



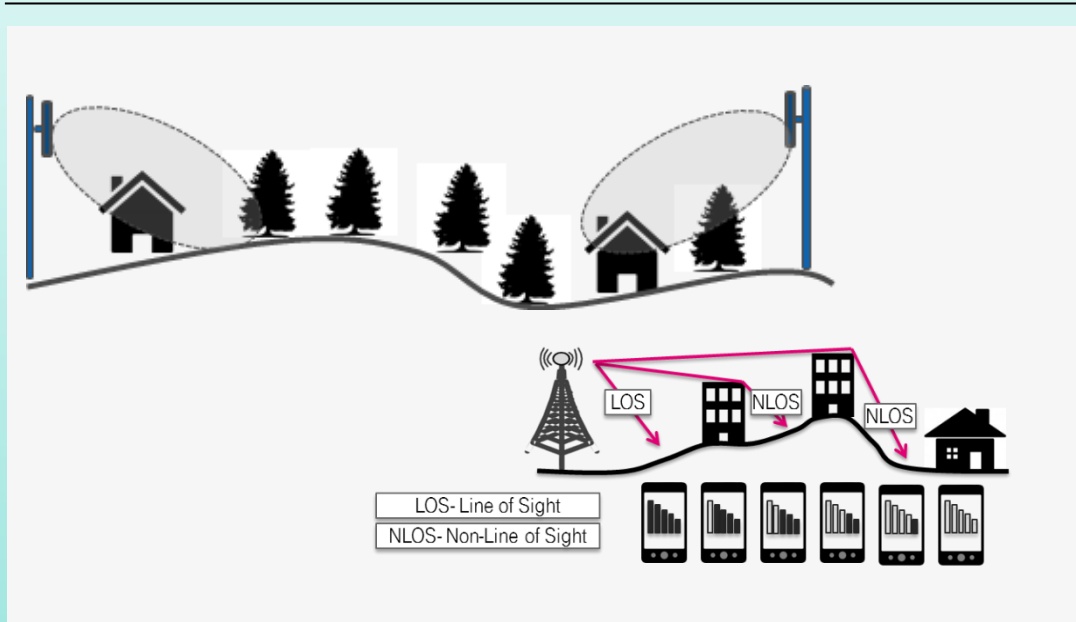
NTN connectivity solutions

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NTN complements mobile network coverage in remote areas

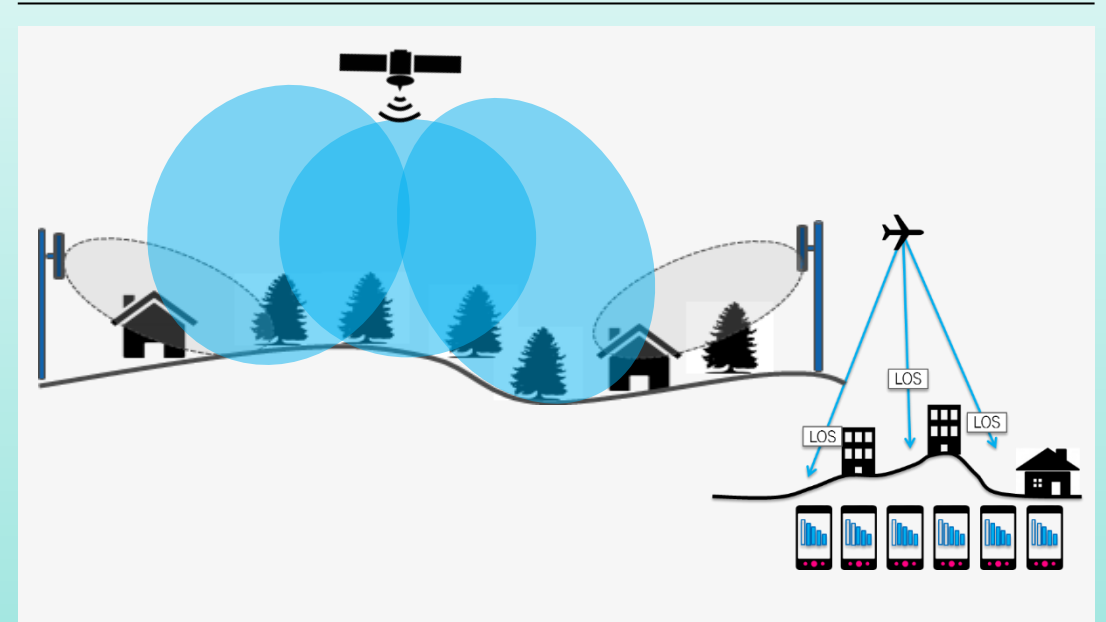
Terrestrial Networks (TN)



