

7signal Sapphire

Loupe User Guide

Release 3.0

PREFACE

Document scope

This document is aimed for people familiarizing themselves with 7signal Sapphire measurements and the use of 7signal Sapphire Loupe. Case studies are included to introduce typical analysis paths of wlan network quality shortcomings.

This document does not describe how the software operates or how to configure testing. The actual use of various 7signal Sapphire applications is explained in detail in 7signal Sapphire Carat User Guide. Software and hardware installation is explained in 7signal Sapphire Deployment Guide.

FCC Warning

The radiated output power of the 7signal Sapphire Eye complies with the FCC RF exposure limits. To avoid the possibility of exceeding the FCC radio frequency exposure limits, a distance of at least 20 cm should be kept with the user and the device while operating.

The FCC ID for 7signal Sapphire Eye is YLF-2010-08-APU2 for IEEE802.11a/b/g

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The FCC ID for 7signal Sapphire Eye is YLF-EYE-ABGN-APU3 for IEEE802.11a/b/g/n

NOTE TO THE USER

Any uninstructed modification to the 7signal products may result in violation of FCC requirements.

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1 LOUPE

Sapphire Loupe is a browser application for viewing test results and saving the test results.

Open Loupe in a browser. Type the Loupe server's IP address into the Address field. Loupe uses the same user database as Sapphire Carat. An encrypted connection is used to transmit the username and password.

1.1 Loupe login

Login and authentication is similar to the management GUI, 7signal Sapphire Carat.

On top of typical username/password combination the user may have to select a group (access context) as well. This is primarily for multi-organization environments where one user account is able to manage numerous wlan networks otherwise separated by access rights. However, only one administrative domain is accessed at one particular session. To manage another wlan network or organization, the same user account has to do another login with another context.

1.2 Loupe at a first-glance

After a successful authentication, a typical Loupe screen is opened. The network topology accessible to the current user is displayed on the left and on the right there is the Summary pane. There are no default charts available to keep the start-up both responsive and relevant. The Summary pane operations and options are explained below.

A common central element between Loupe and Sapphire Carat is the hierarchical tree view in the left pane, depicting the topology of the networks being monitored.

The main Key Performance Indicators (KPIs) are grouped in tabs as well as other relevant report information such as visual tests and events. The tabs are following:

Summary	SLA
TP/SNR	Network
Client	Data rates
Spectrum	TOP
Alarm	

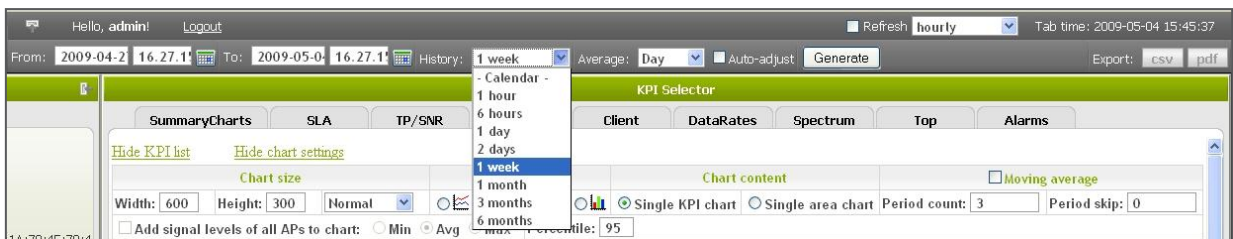
2 USING LOUPE

Sapphire Carat gathers and aggregates into a database the results obtained from running the chosen test profiles. Loupe enables you to view the results and make comparisons between different devices, tests, and time spans.

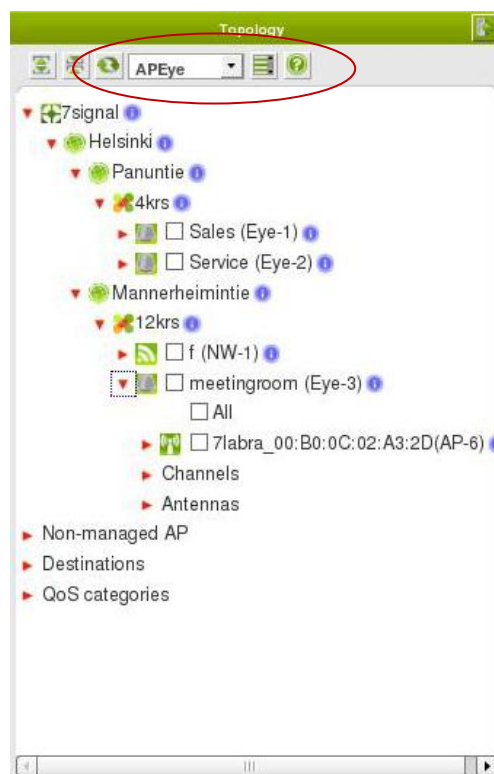
The charts displayed on startup give a simplified view to the status of the networks. Loupe offers many features for getting more detailed views.

Building a Result View:

1. Decide which group of indicators you want to view, for example Network
2. From the list, select the indicators from which you want to generate charts
3. From the top bar, select the time span to include in the results
 - a. you can choose a time span by typing in the times and dates. You can either type the date manually, or select it from a calendar.
 - b. you can also use the preconfigured values under History.



4. Under Average, select the averaging period
(The test results are based on samples, and you can use various averaging periods within the time span chosen in step 3. Changing the averaging period may cause changes in the test results, which is often exactly what is desired.)
5. From the Topology view, choose the level of aggregation
 - a. aggregation is a set of qualifiers that limit the result set



Note! The aggregation level can be chosen freely, but not all aggregation levels can be used with all KPIs. In other words, when choosing the level of aggregation, note the KPI being used. Loupe offers a default viewing level, but other viewing levels might be just as suitable. If you change the level, Loupe uses that level during the session.

Area	Description
NW	Network level
AP	Access point level
APEye	One single managed access point of a single monitoring station
APEyeAnt	One single managed access point of a single monitoring station in particular antenna direction
Eye	Single Eye
EyeAnt	An individual antenna in a chosen Eye
Dest	The Sonar to be tested
DestAP	The access point to be tested with relation to Sonars
ChEye	An individual channel in a chosen Eye
ChEyeAnt	An individual antenna and channel in a chosen Eye
QoSAP	Traffic belonging to a particular QoS level on a single access point
Link	Link consists of a chain Eye - Access Point – Sonar
All	Selects all elements

Note! The more detailed the chosen aggregation is, the more input one must give in the topology tree. For example, ChEyeAnt aggregation requires input on the channel, antenna and monitoring station for the request to be valid.

6. Alternatively, you can select Destinations from the tree hierarchy, and then select a Sonar for which you want to display the results.
7. You can hide the KPI list by selecting Hide KPI
8. Click Generate to display the results.

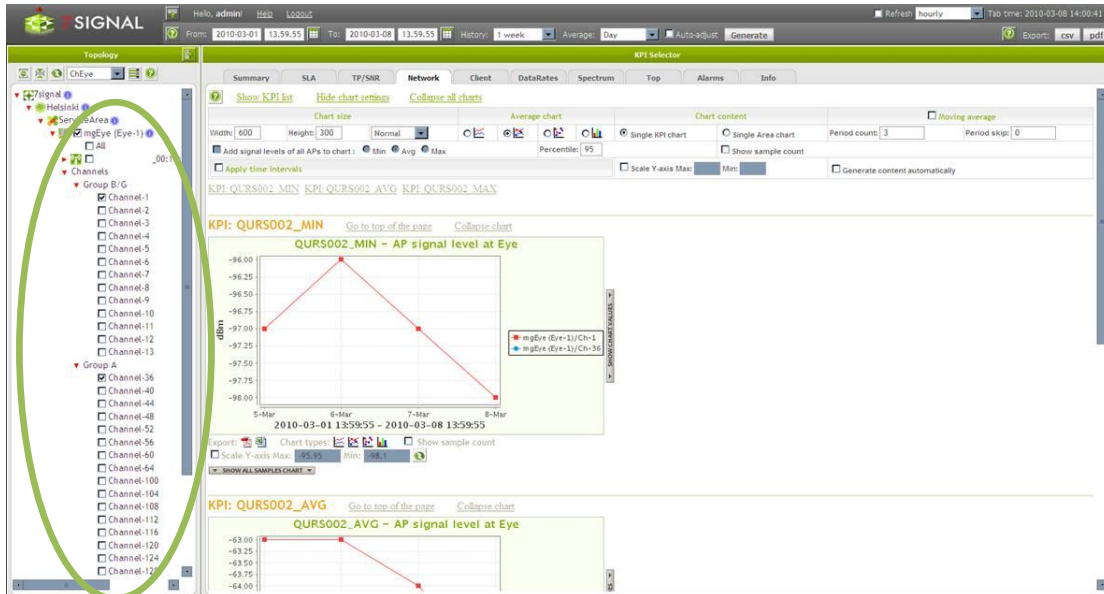
The results open up in the same view / panel.

Note! Rendering the results may take a long time.

Note! If you choose an extremely large number of KPIs, the application may run out of memory. Please use selections like “All KPIs” with caution.

2.1 Channel aggregation and selection

For the convenience of the user, the channels are separated by the IEEE 802.11 standards. The support is for IEEE 802.11b/g, IEEE 802.11a and IEEE 802.11n. The channel list is dynamic is based on the monitoring station country code setting. For example, one monitoring station located in Finland would show channel 13 while a monitoring station in the same organization but located in USA would not show that channel.



2.2 Saving the Charts

You can save the charts either individually under each chart or all at once by choosing Export from the top right corner. You have two saving options:

1. CSV: a comma-separated text file, suitable for importing data into a spreadsheet program
2. PDF: A Portable Document Format file suitable for printing.

Note! The options displayed in the browser might not look exactly the same in the PDF. Some changes are made to make the printed document easier to read.

2.3 Advanced Chart Settings

You can view the details of the results by selecting Show raw chart and Show chart data next to the chart (raw = all data points and samples without averaging). You can modify the charts by choosing or editing the values above the chart listing:

1. Chart size
 - a. Small, Normal, Large
 - b. User-defined size



2. Chart type

- Line, line with data points, scatter plot, bar chart



3. Display method of charts

- Single KPI chart – Each KPI displayed as a separate chart
- Single Area chart – All chosen KPIs in a single chart



Note! A “single area chart” should only contain measurements that have the same unit of measurement, such as millisecond.

4. Moving average



- Period count – the number of previous values to include into the calculation of a moving average. F.ex. with value 3, the moving average at 8:00 is the average of the values in 6:00, 7:00, and 8:00, when area-aggregation is hour.
- Skip – the number of periods to skip from the start of the series. F.ex. for a day’s serie, to ignore the night-time-values from 0:00 to 7:00, set skip to 8

3 TABS

Below the time selectors there are numerous tabs. The tabs divide KPIs by category and to some extent follow the principle that the more abstract, derived or calculated high-level indicators are on the left and the detailed, accurate and raw-level indicators are on the right.

As the amount of information is enormous and the displays may be limited, many of the elements in the user interface may be expanded / collapsed.

3.1 Tabs and analysis

The typical analysis flow is expected to progress from left to right. The outcome and results on the left are more abstract, more compounded and more processed than on the right. On the other hand, the level of detail grows the more the tab is on the right.

Please find the troubleshoot analysis at the end of this manual to see a few examples of typical analysis cases and how the user-interface supports those.

3.2 Tab memory

The tabs remember the last successful query or other similar selection. There is variance per tab on the items that are saved between sessions but in general all the essential information for a proper query is kept.

Also, expansions and collapses of the dynamic elements are saved.

4 SUMMARY

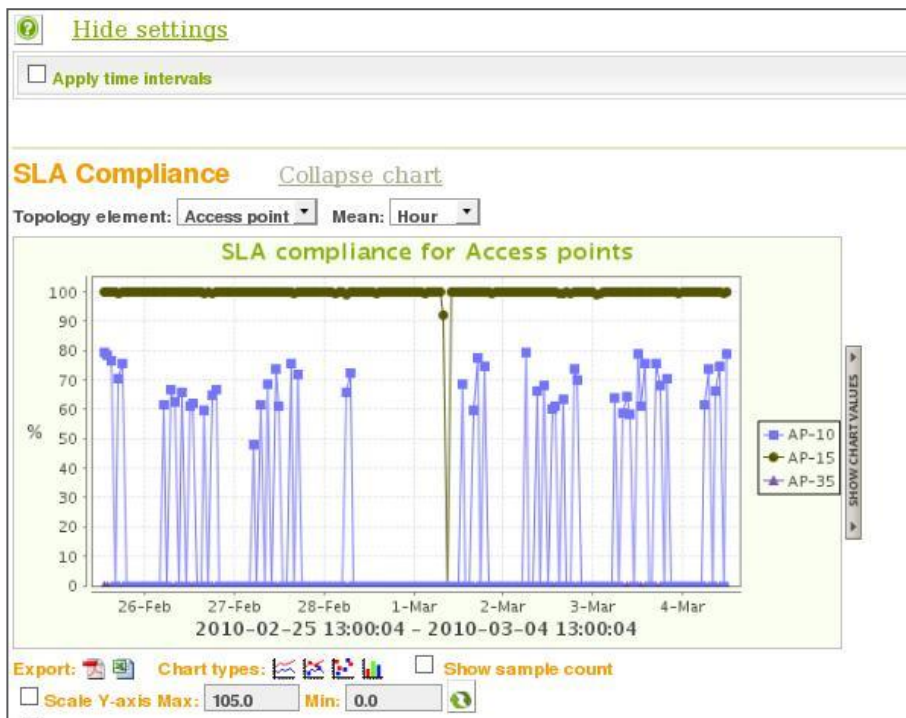
SLA Compliance KPI

To summarize the health of the network element, Loupe analyses multiple KPIs and based on that computes one single value that is called the 'SLA Compliance KPI'. The network element may be either an access point or a link. There has to be a SLA group defined and bound to the network element.

The measurement value averages all the KPIs in the SLA group. As such, this KPI does not provide any tools for analysis but it is rather to point out the need for analysis for the network elements that do not fulfill the quality expectations.

In the picture below, there are threenetwork elements, AP-10, AP-15 and AP-35. Based on the chart one can assume that AP-15 is operating as expected with only one temporary quirk. On the other hand, AP-35 seems to be continuously doing below any expectation. Note that AP-35 might be completely out or it may serve wlan clients but the overall quality is next to nothing, the SLA compliance is non-existent. AP-10 has its moments but obviously it is underperforming.

