Device Status menu

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The "Device Status" page is displayed by default after the authentication step. It displays the main parameters of the unit in real-time. You can set the "*Auto Refresh*" option to refresh the statistics automatically. Refresh frequency can be set by the "*Auto Refresh Time*" parameter. The minimal possible value is “0” seconds and it updates the information instantly.

The device statistics can also be refreshed manually by clicking the «**Refresh**» button.

These options are available in the bottom-left side of the "Device Status" screen:

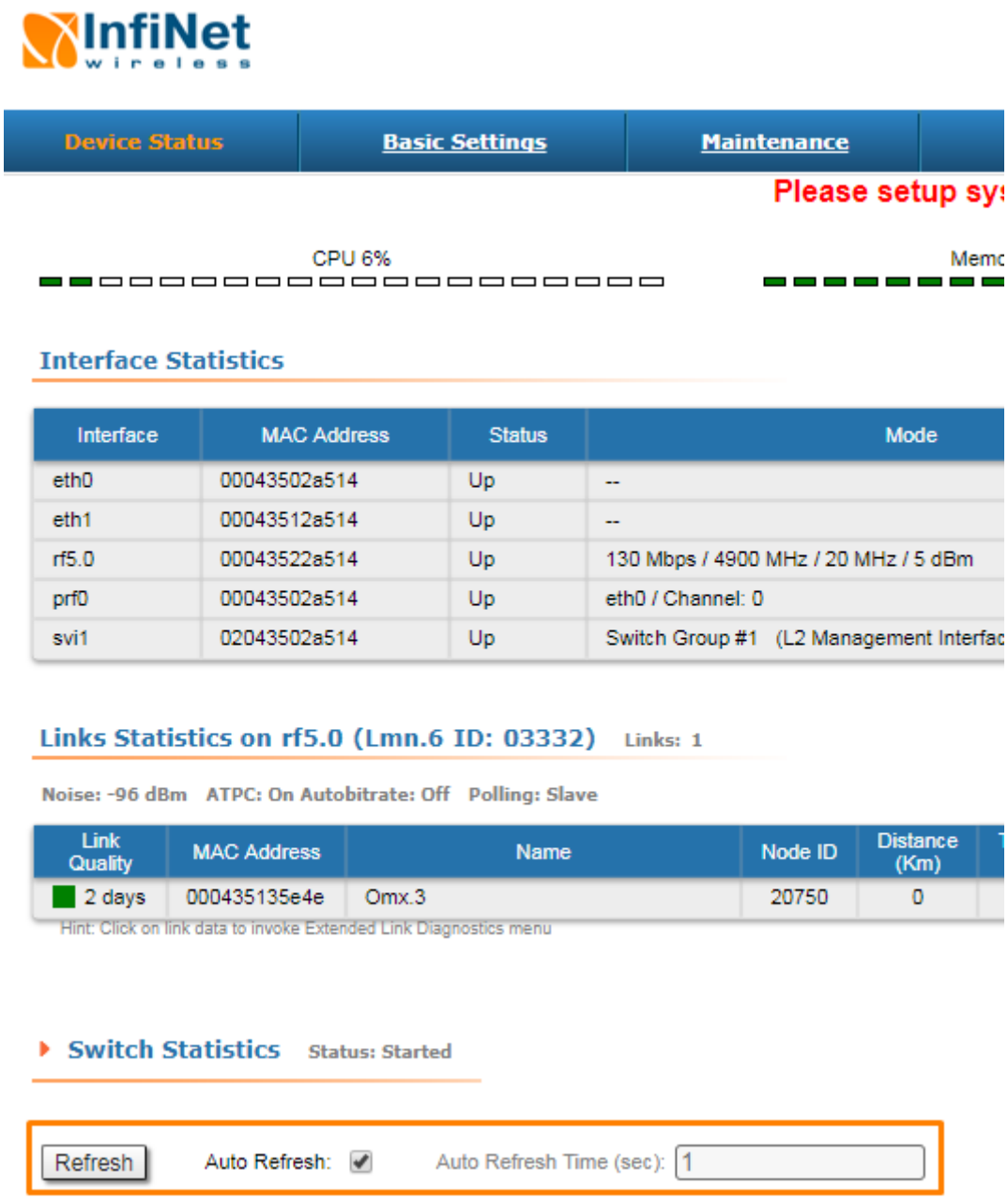


Figure - Refresh option

The "Device Status" page has the following sections:

- "CPU load" - displays the load percentage of the CPU
- "Memory load":
  - Memory (the data stored in volatile memory are valid only during the current session, until the system reset) displays in real-time the total memory available and the used memory by the running processes
  - Flash memory (non-volatile memory) displays in real-time the total memory available and the used memory by the **WANFleX** and configuration files
- "Interface Statistics" - displays the main parameters of all configured interfaces (physical and logical)
- "Wireless Links Statistics" - displays the main parameters of all wireless connections between the device and the neighbor devices
- "Switch Statistics" - displays counters of the frames which have been switched (for example: the number of dropped packets and if they are dropped because of the flood into their reachable destination, because of the STP, because of the firewall, etc).

Interface Statistics

Title

Parameter	Description
Interface	• Displays all physical and configured logical interfaces
MAC Address	• Displays the MAC address of each interface

Status	• Displays status of each interface:
	  ◦ Up - enabled;
	  ◦ Down - disabled.

Mode	• Displays the operation mode of each interface.
	  ◦ Ethernet interface:
	  ▪ 10,100 or 1000 Mbps;
	  ▪ Half or full duplex mode - red value of this parameter informs that transmission is performed in a half-duplex mode.
	  ◦ Radio interface:
	  ▪ Bitrate;
	  ▪ Operating frequency - red value of this parameter indicates an absence of data transmission due to the spectrum scanning by the DFS tool;
	  ▪ Channel width;
	  ▪ TX Power - red value for this parameter may indicate a problem with the transceiver's hardware.;
	  ▪ DFS tool state;
	  ▪ Greenfield mode.
	  ◦ SVI:
	  ▪ Switch group number.
	  ◦ PRF interface:
	  ▪ Parent;
	  ▪ Channel number;
	  ▪ Frame size - red value of this parameter means impossibility to set the optimal size due to external limitation (MTU value on the switch port).
	  ◦ Vlan interface:
	  ▪ Parent;
	  ▪ Vlan ID;
	  ▪ Selected vlan interface operation standard.

Packets	• Displays the number of received and transmitted packets for each interface since the unit is operational. The local system packets are counted, too
Errors	• Displays the number of received and transmitted error packets for each interface since the unit is operational
Load	• Displays the packet flow through each interface in real-time (for the system and the data traffic)

Table - Interface Statistics

All these counters can be reset by clicking the **«Reset All Counters»** button:

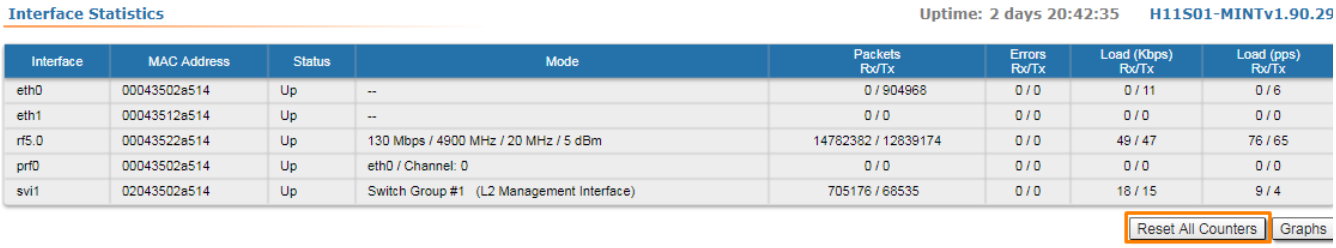


Figure - Counters reset

> **CAUTION**
>
> Clearing these counters by clicking the «**OK**» button in the pop-up page means losing the history data about the functionality of your unit. Avoid this operation unless you are completely sure you don't need these data in the future.

The software version is displayed in the right side of Interface Statistics section (for example: MINTv1.90.5).

Links Statistics on rf5.0

This section displays the following information for the radio interface of the unit:

- Node name and ID
- Noise level
- Number of established links
- ATPC status (activated or deactivated)
- Autobitrate status (activated or deactivated)
- Polling or TDMA mode

Parameter	Description

Status	• Gives a color indication for the wireless connection quality with the neighbor unit:
	  ◦ Red: poor connection
	  ◦ Yellow: good connection
	  ◦ Green: excellent connection
	• Remote device's interface role:
	  ◦ M - master;
	  ◦ S - slave.
	• Link Uptime. Displays the link uptime
	• F – relevance of remote unit firmware (optional). Idicates that the remote unit has the older firmware than the local one
	• ? – system password of the remote unit (optional). Idicates that the remote unit has not the system password
	• E – Ethernet port status on the remote device (optional). Indicates that the remote device Ethernet port is flapping

MAC Address	• Displays the neighbor's MAC address
Name	• Displays the neighbor's name
Node ID	• Displays the sequential number of the neighboring node
Distance	• Displays the calculated (theoretical) distance to the neighbor unit (in Km)
Tx Power	• Displays the power level of the Tx and Rx signals of the neighbor unit (in dBm)
SNR	• Displays the ratio of the useful signal power to the noise power for the input and output signals at the neighbor unit (in dB). For radio link stable operation, the SNR value must in the range of 12-50 dB, higher modulation are available at values of 27-50 dB
Current Level	• Displays the Tx and Rx signals levels for current bitrate of the neighbor unit (in dB)
Bitrate	• Displays the set bitrate value for the Tx and Rx signals of the neighbor unit

Retries	• Displays the percentage of Tx and Rx retries of the neighbor unit
Errors	• Displays the percentage of Tx and Rx errors of the neighbor unit
Load	• Displays the number of kbps and packets that are going inbound and outbound the radio interface of the neighbor unit (main data)

Table - Wireless Links Statistics

By clicking the "**Route Map**" button you can get the MINT topology schematic map with the visualization of the active and alternative routes to each node.

> **NOTE**
>
> Map is available for H08, H09, H11 hardware platforms.

Schematic topology map allows you to visually determine the network connectivity and complexity and to track the route switching, including mobile objects.

The radio interfaces of the Masters devices are marked with a rectangle, the Slaves are marked with ellipses. The device name highlighted in red indicates problems in its operation. Connections are represented by arrows pointing the prevailing direction of data transfer. Arrows have the following color differences:

- Blue - wireless connection, thicker the line, the higher a load on the link.
- Yellow - PRF connection.
- Green - join connection between radio and prf interfaces.
- Red - indicates the interruptions of the link.

Dashed lines represent backup routes.

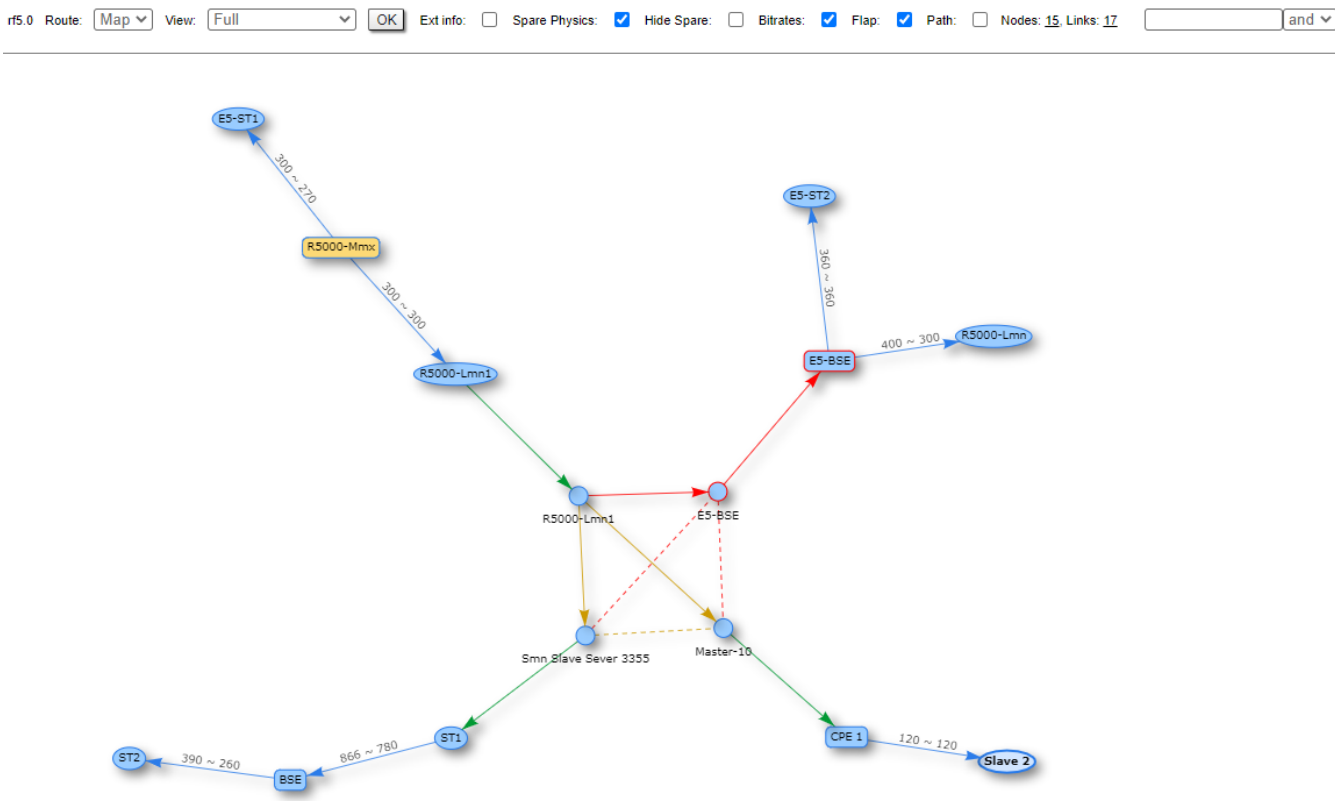


Figure - Schematic map

For additional information on each node, double click on it to get remote commands (rcmd).

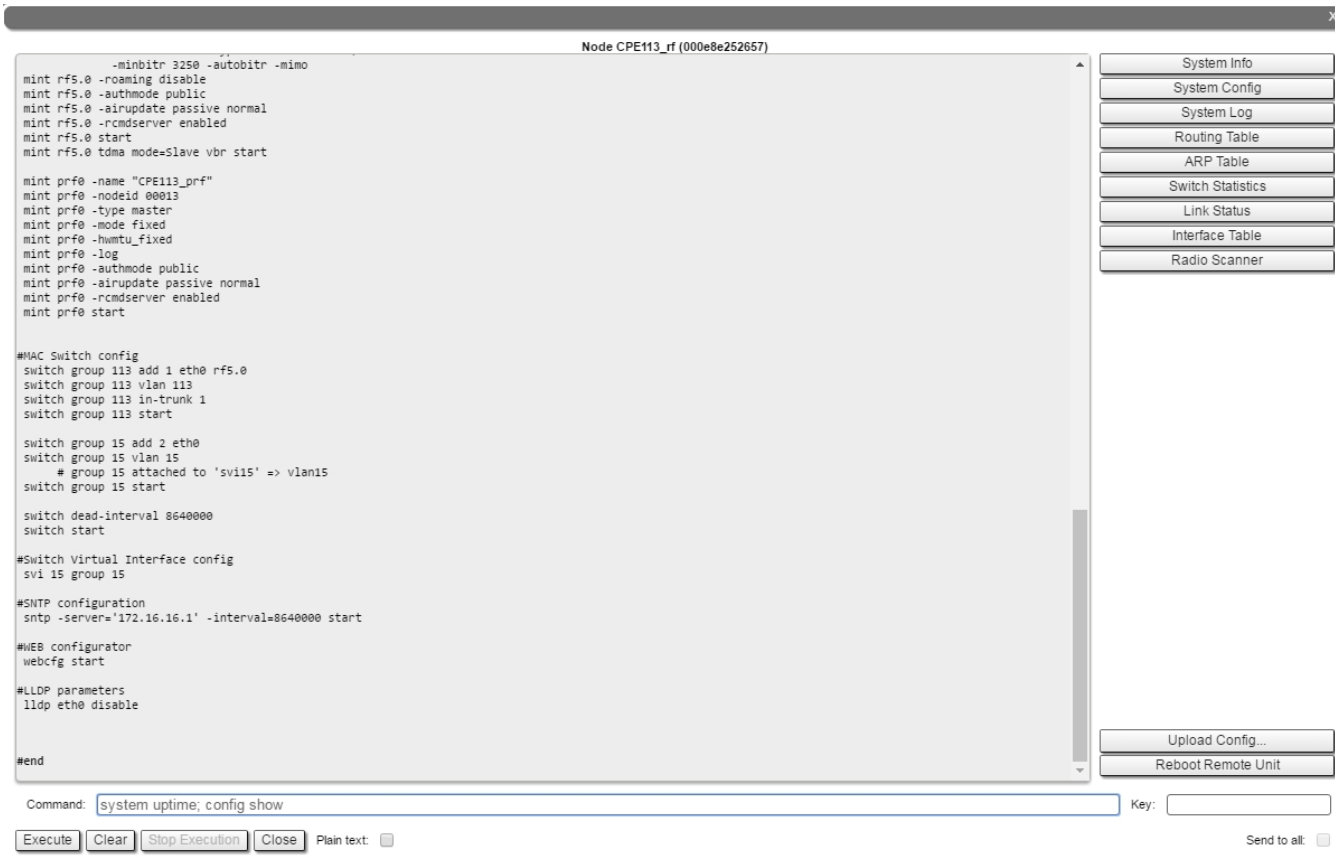


Figure - Remote commands

Detailed information about options in this tool is described in the "Remote Commands" section.

