WIRELESS TECHNOLOGIES

- GPS/GALILEO/GLONASS/BEIDOU/IRIDIUM
- GSM/GPRS/UMTS/CDMA
- LTE/LTE LOW CATEGORY
- NB-IOT (NARROW BAND IOT)
- V2V/V2X (VEHICLE-TO-EVERYTHING)
- ISM (433MHZ, 868MHZ, 2.4GHZ)
- BLUETOOTH, Wi-Fi
- ZIGBEE, THREAD
- ANTENNAS & ACCESSORIES

WWW.MICRODIS.NET
acts as a high-tech distributor for many years, collecting experience in wireless communication devices. We offer not only the latest technology provided by well known suppliers, but also professional technical and commercial support, evaluation kits and reference designs, comprehensive deliveries including accessories such as antennas, connectors and adapters.

Microdis Electronics supports the most sophisticated wireless applications, like Emergency Call - eCall in Europe and Era Glonass in Russia. Both, based on the state of the art GPS/Glonass technology and dedicated GSM and UMTS features provided by u-blox, will save human lives in case of car accidents.
u-bloxF9, u-bloxM9, u-bloxM8 - the latest GNSS technology dedicated to applications requiring high sensitivity, short wake-up time, low energy consumption and stable functionality under harsh conditions in vehicles.

- Supports: GPS, Glonass, BeiDou, QZSS and Galileo
- Up to 4 systems used in parallel
- Multiband versions for high precision also in the cities
- Superb security features:
  - Spoofing & Jamming detection, Message Integrity protection
  - High performance navigation, ultra fast acquisition (<1s)
  - True, dynamic sensitivity as high as -167dBm
- Position accuracy (CEP, SBAS): 1.5m
- High precision NEO-M8P, ZED-F9P accuracy < 0.01m
- Super Efficient low power mode: (6mA/1.8V, 1Hz tracking)
- Assisted positioning service for GPS, Galileo and Glonass:
  - Online, Offline (up to 35 days) and Autonomous
- Best in class jamming immunity
- Geofencing to warn when leaving defined area
- Built in sensors for navigation without sky view (NEO-M8L/U)
- Dedicated modules (NEO-M8T, LEA-M8F) for precise timing
- Extremely small modules with built in antenna (CAM-M8x)
- Backward pin compatibility (ublox5/ublox6/ublox7 generations)
- Versions dedicated to cost sensitive applications
- Easy to design, manufacture and integrate with antennas

**SECURE GNSS PLATFORM FROM U-BLOX**

**Message Integrity** - protection against providing falsification of GNSS position i.e. by the communication “record and replay”.

**Jammer detection** - indicates the presence of GNSS jammer

The best on the market in-band jamming immunity.

**Anti-spoofing protection** - indicates attempts to forge a GNSS signal for false positioning.

Fake data package or jammer

Data is recorded

Data is replayed

Protected

**Geofencing** - receiver reports (by command or I/O pin) if fix lies within defined area (up to 4 can be defined).

**Multi GNSS support** - u-bloxM8 brings real advantage of using few positioning systems in parallel. Multiple GNSS Assisted data (MGA) are available for all systems. Combined with high sensitivity it makes u-bloxM8 modules the best performance products.

**Wrist mode** - to filter out arm motion for wrist worn applications.

**Odometer** - provides ground distance using solely the position and Doppler-based velocity.

**3-Dimensional Dead Reckoning GNSS** - the ability to calculate a position in the X, Y, and Z axis when satellite signals are blocked. Built in sensors (gyroscope, accelerometer) allow full coverage even without GNSS signal (tunnels, car parks).

**Multiple GNSS Assisted data (MGA)** - using GPS, Galileo, Glonass, BeiDou and QZSS data from the u-blox‘ server to boost acquisition, or to be able to get fix despite weak signals and a harsh environment. Available as Online, Offline (up to 35 days ahead) and Autonomous (calculated internally by the GNSS receiver, no access to ublox‘ server required, up to 6 days).

**Precise Positioning** - u-blox’ HPG algorithms (NEO-M8P, ZED-F9P) provide centimeter-level accuracy (up to <0.01m), and line level navigation even in the cities.
GPS, GALILEO, GLONASS, BEIDOU, QZSS MODULES

Quality
u-blox places extraordinary emphasis on delivering high-quality products. The company’s internal quality control process extends to all its manufacturing partners who comply to strict processes imposed by standards, such as ISO/TS16949. GNSS and wireless products are designed and tested to operate in a wide variety of applications, including in vehicle usage.

Development and Reliability
u-blox, continuously introducing new products, takes special care of their existing customers. New families of the modules are designed to keep pin compatibility with the previous ones, which anyway will remain in production for a long time.

GPS/Glonass/Beidou/QZSS/Galileo modules suggested for new designs

High Precision GNSS modules

<table>
<thead>
<tr>
<th>Model</th>
<th>Size [mm]</th>
<th>Power Supply [V]</th>
<th>Number of Parallel GNSS systems</th>
<th>Crystal / TOC / VCTOCO</th>
<th>Spreading Detection, VHT, Anti-aliasing</th>
<th>UART</th>
<th>SPI</th>
<th>DDC (I2C)</th>
<th>Raw data</th>
<th>Assisted: GPS (O), QZSS (O), Galileo, OEM, Autonomous</th>
<th>Precise Positioning</th>
<th>Dead Reckoning</th>
<th>Precision Timing</th>
<th>Frequency output</th>
<th>External Interface/Wakeup</th>
<th>Power Antenna supply, Short detection &amp; protection</th>
<th>Extra LNA, LNA</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZED-F9P</td>
<td>22.0x17.0</td>
<td>2.7-3.6</td>
<td>Multi Band***</td>
<td>T</td>
<td>E</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>MO</td>
<td>RTK&lt;0.2m</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NEO-M8P</td>
<td>16.0x12.2</td>
<td>2.7-3.6</td>
<td>Multiband</td>
<td>T</td>
<td>E</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>MO</td>
<td>RTK&lt;0.025m</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZED-F9R</td>
<td>22.0x17.0</td>
<td>2.7-3.6</td>
<td>Multi Band***</td>
<td>T</td>
<td>E</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>MO</td>
<td>RTK&lt;0.2m</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GNSS modules with dedicated features

<table>
<thead>
<tr>
<th>Model</th>
<th>Size [mm]</th>
<th>Power Supply [V]</th>
<th>Number of Parallel GNSS systems</th>
<th>Crystal / TOC / VCTOCO</th>
<th>Spreading Detection, VHT, Anti-aliasing</th>
<th>UART</th>
<th>SPI</th>
<th>DDC (I2C)</th>
<th>Raw data</th>
<th>Assisted: GPS (O), QZSS (O), Galileo, OEM, Autonomous</th>
<th>Precise Positioning</th>
<th>Dead Reckoning</th>
<th>Precision Timing</th>
<th>Frequency output</th>
<th>External Interface/Wakeup</th>
<th>Power Antenna supply, Short detection &amp; protection</th>
<th>Extra LNA, LNA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEO-M8U</td>
<td>16.0x12.2</td>
<td>2.7-3.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EVA-M8E</td>
<td>7.0x7.0</td>
<td>2.7-3.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NEO-M8L</td>
<td>16.0x12.2</td>
<td>2.7-3.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEA-M8F</td>
<td>22.4x17.0</td>
<td>3.0-3.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZED-F9T</td>
<td>22.0x17.0</td>
<td>2.7-3.6</td>
<td>Multi Band***</td>
<td>T</td>
<td>E</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>MO</td>
<td>RTK&lt;0.2m</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NEO-M8T</td>
<td>16.0x12.2</td>
<td>2.7-3.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GNSS modules with integrated antenna

<table>
<thead>
<tr>
<th>Model</th>
<th>Size [mm]</th>
<th>Power Supply [V]</th>
<th>Number of Parallel GNSS systems</th>
<th>Crystal / TOC / VCTOCO</th>
<th>Spreading Detection, VHT, Anti-aliasing</th>
<th>UART</th>
<th>SPI</th>
<th>DDC (I2C)</th>
<th>Raw data</th>
<th>Assisted: GPS (O), QZSS (O), Galileo, OEM, Autonomous</th>
<th>Precise Positioning</th>
<th>Dead Reckoning</th>
<th>Precision Timing</th>
<th>Frequency output</th>
<th>External Interface/Wakeup</th>
<th>Power Antenna supply, Short detection &amp; protection</th>
<th>Extra LNA, LNA</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAM-M8Q</td>
<td>15.5x15.5</td>
<td>2.7-3.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAM-M8C</td>
<td>14.0x9.6</td>
<td>1.65-3.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAM-M8Q</td>
<td>14.0x9.6</td>
<td>2.7-3.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Q. requires external components
P. control pin to handle active antenna
E. External Flash required
*MO. Multi GNSS Online
** Super E-Low Power Technology, 6mA@1.8V, Hz
*** Multi Band = ZED-F9P/T/R supports: GPS/QZSS L1/L1C/A, Glonass L1/L1C/A, Galileo E1-B/C/E5a, Beidou B1I/B1B/B3I
** Multi GNSS u-blox modules can work with several GNSS systems in parallel. For cost and power optimized solutions u-blox offers u-blox8 modules, which are pin-to-pin compatible equivalents to u-bloxM8 ones. u-blox8 modules also support several GNSS systems, but must be configured to work with one of them.