Operators are building mobile sites on the ground using towers or mast on rooftops

Typical site to site distance depends on tower, height, antenna gain and terrain profile

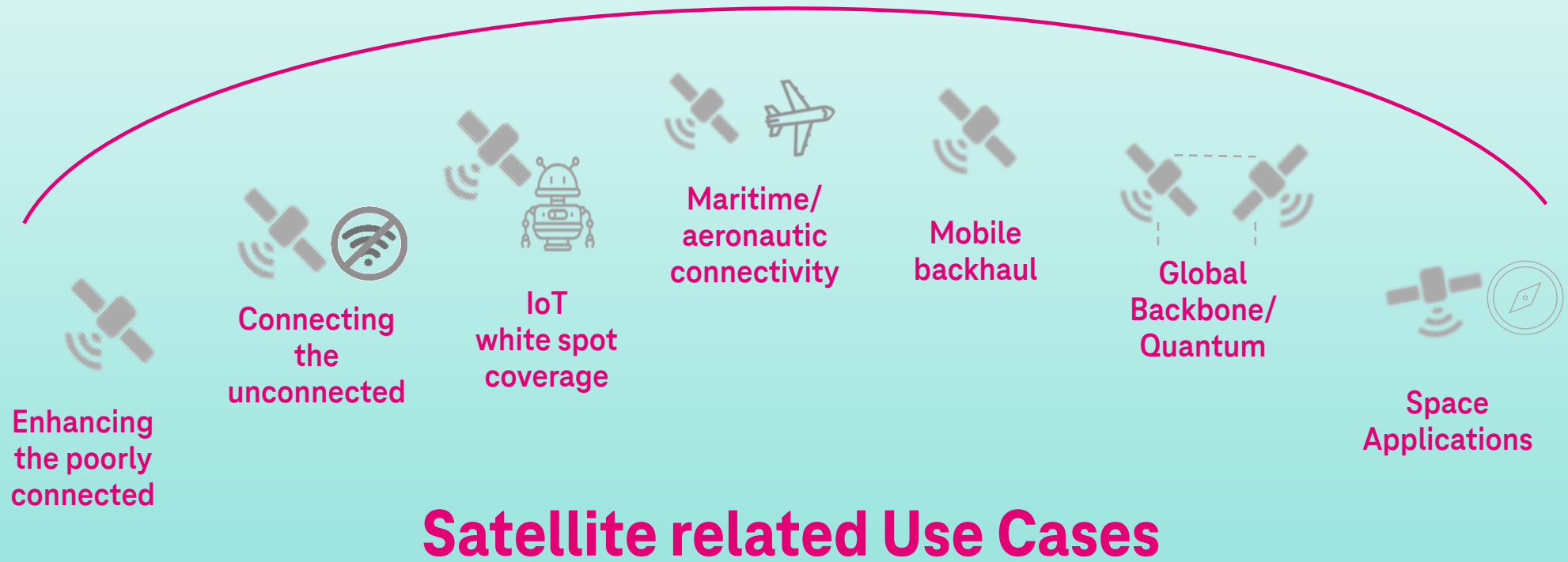
Non-Terrestrial Networks complementing TN



