

Satellite-based 5G: IoT and M2M Communication

Numbers indicate that satellite 5G will disrupt the IoT market. **Become satellite 5G compliant now!**

Standardization in the satellite IoT market will be a key factor in achieving a sustainable business in the massive satellite communication market. The standardization will drive scalability and globalization of satellite communication in the future, which will allow operators to move their focus from technical challenges towards a focus on their core business and providing the services to their customers. The availability of standardized

solutions will both on short term and long term save cost, reduce the struggles, and support the scalability of the business.

A revolutionizing change

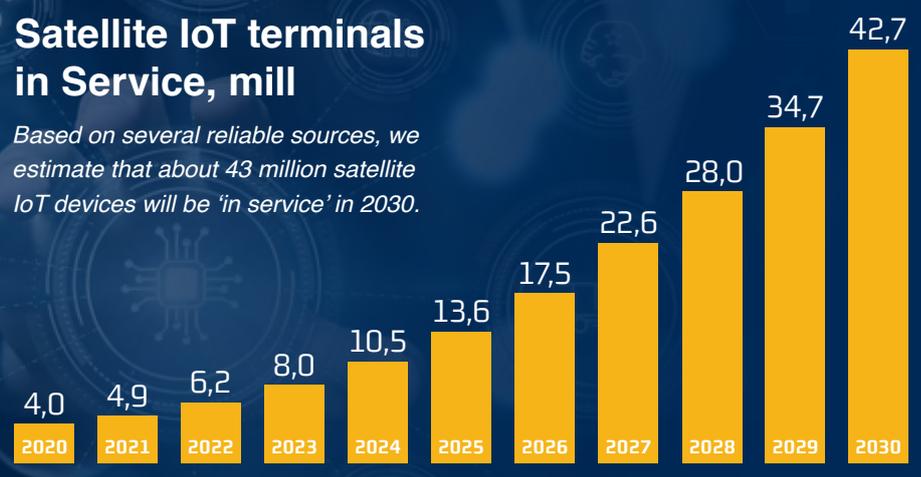
5G for non-terrestrial networks is going to be rolled out in the years to come, and it will change the entire satellite communication industry. Even though the satellite 5G market will be a niche market, we expect a revolutionizing change. And if you want to secure a lead

position and really profit from the introduction of satellite 5G, you need to get ready now to be among the first to introduce the new groundbreaking technology to your customers.

The NB-IoT system envisioned by GateHouse Satcom for non-terrestrial coverage is based on a network of satellites providing true global coverage and thereby extending the coverage of existing terrestrial NB-IoT systems.

Satellite IoT terminals in Service, mill

Based on several reliable sources, we estimate that about 43 million satellite IoT devices will be 'in service' in 2030.



Game-changing satellite-based 5G technology: Stay connected anywhere, anytime

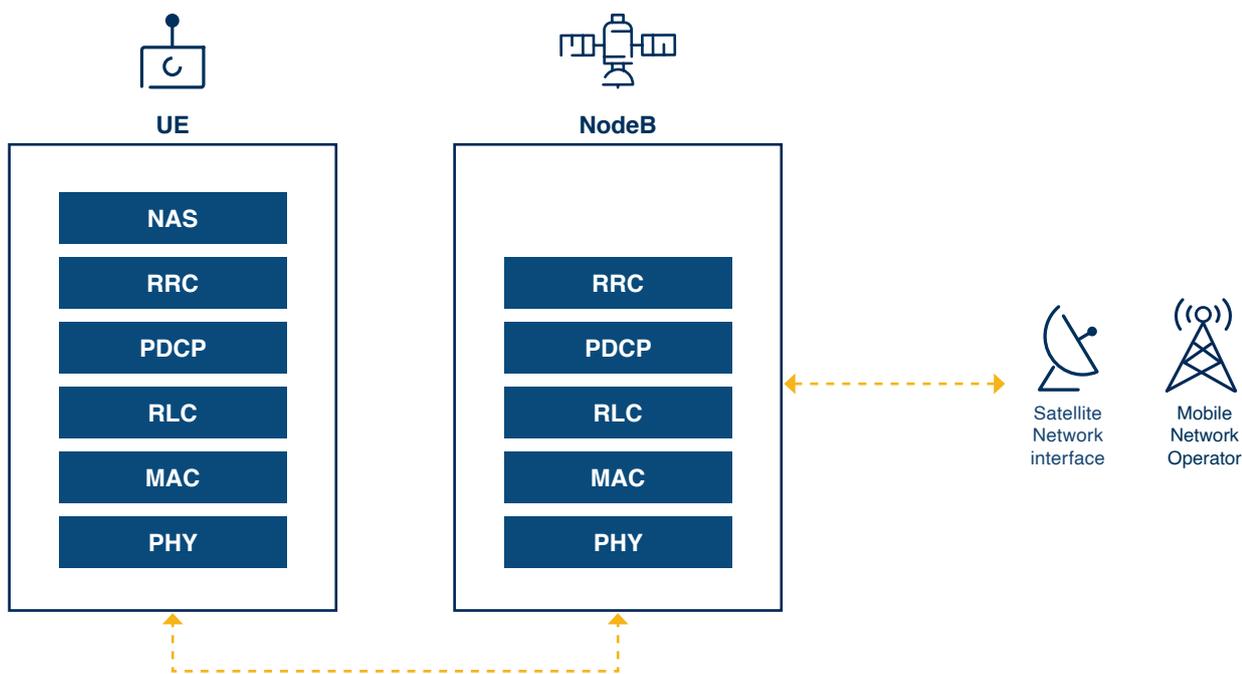
User Terminal (UT):

