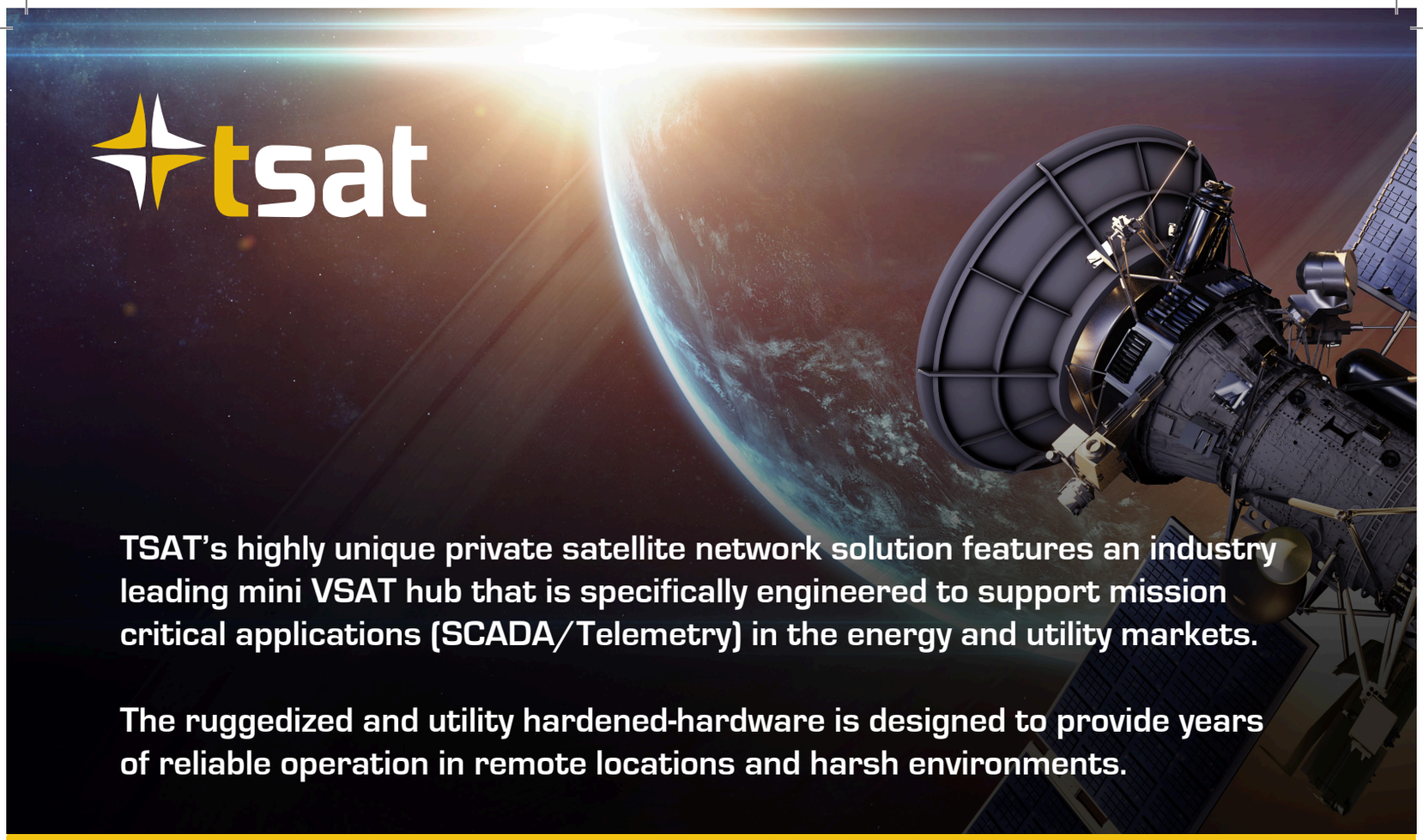


TSAT's highly unique private satellite network solution features an industry leading mini VSAT hub that is specifically engineered to support mission critical applications (SCADA/Telemetry) in the energy and utility markets.

The ruggedized and utility hardened-hardware is designed to provide years of reliable operation in remote locations and harsh environments.

TSAT 3000

With **TSAT's** efficient use of spectrum and bandwidth resources, recurring costs are kept at a minimum for the lowest possible TCO. This makes **TSAT** the ideal primary or back-up solution.