While all elements would benefit from some attention, it is obvious that AP-35 should have the priority. This is elementary to the SLA compliance KPI: one glimpse tells whether some element needs attention or not. The nature of the problem is available through investigating lower-level KPIs.



The SLA group defines the threshold values for all individual KPIs. However, the resultant KPI threshold values may and should be set in Loupe. The value setting is stored between the sessions for each user.

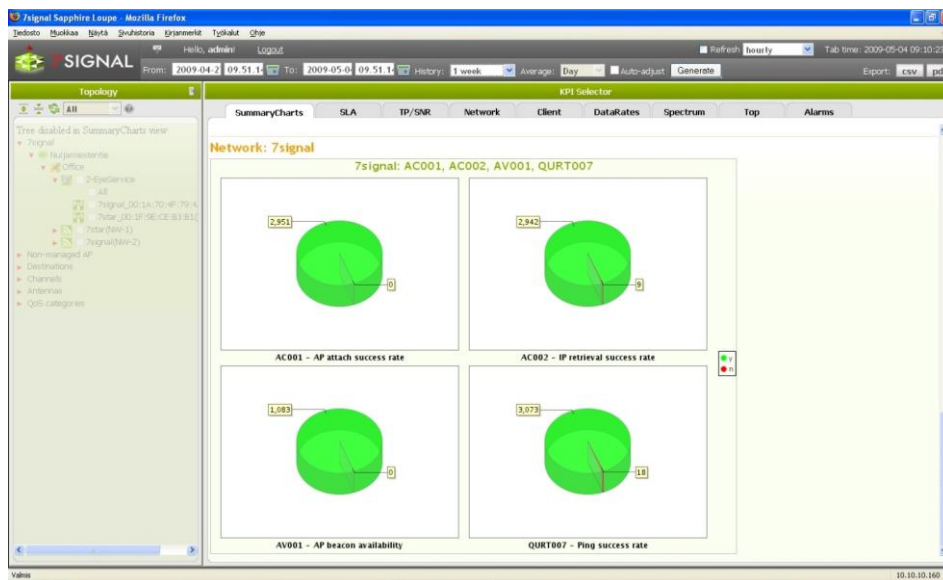
Export for the charts is available both for each chart individually and the global export on the top-menu buttons.

4.1 Elementary KPIs

The Summary tab contains also pie charts on some elementary KPIs. By default, they are now visible but the pie charts are available by selecting the wlan network name.

When expanded, Loupe displays a chart showing the general status of the monitored network from the last 7 days. The view contains the following KPIs:

- AP attach success rate
 - the ratio of successful network attachments to the number of attachments attempted
- IP retrieval success rate
 - the ratio of successful IP address retrievals to retrieval attempts
- AP beacon availability
 - heard beacon signal versus listening attempts
- Ping success rate
 - The ratio of successful reachability tests to the number of tests



The green area in the pie chart indicates successful measurements, and the red area indicates failures. The number of measurements is displayed next to the chart.

5 SERVICE LEVEL AGREEMENT, SLA

The service level agreement (SLA) view contains KPIs that display network functionality and availability as traffic lights.

The default limits are set by 7signal, and the values are based on real-life situations. You can modify the values to conform to the service level agreement currently being used. The values can be modified in the Sapphire Carat's management interface.

The SLA view contains by default the following KPIs:

- AP attach success rate
- IP retrieval success rate
- AP beacon availability
- Ping success rate
- FTP downlink throughput
- FTP uplink throughput
- MOS downlink
- MOS uplink
- Ping RTT
- FTP test success rate
- VoIP test success rate

The screenshot displays the SLA view for AP 7signal_00:1A:70:4F:79:4A (AP-5). The table shows KPI values for various dates from 2009-04-01 to 2009-04-07. The KPIs are color-coded: Green (Good), Yellow (Warning), and Red (Critical). A legend at the bottom defines the KPIs and their targets.

Day	AC001 AP attach success rate	AC002 IP retrieval success rate	AV001 AP beacon availability	QUAP001 FTP DL throughput	QUAP002 FTP UL throughput	QUAP005 MOS Downlink	QUAP006 MOS Uplink	QURTO04 Ping RTT	QURTO07 Ping success rate	RE004 FTP test success rate	RE005 VoIP test success rate
2009-04-07	99.84%	99.92%	100%	100%	100%	100%	99.69%	99.46%	99.92%	100%	99.18%
2009-04-06	99.83%	98.83%	100%	74.33%	73.99%	93.46%	99.59%	99.6%	99.68%	99.6%	99.88%
2009-04-05	99.74%	99.87%	100%	0%	0%	56.91%	99.87%	99.23%	98.73%	100%	100%
2009-04-04	99.86%	100%	100%	0%	0%	81.87%	100%	99.6%	99.08%	100%	99.93%
2009-04-03	100%	100%	100%	87.5%	86.75%	99.17%	99.96%	99.5%	99.78%	100%	100%
2009-04-02	100%	100%	100%	100%	100%	99.94%	99.66%	99.87%	99.88%	100%	99.98%
2009-04-01	99.92%	100%	100%	100%	100%	100%	98.94%	99.64%	100%	100%	100%

KPI	Target	Green	Yellow
AC001: AP attach success rate	≥1.0#	98.0%	90.0%
AC002: IP retrieval success rate	≥1.0#	98.0%	90.0%
AV001: AP beacon availability	≥1.0#	98.0%	90.0%
QUAP001: FTP DL throughput	≥5.5Mbit/s	95.0%	85.0%
QUAP002: FTP UL throughput	≥1.5Mbit/s	95.0%	85.0%
QUAP005: MOS Downlink	>3.0	90.0%	80.0%

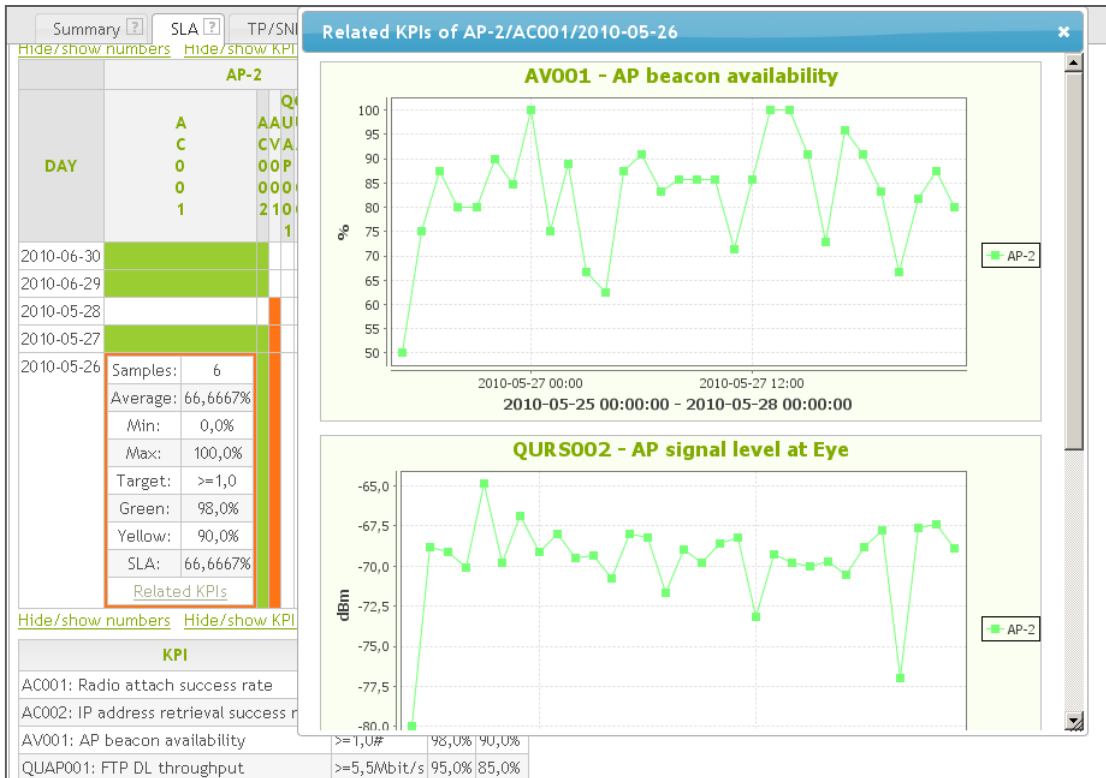
5.1 Three-basket principle

The color-coding indicates the SLA status, it may be either red, yellow or green. The wlan network may be operational and any test and any user-action may be successful yet the color in the SLA table is yellow or even red. This is because SLA view is highly derived data that is compared to expected level of the service.

For example, one may get 100% VoIP calls through but the SLA shows red. The interpretation here is that while the wlan network provides the VoIP service continuously, the service level is not met, thus the alarming color-code. There are not necessarily imminent problems with the wlan network in case red or yellow color but further investigation is surely needed. And obviously it is possible that in case of the red color, the service may be completely down.

5.2 SLA table active cells

To better understand the resulting color-code the cells in the table are active. By clicking a cell one gets immediate information on data that lead to the cell color.



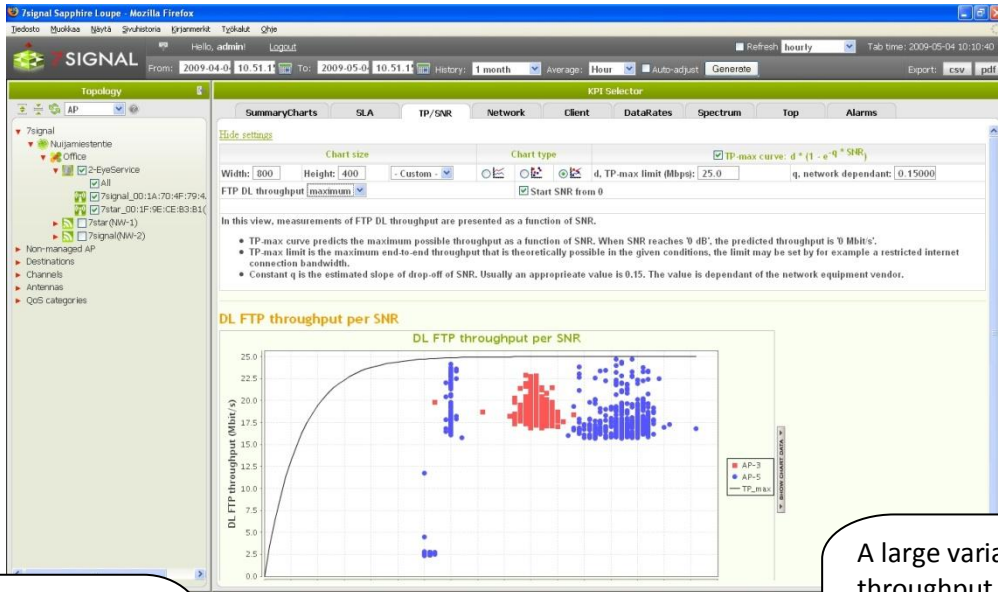
In case further analysis is needed, the link “Related KPIs” pop additional KPI charts up. The charts show a set of KPIs on time-interval that has shown on SLA table row expanded with one unit earlier and later. If the SLA table row is for an hour, the KPI chart includes the preceding and the following hour, too.

The set of KPIs either directly affect the SLA result or would be the KPIs that should be checked in the next step of the analysis. The troubleshoot cases at the end of this manual elaborate on the flow of analysis.

6 TP/SNR

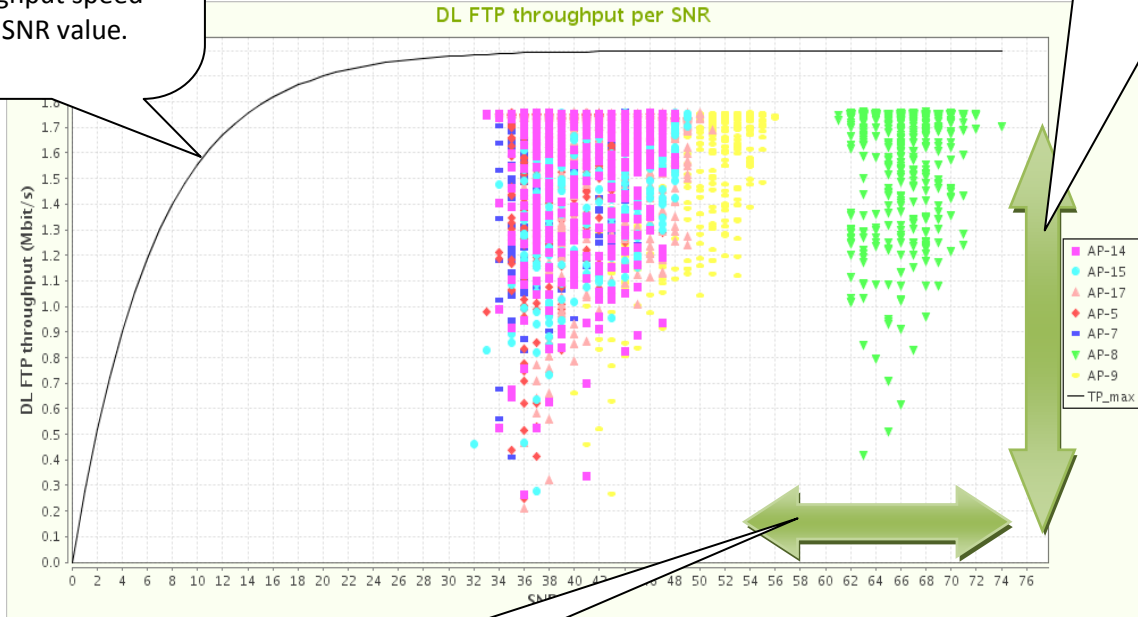
This view has a single chart, which displays the relationship between the measured throughput speed and the signal to noise ratio of a given access point. Measurements usually take into account only the theoretical maximum throughput speed. Since the measurements vary by network and hardware, the view instructs the user to modify the parameters. Modify the parameters directly in the view.

The picture below is an example on how to interpret the TP /SNR chart.



The maximum speed of an end-to-end connection is 2Mbps. The theoretical TP/SNR curve indicates the best data throughput speed for a given SNR value.

A large variation in throughput rate when the SNR value is good indicates possible performance issues in a wired network or a severely loaded radio



Variation in the SNR indicates variation in radio frequency interference.