All wheels are round, but are they all the same?

There are also many GNSS receivers...
HIGH PRECISION POSITIONING

u-blox, a global provider of leading positioning and wireless communication technologies, has released the ZED-F9P multi-band GNSS module with integrated multi-band real-time kinematics (RTK) technology for machine control, ground robotic vehicles and high-precision unmanned aerial vehicles (UAV) applications.

The ZED-F9P measures 22 x 17 x 2.4 millimeters and uses technology from the u-blox F9 platform to deliver robust high-precision positioning performance in seconds - fully geared to clearing the three main hurdles that have kept centimeter-level positioning accuracy from breaking into mass-market applications: cost, size and power consumption. Significantly smaller and more energy efficient than existing solutions, and as a cost efficient alternative, the ZED-F9P will enable new high-precision positioning applications.

The u-blox ZED-F9P is a mass market multi-band receiver that concurrently uses GNSS signals from all four GNSS constellations (GPS, GLONASS, Galileo and BeiDou). Combining GNSS signals from multiple frequency bands (L1/L2/E5) and RTK technology lets the ZED-F9P achieve centimeter-level accuracy in seconds. Receiving more satellite signals at any given time maximizes the availability of centimeter-level accuracy even in challenging environments such as cities.

With its high update rate, the ZED-F9P is suitable for highly dynamic applications such as UAVs. Featuring on-chip integration of advanced multi-band RTK algorithms, it requires no additional hardware or third-party RTK libraries. Using OSR or SSR provides flexibility to the platform.

The u-blox F9 platform may work with both of the standard correction services - the OSR (which includes network RTK but also the single Baseline RTK used e.g. the NEO-M8P) and the SSR (e.g. the Sapcorda services provided by u-blox, Bosch, Geo++ and Mitsubishi Electric joint venture).

### OSR
- using actual observations from nearby reference stations (private base station, or other) - needs a two way communication usually (the rover needs to report a position to get the corrections for its area), resulting in high bandwidth requirements. The solution is also a local one - the data from the reference station applies only to a small area. It is however a free system, that can be tailored for the customer specific needs.

### SSR
- worldwide service providing corrections via internet or satellites, where only one way communication is used. Low data rate is needed, as the rover will apply the received corrections, by performing calculations, only to its area. The result is a global coverage. The SSR corrections will be supported by future versions of the F9 platform.

The u-blox F9 platform may work also as a stand alone GNSS module. The multi-band, multi-constellation GNSS receiver enables sub-meter level performance without the use of any premium correction services.

### Mechanical data
- Weight: 167 g (Typ. including cable)
- Size: 60.0 x 55.0 x 22.5 mm
- Cable: 5 m RG174 standard
- Connectors (choice): SMA, SMB, MCX
- Mounting: Magnetic base, fixed installation option
- Waterproof: IP 67
- Operating temperature: -40 °C to +105 °C

### u-blox F9 platform benefits

<table>
<thead>
<tr>
<th>Type</th>
<th>without corrections</th>
<th>with corrections</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNSS</td>
<td>GPS, GLONASS, BeiDou, Galileo, QZSS, NAVIC, SBAS</td>
<td>GPS, GLONASS, BeiDou, Galileo, QZSS, NAVIC, SBAS</td>
</tr>
<tr>
<td>Bands</td>
<td>L1 and E5</td>
<td>L1 and L2/E5</td>
</tr>
<tr>
<td>Corrections</td>
<td>SBAS, Sapcorda Basic</td>
<td>SBAS, E5, RTCM 3.x</td>
</tr>
<tr>
<td>Accuracy (1-sigma)</td>
<td>&lt;10cm w/ SBAS</td>
<td>&lt;10cm w/ SBAS, &lt;0.03m (RTCM 3.x), &lt;0.20m (SSR)</td>
</tr>
<tr>
<td>Dead Reckoning</td>
<td>optional</td>
<td>optional</td>
</tr>
</tbody>
</table>

A technology which was reserved for military and niche applications is now presented to the mass market - a consumer market - where many times the antenna was not even a part of the design process, and its selection was the last part of the production. Choosing an antenna for the multiband receivers is even more important than with standard single band modules, because providing superb signal levels is crucial for the centimeter level positioning. It is a premium accuracy, and needs additional efforts to guarantee the performance.

The u-blox ANN-MB multi-band (L1, L2/E5) active GNSS antennas are designed to reduce time to market for the next generation of high-precision GNSS applications, which require highly accurate location abilities. The compact design, excellent price-performance ratio and versatile mounting & connector choices provide customers with fast, easy and reliable multi-band antenna solutions. The ANN-MB antenna is a perfect match to the latest u-blox F9 platform including the ZED-F9P module, thus providing customers with the valuable antenna solution they need to minimize design-in efforts.
ASSISTING SERVICES FOR POSITIONING APPLICATIONS

The expectations of modern applications that use GNSS positioning are very demanding. Devices must be low power, small size and able to calculate position under difficult conditions. Small size means degraded performance of antenna, as size is very important factor of the GNSS antenna performance. Difficult conditions – weak, reflected and corrupted signal due to small antennas, or bad sky visibility due to pocket design, indoor navigation, or urban canyons.

Under **good signal conditions** Acquisition process (cold start) takes approx. 30s, consisting from 2 stages. Searching and synchronization with satellites (SVs) – takes short time. Receiving orbital position data (called Ephemeris) from minimum 4 (3D fix) SVs takes approx. 30s and the receiver starts to navigate (Tracking). Tracking does not need a signal as strong and stable as acquisition.

Under **poor signal conditions** Acquisition it takes much more time, or is not possible at all. Collecting Ephemeris from 4 SVs needs uninterrupted good quality signal from each SV for approx. 30s. Under adverse signal conditions it can take minutes, hours or even fail altogether.

u-blox is the leader, and pioneer, in **Assisted GNSS (A-GNSS)** technology, which accelerates calculation of position by delivering satellite data such as Ephemeris, Almanac, accurate time and satellite status to the GNSS receiver via wireless networks or the Internet. This aiding data enables a GNSS receiver to compute a position within seconds, even under poor signal conditions. Assisted GPS was introduced by u-blox in previous generations of the receivers and is already a market proven technology. The latest implementation includes also Assisted Glonass data, improving significantly the performance, and will be extended by Assisted Galileo and other systems – so it is called Multi GNSS Assistance (MGA), or A-GNSS.

The system is very simple in configuration and makes applications using GNSS receivers really shining among the competitive units on the market.

**With A-GNSS Online** – GNSS device downloads data (real Ephemeris, time, etc.) from u-blox’ server. It’s the most helpful way to get position under difficult conditions, but must be triggered every time when position is necessary (validity of data is 2-4 hours). Usually used in personal trackers (in case of emergency like heart attack of the user), theft protection systems etc.

**A-GNSS Offline** – Differential Almanac Correction Data downloaded from u-blox’ server, which is valid for up to 35 days. It needs 10kB (1 day file) ... up to 125kB (28 days GPS&GLO) memory to be stored. GNSS module uses the data whenever the signal conditions are poor – which improves navigation performance of the unit. It’s used in all kinds of applications, also to decrease power consumption (A-GNSS makes acquisition – the most power demanding process - shorter).

**A-GNSS Autonomous** does not need any data exchange with external server. Orbit prediction data is calculated by the GNSS module itself and is valid for up to 6 days. Activation of this feature is highly recommended.

Although using A-GNSS is simple, u-blox GSM/UMTS/LTE modules (SARA, LISA, LARA, TOBY) offer a built-in client handling Assisted GNSS features and using own resources (flash memory).

<table>
<thead>
<tr>
<th></th>
<th>ASSISTNOW ONLINE</th>
<th>ASSISTNOW OFFLINE</th>
<th>ASSISTNOW AUTONOMOUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data download frequency</td>
<td>At every startup</td>
<td>Once every X days</td>
<td>Never</td>
</tr>
<tr>
<td>Data retrieval at start-up</td>
<td>Data downloaded from server</td>
<td>Pre-downloaded data from local memory</td>
<td>Retrieved from local memory</td>
</tr>
<tr>
<td>Aiding data type</td>
<td>Ephemeris, almanac, time, health</td>
<td>Differential almanac correction data</td>
<td>Automatically generated</td>
</tr>
<tr>
<td>Data validity period</td>
<td>2-4 hours</td>
<td>35 days</td>
<td>Up to 6 days</td>
</tr>
<tr>
<td>Size of downloaded data</td>
<td>1-3 kB</td>
<td>125kB (GPS&amp;GLO 28days)</td>
<td>None</td>
</tr>
<tr>
<td>Acquisition (TTFF) performance</td>
<td>Typ. 1-3s</td>
<td>5-20s</td>
<td>13-18s (after 3 days)</td>
</tr>
</tbody>
</table>
DEAD RECKONING - NAVIGATION WITHOUT THE SKY VIEW

Increasingly dense urban environments, park houses and multi-level interchanges pose a significant problem to navigation systems. Signal reflected from buildings makes position not accurate, vehicles are also more and more often used in areas where GNSS signal is blocked (tunnel, garage etc). Reduced size of antenna, necessary in many applications, also harms the positioning performance.