Areas without coverage could be served easier with low cost, yet with limited service (SOS, messages)


NTN systems could provide **complementary coverage**, but are **not able to compete with terrestrial broadband networks** in terms of capacity and services (downlink/uplink)

Mobile terrestrial business could be supplemented with NTN-solutions

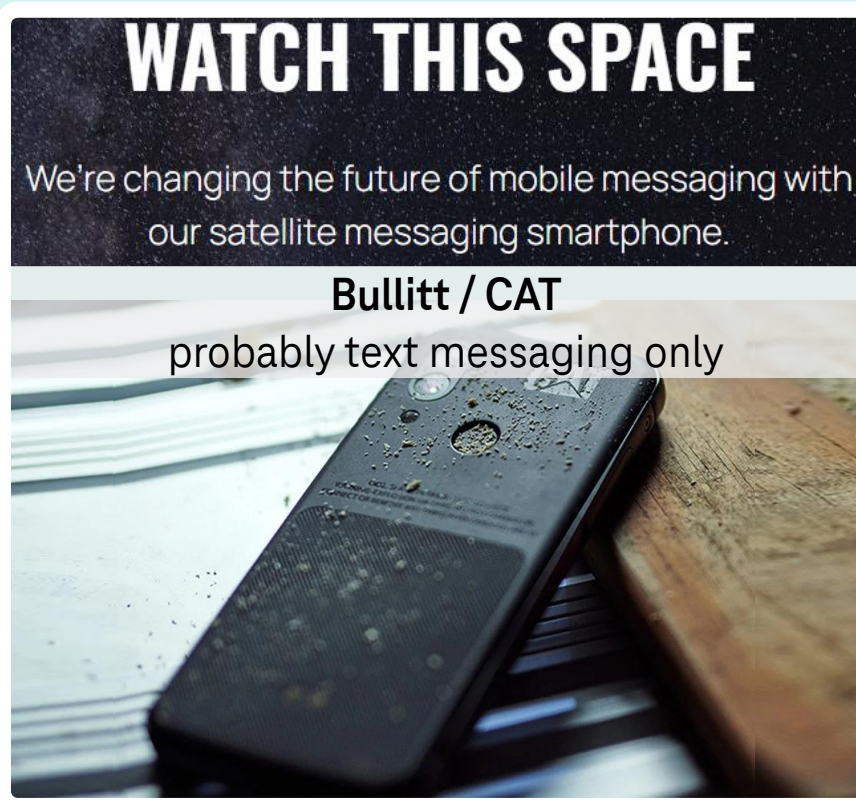


Direct to Device/Direct to Satellite – Non-Cellular

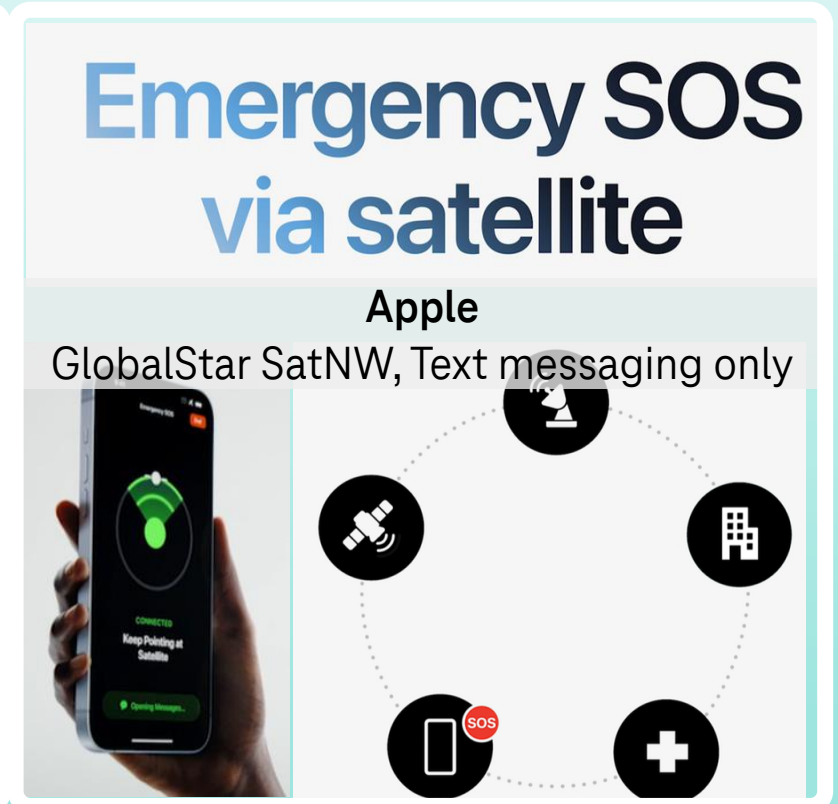
Device manufacturers include chipsets to support existing Satellite services in addition to terrestrial mobile.