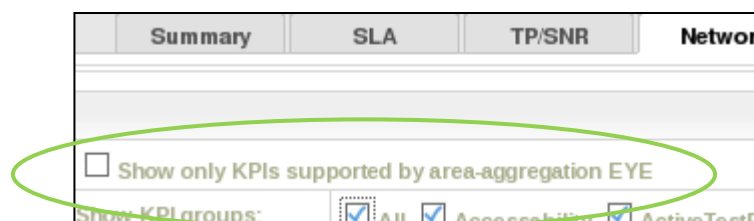
7 NETWORK PERFORMANCE INDICATORS

The KPIs in the Network tab are divided into four groups: Accessibility, Availability, Quality, Volume and Active test failures.

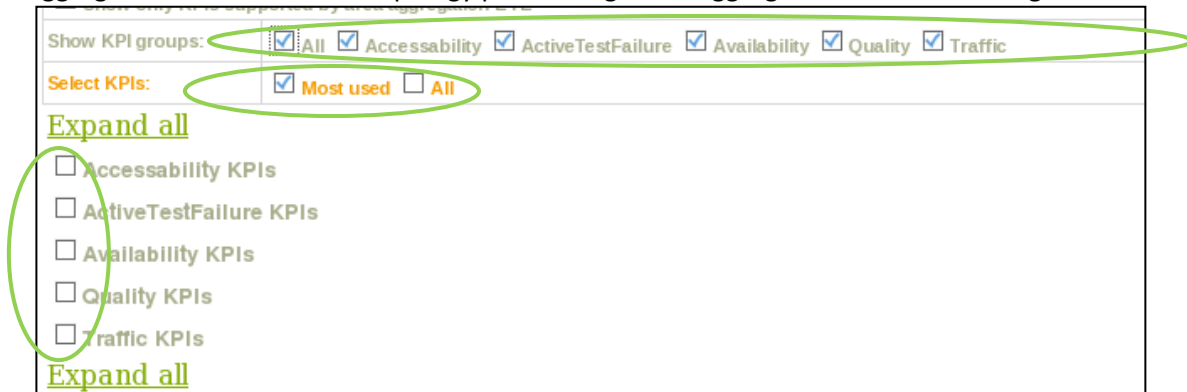
- Apply time intervals – You can limit the time of day, from which the measurements are included. F.ex. set time interval to 7:00 - 18:00 to ignore the results from night time.
- Scale Y-axis – You can set the minimum and maximum values of the y-axis to be the same in all of the charts.

Active controls in the tab pane

Selections in other panes affect KPI lists and other elements in the tab pane.



Aggregation selection in the Topology pane changes the aggregation-based KPI listing function.



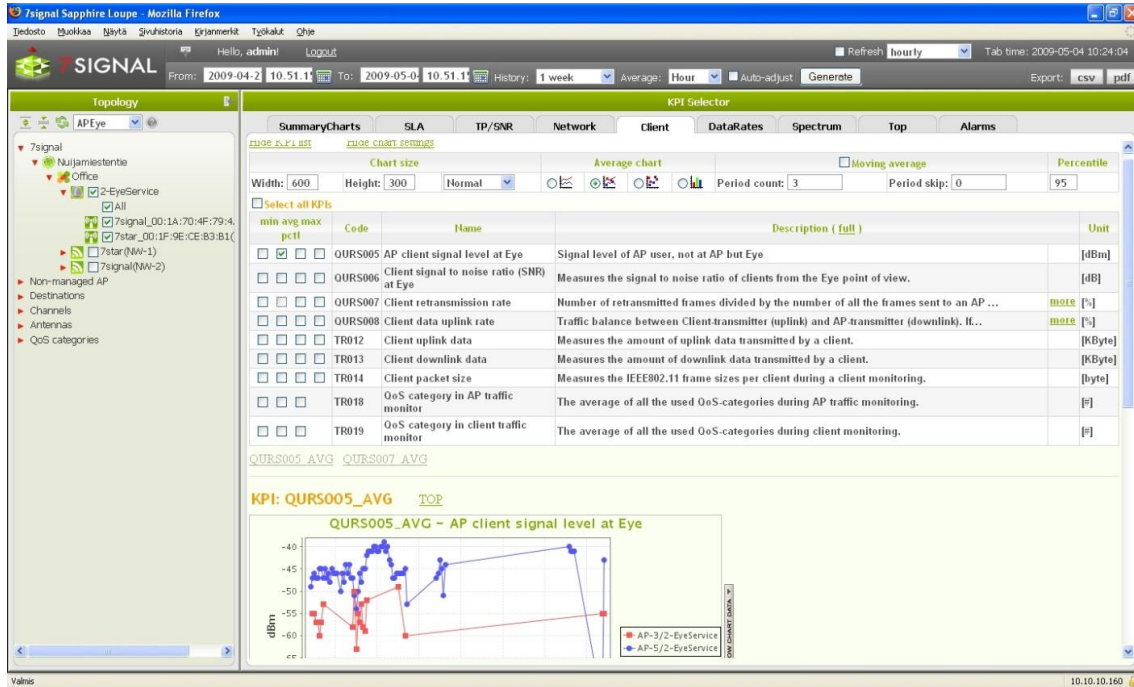
The Network tab contains the highest number of KPIs of all tabs. Therefore check-boxes are added to enable control of visibility. Both top-horizontal and vertical check-boxes control the same set of KPIs. Even when the horizontal selection limits the number of KPIs, the user benefits from the vertical control as well.

“Expand all” is there to show all KPIs at once.

8 CLIENT INDICATORS

The Client tab contains charts that indicate network functionality and the network quality as experienced by the user.

You can view the results by user (i.e. by client) by choosing the Client level from the Topology view.

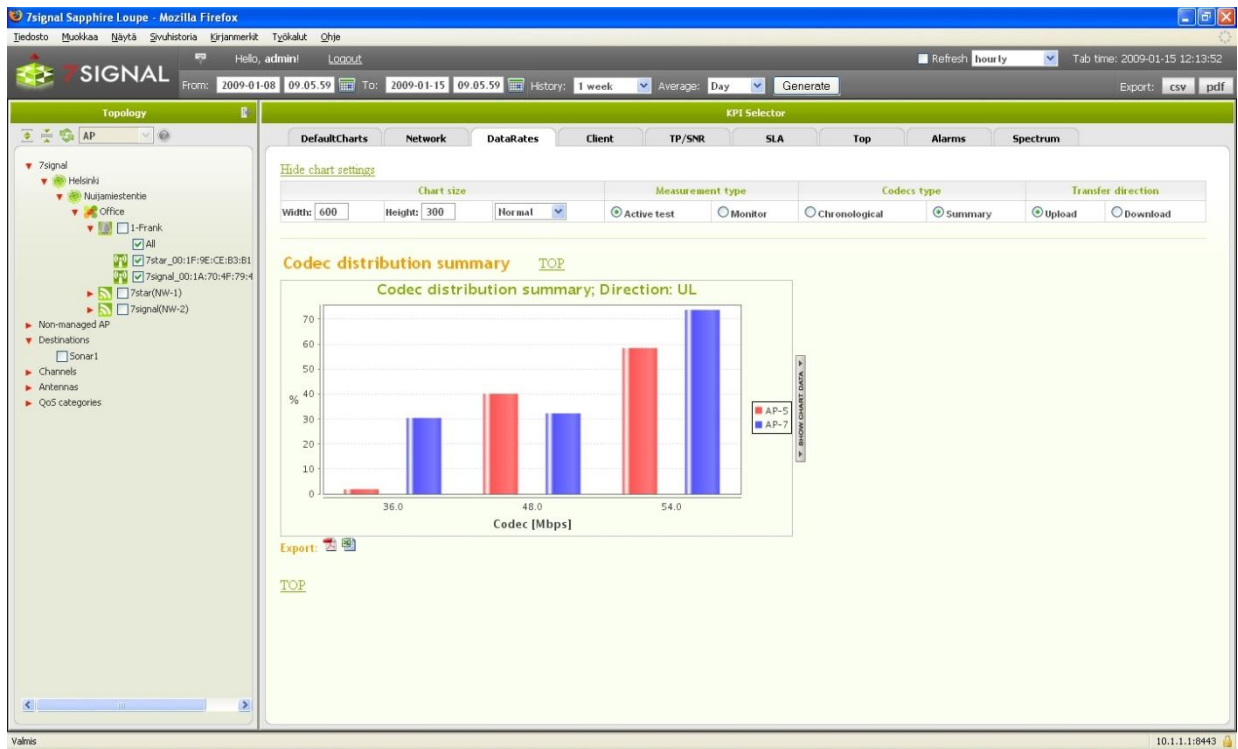


9 CODEC INDICATORS

This view displays the distribution of codecs used during the active tests. The codec used indicates the data transfer rate (Mbps). The use of small codecs is a sign of functionality problems in the network. In a properly functioning network, the maximum data transfer rate is used almost continuously.

When the Active test measurement type is used, the picture displays the codecs of each access point selected in the Topology view. When the Monitor test measurement type is used, the picture displays the codecs for each client selected in the Topology view.

You can view a summary or a chronological distribution of the codecs. In the summary, the codecs are aggregated as an average over the time span entered in the top bar.



9.1 Codec and channel history

Loupe provides an alternative view on codecs i.e. bitrates used by access points. This view is not based on a single active test but events that affect bitrates and channels used by the managed access points are stored in the database and thus available to Loupe.

The topology-tree provides the history by right-click pop-up menu on access point icons. The change history is the last item in the pop-up window. Alternatively the Info tab has the a link called "Show AP history" among other access point information. By following the link the change history is available.

10 SPECTRUM

The spectrum analysis is an interactive troubleshooting tool in Sapphire, and is most useful when used in Carat. Loupe displays the spectrum analysis results from the chosen time span to assist you in continuous monitoring.

In all of the spectrum charts, the swept frequency band lays on the x-axis. The band constitutes of the 256 WLAN subcarrier channels that are mapped to frequencies and WLAN channels, as described in below table:

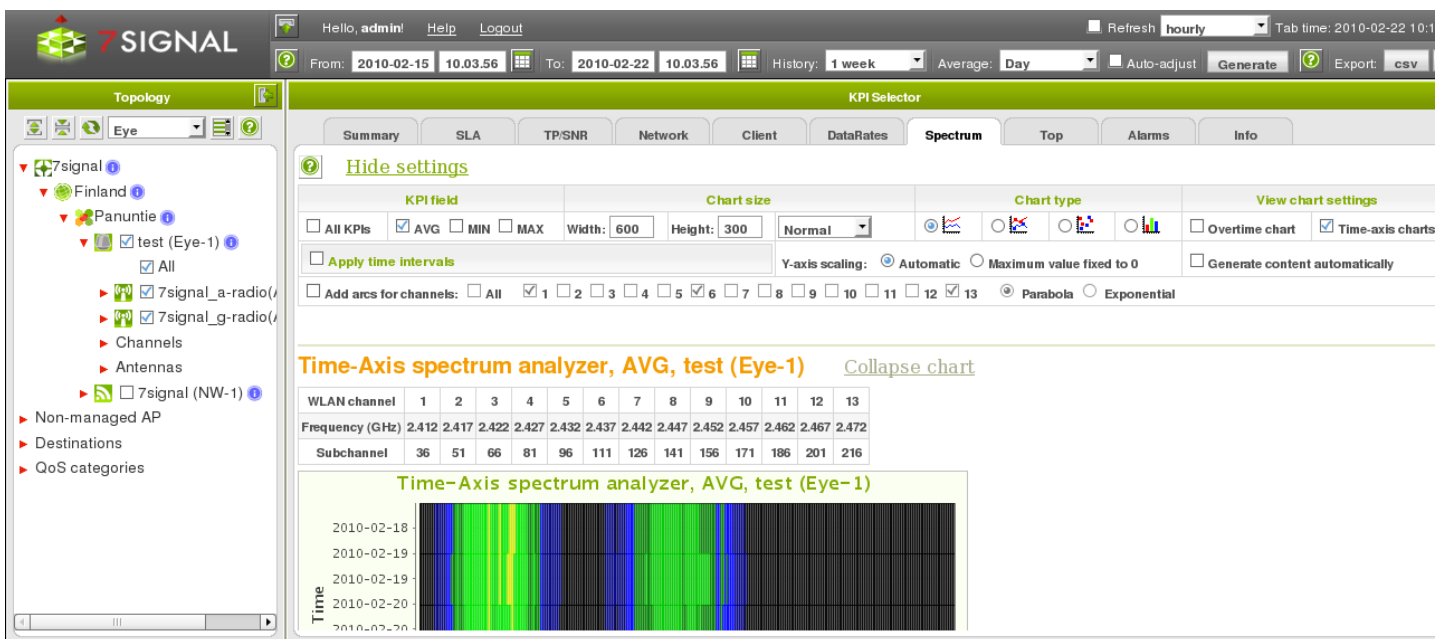
Subcarrier	36	51	66	81	96	111	126	141	156	171	186	201	216
Frequency	2.412	2.417	2.422	2.427	2.432	2.437	2.442	2.447	2.452	2.457	2.462	2.467	2.472
Channel	1	2	3	4	5	6	7	8	9	10	11	12	13

10.1 Over period chart

Loupe displays the spectrum analysis results from the chosen time span to assist you in continuous monitoring. In the “over period chart”, the signal level is plotted on the y-axis, and each antenna is represented by an individual chart. The swept frequency band is on the x-axis. If you select several Eyes, the results will be displayed individually for each Eye. To help to plot signal levels to the actual WLAN channels (1-13), you can activate the “Add arcs for channels”-checkbox. This selection adds parabolic lines to the chart to show the location of the selected channel numbers.

10.2 Time-axis chart

Time-axis chart plots the measurement time to the y-axis. Each antenna is represented by an individual time-axis chart. If you select several Eyes, the results will be displayed individually for each Eye.



11 TOP

This view displays the extremes – the highest or lowest KPI values. The current value extremes of a KPI can be seen in this view even when they are far from the alarm limits. This enables you to react to worrying developments and trends before they cause actual problems.