The latest NEO-M8L and NEO-M8U Dead Reckoning modules provide simple in implementation, and convenient, solution:
- leading GNSS platform u-bloxM8 optimized for the best performance with Dead Reckoning
- due to built-in sensors (gyro, accelerometer, temperature), NEO-M8U provides accurate 3D position even in case of reflections, or lack of GNSS signal. NEO-M8L requires distance provided by CAN messages or analog speed tick pulses
- DR technology is suitable for 4 wheels cars, trucks, buses and 2 wheels motorbikes or scooters (not for lightweight i.e. bikes)

RAW sensor data
- information from sensors can be read (up to 100Hz) and used for example to register behaviour of vehicle during an accident
- very precise information about fuel consumption
- simple integration and pin compatibility with the other NEO-M8 family modules for the fast time to market
- dedicated interface to connect u-blox cellular module (SARA, LARA, LISA, TOBY)

NEW GNSS SOLUTIONS

ZOE-M8G/Q - more than usual performance in smaller than usual, simple in use module

- ZOE measures only 4.5x4.5x1.0mm, weight is 0.04 gram. In addition to standard GNSS modules it contains a double stage LNA, SAW filter and TCXO. Double LNA makes ZOE the perfect solution for devices working with weak GNSS signal, using hidden or small passive antennas with limited performance. SAW filter helps to eliminate noise, including the one coming from GSM or other RF transmitters nearby.
- Superb, usual for u-blox, parameters - like the market leading -167dBm real navigation sensitivity, parallel work with up to 3 navigation systems (including Galileo), real Assisted GNSS, Geo-fencing, filtering of arm motion and many others - fulfills the picture of an outstanding product.
- Design with ZOE-M8G does not need deep RF skills - critical components (double LNA, SAW, TCXO) are integrated and matched.

ZOE-M8B - Super-Efficient low power receiver in ZOE form factor

- Super-E technology, integrated in the ZOE-M8B, is a breaking point for portable and wearable applications with limited space for antenna and battery. Positioning every second (1Hz) needs as low as 12mW, which is 83% power saving vs. usual receivers with similar position accuracy.
- Pin compatible with other ZOE modules.

SAM-M8Q - ”plug & play” design concept, high performance receiver with antenna

- SAM-M8Q is the best solution for simple and reliable GNSS integration. Customer can design an application, with robust performance regardless of installation, without deep RF expertise, without long tests and plenty of redesigns.
- Antenna size was carefully selected to keep good performance in small form factor. Smaller antennas significantly degrade navigation performance and should be considered only if there is no other option. However, solution is scalable, bigger ground plane can be used to achieve even more optimal performance, depending on available space on PCB.
The cellular data transmission technology is evolving in two different directions:

- **High data rate**: LTE High Cat. modules, with high data rate (streaming) and high power consumption, required mostly by the consumer market.
- **Longevity**: LTE Low Cat. modules for IoT/M2M customers aware of evening of the 2G/3G technology. They are looking for longer availability of the network, keeping the cost and power consumption low, with limited data throughput.

u-blox is a leading supplier of LTE Low Cat. modules meeting such industrial IoT requirements.

**The evolution of technology - do not leave your application behind**

The cellular data transmission technology is evolving in two different directions:

- **High data rate**: LTE High Cat. modules, with high data rate (streaming) and high power consumption, required mostly by the consumer market.
- **Longevity**: LTE Low Cat. modules for IoT/M2M customers aware of evening of the 2G/3G technology. They are looking for longer availability of the network, keeping the cost and power consumption low, with limited data throughput.

u-blox is a leading supplier of LTE Low Cat. modules meeting such industrial IoT requirements.

**SARA, LARA, LISA and TOBY - selected features**

### Modules optimized for low power, small size, cost saving and superb security

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin compatibility between technologies</td>
<td>common concept of the same SARA form factor for modules supporting GSM 2G (SARA-Gx), UMTS 3G (SARA-U2), LTE Low cat. (SARA-Rx, LARA-Rx use the same pads as SARA), and NB-IoT (SARA-Nx, SARA-Rx). Reference PCB design to support SARA and TOBY (fast LTE Cat.4 and Cat.6)</td>
</tr>
<tr>
<td>Multiband</td>
<td>global LTE modules with plenty of bands and network profiles to be selected by the application</td>
</tr>
<tr>
<td>Security</td>
<td>built in features like SSL/TLS, Secure Boot etc. (see more on page 13)</td>
</tr>
<tr>
<td>Last Gasp</td>
<td>sending a predefined last notification (via SMS or TCP/UDP) in case of power outage, just before the power goes off</td>
</tr>
<tr>
<td>TCP sockets always on</td>
<td>automatic TCP direct link connection at each start up</td>
</tr>
<tr>
<td>Low power</td>
<td>the market leading low power consumption across technologies (i.e. 2G: 0.6mA IDLE, 2.9mA active mode; NB-IoT: 3uA Deep Sleep etc.)</td>
</tr>
<tr>
<td>RRC Release Assistance</td>
<td>feature supported by the most low power advanced LTE Cat.NB1 (NB-IoT) modules like SARA-N2. Changing network timer SARA-N2 saves even 93% of power (calculated with 200 bytes data packages)</td>
</tr>
<tr>
<td>Custom timers</td>
<td>commands used to control search and sleep time when there is no network available, and to thereby reduce power consumption</td>
</tr>
<tr>
<td>Antenna/SIM detection</td>
<td>provides antenna/SIM presence detection capability</td>
</tr>
<tr>
<td>Smart Temperature Supervisor</td>
<td>monitoring of the module board temperature, warning notifications or shutdown to prevent damage of the module</td>
</tr>
<tr>
<td>CoAP, MQTT, LWM2M</td>
<td>support of protocols dedicated to IoT/M2M</td>
</tr>
<tr>
<td>BIP</td>
<td>Bearer Independent Protocol for Over-the-Air SIM provisioning (eSIM / embedded SIM, eUICC)</td>
</tr>
<tr>
<td>SNI</td>
<td>Server Name Identification - extension of SSL/TLS which allows the server to present different certificates for different base URL’s pointing at the same IP address</td>
</tr>
<tr>
<td>Jamming detection</td>
<td>detects and reports potential jamming</td>
</tr>
<tr>
<td>CellLocate</td>
<td>localization using signals from BTS, not as accurate as GNSS, but very helpful and supplementary (i.e. in a car park, where a GNSS signal is unavailable). Cellular module becomes a very important component for GNSS systems</td>
</tr>
<tr>
<td>GNSS support</td>
<td>GNSS receiver can be connected directly to cellular module, creating tandem. Built in Assisted GNSS client (see more on page 11)</td>
</tr>
<tr>
<td>In-band Modem</td>
<td>embedded modem for communication within eCall, the European security system, and Era Glonass, Russian system</td>
</tr>
<tr>
<td>CellTime</td>
<td>a command set that allows applications to retrieve precise timing using CellLocate (SARA-U201)</td>
</tr>
<tr>
<td>FOTA / uFOTA</td>
<td>Firmware Over The Air update allows to keep even the deployed devices up to date with the newest functionalities</td>
</tr>
</tbody>
</table>
2G and 3G - traditional technology in highly reliable, well established SARA form factor. Small SARA-U201 covers all 2G/3G bands for global operation. SARA-G/U is an entry point into the current networks, preparing an application for the new technologies.

LTE Low Category - proposal for IoT customers looking not for the highest speed, but for price reasonable successor of retiring 2G/3G technology (LTE Cat.1, LTE Cat.M1), or low power solution (LTE Cat.NB1).

LTE Cat.NB1 (Narrow Band IoT) - technology breaking point, u-blox is the leading company working on this new way of communication with “things”, that require small amounts of data, over long periods, in hard to reach places.
- excellent coverage (based on current 3G/4G infrastructure), with -20dB better penetration than GSM, to perform well i.e. under the ground.
- very low power consumption (3uA IDLE, 10y on battery)
- low cost
- high data rate is not necessary

u-blox offers modules based on well known SARA platform to simplify migration to this new technology.

u-blox - the technology leader in NBIoT development:
- SARA-N2 family, verified on the field since 2015
- superb power saving features
- comprehensive roadmap of NBIoT

LTE Cat.M1 - aspiring to be the successor of 2G/3G, with long network availability (LTE), cost lower than 3G and voice (VoLTE) available soon. Currently deployed in US and will be supported worldwide soon.

