

# LTE-M / NB-IoT modules - secure



LTE-M / NB-IoT modules with Secure Cloud								
	ALEX-R510M8S	SARA-R500S	SARA-R510S	SARA-R510M8S	SARA-R540S	SARA-R422	SARA-R422S	SARA-R422M8S
<b>Grade</b>								
Automotive								
Professional	•	•	•	•	•	•	•	•
Standard								
<b>Physical</b>								
Image								
Size [mm]	14 x 14 x 1.5	16.0 x 26.0 x 2.2			16.0 x 26.0 x 2.5			
Package and pins	133-pin LGA	96-pin LGA			96-pin LGA			
Regions	Multi-region	Multi-region			Multi-region			
<b>Access technology</b>								
GSM/GPRS bands						Q	Q	Q
LTE-M / NB-IoT bands	1, 2, 3, 4, 5, 8, 12, 13, 17, 18, 19, 20, 25, 26, 28, 66, 71, 85				*	1, 2, 3, 4, 5, 8, 12, 13, 20, 25, 26, 28, 66, 85		
Data rate	M1/NB2	M1/NB2	M1/NB2	M1/NB2	M1/NB2	M1/NB2	M1/NB2	M1/NB2
450 MHz spectrum power class					26 dBm			
410 MHz spectrum power class					23 dBm			
<b>Positioning</b>								
Integrated u-blox GNSS receiver	•			•				•
GNSS antenna interface	•			•				•
External GNSS control via modem		•	•		•		•	
<b>Compatible with u-blox services</b>								
MQTT Anywhere, MQTT Flex	•	•	•	•	•	•	•	•
AssistNow™	•	•	•	•	•	•	•	•
CellLocate®	•	•	•	•	•	•	•	•
IoT Security-as-a-Service	•	•	•	•	•	•	•	•
<b>Interfaces</b>								
UART	2	2	2	2	2	1	1	1
USB (for diagnostics)	1	1	1	1	1	1	1	1
DDC (I2C)	1	1	1	1	1	1	1	1
USIM	1	1	1	1	1	1	1	1
GPIO	11	6	6	6	6	6	6	6
Digital audio		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>
<b>Features</b>								
Secure boot, updates, production	•	•	•	•		•	•	•
Root of trust	SE	SE	SE	SE	SE	TEE	TEE	TEE
MQTT, MQTT-SN	•	•	•	•	•		•	•
Antenna dynamic tuning	•	•	•	•	•			
CellTime™	•	•	•	•	•			
Power save mode (PSM)	•	•	•	•	•	•	•	•
Ultra low power save mode	•	•	•	•	•	•	•	•
Last gasp	•	•	•	•	•	•	•	•
Antenna detection	•	•	•	•	•	•	•	•
Embedded TCP/UDP stack	•	•	•	•	•	•	•	•
Embedded HTTPS, FTPS	•	•	•	•	•	•	•	•
Embedded TLS, DTLS	•	•	•	•	•	•	•	•
eDRX	•	•	•	•	•	•	•	•
FW update via serial	•	•	•	•	•	•	•	•
uFOTA	•	•	•	•	•	•	•	•
Dual stack IPv4/IPv6	•	•	•	•	•	•	•	•
Embedded CoAP/DTLS	•	•	•	•	•	•	•	•
LwM2M device management	•	•	•	•	•	•	•	•

M1 = LTE Cat M1, Rel 13 (300 kb/s DL, 375 kb/s UL)  
 LTE Cat M1, Rel 14 (300 kb/s DL, 1200 kb/s UL)  
 NB2 = Cat NB2 (125 kb/s DL, 140 kb/s UL)  
 Q = quad-band

= available in future firmware  
 TEE = trusted execution environment  
 SE = secure element

\* = LTE bands 1, 2, 3, 4, 5, 8, 12, 13, 18, 19, 20, 25, 26, 28, 31, 66, 71, 72, 73, 85, 87, 88