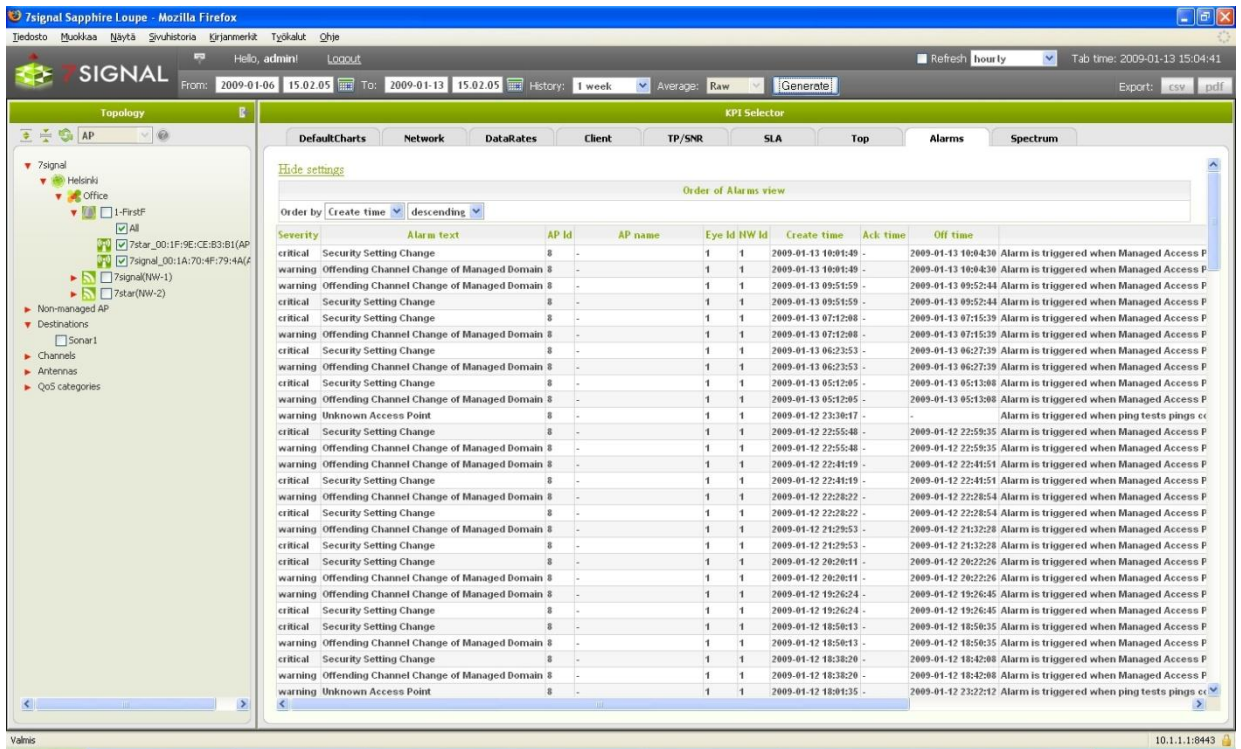
The screenshot shows the 'KPI Selector' interface in the 7signal Sapphire Loupe. The main area displays a table of KPI data for various APs, sorted by 'AV001' (AV002 for the bottom section). The table is split into 'Best' and 'Worst' columns. The 'Best' column shows high AV001 values (e.g., 100.0000%), while the 'Worst' column shows low AV001 values (e.g., 8.8900%). The table includes columns for AP ID, Time, and AV001/AV002. The interface also features a 'Topology' sidebar on the left and a 'DefaultCharts' tab at the top.

Best			Worst		
AP	Time	AV001	AP	Time	AV001
AP-1	2009-01-09	100.0000 %	AP-8	2009-01-12	98.5074 %
AP-16	2009-01-09	100.0000 %	AP-8	2009-01-11	98.6197 %
AP-15	2009-01-09	100.0000 %	AP-8	2009-01-10	98.6301 %
AP-13	2009-01-09	100.0000 %	AP-8	2009-01-09	98.8875 %
AP-12	2009-01-09	100.0000 %	AP-5	2009-01-13	99.0654 %
AP-11	2009-01-09	100.0000 %	AP-8	2009-01-13	99.0654 %
AP-10	2009-01-09	100.0000 %	AP-5	2009-01-10	99.3150 %
AP-9	2009-01-09	100.0000 %	AP-5	2009-01-12	99.3444 %
AP-7	2009-01-09	100.0000 %	AP-2	2009-01-11	99.5065 %
AP-6	2009-01-09	100.0000 %	AP-5	2009-01-11	99.5175 %
AP-4	2009-01-09	100.0000 %	AP-2	2009-01-10	99.5911 %
AP-3	2009-01-09	100.0000 %	AP-5	2009-01-09	99.7536 %
AP-2	2009-01-09	100.0000 %	AP-2	2009-01-12	99.7686 %
AP-17	2009-01-09	100.0000 %	AP-1	2009-01-09	100.0000 %
AP-16	2009-01-09	100.0000 %	AP-2	2009-01-09	100.0000 %

Best			Worst		
AP	Time	AV002	AP	Time	AV002
AP-8	2009-01-11	99.3301 %	AP-2	2009-01-09	8.8900 %
AP-8	2009-01-10	99.3300 %	AP-2	2009-01-12	8.8900 %
AP-3	2009-01-11	99.3225 %	AP-2	2009-01-11	8.8900 %
AP-3	2009-01-12	99.7544 %	AP-2	2009-01-10	8.8900 %
AP-8	2009-01-09	99.4339 %	AP-5	2009-01-13	89.4067 %
AP-5	2009-01-11	92.1401 %	AP-5	2009-01-09	90.5158 %
AP-5	2009-01-10	91.8901 %	AP-5	2009-01-12	90.3803 %
AP-5	2009-01-12	90.8803 %	AP-5	2009-01-10	91.9091 %
AP-5	2009-01-09	90.5158 %	AP-5	2009-01-11	92.1401 %
AP-5	2009-01-11	89.6867 %	AP-8	2009-01-09	99.4339 %

12 ALARMS

This view lists the alarms activated by Sapphire. Alarms are handled in Sapphire Carat. Loupe simply offers an alternative view and reporting functionality.



13 CONTINUOUS AND AUTOMATED REPORTING

Loupe is an interactive tool for studying network phenomena of interest and for in-depth investigation of problems. Reports in standard, easy-to-interpret formats are available to support routine monitoring. The reports take almost the same form as the indicator view of Loupe, and subscribing for a report is similar to using Loupe. Subscription must, however, be done via the Carat management interface.

By using the report view in Carat, the user can configure reports from elements that are familiar from Loupe. In addition to the user-selected indicators, a report configured here contains the time of compilation and delivery and a list of the delivery addresses. At the specified time, Carat generates the report and delivers it to the recipients, specified as either e-mail addresses or directories in the Carat server file system. A report can include KPIs, service level views, and alarms, referred to below as report items.

Note: Configuring the mail server settings found under “Edit | SMTP server” enables the use of email in reporting.

13.1 Subscription for a new report

1. Select “Manage | Automated report configuration”
2. Select “New” to create a new subscription and open a report template
 - a. Use “Edit” for editing a subscription
 - b. The “Delete” option allows you to delete a subscription
 - c. When you select a report name, the description of this existing report is displayed

In the “Report Properties Configuration” area:

3. Enter a name for the subscription
4. Enter a description for the subscription (optional)
5. Select an image from the Carat server file system (optional)
6. Choose the location for the image on the page
The image will be repeated on each page of the report. It might represent, for example, a company or a target network.

7. Select the resolution (quality) to be used for the report graphics, mainly relevant to charting.

In the “Report items” area:

8. Configure the items to be included in the report by selecting “Add”
 - a. this starts content-dependent workflows, instructions below
9. Specify the send time
 - a. recurrence is weekly or monthly
 - i. Field “When to send” is dynamic and let’s one choose either numerous week days or a day in month
 - b. circadian time has 30 minutes resolution in a drop-down menu
10. “Generate preview” creates a report and opens it in a viewer tool
11. “Generate and send now” are available for subscriptions that have been saved.

In the “Report destination settings” area:

12. Choose the delivery format (**Media type**) of the PDF report
 - a. **Email**
 - b. save to **File system**
 - i. an absolute path gives the location in the Carat server file system
 - ii. relative paths are relative to the Carat startup directory (default: /opt/7signal/Carat/7signal)
13. Add one or more formats in the “Destinations” field by clicking “New”
14. Save the subscription by clicking “Save”

13.2 Adding Report Items

There are three report item types. A report item is an individual piece of information – a single KPI chart or SLA table or a set of alarms – that is part of the report. A report is a series of report items.

The screenshot shows a web-based configuration window titled "Add report item". The window has three tabs: "Configuration of automated reports", "Automated report configuration", and "Add report item". The main content area is titled "Report item" in green. It contains the following fields and controls:

- Report item type:** A group of three radio buttons: "Kpi" (unselected), "SlA" (unselected), and "Alarm" (selected).
- Name:** A text input field containing the word "report".
- Description:** A large, empty text area for entering a description.

At the bottom of the window, there are three buttons: "Cancel", "Back", and "Next".

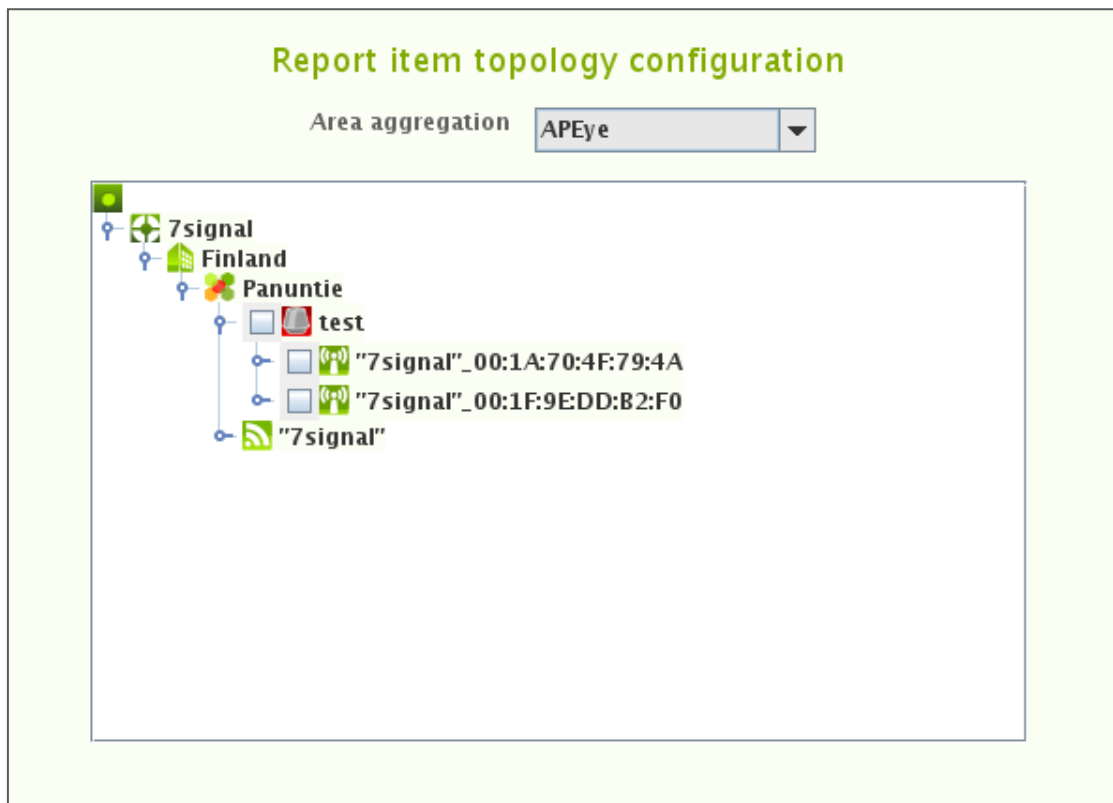
To add a report item:

1. Choose the content type
2. Give a name to the report item
 - a. a descriptive name is good especially if the item content groups together numerous pieces of information
3. Optionally write a description of the report item
4. Select “Next”

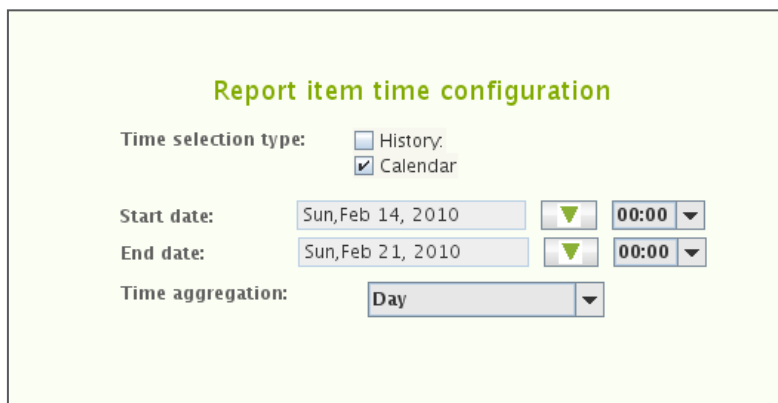
13.3 Indicator Content Type

The screenshot shows the 'KPI report item configuration' dialog box. The 'Add report item' tab is selected. The 'Available KPIs' list includes: Radio attach success rate, IP address retrieval success rate, Radio attach time, IP address retrieval time, AP beacon availability, Radio IP connection availability, Number of available SSID-AP-pairs, Beacon availability in managed AP scan, and Access point beacon availability in global AP. The 'Chart type' is set to 'Line', 'Chart content' is 'Single KPI chart', and 'Presentation type' is 'Chart'.

