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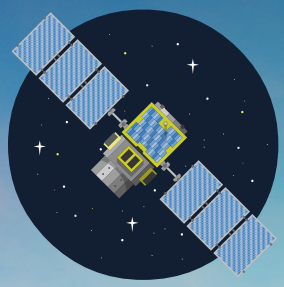
THE ASCENDING SATELLITE NTN MARKET

How the IoT and NTN Mobile Technologies are Propelling the $124.6 Billion Satellite Services Market—and What That Means for SatCom Providers, Mobile Operators, and Technology Vendors



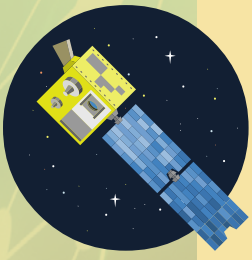
New Opportunities. New Players

In June 2022, the Third Generation Partnership Project (3GPP) published a set of communication standards for satellite networks. These Non-Terrestrial Networks (NTNs) standards were designed to enable the integration of satellite networks and terrestrial networks, ushering in a new era for the Internet of Things (IoT) and mobile connectivity.

It appears that the initiative is having a profound impact on the Satellite Communications (SatCom) industry, with a wave of notable satellite operators—SpaceX, Viasat, Globalstar, Sateliot, OQ Technology, OneWeb, Intelsat, and others—looking to take advantage of the market opportunity being created by the convergence of satellite communications and terrestrial cellular networks. For example, SatCom operators are increasingly collaborating with IoT solution providers like eSAT Global, hiSky, Skylo Technologies, and Wyld Networks, to offer IoT services with ubiquitous connectivity.

On the other side of the coin, smartphone manufacturers and chipset makers like Apple, Qualcomm, Motorola, MediaTek, Huawei, and ZTE are making moves that highlight excitement for consumer-grade devices supporting satellite communications via Narrowband (NB)-NTN, NTN unmodified, and eventually, 5G New Radio (NR)-NTN. Much of this growth is thanks to the smaller form factor of satellites, as well as reduced launch costs by 98%, thanks to reusable rockets by SpaceX, and better economies of scale thanks to standardized satellite bus and payload design. All of these developments make it more affordable to launch satellites into orbit and offer SatCom services to a wider audience, driving further market developments.

Highlighting this trend, the deployment of satellite constellations in Low Earth Orbit (LEO) for low-latency, high throughput network applications, and extending terrestrial network (TN) coverage continues to drive the adoption of satellite services in the global telecommunications sector. This will help translate to US$124.6 billion in annual satellite services revenue by the end of the decade.



"Satellite communications services have seen a new wave of enthusiasm and convergence with terrestrial networks looking to extend past their coverage zones and bridge the digital divide … We are witnessing a growing trend of operators leveraging software-defined satellites and multi-orbit solutions to meet the connectivity demands of the future."

– Andrew Cavalier, ABI Research Industry Analyst

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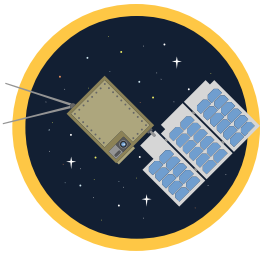
TRENDS TO WATCH: SATELLITE IOT MARKET PLAYERS

For satellite IoT players, ABI Research suggests factoring in the following to formulate an optimal business model:

