romantis
Satellite communications

SATELLITE ROUTER

UHP-1000

USER MANUAL

SOFTWARE RELEASE 3.0

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1. Glossary

16APSK	16 Amplitude and Phase-shift keying or Asymmetric Phase-shift keying, (APSK), is a digital modulation scheme that conveys data by changing, or modulating, both the amplitude and the phase of a reference signal (the carrier wave).
8PSK	Phase-shift keying (PSK) is a digital modulation scheme that conveys data by changing, or modulating, the phase of a reference signal (the carrier wave).
AGC	Automatic Gain Control
BCH	BCH code is a multilevel cyclic variable-length digital error-correcting code used for correcting multiple random error patterns. BCH codes may also be used with multilevel phase-shift keying whenever the number of levels is a prime number or a power of a prime number.
BUC	Block Up-Converter is used in the transmission (uplink) of satellite signals. It converts a band (or "block") of frequencies from a lower frequency to a higher frequency.
C/N	Carrier-to-noise ratio, often written as CNR or C/N, is the signal-to-noise ratio (SNR) of a modulated signal.
CCM	Constant coding and modulation. DVB-S2 mode when MODCOD is not changed during channel operation.
COTM	Communication on the move.
CRTP	Compressed Real-time Transport Protocol, header compression of IP/UDP/RTP datagrams reduces header overhead.
DAMA	Demand Assigned Multiple Access. Channel establishment on demand.
DSCP	Differentiated Services Code Point (DSCP) is a 6-bit field in the header of IP packets for packet classification purposes. DSCP replaces the outdated IP precedence, a 3-bit field in the Type of Service byte of the IP header originally used to classify and prioritize types of traffic
DVB	Digital Video Broadcasting (DVB) is a suite of internationally accepted open standards for digital television.
Eb/N0	Ratio of Energy per bit (Eb) to Noise density (N0).
EIRP	Effective Isotropically Radiated Power.
ETSI	The European Telecommunications Standards Institute is an independent, non-profit, standardization organization in the telecommunications industry (equipment makers and network operators) in Europe, with worldwide projection.
FEC	In telecommunication and information theory, forward error correction (FEC) is a system of error control for data transmission, whereby the sender adds redundant data to its messages, also known as an error-correction code.
Hard priority	Method of transmission queues handling when packets from lower priority queue are not transmitted until all packets from higher priority queue are transmitted.
HTTP	Hypertext Transfer Protocol (HTTP) is an application-level protocol for distributed, collaborative, hypermedia information systems.
Frame	Sequence of time slot s. Number of slots is frame length . Repeated every ~100 ms while assignment of stations to slots can vary every frame.
Frame plan	TDMA service packet describing which station should transmit in which time slot . Generated ~10 times per second.
HUB	Central Station of satellite network that is managing all the stations and resources
Hubless	Special mode of operation when all stations are transmitting to one TDMA carrier and all receiving this carrier.
HW	Hardware
ICMP	The Internet Control Message Protocol (ICMP) is used by networked devices to send error messages indicating, for instance, that a requested service is not available or that a host or router could not be reached.
IESS	Intelsat Earth Station Standards
IFL	Connection from the indoor equipment (modem/router) to the outdoor equipment at the antenna normally involves two inter-facility (IFL) cables.
IGMP	The Internet Group Management Protocol (IGMP) is a communications protocol used by hosts and adjacent routers on IP networks to establish multicast group memberships.

Inroute	Channel from stations to hub.
IP	IP is the usual abbreviation for Internet Protocol.
LDPC	Low-density parity-check (LDPC) code is a linear error correcting code, a method of transmitting a message over a noisy transmission channel, and is constructed using a sparse bipartite graph.
LNB	Low-noise block converter installed at satellite antenna.
Local oscillator	Oscillator built into RF block converter (BUC or LNB). Value of LO is usually written on block enclosure or in datasheet.
Long frames	DVB-S2 frames 64800 bits long (including FEC). Require slightly lower C/N than short frames .
Master	Main station of hubless network. Master allocates bandwidth and performs stations acquisition.
MCPC	Multiple channels per carrier. All TDM carriers generated by UHP can be treated as MCPC. Even if they are called SCPC .
Mesh	Capability of station allowing to receive other stations via TDMA link.
MF-TDMA	TDMA working on several RF channels simultaneously. All MF channels work as one aggregate TDMA channel.
MODCOD	Modulation and coding mode of DVB-S2 transmission.
NMS	Network Management System
Node	Station of satellite network which is able to receive information directly from other network stations.
ODU	Out-Door Unit
Outroute	Forward TDM channel from HUB to stations.
QPSK	Phase-shift keying (PSK) is a digital modulation scheme that conveys data by changing, or modulating, the phase of a reference signal (the carrier wave).
RSV	Concatenated Reed-Solomon/Viterbi FEC used in DVB-S1 standard.
RF level	Absolute RF level of entire signal (carrier + adjacent carriers) expressed in dBm.
SCPC	Single Channel Per Carrier
Short frames	DVB-S2 frames 16200 bits long (including FEC). Advisable to use at lower symbol rates. Produce less delay than Long frames .
SNMP	Simple Network Management Protocol
SNTP	Simple Network Time Protocol (SNTP) is a protocol and software implementation for synchronizing the clocks of computer systems over packet-switched, variable-latency data networks.
SNR	SNR Signal to Noise Ratio" In analog and digital communications, signal-to-noise ratio, (S/N or SNR), is a measure of signal strength relative to background noise. The ratio is usually measured in decibels (dB).
SR	Symbol Rate
Star	Type of network with one central station (hub) and several peripheral stations.
SW	Software
TDM	Time Division Multiplexing. Access mode when streams for different users are mixed in one channel.
TDMA	Time Division Multiple Access. Access mode when channel is shared between users with allocatind time periods when each user is using the channel.
Telnet	Telecommunication Network (Telnet) is a network protocol used on the Internet or local area networks to provide a bidirectional interactive communications facility. Typically, telnet provides access to a command-line interface on a remote host via a virtual terminal connection.
TFTP	Trivial File Transfer Protocol (TFTP) is a file transfer protocol, with the functionality of a very basic form of File Transfer Protocol (FTP).
UDP	The User Datagram Protocol (UDP) is the set of network protocols used for the Internet. With UDP, computer applications can send messages, in this case referred to as datagram, to other hosts on an Internet Protocol (IP) network without requiring prior communications to set up special transmission channels or data paths.
Timestamp	Time format used by UHP. Plus sign at the begining (+HH:MM:SS or +NN d HH:MM:SS)denotes relative time from some event or UHP start-up. If UHP has time synchronized to hub or SNTP absolute time can be displayed. Time zone affects absolute time.
Time slot	Time interval for station transmission.

USB	USB (Universal Serial Bus) is a specification to establish communication between devices and a host controller (usually personal computers).
VLAN	A virtual LAN, commonly known as a VLAN, is a group of hosts with a common set of requirements that communicate as if they were attached to the same broadcast domain, regardless of their physical location.
VoIP	Voice over Internet Protocol (VoIP) is a general term for a family of transmission technologies for delivery of voice communications over IP networks such as the Internet or other packet-switched networks.
VSAT	Very Small Aperture Terminal" satellite earth station with small-size antenna
WFQ	Weighted fair queueing. Method of proportional division of bandwidth between transmission queues.
X-modem	Simple file-transfer protocol working through terminals and serial lines.

2. Hardware overview and functions

2.1 Interfaces and controls

Back panel of UHP has connectors for attachment of radio equipment cables, power and USB. It also has reset button.

UHP back view

Power connector (DC IN)
UHP-1000 router is powered with 24 VDC. AC Power supply adaptor is supplied with the set. The router can be powered from a DC power source (batteries, DC-DC converter), but the specific power supply mode should be agreed upon with the Manufacturer. Power supply connector features dimensions 5.5 / 2.1 mm (outer and inner diameters). Positive terminal of the source is on the center contact.

LAN interface connector
LAN connector is purposed for connecting to Ethernet switch using a straight cable. Bit rate 10 or 100 and duplex mode are software selectable. Indicators built into the connector mean the following: left one (green) - connection (Link) and data transmission (Activity), the right one - yellow) - activation of half-duplex mode.

USB Console
The console port provides local control of the device.

RESET button
Router reset is provided using this button. Also, using special combination of pressings this button allows router reset to factory settings.

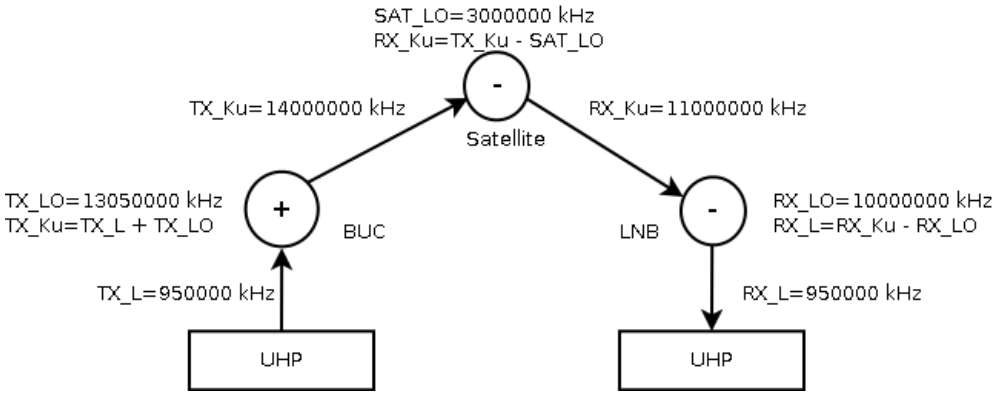
High-speed demodulator IF input (SCPC RX)
SCPC-RX is one of the two signal inputs to receive signals from the satellite (LNB). This input is designed to receive continuous (SCPC/MCPC) carriers in DVB-S and DVB-S2 formats from the satellite. 18 V DC LNB power can be output to this connector by UHP. Whether power source in on or off, the input can withstand external voltage up to 50 V (power supply circuit is provided with a diode). Power supply circuit is protected with a self-recovering thermal fuse operating in case of short circuiting. After short circuiting is removed it may be required to disconnect load from Rx inputs for several seconds so as to allow the fuse to return to its initial state.
Cable length and cable quality (losses level) can affect the quality and possibility of receiving signals.

Demodulator of the continuous signals is intended for reception of satellite channels transmitted by another UHP router only. On the physical level, transmission format complies with DVB-S and DVB-S2 standards but the channel information filling (encalsulation) is proprietary and incompatible with DVB - there are no PIDs, etc.

To receive signal (carrier) from satellite, it is essential to know at least four parameters:
- The satellite used in the network (antenna should be pointed to this satellite)
- Polarization (proper polarization should be selected on in the demodulator configuration or the receive converter on the antenna should be turned to the required position if its polarization cannot be switched over using its supply voltage)
- Carrier center frequency (enter its value in the demodulator configuration)
- Carrier symbol rate (enter the value in the demodulator configuration)

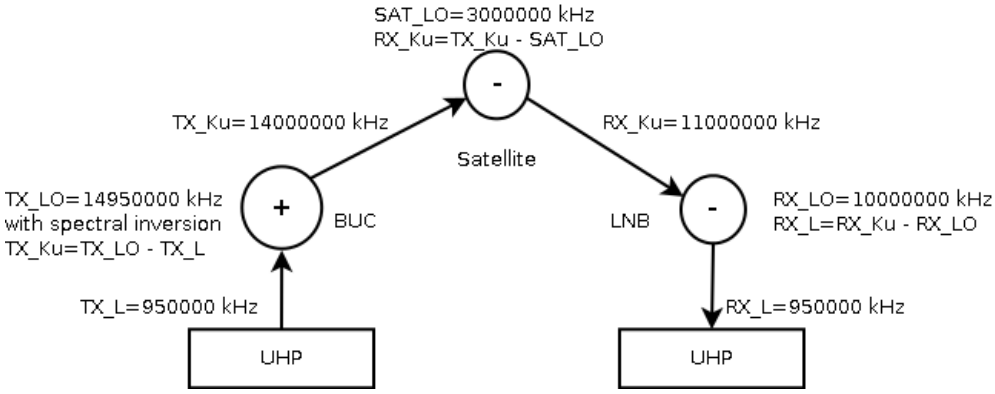
Channel frequency conversion
Satellite channel frequencies fall into five bands:
- Ka (24.0 GHz - 31.5 GHz) - frequency at which Ka satellites transmit and receive carriers
- Ku (10.7 GHz - 12.5 GHz) - frequency at which Ku satellites transmit and receive carriers
- X (7.2 GHz - 11 GHz) - frequency at which X satellites transmit and receive carriers
- C (4 GHz - 5 GHz) - frequency at which C satellites transmit and receive carriers
- L (950 MHz -2050 MHz) - frequency converted by the receive converter (LNB) and which is applied to the router's demodulator input

UHP itself outputs and inputs L-band frequencies. RF equipment attached to antenna - BUC transmitter and LNB receiver shift frequencies to fit them to ranges accepted by satellite.



Frequency conversion

Some BUCs and LNBs (most of C-band LNBs) use special conversion scheme having down-side frequency conversion with spectrum inversion. Inversion occurs when BUC LO is higher than required TX frequency. TDM demodulator can automatically detect spectrum inversion. TDMA demodulator cannot detect it itself and will not work if inversion is not switched on on modulator to compensate BUC inversion.



Frequency conversion with BUC spectrum inversion

Reception of the signal is done by receive converter (LNB). It performs two functions: amplification of the weak signals and converting them to signals at a much lower frequency called intermediate frequency or IF. When converting the frequency, frequency of the local oscillator (LO) is subtracted from that of the signal received by LNB from the satellite. LO frequency of various LNBs can be 10 GHz (professional converters), 0.975 GHz and 10.7 GHz (sat TV converters). LO frequency is usually written on the converter case label or in its Manual.
There are double-frequency (wideband) converters containing two LOs with different frequencies. These converters are switched over using frequency 22 KHz. UHP-1000 routers do not support 22 KHz control signals and cannot switch LO in such converters. If converter switches the LO using voltage of 13/18 V, the router will be capable of switching LO frequency.

Burst demodulator IF input (TDMA RX)
TDMA-RX is the second input for the signal from the satellite (LNB). This input is designed to receive bursts (TDMA) in UHP proprietary format. The input can also provide, from the router side, supply voltage 13 or 18 V, similar voltages being simultaneously fed to both inputs. The router can feed this input with a reference signal for using PLL LNB requiring external reference signal. When reference signal is switched off the router will not distort reference signal arriving at the input from outside. The rest conditions are similar to those across SCPC RX.

Warning: The total current consumed by external equipment through both RX inputs should not be in excess of 750 mA. Normally, current consumption by DRO LNB is 150 mA, PLL LNB - 500 mA.

Modulator output (TX OUT)

UHP-1000 modulator is compatible with most satellite transmitters/converters (BUC). Those incompatible are only transmitters that require to explicit "TX On" FSK command but such transmitters are extremely rare and are not widely employed.
Modulator is connected directly to the transmitter IF connector. Router provides 24 VDC power supply to the transmitter and 10 MHz reference signal. UHP-1000 is not provided with a separate protection on the transmitter power supply circuitry. Use is made of current protection for the power supply adapter. In case of a short circuit the router is de-energized and then gets restarted. If power supply is switched on in the configuration, restarts continue at 5 seconds interval until short circuiting is removed. Powering UHP via TX cable with 24V is possible.

Warning: Any operations with TX IF cable should be performed with 24 V supply voltage turned off. Otherwise, self-induction across a long cable can damage the transmitter and/or UHP. TX out output can feature 24 VDC with a high short-circuit current. Short circuiting can cause sparks and burns. This voltage can damage measurement equipment if it is not protected at its inputs. External voltage supplied to this connector will be "diode added" to UHP power voltage. Supplying negative voltage to center pin more than 24 V of positive voltage is prohibited.

3. State analysis

There are several sources giving information about UHP status and problems.

3.1 Front panel indication

UHP has six LED (Light Emitting Diode) indicators on the front panel. These indicators show status information and information flow through interfaces.

ERROR
"ERROR" red indicator makes it possible to infer about problems in the router functioning. The type of the generated problem can be judged by the number of indicator flashes:
1 - Demodulator cannot receive MCPC channel from the Hub or other UHP. Please check AGC value in the demodulator statistics to determine whether there is a signal from antenna (see description of reception problems) to separate LNB and cable faults.
2 - Router cannot receive TDMA configuration from the HUB (TDM/TDMA network mode). The reason can be in the non-availability of receive channel from the HUB, CRC errors during reception, wrong configuration of the station.
3 - Router cannot calculate time shift with respect to the HUB. The reason can be in the non-availability of reception or a large number of CRC errors during reception.
4 - HUB cannot receive signal from this station. Please check transmit signal level of the terminal, whether power supply and the reference signal for the transmitter are switched on (or off if required), whether DTTS or geographical coordinates are set correctly in the TDMA settings.
5 - Unit is in Backup state of Redundancy mode. Not an error.
Continuous signal with short dims means that the router has hardware or configuration errors, which can be viewed with the command `# show errors` .
If ERROR indicator is continuously lit upon power on it means hardware failure of UHP occured which prevents software from starting. Try to power it off and power on again or press RESET button on rear panel.

STATUS
"STATUS" green indicator indicates the router operation mode. This indicator is always flashing. If it does not flash it means that the router is not running properly (try to power off or reset). Slow flashing (once every second) means router normal operation. Faster flashing (3 times every second) means that a Telnet remote control session is established (in this case USB console does not operate until session is over).
Fast (6 times every second), simultaneous flashing of "ERROR" and "STATUS" indicators means that the router is functioning with the factory default configuration. Access to the router in this mode is possible either via USB of via IP-address 192.168.222.222 (mask 255.255.255.248 or /29).

LOCK
"LOCK" green indicator indicates whether the router receives a channel from the HUB. If there are CRC errors during reception of information from the channel (e.g. with weak signal from the antenna), the indicator extinguishes for a fraction of a second at every error. If there are too many errors the indicator may not glow at all in spite of the fact that the router receives the channel (in this case please check the router demodulator statistics).

TDMA
"TDMA" yellow indicator flashes every time a data placket is received via TDMA RX interface.

SCPC
"SCPC" yellow indicator flashes every time a data placket is received via SCPC RX interface.

TX
"TX" yellow indicator flashes every time a data placket is transmitted in the MCPC mode, and also a burst in the TDMA mode (bursts can be transmitted even if no data is transmitted inside them).

3.2 Faults

In the router software, there is an information block, which indicates any configuration errors. SYS event in HTTP interface and "ERROR!!!" message in console prompt appears if the router has any configuration errors:

There are three types of messages:
- Hardware errors.
- Errors associated with the wrong choice of software or router mode.
- Configuration errors.

Current errors can be displayed by clicking on link inside SYS event in using UHP telnet command `# show errors` .

Hardware errors inform about hardware problems with the router. Probably repair is needed.

RAM fail	Errors with router memory.
LAN fail	Errors with Ethernet interface.
FPGA fail	Errors in the programmable logic of router.
Demodulator fail	Errors with SCPC Rx interface.
Burst demod. fail	Errors with TDMA Rx interface.

Software or Mode of Operation errors indicate any mismatch between hardware, software and activated feature licenses.

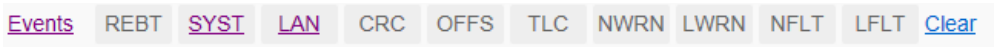
Unit mode not	This mode is not supported by active software. Change software type.
SW option missing	Activated mode required special SW feature license. Request option key from manufacturer.

Configuration error messages focus user's attention on the most important points in the router configuration, that may lead to instability of operation.

DVB-S2 RX not	DVB-S2 RX not supported. Change software type.
FEC cannot be used	FEC cannot be used. Select another modulator FEC (MODCOD).
Long frames cannot	Long frames cannot be used. Switch to short frames or change software type.
DVB-S2 16APSK	The maximum symbol rate limit exceeded for DVB-S2 16APSK. Reduce SR.
Burst duration too	Too low duration of TDMA time slots (less than 0.3 msec.). Increase slot length.
Frame duration	TDMA frame duration is outside the operating range: from 0.05 to 2 sec. Increase frame length.
Idle / down counters too low	Too low values for the status of IDLE/DOWN. Increase value(s).

3.3 Events

Events indicate critical conditions of UHP operation. Inducators are red if events are occurring now or yellow if events occurred before but now their state recovered. Icons remain yellow intil they are cleared with "Clear" link or until UHP is rebooted. Fault state of stations is transmitted to the hub and then to NMS (if any).



Events

REBT	UHP was rebooted. Self cleard after 30 seconds of operation.
SYST	System fault. See fault messages by clicking on link.
LAN	LAN interface is down.
CRC	CRC errors are occurring on TDM or TDMA RX interface.
OFFS	TDM RX frequency offset has reached 3/4 of search bandwidth . Carrier search can fail.
TLC	TX level driven by TLC has reached maximal allowed value.

Service monitoring generated events.

NWRN	Network side warning (high delay, improper speed).
LWRN	Local side warning.
LFLT	Local (station) side fault. No PING to specified host towards LAN.
NFLT	Network (hub) side fault. No PING to specified host towards hub.

