

UHP ADVANTAGES

Disruptive Technology for VSAT Networks

For decades operators of satellite data and multimedia networks were faced with a stark choice: either a low total cost of equipment (hubs and terminals) with a high cost of ongoing operation or a low operating cost (satellite capacity, network management) with high-cost equipment. UHP is a revolutionary technology recently developed by satellite network operators for satellite network operators. By using the most innovative networking algorithms in combination with the latest semiconductor technology, UHP optimizes **both** the cost of equipment and the operating cost. The advent of UHP spells end of an era for complex and expensive hubs in all but a small number of very large networks: the network hub from UHP is one compact unit that fits in the palm of your hand and can support up to 250 remotes. The network easily and seamlessly scales up to support many thousands of remotes. The UHP technology is uniquely easy to install and maintain. In summary, UHP is a truly disruptive technology that offers a fresh new thinking for the ecosystem of satellite networks.

Unique Versatility

Traditionally, VSAT technologies developed in three distinct directions.

- Medium to large size star networks with TDM/TDMA with high-complexity costly hub stations and low-cost remote terminals with low to medium throughput; mesh networking feature is often available in which case more expensive and complex terminals are used and a complex and expensive hub is still required to control the mesh connections.
- Small to medium size hub-less TDMA mesh networks; these are typically customized for specific applications; the terminals have high complexity and cost and medium throughput.
- Small to medium size MCPC/SCPC networks (star or mesh), including point-to-point links; the terminals have high cost and medium to high throughput.

Latest advances in digital signal processing, network engineering and semiconductor technology made it possible to bridge the gaps between the above three segments of satellite networking. UHP achieves just that. At the heart of the system is the UHP high-performance router developed by the UHP engineering team and optimized for networking over satellite.

The result is truly ground-breaking: **Hub that fits in the palm of your hand. UHP Satellite Router is an ultra-compact Indoor Unit (IDU) that consumes less than 10W and can be configured as a Hub or as a Remote Terminal in a star network or a Master Terminal in a fully meshed hub less network.** Such a compact Hub can support up to 250 remote terminals or nodes. If the number of network nodes grows beyond 250, the hub in a star network becomes a combination of two or more IDU units. Provision of node redundancy in high-performance networks is also very straightforward.

UHP leverages most advanced software defined radio architectures and processing platforms to produce a uniquely versatile solution. Software re-configuration of any UHP Satellite Router is carried out by activating a software key. The Network Operation Centre (NOC) can activate the key remotely via the satellite link. For example, any terminal in a star network can be easily upgraded to become a network hub i.e. a node that concentrates some or all of the traffic emanating from the other terminals.

Such flexibility greatly simplifies operation of the network equipment as well as provides unparalleled opportunities for future growth and expansion.

Ease of Support and Maintenance

Many operators are used to traditional network hubs that comprise multiple “boxes” with expensive and potentially unreliable cable or backplane connections. Typically many of the hardware or software modules are acquired by the VSAT equipment vendor from different suppliers, hence the different and hard-to-manage obsolescence cycles and feature release plans. In addition, the integrated product in the traditional Hub and network solutions prove so complex to install and maintain that even many volumes of in-depth operating manuals are not sufficient for the operator. Hence the requirement for lengthy and costly training courses and the need to have an expensive support contract from the vendor even for a simple reconfiguration or troubleshooting of equipment-related problems.

None of these problems exist with the UHP technology that offers **an elegant and simple, single-vendor and in many cases single-unit architecture of the Hub**. The UHP design team has many years of hands-on experience in installation, commissioning and operation of satellite networks across a range of topologies and applications. That is why the product lends itself in a unique way to an **easy installation and set-up and seamless maintenance of the network, ensuring superior reliability and availability**.

To start with, there is just one hardware device (UHP Satellite Router) to learn, install and manage, and hence only a single component to be held in stock of spares for the entire network.

The single-board architecture of the UHP Satellite Router guarantees superior reliability of the product.

The Network Management Software (NMS) interface is simple and intuitive, with a good breadth of performance characteristics represented.

The system manual is only 57 pages long. It is found to be fully sufficient for autonomous operation of the network by the vast majority of UHP customers.

Should the customer require a more in-depth familiarity with the UHP technology, customized technology transfer programs are also available and can be easily implemented due to a simple and transparent design of the UHP product.

Lowest Total Cost of Ownership

UHP VSAT platform ensures the best total cost of network ownership for the vast majority of network sizes and topologies. It minimizes both Capital Expenditure (CAPEX) and Operating Expenditure (OPEX). CAPEX is minimized due to the industry-lowest cost of the network Hub combined with a very competitive pricing for remote terminals. The UHP solution has at least 30% advantage in CAPEX cost compared to competing VSAT vendors for networks comprising from one terminal to a few thousands of terminals. Such a major advantage is attributable to superiority of UHP’s latest-generation technology. The price comparison was made in various projects and case studies for straightforward equipment sales, without any implied obligatory services or features restrictions.