TSAT's satellite solution is designed to comply with **IEC 61850**. The global standard for utility and industrial communication and automation.

A **TSAT solution** provides cyber-secure communications to and from your remote locations. Data is 'piped' directly to your control center without the need to use public communications infrastructure (PSTN) or the Internet.

TSAT enables the highest levels of network reliability by being able to support geo-redundant and load-sharing HUB installations.

TSAT's low capital investment cost makes private satellite network implementations a real option even for small utilities.

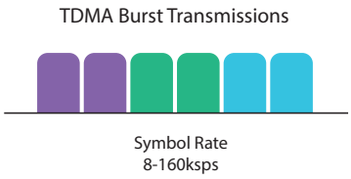
The **TSAT remote terminal** provides the power and flexibility to adapt to all kinds of communication needs, ranging from legacy **SCADA protocols** to **TCP/IP-based communications**. IP compression schemes ensure efficient channel throughput.

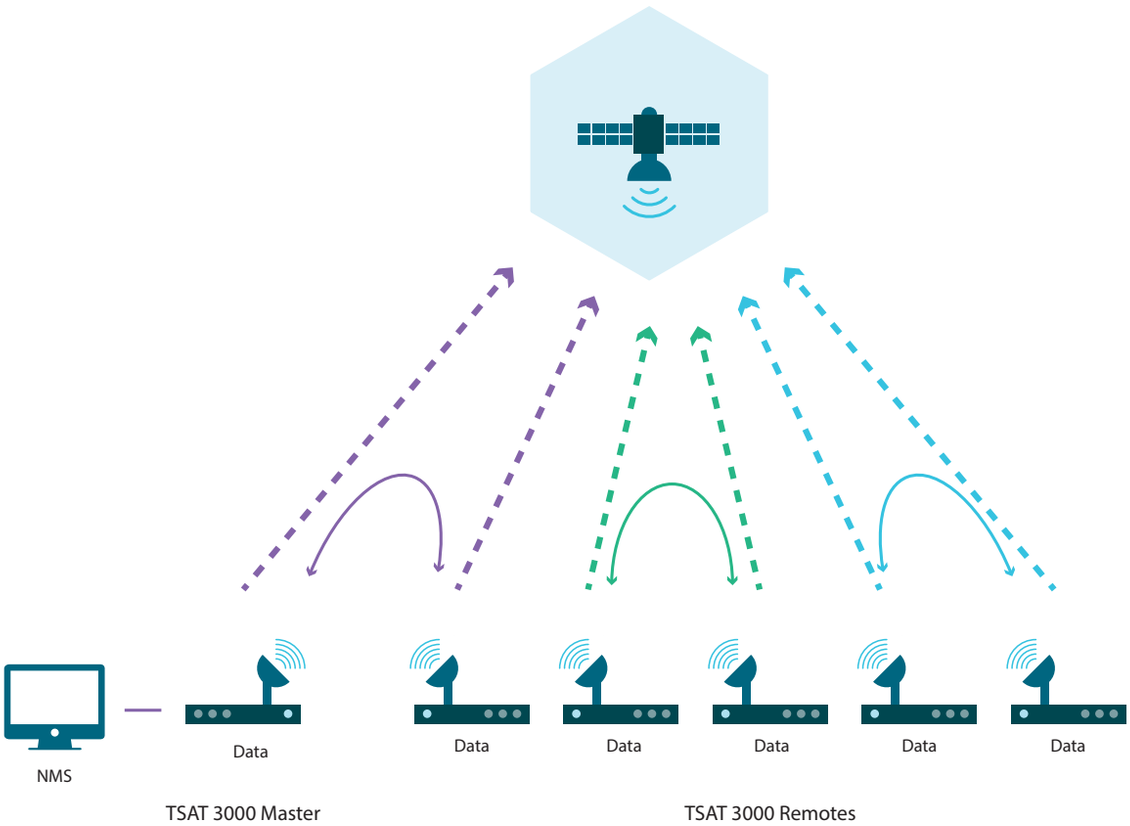
Advanced power saving features makes **TSAT** the ideal choice when solar panels or batteries are the only available power options.

