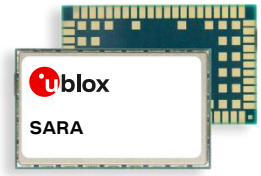
SARA HW migration guide

Hardware guidelines to migrate between SARA modules

Application note



Abstract

This document provides hardware design guidelines to migrate between u-blox cellular modules based on SARA form factor. u-blox cellular modules having 2G, 3G, LTE-M, NB-IoT as dominant technology use this compact form factor to provide complete and cost-efficient solutions, specifically designed for IoT, offering multi-band data transmission.

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This document applies to the following products:

Product name	Ordering code
SARA-R410M	SARA-R410M-02B
	SARA-R410M-52B
	SARA-R410M-63B
	SARA-R410M-73B
	SARA-R410M-83B
SARA-R412M	SARA-R412M-02B
SARA-R422	SARA-R422-00B
	SARA-R422-01B
SARA-R422S	SARA-R422S-00B
	SARA-R422S-01B
SARA-R422M8S	SARA-R422M8S-00B
SARA-R422M10S	SARA-R422M10S-01B
SARA-R500E	SARA-R500E-01B
SARA-R500S	SARA-R500S-00B
	SARA-R500S-01B
	SARA-R500S-61B
	SARA-R500S-71B
SARA-R510S	SARA-R510S-00B
	SARA-R510S-01B
	SARA-R510S-61B
	SARA-R510S-71B
SARA-R510M8S	SARA-R510M8S-00B
	SARA-R510M8S-01B
	SARA-R510M8S-61B
	SARA-R510M8S-71B
SARA-R520	SARA-R520-02B
SARA-R520M10	SARA-R520M10-02B
SARA-G300	SARA-G300-00S
SARA-G310	SARA-G310-00S
SARA-G340	SARA-G340-00S
	SARA-G340-01S
	SARA-G340-02S
SARA-G340 ATEX	SARA-G340-00X
	SARA-G340-02X

Product name	Ordering code
SARA-G350	SARA-G350-00S
	SARA-G350-01S
	SARA-G350-01B
	SARA-G350-02S
SARA-G350 ATEX	SARA-G350-00X
	SARA-G350-02X
SARA-G350 Automotive	SARA-G350-02A
SARA-G450	SARA-G450-00C
	SARA-G450-01C
SARA-U201	SARA-U201-03B
	SARA-U201-63B
	SARA-U201-04B
SARA-U201 ATEX	SARA-U201-03X
	SARA-U201-04X
SARA-U201 Automotive	SARA-U201-03A
	SARA-U201-04A
SARA-U260	SARA-U260-00S
	SARA-U260-03S
SARA-U270	SARA-U270-00S
	SARA-U270-03S
	SARA-U270-04B
	SARA-U270-53S
	SARA-U270-73S
SARA-U270 ATEX	SARA-U270-00X
SARA-U270 Automotive	SARA-U270-03A
SARA-U280	SARA-U280-00S
	SARA-U280-03S
SARA-N200	SARA-N200-02B
SARA-N201	SARA-N201-02B
SARA-N210	SARA-N210-02B
SARA-N211	SARA-N211-02X
SARA-N280	SARA-N280-02B
SARA-N310	SARA-N310-00X

Contents

1 SARA-R4 / SARA-R5 modules description

u-blox SARA-R4 series LTE-M / NB-IoT / EGPRS and SARA-R5 series LTE-M / NB-IoT modules are ideal for IoT solutions, in the miniature SARA LGA form factor (26.0 x 16.0 mm, 96-pin).

They are easily integrated into compact designs and provide a seamless drop-in migration from/to other u-blox LPWA, GSM/GPRS, CDMA, UMTS/HSPA and LTE module families. They are form-factor compatible with u-blox LISA, LARA, LENA and TOBY cellular module families and they are pin-to-pin compatible with u-blox SARA cellular module families, currently including the SARA-N, SARA-G and SARA-U families, thus maximizing customer investments, simplifying application design, and enabling a very short time-to-market.

Table 1 summarizes the main features and interfaces of SARA-R4 and SARA-R5 series modules.

SARA-R4 and SARA-R5 series modules are the optimal choice for LPWA applications with low to medium data throughput rates, as well as devices that require long battery lifetimes, such as those used in smart metering, smart cities, telematics, and connected health.

The modules support handover capability and deliver the technology necessary for applications such as vehicle, asset and people tracking where mobility is a prerequisite. Other applications where the modules are well-suited include but are not limited to smart home, security systems, industrial monitoring, and control.

The modules support multi-band data communication over an extended operating temperature range of –40 to +85 °C, with extremely low power consumption, and with coverage enhancement for deeper range into buildings and basements (and underground with NB-IoT).

Table 2 summarizes cellular and GNSS characteristics of SARA-R4 and SARA-R5 series modules.

Product version	Region	RAT				Positioning				External Interfaces						Features																Grade		
		3GPP release baseline	3GPP LTE category	LTE FDD bands	(E)GPRS 4-band	Integrated GNSS receiver	External GNSS control via modem	AssistNow software	CellLocate®	UART	USB	I2C	SIM	GPIOs	ADC	Secure boot, update & production	Open CPU (uCPU)	Antenna dynamic tuning	CellTime™	Ultra-low consumption in PSM	Embedded TCP/UDP stack	Embedded HTTPS, FTPS, TLS	DTLS	FW update via serial	u-blox FOTA (uFOTA)	LwM2M device management	MQTT	MQTT-SN	CoAP	Last gasp	Jamming detection	Antenna detection	Standard	Professional	Automotive
SARA-R410M-02B	Multi Region	13	M1 NB1	*		●	●	●		●	●	●	●	●						●	●	●		●	●	●	●			●		●			●
SARA-R410M-52B	North America	13	M1	2,4,5 12,13		●	●			●	●	●	●	●						●	●	●		●	●	●	●			●		●			●
SARA-R410M-63B	Japan	13	M1	1,8,19		●	●	●		●	●	●	●	●		●				●	●	●	●	●	●	●	●			●		●			●
SARA-R410M-73B	Korea	13	M1	3,5 26		●	●	●		●	●	●	●	●		●				●	●	●	●	●	●	●	●			●		●			●
SARA-R410M-83B	Multi Region	13	M1 NB1	3,5,8 20,28		●	●	●		●	●	●	●	●		●				●	●	●	●	●	●	●	●			●		●			●
SARA-R412M-02B	Multi Region	13	M1 NB1	*	●	●	●	●		●	●	●	●	●						●	●	●		●	●	●	●			●		●			●
SARA-R422-00B	Multi Region	14	M1 NB2	*	●					●	■	●	●	●		●				●	●			●	●	●						●			●
SARA-R422-01B	Multi Region	14	M1 NB2	*	●					●	■	●	●	●		●		●		●	●			●	●	●						●			●
SARA-R422S-00B	Multi Region	14	M1 NB2	*	●	●	●	●		●	■	●	●	●		●				●	●	●	●	●	●	●	●	●	●	●	●	●			●
SARA-R422S-01B	Multi Region	14	M1 NB2	*	●	●	●	●		●	■	●	●	●		●		●		●	●	●	●	●	●	●	●	●	●	●	●	●			●
SARA-R422M8S-00B	Multi Region	14	M1 NB2	*	●	●		●	●	●	■	●	●	●		●				●	●	●	●	●	●	●	●	●	●	●	●	●			●
SARA-R422M10S-01B	Multi Region	14	M1 NB2	*	●	●		●	●	●	■	●	●	●		●		●		●	●	●	●	●	●	●	●	●	●	●	●	●			●
SARA-R500E-01B	North America	14	M1	*			●	●	●	●	♦	●		●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●			●
SARA-R500S-00B	Multi Region	14	M1	*			●	●	●	●	♦	●	●	●		●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●			●
SARA-R500S-01B	Multi Region	14	M1 NB2	*			●	●	●	●	♦	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●			●
SARA-R500S-61B	Japan	14	M1 NB2	*			●	●	●	●	♦	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●			●
SARA-R500S-71B	Korea	14	M1 NB2	*			●	●	●	●	♦	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●			●
SARA-R510S-00B	Multi Region	14	M1	*			●	●	●	●	♦	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●
SARA-R510S-01B	Multi Region	14	M1 NB2	*			●	●	●	●	♦	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●
SARA-R510S-61B	Japan	14	M1 NB2	*			●	●	●	●	♦	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●
SARA-R510S-71B	Korea	14	M1 NB2	*			●	●	●	●	♦	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●
SARA-R510M8S-00B	Multi Region	14	M1	*		●		●	●	●	♦	●	●	●		●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●			●
SARA-R510M8S-01B	Multi Region	14	M1 NB2	*		●		●	●	●	♦	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●
SARA-R510M8S-61B	Japan	14	M1 NB2	*		●		●	●	●	♦	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●
SARA-R510M8S-71B	Korea	14	M1 NB2	*		●		●	●	●	♦	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●
SARA-R520-02B	Multi Region	14	M1 NB2	*		●[1]	●	●	●	●	♦	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●
SARA-R520M10-02B	Multi Region	14	M1 NB2	*		●		●	●	●	♦	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●

● = supported by all FW versions ■ = supported for FW update and diagnostic ♦ = supported for diagnostic

* = see Table 2 for the complete list of LTE FDD bands supported by related product versions