The industry-lowest OPEX is achieved by optimizing utilization of satellite capacity. The latter is the most expensive component of most VSAT networks. Satellite bandwidth required for a given traffic model depends on a number of network parameters: bandwidth allocation, or scheduling, algorithm, signaling overhead, modulation, Forward Error Correction (FEC), encapsulation as well as on performance of the satellite modems (receivers/demodulators). Most VSAT manufacturers claim to support modern modulation and coding techniques; however they typically do not disclose the overall bandwidth efficiency of the network and of each link. In contrast, UHP Satellite Routers were designed to achieve the best utilization of satellite capacity. The designers achieved that goal by relentlessly focusing on the overall end-to-end spectrum efficiency in the network and by using several ground-breaking, innovative design concepts. More details on how UHP optimizes utilization of satellite resource are given hereafter.

Eb/No performance of demodulators

Signal to noise ratio (Eb/No) required in order to achieve a given bit error rate (BER) is a fundamental metric for determining performance of any demodulator. Lower Eb/No for a given BER means better efficiency of satellite capacity utilization.

Many of Forward Channel, or Outbound, demodulators (SCPC/MCPC) in modern VSAT networks are based on the same DVB-S / DVB-S2 chip-set, thus the performance of Forward Channel demodulators is more or less similar regardless of the manufacturer. However, performance of Return Channel, or Inbound, demodulators (TDMA) varies widely from manufacturer to manufacturer. UHP Satellite Router is first in the industry to implement the most advanced LDPC FEC coding for TDMA Return Channels. The Eb/No required for BER=10⁻⁷ is only 4.2 dB (QPSK, FEC=2/3). This is 2 dB lower than Eb/No required for the same BER in some competing systems based on Reed-Solomon/Viterbi FEC and approximately 1 dB lower than the corresponding Eb/No for many other competing technologies that make use of Turbo coding. The lower Eb/No required in the UHP Return Channel demodulator in the UHP network translates into up to **40% extra gain in satellite capacity compared to many competitive technologies.**

Bandwidth Efficiency in the Forward Channel

UHP Satellite Router transmits data over Forward Channel by using the original IP packets, with an extremely low encapsulation overhead. Compared with traditional DVB-S / DVB-S2 systems, where the size of a data segment in the link is tied to a MPEG/ATM cell size, this approach **gives a significant efficiency gain of 30% or more**, depending on the size of IP packets.

Bandwidth Efficiency in the Return Channel

Most methods for dynamic bandwidth allocation in satellite networks are based on a variant of Time Domain Multiple Access (TDMA). Efficiency of a TDMA system depends on its frame structure, packet overhead/preamble size as well as on performance of the scheduler/radio resource manager i.e. its ability to quickly and efficiently allocate every single element of available capacity to useful data traffic, avoiding wasteful protocol conversions, data “paddings” and retransmissions. The innovative TDMA algorithm implemented in the UHP system comes close in its performance to the theoretically possible upper limit of TDMA efficiency. Fast and efficient polling and reservation methods, versatile encapsulation and nearly-zero packet overhead in the Return Link are among innovations in the UHP system design, that contribute to the nearly optimum performance of the system.

Compared with a “clear channel” SCPC channel, UHP TDMA algorithm provides up to 96% efficiency of channel utilization in all modes of operation, as measured by a number of independent testers. The “clear channel” comparative test is believed to be the most meaningful and accurate way of measuring bandwidth efficiency in a multi-point network. The highly efficient **UHP TDMA algorithm ensures up to 15-30% advantage in bandwidth utilization over competing VSAT systems.**

Bandwidth friendly and scalable technology

One of the most remarkable features of the UHP technology is its ability to support low symbol rate carriers, ensuring lowest OPEX of low-traffic networks (e.g. SCADA). For example, **a network with 250 Full Mesh terminals or a Star Network with 250 limited throughput nodes can be deployed just in 130 kHz of satellite bandwidth.** At the same time the system is highly scalable when traffic demands are growing. This is another feature that makes the UHP technology unique, with unrivalled performance in terms of both bandwidth efficiency and scalability.

Incredible throughput

UHP Satellite Router **is capable of receiving and transmitting IP data with rates up to 85 Mbps in SCPC or TDM/SCPC modes and up to up to 6.5 Mbps in TDMA mode.** These are sustainable IP throughput values **measured at the user LAN port.** Terminals with such maximum throughput can be used in broadcasting networks with heavy content, e.g. IPTV and HD SNG. Powerful built-in IP router is also fully adequate for such traffic Satellite Router and **capable handling up to 20 thousands packets per second.**

Ultra-fast network startup and recovery

Frequent occurrence of power interruptions (blackouts and brownouts) is one of the challenges to service provision in rural areas with poor infrastructure. Therefore, recovery time of satellite terminals after such an interruption is an important indicator of the quality of service and as a result, of the customer satisfaction.

Modern VSAT systems recover within a few minutes, but UHP sets a new standard: the **average time to restore the service after a complete network reboot (including the Hub) is only about 20 seconds!**

In addition, such ultra-fast startup makes very efficient use of the UHP routers in applications with episodic, low-intensity traffic and with alternative power sources (solar-power pay phones, access points, etc.). In the idle state UHP terminals can be switched off to save energy, only to be “woken up” very quickly when there is data to be transmitted. And by the way, the power consumption of the UHP router is only 10 Watt!