Product summary

# ALEX-R5 series

## Ultra-small LTE-M / NB-IoT SiP with Secure Cloud

Standard

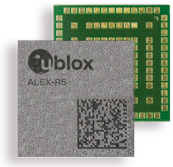
Professional

Automotive

**Miniature form factor with integrated u-blox UBX-R5 and UBX-M8 chipsets**

- Super low power, accurate, and reliable positioning with u-blox M8 GNSS receiver
- Concurrent accurate positioning and LTE signalling, as needed by tracking applications
- Cost-effective, power efficient, end-to-end IoT communication with MQTT Anywhere
- IoT-Security-as-a-Service protects your business-critical data from device to cloud
- Designed to last an IoT lifetime and 5G-ready

14.0 × 14.0 × 1.5 mm




### Product description

The very small ALEX-R510M8S delivers LTE-M and NB-IoT connectivity with GNSS positioning. It combines the secure u-blox UBX-R5 IoT chipset and the u-blox UBX-M8230 GNSS chipset with the highest level of integration in a System-in-Package (SiP).

Measuring just 14 x 14 x 1.5 mm, ALEX-R510M8S occupies less than 50% of SARA-R5's PCB without affecting the overall LTE and positioning performance. It is ideal for size-constrained devices like people and animal wearables, small asset trackers, portable healthcare systems and other small IoT applications.

The GNSS receiver Super-E mode provides ALEX-R510M8S with an ideal balance between low power and good performance. It is optimized for power-sensitive and battery-powered applications, featuring a market-leading sub-µA current consumption in PSM mode.

ALEX-R510M8S offers a dedicated GNSS serial interface and a dedicated GNSS antenna interface, which provides highly reliable and accurate positioning data concurrent with LTE communication. The module works seamlessly with u-blox location services: AssistNow A-GNSS, CellLocate mobile network-based location, and CloudLocate positioning in cloud service.

u-blox Secure Cloud functionality, which supports IoT-Security-as-a-Service, makes ALEX-R510M8S the ideal choice for devices that transmit critical and confidential information.

With all in-house technology and full hardware and software ownership, u-blox can guarantee long-term device availability and provide lifetime support of the entire platform, down to the chipset level. u-blox R5 series modules are the only products in the market with a real LTE and GNSS chip-down integration, supporting the standard LTE-M and NB-IoT Power Class 3 of 23 dBm maximum output power, yielding better performance at cell edges and under more challenging network conditions.

The LTE-M and NB-IoT module supports a comprehensive set of 3GPP Rel. 14 features that are relevant for IoT applications, like improvements to power consumption, coverage, data rate, mobility, and positioning. It is 5G-ready, meaning customers will be able to upgrade software on their deployed devices once 5G LTE has been rolled out by mobile operators, which greatly improves product scalability and lifetime.

| | ALEX-R510M8S |
|---|---|
| **Grade** | |
| Automotive | |
| Professional | • |
| Standard | |
| **Regions** | |
| | Multi-region |
| **Access technology** | |
| LTE bands | 1, 2, 3, 4, 5, 8, 12, 13, 18, 19, 20, 25, 26, 28, 66, 71, 85 |
| Data rate | M1/NB2 |
| LTE Power class | 23 dBm |
| **Positioning** | |
| Integrated GNSS receiver | • |
| Dedicated GNSS antenna interface | • |
| **Compatible with u-blox Services** | |
| MQTT Anywhere, MQTT Flex | • |
| AssistNow™ | • |
| CellLocate® | • |
| CloudLocate | • |
| IoT Security-as-a-Service | • |
| **Interfaces** | |
| UART | 2 |
| USB (for diagnostics) | 1 |
| DDC (I2C) | 1 |
| USIM | 1 |
| GPIO | 11 |
| **Features** | |
| Root of trust: secure element | • |
| Secure boot, updates, and production | • |
| MQTT, MQTT-SN | • |
| Antenna dynamic tuning | • |
| Ultra low PSM | • |
| TCP/UDP | • |
| HTTP, FTP | • |
| TLS/DTLS | • |
| FW update via serial (FOAT) | • |
| uFOTA | • |
| CoAP and LwM2M | • |
| Last gasp | • |
| Jamming detection | • |
| Antenna and SIM detection | • |