Table 1: SARA-R4 and SARA-R5 series main features summary

[1] u-blox SpotNow A-GPS receiver

Feature	SARA-R410M	SARA-R412M	SARA-R422 SARA-R422S SARA-R422M8S SARA-R422M10S	SARA-R500E SARA-R500S SARA-R510S SARA-R510M8S SARA-R520 SARA-R520M10
Protocol stack	3GPP release 13	3GPP release 13	3GPP release 14	3GPP release 14
Cellular RAT	LTE Cat M1 Half-Duplex LTE Cat NB1 Half-Duplex [2,3]	LTE Cat M1 Half-Duplex LTE Cat NB1 Half-Duplex 2G GPRS / EGPRS	LTE Cat M1 Half-Duplex LTE Cat NB2 Half-Duplex 2G GPRS / EGPRS	LTE Cat M1 Half-Duplex LTE Cat NB2 Half-Duplex [4]
LTE FDD bands	Band 1 (2100 MHz) [2,6] Band 2 (1900 MHz) [3,6] Band 3 (1800 MHz) [2] Band 4 (1700 MHz) [3,6] Band 5 (850 MHz) Band 8 (900 MHz) [2] Band 12 (700 MHz) [3,6] Band 13 (750 MHz) [3,6] Band 18 (850 MHz) [2,3,6] Band 19 (850 MHz) [2,6] Band 20 (800 MHz) [2,3] Band 25 (1900 MHz) [2,3,5,6] Band 26 (850 MHz) [2,6] Band 28 (700 MHz) [2,3]	Band 2 (1900 MHz) Band 3 (1800 MHz) Band 4 (1700 MHz) Band 5 (850 MHz) Band 8 (900 MHz) Band 12 (700 MHz) Band 13 (750 MHz) Band 20 (800 MHz) Band 26 (850 MHz) Band 28 (700 MHz)	Band 1 (2100 MHz) Band 2 (1900 MHz) Band 3 (1800 MHz) Band 4 (1700 MHz) Band 5 (850 MHz) Band 8 (900 MHz) Band 12 (700 MHz) Band 13 (750 MHz) Band 18 (850 MHz) [7] Band 19 (850 MHz) [7] Band 20 (800 MHz) Band 25 (1900 MHz) Band 26 (850 MHz) Band 28 (700 MHz) Band 66 (1700 MHz) Band 85 (700 MHz)	Band 1 (2100 MHz) Band 2 (1900 MHz) Band 3 (1800 MHz) Band 4 (1700 MHz) Band 5 (850 MHz) Band 8 (900 MHz) Band 12 (700 MHz) Band 13 (750 MHz) Band 18 (850 MHz) Band 19 (850 MHz) Band 20 (800 MHz) Band 25 (1900 MHz) Band 26 (850 MHz) Band 28 (700 MHz) Band 66 (1700 MHz) Band 71 (600 MHz) Band 85 (700 MHz)
2G bands		GSM 850 MHz E-GSM 900 MHz DCS 1800 MHz PCS 1900 MHz	GSM 850 MHz E-GSM 900 MHz DCS 1800 MHz PCS 1900 MHz	
Power class	LTE Cat M1 / NB1[8]: Class 3 (23 dBm)	LTE Cat M1 / NB1: Class 3 (23 dBm) 2G GMSK: GSM/E-GSM bands: Class 4 (33 dBm) DCS/PCS bands: Class 1 (30 dBm) 2G 8-PSK: GSM/E-GSM bands: Class E2 (27 dBm) DCS/PCS bands: Class E2 (26 dBm)	LTE Cat M1 / NB2: Class 3 (23 dBm) 2G GMSK: GSM/E-GSM bands: Class 4 (33 dBm) DCS/PCS bands: Class 1 (30 dBm) 2G 8-PSK: GSM/E-GSM bands: Class E2 (27 dBm) DCS/PCS bands: Class E2 (26 dBm)	LTE Cat M1 / NB2[4]: Class 3 (23 dBm)

[2] Not supported by SARA-R410M-52B-01 or SARA-R410M-52B-02 product version
[3] Not supported by SARA-R410M-63B or SARA-R410M-73B product versions
[4] LTE Cat NB2 not supported by SARA-R500E, SARA-R500S-00B, SARA-R510S-00B, SARA-R510M8S-00B product versions
[5] Not supported in LTE Cat NB1 by SARA-R410M-02B-01, SARA-R410M-02B-02, or SARA-R410M-02B-03 product version
[6] Not supported by SARA-R410M-83B product version
[7] Not supported by SARA-R422-00B, SARA-R422S-00B, SARA-R422M8S-00B
[8] LTE Cat NB1 not supported by SARA-R410M-52B, SARA-R410M-63B, SARA-R410M-73B product versions

Feature	SARA-R410M	SARA-R412M	SARA-R422 SARA-R422S SARA-R422M8S SARA-R422M10S	SARA-R500E SARA-R500S SARA-R510S SARA-R510M8S SARA-R520 SARA-R520M10
Data rate	LTE Cat M1: up to 375 kbit/s UL up to 300 kbit/s DL LTE Cat NB1[9]: up to 62.5 kbit/s UL up to 27.2 kbit/s DL	LTE Cat M1: up to 375 kbit/s UL up to 300 kbit/s DL LTE Cat NB1: up to 62.5 kbit/s UL up to 27.2 kbit/s DL GPRS multi-slot class 33[10] up to 85.6 kbit/s UL up to 107 kbit/s DL EGPRS multi-slot class 33[10] up to 236.8 kbit/s UL up to 296.0 kbit/s DL	LTE Cat M1: up to 1119 kbit/s UL up to 588 kbit/s DL LTE Cat NB2: up to 158.5 kbit/s UL up to 127 kbit/s DL GPRS multi-slot class 33[10] up to 85.6 kbit/s UL up to 107 kbit/s DL EGPRS multi-slot class 33[10] up to 236.8 kbit/s UL up to 296.0 kbit/s DL	LTE Cat M1: up to 1200 kbit/s UL up to 588 kbit/s DL LTE Cat NB2[11]: up to 140 kbit/s UL up to 125 kbit/s DL
GNSS receiver			SARA-R422M8S only: u-blox UBX-M8030 SPG 3.01 with concurrent reception of up to 3 GNSS GPS L1C/A Galileo E1B/C GLONASS L1OF BeiDou B1I SARA-R422M10S only: u-blox UBX-M10050 SPG 5.10 with concurrent reception of up to 4 GNSS GPS L1C/A Galileo E1B/C GLONASS L1OF BeiDou B1I, B1C	SARA-R510M8S only: u-blox UBX-M8030 SPG 3.01 with concurrent reception of up to 3 GNSS GPS L1C/A Galileo E1B/C GLONASS L1OF BeiDou B1I SARA-R520M10 only: u-blox UBX-M10050 SPG 5.10 with concurrent reception of up to 4 GNSS GPS L1C/A Galileo E1B/C GLONASS L1OF BeiDou B1I, B1C SARA-R520 only: u-blox SpotNow A-GPS GPS L1C/A

Table 2: SARA-R4 and SARA-R5 series modules cellular and GNSS characteristics summary

[9] LTE Cat NB1 not supported by SARA-R410M-52B, SARA-R410M-63B, SARA-R410M-73B product versions
[10] GPRS/EGPRS multi-slot class 33 implies a maximum of 5 slots in downlink and 4 slots in uplink, with 6 slots in total
[11] LTE Cat NB2 not supported by SARA-R500E, SARA-R500S-00B, SARA-R510S-00B, SARA-R510M8S-00B product versions

2 SARA-N2 / SARA-N3 modules description

SARA-N2 and SARA-N3 series modules are NB-IoT solutions in the miniature SARA LGA form factor (26.0 x 16.0 mm, 96-pin), offering LTE Cat NB1 / NB2 data communication over an extended operating temperature range of –40 to +85 °C, with extremely low power consumption.

The SARA-N2 series includes four variants supporting single-band NB-IoT data communication for Europe, China, APAC and South America, plus a dual-band variant mainly designed for Europe.

The SARA-N3 series offers multi-band NB-IoT data communication enabling multi-regional coverage, and they introduce several new functionalities for NB-IoT products, including features like TCP, MQTT, DTLS, SSL/TLS, LwM2M, HTTP(S) and many others.

SARA-N2 and SARA-N3 modules are ideally suited to battery-powered IoT applications characterized by occasional communications of small amounts of data.

The modules are the optimal choice for IoT devices designed to operate in locations with very limited coverage and requiring low energy consumption to permit a very long operating life with the primary batteries. Examples of applications include and are not limited to: smart grids, smart metering, telematics, street lighting, environmental monitoring and control, security and asset tracking.

Table 3 describes a summary of interfaces and features provided by SARA-N2 and SARA-N3 modules.

Module	Region	Cellular RAT			Interfaces						Features														Grade		
		3GPP Release Baseline	3GPP LTE Category	LTE FDD bands	UARTs	USB	I2C	USIM	ADCs	GPIOs	Antenna supervisor	Power Save Mode	eDRX	UDP/IP, CoAP	TCP/IP, MQTT, MQTT-SN	DTLS, TLS, SSL	HTTP(S), FTP(S), PPP, DNS	IPv4	IPv4 / IPv6	LWM2M Device Management	Last gasp	FW update over AT (FOAT)	FW update over the air (FOTA)	Standard	Professional	Automotive
SARA-N200	Europe APAC	13	NB1	8	•			•		•		•	•	•				•				•	•		•	
SARA-N201	APAC	13	NB1	5	•			•		•		•	•	•				•				•	•		•	
SARA-N210	Europe	13	NB1	20	•			•		•		•	•	•				•				•	•		•	
SARA-N211	Europe	13	NB1	8,20	•			•		•		•	•	•				•				•	•		•	
SARA-N280	South America APAC	13	NB1	28	•			•		•		•	•	•				•				•	•		•	
SARA-N310	Global	14	NB2	3,5,8 20,28	•			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•	

Table 3: SARA-N2 and SARA-N3 characteristics summary

Table 4 summarizes cellular radio access technology characteristics of SARA-N2 / SARA-N3 modules.

Item	SARA-N2 series	SARA-N310
Protocol stack	3GPP Release 13	3GPP Release 14[12]
Radio Access Technology	LTE Category NB1 Half-Duplex Single-tone Single HARQ process eDRX Power Saving Mode Coverage enhancement A and B	LTE Category NB2 Half-Duplex Multi-tone Two HARQ process eDRX Power Saving Mode Coverage enhancement A and B
Operating band	SARA-N200: • Band 8 (900 MHz) SARA-N201: • Band 5 (850 MHz) SARA-N210: • Band 20 (800 MHz) SARA-N211: • Band 8 (900 MHz) • Band 20 (800 MHz) SARA-N280: • Band 28 (700 MHz)	Band 3 (1800 MHz) Band 5 (850 MHz) Band 8 (900 MHz) Band 20 (800 MHz) Band 28 (700 MHz)
Power class	Class 3 (23 dBm)[13]	Class 3 (23 dBm)[13]
Deployment mode	In-Band Guard-Band Standalone	In-Band Guard-Band Standalone
Radio link data rate	Up to 31.25 kb/s UL Up to 27.2 kb/s DL	Up to 140 kb/s UL Up to 125 kb/s DL

Table 4: SARA-N2 and SARA-N3 modules NB-IoT characteristics summary

[12] Key subset of features
[13] Configurable to other power class by AT command

3 Migration between SARA modules

3.1 Overview

The u-blox SARA form factor (26.0 x 16.0 mm, 96-pin LGA) includes the following series of modules, with compatible pin assignments as described in Figure 1, so that the modules can be alternatively mounted on a single application PCB using exactly the same copper, solder resist and paste mask:

- SARA-R41 series modules supporting LTE Cat M1, LTE Cat NB1 and 2G radio access technologies
- SARA-R42 series modules supporting LTE Cat M1, LTE Cat NB2 and 2G radio access technologies
- SARA-R5 series modules supporting LTE Cat M1 and LTE Cat NB2 radio access technologies
- SARA-N2 series modules supporting LTE Cat NB1 radio access technology
- SARA-N3 series modules supporting LTE Cat NB2 radio access technology
- SARA-G3 series modules supporting 2G radio access technology
- SARA-G4 series modules supporting 2G radio access technology
- SARA-U2 series modules supporting 3G and 2G radio access technologies