4. UHP access for configuration

4.1 USB interface

When router is connected to a computer via a USB cable the computer creates a serial COM port. The port number can be found in the Device Manager. To access the port use can be made of either the OS-integrated terminal (Hyperterminal) or third-party terminal programs.
With the fist connection of UHP-1000 Router to PC the system will request the device driver. UHP.INF driver is available on CD with documentation or can be downloaded from our web site. In response to the request for driver you should refuse from search in Internet and select setting from the specified place where UHP.INF is saved.
The system will request confirmation for using a non-certified driver. Ignore any system warnings and proceed with installation. When finished, please check whether a COM port appeared in the Device Manager. If it is appeared you can start working with the router.
When working with the port from the terminal program the data rate and control parameters can be set to any value since they are ignored.

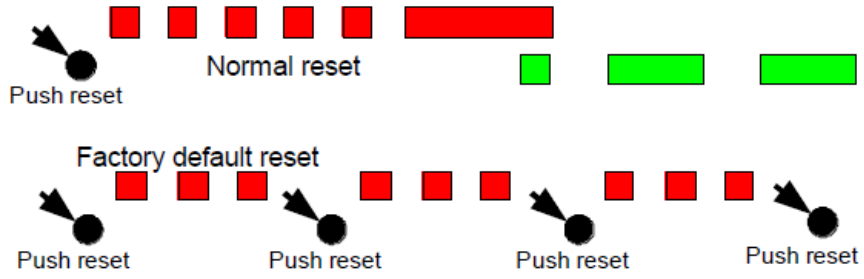
Note: With Windows usb protocol stack there is a peculiarity which leads to "hanging" of the usb-port if it carried an active session and the connected device (router) at this moment was rebooted. in this case you have to log out from the terminal program and log in again. you can avoid this by cutting off the session by "hang-up" command and only then restart the router using reset button or via power supply circuit.

4.2 Telnet interface

Remote access to the configuration can be performed using Telnet protocol. The connection can be provided to any of IP addresses that are set on the router. UHP-1000 supports simultaneously only one Telnet session. In order the hang session does not block access to the device forever in case on non-activity (pressing ENTER key), the router auto-terminates the session after a certain time of inactivity. The time can be set in the configuration, and by default it is 10 minutes.

4.3 Default configuration

By default, UHP-1000 router is configured with IP-address 192.168.222.222 with mask 255.255.255.248 (/29). Respectively, the computer should be configured with an address, e.g. 192.168.222.217 with the same mask.
Reset to default configuration can be made iither with command `# config load default` or with special reset button press sequence. Reset button should be pressed 4 times with ~2 second intervals.



Reset to defaults

Successful reset will be evidenced by fast and simultaneously flashing indicators ERROR and STATUS.
The default address is not shown in the route Table. And what is more, it disappears after the first saving of the configuration. Thus the first thing to do, with the Telnet access, is to set a new IP-address (it may be equal to the default address if needed), exit the session, and connect to the new address and only then save the configuration.
After the first saving of the configuration the ERROR and STATUS indicators stop flashing simultaneously.

5. Command interface

UHP has command interface suitable for initial routing setup, monitoring and diagnostics. Command interface works equally when connecting via USB or Telnet or via local serial console (available in OEM versions of UHP).
Telnet has precedence over USB and serial console. USB has precedence over serial console.
When opening a command session (Telnet of USB) the router can, depending on the configuration, request a password. If password is not set the commands can be entered immediately.
The system invitation starts with the router name (it is set using the relative command). Then enter "#" symbol in the administrator mode or ">" symbol in the user mode (user cannot change configuration).
Router commands include key words and parameters. All key words can be reduced to two letters. Letter case is unimportant. Wrong entered symbols can be edited by returning to them using Backspace key. "Left" and "right" arrows cannot be used for editing. "Up" arrow is used to recall commands used earlier.

Command syntax meaning
[ ] - optional parameter
x|y - selection of one of the key words, e.g. "on" or "off"
x-y - numerical value in the range from x to y inclusive
STRING - symbols string
IP_ADDR - IP address, e.g. 192.168.0.1
IP_MASK - IP mask in classical or CIDR form (255.255.255.0 /24 /32)

Note: IP address and mask must be separated by blank space - these are different parameters.

Full list of commands
Commands list can be displayed using `# help` . Most of commands have equal items in HTTP interface. Commands which do the things unavailable in HTTP or have additional modes are shown in **bold**.

```
UHP# help
          ----------  IP set-up
ip address IP_ADDR [1-4095]   - Add IP address to interface [VLAN]
ip route IP_ADDR IP_MASK IP_ADDR [1-4095]   - Add static route [VLAN]
ip delete IP_ADDR IP_MASK [1-4095]   - Delete IP address, route or map [VLAN]
ip update off|on   - Routing table update prevention
          ----------  System statistics
show profiles   - Show profile settings
show interface ethernet|serial|demod|modulator   - Interface stats
show system   - Show system parameters
show errors   - Show device errors
show memory ram|flash   - Show memory state
clear counters all|ethernet|demod|modulator|tdma|ip|redtl|prot   - Reset stats
          ----------  Protocol statistics
show ip [0-4095]   - Routing table and forwarding statistics
show arp   - ARP table
show rtp   - RTP header compression statistics
show snmp   - Display SNMP parameters
show dhcp   - Display DHCP parameters
show multicast   - Display multicast parameters
show acceleration   - TCP acceleration stats
show shaper   - Print Traffic Shaper statistics
          ----------  Satellite network statistics
show net   - Display network state
show stations traffic [1-2040]   - Display stations traffic statistics
show stations [1-2040]   - Show station statistics
show mf   - Show MF inroutes statistics
show tlc   - Show SCPC TLC statistics
show backup   - Show redundancy backup statistics
          ----------  Demodulator utilities
demod phase-graph   - Display phase constellation
demod bert qpsk|re|data   - Bit error rate meter
demod antenna [0-800] [0-800]   - Antenna pointing mode [RF min] [RF max]
          ----------  Overall control
admin   - Switch to Administrator mode
exit   - Log out from console
clear interface ethernet|demod|mod|tdma   - Reinitialize interface
```

```
clear arp-table   - Purge contents of ARP table
time set 0-24 0-60 1-31 1-12 0-99   - Set date/time  HH MM DD MM YY
unit key 0-15 [0-65535] [0-65535] [0-65535]   - Set features key
watchdog reset|interrupt   - Watchdog timer overflow action
reboot stop   - Stop delayed reboot
reboot [0-1000]   - Reboot device [delay in minutes]
run profile 1-8   - Run profile
network command 0-111111111 STRING   - Command to terminal(s) by SN
          ----------  Logging & debug management
show log   - Display logs
clear log   - Purge logs
logging interface|demod|config|system|tdma off|on   - Logging events
debug packets|arp|rtp|ping|igmp|dhcp|backup|otg|rip|tlc|smon off|on   - Debugging
          ----------  Diagnostics
ping IP_ADDR [1-1000000] [40-1500] [1-10000] [0-4095]   - IP Num Len Int/ms VLAN
traffic-generator off   - Disable traffic generator
traffic-generator IP_ADDR 1-50000 36-1470 [0-4095]   - IP Pps Len [VLAN]
          ----------  Controlled SCPC entry
dama 1-1000000 950000-1800000 100-32000 1-360 1-4 1-28 0-1 :SN FR SR LV MD MC MM
          ----------  Configuration and SW image management
tftp-server IP_ADDR 0-4095   - TFTP server access
configuration load default   - Load default configuration
configuration load tftp STRING   - Load configuration from TFTP
configuration save tftp STRING   - Save current configuration to TFTP
configuration load 0-1   - Load configuration from specified profile
configuration save 0-1   - Save current configuration to specified profile
image load tftp STRING   - Load image by TFTP to RAM
image load xmodem   - Load image with X-modem to RAM buffer
image load flash   - Copy image from flash to RAM
image write   - Write image from RAM to Flash
erase flash   - Erase flash bank
          ----------  Boot control
show boot   - Show software boot options
boot main 0-3 0-1   - Main boot profile FLASH_BANK(0-auto) CONF_BANK
boot temp 0-3 0-1   - Temp boot profile FLASH_BANK(0-none) CONF_BANK
boot fallback timeout 1-10000   - Temp image auto fallback period (min)
boot fallback stop   - Abandon auto fallback
          ----------  Help
help   - Print this help
```

6. HTTP interface

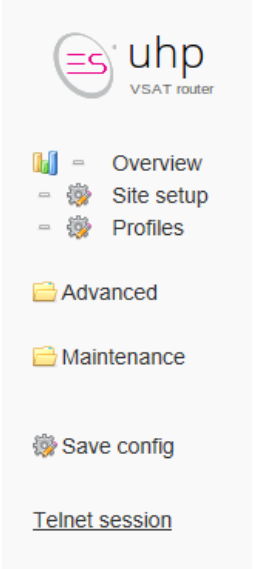
6.1 Introduction

UHP has plenty of control and statistics parameters which will be described further. Some parameters can have many discrete values which will also be explained. To classify different parameters special style conventions were implemented:

Style conventions

WWW field	Input field of WWW interface form changeable by user.
Output value	Statistics value displayed in WWW or Telnet statistics page.
Parameter value	Set of values of certail parameter.
# Telnet command	Command of Telnet interface.

6.2 Selection tree



Selection tree

- folder which can be opened
- control icon showing settings
- statistics icon showing real time statistics

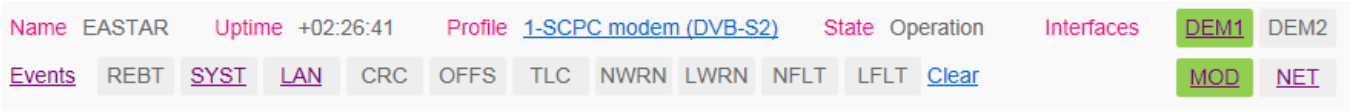
Some items can have both settings and statistics. When clicking on item titlecontrol information is opened by default.

Overview - overview of overall UHP state
Site setup - location, RF connections, frequency shifts
Profiles - 8 service profiles
Advanced - advanced settings
  IP routing - IP addresses, routing and bridging
  IP protocols - All IP service protocols
    ARP - ARP protocol MAC to IP address translation on LAN
    SNMP - SNMP protocol for external monitoring
    SNTP - SNTP protocol for time synchronization
    TFTP - TFTP protocol for software download
    DHCP - DHCP protocol for automatic IP address assignment
    RIP - RIP dynamic routing protocol
    RTP - RTP packets headers compression

Multicast - IGMP protocol for videoconferencing
Acceleration - TCP acceleration
COTM/AMIP - Interface to mobile antennas
Other - Other IP related settings
QOS - Quality of service settings
Policies - Filtration, prioritization rules for IP packets
Shapers - Rate limiting, guaranteed speeds
Realtime BW allocation - TDMA bandwidth requesting for rea ltime traffic
Service mon - Quality of service monitoring
Network - Network related settings and stats
Overview - TDMA protocol stats
Stations - Stations setup and stats
MF-TDMA - Multi frequency TDMA stats
ACM - Automatic coding and modulation stats
System - System parameters
Overview - General system stats
Ethernet - LAN mode and stats
Demodulator - High speed demodulator stats and pointing option
Modulator - Modulator stats
Time related - Time zone, console timeout
User access - Passwords
Flash/Boot - Software boot control
Save/Load - Configuration saving and loading
Maintenance - Maintenance utilities
Support info - Information printout for technical support query
Pointing - Antenna pointing screen
Network command - Issuing commands on stations from hub
Traffic generator - Configurable generator of IP packets
Save config - Saving current configuration to flash memory
Telnet session - Launch telnet session to UHP
>

6.3 Statistics frame

Statistics frame displays realtime information about UHP state. It is automatically refreshed every 5 seconds. In case of loosing a link to UHP browser can display error instead of information here. In this case user should refresh the page with browser "Refresh" button of F5 key. Some items of top frame are links to appropriate settings or stats.



Top statistics frame

Name	Name set in site setup
Uptime	Uptime since reboot in timestamp format
Profile	Currently running profile , format is number-type (title)
State	Current profile state
Events	Current status of events (red-current, yellow - historic)
Clear	Clear historic events
Interfaces	State of interfaces (green means interface is up)

Then events are listed. See state analysis chapter.

6.4 Main screen overview

Overview screen shows thorough real time statistics of software modules. It is automatically refreshed every 30 seconds. In case of loosing a link to UHP browser can display error instead of information here. In this case user should refresh the page with browser "Refresh" button of F5 key. Some items of overview are links to appropriate settings or stats. Screen consists of several sections. First three sections are always there, other section presence depends on current profile mode and activation of certain services. All information from sections is also available in extended statistics screens which can be opened from tree or from direct links in sections.

UHP overall information section

Refresh	SN: 3848	SW: UHP ACM S2 SCPC/Hub SW3	Ver: 2.9.6-D1 (Jan 18 2013)
CPU load: 5 %	Buffers: 1 %	Temp: 44 C	Profile: UP during +00:02:53 (35 runs)

Overview section

Refresh	Link for immediate refresh of the frame.
SN	UHP serial number.
SW	Currently running software type. Link to select software bank.
Ver	Currently running software version and its release date.
CPU load	Load of CPU in percent, loads above 60% are not recommended.
Buffers	Percentage of IP packet buffers free.
Temp	Internal temperature, range 0 to 60 is acceptable.
Profile	Duration of current profile state and number of runs so far.

Interface statistics section

Interface	State	Info	TX rate (bps)	RX rate (bps)	RX errors
Ethernet	Up	Link: 100/Full	9153	4166	0
Demodulator	Down	Lvl: - 80.0 dBm	-	0	0
Modulator	Down	Tx Lvl: - 0.0 dBm	0	-	-
Network	Down	Init	-	0	0

Interface statistics

Main operation information, traffic and errors for each interface are shown. Counters can be cleared in clear counters screen. For LAN interface link state is shown, for demodulator search information or reception quality, for modulator TX level and TLC state. For Network interface number of RX errors is a sum of all errors of all stations plus errors of TDMA protocol itself.

Network statistics section

This section appears only if current profile is hub profile. Section is divided into three colums showing statistics of stations, bandwidth allocation and TDMA protocol.

Stations		Bandwidth		TDMA	
Enabled	0	Total Req	0 (0 k)	BD RF M	- 77.0 dBm
Online	0	RT Req	0 (0 k)	FP lost	0
Active	0	CIR Req	0 (0 k)	TTS	0 us
Hub CN Low/High	0/0	Request Slots	0	TTS errors	0
Rem CN Low/High	0/0	Load	0 %	Act channels	0

Network statistics

Stations

Enabled	Number of enabled stations in stations table
Online	Number of online stations.

Active	Number of active station s which are requesting bandwidth.
Hub C/N low/high	Number of stations having 1 dB lower/higher C/N on hub than set hub TLC reference.
Rem C/N low/high	Number of stations having 1 dB lower/higher C/N on station than set remote TLC reference.

Bandwidth

Total Req	Amount of time slot requested by all stations (equivivalent traffic in kbps).
RT Req	Amount of time slots requested by all stations for realtime traffic.
CIR Req	Amount of time slots requested within shaper guaranteed speeds CIR.
Request slots	Amount of time slots allocated in frame for station bandwidth request
Load	Persentage of requests related to frame length can be >100% during overload.

TDMA

BD RF lvl	Total input RF level on burst demodulator input.
FP lost	Number of frame plan lost so far, increasing means packet drops.
TTS	Measured or set TTS .
TTS errors	Number of TTS measurement errors so far.
Act channels	For MF-TDMA number of active return channels.

Station section

Station									
Number	0	FP lost	0	DTTS cor	0 us	Frq cor	0 Hz	Lvl cor	0.0 dBm
Cur BW	0 (0 k)	Sum Rq	0 (0 k)	RT rq	0 (0 k)	Codecs	0	Timeout	0

Station section

Number	Number of station in the network.
FP lost	Number of frame plan lost so far, increasing means packet drops.
DTTS cor	Corrected value of DTTS after acquisition.
Frq cor	TX frequency correction after acquisition.
Lvl cor	TX level correction according to hub TLC settings.

Bandwidth

Cur Bw	Amount of time slot allocated now to this station (equivivalent traffic in kbps).
Sum Req	Amount of time slots requested by station.
RT Req	Amount of time slots requested by station for realtime traffic.
Codecs	Amount of realtime codecs assumed.
Timeout	Timeout counter of realtime bw requesting algorithm.

Traffic generator section

Traffic generator to 10.0.0.19	Ethernet bandwidth: 94400 bps	Sat. bandwidth: 83200 bps

Traffic generator section

This section appears only if traffic generator is activated. Generator settings are shown.

Redundancy section

Redundancy	Local state: BACKUP	Remote state: No reply	Flaps: 0

Redundancy section

This section appears only if redundancy is activated. Redundancy state is shown.

TLC section

SCPC TLC	RX cor: 0.0 dBm	Remote state: Rem_CN: 0.6	Rem comp: -12.4

TLC section

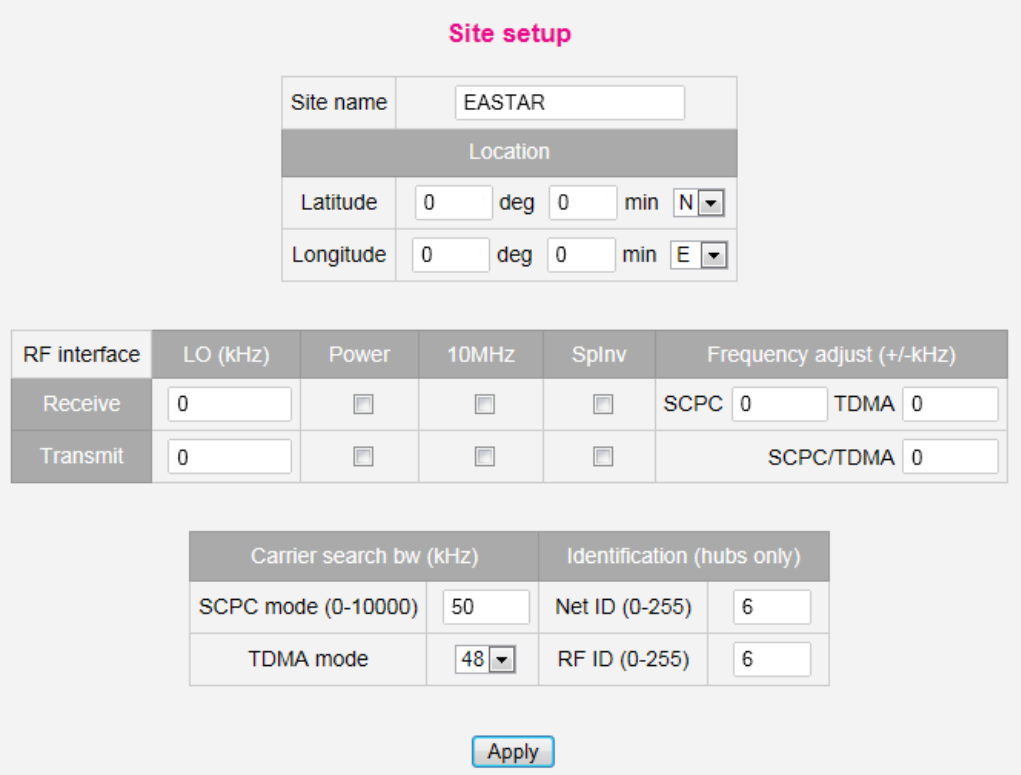
This section appears only if TLC is activated. TLC state and settings are shown.

NMS section

NMS section

This section appears only if NMS access is activated. Current NMS IP address is shown.

7. Site setup



Site setup

Site setup screen allows to configure UHP parameters related to installation site.
First unit name is configured. This name appears in top frame and in Telnet command prompt.

Location
Site georgaphical location is specified. Location is used in TDMA timing calculations for stations and neseserity of location setup depends on timing mode selected. By default location is required for proper TDMA station installation.

RF interface
Here parameters needed for proper functioning of antenna RF equipment are set. Compensations for RF equipment or satellite frequency shifts are also set here. Compensations of frequencies are needed to adjust actual RX and TX frequency values to adjust values supplied by hub.

Receive LO

Local oscillator of LNB. Obtained from datasheet. Typical values are 10000000 or 9750000 kHz. This value is usuallly subtracted (if spectral iversion is off) from all RX frequencies set in profiles or received from hub within return channel configuration to produce final L-band вњ– value of RX frequency set on demodulator 950000-2150000. If value is zero (by default) all frequencies should be set in L-band.

Critical: LO frequencies should either be properly set on WHOLE network or left zeroes on WHOLE network. Mismatch can result in completely wrong final frequency calculations, system faults, no service, carrier interference.

Transmit LO

Local oscillator of BUC transmitter obtained from datasheet. Typical values 13050000 or 12800000 kHz. This value is subtracted from all TX frequencies set in profiles or received from hub within return channel configuration to produce final L-band вњ– value of TX frequency set on modulator 950000-1750000. If value is zero (by default) all frequencies should be set in L-band. The same warning as in receive LO applies.

Power

Turns on LNB power 18V on demodulator or 24V power for BUC on modulator, see current limitations in specification.

10MHz	Turns on 10 MHz signal on burst demodulator connector or modulator connector.
SpInv	Spectrum inversion Setup on RX or TX. Wrong setting will terminate the service.
Frequency adjust	Signed adjustment figures for two demodulators and modulator.
Carrier search bw	Range around set frequency (+/-) where carrier search is done by demodulators. Widening range slows search, narrowing can result in faiiling to find the carrier.
Identification	Net ID and RF ID are set here allowing to dedicate UHPs to networks or satellites.

Warning: Applying settings in this form (even without changing) results in current profile restart.