In TDMA based software in the "Wireless Links Statistics for Interface rf5.0" section some additional information is available:

- about wireless link parameters;
- deflection angle from the main antenna direction towards the subscriber terminal, in the column "Distance" (only for **R5000-Qmxb** sector base station with beamforming technology).

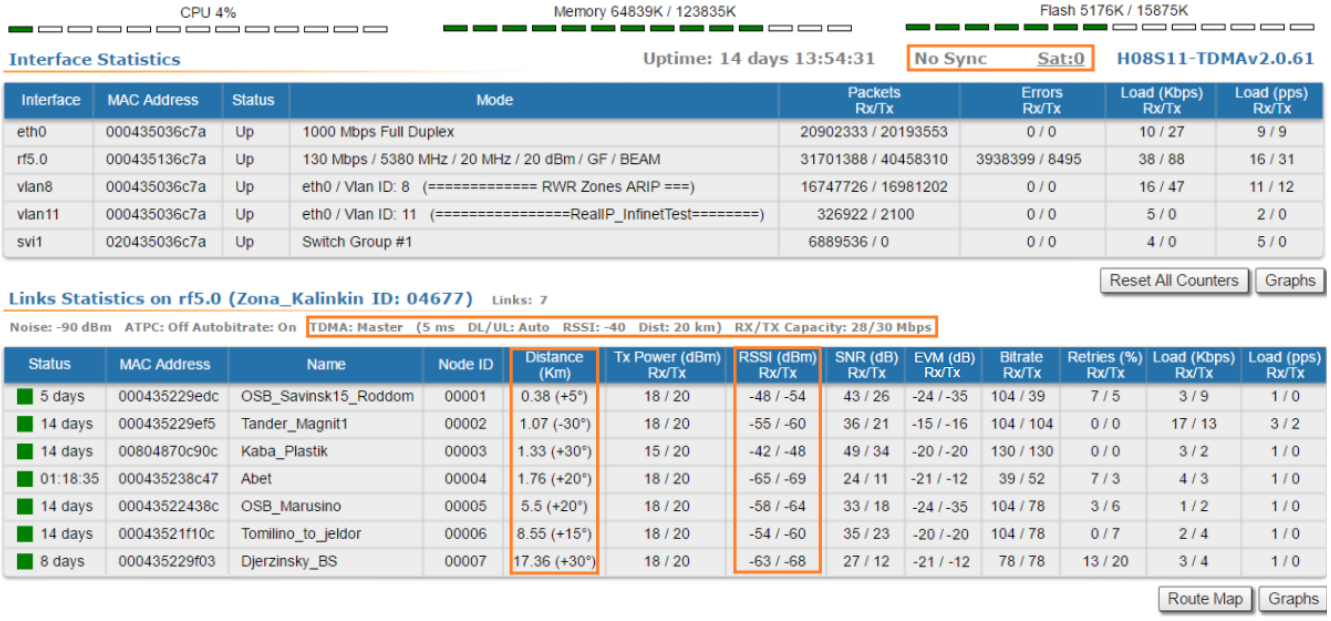


Figure - Wireless Links Statistics for the Radio interface in the TDMA based software

Parameter	Description

Current TDMA parameters	• Operational mode of the unit (Master/Slave)
	• Displays the current TDMA parameters for Master:
	  • Time slot duration (in microseconds)
	  • Downlink percentage of the time slot
	  • Maximum RSSI level (in dBm)
	  • Maximum operational distance (in kilometers)
	  • RX/TX Capacity

RSSI (dBm) Rx/Tx	• Displays the power present in a received radio signal
	  • "*Rx*" – the power of received radio signal, measured at the local unit
	  • "*Tx*" – the power of received radio signal, measured at the remote unit
	  • "*" – indicates the difference in the signals power of the vertical and horizontal polarizations

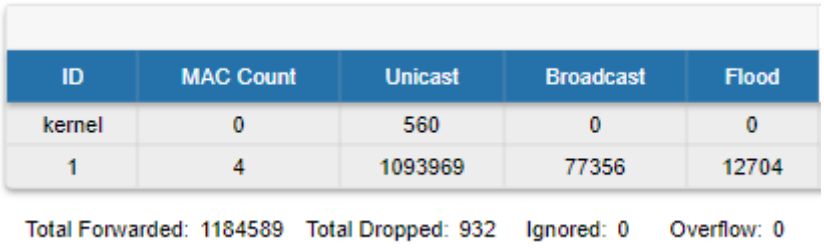
Sync Status	• Displays the current status of device synchronization with external timing reference from GPS/GLONASS
	  • "*Sync*": the device is in sync. The value in brackets is current value of the offset (in microseconds) between the internal clock of the device and the external timing reference from GPS/GLONASS
	  • "*Wait Sync*": the device is waiting the external timing reference from GPS/GLONASS. Synchronization is enabled on the device, but it doesn't receive external timing reference from GPS/GLONASS
	  • "*No Sync*": the device is not in sync. The current value of offset between the internal clock and the external timing reference from GPS/GLONASS is beyond the allowed value range (±10 microseconds)

Sat:	• The number of visible GPS/GLONASS satellites

Table - Wireless Links Statistics - Radio particular parameters in the TDMA based software

Switch Statistics

This section displays the number of unicast, broadcast and flood packets switched within each Switch group and also within kernel system (internal traffic), in real-time (since the last reboot):

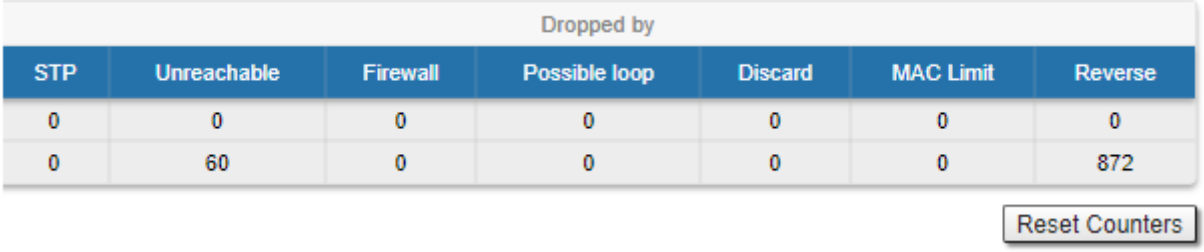


ID	MAC Count	Unicast	Broadcast	Flood
kernel	0	560	0	0
1	4	1093969	77356	12704

Total Forwarded: 1184589 Total Dropped: 932 Ignored: 0 Overflow: 0

Figure - Switch Statistics

It also displays the number of dropped packets for: STP, unreachable destination, firewall, possible loop, discard, MAC limits and reverse, within each Switch group and kernel, in real-time (since the last reboot):



Dropped by						
STP	Unreachable	Firewall	Possible loop	Discard	MAC Limit	Reverse
0	0	0	0	0	0	0
0	60	0	0	0	0	872

Reset Counters

Total forwarded, dropped and ignored packets are displayed in real-time, too.

All these counters can be reset by clicking the «**Reset All Counters**» button.

Switch Statistics parameters:

Parameter	Description
Unicast	• Sending a packet to a single host (network destination) identified by a unique address
Broadcast	• Sending a packet to all hosts (network destinations) simultaneously (broadcasting is done by specifying a special broadcast address on packets)
Flood	• Sending a packet along the same link multiple times (without specifying a destination address for the packets) • Several copies of the same packet would ultimately reach all nodes in the network in flooding
STP	• Spanning Tree Protocol - standardized as IEEE 802.1D • Creates a spanning tree within a network of connected layer-2 bridges (typically Ethernet switches) and disables those links that are not part of the spanning tree, leaving a single active path between any two network nodes • The value displayed in the Switch Statistics table represents the number of the packets blocked by the Spanning Tree Protocol
Unreachable	• The sender could not reach the specified network destination • The value displayed in the Switch Statistics table represents the number of the packets dropped because they flood to unreachable destination
Firewall	• A software or hardware-based network security system that controls the incoming and outgoing network traffic by analyzing the data packets and determining whether they should be allowed through or not, based on applied rules set • The value displayed in the Switch Statistics table represents the number of the packets dropped by the firewall system in the network
Possible loop	• A switching or bridging loop occurs in a network when there is more than one Layer 2 path between two endpoints • Because a physical topology that contains switching or bridging loops is needed for the redundancy reasons, the solution is to allow physical loops, but create a loop-free logical topology using the spanning tree protocol (STP) on the network switches • The value displayed in the Switch Statistics table represents the number of the packets dropped because they belong to a possible loop (more than one port declares same packet source)
Discard	• The value displayed in the Switch Statistics table represents the number of the packets dropped by the configuration (for example: "switch group N start [discard]")
MAC Limit	• MAC address-table limit reached (switch maxsources (MAXSOURCES|0) # default 5000) • The value displayed in the Switch Statistics table represents the number of the packets dropped because the limit of MAC address-table was reached
Reverse	• The value displayed in the Switch Statistics table represents the number of the packets dropped because they have the same source and destination port (the frame came to the unit through one port and according to the switching table it must leave through the same port)

Table - Switch statistics parameters

By clicking the «**Show System Log**» button, you can view the "System Log" section:

Figure - System log

The "System Log" section allows browsing the unit's system log. It is possible to minimize/enlarge the system log window by clicking the buttons: 

You can delete all the information saved in the system log by clicking the «**Clear System Log**» button. You can hide the System Log section by clicking the «**Hide System Log**» button.

Extended Interface Statistics

The "Extended Interface Statistics" tools gather complete information and enhanced statistics for each interface of the unit. Each interface type has its own set of available tools applicable to it.

In order to access the "Extended Interface Statistics" tools, click on the row of each interface within the "Interface Statistics" section:

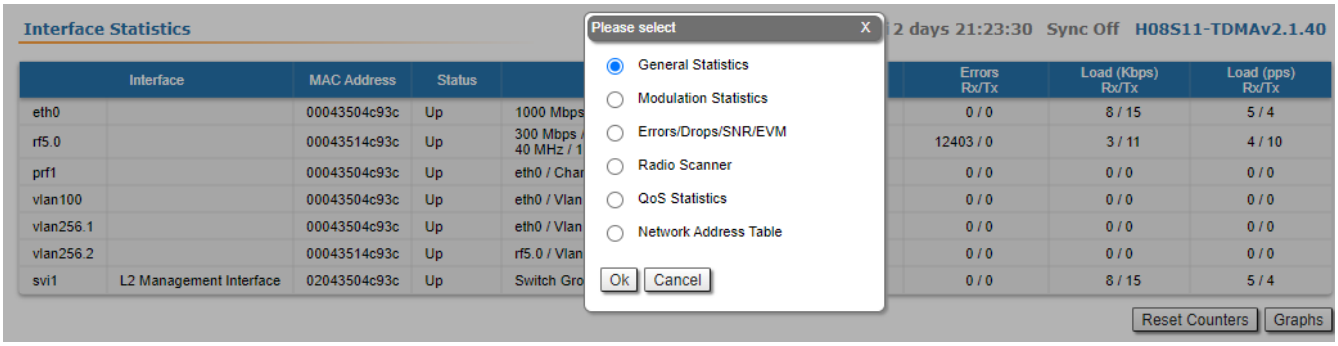


Figure - Extended Interface Statistics

General Statistics

The "General Statistics" tool displays the information about the interface such as the *interface mode, current status, Rx and Tx statistics,* etc. The actual statistics details depend on the interface type.

For Ethernet interfaces information about current status, operational mode and load statistics is available.

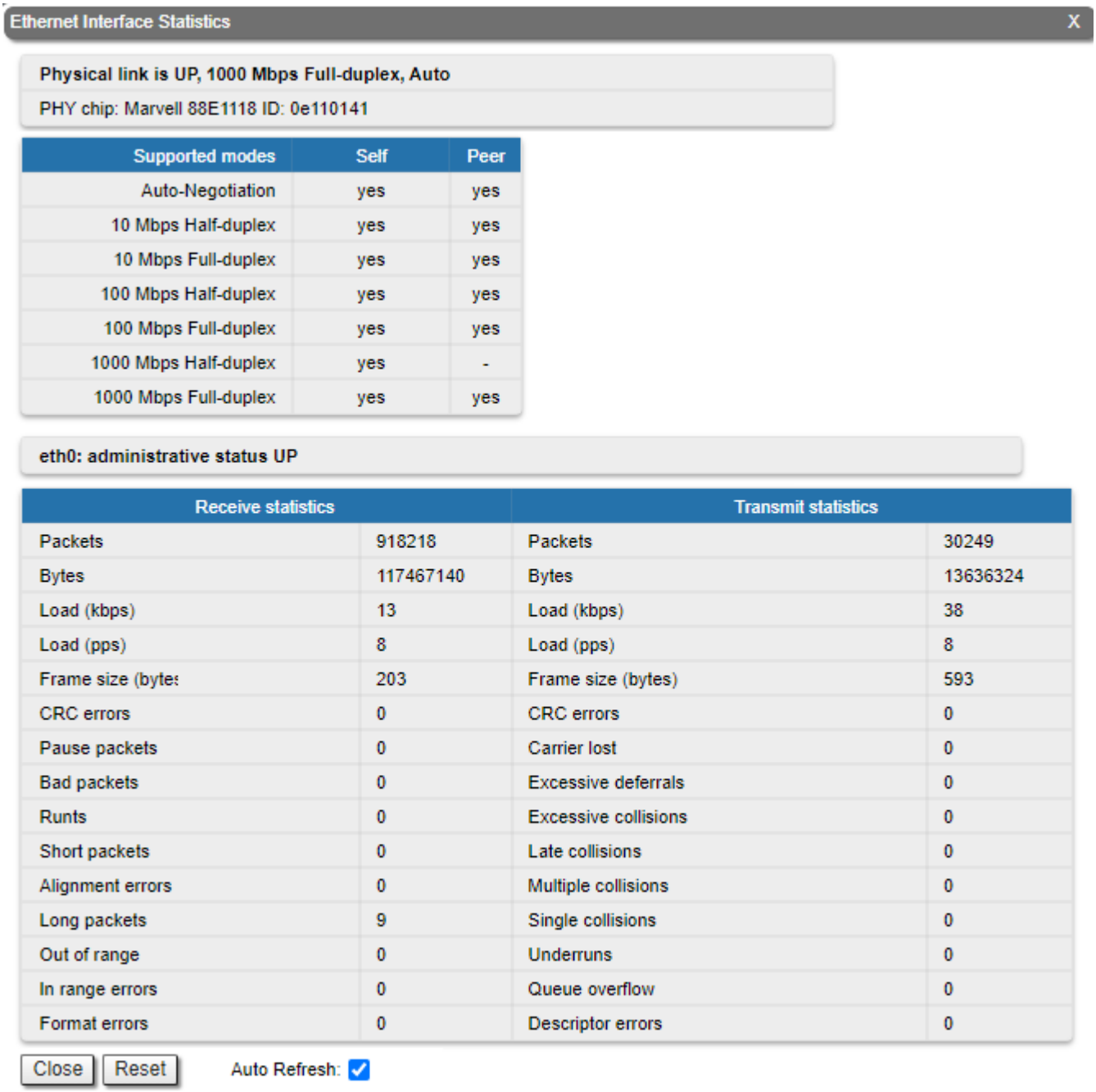


Figure - General Statistics Ethernet

Rx and Tx statistics parameters:

Parameter	Description
Receive statistics	
Packets	The total number of received packets
Bytes	The sum of lengths of all good Ethernet frames received
Load (kbps)	The link load, Kbit/s
Load (pps)	The link load, packets per second
Frame size (bytes)	The frame size in bytes

CRC errors	Total frames received with a CRC error
Pause packets	The number of good frames received that have a Pause destination MAC address
Overruns	Packets dropped due to queue overflow
Runts	Total frames received with a length of less than 64 octets and an invalid FCS
Short packets	Total frames received with a length of less than 64 octets but with a valid FCS
Alignment errors	Number of frames received with bad number of octets and bad CRC
Long packets	Total frames received with a length of more than MaxSize octets but with a valid FCS
Transmit statistics	
Packets	The total number of transmitted packets
Bytes	The sum of lengths of all good Ethernet frames sent
Load (kbps)	The link load, Kbit/s
Load (pps)	The link load, packets per second
Frame size (bytes)	The frame size in bytes
Excessive deferrals	The number of packets that were delayed due to the busy transmission medium
CRC errors	Total frames received with a CRC error
Late collisions	The number of times a collision is detected later than 512 bits-times into the transmission of a frame
Multiple collisions	The total number of successfully transmitted frames that experienced more than one collision
Single collisions	The total number of successfully transmitted frames that experienced exactly one collision
Excessive collisions	The total number of frames dropped after 16 attempts to send ended with collision
Queue overflow	Packets dropped due to queue overflow

For the radio interface information about current status, DFS mode and load statistics is available.

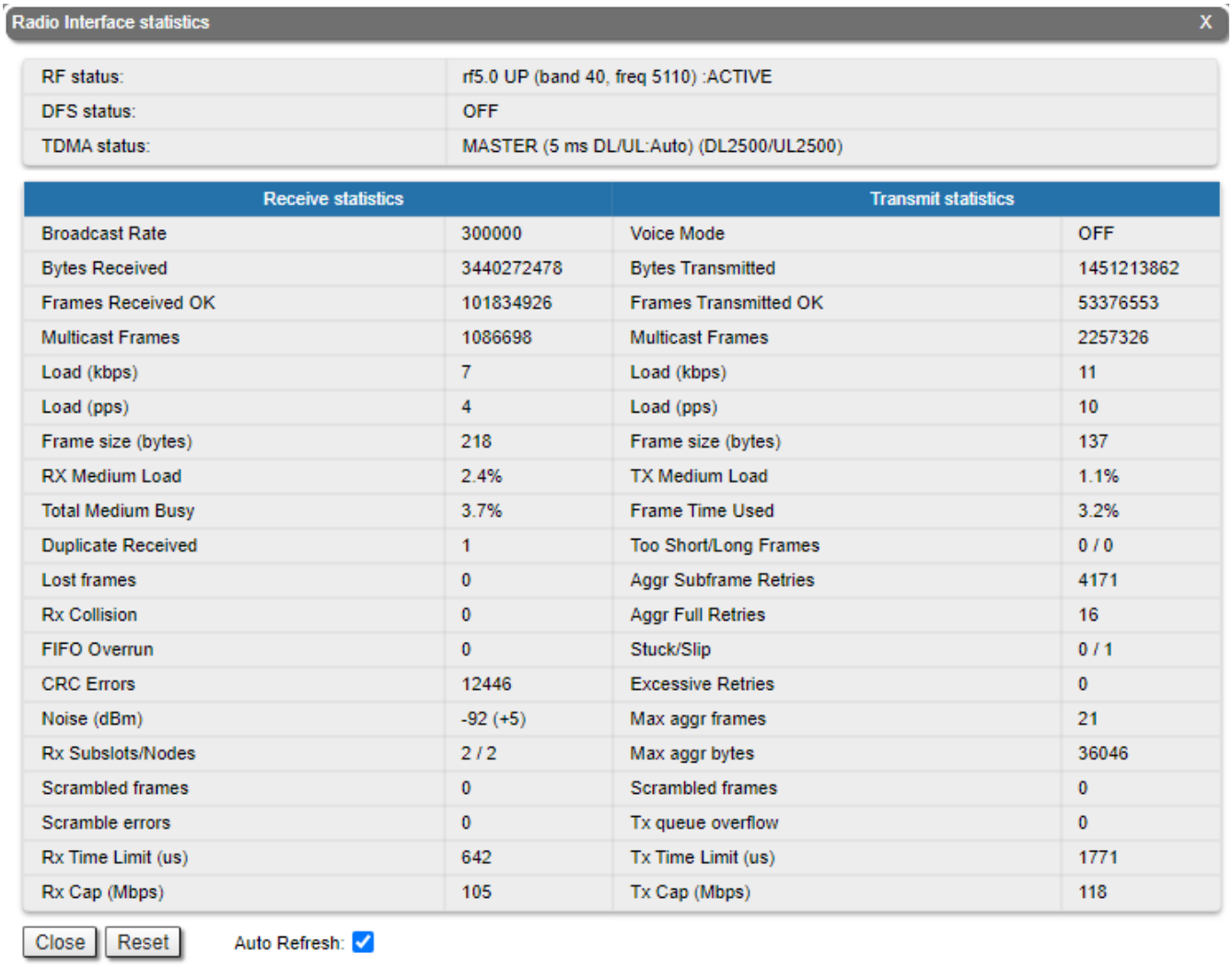


Figure - General Statistics RF

Rx and Tx statistics parameters:

Parameter	Description
Receive statistics	
Broadcast Rate	Current Bitrate for broadcast and multicast packets on the BS depends on the speed of the slowest subscriber
Bytes Received	Number of received bytes including headers
Packets Received OK	Number of correctly received packets
Load (kbps)	The link load, Kbit/s
Load (pps)	The link load, packets per second
Frame size (bytes)	The frame size in bytes
RX Medium Load	Time spent on receiving frames (%)
Total Medium Busy	The total time medium was busy (both DL and UL) (%)
Duplicate Received	The number of duplicate packets received
FIFO Overrun	Number of FIFO queues overruns in the radio when receiving
CRC Errors	Total frames received with a CRC error

Noise Floor	Input noise level. Measurement cycle –10 seconds
Noise Floor Threshold	Noise floor threshold for carrier detect
Scrambled frames	The total number of scrambled frames received
Scramble errors	The number of descrambling errors
Rx Cap (Mbps)	Throughput limit for UL (Mbps) - only in TDMA version
Transmit statistics	
Voice Mode	Voice mode ON/OFF value. If turned ON, the mode of voice traffic prioritized processing is turned on
Bytes Transmitted	Number of transmitted bytes including headers
Packets Transmitted OK	Number of correctly transmitted packets
Load (kbps)	The link load, Kbit/s
Load (pps)	The link load, packets per second
Frame size (bytes)	The frame size in bytes
TX Medium Load	Time spent on transmitting frames (%)
Frame Time Used	Average loading of frame (%) - only in TDMA version
Total Retries	Total number of retries
Aggr Subframe Retries	Number of packet drops in an aggregate due to protocol excesses
Aggr Full Retries	Number of duplicate aggregates transmitted
FIFO Underrun	Number of FIFO queues underruns in the radio while transmitting
Excessive Retries	Number of packets which were not transmitted with maximal number of retries
Max aggr frames	Maximal detected number of packets in an aggregate
Max aggr bytes	Maximal detected bytes in an aggregate
Scrambled frames	The total number of scrambled frames sent
Tx queue overflow	Packets dropped due to queue overflow
Tx Cap (Mbps)	Throughput limit for DL (Mbps) - only in TDMA version

For the pseudo-radio interface information about parent interface, MTU value and load statistics is available.

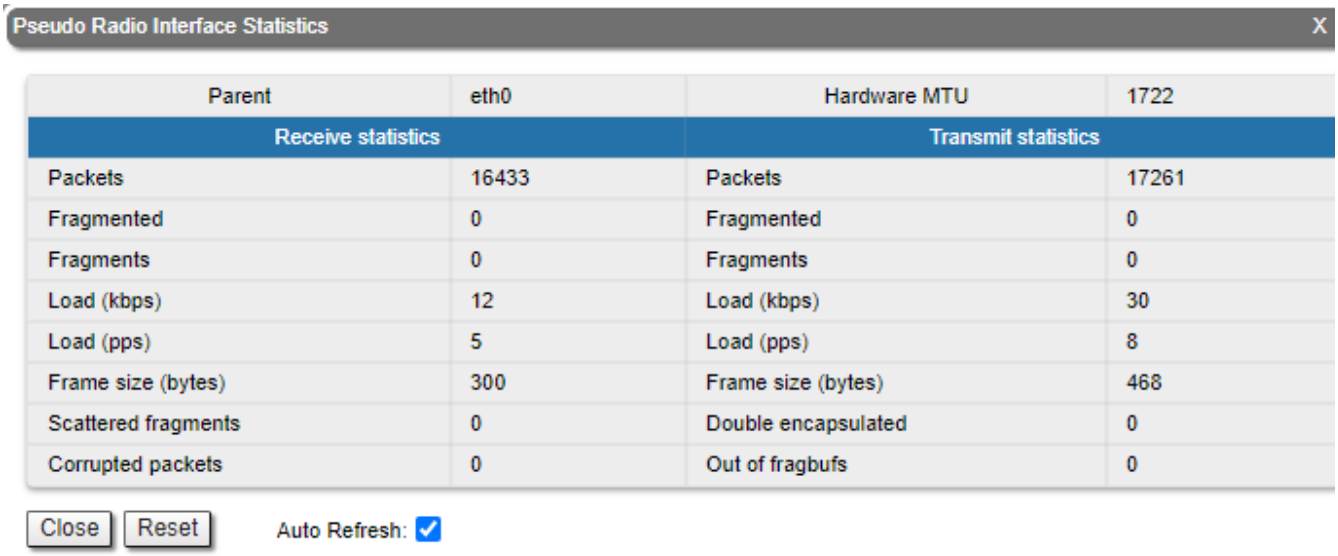


Figure - General Statistics PRF

Parameter	Description
Receive statistics	
Packets	Number of correctly received packets
Fragmented	Number of fragmented packets
Fragments	Number of fragments
Load (kbps)	The link load, Kbit/s
Load (pps)	The link load, packets per second
Frame size (bytes)	The frame size in bytes
Scattered fragments	Number of frames where one or several fragments were lost, the frame cannot be restored
Corrupted packets	Number of frames with the wrong length or structure
Transmit statistics	
Packets	Number of correctly transmitted packets
Fragmented	Number of fragmented packets
Fragments	Number of fragments
Load (kbps)	The link load, Kbit/s
Load (pps)	The link load, packets per second
Frame size (bytes)	The frame size in bytes
Double encapsulated packets	Number of frames with double encapsulation
Out of fragbufs	Number of errors as a result of frame assembly buffer overflow due to too many fragments (neighbors) sources

For the SVI interface information about current status, RX and TX staistics is available.

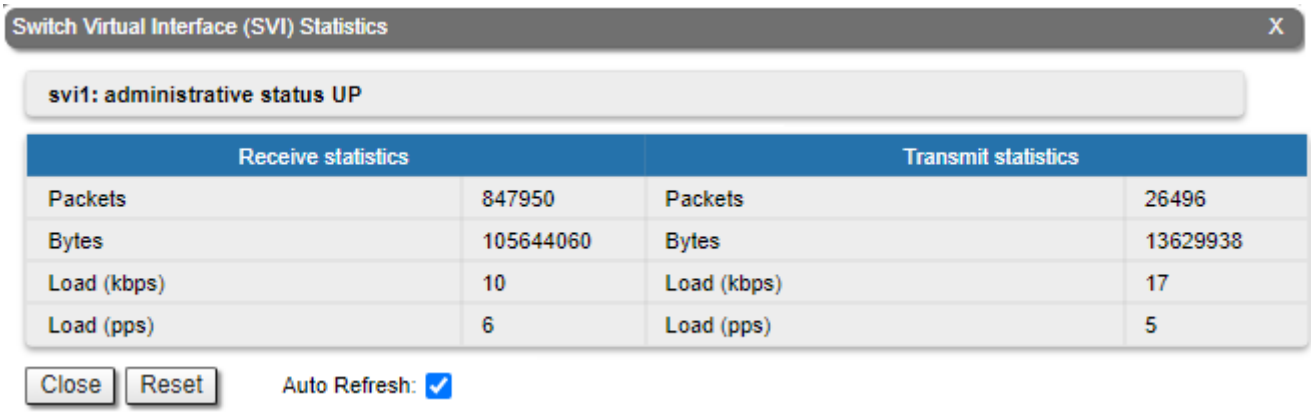


Figure - General Statistics SVI

By clicking the «**Close**» button, you return to the "Device Status" page.

By clicking the «**Reset**» button, you clear all counters displayed in the page.

The "*Auto Refresh*" option is active by default and refreshes the statistics automatically. You can disable the auto refresh.

Modulation Statistics

The "Modulation Statistics" tool displays the information about modulation types, such as receive and transmit statistics for different coding scheme. This statistic is available in the firmware version with "TDMA" support.

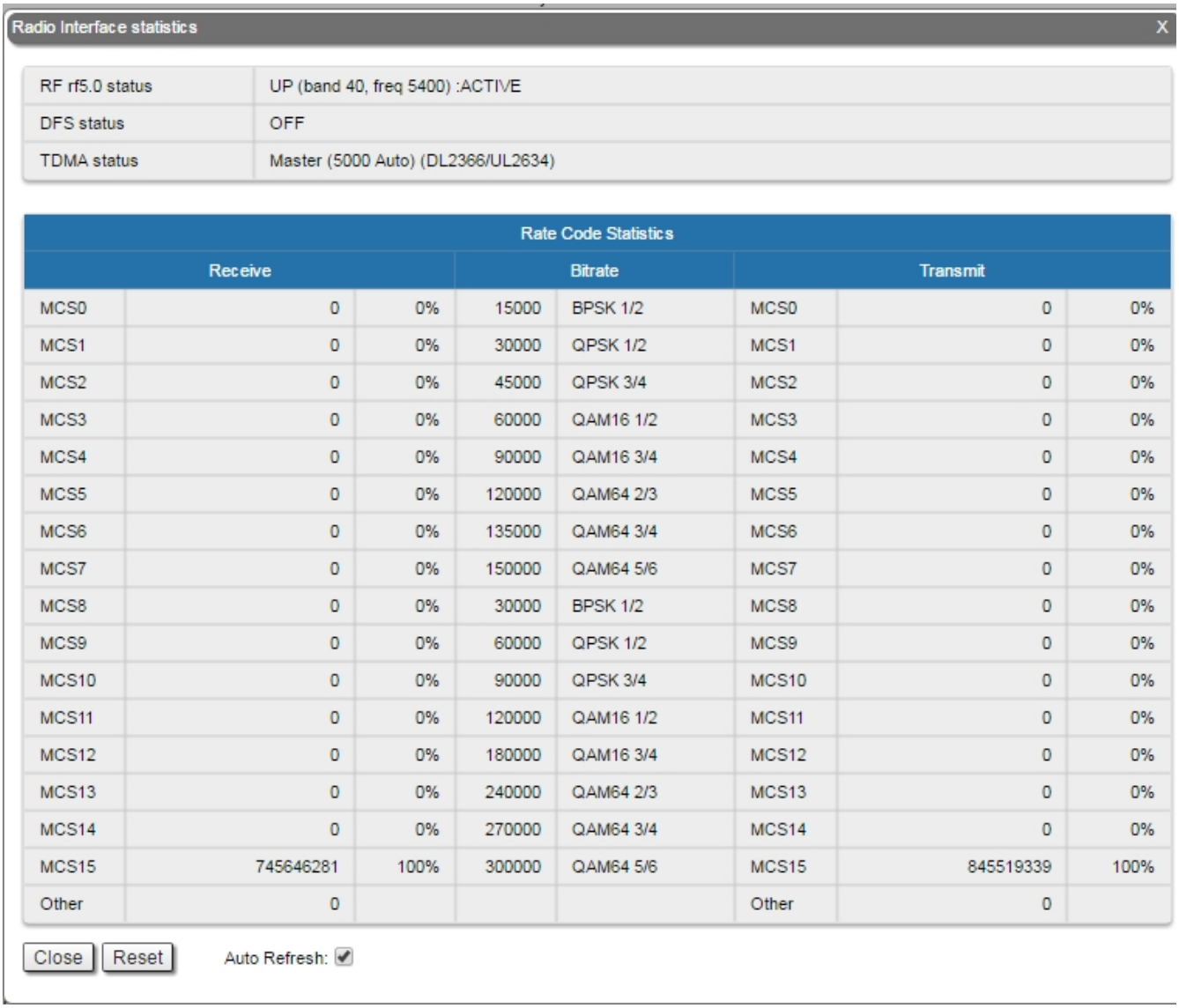


Figure - Modulation Statistics

By clicking the «**Close**» button, you return to the "Device Status" page.