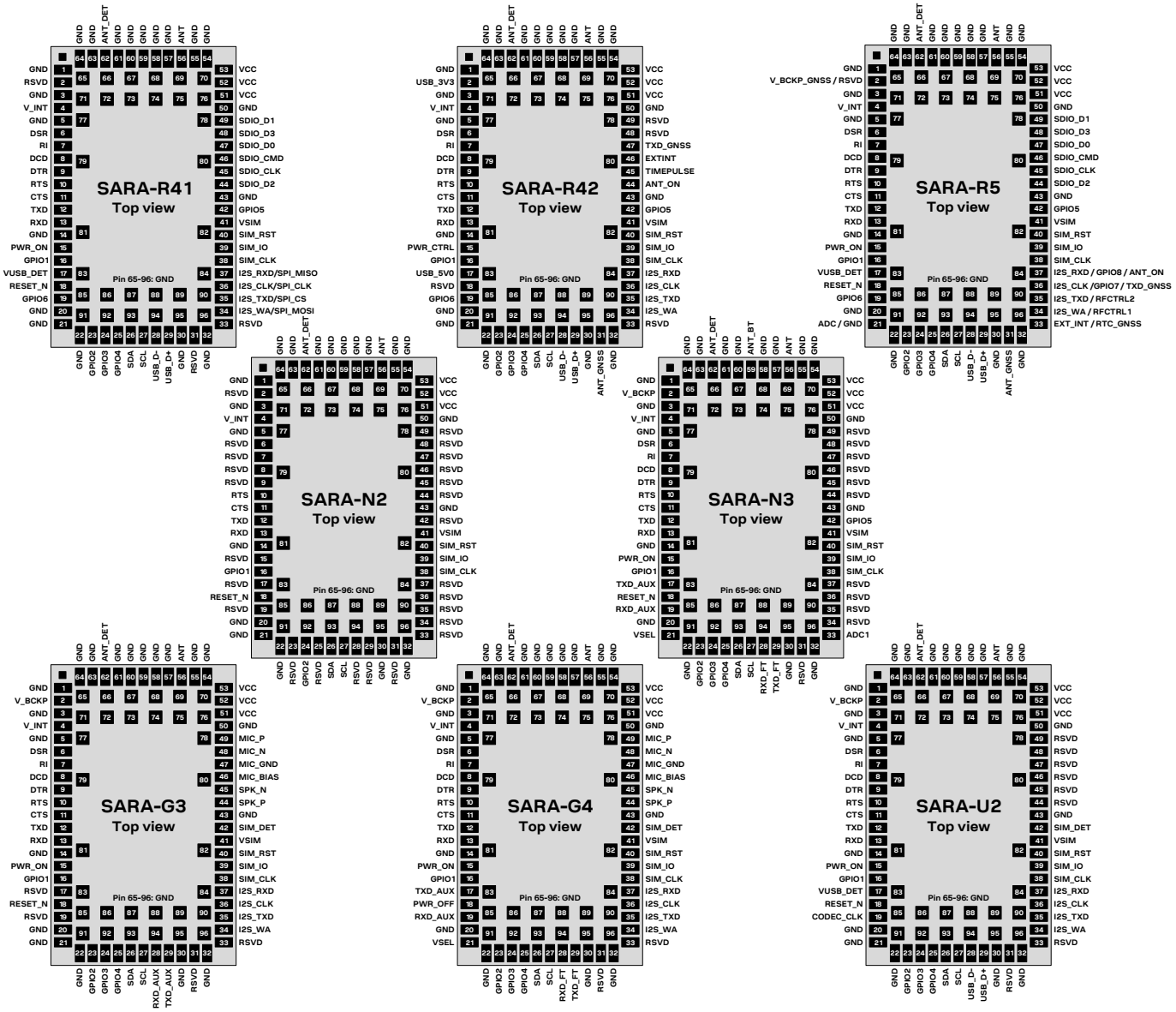

Figure 1: SARA-R4, SARA-R5, SARA-N2, SARA-N3, SARA-G3, SARA-G4, and SARA-U2 series modules layout and pinout

The SARA modules are also form-factor compatible with the u-blox LARA, LISA, and TOBY cellular module families. Although each has a different form factor, the footprints for the TOBY, LISA, LARA, and SARA modules have been developed to ensure layout compatibility.

With the u-blox "nested design" solution, any TOBY, LISA, LARA, or SARA module can be alternatively mounted on the same space of a single "nested" application board as described in Figure 2. Guidelines to implement a nested application board, description of the u-blox reference nested design and comparison between TOBY, LISA, LARA and SARA modules are provided in the nested design application note [12].

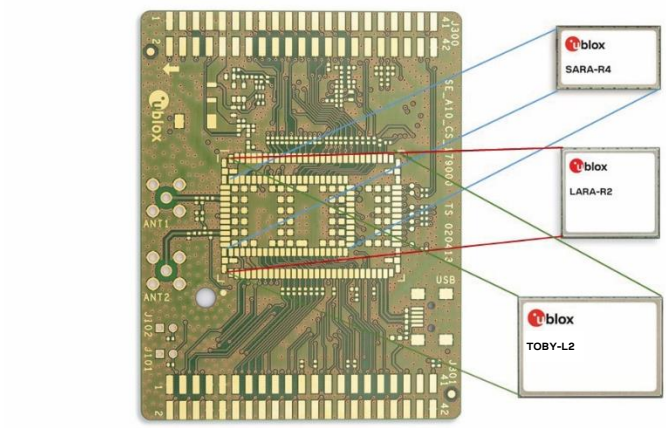

Figure 2: Cellular modules' layout compatibility: all modules can be mounted on the same nested footprint

Table 5 summarizes the main interfaces provided by SARA modules:

Modules	RF						Power			System			SIM		Serial				Audio			Other			
	LTE Cat M1	LTE Cat NB1	LTE Cat NB2	2G	3G	Integrated GNSS receiver	RTC supply I/O	V_INT supply at 1.8V	V_INT supply configurable	Switch-on input pin	Switch-off input pin	Reset input pin	SIM interface	SIM detection	UART	UART AUX	USB	I2C	Analog audio	Digital audio	13/26 MHz output	GPIOs	Network indication	Antenna detection	External GNSS control
SARA-R41	●	●		●				●		●	●		●	●	●		●	●				●	●	●	●
SARA-R42	●		●	●		●		●		●	●	●	●	●	●	●	■	●				●	●	●	●
SARA-R5	●		●			●		●		●	●	●	●*	●*	●	●	♦	●				●	●	●	●
SARA-N2		●						●				●	●		●							●	●		
SARA-N3			●				●	●	●	●	●	●	●	○	●	○		○				●	●	●	
SARA-G3				●			●	●		●		●	●	●	●	●		●	●	●		●	●	●	●
SARA-G4				●			●	●	●	●	●		●	●	●	●		●	●			●	●	●	●
SARA-U2				●	●		●	●		●	●	●	●	●	●	●	●	●		●	●	●	●	●	●

● = supported by available product version ■ = supported for FW update & diagnostic ♦ = supported for diagnostic
* External SIM interface not supported by SARA-R500E modules

Table 5: Summary of interfaces in SARA modules

Figure 3 summarizes the frequency ranges of the SARA modules' operating bands.

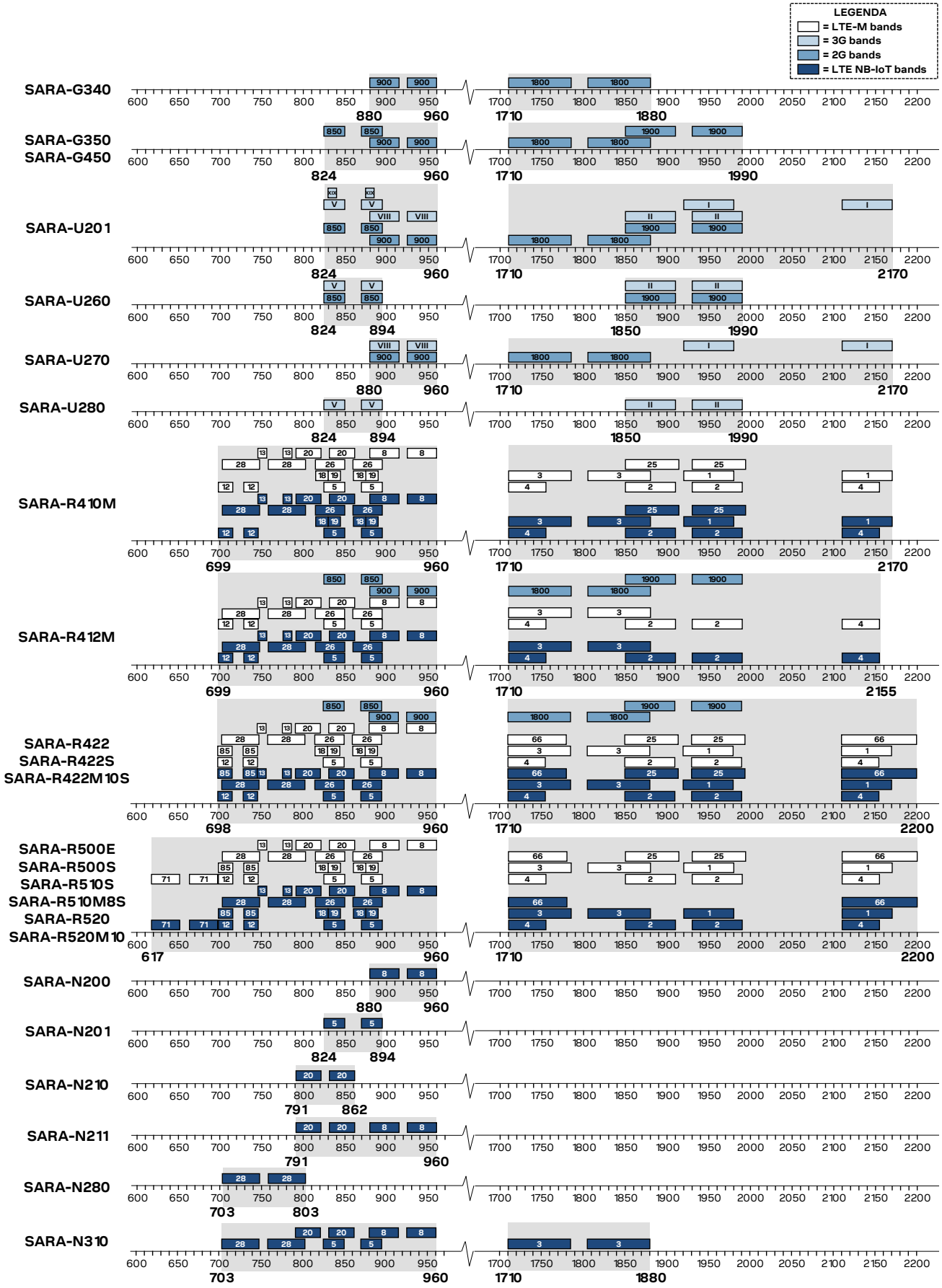

Figure 3: Summary of operating frequency bands supported by latest product versions of SARA modules

3.2 Pin-out comparison between SARA modules

Table 6 shows a pin-out comparison between the SARA-R4, SARA-R5, SARA-N2, SARA-N3, SARA-G3, SARA-G4, and SARA-U2 modules.

