PRODUCT PORTFOLIO

- Universal carrier-grade VSAT ground segment technology for GSO and NGSO satellites
- All network components, including Terminals, Hubs and Network Management System
- Universal topologies (P2P, star, tree, mesh, full mesh) and waveforms (SCPC, SCPC-DAMA, TDM, TDMA)
- Compatibility with any standard L-band RF equipment and C, X, Ku, Ka band satellites
**UNIVERSAL HARDWARE PLATFORM**

- **One-for-all** technology: Software-Defined Functionality
- **Made for HTS** VSAT with support of multiple beams and frequency bands
- Efficient **DVB-S2X** MODCODs and highest **TDMA efficiency: 96% vs SCPC**
- **Mesh** capability: eliminate double bandwidth allocation due to double hop
- Layer 3 routing architecture and **Layer 2 bridging mode**
- Superior IP router **productivity** and rich set of supported protocols with QoS
- **NMS** with support of **VNO** and **API** for interfacing with OSS/BSS, etc.
- Smallest, lowest power consumption, most **reliable** IDU
- The most versatile and lowest-cost hub with **M:N local/geo-redundancy**
SOFTWARE DEFINED VSAT

Universal Hardware Platform + Software-activated Features = AVAILABLE IN DIFFERENT HOUSINGS

Remotely activated and transferable

Available in different housings

Software-defined VSAT

UHP NETWORKS - PROPRIETARY
SCALABLE HUBS

Mini Hub
- Up to 30 Msp's Outbound (OC)
- Up to 2000 terminals
- 4 channel MF-TDMA max

Standard Hub
- Up to 64 Msp's Outbound
- Up to 500k Terminals
- Up to 250 MF-TDMA Inbounds

HTS Hub
- Multi-spot Hub
- Universal Controllers & Dynamic Licenses
- Local/Geo Redundancy

Wideband Hub
- Up to 200 Mps Outbound
- Multiple OC per carrier
- Local/Geo Redundancy

CAPEX- FRIENDLY:
SCALABILITY WITHOUT HARDWARE REPLACEMENT
NETWORK MANAGEMENT SYSTEM

Standard Server (Ubuntu) + Proprietary Software + Software-activated Features = UHP Network Management System
NEW SOFTWARE RELEASE V3.6

- **WIDEBAND HUBMUX**: HTS–based networks with multiple services in one wideband carrier
- **MOBILITY**: Communication on the move with roaming and GXT maps support
- **ADVANCED WAVEFORMS**: 11 Msps TDMA, more TDM MODCODs and load balancing
- **ENHANCED NMS**: Updated and accelerated NMS with footprints and tracking of mobile terminals
Aggregation of multiple TDM/TDMA and SCPC networks in a single wideband carrier
- Dedicated bandwidth and full traffic isolation of embedded networks
- Efficient multiservice use of HTS capacity and new dimension of VNO cooperation
- VSAT HUB virtualization with SW-activated pay-as-you-grow functionality
- 1U Rack-mountable wideband satellite router
- DVB-S2X ACM modulator with 5%-20% roll-off
- QPSK – 256APSK modulations
- Symbol rates: 300 kps – 200 Msps
- HubMux feature with support for 4 subnetworks
- 650 Mbps aggregate throughput per carrier
- Hot-standby 1:1 redundancy option
DVB-S2X ANNEX M TIME-SLICING

- Operation in wideband mode, without requiring a full-speed decoding of the total carrier capacity
- Suitably mapping the transmitted services in multiple time-slices (bursts)
- A time-slicing burst (identified by a TSN) corresponds to one PL-Frame
- Terminals select and decode a specific stream (time-slice) carrying one or more service(s) within its performance capabilities, while discarding the other streams and services of the wide-band carrier
- Hub’s Slice Controllers (may act as SCPC or OC) prepare PL-Frames with unique TSN and deliver it to HubMux wideband modulator via GBE LAN
- HubMux modulator transmits the bursts (time-slices) within a single DVB-S2X carrier
- The return channels are associated with the respective slice controller and transmitted in a standard way via separate carriers
Advantages

- Single-signal transponder operation
- Increased Hub performance
- Multiple services in the same carrier
- Multiple networks with traffic isolation
- Diversification of applications and customers
- New VNO business model with virtual Hubs
- Pay-as-you-grow Hub infrastructure
- Multi-vendor opportunities due to open DVB-S2X Annex M standard