THE TSAT ADVANTAGE

- **Ku-band platform for remote industrial locations**
- **Private networking, ruggedized hardware and low operational cost**

MESH NETWORK CONNECTIVITY





The TSAT 3000 mesh feature is implemented with a single TDMA carrier, and where one of the remotes is designated as the master. The master provides timing and bandwidth (slot) allocations to the connected remotes in the network.

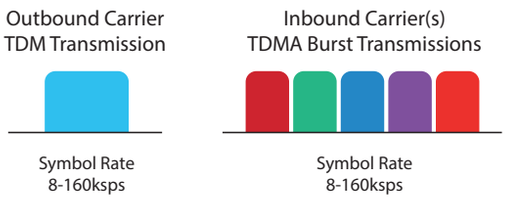
Since transmission from any remote is received by all remotes, any network topology is possible (hub and spoke, multilevel tree and full mesh). Network configuration and bandwidth allocations are highly flexible and can be dynamically changed.

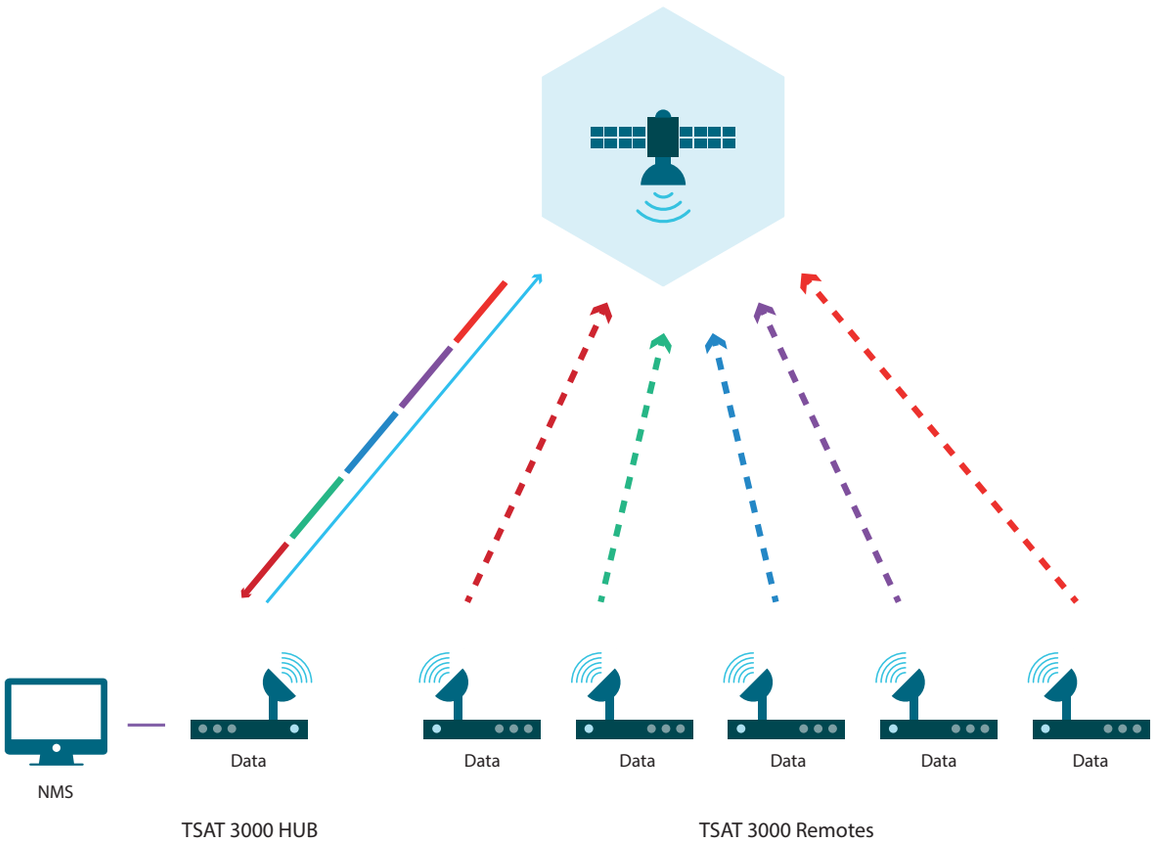
Mesh connectivity enables remote-to-remote connectivity via a single “hop”. Single hop connectivity is a highly desired capability for several utility distribution use-cases where latency is critical. One example is the signaling of a transfer-trip from a distribution re-closer to the related substation.