No	SARA-R41 series	SARA-R42 series	SARA-R5 series	SARA-N2 series	SARA-N3 series	SARA-G3 series	SARA-G4 series	SARA-U2 series
1	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**
	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
2	**RSVD**	**USB_3V3**	**RSVD / V_BCKP_GNSS**	**RSVD**	**V_BCKP**	**V_BCKP**	**V_BCKP**	**V_BCKP**
	Reserved	USB 3V3 supply Input TestPoint recommended	All except SARA-R520M10: Reserved SARA-R520M10: GNSS backup supply 1.65 ÷ 3.6 V	Reserved	RTC supply I/O	RTC supply I/O	RTC supply I/O	RTC supply I/O
3	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**
	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
4	**V_INT**	**V_INT**	**V_INT**	**V_INT**	**V_INT**	**V_INT**	**V_INT**	**V_INT**
	Supply output: 1.8 V typ ON when SARA is on, outside deep-sleep TestPoint recommended	Supply output: 1.8 V typ ON when SARA is on, outside deep-sleep TestPoint recommended	Supply output: 1.8 V typ ON when SARA is on, outside deep-sleep TestPoint recommended	Supply output: 1.8 V typ ON when radio is on TestPoint recommended	Supply output: 1.8 V typ / 2.8 V typ ON when SARA is on, outside deep-sleep Voltage value set by VSEL TestPoint recommended	Supply output: 1.8 V typ ON when SARA is on TestPoint recommended	Supply output: 1.8 V typ / 3.0 V typ ON when SARA is on Voltage value set by VSEL TestPoint recommended	Supply output: 1.8 V typ ON when SARA is on TestPoint recommended
5	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**
	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
6	**DSR**	**DSR**	**DSR**	**RSVD**	**DSR**	**DSR**	**DSR**	**DSR**
	UART DSR output V_INT level (1.8 V) Driver strength: 2 mA	UART DSR output V_INT level (1.8 V) Driver strength: 2 mA Also RTS for 2nd UART	UART DSR output V_INT level (1.8 V) Driver strength: 5 mA Also RTS for 2nd UART	Reserved	UART DSR output[14] V_INT level (1.8 / 2.8 V)	UART DSR output V_INT level (1.8 V) Driver strength: 6 mA	UART DSR output V_INT level (1.8 / 3.0 V) Driver strength: 3 mA	UART DSR output V_INT level (1.8 V) Driver strength: 1 mA
7	**RI**	**RI**	**RI**	**RSVD**	**RI**	**RI**	**RI**	**RI**
	UART RI output V_INT level (1.8 V) Driver strength: 2 mA	UART RI output V_INT level (1.8 V) Driver strength: 2 mA Also CTS for 2nd UART	UART RI output V_INT level (1.8 V) Driver strength: 5 mA Also CTS for 2nd UART	Reserved	UART RI output V_INT level (1.8 / 2.8 V) Driver strength: 3 mA Configurable as GPIO	UART RI output V_INT level (1.8 V) Driver strength: 6 mA	UART RI output V_INT level (1.8 / 3.0 V) Driver strength: 3 mA	UART RI output V_INT level (1.8 V) Driver strength: 2 mA
8	**DCD**	**DCD**	**DCD**	**RSVD**	**DCD**	**DCD**	**DCD**	**DCD**
	UART DCD output V_INT level (1.8 V) Driver strength: 2 mA	UART DCD output V_INT level (1.8 V) Driver strength: 2 mA Also RXD for 2nd UART	UART DCD output V_INT level (1.8 V) Driver strength: 5 mA Also RXD for 2nd UART	Reserved	UART DCD output[14] V_INT level (1.8 / 2.8 V)	UART DCD output V_INT level (1.8 V) Driver strength: 6 mA	UART DCD output V_INT level (1.8 / 3.0 V) Driver strength: 3 mA	UART DCD output V_INT level (1.8 V) Driver strength: 2 mA
9	**DTR**	**DTR**	**DTR**	**RSVD**	**DTR**	**DTR**	**DTR**	**DTR**
	UART DTR input V_INT level (1.8 V) Internal pull-up: ~100 kΩ Set low for URCs/Greeting	UART DTR input V_INT level (1.8 V) Internal pull-up: ~100 kΩ Set low for greeting text Also TXD for 2nd UART	UART DTR input V_INT level (1.8 V) Internal pull-up: ~56 kΩ Set low for greeting text Also TXD for 2nd UART	Reserved	UART DTR input[14] V_INT level (1.8 / 2.8 V)	UART DTR input V_INT level (1.8 V) Internal pull-up: ~33 kΩ	UART DTR input V_INT level (1.8 / 3.0 V) Internal pull-up: ~166 kΩ	UART DTR input V_INT level (1.8 V) Internal pull-up: ~14 kΩ Set low for greeting text

[14] Not supported by "00" product version

No	SARA-R41 series	SARA-R42 series	SARA-R5 series	SARA-N2 series	SARA-N3 series	SARA-G3 series	SARA-G4 series	SARA-U2 series
10	**RTS**	**RTS**	**RTS**	**RTS**	**RTS**	**RTS**	**RTS**	**RTS**
	UART RTS input V_INT level (1.8 V) Internal pull-up: ~100 kΩ Must be low to use UART on “00”, “01” versions	UART RTS input V_INT level (1.8 V) Internal pull-up: ~100 kΩ	UART RTS input V_INT level (1.8 V) Internal pull-up: ~56 kΩ	UART RTS input[15] VCC level (3.6 V typ.) Internal pull-up: ~78 kΩ	UART RTS input V_INT level (1.8 / 2.8 V) Internal pull-up: ~171 kΩ Configurable as GPIO	UART RTS input V_INT level (1.8 V) Internal pull-up:~58 kΩ	UART RTS input V_INT level (1.8 / 3.0 V) Internal pull-up: ~166 kΩ	UART RTS input V_INT level (1.8 V) Internal pull-up: ~8 kΩ
11	**CTS**	**CTS**	**CTS**	**CTS**	**CTS**	**CTS**	**CTS**	**CTS**
	UART CTS output V_INT level (1.8 V) Driver strength: 2 mA	UART CTS output V_INT level (1.8 V) Driver strength: 2 mA	UART CTS output V_INT level (1.8 V) Driver strength: 5 mA	UART CTS output[15] VCC level (3.6 V typ.) Driver strength: 1 mA Configurable as RI or Network Indicator	UART CTS output V_INT level (1.8 / 2.8 V) Driver strength: 3 mA Configurable as GPIO or Network Indicator	UART CTS output V_INT level (1.8 V) Driver strength: 6 mA	UART CTS output V_INT level (1.8 / 3.0 V) Driver strength: 3 mA	UART CTS output V_INT level (1.8 V) Driver strength: 6 mA
12	**TXD**	**TXD**	**TXD**	**TXD**	**TXD**	**TXD**	**TXD**	**TXD**
	UART data input V_INT level (1.8 V) Internal PU/PD ~100 kΩ	UART data input V_INT level (1.8 V) Internal pull-up ~100 kΩ	UART data input V_INT level (1.8 V) Internal pull-up: ~56 kΩ TestPoint recommended	UART data input VCC level (3.6 V typ.) No internal pull-up/down TestPoint recommended	UART data input V_INT level (1.8 / 2.8 V) Internal pull-up: ~171 kΩ	UART data input V_INT level (1.8 V) Internal pull-up: ~18 kΩ	UART data input V_INT level (1.8 / 3.0 V) Internal pull-up: ~166 kΩ	UART data input V_INT level (1.8 V) Internal pull-up: ~8 kΩ
13	**RXD**	**RXD**	**RXD**	**RXD**	**RXD**	**RXD**	**RXD**	**RXD**
	UART data output V_INT level (1.8 V) Driver strength: 2 mA	UART data output V_INT level (1.8 V) Driver strength: 2 mA	UART data output V_INT level (1.8 V) Driver strength: 5 mA TestPoint recommended	UART data output VCC level (3.6 V typ.) Driver strength: 1 mA TestPoint recommended	UART data output V_INT level (1.8 / 2.8 V) Driver strength: 3 mA	UART data output V_INT level (1.8 V) Driver strength: 6 mA	UART data output V_INT level (1.8 / 3.0 V) Driver strength: 3 mA	UART data output V_INT level (1.8 V) Driver strength: 6 mA
14	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**
	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
15	**PWR_ON**	**PWR_CTRL**	**PWR_ON**	**RSVD**	**PWR_ON**	**PWR_ON**	**PWR_ON**	**PWR_ON**
	Power-on/off input Internal pull-up: ~200 kΩ L-level: -0.30 ÷ 0.35 V ON L-level time: 0.15 s min – 3.2 s max OFF L-level pulse time: 1.5 s min TestPoint recommended	Power-on/off / reset input Internal pull-up L-level: -0.30 ÷ 0.35 V ON L-level pulse time: 0.01 s min – 1.7 s max OFF L-level pulse time: 1.5 s min – 14 s max Reset L-level pulse time: 16 s min TestPoint recommended	Power-on/off input Internal pull-up: ~10 kΩ (SARA-R500E/ R500S/R510S/R510M8S) ~100 kΩ (SARA-R520/ R520M10) L-level: -0.30 ÷ 0.30 V ON L-level time: 0.1 ÷ 2 s (all except SARA-R510S) 1 ÷ 2 s (SARA-R510S) OFF L-level pulse time: 1.5 ÷ 2.5 s (SARA-R520/ R520M10 only) TestPoint recommended	Reserved	Power-on/off input Internal pull-up: ~90 kΩ L-level: 0.00 ÷ 0.20 V ON L-level pulse time: 1 s min – 2.5 s max OFF L-level pulse time: 2.5 s min TestPoint recommended	Power-on input No internal pull-up L-level: -0.10 ÷ 0.65 V ON L-level time: 5 ms min OFF L-level pulse time: Not Available TestPoint recommended	Power-on input Internal pull-up: ~28 kΩ L-level: 0.00 ÷ 0.30 V ON L-level time: 2 s min OFF L-level time: Not Available TestPoint recommended	Power-on/off input No internal pull-up L-level: -0.30 ÷ 0.65 V ON L-level pulse time: 50 µs min / 80 µs max OFF L-level pulse time: 1 s min TestPoint recommended
16	**GPIO1**	**GPIO1**	**GPIO1**	**GPIO1**	**GPIO1**	**GPIO1**	**GPIO1**	**GPIO1**
	GPIO V_INT level (1.8 V) Driver strength: 2 mA	GPIO V_INT level (1.8 V) Driver strength: 2 mA	GPIO V_INT level (1.8 V) Driver strength: 5 mA	Trace data output V_INT level (1.8 V) Driver strength: 1 mA TestPoint recommended	GPIO V_INT level (1.8 / 2.8 V) Driver strength: 3 mA	GPIO V_INT level (1.8 V) Driver strength: 6 mA	GPIO V_INT level (1.8 / 3.0 V) Driver strength: 3 mA	GPIO V_INT level (1.8 V) Driver strength: 6 mA
17	**VUSB_DET**	**USB_5V0**	**VUSB_DET**	**RSVD**	**TXD_AUX**	**RSVD**	**TXD_AUX**	**VUSB_DET**
	5 V, USB detect input TestPoint recommended	USB 5V0 supply Input TestPoint recommended	5 V, USB detect input TestPoint recommended	Reserved	AUX UART data input[16] V_INT level (1.8 / 2.8 V)	Reserved	AUX UART data input[16] V_INT level (1.8 / 3.0 V) Internal pull-up: ~166 kΩ	5 V, USB detect input TestPoint recommended