2G and 3G - traditional technology in highly reliable, well established SARA form factor. Small SARA-U201 covers all 2G/3G bands for global operation. SARA-G/U is an entry point into the current networks, preparing an application for the new technologies.
LTE Cat.1 - offers coverage already now (supported by usual LTE providers), and long availability of LTE networks, with price of modules significantly lower than high speed versions. LARA-R2 with efficient Cat.1 data rate (10 Mb/s DL, 5 Mb/s UL) are suitable for the voice implementation (VoLTE) and enough for majority of data streaming applications.

LTE Cat.1. LARA/TOBY

LARA-R211

<table>
<thead>
<tr>
<th>ATEx</th>
<th>Europe+EMEA(EU), N. America (NA), S. America(SA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LARA-R202</td>
<td>EU</td>
</tr>
<tr>
<td>LARA-R204</td>
<td>NA</td>
</tr>
<tr>
<td>LARA-R220</td>
<td>Japan</td>
</tr>
<tr>
<td>LARA-R280</td>
<td>AP</td>
</tr>
<tr>
<td>LARA-R281</td>
<td>EU</td>
</tr>
<tr>
<td>LARA-R3121</td>
<td>AP</td>
</tr>
<tr>
<td>TOBY-R200-82B</td>
<td>GLOBAL</td>
</tr>
<tr>
<td>TOBY-R202</td>
<td>NA</td>
</tr>
</tbody>
</table>

LTE High Category - fast cellular technology, supported by u-blox’ TOBY modules and MPCI - mini PCI Express cards. Reference PCB design available to make application ready for SARA/LARA modules and TOBY. TOBY-L4xxx-0x is uCPU with embedded Linux for customer application, dedicated for high volume automotive customers.

LTE Cat.6/Cat.4 TOBY-L4/L2

LARA-R281

TOBY-L4006-01/-51

| LARA-R3121 | AP | B1, B3, B7, B20 |
| TOBY-R200-82B | GLOBAL | B1, B3, B7, B20 |
| TOBY-R202 | NA | B1, B3, B7, B20 |

MPCI-L2xx mini PCI Express cards are based on TOBY-L2 modules

NA(A) - AT&T, T-Mobile version NA(V) - Verizon version Japan - NTT docomo C1 = Cat.1, 10/5 Mb/s Downlink/Uplink C - CSFB only - available in future FW version

NA(A) - AT&T, T-Mobile version NA(V) - Verizon version Japan - NTT docomo C1 = Cat.1, 10/5 Mb/s Downlink/Uplink C - CSFB only - available in future FW version

10
Power consumption is the most important parameter for NB-IoT technology. The throughput and response time are not critical. Amount of data is small, sent infrequently. Responses from the server can be buffered by the network, which is simplified by publish-subscribe services utilized by CoAP or MQTT.

NB-IoT brings many additional features to tune the application and network for the lowest energy consumption in a given scenario. u-blox modules are well tuned by experienced team of engineers to support these features. FAEs provide support to u-blox customers for efficient configuration.

**Power Saving Mode (PSM)** - the module shall remain registered but in deep sleep (3uA) for most of the time. Wake up is possible with data to be sent, or on a schedule by T3412 timer (even once per several days). Dedicated for applications where most traffic will be Mobile Originated.

**eDRX (extended Discontinuous Reception)** - the module wakes up in scheduled paging occasions, during which reception is possible, with an interval of up to 3 hours between them. Dedicated for Device Terminated applications.

**RRC Release Assistance** - unique feature for NB-IoT supported by u-blox modules, can influence RRC Release network timer to significantly reduce the power consumption. After data package is sent application requests immediate RRC release from the network, instead of default network behaviour which is 10-20s RRC release time.

**SMART AND EFFICIENT COOPERATION**

Wireless (GSM, UMTS, LTE) + GNSS (GPS, GLONASS, GALILEO,..)

There are many modern applications on the market that require two technologies: GNSS positioning and 2G/3G/4G communication. Expectation is to have a small, low power and highly integrated solution.

Since GSM/GPS combo modules are not a flexible solution, and do not fit into the market, u-blox has implemented special features to ease the design effort required for such integration.

For example, connecting u-blox' wireless and GNSS modules together simplifies design (one UART is enough), allowing full access to GNSS module via the wireless modem. It is also possible to use very useful features built in GSM/UMTS module like:

- GNSS power control with AT commands (GNSS supply enable)
- Assisted GNSS client built in GSM module, handling of A-GNSS data exchange and storage (Flash memory built in GSM module)
- Time synchronization between modules (GNSS RTC sharing)
- GNSS data ready - optimizes the wireless module power consumption, since it wakes-up only when there is data ready from the GNSS receiver.

Moreover, u-blox' GSM/UMTS modules offer additional service, CellLocate, making such GSM + GNSS tandem not only highly integrated and low power, but also an extremely functional solution, offering information about position even under poor or no sky visibility and no GNSS signal conditions, or jamming. Wireless module collects information from visible cells and reports to ublox' server. CellLocate calculates position based on proprietary algorithm and database, and returns to the wireless module. CellLocate database is a self-learning structure, which continuously improves accuracy.

**Full cooperation between u-blox' wireless and GNSS modules is possible with very simple hardware design, presented on picture.**
**Stand-alone modules** are equipped with a powerful processing unit and built-in Wi-Fi / BT stacks. They work as Wi-Fi or BT transceiver, with reliable, secure and approved by u-blox firmware (uCx), or customer application (Open CPU). Make design time shorter, and certification, due to u-blox approvals, easier.

Providing different technology in pin compatible form factor (i.e. NINA) is one of the driving forces that draws the professional industrial customers to u-blox. The NINA series - designed for IoT - allows a flexibility of communication solutions.

**Classic Bluetooth v2.1/v3.0** - robust communication, but needs time to connect, high data rates, older phones are equipped with it. Agreement with Apple must be signed to communicate with iOS. BLE is not compatible with Classic.

BLE - Bluetooth low energy (v.4.0-5.1) also known as Bluetooth Smart, low payload, fast negotiation and connection, low power, most smartphones are equipped with BLE, works also with iOS. BLE is not compatible with Classic.

**Bluetooth dual-mode** (BLE + Classic BT) modules are known as Bluetooth Smart Ready.

### NINA Series, selected features:
- **u-connectXpress (uCX)** - pre-flashed u-blox application, allows immediate use of the module with reliable, approved by u-blox firmware, simple control via AT commands and added features like SPS (Serial Port Service) or GATT
- **Open CPU** - allows to upload customized stacks and customer specific applications using third party APIs, allowing f.e. to program the CPU with your own firmware, or customer application (Open CPU) or u-blox firmware (uCX), or customer application (Open CPU). Make design time shorter, and certification, due to u-blox approvals, easier.
- **Secure boot** - allows to upload customized stacks and customer specific applications using third party APIs, allowing f.e. to program the CPU with your own firmware, or customer application (Open CPU) or u-blox firmware (uCX), or customer application (Open CPU). Make design time shorter, and certification, due to u-blox approvals, easier.
- **Advanced data mode** - allows the module to use only in the presence of original certified software, preventing network hacks via compromised hardware.

### Bluetooth in SIP package

#### ANNA-B112
- **Supply voltage (V):** 2.7–3.6
- **Power consumption (mA):**
  - idle: 1.2
  - connected: 2.5
- **Max range (meters):**
  - u-blox uCX software: 14
  - BLE/Classic BT: 26

#### NINA Series

| Model | Supply Voltage (V) | Power Consumption (mA) | SW (uCX or BLE), Bluetooth Classic BT + BLE | UART | SPI | I2C | USB | GPIO pins | UART T | SPI | I2C | UV | I/P | P | E |
|-------|--------------------|------------------------|---------------------------------------------|------|-----|-----|-----|-----------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| ANNA-B112 | 3.0–3.6 | 1400 | v4.2 | 200 | E | | | | | | | | | 
| NINA-W10 | 400 | 1400 | v4.2 | 200 | E | | | | | | | | | | 
| NINA-W115 | 300 | 1400 | v4.2 | 200 | E | | | | | | | | | | 

### Rigado series Open CPU Bluetooth modules

| Model | Supply Voltage (V) | Power Consumption (mA) | SW (uCX or BLE), Bluetooth Classic BT + BLE | UART | SPI | I2C | USB | GPIO pins | UART T | SPI | I2C | UV | I/P | P | E |
|-------|--------------------|------------------------|---------------------------------------------|------|-----|-----|-----|-----------|--------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| NINA-W13 | 2.0–3.6 | 1400 | v4.2 | 200 | E | | | | | | | | | | 
| NINA-W14 | 300 | 1400 | v4.2 | 200 | E | | | | | | | | | | 

*Power consumption in idle mode: Wi-Fi enabled, connected, Bluetooth Classic and BLE discoverable and connectable, average value
** Power consumption in Tx mode: All available technologies transmitting, average value

Antenna type: I - internal PIFA antenna, P - antenna pin U - U.FL connector for external antenna

Shown sizes are for modules with internal antenna and external antenna connections (U.FL or Pin) - available in future FW version
The Internet of Things concept is the road the whole world is taking, but in a connected world security breach prevention is one of the most important aspects of proper system design. u-blox, as manufacturer of reliable industrial, professional products, provides exceptional security built into their solutions. Protect your application by using u-blox GNSS, Cellular or Short-range modules.