The top part of the image shows a map of China with several satellite orbits (C01-C14) and ground stations (LEIP, CHEN, LAS, etc.) marked. Below the map, the text "Huawei" and "BeiDou GNSS based messaging" is displayed. The bottom part shows two smartphone screens: the left one displays a welcome message for BeiDou satellite messaging, and the right one shows a "Searching" screen with a circular progress indicator and the instruction "向右转动手机" (Turn the phone to the right).



The top part of the image has a black background with the text "WATCH THIS SPACE" in large white letters, followed by "We're changing the future of mobile messaging with our satellite messaging smartphone." Below this, the text "Bullitt / CAT" and "probably text messaging only" is shown. The bottom part is a close-up photograph of a black smartphone with water droplets on its back, resting on a wooden surface.



The top part of the image has a white background with the text "Emergency SOS via satellite" in blue. Below this, the text "Apple" and "GlobalStar SatNW, Text messaging only" is displayed. The bottom part shows a hand holding a smartphone with the "Emergency SOS" screen, which says "CONNECTED" and "Keep Pointing at Satellite". To the right is a diagram showing a satellite in orbit connected to a ground station, which is connected to a building and a smartphone with an "SOS" icon, and a plus sign icon.

<https://asia.nikkei.com/Business/Technology/Huawei-unveils-Mate-50-phone-that-links-with-China-s-own-GPS-system>

<https://www.pocket-lint.com/phones/news/162558-bullitt-teases-a-phone-with-satellite-messaging-launching-in-early-2023>

