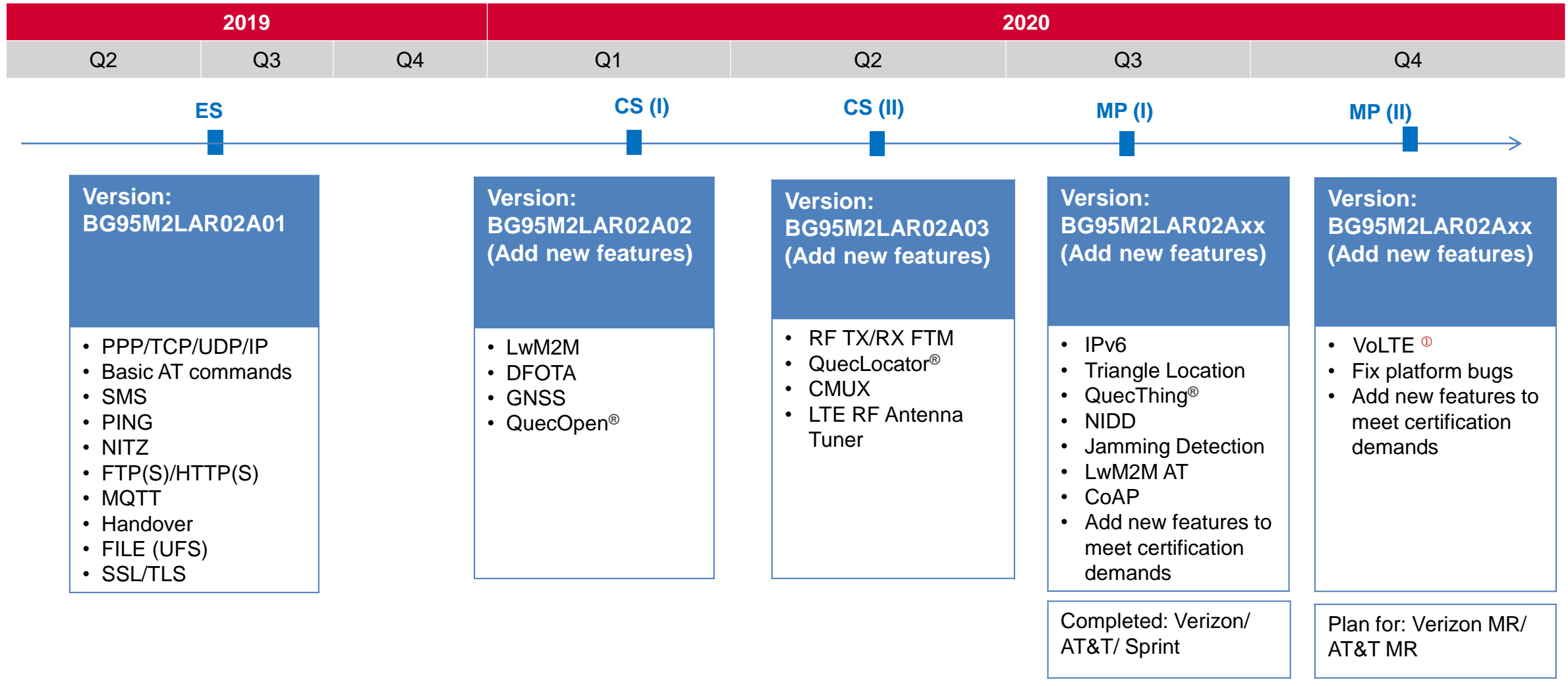
Verizon/ AT&T/ Sprint **Completed**

Regulatory Certification Schedule

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



BG95-M2 Development Schedule



① Based on market demands

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 Stage

BG95-M2 MP

Carrier Certification Schedule

Verizon/ AT&T/ Sprint **Completed**

Vodafone ● —————→
Start (Planned) Complete (Planned)

T-Mobile ● ————→

Rogers/Telus ● ————→

Deutsche Telekom/ Telefónica/ China Telecom/ China Mobile/ China Unicom **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 (2)



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

Regulatory Certification Schedule

GCF/ CE/ PTCRB/ FCC/ IC/ Anatel/ IFETEL/ RCM

Completed

JATE/TELEC



ATEX

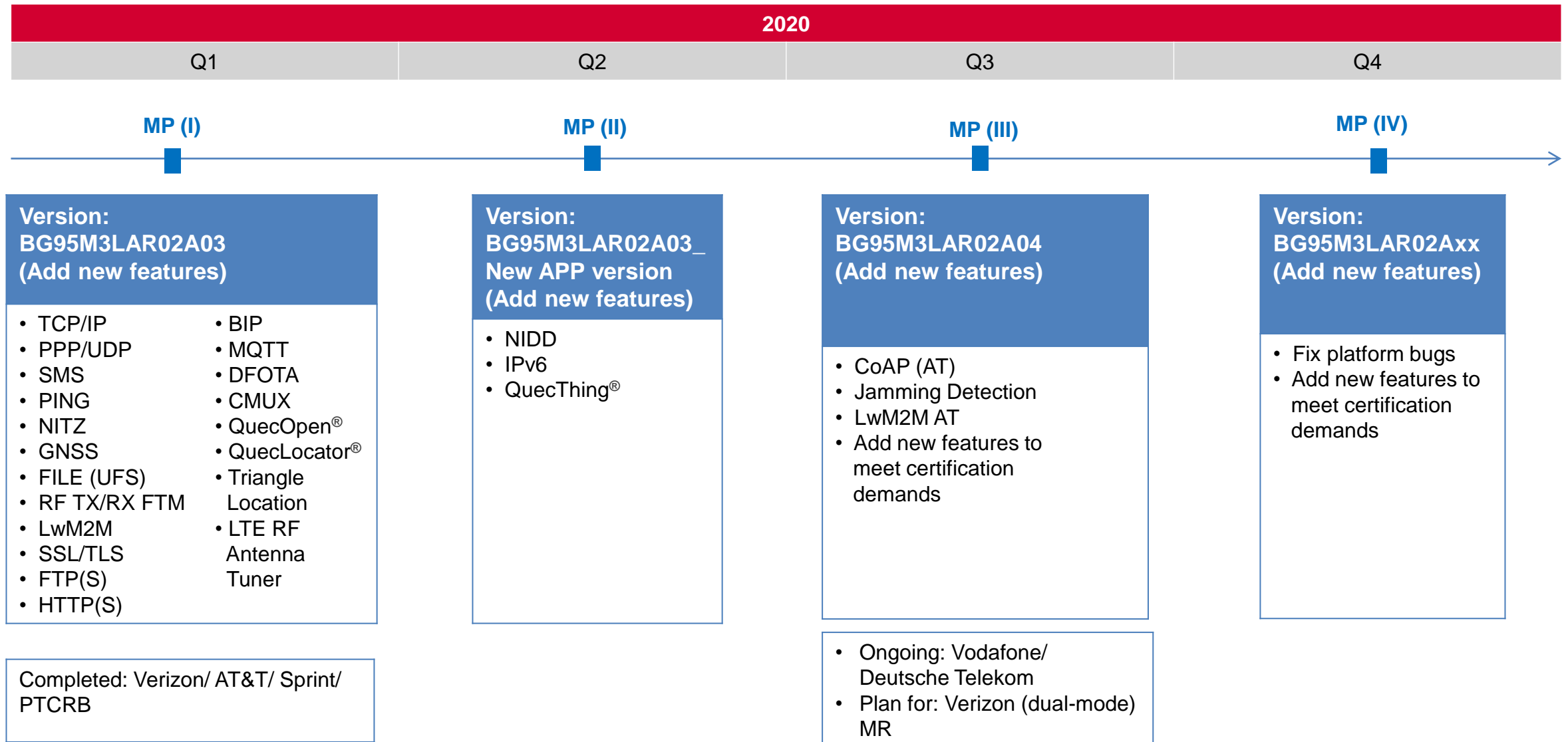


SRRC/ NAL/ CCC/ KC/ NCC/ NBTC/ IMDA

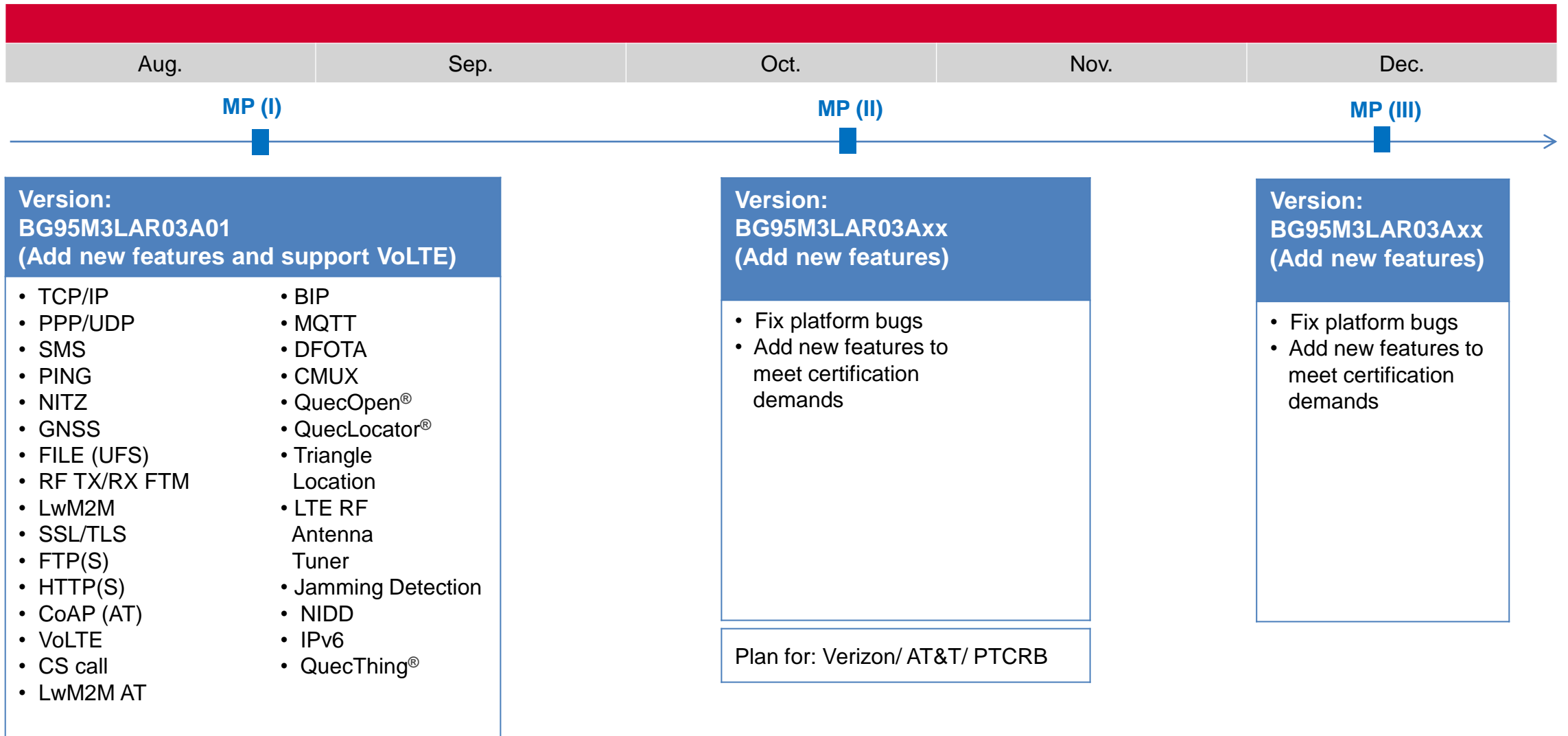
TBD

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 (R02Axx)



BG95-M3 Development Schedule (R03Axx with VoLTE)



