FROST & SULLIVAN

2024 ENABLING TECHNOLOGY LEADER

IN THE EUROPEAN INTERNET OF THINGS NON-TERRESTRIAL-NETWORK INDUSTRY

ECHOSTAR®

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2024 BEST PRACTICES AWARD

Best Practices Criteria for World-Class Performance

Frost & Sullivan applies a rigorous analytical process to evaluate multiple nominees for each award category before determining the final award recipient. The process involves a detailed evaluation of best practices criteria across two dimensions for each nominated company. EchoStar excels in many of the criteria in the Internet of Things Non-Terrestrial-Network space.

EchoStar Mobile, a Pioneer of the Satellite and Pan-European LoRa®-enabled IoT Network

Founded in 2008, EchoStar Mobile Limited (EchoStar Mobile) is a mobile satellite service provider and subsidiary of EchoStar Corporation, a leading global provider of satellite communication solutions.

> *"EchoStar Mobile is revolutionizing the IoT NTN market with its pioneering pan-European LoRa®-enabled IoT network for direct sensor-to-satellite connectivity. The state-of-the-art solution empowers clients to innovate and scale their business via bidirectional transmission and secure and affordable real-time communication for massive IoT deployments."*
>
> ***- Cecilia Pérez***
> ***Senior Research Analyst***

EchoStar Mobile is revolutionizing the IoT NTN market with its pioneering pan-European LoRa®-enabled IoT network for direct sensor-to-satellite connectivity. The state-of-the-art solution empowers clients to innovate and scale their business via bidirectional transmission and secure and affordable real-time communication for massive IoT deployments.

The connectivity service—currently available in countries across the European continent—uses a satellite network that operates in the licensed S-band spectrum from the company's geostationary (GEO) satellite EchoStar XXI and multi-transport satellite-terrestrial module within IoT devices.

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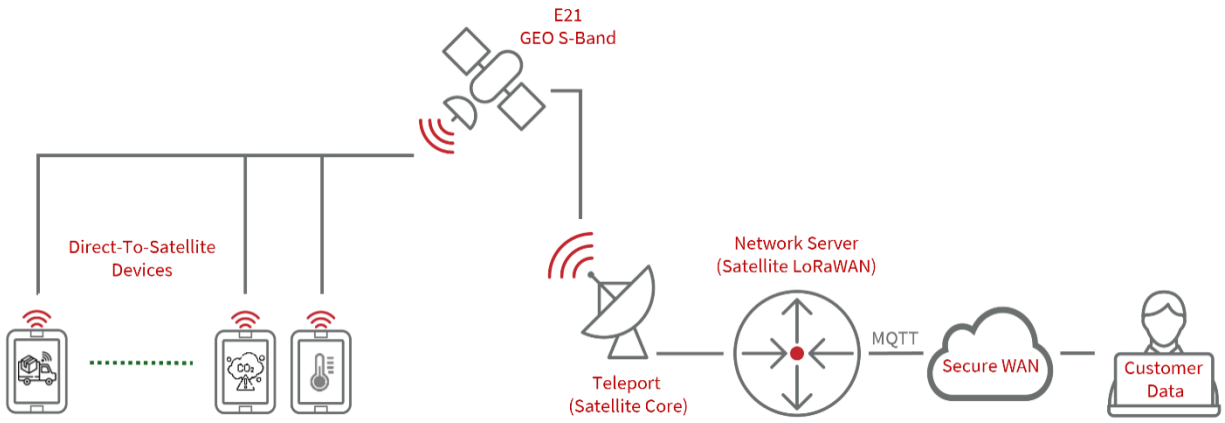
EchoStar Mobile's pan-European LoRa-enabled IoT network allows clients to connect ubiquitous IoT devices in hard-to-reach locations, fulfilling the most pressing technology requirements of low power consumption capabilities, security, and extended coverage. The satellite LoRaWAN®-enabled IoT network efficiently supports massive IoT deployments across verticals by leveraging LoRaWAN, a leading wireless technology (standardized by the LoRa® Alliance) capable of transmitting small amounts of data over long distances with minimal and low energy use. This enables lower operational costs, enhanced scalability, improved operational efficiency, and data monetization.