- **Satellite IoT Solutions Should Improve Upon Existing Monitoring Applications:** While satellite IoT is not a new concept, the idea of leveraging satellite connectivity for IoT applications is gaining traction across industries. Enterprises expect satellite IoT solutions to augment traditional monitoring applications (Condition-Based Monitoring (CBM), fleet management) that use terrestrial infrastructure. This added value will come in the form of more accurate and granular operational data, especially for job sites in remote areas lacking proper TN support.
- **Most Satellite IoT Connections Will Support Fleet Management and CBM Applications:** Fleet management and CBM account for the lion's share of the satellite IoT revenue opportunity. Maritime vessels, airplanes, and heavy equipment vehicles in remote areas are often in cellular dead zones, which satellite services could remedy. In turn, enterprises can track their fleets (location, equipment failure, etc.) in real-time without any interruptions. For CBM applications, satellites are essential in providing connectivity to IoT sensors located outside the range of TNs. Agriculture, mining, drone, and video surveillance applications are significant beneficiaries, given they are often in remote and rural settings.
- **Collaboration Is Commonplace in the Satellite IoT Market:** Product uniqueness is the name of the game in the satellite IoT market. As various players race to the top of the market, partnerships have become a common strategy to fill the voids that exist in their solutions. Industry collaboration enables companies to leverage the differentiated capabilities of their partners, which helps improve the end product.
- **Constellation Type Affects Satellite IoT Capabilities:** Geostationary Earth Orbit (GEO) and Low Earth Orbit (LEO) constellations are the most common deployments for satellite IoT. Regarding satellite IoT use cases, GEO constellations are best matched for high IoT device density use cases where near real-time data updates are a priority. LEO constellations, on the other hand, are better apt for use cases where IoT devices are widely dispersed, and real-time data updates are not essential. Another key difference between GEO and LEO constellations is that the latter typically does not require an additional gateway to aggregate sensor data; instead, the data can be sent straight to the LEO satellite.



TRENDS TO WATCH: NTN MOBILE MARKET PLAYERS

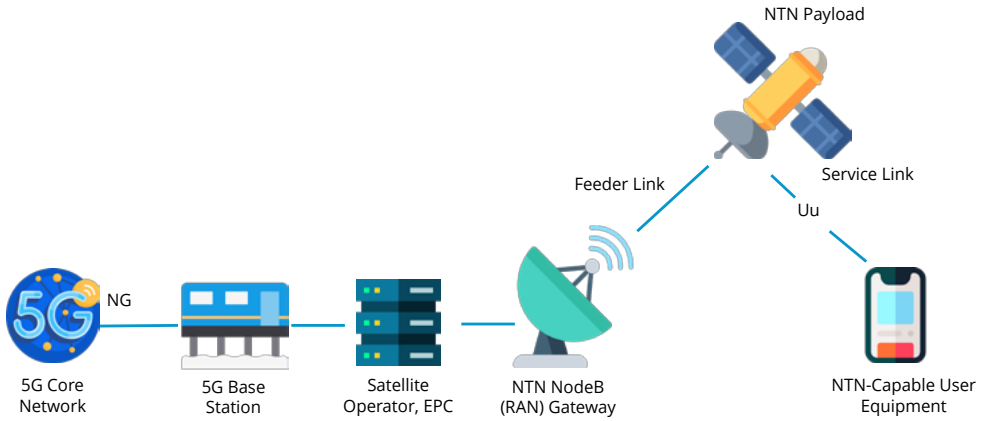
The emerging trends defining the NTN mobile market include:

- **NTN Mobile Is Seen As a Mitigator of Cellular Network Disconnectivity:** According to an analysis conducted by Lynk, roughly 3 billion mobile users worldwide experience extended periods of cellular connectivity every year. NTN mobile satellite is seen as a prime technological candidate for filling in the gaps as it provides ubiquitous coverage despite environmental and topographic conditions.
- **Emergency Services Dominate the Early Market Opportunity for Satellite-to-Mobile:** NTN mobile use cases will primarily be tied to emergency services communications (emergency SOS, Short-Message Service (SMS), and PPT) for the near future using NB-IoT and NTN unmodified devices. Whereas TNs are susceptible to physical damage and dysconnectivity during natural disasters, NTN satellite keeps cellular coverage viable so that users can contact first responders. Critical government-issued alerts, such as Wireless Emergency Alerts (WEAs) and personal device communications enabled via satcom, play a critical role in assisting the estimated 218 million people affected by natural disasters annually.
- **The Enterprise Opportunity Lies with Business-Critical Applications in Tough-to-Reach Areas:** On the enterprise side of things, NTN mobile is best suited for remote operations connectivity in business-critical settings. Examples of these enterprise settings include rural workers, transportation, utilities, oil & gas, mining, and logistics.
- **New Radio (NR)-NTN Will Introduce Higher-Bandwidth Mobile Use Cases and More Revenue:** New Radio (NR)-NTN is set to expand the satellite-to-mobile market opportunity beyond business and mission-critical applications with low data needs. As satellite networks embrace NR-NTN technology in the coming years, satcom use cases will extend to more sophisticated applications such as video conferencing, voice calls, social media, etc. This will result in higher Average Revenue Per User (ARPU) for satellite-to-mobile services, particularly in the North American, European, and Asia-Pacific markets.
- **Asia-Pacific and North America Are the Biggest Regional Segments for NTN Mobile:** Asia-Pacific will be the largest NTN mobile segment, given the significant amount of citizens affected by natural disasters. Moreover, the island and mountainous topography of various countries in the region make TNs unreliable. This brings satellite-to-mobile to the forefront as a supplemental or replacement technology. North America will be the second-largest segment of the NTN mobile market, due to millions of people in the region residing or working in remote areas with poor cellular coverage. Additionally, many regions of North America live in the path of tornados, hurricanes, earthquakes, and wildfires—making satellite connectivity important for emergency services communication.

Unlocking New Enterprise and Consumer Opportunities with Satellite NTN

The future of SatCom services will be heavily defined by enterprise IoT and consumer mobile applications. However, these two segments target different use cases and customer bases. Therefore, to truly understand the NTN opportunity, it's important to distinguish between the primary market opportunities presented with these segments.

Figure 1: The 5G NTN Architecture (Based on a Transparency Payload)
(Source: ABI Research)



SATELLITE IoT OPPORTUNITIES

Satellite IoT is a perfect marriage for use cases where complexity is low, data transmissions are aperiodic, and energy-saving features are desired for low data rates and superior Quality-of-Service (QoS) communications. Satellite IoT encompasses use cases like fleet management, condition-based monitoring, and asset tracking. However, ABI Research also distinguishes this category from a sub-segment called NB-NTN that targets consumer devices with low data needs and minimal complexity, which is discussed in later sections.

Market Drivers for Satellite IoT Services

The following factors are driving demand for satellite IoT services:

- **More Ubiquitous LEO Deployments:** LEO satellite constellations are growing rapidly, with many SatCom providers planning large-scale LEO deployments. These developments open up better possibilities for IoT solution providers to make their move.
- **Lower Satellite Launch Costs:** Between reusable rocket technology and a more competitive market, the cost of launching satellites into orbit is dropping rapidly, and that trend is expected to continue. A prominent example comes from China, with the Long-Range Aerospace Transportation System expected to reduce payload costs from US$3,000 per kg to roughly US$150 per kg.
- **CubeSat Technology:** LEO satellites can be deployed quicker and more economically with square-shaped miniature satellites (CubeSats) because they can be built with standard off-the-shelf components and "piggyback" off other launch missions. A lot of new entrants to the satellite IoT market, such as Lacuna Space, Myriota, Sateliot, and Astrocast, have made CubeSats their design of choice.

Enterprise Applications of Satellite IoT

Fleet management, condition-based monitoring, and asset tracking are the primary applications of satellite IoT in the enterprise domain. Satellite communication services facilitate reliable connectivity for objects in remote areas, making industry verticals where objects are in motion a big focus. In the supply chain, for example, monitored assets or goods could lose connection to a TN if the vehicle is out of range or the cell tower is experiencing a disruption. However, if those same IoT-enabled assets or goods are leveraging satellite connectivity, coverage is always seamless.