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

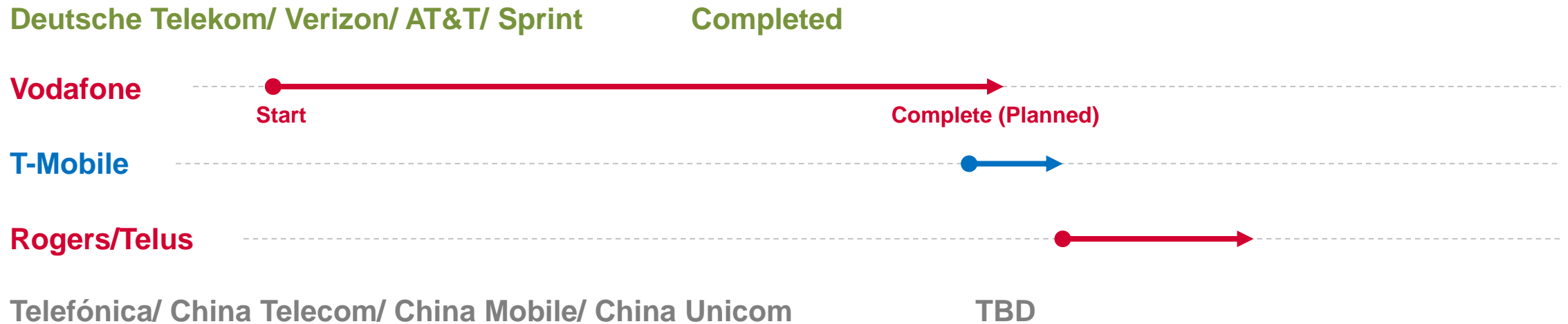
BG95-M3 Timeline (1)

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



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/ IFETEL/ RCM/ PEN

Completed

CCC



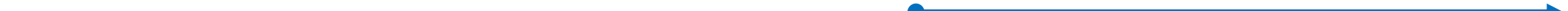
Start (Planned)

Complete (Planned)

JATE/TELEC



ATEX

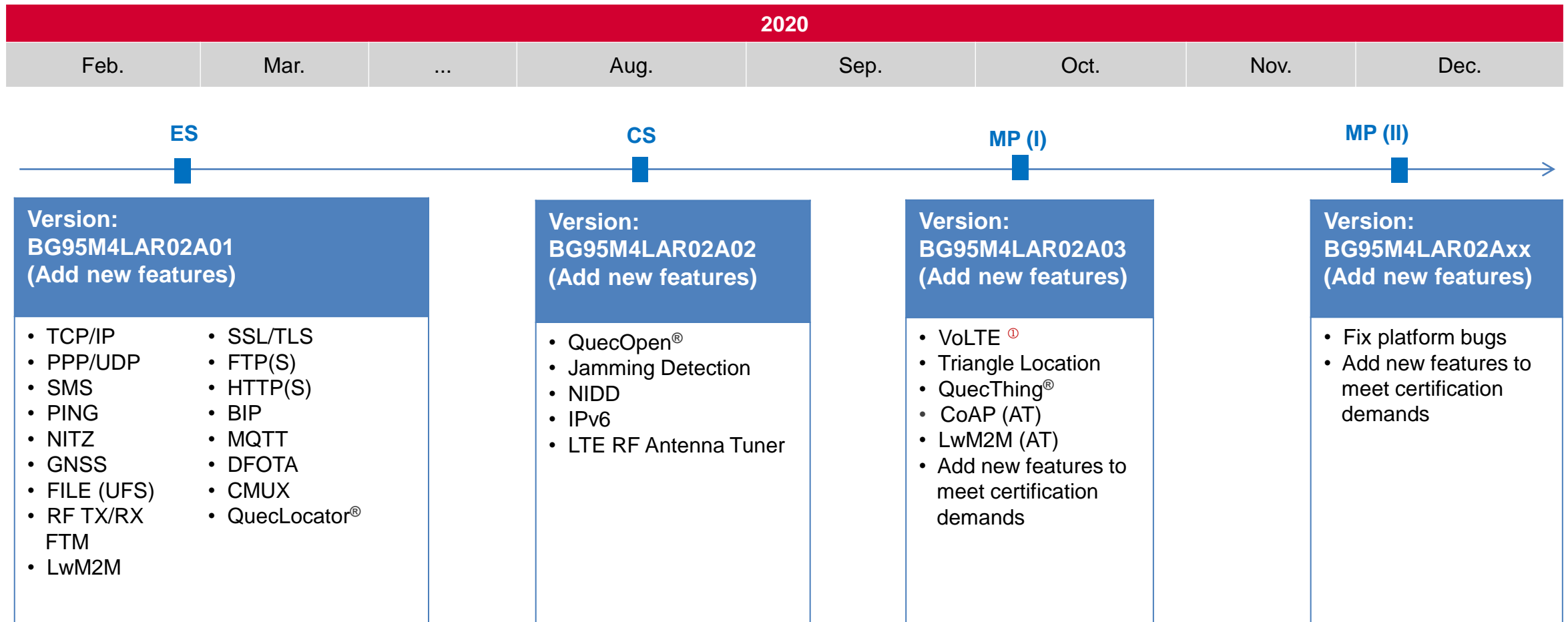


SRRC/ NAL/ KC/ NCC/ NBTC/ IMDA

TBD

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

BG95-M4 Development Schedule



① Based on market demands

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

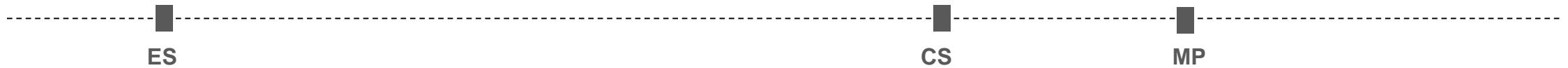
BG95-M3 is the main variant to be developed, and BG95-M4 will leverage the development functions of BG95-M3.

BG95-M4 Timeline

2020

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

Project Schedule



ES: 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.

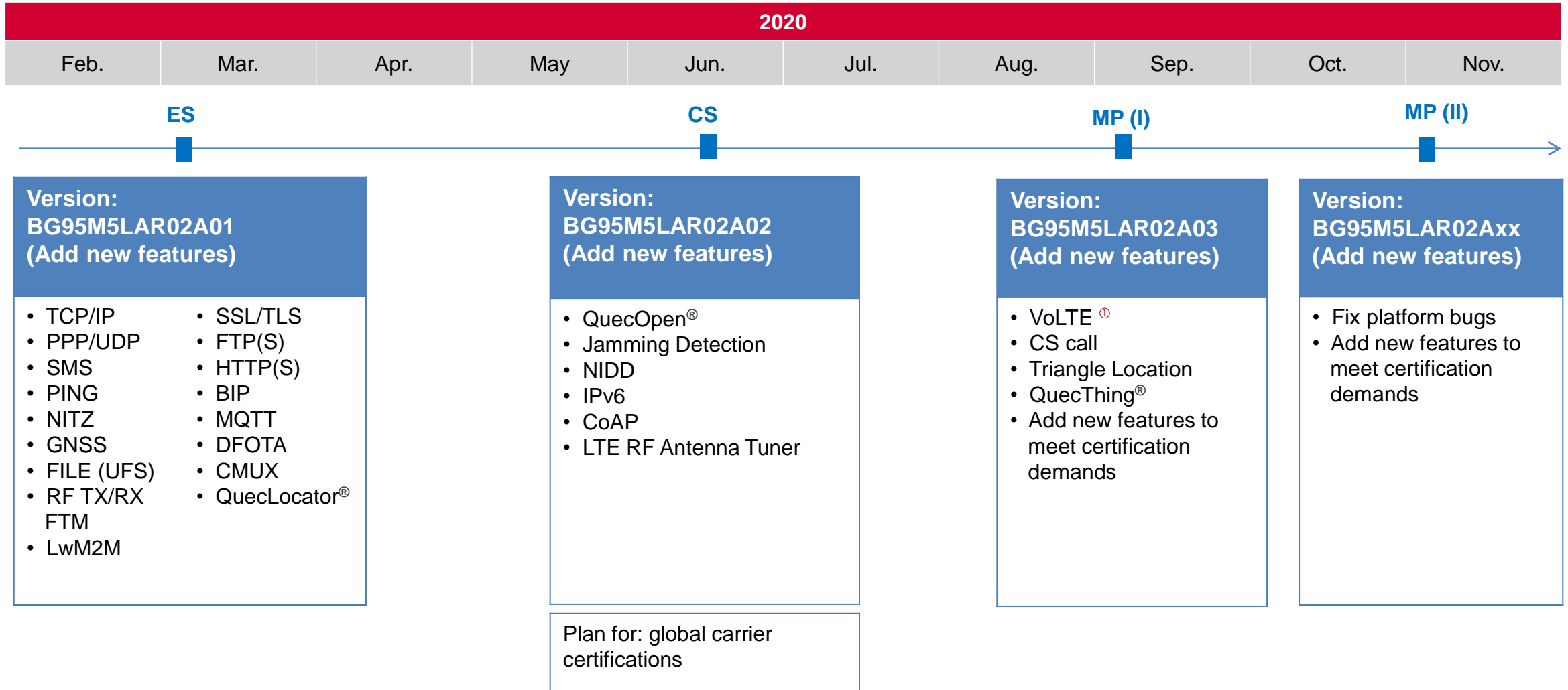
MP: Hardware and software ready for mass production. For certification status, please refer to the "certification schedule".

Regulatory Certification Schedule



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



① Based on market demands

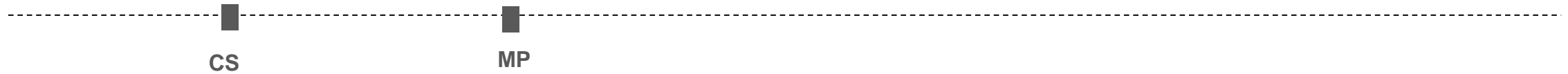
The timeline may be adjusted according to the actual development status.

BG95-M3 is the main variant to be developed, and BG95-M5 will leverage the development functions of BG95-M3.

BG95-M5 Timeline (1)

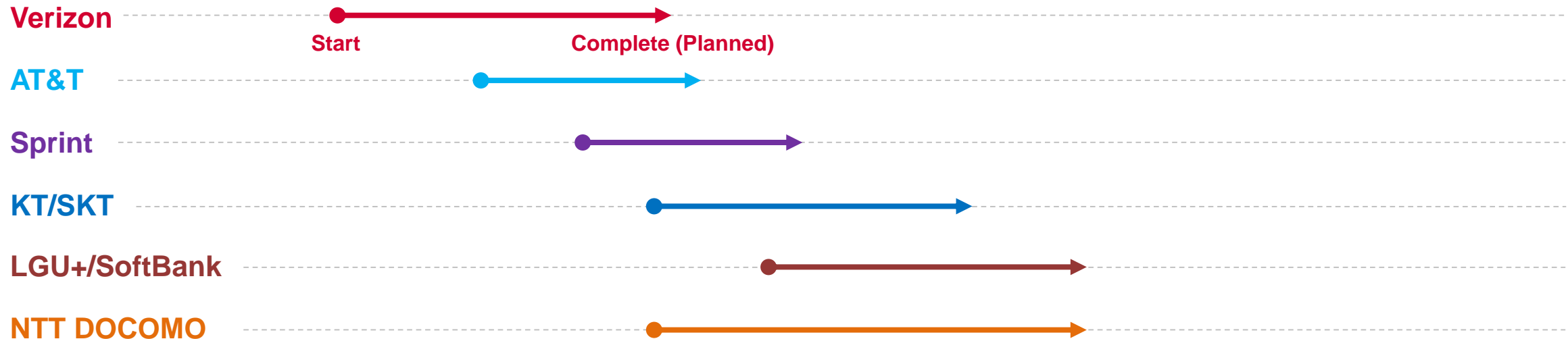


Project Schedule



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

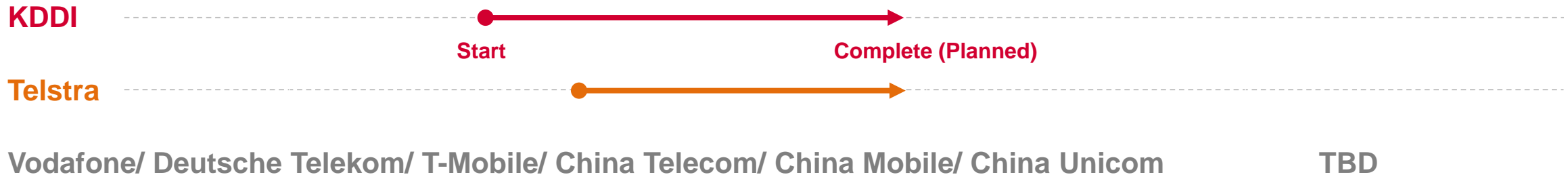


The timeline may be adjusted according to the maturity of Qualcomm baseline.
BG95-M5 will leverage some test results of BG95-M3. Version: 1.6 | Status: Released