[15] Not supported by “02” product version
[16] Not supported by “00” product version

No	SARA-R41 series	SARA-R42 series	SARA-R5 series	SARA-N2 series	SARA-N3 series	SARA-G3 series	SARA-G4 series	SARA-U2 series
18	**RESET_N**	**RSVD**	**RESET_N**	**RESET_N**	**RESET_N**	**RESET_N**	**PWR_OFF**	**RESET_N**
	Shutdown input Internal pull-up: ~37 kΩ L-level: -0.30 ÷ 0.63 V H-level: 1.17 ÷ 2.10 V It triggers shutdown of the whole module when set low or toggled. TestPoint recommended	Reserved	Reset input Internal pull-up: ~56 kΩ L-level: -0.30 ÷ 0.50 V H-level: 1.3 ÷ 2.1 V It triggers module reboot when toggled, without PMU shutdown when low. TestPoint recommended	Reset input Internal pull-up: ~78 kΩ L-level: 0 ÷ 0.36*VCC H-level: 0.52*VCC ÷ VCC It triggers module reboot when toggled, without PMU shutdown when low. TestPoint recommended	Reset shutdown input Internal pull-up: ~70 kΩ L-level: 0.00 ÷ 0.20 V H-level: 0.90 ÷ 1.10 V It triggers module reboot when toggled, with PMU shutdown when low. TestPoint recommended	Reset input Internal diode & pull-up L-level: -0.10 ÷ 0.15 V H-level: 1.40 ÷ 4.50 V It triggers module reboot when toggled, without PMU shutdown when low. TestPoint recommended	Shutdown input Internal diode L-level: 0.00 ÷ 0.10 V H-level: 1.20 ÷ 1.50 V It triggers shutdown of the whole module when set low or toggled. TestPoint recommended	Reset shutdown input Internal pull-up: 10 kΩ L-level: -0.30 ÷ 0.51 V H-level: 1.32 ÷ 2.01 V It triggers module reboot when toggled, with PMU shutdown when low. TestPoint recommended
19	**GPIO6**	**GPIO6**	**GPIO6**	**RSVD**	**RXD_AUX**	**RSVD**	**RXD_AUX**	**CODEC_CLK**
	GPIO V_INT level (1.8 V) Driver strength: 2 mA	GPIO V_INT level (1.8 V) Driver strength: 2 mA	GPIO V_INT level (1.8 V) Driver strength: 5 mA	Reserved	AUX UART data output[17] V_INT level (1.8 / 2.8 V)	Reserved	AUX UART data output[17] V_INT level (1.8 / 3.0 V) Driver strength: 3 mA	13 or 26 MHz output V_INT level (1.8 V) Driver strength: 4 mA
20	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**
	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
21	**GND**	**GND**	**GND / ADC**	**GND**	**VSEL**	**GND**	**VSEL**	**GND**
	Ground	Ground	"00B" product version: Ground "x1B" versions onwards: 12-bit ADC input, which can also be grounded	Ground	V_INT voltage selection VSEL connected to GND: V_INT = 1.8 V VSEL unconnected: V_INT = 2.8 V	Ground	V_INT voltage selection VSEL connected to GND: V_INT = 1.8 V VSEL unconnected: V_INT = 3.0 V	Ground
22	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**
	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
23	**GPIO2**	**GPIO2**	**GPIO2**	**RSVD**	**GPIO2**	**GPIO2**	**GPIO2**	**GPIO2**
	GPIO V_INT level (1.8 V) Driver strength: 2 mA	GPIO V_INT level (1.8 V) Driver strength: 2 mA	GPIO V_INT level (1.8 V) Driver strength: 5 mA	Reserved	GPIO V_INT level (1.8 / 2.8 V) Driver strength: 3 mA	GPIO V_INT level (1.8 V) Driver strength: 6 mA	GPIO V_INT level (1.8 / 3.0 V) Driver strength: 3 mA	GPIO V_INT level (1.8 V) Driver strength: 6 mA
24	**GPIO3**	**GPIO3**	**GPIO3**	**GPIO2**	**GPIO3**	**GPIO3**	**GPIO3**	**GPIO3**
	GPIO V_INT level (1.8 V) Driver strength: 2 mA	GPIO V_INT level (1.8 V) Driver strength: 2 mA	GPIO V_INT level (1.8 V) Driver strength: 5 mA	GPIO[18] V_INT level (1.8 V) Driver strength: 1 mA	GPIO V_INT level (1.8 / 2.8 V) Driver strength: 3 mA	GPIO V_INT level (1.8 V) Driver strength: 5 mA	GPIO V_INT level (1.8 / 3.0 V) Driver strength: 3 mA	GPIO V_INT level (1.8 V) Driver strength: 6 mA
25	**GPIO4**	**GPIO4**	**GPIO4**	**RSVD**	**GPIO4**	**GPIO4**	**GPIO4**	**GPIO4**
	GPIO V_INT level (1.8 V) Driver strength: 2 mA	GPIO V_INT level (1.8 V) Driver strength: 2 mA	GPIO V_INT level (1.8 V) Driver strength: 5 mA	Reserved	GPIO V_INT level (1.8 / 2.8 V) Driver strength: 3 mA	GPIO V_INT level (1.8 V) Driver strength: 6 mA	GPIO V_INT level (1.8 / 3.0 V) Driver strength: 3 mA	GPIO V_INT level (1.8 V) Driver strength: 6 mA
26	**SDA**	**SDA**	**SDA**	**SDA**	**SDA**	**SDA**	**SDA**	**SDA**
	I2C data[19] V_INT level (1.8 V) Open drain Internal pull-up: 2.2 kΩ	I2C data V_INT level (1.8 V) Open drain Internal pull-up: 2.2 kΩ	I2C data V_INT level (1.8 V) Open drain Internal active pull-up	I2C data[18] V_INT level (1.8 V) Open drain No internal pull-up	I2C data[17] V_INT level (1.8 / 2.8 V) Open drain Internal pull-up: 10 kΩ	I2C data V_INT level (1.8 V) Open drain No internal pull-up	I2C data[17] V_INT level (1.8 / 3.0 V) Open drain No internal pull-up	I2C data / AUX UART input V_INT level (1.8 V) Open drain No internal pull-up
27	**SCL**	**SCL**	**SCL**	**SCL**	**SCL**	**SCL**	**SCL**	**SCL**
	I2C clock[19] V_INT level (1.8 V) Open drain Internal pull-up: 2.2 kΩ	I2C clock V_INT level (1.8 V) Open drain Internal pull-up: 2.2 kΩ	I2C clock V_INT level (1.8 V) Open drain Internal active pull-up	I2C clock[18] V_INT level (1.8 V) Open drain No internal pull-up	I2C clock[17] V_INT level (1.8 / 2.8 V) Open drain Internal pull-up: 10 kΩ	I2C clock V_INT level (1.8 V) Open drain No internal pull-up	I2C clock[17] V_INT level (1.8 / 3.0 V) Open drain No internal pull-up	I2C clock / AUX UART out V_INT level (1.8 V) Open drain No internal pull-up

[17] Not supported by "00" product version
[18] Not supported by "02" product version
[19] Not supported by "00" and "01" product versions

No	SARA-R41 series	SARA-R42 series	SARA-R5 series	SARA-N2 series	SARA-N3 series	SARA-G3 series	SARA-G4 series	SARA-U2 series
28	**USB_D-**	**USB_D-**	**USB_D-**	**RSVD**	**RXD_FT**	**RXD_AUX**	**RXD_FT**	**USB_D-**
	USB data I/O (D-) High-speed USB 2.0 TestPoint recommended	USB data I/O (D-) High-speed USB 2.0, only for FW update / diagnostic TestPoint recommended	USB data I/O (D-) High-speed USB 2.0, only for diagnostic TestPoint recommended	Reserved	FW update & Trace output V_INT level (1.8 / 2.8 V) Driver strength: 3 mA TestPoint recommended	AUX UART data output V_INT level (1.8 V) Driver strength: 5 mA TestPoint recommended	FW update & Trace output V_INT level (1.8 / 3.0 V) Driver strength: 3 mA TestPoint recommended	USB data I/O (D-) High-speed USB 2.0 TestPoint recommended
29	**USB_D+**	**USB_D+**	**USB_D+**	**RSVD**	**TXD_FT**	**TXD_AUX**	**TXD_FT**	**USB_D+**
	USB data I/O (D+) High-speed USB 2.0 TestPoint recommended	USB data I/O (D+) High-speed USB 2.0, only for FW update / diagnostic TestPoint recommended	USB data I/O (D+) High-speed USB 2.0, only for diagnostic TestPoint recommended	Reserved	FW update & Trace input V_INT level (1.8 / 2.8 V) Internal pull-up: ~171 kΩ TestPoint recommended	AUX UART data input V_INT level (1.8 V) Internal pull-up:~18 kΩ TestPoint recommended	FW update & Trace input V_INT level (1.8 / 3.0 V) Internal pull-up: ~166 kΩ TestPoint recommended	USB data I/O (D+) High-speed USB 2.0 TestPoint recommended
30	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**
	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
31	**RSVD**	**ANT_GNSS**	**ANT_GNSS**	**RSVD**	**RSVD**	**RSVD**	**RSVD**	**RSVD**
	Reserved	GNSS RF input[20]	GNSS RF input[21]	Reserved	Reserved	Reserved	Reserved	Reserved
32	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**
	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
33	**RSVD**	**RSVD**	**EXT_INT / RTC_GNSS**	**RSVD**	**ADC1**	**RSVD**	**RSVD**	**RSVD**
	Reserved It can be grounded	Reserved TestPoint recommended	All except SARA-R520M10: External interrupt It can be grounded SARA-R520M10: GNSS RTC input for external 32.768 kHz clock	Reserved It can be grounded	ADC input It can be grounded	Reserved It must be grounded	Reserved It can be grounded	Reserved It must be grounded
34	**I2S_WA / SPI_MOSI**	**I2S_WA**	**I2S_WA / RFCTRL1**	**RSVD**	**RSVD**	**I2S_WA**	**I2S_WA**	**I2S_WA**
	I2S W.A.[22] / SPI MOSI[22] V_INT level (1.8 V) Driver strength: 2 mA	I2S Word Alignment[23] V_INT level (1.8 V) Driver strength: 2 mA Configurable as antenna dynamic tuner on “01B” versions onwards	SARA-R500E/R500S/ R510S/R510M8S: I2S Word Alignment[24] Configurable as antenna dynamic tuner SARA-R520/R520M10: Antenna dynamic tuner V_INT level (1.8 V) Driver strength: 5 mA	Reserved	Reserved	I2S Word Alignment V_INT level (1.8 V) Driver strength: 6 mA	Not supported	I2S Word Alignment V_INT level (1.8 V) Driver strength: 2 mA Configurable as GPIO
35	**I2S_TXD / SPI_CS**	**I2S_TXD**	**I2S_TXD / RFCTRL2**	**RSVD**	**RSVD**	**I2S_TXD**	**I2S_TXD**	**I2S_TXD**
	I2S out[22] / SPI CS[22] V_INT level (1.8 V) Driver strength: 2 mA	I2S data output[23] V_INT level (1.8 V) Driver strength: 2 mA Configurable as antenna dynamic tuner on “01B” versions onwards	SARA-R500E/R500S/ R510S/R510M8S: I2S data output[24] Configurable as antenna dynamic tuner SARA-R520/R520M10: Antenna dynamic tuner V_INT level (1.8 V)Driver strength: 5 mA	Reserved	Reserved	I2S data output V_INT level (1.8 V) Driver strength: 5 mA	Not supported	I2S data output V_INT level (1.8 V) Driver strength: 2 mA Configurable as GPIO