Unlike competitive technologies like wired and cellular connectivity, LoRaWAN S-band connectivity over GEO enables widespread and constant coverage, high availability, and low data rate. These features are crucial for low-power-wide-area network (LPWAN) use cases like real-time earth monitoring, critical infrastructure monitoring, asset tracking, search and rescue, and livestock farming. Furthermore, LoRaWAN allows public and private networks as it is an open standard that can set up a private network autonomously—thus without third-party infrastructure—while other comparable technologies only allow public network deployments.

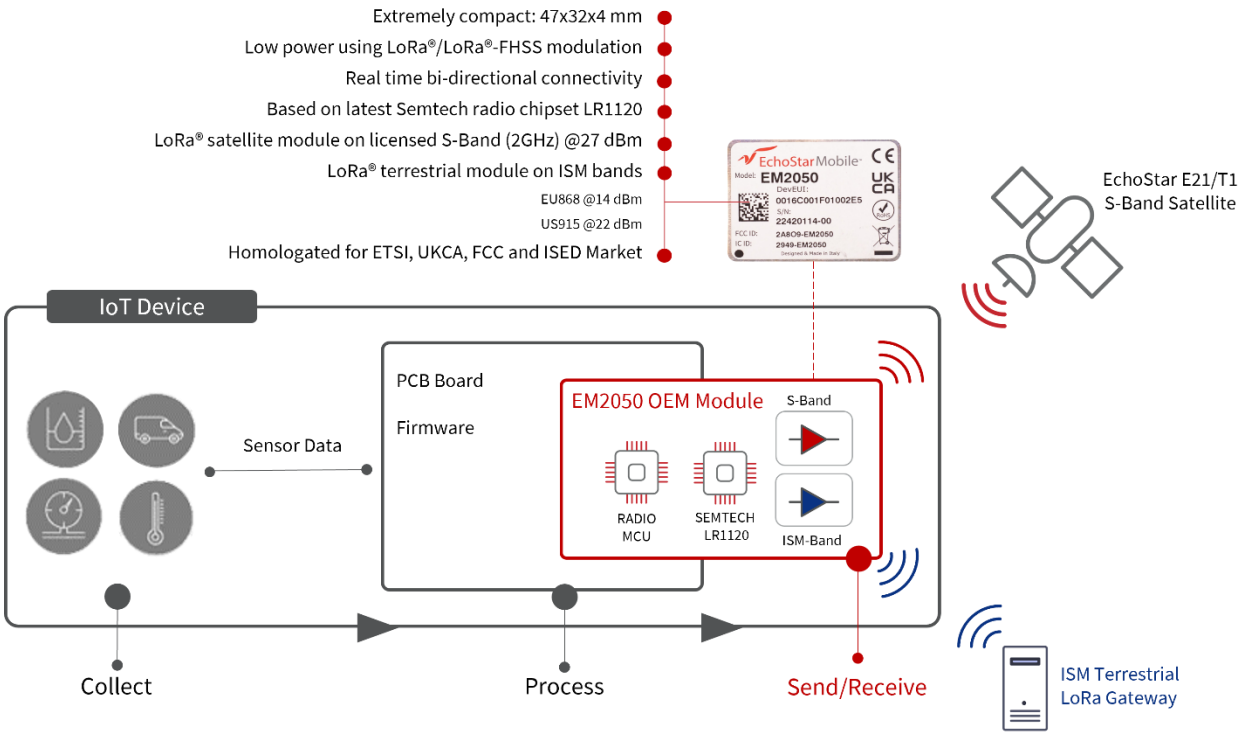
In addition, the company has collaborated with members of the 3rd Generation Partnership Project (3GPP) organization and the LoRa Alliance to create satellite connectivity solutions based on standards.

Offers Performance Value with Satellite LoRaWAN®-enabled IoT Network and Dual-mode Module

Frost & Sullivan considers EchoStar Mobile's pan-European LoRaWAN-enabled-IoT network impressive because it ensures the best performance value and cost efficiency for massive IoT connectivity deployments. The main features of the IoT solution include:

Dual-mode connectivity: The service uses EM2050, the dual-mode satellite IoT module that transmits and receives LoRa® signals on both licensed 2 GHz satellite spectrum (S-band) and sub-GHz E/US Industrial, Scientific, and Medical (ISM) bands. The system allows bidirectional connectivity to assets as well as access to satellite and terrestrial coverage.

The module can easily integrate into the customer's devices. Furthermore, it is based on Semtech's LR1120 radio chipset, which has radio frequency components for operation on satellite. The technology is suitable for applications with moving assets or distributed across wide areas like asset tracking; transportation; fleet management; agriculture; and infrastructure monitoring, including road, rail, and pipelines.