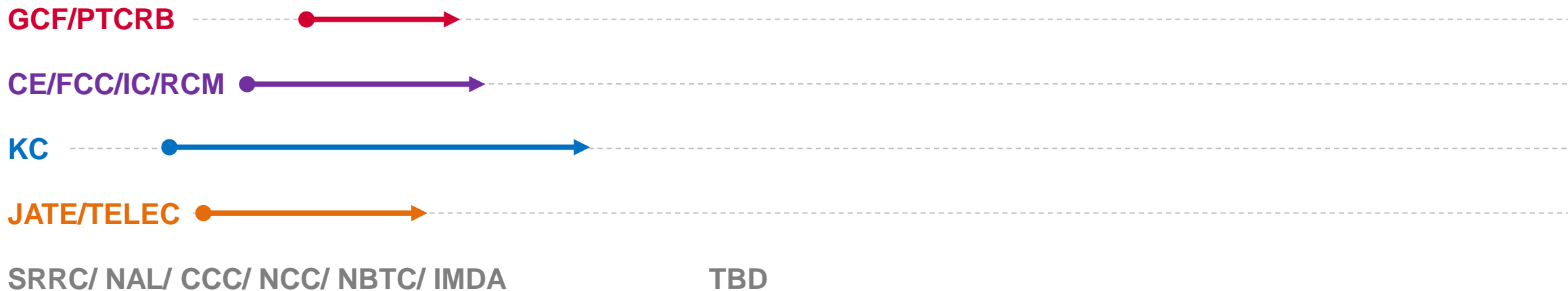
BG95-M5 Timeline (2)



Carrier Certification Schedule

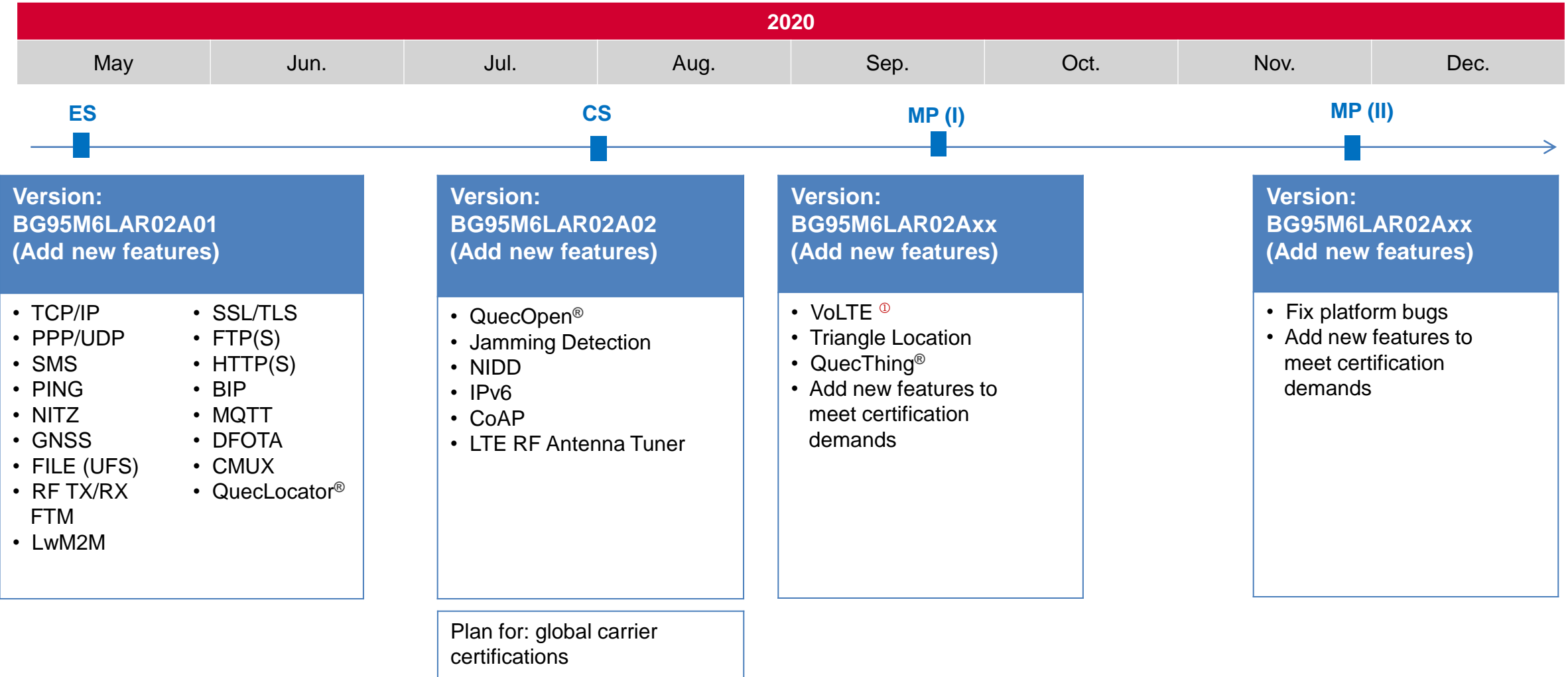


Regulatory Certification Schedule



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

BG95-M6 Development Schedule



^① Based on market demands

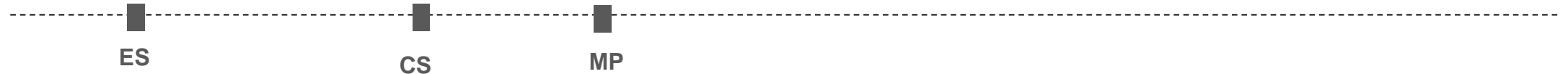
The timeline may be adjusted according to the actual development status.

BG95-M3 is the main variant to be developed, and BG95-M6 will leverage the development functions of BG95-M3.

BG95-M6 Timeline (1)

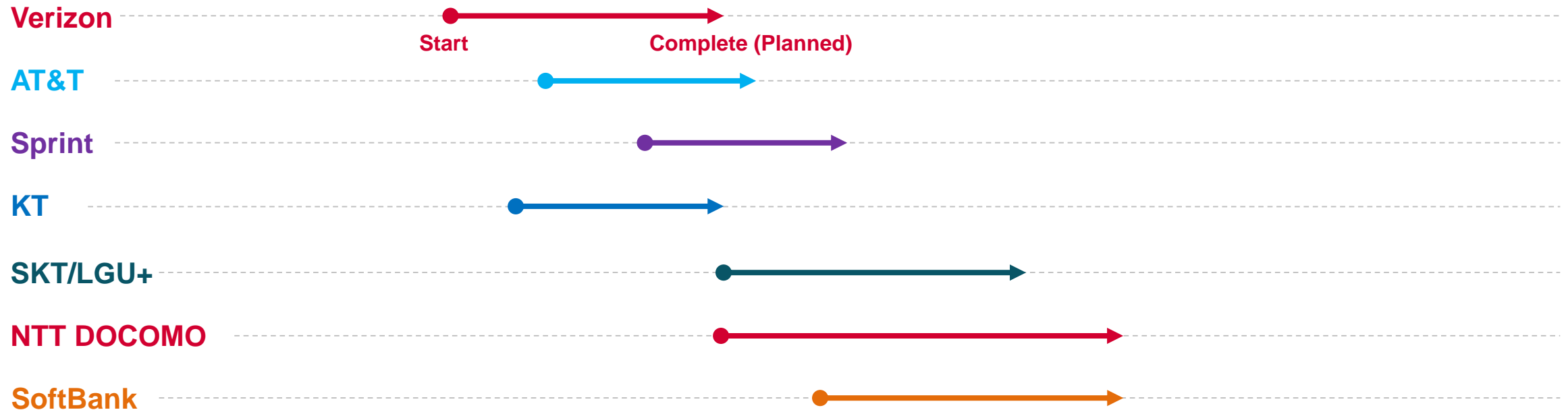


Project Schedule



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



The timeline may be adjusted according to the maturity of Qualcomm baseline.
 BG95-M6 will leverage some test results of BG95-M3. Version: 1.6 | Status: Released

BG95-M6 Timeline (2)



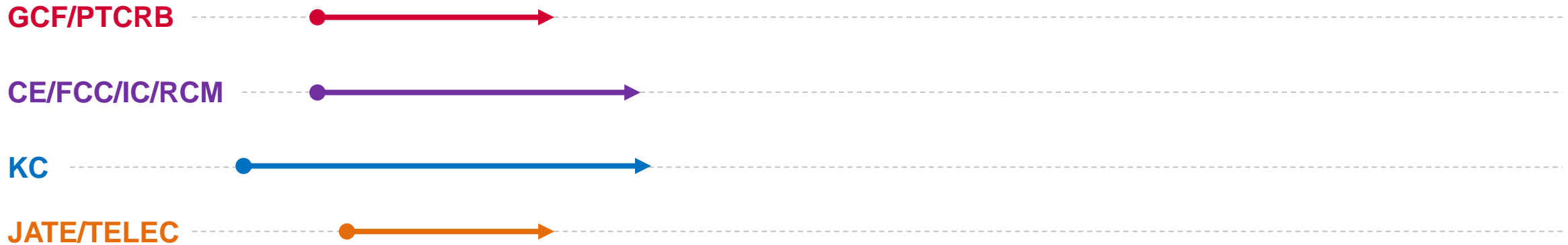
2020										2021					
Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.