UBX-13004714 - R31



# LTE-M / NB-IoT modules



	LTE-M / NB-IoT modules						LTE Cat NB2
	SARA-R410M-63B	SARA-R410M-73B	SARA-R410M-83B	SARA-R410M-52B	SARA-R410M-02B	SARA-R412M	SARA-N310 <sup>A</sup>
<b>Grade</b>							
Automotive							
Professional	•	•	•	•	•	•	•
Standard							
<b>Physical</b>							
Image							
Size [mm]	16.0 x 26.0 x 2.5						16.0 x 26.0 x 2.4
Package and pins	96-pin LGA						96-pin LGA
Regions	Japan	Korea	Multi-region	N America	Multi-region	Multi-region	Multi-region
<b>Access technology</b>							
GSM/GPRS bands							Q
LTE-M / NB-IoT bands	1, 8, 19	3, 5, 26	3, 5, 8, 20, 28	2, 4, 5, 12, 13	*	*	3, 5, 8, 20, 28, +
Data rate	M1	M1	M1/NB1	M1	M1/NB1	M1/NB1	NB2
<b>Positioning</b>							
External GNSS control via modem	•	•	•	•	•	•	
<b>Compatible with u-blox services</b>							
MQTT Anywhere	•	•	•				
MQTT Flex							•
AssistNow™	•	•	•	•	•	•	•
CellLocate®	•	•	•		•	•	•
IoT Security-as-a-Service	•	•	•				
<b>Interfaces</b>							
UART	1	1	1	1	1	1	2
USB	1	1	1	1	1	1	
DDC (I2C)	1	1	1	1	1	1	
USIM	1	1	1	1	1	1	1
ADC							2
GPIO	6	6	6	6	6	6	8
<b>Features</b>							
Root of trust	TEE	TEE	TEE				
MQTT-SN	•	•	•				•
MQTT	•	•	•	•	•	•	•
SIM detection	•	•	•	•	•	•	□
Jamming detection							•
Power save mode (PSM)	•	•	•	•	•	•	•
Ultra-low / deep sleep mode	•	•	•	•	•	•	•
Last gasp	•	•	•	•	•	•	•
Antenna detection	•	•	•	•	•	•	•
Embedded TCP/UDP stack	•	•	•	•	•	•	•
Embedded HTTPS, FTPS	•	•	•	•	•	•	•
Embedded TLS, DTLS	•	•	•	•	•	•	•
eDRX	•	•	•	•	•	•	•
FW update via serial	•	•	•	•	•	•	•
FOTA / uFOTA	•	•	•	•	•	•	•
Dual stack IPv4/IPv6	•	•	•	•	•	•	•
Embedded CoAP/DTLS	•	•	•				•
LwM2M device management	•	•	•	•	•	•	•

M1 = LTE Cat M1, Rel 13 (300 kb/s DL, 375 kb/s UL)  
 LTE Cat M1, Rel 14 (300 kb/s DL, 1200 kb/s UL)  
 NB1 = Cat NB1 (27.2 kb/s DL, 62.5 kb/s UL)  
 NB2 = Cat NB2 (125 kb/s DL, 140 kb/s UL)

Q = quad-band  
 □ = available in future FW  
 TEE = trusted execution environment  
 A = ATEX variant available

+ = LTE bands 1, 2, 4, 12, 13, 18, 19, 26, 66, 71, 85 available in future firmware

UBX-13004714 - R31

# LTE Cat 4 modules



LTE Cat 4 modules										
	TOBY-L200	TOBY-L201	TOBY-L210	TOBY-L220	TOBY-L280	MPCI-L200	MPCI-L201	MPCI-L210	MPCI-L220	MPCI-L280
<b>Grade</b>										
Automotive	•		•		•					
Professional	•	•	•	•	•	•	•	•	•	•
Standard										
<b>Physical</b>										

Image



Size [mm]	24.8 x 35.6 x 2.6					30.0 x 51.0 x 3.7				
Package and pins	152-pin LGA					52-pin PCI Express Full-Mini Card Type F2				
Region	North America	North America	EMEA/APAC	Japan	S. America/APAC	North America	North America	EMEA/APAC	Japan	S. America/APAC
<b>Access technology</b>										
GSM/GPRS bands	Q		Q		Q	Q		Q		Q
UMTS/HSPA [MHz]	850, 900, 1700, 1900, 2100	850, 1900	850, 900, 1900, 2100	850, 900, 2100	850, 900, 1900, 2100	850, 900, 1700, 1900, 2100	850, 1900	850, 900, 1900, 2100	850, 900, 2100	850, 900, 1900, 2100
LTE FDD bands	2, 4, 5, 7, 17	2, 4, 5, 13, 17	1, 3, 5, 7, 8, 20	1, 3, 5, 6, 8, 19	1, 3, 5, 7, 8, 28	2, 4, 5, 7, 17	2, 4, 5, 13, 17	1, 3, 5, 7, 8, 20	1, 3, 5, 6, 8, 19	1, 3, 5, 7, 8, 28
Data rate	Cat 4	Cat 4	Cat 4	Cat 4	Cat 4	Cat 4	Cat 4	Cat 4	Cat 4	Cat 4
<b>Interfaces</b>										
UART	1	1	1	1	1					
USB	1	1	1	1	1	1	1	1	1	1
DDC (I2C)	1		1	1	1					
SDIO (master)	1	1	1	1	1					
GPIO	14	14	14	14	14					
<b>Audio</b>										
Digital audio	1		1	1	1					
<b>Features</b>										
Network indication	•	•	•	•	•	•	•	•	•	•
Antenna detection	•	•	•	•	•					
Embedded TCP/UDP	•	•	•	•	•	•	•	•	•	•
Embedded FTP/HTTP	•	•	•	•	•	•	•	•	•	•
Embedded TLS 1.2	•	•	•	•	•	•	•	•	•	•
FW update via serial	•	•	•	•	•	•	•	•	•	•
FOTA	•	•	•	•	•	•	•	•	•	•
Rx diversity	•	•	•	•	•	•	•	•	•	•
Dual stack IPv4/IPv6	•	•	•	•	•	•	•	•	•	•
MIMO 2x2	•	•	•	•	•	•	•	•	•	•