Warning: When use is made of splitters and combiners for connection with radio equipment, it is essential that enough 10 MHz reference signal level on LNB and BUC be maintained. Conventional low cost and simplified dividers and adders introduce 5 to 10 dB attenuation. This attenuation usually does not create problems for RF signal, but 10M reference signal level may become insufficient, and this will lead to non-availability or instability of reception. It makes sense to use professional dividers to ensure reference signal passage without losses via one of the ports.

8. Profiles

8.1 Profiles basics

Profile is a set of settings needed to set up station or network service. UHP configuration includes 8 profiles. All of them are independent of one another. Each profile can be configured in any profile mode with appropriate set of settings.

Profiles

Num	Mode	Valid	Autorun	Check	Title	Run	Runs
1	SCPC modem	+	+		DVB-S2	*	41
2	Star hub	+			Config. 1	*	0
3	Star hub				Config. 2		
4	CrossPol test	+			CW mode	*	0
5	Star station						
6	MF hub	+				*	0
7	none						
8	Hubless station						

Profile list

Num	Profile number
Mode	Mode of operation, also a link to open profile settings
Valid	Whether profile is marked valid (configured)
Autostart	Whether profile can be automatically run by UHP (several profiles can be marked auto-startable)
Check	Not used now
Title	User set title
Run	Link for manually running profile
Runs	Number of profile runs so far

There is a corresponding Telnet interface command `# show profiles` which shows similar table plus information about currently running profile.

8.2 Profile running rules and profile operation states

Only valid profiles can be potentially run - protection from running partially configured or unwanted profiles. Only profiles with autostart will run on themselves upon UHP power on. Profiles without autostart set can be run only manually.

> **Warning:** Do not forget to make desired profile valid and autostart or it will not be rerun upon fail.

Running profile means switching software operation to mode set in profile, setting RF parameters and making all the rest to fully support selected profile mode. Only one profile runs at any given time. Profile can run through different states until it reaches last state "operation". There are 17 states which are switched sequentially however some states are omitted in certain profile modes (for example all TDMA states in SCPC modes).

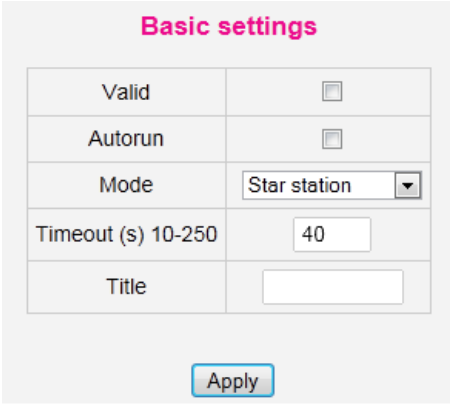
OFF	profile is inactive
Init	Initialization of UHP subsystems.
No config	(hubs) NMS mode selected but no configuration received from NMS.
Use config	Application of configuration.
Redundancy	Checking for redundancy state, waiting in redundant mode while other set operates.
Start RX	Turning on reception.

COTM stop	Waiting if mobile antenna has disabled transmission or did not supply location.
Start hub TX	Turning on transmission on hub.
Waiting for RX	Waiting for demodulator to lock in modes requiring reception.
Identify	Determining station number and inroute from hub control information set in hub stations table .
Get net config	Waiting for return channel configuration from hub.
Measure delays	Calculating TDMA timing information.
Start TDMA	Starting TDMA operation.
Start TX	Waiting if transmission is disabled by configuration or COTM antenna controller.
Acquisition	Starting to transmit special qcquisition bursts to hub.
Adjustment	Hub has seen transmission from station and is adjusting station frequency and timing.
Waiting stations	For hub modes waiting for at least one station to come up.
Operation	Final state. Successful profile operation.

Profile execution
If profile reaches operation state profile succeeds and continues running indefinitely or until some events depending on mode occur requirinn profile to fail - carrier down, all stations down, ... Some states require certain conditions to proceed further to next state (example - SCPC or TDMA reception in "Waiting for RX" state. If at some intermediate state required conditions are not met during user specified timeout profile also fails.

Profile auto-switching
If profile fails UHP looks sequentially through all subsequent profiles. If it finds another profile with autostart this profile is run. After ending with profile 8 system loops to profile 1 and continues profile scanning until any autostart profile reaches operation state.

8.3 Basic profile configuration



Basic profile settings

Profile configuration consists of several tabs with parameter sets. List of available tabs is under profile title.
Set of tabs depends of profile mode. Examples:

First and always existing tab is "Basic". This is a main profile parameters tab.

Mode	Profile mode.
Valid	Whether profile is valid (fully configured and usable).
Autostart	Whether profile can be automatically run by UHP (several profiles can be marked autostart).
Timeout	Timeout value counted down during profile state wait. If any state is waiting longer profile is assumed to fail.
Title	Profile title to show in statistics.

Station modes

none	profile not configured
SCPC Modem	SCPC / MCPC TDM modem
Star Station	Station of star (including MF-TDMA)network
Mesh Station	Station of star network with mesh capability
Hubless Station	Station of hubless network
DAMA Station	Station of DAMA network

Test mode

Pure Carrier	Test mode producing unmodulated pure carrier for cross polarization or spectrum purity testing

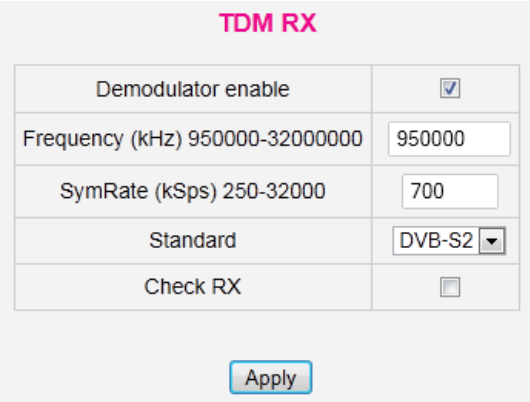
Hub modes

Star Hub	Hub of star TDMA network
MF Hub	Hub of MF-TDMA network
Outroute	Forward channel transmitter of star network outroute channel
Inroute	Return channel receiver of star network inroute channel
MF Inroute	Return channel receiver of star network multifrequency inroute channel
Hubless Master	Hubless network master control station
DAMA Hub	Hub for DAMA MCPC network
DAMA Inroute	Return channel receiver for DAMA MCPC network

Note: Changing profile mode clears entire profile settings loading default parameters and also clears valid and autostart flags.

Note: Pressing "apply" button in any profile tab (several exceptions noted further) even if settings were not changed re-runs profile if it is currently running. If other profile is running it continues to run.

8.4 TDM/SCPC RX

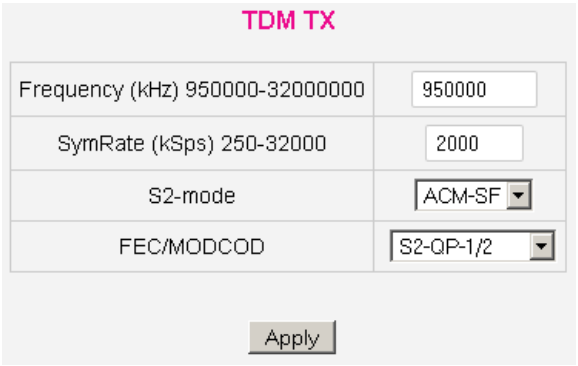


TDM RX

This tab controls TDM/SCPC demodulator RF settings.

Demodulator enable	Enable demodulator operation. This field is omitted in mode where demodulator usage is not obligatory.
Frequency	Receive center frequency.
SymRate	Receive symbol rate. See limitations for S1/S2 standards in specification.
Standard	DVB-S1 / DVB-S2 mode switching.
Check RX	Forces check of reception presence. If no carrier is received profile execution will wait in state Waiting stations If RX is not checked profile will pass to operation .

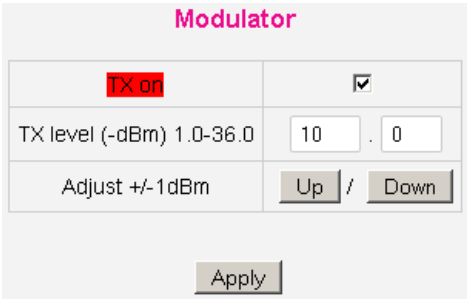
8.5 TDM/SCPC TX



TDM TX

Frequency	Transmit center frequency.
SymRate	Transmit symbol rate.
S2-mode	Data encapsulation and framing mode for DVB-S2. Ignored in DVB-S1 mode. CCM mode is compatibility mode with older non-ACM boards. ACM-LF - ACM mode with long frames ,ACM-SF - ACM mode with short frames
FEC/MODCOD	FEC selection for DVB-S1, MODCOD selection for DVB-S2.

8.6 MODULATOR

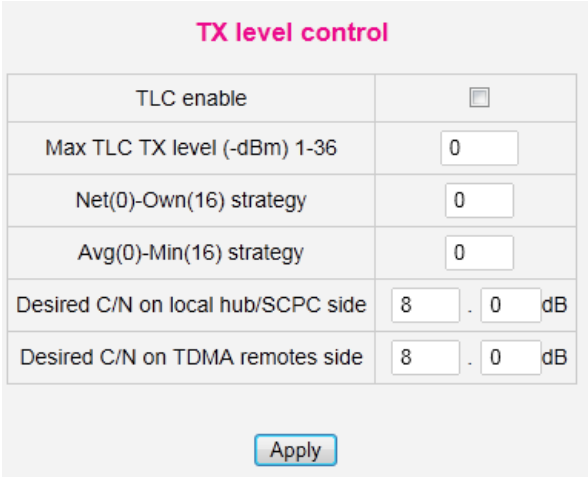


MODULATOR

TxOn	Allows transmission on modulator.
TX level	Transmit level (set level) of modulator. Expressed in negative dBm. Actual transmit level can be changed by TLC algorithm if enabled.
Adjust	Two buttons allow to adjust level in 1 db steps.

Note: Changing level by buttons or altering value does not restart profile if edited profile is running. Changing TxOn value restarts profile if it is running now.

8.7 TLC



TLC

TLC - transmission level control allows to adjust local transmission level based on information about reception quality on remote side. Goal of TLC algoritm is to provide desired "reference level" (C/N on remote side. Reference must be selected to allow error free reception. Reference should be at least 0.5 dB higher than threshold C/N. Upper value is not explicitly limited. Generally TLC algorithm is supplied with deviation between reference and actual reception levels on remote side(s) and adjusts local TX level to reduce this deviation to zero. Source of deviation value depends on operation mode

SCPC TLC

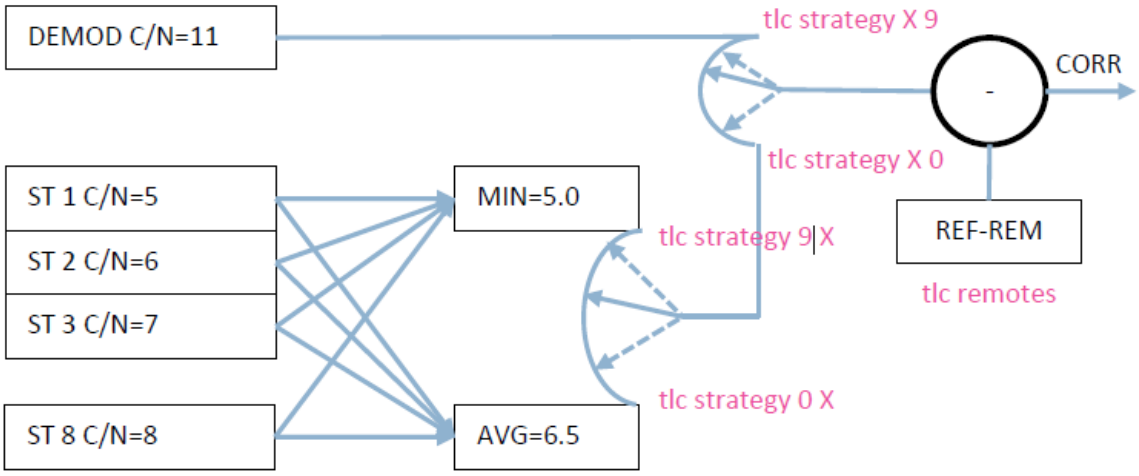
In point to point (SCPC) modes reference level is specified on remote side. Deviation is calculated as actual deviation on remote side and transmitted to local modem via IP protocol. Operation of TLC can be unidirectional or bidirectional. TLC shares protocol with NMS so both parties should have configured passwords and other data required for information exchange.

Hub TLC in network modes

In network modes (star, hubless, DAMA) desired levels of both local (hub) and remote (stations) sides are specified on the hub. Hub adjusts its TX level based on C/N information supplied by remotes via TDMA service protocols. No need to configure anything on stations for C/N level transfer to hub - it is accomplished automatically.

Hub also reports deviation between desired reference level on hub and actual reception level of each station to this station. If TLC is enabled on stations they can use this information to adjust their TX levels.

For regulation of hub TX level, deviation calculation is more complex as it involves averaging of multiple remote C/N values. Sometimes it can be desirable to preserve some average optimal level on stations, sometimes it is required to provide even the worst receiving stations with enough C/N. Sometimes it is desirable to regulate TX level based on own self-reception only. To cover all this cases strategy mechanism is used. Strategies allow to fine tune TLC operation of hub.



TLC strategies

The level of transmission of point-to-point SCPC links can be automatically adjusted to ensure proper reception of the receiving side of the link. The predefined level set on receiving station is continuously compared with current level and transmitting site in notified about such difference. Is TLC feature is activated on transmitting site it will try to adjust the level

to ensure optimal level of reception on the receiving site. TLC can be activated for both or just one direction of duplex SCPC link. In contrast to TLC in the TDM/TDMA networks and HUBLESS TDMA, SCPC TLC parameters are transmitted between stations over UDP, which allows you to send them both via satellite and by terrestrial networks.

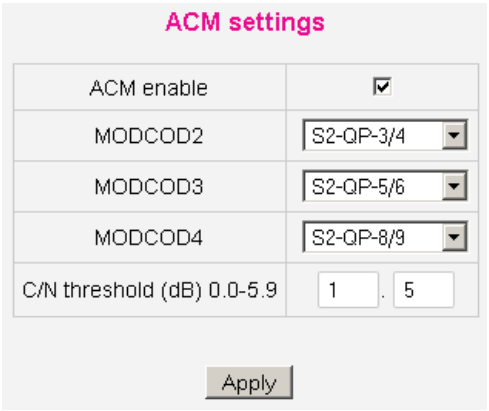
TLC enable	Enabling of TLC algorithm.
Max TLC TX level	Maximal level allowed to reach during TLC operation. The upper limit for cases when most of transmitter power is used should be set by 1 decibel above the BUC compression point, whereas the lower limit should be placed 8-10 decibel below the upper limit.
Net(0)-Own(16)	Which behavior dominates in TLC operation - orient on network reported levels or on own reception.
Avg(0)-Min(16) strategy	Which behavior dominates in TLC operation - orient on average level of all stations or on level of the worst case level from all stations.
Desired C/N on local	Reference C/N level on hub. Hub wants to receive all stations with this C/N level.
Desired C/N on on	Reference C/N level on stations. Hub wants all stations to receive hub with this level.

8.8 ACM

ACM function allows to change transmission MODCOD on the fly without data loss. Function works only in DVB-S2 modes SCPC or TDM modes. Two major ACM modes are realized - SCPC point to point ACM and network ACM.

SCPC ACM
In this mode remote C/N level received via TLC exchange protocol is used to optimize coding and modulation of local transmission to maximize channel bandwidth or provide stable channel operation under fading conditions. Entire channel starts working with new MODCOD. If there is no remote reception or no data from remote side coding is returned to the value set in TDM/SCPC TX profile settings.

Network ACM
In this mode forward TDM channel carrying information towards stations is divided into four sub-channels each working with different MODCOD. MODCODs are fixed and set in configuration. Hub receives current C/N from each station and based on internal C/N threshold table divides all stations to four groups. Forward traffic for this four groups goes through appropriate four sub-channels. First sub-channel (1) is base sub-channel where all network service information is broadcasted. Traffic can also be transmitted via this sub-channel. All stations start working in sub-channel 1 then go to other sub-channels if their reception is good enough. MODCOD of sub-channel 1 is set in TDM/SCPC TX settings and is lowest (most robust) amount other sub-channels to ensure all stations will receive hub in fade conditions. Other MODCODs must sequentially increase for proper operation of ACM algorithm.



ACM

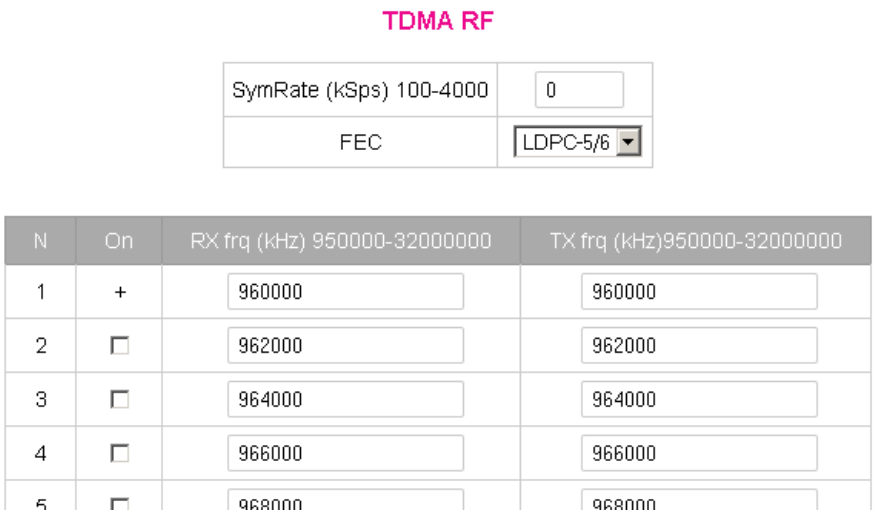
ACM enable	Enable ACM. DVB-S2 ACM-Long or ACM-short mode should be configured in TDM/SCPC TX
MODCOD2	MODCOD of the second sub-channel.
MODCOD3	MODCOD of the third sub-channel.
MODCOD4	MODCOD of the fourth sub-channel.
C/N threshold	Margin over MODCOD C/N thresholds for sub-channel assignment. Should be set at least 0.5 dB for stable operation.

Examples of MODCODs set:
Low range:
1 - QPSK 2/3

2 - QPSK 3/4
3 - QPSK 5/6
4 - QPSK 8/9
Medium range:
1 - QPSK 2/3
2 - QPSK 5/6
3 - 8PSK 2/3
4 - 8PSK 8/9
High range:
1 - QPSK 2/3
2 - QPSK 8/9
3 - 8PSK 5/6
4 - 16APSK 3/4

Warning: Using MODCODs with FEC below 2/3 can make ACM algorithm to work unstable because of low difference between C/N. At This moment FEC 1/2 in any modulation does not work.

8.9 TDMA RF



TDMA RF (last string is cut intentionally)

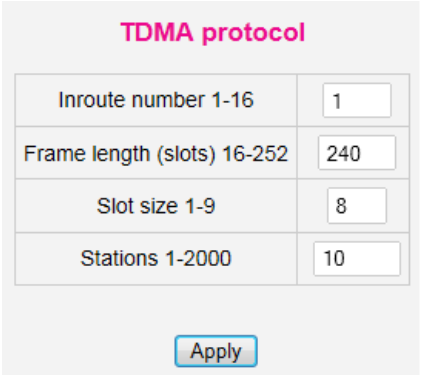
SymRate	Symbol rate of TDMA carrier. Symbol rate is involved in TDMA protocol calculations and after setting or changing SR protocol parameters frame length and slot size can need adjustment to keep optimal (or valid) frame duration and slot duration
FEC	Error correction coding.

Carrier definition (single carrier in HUB mode, up-to 16 carriers in MF-TDMA HUB mode).

On	Enable carrier for usage.
RX frequency	Frequency at which hub receives the carrier.
TX frequency	Frequency at which stations transmit the carrier.

Warning: Remember about RX LO usage in Site setup to avoid unexpected final TX frequencies on stations.