- **Fleet Management:** Maritime and air-based vehicles often lose connectivity due to the nature of their travel journeys. This makes it challenging to collect location, safety, and equipment related data, which is critical to ensure safety and prevent assets from withering. Satellite IoT is especially useful in Oil and Gas (O&G) industries and mining because operations are often located in remote regions where TNs struggle. Satellite IoT services ensure heavy equipment like cranes and excavators are transmitting telemetry information back to control centers for performance monitoring and preventative maintenance.
- **Condition-Based Monitoring:** Satellite IoT enables uninterrupted and accurate monitoring of water, gas, and electrical networks. If there's a water or gas leak, for example, utility operators will be alerted right away. Satellite IoT also enables CBM IoT sensors to complement traditional environment/weather monitoring solutions by providing a low-cost, low-power SatCom solution to gather additional data points from remote areas. Finally, satellite-based CBM IoT sensors provide farmers with data-driven insights in a low-cost manner.
- **Asset Tracking:** As assets like cargo and containers are being transported from one location to another, they will typically move out of the reach of TNs, especially when being transported by sea or air. Other assets, such as livestock and animals, are also typically located in remote areas where there is limited or unreliable terrestrial cellular service. Satellite IoT connectivity is key to ensuring continuous monitoring of key assets to prevent damage or losses.

Partnerships Fill in the Gaps

Forming strategic partnerships is a major underlying theme swirling through the satellite IoT market. These alliances come in two forms: one, satellite operators-IoT solution providers; and two, satellite operator-operator.

For the first type of partnership, satellite operators and IoT solution providers team up to deliver a full End-to-End (E2E) IoT solution for customers. For example, the partnership between Lacuna Space and Wyld Networks sees the former providing connectivity from space, while the latter is tasked with managing software applications and IoT terminals/devices on the ground.

Relationships are also being molded between different satellite operators themselves. This allows operators to expand coverage and take advantage of various orbits, technologies, and spectrums. A good example of this comes from Astrocast and Thuraya, where the former will use the latter's L-band spectrum to provide IoT services. Or another example is the conjoining of Omnispace and Ligado's L-and S-band spectrum for direct-to-device SatCom services.

All in all, there is a large number of companies looking to capitalize on the satellite IoT opportunity with ecosystem synergy being key to maximizing potential customer bases.

NTN MOBILE OPPORTUNITIES

Where terrestrial communication infrastructure is limited or non-existent, satellite-to-mobile services are a practical solution. Historically, "Satphones" have been unattainable in the consumer markets due to prohibitively high costs, but 5G NTN is changing this trend. While User Equipment (UE) won't be solely dedicated to satellite communications like Satphones are, they will support these services in addition to mainstream features. Within the NTN mobile market, three primary technology segments have materialized: NB-NTN, NTN unmodified, and 5G NR-NTN.

As a result, the popularity of satellite-enabled smartphones and services is increasing, allowing consumers to access satellite services to communicate with first responders and, eventually, for more sophisticated use cases. The first NTN satellite-connected devices will be of the NB-NTN variety, prioritizing low data rate text messaging and Push-to-Talk (PTT) for emergency coverage outside of TNs. For example, a story has recently circulated through news outlets of a family caught in the Maui wildfires that was rescued via iPhone 14's satellite-based Emergency SOS services. This allowed for contact with the local fire department and dispatchers, which tracked their location and came to the scene in half an hour.

Meanwhile, NTN unmodified devices use satellite communications without NTN System on Chips (SoCs), instead relying on 5G NTN UE software for NTN connectivity. Gradually, the market will shift to device-native NR-NTN satellite to enable higher data rates and Internet access. This will open the potential for new consumer, enterprise, and industrial use cases.

Table 1 summarizes the differences between IoT-NTN and NR-NTN, which will compete as the main satellite-to-mobile segments in the future (with unmodified devices gradually dissipating).