<table>
<thead>
<tr>
<th>Modules</th>
<th>Supply voltage (V)</th>
<th>Power consumption, idle (mA)</th>
<th>UART</th>
<th>GPIO pins</th>
<th>Max range (m)</th>
<th>Antenna Type</th>
<th>BLE qualification</th>
<th>BLE Classic Bluetooth, 2.4GHz (S), 2.4GHz &amp; 5GHz (D)</th>
<th>Throughput [Mbps]</th>
<th>Max connections</th>
<th>AT commands support</th>
<th>Secure boot</th>
<th>Mesh networking</th>
<th>FOTA</th>
<th>AoA/AoD</th>
<th>ATEX/IECEx cert.</th>
</tr>
</thead>
<tbody>
<tr>
<td>NINA-W131</td>
<td>3.0-3.6</td>
<td>115</td>
<td>190</td>
<td></td>
<td>S</td>
<td>400</td>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NINA-W132</td>
<td>3.0-3.6</td>
<td>115</td>
<td>190</td>
<td></td>
<td>S</td>
<td>300</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NINA-W135</td>
<td>3.0-3.6</td>
<td>35</td>
<td>320</td>
<td></td>
<td>v4.2</td>
<td>S</td>
<td>400</td>
<td>E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NINA-W152</td>
<td>3.0-3.6</td>
<td>35</td>
<td>320</td>
<td></td>
<td>v4.2</td>
<td>S</td>
<td>300</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ODIN-W260</td>
<td>3.0-3.6</td>
<td>150</td>
<td>300</td>
<td></td>
<td>v4.0</td>
<td>D</td>
<td>300</td>
<td>U</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ODIN-W262</td>
<td>3.0-3.6</td>
<td>150</td>
<td>300</td>
<td></td>
<td>v4.0</td>
<td>D</td>
<td>250</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ODIN-W263***</td>
<td>3.0-3.6</td>
<td>150</td>
<td>300</td>
<td></td>
<td>v4.0</td>
<td>D</td>
<td>250</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Power consumption in idle mode: Wi-Fi enabled, connected, Bluetooth Classic and BLE discoverable and connectable, average value
** Power consumption in Tx mode: All available technologies transmitting, average value.
Antenna type: I - internal PIFA antenna, E - antenna pin, P - PCB antenna, U - U.FL connector for external antenna
Shown sizes are for modules with internal antenna and external antenna connections (UFL or Pin)
*BLE Serial Port (SPP), BLE Peripheral Device (PDP), BLE Access Point (AP), BLE Secure Port (SP)
** BLE Dual-Mode modules support SPP, DUN, PAN and GATT profiles, Single-Mode BLE modules support GATT

WIFI, BLUETOOTH
Stand-alone short range radio modules

U-BLOX WIRELESS SECURITY

The Internet of Things concept is the road the whole world is taking, but in a connected world security breach prevention is one of the most important aspects of proper system design. u-blox, as manufacturer of reliable industrial, professional products, provides exceptional security built into their solutions. Protect your application by using u-blox GNSS, Cellular or Short-range modules.

## Threats

<table>
<thead>
<tr>
<th>Threats to the way that u-blox and customers’ products work</th>
<th>Principle</th>
<th>The u-blox approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modifications to the way that u-blox and customers’ products work</td>
<td>Secure Boot</td>
<td>u-blox products are secured against security threats originating from attacking the module behavior, man-in-the-middle and replay attacks. Bootloader accepts only authenticated Software</td>
</tr>
</tbody>
</table>
| Changing the data as it flows through the system | Secure communications | u-blox AssistNow service cannot be used to attack the GNSS receivers
Encrypted and authenticated via certificate connections for Wi-Fi and Cellular modules
EAP-TLS Wi-Fi modules will connect to APs only with a trusted certificate
BLE secure connections use Elliptic Curve Diffie Hellman (ECDH) for key generation |
| Unauthorised systems taking control of u-blox products | Spoofing and jamming protection | Protection against malicious attacks, also at the antenna side
Management action frames are protected from both eavesdropping and forging |

Secure boot will not allow the module to run with malicious software

---

Bluetooth Dual-Mode modules support SPP, DUN, PAN and GATT profiles, Single-Mode BLE modules support GATT

* Power consumption in idle mode: Wi-Fi enabled, connected, Bluetooth Classic and BLE discoverable and connectable, average value
** Power consumption in Tx mode: All available technologies transmitting, average value.
Antenna type: I - internal PIFA antenna, E - antenna pin, P - PCB antenna, U - U.FL connector for external antenna
Shown sizes are for modules with internal antenna and external antenna connections (UFL or Pin) - available in future FW version
*** version only for EU, supports more channels from start up
### Host-based modules

Host-based modules require an additional host MCU with Wi-Fi / BT drivers and stacks. The Host can be an Android, Windows or Linux based unit. Integration with OS requires experience and longer development time, but allows higher flexibility in application design and utilization of specialized software from third party companies.

Most of the Host-based modules are dedicated for Automotive, especially the V2X VERA Series.

u-blox’ Automotive grade guarantees that the units will perform without a hitch even in demanding conditions.

---

#### Wi-Fi modules

<table>
<thead>
<tr>
<th>Model</th>
<th>Supply voltage [V]</th>
<th>Bluetooth profile</th>
<th>Bluetooth Low Energy</th>
<th>Wi-Fi IEEE 802.11 (a/b/g/n/ac)</th>
<th>Spatial streams</th>
<th>Antenna type</th>
<th>LTE filter</th>
<th>High-speed UART</th>
<th>USB 2.0</th>
<th>GPIO</th>
<th>1PPS</th>
<th>SPI</th>
<th>AES hardware support</th>
<th>Multi-band</th>
<th>External antenna</th>
<th>Int. antenna</th>
<th>WMAC address stored in module</th>
<th>PX</th>
<th>PX</th>
<th>PX</th>
<th>PX</th>
</tr>
</thead>
<tbody>
<tr>
<td>LILY-W131</td>
<td>1.7-3.6</td>
<td>Wi-Fi4</td>
<td></td>
<td></td>
<td></td>
<td>S</td>
<td>1a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LILY-W132</td>
<td>1.7-3.6</td>
<td>Wi-Fi4</td>
<td></td>
<td></td>
<td></td>
<td>S</td>
<td>ind</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Multiradio (Wi-Fi + Bluetooth) modules

<table>
<thead>
<tr>
<th>Model</th>
<th>Supply voltage [V]</th>
<th>Bluetooth profile</th>
<th>Bluetooth Low Energy</th>
<th>Wi-Fi IEEE 802.11 (a/b/g/n/ac)</th>
<th>Spatial streams</th>
<th>Antenna type</th>
<th>LTE filter</th>
<th>High-speed UART</th>
<th>USB 2.0</th>
<th>GPIO</th>
<th>1PPS</th>
<th>SPI</th>
<th>AES hardware support</th>
<th>Multi-band</th>
<th>External antenna</th>
<th>Int. antenna</th>
<th>WMAC address stored in module</th>
<th>PX</th>
<th>PX</th>
<th>PX</th>
<th>PX</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMMY-W161</td>
<td>1.0-3.6</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMMY-W163</td>
<td>1.0-3.6</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMMY-W165</td>
<td>1.0-3.6</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JODY-W163</td>
<td>1.2-4.8</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JODY-W164</td>
<td>1.2-4.8</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JODY-W167</td>
<td>1.2-4.8</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JODY-W263</td>
<td>2.9-5.5</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JODY-W374</td>
<td>TBD</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### V2X modules

<table>
<thead>
<tr>
<th>Model</th>
<th>Supply voltage [V]</th>
<th>Bluetooth profile</th>
<th>Bluetooth Low Energy</th>
<th>Wi-Fi IEEE 802.11 (a/b/g/n/ac)</th>
<th>Spatial streams</th>
<th>Antenna type</th>
<th>LTE filter</th>
<th>High-speed UART</th>
<th>USB 2.0</th>
<th>GPIO</th>
<th>1PPS</th>
<th>SPI</th>
<th>AES hardware support</th>
<th>Multi-band</th>
<th>External antenna</th>
<th>Int. antenna</th>
<th>WMAC address stored in module</th>
<th>PX</th>
<th>PX</th>
<th>PX</th>
<th>PX</th>
</tr>
</thead>
<tbody>
<tr>
<td>VERA-P171</td>
<td>3.3 &amp; 5.5</td>
<td>p</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VERA-P173</td>
<td>3.3 &amp; 5.5</td>
<td>p</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VERA-P174</td>
<td>3.3 &amp; 5.5</td>
<td>p</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VERA-P311</td>
<td>3.3 &amp; 5.5</td>
<td>p</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VERA-P321</td>
<td>3.3 &amp; 5.5</td>
<td>p</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*V2V/V2X standard, as well as modules and stacks, are currently in development. u-blox, as the wireless technology leader, is providing the hardware expertise, stacks should be delivered by third parties.