Applications

- High-performance TDM/TDMA networks with slicing and load balancing
- Ultra high speed SCPC channels for GSO and NGSO satellites
- Multiservice VNO networks with dedicated virtual Hubs and traffic isolation
- Support of GXT coverage maps
- Preloaded coverage maps in terminals
- Location-based make-before-break beam switching
- Priority of overlapped beams
- Network roaming without pre-dedicated bandwidth
- Tracking of mobile terminals
ADVANCED WAVEFORMS AND ACCESS SCHEMES

**TDM**
- Support of short and normal frames to optimize network efficiency
- More MODCODs for better utilization of satellite bandwidth
- 8 ACM channels for TDM carriers to increase service availability and performance
- System and user data AES-256 radio-channel protection

**TDMA**
- 100 kbps – 11 Msps TDMA symbol rate for high-throughput TDM/TDMA and Hubless TDMA networks
- Slotted-Aloha network entry for roaming or long-time inactive terminals
- Dynamic load balancer for MF-TDMA groups
- System and user data AES-256 radio-channel protection
SLOTTED-ALOHA NETWORK ENTRY

- Roaming Hub controller allows terminals to enter a new network without having the predetermined slots.
- TDM/TDMA Hub allocates common Slotted Aloha bandwidth in the first TDMA carrier.
- Newly arrived terminals can request roaming to this network through such common Aloha slots.
- Random retransmissions in case of collisions.
- If roaming is granted, terminal will start receiving standard predetermined slots as usual.
- The hub will not allocate slots to terminals that have switched to another network or are inactive.

![Diagram of SLOTTED-ALOHA NETWORK ENTRY](image)
TDMA LOAD BALANCING

- NMS-based controller that is distributing network terminals across multiple Inroute TDMA controllers (standalone and MF)
- This ensures no single Inroute controller bears too much average traffic demand (average demand / capability ratio)
- Configurable max demand threshold and load difference to trigger the balancing process
- Balancing is done by changing the assigned Rx controller for terminals with longest uptime or low traffic (configurable)
- One network may have a few Load Balancing controllers with different strategies
Support for HubMux and Slice Controllers
Footprints, roaming and tracking of mobile terminals
64-bit operating system and x64 architecture
Improved productivity and response time
Ability to use a separate disk for statistics
Hot-standby 1:N NMS server redundancy
Bug fixes and increased reliability
KEY FEATURES

UNIVERSAL HARDWARE PLATFORM
SOFTWARE DEFINED NETWORK

- Universal routers for all network roles
- Dynamic SW-definable mode of operation
- Quick and easy transfer/swap of the functionality SW licenses
- Reduced CAPEX for spare parts and network upgrades
- Quick and easy field replacement and change of network topology

- Powerful L3/L2 router with 190 000 pps
- Mesh: eliminate double bandwidth allocation
- Multiple configuration profiles
- Embedded Computer for advanced applications and traffic processing
- Sophisticated QoS with VLAN management and built-in 2G, 3G & LTE backhaul optimization
BANDWIDTH EFFICIENCY

- Dual DVB-S2X 500 Msps demodulators with separate IF inputs
- QPSK - 256APSK MODCODS with ACM
- Integrated high-speed DVB-S2X modulator for SCPC return channel
- Proprietary encapsulation with 99% efficiency and advanced QoS
- Up to 20% savings on bandwidth

- Multichannel MF-TDMA LDPC demodulator
- 12 MODCODs with QPSK, 8PSK & 16APSK
- Symbol rates up to 11 Msps/terminal
- Hubless and Mesh topologies
- Highest TDMA efficiency of 96% and flexible frame structure
- Alternative Slotted Aloha network entry
MULTI-SPOT HTS HUB

- Designed for multi-spot HTS networks
- Based on low-CAPEX universal controllers
- Required functionality is activated by SW license as network develops
- Easy SW license transfer between teleports, beams and satellites
- Cost-effective scalability up to 64 spot-beams and 500,000 remotes