Carrier Certification Schedule



Vodafone/ Deutsche Telekom/ T-Mobile/ China Telecom/ China Mobile/ China Unicom TBD

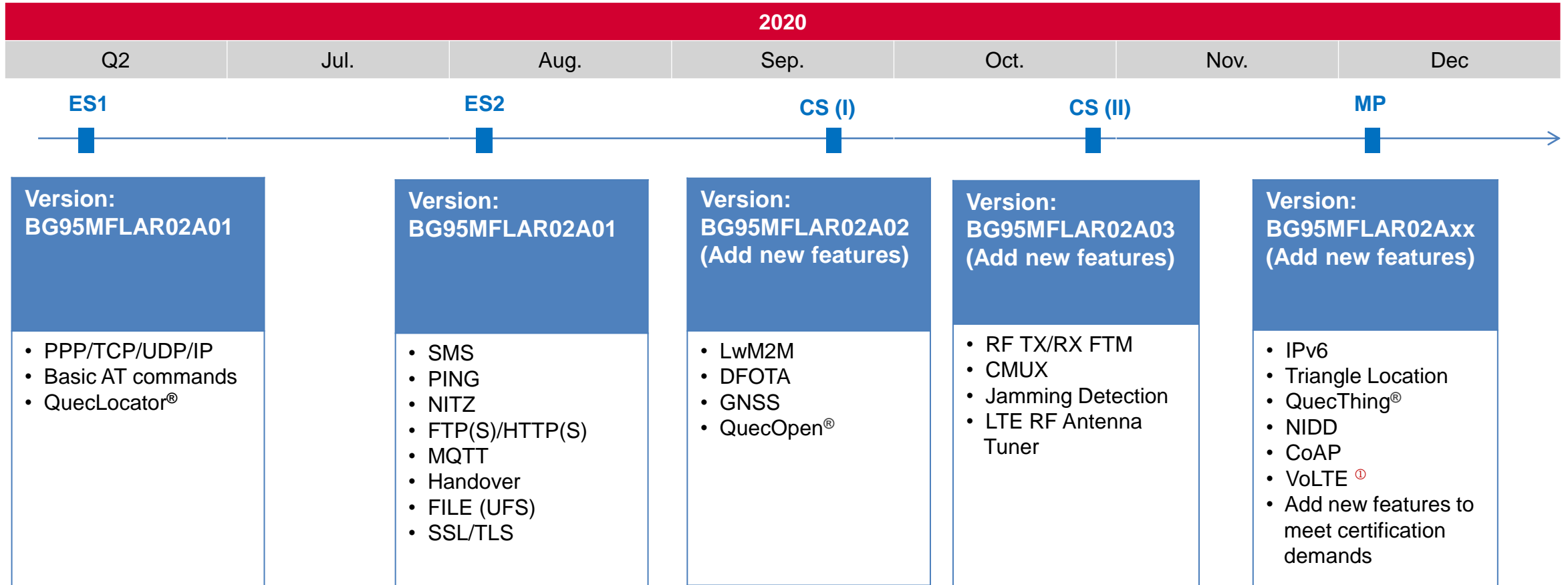
Regulatory Certification Schedule



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

The timeline may be adjusted according to the maturity of Qualcomm baseline. BG95-M6 will leverage some test results of BG95-M3. Version: 1.6 | Status: Released

BG95-MF Development Schedule



① Based on market demands

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

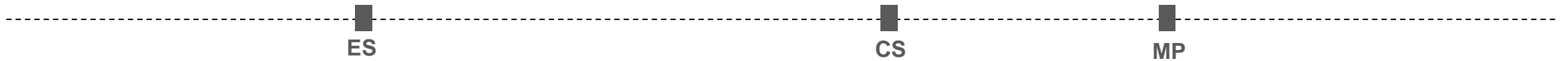
BG95-M3 is the main variant to be developed, and BG95-MF will leverage the development functions of BG95-M3.

BG95-MF Timeline



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

Project Schedule

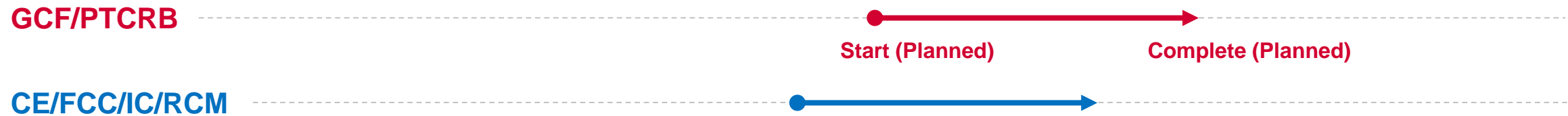


ES: Engineering samples ready. Basic functions are available for customers' simple demo purpose.

CS: Commercial samples ready. Stable hardware design and quite stable software design. New software features can be added upon request.

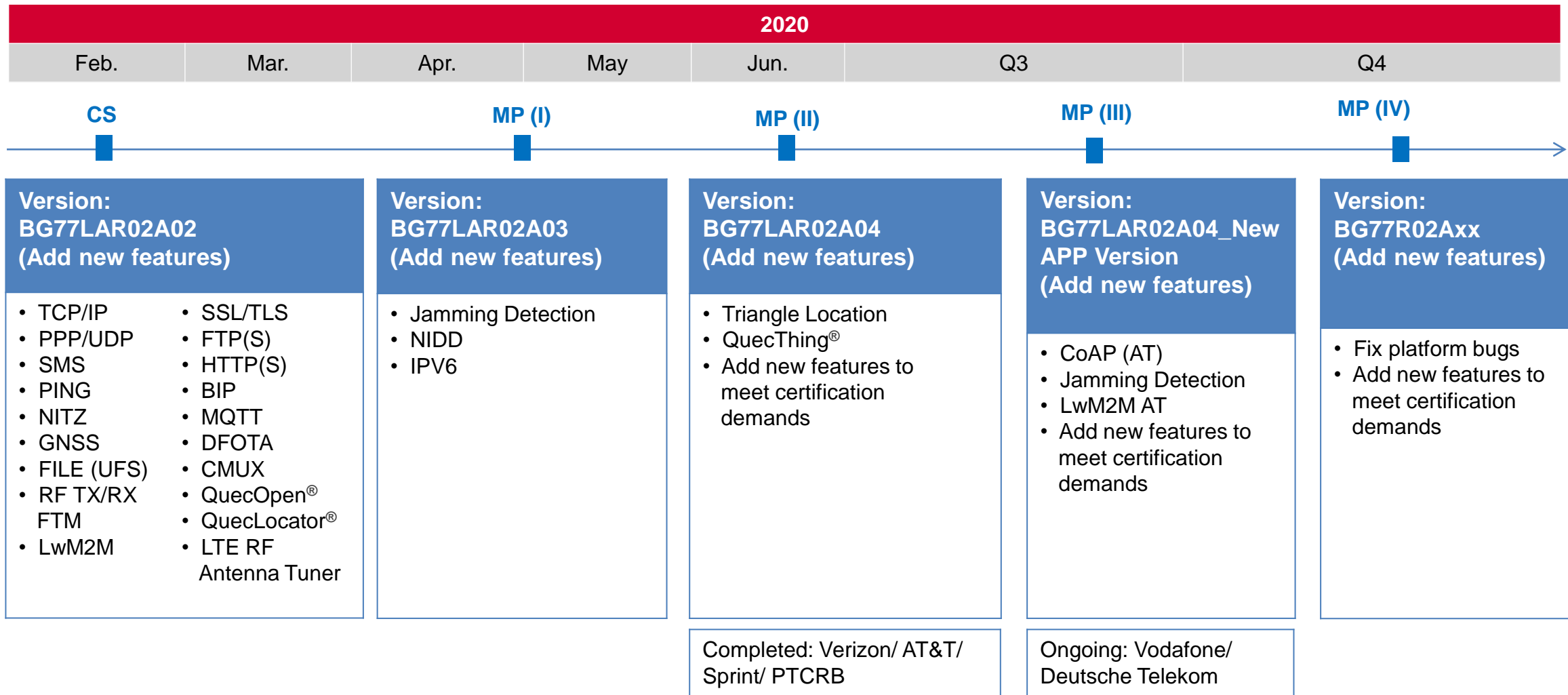
MP: Hardware and software ready for mass production. For certification status, please refer to the "certification schedule".

Regulatory Certification Schedule



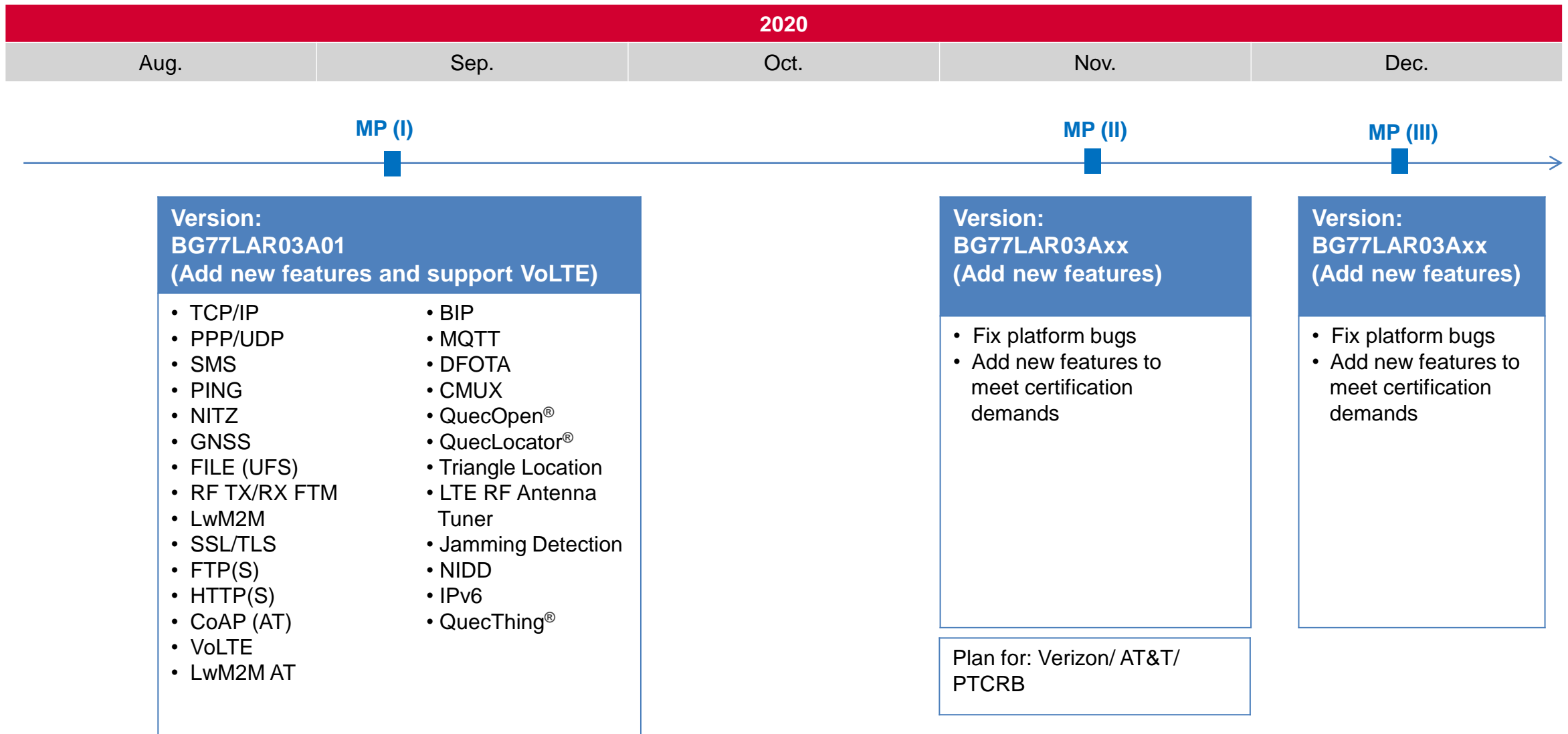
The timeline may be adjusted according to the maturity of Qualcomm baseline. BG95-MF will leverage some test results of BG95-M3.

