

5G Non-Terrestrial Networks

Direct 5G connectivity to handheld
terminals via LEO satellites

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Complement to terrestrial coverage



Coverage gap

- **97%** of world population covered by Cellular
- **94%** of world population covered by mobile broadband 3G, 4G & 5G
- **450 million people** without access to mobile broadband in 2022
- **19%** of Sub-Saharan Africa population without mobile broadband coverage (250m)
- **70%** of landmass has no cellular coverage for sparsely populated areas

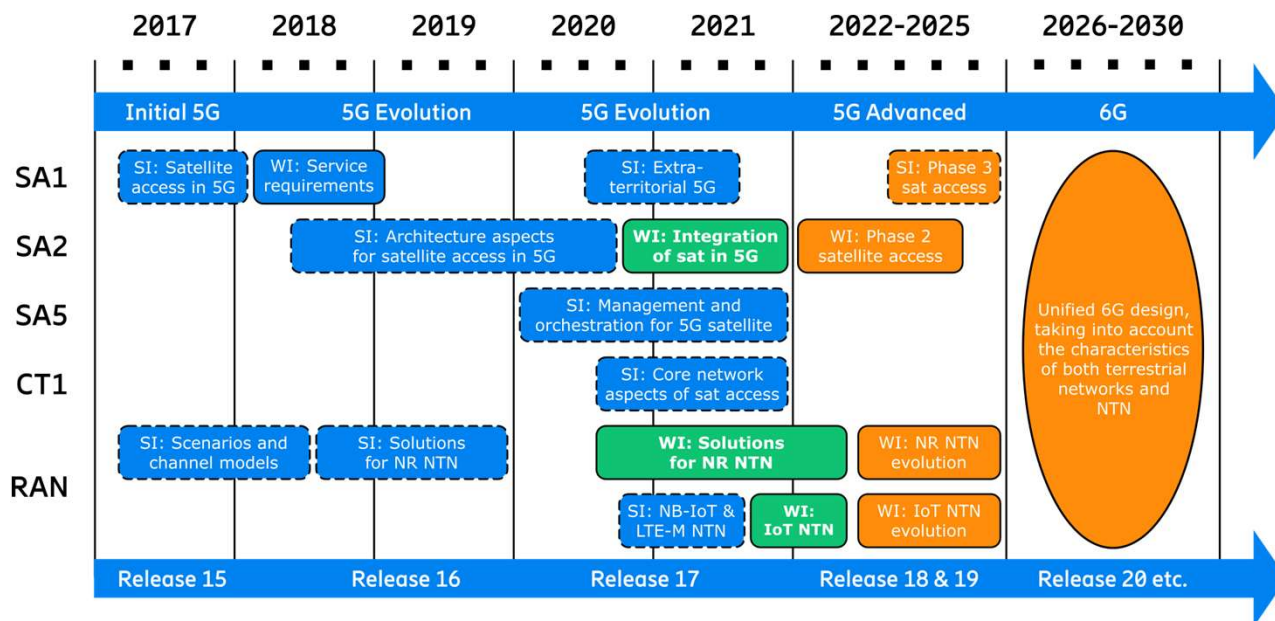
Source: GSMA, Worldbank, ITU, Ookla

Paradigm shift in the space industry

Old Space	New Space
Mainly GEO satellites	LEO satellites
Few satellites	Large constellation
Semi-static coverage	Dynamic coverage
Expensive launches	Reusable rockets
TV broadcast & selected broadband	Broadband connectivity
Parabolic VSAT receivers	Flat panel beamforming antennas

→ 5G NTN can serve as a complement to terrestrial networks to close these gaps and achieve truly global coverage

3GPP (unofficial) Roadmap for NTN



Why 3GPP standards for NTN?

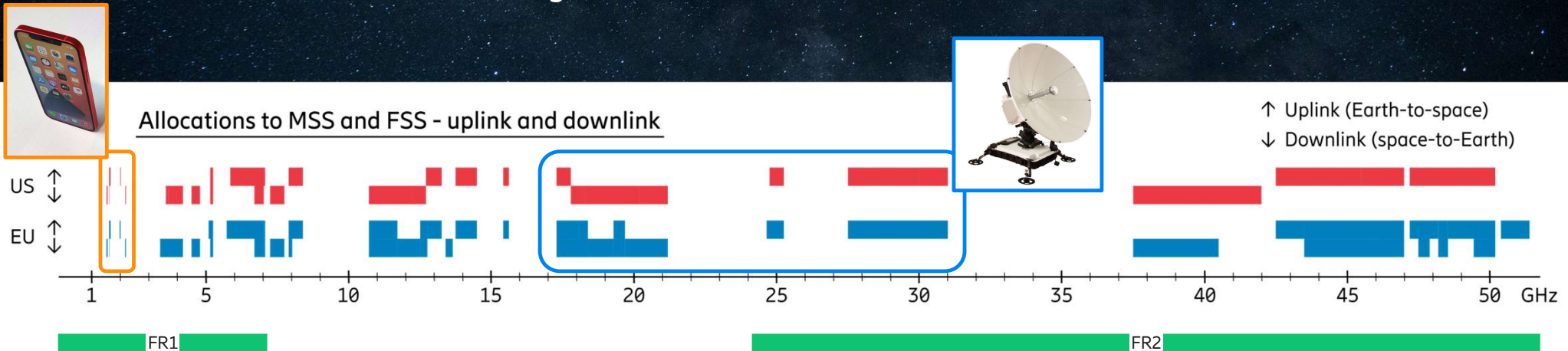
- Technology commonality with cellular ensures access to economies of scale and allows cost reduction, large product diversity and a wider ecosystem
- Open and global standards ensure future proof solutions and multi-vendor interoperability
- Confluence of interests of satellite and telecom industries

Future roadmap for 6G on is not 3GPP official, but based on plans from NTN proponents (see e.g., [RWS-210074](#), Thales)

3GPP NTN Spectrum and Devices



- 3GPP assume operation on Satellite-exclusive MSS/FSS spectrum
- 3GPP studied two frequency ranges, corresponding to two types of devices:
 - "S-band" & "L-band" (2 GHz & 1.6 GHz) → handheld devices (regular smartphones, 23 dBm Tx power)
 - Link budget is tight, but good enough for outdoor use
 - "Ka-band" (20/30 GHz) → high-gain devices with directive antenna (part of Rel-18)
 - IoT and FWA main driving use cases



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Use cases and opportunities



New opportunities for operators

- Revenue upside to the existing customer base and increasing customer satisfaction, i.e., limited out-of-coverage risk
- Larger addressable market – customers in the current coverage gap
- Provides an entry route into businesses that can be upsold with other services

Consumer connectivity



Industrial service continuity



Public safety resilience



5G NTN ecosystem

Cooperation between SatCom and Telco

- Satellite Network Operator (SNO) owns and operates satellite constellation and 5G equipment and offer 5G NTN services to a global mass market
- Mobile Network Operator cooperates with SNO allowing NTN roaming service.
- Complementary service – not a replacement.
- Dedicated NTN spectrum for regulatory compliance.