- Self-healing hub architecture
- Dynamically assigned network roles
- Automatic M:N local and geographic redundancy
- M:N site diversity with multiple teleports for increased availability
- Saves over 40% of Hub CAPEX due to functionality SW license reuse
Hierarchical topologies with basic STAR remotes
Single-hop connectivity with Hub and Gateway
Unlimited number of Gateways
High spectral efficiency of all TDM channels
Compatible with multi-spot and dual-band HTS
>50% CAPEX savings compared to Mesh network
QUALITY OF SERVICE

- Classification of IP packets
- Customized action rules
- Traffic policy manager
- Multichannel hierarchic traffic-shaper:
  - CIR – committed data rate
  - MIR – maximum data rate
  - MIR to CIR slope factor
  - Day/Night CIR change
- Multiple Tx priority queues with Class-Based Queueing
SATELLITE ROUTERS

UNIVERSAL HARDWARE PLATFORM
UHP-200 SERIES UNIVERSAL SATELLITE ROUTER

- Two DVB demodulators with separate IF inputs: up to 500 Msp s DVB-S2X ACM with modulations up to 256APSK
- 4-channels TDMA demodulator: 0.1 … 11 Msp s LDPC ACM; QPSK, 8PSK, 16APSK
- Return Channels (modulator):
  - TDMA: 0.1 … 11 Msp s LDPC ACM; QPSK, 8PSK, 16APSK
  - SCPC: 0.3…64 Msp s DVB-S2X ACM; QPSK - 64APSK
- Superior processing capability up to 190 kpps
- TDM/TDMA Star&Mesh&Hub, SCPC and TDMA Hubless
- Built-in adaptive hierarchic traffic shaper and QoS
- Switch with two Gigabyte Ethernet user ports
- Housings: compact [UHP-200]; board [UHP-210]; outdoor [UHP-220], rack-mountable [UHP-230]; dual rack-mountable [UHP-240]
- Two DVB demodulators with separate IF inputs: up to 500 Msps DVB-S2X ACM with modulations up to 256APSK
- TDMA Modulator: 0.1 ... 11 Msps LDPC ACM; QPSK, 8PSK, 16APSK
- Superior processing capability up to 150 kpps
- TDM/TDMA Star & Dual-Gateway
- Built-in adaptive hierarchic traffic shaper and QoS
- Switch with two Fast Ethernet user ports
- The same form factor as UHP-200
- Housings: compact [UHP-100]; board [UHP-110]; outdoor [UHP-120], rack-mountable [UHP-130]; dual rack-mountable [UHP-140]
NETWORK MANAGEMENT SYSTEM

- Support of multiple networks with different satellites or modes of operation
- Multiuser VNO access to divide global network infrastructure
- Full details on status, alarms, levels, traffic, terminals activity, weather conditions, etc.
- API interface to external OSS/BSS systems
- Group management and scheduled firmware update of network terminals
- M:N Local- and Geo-Redundancy of Hubs
- 1:N NMS Server Redundancy
TDM/TDMA MINI HUB

- Based on a single UHP-200 router in any housing
- Combined Outroute and Inroute controllers
- One DVB-S2X forward channel up to 30 Msps and 64APSK
- Up to four MF-TDMA channels 11 Msps aggregate
- Support for up to 2000 Star/Mesh terminals
- Hot-standby 1:1 local redundancy
- Permanent SW licenses only
- May operate without NMS
- Easily expandable to full-scale Standard and HTS Hubs


TDM/TDMA STANDARD HUB

- Based on UHP-240 dual routers
- Separate UHP router for each OC or IC controller
- Scalable design: up to 252 RTN channels and 500k Star&Mesh terminals
- FWD: TDM up to 64 Msps DVB-S2X ACM QPSK - 64APSK
- RTN: MF-TDMA up to 11 Msps LDPC ACM with QPSK, 8PSK and 16APSK
- RTN: SCPC up to 64 Msps DVB-S2X ACM up to 64APSK
- 5% & 20% roll-off for TDM, SCPC and TDMA
- Permanent SW licenses only
- Hot-standby local redundancy (1:1 OC & 1:N IC)
- NMS is required
UHP HIGH-THROUGHPUT SATELLITE HUB