BG77 Development Schedule (R02Axx)



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

BG77 Development Schedule (R03Axx with VoLTE)



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

BG77 Timeline (1)

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

Project Stage

BG77 MP

Carrier Certification Schedule

Verizon/ AT&T/ Sprint

Completed

Vodafone

Start

Complete (Planned)

Deutsche Telekom

T-Mobile

China Mobile/ China Telecom/ China Unicom

TBD

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

BG77 Timeline (2)



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

Regulatory Certification Schedule

GCF/ CE/ PTCRB/ FCC/ IC/ JATE/ TELEC/ RCM

Completed

NCC



Start

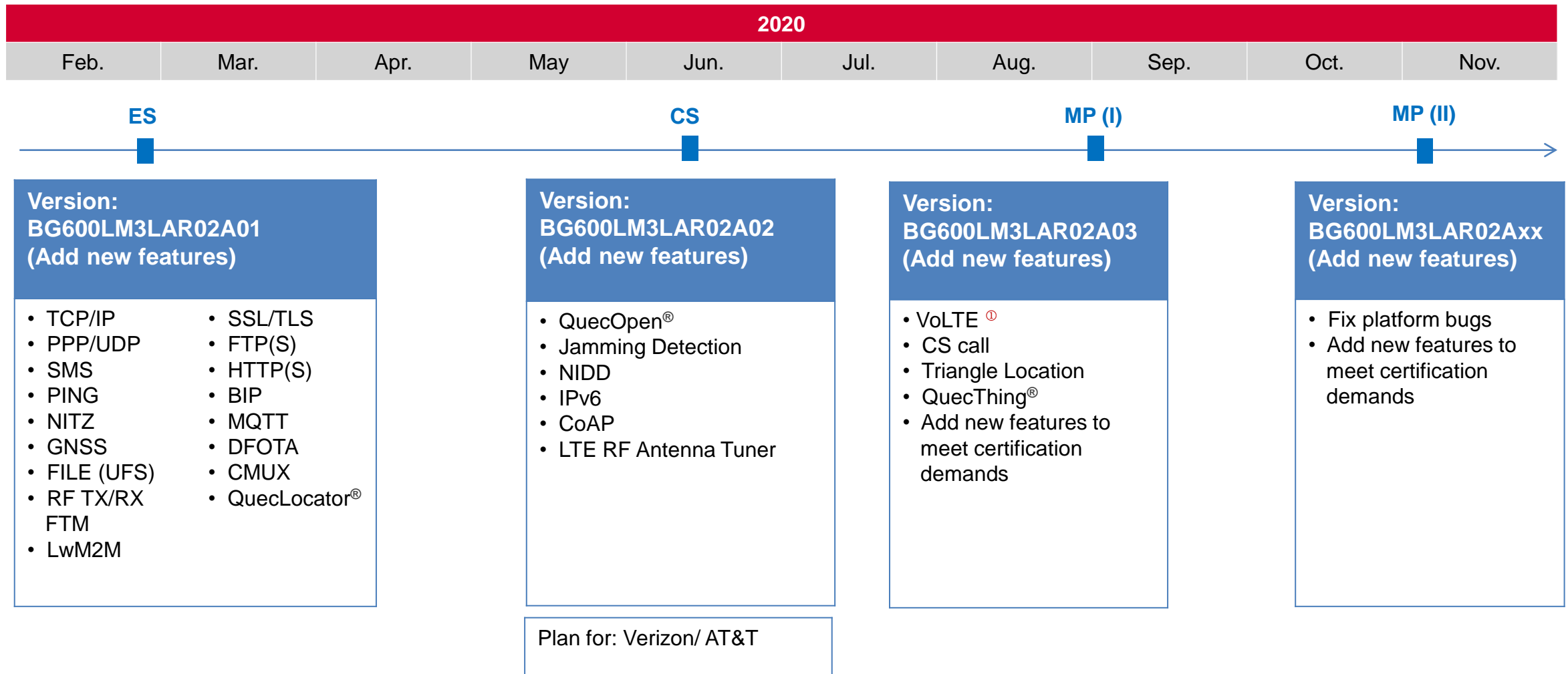
Complete (Planned)

SRRC/ NAL/ CCC/ KC/ NBTC

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

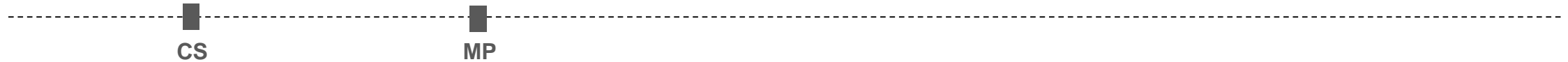


① Based on market demands
 The timeline may be adjusted according to the actual development status.

BG600L-M3 Timeline (1)

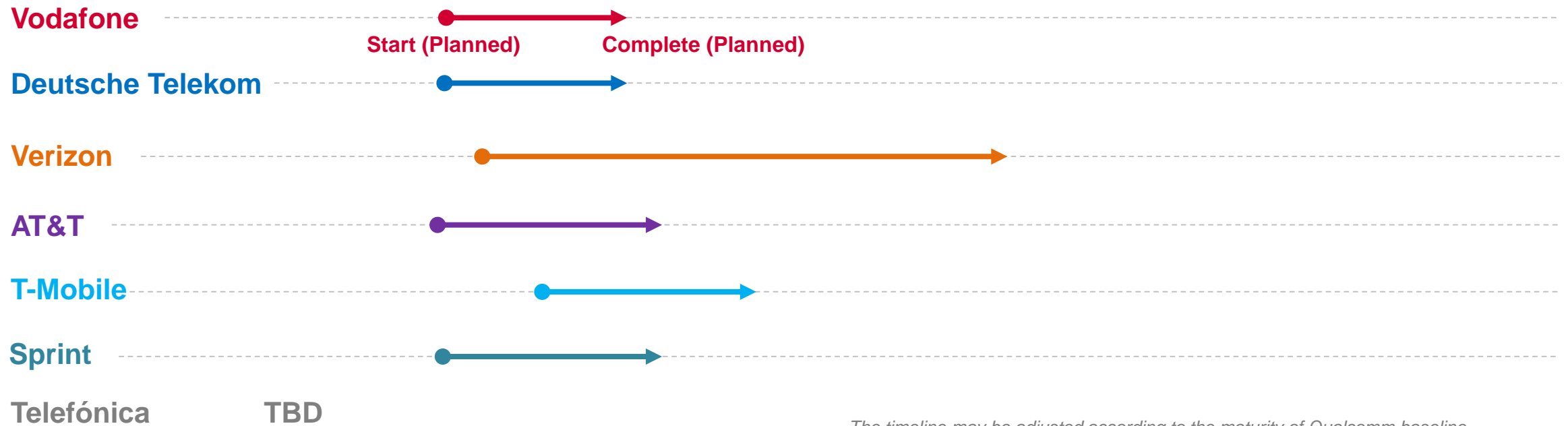


Project Schedule



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



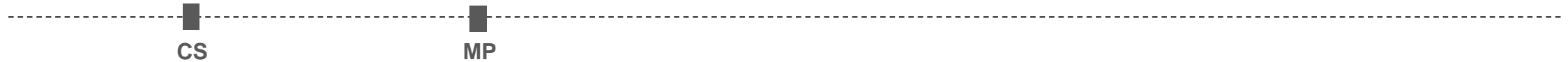
The timeline may be adjusted according to the maturity of Qualcomm baseline. BG600L-M3 will leverage some test results of BG95-M3. Version: 1.6 | Status: Released

BG600L-M3 Timeline (2)