By clicking the «**Reset**» button, you clear all counters displayed in the page.

The "*Auto Refresh*" option is active by default and refreshes the statistics automatically. You can disable the auto refresh.

Errors/Drops Statistics/SNR/EVM

The "Errors/Drops Statistics/SNR/EVM" window displays the number of errors, retries and droped packets during transmission for each link. This tool provides information about the SNR level for each polarization of the remote and local devices. In addition, this section displays the estimated throughput per subscriber in Mbps. The lower values show the guaranteed throughput in the worst case scenario when all subscribers are actively transmitting. The upper values display the throughput in the best scenario, when data is transmitted only by the selected subscriber.

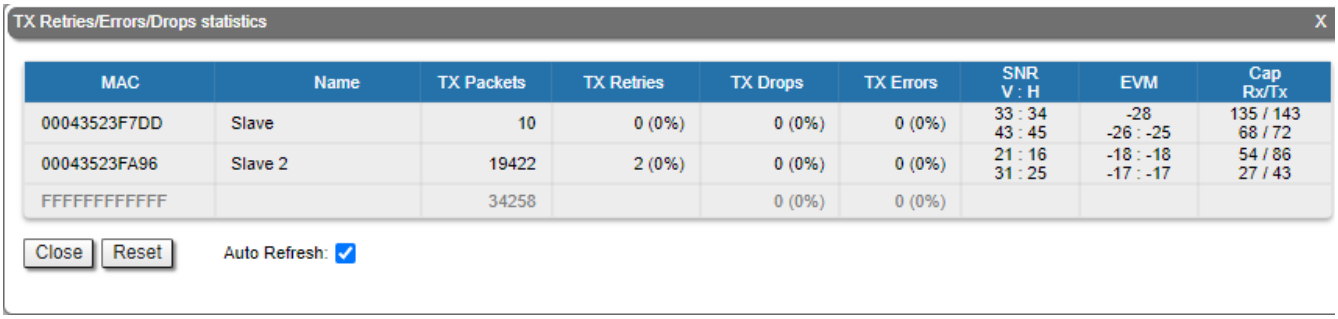


Figure - Errors/Drops Statistics

The EVM value is measured not at the operation modulation, but at the lowest possible. In case the misoctl option is enabled and VBR is disabled on Slave, the lowest possible modulation uses a single data stream. If misoctl is turned off or VBR is turned on, both channels will be used for transmission, and the EVM parameter values will be displayed for each modulation.

By clicking the «**Close**» button, you return to the "Device Status" page.

By clicking the «**Reset**» button, you clear all counters displayed in the page.

The "*Auto Refresh*" option is active by default and refreshes the statistics automatically. You can disable the auto refresh.

Radio Scanner

The "Radio Scanner" tool allows to estimate the efficiency of the radio links utilization, analyzing the radio-frequency environment for the current frequency, under the current channel bandwidth, without the radio link interruption and displays the following statistics:

- Radio parameters of every source in the radio link
- Number of sources, number of packets, including the skipped ones
- Number of pulses, their average level and average number of pulses per second

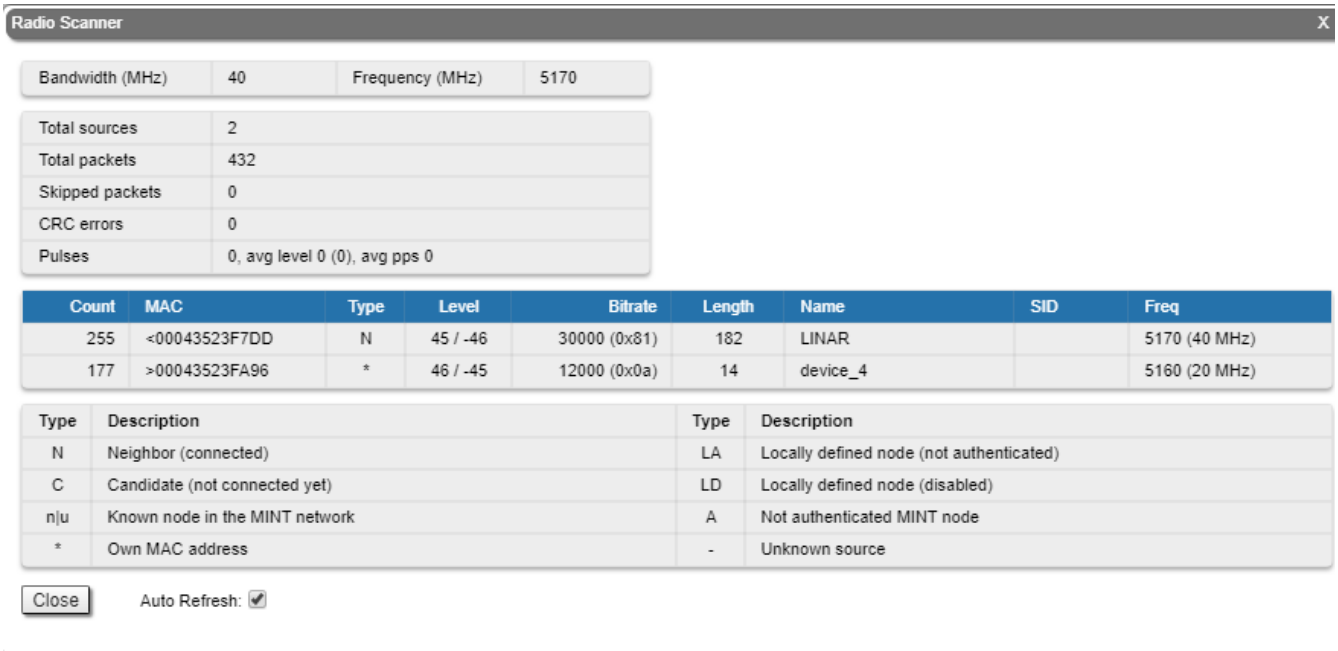


Figure - Radio Scanner

Parameter	Description
Count	• Number of the registered frames (packets)

MAC	• Host MAC address
Type	• Host type
Level	• First value - signal level relative to the receiver sensitivity at a given modulation (bitrate), in dB • Second value - absolute input signal level, in dBm
Bitrate	• Current bitrate value
Length	• Average frame length in bytes
Name	• Host name
SID	• Network system identifier
Freq	• Current center frequency
Total sources	• Number of sources
Total packets	• Total number of the registered frames (packets)
Skipped packets	• Number of skipped (unaccounted) packets due to queue overflow or lack of CPU resources
CRC errors	• Number of errors in the checksum calculation

Pulses	• Pulses noise counter:
	  • The first value is the number of electromagnetic energy peaks during the scanner operation. The Pulses counter includes frames for which the modulation and source MAC address could not be recognized.
	  • The "avg level" value shows an average noise level, the first value is a noise level relative to the receiver sensitivity at a given modulation (dB), the second is an absolute input signal level (dBm).
	  • The "avg pps" value indicates an average pulses per second number. The value over 50 pps indicates a high noise level.

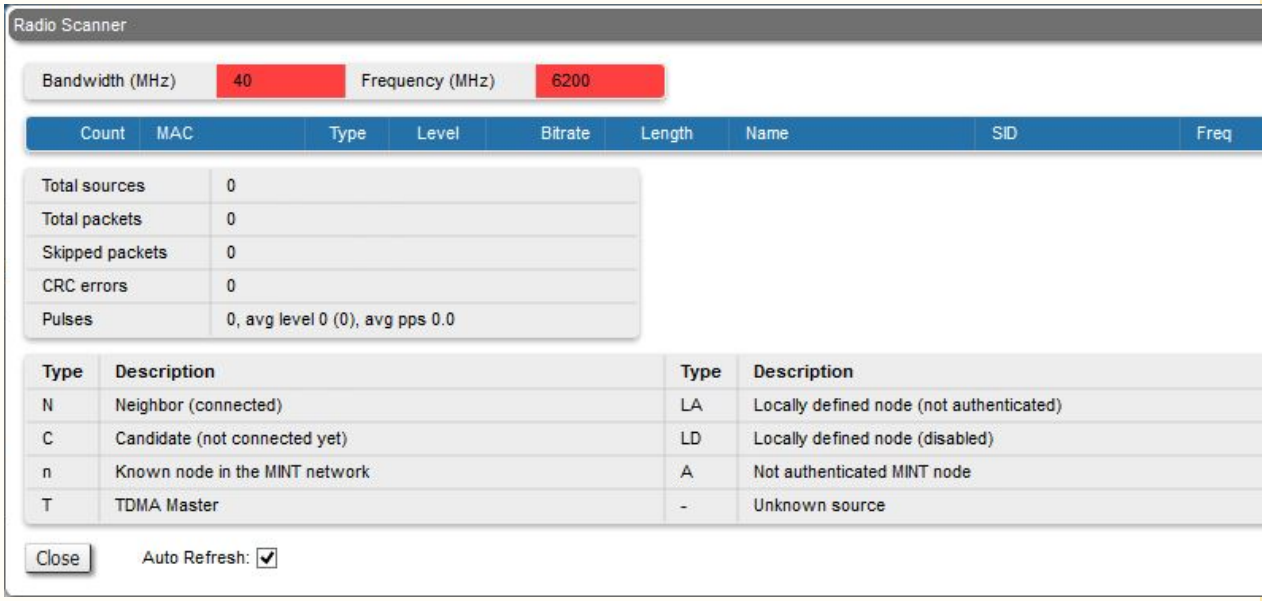
The abbreviations for each node type are also displayed in the interface:

Type	Description
N	• Neighbor (connected)
C	• Candidate (not connected yet)

n|u	• n - known node in the MINT network • u - node in the same MINT domain connected to another sector
-	• Unknown source
LA	• Locally defined node (not authenticated)
LD	• Locally defined node (disabled)
A	• Not authenticated MINT node
*****	• Own MAC address (in software version with Polling technology support)
T	• Master devices (in software version with TDMA technology support)

Table - Node types

NOTE



"Frequency" and "Bandwidth" are highlighted in red when the frequency and bandwidth values are already not the same as they were when Radio Scanner was started. This may occur when several profiles at the subscriber terminal link settings are configured. While searching the base station sector the subscriber terminal loops through all available profiles with different settings, highlighting them in red.

By clicking the «**Close**» button, you return to the "Device Status" page.

The "*Auto Refresh*" option is active by default and refreshes the statistics automatically. You can disable the auto refresh.

QoS Statistics

QoS (Quality of Service) characterizes the entire network performance which is defined by the parameters such as: throughput, latency, jitter, error rate, available bandwidth, etc. In order to provide the guaranteed Quality of Service for certain applications, users or data flows, different prioritization methods are used.

The "QoS Statistics" tool displays the statistics of the MINT priority queues for the interface.

Priority is one of the parameters which define in what sequence, different types of data traversing every InfiNet device in MINT network are treated. Each channel may be assigned a priority (for example: P01, P02 … P16).

Once assigned, a priority is automatically recognized by every node inside the MINT network. Each priority value corresponds to a device queue. Once in a queue, every packet is scheduled according to the queuing algorithm set on the device. QM manager supports "*Strict Priority Queuing*" and "*Weighted Fair Queuing*" scheduling algorithms. "*Strict Priority Queuing*" means that the packets from queue with lower priority are not processed until the queue with higher priority is not empty. "*Weighted Fair Queuing*" uses weights for every queue of an interface and allows different queues to have different service shares, depending on that weight.

Every channel is also characterized by the latency parameter. This parameter determines the maximum time for the packets to stay in the channel. If a packet is waiting in a queue of the channel more than the time specified in the latency parameter, then it is discarded. Latency can be set for each channel in the "Traffic Shaping" section.

Channal	Priority
BACKGROUND	16
REGULAR Best Effort	15
BUSINESS6	14
BUSINESS5	13
BUSINESS4	12
BUSINESS3	11
BUSINESS2	10
BUSINESS1	9
QOS4	8
QOS3	7
QOS2	6
QOS1	5
VIDEO2	4
VIDEO	3
VOICE	2
CONTROL	1
NETCRIT	0

Table - MINT priorities

Transparent packet prioritization is a **WANFleX** feature which allows QM manager to transparently map 802.1p/TOS/DSCP priority to MINT priority for the ease of deployment.

You have to make sure that "*Dot1p Tags*" and/or "*IP ToS*" options are enabled in the "QoS" section.