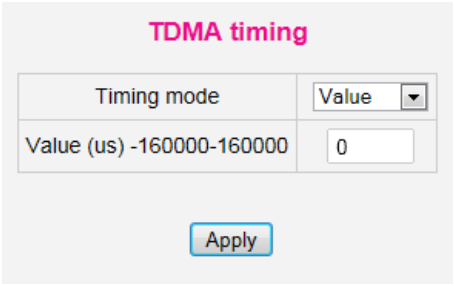
8.10 TDMA protocol



TDMA protocol

Inroute number	Number of inroute channel. Should be unique for each hub inroute.
Frame length	Length of TDMA frame in time slot Must be multiple of four. At high symbol rates in MF TDMA mode automatically rounded down to nearest 8 or 16.
Slot size	Size of time slot in 32 (for FEC=2/3) or 40 (for FEC=5/6) bytes increments. Lower value is used at lower symbol rates and vice versa.
Stations	Number of stations in the inroute. Should be less or equal to number of stations in stations table

8.11 TDMA Timing



Timing

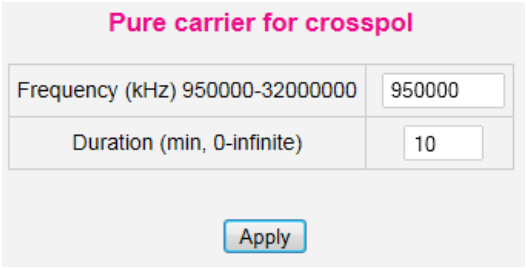
All stations receive from Hub data test packets used by OC to measure TTS. Using these packets stations perform partially procedures on synchronizing to Hub. TTS calculation algorithm statistics on station shows TDT (Time Delta). TDT itself is not informative for the diagnostics, however TDT value preserves its meaning and should be greater than 1, and otherwise station will not try to communicate with Hub. TDT can be zero if station does not receive Outroute from Hub. Stations are certain distance away from the satellite (the distance is different for each stations location). Thus each station has its own TTS. station TTS must be known with a high accuracy, otherwise their TDMA busts will overlap and cause transmission errors. One stations with wrong information about its TTS can block normal operation of the entire Inroute. For network station, use is made of the difference between the given station TTS and Hub TTS instead of TTS absolute value. This difference is referred to as DTTS and also is measured in microseconds DTTS_station = TTS_station - TTS_hub. If station is co-located with Hub, then its DTTS is zero. If station is located closer to satellite than Hub, then its DTTS is negative, and if farther - then it is positive. Usually DTTS lies in the range from -8,000 to 8,000 us in networks covering a large territory, and from -1,000 to 1,000 in regional networks.
Hub (OC) is capable of receiving its own transmission and hence can measure its own TTS at any time. stations do not have such capability since their transmission normally can be received only by Hub, hence only Hub can determine accurately the exact DTTS value for each station. It is worth noting that Hub cannot measure station DTTS in any frequency band since Inroute channel is used also by other stations, and station with no knowledge of its own DTTS at all cannot fit its transmission at moments when Hub permits station to transmit.
Thus, with the first connection to the network, DTTS calculated for the station with certain accuracy should be set in the station. If the accuracy is sufficient Hub will receive special shortened TDMA packets from this station, calculate the timing error and immediately send the error value to the station via Inroute. station will adjust its DTTS value on the Hub command and will start normal operation in the network. This corrected DTTS value will be present in the station TDMA statistics and can be entered in station as the final value.

Timing mode	Selection of timing source.
Satellite longitude	Longitude of satellite orbit point. Should be properly set if stations use location or GPS modes for timing calculations because longitude is broadcasted to all stations and there participates in DTTS calculations.
Value	TTS or DTTS value when timing mode set to "value".

The required accuracy in the calculated DTTS value is +/-0.25 of the TDMA burst duration. TDMA burst duration depends

on several factors (symbol rate, TDMA burst duration) and is presented in TDMA statistics. Usually, TDMA burst duration lies in the range from 500 to 10,000 us, and thus calculated DTTS value accuracy lies in the range from 63 to 1,250 us. This accuracy is sufficient for Hub to capture station without causing interference to other stations.
If accuracy of the calculated value is within +/-0.25 of the TDMA burst duration, then interferences for one or more stations in the network will be generated at the moment when "inaccurate" station is establishing communication with Hub (for a few seconds). Then station DTTS will be adjusted by Hub, and station will work without interferences. During installation of station, it will not be a problem, but what is important is that DTTS value logged into station is afterwards corrected.
If DTTS is corrected on station with an error exceeding 0.5, Hub will not "see" station at all, and this station will, most likely, create interferences for other stations.
To calculate DTTS value, use should be made of the UHP Installation Calculator utility to calculate the initial DTTS value as well as elevation and azimuth towards satellite. These parameters can be calculated if Hub and station geographical coordinates and satellite longitude in the orbit are known.

8.12 Crosspol RF

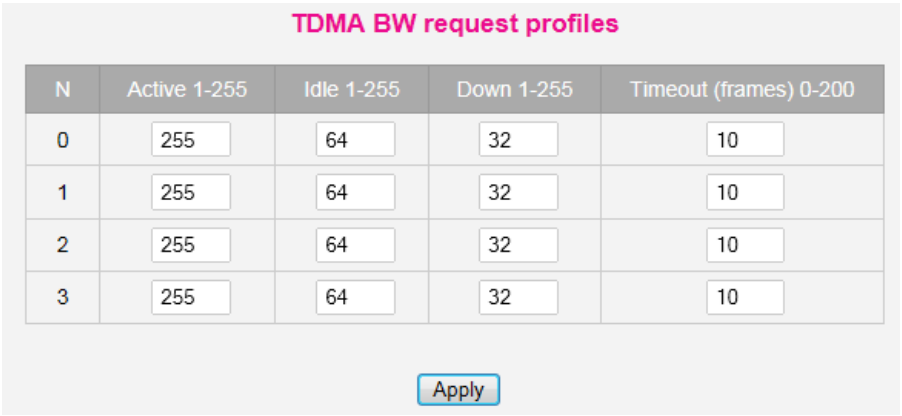


Crosspol RF

Used for producing unmodulated pure carrier on modulator. Used for cross polarization leakage measurement, P1dB measurements, spectrum purity check and other tests.

Frequency	Center frequency.
Duration	Duration of test. After this period next profile will be automatically picked.

8.13 TDMA Bandwidth allocation



TDMA BW

Stations that are not in the network (switched off temporarily) shall be provided with a possibility of joining the network when switched on. That is why Hub must provide such stations with some bandwidth. The wider this bandwidth is the faster stations establish communication with Hub when switched on, and the more bandwidth will be wasted when these stations remain switched off.
A similar situation exists with stations operating in the network but at the moment not requesting a bandwidth owing to absence of user traffic. These stations should also be provided a possibility, from time to time, to request a bandwidth from Hub when needed. The more frequently bandwidth is provided for request to such stations, the faster network will respond to emergence of traffic but the more bandwidth will be wasted if stations do not make use of it.
TDMA network operation conditions can be substantially different, e.g. access to Internet where traffic changes randomly and a quick response to its changes are required, or SCADA where multiple stations occasionally transmit short messages and practically there are no critical requirements to delaying these messages, but it is recommended that the bandwidth in use be minimized.

To enable the possibility to provide optimal functioning of various-purpose networks, UHP Hub first of all dynamically divides stations into three groups:
down - stations not in the network.

idle - stations in the network but not requesting bandwidth.
active - stations in the network and making requests for bandwidth.

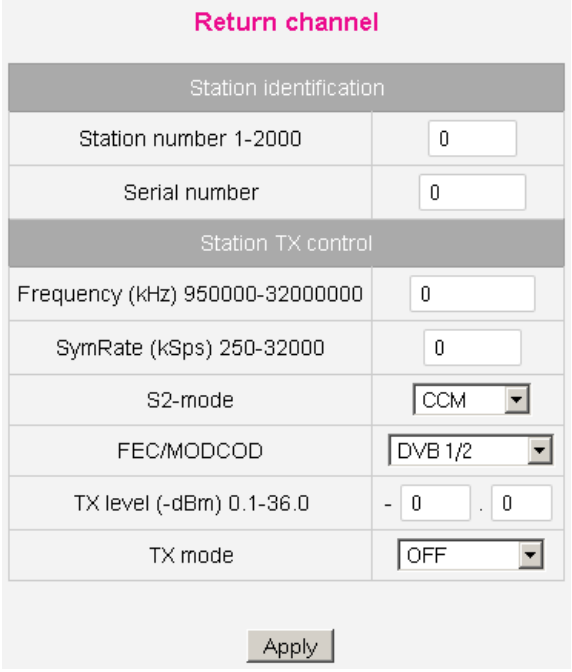
Each group is assigned a probability with which Hub will allocate a bandwidth to stations belonging to this group. The term "allocate a bandwidth" means providing at least one TDMA time slot. Probability is a number from 1 to 255 meaning how many times during 255 sequential TDMA frames Hub (IC) will provide each station with one TDMA slot for transmission. If probability is 255, such slot is provided to stations in each frame. If probability is 128, such slot is provided in each other frame, and if 32 - in each eighth frame

Table here defines bandwidth requesting parameters of stations. For profiles exist. Each TDMA station is always assigned one of profiles.

Active	Coefficient for active stations.
Idle	Coefficient for idle stations.
Down	Coefficient for down stations.
Timeout	Timeout in frames to declare station idle if it doesn't request bandwidth.

A question may arise on why probability is needed for active stations if they request a bandwidth and already have a possibility to transmit new requests to Hub. But if there is a request for bandwidth it does not mean that they will get it - it depends on the network and traffic settings. But if these stations do not obtain a bandwidth, Hub should be aware of their requests, e.g. owing to the fact that requests from stations may grow and then Hub will allocate a bandwidth for them. Typical probabilities are 255 for active stations, 32 for idle ones and 32 for "down" stations.

8.14 Return channel



Return channel

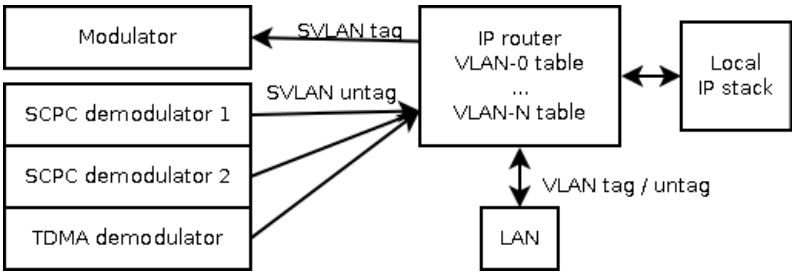
DAMA mode return channel settings for one remote station are set here. Station transmission can be fully controlled. This interface theoretically allows to control network of stations but as local unit can receive only one station receivers for other stations should be configured elsewhere. More complex networks can work only under NMS control.

Station number	Number of station. Station will report its state and stats with this number.
Serial number	Serial number of station.
Frequency	Transmit frequency of station. (meaning of further parameters are like TDM/SCPC TX screen settings)
SymRate	Symbol rate.
S2-mode	Mode of DVB-S2 coder.
FEC/MODCOD	MODCOD or FEC.
TX level	Transmit level.
TX mode	Modulated or pure carrier mode.

9. Routing and Bridging

9.1 SVLAN overview

UHP-1000 routers make use of a special protocol to transmit information via the satellite. Requirements to such protocol are minimal overhead and a possibility to split and group data streams. With the UHP-1000 routers, this protocol is named SVLAN.
SVLAN channels are similar to the VLAN notion in Ethernet but it is simpler - it is just "pipes" with numbers. If you send traffic into such a pipe (SVLAN) at the modulator, then at the other link end you will receive these packets to be dealt with by the IP-router, provided you set the same SVLAN number for reception.
SVLAN with number 0 differs from others by that traffic through it is transmitted without additional headers at all, thus providing the highest transmission efficiency. The rest SVLAN (1-4000) add two bytes to each packet.
Into one SVLAN one can, using router facilities, route the required number of networks, each of them having its own priority level.



Routing schematics

9.2 IP router

UHP-1000 routers implement a standard IP-router supporting static routing. The routing table can contain the following records:
IP-address on LAN
Statistical route in the LAN direction
IP-map - a route to the modulator into SVLAN
SVLAN Receive - a command to receive SVLAN from one of the demodulators

Records in the Table are arranged according to the network mask. The first ones are records with mask /32. Any of the records can contain VLAN and then it is referred to the Table of the relevant VLAN and will work only in it.

Altogether, the Table can contain up to 1,000 records. Routing speed is practically independent of the number of records.

Note: UHP-1000 router has no limitations on overlapping the addresses, incompliance of masks, etc. This makes it possible to obtain more capabilities from routers but these capabilities should be used with care.

9.3 Routing Table

Routing table

T	Vlan	Net/Source	Destination	SVLAN	Prio/Pol	Shaper	Title
M	5	Bridge	Station - 6	67	LOW	-	Bridge
A	-	10.0.0.11 /24	LAN, LOCAL				IP addr
A	7	10.0.0.11 /24	LAN, LOCAL				Tagged IP
M	-	20.0.0.0 /24	Station - 2	11	LOW	-	TX Map 1
M	-	40.0.0.0 /20	Station - 888	33	HIG	-	High prio
M	-	60.0.0.0 /17	Station - 9	17	Pol-76	15	Pol CIR
S	-	0.0.0.0 /0	10.0.0.1				Default
R	-	Svlan-22					RX SVLAN
R	7	Svlan-44					VL7 RX

Add IP address | Add static route | Add TX map | Add VLAN bridge | Add SVLAN RX

Routing Table

Strings description:

Bridge - VLAN 5 is bridged to satellite SVLAN 67
IP addr - IP address 10.0.0.11/24, untagged
Tagged IP - IP address 10.0.0.11/24 in VLAN 7
TX map 1 - Network 20.0.0.0/24 routed to satellite SVLAN 11, low priority, to station 2
High prio - Network 40.0.0.0/20 routed to satellite SVLAN 33, high priority, to station 888
Pol CIR - Network 60.0.0.0/17 routed to satellite SVLAN 17, policy 76, shaper 15, to station 9
Default - Default gateway to 10.0.0.1
RX SVLAN - SVLAN 22 received to untagged VLAN 0
VL7 RX - SVLAN 44 received to VLAN 7

The same table displayed with `# show ip` command.

```
T VLAN  Network/Source   Mask Destination  Stn   Pol   TrSh Packets     Title
M 5     Bridge                LOW->67      6                0           Bridge
A       10.0.0.11        /24    LAN,LOCAL                  16926       IP addr
A 7     10.0.0.11        /24    LAN,LOCAL                  0           Tagged IP
M       20.0.0.0         /24   LOW->11      2               0           TX Map 1
M       40.0.0.0         /20   HIG->33      888             0           High prio
M       60.0.0.0         /17   POL->17      9     76   15   0           Pol CIR
R       0.0.0.0          /0    10.0.0.1                     0           Default
V       RX SVLAN 22                                         0           RX SVLAN
V 7     RX SVLAN 44                                         0           VL7 RX
Unrt: 1406   Last: 10.0.0.10 -> 10.0.0.11   IP Scr: A/ON  (0)
PxARP: OFF  PolDrops: 0
```

T	Type of record A - IP address, R - static route, M - IP map, V - SVLAN RX.
VLAN	VLAN if tagged or - if untagged.
Network/Source	Network address.
Mask	IP mask.
Destination	Routing or map destination.
Stn	Station number for maps.
Pol	Policy number if set.
TrSh	Traffic shaper channel number if set.
Packets	Number of packets passed so far. Maximal value is 65535!!! Packets for static routes are not counted.
Unrt	Number of unroutable packets.
Last	Source and destination IP addresses of last unroutable packet.
IP Scr	Current mode of IP screening and number of packets screened.
Px ARP	Proxy ARP mode.

PolDrops	Number of packets dropped by all policies.

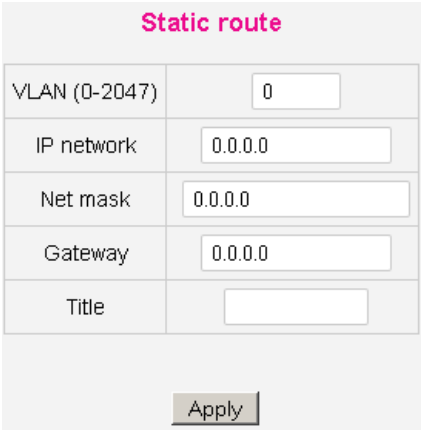
Warning: Maximal value of packets counters on this screen is 65535. Then they continue counting from 0.

9.4 IP address

IP address

VLAN	VLAN number or 0 for untagged.
IP address	IP address.
Net mask	Network mask in dotted (255.255.255.0) or classless (/24) notation.
Local access	Whether UHP control mechanisms (HTTP,SNMP,NMS) will listen on this IP address.
Title	Optional title.

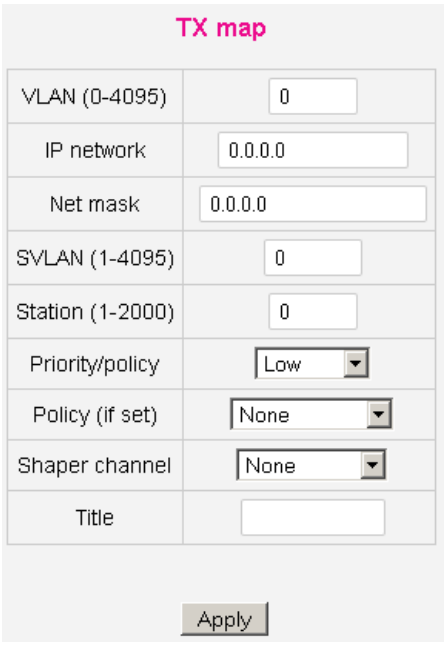
9.5 Static Route



Static Route

VLAN	VLAN number or 0 for untagged.
IP network	IP network.
Net mask	Network mask in dotted (255.255.255.0) or classless (/24) notation.
Gateway	Route destination. Destination reachability is not checked.
Title	Optional title.

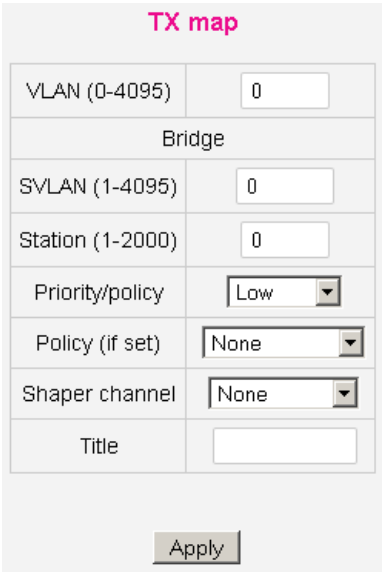
9.6 TX map



TX map

VLAN	VLAN number or 0 for untagged.
IP network	IP network.
Net mask	Network mask in dotted (255.255.255.0) or classless (/24) notation.
SVLAN	SVLAN number.
Station	Station number. Map traffic will be counted as TX traffic towards this station.
Priority/policy	Fixed priority or policy mode.
Policy	Policy selection if policy mode is selected.
Shaper channel	Shaper channel selection.
Title	Optional title.

9.7 VLAN Bridge

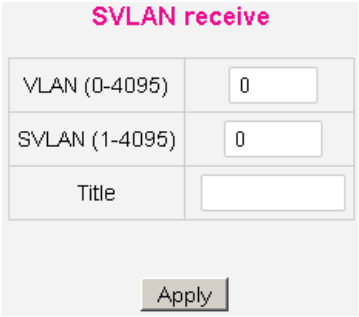


VLAN Brige

VLAN	VLAN number or 0 for untagged.
SVLAN	SVLAN number.
Station	Station number. Map traffic will be counted as TX traffic towards this station.
Priority/policy	Fixed priority or policy mode.
Policy	Policy selection if policy mode is selected.
Shaper channel	Shaper channel selection.

Title	Optional title.

9.8 SVLAN Receive



SVLAN Receive

VLAN	VLAN number or 0 for untagged.
SVLAN	SVLAN number to receive.
Title	Optional title.

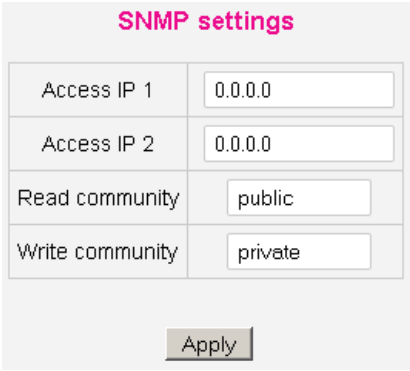
10. IP Protocols

10.1 SNMP

UHP router supports SNMP protocol versions V1 and Community-based V2. The following SNMP classes are supported:

.iso.org.dod.internet.management.mib2.
system.
interfaces.
private.enterprises.UHP.uhpV30.

Information about variables can be obtained from the MIB file supplied with the router.

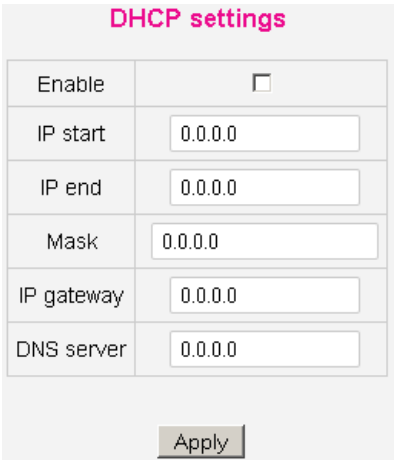


SNMP

Read community	Password for reading SNMP variables.
Wrt. community	Password for writing SNMP variables.
IP permitted 1	IP of external SNMP manager for allowing access (255.255.255.255 for access from any IP).
IP permitted 2	Second IP for allowing access. Zero (0.0.0.0) if not used.
Input requests	Number of input SNMP requests.
Illegal IP address	Number of requests from non-pernitted IP addresses.
Wrong rd.community	Number of packets with wrong read community.
Wrong wr.community	Number of packets with wrong write community.
No variable in MIB	Number of requests of non existent variables.
Table out of index	Number of requests going out of indexes of SNMP tables.

10.2 DHCP

DHCP allows automatic IP addresses assignment to the network hosts. It also allows passing additional parameters like default gateway and DNS server addresses. Current realization works only on VLAN 0 (untagged).



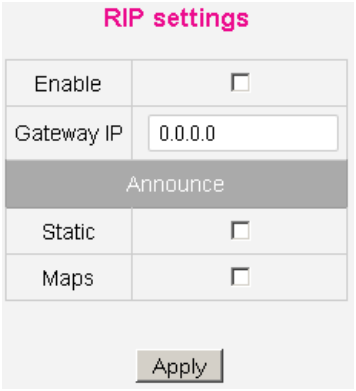
DHCP

Enable	Turn on DHCP.