<https://support.apple.com/en-us/HT213426>

Direct to Device / Direct to Satellite - Cellular

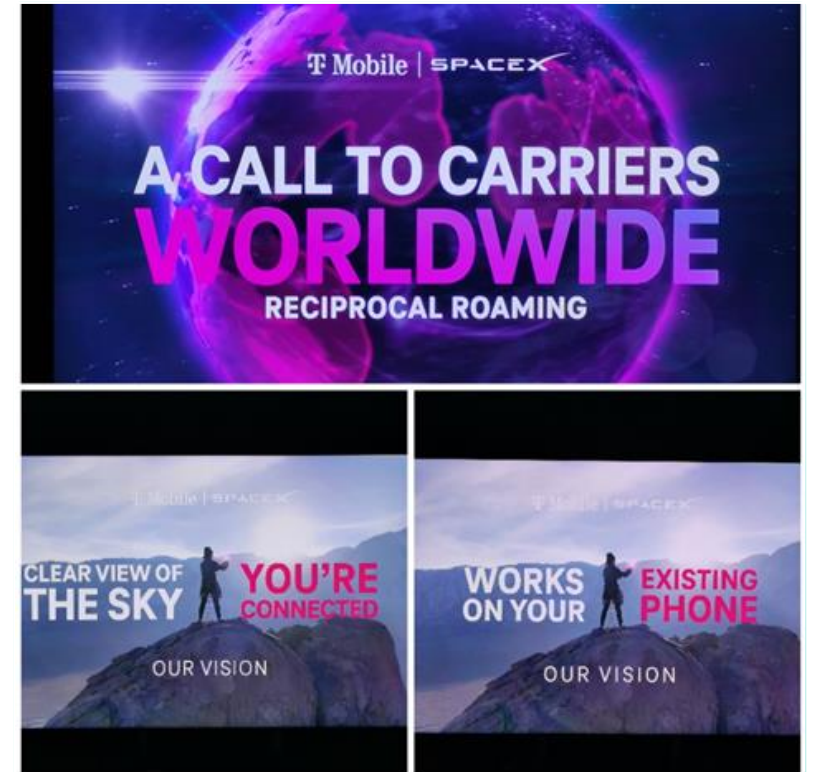
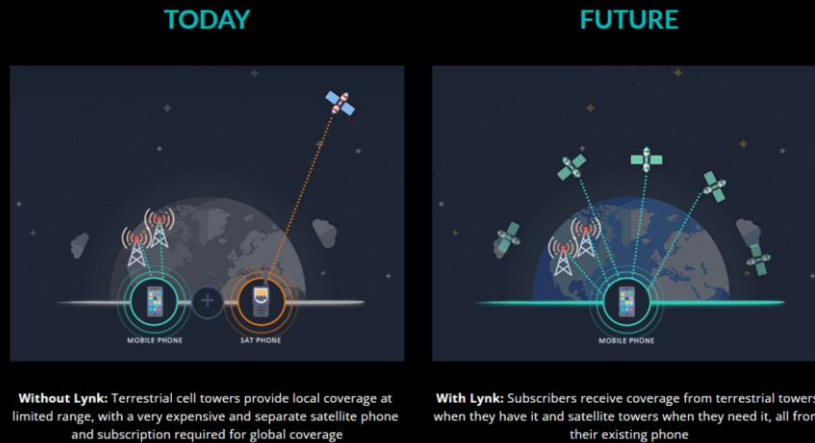
Satellite companies intend to provide connectivity direct from space to conventional unchanged cellphones.

Vodafone, AT&T sign up for 5G via SpaceMobile's satellites



FEBRUARY 23, 2022

Lynk Global Inc. Signs Contracts with MNOs to Bring Satellite-Direct-to-Phone Connectivity to Seven Pacific and Caribbean Island Nations



<https://www.lightreading.com/ossbss/vodafone-atandt-sign-up-for-5g-via-spacemobiles-satellites/d/d-id/766194>



<https://lynk.world/lynk-global-inc-signs-contracts-with-mnos-to-bring-satellite-direct-to-phone-connectivity>

<https://www.t-mobile.com/news/un-carrier/t-mobile-takes-coverage-above-and-beyond-with-spacex>

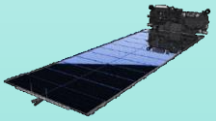
What does it mean for spectrum (regulation)?



- **Broadband by Satellite:** Systems providing broadband or other connectivity services on frequencies already identified for satellite service are governed by already established regulatory framework and assignment procedures.



- **Service combination by UE:** The combination of terrestrial mobile service with satellite services operating in satellite bands is covered by the regulatory provisions developed for terrestrial mobile networks and regulatory provisions for those satellite service. Both services are combined in the UE.



- **Direct-to-cellphone:** New LEO systems using 3GPP technology and operating in mobile bands complement terrestrial network coverage and needs in any case agreement from the terrestrial operator. Approval from regulators can be obtained via Article 4.4 of the Radio Regulations assuming coexistence with incumbents operating in-band but also in adjacent bands.

Established regulatory provisions are suitable for satellite services complementary to terrestrial mobile service.

Thank you