MINT Priority	Traffic Types (802.1p)	dot1p	TOS	DSCP Name	DS Field Value
16 BACKGROUND	Background	1			

15 REGULAR Best Effort	Best Effort	0	0	CS0	0
14 BUSINESS6			1	CS1, AF11-13	8, 10
13 BUSINESS5					12, 14
12 BUSINESS4			2	CS2, AF21-23	16, 18
11 BUSINESS3					20, 22
10 BUSINESS2			3	CS3, AF31-33	24, 26
9 BUSINESS1	Excellent Effort	2			28, 30
8 QOS4			4	CS4, AF41-43	32
7 QOS3					34
6 QOS2					36
5 QOS1	Critical Applications	3			38
4 VIDEO2	Video	4	5	CS5, EF	40, 42
3 VIDEO					44, 46
2 VOICE	Voice	5	6	CS6	48, 50
1 CONTROL	Internetwork Control	6			52, 54
0 NETCRIT	Network Control	7	7	CS7	56, 58, 60, 62

Table - MINT priority to 802.1p/TOS/DSCP

This section displays the number of inbound packets to each priority queue and the number of dropped packets:

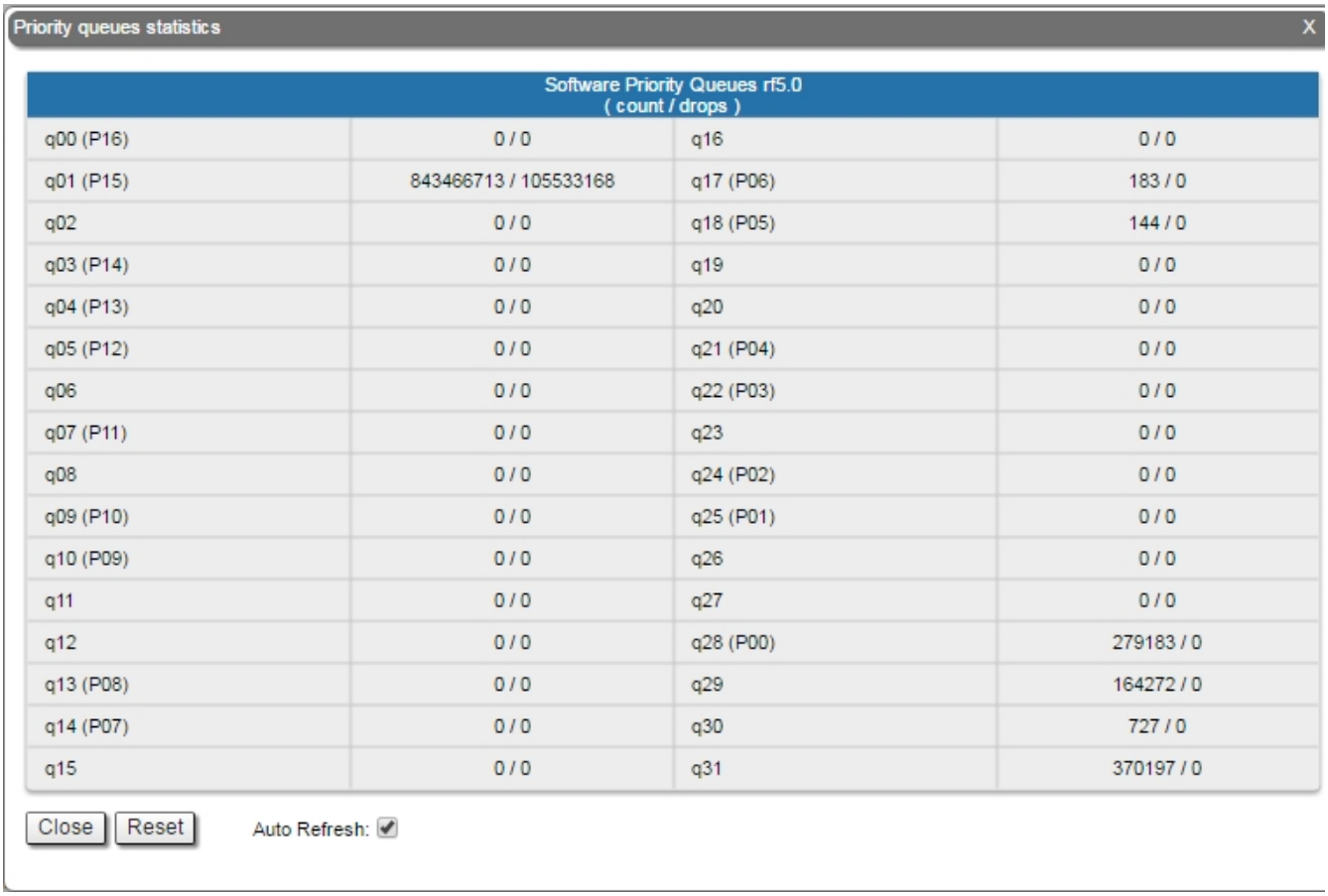


Figure - QoS Statistics

By clicking the «**Close**» button, you return to the "Device Status" page.

By clicking the «**Reset**» button, you clear all counters displayed in the page.

The "*Auto Refresh*" option is active by default and refreshes the statistics automatically. You can disable the auto refresh.

Network Address Table

The "Network Address Table" tool shows the network address table for the interface.

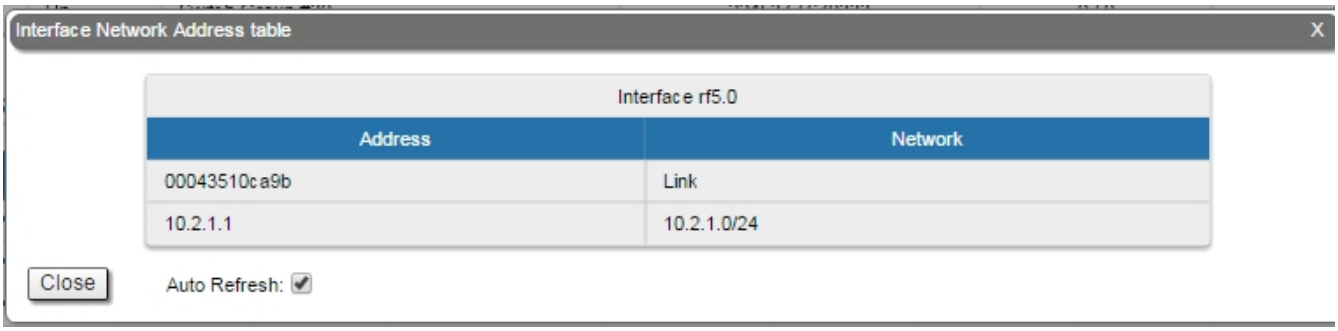


Figure - The Network Address Table for the local unit

By clicking the «**Close**» button, you return to the "Device Status" page.

The "*Auto Refresh*" option is active by default and refreshes the statistics automatically. You can disable the auto refresh.

LLDP Information

The "LLDP Information" tool allows to get information on the link layer discovery protocol.

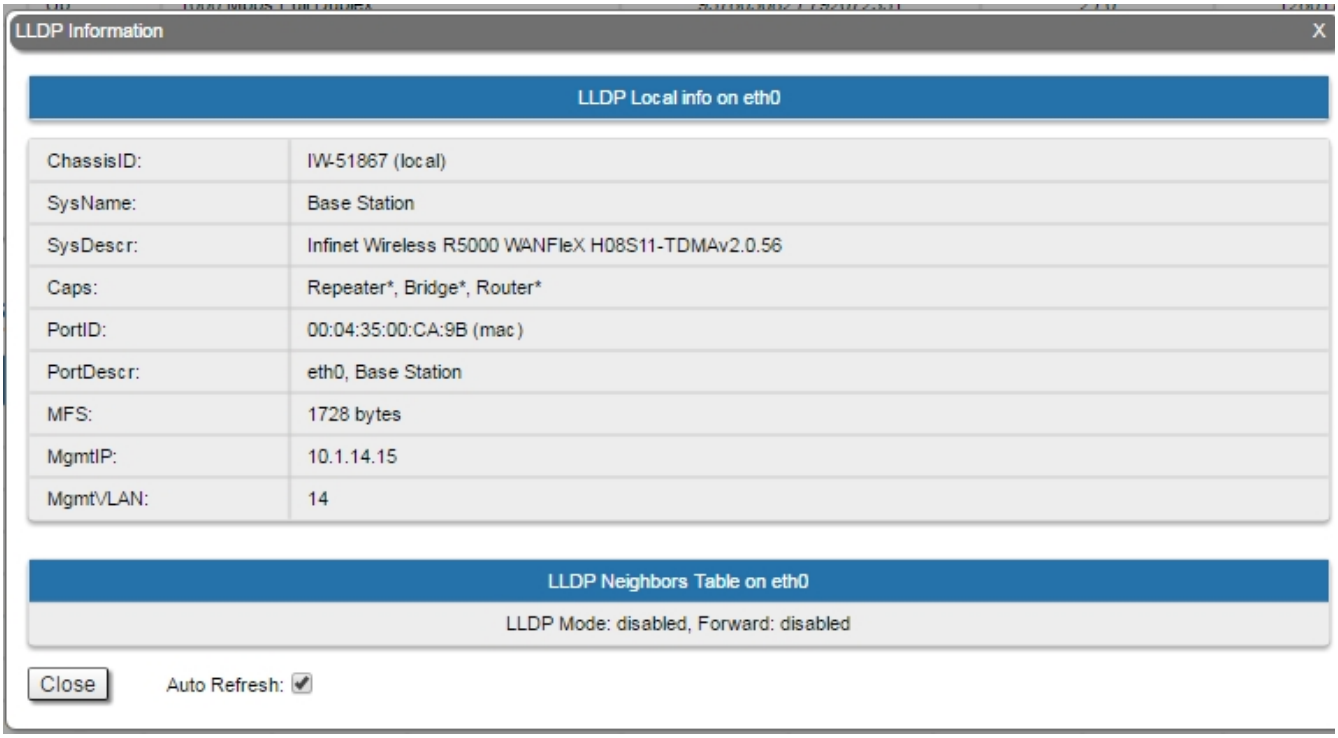


Figure - LLDP Information

By clicking the «**Close**» button, you return to the "Device Status" page.

The "*Auto Refresh*" option is active by default and refreshes the statistics automatically. You can disable the auto refresh.

Extended Link Diagnostics

Once a wireless connection between the unit and the remote neighbor is established, it is possible to make extended diagnostics and optimization for the wireless link.

In order to access the "Extended Link Diagnostics" tools, click on the row of each wireless link within the "Links Statistics on rf5.0" section:

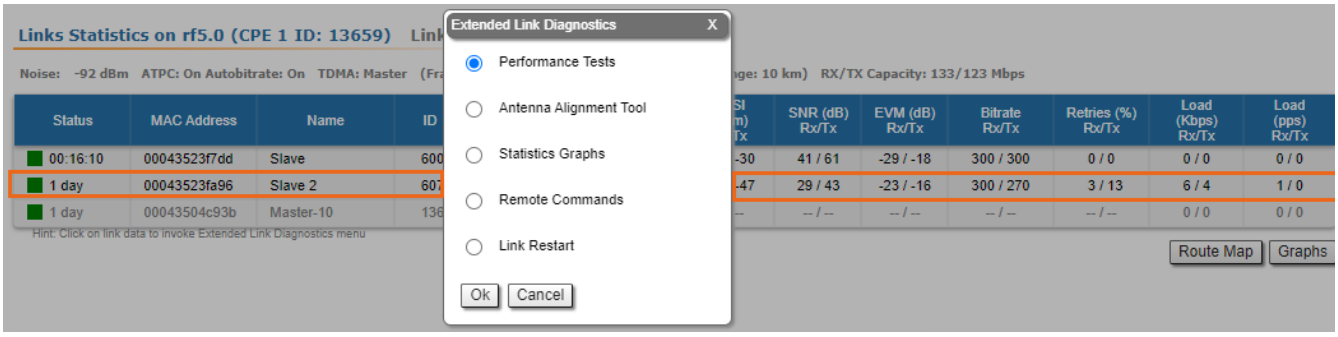


Figure - Extended Link Diagnostics

Five options are available: "Performance Tests", "Antenna Alignment Tool", "Statistics Graphs", "Remote Commands" and "Link Restart".

Performance tests

The "Performance tests" tool performs link throughput tests for the configured channel bandwidth and on the current frequency, without radio link interruption.

Title

The "Performance tests" tool generates traffic between the devices and displays the channel throughput for the traffic with chosen priority. For the full throughput tests of the channel, you must set the highest priority “0” for the test traffic. In this case, the transmission of any other traffic is stopped for the testing time and the traffic generated by the tool will occupy all the channel.

The "Performance tests" tool displays the values of the full channel throughput which is available under the current settings, for each bitrate.

> **NOTE**
>
> All results are given in kilobits per second and retries levels are shown as a red chart.

Performance tests for "*MINT*" and "*TDMA*" firmware are not the same. There are two tests in "*MINT*": one with graduation on bitrate, other in "*Use MINT*" mode. In "*Use MINT*" mode 8 tests are performed on established bitrate. In case of "*TDMA*" firmware teat of graduation on bitrate is not performed. Both firmware support bidirectional test.

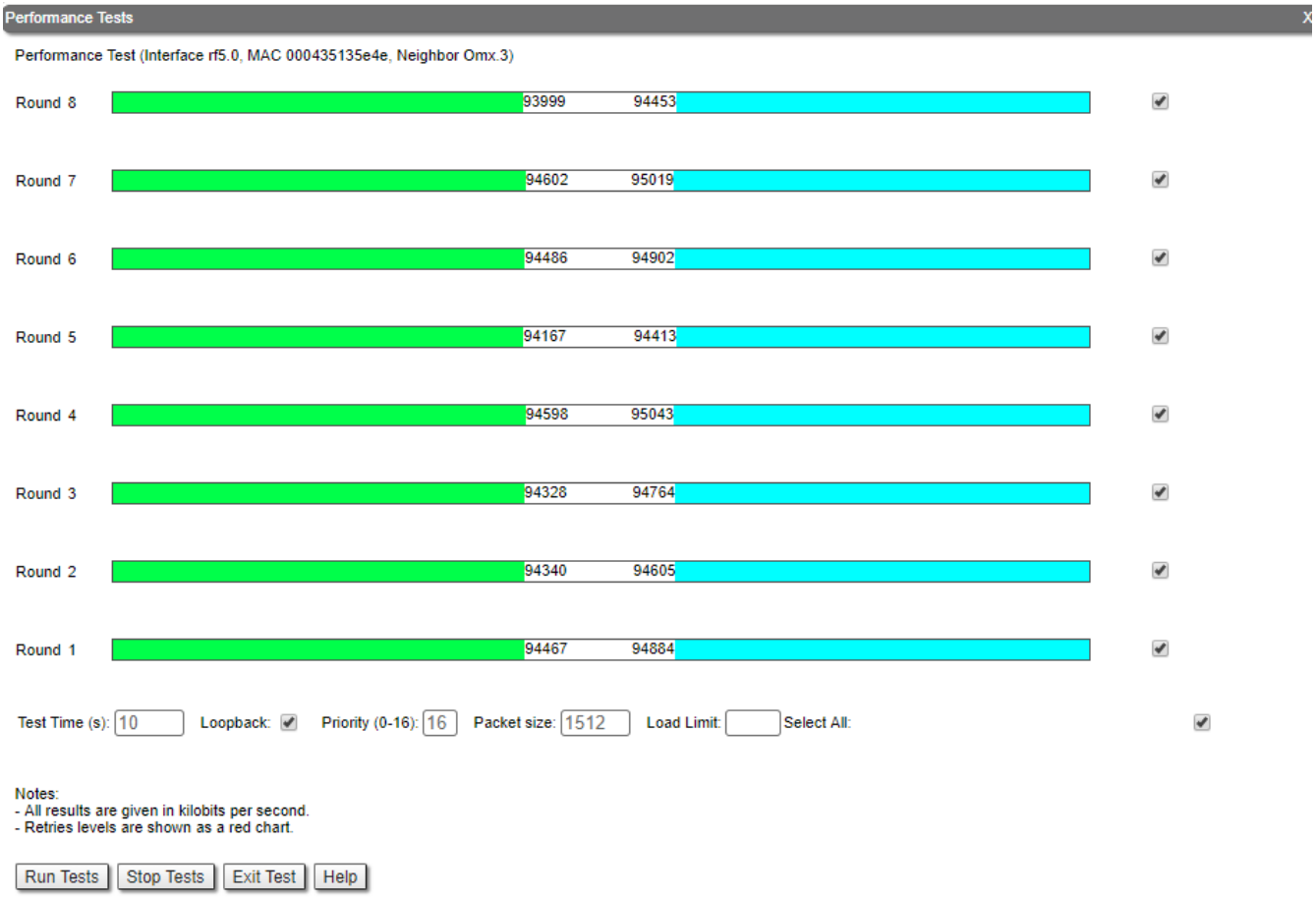


Figure - Performance test in case of "TDMA"

