# JUPITER™ System for Satellite Backhaul of 3G/4G/LTE Cellular Networks

The growing global demand for 4G and LTE mobile connectivity presents a significant challenge in many ex-urban and semi-rural areas. These markets are often located in difficult-to-serve, remote areas where terrestrial fiber or microwave services are not readily available to support the backhaul links for base station locations. To bring service to these areas, mobile operators require a low-cost and effective means for interconnecting cellular base stations, regardless of distance, infrastructure, or terrain. Satellite technology, which can be rapidly and cost-effectively deployed to nearly any area around the globe, is an ideal solution for meeting this challenge.

Modern day 4G/LTE mobile networks support a combination of voice and data traffic and require a high-performance, cost-effective, next-generation cellular backhaul solution that can be quickly and easily deployed to any location. Hughes JUPITER System is ideally suited to serve such networks. With industry leading latency (~600 ms) and jitter (~10 ms) performance, the JUPITER System offers the best user experience compared to other VSAT systems. Furthermore, through the use of Time Division Multiplexing (TDM)/Time Division Multiple Access (TDMA), the JUPITER System is highly economical on satellite bandwidth utilization, particularly when traffic is dynamically shared and assigned on an as-needed basis among multiple sites.

## JUPITER Cellular Backhaul Overview

The JUPITER System offers operators a powerful solution for satellite backhaul, which has a low total cost of ownership and is highly scalable. The figure below illustrates the star architecture of the Hughes satellite cellular backhaul solution on the JUPITER platform.
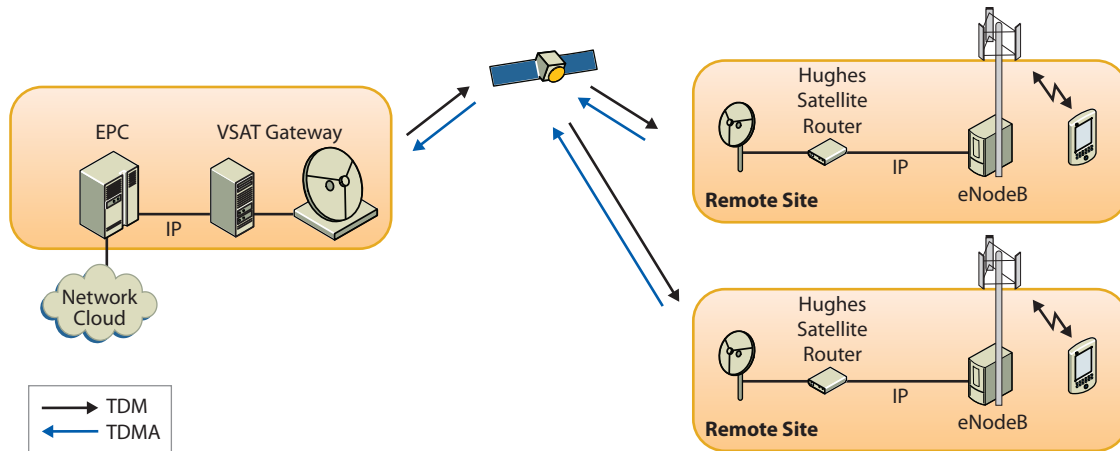


## TDM/TDMA

With TDM/TDMA, remote sites share the same satellite capacity for their traffic, and the capacity is dynamically assigned as needed to each RAN.

In a dispersed multisite network, peak busy hour occurs at different times at different site locations. This can be effectively accommodated by dynamic sharing of the same satellite capacity, a key attribute of a TDM/TDMA system, where a TDM/TDMA system will allocate satellite capacity to different sites and times on as-needed basis. For sites that may require dedicated capacity, a "nailed up" TDM return channel, implemented as DVB-S2X, can be used. The JUPITER System will support the DVB-S2X return channel in the future.

Hughes offers a full range of satellite-based RAN backhaul solutions that have been specifically designed for mobile operators to enable rapid and cost-effective service expansion into rural or hard-to-serve markets. These solutions provide high-quality links while optimizing space segment resource utilization by coupling the appropriate satellite technology with intelligent traffic optimization.

In addition, the time to implement a satellite backhaul connection is quite short. Once the satellite solution is installed, the service can begin immediately. Also, satellite offers a significantly lower CAPEX versus the cost of installing and maintaining a terrestrial backhaul system using fiber or microwave (with multiple hops) to hard-to-reach rural areas.

## Bandwidth Optimization

In 4G/LTE networks, the traffic between the eNodeB and the EPC uses the S1-U interface on which GPRS Tunneling Protocol (GTP) is implemented to encapsulate the user traffic. To minimize the traffic carried on the satellite link, the JUPITER system strips off the GTP header information and reconstitutes it at the Gateway, yielding 30-60% less traffic carried over the satellite link.

For 2G and 3G applications where the backhaul traffic is not optimized or not already IP, the Hughes solution for cellular backhaul uses a bandwidth optimizer that significantly reduces the traffic from the data and control channels sent over the space segment. Key functions of the optimizer include:

- Increase of network throughput
- Reduction of satellite bandwidth requirements
- Improvement in network response times and reliability
- Enhancement of mobile users experience and network performance
- Minimization of effects of latency

## Conclusion

The Hughes JUPITER System is an efficient and economical satellite backhaul solution. With efficient TDM/TDMA channels and a highly scalable architecture, the JUPITER System provides a lower overall total cost of ownership; a future release will support DVB-S2X return channel for applications that require a high-capacity dedicated bandwidth. The JUPITER System, when combined with high-throughput satellites, meets most RAN backhaul requirements, including very-high-capacity links. It can effectively handle the ever-increasing demand for data over 4G/LTE networks through its powerful features and efficiency. Additionally, the JUPITER System has been successfully tested and integrated with leading RAN equipment manufacturers, ensuring that operators can successfully implement a backhaul system in the shortest period of time.

### Some of the key features that make the JUPITER System ideally suited for cellular backhaul include:

**Industry-leading latency and jitter**
- 600 ms latency, 10 ms jitter

**High efficiency**
- DVB-S2X forward channel
- FM/TDMA return channel with 8PSK (16APSK in future) and 90% efficiency
- Future DVB-S2X on return channel

**High-throughput remote terminals**
- More than 200 Mbps throughput

**Low power consumption**
- 25 W IDU

**Base station/eNodeB synchronization**
- GPS, NTP, IEEE1588 PTP (Future)

**Security**
- AES256 (optional; subject to local government approval)

**Power options**
- AC power supply (90–240 VAC)
- DC power supply (+24 or -48 VDC)

**Scalability**
- Highly scalable gateways

**Full network management system**
- Provides ease of managing every network element

## Proprietary Statement

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