- Designed for multi-spot HTS enterprise-class networks
- Support of: TDM/TDMA Star, TDM/TDMA Mesh and SCPC terminals
- Scalable design: up to 64 forward, 16k TDMA return channels and 510k terminals
- Independent IF interface for each FWD and associated RTN links
- Scalable throughput: from 0.2/0.1 Mbps and up to 14/5 Gbps per Hub
- FWD: TDM DVB-S2X ACM up to 200 Mfps with QPSK, 8PSK, 16APSK, 32APSK & 64APSK
- RTN: MF-TDMA up to 11 Mfps per carrier; LDPC ACM with QPSK, 8PSK and 16APSK
- RTN: SCPC DVB-S2X ACM up to 64 Mfps with QPSK, 8PSK, 16APSK, 32APSK & 64APSK
- 5% or 20% roll-off and efficient TDMA protocol
- Smart load balancing in FWD and RTN channels every 30-100 ms time frame
- Rich set of supported protocols with QoS, acceleration and compression
- Hot-standby M:N local and geographical redundancy
HTS HUB WITH DYNAMIC LICENSES

- One HTS NMS per multi-sat network
- Optional 1:N redundant servers
- One router for each universal controller (UC)
- Idle UC will act as a redundancy
- Required number of OC and IC licenses
- Common licenses for local- or geo-redundancy
- Support for multiple beams and satellites
- Easy scalability by new UC and licenses
- Smart Local- and Geo-redundancy
HTS HUB ARCHITECTURE

- UHP Hub includes one or multiple IF Groups
- Each IF Group uses a common IF subsystem with aggregate Tx and Rx ports (L-band 950-2150 MHz)
- Universal Controllers are the building blocks of the hub and can perform various Hub roles
- Optional wideband modulators with HubMux feature allow combining several slice controllers within a single wideband carrier (200 Msps)
- Network Management System dynamically assigns roles to the universal controllers, configures and monitors each network component
UNIVERSAL CONTROLLERS (UHP-240)

- Universal Controllers (UC) can perform one of the following roles:
  - Outroute Controller (TDM carrier up to 64 Msps)
  - Slice Controller (TDM or SCPC BBFrames for HUBMUX modulator)
  - TDMA Inroute Controller (MF-TDMA carriers, up to 11 Msps)
  - SCPC Inroute Controller (2 SCPC channels, up to 64 Msps)
- NMS manages all UCs and dynamically assigns licenses with appropriate configuration to build the defined Hub setup
- All UC without actual role are considered as redundancy units and managed by Local- / Geo- Smart Redundancy System
- Required licenses can be added as the network develops
HTS HUB: SELF-HEALING EXAMPLE

- **INITIAL SETUP**
  - Dynamic License Assignment
  - Standby Universal Controller
  - NMS stores all licenses

- **BACKUP**
  - Preemption by high-priority role
  - Failed UC

- **PREEMPTION**
  - Failed UC
  - Network bandwidth reduced, but operational

- **TDM**
  - MF-TDMA

- **IC[1]**
  - OC

- **IC[2]**
  - IC

- **OC[1]**
  - Failed UC
TOPOLOGIES

UNIVERSAL HARDWARE PLATFORM
SOFTWARE DEFINED TOPOLOGIES

P2P and Star

Mesh

Dual Gateway

Full Mesh
Advantages

- Bandwidth-efficient DVB-S2X MODCODs up to 64APSK
- L2 Bridge and advanced IP router with traffic acceleration
- High throughput up to 225 Mbps
- Automatic power level control and two-way ACM
- Dual Gateway feature for hierarchical topologies
- 1:1 automatic hot-standby redundancy
- Ultra-compact, reliable HW platform with low power consumption

Applications: Cellular backhaul, Network backup, IP broadcasting and data delivery, Satellite news gathering

Topologies: Point-to-point SCPC, TDM broadcast, TDM/SCPC network, On-demand SCPC-DAMA
Advantages

- Full-Mesh Single- or Multi-Frequency TDMA operations
- Innovative TDMA protocol with proven efficiency of 96% vs SCPC
- 12 MODCODS with QPSK, 8PSK, 16APSK modulations and ACM
- Up to four MF-TDMA carriers per channel to minimize BUC power
- Minimal BW requirement is just 105 kHz
- Ultra-low latency VSAT system with round-trip delay about 570 ms
- Up to 2040 terminals per network
- 1:1 Automatic Redundancy option

Applications: Air Traffic Control, Governmental/Defense, Video/Voice collaboration, Network backup