IP start	First IP address of DHCP pool.
IP end	Last IP address of DHCP pool.
Mask	Network IP mask to report.
IP gateway	Gateway IP to report (usually one of IP addresses of UHP).
DNS server	DNS server to report (supplied by ISP).

10.3 RIP

RIPv2-multicast route announcement is supported by UHP. Accepting of external routes is not realized. Static routes and maps can be advertized by RIP.

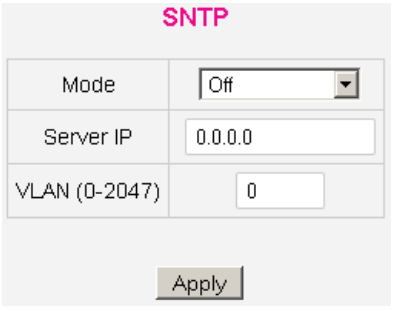


RIP

Enable	Enable RIP announcement.
Gateway IP	Gateway IP address to advertize (usually one of UHP IP addresses).
Static	Whether to advertize static routes from routing table.
Maps	Whether to advertize map from routing table.

10.4 SNTP

UHP router supports Simple Network Time Protocol (SNTP). It is a simplified implementation of the protocol NTP and used in embedded systems and devices that do not require high accuracy. Using this protocol allows synchronizing time on all devices within the network. The router can be a client that synchronizes its time counter with external NTP server and/or act as a server responding to respective client requests. To obtain NTP server to set it is possible to **ping pool.ntp.org** from any PC and note IP address of offered NTP server.



SNTP

Mode	Mode of SNTP operation.
Server IP	NTP server IP for "server" or "both" mode.
VLAN	VLAN to use for NTP requests to server.

10.5 RTP

When transmitting VoIP traffic by IP-protocol the size of headers of IP, UDP and RTP protocols (in total not less than 42 bytes) can exceed the size of the voice portion of the packet.

Transmission of such packets via a satellite is extremely inefficient with respect to bandwidth usage, hence use is made of compression of protocols headers based on the fact that only few fields change from placket to packet, and furthermore this change can often be predicted.
In most cases the router compresses packet headers to up to two bytes. To make compression work, it is essential that at the transmitting side (or at both sides) the ranges of UDP (destination) port packets that the router will try to compress be adjusted accordingly. Compression will work also in simplex mode (in one direction only). Packets passing successful compression will always be sent with high priority.
RTP compression is activated by policies set-up.

Statistics of the compression functioning can be made available using `# show rtp` command.
Each string there is a single compressed flow.

```
Transmit -------------------------------------------------
Source_IP         Destination_IP       Plt       Errors
10.0.0.17         10.1.0.1             11        0
Receive --------------------------------------------------
Source_IP    Port Destination_IP  Port  TOS  Plt  Packets  Errors
10.1.0.1     4001 10.0.0.17       16011  0   11   1171     3
```

Transmit compression

Source IP	Flow source IP.
Destination IP	Flow destination IP.
PLT	RTP payload type
Errors	Number of errors ocurred.

Receive decompression

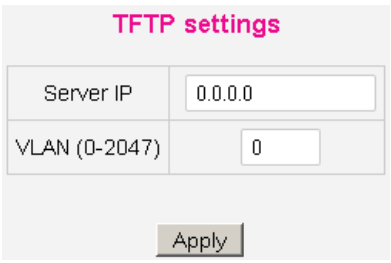
Source IP	Flow source IP.
Destination IP	Flow destination IP.
TOS	Type of service (TOS) field value.
PLT	RTP payload type
Packets	Number of packets decompressed.
Errors	Number of errors ocurred.

Note: Compression processes to both directions are completely independent. Simplex mode can also be used.

Note: If traffic generates many random statistics this traffic is probably not RTP.

10.6 TFTP

TFTP server parameters are set here to download software and upload or download configuration.

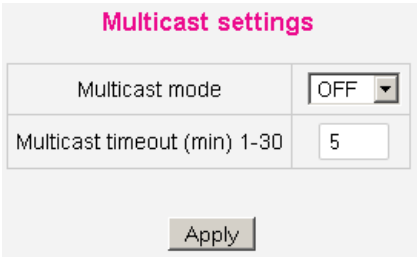


TFTP

Server IP	IP address of TFTP server.
VLAN	VLAN of TFTP server.

10.7 Multicast

UHP routers support IGMP version 1-3, as well as static routing of multicast traffic.
Static routing of multicast traffic is implemented in UHP-1000 routers as follows:
To collect Multicast traffic from LAN to specified address you have to assign a map for this traffic on the modulator. The router will itself understand that the address (network) belongs to the Multicast range and will tune LAN to receive it.
At the other side, to transmit this traffic to LAN it is necessary (apart from the command to receive SVLAN used to receive this traffic) to assign a static route to the Multicast address (network) of the transmitted traffic, having selected, as the destination address, any address within the range of any of the IP networks assigned to the router. The device with such address may be missing, it is more important that the packets be routed to LAN.
IGMP - Internet Group Management Protocol - provides multicast data transmission in IP networks. IGMP is used by routers and IP-nodes to arrange network devices into the group. IGMP can be used to support streaming video and online games, for these types of applications it allows using network resources more efficiently.
IGMP protocol can provide the routing of traffic between all network elements in different network topologies.



Multicast

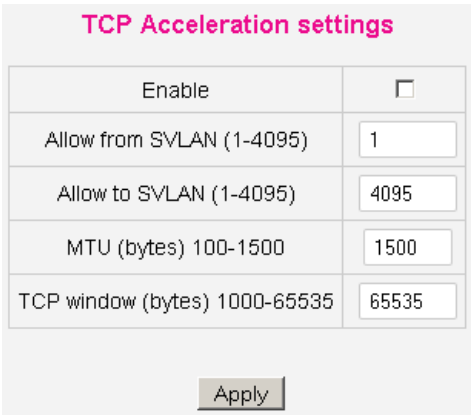
Multicast IP	Multicast IP address.
Source IP	Source IP address (first octet can be different, ignore it)
LanT	Timeout for LAN traffic forwarding. This value it is reduced by 1 every 4th part of set lifetime. When this value reaches 0 the route is considered obsolete and is removed from the routing table. With every JOIN packet received from respective LAN multicast listener the counter is reset to 3.
SatT	Timeout for satellite traffic forwarding. Works like LanT
Multicast mode	Mode set in configuration.
Multicast timeout	Timeout set in configuration.
IGMP	Whether IGMP is on.

Statistics is also displayed with `# show multicast` command.

```
Multicast IP      Source IP(X.)     LanT     SatT   Mcast: ON  IGMP: ON  TO: 5 min
229.0.0.2         10.0.0.73         3        2
239.255.255.239   10.0.0.21         3        0
239.255.255.250   10.0.0.50         3        0
224.0.0.251       10.0.0.100        3        0
224.0.0.252       10.0.0.98         3        0
```

10.8 Acceleration

Controls TCP acceleration service.
On stations acceleration enabling is controlled exclusively by hub - local enable setting is ignored.



Acceleration

Enable	Enable acceleration.
Allow from SVLAN	Allow SVLANS from ... to be accelerated. Used to make un-accelerated subnetwork.
Allow to SVLAN	Allow SVLANS to ... to be accelerated.
MTU	MTU to set in accelerated packets.
TCP window	TCP window to set in accelerated packets.

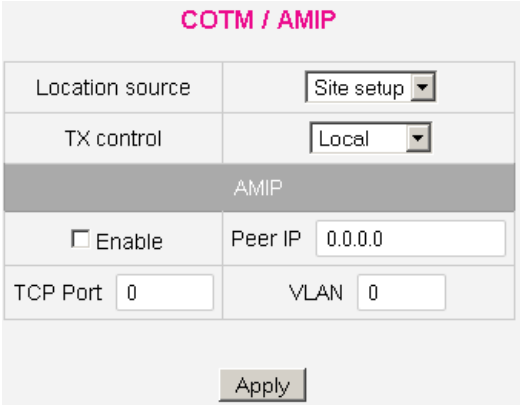
Statistics `# show acceleration` command.

Sessions	Number of sessions accelerated so far.
Misses	Number of sessions referenced by remote side which are not present locally.
No place	No place in acceleration table. Increases under heavy load.
Opt-errs	Times TCP packets with TCP options were seen while session flow.

10.9 COTM/AMIP

Mobile applications require utilization of antenna controllers able to automatically aim satellite antenna to the satellite. Such controllers require information exchange with UHP. Information usually includes:
- Lock state (to controller)
- C/N level (to controller)
- Geographical location (to UHP)
- Transmit permission (to UHP)

UHP has 2 interfaces to mobile antenna controllers - SNMP and Open AMIP. Here Open AMIP settings are listed



COTM/AMIP

General settings of mobile modes.

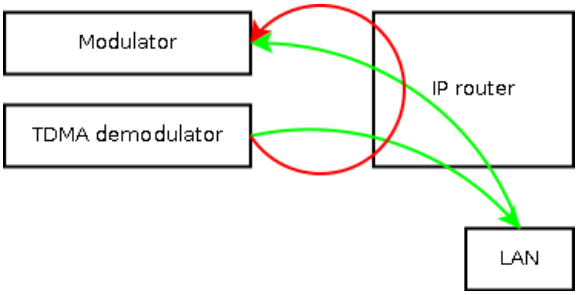
Location source	Source of location used in UHP system.
TX control	Allows TX control from antenna.

AMIP related parameters.

Enable	Enable AMIP protocol.
Peer IP	Antenna controller IP address.
TCP Port	Antenna controller TCP port.
VLAN	Antenna controller VLAN.

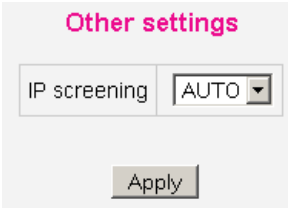
10.10 Other settings

Satellite channels by nature are broadcasting. In this case in a point-to-multipoint topology network, IP-packets transmitted to the satellite from Hub can be received on many stations simultaneously. Since different networks are routed to different stations, it is logical that each SVLAN be assigned to a separate direction, and this is what is usually done. But it may happen so that due to the router wrong configuration or in case of mixing routers traffic into one SVLAN (e.g. into SVLAN 0 for a better channel efficiency), not all traffic received via SVLAN will be lead out from the router to LAN (there will be no routes). If in this case the default route on the router is set to the HUB, a rooting loop may be generated, the result being that channels will be instantly overloaded with circulating packets.



IP screening

To avoid this situation, UHP-1000 router is provided with a special mechanism - IP screening. This mechanism works as follows: each packet received from satellite gets a tag. If during routing this packet tries to go back to the satellite it will be dropped. Packets coming from LAN and generated by the router itself are not tagged and they have no limitations whatsoever.



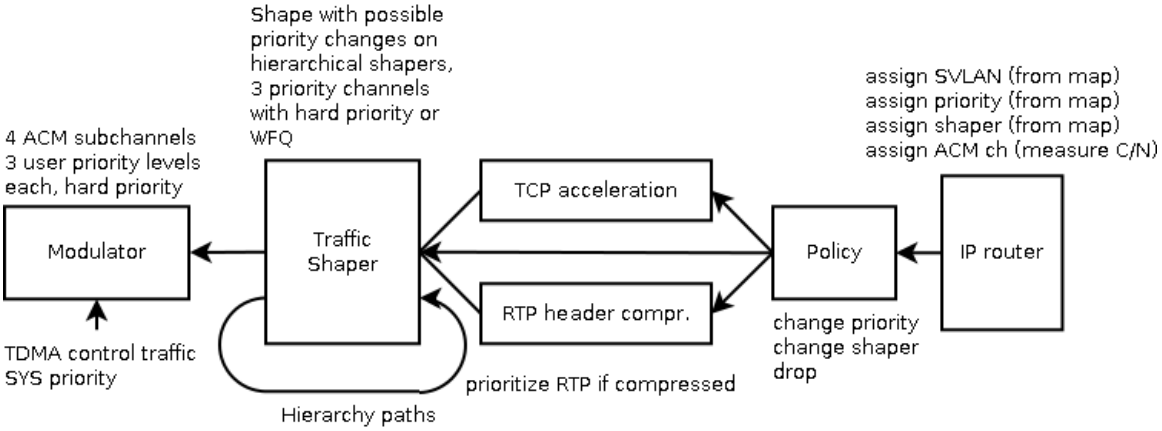
Other settings

IP screening — Enable IP screening.

Automatic IP screening is active by default for the following modes of router operations: STAR station, MESH station, DAMA station and HUBLESS station. This mechanism automatically disabled in modes: SCPC, HUB and HUBLESS Master avoiding blockage of station-to-station traffic.
When IP screening is disabled (parameter OFF), this functionality is forcibly turned off for any mode of operation. IP screening can be forcibly activated (parameter ON).
Router statistics `# show ip` is provided with a counter indicating how many packets have been dropped because of screening.

11. QOS

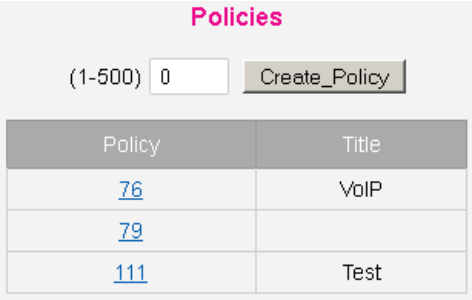
Quality of service in UHP has several mechanisms providing prioritizing and traffic regulation.



QOS scheme

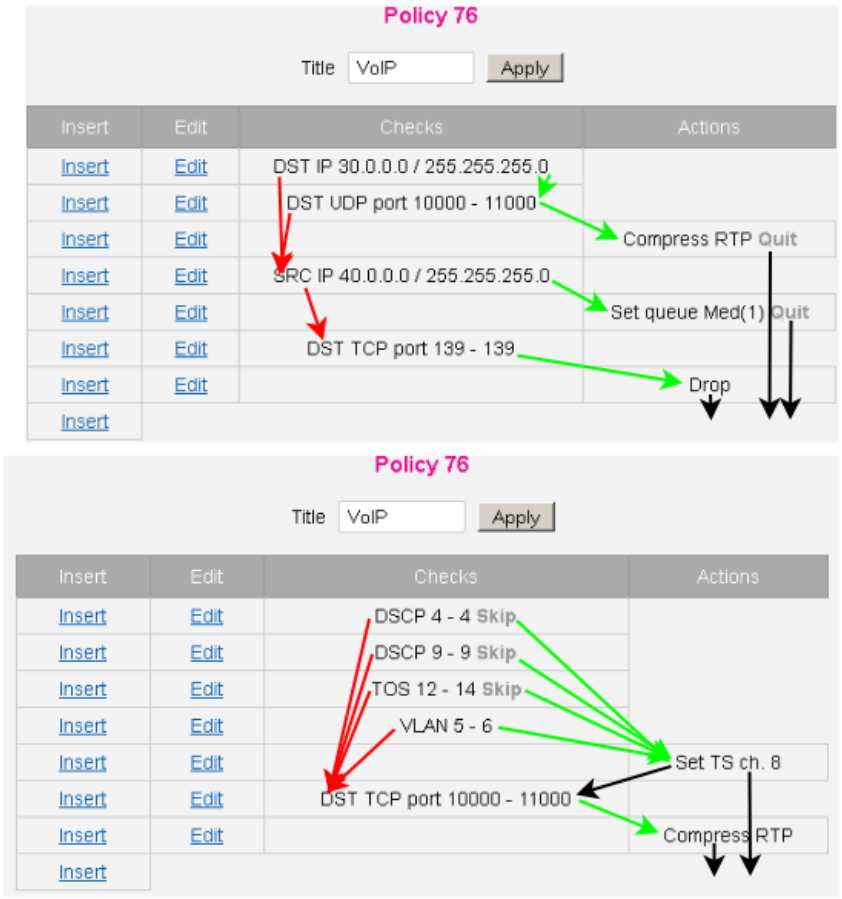
11.1 Policies

Policies allow to classify IP packets and according to classification to perform certain actions on this packets.
UHP contains list of policies.



Policies list

Policy is referenced from IP map . One policy can be used for unlimited number of maps and works for all maps independently.
Each policy is a set of rules. Rules are of two types **checks** and **actions**. Checks perform matching of packet header fields against predefined ranges. Actions perform some actions on packet.
Inside the policy sequence of checks is usually followed by sequence of actions. Checks can be omitted. Policy containing only actions performs actions on all packets unconditionally. If needed after sequence of actions another sequence of checks can start.

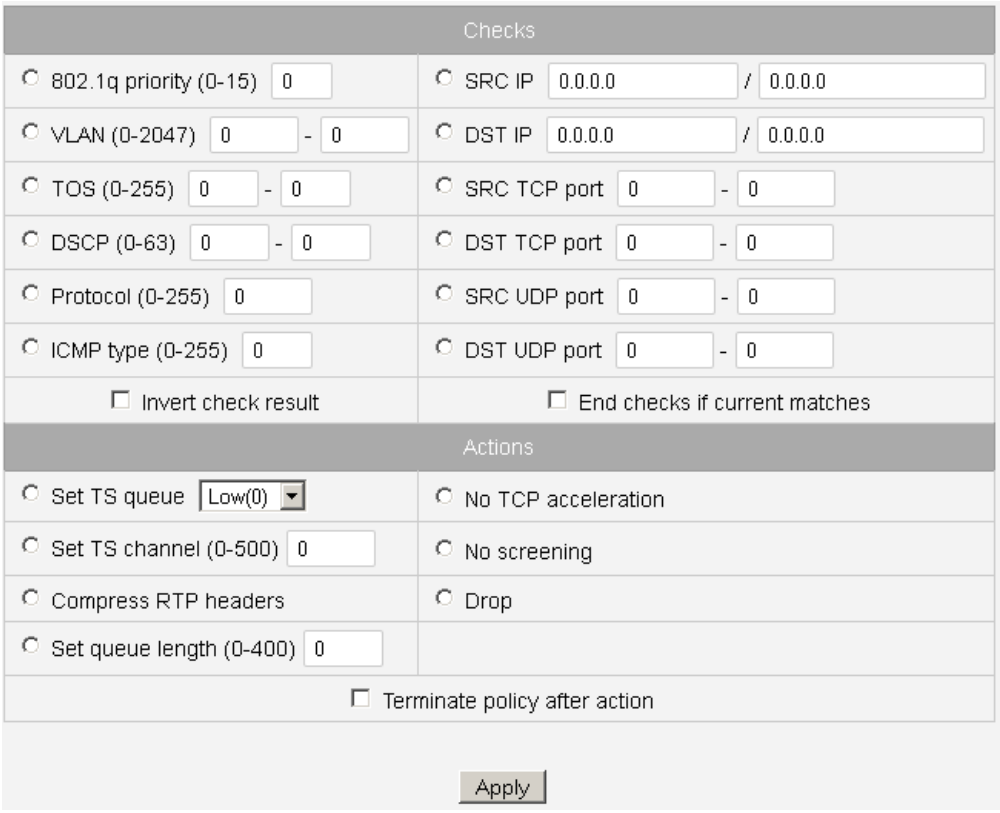


Policy

On the picture green arrows mean successful checks, red arrows - unsuccessful checks, black arrows - unconditional jumps.
In this policy first destination IP address AND destination UDP port is checked. If they match RTP compression is performed. After RTP compression policy is ended (note "Quit" flag). There is no priority assignment action here as RTP compressor automaticaly assigns high priority to packets which it has compressed.
If either IP or port did not match next section check is performed. Source IP is checked and medium priority is assigned. Again if check was successful policy ends on priority assignment.
If source IP was not in range third check is made for TCP port 139. All packets with this port are dropped.

Second example shows that checks can have "OR" treatment rather than "AND" treatment ("Skip" flag). If any of checks matches policy immediately jumps to nearest actions. Another behavior demonstrated here is sequential processing of several check-action sequences (no "Quit" flag within last action).

Rules can be edited, inserted or deleted.



Policy rule

Checks

802.1q priority	Match priority field of VLAN tag.
VLAN	Match VLAN value.
TOS	Match TOS byte value.
DSCP	Match DSCP bits value.
Protocol	Match IP protocol.
ICMP type	Match ICMP protocol message type.
SRC IP	Match source IP address / network.
DST IP	Match destination IP address / network.
SRC TCP port	Match source TCP port.
DST TCP port	Match destination TCP port.
SRC UDP port	Match source UDP port.
DST UDP port	Match destination UDP port.

Check modificators

Invert check result	Result of current check is inverted.
End checks if current	If current check matches skip all subsequent checks and start applying actions.

Actions

Set TS queue	Assign priority.
Set TS channel	Assign traffic shaper channel.
Compress RTP	Try to compress RTP headers.
Set queue length (0-	Set queue length (not realized now).
No TCP acceleration	Do not make TCP acceleration.
No screening	Disable IP screening for packets.
Drop	Drop packets. Command `# show ip` has counter of dropped packets.

Actions modificators

Terminate policy after	Immediately terminate policy after making current action. May be needed in complex policies havind several checks+actions sections.

11.2 Shapers

Traffic shaper (TS) is intended for adjustment of the bandwidth occupied by data streams transmitted via a satellite. TS is based om set of channels - controlled "pipes" for traffic between router and modulator.

