

# CELLULAR BACKHAULING OVER SATELLITE – NOT FOR YOU? **THINK AGAIN**

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WHITE PAPER

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## CBH OVER SATELLITE - THE PROMISE TO BRIDGING THE DIGITAL DIVIDE


The need to bridge the digital divide is now stronger than ever and is exasperated with the COVID-19 pandemic causing a rise in demand for connectivity and especially a surge of demand on cellular networks. We see a record need for video streaming and bandwidth hungry applications, which are coming about due to work and study from home, a social distancing that is increasing the reliance on communication from home, as well as additional connectivity requirements to support the crisis.

Since not everyone in the developing world can afford computers, but many have 4G smart phones, internet via their mobile phones backhauling over satellite is the fastest solution for bridging the digital divide. There is a need to reach underserved areas quickly with a satellite alternative to the terrestrial networks, that do not provide an adequate solution or are nonexistent altogether.

The adoption of cellular backhaul (CBH) over satellite has grown substantially over the past years and is expected to continue to do so, according to various industry analysts. In a recent report by research firm NSR, CBH was singled out as the key vertical expected to drive growth in the satellite communications market.

Satellite backhauling has become an economically viable solution answering the strictest Service Level Agreements (SLAs), and for many Mobile Network Operators (MNOs) is no longer a niche play. In the past, the satellite option for CBH was often used only as a fallback for hard to reach rural areas such as islands, mountains and deserts, where terrestrial infrastructure such as fiber, next-generation copper or microwave were either too expensive or unfeasible.



A network diagram in the top left corner shows a series of interconnected nodes. Some nodes are represented by circles of different colors (red, blue, grey) and sizes, connected by thin grey lines. The diagram is partially cut off by the left edge of the page.

Today, Gilat sees that the increasing need for high-throughput data networks together with improved economics and advancements in technology, in both satellite capacity and the ground-segment, are causing MNOs to rethink old habits. Further, the advantages of satellite communication are particularly relevant during this pandemic due to record-time deployment as well as being able to reach anywhere. In addition, MNOs are increasingly focused on their core business and outsourcing non-core competencies, thus opening the opportunity for satellite communication as a managed service.

Gilat is recognized as the world leader in CBH over satellite, reaching 44% market-share in modem shipments according to a report by industry analyst NSR, 2020. Gilat with its SkyEdge II-c platform and Capricorn family of VSATs has deployments of large networks worldwide, consisting of tens of thousands of sites that are being connected with satellite backhaul, thus providing a major impact in narrowing the digital divide and promoting equal opportunity. On top of this, these network extensions over satellite are a significant source of revenue generation to the MNOs, indicating that indeed satellite backhaul has moved into the mainstream.

## DISPELLING THE MYTHS ABOUT CELLULAR BACKHAULING OVER SATELLITE

While the business case for satellite backhaul has never been stronger, there still remains one major barrier to widespread deployment – and that is perception. Common negative misperceptions of satellite backhaul revolve around three myths: inadequate performance, high costs and unmanageable complexity. One of the main reasons for these misperceptions is a lack of familiarity with satellite technology. Often, decision makers are unaware of the recent innovations in satellite technology, leading to apprehension about its suitability for cellular backhaul.

The best way to alleviate these false impressions is to examine the common myths one by one.

### **MYTH 1: 4G/5G PERFORMANCE CANNOT BE MET WITH SATELLITE BACKHAUL**

With the large amounts of required data communication, MNOs raise concerns that VSATs are not able to deliver the required LTE performance to the handset and will not be able to support the high throughput required for the 5G network architecture. In addition, as satellite communication has an inherent delay, a concern is raised that this will result in poor backhaul performance and consequentially a poor user experience.

### **FACT: ACCELERATION TECHNOLOGY AND HIGH-PERFORMANCE MODEMS MITIGATES LATENCY EFFECTS**

The inherent satellite delay can be overcome by using acceleration technology that addresses the latency effects. Mitigating the latency effect, makes it possible to achieve high throughput which requires high performance modems to accommodate the traffic and provide the required high-quality user-experience. Such a solution is especially critical when high bandwidth is required, like in 4G/5G deployments.

