

Satellite communication for 5G

Coexistence and cooperation of terrestrial and satellite networks

AT A GLANCE

This study 26 examines how **satellite (Non-Terrestrial Networks, NTN)** and **terrestrial 5G networks** can coexist and cooperate to extend high-quality, gigabit-class connectivity everywhere — including remote areas where terrestrial infrastructure is unavailable. It maps the technical integration models, the regulatory landscape (3GPP, ETSI, ITU-R) and the economics, and sets out recommendations for the national level.

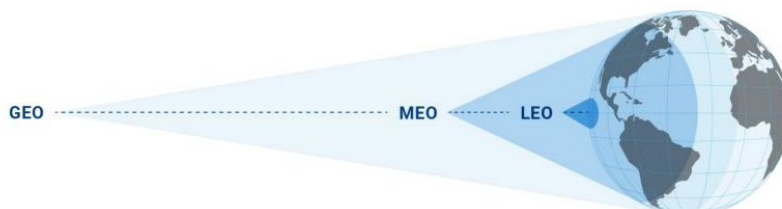
What the study covers

Satellite networks provide stable connections and can be integrated with terrestrial networks in several ways. Thanks to low Earth orbit (LEO) constellations, high-quality connectivity is now achievable even in remote areas without terrestrial infrastructure. The study describes the known technical integration models, identifies the key barriers, and gives recommendations for overcoming them — with emphasis on harmonised spectrum access, economic feasibility and compliance with the European regulatory framework, while reflecting conditions in the Czech Republic.

Why it matters

Coexistence of satellite and terrestrial 5G requires optimising spectrum use and developing hybrid network architectures. Combining the two is a flexible, practical way to extend 5G coverage to every location and to move closer to the EU's gigabit-connectivity goals — turning a once-exotic capability into a mainstream option as device penetration grows.

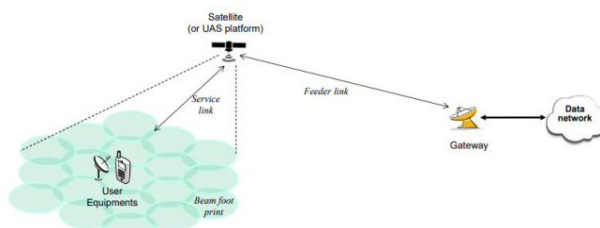
From GEO to LEO — choosing the right orbit



Orbital altitudes of satellites and their coverage reach (source: study, after EuroSkyPark)

	LEO — Low Earth Orbit	MEO — Medium Earth Orbit	GEO — Geostationary
Altitude	500–1 200 km	2 000–36 000 km	≈ 36 000 km
Round-trip latency	20–50 ms (10× lower than GEO)	30–120 ms	500–700 ms
Best suited for	Mass-market broadband, real-time voice/video, IoT	Low-latency data, maritime, aviation, redundancy	Broadcast, weather, wide-area HTS coverage

How NTN fits into 5G



Basic NTN scheme: service link to user equipment, feeder link to the gateway and data network (source: study, after 3GPP)

Use cases for terrestrial - satellite 5G

Enhanced Mobile Broadband (eMBB)

High-speed broadband to fill white spots and reach hard-to-serve locations where fixed or mobile networks do not pay off.

Massive IoT & M2M (mMTC)

Capacity-demanding but dispersed connectivity for sensors and machines in agriculture, forestry, water and energy management.

Highly Reliable Communication (HRC)

Resilient links for emergency, security and defence — including crisis communication when terrestrial infrastructure is disrupted.

Mobile platforms & autonomous use

Coverage at speed for aircraft, ships and trains, plus air-traffic management and autonomous drone access to airspace.

Standards & regulation

International standardisation

5G specifications were not originally designed for satellites — long delay, Doppler shift and moving base stations.

3GPP (Rel 15–19), ETSI and ITU-R have since made major progress so that NTN and terrestrial 5G interoperate.

Spectrum & the 2027 MSS question

The near-term priority is the allocation of the MSS (2 GHz) band after current licences expire in 2027.

ITU-R Resolutions 253 & 254 (WRC-23) are to be codified at WRC-27; RSPG is preparing fair-access rules.

RECOMMENDATIONS FOR THE NATIONAL LEVEL

- Explore TN–NTN cooperation** in fitting scenarios: secured communication for emergency services (IRS), state crisis communication, air-traffic safety and navigation, and monitoring of transport and energy infrastructure.
- Support further sectors** — agriculture, forestry and water management — where dispersed and mobile devices need fast data links in areas with uneven terrestrial coverage.
- Act on the near-term MSS (2 GHz) allocation** after the 2027 licence expiry, aligned with RSPG variant proposals and EC procedural steps in preparation for COCOM.

ECONOMIC SIGNAL For the most remote, hardest-to-connect households in the Czech Republic, satellite delivery already beats new fixed (FTTx) build-out — the break-even sits around the top **0.22 % of premises (≈ 5 455 households)**. Nationwide, though, NTN is expected to play a complementary role alongside terrestrial networks.

KEY TAKEAWAY Coexistence of satellite (NTN) and terrestrial 5G/6G networks can extend gigabit connectivity to the places fixed and mobile networks cannot reach economically — provided spectrum is harmonised and emerging standards are transposed into national rules. A shared, medium-term (≈ 5-year) priority for the European Union.