

# THE CELLULAR BACKHAUL OPPORTUNITY ANALYSIS

A Report Produced  
by NSR and  
ST Engineering iDirect

# Advancing the Business Case

Satellite Backhaul has historically allowed MNOs to expand their coverage. However, these opportunities were traditionally restrained to very remote locations, driven by government incentive programs. Satellite was perceived as a slow, expensive and cumbersome solution, able to capture a mere 1.7 percent of global installations of base stations (2019 Satellite Market Share by BTS Backhaul Technology).

However, combining the rapid drop in space segment prices with sophisticated and highly capable ground equipment, the picture is changing radically. Today, satellite is attracting large deployments across the globe and is considered a very flexible and capable solution in the backhaul technology mix. The need to extend quality 4G coverage beyond urban areas and the advent of 5G generating expectations of ubiquitous connectivity will only make satellite more relevant in the backhaul ecosystem.

## Satellite Enabling MNOs' Revenue Growth

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Global mobile operator revenue growth has slowed. Subscribers have reached saturation in key battleground areas where MNOs rely on data services for revenue growth. **Helping mobile operators extend these services to remote locations and ensuring the quality of the link with services that include resiliency overlay, are and will be key opportunities for satcom.** At the same time, risk aversion among MNOs is growing, thus a solution requiring **low CAPEX to target Greenfield markets is highly attractive.**

With new satellite backhaul economics, mobile operators no longer consider satellite as a low bandwidth solution, and now regularly **implement broadband services over satellite.** Peak capacity consumption for 4G sites can climb as high as multiple 100s of Mbps, a clear indication that broadband demand is taking off.

In the transition to 5G, MNOs expect to unlock new sources of revenues, where satellite has a key role to play. Enterprise services is a wide area of focus, with satellite becoming a key tool to connect remote locations or to offer an additional resilient path for

SD-WAN networks. Furthermore, the reach of satellite is unmatched by any other technology and its role in activating connectivity to mobility platforms such as connected cars, aircrafts and vessels is unquestionable. Similarly, IoT also shows extraordinary potential, and satellite is the perfect solution to offer truly ubiquitous connectivity. 5G will also accelerate the Video OTT revolution, with many MNOs launching “triple-play” offers to monetize their infrastructure. Nothing beats satellite in content distribution to large audiences, and it can be the perfect solution to distribute content to the edge at minimal infrastructure investment.

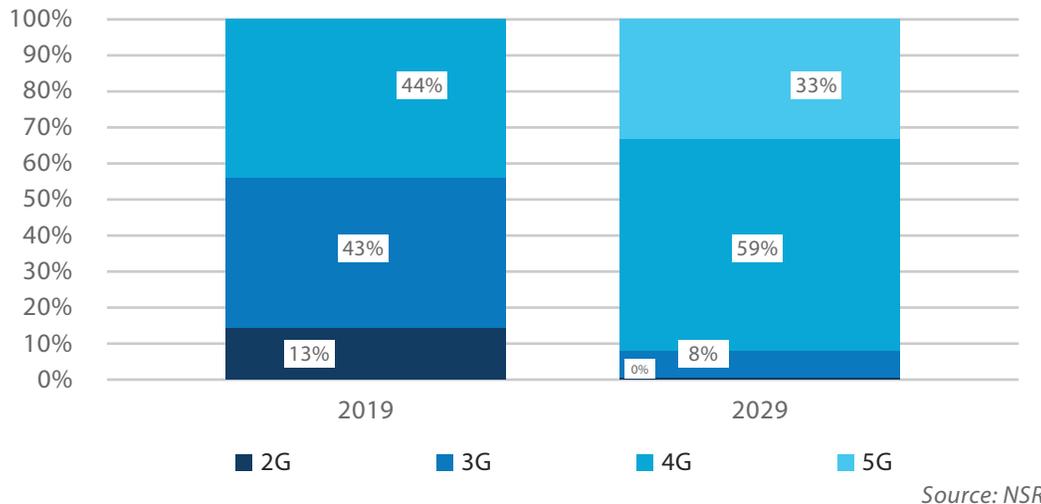


Exhibit 1: Cellular Backhaul Capacity Share by BTS Technology

In summary, **new use cases are opening for MNOs to capture additional sources of revenues where satellite is a key enabling technology.** A few examples that are becoming profitable applications for the satellite industry include:

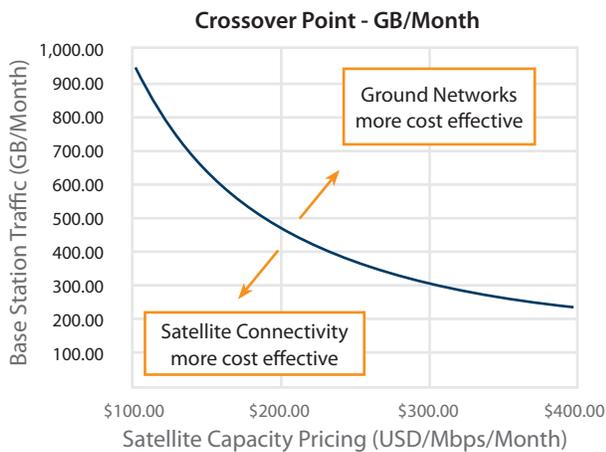
- Expanding coverage into unconnected populations
- Offloading traffic in congested areas
- Postponing or avoiding ground network upgrades
- Sporadic use cases like highways, railroads or sporting events
- First-responder networks requiring ubiquitous and reliable coverage

Furthermore, new markets for MNOs such as corporate networks, mobility, IoT or Media distribution will find in satellite the perfect technology partner to activate new sources of revenue.

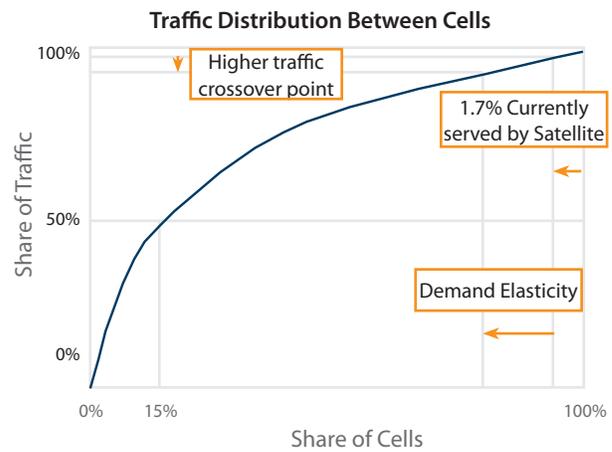
In this context, the MNO must ensure that the selected partner **VSAT platform is future-ready with a clear path to transition to 5G and with the flexibility to serve this wide array of use cases** without compromising performance and efficiency.

## Pricing Elasticity in Cellular Backhaul

Decreasing the Total Cost of Ownership for satellite backhaul has an **immediate and significant effect** on the demand the industry can attract. If the cost of satellite capacity declines, the crossover point where microwave is more cost effective than satellite moves towards higher traffic. Conversely, if capacity becomes cheaper, satellite can compete against microwave in higher-traffic sites.



Source: NSR



Source: Nokia & NSR

Exhibit 2: Pricing Elasticity in Cellular Backhaul

Mobile data traffic is highly concentrated in the denser segments of the network. According to Nokia, just 15 percent of base stations carry 50 percent of total traffic. Hence, there is a **long tail of stations carrying small levels of traffic**. A slight increase in crossover traffic, at which satellite is more cost efficient than microwave, will rapidly translate into higher levels of demand for the satellite industry.