---

**Notes:**

- 1p = 1 antenna pin for combined Bluetooth and Wi-Fi
- 2p = 2 antenna pins, one each for Bluetooth and Wi-Fi
- 3p = 3 pins, 2 for Wi-Fi and 1 for Bluetooth antenna
- H = HCI profile
- int = Internal antenna
- * = on request
- Can be configured by the user as dual-channel diversity
U-BLOX TOOLS

u-blox software tools
For easy evaluation, configuration, testing and performance analysis u-blox provides a series of software tools, called u-center (for GNSS), m-center (for Cellular) and s-center (for Short Range products). The “centers” are PC-compatible, and provide an intuitive, easy to understand and use graphical interface. They may also be used for firmware upgrades.

u-center - u-blox GNSS receivers can be configured using the u-center evaluation software with a highly flexible platform to test GNSS products and visualize the collected GNSS data. It supports NMEA as well as u-blox UBX binary protocol, calibrated map files and data recording with u-center mobile. Debugging of a target application is also possible.

m-center - m-center makes configuration of u-blox cellular modules simple and convenient. It is also possible to view and edit SIM phonebook entries, send text messages and communicate with the wireless module using AT commands. In addition, when using u-blox cellular evaluation kits, m-center allows for simple communication with the onboard GNSS module. u-blox wireless modules may also be used for collection of trace files for debugging if the module and BTS communication is affecting the modules performance.

s-center - dedicated software to connect with u-blox ANNA, NINA, ODIN Wi-Fi and Bluetooth products, providing intuitive tools to test the unique functionalities of the modules.

Bluetooth iOS and Android app - source code for developers to evaluate u-blox stand-alone Bluetooth Low Energy modules.

u-track - software tool that replicates a real low-power tracking application. Within 15 minutes of installing it, the user can see the first results. It covers three main use cases (sport tracking, people tracking and asset tracking) with optimized presets and is based on the most power-optimized GNSS and LTE Cat M1/NB1 u-blox technology. It is designed to easily record and visualize logs, including power consumption. The solution is composed of embedded firmware that runs on a C030-R412M board and the u-track PC application software.

u-blox hardware tools
EVK-xxx evaluation kits provide a simple, flexible and ready to use environment for evaluating of u-blox’ modules, as well as for designing and testing of wireless and GNSS applications.

GNSS kits enable simple evaluation of the high performance u-blox 8 and u-blox M8 positioning technology. The built-in USB interface provides both power supply and high-speed data transfer, and eliminates the need for an external power supply. u-blox 8/M8 evaluation kits are compact, and their user-friendly interface and power supply make them ideally suited for use in laboratories, vehicles and outdoor locations. The kits are to be used with a PC via USB interface. USB drivers are provided with the software package.

In case of cellular EVKs a modular design allows to replace adapter board (ADP-xx with cellular module) to test selected technology on the same main board. The cellular kits come with a built-in u-blox GNSS receiver module, to either test cellular functionality alone or to integrate it together with u-blox GNSS technology. For evaluating Assisted-GNSS (A-GNSS) a u-blox A-GNSS client is embedded in the firmware stack.

The short range kits are equipped with a J-Link debugger and a processor for own application development - designed for use with Arm® Mbed™ or radio chipset manufacturers SDK. They are complete starter kits that allow quick prototyping of a variety of Bluetooth low energy and WiFi sensor applications for Internet of Things.

For easy application development u-blox provides reference designs called Blueprints and ready boards called application boards, both in many cases may be used without changes in the customers application.

For example the B200-NINA-B1 blueprint is a small Bluetooth battery powered solution. The C030 board is a Mbed enabled IoT starter kit with various cellular modules and a GNSS module. The C099 (for ZED-F9P) board may be used to test the RTK functionality without an effort. Based on the EVA-M8E module, the C93-MBE enables immediate evaluation of u-blox’s Untethered Dead Reckoning technology in most vehicle applications.
For many years Microdis Electronics has provided wireless products for customers in Eastern Europe. Including ISM solutions (Bluetooth, Wi-Fi), GSM/UMTS/LTE modules, GPS/Galileo/Glonass modules. Together with the wireless products Microdis can also offer a comprehensive range of accessories necessary to support wireless applications, including: antennas, HF connectors, HF adapter cables and SIM card holders.

**HF CONNECTORS**

- Right angle, SMA female, THT
  - SMA_FEMALE_PCB_ANGLE_LF

- Right angle, SMA female, Edge mounted
  - SMA_FEMALE_PCB_THROUGH_SMD

- Right angle, MMCX female, SMD
  - MMCX_FEMALE_SMD_ANGLE_LF

- Right angle, MCX female, THT
  - MCX_FEMALE_PCB_ANGLE_LF

- Right angle, MCX female, SMD
  - MCX_FEMALE_SMD_ANGLE_LF

- Compatible with u.fl
  - I-PEX_FEMALE_SMD

Global Connector Technology portfolio includes Push-push SIM holders, Low-profile SIM holders, Dual SIM holders and also many standard SIM holders. The whole SIM holder portfolio may be found on www.gct.co

The RF portfolio of Microdis Electronics consists also of customized pigtails, prepared according to the specifications sent by customers.

These products are only a small fraction of the high frequency portfolio of Microdis Electronics. The standard offer contains other connectors and adapters which are not presented here.
Gain describes how well the antenna converts radio waves arriving from a specified direction into electrical power or how well it converts input power into radio waves headed in a specified direction. When no direction is specified, gain is understood to refer to the peak value of the gain. A plot of the gain as a function of direction is called the radiation pattern.

Ground plane
A ground plane is the most important design issue to consider while developing a GNSS receiver system. A dependable antenna can lose all attributes (gain, polarization, center frequency) if a ground plane is small or non-existent. In almost all cases the parameters stated in the datasheets are based on measurements done with the antenna placed on an optimal ground plane (i.e. 50x50mm), which is a very important point to remember when testing the antenna. The distance to ground plane edge has a similar effect to the size of the ground plane.

Choosing an antenna, and properly implementing it, is the second most important part of GNSS system design, right behind the module selection. An antenna choice is a series of trade-offs that an engineer must take into account. Depending on the desired outcome this part of the system must be either power efficient, have high gain or have small size. These three are the main technological arguments, additional ones would be: polarization (linear polarization antennas tend to be more affected by reflected signals than RHCP), de-tuning resistance and ground plane dependence. A sum of six points that are important for antenna operation. Other arguments that must be considered are based on End-device requirements, and they may include: ease of installation, ease of servicing, robustness, visual design traits (embedded or external antenna) and one of the most significant - cost.

Passive or Active
Because of the weak GNSS signals using passive antennas that are additionally mounted via a long cable can be impossible. That is where active antennas are mostly used. An active antenna is a passive patch with an LNA, and the gain is mostly described as the LNA gain. Such antennas need to be supplied from a power source, which makes the system less power efficient (an active antenna can consume 10-20mA), but for some applications it is necessary. External antennas are also very popular because there is very little design needed - just plug the antenna to the RF connector.

*Low-noise amplifier (LNA) is an electronic amplifier used to amplify possibly very weak signals (captured by an antenna). The LNA boosts the antenna signal to compensate for the feedline losses going from the (outdoor) antenna to the (indoor) receiver. It amplifies both noise and signal, so it does not affect the SNR.

Patch, chip or helical
Deciding which antenna to use is directly connected to the end-device application. Some rules of thumb for the designer exist however:

- A power hungry antenna in a battery driven system is not desired.
- A ceramic patch or chip in a pocket application will detune due to human body proximity.
- A fixed system will work better with a big 25x25mm patch, with optimal ground plane, than with a helical or chip antenna.
- A small patch will never have optimal performance, it is a trade-off between performance with small size. The performance depends on groundplane size.
- A high gain antenna has lower directional gain, but will work better inside a pocket and in a device position changing application.
- An external active antenna mounted on a i.e. car (metal) roof will have the best possible gain and may be used as a reference.

