APEX STANDARDS

Satellite to Device Market Dynamics and 3GPP NTN Developments

Tech Report C20003157
Unclassified

10 Dec 2023

The satellite communications industry is undergoing a transformative phase, characterized by strategic consolidations and technological advancements. A notable event in this transformation is the merger between Dish Network and EchoStar, which marks a significant integration of Terrestrial Network (TN) and Non-Terrestrial Network (NTN) operators. This strategic merger was greenlit by the Federal Communications Commission (FCC) on December 6, 2023, underlining its importance in the evolving telecommunications landscape. The FCC's approval was crucial for the transfer of all Dish Network's licenses and authorizations to EchoStar. The approval indicated that EchoStar would emerge as the surviving entity in this merger, reflecting a shift in the industry dynamics.

The FCC's approval of the Dish Network and EchoStar merger took into account factors of market competition and ownership. After its separation from EchoStar in 2008, Dish Network shifted focus towards terrestrial mobile and online streaming, diverging from its satellite TV roots to stay competitive against cable providers and diversify its revenue streams. Meanwhile, EchoStar maintained its focus on space-based broadband services, anticipating growth following the launch of Jupiter-3. With the merger, Charlie Ergen regains control over the combined Dish-EchoStar entity, owning more than 90% of the voting stock and 54% of the equity. The FCC's assurance that the merger would not lead to substantial changes in the ownership or control of Dish Network's licenses was a key step in completing the merger, setting the stage for the unified company to become the first player in both satellite and terrestrial networks.

Historically, the satellite communications market has navigated through various phases. In December 2001, the FCC received applications for the transfer of control of licenses from Hughes to EchoStar, indicating the sector's evolving nature. This period saw the early stages of integrating satellite communications with broader telecom networks, setting the stage for future advancements.

The industry's progression is further exemplified by the advent of Low Earth Orbit (LEO) satellite technology. This technology marks a shift toward a market primed for high-capacity, global broadband services, reflecting a transition towards more extensive satellite-based internet coverage. The shift to LEOs, known for their lower latency and higher bandwidth, is crucial for services like high-speed internet and IoT applications. Simultaneously, advancements in ground-based satellite communication equipment have enhanced the feasibility and accessibility of these services.

Regulatory developments have been pivotal in shaping the industry. The FCC's role in approving mergers and licensing new satellite constellations indicates a regulatory environment adapting to these advancements. Concurrently, the market has been responsive to evolving consumer demands, particularly for reliable, high-speed internet access in remote and underserved areas. Companies like Starlink target these segments, driven by the globalization of businesses and the need for robust communication networks.

The rapid development of LEO satellites, especially by companies like Starlink, marks a shift toward a readiness for high-capacity, global broadband services. This move heralds significant potential for disruption in traditional broadband markets. However, challenges persist, including high satellite launch costs, space debris management, and the need for technological innovation. These challenges pose financial risks, as evidenced by the historical struggles of Iridium.

Iridium's failure serves as a poignant lesson in the necessity of adapting to evolving market conditions. Initially, Iridium planned for a network of up to 77 satellites, a number derived from the atomic number of the element iridium (77), which was thought sufficient for global coverage. However, in stark contrast, Starlink intends to deploy thousands of satellites, operating primarily in the higher frequency Ka and Ku bands. This marks a departure from Iridium's strategy.

A key difference between the two systems lies in the infrastructure required for operation. Iridium's satellites are designed to offer lower data rates for handset users and, utilizing the Ka-band, provide data speeds of up to 8 Mbps for fixed or transportable terminals. On the other hand, Starlink satellites necessitate a dedicated terrestrial receiver to function effectively, primarily serving as hotspots.

Starlink's approach, characterized by a larger constellation and the use of varied frequency bands, demonstrates a strategic adaptation to the current technological environment and evolving user needs. These factors were not mature during the initial phase of Iridium. At its launch, Iridium was ahead of its time, but the then-nascent state of technology and the limited prevalence of cellular phones led to its Chapter 11 bankruptcy in 1999. More recently, however, companies like Starlink are positioned more favorably, owing to technological advancements and a shift in user behavior, factors that were not as conducive to Iridium's success in the 1990s.

To finance this ambitious endeavor, SpaceX aims to generate significant annual revenues, leveraging their technological expertise and market strategy. However, the profitability of ventures like Starlink over the next decade remains uncertain among industry experts. The advancements in 5G NTN technology are pivotal, with a focus on high-speed connectivity in geographically challenging areas through satellite integration into mobile networks. Current broadband offerings primarily use Very Small Aperture Terminals VSAT/Dish antennas operating on Ka or Ku bands. A distinction is made between GEO satellites, preferred for fixed broadband, and LEO satellites, favored for lower latency and proximity to Earth.

The implementation of 3GPP standards in NTN deployment is critical. Release-17 facilitates high-speed downlink and low latency, using the sub-2Ghz band spectrum. Release-18 is expected to extend capabilities with additional Ka band spectrum. The satellite system operators' landscape is diverse, with some employing proprietary technology and others transitioning towards 3GPP standards for interoperability. Operators like SpaceX and Amazon's Project Kuiper emphasize massive LEO constellations for broadband services, while partnerships like T-Mobile/SpaceX and AT&T/AST SpaceMobile focus on integrating satellite capabilities with mobile networks.