Table 1: 3GPP NTN Satellite Communication Standards
(Source: ABI Research)

	IoT-NTN	New Radio-NTN (NR-NTN)
Category	Narrowband	Broadband
Wireless Communication Standard	Narrowband IoT (NB-IoT) & LTE-M	New Radio (NR)
Bandwidth	200 kHz	5 MHz to 20 MHz
Frequency Band	L-Band (255)/S-Band (256) Narrow frequency bands typically in the sub-GHz range	L-Band (255) / S-Band (256) Wider frequency bands, including both sub-6 GHz and Millimeter Wave (mmWave)
Data Rate	~Kilobits per Second (Kbps)	~Megabits per Second (Mbps) (handheld)
Applications	Data	Data and voice
Communication Features	Typically optimized for low-power consumption, extended coverage, and efficient communication of small amounts of data, suitable for IoT applications, such as smart meters, asset tracking, and agricultural monitoring.	Designed to support higher data rates and lower latency for tradition broadband communications, such as video chats, voice calling, video streaming, gaming, web surfing, etc.

NB-NTN Facilitates Mobile Applications with Low Data Needs

Initial satellite-to-mobile use cases will be restricted to low-power, low-complexity use cases. This will be done via LTE NB-NTN and primarily encompass simple SMS messaging and emergency service communications for the consumer segment. This first wave will begin the process of turning traditional consumer smartphones into satellite-capable devices. NB-NTN devices include 3GPP and non-3GPP compliant technologies and provide satellite communications through L- and S-bands over adapted cellular, non-cellular, and proprietary protocols directly to NTN-native UE.

NTN Unmodified Targets the Entire Mobile Userbase

Many satellite players, such as Starlink, Lynk, and AST, are interested in providing NTN connectivity to users with mobile devices lacking native NTN capabilities. This means 5G UE software is used for connectivity instead of NTN SoCs or modems. As a result, the potential customer base is greatly expanded to essentially the entire existing mobile user base, especially those unsubscribed to mobile services or not currently covered by a Mobile Network Operator (MNO). While some satellite market players aim to unlock NR-NTN type capabilities (e.g., video streaming, voice call, social media, etc.) with NTN unmodified, there are some technical challenges making this a difficult task. Currently, these players only support low data rate IoT-NTN-type capabilities, though the NTN unmodified segment will be relatively short-lived as native satellite-to-mobile support becomes mainstream.

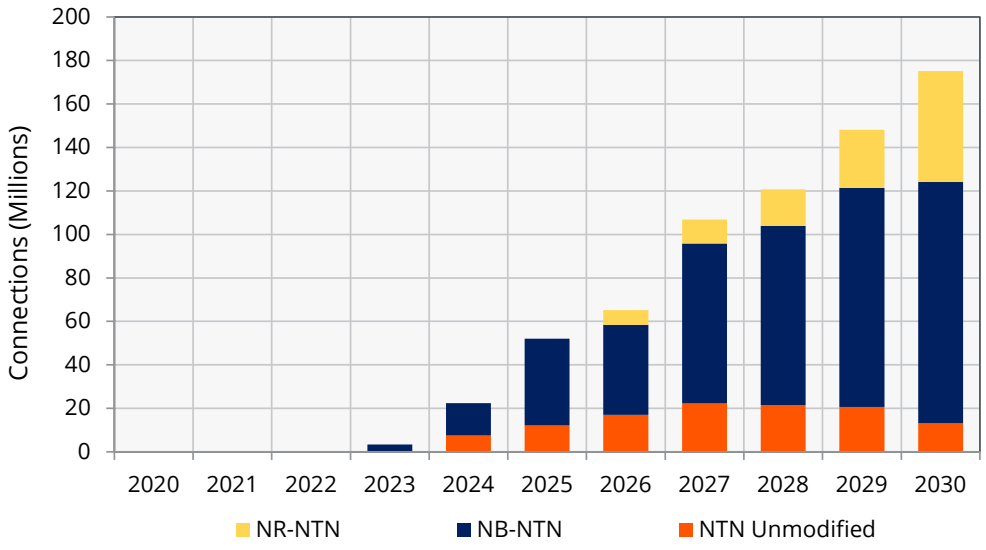
NR-NTN Introduces More Complex Mobile Applications

Eventually, smartphone-based satellite connectivity is expected to move beyond emergency services with the increasing capacity of satellite networks for NR-NTN in the coming years. NR-NTN is 3GPP-compliant and enables higher data rates supporting video calls, email, social media, and other high-bandwidth applications. NR-NTN's upgrades will bring many exciting new opportunities for consumer, enterprise, and industrial applications as reliable connectivity becomes available everywhere for smartphones, IoT devices, and vehicles.