The reliability of TSAT’s mesh network implementation is further enhanced by an optional “hot” stand-by master. It enables uninterrupted operation in case of a master outage.

STAR NETWORK CONNECTIVITY

The TSAT 3000 HUB provides network signalling and data transmission over the outbound TDM carrier. The transmission is continuously received by all remotes. The remotes will transmit on the inbound TDMA carrier according to a user-configured slot allocation scheme. The outbound and inbound carriers can be sized independently to meet exact throughput requirements. For most SCADA/Telemetry networks, the inbound traffic is larger than the outbound. When network traffic exceeds the capacity of the single outbound and inbound carrier, the solutions scales up by adding TSAT 3000 HUB main units to provide additional carriers. Geo-redundant/load-sharing and hot stand-by HUB options are available for maximum network availability in case of an outage at the primary HUB.





Features & Benefits

Ruggedized Hardware
Designed to comply with relevant parts of **IEC 61850-3** and **IEEE 1613** to ensure reliable operation in the most demanding environments.

Low Cost HUB
Makes **TSAT-3000** suitable for even for small private network implementations.

Low Operating Expense
Spectral efficency and the ability to support a duplex carrier within as little as **25kHz** of spectrum ensure low recurring operating expenses.

Powerful NMS
Windows based user interface makes operation and support of a private satellite network an easy task.

Scaleable Solution
Start with a small network and expand data throughput and number of carriers as network size grows.

SCADA Optimized
Unique protocol acceleration features minimal e latency when operating legacy SCADA communication protocols over satellite. **Powerful and flexible traffic management** and link access configuration options optimize data throughput with minimum use of satellite spectrum.

Cyber Secure
TSAT operates as a closed private network totally isolated from public communications networks and the Internet. **Secure terminal authentication** and **AES-256 link encryption** provide higher levels of cyber security.

Smart Investment
Future proof technology for next generation utility networks

The TSAT 3000 Ku-band platform enables private networking at a low operational cost. It requires minimal initial capital outlay for HUB hardware. The platform is ideal for small- to medium-sized networks and integrates easy into existing communications infrastructure.

Capex friendly
Affordable narrowband technology versus broadband satellite systems, **low barrier to adopt.**

Opex friendly
Engineered to provide critical networking with **minimal space segment** requirements.

User friendly
Supports **legacy SCADA protocols,** integrates both IP/ETH and RS232 serial devices.

Market friendly
Designed for **SCADA/Telemetry** and related utility applications.

tsat

Trusted communication – anywhere

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SATELLITE SOLUTIONS FOR ENERGY AND NATURAL RESOURCE MANAGEMENT

TSAT 3000

TSAT 3000 TECHNICAL SPECIFICATIONS

Network Configuration:
Topology – SCPC, Star and Mesh
Data rates – 8 to 160kbps
Modulation – QPSK
FEC – Turbo coding 0.250 to 0.969
Access – outbound - TDM, inbound - TDMA, Enhanced Slotted Aloha and Slot Request & Reservation (DAMA/BoD)

Terminal Interfaces:
Tx– Type N , 950 to 1450MHz
Rx – Type N, 950 to 1450MHz
Serial data - 2 ports, RS232 DB9
Packet data - 2 ports, Ethernet RJ-45, Web based GUI for configuration and diagnostics
M & C – 2 ports, Serial RJ -11 for local and out-of-band management

Satellite Frequency support:
Ku and C - band – With appropriate ODU's
Ka band – Future option

Antenna size:
HUB – 1.8 to 2.4M
Remote – 0.75 to 1.8M

Protocols:
Packet switched – TCP/IP, UDP, RIPv2, ACL ICMP, Static Routes, cRTP, GRE
Circuit switched – Leased line, dial-up, and multi-drop (grouping)
SCADA – RP750, ADPL 180, Comli, Sinaut S1, Modbus RTU/IP/ASCII, DNP-3.0, WITS, Serck Proteus, IEC 60870 - 101 and - 104, IEC - 61850 etc.

Optimization:
RoHC, IP payload compression, serial protocol acceleration

Traffic engineering:
By application, by port (RS232), Min CIR, CIR (static and dynamic)

Others:
Automatic uplink power control, frequency and timing control, authentication, AES-256 link encryption

TSAT 3000 FEATURES AND BENEFITS

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