[20] Not supported by SARA-R422, SARA-R422S
[21] Not supported by SARA-R500E, SARA-R500S, SARA-R510S
[22] Not supported by “00”, “01”, “x2” and “x3” product versions
[23] Not supported by “00” and “01” product version
[24] Not supported

No	SARA-R41 series	SARA-R42 series	SARA-R5 series	SARA-N2 series	SARA-N3 series	SARA-G3 series	SARA-G4 series	SARA-U2 series
36	**I2S_CLK / SPI_CLK**	**I2S_CLK**	**I2S_CLK / GPIO7 / TXD_GNSS**	**RSVD**	**RSVD**	**I2S_CLK**	**I2S_CLK**	**I2S_CLK**
	I2S clock[25] / SPI clock[25] V_INT level (1.8 V) Driver strength: 2 mA	I2S clock[26] V_INT level (1.8 V) Driver strength: 2 mA	SARA-R500E/R500S/ R510S: I2S clock[27] SARA-R510M8S-x1B: GEOFENCE 1.8 V PIO15 of the internal UBX-M8 SARA-R520: GPIO V_INT level (1.8 V) Driver strength: 5 mA SARA-R520M10: GNSS UART data output	Reserved	Reserved	I2S clock V_INT level (1.8 V) Driver strength: 5 mA	Not supported	I2S clock V_INT level (1.8 V) Driver strength: 2 mA Configurable as GPIO
37	**I2S_RXD / SPI_MISO**	**I2S_RXD**	**I2S_RXD / GPIO8 / ANT_ON**	**RSVD**	**RSVD**	**I2S_RXD**	**I2S_RXD**	**I2S_RXD**
	I2S input[25] / SPI MISO[25] V_INT level (1.8 V)	I2S input[26] V_INT level (1.8 V)	SARA-R500E/R500S/ R510S: I2S data input[27] SARA-R510M8S-x1B: ANT_ON 1.8 V PIO16 of the internal UBX-M8 SARA-R520: GPIO V_INT level (1.8 V) Driver strength: 5 mA Configurable as ANT_ON for SpotNow activities SARA-R520M10: ANT_ON 1.8 V of the internal UBX-M10	Reserved	Reserved	I2S data input V_INT level (1.8 V) Internal pull-down: ~18 kΩ	Not supported	I2S data input V_INT level (1.8 V) Internal pull-down: ~8 kΩ Configurable as GPIO
38	**SIM_CLK**	**SIM_CLK**	**SIM_CLK**[28]	**SIM_CLK**	**SIM_CLK**	**SIM_CLK**	**SIM_CLK**	**SIM_CLK**
	1.8 V / 3 V SIM clock	1.8 V SIM clock	1.8 V / 3 V SIM clock	1.8 V SIM clock	1.8 V / 3 V SIM clock	1.8 V / 3 V SIM clock	1.8 V / 3 V SIM clock	1.8 V / 3 V SIM clock
39	**SIM_IO**	**SIM_IO**	**SIM_IO**[28]	**SIM_IO**	**SIM_IO**	**SIM_IO**	**SIM_IO**	**SIM_IO**
	1.8 V / 3 V SIM data I/O Internal pull-up: 4.7 kΩ	1.8 V SIM data I/O Internal pull-up: 4.7 kΩ	1.8 V / 3 V SIM data I/O Internal pull-up: 4.7 kΩ	1.8 V SIM data I/O Internal pull-up: 4.7 kΩ	1.8 V / 3 V SIM data I/O Internal pull-up: 4.7 kΩ	1.8 V / 3 V SIM data I/O Internal pull-up: 4.7 kΩ	1.8 V / 3 V SIM data I/O Internal pull-up: 4.7 kΩ	1.8 V / 3 V SIM data I/O Internal pull-up: 4.7 kΩ
40	**SIM_RST**	**SIM_RST**	**SIM_RST**[28]	**SIM_RST**	**SIM_RST**	**SIM_RST**	**SIM_RST**	**SIM_RST**
	1.8 V / 3 V SIM reset	1.8 V SIM reset	1.8 V / 3 V SIM reset	1.8 V SIM reset	1.8 V / 3 V SIM reset	1.8 V / 3 V SIM reset	1.8 V / 3 V SIM reset	1.8 V / 3 V SIM reset
41	**VSIM**	**VSIM**	**VSIM**[28]	**VSIM**	**VSIM**	**VSIM**	**VSIM**	**VSIM**
	1.8 V / 3 V SIM supply	1.8 V SIM supply	1.8 V / 3 V SIM supply	1.8 V SIM supply	1.8 V / 3 V SIM supply	1.8 V / 3 V SIM supply	1.8 V / 3 V SIM supply	1.8 V / 3 V SIM supply
42	**GPIO5**	**GPIO5**	**GPIO5**	**RSVD**	**GPIO5**	**SIM_DET**	**SIM_DET**	**SIM_DET**
	GPIO / SIM detection input V_INT level (1.8 V) Driver strength: 2 mA	GPIO / SIM detection input V_INT level (1.8 V) Driver strength: 2 mA	GPIO / SIM detection[28] V_INT level (1.8 V) Driver strength: 5 mA	Reserved	SIM detection[29] / GPIO V_INT level (1.8 / 2.8 V) Driver strength: 3 mA	SIM detection input V_INT level (1.8 V)	SIM detection input V_INT level (1.8 V / 3.0 V)	SIM detection input V_INT level (1.8 V) Configurable as GPIO
43	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**
	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground

[25] Not supported by “00”, “01”, “x2” and “x3” product versions
[26] Not supported by “00” and “01” product version
[27] Not supported
[28] External SIM interface not supported by SARA-R500E modules
[29] Not supported by “00” product version

No	SARA-R41 series	SARA-R42 series	SARA-R5 series	SARA-N2 series	SARA-N3 series	SARA-G3 series	SARA-G4 series	SARA-U2 series
44	**SDIO_D2**	**ANT_ON**	**SDIO_D2**	**RSVD**	**RSVD**	**SPK_P**	**SPK_P**	**RSVD**
	SDIO serial data [2][30]	GNSS LNA on/off signal connected to the internal GNSS chip and LNA[31]	SDIO serial data [2][32] Settable as SPI_CLK[32]	Reserved	Reserved	Analog audio output (+)	Analog audio output (+)[33]	Reserved
45	**SDIO_CLK**	**TIMEPULSE**	**SDIO_CLK**	**RSVD**	**RSVD**	**SPK_N**	**SPK_N**	**RSVD**
	SDIO serial clock[30]	GNSS time pulse output[31]	SDIO serial clock[32]	Reserved	Reserved	Analog audio output (-)	Analog audio output (-)[33]	Reserved
46	**SDIO_CMD**	**EXTINT**	**SDIO_CMD**	**RSVD**	**RSVD**	**MIC_BIAS**	**MIC_BIAS**	**RSVD**
	SDIO command[30]	GNSS external interrupt[31]	SDIO command[32]	Reserved	Reserved	Microphone supply	Microphone supply[33]	Reserved
47	**SDIO_D0**	**TXD_GNSS**	**SDIO_D0**	**RSVD**	**RSVD**	**MIC_GND**	**MIC_GND**	**RSVD**
	SDIO serial data [0][30]	GNSS UART data output[31]	SDIO serial data [0][32] Settable as SPI_MOSI[32]	Reserved	Reserved	Microphone ground	Microphone ground[33]	Reserved
48	**SDIO_D3**	**RSVD**	**SDIO_D3**	**RSVD**	**RSVD**	**MIC_N**	**MIC_N**	**RSVD**
	SDIO serial data [3][30]	Reserved	SDIO serial data [3][32] Settable as SPI_CS[32]	Reserved	Reserved	Analog audio input (-)	Analog audio input (-)[33]	Reserved
49	**SDIO_D1**	**RSVD**	**SDIO_D1**	**RSVD**	**RSVD**	**MIC_P**	**MIC_P**	**RSVD**
	SDIO serial data [1][30]	Reserved	SDIO serial data [1][32] Settable as SPI_MISO[32]	Reserved	Reserved	Analog audio input (+)	Analog audio input (+)[33]	Reserved
50	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**
	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
51-53	**VCC**	**VCC**	**VCC**	**VCC**	**VCC**	**VCC**	**VCC**	**VCC**
	Module supply input Normal op. range: 3.20 ÷ 4.20 V Extended op. range: 3.00 ÷ 4.30 V No turn-on by VCC apply	Module supply input Normal op. range: 3.20 ÷ 4.50 V Extended op. range: 3.00 ÷ 4.50 V No turn-on by VCC apply	Module supply input Normal op. range: 3.30 ÷ 4.40 V Extended op. range: 3.00 ÷ 4.50 V All except SARA-R510S: Turn-on by VCC apply SARA-R510S: No turn-on by VCC apply	Module supply input Normal op. range: 3.10 ÷ 4.00 V Extended op. range: 2.75 ÷ 4.20 V Turn-on by VCC apply	Module supply input Normal op. range: 3.20 ÷ 4.20 V Extended op. range: 2.60 ÷ 4.20 V No turn-on by VCC apply	Module supply input Normal op. range: 3.35 ÷ 4.50 V Extended op. range: 3.00 ÷ 4.50 V Turn-on by VCC apply	Module supply input Normal op. range: 3.40 ÷ 4.20 V Extended op. range: 3.10 ÷ 4.50 V No turn-on by VCC apply	Module supply input Normal op. range: 3.30 ÷ 4.40 V Extended op. range: 3.10 ÷ 4.50 V Turn-on by VCC apply
54-55	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**
	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
56	**ANT**	**ANT**	**ANT**	**ANT**	**ANT**	**ANT**	**ANT**	**ANT**
	Cellular RF I/O	Cellular RF I/O	Cellular RF I/O	Cellular RF I/O	Cellular RF I/O	Cellular RF I/O	Cellular RF I/O	Cellular RF I/O
57-58	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**
	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
59	**GND**	**GND**	**GND**	**GND**	**ANT_BT**	**GND**	**GND**	**GND**
	Ground	Ground	Ground	Ground	Bluetooth RF I/O[33] It can be grounded	Ground	Ground	Ground