NTN Mobile Market Forecasts

By 2030, ABI Research anticipates that there will be more than 175 million NTN mobile connections worldwide. This will translate to US$16.3 billion in revenue generated by the end of the forecast window, which is a Compound Annual Growth Rate (CAGR) of 76% between 2022 and 2030. Despite having more global connections, NB-NTN revenue will be surpassed by NR-NTN, given the latter's better performance and, thus, higher price points.

Chart 1: NTN Mobile Connections by Service Segment World Markets: 2020 to 2030
(Source: ABI Research)



NTN mobile will initially be spurred by users accessing NB-NTN SatCom services (e.g., emergency SOS, SMS, and PTT), especially in rural North America and natural disaster-prone Asia-Pacific. In the enterprise domain, NB-NTN will be used for low-powered applications in mission-critical sectors like transport and logistics, mining, energy, and defense. NB-NTN services are anticipated to become crucial and even necessary support services worldwide and are expected to reach 111 million connections by 2030.

The demand for unmodified mobile devices is expected to peak in 2027 (22 million connections) before phasing off as NTN-native devices become more ubiquitous. Finally, ABI Research predicts that NR-NTN will roll out in 2026, with early movers like Globstar capturing early value among outdoor enthusiasts and mission-critical professionals who require enhanced data rates. Consequently, the market for NR-NTN is projected to increase to more than 51 million connections by 2030.

Smartphone Ecosystem Activities

Smartphone equipment manufacturers, solutions providers, chipset vendors, and network operators are very active in the NTN mobile market. Table 2 summarizes how some of these companies are responding to the demand for NTN satellite-to-phone services.

Table 2: Companies in the NTN Mobile Market
(Source: ABI Research)

Company	Product (s)	NTN Mobile Capabilities
Apple	iPhone 14; iPhone 14 Pro (smartphones)	• Send preselected text messages to emergency services • L-band for uplink and S-band for downlink
Bullit Group	Bullit Satellite Messenger (mobile app)	• Two-way satellite-based messaging • Emergency services communication • Automatically switches to satellite when cellular or Wi-Fi is unavailable • Uses GEO constellations from Inmarsat and EchoStar
Huawei	Mate 50, P60, Mate X3, and Nova 11 Ultra models (smartphones)	• Short text messages via China's BeiDou Navigation Satellite System • One-way messaging with Mate 50 • Two-way messaging with P60, Mate X3, and Nova 11 Ultra
MediaTek	MT6825 (chipset)	• Compatible with 3GPP Rel-17 standard for NTN satellite networks • Phones with the chip can connect with any IoT-NTN-supported constellation
Motorola	Motorola Defy 2; Motorola Defy Satellite Link devices (smartphones)	• Defy 2 natively supports 5G two-way satellite connectivity • Defy Satellite Link is a Bluetooth accessory enabling two-way emergency texting for normal smartphones
Qualcomm	Snapdragon Satellite (chipset)	• Pole-to-pole emergency satellite connectivity in previously unreached regions • Two-way SMS messaging with custom messages supported • Limited to 160 characters per text • Message contacts in the address book
Samsung Electronics	Exynos (modem); Samsung Galaxy S24 series (smartphone)	• Exynos modems are 5G NTN-standardized and support two-way text messaging and High-Definition (HD) image and video sharing • Galaxy 24 series rumored to sport the Snapdragon chip, enabling two-way satellite connectivity
Skylo	Skylo Hub (terminal)	• Acts like a wireless gateway for satellite • Currently compatible with GEO MSS satellites (e.g., Inmarsat and EchoStar); plans to support LEO constellations soon • Uses NB-NTN protocol, thus only supporting SMS or text messaging with small sizes (50-byte or 10-byte packets
ZTE	Axon 50 Ultra (smartphone)	• Two-way messaging via BeiDou satellites • First 5G consumer mobile phone to support secure SatCom (in-house security chip with hardware-level encryption) • Potential for restriction to Chinese markets due to reliance on BeiDou