Passing traffic to the channel
- Traffic is routed to the channel by setting channel number in map record of routing table.
- Multiple maps can use one channel, it passes their total traffic. SVLANs and priorities can be different.
- Packets from channel output go either to modulator or to the input of other channel - upper channel
- link of shapers can be up to 8 shapers long.
- Input to channel can be from both router maps and other channels.

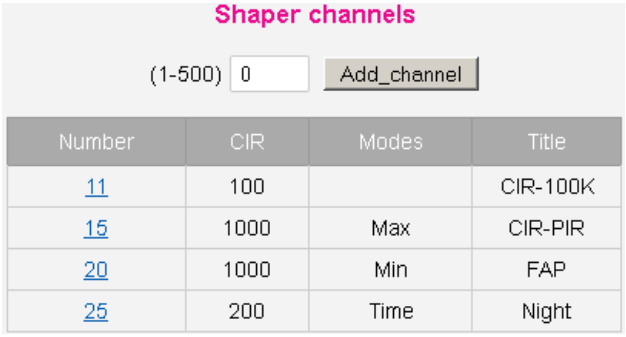
Channel output queueing
- Three priority queues - low, medium, high.
- Output hard priority - high queue emptied first then medium then low.
- Optional weighted fair queuing WFQ - proportional bandwidth division between low and medium queues.

Channel bandwidth (CB)
- Channel output bandwidth is limited to certain value - **channel bandwidth**.
- CB can be dynamically regulated based on channel load and upper channel (or modulator) load.
- If input rate is higher then current CB channel buffers traffic thus creating delay.
- If still too much input traffic upon filling buffers channel drops packets.

CB value manipulation
- Base value for CB is CIR - committed information rate. Mandatory parameter for channel.
- If channel load is high and upper channel is not overloaded CB will be raised automatically.
- Peak value of CB auto-raise can be optionally limited. If peak value = CIR then CB will never raise.
- Opposite action - CB can be optionally lowered in case of heavy channel load. Measure against downloaders (FAP). When load is reduced CB returns to CIR.
- Another option - night CIR. Change CIR at night hours.

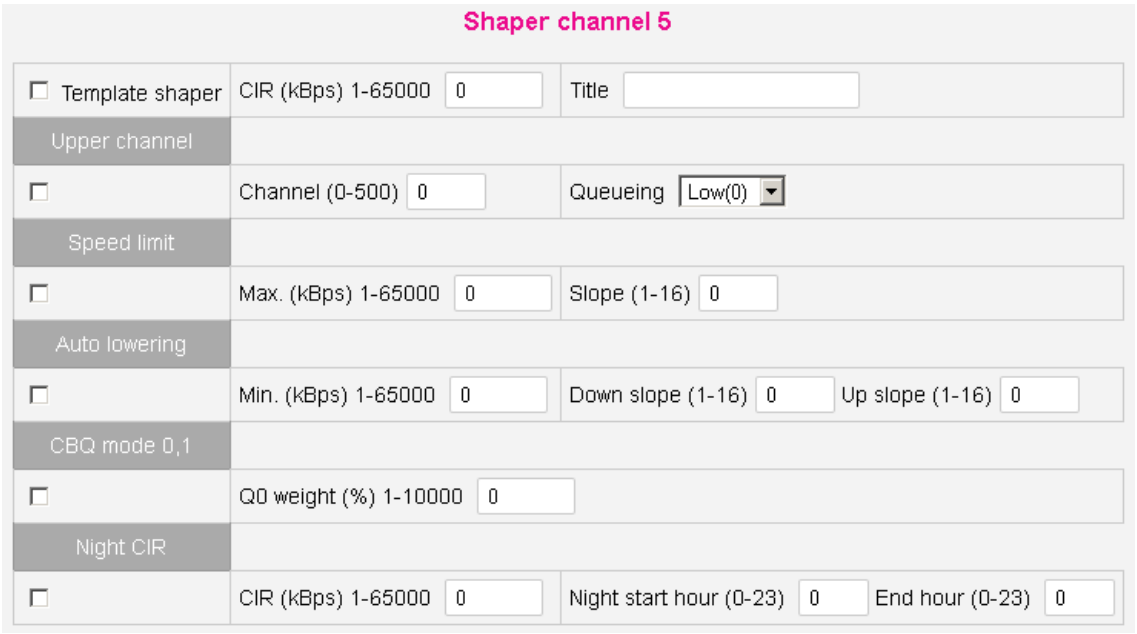
Shapers for TDMA return channel:
- Shaper is assigned to station in stations table .
- Operation is totally different - no shaping of packets.
- Just channel settings are used instead of using channel itself.
- Shaper settings copied to station data and actual bandwidth calculation is done by frame planner.
- Regulating number of TDMA time slot s assigned to station based on station bandwidth request.
- Templating allows copying of equal settings to many stations to avoid creation of many equal channels.
- One channel can be used for both forward shaping and station.

Shapers are organized as a list.



Shapers

Shaper channel configuration includes several mandatory fields and several optional sections extending shaper functionality.



Shapers

Template shaper	Activates template mode for station shapers. (NMS behaves differently, see manual!)
CIR	Guaranteed speed. Initial value of CB.
Title	Optional title of shaper.
Upper channel	Enabling upper channel for shaper. If not enabled then modulator is upper channel.
Channel	Upper channel number.
Queueing	Allows to manilulate priorities sending all three queues to one of queues of upper channel.
Speed Limit	Enabling hard speed limit for channel.
Max	Speed limit value.
Slope	Rate of CB raise.
Auto Lowering	Enabling auto-lowering of CB in case of heavy channel load.
Min	Minimal value of CB.
Down slope	Slope of lowering towards minimum.
Up slope	Slope of recovering towards CIR.
CBQ Mode 0,1	Switching to weighted fair queueing.
Q0 weight	Low queue weight. 100 means equal division between low and medium queues.
Night CIR	Enabling night CIR mode. During night hours CIR is changed.
CIR	Night CIR value.
Night start hour	Beginning of night. Inclusive. Time zone is taken into account.
End hour	End of night. Non-inclusive. Value example start/end 21/7 (from 21:00:00 to 07:00:00 next day).

Real time shaper statistics is available in WWW interface. It can also be accesses by `# show shapers` command.

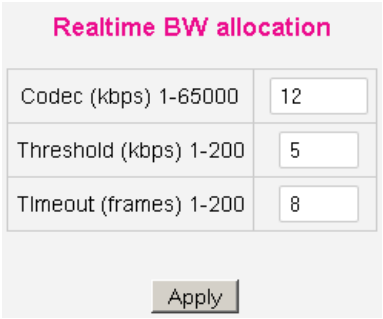
```
ModSpeed(Bps): 0(0%)   ModDelay(s): 0.0   Hour: 2   Drops: 0
Strm| CIR.K Max.K | Spd.K     %    | Del. | LowSp MedSp HigSp | BW.K
8   | 128   -     | 0         0    | 0.0  | 0     0     0     | 128
11  | 256   -     | 0         0    | 0.0  | 0     0     0     | 256
12  | 1000  2000  | 0         0    | 0.0  | 0     0     0     | 1000
```

ModSpeed	Current traffic rate on modulator. Absolute value and percentage.
ModDelay	Delay in seconds on modulator due to buffering. Overload indicator.
Hour	Current day hour (used for night mode of shapers).
Drops	Total number of packet drops on all shaper channels.
Strm	Shaper channel number.
CIR.K	CIR setting.
Max.K	Maximal speed setting.

Spd.K	Current input rate of channel.
%	Percent of CIR.
Del.	Delay in seconds generates by channel.
LowSp	Input rate of low priority queue.
MedSp	Input rate of medium priority queue.
HigSp	Input rate of high priority queue.
BW.K	Current channel bandwidth.

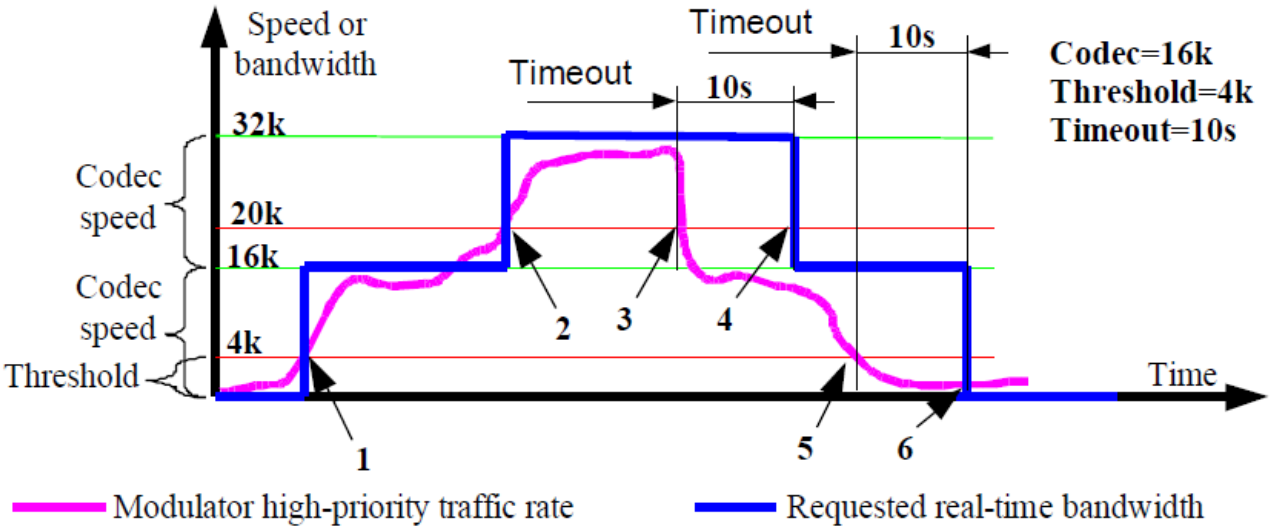
11.3 Real-Time

To make a request for bandwidth from Hub, stations analyze the speed and size of traffic they need to send via modulator. Stations have two simultaneously working algorithms to request a bandwidth - for low-priority (plus medium priority) and high-priority (real-time, RT) traffic. Traffic type is determined by the modulator queue (ML, MM, MH), passing this traffic.
For low-priority and medium priority traffic, analysis is made with respect to the modulator transmission queue length and the transit traffic speed. The higher these parameters are the wider bandwidth is requested by this station.
For high-priority traffic (RT), analysis is made basically with respect to the speed. With the UHP platform, RT traffic is always considered as a stream (VoIP, videoconferencing). This approach makes it possible to predicatively allocate a bandwidth for this traffic.
The process for requesting RT bandwidth is user-defined for each station individually.



Real-Time

Codec	Speed of used codec. Bandwidth is requested in increments of this value.
Threshold	Threshold over codec speed to detect activation of additional codec.
Timeout	Timeout before releasing codec bandwidth.



Real-Time

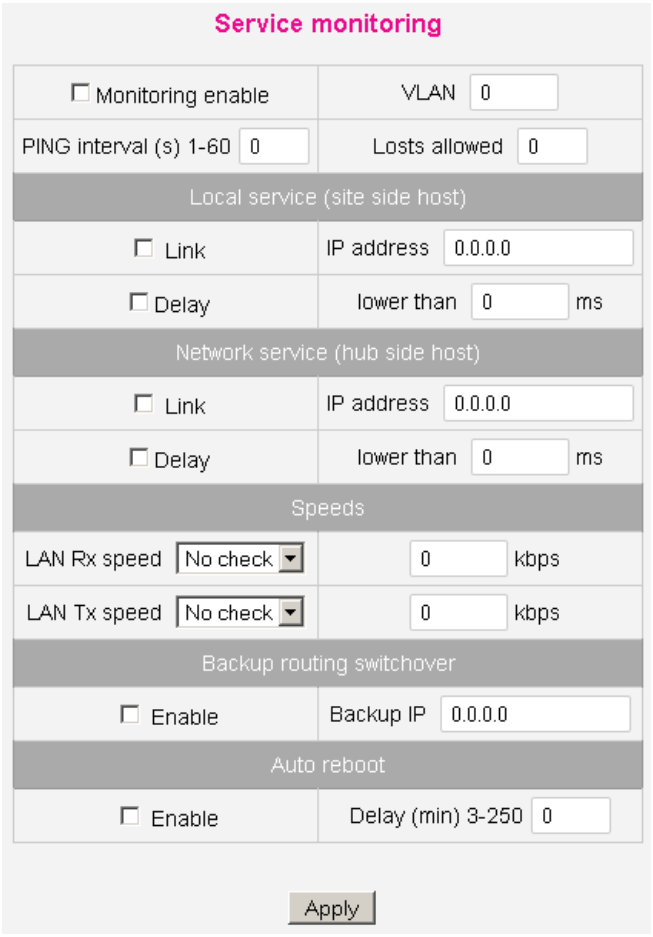
1. First call starts. High-priority modulator traffic exceeded threshold value. Real-time bandwidth for full codec speed is

requested (16K).
2. Second call starts. Traffic exceeded value of 20K (codec + threshold). Dual codec-rate bandwidth is requested (32K).
3. One of calls drops. Station still does not decrease its bandwidth request, since it does not know whether the call is completed or whether there is just a pause. 10-second time-out count is started.
4. Within 10 seconds traffic did not exceed 20K, station refuses from one codec bandwidth.
5. Second call is being completed, traffic drops below 4K, and 10-second time-out count is started.
6. Within 10 seconds traffic did not exceed 4K, station refuses from second codec bandwidth.
The bandwidth request result is in the form of transmission TDMA slots in a TDMA frame which station would like to receive. Respectively, if there is 1 Mbit lnroute channel, and the frame duration is selected, e.g. 40 TDMA slots, then by requesting 1 time slot station can obtain 1000/40=25 kbit/s. Bandwidth per slot depends on the channel rate and TDMA burst size. When selecting network parameters it is worth to be guided by applications traffic profile that is operating in the network to provide optimal bandwidth distribution.

11.4 Service monitoring

Service monitoring allows to measure service quality and generate faults if service parameters are out of limits.

The following service parameters can be measured:
- PING reachability of 2 hosts. One of hosts can be local (on the station), another on hub side (network).
- PING delay to 2 hosts.
- LAN traffic on station in each of directions independently.



Service mon.

Monitoring enable	Enable service quality monitoring.
VLAN	What VLAN to use for PINGs.
PING interval	Interval between sent PINGs.
Losts allowed	Maximal amount of consecutive unreplied PINGs.

Local service is service on the station side (in LAN). Not obligatory - it can be anywhere.

Link	Whether to check connectivity.

IP address	IP address to PING.
Delay	Whether to check delay. Connectivity check should be enabled.
lower than	Delay must be lower than this value.

Network service is service towards hub and network beyond hub. Again, not obligatory.

Link	Whether to check connectivity.
IP address	IP address to PING.
Delay	Whether to check delay. Connectivity check should be enabled.
lower than	Delay must be lower than this value.

Speed checking.

LAN Rx speed	Mode of checking traffic incoming from LAN.
LAN Tx speed	Mode of checking traffic outgoing to LAN.

Special backup mode. If profile state is not "operation" all map s turn to static routes to specified IP addreess providing link backup (not realized yet !).

Enable	Enable maps switching.
IP	IP address to route outgoing traffic to.

Auto reboot allows to reboot UHP if it cannot establish operation under any of profiles.

Enable	Enable auto-reboot.
Delay	Delay in minutes before auto-reboot.

12. Network

12.1 Network Overview

This statistics screen shows overall network parameters and statistics.
Not all sections are shown in various modes.
Network overview is also available by `# show network` command.

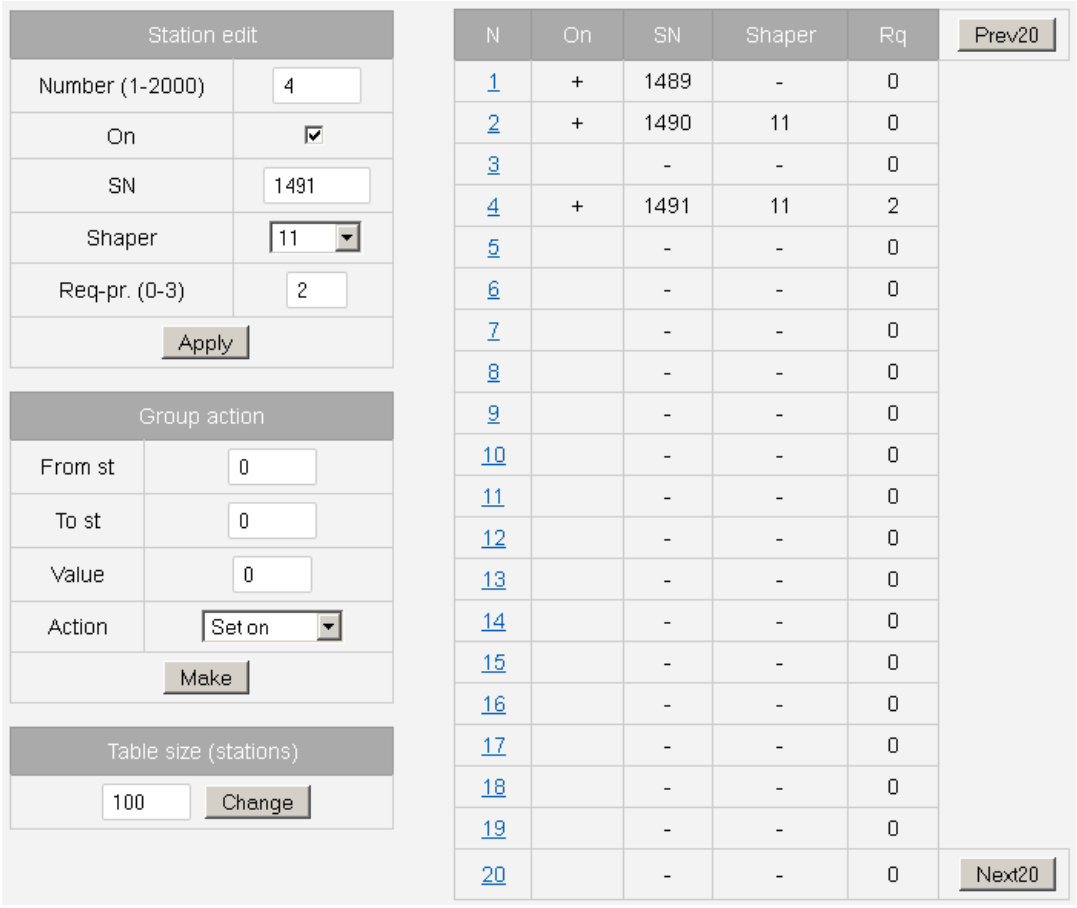
```
--------------------------- Unit state ---------------------------
Mode: none   State: Init
------------------------- Identification -------------------------
Net: 0  RF: 0   Inroute: 0
---------------------------- TDMA RF ----------------------------
Rx - Frq: 1000000   SR: 1000      FEC: 2/3    AcqBw: 12
Tx - Frq: 0         SR: 0         FEC: N/A
------------------------- TDMA protocol -------------------------
SlLen: 8     FrLen: 0     StNum: 0     ActChannels: 0
------------------------- TDMA calculated -----------------------
BitR: 1333  SlDur: 1.5   FrDur: 0      SlotBw: 0
---------------------- Burst demodulator ----------------------
InLvl: 77.0   NoBurst: 0   ZeroSt: 0   FpLost: 0
---------------------------- Station ----------------------------
Number: 0      CurBw: 0 (0 k)   FpLost: 0
------------------------- Corrections -------------------------
DttsCor: 0      FrqCor: 0      LvlCor: 0.0
--------------------------- BwRequest ---------------------------
TxRate(k): 0       TotRq: 0     RtRq: 0     Codecs: 0
---------------------------- Timing -----------------------------
Mode: Location  NetTTS: 0       TCL: 0    Errors: 0
SatPos: 0  d 0 ' E   GpsPkts: 0
Set  location: 0 d 0 ' N / 0  d 0 ' E  Set  DTTS=0
Used location: 0 d 0 ' N / 0  d 0 ' E  Used DTTS=0
```

Mode	Profile mode.
State	Profile state.
Net	Network ID (from site setup).
RF	RF ID.
Inroute	Inroute number.
---------- TDMA RF ----------	
Rx - Frq	Receive frequency of TDMA carrier.
SR	Receive symbol rate.
FEC	Receive FEC.
AcqBw	TDMA RX acquisition bandwidth.
Tx - Frq	TDMA transmit frequency (local or for stations)
---------- TDMA protocol ----------	
SlLen	Slot length set in profile.
FrLen	Frame length set in profile.
StNum	Stations number set in profile.
ActChannels	Current amount of active TDMA channels.
---------- TDMA calculated ----------	
BitR	Calculated TDMA bit rate.
SlDur	Calculated time slot duration in milliseconds.
FrDur	Calculated frame duration in milliseconds.
SlotBw	Calculated bandwidth per slot (bandwidth of station having 1 slot in frame).
---------- Burst demodulator ----------	
InLvl	Composite RF level on burst demodulator input.

