Gatehouse Satcom

5G NTN
NB-IoT User Equipment Software

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NB-IoT UE Software

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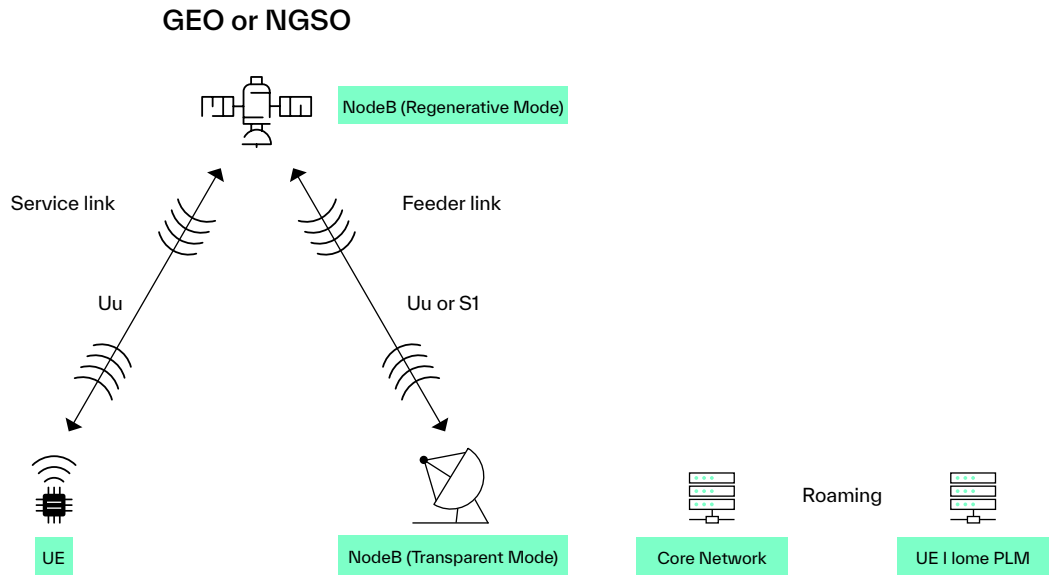
The Gatehouse Satcom NB-IoT UE Software is designed for use in a 5G Non-Terrestrial Network and can provide direct-to-device connectivity.

The User Equipment (UE) software (SW) is at the core of devices, modules, or terminals for Internet-of-Things (IoT) or other narrowband services like messaging. It is the component that implements the communication link to the 5G NTN NB-IoT network. When data needs to be transmitted or received the UE SW sets up the radio channel from the UE side and handles transformation between radio signals and application data. Through the radio link (Uu interface) it communicates with a 5G NTN NodeB located either in a satellite or on the ground station and a Satellite Operator Core Network.

The UE is registered by a Mobile Network Operator and the UE SW ensures registration and authentication to secure data integrity and billing of data usage. It does not make any difference whether the UE SW operates on a Non Terrestrial Network (NTN) or a Terrestrial Network (TN) as it includes the 5G specified adaptations needed for satellite based 5G connectivity thereby supporting seamless connectivity when moving between NTN and TN networks.

The UE SW is optimized for Software Defined Radio (SDR) based devices and it is easily portable to hardware platforms of very low requirements to Size, Weight and Power (SWaP).

Fig. 1



Benefits

The 5G NTN NB-IoT UE SW is the optimal alternative to using a standard chipset for when you need to comply to dedicated form factors, protect compliance or go beyond the standards.

- Applying 5G NTN NB-IoT UE SW gives your devices access to global services via satellite connectivity
- Based on 5G open standards and optimized for SDR platforms
- Ideal for government applications and protecting compliance
- Built on more than two decades of experience in the satellite industry
- Ideal for update of existing and already deployed devices
- Ideal for complying to dedicated form factors or specific device requirements
- Can be combined with other connectivity solutions on the same hardware
- Can be embedded into other solutions – for example messaging devices
- We offer support and maintenance, which will guarantee you continuously updated software as Gatehouse Satcom is actively contributing to the 3GPP standards

Use cases

Logistics

With 5G NTN NB-IoT SW your device can connect practically anywhere and provide position and other relevant information – for example temperature. In logistics it is important to know where goods are during the whole transportation chain. This is possible with devices that are prepared for satellite-based connectivity. When leaving terrestrial coverage the device roams to a satellite network. Hence, global tracking of goods is possible.