Topologies: Point-to-point, Full-Mesh, Star
### TDM/TDMA STAR & MESH

- **Advantages**
  - Star, Dual-Gateway and Mesh topologies
  - Highly-efficient MF-TDMA and DVB-S2X TDM with ACM
  - Bandwidth saving and latency reduction due to Mesh capability
  - Optional DVB-S2X SCPC and SCPC-DAMA return channels
  - Throughput up to 225 Mbps (190 000 PPS) per terminal
  - Layer 3 routing architecture and Layer 2 bridging mode
  - Support of VLAN, QoS, RT traffic, TCP acceleration, AES encryption

- **Applications:** Enterprise Networks, Broadband access, Cellular Backhaul, Satellite News Gathering, SCADA / M2M

- **Topologies:** Star, Dual-Gateway, Mesh
APPLICATIONS

UNIVERSAL HARDWARE PLATFORM
ENTERPRISE NETWORKS

- **One-for-all** technology: Software-Defined Functionality
- Highest **transmit capability** from remote: 225 Mbps
- Smallest, lowest power consumption, most **reliable** IDU
- **AES-256** encryption of user data and network management
- NMS with **API** for interfacing with OSS/BSS, etc.
- **Mesh** capability: eliminate double bandwidth allocation due to double hop
- **VNO** capability with hierarchical traffic shaper
- **QoS**: support for VoIP with cRTP header compression + Video over TDMA
- High availability: **Local-/Geo- Redundant** Teleports with Fast switchover
**BACKHAUL**

- **DVB-S2X bandwidth-efficient** modulation and coding
- **Scalability**: start with a SCPC link and SW migrate to a TDM/TDMA network
- Highest **TDMA efficiency**: 96% and fast BW allocation
- Highest **transmit capability**: 450 Mbps aggregate
- Extremely high processing capability up to **190K PPS**
- Robust **L2** interface can carry Metro Ethernet traffic, as well as **Layer 3**
- NMS with XML-based **API** for easy integration with OSS/BSS
- Sophisticated **QoS** with built-in 2G, 3G & LTE **backhaul optimization**
- **Field proven** with major Mobile Network Operators in the USA
BROADBAND

- Designed for multi-spot **High-Throughput Satellites**
- **HUBMUX** – multiservice use of wideband transponders
- High availability: **Local-/Geo- Redundant** Teleports with Fast switchover
- **DVB-S2X bandwidth-efficient** modulation and coding
- Highest **TDMA efficiency**: 96% and fast BW allocation
- **Slotted Aloha** network entry for periodically active terminals
- NMS with XML-based **API** for easy integration with OSS/BSS
- **Network-locked** terminals for aggressive subsidized business models
- Easy to use, reliable terminals with **ultra-fast start** on power on
MOBILITY

- Efficient MODCODs with ACM and **high throughput**
- Software-defined equipment with **TDMA and SCPC return channels**
- **OpenAMIP** and other proprietary protocols to interface with antennas
- Automatic **beam switching** with network roaming
- Support for **GXT coverage maps** with prioritization of overlaps
- **Doppler effect** compensation up to 1300 km/h speeds
- **Load balancing** of channels and beams with predefined priorities
- Satellite router board for **integration into antennas**
Universal network for content **contribution and distribution**

Effective **DVB-S2X broadcasting** up to 225 Mbps

Powerful **IP router** with Gigabit Ethernet ports

Dynamic **bandwidth allocation** for DSNG transmissions

**Mesh** capability: eliminate double bandwidth allocation

**QoS**, support for VoIP with cRTP header compression, TDMA with low jitter

**AES-256 encryption** of transmitted content

Best network availability: **Local-/Geo- Redundant** Teleports
MISSION-CRITICAL

- **One-for-all** technology: Software-Definable Satellite Router
- Dynamic topologies and **M:N redundancy**
- Ready for integration with **manpack** antenna systems
- **Ultra-fast start** and extended operational temperatures
- Superior network **Reliability and Survivability**
- **Ruggedized outdoor Hub** for field-deployable networks
- Support of C-, X-, Ku- and Ka-bands, including **HTS**
- **Ultra-low latency** VSAT system with TDMA Mesh topology
- Support of **OpenAMIP** and other protocols to interface with mobile antennas