NoBurst	???
ZeroSt	Number of times frame plan was not filled entirely - unassigned slots left.
FpLost	Frame plans lost due to forward channel problems.
---------- Station ----------	
Number	Station number decoded from hub information.
CurBw	Currently assigned bandwidth.
FpLost	Frame plans lost due to forward channel problems.
---------- Corrections ----------	
DttsCor	Corrected DTTS value of station.
FrqCor	Frequency shift of station corrected by hub.
LvlCor	On-hub C/N level deviation from desired (used by station TLC).
---------- BwRequest ----------	
TxRate(k)	Current transmit rate.
TotRq	Total time slots requested from hub.
RtRq	Realtime slots requested from hub.
Codecs	Number of codecs calculated by realtime mechanism.
---------- Timing ----------	
Mode	Timing mode. Set in profile.
NetTTS	TTS value in microseconds measured by hub.
TCL	Confidence value of TTS.
Errors	Number of errors occurred during TTS measurement by TDMA timing algorithms.
SatPos	Satellite longitude set on hub.
GpsPkts	Number of GPS location packets read from RS-232 console.
Set location	Geo location set in site setup .
Set DTTS	Set timing value.
Used location	Location which is currently in use.
Used DTTS	DTTS which is currently in use.

12.2 Stations

Stations table holds stations list for hub, hubless master and DAMA hub. Basic stations parameters are also assigned here.
First of all number of stations should be defined. This number is independent of profiles where stations number is also set. Number of stations in table should generally be higher or equal to maximal stations number in any of used profiles.
On the right the table itself is shown. Scroll in table is possible. Clicking on station number loads its parameters for editing. Left side is for table editing. Operations with single station or with group of stations are possible.



Stations

Number	Station number.
On	Enable station.
SN	Serial number of station UHP.
Shaper	Traffic shaper channel settings to use in guaranteed bandwidth calculations.
Req-pr.	Bandwidth bandwidth request profile to use.

Group actions on stations.

From st	From station.
To st	To station (inclusive).
Value	Value to use.
Action	What to do.

Stations reception statistics can be seen on WWW page here or by command `# show stations`

```
Rem | Bytes_rcvd CRC_errs | Req All | C/N  Offset RF |HblACM| never
1   | 0          0        | -   3   | 11.9 0      43 |10.7 2| UP           0
2   | 10899098   13       | 28  32  | 12.2 15     44 |10.9 2| UP           0
3   | 0          0        | -   4   |  -    -     9  |  -   |    DOWN      0
4   | 0          0        | -   4   |  -    -     9  |  -   |    DOWN      0
5   | 0          0        | -   0   |  -    -     0  |  -   |      OFF     0
6   | 0          0        | -   0   |  -    -     0  |  -   |      OFF     0
7   | 0          0        | -   3   |  -    -     9  |  -   |    DOWN      0
8   | 0          0        | -   5   |  -    -     9  |  -   |    DOWN      0
9   | 10790108   0        | 31  32  | 11.7 -4     39 |10.9 2| UP           0
10  | 0          0        | -   0   |  -    -     0  |  -   |      OFF     0
11  | 0          0        | -   4   |  -    -     10 |  -   |    DOWN      0
12  | 0          0        | -   0   |  -    -     0  |  -   |      OFF     0
13  | 0          0        | -   0   |  -    -     0  |  -   |      OFF     0
14  | 0          0        | -   0   |  -    -     0  |  -   |      OFF     0
15  | 0          0        | -   0   |  -    -     0  |  -   |      OFF     0
16  | 0          0        | -   0   |  -    -     0  |  -   |      OFF     0
17  | 0          13       | -   4   | 10.5 15     36 |10.7 2| UP           0
```

Rem	Remote station number.
Bytes_rcvd	Number of bytes received from station.
CRC_errs	Number of CRC errors.
Req	Number of time slots currently requested by station.
All	Number of time slots currently assigned to station.
C/N	C/N value on hub.
Offset	Frequency offset in Hertz.
RF	RF absolute level in station slots.
HbLv	How station receives hub.
ACM	ACM sub-channel to which this station is assigned.
never	Time when counters were last cleared.

Traffic mode has different layout. Appropriate Telnet command is `# show station traffic` .

```
Rem    SN      Shap | LP bytes    MP bytes    HP bytes    | RTr NRr | Guar | Alloc
1     1489     0    | 0           0           0           | 0   0   | 0.0  | 0
2     1490     11   | 0           0           0           | 0   0   | 0.0  | 0
3     0        0    | 0           0           0           | 0   0   | 0.0  | 0
4     1491     11   | 0           0           0           | 0   0   | 0.0  | 0
5     0        0    | 0           0           0           | 0   0   | 0.0  | 0
6     0        0    | 0           0           0           | 0   0   | 0.0  | 0
7     0        0    | 0           0           0           | 0   0   | 0.0  | 0
8     0        0    | 0           0           0           | 0   0   | 0.0  | 0
9     0        0    | 0           0           0           | 0   0   | 0.0  | 0
10    0        0    | 0           0           0           | 0   0   | 0.0  | 0
```

Rem	Remote station number.
SN	Serial number of station UHP.
Shap	Shaper number assigned to station.
LP bytes	Low priority bytes received from station.
MP bytes	Medium priority bytes received from station.
HP bytes	High priority bytes received from station.
RTr	Realtime time slots request.
NRr	Non realtime slots request.
Guar	Current guaranteed speed in fractional slots.
Alloc	Time slots currently allocated to station.

12.3 MF-TDMA

This statistics shows state of MF inroute controllers of MF hub.

```
Ch     SN       Flags     Flts  RFl FpLost     CRCs       LastChange       Changes
1   (local)
Active channels=0
```

Ch	Channel number.
SN	Serial number of channel controller UHP.
Flags	Flags. ???
Flts	Faults bit mask ???
RFl	RF level on controller input.
FpLost	Frame plans lost on controller.
CRCs	CRC errors on controller.
LastChange	Time when controller state was last changed.

Changes	Number of times controller state changed.

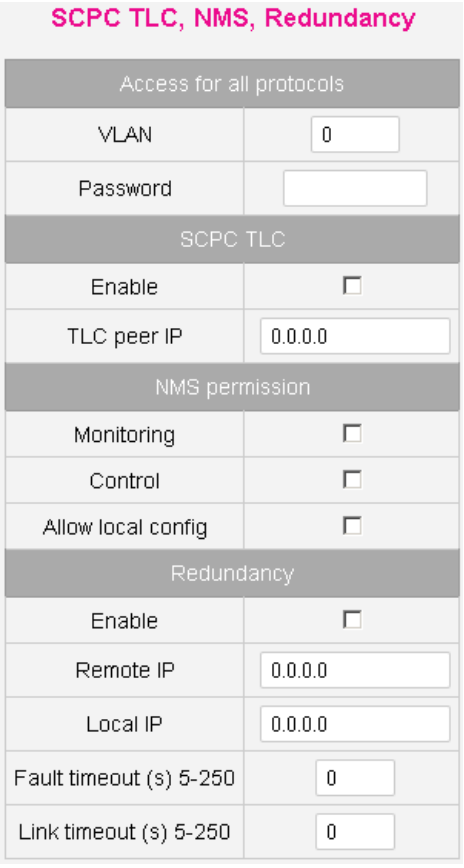
12.4 Statistics of ACM

This statistics shows ACM sub-channels operation.

Ch	MODCOD	CN_min	CN_cor	Stations	Frames_TX	Bytes_TX
1	QPSK-2/3	2.0	3.0	10	0	435
2	QPSK-5/6	3.6	4.6	0	0	0
3	QPSK-8/9	5.4	6.4	0	0	0
4	8PSK-5/6	8.8	9.8	0	0	0

Ch	Channel number.
MODCOD	MODCODs of sub-channels. First is set in profile TDM/SCPC TX , others in ACM .
CN_min	Minimal C/N for this MODCOD
CN_cor	C/N with threshold set in ACM .
Stations	Numbed of stations assigned to sub-channel.
Frames_TX	Number of DVB frames (including empty ones) transmitted with this MODCOD.
Bytes_TX	Bytes transmitted via sub-channel.

12.5 SCPC TLC / NMS / Redundancy



STLC/NMS/RED

Three different items are listed together because they use common protocol to exchange between UHP and other UHP or NMS. This protocol is password protected so passwords should be set on all communicating units. One UHP can communicate to NMS for configuration or monitoring, another UHP for redundancy and remote UHP for TLC simultaneously.

Common parameters for external access protocol

Access VLAN	VLAN over which communication operates
Access Password	Password for authentication

12.5.1 SCPC TLC

SCPC TLC works between two UHPs in point to point mode. See TLC chapter.
SCPC TLC is set up in two places - here and profile TLC screen. Here exchange is set, in profile TLC itself is enabled.

SCPC TLC Enable	Enable of information exchange. If TLC on modulator is off at remote side nothing will happen.
SCPC TLC peer IP	IP address of peer. Packets will be tagged (if not zero) with "Access VLAN".

```
SCPC TLC state
TX_Mode: OFF     TX_Peer: 0.0.0.0          VLAN: 0     Nom.: 8.0
RX_pkts: 0       RX_Peer: 0.0.0.0          Last: never             RX_Cor: 8.0
Remote state:  No data
```

TX_Mode	Whether transmission of local state is enabled.
TX_Peer	IP address of remote UHP.
VLAN	Set local VLAN.
Nom.	Nominal value of local C/N (reference level).
RX_pkts	Number of TLC packets received from peer.
Last	Time since last packet was received.
RX_Cor	Correction value (delta from reference) sent to peer.
Remote state	State of peer.

12.5.2 NMS

NMS allows to control UHP configuration remotely and gather statistics. NMS is active and makes requests. UHP is passive and is not sending any information to NMS itself.

NMS Monitoring	Allow statistics transfer to NMS.
NMS Control	Allow control from NMS.
Allow local config	Do not wait for config from NMS upon restart. Use local configuration from flash. Helps to start network if NMS is not operational and actual (or semi-actual) config is saved to flash.

```
NMS state
ServerIP: 0.0.0.0  VLAN: 0  Mon: OFF  Ctl: OFF
Packets_in: 0              Passwd_errs: 0
```

ServerIP	Set peer IP.
VLAN	Set VLAN.
Packets_in	Number of packets received from all parties.
Passwd_errs	Number of password errors occured.

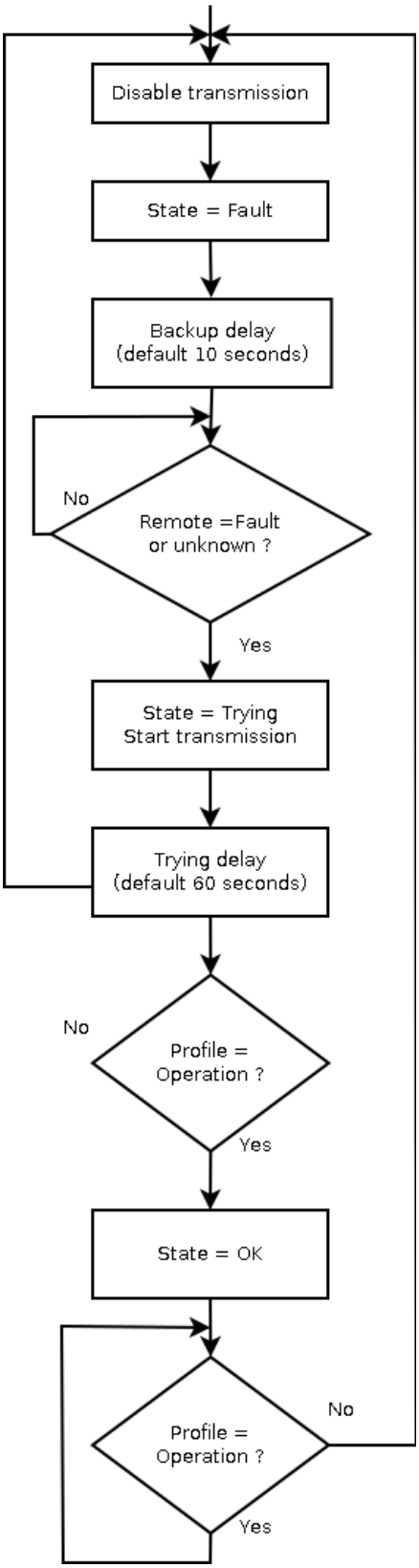
12.5.3 Redundancy

To organize a HUB with a hot redundancy function for a TDM/TDMA hub two UHP-1000 routers with the TDM/TDMA hub function. Every router has to be connected to transmit and receive paths of the station.
The hot redundancy mode supports an automatic power switch for the modulator and for the RX and TX reference signals from one router to another one. This functionality limits the splitters/combiners that are used in the scheme - they must have two ports with the ability to pass reference signals and power. This functionality is not required if reference or (and) power are supplied via other connections.
Mode changes of the reference signal and power of a router are not visible in HTML statistics or `# show interface modulator` and `# show interface demodulator` commands. This means that if a router was initially configured to use, for example, BUC power but the redundancy system shifted it into the BACKUP state (stopped transmitting, switched of the BUC power and reference frequencies) the statistics window will not indicate changes.
Once per 4 seconds both redundancy routers exchange with information about their status via UDP protocol.

Redundancy states

OFF	Redundancy is disabled.
Fault	Last try to start network was unsuccessful.
Backup	Backup mode. Peer is running the network.
Trying	Trying to run the network.
Active	This unit is running the network.

When started, the router is in BACKUP mode. In this mode the router starts a ten seconds timer. During this time a message reporting the status of the second router is awaited. If by the time the timer expires the first router does not receive any information from the second router or if it is in FAULT or BACKUP mode, the first router enters TRYING mode. In this mode the router starts transmission of Outroute channel and waits for a set amount of time, which is set by the administrator (backup timer command), for at least one remote station to connect to the network. If during this time at least one remote station establishes connection then the router changes its state to ACTIVE. The standby router receives a message making it stay in BACKUP mode.
In case two routers are trying to wake up the network simultaneously the priority will be given to the router with the higher serial number.
If during ACTIVE mode all stations go down, one attempt is taken to recover the network and router goes to TRYING mode. If it fails, it stops transmission and goes to FAULT mode giving another router a try.



Redundancy states

IP routing has specific issues in redundancy mode. First of all an IP address must be configured on UHP which becomes "Monitoring" IP address. Other IP addresses which are used for user data forwarding are called "Data" addresses. When UHP is in TRYING/ACTIVE mode all IP routing works as usual. When UHP is in FAULT/BACKUP mode it stops to respond to all IP addresses except monitoring address.

Rules to set IP addressing for redundancy:
- Monitoring addresses should be within one /24 network. Usually it is NMS network. Addresses must be different.
- Data IP addresses should be set EQUAL on both UHPs together with all maps and SVLAN receives.
- Monitoring addresses should be in different /24 network than all data addresses.

Redundancy Enable — Enable redundancy.

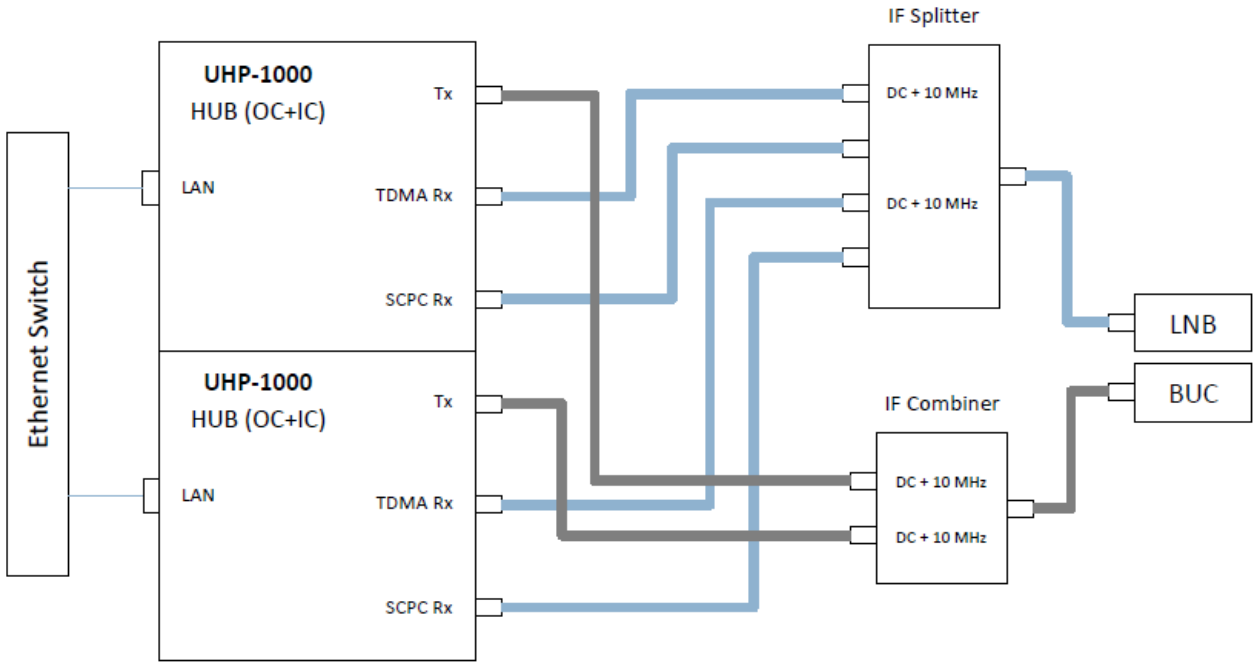
Remote IP	Peer IP for redundancy. Should be set as local IP on another side.
Local IP	Local IP address to leave operating in redundant mode.
Fault timeout	Timeout which allows units to prepare themselves for operation and establish link with one another.

Note: Sometimes Ethernet switches bring ports up for a long time. Fault timeout should be long enough to establish communications between UHPs or both will try to go ACTIVE.

```
Redundancy state
Mode: OFF  AccessIP: 0.0.0.0  VLAN: 0  RemoteIP: 0.0.0.0
TRYING_timeout: 0  FAULT_timeout: 0
Local  state: OFF      Flaps OK->FAULT: 0
Remote state: No reply
```

Mode	Whether transmission of local state is enabled.
AccessIP	Local access IP address.
VLAN	Local VLAN.
AccessIP	Access IP address of remote UHP.
TRYING_timeout	Trying phase duration.
FAULT_timeout	Fault phase duration.
Local state	Local redundancy state.
Flaps OK->FAULT	Number of times unit switched from OK to FAULT state.
Remote state	Remote redundancy state if known.

Redundant hub is assembled as follows:



Redundant hub

Special splitters/combiners passing DC power and 10 MHz should be used.

13. System

13.1 Overview

Overall UHP status is shown. Keys and system errors are shown.

```
UHP ACM DVB-S1 SW3  Ver: 2.9.6 (Jan 23 2013  D1/M1)   SN: 00001699
Uptime: +05:48:22        CurrentTime: +05:48:22        TimeShift: 0
RateAvgTime: 5     BuffersFree: 1286    NoBuffer: 0         ScDesc: 4063
CPUload: 14 %  IdleTimeout: 10      Temperature: 41c
LastTelnetIP: 0.0.0.0   AutoRestartDelay: 0


Key information:
OutKey: 37387 - 22343 - 60690    InKey 0: 58977 - 48287 - 61973
Options: OUTR INR HMESH FMESH ELAN DVBS2


Errors report:
No SW errors
    Configuration  errors
!!! Burst duration too small
!!! Frame duration invalid
```

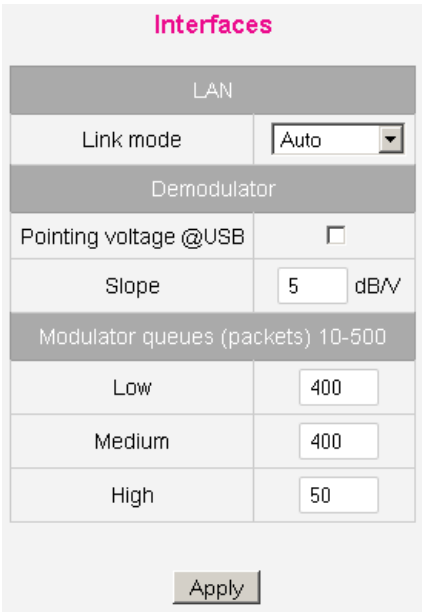
S/N	Serial number of UHP.
SW	Software type running.
Ver	Software version.
CPU Load	Current CPU load.
Buffers	Amount of free packet buffers. When buffers are over software usually crashes.
Temp	Internal temperature.
Profile	Number of currently running profile.
Uptime	Time since reboot (timestamp format).
CurrentTime	Current time if synchronized via SNTP.
TimeShift	Time zone setting.
RateAvgTime	Period of traffic averaging on interfaces.
NoBuffer	Number of times no buffer was available.
ScDesc	Internal scheduler descriptors free.
IdleTimeout	Timeout of Telnet or console sessions.
LastTelnetIP	IP address of last Telnet user.
AutoRestartDelay	Auto-reboot delay if set.

Keys activate options in software.

OutKey	Output option key to report when requesting software options.
InKey	Currently entered key.
Options	Options enabled with current key.

Next system errors are reported if any.

13.2 Interfaces



Interfaces

Overall interfaces control.

LAN interface.

Mode	Link and duplex mode selection.

Demodulator interface.

Pointing voltage	Enables DC voltage on USB connector proportional to demodulator C/N.
Slope dB/V	Regulates how many dB correspond to one volt of output.

Modulator queues length limits in packets.

Low	Low queue length.
Medium	Medium queue length.
High	High queue length. Usualy length here is lower to better drop than delay realtime packets.

13.3 Ethernet statistics

Ethernet interface statistics.

