3GPP 5G New Radio Standardisation and Simulation for Non-Terrestrial Networks (NTN)
Background Nomor Research GmbH

- Industry: IT Telecommunication
- Headquarter: Munich, Germany
- Founded: September 2004
- Spin off from Munich University of Technology
  - First real-time simulations GPRS/UMTS in 1999
  - Fully privately owned, always profitable from day one
  - Successful sale of LTE eNodeB Protocol Stack business in 2013
  - Today 17 highly qualified R&D engineers + admin staff
- Vendor independent research / consultancy services
- Service focussed around 4G/5G technology
  - Research/development projects and system simulation services
  - Demonstrators and HW/SW prototype development
  - Consultancy, standardisation and patents support
  - Technology training and knowhow transfer
Our Vision

“Global internet connectivity using low cost devices provided by advanced satellite systems using a standardized 5G air interface”

Nomor Research GmbH has a long history of ESA projects
NTN Architecture Options

1. Transparent architecture
   - Satellite acts like a repeater, repeating the base stations (gNB) signal

2. Regenerative architecture
   - Full or partial base station hosted by the satellite
   - Might enable inter-satellite interface as well

Source: 3GPP TR 38.821
Status 3GPP Standardisation of 5G NTN

- Successful creation of several Rel.15/16 work and study items
  - 3GPP SA1 on requirements and SA2 on architecture
  - 3GPP RAN (RAN1/RAN2/RAN3) to enhance 5G new radio for NTN
ESA Project: ALIX

- Support of 3GPP Standardization of a Satellite 5G Air Interface
  - ESA ARTES Program – Future Preparation
- Partners: THALES, nomor research, Fraunhofer IIS
- Major achievements
  - Rel.16 RAN study item supported by 64 companies and agreed
  - 26 (!) 3GPP RAN1/2/3 WGs meetings during 2018 – 2019
  - Large number of contributions (258 TDocs submitted/revised in 3GPP groups 2018)
  - 13 calls of the Special Satellite Interest Group (SSIG)
    - Coordination of the satellite industry
    - SSIG members support our contributions in the different 3GPP groups
  - Growing interest / contributions by mobile communication industry
    - Ericsson, Nokia, Huawei, ZTE, Vodafone, LG, Sony, Interdigital etc.
  - Other activities in ETSI SCN, ITU-R and ITU-T
Nomor Research – 15 years history of System Level Simulations

- Simulators existing for UMTS, HSPA, WiMAX, MBMS, LTE, LTE-A, NR, WiFi
- Leading member of H2020 evaluation group for 5G proposals submitted to ITU-R
- Example: NR Massive MIMO scheme (16 x 16 antenna elements, 32 beams, SU-MIMO with 8 spatial streams, MU-MIMO with up to 12 UEs, IRC receiver)

Simulator will be extended to support NTN

- Satellite channel models, LEO mobility, earth moving beams etc.
- Scheduling, link adaptation, HARQ supporting long propagation delays and limited link budget of satellite links etc.
Interesting Links

- Nomor publications
  [http://nomor.de/resources/publications/](http://nomor.de/resources/publications/)
- Nomor demonstrations
  [http://nomor.de/resources/demonstrations/](http://nomor.de/resources/demonstrations/)
- Nomor 3GPP Newsletter
  [http://nomor.de/resources/3gpp-newsletter/](http://nomor.de/resources/3gpp-newsletter/)
- Nomor Patents
  [http://nomor.de/resources/patents/](http://nomor.de/resources/patents/)
- Our 3GPP LTE Standards Discussion Forum (ca. 60.000 members)
  [https://www.linkedin.com/groups/1180727](https://www.linkedin.com/groups/1180727)
- Our 3GPP NR Standards Discussion Forum (ca. 10.000 members)
  [https://www.linkedin.com/groups/7489690](https://www.linkedin.com/groups/7489690)
Contact

Let us know if we can be of help to you?

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