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

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".*

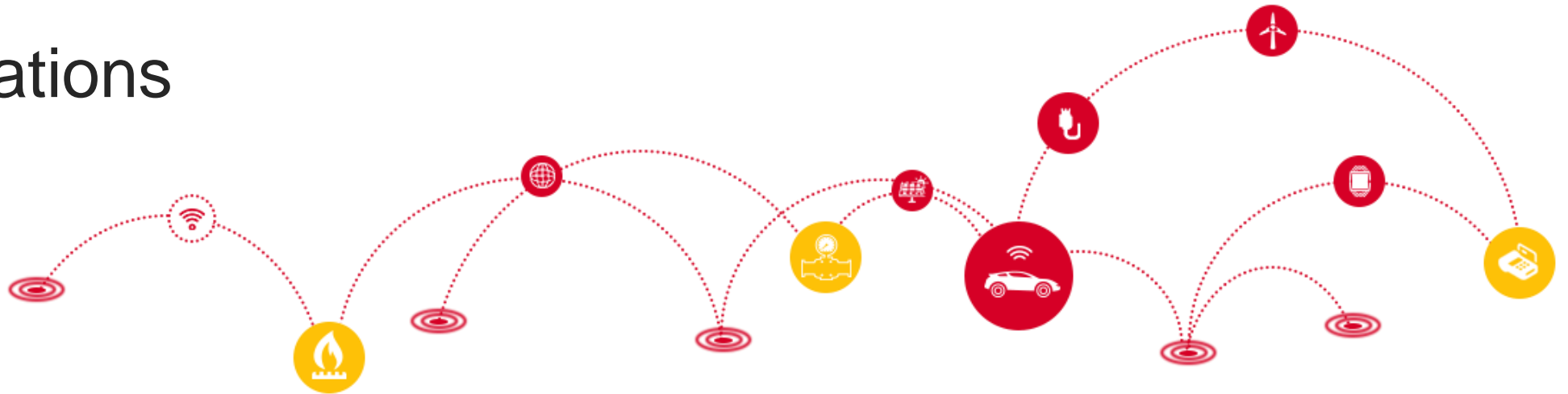
Regulatory Certification Schedule

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

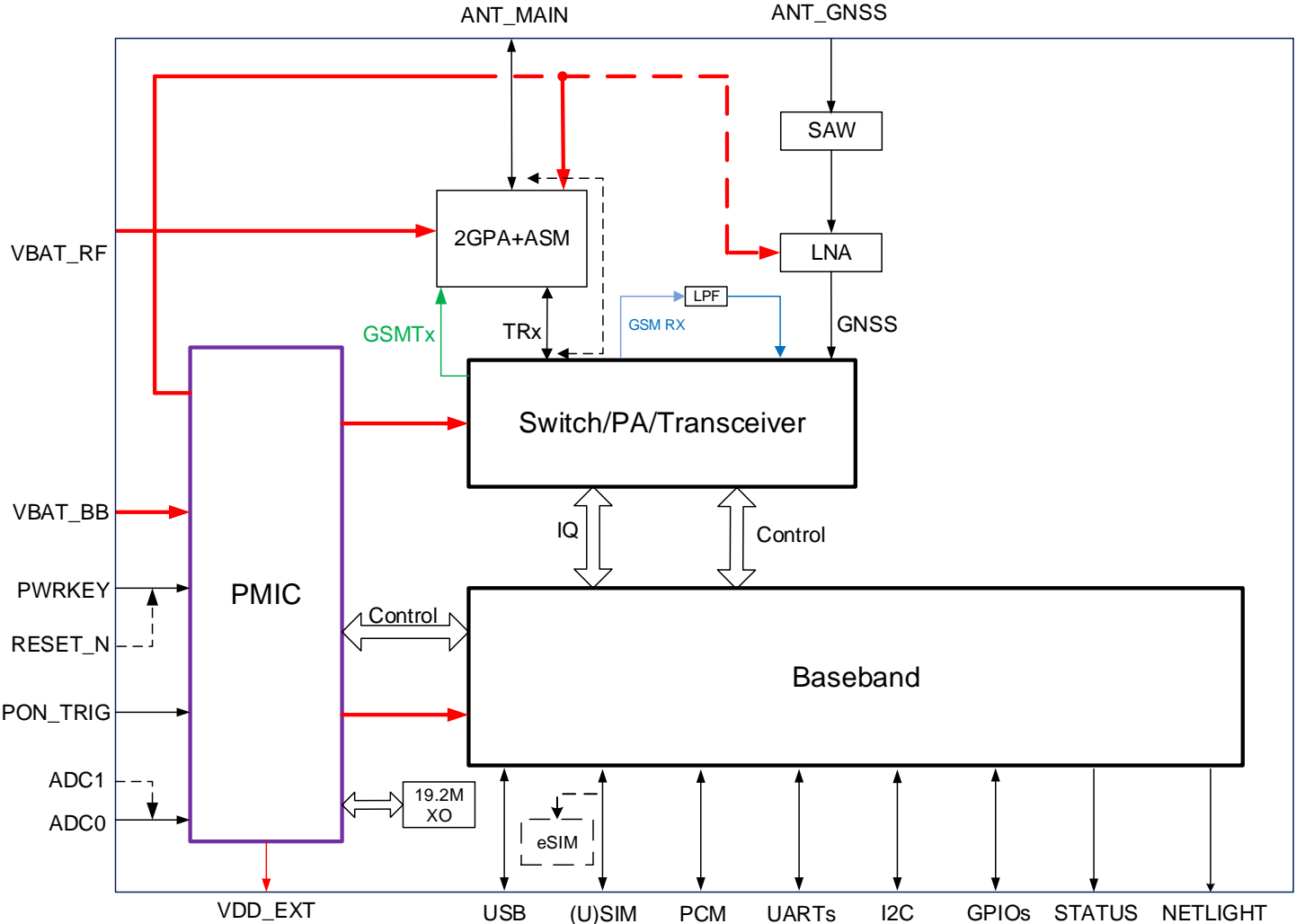
CCC TBD

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



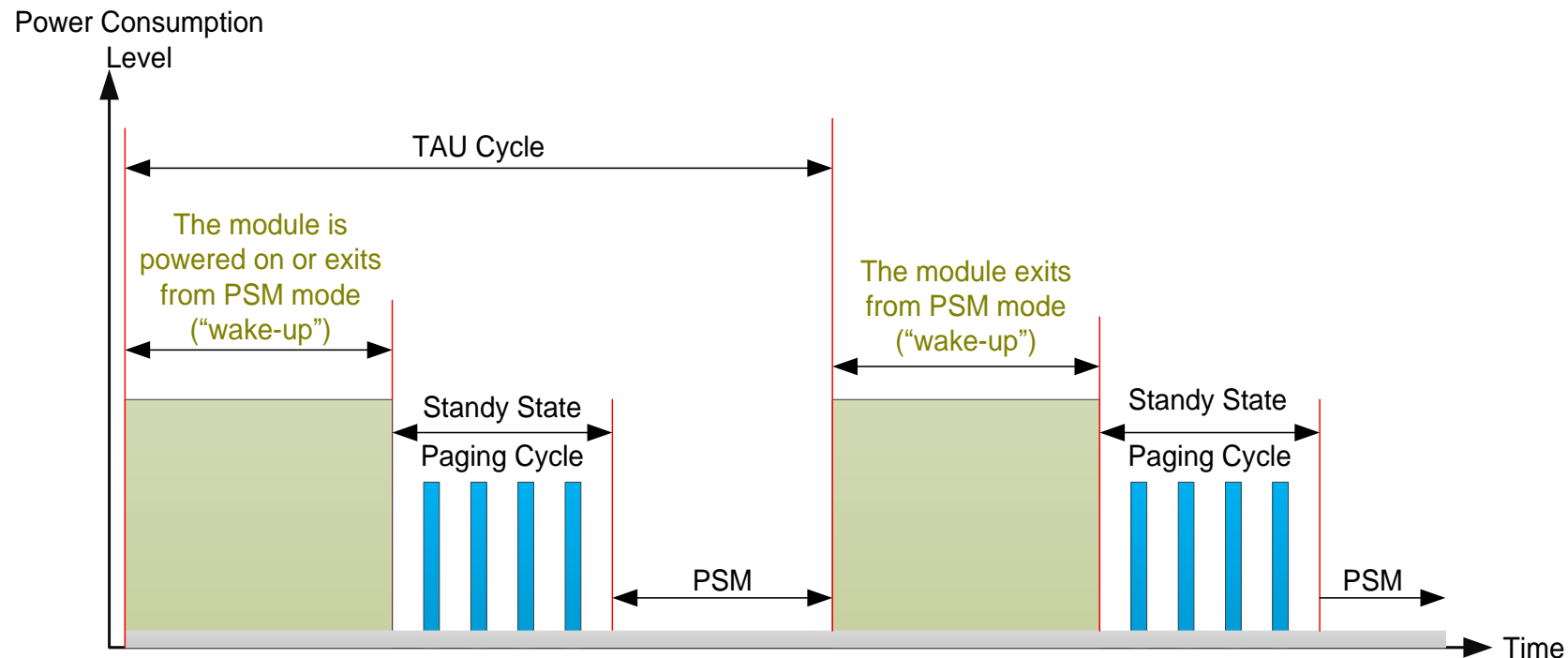
Take BG95-M3 as an example.

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.

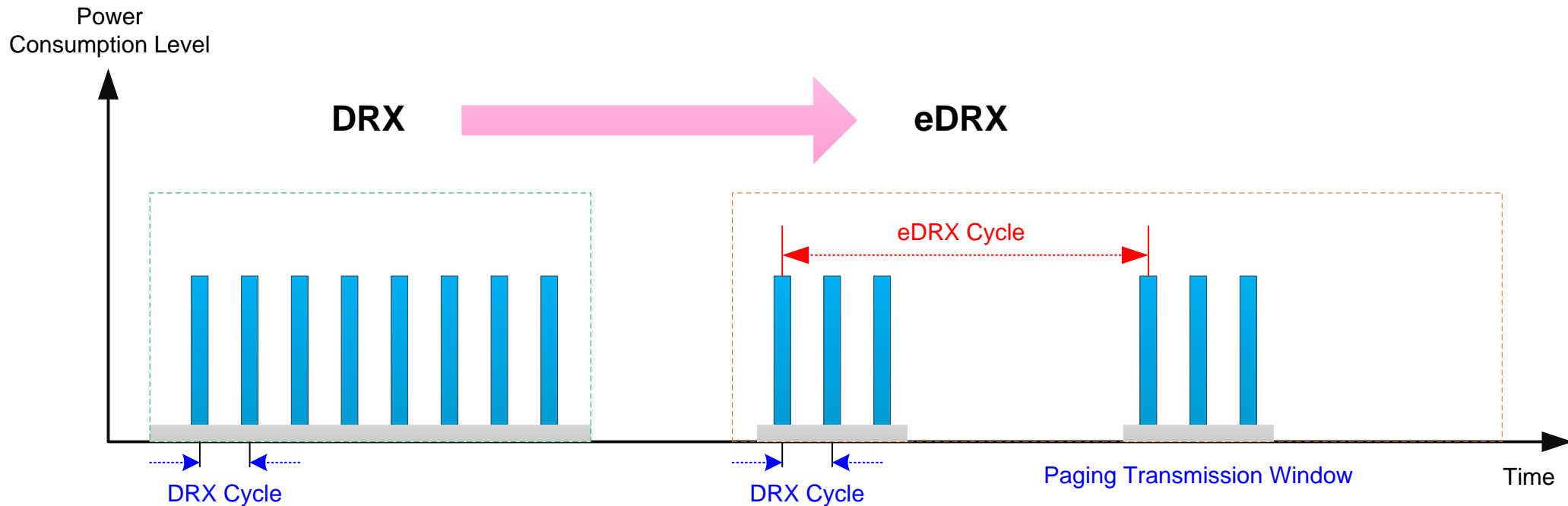


Key Technologies 2 - e-I-DRX

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.

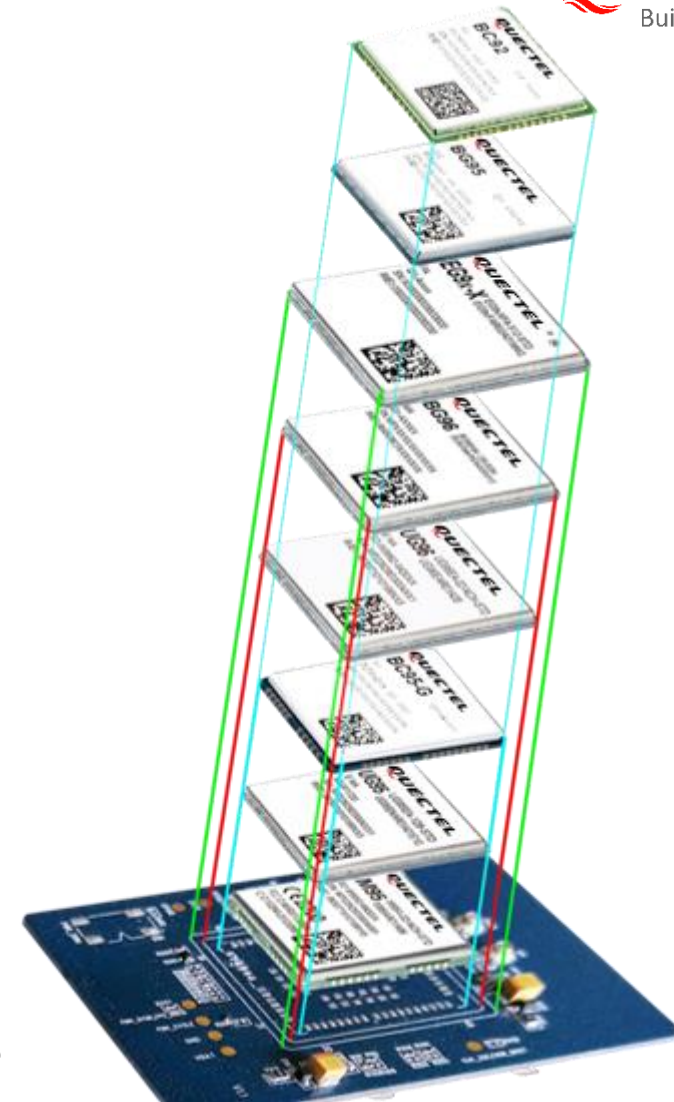
The following figure illustrates the DRX and e-I-DRX cycle of the module.



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



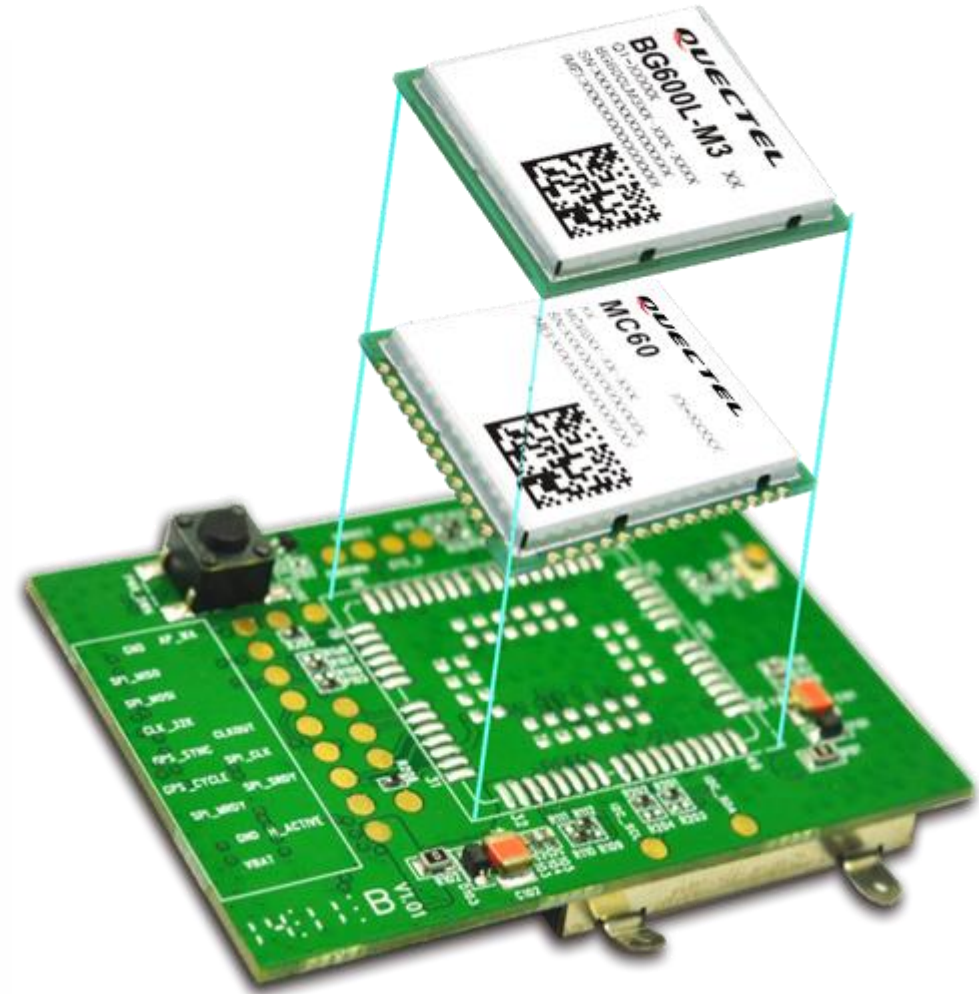
NOTES: 1. The compatibility diagram shown above is for illustration purpose only. The actual appearance of the modules may be different.