Messaging

Current smartphones and other messaging devices often rely on TN networks to operate. With 5G NTN NB-IoT SW incorporated in your messaging device you get connectivity via satellite in remote areas when travelling and hiking outside of cell coverage. This can also be made available via a device with 5G NTN connectivity and for example Bluetooth connectivity to serve a messaging device.

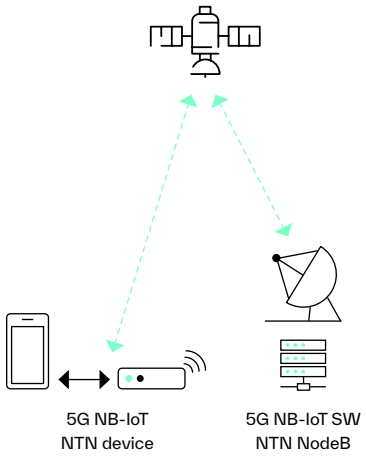
Agriculture

Measuring humidity, temperature, or other parameters in remote fields can be critical to control which measures to take to secure optimal outcome for the farmer. Many fields are located outside coverage of TN networks so adding 5G NTN NB-IoT SW to devices would open the market for many more farmers. It effectively enables Smart Agriculture which can improve pest management, water usage and profitability.

Energy and Infrastructure

Protection and monitoring of critical infrastructure for energy, communication and governmental installations is important, and 5G NTN NB-IoT is an ideal technology due to its independence of other infrastructures such as cabled connections or terrestrial cellular networks.

Fig. 2



Technical Description

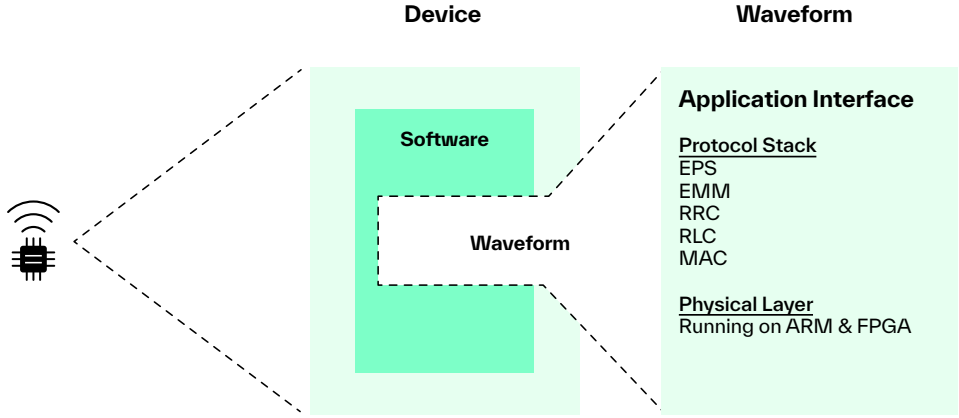
Our UE software is an implementation of the 3GPP standards for 5G NTN NB-IoT and as such a standardized component when building a 5G NTN device. The UE software includes the layers PHY, MAC, RLC, RRC, EMM and EPS. It has been designed and developed for portability and executed on different Commercial of The Shelf (COTS) hardware platforms. The UE software is prepared for being embedded into any capable hardware platform being developed in standard C++ programming language to fit the application needs. UE software is a mature product which will follow the 5G NTN standards as specified by 3GPP. Gatehouse Satcom will continuously update the product according to modifications of the standards.

The 5G NTN NB-IoT UE SW is a waveform to be incorporated into a device as illustrated below. It includes all the software components needed for connecting to a 5G NTN network.