[30] Not supported by “00”, “01”, “x2” and “x3” product versions
[31] Not supported by SARA-R422, SARA-R422S
[32] Supported for diagnostic only
[33] Not supported by “00” product version

No	SARA-R41 series	SARA-R42 series	SARA-R5 series	SARA-N2 series	SARA-N3 series	SARA-G3 series	SARA-G4 series	SARA-U2 series
60-61	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**
	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground
62	**ANT_DET**	**ANT_DET**	**ANT_DET**	**ANT_DET**	**ANT_DET**	**ANT_DET**	**ANT_DET**	**ANT_DET**
	Antenna detection	Antenna detection	Antenna detection	Antenna detection[34]	Antenna detection / ADC	Antenna detection	Antenna detection	Antenna detection
63-96	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**	**GND**
	Ground	Ground	Ground	Ground	Ground	Ground	Ground	Ground

Table 6: SARA-N2, SARA-N3, SARA-R4, SARA-R5, SARA-G3, SARA-G4 and SARA-U2 series modules pin assignment and description, with remarks for migration

For further details regarding characteristics, capabilities, usage or settings applicable for each interface of SARA-N2, SARA-N3, SARA-R4, SARA-R5, SARA-G3, SARA-G4, and SARA-U2 cellular modules, see the related data sheet [1], [2], [7], [8], [9], [13], [14], [15], the related integration manual [3], [4], [10], [11], [16], [17] and the nested design application note [12].

[34] Not supported by "02" product version

3.3 Schematic for SARA modules integration

Figure 4 shows an example of a simple schematic diagram where a u-blox SARA-N2, SARA-N3, SARA-R4, SARA-R5, SARA-G3, SARA-G4, and/or SARA-U2 module is integrated in the same application board, using the main available interfaces and functions of the modules.

The different mounting options for the external parts are highlighted in different colors as described in the legend, according to the interfaces supported by each module, and related characteristics.

VCC supply

In the simple schematic diagram shown in Figure 4, the **VCC** supply of the SARA modules is provided by a suitable supply source, at 3.6 V nominal voltage, not illustrated in the diagram. The application processor controls the **VCC** supply of the modules by a high-side switch. Proper bypass capacitors and EMI filter parts are placed close to the **VCC** input pins of the modules.

While selecting the supply source for SARA cellular modules, consider with adequate safe design margin the maximum current consumption of each SARA cellular module (see related data sheet [1], [2], [7], [8], [9], [13], [14], [15]), as it reflects the RATs supported. For additional specific design guidelines, see the **VCC** interface sections in the related system integration manual [3], [4], [10], [11], [16], [17].

The switch-on sequence of SARA-N2, SARA-R500E, SARA-R500S, SARA-R510M8S, SARA-R520, SARA-R520M10, SARA-G3 and SARA-U2 starts by applying a valid **VCC** supply.

Instead, SARA-N3, SARA-R4, SARA-R510S and SARA-G4 modules continue to be switched off even after a valid **VCC** supply has been applied: the **PWR_ON** input line must be properly toggled, with valid **VCC** supply present, to start the switch-on sequence of these modules.

UART serial interface

The application processor is connected to the SARA modules over main UART interface in the simple schematic diagram illustrated in Figure 4.

The design is implemented with the UART interface configured at the same voltage level on both sides (application processor and SARA module), without using voltage translators, as recommended to minimize any possible leakage and benefit from the extremely low current consumption of the u-blox LPWA modules, particularly in deep-sleep power saving mode.

Thus, the supply level of the application processor is selected to properly set its UART voltage level:

- at the **VCC** level of the module (3.6 V nominal), in case of SARA-N2
- at the **V_INT** level of the module (2.8 V nominal, with **VSEL** unconnected), in case of SARA-N3
- at the **V_INT** level of the module (3.0 V nominal, with **VSEL** unconnected), in case of SARA-G4
- at the **V_INT** level of the module (1.8 V nominal), for all the other SARA modules

The **TXD** and **RXD** data lines, supported by all the SARA modules for AT and data communication, are directly connected with the application processors. For additional specific design guidelines, see the UART sections in the related system integration manual [3], [4], [10], [11], [16], [17].

The **RTS**, **CTS** and **RI** lines are connected to the application processors by 0 Ω jumpers for all the u-blox SARA modules except the SARA-N2 series, which does not support hardware flow control functionality and instead supports **RI** functionality over the **CTS** output pin.

The other UART lines are not implemented in the simple example of design shown in Figure 4, and the **DTR** input is grounded as required to have URCs and/or the greeting text sent by SARA-R4, SARA-R5 and SARA-U2 modules.

System control interfaces

The application processor controls the **PWR_ON** / **PWR_CTRL** line by an open drain driver in the circuit illustrated in Figure 4, with an external pull-up to **V_BCKP** for SARA-G3 and SARA-U2 modules. The whole circuit need not be populated for SARA-N2 modules, which do not provide **PWR_ON** / **PWR_CTRL** input.

The application processor controls the **RESET_N** / **PWR_OFF** line by open drain driver too. The assertion or toggling of this line causes different actions:

- the **RESET_N** line triggers an unconditional reboot of the module when toggled, without internal PMU shutdown when set low, in case of SARA-N2, SARA-R5 and SARA-G3
- the **RESET_N** line triggers an unconditional reboot of the module when toggled, with internal PMU shutdown when set low, in case of SARA-N3 and SARA-U2
- the **RESET_N** / **PWR_OFF** line triggers an unconditional shutdown of the module when set low or toggled, in case of SARA-R4 and SARA-G4

The circuit need not be populated for SARA-R42x modules, not providing **RESET_N** / **PWR_OFF** input.

The timings for proper control of the **PWR_ON** / **PWR_CTRL**, **RESET_N** / **PWR_OFF** lines of the SARA modules are reported in the related data sheet [1], [2], [7], [8], [9], [13], [14], [15].

Cellular RF interface

Figure 4 shows the **ANT** cellular antenna circuit implemented with the optional **ANT_DET** antenna detection circuit according to the design guidelines provided in the antenna interface sections of the related system integration manual [3], [4], [10], [11], [16], [17].

While selecting the antenna for SARA cellular modules, consider the frequency range supported by each SARA module, as illustrated in Figure 3.

Designers must consider the antenna from all perspectives at the very start of the design phase when the physical dimensions of the application board are under analysis/decision, since the RF compliance of the end-device integrating cellular modules with all the applicable required certification schemes depends on the antenna's radiating performance.

While implementing the cellular RF antenna design for SARA modules, consider providing the best possible return loss in the frequency range supported by the modules, and place the antenna far from **VCC** supply line and related parts, as well as far from any possible source of interference and/or noise.

GNSS RF interface

Figure 4 shows the **ANT_GNSS** circuit implemented for the SARA-R422M8S, SARA-R422M10S, SARA-R510M8S and SARA-R520M10 combo modules, which integrate the u-blox GNSS receiver chip, or for the SARA-R520 module, which integrates the u-blox SpotNow A-GPS receiver. The module **ANT_GNSS** RF input is connected to a GNSS antenna without additional external SAW and LNA; dedicated band-pass SAW and LNA are already integrated in the combo modules along the internal GNSS RF path.

Similar to the cellular RF antenna design, the GNSS RF antenna design needs to provide the best possible return loss in the GNSS frequency range supported by the modules, and should have the antenna placed far from any possible source of interference or noise.

SIM interface

Figure 4 also shows the SIM interface circuit implemented with the optional SIM detection function, according to the design guidelines provided in SIM interface sections of the related system integration manual [3], [4], [10], [11], [16], [17]. Bypass capacitors with proper self-resonant frequency are recommended to be placed close to the SIM connector, as well as ESD protections. External SIM interface is not supported by SARA-R500E modules.

GPIO interface

Figure 4 also shows the **GPIO1** that controls an LED, which provides the network status indication. It is supported by all SARA modules, except SARA-N2 series that can provide this function on the **CTS** pin. Other functions can be enabled on the GPIOs of the SARA modules, as described in the related data sheet [1], [2], [7], [8], [9], [13], [14], [15] and related AT commands manual [5], [6], [18], [19].

Test-Points

Table 7 lists the interfaces dedicated for FW update and/or diagnostic purposes on SARA modules.

Module	FW update	Cellular diagnostic	GNSS diagnostic
SARA-R41 series	USB, PWR_ON	USB, RESET_N, V_INT	-
SARA-R42 series	USB, PWR_CTRL	USB, PWR_ CTRL, V_INT, RSVD #33	TXD_GNSS
SARA-R5 series	UART, PWR_ON, V_INT	USB, RESET_N, V_INT	UART AUX (DCD, DTR), TXD_GNSS
SARA-N2 series	UART, RESET_N	GPIO1, RESET_N	-
SARA-N3 series	UART FT, PWR_ON, V_INT	UART FT, RESET_N, V_INT	-
SARA-G3 series	UART AUX, RESET_N, V_INT	UART AUX, PWR_ON, V_INT	-
SARA-G4 series	UART FT, PWR_ON, V_INT	UART FT, PWR_OFF, V_INT	-
SARA-U2 series	USB, RESET_N	USB, PWR_ON, V_INT	-

Table 7: Interfaces for FW update and/or diagnostic purposes on SARA modules

The schematic diagram illustrated in Figure 4 includes accessible test-points directly connected to the following pins, which are strongly recommended for FW update and diagnostic purposes:

- **V_INT**
- **PWR_ON/PWR_CTRL**
- **RESET_N/PWR_OFF**
- **TXD**
- **RXD**
- **GPIO1**
- **VUSB_DET/USB_5V0**
- **USB_3V3**
- **USB_D+/TXD_FT/TXD_AUX**
- **USB_D−/RXD_FT/RXD_AUX**
- **RSVD #33**
- **TXD_GNSS**
- **DCD**
- **DTR**

Other

All the GND pins are intended to be externally connected to ground, while other interfaces are not implemented or not used in the simple example of design as shown in Figure 4.

☞ For additional specific design guidelines, see the related system integration manual [3], [4], [10], [11], [16], [17] of the u-blox SARA modules.