Continent-wide coverage: Using the EchoStar XXI GEO satellite, the IoT network enables coverage across national borders, allowing the simple and efficient connection of numerous devices. The system removes the requirement for multiple network subscriptions.

Low power consumption: As the solution leverages the state-of-the-art LoRaWAN protocol, customers can optimize energy consumption, which reduces maintenance and operational costs. LoRaWAN protocol is designed for low-power use, enabling the connection of battery-operated devices over long periods. This feature is fundamental to connecting massive IoT deployments or in remote and rural areas.

Easy deployment: The company's satellite LoRaWAN-enabled IoT network does not require additional infrastructure, supporting easy deployment and affordable set-up.

Robust security: The network uses data encryption, namely Advanced Encryption Standard 128 bits, which maintains data confidentiality and integrity and leverages the secure element integrated in the Semtech LR1120 chipset for key derivation and key management.

Cost-efficiency: Most satellite network providers use proprietary technology developed by a specific company. However, higher initial investments and additional costs associated with integrating satellite units into the IoT solution result from this deployment type. Implementing LoRaWAN, an open standard, is more affordable because vendors compete through lower equipment, software, and service costs. In addition, modules and connectivity fees are lower than those of other technologies.

Succeeds in Technology Innovation and Creativity Since the Launch of the IoT Network

Frost & Sullivan finds that EchoStar Mobile's growth as a leading company stems from its commitment to pushing the limits of innovation, which results in high-quality solutions, and remaining a reliable and preferred partner in the IoT NTN industry.

In 2023, the company launched an updated version of their satellite IoT network with innovative functionalities. The Adaptive Data Rate (ADR) is a mechanism designed to optimize data rate, airtime, and energy consumption. The ADR controls the transmission parameters of an end device, including the spreading factor, a system that ensures successful transmissions over time, bandwidth, and transmission power. The ADR allows the network server to indicate to the device that it should reduce transmission power or increase data rate. Using ADR with LoRaWAN prolongs battery life by several years. In contrast, customers implementing other IoT connectivity technologies report shorter battery lifetime.

In addition to over-the-air (OTA) activation the system supports activation by personalization (ABP). ABP allows the activation of IoT devices on the network by preconfiguring them with security keys and network parameters.

EchoStar Mobile also introduced the Uplink LoRa-Frequency Hopping Spread Spectrum (FHSS) modulation in their updated network, enabling the spread of data transmissions over multiple frequencies, which minimizes interference and enhances data integrity. This capability is key for high-traffic scenarios like large-scale projects with numerous IoT deployments across vast areas.

The updated network also includes the connection of LoRaWAN Class C devices. Previously, it was only available for Class A devices, which can send uplink messages anytime. In Class A, once the uplink transmission is complete, the device opens two short receive windows for receiving downlink messages from the network. However, Class C extends Class A capabilities by keeping the receive windows open, which allows devices to receive downlink messages at any time. This reduces the latency for downlinks. This device type has the lowest latency compared to Class A and encompasses utility meters, streetlights, beacon lights, and alarms.

Firmware Update Over the Air (FUOTA) is another capability recently introduced that improves network efficiency by allowing IoT devices to receive firmware updates remotely via the network. This feature removes the device's need for physical access to upgrade the software, which is costly and time-consuming. In this sense, FUOTA will deliver one or more compact files over the network to the devices to install the firmware update.

Partnering with Major Industry Players Drives Commercialization Success

EchoStar Mobile has a legacy of technology innovation and competitive differentiation based on signing strategic deals with key partners. Continuous participation in ecosystem collaboration over the years drove the company to achieve commercial success with its IoT network.

In 2021, EchoStar Mobile started a collaboration with Semtech Corporation, a leading semiconductor in the IoT industry, to test satellite IoT connectivity services enabled by the LoRaWAN standard. LoRaWAN is a protocol for LPWANs that can use LoRa and Long Range-Frequency Hopping Spread Spectrum (LR-FHSS) modulations. EchoStar Mobile satellite IoT network supports both LoRa and LR-FHSS modulations. The latter allows for reduction of Packet Error Rate over the satellite link.