1. Select the desired KPI by left-clicking it in the right-hand pane
2. Right-click and select “Add KPI” in the submenu
3. Repeat steps 2–3 until all desired KPIs are in the left pane
4. Select the **Chart type**
5. Select the method for displaying the measurement series in **Chart content**
6. Select the display method
 - a. Data **Table**, Aggregation **Chart**
7. Click “Next” to continue to “Report item topology configuration”



8. Select the method of aggregation in **Area aggregation**
 - a. Note that maybe not all Loupe aggregations are available in the report
9. From the hierarchical tree presented, select the access points or networks to be included in the report by ticking the check-boxes
10. Click "Next" to continue to "Report item time configuration"



11. Select the time interval for the report
 - a. **History** uses pre-defined intervals from the generation time backwards
 - b. **Calendar** (in the picture above) allows free interval definition
12. Time aggregation defines the averaging period for the report item
13. Click "Finish" to return to first subscription page

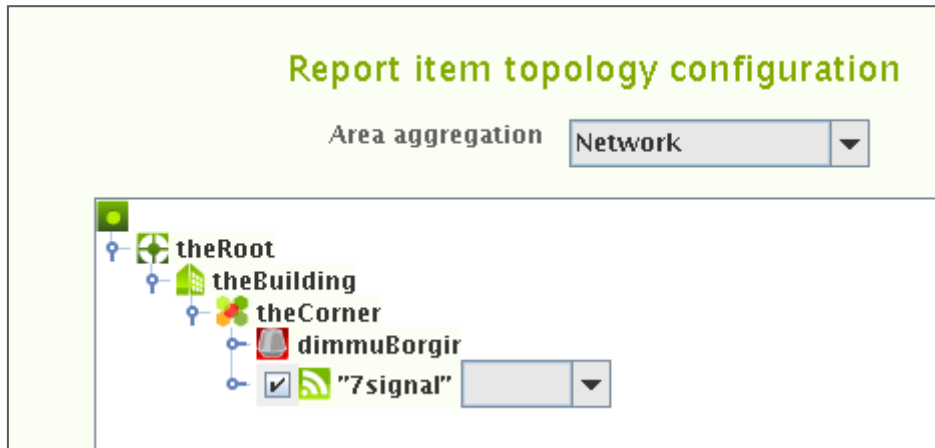
13.4 Service level content type, SLA

The pre-requisite is that there has to be SLA groups defined in the system. SLA report an SLA group to be bound to a topology element. KPI set and related threshold values are defined in

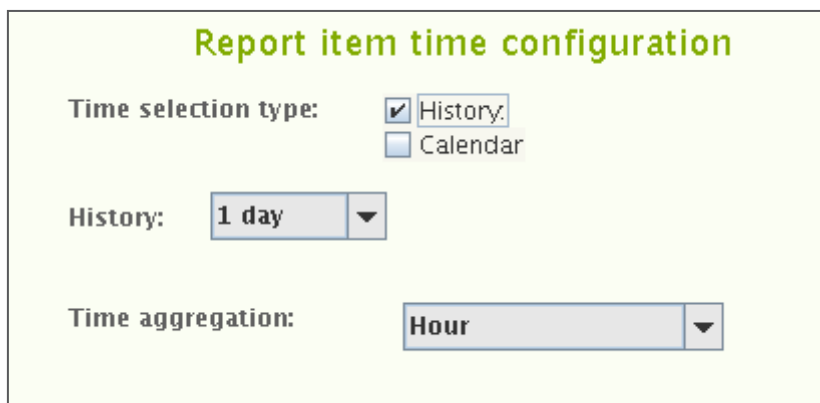
SLA groups, in automated report only SLA group is combined with the elements that should fulfill the SLA defined in the SLA group

The following sequence happens in “Report item topology configuration” pane. It open after choosing SLA type of report item in the previous dialog.

1. Choose the appropriate aggregation in the drop-down box.
- 2.

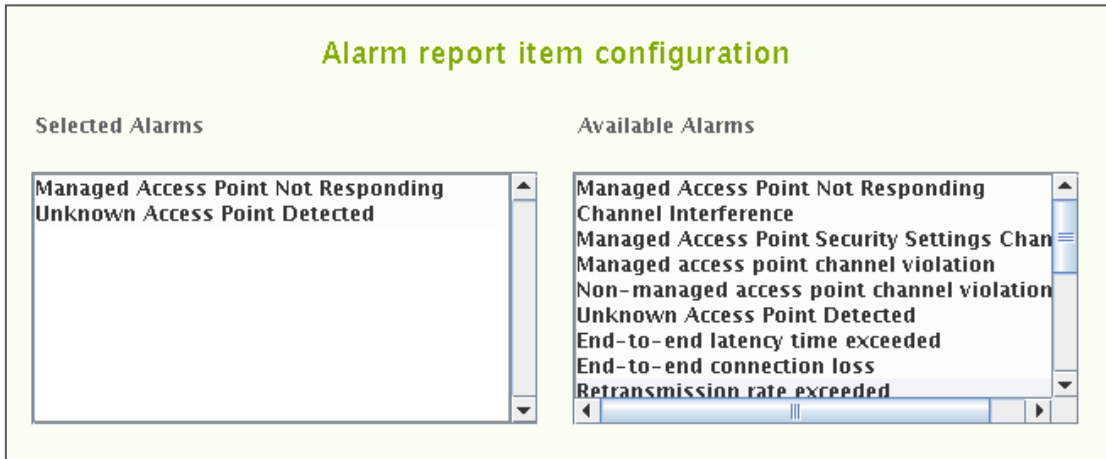


3. Select the elements in the topology tree
4. Select the SLA group to be applied. Available SLA groups are in a drop-down menu on the right of the topology element name.
5. Repeat steps 2-3 until all desired elements are bound to SLA groups.
6. Click “Next” to continue to “Report item time configuration”



7. Select the time interval for the report
 - a. **History** (in the picture above) uses pre-defined intervals from the generation time backwards
 - b. **Calendar** allows free interval definition
8. Time aggregation defines the averaging period for the report item
9. Click “Finish” to return to first subscription page

13.5 Alarm Content Type



1. Select the desired alarm by left-clicking it in the right-hand pane
2. Right-click the alarm and select "Add alarm" in the submenu
 - a. One may remind oneself about the alarm by selecting "Description"
3. Repeat steps 2–3 until all of the desired alarms are in the left pane
4. Select "Next" to continue to "Report item topology configuration" (pictured above)
5. Select the method of aggregation in **Area aggregation**
 - a. Note that maybe not all Loupe aggregations are available in the report
6. From the hierarchical tree presented, select the access points or networks to be included in the report by ticking the check-boxes
7. Select "Next" to continue to "Report item time configuration"
8. Select the time interval for the report
 - a. **History** uses pre-defined intervals from the generation time backwards
 - b. **Calendar** allows free interval definition
9. Time aggregation defines the averaging period for the report item
10. Click "Finish" to return to first subscription page

14 HOW TO TROUBLESHOOT USING LOUPE

14.1 Typical pattern

A typical troubleshooting workflow is as follows:

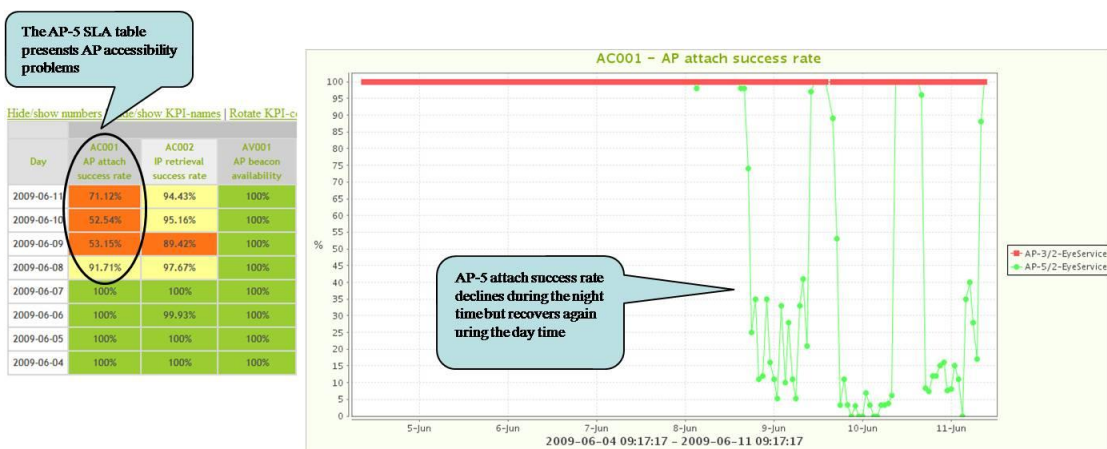
1. When logging in, you discover that there is an unusually large amount of failed wireless connection availability tests (AC001).
2. Go to the SLA tab and choose the access point or network where the problem has occurred. From the pull-down menu, choose the last 7 days as the time span and set the averaging period to 1 hour. These settings bring out the times of the failed tests in more detail.
3. Go to the Network tab, set the time span to cover the problematic times detected in step 2, and use 1-hour averaging. Select the KPIs. The problem with the wireless connection availability in this example is commonly caused by the following factors:
 - a. Increased load in the wireless network
 - i. TR003 (Client count per AP)
 - b. Changes in the interference levels
 - i. QURS002 (AP signal level at Eye)
 - ii. QURS003 (AP signal to noise ratio at Eye)

Additional factors can be:

- c. Authentication or DHCP problems in a wired network
 - i. QURT004 (Ping RTT)

14.2 Troubleshooting: Use Cases

14.2.1 Accessibility Problem



The "AP attach success rate" presents both radio attaching and authentication success rate.

➔ Wireless or fixed network problem?

Check also these KPIs:

KPI ID	Name	Description
AV001	AP beacon availability	The beacon availability presents if AP has been active and achievable
QURS002	AP signal level at Eye	The measured AP signal level and SNR presents the radio environment variations
QURS003	AP SNR at Eye	The measured AP signal level and SNR presents the radio environment variations
AV010	AP Channel information	The AP channel KPI presents the possible radio channel changes of managed and neighbor APs
QURS004	AP retransmission rate	The AP retransmission rate presents the possible radio problems between AP and Clients
TR003	Client count per AP	The AP Client count presents radio load issues
QURS001	Channel noise level at Eye and Spectrum-view	The channel noise level together with Spectrum-view presents possible interference issues and locations

AP beacon availability (AV001)

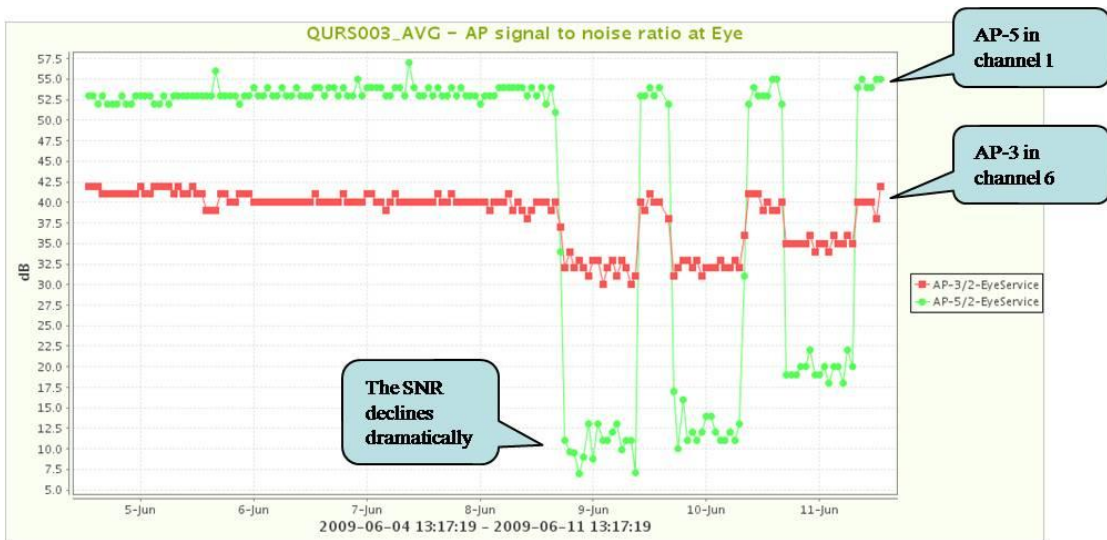
The beacon availability presents if AP has been active and achievable



➔ AP radio transmission has been active

AP SNR at Eye (QURS003)

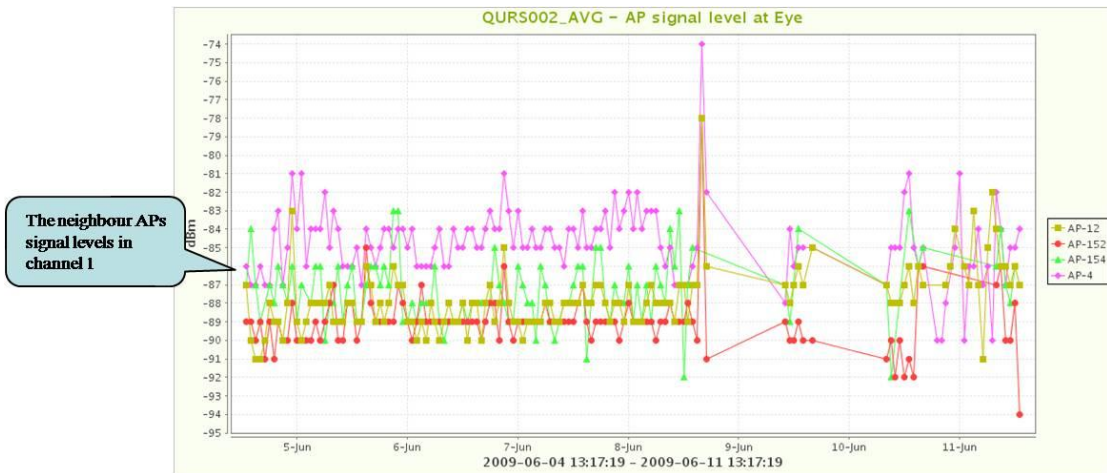
The measured AP signal level and SNR indicate variations in the radio environment



- ➔ The SNR declines dramatically during the night-time
- ➔ Wireless problem; Location and source ?