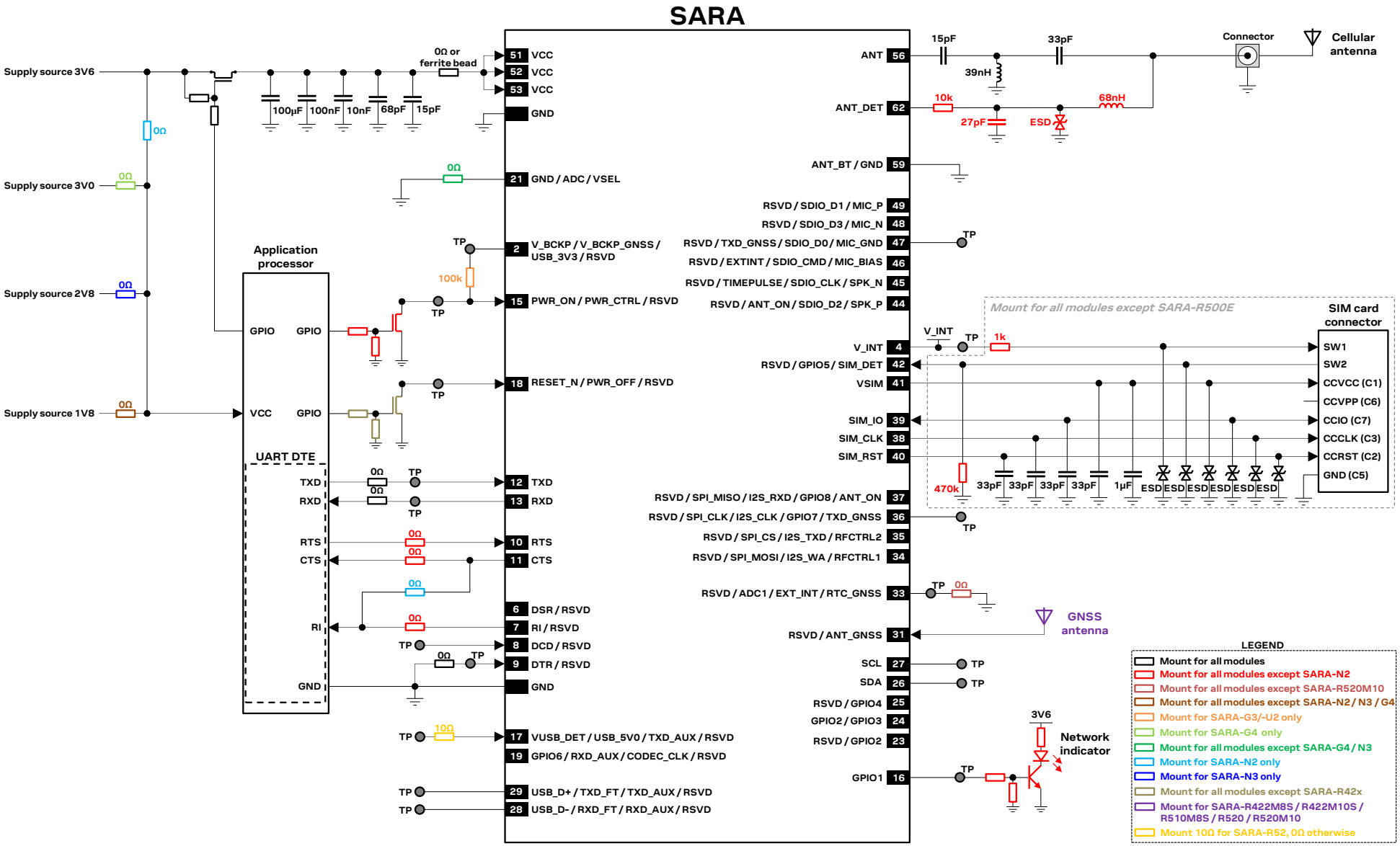

Figure 4: Example schematic to integrate a SARA-R4, SARA-R5, SARA-N2, SARA-N3, SARA-G3, SARA-G4 and/or SARA-U2 module in the same application PCB, using main interfaces

Appendix

A Glossary

Abbreviation	Definition
2G	2nd Generation Cellular Technology (GSM, GPRS, EGPRS)
3G	3rd Generation Cellular Technology (UMTS, HSDPA, HSUPA)
3GPP	3rd Generation Partnership Project
8-PSK	8 Phase-Shift Keying modulation
ADC	Analog to Digital Converter
AT	AT Command Interpreter Software Subsystem, or attention
AUX	Auxiliary
Cat	Category
CDMA	Code Division Multiple Access
CoAP	Constrained Application Protocol
CTS	Clear To Send
DCD	Data Carrier Detect
DCE	Data Communication Equipment
DCS	Digital Cellular System
DL	Down-Link (Reception)
DSR	Data Set Ready
DTE	Data Terminal Equipment
DTLS	Datagram Transport Layer Security
DTR	Data Terminal Ready
EDGE	Enhanced Data rates for GSM Evolution (EGPRS)
EGPRS	Enhanced General Packet Radio Service (EDGE)
EMI	Electro-Magnetic Interference
ESD	Electro-Static Discharge
E-UTRA	Evolved Universal Terrestrial Radio Access
FDD	Frequency Division Duplex
FOAT	Firmware update Over AT commands
FOTA	Firmware update Over The Air
FTPS	File Transfer Protocol Secure
FW	Firmware
GLONASS	GLObal Navigation Satellite System
GMSK	Gaussian Minimum-Shift Keying modulation
GND	Ground
GNSS	Global Navigation Satellite System
GPIO	General Purpose Input Output
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile communication
HSPA	High-Speed Packet Access
HTTPS	HyperText Transfer Protocol Secure
HW	Hardware
I/O	Input/Output

Abbreviation	Definition
I2C	Inter-Integrated Circuit interface
I2S	Inter IC Sound interface
IoT	Internet of Things
LED	Light Emitting Diode
LGA	Land Grid Array
LNA	Low Noise Amplifier
LPWA	Low Power Wide Area
LTE	Long Term Evolution
LwM2M	Open Mobile Alliance Lightweight Machine-to-Machine protocol
MISO	Master Input Slave Output
MOSI	Master Output Slave Input
MQTT	Message Queuing Telemetry Transport
MQTT-SN	Message Queuing Telemetry Transport for Sensor Networks
NB	Narrow Band
PCS	Personal Communications Service
PMU	Power Management Unit
PSM	Power Saving Mode
QZSS	Quasi-Zenith Satellite System
RAT	Radio Access Technology
RF	Radio Frequency
RI	Ring Indication
RTC	Real Time Clock
RTS	Request To Send
SAIF	Sub-meter-class Augmentation with Integrity Function
SAW	Surface Acoustic Wave
SBAS	Satellite-Based Augmentation System
SDIO	Secure Digital Input Output
SIM	Subscriber Identification Module
SMS	Short Message Service
SPG	Standard Precision GNSS
SPI	Serial Peripheral Interface
TBD	To Be Defined
TCP	Transmission Control Protocol
TLS	Transport Layer Security
TP	Test-Point
UART	Universal Asynchronous Receiver-Transmitter
uCPU	u-blox open CPU solution
UDP	User Datagram Protocol
UL	Up-Link (Transmission)
UMTS	Universal Mobile Telecommunications System
URC	Unsolicited Result Code
USB	Universal Serial Bus

Related documentation

[1] u-blox SARA-R5 series data sheet, UBX-19016638
[2] u-blox SARA-R52 series data sheet, UBX-22038918
[3] u-blox SARA-R5 series system integration manual, UBX-19041356
[4] u-blox SARA-R52 series system integration manual, UBX-23004806
[5] u-blox SARA-R5 series AT commands manual, UBX-19047455
[6] u-blox SARA-R4 series AT commands manual, UBX-17003787
[7] u-blox SARA-G3 series data sheet, UBX-13000993
[8] u-blox SARA-U2 series data sheet, UBX-13005287
[9] u-blox SARA-N2 series data sheet, UBX-15025564
[10] u-blox SARA-G3/SARA-U2 series system integration manual, UBX-13000995
[11] u-blox SARA-N2/SARA-N3 series system integration manual, UBX-17005143
[12] u-blox nested design application note, UBX-16007243
[13] u-blox SARA-R4 series data sheet, UBX-16024152
[14] u-blox SARA-N3 series data sheet, UBX-18066692
[15] u-blox SARA-G4 series data sheet, UBX-18006165
[16] u-blox SARA-R4 series system integration manual, UBX-16029218
[17] u-blox SARA-G4 series system integration manual, UBX-18046432
[18] u-blox AT commands manual, UBX-13002752
[19] u-blox SARA-N2/SARA-N3 series AT commands manual, UBX-16014887

For regular updates to u-blox documentation and to receive product change notifications, register on our homepage (www.u-blox.com).

Revision history

Revision	Date	Name	Comments
R01	10-Oct-2019	fvid	Initial release
R02	11-Nov-2019	lpah	Updated document products applicability Minor update on SARA-R5 series products description
R03	24-Jan-2020	sses	Added SARA-R422, SARA-R422S, SARA-R422M8S products applicability Minor update on SARA-R5 series products description
R04	09-Mar-2020	sses	Added SARA-R410M-83B and SARA-R500S products applicability Added jamming detection feature to SARA-R422S and SARA-R422M8S Updated RAT supported by “00” products version of SARA-R5 series modules Minor other corrections and clarifications
R05	22-Jul-2020	sses	Updated SARA-R410M-x3B and SARA-R5 series products status Added second auxiliary UART interface on SARA-R42 series modules Added GNSS UART data output on SARA-R422M8S modules Corrected and clarified SARA-R4 series modules operating bands and RATs Revised schematic design example Minor other corrections and clarifications
R06	12-Oct-2020	sses	Updated SARA-R5 series and SARA-R42 series products status Revised recommended GNSS diagnostic interface for SARA-R5 series Revised supported bands for SARA-R42 series Minor other corrections and clarifications
R07	06-Jul-2021	sses	Extended document applicability to SARA-R410M-02B-03, SARA-R410M-63B-01, SARA-R410M-73B-01, SARA-R410M-83B-01, SARA-R412M-02B-03, SARA-R500S-00B-01, SARA-R500S-01B-00, SARA-R510S-00B-01, SARA-R510S-01B-00, SARA-R510M8S-00B-01 and SARA-R510M8S-01B-00 Updated SARA-R42 series products status Minor other corrections and clarifications
R08	02-Feb-2022	fvid	Extended document applicability to SARA-R500S-61B-00, SARA-R500S-71B-00, SARA-R510S-61B-00, SARA-R510S-71B-00, SARA-R510M8S-61B-00, and SARA-R510M8S-71B-00. Updated some product status. Minor clarifications.
R09	03-Oct-2022	sses	Extended document applicability to SARA-R422-01B, SARA-R422S-01B, and SARA-R422M10S-01B. Other minor corrections and clarifications.
R10	22-Jun-2023	fvid / sses	Extended document applicability to SARA-R500E and SARA-R52 series. Other minor corrections and clarifications.
R11	22-Mar-2024	fvid	Minor correction.
R12	03-Apr-2024	sses	Corrected VUSB_DET guideline for SARA-R52 series. Minor editorial changes and clarifications.

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