An outstanding solution was jointly developed and patented by Gilat and SoftBank. The innovative technology enables true high speeds, through acceleration of traffic inside the GTP tunnel. This acceleration technique has been embedded in Gilat's Capricorn VSAT and was implemented initially in Japan. Now this achievement of enabling true LTE performance is deployed in Tier-1 mobile networks around the globe including in North America, South America, Asia, Europe and Australia. Furthermore, this acceleration technique and the Gilat 5G ready system architecture, in combination with high throughput VSATs, allow operators to start deploying 5G Standalone (SA) and Non-Standalone Architecture (NSA) networks over satellite.

In addition, as the satellite industry evolves to Non-Geostationary Satellite (NGSO) constellations, the satellite latency concern is further mitigated with medium and low orbit (MEO/LEO) constellations, due to significantly reducing the satellite distance from the earth.



### MYTH 2: SATELLITE CONNECTIVITY IS EXPENSIVE

In the past, the cost of satellite bandwidth capacity and management of the satellite backhaul often caused satellite-based communications to be prohibitively expensive for providers of broadband services, such as MNOs.

### FACT A: SATELLITE CAPACITY PRICING AT TIMES RIVALS TERRESTRIAL BANDWIDTH COSTS

With the continued launch of High Throughput Satellites (HTS) and Very HTS (VHTS) satellites, as well as the promise of NGSO constellations, industry analysts are expecting a further decline in bandwidth prices due to the abundance of satellite capacity, propelling satellite solutions into the mainstream. Based on these trends, it is expected that the cost for satellite backhaul networks will compete with those of terrestrial backhaul networks for many use cases.

### **FACT B: BANDWIDTH SHARING FOR EFFICIENT RESOURCE ALLOCATION REDUCES COSTS EVEN FURTHER**

Gilat implements access schemes such as TDM/TDMA that do not waste bandwidth when not needed and provide sufficient capacity to meet peak usage. Gilat's SkyEdge II-c platform ensures that bandwidth is adjusted according to usage, for better cost efficiency.

### **MYTH 3: SATELLITE CONNECTIVITY IS TOO COMPLEX**

A third common misperception is that satellite technology is too complex for cellular backhaul networks. MNOs already have their hands full with their rapidly evolving mobile networks, and the last thing they want is added complexity for backhaul.

### **FACT A: ACCELERATED LAYER-2 SUPPORT FACILITATES SATELLITE NETWORK INTEGRATION**

A factor contributing to satellite backhaul complexity relates to the OSI network layer, at which the integration of the satellite and terrestrial cellular networks takes place. Satellite networks traditionally operate at Layer-3 (network layer) to be able to accelerate the user data, while MNO networks in some cases operate at Layer-2 (data link layer). Gilat's SkyEdge II-c has the advantage of supporting accelerated data while operating at a carrier-grade Layer-2, thus easing MNOs satellite integration while extending traditional terrestrial networks.

### **FACT B: GLOBAL NETWORK MANAGEMENT REDUCES COMPLEXITY**

Another way to reduce satellite backhaul complexity is to use a sophisticated global network management system (NMS). Gilat's TotalNMS enables full provisioning, configuration, control and monitoring of all satellite hub elements, as well as remote terminals, regardless of their physical location. This is crucial for streamlining the management allowing MNOs easily and cost-effectively scale to support any network size, enabling them to start small and add sites as needed.

### **FACT C: MANAGED SERVICE REDUCES COSTS**

Significant savings in cost can be achieved by regarding satellite backhaul as a managed service. The MNO specifies the requirements, the SLA and key performance indicators, as well as the required site locations and the schedule. Considering the managed service as a black box and giving end-to-end responsibility to Gilat, enables the MNO to focus on their core competency and promote their business.