In September 2023, EchoStar Mobile and The Things Industries, a LoRaWAN connectivity service provider, have cooperated in a proof of concept to incorporate EchoStar's satellite IoT features into a cloud-based LoRaWAN network server, The Things Stack. The solution allows customers to connect IoT devices over satellite or LoRaWAN terrestrial networks leveraging a dual-transport generic node, a hardware platform for developing use cases. The collaboration was vital in enabling customers to deploy IoT use cases in a simple, affordable, and convenient way, as the technology integration facilitates seamless reach to both networks and ensures their devices remain remotely connected in remote areas.

Since the commercial availability of the satellite IoT network, EchoStar Mobile has signed distributor partnership with 15 Value Added Resellers to develop and sell solutions harnessing the EchoStar Mobile IoT network. Among the VARs that chose EchoStar Mobile satellite and LoRa-enabled solutions for a wide range of vertical sectors are API-K, Cyric IoT, Dales Land Net, Dryad Networks, ProEsys, Media Broadcast Satellite, RBC Signals, and Symes.

Another significant partnership signed in 2024 was between EchoStar Mobile, Actility, and Swisscom to expand IoT connectivity in Europe. While EchoStar Mobile provides capacity for sensor-to-satellite operations, Actility oversees interworking between Swisscom's terrestrial LoRaWAN network and EchoStar Mobile's satellite network through the ThingPark Exchange roaming hub.

The powerful combination of Swisscom's LoRa® network, Actility's IoT platform, and EchoStar Mobile's satellite IoT network opens unparalleled opportunities for business growth across industries in multiple environments, such as precision agriculture, smart metering, and environmental monitoring.

An Innovative Wholesale Business Model

EchoStar Mobile offers a wholesale commercial model that allows partners and value-added resellers—including distribution partners, service providers (telecom or satellite), and system integrators—to integrate EchoStar Mobile core radio modules and connectivity service into an IoT product or solution and then sell an end-to-end solution to end-user customers. Companies can buy EchoStar Mobile's offering in various ways, such as developing direct sensor-to-satellite solutions harnessing the pan-European LoRaWAN-enabled network or using mobile satellite data services.

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> ***Senior Research Analyst***

On the one hand, with the adaptation of the standardized LoRaWAN protocol, integrating satellite into existing terrestrial IoT solutions is beneficial for customers as it is straightforward and cost-effective. Unlike competitors, EchoStar's IoT network leverages licensed multichannel to allow connectivity rather than unlicensed channels. Moreover, system integrators can specialize in a specific field by developing solutions with satellite and LoRa technology to meet the needs of different industries; for instance, they can specialize in the maritime field or railway solutions.

On the other hand, the company's mobile satellite data services combine the resilience of its S-band satellite network and Hughes' terminals (Hughes is a subsidiary of EchoStar Corporation). Key distribution partners such as Bentley Walker, Galaxy1, Hughes Europe, Marlink, RARTEL,

and GILAT Telecom incorporate these technologies into their offerings and deliver economical and complete connectivity solutions.

The Success of the Early Adopter Program

Notably, EchoStar Mobile creates robust strategies to develop IoT solutions and optimize services with a customer-centric approach. An example of the company's commitment to innovation with a user-focused methodology is the Early Adopter Program, launched in May 2022. The initiative provided a selected group of participants with early access to the IoT network to test capabilities in real-world settings.

The Early Adopter Program tested the adaptation of standardized LoRaWAN protocol on satellite and proved the success of real-time and bidirectional connectivity for low-power devices in European locations with no access to terrestrial networks. With the experiment, users provided feedback to EchoStar Mobile based on whether their demands and operational needs were fully met. This program was crucial for improving the solution before its official commercial launch.

After the successful Early Adopter Program, the company launched the pan-European LoRaWAN-enabled IoT network.

Conclusion

EchoStar Mobile excels among competitors by developing an innovative NTN network using LoRaWAN technology. The company's state-of-the-art solution enables direct sensor-to-satellite connectivity services with crucial capabilities for massive IoT deployments for clients: bidirectional transmission, easy deployment, secure and affordable real-time communication, wide coverage, and low power consumption. In addition, its focus on building a solid ecosystem through strategic deals with industry players (e.g., Semtech, Actility, and Swisscom) and collaboration with standards organizations (e.g., 3GPP, the LoRa Alliance) should drive the company's success in the IoT NTN market.

With its strong overall performance, EchoStar Mobile earns Frost & Sullivan's 2024 European Enabling Technology Leadership Award in the IoT NTN industry.