The evolution of the 5G NTN ecosystem is being propelled by decreasing launch costs and satellite technology advancements. This progression is fostering direct-to-consumer services and improving broadband performance, especially in underserved areas. Contributions to the 3GPP by companies highlight their strategic goals, technological capabilities, and market focus. These inputs, covering use cases, device compatibility, specifications, and network improvements, are key to understanding each company's approach to NTN integration and adoption.

5G NTNs are revolutionizing connectivity by extending coverage to remote, rural, and underserved areas. Essential in emergencies, they ensure reliable communication when terrestrial networks are unavailable. They are key to IoT integration in diverse sectors like agriculture, environmental monitoring, and smart cities, enhancing operations in maritime and aeronautical navigation, and remote healthcare through telemedicine. They support industrial activities in isolated locations, provide critical links in defense and space research, and facilitate educational and financial services in remote regions. As product-market fits evolve, this technology is reshaping global connectivity, paving the way for a more interconnected world. ∎

Organization	Focus Area	Position on NTN	Key Proposals	TDoc
Qualcomm	Semiconductor	Enhancing RedCap UE with NTN	Supports NR NTN to RedCap UEs, enhancing device diversity	RP-233774
Xiaomi	Consumer Electronics	Integration and inter-working	Enhances the integrated NTN/5G network and proposes requirements for network device interaction	RP-233671
CATT	Telecommunication Infrastructure	Power enhancements, RF requirements, high-power UE integration	Advocates for RedCap UE, high-power UE integration in NTN and RF requirements	RP-233009
MediaTek	Semiconductor	Innovation in IoT and high-power UE for NTN	Proposes high-power UE for IoT NTN and enhanced IoT applications	RP-233281
Ericsson	Telecommunication Infrastructure	Defining the scope and clarity of NTN proposals	Calls for focused discussions on clarity and scope for NTN proposals	RP-232782
vivo	Smartphones	Enhancing mobile device capabilities and connectivity in NTN	Supports MUSIM and NTN, and anticipates enhanced mobile capabilities	RP-233065
Thales	Defense and Aerospace	Advocates for IoT-NTN evolution, emphasizing S&F, capacity, and mobility enhancement	Proposes S&F operation improvements, enhanced mobility, robust synchronization and efficiency	RP-232860 RP-233230
ZTE, Sanechips	Multiple	Network congestion, capacity, and store-and-forward operations	Focuses on congestion solutions and proposes enhancements in NTN and S&F operations	RP-233616
SES	Satellite	Broadcast integration and enhanced coverage	Aims for integrated broadcast services and expanded coverage in NTN	RP-233037
National Spectrum Consortium (NSC)	Spectrum	Flexible and relaxed QoS standards in NTN	Proposes for more flexible QoS standards and highlights the importance of having flexible and relaxed QoS in NTN	RP-233078
InterDigital	Wireless R&D	QoS implications and architectural enhancements in NTN	Proposes focused scope for NTN enhancements, including coverage, mobility, and regenerative payloads	RP-233405
Eutelsat	Satellite	Deployment scenarios and satellite networking integration	Provides motivation to support band deployment and studies related to band support	RP-233779
Apple	Consumer Electronics	Multi-access, traffic steering, and network combinations	Involved in multi-access scenarios including network combinations	R4-2318612
GSOA	Satellite	Advocating 3GPP NTN and interoperability	Emphasizes the need for seamless connectivity and integration across mobile networks and NTN	SP-231447
Inmarsat	Satellite	Introducing new bands and improving IoT applications	Contributes to Release 18 description, focusing on L-band (UL 1668-1675MHz, DL 1518-1525MHz) for IoT NTN	CP-233299
NTT DOCOMO	Mobile Operator	Emphasis on 'implicit compatibility' to support HAPS scenario and future NTN development	Views on NR NTN and R19, including support for HAPS scenario and regenerative payload	RP-233542
Intelsat	Satellite	Leveraging existing standards for satellite communications and expanding capabilities	Focuses on new carriers for NTN above 10 GHz, indirectly referencing higher power UE applications	RP-233408

In the context of 3GPP's TSG#102 forthcoming discussions in Edinburgh (Dec 11-15, 2023), companies present nuanced technical contributions shaped by their operational domains and market interests. Qualcomm's advocacy for RedCap UEs' integration with NR NTN is indicative of its continuous push for chipset innovation, striving for diversity in device capabilities that support their extensive semiconductor business. Ericsson's focus on scoping NTN proposals aligns with its infrastructure expertise, aiming for clear standards that underpin scalable network services. MediaTek's emphasis on IoT and high-power UEs for NTN demonstrates its focus on more powerful chipsets for UEs, targeting enhanced performance for a broad spectrum of IoT applications. NTT DOCOMO contributes with a focus on interoperability, reflecting its mobile communication leadership and commitment to service continuity. SES, Intelsat, Inmarsat, and Eutelsat, as satellite operators, share a collective vision for expanded network coverage and capacity, crucial for their global communication services. Xiaomi's input on network integration shows its strategic imperative to ensure its consumer electronics benefit from robust connectivity. These contributions are tethered to each organization's foresight into evolving market demands, ensuring their technological advancements are in lockstep with customer needs and industry progression.