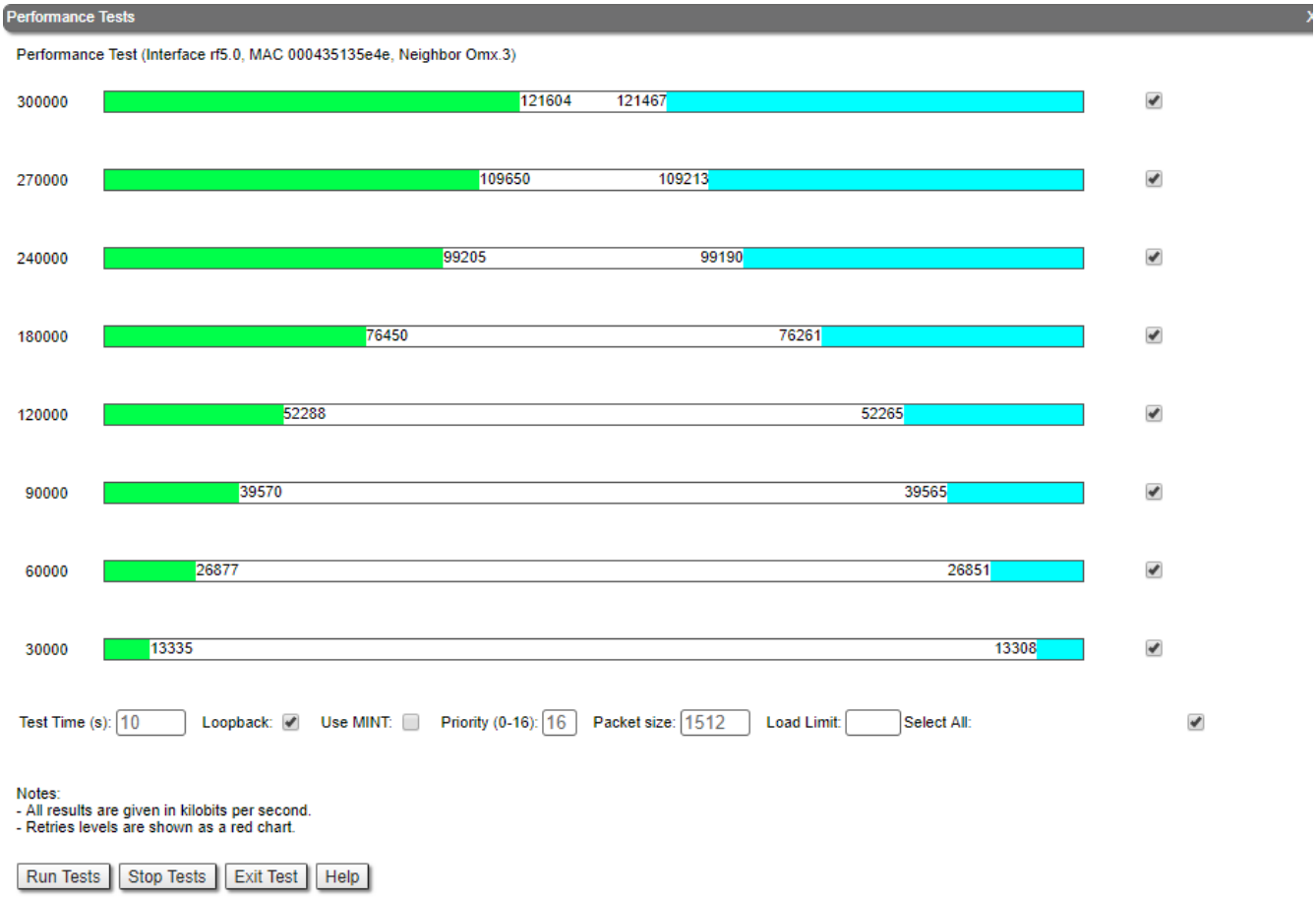


Figure - Performance test in case of "MINT"

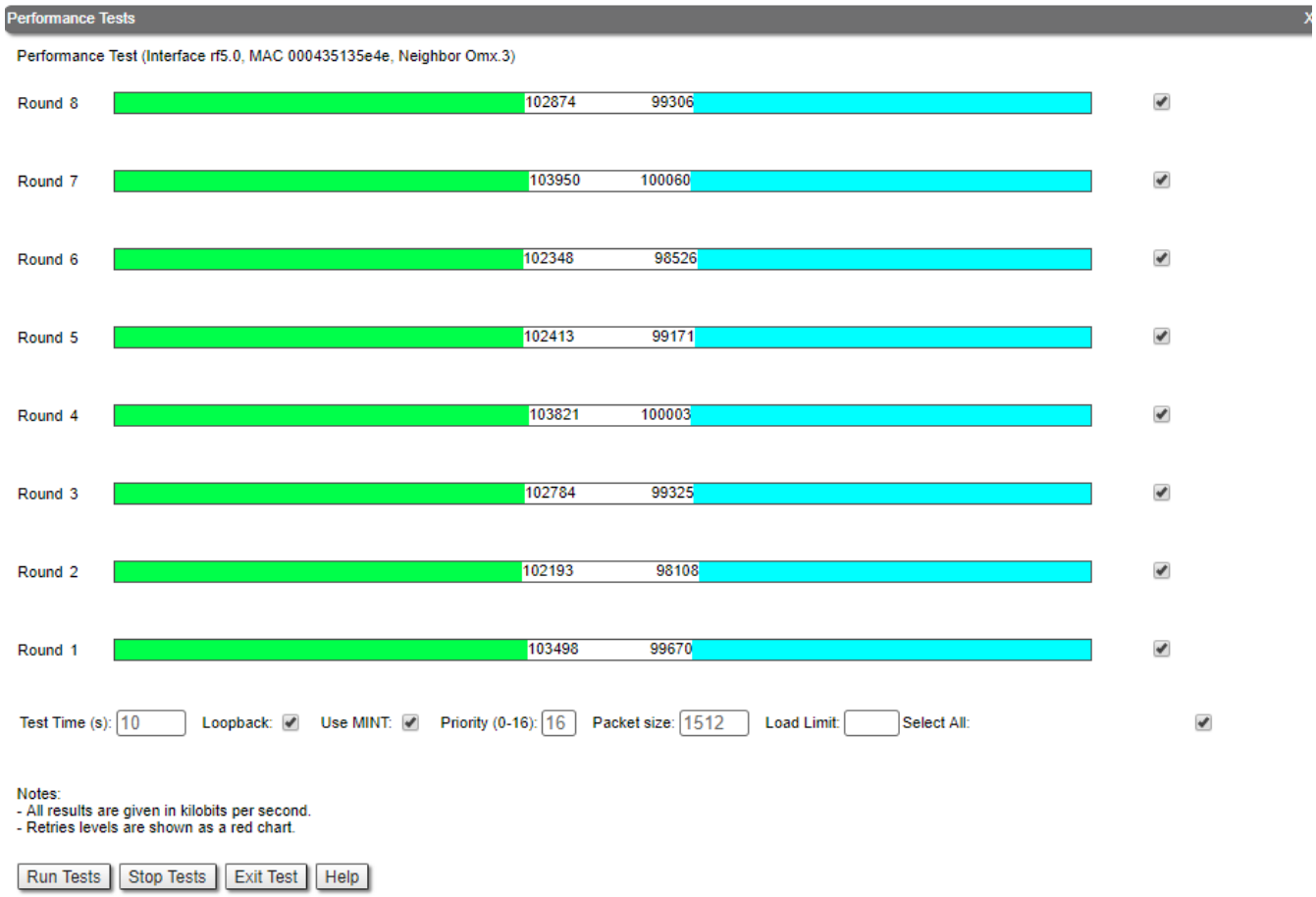


Figure - Performance test in case of "MINT" in "Use MINT" mode

By clicking the «**Run Tests**»/«**Stop Tests**» buttons at the bottom of the page, you can start/stop the performance tests.

By clicking the «**Exit Test**» button, you return to the "Device Status" page.

Each row corresponds to a certain bitrate value and can be selected or deselected for participating in the performance test by marking/unmarking the corresponding check-box on the right side. By marking "*Select all*" check-box, all the bitrates could be selected or deselected at once.

Three more parameters are available for management:

- "*Test time*" parameter - allows setting the duration (in seconds) of the test for each bitrate (5s by default).
- "*Bidirectional*" check-box - allows choosing between bi-directional (when checked) and unidirectional (when unchecked) performance test.
- "*Use MINT*" check-box - performs 8 tests on established bitrate.
- "*Priority (0-16)"* - by default, it is 16, which is lower than the data traffic that has priority 15. You can increase the test priority by setting a lower value.
- "*Packet size*" - allows to set the desired packet size in bytes.
- "*Load limit*" - sets a limit on the data rate at which the test runs, in Mbps.

The bitrates list on the "Performance test" tool consists of the bitrates that correspond to the channel bandwidth set on the unit (5/10/20/40MHz). To perform the tests for the bitrates related to the other channel bandwidth, you need to reconfigure the channel bandwidth (the "*Channel Width*" parameter in the "Radio Setting" section of the "Basic Settings" page) on both units within the tested link.

Examples given:

Bi-directional performance test output description for 180 Mbps bitrate (40 MHz channel bandwidth):

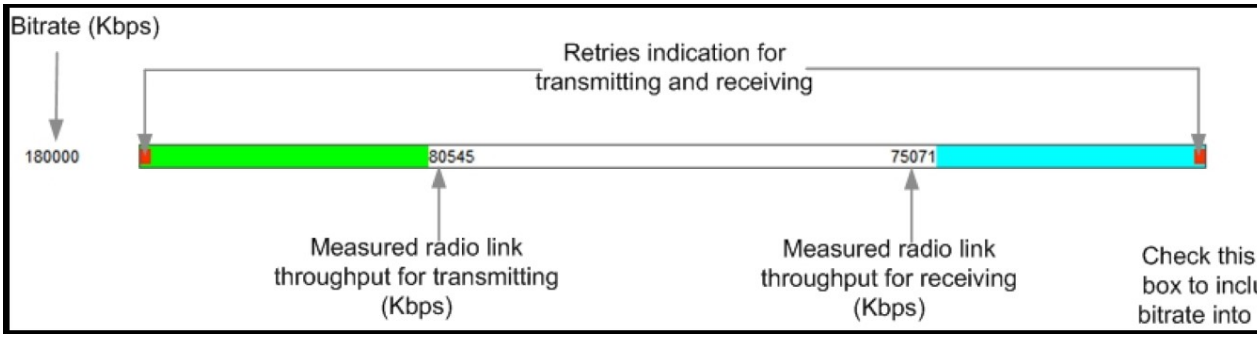


Figure - Bidirectional performance test output

In order to see detailed information about throughput, errors and retries, you can move the mouse cursor over the indication strip of the required bitrate.

Antenna Alignment Tool

The "Antenna Alignment Tool" allows to visualize the signal characteristics on both sides of the link in order to make the antenna alignment process more accurate and easier.

The accuracy of the antenna alignment at the neighbor device is very important for the link quality.

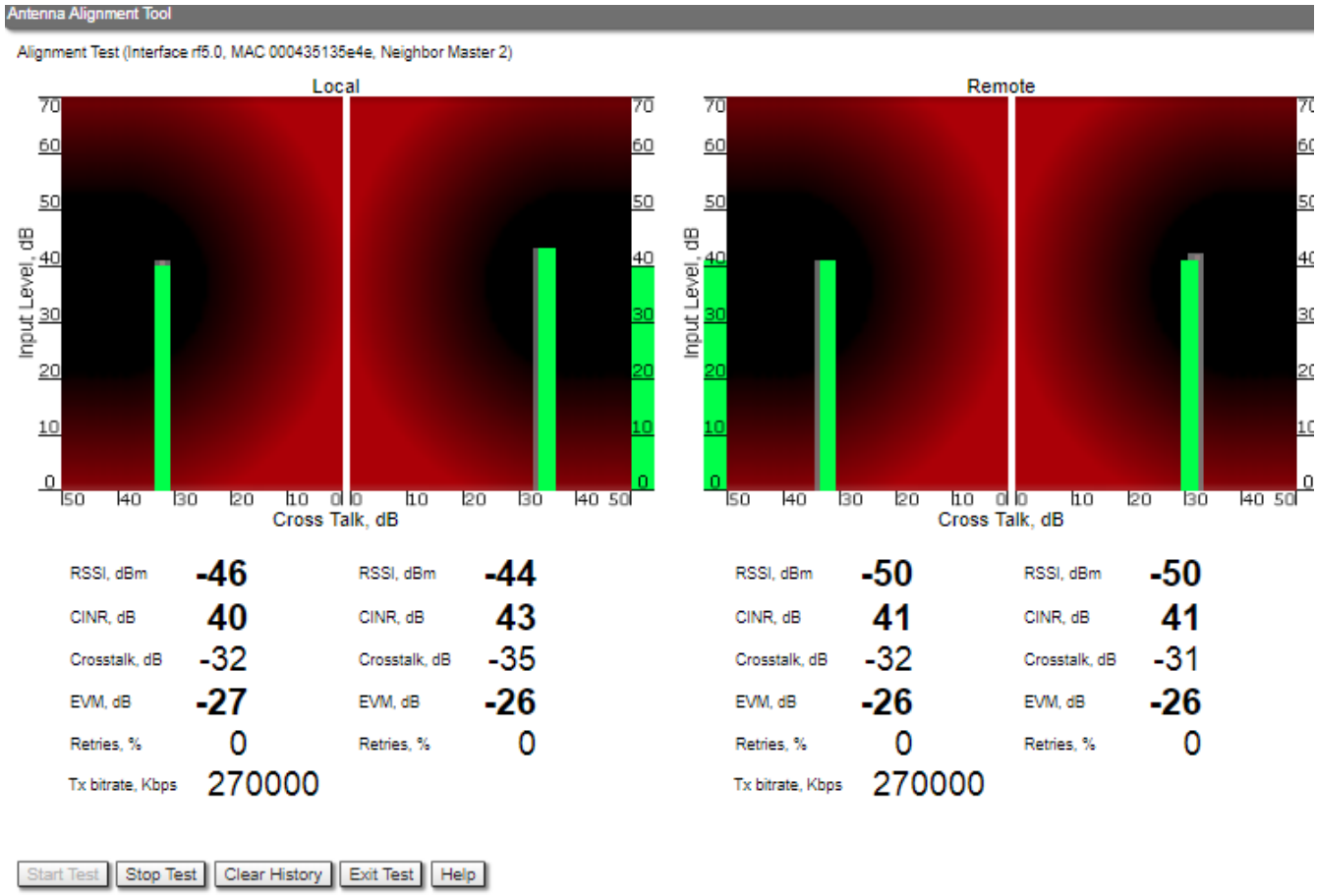


Figure - Alignment test

By clicking the «**Start Test**»/«**Stop Test**» buttons at the bottom of the page, you can start/stop the alignment test.

By clicking the «**Clear History**» button, you delete all data stored from the moment you clicked the «**Start Test**» button.

By clicking the «**Exit Test**» button, you return to the "Device Status" page.

Once the test is started, the antenna alignment can be monitored using the graphic and text indicators. The indicators for both local and remote devices are displayed together in the same page which allows viewing the alignment process for both sides of the link.

Each side of the link (local and remote) has two similar test indicator sets, corresponding to each antenna polarization (one for Vertical polarization and another for Horizontal). This allows controlling the alignment process for each antenna polarization for the local and for the remote device simultaneously.

Graphical indicator:

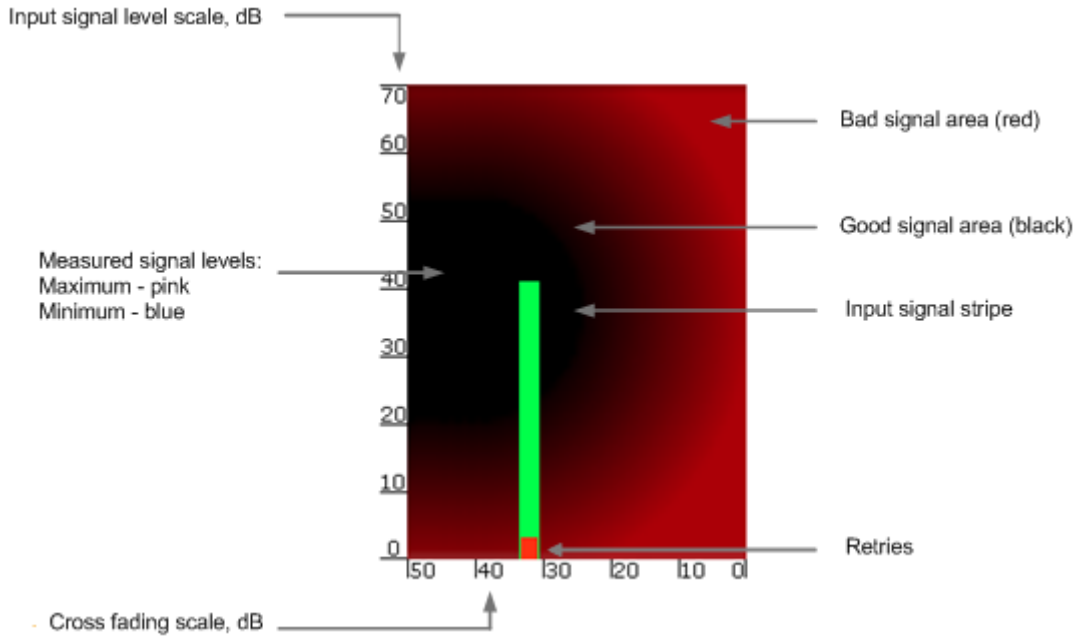


Figure - Alignment test - graphical indicator

The main indicator is the Input Signal stripe.