M1 = LTE Cat M1 (375 kb/s DL, 1200 kb/s UL)
NB2 = Cat NB2 (125 kb/s DL, 140 kb/s UL)

☐ = Available in future FW version

# ALEX-R5 series

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## Features

| | |
|---|---|
| LTE | **3GPP Release 13 LTE Cat M1 and NB1**<br>**3GPP Release 14 LTE Cat M1**: Coverage enhancement mode B, Uplink TBS of 2984b, CIoT optimizations, and Release Assistance Indication (RAI)<br>**3GPP Release 14 LTE Cat NB2**: Higher data rate (TBS of 2536b), mobility enhancement (RRC connection re-establishment), E-Cell ID, lower power class PC6 (14 dBm), two HARQ processes, release assistant, random access on non-anchor carrier, and CIoT optimizations<br>**Cat M1** Half-duplex, 375 kb/s DL, 1200 kb/s UL<br>**Cat NB2** Half-duplex, 125 kb/s DL, 140 kb/s UL |
| SMS | MT/MO PDU / text mode<br>SMS over SG/NAS |

## Compatible with u-blox services

| | |
|---|---|
| Communication | MQTT Anywhere<br>MQTT Flex |
| Location | AssistNow<br>CellLocate<br>CloudLocate |
| Security | Design Security: Local data protection, Local chip-to-chip (C2C) security<br>End-to-End Security: symmetric key management system (KMS), data protection, data integrity<br>Certificate Lifecycle Control: Zero Touch Provisioning, IoT Certificate Manager |

## Software features

| | |
|---|---|
| Protocols | Dual stack IPv4 and IPv6<br>PPP over IPv4 and IPv6<br>Embedded TCP/IP, UDP/IP, FTP, HTTP, DNS<br>Embedded MQTT and MQTT-SN<br>Embedded CoAP and LwM2M<br>Embedded TLS/DTLS<br>SIM provisioning (BIP) |
| Positioning | Integrated u-blox M8 chipset with concurrent GNSS (GPS, GLONASS, BeiDou, Galileo)<br>Dedicated GNSS antenna interface |
| Functionalities | Antenna dynamic tuning<br>Last gasp<br>Jamming detection<br>Antenna and SIM detection |
| Firmware upgrade | Via UART<br>uFOTA client/server solution<br>(firmware upgrade over the air) |

## Package

133-pin LGA: 14.0 x 14.0 x 1.5 mm

## Environmental data, quality, and reliability

| | |
|---|---|
| Operating temperature | –40 °C to +85 °C |
| RoHS compliant (lead-free) | |
| Qualification according to AEC-Q104 | |
| Manufactured in ISO/TS 16949 certified production sites | |

## Certifications and approvals

| | |
|---|---|
| ALEX-R5 series | FCC, ISED, GCF, PTCRB, Verizon, AT&T, T-Mobile, US Cell [1], Telus [1], Rogers [1], RED, Vodafone [1], Deutsche Telekom [1], KCC [1], Giteki, RCM [1], Telstra [1], NCC |

1 = Planned certifications

## Electrical data

| | |
|---|---|
| Power supply | 3.8 V nominal, range 3.0 V to 4.5 V |
| PSM current consumption | 0.5 µA |
| eDRX current consumption | 180 µA |
| LTE Cat M1 Connected mode current consumption | 195 mA (at 23 dBm) |
| LTE Cat NB2 Connected mode current consumption | 135 mA (at 23 dBm) |

## Interfaces

| | |
|---|---|
| Serial | 8-wire UART, configurable as 2x 4-wire UART with ring indication<br>DDC (I2C)<br>USB for diagnostics |
| GPIO | Up to 11 GPIOs, configurable |
| (U)SIM | Supports 1.8 V and 3.0 V |

## Support products

| | |
|---|---|
| EVK-ALEXR510M8S | Evaluation kit for ALEX-R510M8S |

## Product variants

| | |
|---|---|
| ALEX-R510M8S | Secure Cloud LTE-M and NB-IoT SiP with integrated u-blox M8 GNSS receiver for multi-regional use |

## Further information

For contact information, see **www.u-blox.com/contact-u-blox**.

For more product details and ordering information, see the product data sheet.

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