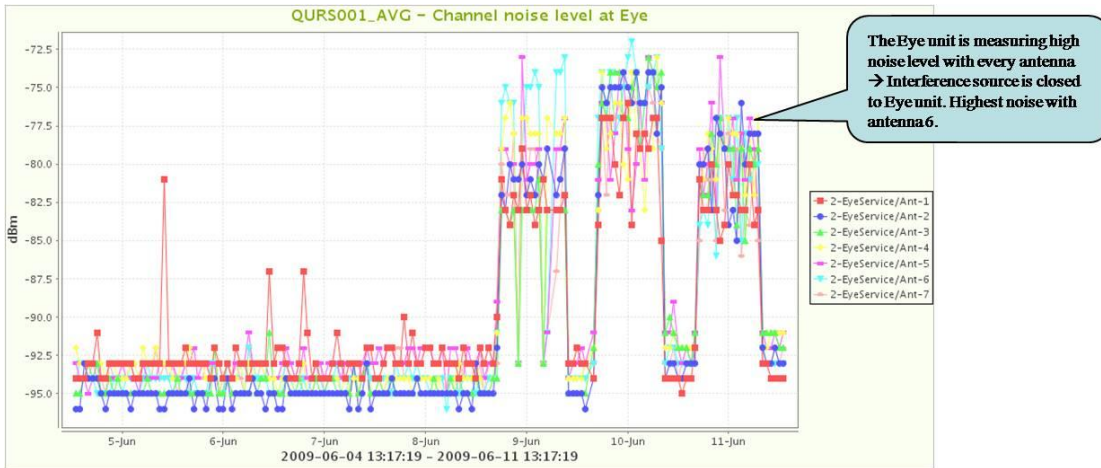
The signal levels of neighbor APs (QRS002)

The measured AP signal level and SNR indicate variations in the radio environment



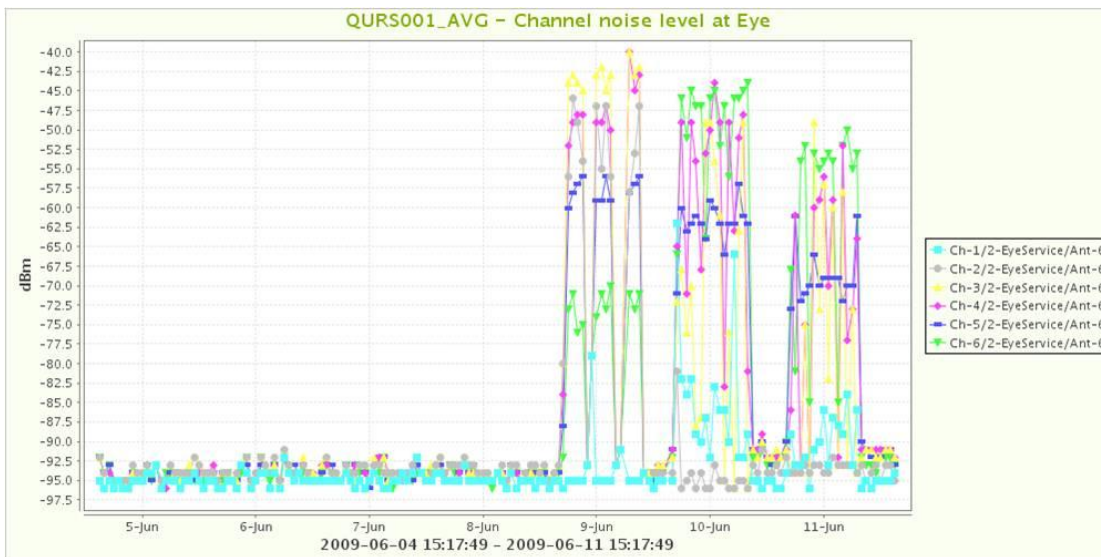
Channel noise level / Antenna (QRS001)

The channel noise level together with Spectrum-view indicates possible interference issues and locations.



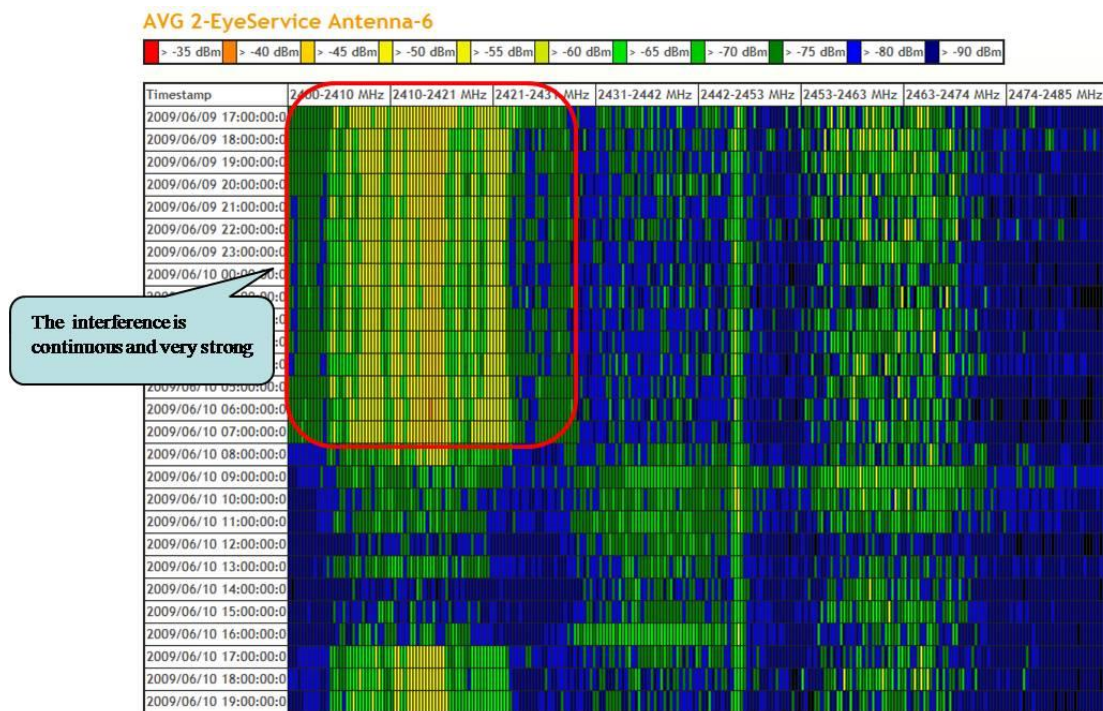
Channel noise level / Antenna 6, channels 1-6 (QRS001)

The channel noise level together with Spectrum-view indicates possible interference issues and locations.



Spectrum-view / Antenna 6 (QRS001)

The channel noise level together with Spectrum-view indicates possible interference issues and locations.



Case 1 summary

The attach success rate declination is also visible in other test results.

Attach times increase, the IP retrieval success rate declines, the FTP and VoIP test success rate declines etc.

The strong SNR declination and noise level increase indicates wireless problems.

The problem is caused by strong interference which is active during the night-times. The interference has a strong impact on Wi-Fi channels 1-6. The interference source is in Eye antenna direction 6.

- ➔ The extensive, strong and continuous interference is caused by FM-modulation wireless observation system in 2.4GHz Wi-Fi band.



14.3 Downlink Performance Problem

Hide/show numbers | Hide/show KPI-names | Rotate KPI-codes | Even width

Day	AC001	AC002	AV001	QUAP001	QUAP002	QUAP005	QUAP006	QURT004	QURT007	RE004	RE005
	AP attach success rate	IP retrieval success rate	AP beacon availability	FTP DL throughput	FTP UL throughput	MOS Downlink	MOS Uplink	Ping RTT	Ping success rate	FTP test success rate	VoIP test success rate
2009-05-05	100%	100%	100%	94.01%	99.08%	76.03%	88.21%	97%	100%	100%	100%
2009-05-04	99.92%	100%	100%	92.61%	96.24%	76.1%	87.13%	98.8%	100%	100%	100%
2009-05-03	100%	100%	100%	100%	100%	96.82%	96.81%	99.1%	100%	100%	100%
2009-05-02	100%	100%	100%	99.26%	99.88%	93.93%	96.34%	99.1%	100%	100%	100%
2009-05-01	100%	100%	100%	99.52%	99.88%	97.53%	97.1%	100%	100%	100%	100%
2009-04-30	100%	100%	100%	90.52%	99.11%	66.08%	86.93%	95.7%	100%	100%	100%
2009-04-29	99.92%	100%	100%	93.67%	99.07%	53.25%	88.14%	97.06%	99.88%	100%	100%
2009-04-28	99.96%	100%	100%	92.34%	96.93%	72.83%	92.01%	94.92%	100%	100%	99.87%
2009-04-27	99.96%	100%	100%	89.82%	96.28%	65.87%	92.09%	91.77%	99.64%	100%	99.23%
2009-04-26	99.87%	90.04%	100%	100%	99.85%	98.42%	97.45%	100%	98.63%	99.77%	99.64%
2009-04-25	99.96%	100%	100%	99.76%	100%	94.06%	97.67%	99.68%	99.89%	100%	100%
2009-04-24	99.76%	87.2%	100%	11.51%	98.48%	57.44%	89.74%	97.88%	98.89%	99.83%	99.49%
2009-04-23	99.84%	83.71%	100%	90.73%	98.21%	70.43%	92.77%	93.01%	97.88%	99.9%	99.35%
2009-04-22	99.79%	85.88%	100%	89.84%	97.67%	77.07%	93.07%	95.35%	96.07%	99.61%	99.45%
2009-04-21	100%	93.65%	100%	82.16%	96.2%	70.57%	88.57%	93.72%	99.19%	100%	99.76%

The FTP DL throughput is below the target level (1Mbit/s)

The VoIP MOS DL performance is unacceptable during the working days

KPI	Target	Green	Yellow
AC001: AP attach success rate	±1.0%	98.0%	90.0%
AC002: IP retrieval success rate	±1.0%	98.0%	90.0%
AV001: AP beacon availability	±1.0%	98.0%	90.0%
QUAP001: FTP DL throughput	±1.0Mbit/s	95.0%	85.0%
QUAP002: FTP UL throughput	±1.0Mbit/s	95.0%	85.0%
QUAP005: MOS Downlink	±3.6	90.0%	80.0%
QUAP006: MOS Uplink	±3.6	90.0%	80.0%
QURT004: Ping RTT	±200.0ms	99.5%	95.0%
QURT007: Ping success rate	±1.0%	80.0%	50.0%
RE004: FTP test success rate	±1.0%	90.0%	75.0%
RE005: VoIP test success rate	±1.0%	90.0%	75.0%

The network SLA table shows the performance situation of all the APs

The table presents downlink performance problems during the working days.

➔ Wireless or fixed network problem?

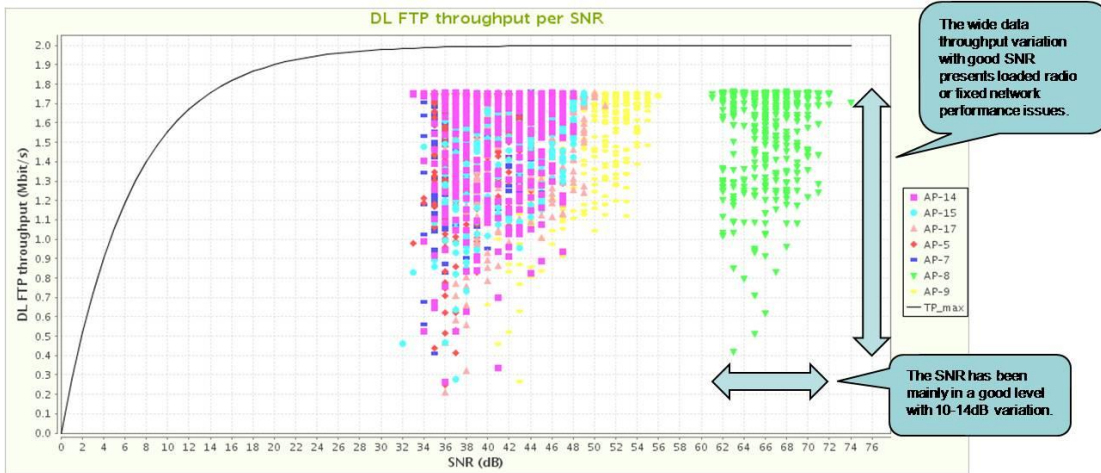
Check also these KPIs:

KPI ID / tab	Name	Description
TP/SNR	FTP DL throughput variation as a function of SNR	The TP/SNR KPI presents if wireless and/or wired side conditions change repeatedly
QUAP005	VoIP MOS downlink (listen)	The VoIP MOS KPI presents detailed information about VoIP MOS variation in the network. With 2 or more Sonar setup the VoIP MOS performance can be observed in wireless and wired side.
QUAP015	VoIP MOS packet loss	The VoIP packet loss KPI presents the network packet loss situation
QURT004	Ping RTT	The round trip time presents the e2e connection delay variation
QUAP001	FTP DL throughput	The FTP DL throughput KPI presents detailed information about throughput variation in the network. With 2 or more Sonar setup the throughput problem can be limit to wireless / wired side.
QUIP005	FTP DL packet size	The radio packet size KPI presents the possible packet size variation in the radio interface
QURS002	AP signal level at Eye	The measured AP signal level and SNR presents the radio environment variations
QURS003	AP SNR at Eye	The measured AP signal level and SNR presents

		the radio environment variations
Client	Client detailed statistics	E.g. Client retransmission rate and client packet size presents also the end-user performance
Data rates	DL codec distribution	The data rates codec distribution KPI presents the downlink codec usage in the active tests
TR003	Client count per AP	The AP Client count presents radio load issues

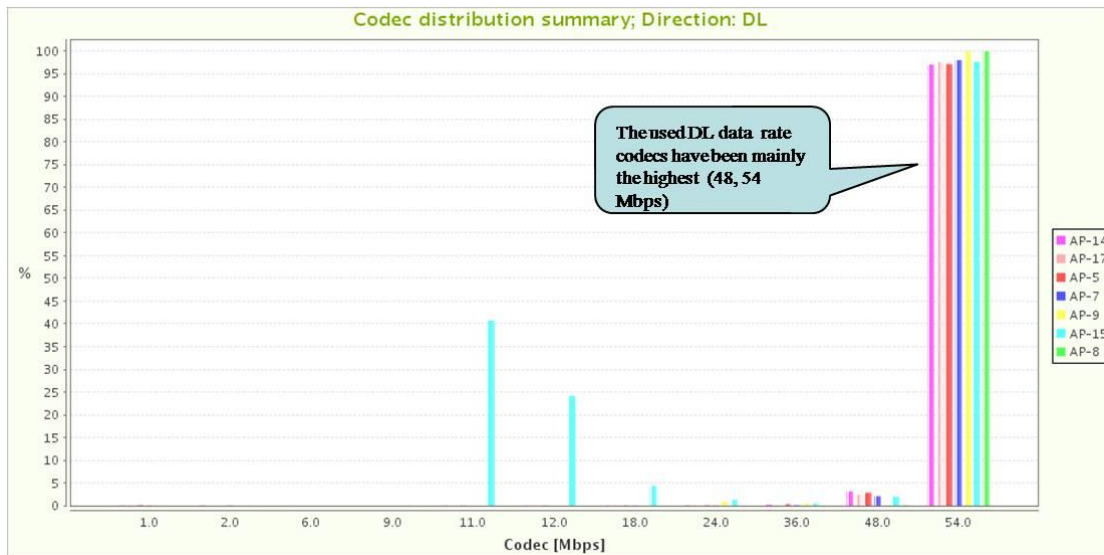
FTP DL throughput / SNR (TP/SNR)

The TP/SNR KPI can be used to determine if wireless and/or wired side conditions change repeatedly.