The height of the Input Signal stripe is measured in dB by the Input Signal Level scale. The higher the stripe is, the stronger the signal is.

The stripe may change its position along the Cross Fading scale, showing how much influence the corresponding device antenna has (for example: how much vertically and horizontally polarized signals influence each other). Higher the value of the stripe according to the Cross Fading scale (the farther stripe is from the 0 dB value), less the influence antennas have on each other.

The top of the Input Signal stripe can be located in black (Good signal) or red (Bad signal) background areas or somewhere in between them. This means the signal is good, bad or average correspondingly. When aligning the antenna, it is recommended to try achieving the stripe top to be located in the black area.

At the bottom of the Input Signal stripe may appear a special red sub-stripe. This sub-stripe indicates the presence of the packet retries and the percentage of the total number of transmitted packets.

During the alignment test, the Input Signal stripe may change its position along the Cross Fading scale and increase or decrease in height, indicating the changes in the received signal. When the top of the stripe changes its location, moving from one point on the background area to another, it leaves pink and blue marks behind, indicating the maximum and minimum measured levels of the signal at a particular point. Thus, it makes possible to observe the “history” of the signal changes.

You can clear the marks by clicking the «**Clear History**» button at the bottom of the page.

The text indicators are:

- "*RSSI*" - indicates the power level of the received radio signal (measured in dBm), optimal parameter value -60 ... -40.
- "*CINR*" - input signal level to noise + interference (measured in dB) indicator, >=28.
- "*Crosstalk*" - indicates how much vertically and horizontally polarized signals influence each other, >20.
- "*Error Vector Magnitude (EVM)*" - indicator of the measured input signal quality (it should be as high as possible in absolute value, the recommended level is not less than 21 dB. Some old firmware had EVM value positive, but most the firmware has negative value, so for the troubleshooting, evaluate the absolute EVM value), > 21 in absolute value.
- "*Retries*" - percentage of transmit packet retries (measured in %), <10.
- "*Tx bitrate*" - displays the current bitrate for the remote and local units (measured in Kbps).

Main recommendations when using the “Antenna Alignment" tool:

- It is recommended to start antenna alignment with searching the maximum signal level on a minimal possible bitrate. Afterwards, automatic MINT mechanisms will set the most appropriate bitrate when “*Autobitrate*” mode is enabled.

- Input signal level (CINR) should be between 12 dB and 50 dB.
- If signal level is more than 50 dB, it is recommended to lower the amplifier power.
- If maximal signal level is less than 12, it is recommended to lower the channel width (for example: from 20 MHz to 10 MHz).
- In some cases, a signal level that is less than 12 may be enough for the radio link operation. In this case, you should be guided by parameters such as the number of retries and Error Vector Magnitude. If the number of retries is low (close to “0”) and EVM is more than 21 (Input Signal stripe is green) then the radio link is most likely, operating properly.
- Retries value should be zero or as low as possible (less than 10%).
- The top of an Input Signal stripe should be located in the black area.
- The signal quality should be good: EVM value should be more than 21.
- Input signals of the two antennas of the device should have similar Cross fading values (Input Signal stripes should be symmetrically to the value of 0 dB).

ALL described recommendations are applicable to both ("Local" and "Remote") sections.

Link samples:

- Good link sample

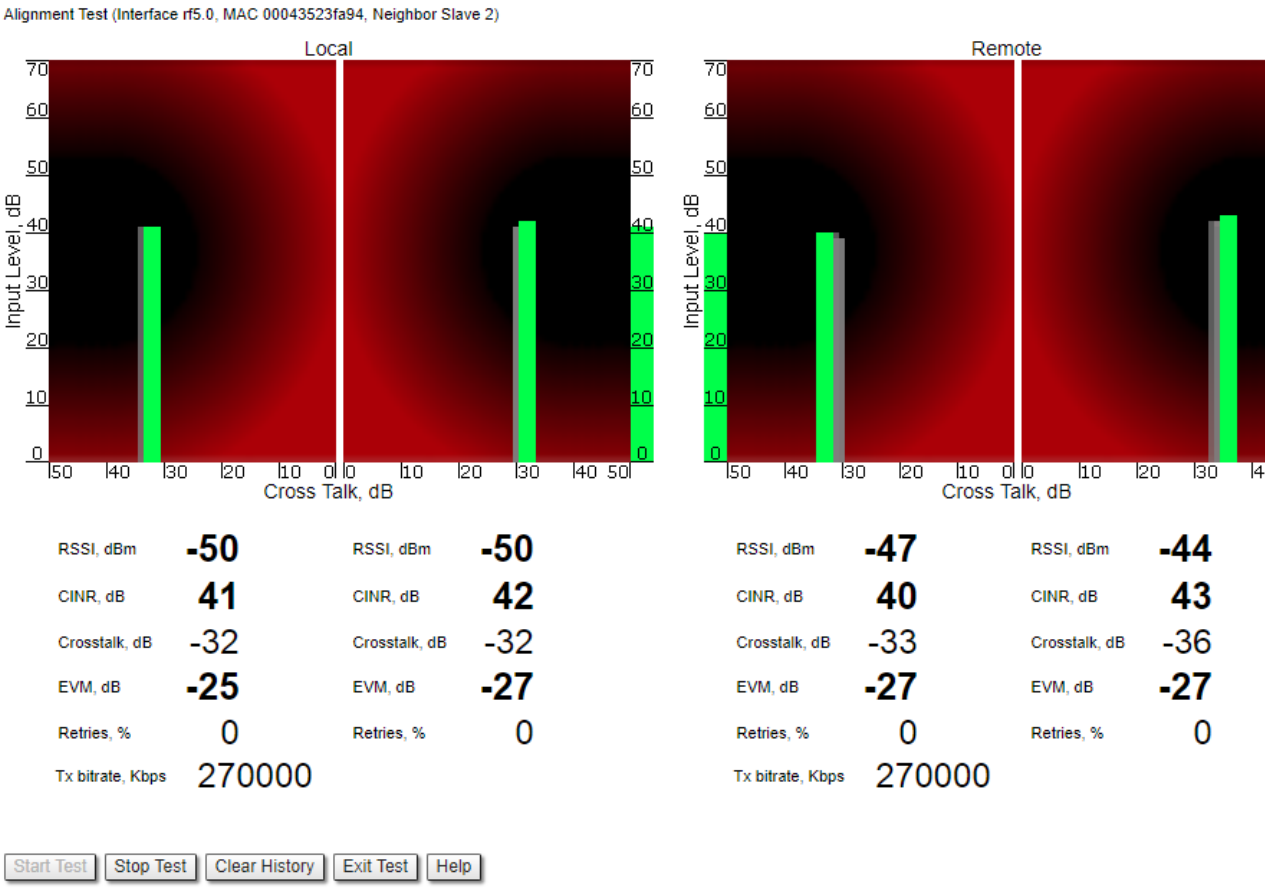


Figure - Alignment test - graphical indicator - positive example

- Bad link sample

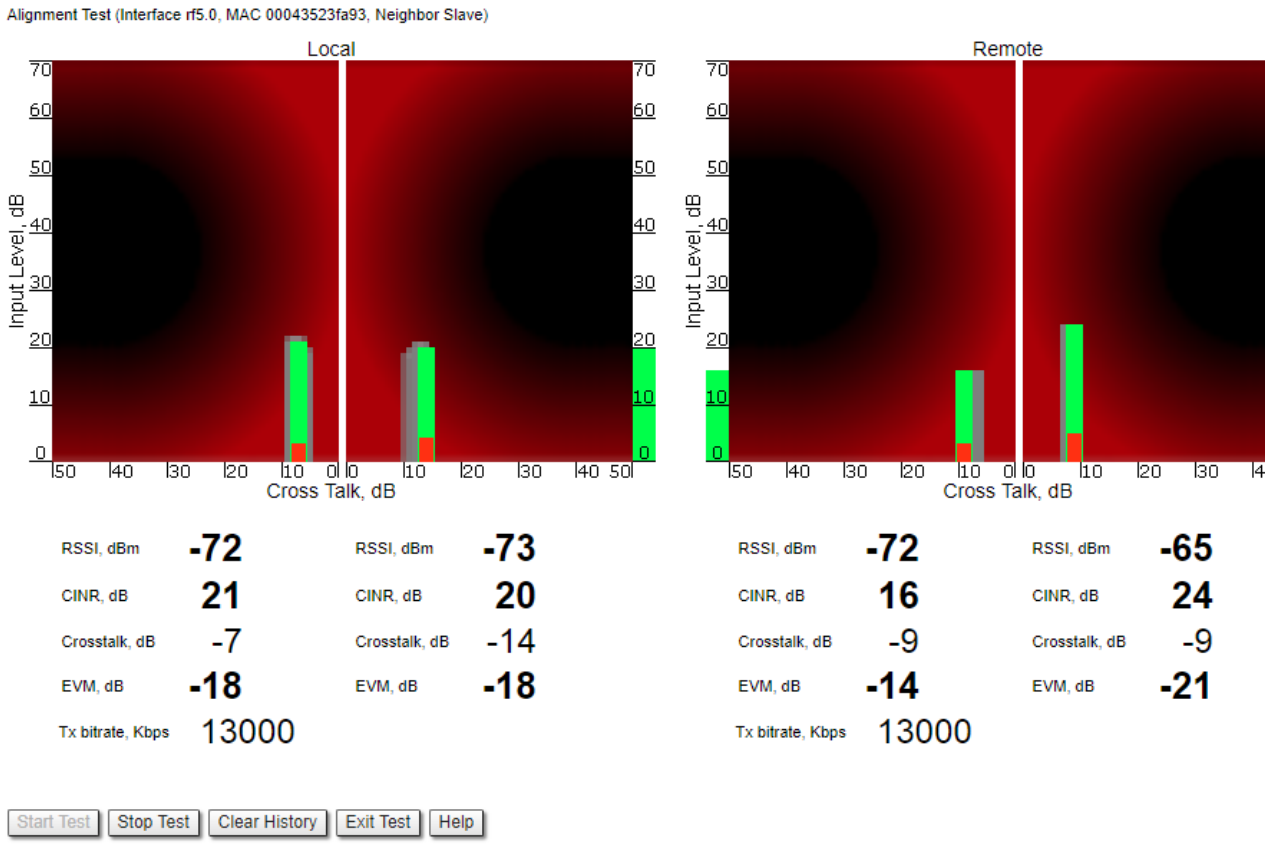


Figure - Alignment test - graphical indicator - negative example

Statistics Graphs

The "Statistics Graphs" tool has been developed based on "*digraphs*", which is a fast, flexible open source JavaScript charting library.

The "Statistics Graphs" tool allows you to monitor the device parameters represented in the graphical charts. The following modes are available: real-time monitoring, daily and monthly data logs display (use the dropdown menu from the top of the page to change the mode).

The system displays, by default, the daily data logs. All charts support simultaneous zoom to improve usability: the "zoom in" action in a certain region on any of the charts reflects on all other charts that are re-scaled automatically to display the data collected during the same period of time.

Critical events like link outages or frequency swaps are marked by small red balloons on the bottom of each graph. Move the mouse over each balloon for details:

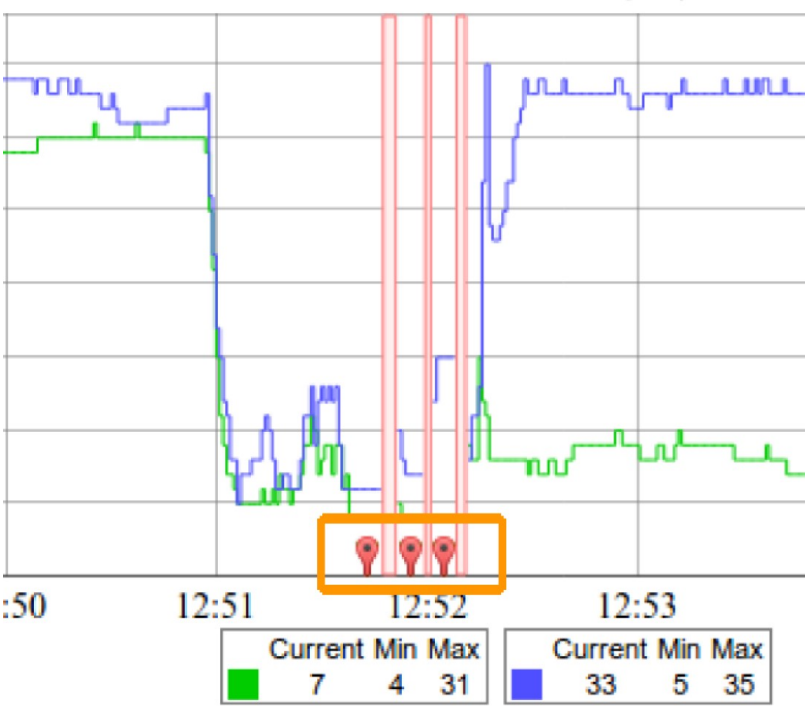


Figure - Statistics graphs - balloon indicators

Working with the charts:

- Select a chart region to zoom in
- Hold the «**Shift**» button and drag the graphs to the pan
- Double-click on any chart to reset the zoom.

The parameters that can be monitored are:

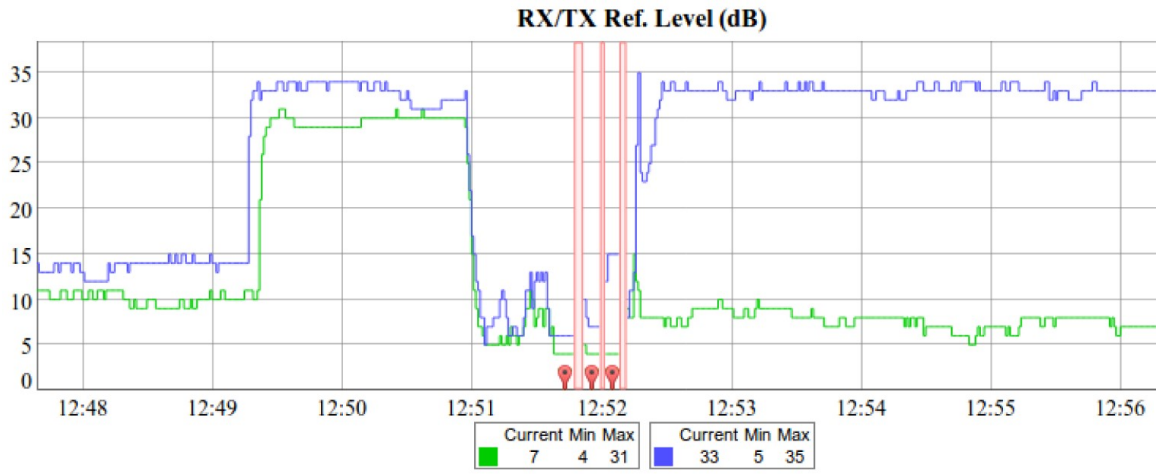


Figure - Statistics Graphs - RX/TX Ref. Level

This chart displays the measured RX (green) and TX (blue) signal levels. Red regions represent link outages. The default graph uses the CINR measurement method; however, the RSSI method can be selected from the drop-down menu.