Each interface statistics begins from common block showing operation history of interface.

```
Ethernet interface is UP
Last U->D: +00:00:02          U->D transitions: 1
Last D->U: +00:00:04          Counters cleared: never
```

The first string shows the current state of the interface:

ADMINISTRATIVELY	switched off by the user command
DOWN	switched on but not working (external conditions)
UP	switched on and working

The interface changes to UP if it is switched on and the following condition is adhered to:
Ethernet - connected to the switch (hub, computer)
TDMA - if signal is received from the satellite
Demodulator - if signal is received from the satellite
Modulator - if transmission is switched on

Then the accumulated statistics on changes in the interface state comes up.

Last U- >D	Time when the last transition from UP to DOWN occurred.
Last D- >U	Time when the last transition from DOWN to UP occurred.

U->D transitions	Number of transitions to DOWN.
Counters reset	Time when the last cleaning of counters occurred.

These counters are reset together with statistics counters on the relevant commands.

Then information on the specific interfaces comes up.

```
MAC: 46:13:00:00:16:99  Set: AUTO      State: 100/Full|TX queue | 0          |
|-----+---- RX ----+---- TX ----+--------+-----------|No buffer| 0          |
|Rate | 2068       | 3923       |Bcasts  | 424       |Collision| 0          |
|Bytes| 9722533    | 20032855   |CRC errs| 0         |16 colls.| 0          |
|Pkts.| 83106      | 77525      |Overruns| 0         |Underruns| 0          |
```

MAC	MAC address of interface (hexadecomal).
Set	Link mode setting.
State	Link mode present.
Rate	Current traffic bit rate.
Bytes	Bytes transmitted and received.
Pkts.	Packets transmitted and received.
Bcasts	Broadcast frames received.
CRC errs	CRC errors occurred.
Overruns	Times packets could not be sent because of overload.
TX queue	Transmit queue length.
No buffer	Times no buffer fro reception was available.
Collision	Number of packet collisions on half-duplex links.
16 colls.	Number of multiple collisions.
Underruns	Times CPU could not write packet to LAN controller.

13.4 Demodulator statistics

Demodulator reception statistics.
Head values see in LAN interface.

```
Demodulator interface is DOWN
Last U->D: never              U->D transitions: 0
Last D->U: never              Counters cleared: never
------------------------ Outdoor Unit -------------------------
| LNB-pwr: OFF  T10M: OFF  Offset: 0    KHz  SearchBW: 1800 KHz |
| Frq: 950000   SR: 1000   Mode: DVB-S1  SpInv: OFF             |
---------------------- Demodulator state ----------------------
| InLvl | SpI | State  | Mod. | LDPC | SRoff | C/N  | RX-offset |
| NoSig | OFF | ------ | ---- | ---- | ----- | 0.0  | 682   KHz |
------------------------ Data received -----------------------
Rate/bps: 0        Packets: 0           Bytes: 0           CRC_errors: 0
```

LNB-pwr	Power 18V on SCPC and TDMA RX interface connectors.
T10M	10 MHZ reference on TDMA RX interface connector.
Offset	LNB offset stored in configuration. ???
SearchBW	Search bandwidth +/- kHz.
Frq	Current RX frequency.
SR	Current RX symbol rate.
Mode	Current reception standard S1/S2.
SpInv	Spectral inversion state.
InLvl	RF input level or "NoSig" if level is too low.
SpI	Current spectral inversion state.
State	Carrier presence state.
Mode	Modulation. Can vary in ACM mode.

LDPC	LDPC FEC rate. Can vary in ACM mode.
SRoff	Symbol frequency error in symbols per second.
C/N	Signal to noise ratio.
RX-offset	Receive frequency offset between set and actual values.
Rate/bps	Input information rate in Bps.
Packets	Packets received.
Bytes	Bytes received.
CRC_errors	CRC errors occurred.

13.5 Modulator statistics

Modulator transmission statistics.
Head values see in LAN interface.

```
----------------------------- Modulator settings -----------------------------
Freq: 950000   SR: 1000                  SetLvl: -36.0   Max: -0.0   10M: OFF
 FEC: DVB 3/4  BR: 1375   TX: ON         OutLvl: -36.0               24V: OFF
------------------------------------------------------------------------------
Rate/bps: 502
LOW  Packets: 0          Bytes: 0          Q_len/400: 0        Drops: 0
MED  Packets: 0          Bytes: 0          Q_len/400: 0        Drops: 0
HIGH Packets: 0          Bytes: 0          Q_len/50 : 0        Drops: 0
CTRL Packets: 23287      Bytes: 497917     Q_len/20 : 0        Drops: 0
```

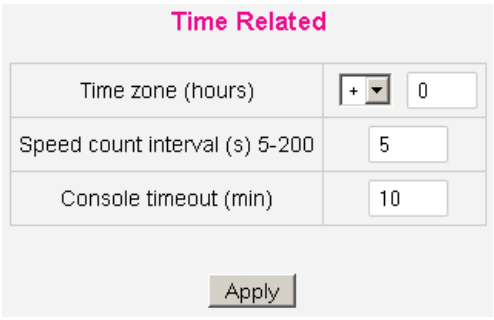
Freq	Current TX frequency.
SR	Current TX symbol rate.
BR	Calculated bit rate.
TX	Transmission enable state.
SetLvl	TX power level set in profile.
OutLvl	Actual TX power level. May change if TLC is on.
Max	Maximul level allowed for TLC.
10M	Whether 10 MHz reference is turned on modulator connector.
24V	Whether 24V power is turned on modulator connector.
Mode	Transmission standard S1/S2.
Modulation	Current modulation.
FEC	Current FEC.
Rate/Bps	Current transmission rate.

Traffic statistics by priorities. In ACM mode 4 sections here for 4 sub-channels.

Packets	Packets transmitted.
Bytes	Bytes transmitted.
Q_Len	Queue length in bytes / maximal possible queue.
Drops	Number of packets dropped because of overload.

13.6 Time-related

Parameters related to time management.

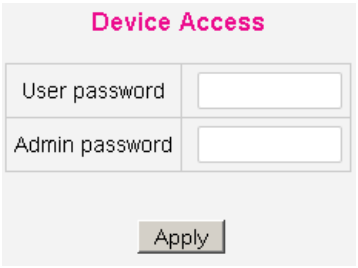


Time-related

Time zone	Time shift with GMT in +/- hours.
Speed count interval	Interval for averaging traffic on interfaces.
Console timeout	Timeout for Telnet or console inactivity auto-logout.

13.7 User access

Initially UHP has no passwords defined. Passwords for user (read only + reboot) and administrator (full access) are set here.

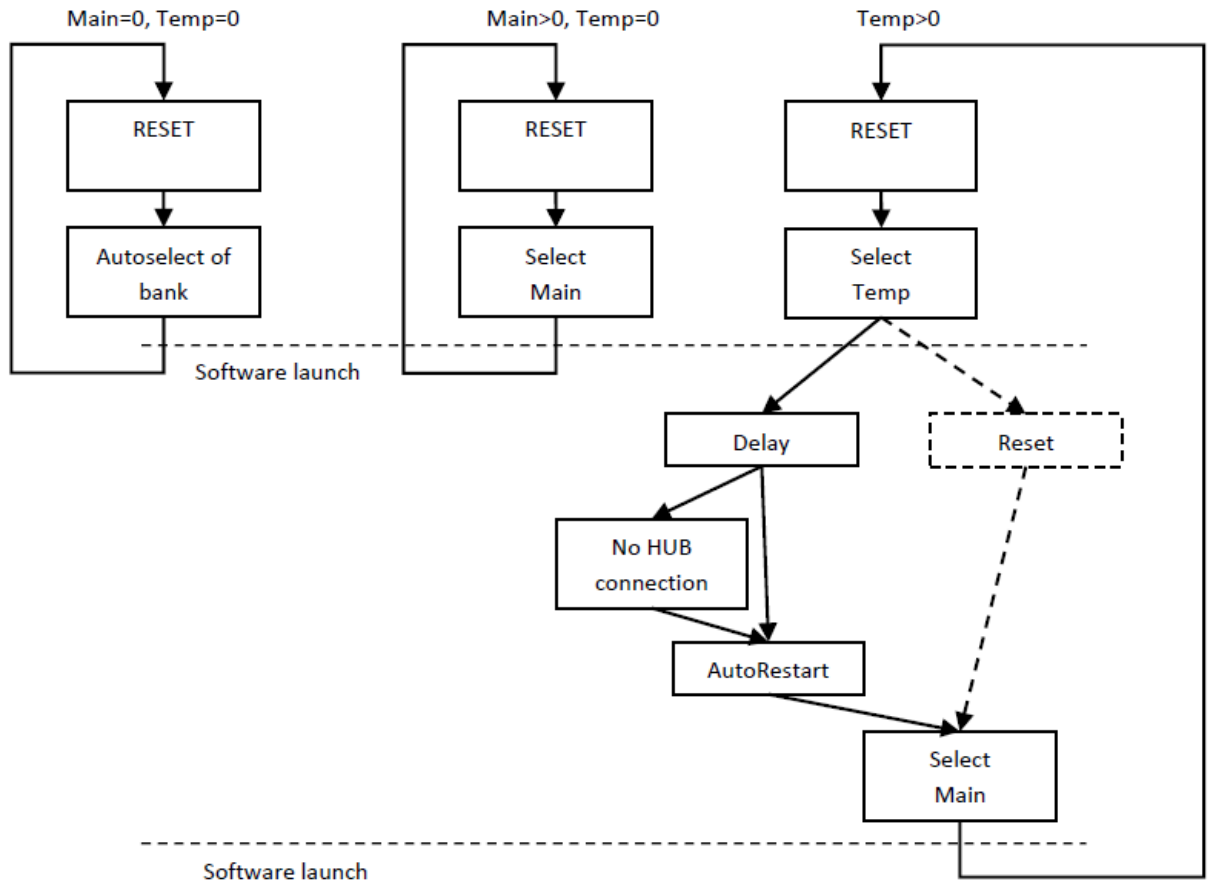


User access

User password	User password.
Admin password	Administrator password.

13.8 Flash/Boot

UHP software (SW) is placed in the non-volatile memory (flash memory). For convenience and wider capabilities the router flash memory can contain up to three different SW versions. SW is written in the memory banks. Memory banks are numbered from 0 to 3. Zero bank contains a loader designed for selecting of which of the banks should be downloaded during start.
The boot loader, when the router is started, selects which of the SW banks to download and which configuration profile to use for SW operation.
Default action - list through the banks in sequence and download the first bank in which SW will be with the correct checksum, having used the zero configuration profile.
You can change the loader behavior by specifying directly the number of the bank which should be used to start SW, and the configuration profile number.
When the router SW is updated there is a possibility of verification of the new SW performance without finally transiting to it. To do so, one can start new SW once and if there are any problems (e.g. Hub communication is unavailable), the router will in some time reboot back to the old SW or in any case or if it failed to establish communication with the Hub. This procedure is named fallback. If, when working with the temporary SW, the router is overloaded with user's activities it will also get loaded in the main SW.
To implement this fallback mechanism, one have to specify which bank should be used to download the main SW from and which - the temporary SW.



Boot procedure

Flash contents

Bank	Image	Version	Length	Date
0	UHP boot loader	00010401	10932	26.Sep.08 18:49:46
1	UHP ACM DVB-S1 SW3	00020906	440956	26.Jan.13 01:44:01
2	UHP DVB-S1 Software	02040126	389936	14.Apr.11 14:20:04
3	UHP DVB-S1 Software	02050000	410260	16.Mar.11 11:18:00

Boot control

Mode	Software bank	Config bank
Main boot	1	0
Temporary boot	None	0

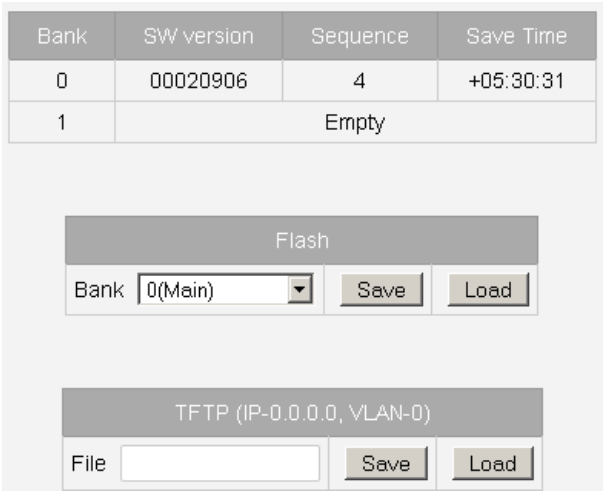
Apply

Flash/Boot

Bank	Bank number.
Image	Image type loaded.
Version	Image version.
Length	Image length in bytes.
Date	Date of image compilation.
Main boot	Main boot flash bank and configuration bank. Auto - scan through banks sequentially from bank 1 and boot from any bank containing valid image.
Temporary boot	Temporary boot flash bank and configuration bank.

13.9 Save/Load

Configuration saving and loading screen.
UHP has 2 banks of configuration. Each bank holds entire configuration with 8 profiles, routing, stations. Bank o is loaded by default.



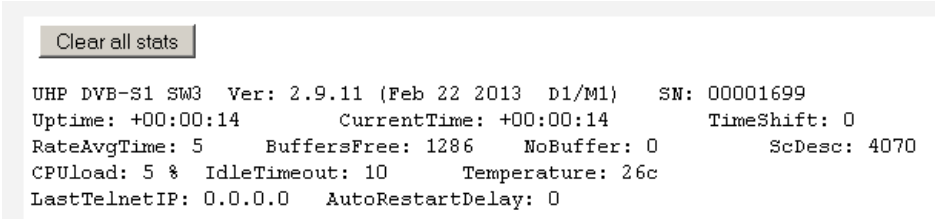
Save/Load

SW Version	Version of software which saved config.
Sequence	Increased by 1 after each saving.
Save Time	Time when config was saved.
Bank	Bank to save or load.
File	File to save or load. TFTP server settings are in protocols section.

14. Maintenance

14.1 Support information

This screen has set of statistics for reporting to technical support center within support requests. This information will be important for knowing current configuration of UHP and preparing accurate answer. Set of statistics is not complete so possibly other statistics may be requested by support center to clarify situation.



Support information

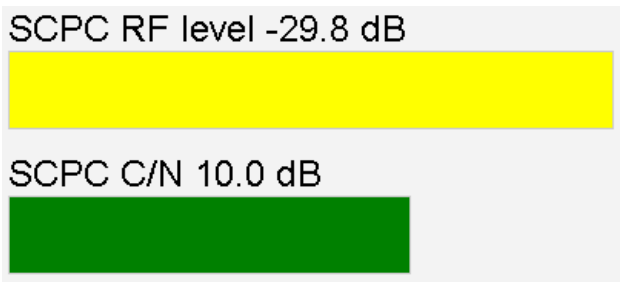
Button clears all statistics. It is important that reported statistics was collected during the problem to distinguish it from other past problems. That is why it is recommended to clear all stats, observe the problem and then gather statistics.

14.2 Pointing

Satellite routers have built-in tools for pointing the antenna to the satellite. The router provides actual information about overall input signal level (RF Level), as well as the quality of the reception of the carrier (C/N) from the Hub (or carrier of another station in SCPC mode) when demodulators locks on such carrier. Such information can be obtained in real time via HTTP interface, a local console (command line) or as an analog DC signal.
Pointing procedure is common for any method of displaying the level of signal quality:

- Calculate expected elevation and azimuth (corrected accordingly to magnetic declination). Such calculations can be performed with UHP Calculation Tool available on the Documentation CD or can be downloaded from the Web.
- Direct the antenna toward the satellite. When installing the angle of elevation please take into account offset angle of parabolic antenna (specified in the description) or use an elevation scale of antenna.
- Access the information about actual signal level of satellite router with any of methods described below.
- Start moving antenna slowly in limited angle of elevation and azimuth. The value of the demodulator input level increases when antenna receives signal from any satellite. Signal peak means proper pointing to the satellite.
- After finding the peak of this signal by adjusting the azimuth and elevation, it is necessary to provide demodulator some time to search for and capture the carrier from the Hub. Search for the carrier with symbol rate of 250 ksps in the band of 3000 kHz (slowest case) may take about 30 seconds. If demodulator is unable to lock on a carrier for a long time it may mean that antenna is pointed to a wrong satellite and it is necessary to continue moving the antenna in search for another satellite.
- When demodulator locks on the carrier the router begin to show actual C/N level, the maximum of which is necessary to achieve by fine tuning the azimuth and elevation of the antenna.
- Once the satellite is found, it is necessary to tune the polarization angle in accordance with the procedures applicable to this satellite. Afterwards, the station may get a permission to start transmission.
- One can reduce demodulator's scanning time by adjusting the frequency shift and narrowing the search range.

HTTP pointing
Pointing window of the router displays information about the quality of signal reception (Figure 23) and simplifies the procedure of an antenna pointing.



Pointing

The information about demodulator’s quality of reception is displayed in the graphical and textual form. Search phase is

also shown below when demodulator is unlocked. Please allow demodulator to pass all search cycle before changing azimuth and/or elevation angle. When demodulator locks on the carrier textual and graphical information about level C/N will replace the information about search phase. Proceed with fine-tuning of antenna azimuth and elevation until a maximum of C/N level is achieved.

Console pointing
Console command `# demodulator pointing` prints pointing information to console:

```
  RFlvl    Max   Min       State       C/N     Max   Min     Q-quit
-80.0    -80.0 -80.0    Search-0 %    0.0     0.0   0.0
```

The string shows the overall level of the signal from LNB. It reports the current RF level, as well as maximum and minimum peaks registered during the pointing assistance. Further, the demodulator state status: percentage of search circle when demodulator is unlocked.
or "Locked" or the percentage of scanned strip search in the current cycle, or a message that the demodulator is found and adopted a signal.
When demodulator is locked on the carrier its status change to "Locked" and further three values represent - the C/N levels of demodulator (current, maximum and minimum).
Type "Q" to exit pointing assistance mode.

Pointing voltage output to USB
The router may output an analog signal via USB port equivalent to quality of reception of the demodulator. This voltage can be used for pointing the antenna to the satellite during installation or/and as a reference signal form automatic antenna tracking system. Pointing voltage is turned on in "Demodulator" settings in "System" menu.

USB pointing voltage output

The analog pointing signal is available on the Pin 1 of USB "Console" port (to be used with "Ground" signal on the Pin 4). In the standard mode the pin 1 used to deliver a 5 VDC power from the computer. When pointing feature is activated the pin 1 represents output voltage ranging from 0 to 3.3 volts. Such voltage does not interfere with standard USB port operations. Short-circuiting this signal to Ground is not critical, however input voltage above 5 VDC is not allowed. Standard (analog or digital) voltmeter connected to this signal could be used as a reference toll for antenna pointing. Installer may use Tx coax cable to deliver such signal from the router (indoor) to antenna (outdoor) - this cable is not used while antenna pointing. Special adapters to connect the F-connector of coaxial cable to USB output and a voltmeter can be purchased from your local distributor or make by your own.
When this mode is active the voltage is changed within the following range:

- When demodulator the voltage is in-between 0 and 1 Volt proportionally to the overall Rx level of the demodulator;
- When demodulator is locked the voltage is proportional to C/N and ranging from 1 V to 3.3 V. Voltage above 1V is proportional to C/N with ration 10dB/1V, e.g. reception of the carrier with C/N signal of 5 dB will be represented as 1.5 V signal on USB port, 10 dB - 2V, etc.

When activating the pointing mode while antenna is already pointed to the satellite the default minimum level may be set too high. It is not a problem if the intention is just fine pointing of antenna to the same satellite. However this may create a problem re-pointing the antenna to another satellite, because the reference level may not react on lower signals when antenna is disoriented from the initial satellite. To prevent this, it is recommended to define the desired range manually.

14.3 Network Command

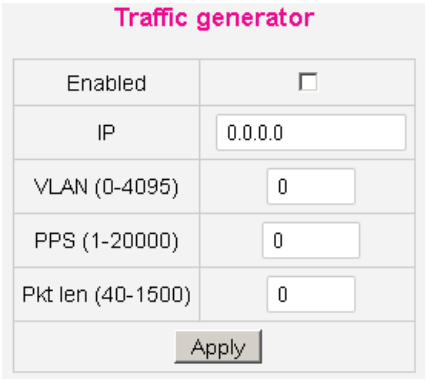
Network command feature is used for remote controlling UHPs via satellite. It is possible to issue textual console commands on UHP beyond satellite channel from local UHP. This mechanism can be used for routing set up on the other end or for rebooting remote unit. Commands are transferred via non-IP service protocol and do not need any IP setup on local or remote end. Only serial number of remote UHP is needed to know.
Command works between SCPC units in both directions or from hub (outroute) towards stations (not backwards).
No answers are received from remote end so all commands are executed "blindly".

Network Command

SN	Serial number of remote UHP or 11111111 (eight ones) for broadcast command to all stations.
Command	Command itself. Commands which need pausing should not be used. They can block remote end console.

14.4 Traffic generator

Traffic generator generates PING packets. It doesn't receive them - only geeneration occurs but rate of generation can be very high. It can be used for testing channel throughput, see the way of routing (where my 10000 packets flowed), for other test purposes. As instrument can generate really huge traffic (to 96 Mbit/s) it should be used with caution.
Traffic generator works on background not affecting other UHP functions.



Traffic generator

Enabled	Enable traffic generator
IP	Destination IP of packets. Source IP is picked automatically.
VLAN	VLAN for specifying routing table.
PPS	Packets per second.
Pkt len	Length of packet. Total length of packet with ICMP and IP header is specified.

14.5 Reboot

Single button here reboots UHP.