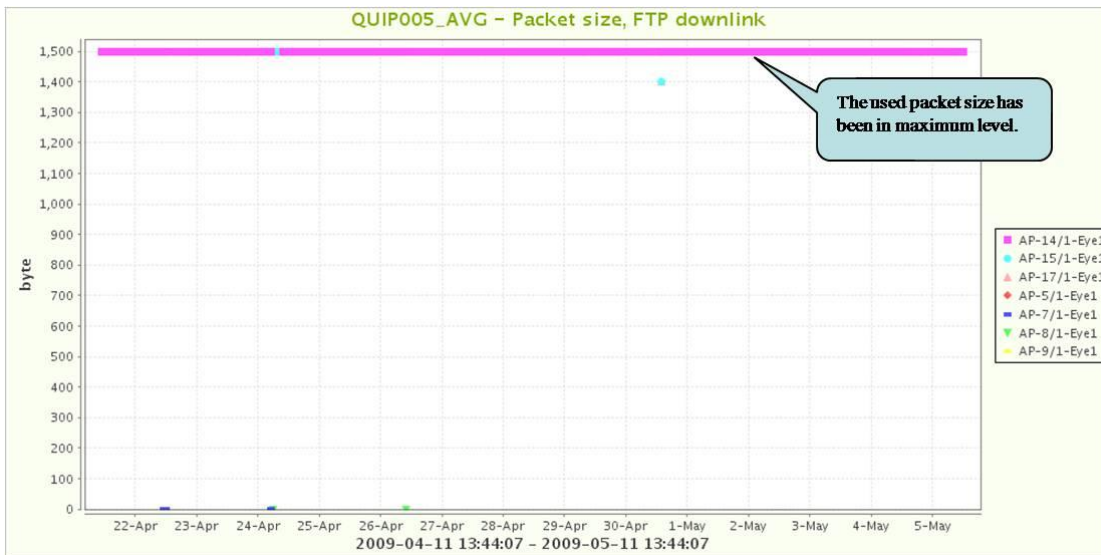
DL codec distribution (Data rates)

The data rates codec distribution KPI presents the downlink codec usage in the active tests



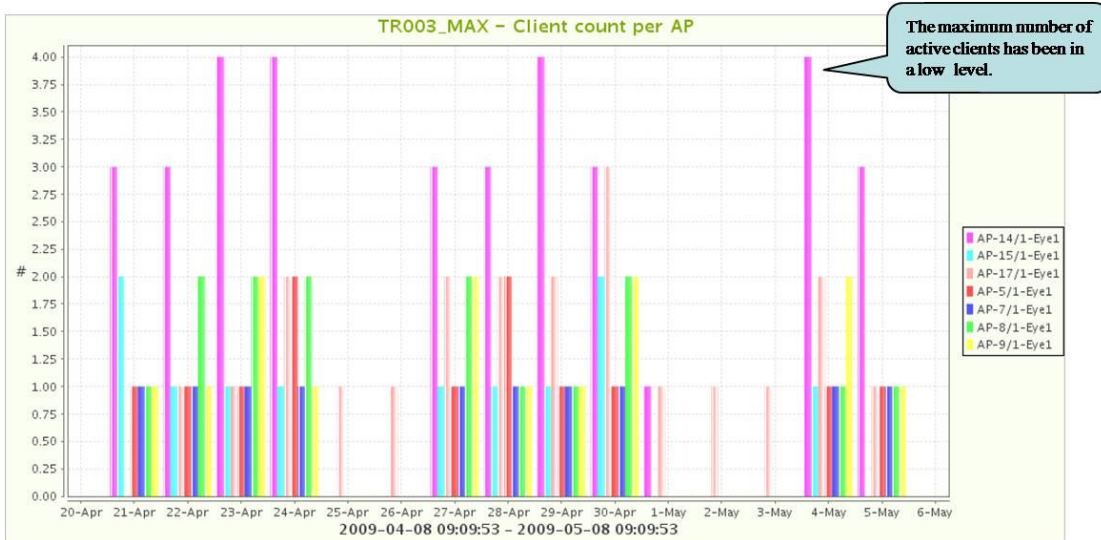
FTP DL packet size (QUIP005)

The radio packet size KPI presents the possible packet size variation in the radio interface.



Client count per AP (TR003)

The AP Client count presents radio load issues



Case 2 Summary

The downlink performance declines during the working days:

- ➔ FTP downlink throughput is at a very low level
- ➔ VoIP MOS downlink is not in an acceptable level
- ➔ Ping round trip time is occasionally very high (>200ms)

The radio KPIs (data rate codecs, SNR, packet size, client count) demonstrate that the downlink performance problem is not in the wireless interface.

The maximum e2e connection between Eye and Sonar end-point is only 1.8 Mbit/s.

- ➔ The fixed interface load is too high during working days

14.4 Downlink And Uplink Performance Problem

2-Eye2

[Hide/show numbers](#) | [Hide/show KPI-names](#) | [Rotate KPI-codes](#) | [Even width](#)

Day	EYE-2									
	AC001 AP attach success rate	AC002 IP retrieval success rate	AV001 AP beacon availability	QUAP001 FTP DL throughput	QUAP002 FTP UL throughput	QUAP005 MOS Downlink	QUAP006 MOS Uplink	QURT004 Ping RTT	QURT007 Ping success rate	
2009-02-16	98.28%	100%	100%	37.76%	39.8%	48.64%	24.34%	98.17%	92.25%	
2009-02-15	98.34%	100%	99.62%	34.25%	37.36%	43.59%	18.76%	96.08%	93.83%	
2009-02-14	95.45%	100%	99.71%	35.31%	38.72%	47.13%	23.96%	96.23%	89.94%	
2009-02-13	98.65%	100%	99.8%	36.07%	35.21%	41.34%	20.42%	97.99%	94.51%	
2009-02-12	96.99%	100%	99.91%	33.92%	39.01%	43.31%	20.34%	93.78%	92.61%	
2009-02-11	98.86%	100%	99.78%	27.23%	37.96%	33.75%	25.73%	95.73%	94.13%	
2009-02-10	96.74%	100%	99.82%	28.45%	36.59%	52.86%	23.44%	95.45%	93.45%	
2009-02-09	97.17%	100%	99.78%	32.08%	37.86%	39.76%	20.04%	98.19%	94.03%	

The FTP and MOS are below the target threshold values

[Hide/show numbers](#) | [Hide/show KPI-names](#) | [Rotate KPI-codes](#) | [Hide/show thresholds](#)

KPI	Target	Green	Yellow
AC001: AP attach success rate	≥1.0#	98.0%	90.0%
AC002: IP retrieval success rate	≥1.0#	98.0%	90.0%
AV001: AP beacon availability	≥1.0#	98.0%	90.0%
QUAP001: FTP DL throughput	≥5.5Mbit/s	95.0%	85.0%
QUAP002: FTP UL throughput	≥1.5Mbit/s	95.0%	85.0%
QUAP005: MOS Downlink	≥3.6	90.0%	80.0%
QUAP006: MOS Uplink	≥3.6	90.0%	80.0%
QURT004: Ping RTT	≤50.0ms	99.5%	95.0%
QURT007: Ping success rate	≥1.0#	80.0%	50.0%

The network SLA table shows the performance situation of the 5 APs.

The table presents downlink & uplink performance problems during the measurement period.

➔ Wireless or fixed network problem?

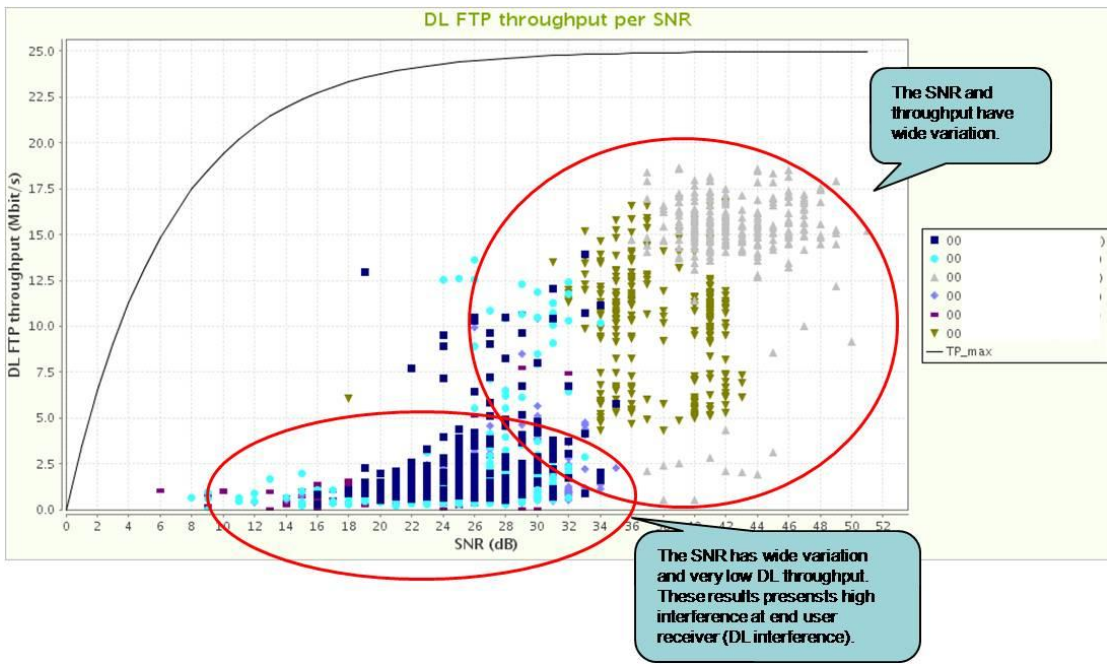
Check also these KPIs:

KPI ID / tab	Name	Description
TP/SNR	FTP DL throughput variation as a function of SNR	The TP/SNR KPI presents if wireless and/or wired side conditions change repeatedly.
AV010	AP Channel information	The AP channel KPI presents the possible radio channel changes of managed and neighbor APs.
QURS001	Channel noise level at Eye and Spectrum-view	The channel noise level together with Spectrum-view presents possible interference issues and locations
QURS004	AP retransmission rate	The AP retransmission rate presents the possible radio problems between AP and Clients

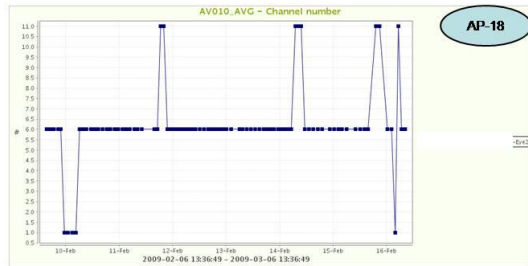
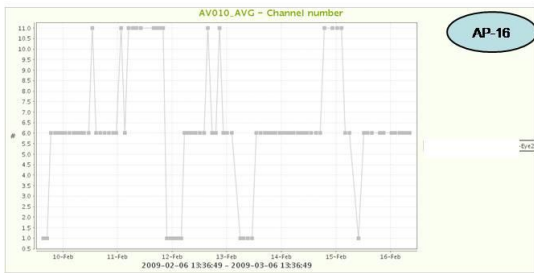
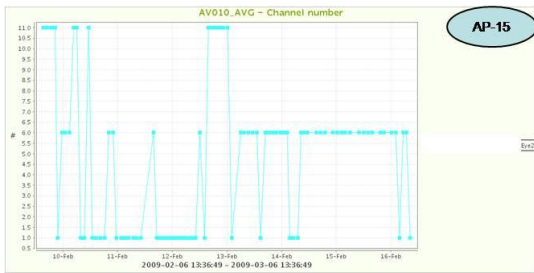
QUAP005 & QUAP006	VoIP MOS downlink (listen) & VoIP MOS uplink (talk)	The VoIP MOS KPI presents detailed information about VoIP MOS variation in the network. With 2 or more Sonar setup the VoIP MOS performance can be observed in wireless and wired side.
QUAP015	VoIP MOS packet loss	The VoIP packet loss KPI presents the network packet loss situation.
QUAP001 & QUAP002	FTP DL throughput & FTP UL throughput	The FTP throughput KPI presents detailed information about throughput variation in the network. With 2 or more Sonar setup the throughput problem can be limit to wireless / wired side.
QUIP005 & QUIP006	FTP DL packet size & FTP UL packet size	The radio packet size KPI presents the possible packet size variation in the radio interface.
QURS002 & QURS003	AP signal level at Eye & AP SNR at Eye	The measured AP signal level and SNR presents the radio environment variations
Client	Client detailed statistics	E.g. Client retransmission rate and client packet size presents also the end-user performance.
Data rates	DL & UL codec distribution	The data rates codec distribution KPI presents the downlink codec usage in the active tests.
TR003	Client count per AP	The AP Client count presents radio load issues.

FTP DL throughput / SNR (TP/SNR)

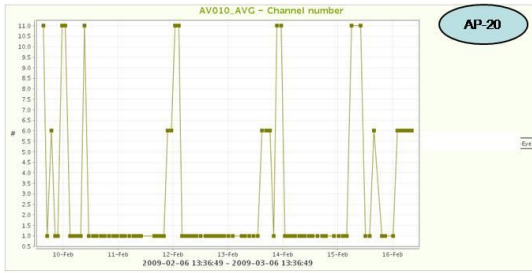
The TP/SNR KPI can be used to determine if wireless and/or wired side conditions change repeatedly.