Q = quad-band

Cat 4 = LTE Cat 4 (150 Mb/s download, 50 Mb/s upload)

UBX-13004714 - R31

# LTE Cat 1 modules - multi-mode / secure



LTE Cat 1 modules					
	LARA-R6001	LARA-R6401	LARA-R6801	LENA-R8001	LENA-R8001M10
<b>Grade</b>					
Automotive					
Professional	•	•	•	•	•
Standard					
<b>Physical</b>					

Image



Size [mm]	24.0 x 26.0 x 2.6			27.0 x 30.0 x 2.6	
Package and pins	100-pin LGA			100-pin LGA	
Regions	Global	North America	Multi-region: EMEA, APAC, Japan, LATAM	Global	Global
<b>Access technology</b>					
LTE FDD bands	1, 2, 3, 4, 5, 7, 8, 12, 13, 18, 19, 20, 26, 28	2, 4, 5, 12, 13, 14, 66, 71	1, 2, 3, 4, 5, 7, 8, 18, 19, 20, 26, 28	1, 2, 3, 4, 5, 7, 8, 12, 20, 28	1, 2, 3, 4, 5, 7, 8, 12, 20, 28
LTE TDD bands	38, 39, 40, 41			38, 40, 41	38, 40, 41
UMTS/HSPA [MHz]	850, 900, 1900, 2100		850, 900, 1900, 2100		
2G bands	Q		Q	Q	Q
Data rate	Cat 1	Cat 1	Cat 1	Cat 1	Cat 1
<b>Positioning</b>					
External GNSS control via modem	•	•	•	•	
Integrated GNSS receiver					•
Dedicated GNSS antenna interface					•
<b>Compatible with u-blox Services</b>					
MQTT Anywhere, MQTT Flex	•	•	•	•	•
AssistNow and CellLocate®	•	•	•	•	•
IoT Security-as-a-Service	•	•	•	•	•
<b>Interfaces</b>					
UART	2	2	2	2	2
USB	1	1	1	1	1
I2C	1	1	1	1	1
I2S	1	1	1	1	1
GPIO	9	9	9	9	9
<b>Features</b>					
Root of trust	•	•	•	•	•
MQTT / MQTT-SN	•	•	•	•	•
Power save mode	□	□	□		
TCP/IP, UDP/IP, HTTP/FTP	•	•	•	•	•
TLS / DTLS	•	•	•	•	•
eDRX	•	•	•		
Secure boot / update	•	•	•	•	•
RxDiversity	•	•	•		
Dual stack IPv4/IPv6	•	•	•	•	•
FW update via serial (FOAT)	•	•	•	•	•
FOTA/uFOTA	•	•	•	•	•
LwM2M	•	•	•		
Last gasp	•	•	•		
Jamming detection	•	•	•	•	•
Antenna and SIM detection	•	•	•	•	•
VoLTE/CSFB	•	VoLTE only	•	□	□