### **To conclude, the presented facts dispel the myths:**

- Inadequate Performance Dispelled - since satellite technology has evolved to deliver speed, performance and terrestrial-grade user experience.
- High Cost Dispelled - since today's satellite TCO rivals' terrestrial solutions in many cases.
- Unmanageable Complexity Dispelled - since comprehensive suites of services simplify deployment, integration and operation.

## GILAT HOLDS OVER 80% MARKET-SHARE OF SATELLITE 4G CBH MARKET

Both the economics, as well as overcoming technical challenges, have brought 4G/LTE satellite backhauling to the forefront in the more established markets as well as in the developing world. Clearly, the traditional markets of Asia, Africa, and Latin America are prime candidates for connectivity due to the lack of terrestrial infrastructure. However, at Gilat we see significant growth and need in the developed world, as well, including North America, Japan and Australia.

Gilat's achievement of holding over 80% market-share in satellite backhaul for 4G/LTE installations worldwide, is due to both technological capabilities, as well as global expertise, local presence, outstanding support and superior delivery capabilities.


The use cases vary greatly and have changed worldwide over the years to serve a variety of applications such as emergency response and Internet of Things (IoT). In addition, today's applications require high throughput just as much for upload, as well as for download. End-users want to share data such as videos and photos over social media, shifting from a download centric traffic profile to a growing need for data upload. To meet these needs Gilat is continually evolving its VSATs to address the changing requirements.



Tier-1 MNOs worldwide have implemented Gilat's solution. Some examples include: in the US: T-Mobile and Sprint, in the UK: BT/EE, in Australia: Telstra and Optus, in the Philippines: Globe Telecom, in South America: Telefonica and TIM, and in Japan: Gilat dominates the satellite backhaul market with Softbank, NTT Docomo and KDDI among others.

In all of these situations, and more, satellite backhauling is a quick solution that can be deployed anywhere. In many circumstances the costs and time involved in setting up a terrestrial infrastructure, if even feasible, would not be cost effective

Extending cellular networks outside of crowded urban areas is the primary reason for MNOs to adopt a satellite backhaul solution. At times the requirement comes from the government, who is looking to include the rural population in the country's economy, with a sincere desire to narrow the digital divide. Often in these cases, it is mandatory for the mobile operator to supply such connectivity to the underserved or unserved

A network diagram in the top left corner shows a series of interconnected nodes. Some nodes are represented by circles of different colors (red, blue, grey) and sizes, connected by thin grey lines. The diagram illustrates a network structure, possibly representing cellular backhaul or IoT connectivity.

areas. Other times, competition between MNOs in increasing their subscriber base drives MNOs to extend networks, so as not to be required to pay roaming costs to a competitor when their subscriber moves out of their current coverage area. In other cases, there are areas where an opportunity arises to support tourist attractions such as hiking trails, scenic travel routes and ski resorts, that require connectivity.

Another example of a CBH application is for the agriculture IoT business. As an example, Gilat provides 4G services to TIM Brasil's IoT agribusiness from the coastline into the country. Gilat's 4G network expansion allows to connect machines and operators to real-time control and monitoring of harvesters and agricultural tractors. This enables cost-effective decisions, and quick and effective crop management and further productivity in the production flow.

And finally, likely the fastest growing application for cellular backhaul is for emergency response and backup. Satellite backhauling is the solution of choice when terrestrial infrastructures collapse. In the next section this topic is further discussed.

## EMERGENCY RESPONSE & BACKUP - A GROWING APPLICATION

Whether dealing with a natural disaster or a terrorist attack, reliable communications and access to information are critical for enabling effective emergency response. Climate change and its impact on natural disasters are causing MNOs and regulators to rethink their emergency preparedness and emergency response strategies.

To meet the public's ever-growing reliance on mobile communications, there is a growing interest in broadband communication that is not dependent on the risk-prone terrestrial infrastructure. Therefore, we are seeing more local governments, MNOs and emergency organizations adopting alternative solutions, such as satellite communications, for emergency response and disaster recovery.