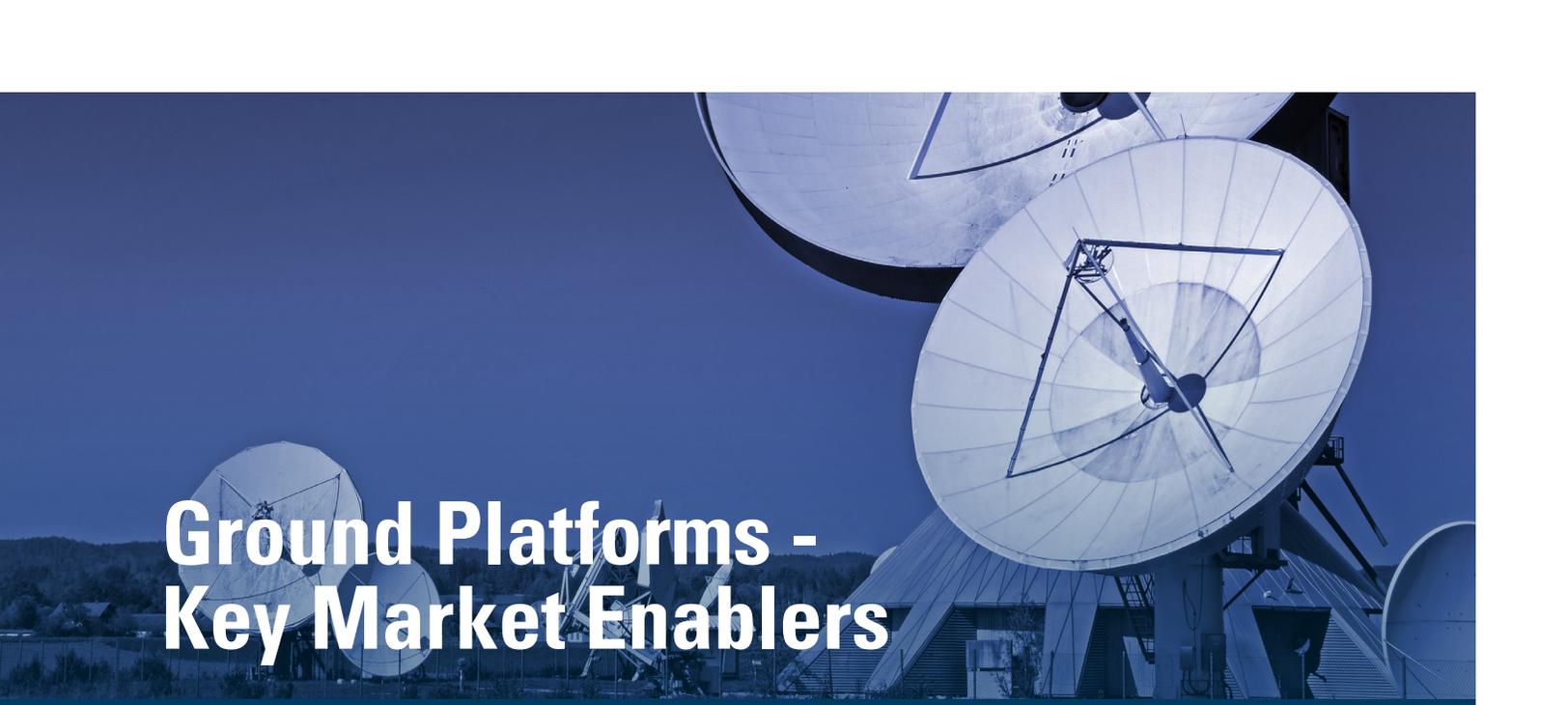
Combining the low CAPEX setup cost of satellite with the current highly competitive capacity pricing, **satellite backhaul is becoming an extremely attractive solution.**

## Case Study: ROI for Macrocell Deployment on GEO Satellite

The combination of cheaper capacity prices and high-performance ground segment together with a reduction in RAN CAPEX make the business case for MNOs expanding network coverage very attractive.