Design Characteristics

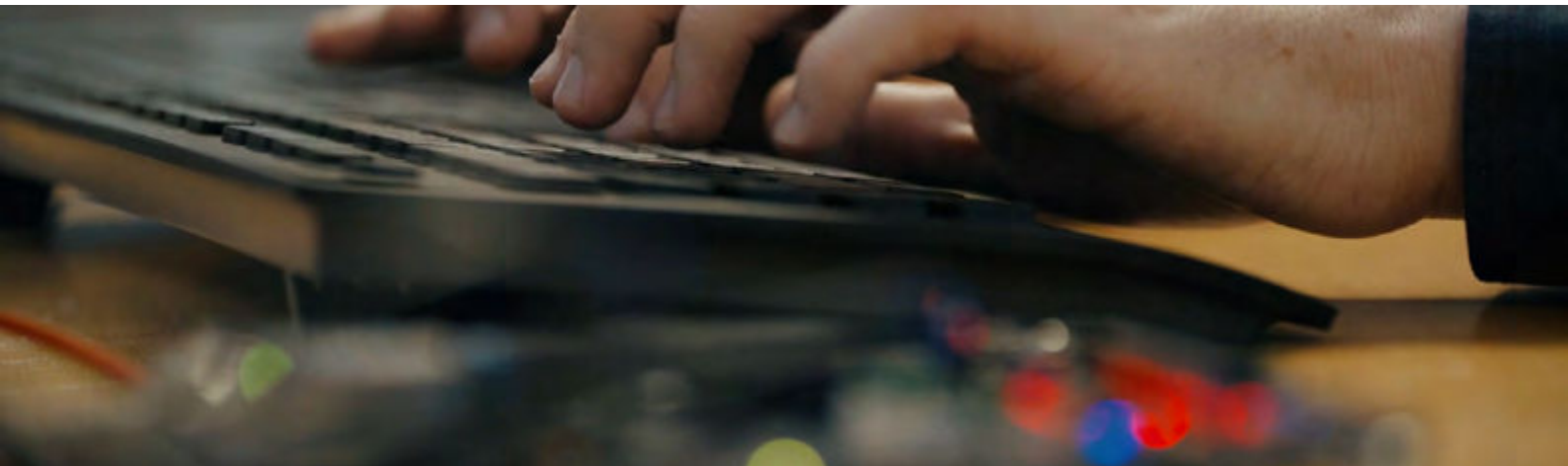
- Independent stack implementation
- Optimized for SDR platforms
- Programming language C++17
- Partly implemented in FPGA
- FPGA programmed in VHDL
- 3GPP NTN compliant (Rel-17)
- Low memory and low cycle count footprints
- Compatible with COTS hardware platform
- Debugging interface
- Higher level interface for ephemeris

Fig. 3



Technical Specifications

Feature	Description
TAU and Periodic TAU	Refer to TN Tracking Area and Tracking Area Update
Paging	TN Paging
Control Plane CIoT Optimization	Control Plane CIoT EPS optimisation allows to transport user data (IP, Non-IP) over NAS
Multiple Coverage Levels (CE0, CE1, CE2)	Coverage enhancement for hard-to-reach areas based on number of repetitions
Single tone (15kHz and 3.75kHz), multitone	
Downlink Channel Quality Reporting	UE reports to eNB the downlink channel quality in Msg3 during RACH
Support of ciphering and integrity protection algorithms	NEA0-2 and NIA0-2
Enhanced UE Measurements	Allows RRM to use both NSSS and NRS for better signal quality assessment.
3GPP Rel17 NB-IoT NTN changes	3GPP Rel17 NB-IoT NTN changes
Discontinuous Coverage	
IoT NTN Parameters	UE timer extension MAC/RLC/PDCP
IoT NTN Parameters	RACH adaptation to handle long RTT
IoT NTN Parameters	Acquiring NTN specific SIB
Debugging Interface for control and logging	
Generic SIM card interface	



Get in touch

Get in touch with us to learn how you can realize 5G NTN NB-IoT or New Radio on your current or future satellite fleet to compete in the evolving market. Reach out to us at satcom@gatehouse.com and set up a meeting to discuss your 5G NTN strategy.

Gatehouse Satcom

5G Satellite Communication Software

That's Out Of This World