Independent from terrestrial and wireless infrastructure, satellite communications provide a secure and reliable solution that can be deployed quickly for disaster response or national emergencies. CBH over satellite solutions enables MNOs to extend network coverage to remote areas beyond the reach of terrestrial infrastructure, enabling emergency services to operate seamlessly in virtually any location. In other cases, satellite backhaul can serve as a backup solution should the terrestrial network go offline due to a disaster or malfunction. This means that precisely when communication is most important for saving lives, it is all-too-often not available due to network breakdown.

When lives are on the line and every second counts, first responders require advanced technologies that can be rapidly deployed anywhere to support voice, video and data applications. Satellite backhauling is the technology that supports effective real-time communications and continuous situational awareness, as they are critical for making high-pressure decisions in the toughest imaginable circumstances.

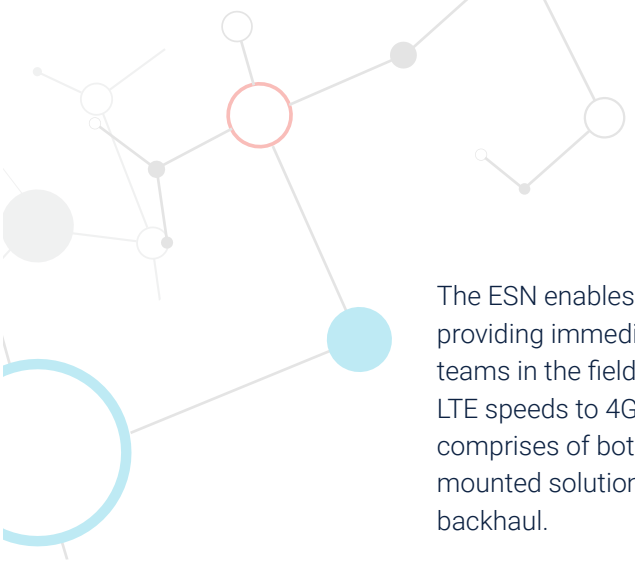
Gilat is involved in numerous real-world emergency response and backup deployments. A particularly massive implementation is going on in the UK with EE/ BT one of Europe's largest 4G networks. EE/BT is working with Gilat to build out the world's largest 4G Emergency Services Network (ESN) to provide network resilience and backup for the UK population.



EE/BT was commissioned by the UK's Home Office to deliver emergency service coverage for the whole of the UK over its 4G nationwide network. The ESN runs over EE/BT's commercial network, which automatically grants priority use to emergency services. EE/BT is using Gilat's field-proven cellular backhaul solution to extend ESN's coverage to remote areas without terrestrial infrastructure, enabling emergency services to operate seamlessly in any location throughout the UK. Moreover, Gilat is in the process of deploying about 1,000 LTE satellite backhaul sites, including weather-proof VSATs in outdoor locations. These sites will enable service in areas without terrestrial infrastructure or in other cases serving as a backup solution.



*EE Emergency Service Deployed with Gilat On-the-Pause VSAT Solution*

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The ESN enables network resilience in the event of a cell site failure, as well as providing immediate high-speed voice and data connectivity to emergency response teams in the field. Gilat's Capricorn VSAT answered the requirement of delivering true LTE speeds to 4G handsets and fully supporting encrypted data. The ESN deployment comprises of both fixed and portable on-the-pause cell sites, which use a vehicle-mounted solution containing both the cell node and the Gilat VSAT that handles the backhaul.

## 5G – THE FUTURE KNOCKING ON OUR DOOR

As the world moves into the future, there is no doubt that satellite communication is essential to materialize the upcoming technologies such as 5G. The 5G vision, of ubiquitous connectivity, is dependent on satellite backhauling as an essential enabler to provide the scale and scope for connectivity everywhere.

Gilat, as the recognized leader in cellular backhaul over satellite, is making significant headway in the evolving 5G ecosystem that will directly influence the way people live and work. Gilat has proven in numerous demonstrations that its SkyEdge II-c platform is 5G ready. As an example, a recent demonstration of carrying 5G traffic with outstanding performance took place in Thailand over Thaicom's IPSTAR GEO HTS Satellite.