<table>
<thead>
<tr>
<th>Gain</th>
<th>External</th>
<th>Embedded</th>
</tr>
</thead>
<tbody>
<tr>
<td>High gain</td>
<td>Active patch (RHCP)</td>
<td>Passive patch (linear polarization)</td>
</tr>
<tr>
<td>Small size</td>
<td>Active Helical</td>
<td>Passive Helical (tuned)</td>
</tr>
<tr>
<td>Power efficiency</td>
<td>Active patch</td>
<td>Passive Helical</td>
</tr>
<tr>
<td>Ground plane independence</td>
<td>Active patch</td>
<td>Passive Helical</td>
</tr>
<tr>
<td>De-tuning resistance</td>
<td>Passive patch</td>
<td>Passive Helical</td>
</tr>
<tr>
<td>Cost</td>
<td>Passive patch</td>
<td>Active patch</td>
</tr>
</tbody>
</table>

Other arguments that must be considered are based on End-device requirements, and they may include: ease of installation, ease of servicing, robustness, visual design traits (embedded or external antenna) and one of the most significant - cost.
GNSS ANTENNAS
THE MOST POPULAR VERSIONS

**ME4D01MP / ME4D01GMP**
- Active GPS antenna
- GPS (ME4D01MP)
- GPS+GLONASS (ME4D01GMP)
- Magnetic version, sticker option
- RG174 cable with the type of connector upon request
- Dimensions (mm): 41 x 34 x 13.7
- Operating temperature: -40°C to +85°C

**MEF0101P**
- Active multi-band (L1, L2/E5) GNSS antennas with excellent price-performance ratio
- GPS, GLONASS, Galileo, and BeiDou
- Past and easy antenna solution for high precision applications
- Versatile mounting and connector options
- Extended temperature range: up to +105°C

**ME6600B**
- 1x GPS (ME6600B)
- 1x GPS+GLONASS (ME6600BGP)
- 1x 2G, 3G
- Vandal proof
- Screw mount
- screw diameter M14
- Dimensions (mm): Ø 77 x H 15
- Operating temperature: -40°C to +85°C
- Flexible

**ME7041BGa**
- 1x 4G LTE/3G/2G MIMO
- 1x GPS/GLONASS/Galileo
- Vandal proof
- Screw mount
- Dimensions (mm): Ø 96 x H 90
- Operating temperature: -40°C to +85°C
- Versions with additional ISM connections available

**ME4441GP**
- 1x 4G LTE/3G/2G
- 1x GPS/GLONASS/Galileo
- Dimensions (mm): 161 x 76.5 x 16
- Cellular efficiency: -70%
- GNSS gain: 25.8 dB@3 V, 24 dB@5 V
- Operating temperature: -40°C to +85°C

**ACTIVE PATCH**

Active patch antennas are a perfect solution for devices where an internal antenna is needed, but a RF signal path SMD design is challenging.

- Available in various sizes: 18 x 18 mm, 26 x 26 mm
- Pre-filter and mid-filter versions for saturation protection or low noise figure
- Two LNA gain possibilities: 14 dB for low power consumption, 28 dB for weak signal environments
- Cable length and connector upon request
- GPS or GPS/GLONASS versions
- Available parts: MEM001F, MEM003F (GF), MEM004F (GF), MEM005F (GF), MEM006F (GF), MEM007F (GF), MEM008F (GF)

**M9706CWT**
- Passive GPS/GLONASS antenna
- Gain: -2.9 dB
- Efficiency: -70%
- Ground plane independent
- Operating temperature: -40°C to +85°C
- Flexible

**M7HCT-A-SMA**
- Passive GNSS antenna
- Gain: -2.9 dB
- Efficiency: -70%
- Operating temperature: -40°C to +85°C
- Flexible

**M1227HCT-A2-SMA**
- Active L1/L2 GPS/GLONASS bands
- Rigged IP-67 rating
- Superior out-of-band rejection
- Ground plane independent
- SMA connector
- Dimensions (mm): Ø 30 x H 31
- Ultra lightweight - 24 grams

**M1516HCT-P**
- Passive GPS/GLONASS antenna
- Very low axial ratio
- IP-67 mounted and unmounted
- Ultra lightweight - 12 grams
- Ground plane independent
- Dimensions (mm): Ø 18.5 x H 48
- SMA connector

**M1575HCT-22P-SMA (GG)**
- High performance passive GPS or GPS/GLO antenna
- Very low axial ratio
- IP-67 mounted and unmounted
- Ultra lightweight - 10 grams
- Ground plane independent
- Dimensions (mm): Ø 35 x H 57
- SMA connector

**M1575HCT-15A-SMA**
- Active quadrifilar helix antenna for RTK applications
- Concurrent GNSS reception on L1, GPS, GLONASS, Galileo, and BeiDou
- L2: GPS L2C, Galileo E5B, and GLONASS L5OC
- L5: GPS (MBHCT-A-SMA)
- Rugged IP-67 rating with SMA
- Ultra lightweight - 25 grams
- Dimensions (mm): Ø 35 x H 57
- SMA connector

**M1516HCT-P**
- High performance Active GPS antenna
- Very low axial ratio
- IP-67 mounted and unmounted
- Ultra lightweight - 10 grams
- Ground plane independent
- Dimensions (mm): Ø 18.5 x H 48
- SMA connector

**MAXTENA PATCH**

Microstrip GPS/GPS+GLONASS patch type antennas are offered by the American company Maxtena in several sizes, to fit almost any application. Starting from 10 mm x 10 mm for very small GNSS receivers and ending with 25mm x 25mm.

Engineering kits (tuning kits) contain 10 pcs of the antennas, but with different resonance frequencies (with a 2MHz interval), which allows a selection of an antenna tuned to a particular environment (housing and other components have a major impact on the efficiency of GNSS antennas).
CELLULAR ANTENNAS
THE MOST POPULAR VERSIONS

ME004
- Standards 2G and 3G
- VSWR -2.2, -1.8
- Efficiency (%) -49, -43
- Peak Gain (dB) -3, -2.3
- Dimensions (mm) 96 x 8 x 2
- Operating temperature -40 °C to +85 °C
- Magnetic version available

MEW0304
- Standards 2G and 3G
- VSWR -1.6, -1.3
- Efficiency (%) -65, -44
- Peak Gain (dB) -2, -1.7
- Dimensions (mm) Ø 31 x 148.4
- Operating temperature -40 °C to +85 °C
- Flexible antenna

ME304M
- Standards 2G and 3G
- VSWR -1.6, -1.3
- Efficiency (%) -75, -47
- Peak Gain (dB) -3.5, -2.8
- Dimensions (mm) 126.5 x 22 x 6.7
- Operating temperature -40 °C to +85 °C
- Adhesive mount

ME5004PL
- Standards 2G and 3G
- VSWR -1.6, -1.3
- Efficiency (%) -52, -43
- Peak Gain (dB) -3.5, -2.8
- Dimensions (mm) 96 x 22 x 6.7
- Operating temperature -40 °C to +85 °C
- Magnetic

MEW1024
- Standards 2G and 3G
- VSWR -1.6, -1.3
- Efficiency (%) -67, -53
- Peak Gain (dB) -3.5, -2.8
- Dimensions (mm) Ø 10 x 7.4
- Operating temperature -20 °C to +65 °C
- Hinge

ME3704M
- Standards 2G and 3G
- VSWR -1.6, -1.3
- Efficiency (%) -49, -28
- Peak Gain (dB) -1.7, -0.3
- Dimensions (mm) 30.9 x 71.5
- Operating temperature -40 °C to +85 °C
- Magnetic

MEW124
- Standards 2G and 3G
- VSWR -2.4, -1.6
- Efficiency (%) -62, -75
- Peak Gain (dB) -0.4, -2.6
- Dimensions (mm) 171 x 8 x 13.8
- Operating temperature -40 °C to +85 °C
- Magnetic version available

ME5224P
- Standards 2G and 3G
- VSWR -2.1, -1.5
- Efficiency (%) -62, -75
- Peak Gain (dB) -0.4, -2.6
- Dimensions (mm) 171 x 8 x 13.8
- Operating temperature -40 °C to +85 °C
- Magnetic

MEW0124
- Standards 2G and 3G
- VSWR -1.6, -1.3
- Efficiency (%) -67, -53
- Peak Gain (dB) -3.5, -2.8
- Dimensions (mm) 10 x 7.4
- Operating temperature -20 °C to +65 °C
- Hinge

ME3104M
- Standards 2G and 3G
- VSWR -1.6, -1.3
- Efficiency (%) -49, -28
- Peak Gain (dB) -1.7, -0.3
- Dimensions (mm) 126.5 x 22 x 6.7
- Operating temperature -40 °C to +85 °C
- Flexible antenna

ME5224M
- Standards 2G and 3G
- VSWR -2.1, -1.6
- Efficiency (%) -62, -75
- Peak Gain (dB) -0.4, -2.6
- Dimensions (mm) 171 x 8 x 13.8
- Operating temperature -40 °C to +85 °C
- Flexible antenna

ME017
- Standards 2G and 3G
- VSWR -1.6, -1.3
- Efficiency (%) -67, -53
- Peak Gain (dB) -3.5, -2.8
- Dimensions (mm) 26 x 7.6 x 3
- Operating temperature -40 °C to +85 °C
- Flexible antenna