2. In the figure above, EG9x-X refers to EG95 and EG91.

BG600L-M3 Layout Compatibility

BG600L-M3 is compatible with

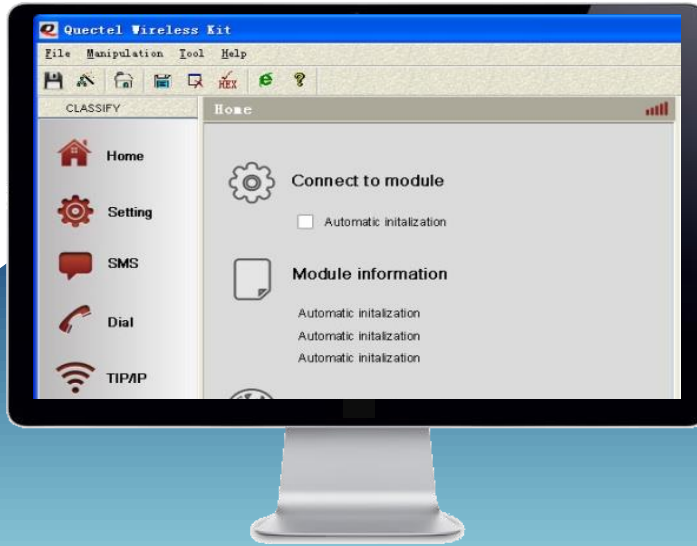
- Quectel GSM/GPRS/GNSS module MC60



*The compatibility diagram shown above is for illustration purpose only.
The actual label design of the modules may be different.*