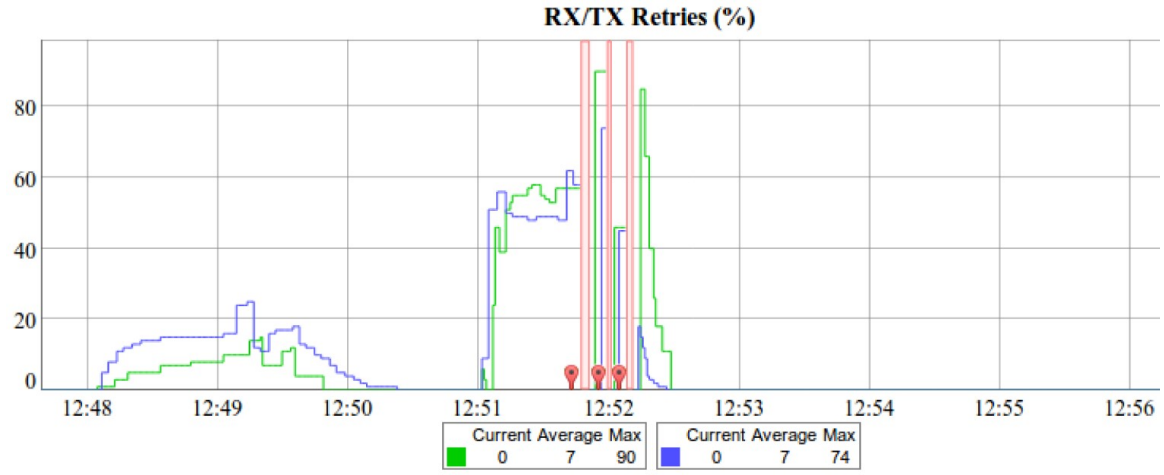


Figure - Statistics Graphs - RX/TX Retries

This chart displays the retry percentage (it provides a quick estimation of the link quality). Similar to the previous graph, RX retries are represented by the green lines, TX retries by the blue lines and link outages by the red lines.

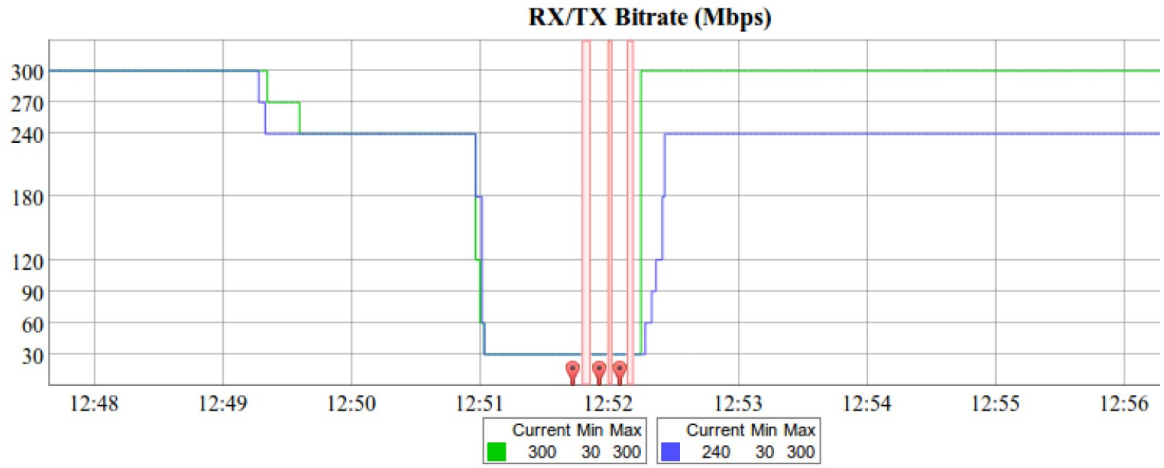


Figure - Statistics Graphs - RX/TX Bitrate

The Bitrate chart displays the bitrate for each of the two units in the link. These parameters indicate the link quality, too.

Figure - Statistics Graphs - RX/TX Load

The load charts display the actual link load information, either in real time or for a set period of time. The yellow lines represent the total link load, the green lines represent the RX load and the blue lines represent the TX load.

You can view the six graphs presented above into one or two columns per page by clicking the «**Change Layout**» button.

Remote Commands

The "Remote Commands" tool allows one MINT node to perform commands on another or all MINT nodes in the network at L2 level using **WANFleX OS** CLI commands.

Run the string you typed into the "*Command*" field by clicking the «**Execute**» button. For the full list and description of **WANFleX OS** CLI commands, please refer to the WANFleX OS User Manual.

For the ease of usage of the "Remote Commands" tool, the corresponding buttons for the most used **WANFleX OS** CLI commands are available in the right side of the screen:

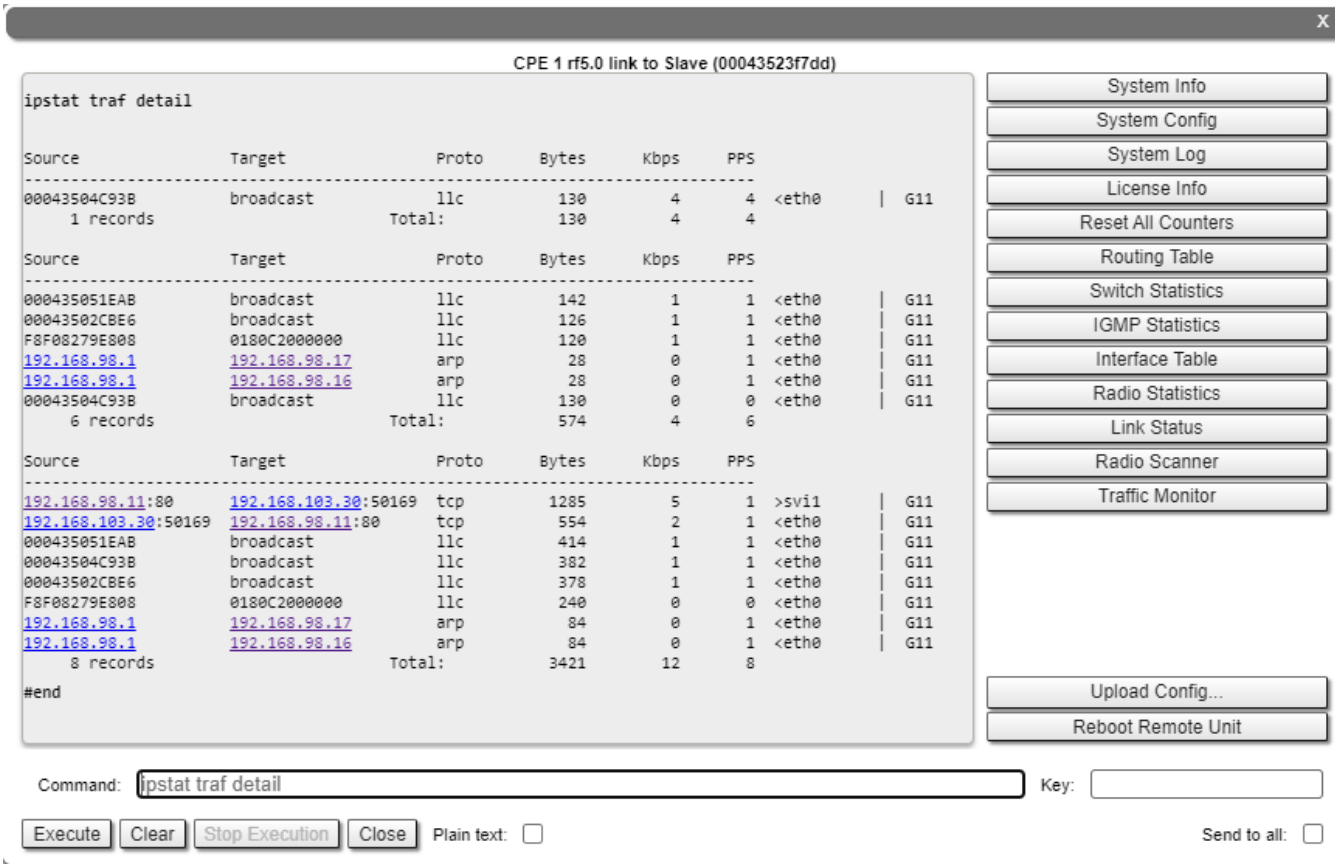


Figure - Remote commands

By clicking the «**System Info**» button, you fill in the command field with "*system version*, *system uptime* and *system cpu*" commands.

By clicking the «**System Config**» button, you fill in the command field with "*system uptime* and *config show*" commands.

By clicking the «**System Log**» button, you fill in the command field with "*system log show*" command.

By clicking the «**License info**» button, you fill in the command field with "*license –show*" command.

By clicking the «**Reset all counters**» button, you can reset the device statistics.

By clicking the «**Routing Table**» button, you fill in the command field with "*netstat -r*" command.

By clicking the «**Switch Statistics**» button, you fill in the command field with "*switch statistics*" command.

By clicking the «**IGMP Statistics**» button, you fill in the command field with "switch igmp-snooping dump name" command, which displays a list of IGMP hosts (clients) subscribed to a multicast group.

By clicking the «**Radio statistics**» button, you fill in the command field with "rf radio cap; rf radio stat1 full; muffer stat" commands, which display information about all connections via the radio interface

By clicking the «**Link Status**» button, you fill in the command field with "*mint map detail*" command.

By clicking the «**Radio Scanner**» button, you fill in the command field with "*muffer rf5.0 -t5 -p mac3*" command, which analyze MAC addresses in order to estimate the number and operation intensity of devices using the same frequency. Analysis duration is 5 seconds..

By clicking the «**Traffic Monitor**» button, you fill in the command field with "*ipstat traf detail*" command, which displays the information on data flows traversing the router.

All commands are executed automatically after clicking one of the buttons mentioned above.

> **NOTE**
>
> All **WANFleX OS** CLI commands can be executed from the "Remote Commands" tool.

You can set the key grant access to the remote node using the "*Key*" textbox and clicking the «**Execute**» button. Please note that this key must be prior set at the remote node via CLI (commands "*guestKey*", "*fullKey*" - see details in the WanFlex OS User Manual).

Erase the string you typed into the "*Command*" field and all output from the display section by clicking the «**Clear**» button.

Stop a command execution during the execution phase by clicking the «**Stop Execution**» button.

By clicking the «**Close**» button, you return to the "Device Status" page.

You can choose between plain and rich text format by marking/unmarking the corresponding checkbox.

You can execute the same command from the BS to all CPEs in the network (to the nodes that are linked to the BS) by marking "*Send to all*" checkbox before clicking the «**Execute**» button.

You can upload the configuration file to the remote node by clicking the «**Upload Config...**» button and you can reboot the remote node by clicking the «**Reboot Remote Unit**» button (a warning message pops up before the reboot).

Link Restart

You can restart the wireless link (re-association, re-authentication and re-connection) by selecting the "**Link Restart**" radio button and then by clicking the «**OK**» button in the link options.

If the operation is executed, the link disappears from "Device Status" page until it is reestablished again.

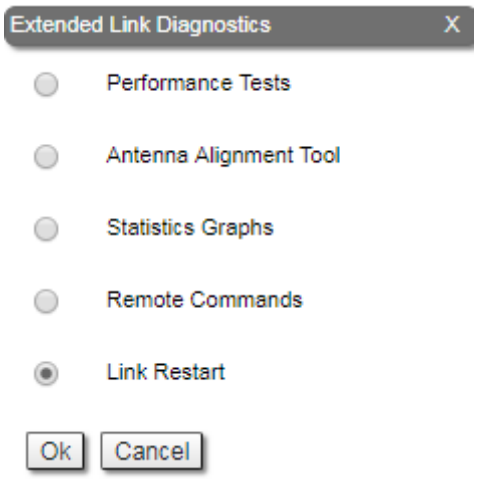


Figure - Link restart

Extended Switch Statistics

The "Extended Switch Statistics" tools allow gathering complete information and enhanced statistics for each group of the unit.

In order to access the "Extended Switch Statistics" tools, click on the row of each switch group or kernel within the "Switch Statistics" section:

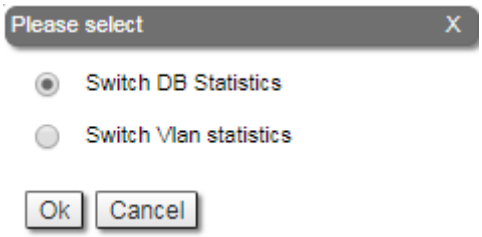


Figure - Extended Switch Statistics

Two options are available: "Switch DB statistics" and "Switch VLAN statistics".

Switch DB Statistics

The "Switch DB Statistics" tool gathers complete information and enhanced statistics for each switch group, including kernel:

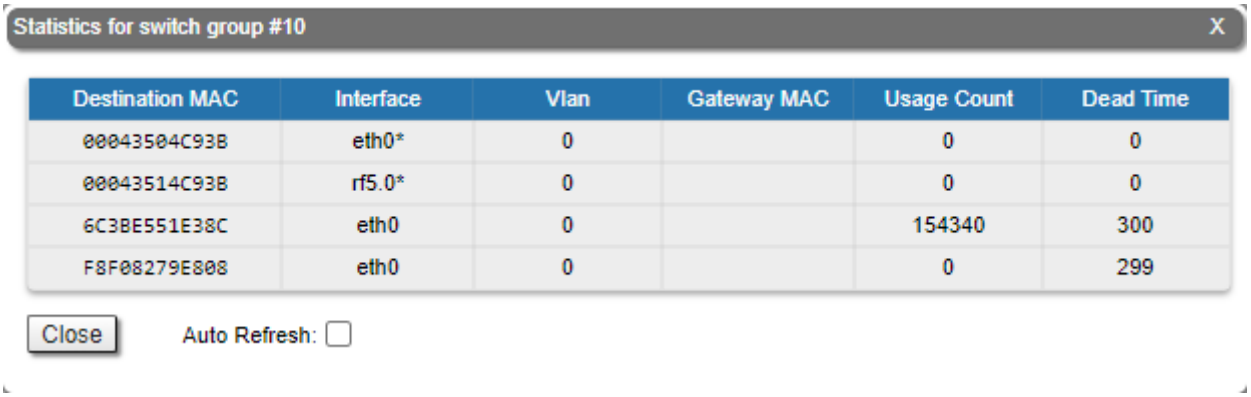


Figure - Switch DB Statistics

By clicking the «**Close**» button, you return to the "Device Status" page.

The "*Auto Refresh*" option is disabled by default. You can enable the auto refresh in order to have the statistics automatically refreshed.

Switch VLAN Statistics

The "Switch VLAN Statistics" tool gathers complete information and enhanced statistics for each VLAN created:

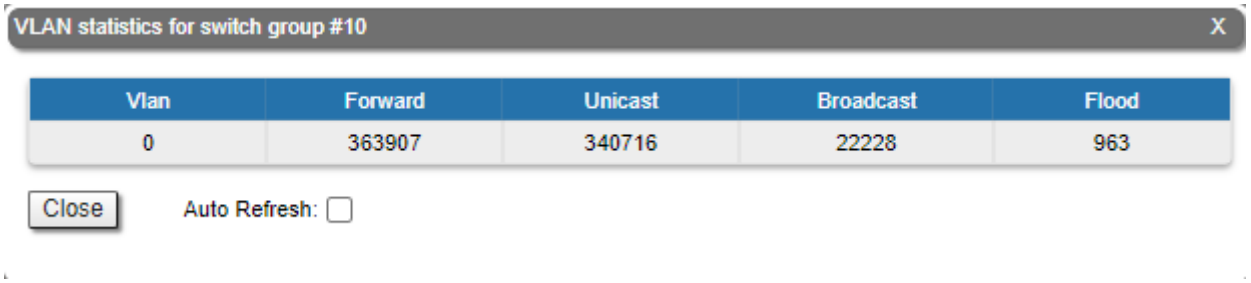


Figure - Switch VLAN Statistics

By clicking the «**Close**» button you return to the "Device Status" page.

The "*Auto Refresh*" option is disabled by default. You can enable the auto refresh in order to have the statistics automatically refreshed.