		Assumptions GEO		
		2G	3G	4G
	Mbps/site	0.5	4.0	8.0
	subs/site	1000	1000	1000
	ARPU (USD)	\$6.00	\$9.00	\$12.00
	Depreciation period (years)	5	5	5
	Net revenues (after customer relations and misc. cost)	65%	65%	65%
	Total cost of ownership (5 year) - Satellite Capacity 500 USD/Mbps/Month	\$231,870.00	\$352,870.00	\$489,870.00
	Total cost of ownership (5 year) - Satellite Capacity 250 USD/Mbps/Month	\$224,370.00	\$292,870.00	\$369,870.00
	Total cost of ownership (5 year) - Satellite Capacity 100 USD/Mbps/Month	\$219,870.00	\$256,870.00	\$297,870.00
<b>CapEx</b>	Satellite System (VSAT equipment, antenna, BUC, modem)	\$3,000.00	\$4,000.00	\$6,000.00
	RAN Systems (Cell, tower...)	\$50,000.00	\$60,000.00	\$70,000.00
	Additional Cost (Services, accessories, installation...)	\$20,000.00	\$20,000.00	\$20,000.00
<b>OpEx</b>	Satellite Capacity - per month (Satellite capacity 500 USD/Mbps/Month)	\$250.00	\$2,000.00	\$4,000.00
	Satellite Capacity - per month (Satellite capacity 250 USD/Mbps/Month)	\$125.00	\$1,000.00	\$2,000.00
	Satellite Capacity - per month (Satellite capacity 100 USD/Mbps/Month)	\$50.00	\$400.00	\$800.00
	Other Satellite & Network (Teleport, HUB, fiber to the core network, Sat equipment maintenance...) - per year	\$8,774.00	\$9,774.00	\$10,774.00
	Other Non-Satellite Related (Site rental, energy...) - per year	\$20,000.00	\$20,000.00	\$20,000.00
	<b>Net Revenue Potential (USD) - per year</b>	\$46,800.00	\$70,200.00	\$93,600.00
<b>ROI</b>	ROI (Satellite Capacity 500 USD/Mbps/Month)	2.9%	-2.2%	-22.8%
	ROI (Satellite Capacity 250 USD/Mbps/Month)	13.2%	69.2%	102.2%
	ROI (Satellite Capacity 100 USD/Mbps/Month)	19.4%	112.1%	177.2%

Source: NSR



# Ground Platforms - Key Market Enablers

Ground equipment plays a leading role in unlocking growth in the satellite backhaul market. As demand transitions to 4G and eventually 5G, modems require elevated levels of sophistication to support new requirements.

To qualify for 4G deployments, a typical requirement from MNOs is that **modem throughput must surpass 100 Mbps** to ensure the site is future proof, even if today's average throughput is below 50 Mbps. Given new traffic patterns (peaky traffic), bandwidth pooling and statistical multiplexing are key features for boosting capacity utilization. With these huge pipes, **spectral efficiency** (Mbps/MHz) is critical and rapidly translates into major OPEX savings.

Furthermore, mobile networks pose stringent requirements for higher layers of communications that satellite terminals need to solve. Minimizing the traffic that needs to go through the satellite link is another major feature of the most advanced terminals. **Data compression, optimization** and local cache are typical attributes of the new generation of terminals. Mobile protocols are some-

times not very well suited for satellite backhaul, and traffic acceleration and protocol trimming are key functions for advanced modems.

**5G-compatibility is going to be the single most crucial element for future networks.** The VSAT platform is at the core of this transition and needs to be a trustful partner with a clear technology roadmap. With standardized service orchestration, satellite will be fully integrable with terrestrial networks, allowing MNOs to solidify their core markets and conquer multiple new opportunities such as Enterprise markets, IoT, Mobility or Hybrid content distribution.

Consequently, the capacity to serve from a single platform with a wide array of use cases with diversity of performance requirements, ranging from Kbps of high contended sites to 100s of Mbps dedicated bandwidth, is of paramount importance in this ecosystem.

## The Opportunity

The cellular backhaul vertical is poised to become a key revenue generator for the satellite industry. With a continually expanding installed base, cellular backhaul will move from being a niche application to generating close to 300,000 high-value terminal shipments in the next 10 years. The transition to 4G and 5G also triggers a move towards higher-end modems, driving revenue growth at 16.5% percent CAGR.