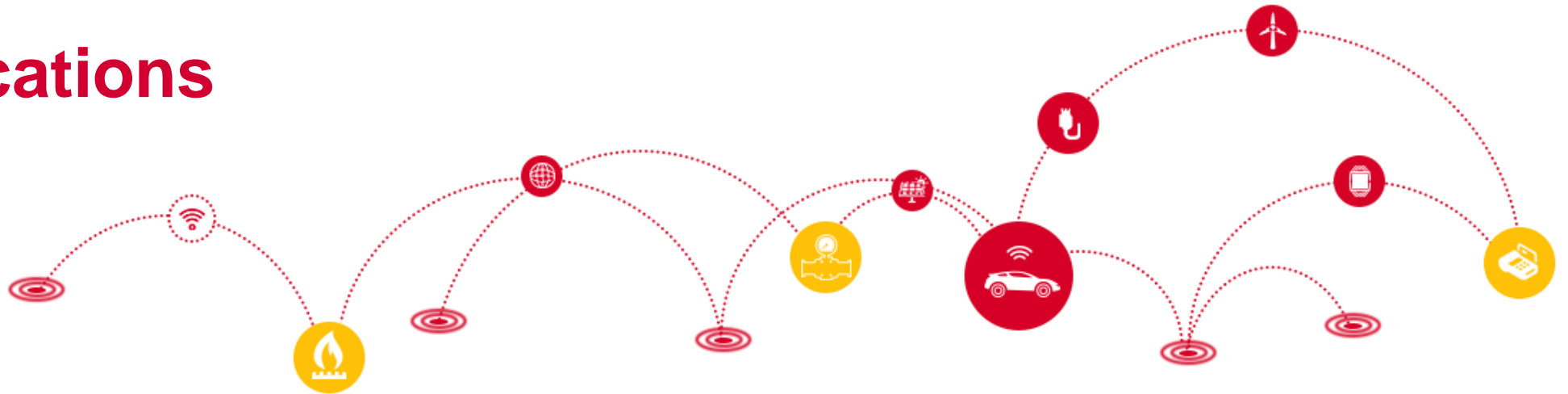
Quick Start

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

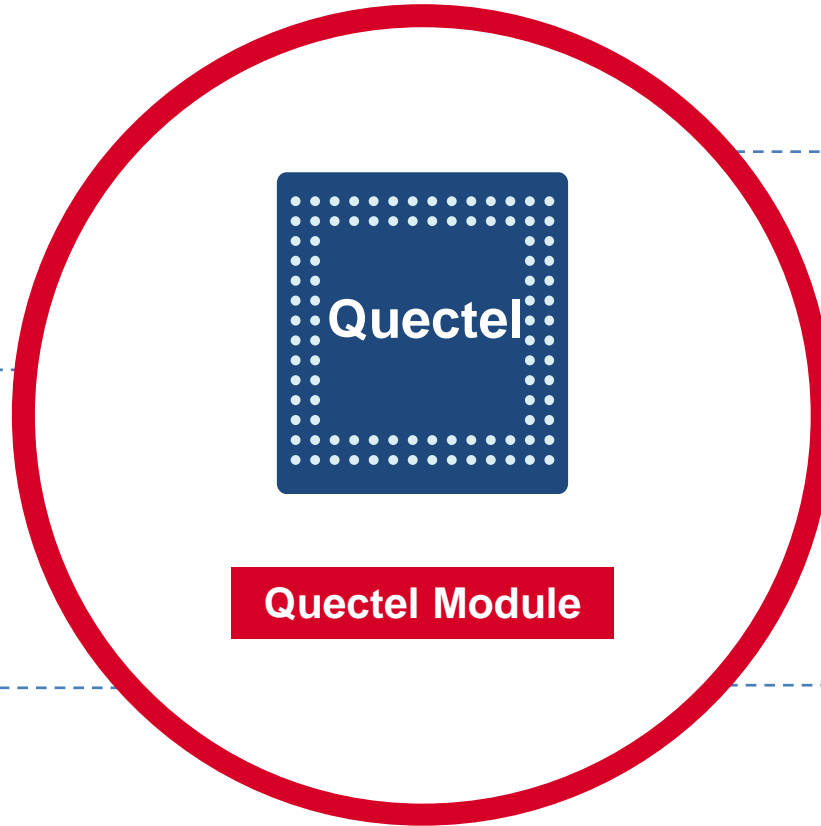


Public Utilities

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

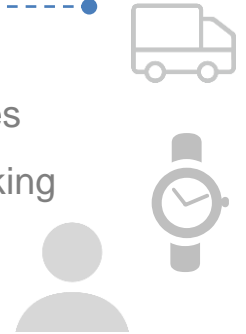
Industry & Agriculture

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



Smart Life

- Asset Tracking
- Wearable Devices
- Person/Pet Tracking



Smart Home

- Intelligent Door Lock
- Intelligent Control



Public Utilities – Smart Metering

By 2024, there will be
1.9 billion
connected meters ^①

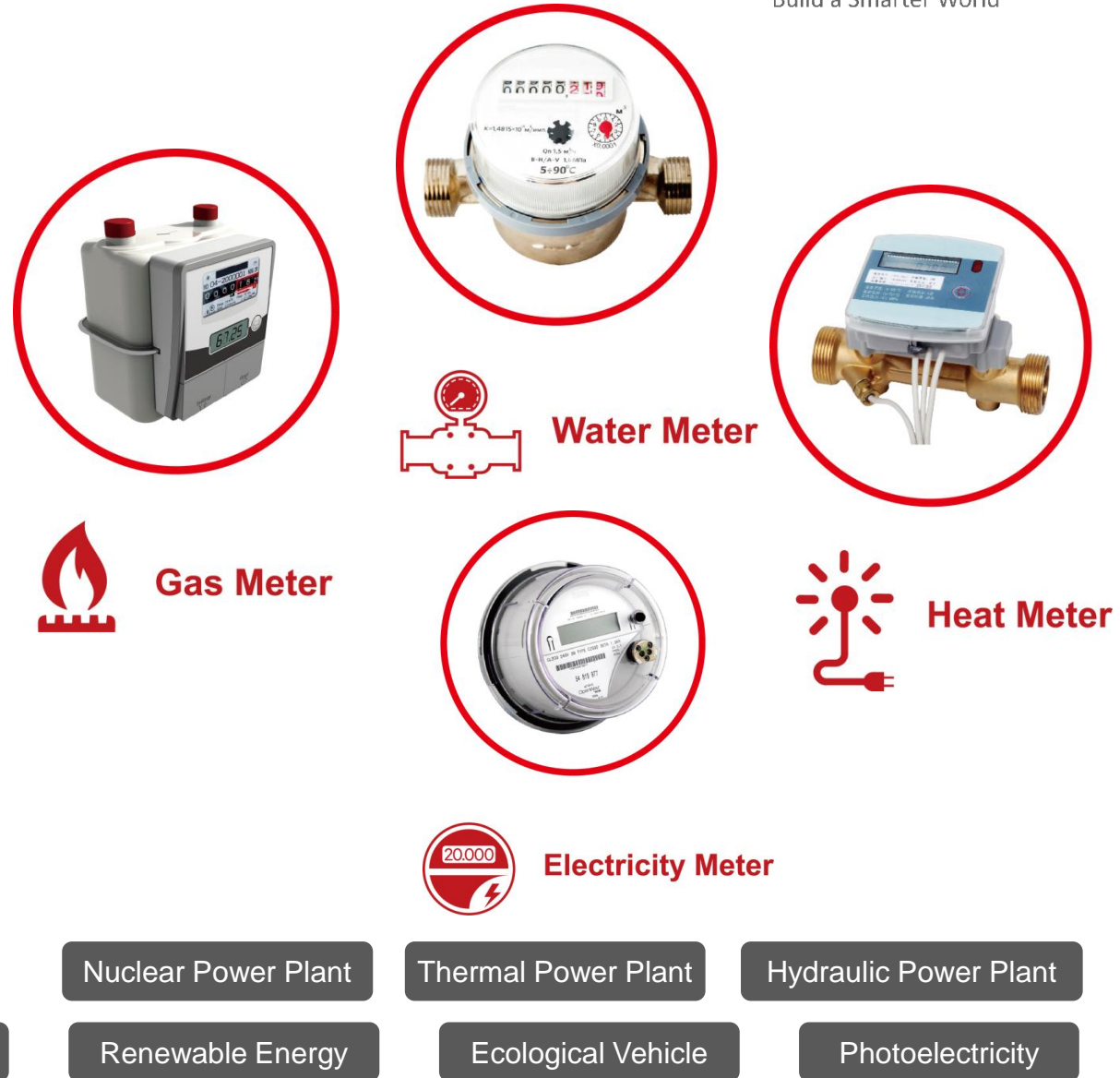


Domestic Meters

Wind Power Plant

Factory

Workplace



Nuclear Power Plant

Thermal Power Plant

Hydraulic Power Plant

Renewable Energy

Ecological Vehicle

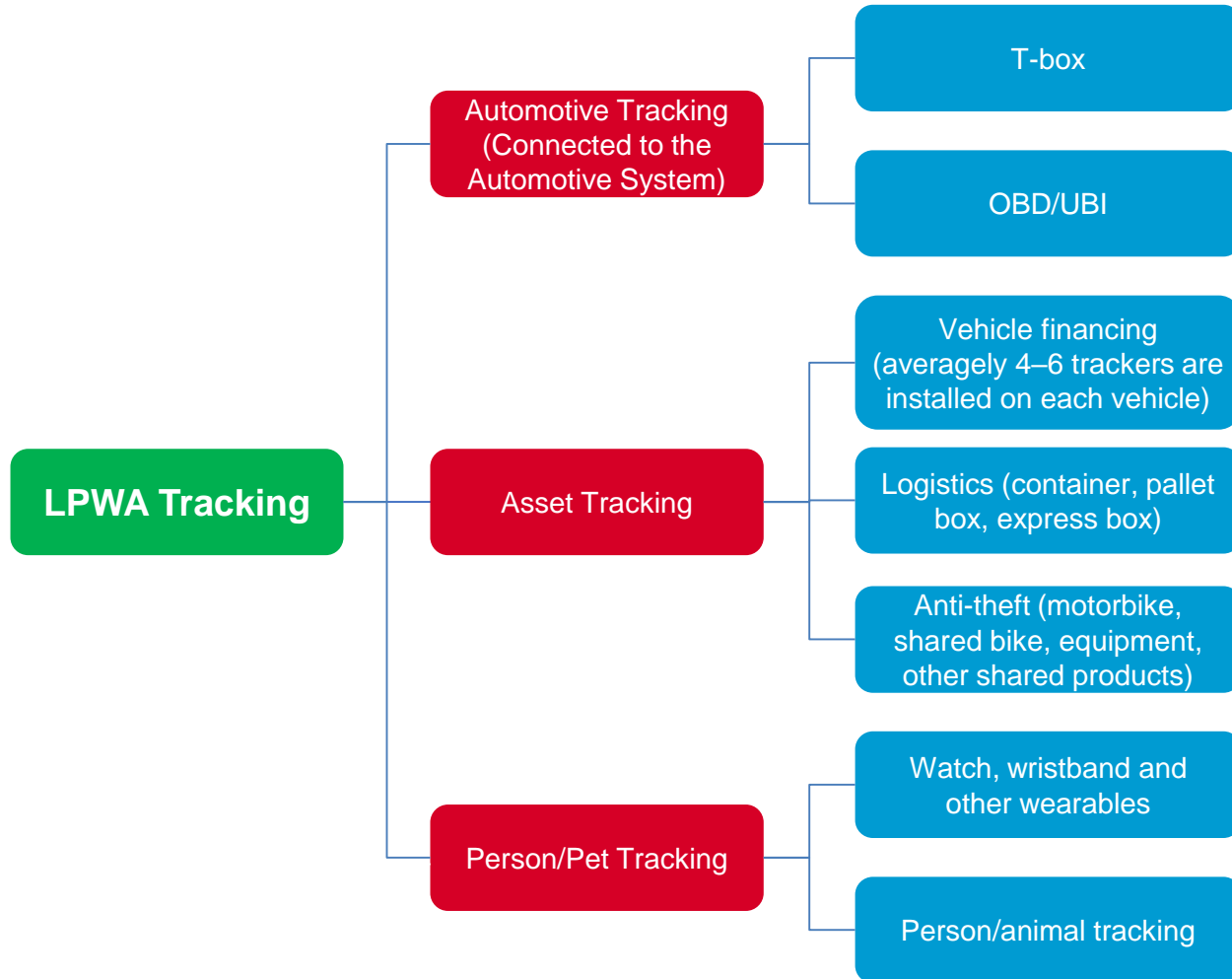
Photoelectricity

Public Utilities – Street Lighting

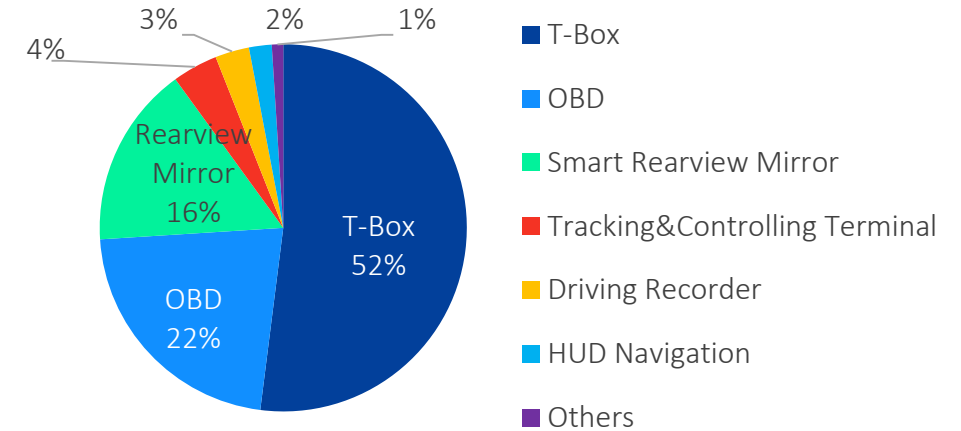


- Real time data feeds directly to the operation center
- Manual brightening of lighting when required
- Improved energy efficiency

Smart Life – LPWA Tracker



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

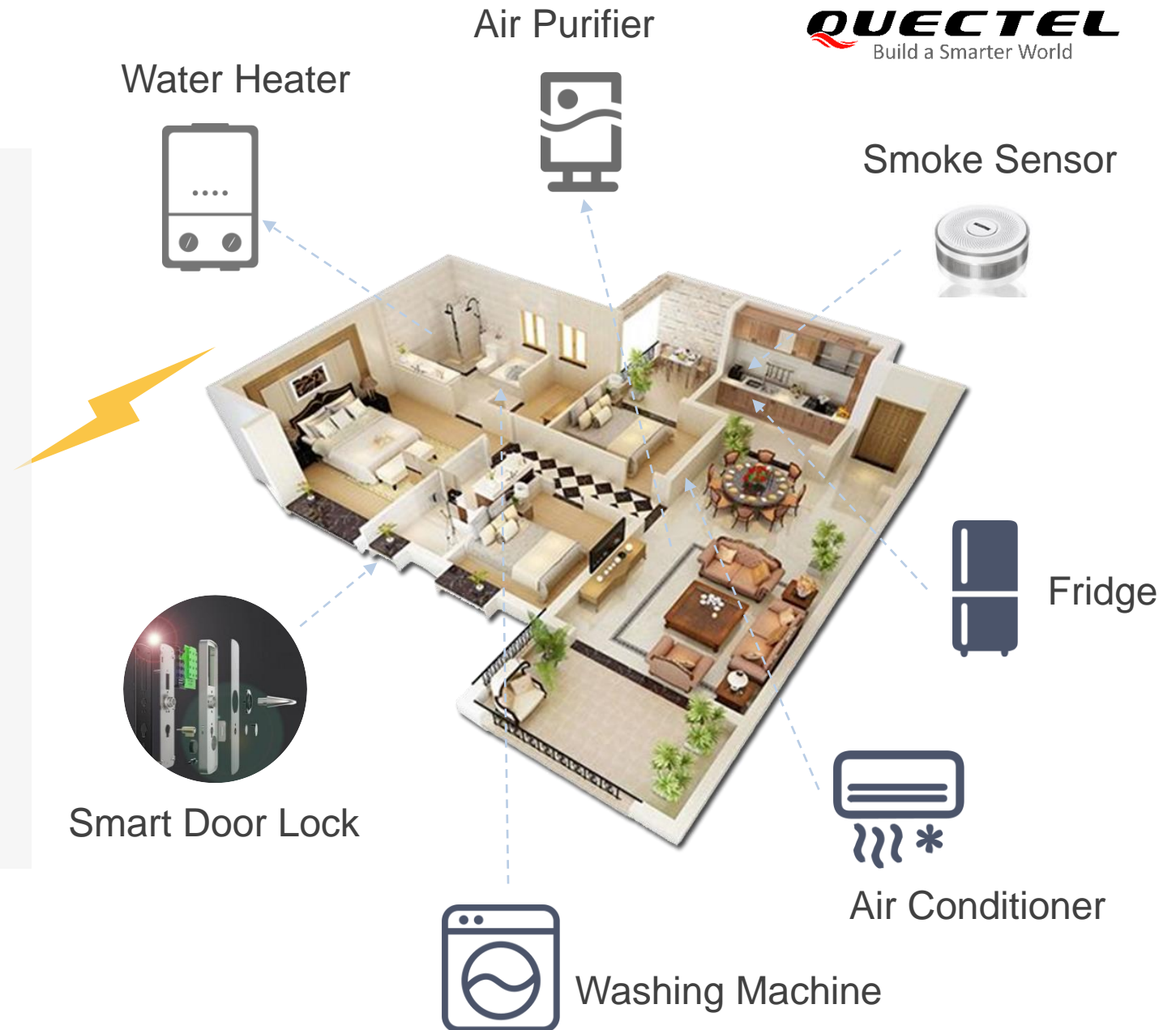


Smart Home

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.

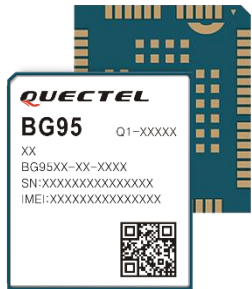


Industry & Agriculture – Multi-gas Detector



- 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)

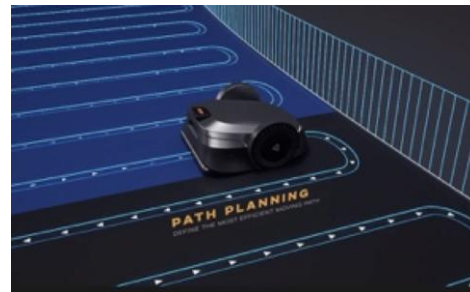


1 Wireless Communication
Easy Operation with APP



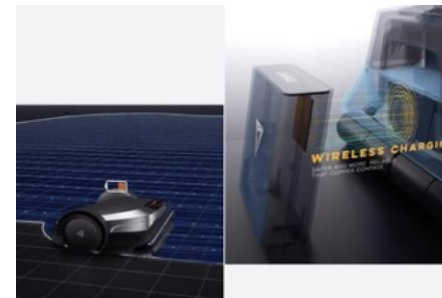
Positioning technology, easy installation

2 Intelligent Cutting
Smart Route



Smart algorithm

3 Wireless Charging
High-efficiency Cutting



Self charging

4 Safe & Eco-friendly
Low Noise and Power Consumption

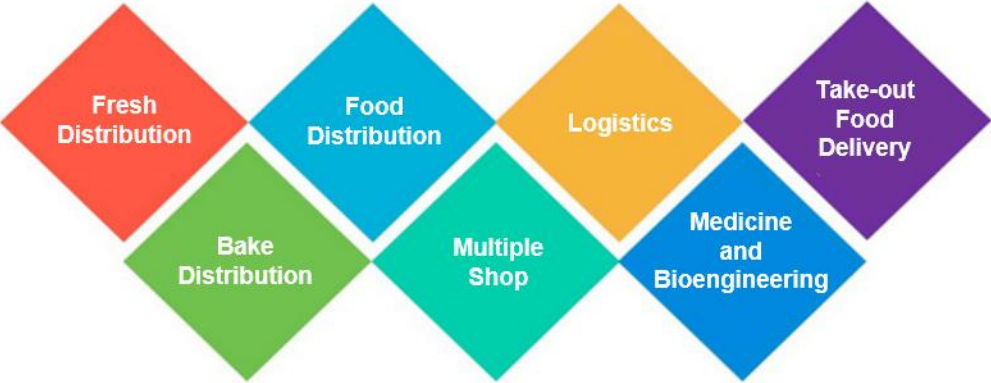
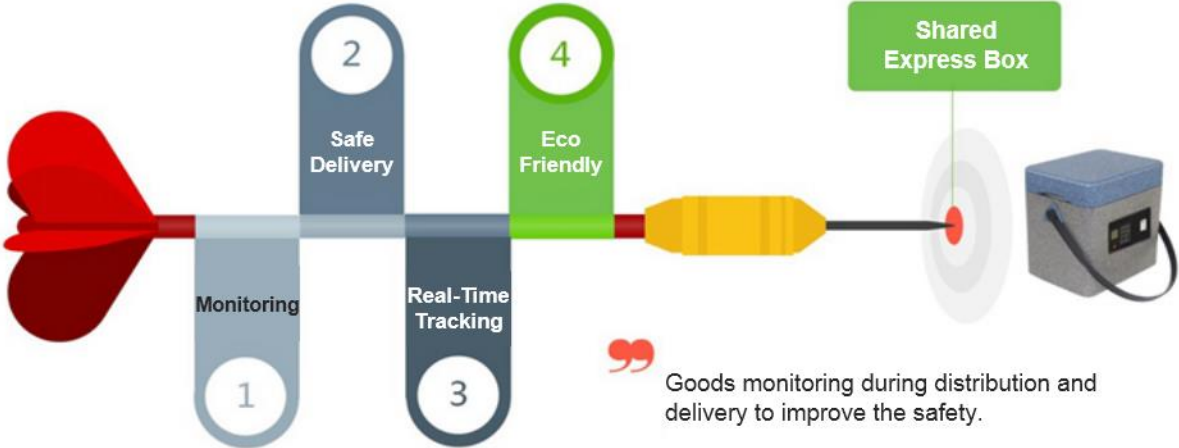


Lower noise

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



Thank you!

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 https://twitter.com/Quectel_IoT