User terminals (UT) are ideally multi-mode IoT devices, capable of using either a terrestrial network or a non-terrestrial network for connectivity. This is especially useful for applications where real-time tracking, monitoring,

or surveillance is required outside terrestrial coverage, and for scenarios where the device moves in and out of terrestrial coverage.

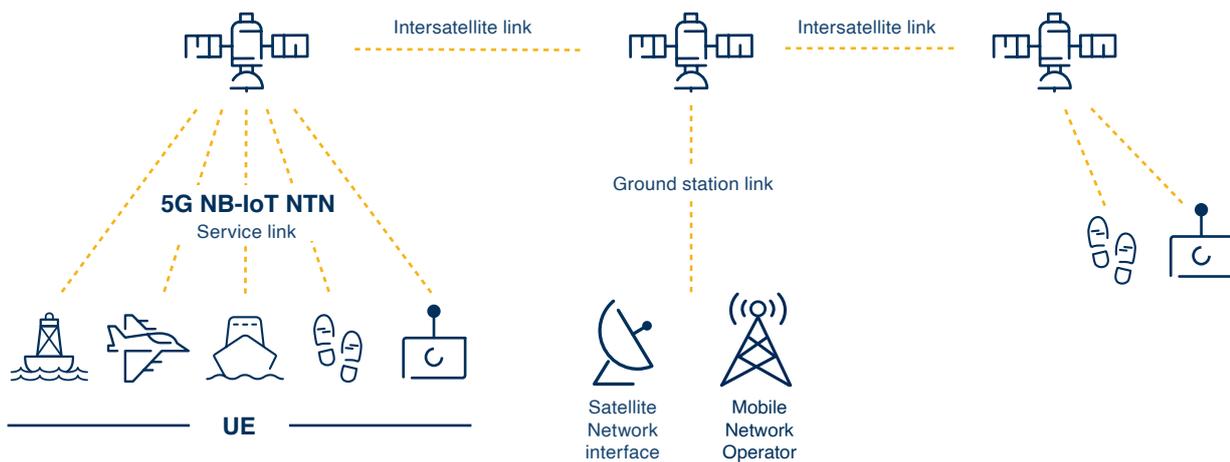
The UE solution provided by GateHouse is designed for integration onto an application specific chip (SoC)

or a general low-cost COTS HW. It supports low power consumption required for long time battery operation. Extensive testing ensures a very robust and well-proven software solution which requires a minimum of maintenance.



General overview of the NB-IoT network including the evolved NodeB and the user equipment (UE)

GateHouse is actively contributing to the standardization of 5G NB-IoT NTN and our solution will evolve with the standardization to be fully compliant both for Release 17 and the following releases.



System overview of NB-IoT

In the system overview (above) each satellite in a constellation communicates with the IoT devices within its “field of view”, collecting data from the terminal or transmitting data to the terminal for controlling e.g. a machinery.

One of the advantages of using a solution based on 5G is that it complies with terrestrial 5G networks and makes seamless roaming possible. Causing the user to not really care whether a device is within reach of a terrestrial network or not – the data will be communicated in either case.

Communication of data

Whenever a satellite is within reach of an IoT device, it communicates the user data scheduled for communication. When the data is received at the satellite, data can be either stored in the satellite, directly communicated to the ground, or passed on to another satellite via intersatellite links.

For satellites in GEO, the satellite will have a permanent link to ground, but for other orbits e.g. LEO, this is not always the case. The solution from GateHouse supports both cases. In 3GPP, this is referred to as transparent mode and regenerative mode, respectively.

Three links can be used (not required) in this concept:

- **Service link (NB-IoT link)** is the link between the IoT device and the satellite.
- **Intersatellite link** for exchange of information between satellites in a constellation.
- **Ground station link** is the communication link between the satellites and the ground stations.

GateHouse NB-IoT Waveform Development