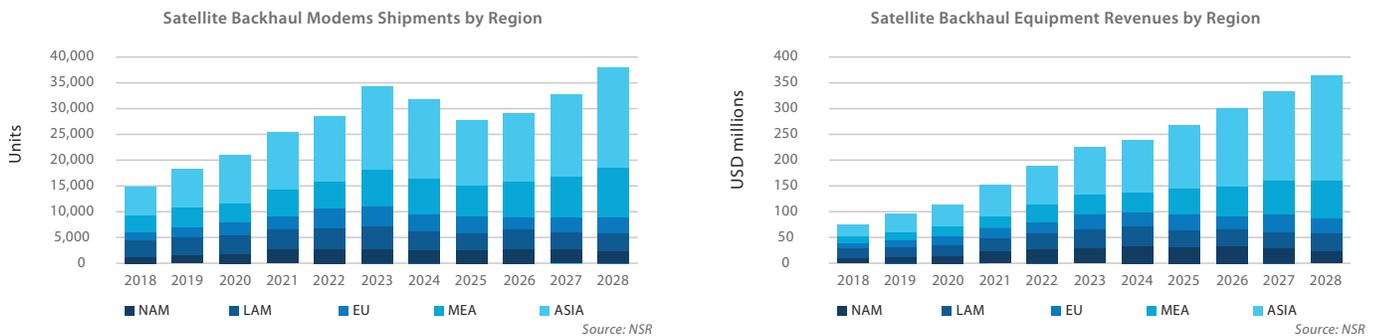


Exhibit 3: Satellite Backhaul Equipment Market Evolution

Developing markets continue to be a strong source of demand for satellite backhaul. The declining cost of mobile phones, a drive to extend network coverage, rapid addition of new subscribers, coupled with government support and obligations, provides big opportunities for satellite backhaul in emerging economies.

With new use cases, large deployments are also appearing in developed economies. The need to provide ubiquitous coverage sometimes driven by land area rather than by population coverage and the requirements for extremely high levels of availability, sometimes combined with the need to provide communications for first responders networks, have opened opportunities for satellite backhaul in developed markets.

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## ST Engineering iDirect Value Proposition and Differentiation

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The choice ground infrastructure is key to unlocking the full spectrum of use cases. Mobile network operators require, as well as the satellite service providers that support them, a platform that can handle every application use case and business requirement.

With over 80+ deployed mobile backhaul networks, including one of the largest networks with over 1,500 active cellular sites, and serving twelve of the top 25 Telcos as customers, ST Engineering iDirect is a leading actor in the satellite ground infrastructure and solutions for cellular backhaul and trunking markets.

ST Engineering iDirect's primary solution for advancing the cellular backhaul market is Dialog. The platform has been used in a multitude of use cases delivering top-notch efficiencies, performance and service capabilities and proving its scalability and flexibility to expand into new markets.

Dialog has been implemented by Mobile Network Operators and Service Providers to increase their revenues by expanding 2G, 3G and 4G/LTE networks. The platform has been deployed in very diverse scenarios including small, medium, or large backhaul networks, and in combination with other use cases like trunking, fiber back-up, or corporate networks and SMEs/SOHO connectivity. Additionally, Dialog enables a high-quality end user experience through its built-in advanced acceleration and compression technology but also through its ability to provide higher service availability including in fade sensitive Ku and KA bands, in addition to C band.

Combined with its high speed modem portfolio can match the network configuration for any customer application. Further, showing strong commitment in the transition to 5G and participating in industry working groups such as Sat5G or SATis5G, ST Engineering iDirect will be a future-proof partner to ensure long-term relevance and ready to power new use cases like Hybrid content distribution, IoT or Mobility services.

One of the most significant distinctions of Dialog is the groundbreaking Mx-DMA MRC return channel technology that combines the benefits of MF-TDMA — ideal for bursty traffic and higher contention services with the spectrum efficiency of SCPC that is more applicable to dedicated higher data and video rate return links, into a single return technology suited to a greatly expanded set of applications. Mx-DMA scales in MHz independent of the number of terminals so customers may be served with a single return link for the majority of their use cases, minimizing operational complexity and maximizing statistic multiplexing. Mx-DMA MRC delivers these benefits by maintaining the efficiency of Mx-DMA HRC while drastically improving the agility, scalability and fill efficiency. Designing an Mx-DMA MRC link does not require precise knowledge of the traffic and terminal mix as the link self-optimizes in real time. Moreover, the high efficiency enables bandwidth savings, higher throughput, better network availability and substantial terminal cost savings.