AP Channel information (AV010)

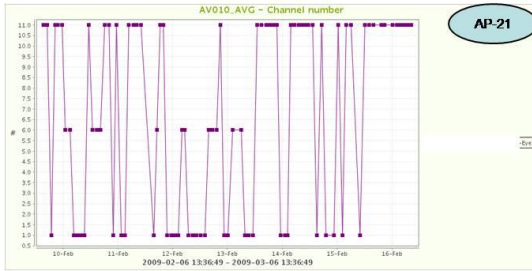


AP Channel information (AV010)

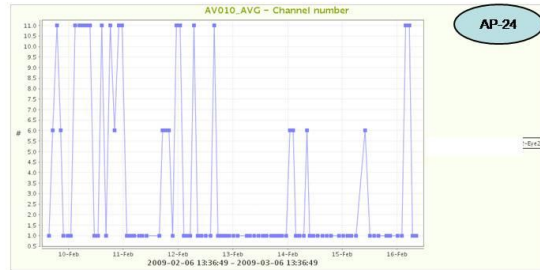


AP-20

The APs have automated channel selection activated



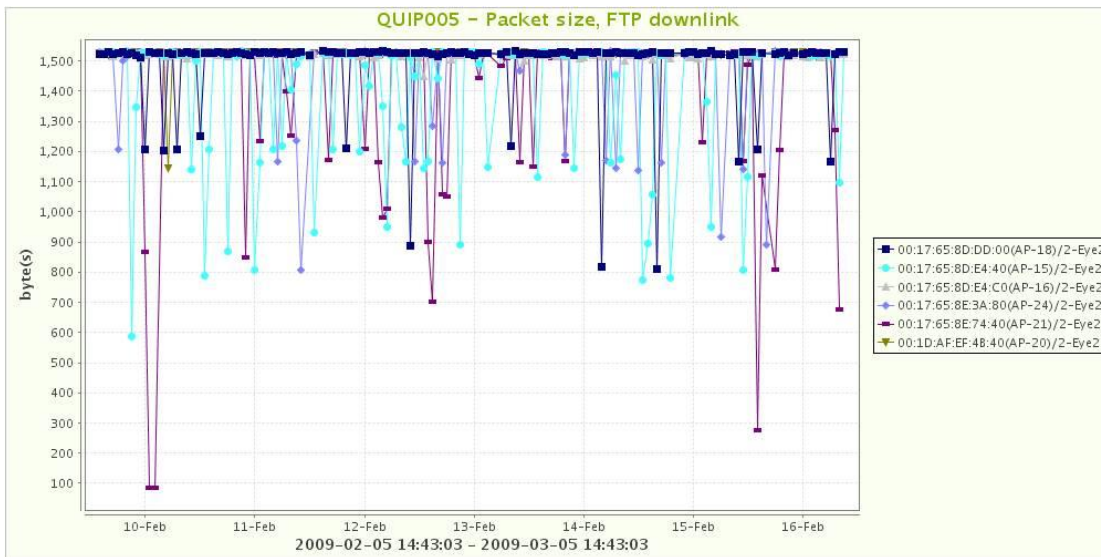
AP-21



AP-24

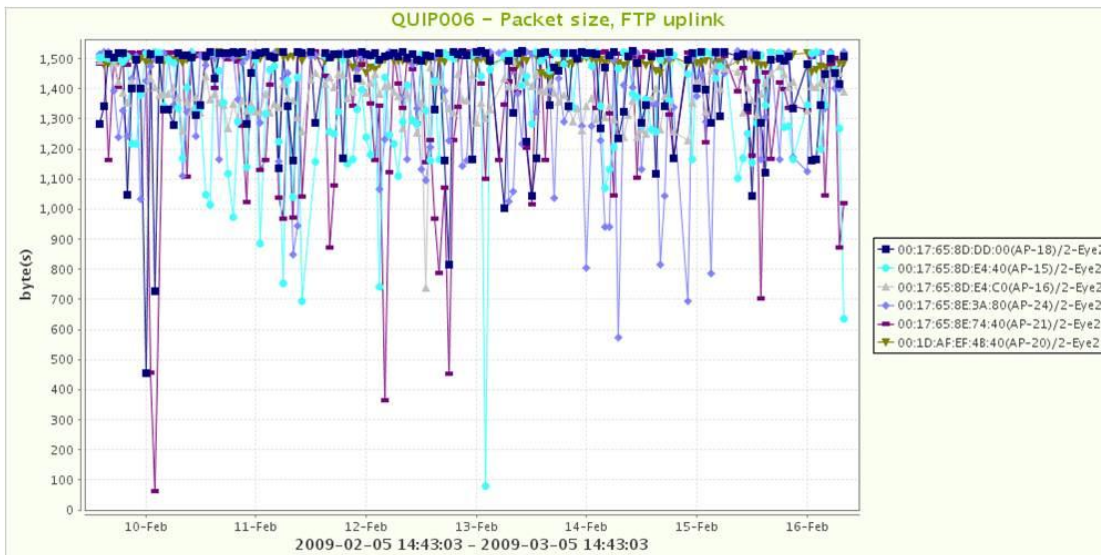
QUIP005 - FTP DL packet size

The FTP DL packet size is changing between 100 and 1500 bytes.



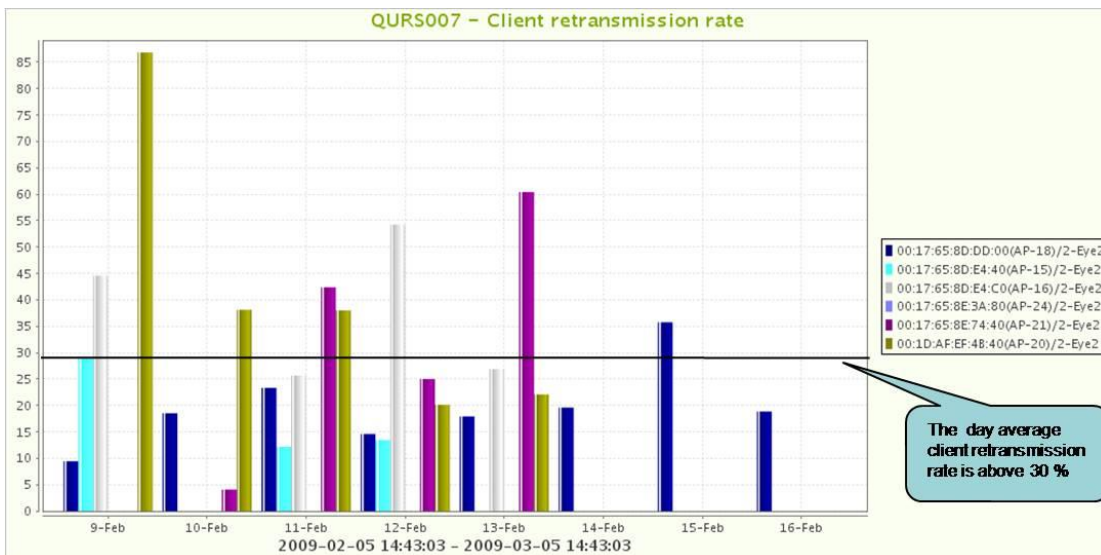
FTP UL packet size (QUIP006)

The FTP DL packet size is changing between 80 and 1500 bytes.



Client detailed statistics (Client)

E.g. Client retransmission rate and client packet size presents also the end-user performance.



Summary

The end-user downlink performance problems are caused by other Wi-Fi APs. All the APs are changing radio channel automatically, trying to avoid interference caused by using the same channels.

The uplink performance problems are caused by high AP interference.

The packet sizes and used data rate codecs vary a lot because of radio interference.

The end-user retransmission rate is high and the data rate codecs vary considerably.

15 KPI GLOSSARY

KPI ID	Name	Description	Unit
Availability			
AV001	Access point beacon availability	Measures beacon signal transmission from each monitored AP. The KPI is the relative amount of received and expected beacons.	%
AV002	Internet connection availability	Measures internet connection availability between a predefined server (Sonar) and an Eye. The Eye pings (32B) the target server three times. If all pings are successful, internet is available. Otherwise internet service is not available.	%
AV004	Number of available APs	Number of APs that have sent a beacon in the selected area. Number of APs that have sent a beacon in the selected area.	#
AV010	Channel number average of selected element	Channel number average of selected element	#
Accessibility			
AC001	Radio resource accessibility	Measures radio resource reservation success rate. During the test, Eye attempts to associate with the monitored AP. KPI is calculated as the number of successful associations divided by the number of all the association attempts.	%
AC002	IP address retrieval success rate	Measures DHCP success rate. The KPI is calculated as the amount of successful IP address retrievals divided by all the requests by Eye.	%
AC004	Radio attach time	Time between Eye starts radio attach to an AP, and attach complete. Time between Eye starts radio attach to an AP, and attach complete.	Ms
AC005	IP address retrieval time	Time between Eye requests an IP address, and IP address retrieved.	Ms
RE001	FTP download success rate	Measures FTP download completion rate.	%
RE002	FTP upload success rate	Measures FTP upload completion rate.	%
RE011	VoIP download test success rate	Measures VoIP (MOS) download completion rate.	%

RE012	VoIP upload test success rate	Measures VoIP (MOS) upload completion rate.	%
Quality			
QUAP001	FTP downlink throughput	Measures downlink throughput in an FTP file transfer. Measures downlink throughput in an FTP file transfer.	Mbit/s
QUAP002	FTP uplink throughput	Measures uplink throughput in an FTP file transfer. Measures uplink throughput in an FTP file transfer.	Mbit/s
QUAP005	Listening voice quality (MOS), downlink	MOS (Mean Opinion Score) value of a VoIP downlink test.	MOS
QUAP006	Listening voice quality (MOS), uplink	MOS (Mean Opinion Score) value of a VoIP uplink test.	MOS
QUAP007	HTTP downlink throughput	Measures downlink throughput in an HTTP document transfer. The test measures both the time of the transfer and the size of the document, from which the throughput in Mbit/s is calculated. Measures downlink throughput in an HTTP document transfer. The test measures both the time of the transfer and the size of the document, from which the throughput in Mbit/s is calculated.	Mbit/s
QUAP011	FTP downlink throughput of E2E maximum	Measured throughput divided by the theoretical maximum throughput that is a function of measured SNR.	
QUAP012	FTP uplink throughput of E2E maximum	Measured throughput divided by the theoretical maximum throughput that is a function of measured SNR.	%
QUAP013	Jitter in VoIP test	The variation of delay (jitter) during a VoIP test.	ms
QUAP015	Packet loss, VoIP test	Packet loss during a VoIP test.	%
QUAP019	Average of used QoS categories in FTP	The average of all the used QoS-categories during FTP transfer tests.	
QUAP022	Average of requested QoS category in VoIP	The average of all the requested QoS-categories for VoIP test.	
QUAP025	Average of used QoS categories in VoIP	The average of all the used QoS-categories during VoIP tests.	
QUAP028	Average of requested QoS category in HTTP	The average of all the requested QoS-categories for HTTP transfer test.	
QUAP031	Average of used QoS categories in HTTP	The average of all the used QoS-categories during HTTP transfer tests.	

QUIP005	Packet size, FTP downlink	Packet size distribution in FTP downlink transfer test. Packet size distribution in FTP downlink transfer test.	byte(s)
QUIP006	Packet size, FTP uplink	Packet size distribution in FTP uplink transfer test.	byte(s)
QUIP013	Packet size, HTTP downlink	Packet size distribution in FTP uplink transfer test. Packet size distribution in FTP uplink transfer test.	byte(s)
QRS001	Channel noise level at Eye	RF noise level in dBm, measured by Eye.	dBm
QRS002	AP signal level at Eye	Measures the AP transmitted power level of radio signal from the Eye point of view. Measures the AP transmitted power level of radio signal from the Eye point of view.	dBm
QRS003	AP signal to noise ratio (SNR) at Eye	Measures the AP transmitted power level of radio signal relative to the power level of noise received by an Eye. Measures the AP transmitted power level of radio signal relative to the power level of noise received by an Eye.	dB
QRS004	AP retransmission rate	Number of retransmitted frames divided by the number of all the frames sent to downlink by an AP.	
QRS026	Eye-AP signal level in FTP DL	Signal power level between AP and Eye, during an FTP download test. Signal power level between AP and Eye, during an FTP download test.	dBm
QRS027	Eye-AP signal level in FTP UL	Signal power level between AP and Eye, during an FTP upload test. Signal power level between AP and Eye, during an FTP upload test.	dBm
QRS028	Eye-AP SNR in FTP DL	Signal to noise ratio between AP and Eye, during an FTP download test. Signal to noise ratio between AP and Eye, during an FTP download test.	dB
QRS029	Eye-AP SNR in FTP UL	Signal to noise ratio between AP and Eye, during an FTP upload test. Signal to noise ratio between AP and Eye, during an FTP upload test.	dB
QRS030	Channel noise during FTP DL	Measures the average channel noise on the channel where the FTP download test is done. Calculated as Signal level minus SNR.	dBm

QURS031	Channel noise during FTP UL	Measures the average channel noise on the channel where the FTP upload test is done. Calculated as Signal level minus SNR.	dBm
QURT004	32B active RTT	Measures the round trip time between Eye and Sonar server. The test uses a serie of pings to ping server 20 times with zero wait time between the pings. The calculation is done internally in Eye and the output of the test is average, 95% percentile, max and min values of RTT. The objective is to measure the ping quality, not ping availability.	ms
QURT007	Ping success rate	Number of successful pings divided by the total amount of ping attempts.	%
Volume			
TR001	AP uplink throughput	Measures the amount of uplink data transmitted to an AP during a measurement period. During the test, an Eye listens traffic for 15 sec per each managed access point.	Kbit/s
TR002	AP downlink throughput	Measures the amount of downlink data transmitted by an AP during a measurement period. During the test, an Eye listens traffic for 15 sec per each managed access point. Measures the amount of downlink data transmitted by an AP during a measurement period. During the test, an Eye listens traffic for 15 sec per each managed access point.	Kbit/s
TR003	Number of clients per AP	Measures the number of concurrent clients using the specified AP during the test. This KPI is measured concurrently with the TRV001 AP uplink throughput. Measures the number of concurrent clients using the specified AP during the test. This KPI is measured concurrently with the TRV001 AP uplink throughput.	
TR015	AP packet size	Measures the IEEE802.11 frame sizes during a monitoring per AP.	byte

TR0018	Average QoS category in AP traffic monitor	The average of all the used QoS-categories during AP traffic monitoring.		7signal Sapp
Client				
QURS005	Client signal level at Eye	Measures the signal power level of clients from the Eye point of view. Measures the signal power level of clients from the Eye point of view.	dBm	Loupe User Guide
QURS006	Client signal to noise ratio (SNR) at Eye	Measures the signal to noise ratio of clients from the Eye point of view. Measures the signal to noise ratio of clients from the Eye point of view.	dB	Release 3.0
QURS007	Client retransmission rate	Number of retransmitted frames divided by the number of all the frames sent to an AP uplink by a client. Number of retransmitted frames divided by the number of all the frames sent to an AP uplink by a client.	%	
QURS008	Client-AP link balance	Traffic balance between Client-transmitter (uplink) and AP-transmitter (downlink). If value is 100%, then all traffic has been uplink (from Client to AP). If value is 0%, then all traffic has been downlink. If value is null, then there has been no traffic in either direction. Traffic balance between Client-transmitter (uplink) and AP-transmitter (downlink). If value is 100%, then all traffic has been uplink (from Client to AP). If value is 0%, then all traffic has been downlink. If value is null, then there has been no traffic in either direction.	%	
TRO12	Client uplink data	Measures the amount of uplink data transmitted by a client.	Kbit/s	
TRO13	Client-downlind data	Measures the amount of downlink data transmitted to a client.	Kbit/s	
TR014	Client packet size	Measures the IEEE802.11 frame sizes during a monitoring per client.	byte	
TR018	QoS category in AP traffic monitor	The average of all the used QoS-categories during AP traffic monitoring.		
TR0019	Average QoS category in client traffic monitor	The average of all the used QoS-categories during client monitoring.		