ME6551BG
- Standards 2G and 3G
- VSWR -2.1, -1.8
- Efficiency (%) -67, -74
- Peak Gain (dB) -3.5, -2.8
- Dimensions (mm) 89.7 x 141 x 0.8
- Operating temperature -40 °C to +85 °C
- Heavy Duty antenna

ME0304P
- Standards 2G and 3G
- VSWR <2.4, <1.5
- Efficiency (%) -41, -41
- Peak Gain (dB) -0.5, -3
- Dimensions (mm) 75 x 25 x 0.8
- Operating temperature -40 °C to +85 °C
- Flexible antenna

MEP0624P
- Standards 2G and 3G
- VSWR -1.5, -1.1
- Efficiency (%) -45, -48
- Peak Gain (dB) -0.3, -1.5
- Dimensions (mm) Ø 31 x 146
- Operating temperature -40 °C to +85 °C
- Heavy Duty antenna

ME7050JGa
- Standards 2G and 3G
- VSWR -1.6, -1.3
- Efficiency (%) -67, -53
- Peak Gain (dB) -3.5, -2.8
- Dimensions (mm) Ø 146 x 315
- Operating temperature -40 °C to +85 °C
- Heavy Duty antenna

ME18
- Standards 2G and 3G
- VSWR -1.6, -1.3
- Efficiency (%) -58, -67, -74
- Peak Gain (dB) -2.3, -2.9
- Dimensions (mm) Ø 10 x 7.4
- Operating temperature -20 °C to +65 °C
- Hinge

ME2124K-B07H
- Standards 2G and 3G
- VSWR -2.1, -1.6
- Efficiency (%) -58, -52, -41.9
- Peak Gain (dB) -3.2, -2.3, -0.7
- Dimensions (mm) 208.3 x Ø 16
- Operating temperature -40 °C to +85 °C
- Magnetic

MEW0124
- Standards 2G and 3G
- VSWR -2.1, -1.6
- Efficiency (%) -62, -75
- Peak Gain (dB) -0.4, -2.6
- Dimensions (mm) 171 x 8 x 13.8
- Operating temperature -40 °C to +85 °C
- Magnetic

ME5224P
- Standards 2G and 3G
- VSWR -2.1, -1.6
- Efficiency (%) -62, -75
- Peak Gain (dB) -0.4, -2.6
- Dimensions (mm) 171 x 8 x 13.8
- Operating temperature -40 °C to +85 °C
- Magnetic
ISM ANTENNAS
THE MOST POPULAR VERSIONS

MEOA02-2.4
- Standards WiFi, BT, ZigBee, ISM
- Frequency 2.4 GHz ISM
- VSWR - 1.1
- Efficiency (%) - 61
- Peak Gain (dBi) - 3.5
- Dimensions (mm) 44 x 9.6
- Operating temperature -40 °C to +85 °C
- Hinge

ME3702M
- Standards WiFi, BT, ZigBee, ISM
- Frequency 2.4 GHz ISM
- VSWR - 1.21
- Efficiency (%) - 43
- Magnetic
- Peak Gain (dBi) - 1.6
- Dimensions (mm) Ø 31 x 71.5
- Operating temperature -40 °C to +85 °C
- Through hole mount

MEW0302-2.4
- Standards WiFi, BT, ZigBee, ISM
- Frequency 2.4/5 GHz ISM
- VSWR - 1.91
- Efficiency (%) - 62
- Peak Gain (dBi) - 1.5
- Dimensions (mm) 30 x 30 x 0.2
- Operating temperature -40 °C to +85 °C
- Flexible antenna

ME0115-868
- Standards ZigBee, ISM, SIGFOX, LoRa
- Frequency 868 MHz ISM
- VSWR - 1.41
- Efficiency (%) - 77.4
- Peak Gain (dBi) - 1.3
- Dimensions (mm) 53 x 10 x 19
- Operating temperature -40 °C to +85 °C
- Flexible antenna

ME0105-868
- Standards ZigBee, ISM, SIGFOX, LoRa
- Frequency 868 MHz ISM
- VSWR - 1.41
- Efficiency (%) - 37.0
- Peak Gain (dBi) - 0.3
- Dimensions (mm) 50 x Ø16
- Operating temperature -40 °C to +85 °C
- Flexible antenna

ME0202P
- Standards WiFi, BT, ZigBee, ISM
- Frequency 2.4/5 GHz ISM
- VSWR - 1.21, -1.51
- Efficiency (%) - 76.3, -74.7
- Peak Gain (dBi) - 4.4, -6.7
- Dimensions (mm) 30 x 30 x 0.2
- Operating temperature -40 °C to +85 °C
- Flexible antenna

ME3915M-868
- Standards ZigBee, ISM, SIGFOX, LoRa
- Frequency 868 MHz ISM
- VSWR - 1.21
- Efficiency (%) - 64.5
- Magnetic
- Peak Gain (dBi) - 2.6
- Dimensions (mm) Ø 30.9 x 91
- Operating temperature -40 °C to +85 °C
- Flexible antenna

ME5215P-868
- Standards ZigBee, ISM, SIGFOX, LoRa
- Frequency 868 MHz ISM
- VSWR - 1.21
- Efficiency (%) - 32.7
- Peak Gain (dBi) - 0.9
- Dimensions (mm) 40.0 x 7.0 x 0.2
- Operating temperature -40 °C to +85 °C
- Flexible antenna

MEP0102
- Standards WiFi, BT, ZigBee, ISM
- Frequency 2.4/5.0 GHz ISM
- VSWR - 2.41, -2.21
- Efficiency (%) - 55, -64
- Peak Gain (dBi) - 3.2, -5.0
- Dimensions (mm) 16.4 x 5.4 x 0.4
- Operating temperature -40 °C to +85 °C

MEF0115P
- Standards ZigBee, ISM, SIGFOX, LoRa
- Frequency 433 MHz ISM
- VSWR - 1.51
- Peak Gain (dBi) - 10.3
- Dimensions (mm) 12 x 4 x 1.6
- Operating temperature -40 °C to +85 °C

ME0115-433
- Standards ZigBee, ISM, SIGFOX, LoRa
- Frequency 433 MHz ISM
- VSWR - 1.51
- Peak Gain (dBi) - 10.3
- Dimensions (mm) 12 x 4 x 1.6
- Operating temperature -40 °C to +85 °C

ME0115-868
- Standards ZigBee, ISM, SIGFOX, LoRa
- Frequency 868 MHz ISM
- VSWR - 1.41
- Efficiency (%) - 77.4
- Peak Gain (dBi) - 1.3
- Dimensions (mm) 53 x 10 x 19
- Operating temperature -40 °C to +85 °C
- Flexible antenna

MEW035
- Standards WiFi, BT, ZigBee, ISM
- Frequency 2.4/5.0 GHz ISM
- VSWR - 2.11, -2.81
- Efficiency (%) - 35, -60
- Peak Gain (dBi) - 1.4, -3.2
- Dimensions (mm) 76 x Ø10
- Operating temperature -40 °C to +85 °C

ME5215P-433
- Standards ZigBee, ISM, SIGFOX, LoRa
- Frequency 433 MHz ISM
- VSWR - 1.51
- Peak Gain (dBi) - 10.3
- Dimensions (mm) 12 x 4 x 1.6
- Operating temperature -40 °C to +85 °C

MEWIFI12
- Standards WiFi, BT, ZigBee, ISM
- Frequency 2.4/5.0 GHz ISM
- VSWR - 1.61, -1.81
- Efficiency (%) - 60, -63
- Peak Gain (dBi) - 7.2, -5.2
- Dimensions (mm) 104 x 104 x 90
- Operating temperature -40 °C to +85 °C
- Mast mount

ME7002Bc
- Standards WiFi, BT, ZigBee, ISM
- Frequency 2.4/5.0 GHz ISM MIMO
- VSWR - 1.91, -1.61
- Efficiency (%) - 58, -64
- Peak Gain (dBi) - 5.6, -5.5
- Dimensions (mm) Ø 96 x H 90
- Operating temperature -40 °C to +85 °C

MAXTENA MEA-DSRC-01P
- Standards V2V, V2X
- Frequency 8800 - 9150 MHz
- DSRC (Dedicated Short Range Communications) products
- Waterproof
- Several versions available
- Peak Gain 5.0 dBi
- Efficiency over 40%
Currently the Microdis Group employs over 100 people, with a large number of electronic engineers, mostly involved in sales and application support.

As a company with an extensive experience in the distribution of electronic components, and a purchasing center in Germany for many years, we are able to offer almost any product from a wide variety of electronic components. We offer also the production of cable harnesses and programming of crystal oscillators for a customised frequency. Cooperation with a catalogue distributor provides fast deliveries (2 days) of a wide range of catalogue products.

We have certificates of quality management DIN EN ISO 9001:2015 for the distribution of electronic components.