Satellite Industry Case Studies

Many changes have been made in the satellite market, with strategic partnerships running rampant. Several recent announcements have shaped this growing space in recent years.

SATELLITE IoT

Zamil Offshore and Inmarsat

Saudi Arabian Oil and Gas company Zamil Offshore conferred with Inmarsat in 2022 to use Inmarsat's Fleet Connect and Fleet Data IoT solution to provide video-based performance management to more than sixty vessels. Inmarsat's IoT solutions offer satellite connectivity and data analytics to Zamil operators in tough-to-reach regions, which is crucial to monitoring activities and optimizing workflows.

Terex and ORBCOMM

The partnership between manufacturer Terex and IoT solution provider ORBCOMM sees the latter utilizing an E2E telematics solution that facilitates the tracking and monitoring of the performance of crushers. When cellular connectivity is unavailable, the IoT solution utilizes satellite communications. ORCOMM's SatCom offering allows Terex's fleet managers to access dynamic dashboards, filters, and custom reports for data-driven insight, even in cellular dead zones.

Digitanimal and Astrocast

Digitanimal has partnered with Astrocast to offer a satellite IoT solution that enables farmers to track their livestock and animals remotely. With this solution, farmers are empowered with real-time location information of their herds and can also be alerted when an animal drifts into an area that it is not supposed to enter.

Semtech Corporation, IoT Ventures, and Lacuna Space

Using the LR-FHSS LoRaWAN module, semiconductor company Semtech Corporation, New Zealand's IoT Ventures, and connectivity provider Lacuna Space developed the Drought Early Warning System. This low-powered, satellite-supported network monitors and analyzes rainfall and water consumption in rural New Zealand and islands in the South Pacific via rainwater tanks and rainwater monitors. Satellites keep the CBM IoT devices connected at these remote locations, which utility providers can use for better water supply management.

NTN MOBILE

AST Mobile and MNOs

AST SpaceMobile bases its business model around leveraging the terrestrial spectrum of MNOs. The company has aligned itself with over twenty-five MNOs, with Vodaphone, Rakuten Mobile, AT&T, and Orange being prime allies.

Qualcomm and Iridium

Qualcomm has chosen Iridium Communications as its preferred satellite partner for its Snapdragon Satellite solution. With this alliance, Qualcomm has access to sixty-six operational LEO satellites positioned in six polar planes intersecting over the North and South Poles.

BeiDou and Chinese Smartphone Manufacturers

BeiDou has partnered with leading Chinese smartphone manufacturers Huawei and ZTE to deliver SatCom capabilities. As a result, these companies provide consumers with mobile devices that can send text messages in areas without cellular connectivity, which is crucial in emergencies.

Apple and Globalstar

Apple reportedly loaned US$252 million to Globalstar to help finance a new fleet of LEO satellites. This move unlocks satellite-based emergency services with Apple products. Moreover, Apple will be allocated up to 85% of the new satellites' capacity.

Next Steps

Do you want a clearer assessment of emerging NTN mobile sectors? Are you in the satellite IoT market?

Then explore our Satellite Communications Research Service

The Satellite Communications research service provides deep technical and quantitative analysis of the SatCom market, leveraging decades of SatCom research and industry relationships for insider insight and expertise.

Along with exclusive research and extensive market data, we also provide expert guidance to our clients, helping them identify their challenges, understand their markets, and optimize technology investments and strategies.

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