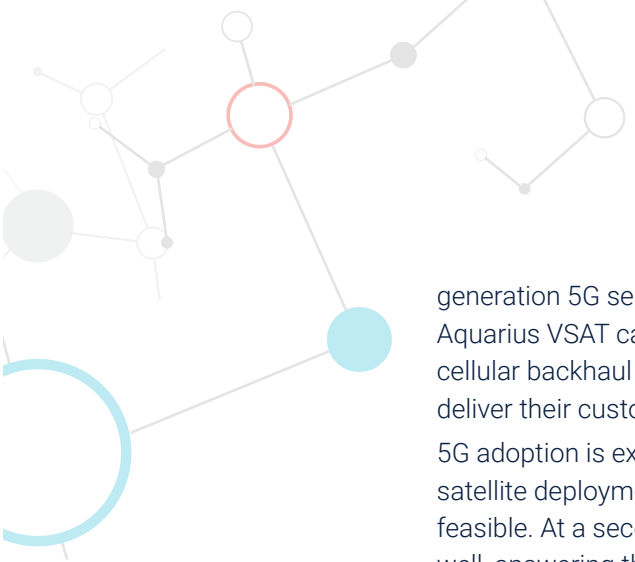
These tests with 5G handsets, demonstrated unique speeds, of 400 Mbps download and 100 Mbps upload, while running a large number of applications including: Browsing, Speedtest, Youtube 4K, VoLTE, ViLTE, Virtual Reality, Augmented Reality and even communication with a drone providing a live video stream. The tests were done with several 5G architecture options, including Standalone (SA) and Non-Standalone (NSA), using Gilat's Capricorn PLUS VSAT with the adaptation of its patented GTP acceleration.

As the requirement for coverage anywhere/anytime continues to expand, the technology roadmap must keep in synch, thus demanding more bandwidth at higher speeds and lower latency. In addition, the technology roadmap must support technologies that will reduce cost and complexity to ensure the most efficient solution.

As such, Gilat recently launched its next generation family of VSATs, Aquarius, supporting 5G Networks in both GEO and NGSO constellations. Gilat's Aquarius family of ultra-high-performance, multi-orbit VSATs provides over 2 Gbps of concurrent speeds and supports seamless satellite handover.

As 5G networks are deployed and customer demands continue to exponentially grow, Gilat's Aquarius VSATs are designed to serve, with maximum efficiency, data and media intensive applications. This new family of VSATs is designed to provide uninterrupted service, ultra-high-performance and support for next generation software defined satellite constellations.

Further, the high-throughput with a Multi Access Edge Computing (MEC) infrastructure, enables deployment and orchestration of 3rd party virtualized network functions on the VSAT, simplifying remote site management and operations for next

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generation 5G services, such as video caching and IoT gateways. These and other Aquarius VSAT capabilities, coupled with Gilat's long-time experience and patented cellular backhaul technology, make it the solution of choice for enabling MNOs to deliver their customers a true 5G experience over satellite.

5G adoption is expected initially in the cities, which will drive additional 4G over satellite deployments into suburban and rural areas, where terrestrial coverage is less feasible. At a second stage, 5G deployment over satellite will spread to rural areas, as well, answering the promise of universal coverage. Gilat with its 80% market share in 4G/LTE satellite backhauling is continuing to address the 4G market and is more than ready to answer the 5G challenge.

## CONCLUSION

The unique attributes of satellite communication and its proven value in numerous applications make it an essential component of cellular networks to enable reach to people wherever they are, thus supporting the narrowing of the digital divide. Furthermore, the dropping prices of satellite capacity are making satellite communication the feasible solution to solve today's communication needs.

Not only does satellite enable connecting remote locations, it strengthens the resiliency of communications networks, and directly contributes to saving lives. Gilat has proven its superior satellite backhauling technology worldwide and is diligently at work for next generation solutions to meet the challenges still ahead.

**For more information please visit: <https://www.gilat.com/solution/cellular-backhaul/>**



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