Cat 1 = LTE Cat 1 (10 Mb/s DL, 5 Mb/s UL)  
Q = quad-band

□ = available in future firmware version

UBX-13004714 - R31

# LTE Cat 1 and 2G modules



	LTE Cat 1 modules							GSM module
	LARA-R202	LARA-R203	LARA-R204	LARA-R211	TOBY-R200-02B	TOBY-R200-82B	TOBY-R202	SARA-G450
<b>Grade</b>								
Automotive								
Professional	•	•	•	•	•	•	•	
Standard								
<b>Physical</b>								
Image								
Size [mm]	24.0 x 26.0 x 2.6				24.8 x 35.6 x 2.6			16.0 x 26.0 x 2.4
Package and pins	100-pin LGA				152-pin LGA			96-pin LGA
Regions	North America	North America	North America	EMEA	North America	Global	North America	Global
<b>Access technology</b>								
2G bands	D1				Q	Q		Q
UMTS/HSPA [MHz]	850, 1900				850, 900, 1900, 2100	850, 900, 1900, 2100	850, 1900	
LTE bands	2, 4, 5, 12	2, 4, 12	4, 13	3, 7, 20	2, 4, 5, 12	1, 2, 4, 5, 8, 12	2, 4, 5, 12	
Data rate	Cat 1	Cat 1	Cat 1	Cat 1	Cat 1	Cat 1	Cat 1	GPRS
<b>Positioning</b>								
External GNSS control via modem	•	•		•	•	•	•	•
<b>Compatible with u-blox Services</b>								
AssistNow	•	•		•	•	•	•	•
CellLocate®	•	•		•	•	•	•	•
<b>Interfaces</b>								
UART	1	1	1	2	1	1	1	3
USB	1	1	1	1	1	1	1	
DDC (I2C)	1	1	1	1	1	1	1	1
GPIO	9	9	9	9	9	9	9	4
<b>Audio</b>								
Analog audio								1
Digital audio	1	1		1	1	1	1	
<b>Features</b>								
VoLTE	v	v		•	v	v	v	
Antenna detection	•	•	•	•	•	•	•	•
Jamming detection								•
Embedded TCP/UDP	•	•	•	•	•	•	•	•
Embedded FTP/HTTP	•	•	•	•	•	•	•	•
Embedded TLS 1.2	•	•	•	•	•	•	•	
Embedded SSL								•
FW update via serial	•	•	•	•	•	•	•	•
FOTA	•	•	•	•	•	•	•	
Rx diversity	•	•	•	•	•	•	•	
Dual stack IPv4/IPv6	•	•	•	•	•	•	•	•

Q = quad-band  
D1 = dual-band 900/1800 MHz

Cat 1 = LTE Cat 1 (10 Mb/s DL, 5 Mb/s UL)  
GPRS = 85.6 kb/s (class 12 (downgradeable to class 10 via AT command))

□ = available in future firmware version  
v = VoLTE available and AT&T certified

UBX-13004714 - R31

# Form factors, technologies, and regions



For each module variant, the main and fallback technologies are shown in the regions where they are to be used.

Modules	EMEA					North America					South America					APAC				
	G	U	N	R	L	G	U	N	R	L	G	U	N	R	L	G	U	N	R	L
ALEX-R510M8S			•	•				•	•				•	•				•	•	
SARA-R500S			•	•				•	•				•	•				•	•	
SARA-R510S			•	•				•	•				•	•				•	•	
SARA-R510M8S			•	•				•	•				•	•				•	•	
SARA-R540S			•	•				•	•				•	•				•	•	
SARA-R422	•		•	•		•		•	•		•		•	•		Δ		•	•	
SARA-R422S	•		•	•		•		•	•		•		•	•		Δ		•	•	
SARA-R422M8S	•		•	•		•		•	•		•		•	•		Δ		•	•	
SARA-R410M-63B																			J	
SARA-R410M-73B																			K	
SARA-R410M-83B																		A	A	
SARA-R410M-52B									•											
SARA-R410M-02B			•	•				•	•				•	•				•	•	
SARA-R412M	•		•	•		•		•	•		•		•	•		Δ		•	•	
SARA-N310			•										•					•		
SARA-G450	•					•					•					Δ				
LENA-R8001	•		•			•		•			•		•			•		•		
LENA-R8001M10	•		•			•		•			•		•			•		•		
LARA-R6001	•	•	•			•	•	•			•	•	•			•	•	•		
LARA-R6401								•					•					•		
LARA-R6801	•	•	•								•	•	•			•	•	•		
LARA-R202							•	•												
LARA-R203								•												
LARA-R204								•												
LARA-R211	•		•																	
TOBY-R200-02B						•	•	•												
TOBY-R200-82B	•	•	•			•	•	•			•	•	•			Δ	•	•		
TOBY-R202						•	•	•												
TOBY/MPCI-L200						•	•		•		•	•		•						
TOBY/MPCI-L201						•			•		•			•						
TOBY/MPCI-L210	•	•		•												Δ	◆		◆	
TOBY/MPCI-L220																	J		J	
TOBY/MPCI-L280											•	•		•		Δ	•		•	

**Legend:**

- G** = GSM/GPRS
- U** = UMTS/HSPA
- N** = NB-IoT
- R** = LTE-M, LTE Cat 1
- L** = LTE Cat 4
- = Main technology
- = Fallback technology
- Δ = GSM/GPRS in APAC, but not supported in Japan or Korea
- ◆ = Some versions have a special firmware version for Japan and Korea; see product documentation
- J** = Japan only
- K** = Korea only
- A** = Australia primarily

For a detailed view of our product offering, see our guided product selector:  
[www.u-blox.com/guided-product-selector](http://www.u-blox.com/guided-product-selector)