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What You Need to Know about the Enabling Technology Leadership Recognition

Frost & Sullivan's Enabling Technology Leadership Award recognizes the company that applies its technology in new ways to improve existing products and services and elevate the customer experience.

Best Practices Award Analysis

For the Enabling Technology Leadership Award, Frost & Sullivan analysts independently evaluated the criteria listed below.

Technology Leverage

Commitment to Innovation: Continuous emerging technology adoption and creation enables new product development and enhances product performance

Commitment to Creativity: Company leverages technology advancements to push the limits of form and function in the pursuit of white space innovation

Stage Gate Efficiency: Technology adoption enhances the stage gate process for launching new products and solutions

Commercialization Success: Company displays a proven track record of taking new technologies to market with a high success rate

Application Diversity: Company develops and/or integrates technology that serves multiple applications and multiple environments

Customer Impact

Price/Performance Value: Products or services provide the best value for the price compared to similar market offerings

Customer Purchase Experience: Quality of the purchase experience assures customers that they are buying the optimal solution for addressing their unique needs and constraints

Customer Ownership Experience: Customers proudly own the company's product or service and have a positive experience throughout the life of the product or service

Customer Service Experience: Customer service is accessible, fast, stress-free, and high quality

Brand Equity: Customers perceive the brand positively and exhibit high brand loyalty

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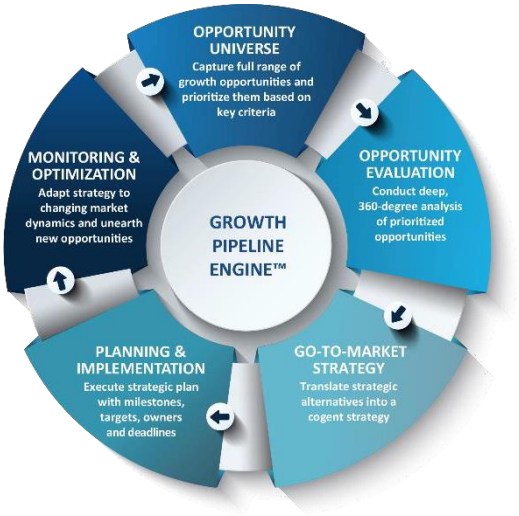
About Frost & Sullivan

Frost & Sullivan is the Growth Pipeline Company™. We power our clients to a future shaped by growth. Our Growth Pipeline as a Service™ provides the CEO and the CEO's growth team with a continuous and rigorous platform of growth opportunities, ensuring long-term success. To achieve positive outcomes, our team leverages over 60 years of experience, coaching organizations of all types and sizes across 6 continents with our proven best practices. To power your Growth Pipeline future, visit Frost & Sullivan at http://www.frost.com.

The Growth Pipeline Engine™

Frost & Sullivan's proprietary model to systematically create ongoing growth opportunities and strategies for our clients is fuelled by the Innovation Generator™. Learn more.

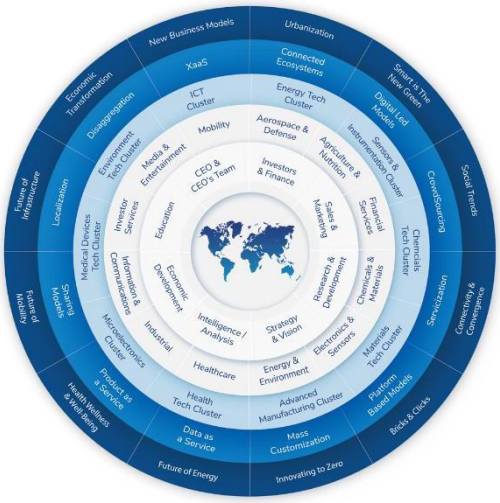


Key Impacts:

- **Growth Pipeline:** *Continuous Flow of Growth Opportunities*
- **Growth Strategies:** *Proven Best Practices*
- **Innovation Culture:** *Optimized Customer Experience*
- **ROI & Margin:** *Implementation Excellence*
- **Transformational Growth:** *Industry Leadership*

The Innovation Generator™

Our 6 analytical perspectives are crucial in capturing the broadest range of innovative growth opportunities, most of which occur at the points of these perspectives.



Analytical Perspectives:

- Mega Trend (MT)
- Business Model (BM)
- Technology (TE)
- Industries (IN)
- Customer (CU)
- Geographies (GE)